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REGIONAL MARKET ASSESSMENT REPORT IN THE MEDITERRANEAN COUNTRIES

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

UNITED NATIONS ENVIRONMENT PROGRAMME

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Acronyms

ADEREE	National Agency for Renewable Energy and Energy Efficiency
AIDMO	Arab Industrial Development and Mining Organization
ALSOL	Algerian Program for promoting Solar Water Heater
AMISOLE	Moroccan Association of Solar and Wind Industries
ANME	Tunisian National Agency for Energy Efficiency
CDER (Al)	Centre de Développement des Energies Renouvelables
CDM	Clean Development Mechanism
CREDEG	Centre de Recherche et de Développement de l'Electricité et du Gaz
CSNER	Chambre Syndicale Nationale des Energies Renouvelables
CSP	Concentrated Solar Power
DSWH	Domestic Solar Water Heater
EGYSOL	Egyptian Program for promoting Solar Water Heater
FNME	Fond National de la Maîtrise de l'Energie
FOGGER	Moroccan Guarantee fund of Energy Efficiency & Renewable Energy
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHI	Global Horizontal Irradiance
IAEREE	Institut Algérien des Energies Renouvelables et de l'Efficacité Energétique
ICCS	Integrated solar combined cycle plant
IEA	International Energy Agency
IMANOR	Moroccan Institute for Standardization
IMELS	Italian Ministry of Environment, Land and Sea
IMF	International Monetary Fund
IRI	Lebanon Industrial Research Institute
LCEC	Lebanese Center for Energy Conservation
LIBNOR	Lebanese Institute for Norms and Standards
LPG	Liquefied Petroleum Gas
LSES	Lebanese Solar Energy Society
MASEN	Moroccan Agency for Solar Energy
MEDREC	Mediterranean Renewable Energy Center
MEDREP	Mediterranean Renewable Energy Programme
NEAL	New Energy Algeria
NEEREA	National Energy Efficiency and Renewable Energy Action
NEPCO	National Electric Power Company
NERC	National Energy Research Center (Jordan)
NERC	National Energy Research Center (Syria)
NREA	New and Renewable Energy Authority
OECD	Organisation for Economic Co-operation and Development
OME	Observatoire Méditerranéen de l'Energie
ONE	Office National de l'Electricité
PDD	Project Design Document
PEA	Palestinian Energy Authority
PPA	Power Purchase Agreement
PROMASOL	Moroccan Program for promoting Solar Water Heater
PROSOL	Tunisian Program for promoting Solar Water Heater
PV	Photovoltaic

RCREEE	Regional Centre for Renewable Energies and Energy Efficiency
RE	Renewable Energy
REAOL	Renewable Energy Authority of Libya
RES	Renewable Energy Sources
RET	Renewable Energy Technology
RETCC	Egyptian Renewable Energy Testing and Certification Centre
RSS	Royal Society
SASMO	Syrian Arab Organization for Standardization and Metrology
SMCs	South Mediterranean Countries
SHIP	Solar Heat for Industrial Process
SNIMA	Service de Normalisation Industrielle Marocaine
ST	Solar Thermal
STEG	Société Tunisienne de l'Electricité et du Gaz
SWH	Solar Water Heater
TFC	Total Final Consumption
TPES	Total Primary Energy Consumption
UNDP	United Nations Development Programme
UNEP	United Nation Environment Programme
USAID	United States Agency for International Development

Units

%/y	percent per year
$GtCO_2$	Gigatonne of Carbon Dioxide = 10^9 tonnes
GW	Gigawatt = 10^9 watt
kWh	kilowatt-hour
kWh/m²/y	kilowatt-hour per square meter per year
Mtoe	Million tonne of oil equivalent
MW	Megawatt = 10^6 watt
MWp	Megawatt peak
PPP	Purchasing Power Parity
toe/cap.	Tonne oil equivalent per capita
TWh	terawatt-hour
USD	United States Dollars
USD/cap.	United States Dollars per capita
USD/kWh	United States Dollars per capita per kilowatt-hour

The GSWH initiative

In order to overcome the main barriers which currently hold back the potential of solar water heating technologies and lead to a long-term, sustainable market transformation worldwide, the Global Environment Facility (GEF), co-financed by the International Copper Association (ICA), has mandated UNDP and UNEP to execute a programme titled the "Global Solar Water Heating (GSWH) Market Transformation and Strengthening Initiative." This programme started in May 2009 and has 60-month duration. Its main objective is to accelerate global commercialization and sustainable market transformation of solar water heating, thereby reducing the current use of electricity and fossil fuel for hot water preparation in residential, private service sector, public buildings and, when applicable, industrial applications. The programme consists of two main components:

1. Global Knowledge Management 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, sharing of international experiences and lessons learnt.

2. UNDP Country Programs: The basic conditions for the development of a SWH market on both the supply and demand side are established, thus leading to the overall, global market transformation goals of the project. Currently, country programmes are ongoing in Albania, Algeria, Chile, Lebanon, India and Mexico, but it is expected that other countries will join as an ultimate outcome of the current initiative.

Within this framework, the Observatoire Méditerranéen de l'Energie (OME) has been selected as a regional partner to coordinate the implementation of the Knowledge Management and Networking components in the Mediterranean area. As such, OME is committed to generate knowledge products and services and facilitate knowledge sharing and dissemination of best practices, both within and outside the Mediterranean borders.

Rationale for the present report

This is the third Market Assessment report prepared by OME within the framework of the GSWH initiative. The purpose of the market assessment report is to help overcome some relevant barriers which currently prevent solar water heating systems from providing a larger share of energy supply, i.e. the lack of knowledge and trust on the technology, as well as the lack of systematic statistics on the solar thermal market and industry, and the very limited return on experiences. Even in those Mediterranean countries where a well developed market and industry infrastructure are in place, access to data is difficult and experiences are not sufficiently documented. The institutional and legal framework for the development of the solar water heating sector of the countries targeted by the initiative needs to be strengthened. Currently, the institutional and legal framework of the thermal solar energy in several Mediterranean countries, both in the Balkans and North African region, is not fully developed or very weak. To overcome this, OME seeks to work together with the policy-makers and other relevant public and private stakeholders (industry associations, researchers, national energy agencies, companies) in the selected countries and carry out an analysis of the existing normative in each country.

In order to change some biased perceptions vis-à-vis the technology and to support forward-looking policy design approaches, the market assessment report proves to be a very useful tool, as it provides a comprehensive overview of the socio-economic framework in the countries analysed, as well as a description of the institutional and regulatory frameworks for solar thermal, market data and the main industry actors.

The regional workshop and Business to Business meetings organised by OME in Tirana, Albania, within the framework of the Global Solar Water Heating Market Transformation and

Strengthening Initiative proved to be a very effective way for enhancing regional coordination, learning through case studies and best practices, and increasing knowledge sharing.

This report intends to further contribute to this knowledge exchange, by presenting updated information on the state of the art of the SWH market in the Mediterranean region as a whole, and in 17 selected countries. This report extends the geographical coverage of the previous Market Assessment reports to include the following Balkan countries: Bosnia and Herzegovina, Croatia, Montenegro, Serbia and the Former Yugoslav Republic of Macedonia. The report is intended to be widely disseminated and regularly updated, in order to keep track of the evolution of the solar energy market in the Mediterranean, and to include new developments in terms of technologies, policies and markets.

The report as well as additional relevant material will be disseminated extensively through the project website, specialized magazines as the OME's Global Energy for the Mediterranean (GEM), and presented at conferences and other events in order to inform public and private sector experts and other stakeholders.

Structure of the report

The present report covers 17 Mediterranean countries, including the Balkans. It complements and extends the "Market Assessment Report" prepared by OME within the second and third phases under the framework of a previous Small Scale Funding Agreement (SSFA) with UNEP in 2011.[1] Compared to the previous market assessment report, the current publication:

- extends its geographical scope to include a wider set of countries focusing on the Balkan region
- update the information with 2012 market figures -when available - as well as new policy developments
- incorporates the results of a new country-by-country analysis looking at the solar industry structure
- adds information on certification, standardization and testing systems in the reviewed countries

The report is organised in two sections:

- Section 1 gives an overview of the economic, social and energy context in the Mediterranean and Balkan countries and draws some prospects up to 2030. Economic data are derived from the Organisation for Economic Co-operation and Development's (OECD) Economic indicators and the World Bank's World Development Indicators 2012. For forecasts of GDP to 2018, data are taken from the International Monetary Fund (IMF) World Economic Outlook database (April 2013 updates); for the period 2015-2030, GDP projections are derived from available scenarios in the long-term IMF and World Bank (FUGI) forecasts. Energy data and prospects are based on the OME's Mediterranean Energy Perspectives (MEP) 2011 publication.[2] In particular, two scenarios are depicted: i) a Conservative Scenario, which takes a cautious approach and assumes a slow rate of implementation of new policies and governmental plans; and ii) a Proactive Scenario, which assumes achievement of targets for renewables and energy efficiency.

- Section 2 presents an overview of the state of the art of solar thermal technologies in the Mediterranean region. Furthermore, it provides the results of the SWH market

[1] Downloadable at: http://solarthermalworld.org/sites/gstec/files/news/file/2013-04-26/regional_market_assessment_report_ome-mediterranean.pdf
[2] downloadable at: www.ome.org

country analyses of selected South Mediterranean and Balkan countries: Albania, Bosnia-Herzegovina, Croatia, Montenegro, Serbia, and the Former Yugoslav Republic of Macedonia as well as Morocco, Algeria, Tunisia, Libya, Egypt, Palestine, Jordan, Israel, Lebanon, Syria, Turkey.

Geographical scope and methodology

Overall, the Mediterranean region covers nine million square kilometres (km^2) and encompasses 25 countries (Figure 1). The region is strategically located at the crossroads of Europe, Africa, the Middle East and the Far East. This geography makes it an important transit corridor for global energy commodities.

Figure 1: The Mediterranean basin

Source: OME

The present report provides a market assessment for 17 countries of the Mediterranean region, split as follows:

- **Balkan Countries:** Albania, Bosnia-Herzegovina, Croatia, Montenegro, Serbia, and the Former Yugoslav Republic of Macedonia.
- **South Mediterranean Countries (SMCs):** Algeria, Egypt, Libya, Morocco, Tunisia, Israel, Jordan, Lebanon, Palestine, Syria and Turkey.

To produce this assessment, both primary and secondary data have been used. In particular:

- Country factsheets[3] have been prepared by OME and completed by private and public experts in most of the countries under review.
- An extensive Internet search and analysis of literature has been conducted in order to cross-check primary data against other sources, or to compensate for missing data.
- An Expert Workshop and Business to Business meetings were organized in Tirana (Albania) on 20-21 March 2013, gathering more than 30 experts from 11 different Mediterranean countries, in addition to the representatives from UNDP, UNEP, and other international and regional organisations. The event, organised under the auspices of the Albanian Ministry of Economy, Trade and Energy, allowed to gather relevant information through the discussion of several topics related to policy and regulatory framework, the role of industry associations, standard and certification schemes, and solar heat for industrial processes.
- Regular exchange with industry, market and policy experts from national and international organisations.

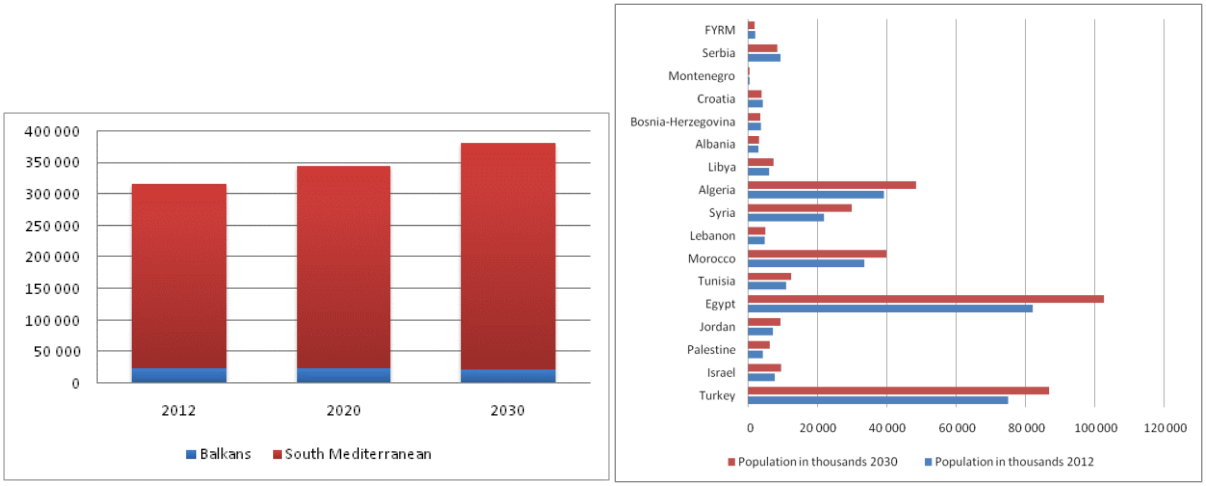
[3] See Annex I

1. Socio-economic and energy context

1.1. Demography

The population of the area covered by the present study reached around 316 Million in 2012. According to the medium variant population growth scenario of the United Nations,[4] from 2012 to 2030 the population will grow up to 380 Million (+20%). Whereas the population in the South Mediterranean is expected to grow by around 22%, the population in the Balkans is expected to decrease by around 5% (Figure 2).

Figure 2: Population evolution (2012-2030) by region and country



Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2012 Revision and the UN Population, Development and the Environment 2013

The bulk of the region's population is concentrated in Egypt, Turkey, Algeria, Morocco, and Syria which together will account for 81% of the total area population by 2030 (Figure 2). Egypt is expected to represent 29% and Turkey 24% of the South Mediterranean population by 2030.

This rise of the population is accompanied by a concentration in urban areas, which increases environmental pressures and results in higher and higher energy demand. As an example, the urban population in Algeria has grown from 61% in 2000 to 73% in 2011 and is expected to reach 83% by 2030.[5] Higher density in the urban areas causes environmental pressure on natural resources, increases the energy demand and overstretches the existing urban infrastructures to satisfy the needs of this increased population.

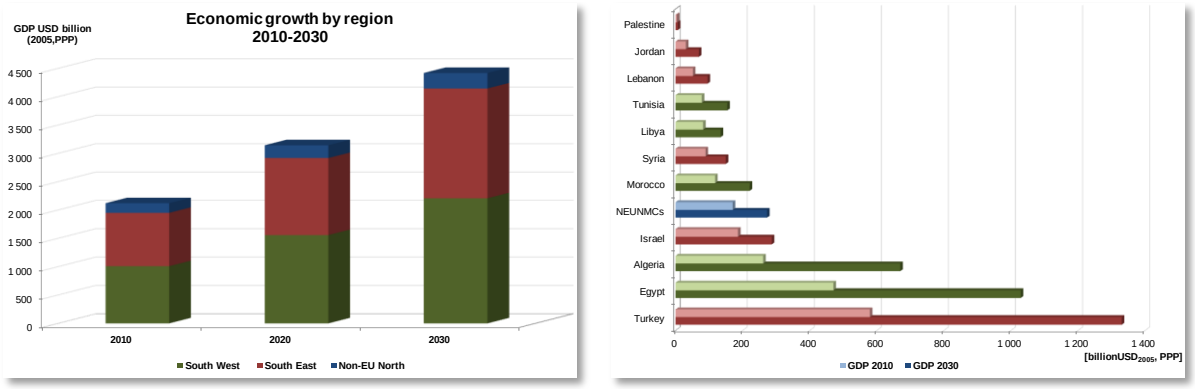
1.2. Economic situation

Economic growth is a key determinant of energy demand. Economic growth in the Balkan countries has increased over the last two decades. In 2010, GDP is about USD 2,120 billion (in year 2005 USD at purchasing power parity [PPP] rates). Scenarios foresee an annual average growth of 4% in SWMCs, 3.7% in SEMCs and 2.4% in the Balkans to 2030. Nevertheless, economic growth varies widely between countries belonging to the same sub-region. In SWMCs, Algeria is expected to grow at an annual average rate of 4.8% while Libya is expected grow at a lower rate of 2.5%. In SEMCs, Turkey and Jordan are expected to pull growth with an annual average rate of 4.2% and 4.1% respectively while Israel is expected to grow at 2.2% rate.

[4] Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2012 Revision, http://esa.un.org/unpd/wpp/

[5] Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Urbanization Prospects: The 2011 Revision; http://esa.un.org/unpd/wup/unup/index_panel1.html

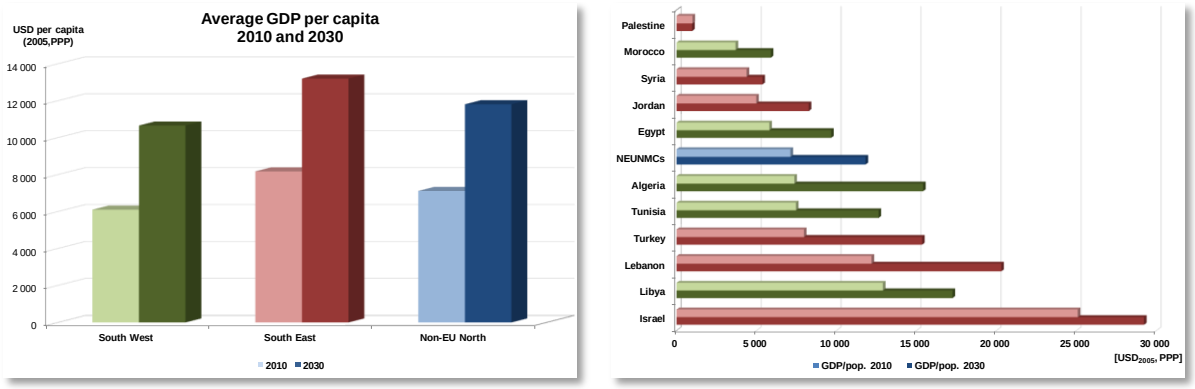
Figure 3: GDP evolution (2010-2030) by region and country



Sources: OME database and International Monetary Fund World Economic Outlook

With such growth rates, a wide set of countries are expected to double their GDP by 2030 (Algeria, Egypt, Jordan, Lebanon, Tunisia, and Turkey). GDPs of the others South West and South East Mediterranean countries are expected to grow in a range from 60% (Israel) to 93% (Morocco) by 2030 (Figure 3).

Figure 4: GDP per capita evolution (2010-2030) by region and country



Sources: OME database and International Monetary Fund World Economic Outlook

Annual average per capita income increased during the lasts decades in all sub-regions. In 2010, the average GDP per capita was about USD 6,100 (2005 PPP) in SWMCs, about USD 8,180 (2005 PPP) in SEMCs, and about USD 7,120 (2005 PPP) in the Balkans Over the projection period, average per capita income is expected to increase to USD 10,600 (2005 PPP) in SWMCs, to USD 13,200 (2005 PP) in SEMCs and to USD 11,810 (2005 PPP) in the Balkans (Figure 4).

Here again, GDP per capita evolution varies widely among the countries. Turkey and Algeria are expected to double their per capita income while in Israel, Libya, Palestine and Syria per capita income are expected to grow less than by 35% (Figure 4).

1.3. Energy prices

One of the major barriers to the development of renewable energy technologies (RETs) is their upfront cost, which might be particularly high in the case of large-scale power generation plants. Thus, in order to be bankable, RE projects need incentives to cover the difference between the cost of generation from RETs and the cost of their fossil fuels alternatives. This cost gap is particularly wide in most SMCs, as energy prices are subsidised in order to guarantee access to energy for all. However, they create market distortions and undermine the growth potential of renewable energy in the region.

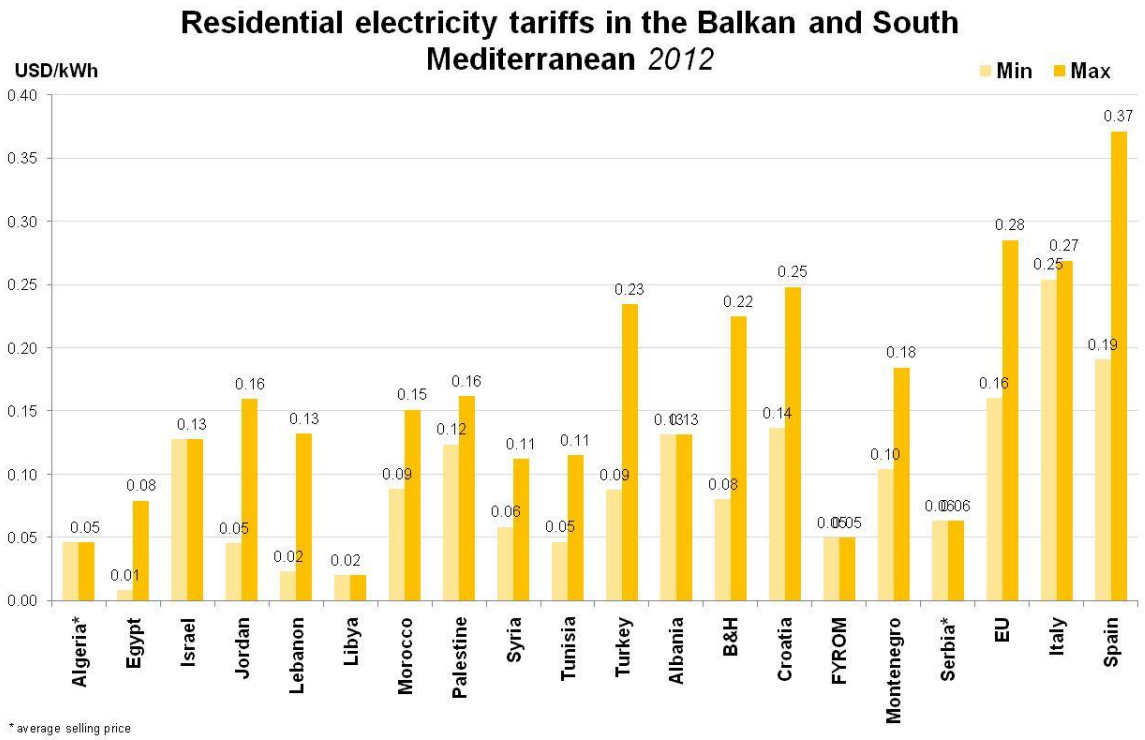
Table 1: Electricity tariffs in residential, tertiary, industry sector in the Balkan and South Mediterranean countries

Electricity tariffs min – max (in local currency)	Residential *(Low voltage)*	Tertiary *(Medium voltage)*	Industry *(High voltage)*
Morocco (Taxes exc.) *(MAD/kWh)*	*0.790 - 1.531*	*0.418 - 1.537* *(annual fee: 346.1 – 2,116.13)*	*0.435 - 2.403* *(annual fee: 289.9 – 1,618.74)*
Algeria (Taxes exc.) *(DA/kWh)*	*0.3784*	*n/a*	*n/a*
Tunisia (Taxes exc.) *(TND/kWh)*	*0.075- 0.186* *(annual fee: 0.2)*	*0.085- 0.180* *(annual fee: 0.5 – 3.5)*	*0.081- 0.176* *(annual fee: 1.25 - 3)*
Libya (n/a) *(LYD/kWh)*	*25*	*30 - 68*	*25*
Egypt (n/a) *(EGP/kWh)*	*0.05 – 0.48*	*0.24 – 0.60*	*0.047 – 0.358* *(+50% during peak period; monthly fee: 11.1 – 12.1))*
Palestine (Taxes exc.) *(NIS/kWh)*	*0.4924 -0.6454*	*0.4924 -0.6454*	*0.4924 -0.6454*
Jordan (n/a) *(JOD/kWh)*	*0.032 – 0.113* *(monthly fee: 2.98/kW)*	*0.036 – 0.086* *(monthly fee: 2.98 – 3.79 /kW)*	*0.036 – 0.086* *(monthly fee: 2.98 – 3.79 /kW)*
Israel (Taxes exc.) *(NIS/kWh)*	*0.5083* *(bi-monthly fee 0.1349)*	*n/a*	*n/a*
Lebanon (n/a) *(LBP/kWh)*	*35 – 200*	*50-140*	*80 - 320*
Syria (n/a) *(SYP /kWh)*	*3.8 – 7.30*	*3.0 – 6.36*	*6.0 – 10.9*
Turkey (Taxes exc.) *(TRY/KWh)*	*0.157-0.421*	*0.123-0.369*	*0.078 - 0.323*
Albania (n/a) *(ALL/kWh)*	*7.7 - 13.5*	*7.1 - 13.23*	*8.5 - 9.78*
Bosnia-Herzegovina	*6.16*	*9.22*	*5.37*
Croatia (c€/kWh)	*9.52*	*9.80*	*7.89*
Montenegro (c€/kWh)	*8.52*	*16.9*	*4.88*
Serbia (c€/kWh)	*4.67*	*6.56*	*4.25*
Former Yugoslav Republic of Macedonia (c€/kWh)	*4.76*	*9.33*	*5.87*

Sources: National sources and Energy Community Regulatory Board for Bosnia-Herzegovina, Croatia, Montenegro and FYRM, for which only the average tariffs are available as of 2009.

One very important indicator is the electricity tariffs in these countries. As can be seen in the graph below, most of electricity tariffs are comparatively low in South Mediterranean and Balkan countries. The relatively low electricity prices could be explained by the subsidies allocated for electricity from conventional resources, which represent a relevant barrier to the implementation of solar water heating policies and the creation of a sustainable market structure.

Figure 5: Residential electricity tariffs in the Balkan and South Mediterranean



Sources: national sources (exchange rates of 1st August 2012)

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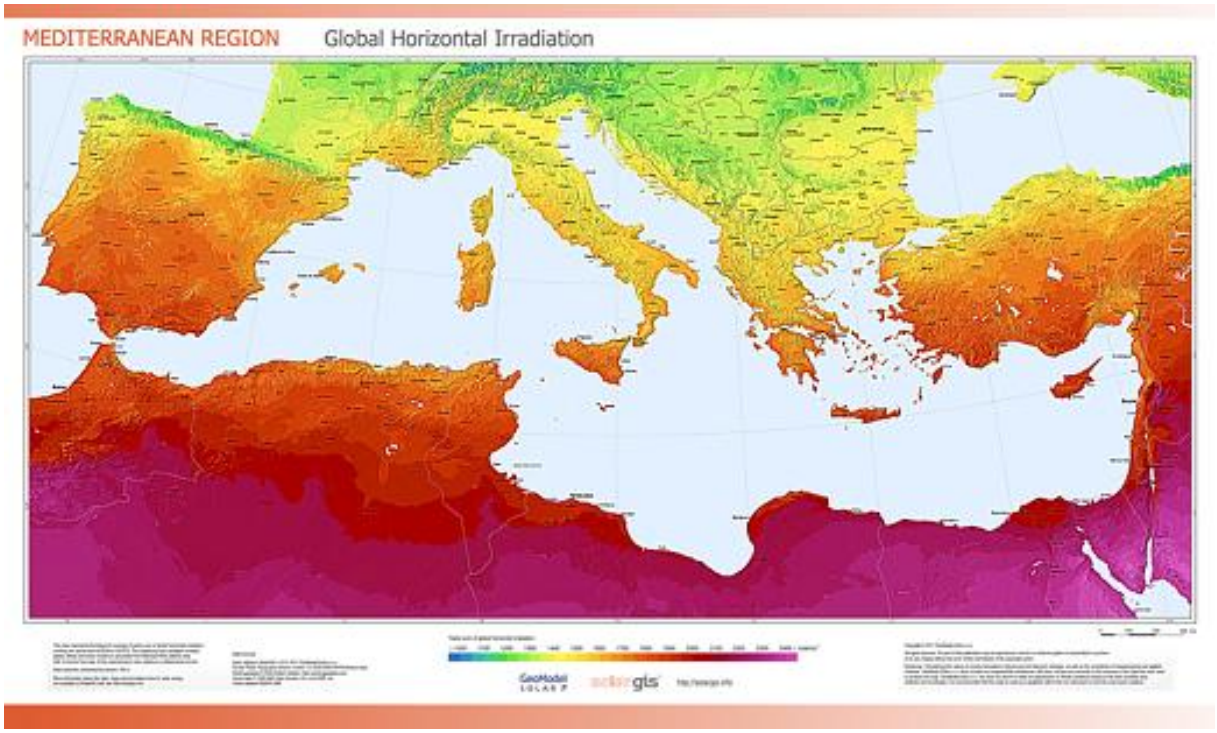
2. Solar Thermal market: regional and country analysis

2.1. Solar resources

Mediterranean countries are endowed with some of the highest potential in solar radiation and long time of sunny hours, particularly along the southern shore (> 2,000 hours per year). The Global Horizontal Irradiance (GHI) ranges in the area between 1,600 kWh/m²/y in coastal areas and 2,600 kWh/m²/y in the desert (Figure 6). In the Balkans, the potential is lower than in the South Mediterranean region but still remains very interesting, with a GHI ranging from about 900 kWh/m²/y to 1,600 kWh/m²/y in coastal areas. Such favourable conditions make the development of solar thermal technologies particularly suitable in the region.

Figure 6: Global horizontal Irradiance (GHI) in Mediterranean area

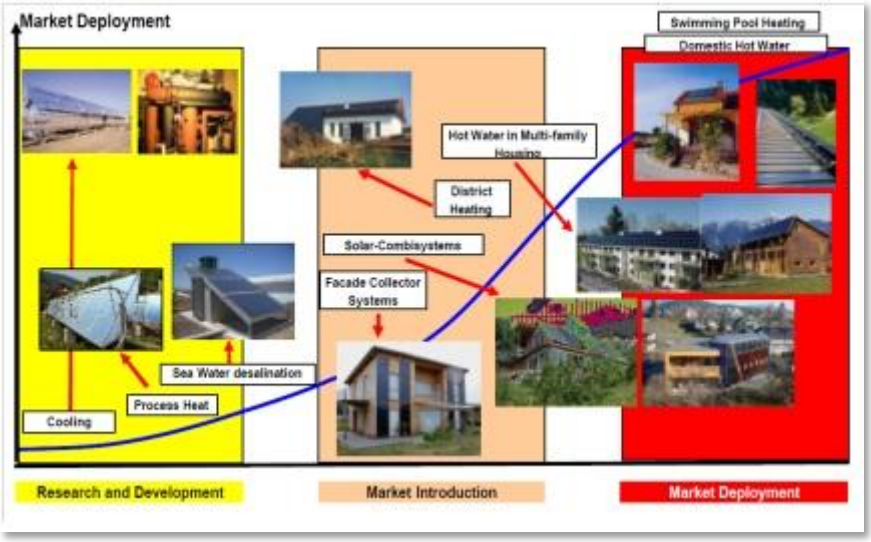


Source: PV GIS

2.2. SWH market potential

Solar thermal systems are wide-spread at world level. Up to now the main applications have been in the domestic sector (domestic solar water heaters – DSWH- and collective solar water heater installations) and swimming pool heating which are in a market deployment stage. Other applications, as district heating, are in a market introduction stage with more and more installations being developed especially in Europe. Solar process heat (as well as solar water desalination and solar cooling) systems are still in a development stage, requiring more experience trough experimental projects implementation (Figure 7).

Figure 7: Market deployment phases of solar thermal systems

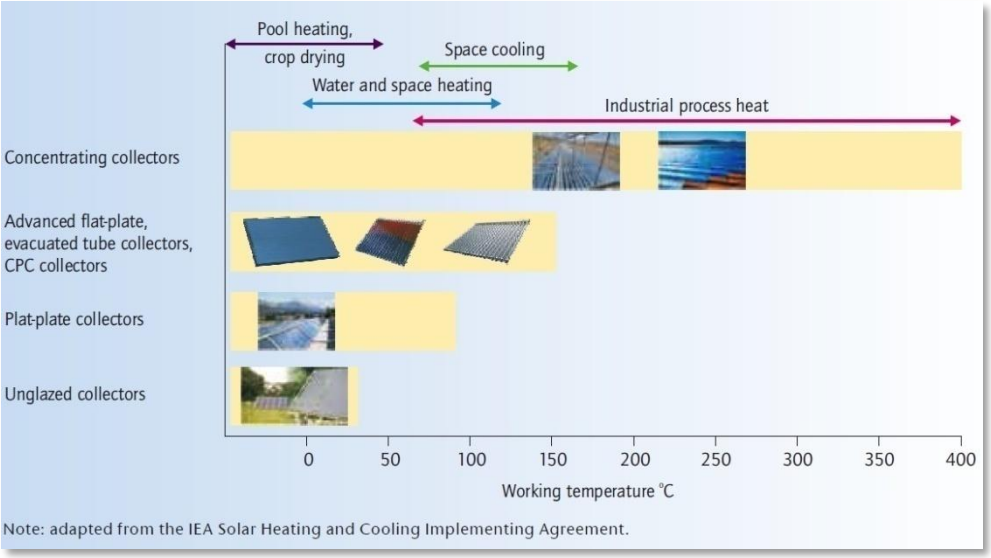


Source: G. Faninger, 2010

Residential and industrial sectors represent together around 60% of the energy consumption of many Mediterranean countries A large portion of this energy is heat, highlighting the possible contribution of heat solution to the global energy supply such as solar thermal technologies.

In 2011, the IEA reported that global energy demand for heat represented around half of total final energy consumption. Looking at the wide range of existing solar applications (Figure 8), one can see the high potential of solar technologies to respond to this demand. As mentioned, the most widespread solar systems are the DSWH responding to the residential needs, but since few years several applications such as solar heat for industrial processes (SHIP), solar cooling and solar desalination applications are also expanding.

Figure 8: Solar collectors and working temperatures for different applications



Source: IEA, 2012

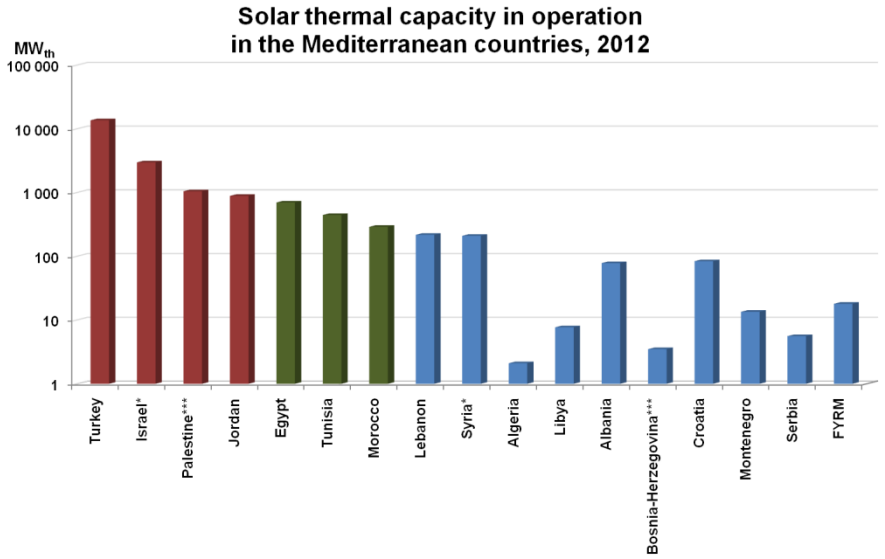
An assessment of the technical potential for solar heating and cooling system for the region is currently missing, and would definitely benefit decision makers and investors, thus leading to increased deployment of these technologies in the Mediterranean area.

2.3. SWH market

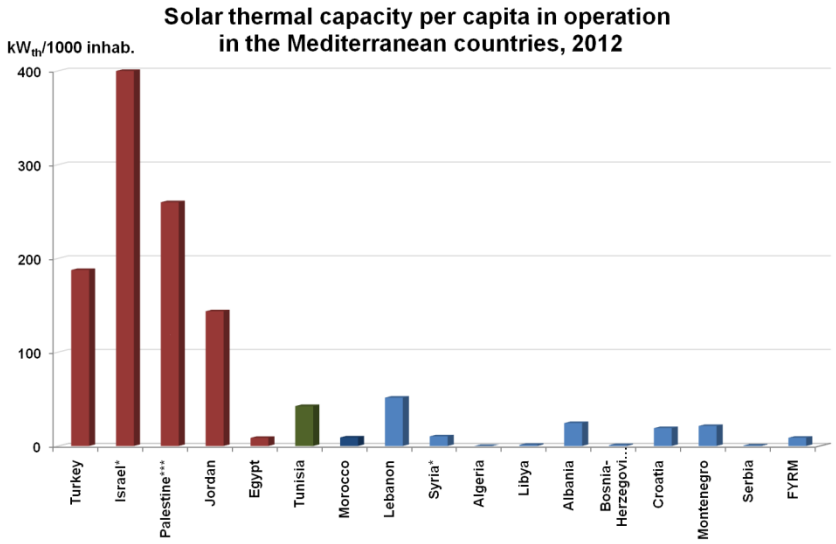
Global installed capacity reached 234.6 GW_{th} (335.1 million m^2) in 2011.[6] The estimated total capacity is 268.1 GW_{th} (383 million m^2) by the end of 2012. China and Europe accounted for the largest shares with 152.2 GW_{th} and 39.3 GW_{th}, respectively in 2011.

Solar thermal capacity in operation in the Mediterranean countries is displayed in Figure 9, both in absolute values and on a per-capita basis. An approximate capacity of about 20 GW_{th} is estimated for the Mediterranean area in the year 2012. This represents more than 8% of the total solar thermal capacity in operation at global level. Turkey alone hosts two-thirds of the Mediterranean solar thermal capacity, followed by Israel and the Palestine. Together, these three countries account for around 87% of the solar thermal capacity in operation in the Mediterranean region. Per capita solar thermal capacity is highest in Israel, followed by Palestine, Turkey and Jordan.

Figure 9: Solar thermal capacity in operation in the Mediterranean Countries in 2012



**2011, **2010, ***2008*



**2011, **2010, ***2008*

Sources: OME database and national sources

[6] Weiss, Werner and Mauthner, Franz, 2013, Solar Heat Worldwide, Markets and Contribution to the Energy Supply 2011.

Based on the figures reported above, countries can be clustered according to their existing installed capacity, as in the following table:

Table 2: Solar thermal market in the Mediterranean Countries, 2010

Installed capacity of Solar Water Heaters (in m²), 2012		
< 300,000 m²	300,000 m² < x < 700,000 m²	> 700,000 m²
Algeria Libya Balkan countries	Egypt Lebanon Morocco Syria Tunisia	Israel Jordan Palestine Turkey

Sources: A. Kraidy, presentation at Regional Solar Thermal Workshop, Beirut 2012 and OME database and national sources

Among South Mediterranean countries, solar thermal is widespread in Israel, where the use of solar energy for water heating dates back to 1970s. Tunisia has established a comprehensive programme to promote the use of solar energy in the residential, tourism and industrial sectors. A solar thermal market also exists in Turkey, Egypt, Jordan, Lebanon, Morocco and Syria.

In terms of per capita installed capacity, three countries in the studied countries covered in this report are among the highest per capita worldwide in 2012. These are led by Israel, (403 kW_{th}/1000 inhabitants) followed by Palestine (260 kW_{th}/1000 inhabitants), then Turkey (188 kW_{th}/1000 inhabitants) and then Jordan (144 kW_{th}/1000 inhabitants).

A number of Mediterranean countries have employed incentive programmes to promote the use of solar thermal technologies, and set targets to enhance the solar thermal market (Table 3). The following table summarizes the main parameters considered for each of the countries covered by the present report. An analytical description and a discussion of these parameters are presented later in the report.

Table 3: Synopsis of the main elements of the SWH market in the Mediterranean

Country	National targets	Certification/ standard	Existing incentives/ obligations	Existing industry association	Average cost of system [USD]	Corresponding system configuration
Morocco	YES	YES	YES	YES	1,060	2 m² with 160 to 200 liters tank
Algeria	NO	NO	NO	NO	820	n/a
Tunisia	YES	YES	YES	YES	890	Thermosyphon system [2 m² surface & 200 L capacity]
Libya	NO	NO	NO	YES	n/a	n/a
Egypt	NO	YES	YES	YES	700	Thermosyphon - 150 lit/day
Palestine	NO	YES	NO	NO	500	Thermosyphon

Jordan	YES	YES	YES	NO	930	Flat plate - local manufactured +hot water tank + cold water tank + stands for tanks
Israel	NO	YES	YES	YES	n/a	n/a
Lebanon	YES	YES	YES	YES	1,300	FP collectors of 3.6 m² + 200 liters tank
Syria	YES	YES	NO	NO	n/a	n/a
Turkey	NO	YES	NO	YES	920	Open-loop, pressureless thermosiphon (180 lit hot water, 70 lt feeding tank)
Albania	YES	NO	YES	NO	1,000	2-3 m² collector and 150-200 liter water tank
Bosnia-Herzegovina	NO	NO	NO	NO	€625/m2	A system of 4 m2 of solar collector, a 300 l tank and other accessories (€ 2500).
Croatia	YES	NO	YES	YES	€850/m2	€850/m2 for a system of 6m2 and €750/m2 for a 15m2 system
Montenegro	NO	NO	YES	n/a	n/a	n/a
Serbia	n/a	YES	n/a	n/a	n/a	n/a
Former Yugoslav Republic of Macedonia	n/a	n/a	YES	n/a	n/a	n/a

Sources: Country factsheets, Beirut 2012 and OME database and national sources

2.4. SHIP applications

Around 200 operating solar thermal systems for process heat are estimated worldwide, for a capacity of 42 MW_{th} (60,000 m^2), or only 0.03% of the total solar thermal capacity installed. Most of these systems are of small-scale experimental nature. Recently, however, large scale solar thermal applications have attracted an increasing interest and, thus, several projects have been implemented (Weiss 2013). A solar thermal system has been designed in 2013 to refine copper in Chile with an installed area of 3900 m^2 with an annual output of 50 GWh. In 2012, a 5.5 MWth (7800m^2) installation was commissioned in April 2012 in North Carolina supplying hot water to a turkey processing plant. Two other projects are in China with 9.1 MW_{th} and 10.5 MW_{th} in the dyeing and weaving mill factories (Weiss 2013). In the European region, Austria is a pioneer in the use of this technology; several North Mediterranean countries including Greece, Italy, Portugal and Spain are also active. In the South Mediterranean region, most countries are still keeping their solar potential largely untapped. There is limited experience in SHIP applications in the Mediterranean, and a general lack of well documented information. Among South Mediterranean countries, Egypt has produced perhaps the most analytical documentation on its experience with SHIP. The Egyptian government formulated a programme for testing and disseminating solar process heat and waste heat recovery systems in the local industry in the 1990s. The programme

aimed at reducing dependence on fossil fuels of this compartment, as Egyptian industry is responsible for about 50% of final energy consumption - and approximately 60% of this portion is for process heat. Tunisia is currently carrying out feasibility studies within its PROSOL industry programming aiming at installing solar system for industrial processes.

In the Balkan Countries, applications for process heat do not exist and not much information is publically available in this regard.

2.5. Certification and standards

As shown in Table 3, the current state of the solar water heating systems market in the Mediterranean countries is quite varied. Most of the surveyed countries have established a certification scheme or a national standard for solar thermal collectors and systems, but in most cases these schemes are not mandatory and are not accompanied by third-party verification. To increase product quality and provide a harmonised framework within the Arab world, the League of Arab States, the Arab Industrial Development and Mining Organization (AIDMO) and the Regional Centre for Renewable Energies and Energy Efficiency (RCREEE) have established a regional certification scheme for solar water heaters in order to harmonise standard and testing systems throughout the region and facilitate trade and market development of solar thermal products. This initiative, called “SHAMCI” (The Solar Heating Arab Mark and Certification Initiative), should increase quality and performance of solar water heaters in the region, and facilitate trading within the region and with the EU. Members of the SHAMCI network are official representatives of the national organizations responsible for renewable energies, testing facilities for SWHs, and standardization agencies in the Arab states.

The certification scheme sets the requirements for SHAMCI certification of solar collectors and solar water heaters, and defines the test methods to be used to check if requirements are fulfilled. All SHAMCI related standards can be summarized in:

- Solar thermal collectors – ISO 9806
- Solar water heating systems – ISO 9459-2 & ISO 9459-5
- Thermal solar systems & components – Factory Made Systems part.2 – EN 12976 -2
- Certification body – ISO/IEC 17065
- Testing facility – ISO 17025

Using same test methods and same conformity attestation makes it possible to compare certified test results and products on the same basis. Certification bodies, testing laboratories, and inspectors established in the Arab countries can apply for becoming members of the SHAMCI network. General Certification Scheme Rules have been developed by SWT Technologie (Germany) and SolarKey Int and were presented at the occasion of a first SHAMCI network meeting held in Stuttgart in June 2012; after a revision process a consensus meeting was held in Cairo in August 2012.

The final version of the draft was sent to the Arab Ministerial Council of Electricity. The SHAMCI process for the adoption is progressing. It is expected to be adopted during the next meeting of the Renewable Energy and Energy Efficiency of the expert committee of the League of Arab States in February 2014.

The SHAMCI certification scheme is based on the Solar Keymark European voluntary scheme. The aim is to harmonise the two systems, in order to reduce market barriers and facilitate trade between Europe and the Arab countries, as well as to promote high quality products in both regions.

The opportunity of implementing a similar regional certification scheme in the Balkans was addressed and discussed during the workshop held in Tirana in March 2013.

In the Blakan countries, certification and standards quite vary from country to country. In Albania, for example, some measures are in place such as minimum technical and efficiency requirements for SWH and certification of SWH and installers by an accredited body.

2.6. Main barriers

Solar thermal technologies have the potential to satisfy a large share of final energy consumption. Estimates (IEA, 2012) calculate that by 2050 about 16% of final energy use for low temperature heat could be covered by solar. These estimates see significant growth for solar hot water and space heating in Africa and the Middle East, as well as for solar cooling applications.

OME forecasts for the Mediterranean region are less optimistic and envisage a more moderate growth of solar thermal technologies until 2030. However, the compound annual growth rate of solar thermal technologies is 3.4% in the Conservative and 7.1% in the Proactive scenario. Overall, solar thermal technologies are expected to contribute 18% of total renewable final consumption in the Conservative Scenario, and 27% in the Proactive Scenario, thus more than doubling their current share.

Currently, solar thermal in the Mediterranean represents less than 1% of total final energy consumption and 13.5% of renewable final energy consumption. Several barriers are indeed preventing solar thermal technologies from satisfying a significant portion of the final energy demand.

A main barrier which is common to most renewable energy is the high investment cost compared to traditional systems. This is particularly relevant since most financiers only look at the return of their investment, regardless of the socio-economic and environmental benefits attached to it. Overcoming this barrier requires the implementation of specific incentive programs, which help reduce the cost gap between solar thermal technologies and their traditional alternative. This is an issue in many Non-EU Mediterranean countries, as subsidies are given to fossil fuels, thus reducing the market prospects for renewable technologies.

Another barrier which is common to many renewable energy technologies is represented by a certain mistrust vis-à-vis new technologies. Much more awareness raising but also the implementation of mandatory certification schemes, with high quality standards, are needed in order to prove that these technologies are reliable and can become competitive if the right signals are given to market operators. In this respect, the SHAMCI initiative represents a significant step forward.

A specific barrier which is particularly relevant in many Mediterranean countries is represented by the subsidies given to fossil fuels, which prevent the creation of a level playing field for renewable energy technologies. Shifting these subsidies from fossil fuels to solar (and other renewable) technologies would be therefore the main recommendation in order to foster the development of a sustainable and long-lasting solar industry in the region.

Also, the lack of synergies among agencies promoting SWH in the region might have a negative impact on the solar thermal market growth. Therefore, stronger coordination at the institutional and regulatory level would be beneficial.

Furthermore, there is a lack of reliable data and statistics on the development of SWH applications. The issue of lack of documented return on experience was raised also at the occasion of the regional workshop organised in Beirut in April 2012 (OME, 2012). Developing and maintaining a database is of paramount importance if we want solar thermal technologies to become mainstream. In this respect, initiatives like the “Global Solar Water Heating Market Transformation and Strengthening Initiative” represent a very relevant step forward in terms of knowledge sharing and access to data.

Another shortcoming is the issue of space availability for solar thermal systems on the roofs. Indeed, in several countries roof surfaces are occupied by other equipments as water tanks, satellite dishes, etc. A more accurate planning and awareness raising campaigns are needed to solve this problem. Building codes are also recommended.

Table 4 summarizes the barriers met by SWH systems and the main recommendations to overcome them.

Table 4: Main barriers and recommendations

High costs of solar systems compare to purchasing power	As many other renewable energy technologies, solar systems are capital-intensive and have high investment costs. However, in the long-term, using these technologies will allow saving conventional energies throughout their operation life. A way to bridge the financial gap is to implement financial incentives	Such mechanisms as the one developed in Tunisia within the "PROSOL" program, would make the access to the technology easier.
High subsidies for conventional energy/electricity	Subsidized fossil fuels or electricity competing with solar water heaters lead to make less attractive solar water heaters. To remove these subsidies will allow SWH to become attractive.	Morocco, within its SHEMSI Program, made a study concluding that the earnings coming from the avoided subsidies to butane will allow the state to invest on SWH through subsidy scheme.
Lack of quality control regulations (testing labs, standards, certification)	The lack of quality control regulation leads to the penetration of low quality products which causes a mistrust vis-à-vis the solar technology from end-users. Put in place a certification scheme in order to ensure the quality of the products put in the market will increase the end users' trust regarding SWH systems.	The Lebanese Center for Energy Conservation (LCEC) has successfully implemented a prequalification scheme for solar water heater manufacturers and suppliers. The scheme enables SWH companies to benefit from the national subsidy programme, which offers SWH clients a USD 200 subsidy in addition to an interest-free loan.
Low awareness of end-users	To overcome this barrier, the setting up of specific awareness raising campaigns could be an adequate solution, targeting not only end-users but also decision and policy makers.	All programmes promoting SWH system such as PROSOL (Tunisia), PROMASOL (Morocco), or ALSOL (Algeria), include an awareness rising component through advertising (TV, radio, etc.).

Surface availability on roofs	Establish building codes including requirements for SWH systems installations and other equipments. Awareness raising campaigns.	Jordan is preparing a Solar Law mandating new buildings to install solar water heating systems, taking into account the roof space challenge, and conflicting use of space.
Lack of data/documentation and monitoring	Most often, data on SWH market are not gathered or access to these data is difficult.	To develop and maintain a database. Initiatives like the "Global Solar Water Heating Market Transformation and Strengthening Initiative" represent a very relevant step forward in terms of knowledge sharing and access to data

Source: OME based on literature review, regional workshop recommendations and interviews with expert

3. Regional Analysis by Country

3.1. South Mediterranean Countries

3.1.1. *Algeria*

3.1.1.1. Socio-economic and energy context

Figure 10: Algerian indicators

Socio-economics [2010]		
Population	35 468	*[Thousands]*
Urban population	72,0%	*[%]*
GDP	261	*[billionUSD 2005, PPP]*
GDP/pop.	7 364	*[USD 2005/cap, PPP]*
HDI rank 2011 [rank 2000]	96 [106]	*[rank]*
Energy [2010]		
Energy production	162,8	*[Mtoe]*
Net Trade	115,4	*[Mtoe]*
TPES	47,4	*[Mtoe]*
Fossil share (TPES)	99,5%	*[%]*
Fossil Fuel Dependance	-244,70%	*[%]*
TFC	27,5	*[Mtoe]*
TPES/pop.	1,34	*[toe/cap]*
TPES/GDP (PPP)	0,18	*[toe/USD 2005]*
Installed Capacity	11 332	*[MW]*
Electricity Generation	45 171	*[GWh]*
Electricity Consumption	35 800	*[GWh]*
Elec. Consump./pop.	1 009	*[kWh/cap]*
CO_2 emissions	106	*[Mt]*
CO_2/pop.	2,99	*[CO 2/cap]*
CO_2/TPES	2,24	*[tCO 2/toe]*
CO_2/GDP (PPP)	0,41	*[tCO 2/000 USD 2005]*
Renewable Energy [2010]		
RE in TPES	0,2	*[Mtoe]*
RE share in TPES	0,4%	*[%]*
RE in Final Energy Consumption	0,12	[Mtoe]
RE in Final Energy Consumption (residential)	0,08	[Mtoe]
RE in Final Energy Consumption (industry)	0,04	[Mtoe]
RE in Final Energy Consumption (transport)	0,00	[Mtoe]
RE in Final Energy Consumption (Other)	0,00	[Mtoe]
RE Electricity generation	173	*[GWh]*
RE installed capacity	286	[MW]
RE in total installed capacity	3%	*[%]*
RE in total installed capacity (excluding hydro)	0%	*[%]*

Algeria is the second most populated country among the SWMCs with 35 million inhabitants. According to UN population prospects, the population will reach more than 43 million by 2030 with an increasing share of the population living in the urban area from 72% to 83%.

GDP is around USD_{2005} 260 billion (PPP) and GDP per capita reached 7,360 USD/cap. in 2010 thanks to a continuous average growth of around 4.4 %/year since the 1970's.

Algeria is a fossil fuel exporter (net trade of around 115 Mtoe) and its energy consumption is extremely dependent on fossil fuels (around 99.5%).

RE is not really developed, even if some PV applications are operating in isolated villages for several purposes (electrification, pumped water, public lighting, and telecommunication...). Total estimated PV installed capacity is around 2 MW.

Energy subsidies

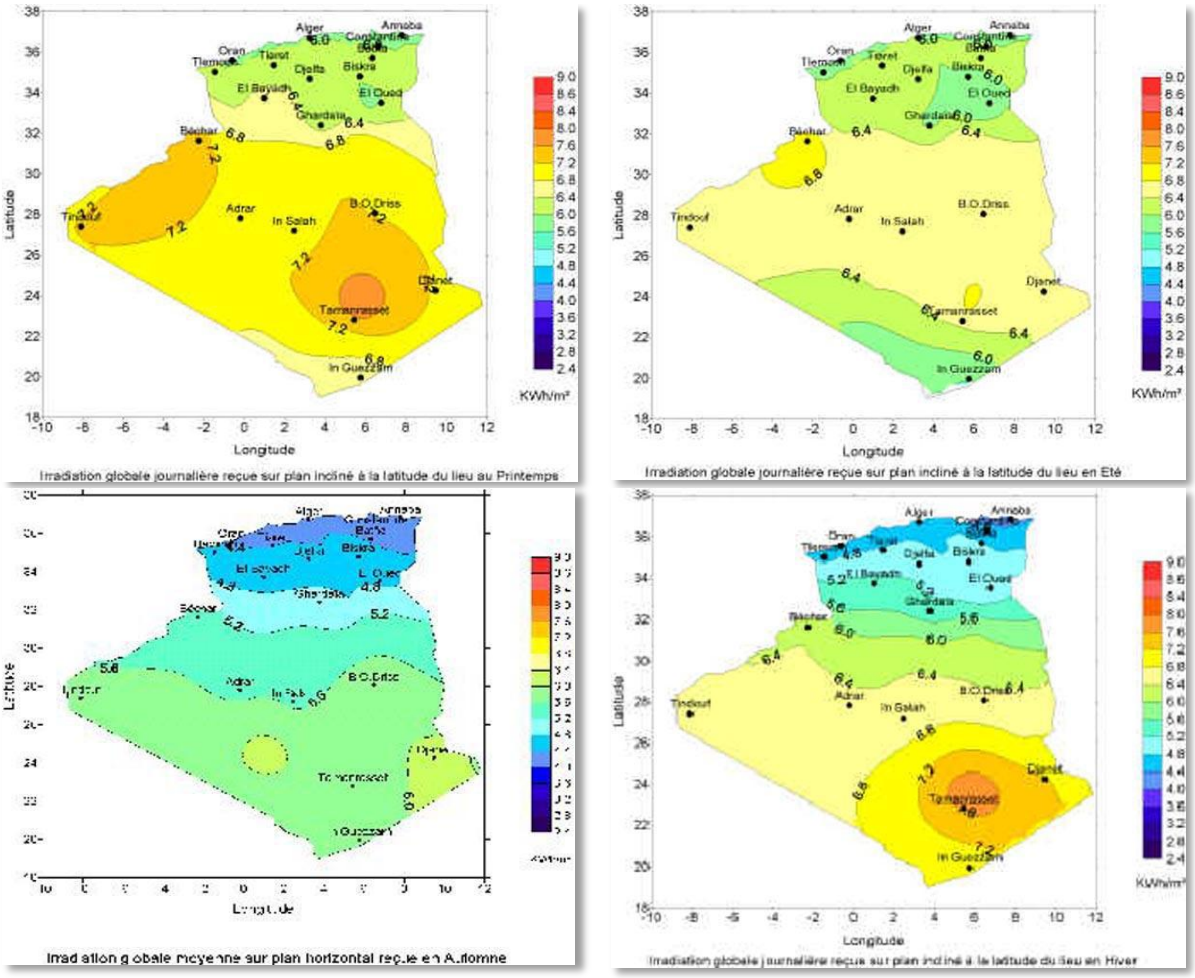
According to IEA analyses, subsidies accounted for 7% of total GDP in 2011. Algeria devoted USD 13.40 billion in 2011 to energy subsidies of which USD 2.13 billion to electricity, the remaining part dedicated to fuels.[7] These grants represent, according to the same data, 6.6% of Gross Domestic Product (GDP) of Algeria, which devotes more than $ 298 per person of energy subsidies per year.

Solar energy resources

Algeria is endowed with one of the highest solar fields in the Mediterranean area. The sunshine duration exceeds 2,000 h/y in almost all the territory and could reach 3,900 h/y in some sites, as in the highlands and Sahara. The "Centre de Développement des Energies Renouvelables" of Algeria has prepared the solar atlas of Algeria for the four seasons (Figure 11).

[7] http://www.iea.org/subsidy/index.html; Analyses based on an indicator average price of crude oil on the international market (30 U.S. cents per litre in 2010) and IEA estimates

Figure 11: Global Horizontal Irradiation in Algeria during the seasons [spring (top left), summer (top right), autumn (bottom left), winter (bottom right)]



Source: Centre de Développement des Energies Renouvelables (CDER)

3.1.1.2. Solar thermal legislative and regulatory framework

There are no specific laws regarding solar thermal in Algeria, and no specific regulatory framework. However, some initiatives have been put in place through UNDP-financed programmes such as “Horizon 2011” to equip 5500 households with SWH systems, or “ALSOL” financed by Fonds national pour la maîtrise de l’énergie (FNME) to install 1000 individual SWH in residential and 1000 in the industry. In March 2011, Algeria announced an ambitious program to develop renewable energies (RE) and promote energy efficiency. This program focuses on RE for electricity generation, but intends to promote SWH as well as solar air conditioning. Two pilot projects for air cooling using absorption and adsorption chillers will be launched for the cooling of buildings in the south of the country.

In addition, Algeria is also a beneficiary country of the “Global Solar Water Heating (GSWH) Market Transformation and Strengthening Initiative.” The aim of the project within the initiative is to install 72,000 m² by the end of the project (2015) and to have a natural growth rate of the market around 10% allowing reaching a total installed capacity of about 490,000 m² by 2020.[8]

The government is also investing in research and development. An institute for renewable energies (Institut algérien des énergies renouvelables et de l'éfficacité énergétique, IAEREE) was established in Bellil, in the south of Hassi R'Mel.

[8] http://www.dz.undp.org/Projets_Cooperation/fiches_projets/Fiche_CES.pdf

3.1.1.3. Solar water heater market

There are no official statistics on the market for solar water heaters in Algeria. It is estimated than no more than 3,000 m² have been installed in the country up to now. During the period of the "Horizon 2011" programme, Algeria offered an incentive scheme to support installation of 400 residential systems with a 200 litre storage tank between 2007 and 2011. A new solar water heating programme to 2014 called ALSOL was launched in 2011 by "l'agence nationale pour la promotion et la rationalisation de l'utilisation de l'énergie (Aprue)," which provides solar water heating systems subsidies of about 45% of the investment costs for an individual system and of about 35% for a collective system through the "Fonds National pour la Maîtrise de l'Energie" (FNME). The programme expects to install about 2,000 solar kits for individual use and 3,000 m² of collective solar water heating systems every year.

SHIP applications

There are no documented experiences. The Algerian manufacturer Thermokad has been asked to carry out feasibility studies for installing solar systems in the process of two important food industrial companies.[9]

Certification and standards

The « Enact » (Entreprise Nationale d'Agréage et de Contrôle Technique, www.enact.dz) is testing and approving solar system components of Thermokad solar products.

In addition, the National Research and Development of the Electricity and Gas (CREDEG) reported that a laboratory certification of photovoltaic equipment and solar water heaters would be set up in 2012 in Algeria, but up to now no structure is in place yet. The first mission of the laboratory certification of photovoltaic equipment and solar water heaters will be the approval of the state-owned equipment group Sonelgaz "Rouiba Light" specialized in the manufacture of photovoltaic panels. Thereafter, registration will be generalized to other Algerian companies, specialized in the manufacture of solar equipment.

System cost

According to an article released on CDER's website,[10] the price of a solar system is around 65,000 DA (Taxes excluded), which corresponds to around USD 820.

3.1.1.4. Main industry actors in ST field

The Thermokad Company is a pioneer in the solar thermal manufacturing. The company started to manufacture solar water heating systems in 2005. The manufacturing industry has witnessed the establishment of GTP (l'entreprise nationale Grands travaux pétroliers), Sonatrach's subsidiary, that conceived a SWH prototype whose cost is 135 000 DA.[11] Besides, another manufacturer, and few retailers are operating in the country, as shown in Table 6.

Table 5: Main Algerian actors in the solar water heater industry

Name	Contact	Type
Thermokad	web: www.thermokad.com	Manufacturer, supplier
Algerian Solar Company	web: www.ascalgeria.com	Importer, distributor, installer
Mek-energie	web: www.mekenergie.com	Retail sales

[9] http://portail.cder.dz/spip.php?article1268
[10] http://portail.cder.dz/spip.php?article1268
[11] http://bejaia-aujourdhui.com/2012/05/chauffe-eau-solaire-100-gtp-sonatrach-peu-trop-cher/.

Ener +	web: www.enerplus-dz.com	
SOLARAL Clean Energies	n/a	Distributor
SCET Energie	web: www.scetenergie.com	
Solargol	web: www.solargol.com	Manufacturer, distributor
Technosolar Systèmes	email : tssdz@yahoo.fr	
Solartech	email : solartech_dz@yahoo.fr	Retail sales

Sources: Algerian Ministry of Energy and Mines

3.1.2. *Egypt*

3.1.2.1. Socio-economic and energy context

Figure 12: Egyptian indicators

Socio-economics [2010]		
Population	81 121	*[Thousands]*
Urban population	43,4%	*[%]*
GDP	471	*[billionUSD_{2005}, PPP]*
GDP/pop.	5 801	*[USD_{2005}/cap, PPP]*
HDI rank 2011 [rank 2000]	113 [115]	*[rank]*
Energy [2010]		
Energy production	92,3	*[Mtoe]*
Net Trade	13,8	*[Mtoe]*
TPES	78,5	*[Mtoe]*
Fossil share (TPES)	96,1%	*[%]*
Fossil Fuel Dependance	-18,33%	*[%]*
TFC	54,0	*[Mtoe]*
TPES/pop.	0,97	*[toe/cap]*
TPES/GDP (PPP)	0,17	*[toe/USD_{2005}]*
Installed Capacity	24 726	*[MW]*
Electricity Generation	139 000	*[GWh]*
Electricity Consumption	120 676	*[GWh]*
Elec. Consump./pop.	1 488	*[kWh/cap]*
CO_2 emissions	184	*[Mt]*
CO_2/pop.	2,27	*[CO_2/cap]*
CO_2/TPES	2,35	*[tCO_2/toe]*
CO_2/GDP (PPP)	0,39	*[tCO_2/000 USD_{2005}]*
Renewable Energy [2010]		
RE in TPES	3,1	*[Mtoe]*
RE share in TPES	4%	*[%]*
RE in Final Energy Consumption	1,7	
RE in Final Energy Consumption (residential)	0,8	[Mtoe]
RE in Final Energy Consumption (industry)	0,8	[Mtoe]
RE in Final Energy Consumption (transport)	0	[Mtoe]
RE in Final Energy Consumption (Other)	0	[Mtoe]
RE Electricity generation	13 996	*[GWh]*
RE installed capacity	3 290	[MW]
RE in total installed capacity	13%	*[%]*
RE in total installed capacity (excluding hydro)	2%	*[%]*

Egypt is the most populated country of the SWMCs with more than 80 million inhabitants. According to UN population prospects, the population will reach more than 105 million by 2030 with an increasing share of the population living in the urban area from 43% to 50%, leading to a high increase of energy demand.

GDP is around USD_{2005} 471 billion (PPP) and GDP per capita reached 5,800 USD/cap. in 2010 thanks to a continuous growth of around 5.4 %/year since the 1970's.

Egypt is an energy exporter (Net trade of about 14 Mtoe) and its energy consumption is highly dependent on fossil fuels (more than 96%).

In 2010, the total installed capacity of renewables for electricity generation amounts to 3,300 MW, with around 490 MW of wind power plants.

Energy subsidies

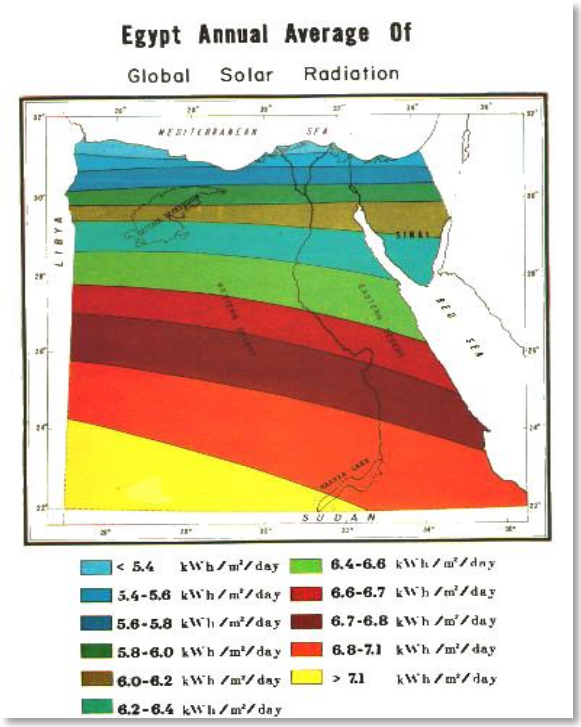
According to IEA, Egypt devoted USD 24.47 billion in 2011 to energy subsidies of which USD 5.42 billion to electricity, USD 15.27 billion to oil and the remaining part dedicated to gas.[12] These grants represent 10.4% of Gross Domestic Product (GDP) of Egypt, which devotes more than $ 296 per person of energy subsidies.

Solar energy resources

Egypt is located in the world's solar belt countries and has an excellent solar resource availability. The NREA (New and Renewable Energy Authority) issued in 1991 a solar Atlas (Figure 13). According to it, Egypt has a high intensity of global horizontal solar radiation ranging between 5.2-7.1 kWh/m²/day from Northern to South-Western part of the country, which means that annual global radiation varies between 1,900-2,600 kWh/m²/y. The total sunshine hours range between 3,200 and 3,600 hr/year.

[12] http://www.iea.org/subsidy/index.html; Analyses based on an indicator average price of crude oil on the international market (30 U.S. cents per litre in 2010) and IEA estimates

Figure 13: Solar radiation in Egypt



Source : NREA

3.1.2.2. Solar thermal legislative and regulatory framework

A solar obligation was introduced in 1987, which called for new residential buildings to consider the use of solar water heaters and include the design for their use and authorizing agencies have to verify the use of solar hot water heaters (by the Minister of New Communities, Housing and Utilities, decree N. 401/1987). However, the solar obligation is not generally applied or enforced.

Since 2006, there is a reduction of 5% on custom duty for renewable components and systems.

3.1.2.3. Solar water heater market

In 2012, collector area installed is estimated at 1,000,000 m2.[13] NREA reported that around 650 000 m^2 was installed in 2010. About 400,000 solar water heating units with a total collector surface of 800,000 m^2 (560 MW_{th}), are estimated to be in place. Solar collectors are mostly used in new residential developments (36% in 2009). Several solar initiatives have been proposed over the years, mostly under the framework of international co-operation programmes. One important project worth highlighting is called EGYSOL and is being implemented within the framework of the “Mediterranean Renewable Energy Programme” (MEDREP), initiated by the Italian government. EGYSOL intends to promote collective solar water heating installations in the Red Sea and South Sinai tourist resorts and other buildings in the service sector. The project is managed by UNEP in co-operation with Egypt’s New and Renewable Energy Authority (NREA) under the direction of the Italian Ministry for the Environment, Land and Sea. A fund of USD 500,000 is used to grant a capital cost subsidy of 25% (up to USD 100/m^2) and a decreasing maintenance cost subsidy over a four-year term. The initial objective is to install 4,000 m^2 of solar thermal for hot water demand. As of end of 2011, 95 funding applications had been submitted. Nine projects with surface of more

[13] Adel Khalil, Solar Thermal Energy in Egypt: Potential, Education and Research, Conference on Solar Thermal Energy in Egypt, Heliopolis University, 11 June 2013.

than 1,100 m^2 have been completed. The average payback period of these running systems is around four years and half, thus making these investments more profitable compared to other countries in the region.

Recent developments have been the interest of introducing a solar water heating programme for the hotel sector. Such program entails obligation for hot water production and energy-efficient lighting in hotels. An objective to supply solar heated water to 100, 000 rooms in the hotels sector over the next 5 years.[14]

SHIP applications

The Egyptian government formulated a programme for testing and disseminating solar process heat and waste heat recovery systems in the local industry in the 1990s. The programme aimed at reducing dependence on fossil fuels of this compartment, as Egyptian industry is responsible for about 50% of final energy consumption - and approximately 60% of this portion is for process heat.

The programme was implemented by NREA with co-funding from the United States Agency for International Development (USAID). Two pilot projects were developed – one in the food industry (United Chicken Company) and the other in the textile industry (Misr-Helwan), both publicly owned. Both projects consisted in 350 m^2 of locally manufactured flat plate collectors delivering 26 m^3/day of hot water at 50-60°C. A waste heat recovery system and a meteorological data acquisition system were also developed. The two plants were stopped in 2005 when the Egyptian government sold the two companies to private investors, which replaced the solar systems by conventional heat supply systems. A third plant was installed by NREA in the chemical industry in 2003, which was financed by the African Development Fund. The El Nasr Pharmaceutical project has a solar field of 1,900 m^2 of parabolic trough collectors and produces 1.3 t/hr of saturated steam at 8 bar and at a temperature of 175°C equivalent to 0.9 MW_{th} to feed the steam network of the company, thereby reducing fuel consumption. The installation of the solar system allowed to replace several oil burners by dual burners which are suitable for mazout and natural gas with installation of an automatic control system. The plant encountered some technical problems, notably in the tracking system and the mirrors, that were repaired.

Market figures

In 2010, over the 650,000 m² of solar collectors, 90% are flat-plate collectors and 90% of the systems are thermosyphon.

In total, the national market turnover in 2011 is estimated to around USD 17 million, and the share of imported products in the total sales reached 20%.

Certification and standards

In 1996, the Ministry of Electricity and Energy in cooperation with the European Union established the Renewable Energy Testing and Certification Centre (RETCC) within NREA. The RETCC is considered as a specialised centre aiming at carrying out the studies, research, testing, and certification activities needed in order to develop RE materials according to testing standard procedures. The RETCC has different RE testing facilities among which a solar thermal testing facility. This one is testing and certifying solar thermal component and systems according to ASHREAE 93/86 Testing Procedures and Egyptian Standards which are almost fully compliant with the international standards ISO 9806/94. Unfortunately, some companies do not follow the standard specifications in the manufacturing process, thus worsening the reputation of solar water heaters.

[14] http://psdp-egypt.info/egypt-starts-green-tourism-initiative-with-hotel-solar-obligation-2/

Table 6: Egyptian standards related to solar thermal

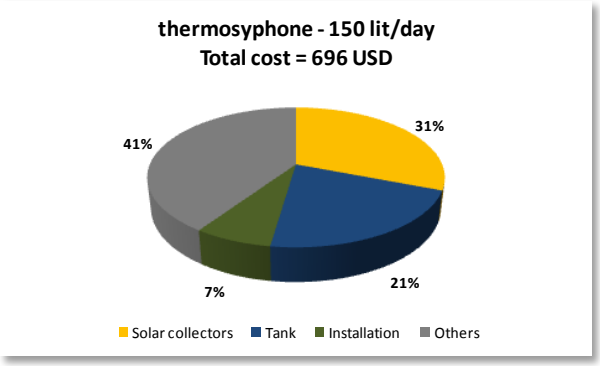
Standard number	Description
EOS-Standard for Solar Heaters	Part1: Technical Definition
	Part2: Solar Heating Systems
	Part3: Components of Solar Flat Plate Collectors
	Part4: Thermal Storage Tank
	Part5: Method of Testing to determine Thermal Performance

Source: H.Salloum, presentation at Regional Solar Thermal Workshop, Beirut 2012

System cost

According to NREA, the average system cost for a thermosyphon (150 lit/day (copper * copper)) is around USD 700. Solar collectors and tank represent half of the total cost of the system.

Figure 14: Average cost of systems in Egypt [individual, residential market]



Source: NREA

3.1.2.4. Main industry actors in ST field

The Solar Egyptian Development Association (SEDA) has been established as an outcome of the Solar Water Heater (SWH) Innovation Network which was developed by the Egyptian German Private Sector Development Programme (PSDP). It is a platform representing *all stakeholders in the Solar Thermal industry; government, private sector, system designers, installers, manufacturers, traders, industry experts, academics, research and development*.

In 2009, nine companies were active in this business area in Egypt: four companies were manufacturers and installers, and five companies were importers and installers of SWH systems.[15]

Some of the main actors of the solar thermal industry are reported below.

[15] Moataz Soliman, *Solar Water Heaters in Egypt: Status and Recommendations,* Workshop on Solar Thermal Application in Egypt, Palestine, Lebanon, Syria and Jordan: Technical Aspects, Framework conditions, and private Sector Needs, Cairo, March 23-25th 2009

Table 7: Main actors in the Egyptian solar water heaters industry

Name	Contact	Type
Egyptian Solar Energy System Company	web: http://egyptsolar.net/en	Manufacturer, installer
Misr America Group For Investments	n/a	Manufacturer, retailer, installer
Sun Misr	n/a	Wholesale supplier, importer
SOLARIS Innovative Solutions	web: www.solaris-eg.com	Importer
Egyptian Association for Energy and Environment	web: www.eaee-eg.com	Installer
Green sun city	web: www.greensuncity.com	Supplier,
Khallouf Future Power	web: www.khallouf-fp.com	Manufacturer
SunPower Company	n/a	retail sales, wholesale supplier, exporter
Taqa Misr	n/a	System provider, wholesale supplier, importer
Sun Energy (SE)	n/a	Retail sales, exporter, importer
German Technology For Solar Systems	n/a	retail sales, wholesale supplier
City Pulse - Trade & Marketing	n/a	retail sales, exporter, importer
Acropol Solar Energy Solutions	web: www.acropol.com.eg	exporter
Ever green solar	email: alwaleed_solar@hotmail.com	Wholesale supplier

Sources: web search

3.1.3. *Israel*

3.1.3.1. Socio-economic and energy context

Figure 15: Israeli indicators

Socio-economics [2010]		
Population	7 418	*[Thousands]*
Urban population	91,8%	*[%]*
GDP	186	*[billionUSD 2005, PPP]*
GDP/pop.	25 079	*[USD 2005/cap, PPP]*
HDI rank 2011 [rank 2000]	17 [22]	*[rank]*
Energy [2010]		
Energy production	3,7	*[Mtoe]*
Net Trade	-19,9	*[Mtoe]*
TPES	23,6	*[Mtoe]*
Fossil share (TPES)	96,4%	*[%]*
Fossil Fuel Dependance	88,87%	*[%]*
TFC	14,2	*[Mtoe]*
TPES/pop.	3,18	*[toe/cap]*
TPES/GDP (PPP)	0,13	*[toe/USD 2005]*
Installed Capacity	11 824	*[MW]*
Electricity Generation	56 147	*[GWh]*
Electricity Consumption	52 037	*[GWh]*
Elec. Consump./pop.	7 015	*[kWh/cap]*
CO_2 emissions	68	*[Mt]*
CO_2/pop.	9,18	*[CO 2/cap]*
CO_2/TPES	2,89	*[tCO 2/toe]*
CO_2/GDP (PPP)	0,37	*[tCO 2/000 USD 2005]*
Renewable Energy [2010]		
RE in TPES	1,1	*[Mtoe]*
RE share in TPES	5%	*[%]*
RE in Final Energy Consumption	1,1	
RE in Final Energy Consumption (residential)	1,1	[Mtoe]
RE in Final Energy Consumption (industry)	0,0	[Mtoe]
RE in Final Energy Consumption (transport)	0	[Mtoe]
RE in Final Energy Consumption (Other)	0	[Mtoe]
RE Electricity generation	108	*[GWh]*
RE installed capacity	120	[MW]
RE in total installed capacity	1%	*[%]*
RE in total installed capacity (excluding hydro)	1%	*[%]*

Israel's population amounted to 7.4 million inhabitants in 2010. According to UN population prospects, the population will reach more than 9.8 million by 2030 with an increasing share of the population living in the urban area from 91.8% to 93%.

GDP is around USD2005 186 billion (PPP) and GDP per capita reached 25,000 USD/cap. in 2010

Israel is an energy importer and its energy consumption is highly dependent on fossil fuels (88%).

Solar energy resources

The annual incident solar irradiance in Israel is about 2,000 kWh/m².

3.1.3.2. Solar thermal legislative and regulatory framework

Israel has been at the forefront and was the first to establish solar energy ordinances for new buildings in 1980. Today, more than 90% of Israel's solar thermal market is beyond what is required by ordinance for new buildings such as retrofits to existing buildings, or systems larger than those required by law. The Ministry of Energy and Water Resources has launched a program to replace 15,000 electrical water heating tanks for the entire population and replace it with solar water heating system through a subsidy scheme. The whole project's budget is about NIS 13M; a subsidy of NIS 900 will be provided by the Ministry.[16]

[16] http://energy.gov.il/English/AboutTheOffice/SpeakerMessages/Pages/GxmsMniSpokesmanECSunHeated.aspx

3.1.3.3. Solar water heater market

Total installed capacity reached 4,265,665 m^2 in 2011. 85% of Israel's 1,650,000 households use solar water heaters. Typical domestic units consist of a 150 litres insulated storage tank and a 2 m^2 flat collector. These systems operate at an annual average efficiency of approximately 50%. Most of the days of the year the use of SWH allow avoiding to employ the electrical backup heating oil (which all storage tanks contain) in order to ensure that the water is warm enough for domestic use. Larger systems, usually pump-driven, are to be found on high-rise housing projects, on several kibbutzim and at a number of industrial plants around the country.

SHIP applications

A number of innovative solar demonstration projects were undertaken by Israeli industry and the government as a result of the onset of the energy crisis of 1974, of which a solar demonstration project involving the use of parabolic-trough reflectors for producing industrial process heat. This was a proof-of-concept project that Luz Corp. carried out at a potato-chip factory in Sha'ar Ha'negev.[17]

Certification and standards

Israel set very high standards for SWH equipment and this prevented the use of inefficient systems. Most of the systems manufactured in Israel comply with International and European standards.

3.1.3.4. Main industry actors in ST field

Table 8: Main Israeli actors in the solar water heaters industry

Name	Contact	Type
Amcor Solar Energies Ltd.	web: www.amcor-solar.co.il	Manufacturer, wholesale supplier, exporter
Amcortec Renewable Energy Ltd.	web: www.amcortec-solar.com	Manufacturer, wholesale supplier, exporter
Chromagen	web: www.chromagen.biz	Manufacturer, export, wholesale supplier, service
Elsol Solar Energy Systems	web: www.elsol.co.il	Manufacturer, wholesale supplier, exporter
G.Systems Ltd	web: www.gsystems.co.il	Manufacturer
Kivun Engineering Ltd.	web: www.kivun.biz	Wholesale supplier, exporter
Millennium Electric T.O.U Ltd.	web: www.millenniumsolar.com	
Nimrod Industries Ltd.	web: www.nimrod-solar.com	Manufacturer
Plastic Magen	web: www.plasticmagen.com	
Prat Solar Industry Energy Ltd.	n/a	Manufacturer, retail sales, wholesale supplier, exporter
Rand Solar Energy Systems	web: www.rand.co.il	Manufacturer
Redclaw Systems	n/a	Exporter
Solarit Doral	web: www.solar-it.co.il	
SolarPower Israel Ltd.	web: www.solarpower.co.il	
Solasol	n/a	Manufacturer, exporter
Solel Solar Systems Ltd.	web: www.solel.com	Manufacturer

Source: http://www.solar.co.il

[17] http://www.mfa.gov.il/MFA/Facts%20About%20Israel/Science%20-%20Technology/Solar%20Energy%20in%20Israel

3.1.4. *Jordan*

3.1.4.1. Socio-economic and energy context

Figure 16: Jordanian indicators

Socio-economics [2010]		
Population	6 187	*[Thousands]*
Urban population	82,5%	*[%]*
GDP	31	*[billionUSD $_{2005}$, PPP]*
GDP/pop.	4 982	*[USD $_{2005}$/cap, PPP]*
HDI rank 2011 [rank 2000]	95 [99]	*[rank]*
Energy [2010]		
Energy production	0,3	*[Mtoe]*
Net Trade	-7,8	*[Mtoe]*
TPES	8,1	*[Mtoe]*
Fossil share (TPES)	98,3%	*[%]*
Fossil Fuel Dependance	98,11%	*[%]*
TFC	5,3	*[Mtoe]*
TPES/pop.	1,31	*[toe/cap]*
TPES/GDP (PPP)	0,26	*[toe/USD $_{2005}$]*
Installed Capacity	3 069	*[MW]*
Electricity Generation	14 683	*[GWh]*
Electricity Consumption	12 920	*[GWh]*
Elec. Consump./pop.	2 088	*[kWh/cap]*
CO_2 emissions	21	*[Mt]*
CO_2/pop.	3,33	*[CO_2/cap]*
CO_2/TPES	2,54	*[tCO_2/toe]*
CO_2/GDP (PPP)	0,67	*[tCO_2/000 USD $_{2005}$]*
Renewable Energy [2010]		
RE in TPES	0,1	*[Mtoe]*
RE share in TPES	2%	*[%]*
RE in Final Energy Consumption	0,1	
RE in Final Energy Consumption (residential)	0,1	[Mtoe]
RE in Final Energy Consumption (industry)	0,0	[Mtoe]
RE in Final Energy Consumption (transport)	0	[Mtoe]
RE in Final Energy Consumption (Other)	0	[Mtoe]
RE Electricity generation	73	*[GWh]*
RE installed capacity	2	[MW]
RE in total installed capacity	0%	*[%]*
RE in total installed capacity (excluding hydro)	0%	*[%]*

Jordan's population amounted 6.2 million inhabitants in 2010. According to UN population prospects, the population will reach more than 8.4 million by 2030 with an increasing share of the population living in the urban area from 83% to 87%.

GDP is around USD_{2005} 31 billion (PPP) and GDP per capita reached 5,000 USD/cap. in 2010 thanks to a continuous growth of around 6.9%/year since the 1970's.

Jordan is an energy importer and its energy consumption is highly dependent on fossil fuels (more than 98%).

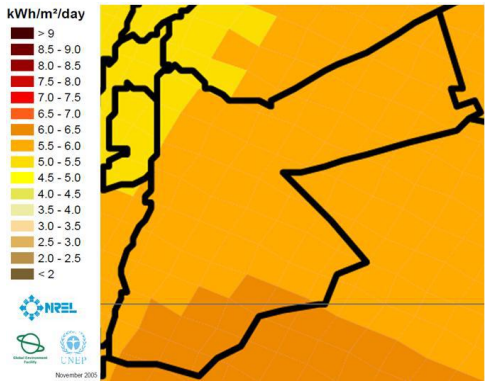
In 2010, share of renewable in the energy mix was still negligible, but the government has set up a series of laws and measures to further expand the use of renewables.

Energy subsidies

After subsidizing petroleum products for many years, the Jordanian energy system came under pressure in 2003, when it lost preferential fuel supply from Iraq. The government then implemented a series of price increases to limit the budgetary effect of the energy subsidies. Nevertheless, in 2008 the subsidy bill for energy still represented about 5% of GDP.[18]

Solar energy resources

Figure 17: Global Horizontal Irradiance in Jordan



Source: SWERA

Jordan is endowed with an abundance of solar energy with annual daily average solar irradiance (average insulation intensity on a horizontal surface) which ranges between 4.5-7 kWh/m², which is one of the highest in the world. This corresponds to an annual total of 1400-2300 kWh/m². The average sunshine duration is more than 300 days per year.

[18] http://siteresources.worldbank.org/EXTESC/Resources/Subsidy_background_paper.pdf

3.1.4.2. Solar thermal legislative and regulatory framework

The solar water heating market is well established and solar thermal energy is seen as an important component of the national strategy to increase the renewable share in the energy mix. A solar thermal obligation for new buildings has been established within the Energy Efficient Building Code, developed in 2008 by the Royal Scientific Society of Jordan. The objective, set up within the "Energy Strategy 2007-2020," is to equip 25% of the households with a SWH system.

The "Royal Decree for Renewable Energy and Energy Efficiency" (Law No. 3, 2010) includes taxes and customs exemption in favour of RE & EE projects.

3.1.4.3. Solar water heater market

The total installed collector surface reached around 1, 270, 000 m^2 in 2012, with more than 200, 000 m^2 installed in 2012. A capacity of 1,000,000 m² was installed in 2011, with 70,000 m² installed in 2011 and 90,000 m² installed in 2009 mainly in the residential sector. With more than 170 m²/1,000 inhabitants, Jordan has one of the highest rates of equipment after Israel, Palestine and Turkey.

Flat plate collectors dominate the market with a share of 90% (80% in 2011) of the panels installed. Thermosyphon represent the main systems installed with a share of 75% (80% in 2011).

SHIP applications

In the industrial sector, 160, 000 m^2 were installed in 2012 compared to 111,788 m² in 2011. A solar thermal field of 96 flat-plate collectors for a total surface of 128 m² and a storage tank of 5 m^3 has been installed in a dairy factory in Russeifa. The garment manufacturer American-Jordanian Industrial Company for Apparel also installed solar panels to heat water for wet processing on its factory roof in Jordan. The system is composed of horizontal panels with multiple coiled glass tubes having a maximal surface area exposure to sunrays, covering some 250 m^2. Water flowing through the system is heated to 70° C and flows to the laundry, thus eliminating completely the need to operate the boiler during day time, over a period of seven months. This results in a saving of nearly 40% of the company's yearly diesel fuel consumption for the boiler. More recently, the company Nur Solar System, has installed a solar system in an aluminium factory. The solar heat system helps the existing heat system (a steam boiler working 4 hours a day) to feed in coils circulating in four basins in order to generate the required heating temperature inside these basins (in the range of 40-60°C). The solar system supports the steam boiler by heating the basins from their cold temperature to as high as 50°C. According to Nur Solar System, the pay-back period of such installation is only 10 months.

Market figures

There are 3 manufacturers operating in the country, 10 retailers and 13 installers. It is estimated that 30% of total sales are products imported.

Certification and standards

Only few actors are following the specifications established by the Royal Scientific Society (RSS). Indeed, whereas the country has its own testing laboratories at the RSS, there are no effective regulations to enter in the market.

Table 9: Jordanian Standards related to solar thermal

Standard number	Description
JS 394:1999	Labeling of Solar Water Heater
JS 434:1999	Flat Plate Solar Collector: Construction Requirements
JS 435-1:1999	Test Method for Solar Collectors Part 1
JS 435-2:1999	Test Method for Solar Collectors Part 2
JS 1224-1:1999	Domestic Water Heating System: Part 1

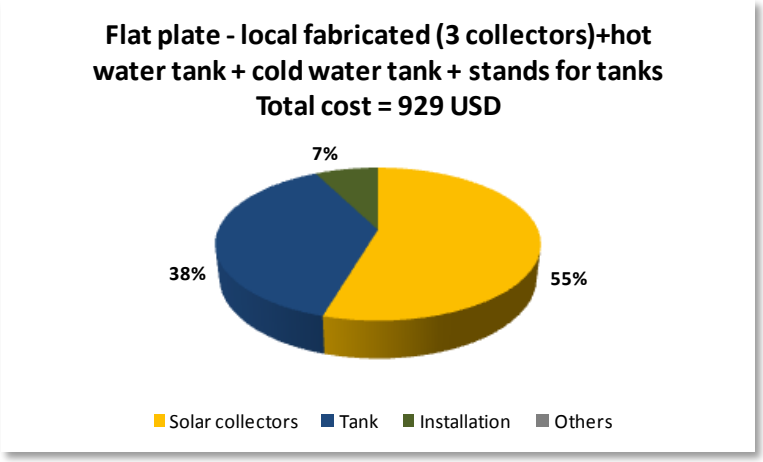
JS 1224-2:1999	Domestic Water Heating System: Part 2
JS 1224-3:1999	Domestic Water Heating System: Part 3

Source: H.Salloum, presentation at Regional Solar Thermal Workshop, Beirut 2012

System cost

According to NERC, the average system cost for a system (Flat plate - locally fabricated (3 collectors) + hot water tank + cold water tank + stands for tanks) is around USD 930. Solar collectors and tank represent more than 90% of the total cost of the system.

Figure 18: Average cost of systems in Jordan [individual, residential market]



Source: NERC

3.1.4.4. Main industry actors in ST field

There is no solar thermal industry association in the country. Below are the main actors operating in the solar thermal field:

Table 10: Main actors in the Jordanian solar water heaters industry

Name	Contact	Type
Hanania	web: www.hanania.jo	Manufacturer
Nur Solar system	web: www.nursolarsys.com	Manufacturer
Alkan For Solar Systems	n/a	Importer
EDOM for renewable energy technology	n/a	Manufacturer, exporter, importer, distributor
Izzat Marji Group	web: web: www.marji.jo	retail sales, wholesale supplier, importer
Jordan Central Company PLC	n/a	importer
Millennium Systems for Advanced Technologies	n/a	Retail sales, wholesale supplier, exporter
Modern Environment Solar Technology Co.	n/a	retail sales, wholesale supplier, importer
Modern Times International for Energy Systems	n/a	retail sales

Sources: internet

3.1.5. *Lebanon*

3.1.5.1. Socio-economic and energy context

Figure 19: Lebanese indicators

Socio-economics [2010]		
Population	4 228	*[Thousands]*
Urban population	87,1%	*[%]*
GDP	52	*[billionUSD_{2005}, PPP]*
GDP/pop.	12 190	*[USD_{2005}/cap, PPP]*
HDI rank 2011 [rank 2000]	71 [75]	*[rank]*
Energy [2010]		
Energy production	0,2	*[Mtoe]*
Net Trade	-6,4	*[Mtoe]*
TPES	6,6	*[Mtoe]*
Fossil share (TPES)	95,0%	*[%]*
Fossil Fuel Dependance	100,00%	*[%]*
TFC	5,2	*[Mtoe]*
TPES/pop.	1,57	*[toe/cap]*
TPES/GDP (PPP)	0,13	*[toe/USD_{2005}]*
Installed Capacity	2 312	*[MW]*
Electricity Generation	11 822	*[GWh]*
Electricity Consumption	15 000	*[GWh]*
Elec. Consump./pop.	3 548	*[kWh/cap]*
CO_2 emissions	19	*[Mt]*
CO_2/pop.	4,40	*[CO_2/cap]*
CO_2/TPES	2,81	*[tCO_2/toe]*
CO_2/GDP (PPP)	0,36	*[tCO_2/000 USD_{2005}]*
Renewable Energy [2010]		
RE in TPES	0,2	*[Mtoe]*
RE share in TPES	3%	*[%]*
RE in Final Energy Consumption	0,1	
RE in Final Energy Consumption (residential)	0,0	[Mtoe]
RE in Final Energy Consumption (industry)	0,0	[Mtoe]
RE in Final Energy Consumption (transport)	0	[Mtoe]
RE in Final Energy Consumption (Other)	0	[Mtoe]
RE Electricity generation	622	*[GWh]*
RE installed capacity	274	[MW]
RE in total installed capacity	12%	*[%]*
RE in total installed capacity (excluding hydro)	0%	*[%]*

The Lebanese population amounted to 4.2 million inhabitants in 2010. According to UN population prospects, the population will reach more than 4.7 million by 2030 with an increasing share of the population living in the urban area from 87% to 89%.

GDP is around USD_{2005} 52 billion (PPP) and GDP per capita reached 12,200 USD/cap. in 2010 thanks to a continuous growth of around 3.6 %/year since the 1970's.

Lebanon is importing almost all the energy it consumes and its energy consumption is highly dependent on fossil fuels (95%).

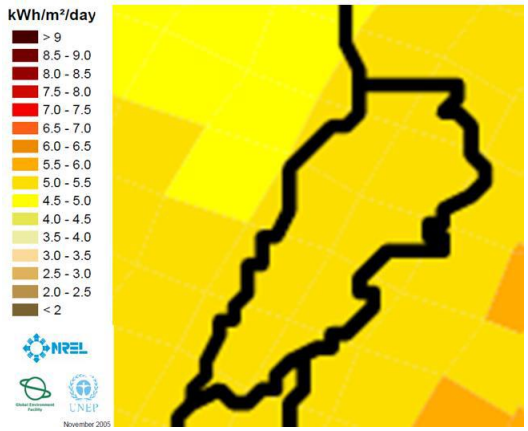
In 2010, the total installed capacity of renewables for electricity generation amounts to 274 MW of hydro power plants.

Energy subsidies

The government heavily subsidizes electricity. These grants totalled USD 1.2 billion in 2007 (17% of state expenditure) and USD 1.45 billion in 2009, representing a subsidy of USD 11.4 cents/kWh in 2007 and USD 12.7 cents/kWh in 2009[19].

Renewable energy resources

Figure 20: Global Horizontal Irradiance in Lebanon



Lebanon has an average daily global horizontal radiation of 4.8 kWh/m² (from 2 kWh/m²/d in December to almost 8 kWh/m²/d June/July) and a yearly sunning period of about 3,000 hours.

Source: SWERA

[19] http://www.planbleu.org/publications/energie_cc_batimentFR.pdf, p71

3.1.5.2. Solar thermal legislative and regulatory framework

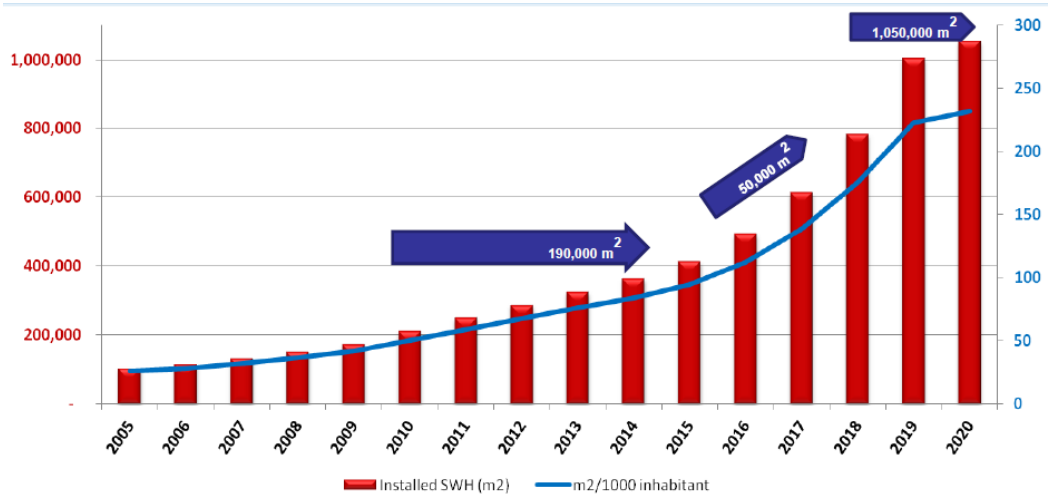
Solar water heating installations started to penetrate the market in Lebanon in the early 1990s. The market is expanding thanks to incentive mechanisms which include low interest rate credit offered by private banks. Within the GSWH initiative, of which Lebanon is beneficiary, the objectives are: 1) to facilitate the installation of 190,000 m^2 of new installed collector area over the period 2009-2014; 2) to facilitate an annual sale of 50,000 m^2 reached by the year 2014; 3) To have a continuing growth to reach the set target of 1,050,000 m^2 of total installed SWH capacity by 2020. In addition, a financing mechanism called NEEREA (National Energy Efficiency and Renewable Energy Action) has been set up, which was initiated by the Central Bank of Lebanon in collaboration with the Ministry of Energy and Water, UNDP, and the LCEC. NEEREA offers loans for SWH installation with 0% interest rate and a repayment period of 5 years (starting from 2010). Finally, a national consultation is ongoing in order to change and update the building code for Lebanon to include mandatory installation of solar water heaters in new buildings.

In addition, qualification criteria for SWH companies working in Lebanon have been set up and a USD 200 grant by MEW is only applicable to qualified SWH companies. The list of qualified companies has become a reference list for all banks.

3.1.5.3. Solar water heater market

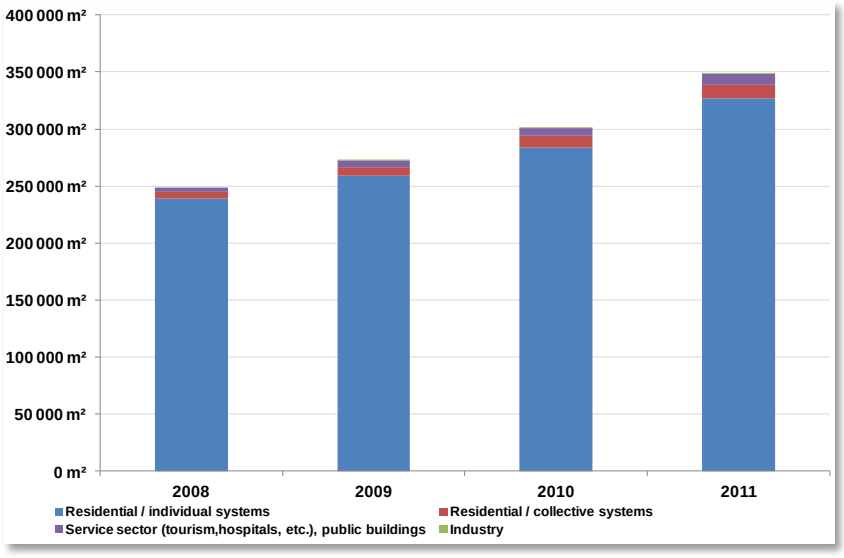
The market of SWH in Lebanon is growing up since the last years. From around 249,000 m^2 by the end of 2008 it reached 349,000 m^2 by the end of 2011 (Figure 22), with 71 systems/1000 inhabitants or 60 m^2/1000 inhabitant.. Thanks to the incentive mechanisms put in place, more than half of the target has been completed in three years representing a market growth of about 40%. In 2011, new 43 500 m^2 has been installed.

Figure 21: SWH installed capacity and perspectives



Source: Nader Hajj Shehadeh, the SWH Market in Lebanon: A Massive Market Transformation, Solar Thermal Workshop in the Mediterranean region, 20-21 March, Tirana, 2013.

Figure 22: Lebanese installed solar water heater collectors' area, 2008-2011



***Source: P. El Khoury, General Description of the National SWH Programme in Lebanon: Achievements and Barriers,* Regional Solar Thermal Workshop, Beirut 2012**

Individual systems in the residential sector represent 94% of the market (327,000 m²), the remaining capacity being shared between collective systems in the residential sector (12,100m²), the systems in the industrial sector (175 m²) and the service sector (9,250 m²).

Flat-plate collectors represent 62% of the market, and thermosyphon systems are estimated to be 85% of the total systems. 69% of the systems installed as part of the national financing mechanism are vacuum tubes systems while 29% are flat plate systems.

SHIP applications

Lebanon has used the Clean Development Mechanisms (CDM) as an opportunity to finance small scale solar process heating installations. The project consists of a solar based steam production system using a 10.3 MWth CSP plant at the Zeenni Trading Agency in the city of Bsarma.

Market figures

In 2011, the national market turnover is estimated to amount to USD 18 131 183 million, with an important share of imports (87%) in the total sales of SWH systems.

Certification and standards

As far as quality is concerned, a testing facility was established at the Industrial Research Institute of Lebanon in 2011 within the framework of a project entitled "Renewable Energy Applications via the Installation of Testing and Measurements Facility of Solar Collectors with Simultaneous Transfer of Know-How" (joint collaboration between Hellenic Aid, CRES and UNDP Lebanon). Mandatory standards for SWH were adopted by the LIBNOR (Lebanese Institute for Norms and Standards).

Table 11: Lebanese Standards related to solar thermal

Standard number	Description
NL EN 12975 Part 1	Thermal solar systems and components - Solar collectors: General requirements
NL EN 12975 Part 2	Thermal solar systems and components - Solar collectors: Test methods
NL EN 12976 Part 1	Thermal solar systems and components - Factory made systems: General requirements
NL EN 12976 Part 2	Thermal solar systems and components - Factory made systems: Test methods
NL ENV 12977 Part 1	Thermal solar systems and components - Custom built systems: General

	Requirements
NL ENV 12977 Part 2	Thermal solar systems and components - custom built systems: Test methods
NL ENV 12977 Part 3	Thermal solar systems and components - custom built systems: Performance characterization of stores for solar heating systems

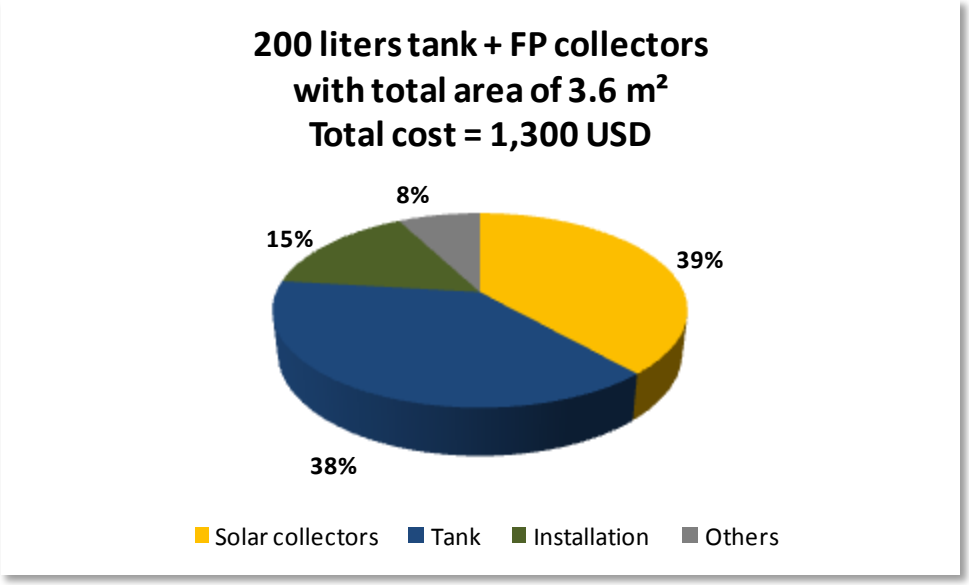
Source: H.Salloum, presentation at Regional Solar Thermal Workshop, Beirut 2012

The National Solar Water Heating Companies (SWHCOs) Qualitification. Out of 110 SWH companies, 53 are qualified by the Lebanese Center for Energy Conservaton (LCEC).

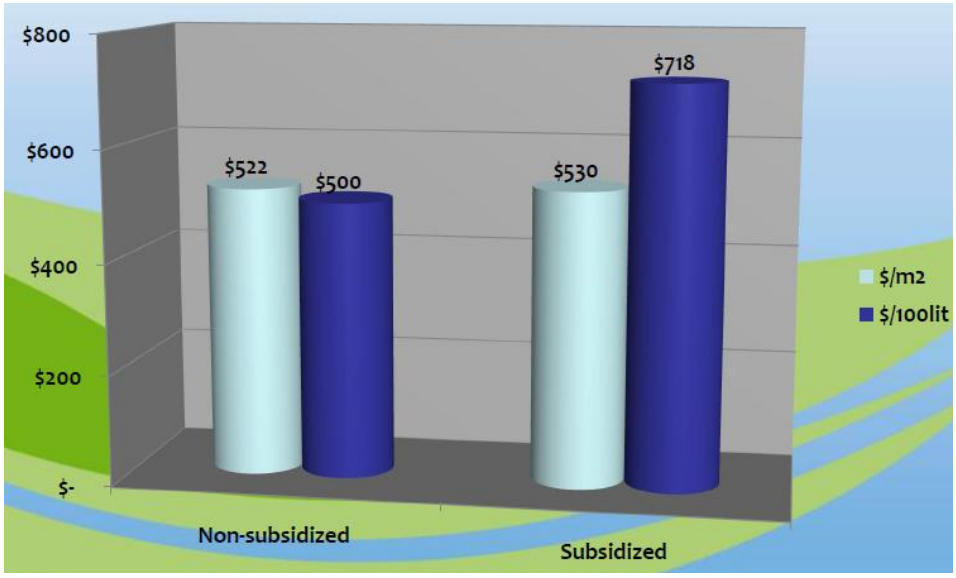
System cost

According to LCEC, LSES and IRI, the average system cost for a system of 3.6 m² of Flat-plate collector with a 200 litres water tank is around USD 1,300. Solar collectors and tank represent 77% of the total cost of the system.

Figure 23: Average cost of systems in Lebanon [individual, residential market]



Sources: LCEC, LSES, IRI



Source: Nader Hajj Shehadeh, the SWH Market in Lebanon: A Massive Market Transformation, Solar Thermal Workshop in the Mediterranean region, 20-21 March, Tirana, 2013.

3.1.5.4. Main industry actors in ST field

There is an industry association called “Lebanese Association of Solar Industrialists” (LASI). The Lebanese Center for Energy Conservation carried out during the last months several studies on solar thermal market and compiled a list of Solar thermal Companies (Table 12) acting in Lebanon. In 2011, the estimated number of manufacturers was 12, retailers were about 100 and installers 105.

Table 12: Main Lebanese actors in the solar water heaters industry

Name	Contact	Type
Adaco	email: adaco@cyberia.net.lb	
Al bina	email: albina@albinagroup.com web: www.albinagroup.com	
Al diyar for engineering & contracting & trade	email: awada1958@yahoo.com	
Al-rida	n/a	
Alternative energy	email: sales@altaka-albadila.com web: www.altaka-albadila.com	
Aqua solar	email: michel_kh@hotmail.com; aqua.solar@hotmail.com	
Aquapro	email: aquapro@terra.net.lb	
AQUATHERMA Engineering S.A.R.L	web: www.aquathermaeng.com	retail sales, wholesale supplier, exporter, importer, distributor
Asalea trading and contracting sarl	email: info@asalea.net web: www.asalea.net	
Avb – energy & water solutions	email: bedros@avbenergy.com	
Avs	email: fassafiri@gmail.com	
Awatef for general trading	email: awatef13@hotmail.com	
axiome	marc@axiome-sarl.com	
Black box	email: mark@blackboxcontrol.com web: www.blackboxcontrol.com	
Century tech	email: centurytech.century@googlemail.com	
Chafic bou younes & co. S.a.r.l	email: info@bouyounes.com	
Climapure	email: info@climapure.com web: www.climapure.com	
Contra international	email: basselb@contraintl.com web: www.contraintl.com	
Dawtec	email: dawtec@dawtec.com web: www.dawtec.com	
Decoflam	email: jomaanashaat@gmail.com	
Dk energy systems	email: info@dkenergysystems.com web: www.dkenergysystems.com	
Earth technologies	email: info@earthtechnologies-me.com web: www.earthtechnologies-me.com	
Eco friendly sarl	web: www.ecofriendlyme.com.lb	
Ecosun	email: eco-sun@hotmail.com	
Ecosys	email: g.geha@itg.com.lb ; e.maalouf@ecosys.com.lb ; info@ecosys.com.lb web: www.ecosys.com.lb	
Electro mechanic est	email: ezzeddinefactory@hotmail.com	
Elements (sun and wind)	web: www.elementssw.com	

Emarts	email: ffarage@emarts.biz; tzaatar@emarts.biz web: www.emarts.biz	
Enercom	ener.com@hotmail.com	
Est. Joseph ziade pour le commerce	email: ziadeh_co@hotmail.com; ziade.alain@gmail.com	
Est. Khalil sleiman	email: eks@hotmail.ca	
Ets.Adib Bahnam	email: bahnam@cyberia.com.lb	
Fakih		
Falcon win trading	email: f-w-t@hotmail.com web: www.falconenergy-lb.com	
Fares Molaeb Company	n/a	
Fayez abou el sheikh	email: gm@fasco-lb.com	
Free sun	web: www.freesun.com.lb	Manufacturer
General organization for trade	email: walidbteddinycenter@hotmail.com	
Georges khoury & co	email: josephe@gkhoury.com web: www.gkoury.com	
Ghaddar commerce and construction	email: zouhourg@hotmail.com	
Ghaddar trade & industry	email: redaghad@inco.com.lb	
Gmg tabbouch sarl	email: mikaelyazbek@hotmail.com web: www.gmgsolarenergy.com	
Green alternative power sources	email: kmerwan@yahoo.com	
Green arms lebanon SARL	email: info@greenarms.co.uk web: www.greenarms.co.uk	
Greendot	web: www.greendotme.com	
Green energy ntc est	email: gtourch2@hotmail.com	
Green energy project SARL	email: manager@greenprojectlb.com web: www.greenprojectlb.com	
Hadatec	email: hadatec@live.com web: www.hadadec.com	
Hage group	email: info@hagegroup.com web: www.hagegroup.com	
Hatoum	email: chark_2011@hotmail.com	
Hijazi trade and industry	email: aheido54@gmail.com web: www.hijazitrade.com	
Houssam rifai and partners co for general trading	email: hassanrifai2@gmail.com	
Ismail ibrahim salloum	email: salloum_general@hotmail.com	
Itany company for trade & industry	email: star20@inco.com.lb web: www.schmellerwaterheaters.com	
Jf group	email: jfgrp@hotmail.com	
Kevork kouladjian	email: office@greentech.com.lb web: www.greentech.com.lb	
Khoueiry for trading and contracting	email: solary_tc@live.com	
Khoury & abou rjeily group	email: Naji@synergy-greenliving.com web: www.synergy-greenliving.com	
Kanaan trading	email: info@solarworld.com.lb web: www.solarworld.com.lb	
Kodorat	email: rabih@kodorat.com web: www.kodorat.com	
Lebeco sal	email: lebeco2000@hotmail.com	

Libanciel S.A.R.L	email: info@libanciel.co web: www.libanciel.co	
Mawared & construction co	email: info@kyprossolar.com web: www.kyprossolar.com	
Mecatech	email: mecatech@mecatechwater.com	
Mecha basics industries	email: zadaco@gmail.com web: www.mecha-basics.com	
Mediterranean for alternative technology and commerce	email: hec.company@yahoo.com web: www.mefalco.com	
Mesmo zreik	email: zreikw@inco.com.lb	
Metacs	email: metacs@metacs.com web: www.metacs.com	
Middle east green energy	email: lara.elkhoury@me-greenenergy.com web: www.me-greenenergy.com	
Monaco global	email: ontop_group@yahoo.com.au web: www.monaco-global.com	
Nakkouzi	email: nakouzico@hotmail.com	
Nassif trading	email: bachir.nassif@gmail.com	
National energy consultants (nec)	email: Ronald@nec-group.com web: www.mec-group.com	
Naturenergy	email: gilbert@skyenergies.com web: www.skyenergies.com	
Phoenix group	email: energy@phoenixlb.com web: www.phoenixlb.com	
Rafale trading	email: info@rafaletrading.com	
Red Tops	email: redtops@inco.com.lb	
Renewable med energies	email: ziad.doumit@rmenergies.com web: www.renewablemed.com	
Rivage Sarl	email: rivagesarl@gmail.com	
Saab international	email: roger.saab@saab-intl.com web: www.saab-intl.com	
Saad el-deen general trade establishment	email: specialheat@hotmail.com web: www.saad-el-deen.com	
Sabbagh trading	email: sabbagh-trade@freesun.com.lb web: www.freesun.com.lb	
Sader Est.	email: georgesader@gmail.com	
Salem International Group	web: www.siglb.com	importer
Sawan solar systems	email: sawan_est@hotmail.com web: www.sawansolarsystems.com	
Sensus international	email: mchehab@antakigppk.com web: www.haierlb.com	
Servicom ecosol	email: info@ecosol-lb.com web: www.ecosol-lb.com	
Skaff	n/a	
Sky Energies	email: gilbert@skyenergies.com	
Sofaya	email: michaelmoussa@hotmail.fr	
Solair watt s.a.r.l.	email: info@solairwatt.com web: www.solairwatt.com	
Solar power	email: rawadhaj@hotmail.com	
Solar solutions	email: jihadghorra@hotmail.com	
Solar tech by al shams group	email: suneshine75@hotmail.com web: www.solartech-lb.com	
Solaris super solar	email: info@supersolarheater.com	

water heater	web: www.supersolarheater.com	
Solarleb	email: info@solarleb-lb.com web: www.solarleb-lb.com	
Solarnet	email: info@solarnet-online.com web: www.solarnet-online.com	
Solartech sarl	web: www.solarteclb.com	
Solec energy	email: alain.azar@solec-energy.com web: www.solec-energy.com	
Soltech lebanon	email: soltech_lebanon@live.com	
Ste. Techno systems sarl	email: sales@technosystems-lb.com web: www.technosystems-lb.com	
Sun island	email: ziad_sunisland@hotmail.com web: www.Sunisland.com.lb	
Sun power	email: sunpower_lebanon@hotmail.com; dany@sunpowerlb.com web: www.sunpowerlb.com	
Sun shining company	email: afif_fadel@hotmail.com	
Tabbara general company	email: ziad@tabbara-general.com web: www.tabbara-general.com	
Takat general trading est	email: deeb_youssef@hotmail.com	
Technicorp sal	email: info@technicorp.net	
Techno mass	email: info@techno-mass.com web: www.techno-mass.com	
Tfaily solar energy	email: sunshine_solar@hotmail.com	
Universal energy	email: energy_universal@yahoo.com	
Wadco establishment	email: Optosolar@hotmail.com	
Webco	email: webco@cyberia.net.lb	
Wehbe technologies	email: jeanwehbe@gmail.com	
White water	email: whitewater660@gmail.com	
Younes group	email: younes_group@hotmail.com	
Zein international	email: contact@zeinsolar.com web: www.zeinsolar.com	

Sources: ALMEE, LSES, internet

3.1.6. *Libya*

3.1.6.1. Socio-economic and energy context

Figure 24: Libyan indicators

Socio-economics [2010]		
Population	6 355	*[Thousands]*
Urban population	77,6%	*[%]*
GDP	82	*[billionUSD 2005 , PPP]*
GDP/pop.	12 897	*[USD 2005/cap, PPP]*
HDI rank 2011 [rank 2000]	64 [64]	*[rank]*
Energy [2010]		
Energy production	98,4	*[Mtoe]*
Net Trade	79,3	*[Mtoe]*
TPES	19,2	*[Mtoe]*
Fossil share (TPES)	99,1%	*[%]*
Fossil Fuel Dependance	-417,23%	*[%]*
TFC	10,4	*[Mtoe]*
TPES/pop.	3,02	*[toe/cap]*
TPES/GDP (PPP)	0,23	*[toe/USD 2005]*
Installed Capacity	6 560	*[MW]*
Electricity Generation	28 125	*[GWh]*
Electricity Consumption		*[GWh]*
Elec. Consump./pop.	0	*[kWh/cap]*
CO_2 emissions	40	*[Mt]*
CO_2/pop.	6,29	*[CO 2/cap]*
CO_2/TPES	2,08	*[tCO 2/toe]*
CO_2/GDP (PPP)	0,49	*[tCO 2/000 USD 2005]*
Renewable Energy [2010]		
RE in TPES	0,2	*[Mtoe]*
RE share in TPES	1%	*[%]*
RE in Final Energy Consumption	0,2	
RE in Final Energy Consumption (residential)	0,2	[Mtoe]
RE in Final Energy Consumption (industry)	0,0	[Mtoe]
RE in Final Energy Consumption (transport)	0	[Mtoe]
RE in Final Energy Consumption (Other)	0	[Mtoe]
RE Electricity generation	0	*[GWh]*
RE installed capacity	0	[MW]
RE in total installed capacity	0%	*[%]*
RE in total installed capacity (excluding hydro)	0%	*[%]*

Libyan population amounts to 6.4 million inhabitants. According to UN population prospects, the population will reach more than 7.8 million by 2030 with an increasing share of the population living in the urban area from 77% to 82%.

GDP is around USD_{2005} 82 billion (PPP) and GDP per capita reached 12,900 USD/inhab. in 2010 thanks to a continuous growth of around 3.7 %/year since the 1970's.

Libya is an energy exporter (Net trade of about 80 Mtoe) and its energy consumption is almost exclusively based on fossil fuels (more than 99%).

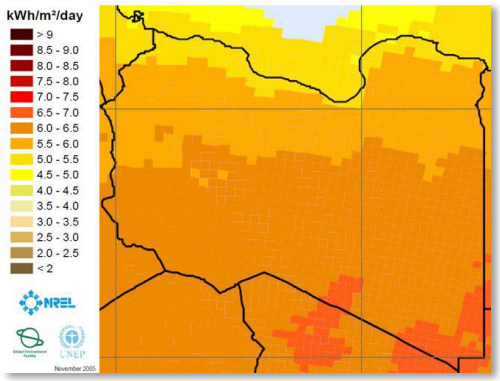
Renewables are not developed yet, mainly because of the high reserves in fossil fuels.

Energy subsidies

According to IEA,, Libya devoted USD 3.13 billion in 2011 to energy subsidies of which USD 0.66 billion to electricity, the remaining part dedicated to fuels.[20] These grants represent, according to the same data, 8.5% of Gross Domestic Product (GDP) of Libya, which devotes more than $ 487 per person to energy subsidies.

Solar energy resources

Figure 25: Global horizontal Irradiance in Libya



The daily average of horizontal solar radiation is 7.1 kWh/m²/day in the coastal region, and 8.1 kWh/m²/day in the southern region, with an average sun duration of more than 3,500 hours per year (Figure 25).

Source: SWERA

[20] http://www.iea.org/subsidy/index.html; Analyses based on an indicator average price of crude oil on the international market (30 U.S. cents per litre in 2010) and IEA estimates

3.1.6.2. Solar thermal legislative and regulatory framework

At present there is no specific legislation focusing on solar thermal, and no energy regulator. The Renewable Energy Authority of Libya (REAOL) has set the goal of reaching 10% of energy supply from renewable energy resources by the year 2020. The plan also includes developing a joint venture with local and foreign investors for the manufacturing of solar water heaters (40,000 units/year). Some programmes are ongoing to install solar water heaters in the residential sector. However, no mandatory targets have been set.

The Centre for Solar Energy Studies (CSES) carries out studies and research programmes in the field of solar energy and proposes plans for wider use of solar energy.

3.1.6.3. Solar water heater market

The use of solar heaters started in 1983 with a pilot project which included 10 systems. Since then, it is estimated that around 8,000 solar water heaters were installed up to 2007 in Libya. An estimated installed capacity of 11,000 m^2 is installed in 2012.

The first programme was initiated by the government and a contractor undertook the work on a turn-key basis. Another Governmental Project was implemented in the early 1980's in the city of Marge, 100 km east of Bengazi, with 2000 units of 160 litres/2m² open loop, imported from Cyprus. In 1983, 35 units of 200 litres/3m² open loop were imported from Japan - "Hitachi" and installed within an “Evaluation Project” in the southern part of the country. In 1993, a local manufacturer under the brand name "Shams" has signed a contract with a manufacturer from Jordan for 3000 units of 100 litres/1.4m² open loop. The company which assembled them is government-owned and does not deal with the production of solar systems, but it is a steel construction and spare parts company. A part of its activities in 1993 was the assembly of those 3000 small solar SWH units, as a trial operation.

Between 1994 and 1996, a large Integrated Project for the demonstration, field test and transfer of SWH technology was developed with a budget of 350.000 Libyan Dinars. This project was initiated by the CSES, which performed the evaluation, quality control and testing of 300 imported SWH according to local operational and meteorological conditions. Market studies and awareness campaigns were also associated to the programme.

Currently, SWH programmes are established by the government. However, some manufacturing industries do exist in Libya. There is a number of well equipped factories and workshops, e.g. the National Company of Metal Works in Tripoli Misurata, the Central Workshops in Tripoli and Benghazi and the plants of the Engineering Industries Authority, as well as a large number of smaller private workshops.

To ensure a more sustainable energy future, Libya is concerned about the development of a SWH market. To boost the use of solar thermal systems, the government is planning to launch a programme which is aiming at installing solar water heating systems in the residential sector, as well as in schools and mosques. An overall amount of 10 million USD is foreseen. The first 3 million USD should be committed already in 2012. A first call for tenders for the installation of 3,000 solar systems in the residential sector has been prepared and sent to potential bidders. The aim was to finalise the contract by October 2012. Another tender was planned to be launched by the end of the first quarter of 2013.

To accompany this market evolution and ensure the quality of products, a new testing facility was also established in the country.

System cost

The cost of a system ranges between 3700 and 4500 Libyan Dinar (1 LYD equals to 0.8 USD).[21]

[21] Ministry of the Electricity and Renewable Energy.

3.1.7. *Morocco*

3.1.7.1. Socio-economic and energy context

Figure 26: Moroccan indicators

Socio-economics [2010]		
Population	31 951	*[Thousands]*
GDP	118	*[billionUSD 2005, PPP]*
Urban population 2010	56,7%	*[%]*
HDI rank 2011 [rank 2000]	130 [123]	*[rank]*
Energy [2010]		
Energy production	1,3	*[Mtoe]*
Net Trade	-14,8	*[Mtoe]*
TPES	16,1	*[Mtoe]*
Fossil share (TPES)	87%	*[%]*
Dependance	92%	*[%]*
TFC	11,7	*[Mtoe]*
TPES/pop.	0,51	*[toe/cap]*
TPES/GDP (PPP)	0,14	*[toe/USD 2005]*
Installed Capacity	6 344	*[MW]*
Electricity Generation	22 851	*[GWh]*
Electricity Consumption	26 531	*[GWh]*
Elec. Consump./pop.	830	*[kWh/cap]*
CO_2 emissions	47	*[Mt]*
CO_2/pop.	1,48	*[CO_2/cap]*
CO_2/TPES	2,92	*[tCO_2/toe]*
CO_2/GDP (PPP)	0,40	*[tCO_2/000 USD 2005]*
Renewable Energy [2010]		
RE in TPES	1,1	*[Mtoe]*
RE share in TPES	7%	*[%]*
RE in Final Energy Consumption	0,5	[Mtoe]
RE in Final Energy Consumption (residential)	0,4	[Mtoe]
RE in Final Energy Consumption (industry)	0,1	[Mtoe]
RE in Final Energy Consumption (transport)	0	[Mtoe]
RE in Final Energy Consumption (Other)	0	[Mtoe]
RE Electricity generation	4 290	*[GWh]*
RE installed capacity	2 070	[MW]
RE in total installed capacity	33%	*[%]*
RE in total installed capacity (excluding hydro)	7%	*[%]*

Morocco is the third most populated country among the SWMCs with 32 million inhabitants. According to UN population prospects, the population will reach more than 37 million by 2030 with an increasing share of the population living in the urban area. GDP is around USD_{2005} 118 billion (PPP) and GDP per capita reached 3,690 USD/inhab. in 2010 thanks to a continuous growth of around 3.9%/year since the 1970's. The energy demand is expected to grow due to improved standards of livings and its accompanied use of more electric devices.

Morocco - which is a non-oil-producing country - is faced with serious energy constraints due to its almost total dependence (around 92%) on imported energy and the high share use of fossil fuels in its consumption (around 87%).

Importing such amount of energy has a heavy impact on the energy bill, which represents a large portion of the country's budget[22] and thus the country is highly vulnerable to the price fluctuations in the global prices of energy commodities.

Power generating capacity amounts 6,544 MW, of which 2,000 MW is renewable (mainly hydro with around 1,700 MW). In 2010, 280 MW of wind power was installed and 20 MW of CSP (ISCC plant of Beni Mathar). Electricity generation amounts around 23 GWh, most of it coming from fossil fuel sources, and the electricity demand reaches 26.5 GWh, leading Morocco to import electricity mainly from Spain.

Energy subsidies

Energy in the country is subsidised through a Compensation Fund. The Government of Morocco provides subsidies on both LPG and diesel through a system of official prices and refunds to petroleum companies to recover the wholesale price. The prices for both products are fixed by the government, at 3.3 DH per kilogram for LPG and 7.5 DH per kilogram for diesel. The subsidy is equal to the difference between what would be the consumer price if it was the result of market forces and the government imposed price. The market prices fluctuate in line with prices on the international market. In addition, the fuel used by the Office National de l'Electricité (ONE) in its fossil plants is highly subsidised. Indeed, as ONEE (public entity) has not the control on the electricity selling price (it is fixed by ministerial decree), ONEE has no means to reflect the changes in international price of commodities to the consumer.

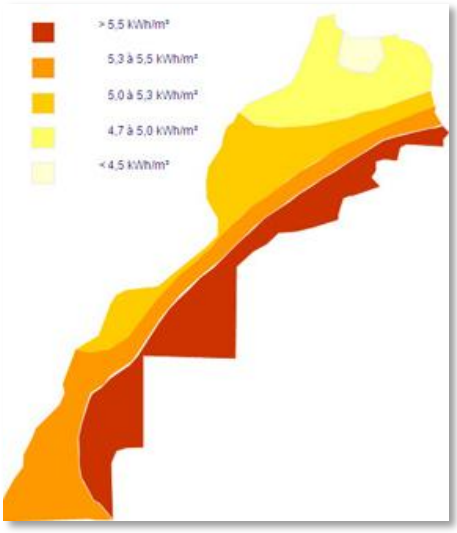
According to the Ministry of Energy, Mines, Water and Environment,[23] the total amount of subsidies dedicated to energy through the expenses of the Compensation Fund reached in 2011 around MAD 41 billion (€ 3.7 billion) and around MAD 48.2 billion in 2012.

[22] About 66 Milliards DH in 2010 according to Ministry of Energy and Mines, http://www.mem.gov.ma
[23] http://www.mem.gov.ma/publucations/Contribution%20Energie%20%20Mines%2027-12-2011.pdf

Solar energy resources

There is a high solar energy potential with a total sunshine hours ranging between 2,800-3,400 hour/year and an average annual global radiation reaching 4.5 in North to more than 5.5 kWh/m²/day in South (Figure 27).

Figure 27: Solar radiation in Morocco [kWh/m²]



Source: MASEN

3.1.7.2. Solar thermal legislative and regulatory framework

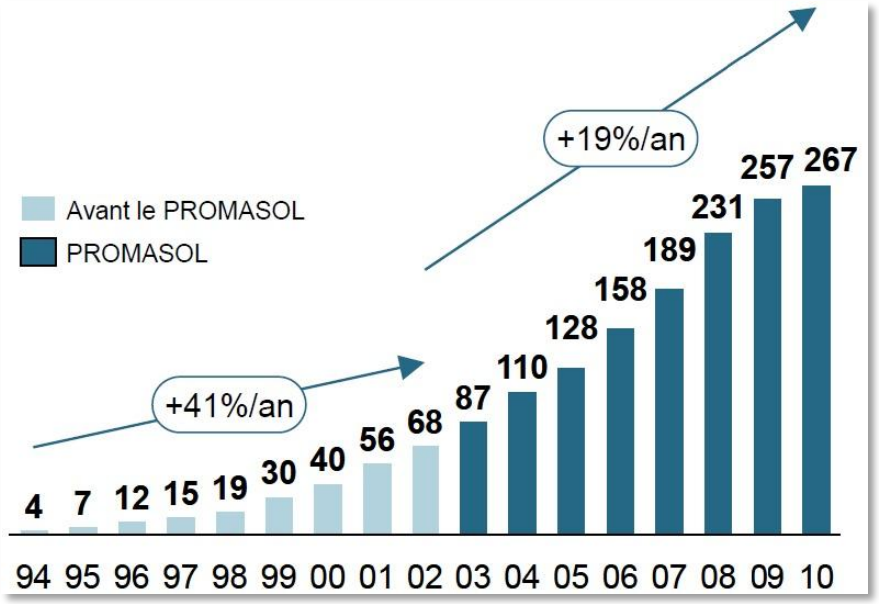
According to ADEREE[24], there are several incentives in Morocco as: a building code, tax reduction for consumers and a leasing facility, as well as grants foreseen in the near future. In addition, within the PROMASOL programme (2002-2008), some incentives were set in order to enhance solar thermal market in the country. The PROMASOL (Programme de développement du marché Maroccain des chauffe-eau Solaires) project was launched in 2002, as a joint initiative between CDER and UNDP, with the aim to boost the solar water heating market thanks to an incentive mechanism and several accompanying measures (labeling and non-binding approval issued by the laboratory CDER; VAT reduction from 20% to 14%; creation of a guarantee fund of EE&RE (FOGEER); awareness-raising programme). The objectives of PROMASOL are to have 440,000 m² of installed surface in 2012 and 1.7 million m² by 2020.

3.1.7.3. Solar water heater market

The SWH market in Morocco was given impulse with the implementation of the PROMASOL programme. The installed collector area grew from about 35,000 m² in 1998 to more than 265,000 m² in 2010 (Figure 28). The installed capacity reached around 340 000 m^2 in 2011 and 415 000 m^2 in 2012. Nevertheless, the real balance of the programme is difficult to assess. According to ADEREE about 8,000 m² per year have been installed thanks to the programme, with the rest coming from the natural growth of the market.

[24] Moroccan, country factsheet, Regional workshop for the Transformation and Strengthening of the Solar Water Heating Market in the Mediterranean, Beirut, April 2012

Figure 28: Cumulative SWH surface [1994-2010, thousand of m²] - Morocco



Source: ADEREE, 2012

As in several other Mediterranean countries, also the Moroccan solar water heating market is characterized by significant barriers hampering its growth, such as: fossil energy subsidies (particularly to Butane), which lengthens the payback time for a SWH system up to 16 years; lack of incentive programmes, weak promotion, reduced availability of space on the roofs (due to competition with satellite receivers and other equipments).

ADEREE is currently putting in place a programme called “SHEMSI” (National programme for SWH development) which aims at elaborating a strategy in order to develop the SWH market based on four pillars: financing, labelling, communication, regulatory and legislative framework. The aim of SHEMSI is to have a total installed capacity of 1.7 million m² by 2020 while nurturing the growth of a local industry based on two components: encouragement of local production (access to economic support depending on the share of local production) and quality development (development of binding quality standards allowing the access to economic support).

According to some analysis carried out by ADEREE, investment needed for installing SWH in new building could be compensated through the earnings coming from the avoided subsidies to butane. Indeed, 1 dirham invested by the State in SHEMSI would bring 4.3 dirham (USD 0.48) back, through the avoided subsidy to butane.

SHIP applications

Morocco has no SHIP installation up to now, but has considered the Clean Development Mechanisms (CDM) as an opportunity to finance small scale solar process heating installations. The project aims at producing steam for eight fish meal factories in Laâyoune from a solar plant using Fresnel technology plus hot water from flat-plate collectors. The project design document (PDD) has been submitted to the CDM Executive Board of the United Nations Framework Convention on Climate Change, but has not been yet registered.

Market figures

The most common used system in Morocco is the thermosyphon system, which represents 95% of the total installed systems. Regarding the collectors installed, flat-plate collectors are widely dominating the market with a share of about 95%.

The estimated annual market turnover in 2011 is around USD 25 Million, with an important share of imports in total sales (90%) and thus a low share of local manufacturing (10%) resulting in relatively high prices for SWH systems.

Certification and standards

Moroccan law No. 12-06 creating the Moroccan Institute for Standardization (IMANOR) came into force on 18 March 2011. The IMANOR resumes all activities performed by the Service de Normalisation Industrielle Marocaine (SNIMA), established in 1970 and placed under the authority of the Ministry of Industry, Trade and New Technologies.

The following table summarises the Moroccan standards related to solar thermal:

Table 13: Moroccan standards related to solar thermal

Standard number	Description
NM ISO 9488	Solar Energy Terminology
NM XX	Test Methods for Liquid Solar Collectors
NM YY	Test Methods for Domestic Solar Hot Water Heaters
NM 06-7-002	Domestic Electrical Apparatus
NM 06-7-003	Domestic Electrical Apparatus
NM 06-7-051	Anticorrosion Protection by Enamelling
NM 06-7-052	Hot Galvanization

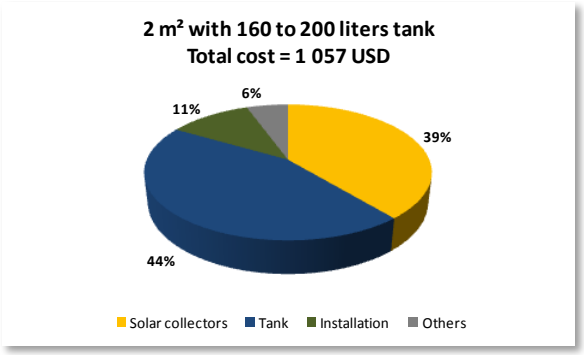
Source: H.Salloum, presentation at Regional Solar Thermal Workshop, Beirut 2012

Within the PROMASOL programme a non-binding label was proposed and the ADEREE (formerly CDER) was hosting two laboratories in charge of testing products and delivering the label certifying that the company's SWH system is compliant with the Moroccan norms. As of 2009, 13 brands of SWH were certified and received the label.

System cost

According to ADEREE and AMISOLE, the average system cost for a system of 2 m² of solar panels with a water tank in a range of 160 to 200 litres is around USD 1,060. Solar collectors and tank represent more than 80% of the total cost of the system.

Figure 29: Average cost of systems in Morocco [individual, residential market]



Sources: ADEREE, AMISOLE

3.1.7.4. Main industry actors in ST field

Most of the actors acting in the solar thermal market in Morocco are integrated companies (installation, distribution and maintenance activities). It is estimated that there are 50 retailers and about 200 installers established in the market. There are also two manufacturers which are: Event Solaire Maroc SARL (German company established in Morocco: www.event-solar.com) and Giordano Maroc.

In 1987, renewable energy actors in Morocco established AMISOLE (Association Marocaine des Industries Solaires et Eoliennes - Moroccan Association of Solar and Wind Industries – www.amisole.com) to advocate their interests and develop the renewable energy industry. AMISOLE aims to have a continuous lobbying action with public players. AMISOLE is not focusing only on solar thermal matters but also on photovoltaic and wind business.

Table 14: Main actors in the Moroccan solar water heater industry

Name	Contact	Type
AG Energie	email : agenergie@menara.ma	Supplier
Batitherm	email : batitherm@batitherm.com	Supplier
Chaffoteaux	email : olivier.bougler@chaffoteaux.com	Supplier
Clean Energie	email : clean_energies@wanadoo.ma	Supplier
Energetica	email : energet@menara.ma web : www.energetica.ma	Supplier
Energies continues	email : energies@menara.ma	Supplier
Energie Innovation	email : khalid.chekkouri@gmail.com	Supplier
Energy Poles	email : eouaknine@energypoles.com	Supplier
First Metal	email : firstmetal.z@gmail.com	Supplier
Giordano Maroc	email : giordanomaroc@menara.ma	Manufacturer, supplier
H2 Energy	email : aboussaid@h2energy-maroc.com; h.hoedt@h2energy-maroc.com	Supplier
Isofoton Maroc	email : m.attoumane@isofoton.ma	Supplier
Itri Environment	email : chris@solairemaroc.com	Supplier
Myfac	email : ababou.khalil@menara.ma	Supplier
Noorweb	email : hadi.berrada@noorweb.ma	Supplier
NRJ International	web : www.nrj.ma	Supplier
Phototherm	email : boudad@menara.ma	Supplier
Sisteclen	email : bazi@sisteclen.com	Supplier
Sococharbo	email: l.aitali@hotmail.com; sococharbo@casanet.net.ma.	Supplier

Solargie	email : hbaiz@solargie.ma	Supplier
Sunlight Power Maroc	email : dgspm@menara.ma	Supplier
Kefal	n/a	Supplier
Temasol	email : k.semmaoui@tenesol.com	Supplier
Tropical Power	http://www.tropicalpower.net	Supplier
Event Solaire Maroc	Web : www.event-solar.com	Manufacturer
Atlas Energy Solaire	Web : www.atlassolaire.com	Supplier

Sources : AMISOLE, internet

3.1.8. *Palestine*

3.1.8.1. Socio-economic and energy context

Figure 30: Palestinian indicators

Socio-economics [2010]		
Population	4 039	*[Thousands]*
Urban population	74,1%	*[%]*
GDP	4	*[billionUSD 2005, PPP]*
GDP/pop.	999	*[USD 2005/cap, PPP]*
HDI rank 2011 [rank 2000]	114 [n/a]	*[rank]*
Energy [2010]		
Energy production	0,4	*[Mtoe]*
Net Trade	-1,3	*[Mtoe]*
TPES	1,7	*[Mtoe]*
Fossil share (TPES)	59,5%	*[%]*
Fossil Fuel Dependance	100,00%	*[%]*
TFC	1,6	*[Mtoe]*
TPES/pop.	0,41	*[toe/cap]*
TPES/GDP (PPP)	0,41	*[toe/USD 2005]*
Installed Capacity	n/a	*[MW]*
Electricity Generation	n/a	*[GWh]*
Electricity Consumption	n/a	*[GWh]*
Elec. Consump./pop.	n/a	*[kWh/cap]*
CO_2 emissions	3	*[Mt]*
CO_2/pop.	0,62	*[CO 2/cap]*
CO_2/TPES	1,50	*[tCO 2/toe]*
CO_2/GDP (PPP)	0,62	*[tCO 2/000 USD 2005]*
Renewable Energy [2010]		
RE in TPES	0,4	*[Mtoe]*
RE share in TPES	23%	*[%]*
RE in Final Energy Consumption	0,4	
RE in Final Energy Consumption (residential)	0,4	[Mtoe]
RE in Final Energy Consumption (industry)	0,0	[Mtoe]
RE in Final Energy Consumption (transport)	0	[Mtoe]
RE in Final Energy Consumption (Other)	0	[Mtoe]
RE Electricity generation	n/a	*[GWh]*
RE installed capacity	n/a	[MW]
RE in total installed capacity	n/a	*[%]*
RE in total installed capacity (excluding hydro)	n/a	*[%]*

Palestinian population amounts to 4 million inhabitants. According to UN population prospects, the population will reach more than 6.8 million by 2030 with an increasing share of the population living in the urban area from 74% to 78%.

GDP is around USD_{2005} 4 billion (PPP) and GDP per capita reached 1,000 USD/inhab. in 2010.

Palestine is an energy importer (Net trade of about -1.7 Mtoe) and its energy consumption is highly dependent on fossil fuels (around 60%), and 100% of its needs of fossil fuels is imported.

Except solar thermal in the residential sector, renewables are not really developed.

Energy subsidies

The consumer prices of electricity in Palestine is one of the most expensive in the region since almost all energy consumed is imported and it is heavily taxed. There is no subsidizing policy in Palestine.

Solar energy resources

Solar insulation has an annual average of 5.4 kWh/m²/day, and approximately an average of 2,860 hours of sunshine throughout the year.

3.1.8.2. Solar thermal legislative and regulatory framework

There is no specific legislative and regulatory framework in favour of solar thermal technologies in Palestine.

3.1.8.3. Solar water heater market

The existing installed capacity in all sectors amounted in 2007 to 1,533,000 m² of which 7,100 m² in the service sector.[25] Most of these applications are in houses, residential apartments, hotel and some hospitals. Around 70% of the Palestinian homes are equipped with solar water heaters installations.[26] Around 63.7% of households have solar water heaters as of January 2011 compared to 61.6% in 2010. In the West Bank, this figure reached 67.6% compared to 56.4% in Gaza Strip.[27]

[25] Short compendium on solar thermal applications and the solar water heaters industry in the Middle East "Solar Thermal Application in Egypt, Jordan, Lebanon, Palestinian Territories & Syria: Technical Aspects, Framework Conditions and Private Sector Needs"; Cairo 23rd - 25th March, 2009

[26] Ibrik, Imad, Art of Renewable Energy in Palestine - Current Research and Future Perspectives, Michelangelo Workshop, Civitavecchia 13-14 April, 2012.

[27] Household Energy Survey Main Results (January 2011), http://www.pcbs.gov.ps/Portals/_PCBS/Downloads/book1767.pdf (Arabic version).

Market figures

The most commonly used system is the thermosyphonic open circuit type in which the heated water is used directly by the consumer. The vacuum tube collectors recently entered the local market.

Certification and standards

Table 15: Palestinian standards related to solar thermal

Standard number	Description
PS 8 part 1 1997	Solar system for heating water: Flat plate collector
PS 8 part 2 1997	Solar system for heating water: thermosiphon
PS 8 part 3 1997	Solar system for heating water: Thermal performance test
PS 8 part 4 1997	Solar system for heating water: thermosiphon installation instruction
PS 8 part 5 1997	Solar system for heating water: Building central system

Source: H.Salloum, presentation at Regional Solar Thermal Workshop, Beirut 2012

System cost

In 2007, the unit price of a SWH system was estimated at around 400€.

3.1.8.4. Main industry actors in ST field

Industry of SWH in the Palestine is small and simple, and needs to be developed and structured. SWH systems are locally manufactured in more than 15 major workshops where the raw material is imported from Israel. The annual production rate is more than 26,000 units. The workshops are capable of fulfilling the local market needs and also export to external markets when provided with the appropriate technical support and advisory as well as financial facilities from the local institutions.

3.1.9. *Syria*

3.1.9.1. Socio-economic and energy context

Figure 31: Syrian indicators

Socio-economics [2010]		
Population	20 411	*[Thousands]*
Urban population	55,7%	*[%]*
GDP	89	*[billionUSD_{2005}, PPP]*
GDP/pop.	4 377	*[USD_{2005}/cap, PPP]*
HDI rank 2011 [rank 2000]	119 [108]	*[rank]*
Energy [2010]		
Energy production	25,1	*[Mtoe]*
Net Trade	5,6	*[Mtoe]*
TPES	19,5	*[Mtoe]*
Fossil share (TPES)	98,6%	*[%]*
Fossil Fuel Dependance	-29,08%	*[%]*
TFC	13,3	*[Mtoe]*
TPES/pop.	0,96	*[toe/cap]*
TPES/GDP (PPP)	0,22	*[toe/USD_{2005}]*
Installed Capacity	7 150	*[MW]*
Electricity Generation	41 800	*[GWh]*
Electricity Consumption		*[GWh]*
Elec. Consump./pop.	0	*[kWh/cap]*
CO_2 emissions	53	*[Mt]*
CO_2/pop.	2,62	*[CO_2/cap]*
CO_2/TPES	2,74	*[tCO_2/toe]*
CO_2/GDP (PPP)	0,60	*[tCO_2/000 USD_{2005}]*
Renewable Energy [2010]		
RE in TPES	0,3	*[Mtoe]*
RE share in TPES	1%	*[%]*
RE in Final Energy Consumption	0,03	
RE in Final Energy Consumption (residential)	0,01	[Mtoe]
RE in Final Energy Consumption (industry)	0,0	[Mtoe]
RE in Final Energy Consumption (transport)	0,0	[Mtoe]
RE in Final Energy Consumption (Other)	0,02	[Mtoe]
RE Electricity generation	2 900	*[GWh]*
RE installed capacity	1 100	[MW]
RE in total installed capacity	15%	*[%]*
RE in total installed capacity (excluding hydro)	0%	*[%]*

The Syrian population amounted to 20 million inhabitants in 2010. According to UN population prospects, the population will reach around 28 million by 2030 with an increasing share of the population living in the urban area from 56% to 65%.

GDP is around USD_{2005} 89 billion (PPP) and GDP per capita reached 4,400 USD/cap. in 2010 thanks to a continuous growth of around 5.3 %/year since the 1970's.

Syria is a net exporter of energy (around 6 Mtoe) and its energy consumption is highly dependent on fossil fuels (98.5%).

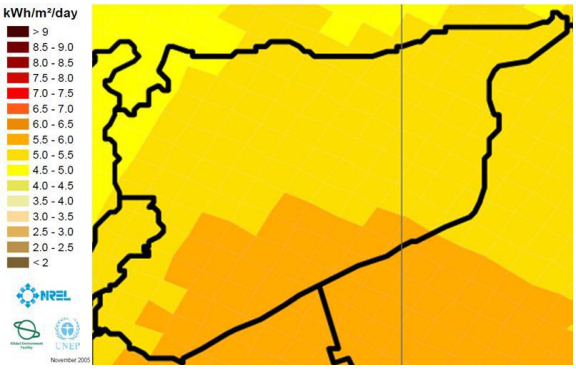
In 2010, the total installed capacity of renewable for electricity generation amounted to 1,100 MW exclusively from hydropower plants.

Energy subsidies

According to the Middle East Economic Survey, Syria spent $3 billion on petroleum product subsidies in 2010. Syria had announced a long-term plan to phase out these subsidies, but the onset of political turmoil in 2011 in Syria forced a delay in these plans.[28]

Renewable energy resources

Figure 32: Global horizontal Irradiance in Syria



Syria has an average GHI of 4.4 kWh/m²/d in the mountains and 5.2 kWh/m²/d in the desert regions (Figure 32). The annual sunshine hours vary in a range from 2,800 to 3,200 hours. A solar atlas was completed in 1994 by the Meteorological Department and Scientific Studies and Research Centre (SSRC).[29]

Source: SWERA

[28] Energy information administration, *Country Analysis brief*, August 2011

[29] Mohammed Khalil Sheki, National Energy Research Center, Solar energy in Syria present and the prosepects, Berlin, April 14th, 2011. http://www.numov.org/de/publikationen-de/iranian-german-business-forum/doc_view/809-photovoltaic-and-solar-thermal-energy-sector-in-syria

3.1.9.2. Solar thermal legislative and regulatory framework

The National Energy Research Centre is in charge of the dissemination of solar thermal technology, through the execution of several pilot projects. A national strategy programme envisages the installation of 100,000 m^2 per year, targeting specifically the residential and commercial sectors. The Ministry of Electricity Plan to 2030 envisages the installation of 4.5 million solar heating for heating water (3.5 million for domestic solar water heating systems and 1 million for industrial solar water heating systems).[30] In addition to new standards, also new incentive mechanisms are becoming available, both in terms of government subsidies and low interest rate loans from private banks.

3.1.9.3. Solar water heater market

SWH is the most common renewable energy technology (RET) used in Syria. Up to 2008, the total surface collectors installed are about 300,000 m², one third installed during the last three years, due to the fact that fossil fuels were no longer easily available than during the last decades.[31]

Certification and standards[32]

Syrian Arab Organization for Standardization and Metrology (SASMO) is the national reference approved in Syria, responsible for performing all activities of Standards and Quality.

SASMO adopted in 1988, through a technical committee representative to all stakeholders in Syria, several standards for solar energy. In 2008 and 2009, a new series of standards have been adopted, based on European standards (EN 12975; EN12976 and EN 12977). But almost none of the SWH systems marketed in Syria have been certified due to the lack of integrated laboratories with a reliable reference in compliance with the standard specifications. The testing facilities at the Center for Studies and Research Scientific of Syria consist of a test circuit for liquid flat plate solar collectors and a test circuit for air flat plate solar collectors.

There is also a testing facility for solar thermal heating systems at the Centre for Tests and Industrial Research of the Ministry of Industry, which is formally approved by the Ministry of Industry to ensure conformity of products with the standard specifications, notably for testing solar thermal heating systems. The Center started in 2011 to test solar collectors & solar System according to requirement in the Syrian Standards which comply with EN-12975, EN-12976, EN-12977.

System cost

The flat plate system produced locally costs around 100 **€** while the evacuated system imported from China costs around 300 **€**.[33]

3.1.9.4. Main industry actors in ST field

The local SWH industry is quite developed since the 80's, and it is developing progressively until nowadays. According to the Ministry of Industry, about 25 entities are manufacturing SWHs, varying from small workshops (~100 DSWHs per year) and big factories with a yearly production of about 20,000 m². The market is nowadays affected by the evacuated tubes

[30] Mohammed Khalil Sheki, National Energy Research Center, Solar energy in Syria present and the prosepects, Berlin, April 14th, 2011. http://www.numov.org/de/publikationen-de/iranian-german-business-forum/doc_view/809-photovoltaic-and-solar-thermal-energy-sector-in-syria.

[31] Short compendium on solar thermal applications and the solar water heaters industry in the Middle East "Solar Thermal Application in Egypt, Jordan, Lebanon, Palestinian Territories & Syria: Technical Aspects, Framework Conditions and Private Sector Needs"; Cairo 23rd - 25th March, 2009

[32] M. Kordab, *The present situation and the main regulations, standards and codes to ensure quality of solar thermal components and systems existing in their countries*, Regional workshop for the Transformation and Strengthening of the Solar Water Heating Market in the Mediterranean, Beirut, April 2012

[33] http://www.solarthermalworld.org/content/syria-it-crazy-market

systems imported from China with lower prices than the locally manufactured flat plate collectors.

Table 16: Main Syrian actors in the solar water heaters industry

Name	Contact	Type
Al Sahmat Co.	n/a	Importer
Baulbek Industrial Co.	n/a	Manufacturer
IDRISS Green Energy	web: www.ige-sy.com/site/en	Importer, distributor
Kallouf Future Power (KFP)	web: www.khallouf-fp.com	Manufacturer, wholesale supplier, exporter
Lava	web: www.lava-sy.com/	Manufacturer, wholesale supplier, exporter, importer
Prima Energy (Altawfeer)	web: www.altawfeer-solar.com/en	Manufacturer
TekVal Int'l Inc.	web: tekval.org/index.html	retail sales, wholesale supplier, exporter, importer
Orient Heating & Ventilation	web: www.orientheat.com	manufacturer, wholesale supplier, exporter
ALTAOOS Co. For Thermal Industries	web: www.altaoos.com	Manufacturer, Distributor/Wholesale
SOLAR DAST	web: www.solardast.com/en	

Sources: internet

3.1.10. *Tunisia*

3.1.10.1. Socio-economic and energy context

Figure 33: Tunisian indicators

Socio-economics [2010]		
Population	10 481	*[Thousands]*
Urban population	66,1%	*[%]*
GDP	78	*[billionUSD $_{2005}$, PPP]*
GDP/pop.	7 460	*[USD $_{2005}$/cap, PPP]*
HDI rank 2011 [rank 2000]	94 [97]	*[rank]*
Energy [2010]		
Energy production	9,0	*[Mtoe]*
Net Trade	-0,7	*[Mtoe]*
TPES	9,7	*[Mtoe]*
Fossil share (TPES)	88,7%	*[%]*
Fossil Fuel Dependance	8,67%	*[%]*
TFC	7,5	*[Mtoe]*
TPES/pop.	0,93	*[toe/cap]*
TPES/GDP (PPP)	0,12	*[toe/USD $_{2005}$]*
Installed Capacity	3 599	*[MW]*
Electricity Generation	14 870	*[GWh]*
Electricity Consumption	14 889	*[GWh]*
Elec. Consump./pop.	1 421	*[kWh/cap]*
CO_2 emissions	22	*[Mt]*
CO_2/pop.	2,13	*[CO_2/cap]*
CO_2/TPES	2,30	*[tCO_2/toe]*
CO_2/GDP (PPP)	0,29	*[tCO_2/000 USD $_{2005}$]*
Renewable Energy [2010]		
RE in TPES	1,1	*[Mtoe]*
RE share in TPES	11%	*[%]*
RE in Final Energy Consumption	1,1	
RE in Final Energy Consumption (residential)	1,1	[Mtoe]
RE in Final Energy Consumption (industry)	0,0	[Mtoe]
RE in Final Energy Consumption (transport)	0	[Mtoe]
RE in Final Energy Consumption (Other)	0	[Mtoe]
RE Electricity generation	139	*[GWh]*
RE installed capacity	115	[MW]
RE in total installed capacity	3%	*[%]*
RE in total installed capacity (excluding hydro)	1%	*[%]*

Tunisian population amounts to 10 million inhabitants. According to UN population prospects, the population will reach more than 12 million by 2030 with an increasing share of the population living in the urban area from 66% to 71%.

GDP is around USD_{2005} 78 billion (PPP) and GDP per capita reached 7,460 USD/cap. in 2010 thanks to a continuous growth of around 5 %/year since the 1970's.

Tunisia is an energy importer since 2001 and its energy consumption is highly dependent on fossil fuels (around 89%).

In 2010, Tunisia had a total wind power generation capacity of 53 MW, and the wind farm of Bizerte (190 MW) is under construction and is planned to be commissioned during 2012.

Energy subsidies

According to R. Missaoui,[34] public subsidies devoted to conventional energy increased from 111 M€ in 2003 to 889 M€ in 2007. A large part of this amount is due to LPG subsidies, taking into account that LPG boilers were representing 65% of the water heater market in 2009. STEG is developing natural gas for the domestic market in order to reduce the dependence on LPG, which is highly subsidized. On average, a household composed of 4 people consumes 24 bottles of LPG a year. The total budget of LPG is around 180 TND for the household and the same for the State through subsidies. According to STEG, switching to natural gas will be 40% less expensive for the household. However, the network of natural gas is not well distributed over the country and will require investments.[35]

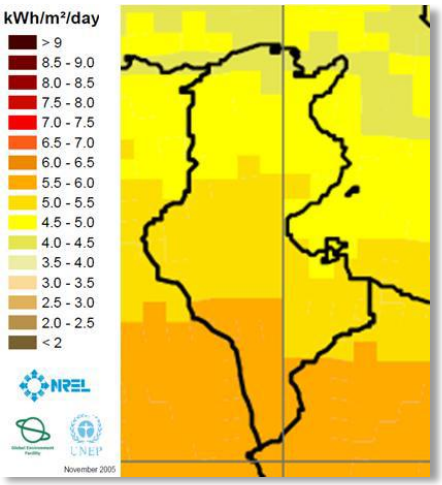
Solar energy resources

Tunisia has a good potential of solar energy. The Global Horizontal Irradiance varies from 1,600 kWh/m²/year in North coastal areas to more than 2,200 kWh/m²/year in South (Figure 34).

[34] R. Missaoui, *Energie et changement climatique, le coût de l'action en Tunisie*, Changement climatique, raréfaction des ressources énergétiques: des opportunités pour innover et entreprendre dans les énergies renouvelables et l'efficacité énergétique en Tunisie et en Méditerranée, Tunis, 2009

[35] http://fr.allafrica.com/stories/201205291346.html

Figure 34: Global horizontal Irradiance in Tunisia



Source: SWERA

3.1.10.2. Solar thermal legislative and regulatory framework

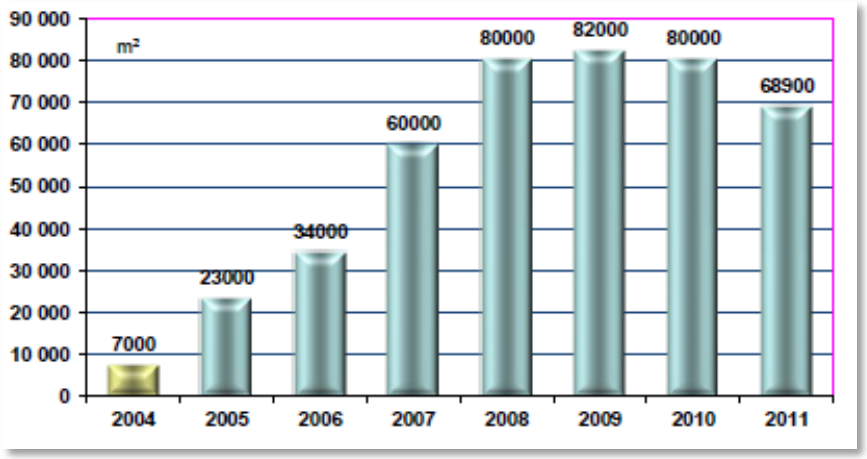
In Tunisia, solar thermal has been proposed repeatedly since the 1980s as a solution to reduce dependence on imported fossil fuels. A market and technology infrastructure was developed in 1997-2001, thanks to a project financed by the GEF and the Belgian co-operation. The support mechanism was based on a 35% capital cost subsidy. By 2001, 50,000 m^2 of additional solar thermal panels had been installed, and an industry supply chain had been created. After a series of stop-and-go policies, Tunisia launched its PROSOL programme in 2005, in cooperation with the Italian Ministry for the Environment, Land and Sea and UNEP. The programme helped to revitalise the solar thermal market. The PROSOL mechanism is based, among others, on a capital cost subsidy financed by the National Fund for Energy Management (FNME) (105 € (200 TND) for the SWH collector area from 1 to 3 m² and 210 € (400 TND) for the SWH collector area between 3 to 7 m²), but also on a refundable bank loan over 5 years by the STEG, through electricity bills (Loan amount : 230 € (550 TND) , 380 €, 455 € and 575 € (1,150 TND); Interest rate : TMM+1 (6,25 %) for 2007 and TMM+1,2 for the next year). The success of this program is due to a strong support from the banking sector and a strong membership with the STEG. Following the success of the first PROSOL, follow-up initiatives have been launched in the residential, tourism and industrial sectors. The solar systems installed within the PROSOL programme in tourism sector, launched in 2009, benefit from a subsidy financed by the Fond National pour la Maîtrise de l'Energie (FNME) (30% of the investment with a ceiling 75 €/m², 70% of the cost of the study and control), but also from the funds IMELS-UNEP (10% investment with ceiling 25 €/m²; 2% bonus on the interest rate of loans; 50% of maintenance costs for two years after the supplier guarantee) and accompanied by different support measures (training, communication plan...). The PROSOL industrial, launched in 2010, is also beneficiary of a subsidy (30% of the investment with a ceiling of 75 €/m²; 70% of the cost of the study and control) financed by FNME.

3.1.10.3. Solar water heater market

Tunisia is recognized as a successful case in developing SWH notably thanks to the PROSOL programme. The different components of the program (Financial mechanism, VAT exemption, reduced custom duties, capacity building, and awareness raising) led to create a long-term market, with an annual installed capacity of more than 70,000 m² per year during 4 consecutive years (2008 to 2011) (Figure 35). By 2016, Tunisia aims to have an installed capacity of about 575,000 m² reaching an annual solar thermal panels installed around 70,000 m² in the residential sector, 10,000 m² in the tertiary sector and 10,000 m² in the industrial sector. If these targets are met, total solar thermal capacity in operation would reach approximately 70 kWt_h/1000 inhab., thus being higher than the level currently reached

in countries like Switzerland and Denmark, which are pioneers in solar thermal technologies. In 2011, the total capacity installed in the country amounted 561,690 m², almost reaching the target fixed for the year 2016. In the 2012, the installed capacity reached 637 010 m^2, thus over-passed the target set for 2016.

Figure 35: Annual installation of SWH in Tunisia, 2004-2011



Source: ANME

Since the beginning of the PROSOL Tertiary, 2,255 m² have been installed in hotels and 2,783 m² in the other tertiary establishments. It is worth mentioning, however, that a high share of installations has been achieved without recourse to the advantages provided by PROSOL program and none of hotels took advantage of discounted interest rate loans.

SHIP applications

So far there is no SHIP installation in operation. However, following the success of the PROSOL programme in the residential and service sectors, a similar initiative has been launched, which targets industries. The PROSOL Industrial is currently in the preliminary stages of implementation. Energy audits have been conducted on 80 Tunisian manufacturing companies from the agro-food, textile, chemical and paper sectors. Some 40 pre-feasibility studies have been performed, and 6 detailed feasibility studies have been elaborated: 3 in the textile industry and 3 in the food industry. Results of the feasibility studies show a payback period ranging from 6 to 25 years depending on the type of energy substituted and the technology used. The installations with most relevant results are those for low temperature needs using flat plate collectors with storage. The installations with higher temperatures required using parabolic trough collectors without storage lead to high payback period. In addition to the technical component of the initiative, the PROSOL Industrial includes also a capacity building, training, and awareness raising programme. Next step of the PROSOL industrial is to implement a demonstrative solar plant in a low temperature industrial process and analyse real figures from this pilot plant. The construction of this demonstrative plant was expected to start in August 2012 and would be implemented in Sousse. The plant will be funded by MEDREC and co-funded by the Italian group Benetton.

Market figures

In the Tunisian market, 99% of the SWH systems installed are thermosyphon systems and 89% of the solar collectors are flat-plate collectors. It is estimated that 20% of the systems sold are imported products.

The national market turnover of solar thermal industry in Tunisia is estimated around USD 25 million in 2011.

Certification and standards

In order to ensure the sustainability of solar thermal market in the residential sector, government decided to create a new label called “Qualisol” which entitles installers to operate under the PROSOL scheme.

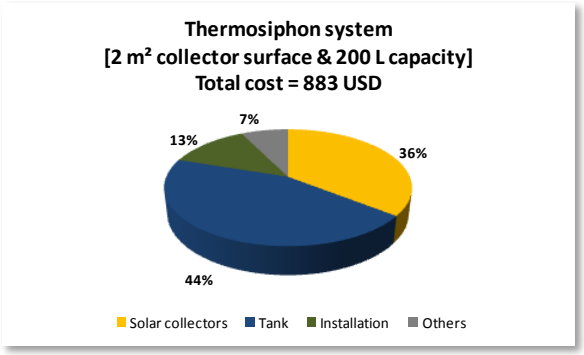
There are two testing facilities under accreditation process: the Centre Technique des Matériaux de Construction de la Céramique et du Verre (CTMCCV) laboratory and the Thermal Processes Laboratory of the Research and Technology Centre of Energy (CRTEn) in the “Eco-Park de Borj Cedria.” The accreditation is given by the Tunisian Accreditation Council (TUNAC). The National Institute for Standardization and Industrial Property (INNORPI) provides technical assistance and support for the accreditation process.

Today, Tunisian standards are extensions of EN norms for solar water heating systems, which are TN-EN-12975 and TN-EN-12976.

System cost

According to the Agence National pour la Maîtrise de l’Energie (ANME) and the Chambre Syndicale Nationale des Energies Renouvelables (CSNER), the average system cost for a system of 2 m² of solar panels with a water tank in a range of 160 to 200 litres is around USD 880. Solar collectors and tank represent 80% of the total cost of the system.

Figure 36: Average cost of systems in Tunisia [individual, residential market]



Sources: ANME, CSNER

3.1.10.4. Main industry actors in ST field

Thanks to the three PROSOL programmes, the numbers of actors in the market has increased rapidly. From 6 suppliers in 2005, there were 49 eligible suppliers as of end 2011 of which 10 manufacturers. Today, 1150 installers are eligible for the PROSOL (most of them are micro-companies, 120 in 2005) and over 400 installers are qualified for “Qualisol systems.” ANME estimated that more than 7,000 direct jobs were created since the start of PROSOL.

In 2003, the CSNER has been created as industrial association, which aims at building and maintaining a sustainable market in the field of renewable energy and a strong position at the national level for sector representation. Starting from 2010 it established Qualisol label (that is revised constantly every three years) that installers must have.

Table 17: List of suppliers eligible to the PROSOL program in the residential sector

Name	Contact	Type
SOFTEN	web: www.soften.com.tn	Manufacturer, supplier
SINES	web: www.sines.com.tn	Manufacturer, supplier
Société Industrielle des Energies Renouvelables	email : kammoun.hichem@planet.tn	Supplier
Etablissement Rami Daoued	email : ramidaoued1970@yahoo.fr commercial@sdr.com.tn	Supplier
Alternative Energy System	email : aes@planet.tn	Supplier

Société Anonyme de Constructions Electro-Mécanique	email : sacem.tn@planet.tn	Supplier
Comptoir d'Equipement Général en détail	email : ceg@tunet.tn	Supplier
Solar Energy Systems	email : ses@planet.tn	Supplier
Société Industrielle d'Appareillage et de Matériels Electriques	email : siame@siame.com.tn	Supplier
Marketing d'Equipement Company	email : cme@tunet.tn	Supplier
Horizon International Tourisme	email : sotuvit.tn@planet.tn	Supplier
Technologies du Solaire	email : ta.tecsol@wanadoo.tn	Supplier
Ocean Commercial	email : sliman@ocean.com.tn	Supplier
Domotech	email : karem@bsb.com.tn	Supplier
CTM Distribution	email : developpement@groupe-ctm.com	Supplier
Société Tunisienne de Chauffage	email : mba@stctunisie.com	Supplier
International Power Service	email : ips1105@yahoo.fr	Supplier
Biome Solar Industry	email : ahmed.ernez@biomesolar.com	Supplier
Skyenergy	email : commercial@sky-energy.biz	Supplier
Solar Technolgy	email : solar_Technology@yahoo.fr	Supplier
Société Tunisiennes des Energies Renouvelables	email : ster.soleil@tunet.tn	Supplier
SPECTRA	email : mohamed.sellami@mpbs.com.tn	Supplier
Sacem Industries	email : sacem.industries@sacemindustries.com.tn	Supplier
Soltech	email : contact@soltech.co.tn	Supplier
Futener Solaire	email : futener@yahoo.fr	Supplier
Société Allemande des Technologies	email : boubaker.siala@sater-solar.com	Supplier
EPC InternationaL	email : contact@epc-int.com epc.tec@topnet.tn	Supplier
Sogeser SARL	web : www.sogeser.com.tn	Supplier
Traiding United Industries	email : iunited@yahoo.fr	Supplier
Fayzer North Africa		Supplier
Italie solaire	email : infoitaliesolaire@gmail.com	Supplier
Risol	n/a	Supplier
Société Tunisienne des Energies Renouvelable	email : terjobs@genet.com	Supplier
Shamsy	email : n.khanfir@arengroup.com	Supplier
Energie Del Sole	n/a	Supplier
Société Tunisienne de Technologie De L'Energie Solaire	email : sttes_sonne@topnet.tn	Supplier
Sotutex	n/a	Supplier

Coala	web : www.coala-tunisie.com	Supplier
Focus Energie	email : focusenergie@tunet.tn	Supplier
Same	email : info@same.com.tn	Supplier
Solar Industries	n/a	Supplier
Maghreb Motors Services	n/a	Supplier
Clean Power Energy	n/a	Supplier
3 E Solaire	email : contact@3esolaire.com	Supplier
Tunisie Energie	n/a	Supplier
Société Energie Nouvelle	n/a	Supplier
Enersol	n/a	Supplier
Solarbio	n/a	Supplier
Advance Technology Solar	email : atsolar@topnet.tn	Supplier

Source: ANME

3.1.11. *Turkey*

3.1.11.1. Socio-economic and energy context

Figure 37: Turkish indicators

Socio-economics [2010]		
Population	72 752	*[Thousands]*
Urban population	70,5%	*[%]*
GDP	579	*[billionUSD $_{2005}$, PPP]*
GDP/pop.	7 963	*[USD $_{2005}$/cap, PPP]*
HDI rank 2011 [rank 2000]	92 [85]	*[rank]*
Energy [2010]		
Energy production	31,9	*[Mtoe]*
Net Trade	-78,2	*[Mtoe]*
TPES	110,2	*[Mtoe]*
Fossil share (TPES)	90,2%	*[%]*
Fossil Fuel Dependance	78,72%	*[%]*
TFC	83,9	*[Mtoe]*
TPES/pop.	1,51	*[toe/cap]*
TPES/GDP (PPP)	0,19	*[toe/USD $_{2005}$]*
Installed Capacity	49 109	*[MW]*
Electricity Generation	209 000	*[GWh]*
Electricity Consumption		*[GWh]*
Elec. Consump./pop.	0	*[kWh/cap]*
CO_2 emissions	320	*[Mt]*
CO_2/pop.	4,40	*[CO_2/cap]*
CO_2/TPES	2,91	*[tCO_2/toe]*
CO_2/GDP (PPP)	0,55	*[tCO_2/000 USD $_{2005}$]*
Renewable Energy [2010]		
RE in TPES	10,8	*[Mtoe]*
RE share in TPES	10%	*[%]*
RE in Final Energy Consumption	6,6	[Mtoe]
RE in Final Energy Consumption (residential)	6,1	[Mtoe]
RE in Final Energy Consumption (industry)	0,1	[Mtoe]
RE in Final Energy Consumption (transport)	0	[Mtoe]
RE in Final Energy Consumption (Other)	0	[Mtoe]
RE Electricity generation	44	*[GWh]*
RE installed capacity	15 504	[MW]
RE in total installed capacity	32%	*[%]*
RE in total installed capacity (excluding hydro)	2%	*[%]*

Turkey is by far the country the most populated among the SEMCs with an estimated population in 2010 around 73 million. According to UN population prospects, the population will reach around 87 million by 2030 with an increasing share of the population living in the urban area from 70% to 83%.

GDP is around USD_{2005} 579 billion (PPP) and GDP per capita reached 7,900 USD/inhab. in 2010.

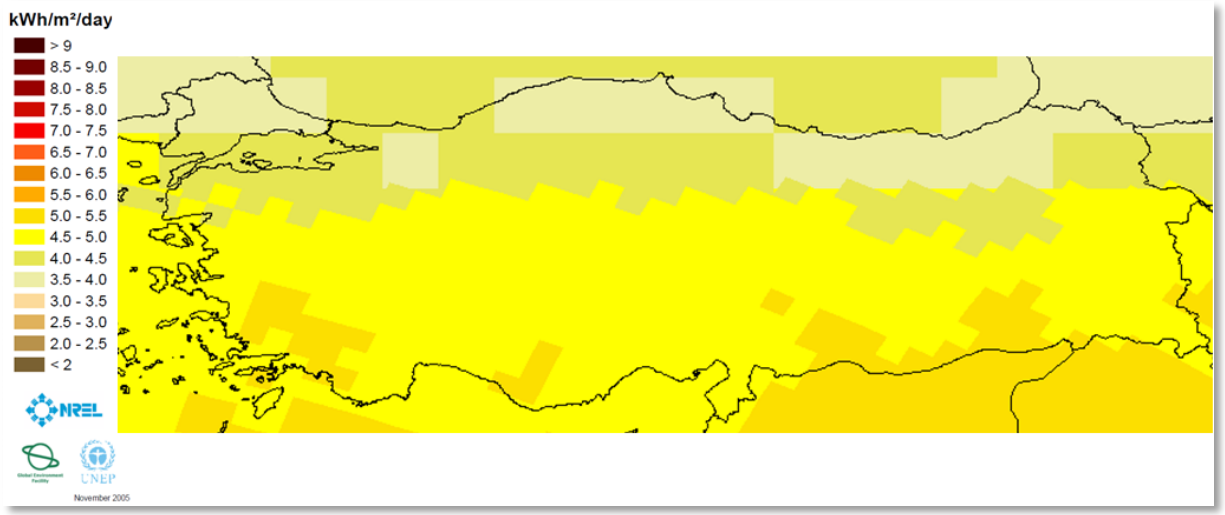
Turkey is a net importer of energy and its energy consumption is highly dependent on fossil fuels (90%).

In 2010, the total installed capacity of renewable for electricity generation amounts to 15,500 MW mainly hydro power plants. Nevertheless, wind power plants reached a total capacity of 1.3 GW in 2010.

Renewable energy resources

Turkey's geographical location provides the country with a large potential for solar thermal energy. The total annual sunshine duration is 2,640 hours, which amounts to 7.2 hours daily on average. The average annual solar radiation is 1,311 kWh/m² per year, equivalent to 3.6 kWh/m² per day.

Figure 38: Global Horizontal Irradiance in Turkey



Source: SWERA

3.1.11.2. Solar thermal legislative and regulatory framework

There is no specific legislative and regulatory framework in Turkey, but an incentive is available for family living in remote areas ("forest villages"). Since 2004 around 100 000 families took benefit from an interest-free credit (covering 100% of the investment costs and to be repaid in three equal repayments).

In July 2011, the government raised the import tax on vacuum tubes. This new regulation significantly increases the price of a vacuum tube, and made importers move system production to Turkey. Nowadays, Almost all of vacuum tube systems sold on the market today are Made in Turkey.

3.1.11.3. Solar water heater market

In Turkey, the accumulated installed capacity reached around 19 million m² in 2012.[36] Flat plate collectors are dominating the market but Vacuum tube technology is gaining influence.

SHIP applications

Turkey is gradually discovering solar process heat, given the high potential which is estimated at around 14 million square meters. In particular, the textile and food processing industries seem to represent two potentially attractive markets. Despite the country has a long experience in the use of solar energy for water heating, there is still a limited awareness on SHIP applications. Among the reported experiences, there is a steam-producing system with a collector area of 150 m² installed by Solimpeks Solar Energy company at the Canicas textile factory in Tokat in 2008. Also in the case of the Iberotel Sarigerme Park hotel, the parabolic trough collectors system is used, amongst others, to supply steam for the laundry.[37]

Market figures

According to Ezinç Metal,[38] the total market volume for 2011 was about 1.8 Million m². The market is by far dominated by flat plate collectors that accounted for 80% of the total market. The total newly installed capacity in 2012 is 1 619 610 m2 with flat plate collectors accounting for 70% of the newly installed capacity (1 141 410 m^2 of flat plate collectors against 478 200 m^2 of vacuum tube collectors). Nevertheless, between 2007 and 2011, the share of vacuum tubes in the newly installed collector area has highly increased from 4% to 28%. The annual market turnover for 2010 is estimated around €88 Million (at manufacturer selling price of collector).

The main market for solar thermal applications is the residential segment with a share of 80% of the whole market in 2010, the remaining part is installed in the commercial segment.

Certification and standards

Today, Turkish Standards (TS) are existing norms and these are extensions/duplicates of EN norms for solar water heating systems, which are TS-EN-12975; TS-EN-12976; TS-EN-12977.

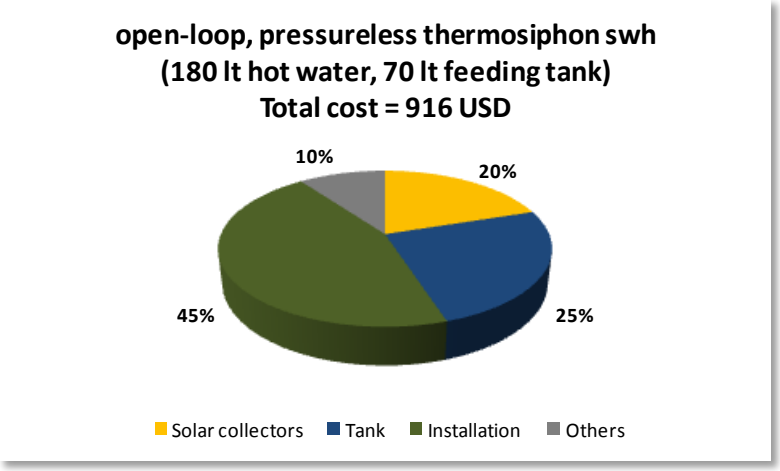
Government tenders is asking for the availability of Solar Keymark certificate for solar collectors since last 3-4 years which is encouraging manufacturers to certify their products.

System cost

According to EIE and Ezinç, the average system cost for a system of open-loop, pressureless thermosiphon (180 lt hot water, 70 lt feeding tank) is around USD 920. Solar collectors and tank represent 45% of the total cost of the system.

[36] In the Solar Heat World Wide 2013 Report, only 14,519,361 m2 has been reported.
[37] Kadirgan, F. (2011). Solar Energy Use for Sustainable Development in Turkey, World Sustainable Energy Days, 2-4 March 2011, Wels.
[38] http://www.solarthermalworld.org/content/turkey-vacuum-tubes-rise

Figure 39: Average cost of systems in Turkey [individual, residential market]



Sources: EIE, Ezinç

3.1.11.4. Main industry actors in ST field

The industry is well developed with high quality manufacturing and export capacity. There is a solar energy association which is called "GUNDER", and which is the Turkish division of the International Solar Energy Society (www.gunder.org.tr/).

Table 18: Main Turkish actors in the solar water heaters industry

Name	Contact	Type
Alurator	n/a	Manufacturer, exporter
Anages	www.anages.com/defaulteng.asp	
Ayba Solarco	n/a	
Baymak A.S	web: www.baymak.com.tr/eng	Manufacturer, wholesale supplier, exporter
Bilgen Solar Energy Systems	n/a	
Burak Inox Solar System	email: info@buranikos.com.tr	Manufacturer, exporter
CAN METAL A.S.	n/a	
Ceren Engineering	web: www.cerenmuhendislik.com.tr	Manufacturer, wholesale supplier, exporter
Dagsan A.S	web: www.dagsan.com.tr	Manufacturer, retail sales, service, exporter
DemirDöküm	web: www.demirdokum.com.tr/en	
Derya Gunes Kollektorleri A. S.	web : www.deryasolar.com.tr	Manufacturer, exporter
Diko Elektrikli Cihazlar San. ve Tic. A.S	web: www.diko.com.tr	Manufacturer, exporter, importer
Dinler	web: www.dinlersolar.com.tr/english.htm	
Efsun Metal Ltd.	web: www.efsunsolar.com/en	Manufacturer, wholesale supplier
Elit Renewable Energies Ltd. Co.	n/a	
Eraslan	web: www.eraslan.com.tr	
Ezinc Metal Sanayi ve Ticaret A.S.	web: www.ezinc.com.tr	Manufacturer, wholesale supplier, exporter
Güne Enerji Sistemleri	web: www.simseksolar.com	Manufacturer, wholesale supplier, exporter, importer

Kaisun	web: www.kaisun.com.tr/en/	
Kiska Tech		
Kodsan A.S	web: www.kodsan.com.tr/en/	Manufacturer, Wholesale supplier, Exporter
Kuzey Enerji Sanayi ve Ticaret Ltd.	n/a	
Kuzeymak	web: www.kuzeymak.com/en/	Manufacturer, retail sales, exporter, importer
Lara Solar	web: www.larasolar.com	
MAS Aluminium and Elevator Systems	n/a	
Merit Ltd	web: www.meritltd.com/eng/	Manufacturer, retail sales, wholesale supplier, exporter, importer
Ouraset Solar Thermal Systems	web: www.ouraset.com	Manufacturer, exporter
Özgün	web: www.ozgungrup.com/en/	
Permak Energy	web: www.permakenerji.com/eng	
Ser-gün	web: www.sergun.com/index.php	
Sim ek Günej Enerji Sistemleri	n/a	
Solar Isi Sistemleri A.S.	web: www.isteksolar.com.tr/	Manufacturer, retail sales, wholesale supplier, exporter, importer
Solartek	web: www.solartek.com.tr/ENG/	
Solimpeks Solar Energy Systems Co.	web: www.solimpeks.com	Manufacturer, wholesale supplier, exporter, importer
Sunstrip Turkiye	web: www.sunstrip.com.tr	Manufacturer, retail sales, wholesale supplier, exporter, importer
Termosan heating systems co.	web: www.termosan.com/	Manufacturer, exporter
Solareks	web: www.solareks.com/en	
Vaillant'a Hoşgeldiniz	web: www.vaillant.com.tr/	

Source: Gunder, internet

3.2. Balkan Countries

3.2.1. *Albania*

3.2.1.1. Socio-economic and energy context

Figure 40: Albanian indicators - source IEA

Key Indicators:	
Population (millions)	3.22
GDP (billion 2005 USD)	11.05
GDP PPP (billion 2005 USD)	25.28
Energy production (Mtoe)	1.49
Net imports (Mtoe)	0.71
TPES (Mtoe)	2.17
Electricity consumption* (TWh)	6.38
CO2 emissions** (Mt of CO2)	3.87

Compound Indicators:	
TPES/population (toe/capita)	0.68
TPES/GDP (toe/thousand 2005 USD)	0.2
TPES/GDP PPP (toe/thousand 2005 USD)	0.09
Electricity consumption / population (MWh/capita)	1.98
CO2/TPES (t CO2/toe)	1.78
CO2/population (t CO2/capita)	1.20
CO2/GDP (kg CO2/2005 USD)	0.35
CO2/GDP PPP (kg CO2/2005 USD)	0.15

*Gross production + imports - exports - losses

**CO2 Emissions from fuel combustion only. Emissions are calculated using IEA's energy balances and the Revised 1996 IPCC Guidelines.

The estimated population of Albania reached 3.22 Million in 2011. 52% of the population are living in urban areas and this ratio is expected to increase up to 70% by 2030.

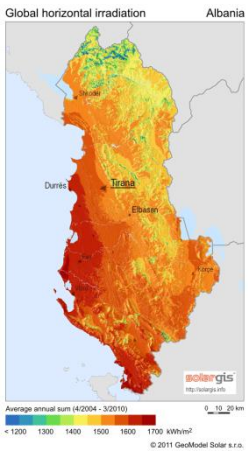
Albania is highly dependent on import with almost one third of its primary energy consumed is imported.

Renewable energy accounts for 30.5% of total primary energy supply in 2011. Hydropower alone accounts for almost 19% of total primary energy supply and almost all the total electricity production. Only one thermal power plant is in operation, with 97 MW installed capacity.

Energy subsidies

Energy prices are subsidised particularly electricity with an average tariff which is below the calculated long-term marginal running cost of generation/transmission/distribution, even if the government and the local utility KESH have programmes to increase electricity prices and enforce payment discipline and improve opportunities for energy saving and renewable energy. Estimated energy related subsidies from 2005-2009 observations is around 7-8% of GDP. Fuel for power generation is exempted from taxes. Imported equipments for power utility are also exempted from VAT for a 12 month period.[39]

Solar resources



According to radiation measurements undertaken by the Institute of Hydrometeorology, radiation varies between 1,170 kWh/m²/year in the North East part of Albania and 1,680 kWh/m²/year in Fier, with a country average of 1,460 kWh/m²/ year.

[39] Fossil Fuel Subsidies in the Western Balkans, a report for UNDP, December 2011.

3.2.1.2. Solar thermal legislative and regulatory framework

In May 2012, a roundtable discussion was organized in Tirana to launch the draft of the national renewable energy action plan for Albania and to discuss the legal framework for the promotion of solar water heating. In the new draft RES law, a chapter on promotion of Solar Water Heating Systems is introduced. This chapter establishes a number of measures and incentives including:

(i) mandatory installation of SWH systems in buildings and the inclusion of such an obligation in the certification of the energy performance of buildings;

(ii) minimum technical and efficiency requirements for SWH;

(iii) certification of SWH and installers by an accredited body;

(iv) and exemption from custom duties and VAT of imported or domestically assembled SWH systems.

The draft RES Action Plan for Albania and other RES legislation to promote solar energy are provided in the frame of the "Country Programme of Albania under the Global Solar Water Heating Market Transformation and Strengthening Initiative." Albania is also a beneficiary country of the "Global Solar Water Heating (GSWH) Market Transformation and Strengthening Initiative.". The aim of the project within the initiative is to facilitate the installation of 75,000 m² of new installed collector area over the duration of the project, an annual sale of 20,000 m² aiming to reach the set target of 520,000 m² of total installed SWH capacity by 2020.

The National Action Plan on RES sets a target for RES of 38% by 2020. The target for heat produced by RES is 12.1%. The target for the thermal heat produced by the solar system is 1.23%. The RES law sets mandatory installation of SHW in new/renovated buildings, exemption from the VAT and custom duties of the imported systems/parts, and provision for quality control and European standards. Some sub-legal acts also provide for exemption from the VAT and custom duties for the solar thermal systems/parts, obligatory installation of SWH systems in different categories of public buildings, inclusion of SWH systems as common property under the law "on condominiums," and draft decision of the Municipal Councils for the obligatory installation of SWH systems on their public buildings.

The country prgramme of Albania on Solar Water Heating Market Transformation and Strengthening Initiative is based on several components: i) an enabling legal and regulatory framework to promote sustainable SWH market; ii) enhanced awareness and capacity building of the targeted and users and building sector professional to consider and integrate SWH systems into different types of buildings; iii) increased demand for SWH systems by the availability of attractive end-user financing mechanisms or other delivery models, such as ESCOs or utility driven models; iv) a certification and quality control scheme applicable for Albanian conditions and enhanced capacity to offer products and services promoting sustainable SWH market; and v) the provided support institutionalized and the results, experiences and lessons learned documented and disseminated.

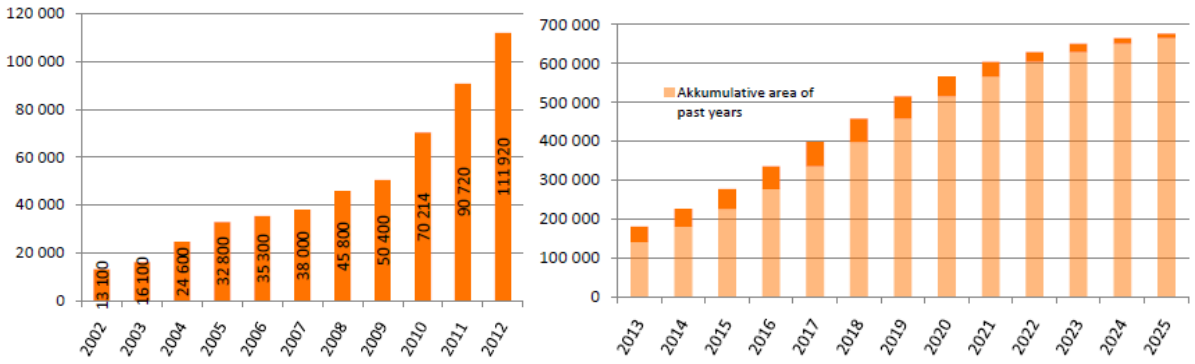
3.2.1.3. Solar water heater market

Since 2006, Albanian data on installed solar thermal collectors are integrated into the solar thermal statistics published by the Solar Heating and Cooling Program of the International Energy Agency. According to the IEA-SHC 77,733 m² was installed by the end of 2010, with 7,562 m² installed during 2010. The cumulative installed capacity reached 90 720 m² in 2011 and 111 920 m² in 2012.[40] A previous market survey carried out in 2006[41] estimated that 55%

[40] Mirela Kamberi, General description and results achieved to date, Regional Workshop and B2B Meetings, 20-21 March 2013, Tirana, Albania.
[41] Market Analysis for the Solar Water Heating – Albania, Energy and Environment for the Sustainable Development Center (EESDC), April 2006;

of the installed capacity in 2005 was installed in the service sector (hotels etc.), the remaining installed in the residential sector.

Figure 41: Albanian installed solar water heater collectors' area, 2002-2012 and perspective to 2025



Source: UNDP Albania

Market figures

The flat collectors were estimated to account for about 99% of the total installed area, the evacuated tubes for 1%.[42] The combisystems used for both heating and hot water preparation were estimated to account for about 9% of the total installed area in 2005[43].

Certification and standards

In September 2008, one of the main outputs of the project entitled "Solar Water Heaters - Training of Experts & Professionals and Improvement of Technology & Production" was the establishment of an "Albanian Solar Test Centre" hosted by the Harry Fultz Institute in Tirana and co-financed by the Austrian Development Cooperation and UNDP. The facility provides product quality and certification services for manufacturers of solar water heating systems, in accordance with recognized European standards.

Under the GSWH initiative, several advancements have been achieved. In terms of standards, there has been the adoption of all related EU/international standards in close cooperation with the General Directory of Standardization. Regarding testing/certification; the establishment/running of the Albanian Solar Testing Centre (first trial tests already performed); concrete proposal for the certification scheme for SWH products: an Albanian provisional label proposed allowing an interim period of 5 years to meet requirements for quality management of products as per the "Solar Keymark." As for technical expertise/training; technical expertise in collaboration with Swiss Consortium INFRAS for (i) different hotels, members of ATA and (ii) Albanian producers; technical expertise in collaboration with the Stuttgart Institute SWT to use/run the Albanian Solar Testing Centre.

System cost

In 2006, a typical unit price of a family size SWH system in Albania consisting of a 2-3 m² collector and a 150-200 litre water tank is around USD 1,000 (including installation) with an expected minimum lifetime of 15-20 years.

[42] Calculation based on data from Weiss W. and Mauthner F., *Solar Heat Worldwide – Markets and Contribution to the Energy Supply 2010*, IEA SHC programme, May 2012

[43] Market Analysis for the Solar Water Heating – Albania, Energy and Environment for the Sustainable Development Center (EESDC), April 2006;

3.2.1.4. Main industry actors in ST field

The market review conducted in early 2006 identified 6 local companies in Albania that supply solar thermal equipments. Three out of these six companies are manufacturing or assembling the SWH systems themselves by relying on Greek or Turkish technology, while the other three are relying on imported equipment with the main supplying countries (the situation early 2006) being Greece, Italy, Germany and Austria.

The Albanian Energy Association was established in 2011.[44] It covers energy industry, including all renewable power, heat and fuels. It represents energy producers, consumers and also promotes sustainable energy in Albania. Its main objective is to ensure the best legislative and regulatory framework for using renewable energy. In this respect, the association performs policy development and provide input to government departments, agencies, regulators, NGOs and others.

[44] http://aea-al.org/about/

3.2.2. *Bosnia and Herzegovina*

3.2.2.1. Socio-economic and energy context

Figure 42: BIH indicators - source IEA

Key Indicators:	
Population (millions)	3.75
GDP (billion 2005 USD)	13.04
GDP PPP (billion 2005 USD)	28.55
Energy production (Mtoe)	4.62
Net imports (Mtoe)	2.36
TPES (Mtoe)	7.10
Electricity consumption* (TWh)	12.24
CO2 emissions** (Mt of CO2)	22.81

Compound Indicators:	
TPES/population (toe/capita)	1.89
TPES/GDP (toe/thousand 2005 USD)	0.54
TPES/GDP PPP (toe/thousand 2005 USD)	0.25
Electricity consumption / population (MWh/capita)	3.26
CO2/TPES (t CO2/toe)	3.21
CO2/population (t CO2/capita)	6.08
CO2/GDP (kg CO2/2005 USD)	1.75
CO2/GDP PPP (kg CO2/2005 USD)	0.8

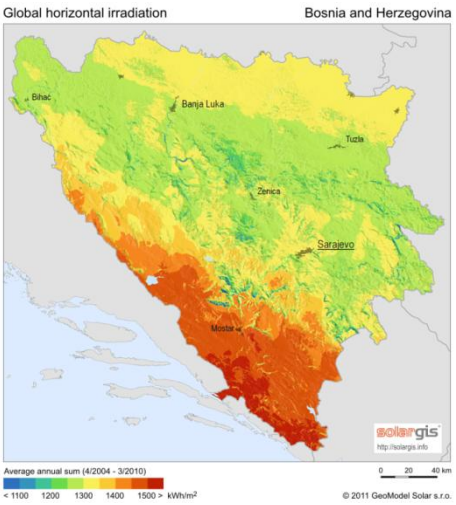
*Gross production + imports - exports - losses
**CO2 Emissions from fuel combustion only. Emissions are calculated using IEA's energy balances and the Revised 1996 IPCC Guidelines.

The estimated population of Bosnia and Herzegovina reached 3.75 Million in 2011.Total GDP reached 13.04 billion (2005 USD). Albania is dependent on import with more than one third of its primary energy consumed (35%).

Energy subsidies

Estimated energy related subsidies from 2005-2009 observations is around 9-10% of GDP. Some industrial consumers benefit from preferential electricity prices. Consumers of electricity in poor or disadvantaged areas also benefit from some assistance. Direct public subsidies and cross-subsidies of public and commercial consumers towards household consumers are provided for district heating.[45] Energy prices are generally kept artificially low for social reasons. Some changes are undertaking place, however.[46]

Solar energy resources



Solar irradiation ranges between 1,240 kWh/m^2/year in the north and 1,600 kWh/m^2/year in the south.[47] In the south, sunny days can get up to about 270 days per year, with a potential of approximately 1,900 TWh.[48] A difficult orography characterises Bosnia and Herzegovina, which affects spacial distribution of solar radiation. Whereas highest values can be expected in July (6,1 kWh/m2 in Brčko and 7,5 kWh/m2 in Ljubuški), lowest values can be expected in December (0.98 kWh/m2 in Prijedor and 1.46 kWh/m^2 in Trebinje).[49]

3.2.2.2. Solar thermal legislative and regulatory framework

The legislative and regulatory framework is not well developed. Bosnia and Herzegovina does not have an energy development and efficiency strategy, law on energy and energy efficiency, and a dedicated agency/center for energy or energy efficiency (National Background Report on Energy 2012). An Energy Strategy has been prepared by the Republika Srpska and is to be passed by the National Assembly of Republika Srpska. In the Federation of BiH, only Strategic Plan and Programme for the Development of Energy Sector

[45] Fossil Fuel Subsidies in the Western Balkans, a report for UNDP, December 2011.
[46] In-depth review of energy efficiency policies and programmes: Bosinia and Herzegovina, Energy Charter Secretariat 2012.
[47] National background report on Energy for Bosnia and Herzegovina.
[48] Country Report-Bosnia and Herzegovina/JICA JFY 2010 PROGRAM-Energy Policy.
[49] Energy Sector Study by BIH.

exists. The two documents are expected serve as a basis for the State Energy Strategy.[50] A recent development has been the adoption of the National Energy Strategy by the National Assembly in March 2012.

3.2.2.3. Solar water heater market

Solar thermal market figures are very low in Bosnia and Herzegovina. The installed solar thermal capacity could be estimated at around 2000 – 3000 m2.[51] Other figures indicate that between 4000 and 6000 m^2 of solar collectors are installed with an average annual production of 3.3 GWh, however, and that most of it is in the southern region of the country.[52]

In terms of barriers, lack of knowledge and the misconception about the technology as being expensive and not suitable for BIH are among the main barriers for a market uptake in Bosnia and Herzegovina. Other barriers include poorly developed institutional framework related to RES as well as absence of an energy policy and strategy and regulation framework.[53]

SHIP applications

As of 2014, no solar heating for industrial processes exist in Bosnia and Herzegovina.

System cost

A typical solar thermal system consisting of 4 m^2 of solar collectors, a tank of 300 l, and other necessary accessories as well as the installation of the system costs **€** 2 500 i.e. (**€** 625/m^2.)[54]

3.2.2.4. Main industry actors in ST field

Solar collector manufacturing is not developed in Bosnia and Herzegovina. A 3-year Solar Energy as the future of Sustainable Development project was initiated in 2011 and aims at increasing local production of solar panels and the use of solar systems.[55] With 1, 250, 000 USD, the initiative is partly funded by USAID. Its goal is to enable 20 small, local enterprises with existing production line in developing capacities for solar panels production through providing technical and business training and final support (half as loan and half grant scheme). An example of supported company is HDI from Sarajevo that has started production of solar collectors in early 2013. [56]

[50] In-depth review of energy efficiency policies and programmes: Bosinia and Herzegovina, Energy Charter Secretariat 2012.
[51] Energy Sector Study by BIH, p 254.
[52] Aleksandra Nikolic, Sabahudin Bajramovic and Dragana Ognjenovic, AgriPolicy, Enlargemnt Network for AgriPolicy Analysis, Analysis of Renewable Energy and Its Impact on Rural Development in Bosnia and Herzegovina, November, 2009, p.21.
[53] Aleksandra Nikolic, Sabahudin Bajramovic and Dragana Ognjenovic, AgriPolicy, Enlargemnt Network for AgriPolicy Analysis, Analysis of Renewable Energy and Its Impact on Rural Development in Bosnia and Herzegovina, November, 2009, p.21.
[54] Energy Sector Study by BIH, p 254.
[55] http://www.european-microfinance.org/data/file/good_practices/partner-bosnia-2013.pdf
[56] http://www.sarajevotimes.com/production-of-solar-collectors/

3.2.3. *Croatia*

3.2.3.1. Socio-economic and energy context

Figure 43: Croatia indicators - source IEA

Key Indicators:	
Population (millions)	4.41
GDP (billion 2005 USD)	46.27
GDP PPP (billion 2005 USD)	70.31
Energy production (Mtoe)	3.79
Net imports (Mtoe)	4.68
TPES (Mtoe)	8.44
Electricity consumption* (TWh)	16.70
CO2 emissions** (Mt of CO2)	18.77

Compound Indicators:	
TPES/population (toe/capita)	1.91
TPES/GDP (toe/thousand 2005 USD)	0.18
TPES/GDP PPP (toe/thousand 2005 USD)	0.12
Electricity consumption / population (MWh/capita)	3.79
CO2/TPES (t CO2/toe)	2.22
CO2/population (t CO2/capita)	4.26
CO2/GDP (kg CO2/2005 USD)	0.41
CO2/GDP PPP (kg CO2/2005 USD)	0.27

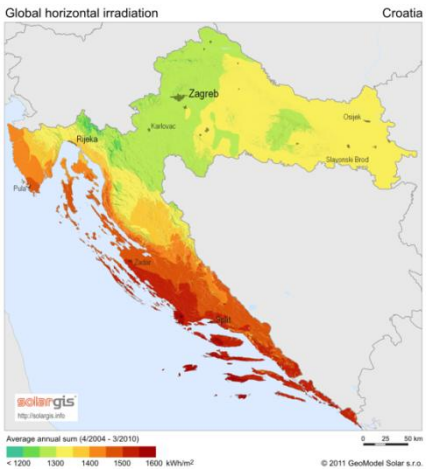
*Gross production + imports - exports - losses
**CO2 Emissions from fuel combustion only. Emissions are calculated using IEA's energy balances and the Revised 1996 IPCC Guidelines.

The estimated population of Croatia reached 4.41 Million in 2011.Total GDP reached 46.27 billion (2005 USD). Croatia is dependent on import with more than 55% of its primary energy demand.

Energy subsidies

Estimated energy related subsidies from 2005-2009 observations is around 5-6% of GDP. Electricity is subsidized through the sale from the national electricity company, Hrvatska Elektroprivreda (HEP) to aluminium company, Tvornica lakih metala (TLM), below market prices. Small and medium enterprises also benefit from electricity subsidies.[57]

Solar energy resources



Solar radiation ranges between 3.4 and 4.2 kWh/m^2 in the continental part, between 4.2 and 4.6 kWh/m^2 in the north Adriatic coast and 5.0 and 5.2 kWh/m^2 in the south Adriatic coast.[58]

3.2.3.2. Solar thermal legislative and regulatory framework

In terms of solar targets, an indicative target of 300 000 residents with at least 1.5 m^2 solar collectors installed is set to be achieved by 2020; 50% of newly constructed buildings are to be equiped with solar energy sources; and the goal to reach the 4th place in Europe in terms of MW of soalr thermal systems per capita by 2030.

To further promote the solar thermal systems, a co-financing scheme is in place, offering households the installation of solar thermal collectors in 2008 for Sisacko-moslavacka and 2009 (solar systems for domestic hot water warming) a maximum of 40% or 1500 Euro. The Fund for Environmental Protection and Energy Efficiency also provides a 30% for private and commercial projects and up to 100% for state and local organizations. Financial assistance for the installation of SWH systems is also provided by the third part financing (counties). For example, Sisak-Moslavina County provided finance for SWH systems up to 20% of investment (up to 10 000 HRK).[59] Recent developments have been the introduction of such

[57] Fossil Fuel Subsidies in the Western Balkans, a report for UNDP, December 2011.
[58] Yann Delomez, Renewable Energy in Croatia Brussels Young Exporters Programme, July 2012.
[59] Croatia National Report, the TranSolar Project, p.24.

support schemes applicable to solar thermal, heat pumps and off-grid solar photovoltaics for both residential (grant up to 40% of the solar water heater investment) and commercial (interest free loans amount to 40% of the total investment) sectors, and they are both administered by the Croatian Environmental Protection and Energy Efficiency Fund (FZOEU).[60]

3.2.3.3. Solar water heater market

The total estimated installed capacity by 2012 is approximately 120 000 m^2. An annual installed capacity reached 14 500 m2 in 2011 and between 13 000 and 14 500 in 2012.[61] Mostly used systems are flat plate collectors with selective absorber, close loop systems with pump, heat exchanger, integrated in heat storage and antifreeze protection. The relatively low penetration could be attributed to the lack of government incentives.[62]A subsidy scheme has, however, been put in place by the Ministry of Economy with the cooperation of the Environmental Protection and Energy Efficiency Fund. Applications are mainly in domestic hot water production; large systems are in tourist industry; space heating is rare; and there are no distric heating applictions in Croatia.[63]

Certification and standards

In terms of testing, no national testing center exists. One is under preparation, however. Nevertheless, technical committee TO – 180 “Solar Energy” has been established to conform with international norms, including ISO and EN.[64] The Faculty of Mechanical Engineering and Naval Architecture has a laboratory for testing water collectors based on European norms EN12975, EN12976 and EN12977.

System cost

Solar system Costs for typically sized systems		
	6m²	15m²
Total costs (excl. VAT)	710 Euro / m²	620 Euro / m²
VAT (23%)	140 Euro / m²	130 Euro / m²
Total cost (incl. VAT)	850 Euro / m²	750 Euro / m²

Source : Croatian National Report : Tran Solar Project

3.2.3.4. Main industry actors in ST field

The manufacturing industry of solar collectors is not well developed. There is only one manufacturer of solar collectors (Tehnomont Pula) and two solar tank producers in the country, and most of products are imported. In the 1980s, several solar collector producers existed, but ceased operation. This could be attributed to several reasons. In addition to the War from 1991 to 1995, other problems included: lack of government incentives, unorganized market for solar systems and subsidies creating market distortions.[65] A Croatian Society for Solar Energy was established in 1988 in Rijeka and Croatian Professional Society for Solar Energy (http://www.hsuse.hr/) established in 2004 in Zagreb.

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[60] http://www.estif.org/fileadmin/estif/content/market_data/downloads/Solar_Thermal_M%20arkets%202012.pdf
[61] http://www.estif.org/fileadmin/estif/content/market_data/downloads/Solar_Thermal_M%20arkets%202012.pdf
[62] http://www.estif.org/fileadmin/estif/content/market_data/downloads/Solar_Thermal_M%20arkets%202012.pdf
[63] Croatia National Report, the TranSolar Project, p. 17.
[64] Croatia National Report, the TranSolar Project, p. 21-22.
[65] Croatia National Report, the TranSolar Project, p. 11.

3.2.4. *Montenegro*

3.2.4.1. Socio-economic and energy context

Figure 44: Montenegro indicators - source IEA

Key Indicators:	
Population (millions)	0.63
GDP (billion 2005 USD)	2.89
GDP PPP (billion 2005 USD)	6.62
Energy production (Mtoe)	0.79
Net imports (Mtoe)	0.4
TPES (Mtoe)	1.18
Electricity consumption* (TWh)	3.57
CO2 emissions** (Mt of CO2)	2.50

Compound Indicators:	
TPES/population (toe/capita)	1.87
TPES/GDP (toe/thousand 2005 USD)	0.41
TPES/GDP PPP (toe/thousand 2005 USD)	0.18
Electricity consumption / population (MWh/capita)	5.64
CO2/TPES (t CO2/toe)	2.12
CO2/population (t CO2/capita)	3.95
CO2/GDP (kg CO2/2005 USD)	0.86
CO2/GDP PPP (kg CO2/2005 USD)	0.38

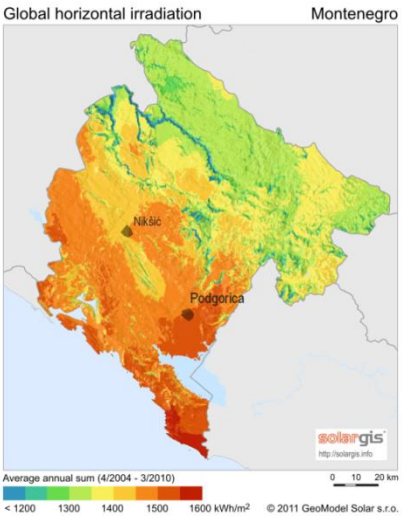
*Gross production + imports - exports - losses
**CO2 Emissions from fuel combustion only. Emissions are calculated using IEA's energy balances and the Revised 1996 IPCC Guidelines.

The estimated population of Montenegro reached 0.63 Million in 2011. Total GDP reached 2.89 billion (2005 USD). Montenegro is dependent on import with around one third (33%) of its primary energy demand.

Energy subsidies

Estimated energy related subsidies from 2005-2009 observations is around 10-11% of GDP. Subsidies are provided for vulnerable electricity consumers. Electricity prices are fixed below market prices. A tariff system contains an important cross-subsidy between commercial and households consumers.[66]

Solar energy resources



Montenegro enjoys more than 2000 hours/year of sun in most of its territory and more than 2500 hours/year along the sea coast. In Podgorica, solar radiation is 1602 kWh/m^2.[67]

3.2.4.2. Solar thermal legislative and regulatory framework

In terms of the legislative and regulatory framework, a law on energy efficiency was adopted in April 2010. An indicative target for 58.9 ktoe or 9% of final primary consumption was also set up in April 2010 for the period 2010-2018, but no particular target for SWH systems. Several rulebooks are detailed in the law; rulebooks on minimal energy efficiency requirements in buildings, regular energy performance certification of buildings, methodology for performing energy audits of buildings, training program for energy audits, content of the request for issuing authorizations and registry of authorized persons, and energy audits of air conditioning systems and heating systems. Under Article 14 of the Rulebook on minimum energy efficiency requirements in buildings, adopted in May 2013, solar collectors for the

[66] Fossil Fuel Subsidies in the Western Balkans, a report for UNDP, December 2011.
[67] Renewable Energy Resources in Montenegro, Montenegro Ministry of Economic Development, Istanbul, November 13-15, 2007.

preparation of at least 30% of annual needs for sanitary hot water are mandated on buildings located in climate zone 1 (Podgorica and the coastal region) while designing a system for preparation of hot water. Swimming pools are also mandated to use solar collectors for preparation of 100% of annual needs for hot water.[68]

Montenegro is a part for the Montesol programme (July 2011 – September 2013) providing for interest-free credit lines for the installation of solar thermal systems for households. The project is implemented in cooperation with the United Nations Environment Programme (UNEP) and the Italian Ministry for Environment, Land and Sea (IMELS). The financial incentive mechanism is administered through NLP Montengrobanka and Hypo Alpe Adria bank. Installation and maintenance of the systems are guaranteed by selected eligible dealers/installers.

The second phase of Montesol started in May 2012. For further supporting the deployment of SWH systems, the Ministry of Economy has opted for simplifying the project regulations and credit conditions, thus increasing the maximum interest-free loan to EUR 5, 000 (to be paid monthly over 7 years).

3.2.4.3. Solar water heater market

The information about the solar thermal market in Montenegro is not well known or documented. However, one main project undertaken by the Ministry of Economy of Montenegro is worth highlighting; Montesol. Under the Montesol programme, 105 SWH systems were installed with a total surface of 530 m^2. Discussions are ongoing to expand the Montesol project to legal persons in the tourism sector.

Certification and standards

Under the Montesol program, some of the requirements of the systems are provision of an annual solar yield of 500 kWh/m^2 according to: EN 12976-2: 2006 if factory-made solar systems and EN 12977-2: 2001 for other solar systems.[69]

3.2.4.4. Main industry actors in ST field

Companies active under the Montesol program are Tedeko Solar Energy, Solaria and Termoinženjering.

[68] Interview with Vilibor Sinanovic, Ministry of Economy of Montenegro, Directorate for Energy Efficiency.
[69] http://solarthermalworld.org/content/montesol-solar-water-heating-project-montenegros-domestic-sector.

3.2.5. *Former Yugoslav Republic of Macedonia*

3.2.5.1. Socio-economic and energy context

Figure 45: FYROM indicators - source IEA

Key Indicators:	
Population (millions)	2.06
GDP (billion 2005 USD)	7.28
GDP PPP (billion 2005 USD)	19.51
Energy production (Mtoe)	1.78
Net imports (Mtoe)	1.43
TPES (Mtoe)	3.12
Electricity consumption* (TWh)	8.17
CO2 emissions** (Mt of CO2)	9.07

Compound Indicators:	
TPES/population (toe/capita)	1.51
TPES/GDP (toe/thousand 2005 USD)	0.43
TPES/GDP PPP (toe/thousand 2005 USD)	0.16
Electricity consumption / population (MWh/capita)	3.96
CO2/TPES (t CO2/toe)	2.91
CO2/population (t CO2/capita)	4.40
CO2/GDP (kg CO2/2005 USD)	1.25
CO2/GDP PPP (kg CO2/2005 USD)	0.47

*Gross production + imports - exports - losses
**CO2 Emissions from fuel combustion only. Emissions are calculated using IEA's energy balances and the Revised 1996 IPCC Guidelines.

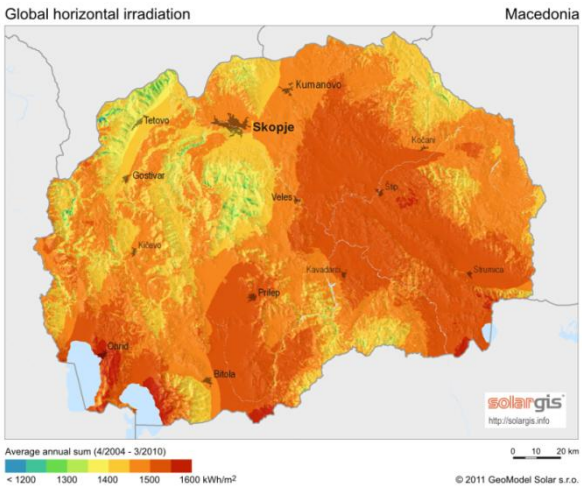
The estimated population of FYROM reached 2.06 Million in 2011. Total GDP reached 7.28 billion (2005 USD).

FYROM is dependent on import with around 43% of its primary energy demand.

Energy subsidies

Estimated energy related subsidies from 2005-2009 observations is around 8-9% of GDP. Electricity consumers in poor or disadvantaged areas (58 000 households) benefit from €10 per month as subsidy. Other assistance is provided in the forms of assistance to power producers promoting waste management of energy efficiency and preferential rights for public companies in terms of concession agreements.[70]

Solar energy resources



Annual irradiation varies from 1250 kWh/m^2 in the north to 1530 kWh/m^2 in the south-western. Average daily radiation varies between 3.4 kWh/m^2 in the north (Skopje) and 4.2 kWh/m^2 in the south-western part (Bitola). Macedonia is characterized by climatic conditions with high solar intensity and duration, temperature, and humidity.[71]

3.2.5.2. Solar thermal legislative and regulatory framework

The energy sector is under the jurisdictions of the Energy Department of the Ministry of Economy,. The Energy Agency issues and conducts register for issued origin guarantee certificates of the electricity produced from RES and high efficiency combined plants. The Energy Regulatory Commission guarantees preferential tariffs for electric energy from high-efficiency combined plants.[72]

The Energy Efficiency Action Plan (EEAP) targets different final energy consumption sectors; residential, commercial and services, industry and transport. New Energy Law was adopted

[70] Fossil Fuel Subsidies in the Western Balkans, a report for UNDP, December 2011.
[71] Strategy for Utilisation of Renewable Energy Sources in the Republic of Macedonia by 2020, Government of the Republic of Macedonia Ministry of Economy, Skopje, August 2010.
[72] Sanja Popovsak-Vasilevska, November 2010.

and entered into force February 2011. In the buildings, the New Energy Law mandates the installation of solar collectors for hot water (when deemed cost effective) in newly constructed buildings or where major renovations are undertaken. Another program was subsidies for solar thermal collectors for not more than 300 households (Andon Kirov).

3.2.5.3. Solar water heater market

Installed capacity (both flat plate and evacuated tube collectors) in 2010 is 13.5 MW_{th} or 6.6 kW_{th}/1000 inhabitants.[73] Domestic solar water heating is the main application. Large SWH systems are in the tourist sector. Few individual combined solar systems for space and water heating are also in place.[74]

Barriers for solar water heating systems are: policy makers ignorance about RES, especially heat production, unreal prices of electricity, low economy standards, lack of awareness, lack of legislation providing for sustainable support, lack of permanent financial support mechanisms, lack of legislation/regulation for quality maintenance, lack of experience in system design and installation, anaesthetic integration of systems in buildings, and no good business practice for guarantees, maintenance and services is in place.[75]

3.2.5.4. Main industry actors in ST field

Camel Solar is one of the pioneering industry actors in FYROM, especially in manufacturing. Other installers include Conseko, Termogas, Energo Pro, and BB Solar. An industry association also exists under the name of Macedonian association for solar energy (SOLAR).

[73] Sanja Popovsak-Vasilevska, November 2010.
[74] Sanja Popovsak-Vasilevska, November 2010.
[75] Sanja Popovsak-Vasilevska, November 2010.

3.2.6. *Serbia*

3.2.6.1. Socio-economic and energy context

Key Indicators:	
Population (millions)	7.26
GDP (billion 2005 USD)	28.42
GDP PPP (billion 2005 USD)	71.38
Energy production (Mtoe)	11.17
Net imports (Mtoe)	4.87
TPES (Mtoe)	16.19
Electricity consumption* (TWh)	32.48
CO2 emissions** (Mt of CO2)	49.78

Compound Indicators:	
TPES/population (toe/capita)	2.23
TPES/GDP (toe/thousand 2005 USD)	0.57
TPES/GDP PPP (toe/thousand 2005 USD)	0.23
Electricity consumption / population (MWh/capita)	4.47
CO2/TPES (t CO2/toe)	3.08
CO2/population (t CO2/capita)	6.86
CO2/GDP (kg CO2/2005 USD)	1.75
CO2/GDP PPP (kg CO2/2005 USD)	0.7

*Gross production + imports - exports - losses
**CO2 Emissions from fuel combustion only. Emissions are calculated using IEA's energy balances and the Revised 1996 IPCC Guidelines.

The estimated population of Serbia reached 7.26 Million in 2011. Total GDP reached 28.42 billion (2005 USD). Serbia is dependent on imports accounting for around 31% of its primary energy demand.

Energy subsidies

Estimated energy related subsidies from 2005-2009 observations is around 7-9% of GDP. Electricity prices are subsidized through a cross-subsidy between household consumers. Industrial consumers also benefit from such low energy prices. District heating is also supported through direct public subsidies and cross-subsidies of public and commercial consumers towards household consumers, delayed payment for fuels, public payment guarantees and direct subsidies.[76]

Solar energy resources

Serbia enjoys about 2300 sunny hours (about 272 days) a year. Solar radiation ranges from 1,1 kWh/m^2/day in the north to 1,7 kWh/m^2/day in the south (during January), and from 5,9 to 6,6 kWh/m^2/day (during July).[77]

3.2.6.2. Solar thermal legislative and regulatory framework

A law on planning and installation was adopted in 2009, defining the conditions for the installation of solar systems for water or area heating and drying of agricultural products.

3.2.6.3. Solar water heater market

There are no official statistics of the solar thermal market in Serbia. According to the Serbian Solar Association, 8000 m^2 of solar collector area is estimated to be installed in the period

[76] Fossil Fuel Subsidies in the Western Balkans, a report for UNDP, December 2011.
[77] Pablovic, Solar Energy in Serbia.

2007-2012, 3000 collectors of which are in the northern province of Vojvodina.[78] Some applications are in households, hotels, hospitals, military and other facilities. One of the biggest installations is on General hospital in Požarevac with 210 collectors. Another example, a solar air collector system with 40m^2 of collector area is installed on the roof of the gymnasium of Smerdervo's primary school in Serbia for purpose of heating and ventilation of the hall and providing hot water in the showers.[79]

Certification and standards

In terms of testing, the Solar Energy Laboratory at the Department of Physics, Faculty of national Sciences and Mathematics was established in 2003. There is also the laboratory for thermal technique, thermal energy and processing techniques at the Faculty of Civil engineering in Niš that was founded in 2004. It conducts hydraulic and thermo-technical investigations of flat plate collectors with liquid and compound parabolic collectors for middle temperature conversion of sun radiation.[80]

System cost

The unitary system cost is 750 EUR/m^2 including all the accessories necessary for the installation.[81]

3.2.6.4. Main industry actors in ST field

Several flat collector manufacturers existed between the 1978-1985 period. Some of these are Nissal, Šinvoz, Petar Drapšin, Goša and Jugoterm. After 1985, however, there has been some interest decline in manufacturing of solar collectors. The table below lists the main manufacturers and installers in the market.[82]

Name	Type
Agrosistems	Manufacturer
Termovent	Manufacturer
Elsol	Manufacturer
Danone Solar	Manufacturer
KMont d.o.o.	Manufacturer
Energo Pro–Teh	Installer
Termogas	Installer
Conseko d.o.o.	Installer

Source: Pablovic, solar energy in Serbia

The Serbian Solar Association[83] is a non-governmental organization dedicated to the development and simulation of solar energy. Some of its activities include conducting seminars, academic expert meetings and publications.

[78] http://solarthermalworld.org/content/serbia-conditions-solar-thermal-continue-improve.
[79] Serbia: Solar Ait Collectors on Smederevo's Primary School, http://solarthermalworld.org/content/serbia-solar-air-collectors-smederevos-primary-school
[80] Pablovic, solar energy in Serbia.
[81] Kljajić, M. V. *et al.*: Applicability Assessment of Central and Solar Hot Water Systems Integration in Serbia, THERMAL SCIENCE, Year 2012, Vol. 16, Suppl. 1, pp. S173-S188
[82] Pablovic, solar energy in Serbia.
[83] http://solar-srbija.org/english.htm

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- http://www.lcecp.org.lb/
- http://www.lses-lb.org/
- http://www.medrec.org/en
- http://www.nerc.gov.jo/
- http://www.nrea.gov.eg
- http://www.one.org.ma/
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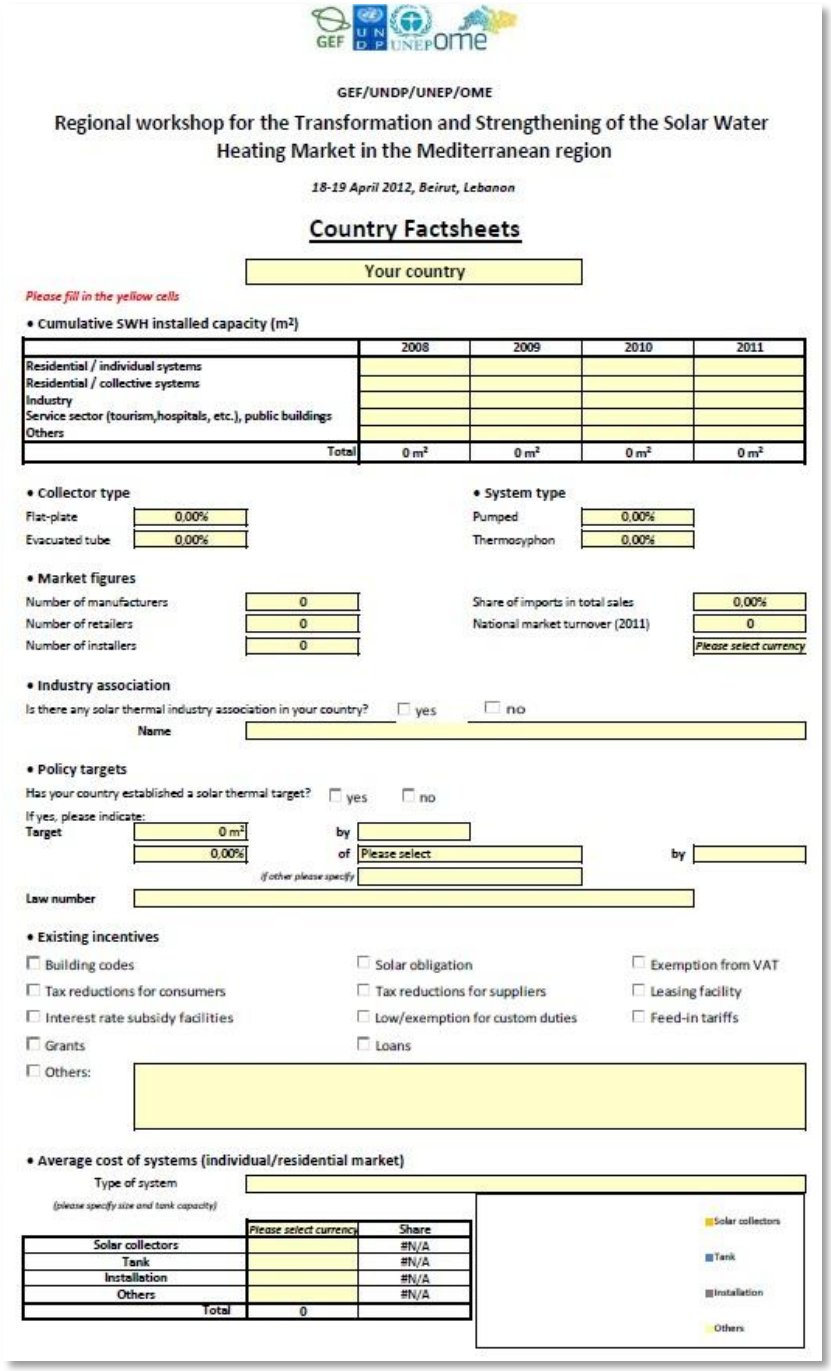
Annex I

The following figure represents the template of the country factsheet developed within the frame of the Expert Workshop organized in Beirut on 18-19 April 2012 and completed by private and public experts.



GEF/UNDP/UNEP/OME

Regional workshop for the Transformation and Strengthening of the Solar Water Heating Market in the Mediterranean region

18-19 April 2012, Beirut, Lebanon

Country Factsheets

Your country

Please fill in the yellow cells

• Cumulative SWH installed capacity (m²)

	2008	2009	2010	2011
Residential / individual systems				
Residential / collective systems				
Industry				
Service sector (tourism,hospitals, etc.), public buildings				
Others				
Total	0 m²	0 m²	0 m²	0 m²

• Collector type

Flat-plate	0,00%
Evacuated tube	0,00%

• System type

Pumped	0,00%
Thermosyphon	0,00%

• Market figures

Number of manufacturers	0	Share of imports in total sales	0,00%
Number of retailers	0	National market turnover (2011)	0
Number of installers	0		*Please select currency*

• Industry association

Is there any solar thermal industry association in your country? ☐ yes ☐ no

Name

• Policy targets

Has your country established a solar thermal target? ☐ yes ☐ no

If yes, please indicate:

Target 0 m² by

0,00% of Please select by

If other please specify

Law number

• Existing incentives

☐ Building codes ☐ Solar obligation ☐ Exemption from VAT

☐ Tax reductions for consumers ☐ Tax reductions for suppliers ☐ Leasing facility

☐ Interest rate subsidy facilities ☐ Low/exemption for custom duties ☐ Feed-in tariffs

☐ Grants ☐ Loans

☐ Others:

• Average cost of systems (individual/residential market)

Type of system

(please specify size and tank capacity)

	Please select currency	Share
Solar collectors		#N/A
Tank		#N/A
Installation		#N/A
Others		#N/A
Total	0	

Solar collectors
Tank
Installation
Others

Annex II

1. INTRODUCTION

Within the framework of developing knowledge products under the framework of the GSWH Market Transformation and Strengthening Initiative, the SWH TechScope Market Readiness Assessment methodology and Analysis Tool[84] has been developed to evaluate the solar water heating policy, finance and investment, business and quality control infrastructure across the countries. The tool uses a system of weighted indicators to develop a score for national SWH enabling environments.

The TechScope methodology focuses on four interrelated parameters:

- SWH Support Framework: SWH targets, financial incentives, loan programs, building mandates, and outreach campaigns.
- National Conditions: Solar radiation (i.e. insolation), SWH penetration and market growth, energy demand trends, and the competitiveness of SWH compared to other heating fuels.
- Financing: National macroeconomic conditions and data on access to loans and the cost of financing.
- Business Climate: The ease of doing business, the existence of SWH quality standards, and the presence of associations that support SWH.

The four parameters are composed of 18 indicators.

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

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.

[84] For more information, refer to Rickerson, Wilson (2013), Solar Water Heating Techscope Market Readiness Asessment.

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%

In terms of scoring, each country is given a score on a scale between 0 and 5. 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.

This report applies the TechScope Tool to five selected Mediterranean countries: Morocco, Tunisia, Egypt, Jordan and Turkey. The countries are analyzed using the four main parameters of the TechScope tool: SWH support framework, national conditions, financing and the business climate.

2. EGYPT

Summary: The SWH market in Egypt has grown by 4% over the past five years, moving from 420 MW_{th} in 2008 to 700 MW_{th} in 2012. Egypt's overall TechScope score is 2.25, which will be discussed in more details in the sections below in order to give greater insight into the SWH TechScope Market Readiness Assessment for Egypt.

General Information	
Population	80 721 874
GDP	US$ 262 831 912 587
Total installed solar thermal (flat plate and evacuated tube collectors)	700 MW_{th}

Parameter	Score
Solar Water Heating Support Framework	0.40
National Conditions	0.95
Financing	0.24
Business Climate	0.67

a. PARAMETER I: SOLAR WATER HEATING SUPPORT FRAMEWORK

Parameter	Score	Indicator	Weight	Indicator Score (Raw)	Indicator Score (Weighted)
SWH Support Framework	0.40	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
		Building Mandates	5%	0.0	0.00
		Outreach Campaigns	4%	0.0	0.00
		Subtotal	**29%**	**5.0**	**0.40**

SWH Targets

SCORE 0.0 / 5.0

As of May 2014, there are no solar water heating targets in Egypt. Given the absence of such targets, Egypt's score for this section is 0, but it will get a score of 5 once a target is put in place.

Financial Incentives for System Installation

SCORE 0.4 / 5.0

There are no major financial incentives given for installing SWH systems in Egypt. Since 2006, however, there is a reduction of 5% on custom duty for renewable components and systems.

Several solar initiatives have been proposed over the years, mostly under the framework of international co-operation programmes. One important project worth highlighting is called EGYSOL and is being implemented within the framework of the "Mediterranean Renewable Energy Programme" (MEDREP), initiated by the Italian government. EGYSOL intends to promote collective solar water heating installations in the Red Sea and South Sinai tourist resorts and other buildings in the service sector. The project is managed by UNEP in co-operation with Egypt's New and Renewable Energy Authority (NREA) under the direction of the Italian Ministry for the Environment, Land and Sea. A fund of USD 500,000 is used to grant a capital cost subsidy of 25% (up to USD 100/m^2) and a decreasing maintenance cost subsidy over a four-year term. Egypt, thus, receives a score of 0.4 for this section.

SWH Loan Programs

SCORE 0.0 / 5.0

As of May 2014, there are no SWH loan programs in place. So, a score of 0 is given for the absence of a loan program.

Building Mandates

SCORE 0.0 / 5.0

A solar obligation was introduced in 1987, which called for new residential buildings to consider the use of solar water heaters and include the design for their use and authorizing agencies have to verify the use of solar hot water heaters (by the Minister of New Communities, Housing and Utilities, decree N. 401/1987). However, the solar obligation is not generally applied or enforced.

Recent developments have been the interest of introducing a solar water heating programme for the hotel sector. Such program entails obligation for hot water production and energy-efficient lighting in hotels. An objective to supply solar heated water to 100, 000 rooms in the hotels sector over the next 5 years.[85]

Egypt receives a score of 0 for this section. It would get a score of 5 once the obligation is reinforced and generally applied.

Outreach Campaigns

SCORE 0.0 / 5.0

As of May 2014, there are no outreach and communication campaigns promoting the use of solar water heating systems in Egypt.

The score of this section is, thus, 0.

b. PARAMETER II: NATIONAL CONDITIONS

Parameter	Score	Indicator	Weight	Indicator Score (Raw)	Indicator Score (Weighted)
National Conditions	0.95	Insolation	5%	5.0	0.25
		SWH Market Penetration	4%	0.2	0.01
		Energy Consumption	5%	5.0	0.25

[85] http://psdp-egypt.info/egypt-starts-green-tourism-initiative-with-hotel-solar-obligation-2/

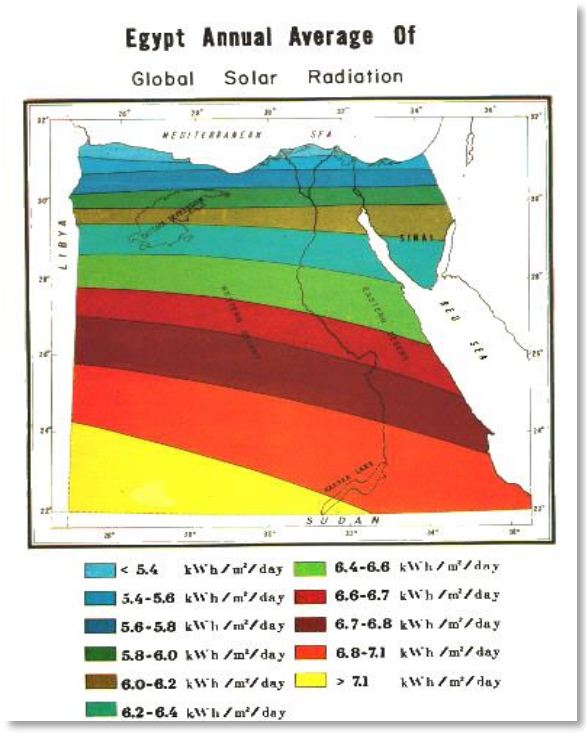
		Growth			
		SWH Market Growth	4%	4.0	0.16
		Competitiveness: LCOE Comparison/Payback Period	7%	4.0	0.28
		Competitiveness: Heating Fuel Subsidy	5%	0.0	0.00
		Subtotal	**30%**	**16.2**	**0.95**

Insolation

SCORE 5.0 / 5.0

Egypt is located in the world's solar belt countries and has an excellent solar resource availability. The NREA (New and Renewable Energy Authority) issued in 1991 a solar Atlas (Figure 13), according to which, Egypt has a high intensity of global horizontal solar radiation ranging between 5.2-7.1 kWh/m²/day from Northern to South-Western part of the country, which means that annual global radiation varies between 1,900-2,600 kWh/m²/y. The total sunshine hours range between 3,200 and 3,600 hr/year. For solar irradiation, Egypt receives a score of 5.

Figure 46: Solar radiation in Egypt



Source: NREA

SWH Market Penetration

SCORE 0.2 / 5.0

SWH market penetration rate in Egypt is 8.67 kW_{th}/1000 people. In terms of application by sector, solar collectors are mostly used in new residential developments (36% in 2009). The score of this section is 0.2.

Residential Energy Consumption Growth

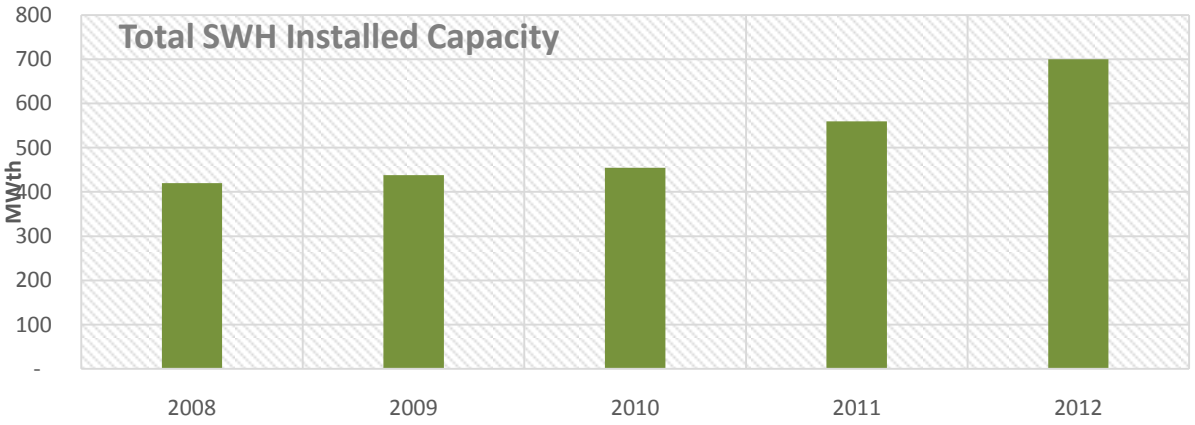
SCORE 5.0 / 5.0

Energy consumption in the residential sector has been increasing on average by 6% during the 2006-2011 period. It moved from 8593 Ktoe in 2006 to 11515 Ktoe in 2011. The score of this section is 5.

SWH Market Growth

SCORE 4.0 / 5.0

In 2012, collector area installed is estimated at 1,000,000 m2.[86] NREA reported that around 650 000 m^2 was installed in 2010. About 400,000 solar water heating units with a total collector surface of 800,000 m^2 (560 MW_{th}), are estimated to be in place. The average annual market growth is 14% during the 2008-2012 period. The score of this section is 4.



SWH Competitiveness: Payback Period

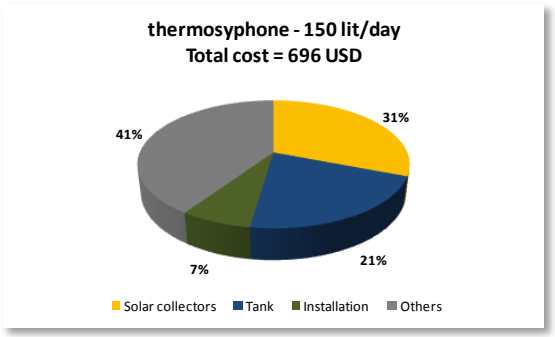
SCORE 4.0 / 5.0

As of end of 2011, 95 funding applications had been submitted. Nine projects with surface of more than 1,100 m^2 have been completed. The average payback period of these systems is around four years and half, thus making these investments more profitable compared to other countries in the region.

According to NREA, the average system cost for a thermosyphon (150 lit/day (copper * copper)) is around USD 700. Solar collectors and tank represent half of the total cost of the system. A score of 4 is given this indicator.

[86] Adel Khalil, Solar Thermal Energy in Egypt: Potential, Education and Research, Conference on Solar Thermal Energy in Egypt, Heliopolis University, 11 June 2013.

Figure 47: Average cost of systems in Egypt [individual, residential market]



SWH Competitiveness: Heating Fuel Subsidy

SCORE 0.0 / 5.0

According to IEA, Egypt devoted USD 24.47 billion in 2011 to energy subsidies of which USD 5.42 billion to electricity, USD 15.27 billion to oil and the remaining part dedicated to gas.[87] These grants represent 10.4% of Gross Domestic Product (GDP) of Egypt, which devotes more than $ 296 per person of energy subsidies. Given the amounts allocated for energy subsidies in Egypt, the score of this section is 0.

c. PARAMETER III: FINANCING

Parameter	Score	Indicator	Weight	Indicator Score (Raw)	Indicator Score (Weighted)
Financing	0.24	Country Credit Rating	5%	0.3	0.01
		Access to Finance	15%	1.5	0.23
		Subtotal	**20%**	**1.8**	**0.24**

Country Credit Rating

SCORE 0.3 / 5.0

Egypt is rated with a Caa1 and B- from Moody's and S&P, respectively. Egypt receives a score of 0.3 for this section.

Access to Finance

SCORE 1.5 / 5.0

Egypt's average real interest rate during the 2010-2012 period is 0, resulting in a score of 0. In terms of domestic credit provided by the banking sector (%of GDP) is 78%, resulting in a score of 3. Both credit provided by domestic banking and real interest rate would give a score of 1.5.

[87] http://www.iea.org/subsidy/index.html; Analyses based on an indicator average price of crude oil on the international market (30 U.S. cents per litre in 2010) and IEA estimates

d. PARAMETER IV: BUSINESS CLIMATE

Parameter	Score	Indicator	Weight	Indicator Score (Raw)	Indicator Score (Weighted)
Business Climate	0.67	Doing Business Index	5%	2.0	0.10
		Domestic Manufacturing	3%	4.0	0.12
		Product Certification	5%	4.0	0.25
		Installer Certification	4%	0.0	0.00
		Industry Association	4%	5.0	0.20
		Subtotal	**21%**	**15**	**0.67**

Doing Business Index

SCORE 2.0 / 5.0

According to Doing Business 2014, Egypt ranks 128 out of 189. The scores of each individual indicator within the Doing Business Rank are shown in the table below. Whereas the "starting a business" indicator is relatively high, others like enforcing contracts, dealing with construction permits, resolving insolvency and protecting investors have low scores. So, Egypt's overall score for this section is 2.

Category	Doing Business Ranking
Starting a Business	50
Dealing with Construction Permits	149
Getting Electricity	105
Registered Property	105
Getting Credit	86
Protecting Investors	147
Paying Taxes	148
Trading Across Border	83
Enforcing Contracts	156
Resolving Insolvency	146

Domestic Manufacturing

SCORE 4.0 / 5.0

In 2009, nine companies were active in solar water heating business in Egypt: four companies were manufacturers and installers, and five companies were importers and installers of SWH systems.[88] In terms of MVA as percentage of GDP, Egypt has an MVA of 16.38% in 2012, very close the global average (16.71%). The overall TechScope score of Egypt for this section is 4.

[88] Moataz Soliman, *Solar Water Heaters in Egypt: Status and Recommendations,* Workshop on Solar Thermal Application in Egypt, Palestine, Lebanon, Syria and Jordan: Technical Aspects, Framework conditions, and private Sector Needs, Cairo, March 23-25th 2009

Product Certification

SCORE 4.0 / 5.0

Standards in Egypt fall under the auspices of the Egyptian public authority for standards and quality. In 1996, the Ministry of Electricity and Energy in cooperation with the European Union established the Renewable Energy Testing and Certification Centre (RETCC) within NREA. The RETCC is considered as a specialised centre aiming at carrying out the studies, research, testing, and certification activities needed in order to develop RE materials according to testing standard procedures. The RETCC has different RE testing facilities among which a solar thermal testing facility. This one is testing and certifying solar thermal component and systems according to ASHREAE 93/86 Testing Procedures and Egyptian Standards which are almost fully compliant with the international standards ISO 9806/94. Unfortunately, some companies do not follow the standard specifications in the manufacturing process, thus worsening the reputation of solar water heaters. It is worth highlighting the “SHAMCI” certification initiative as a regional certification scheme in the Arab region. So, Egypt gets a score of 4.

Installer Certification

SCORE 0.0 / 5.0

As of May 2014, there are no certification requirements for SWH systems installers in Egypt. So, the overall score for this section is 0.

Industry Association

SCORE 5.0 / 5.0

The Solar Egyptian Development Association (SEDA) has been established as an outcome of the Solar Water Heater (SWH) Innovation Network which was developed by the Egyptian German Private Sector Development Programme (PSDP). It is a platform representing all stakeholders in the Solar Thermal industry; government, private sector, system designers, installers, manufacturers, traders, industry experts, academics, research and development. The score for this section is 5.

3. JORDAN

Summary: The SWH market in Jordan has grown by 13% over the past four years, moving from 624 MW_{th} in 2009 to 889 MW_{th} in 2012. Jordan's overall TechScope score is 3.41, which will be discussed in more details in the sections below in order to give greater insight into the SWH TechScope Market Readiness Assessment for Jordan.

General Information	
Population	6 318 000
GDP	US$ 31 015 239 496
Total installed solar thermal (flat plate and evacuated tube collectors)	889 MW_{th}

Parameter	Score
Solar Water Heating Support Framework	1.45
National Conditions	0.90
Financing	0.64
Business Climate	0.42

a. PARAMETER I: SOLAR WATER HEATING SUPPORT FRAMEWORK

Parameter	Score	Indicator	Weight	Indicator Score (Raw)	Indicator Score (Weighted)
SWH Support Framework	1.45	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
		Building Mandates	5%	5.0	0.25
		Outreach Campaigns	4%	5.0	0.20
		Subtotal	**29%**	**25**	**1.45**

Solar Water Heating Targets

SCORE 5.0 / 5.0

The objective, set up within the "Energy Strategy 2007-2020," is to equip 30% of the households with a SWH system. So, Jordan receives a score of 5 for this section.

Financial Incentives for System Installation

SCORE 5.0 / 5.0

The "Royal Decree for Renewable Energy and Energy Efficiency" (Law No. 3, 2010) includes taxes and customs exemption in favour of RE & EE projects. Jordan receives a score of 5 for this section.

SWH Loan Programs

SCORE 5.0 / 5.0

To promote the installation of domestic SWH systems, the Ministry of Energy and the Jordan River Foundation joinded efforts to provide loans of $1.8 milion.[89] So, a score of 5 is granted for this indicator.

Mandates

SCORE 5.0 / 5.0

A solar thermal obligation for new buildings has been established within the Energy Efficient Building Code, developed in 2008 by the Royal Scientific Society of Jordan. This has been recently enforced. Given the existence of such solar thermal obligations, Jordan receives a score of 5 for this section.

Outreach Campaigns

SCORE 5.0 / 5.0

Serval awareness raising and communication campaigns were organized by the governments in the field of renewable energy and energy efficiency. So, Jordan receives a score of 5 for this indicator.

b. PARAMETER II: NATIONAL CONDITIONS

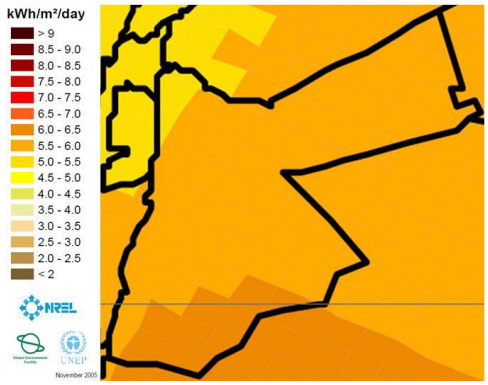
Parameter	Score	Indicator	Weight	Indicator Score (Raw)	Indicator Score (Weighted)
National Conditions	0.87	Insolation	5%	3.9	0.19
		SWH Market Penetration	4%	3.4	0.13
		Energy Consumption Growth	5%	2.8	0.14
		SWH Market Growth	4%	4.0	0.16
		Competitiveness: LCOE Comparison/Payback Period	7%	4.0	0.28
		Competitiveness: Heating Fuel Subsidy	5%	0.0	0.00
		Subtotal	**30%**	**18.1**	**0.9**

[89] http://www.jordanriver.jo/?q=content/project-provide-affordable-solar-water-heaters-families

Insolation

SCORE 3.9 / 5.0

Figure 48: Global Horizontal Irradiance in Jordan



Source: SWERA

Jordan is endowed with an abundance of solar energy with annual daily average solar irradiance (average insulation intensity on a horizontal surface) which ranges between 4.5-7 kWh/m², which is one of the highest in the world. This corresponds to an annual total of 1400-2300 kWh/m². The average sunshine duration is more than 300 days per year.

So, Jordan gets a score of 5 for this section.

SWH Market penetration

SCORE 3.4 / 5.0

With more than 170 m²/1,000 inhabitants, Jordan has one of the highest rates of equipment after Israel, Palestine and Turkey. A score of 3.4 is given for this section.

Residential Energy Consumption Growth

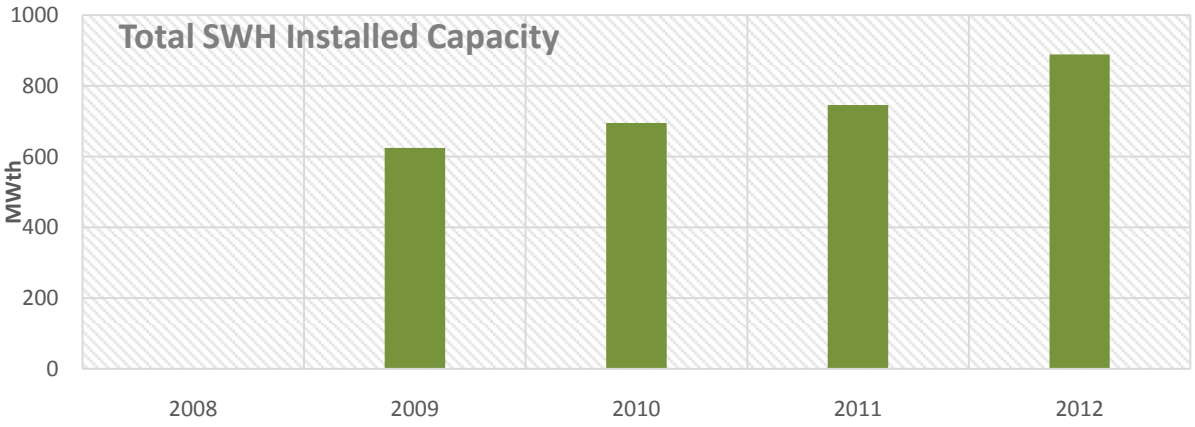
SCORE 2.8 / 5.0

On average, residential energy consumption growth has been low during the 2006-2011 period. It even went down by 6% in 2008 and 2010. It moved from 1086 Ktoe in 2006 to 1149 Ktoe in 2011. So, a score of 2.8 is given for this section.

SWH Market Growth

SCORE 4.0 / 5.0

The total installed collector surface reached around 1, 270, 000 m^2 in 2012, with more than 200, 000 m^2 installed in 2012. An accumulative capacity of 1,000,000 m² was installed in 2011, with 70,000 m² installed in 2011 and 90,000 m² installed in 2009 mainly in the residential sector. Flat plate collectors dominate the market with a share of 90% (80% in 2011) of the panels installed. Thermosyphon represent the main systems installed with a share of 75% (80% in 2011). The market volume has grown on average by 13% during the 200-2012 period. Jordan receives a score of 4 for this section.

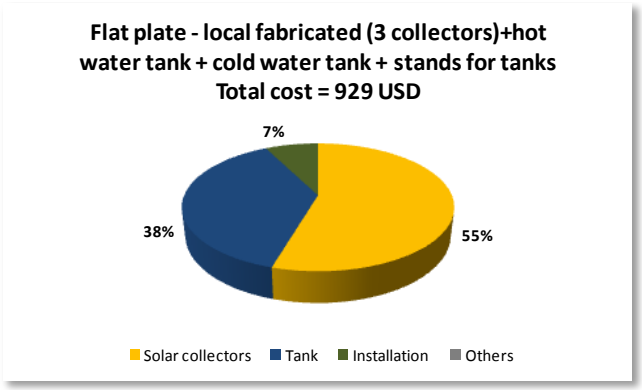


Competitiveness: Payback Period

SCORE 4.0 / 5.0

According to NERC, the average cost for a system (Flat plate - locally fabricated (3 collectors) + hot water tank + cold water tank + stands for tanks) is around USD 930. Solar collectors and tank represent more than 90% of the total cost of the system. A score of 4 is given for this section.

Figure 49: Average cost of systems in Jordan [individual, residential market]



Source: NERC

Competitiveness: Heating Fuel Subsidy

SCORE 0.0 / 5.0

After subsidizing petroleum products for many years, the Jordanian energy system came under pressure in 2003, when it lost preferential fuel supply from Iraq. The government then implemented a series of price increases to limit the budgetary effect of the energy subsidies. Nevertheless, in 2008 the subsidy bill for energy still represented about 5% of GDP.[90] Given amounts of subsidies available, Jordan receives a score of 0 for this section.

[90] http://siteresources.worldbank.org/EXTESC/Resources/Subsidy_background_paper.pdf

c. PARAMETER III: FINANCING

Parameter	Score	Indicator	Weight	Indicator Score (Raw)	Indicator Score (Weighted)
Financing	0.64	Country Credit Rating	5%	0.8	0.04
		Access to Finance	15%	4.0	0.60
		Subtotal	**20%**	**4.8**	**0.64**

Country Credit Rating

SCORE 0.8 / 5.0

The ratings from Moody's and S&P are B1 and BB-, respectively. Jordan's score for this section is 0.8 points.

Access to Finance

SCORE 4.0 / 5.0

Jordan's average interest rate during the 2010-2012 period is 2%, resulting in a score of 4. In terms of domestic credit provided by the banking sector (%of GDP) it reached 114% in 2012, resulting in a score of 4. So, a combination of the two give an overall score of 4 for this section.

d. PARAMETER IV: BUSINESS CLIMATE

Parameter	Score	Indicator	Weight	Indicator Score (Raw)	Indicator Score (Weighted)
Business Climate	0.42	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%	0.0	0.00
		Industry Association	4%	0.0	0.00
		Subtotal	**21%**	**10**	**0.42**

Business Climate

SCORE 2.0 / 5.0

Category	Doing Business Ranking
Starting a Business	117
Dealing with Construction Permits	111
Getting Electricity	41
Registered Property	104
Getting Credit	170

Protecting Investors	170
Paying Taxes	35
Trading Across Border	57
Enforcing Contracts	133
Resolving Insolvency	113

Jordan ranks 119 out of 189, falling in 37% percentile. Jordan performs relatively well in some indicators, mainly getting electricity and paying taxes. For other indicators, on the other hand, like getting credit and protecting investors, its rank 170 out of 189. So, overall Jordan receives a score of 2 for this section.

Domestic Manufacturing

SCORE 4.0 / 5.0

A manufacturing industry exists in Jordan. In 2012, Jordan had an MVA of 16.52% as a percentage of GDP, which is close the global average 16.71%. Jordan, therefore, receives a score of 4.

Product Standards and Certification

SCORE 4.0 / 5.0

Jordan Standardization Organization is the main body responsible for standardization in Jordan. Even though standards exist, they are not mandatory. Only few actors are following the specifications established by the Royal Scientific Society (RSS). Whereas the country has its own testing laboratories at the RSS, there are no effective regulations to enter in the market. Jordan receives a score of 4 for this section.

Installer Certification

SCORE 0.0 / 5.0

Installers are not required to be certified in Jordan. So, a score of 0 is give for this indicator.

Industry Association

SCORE 0.0 / 5.0

There is no solar thermal industry association in the country. So, Jordan receives a score of 0 for this section.

4. MOROCCO

Summary: The SWH market in Morocco has grown by 16% over the past five years, moving from 155 MW_{th} in 2008 to 291 MW_{th} in 2012. Morocco's overall TechScope score is 3.28, which will be discussed in more details in the sections below in order to give greater insight into the SWH TechScope Market Readiness Assessment for Morocco.

General Information	
Population	32 521 143
GDP	US$ 95 981 572 517
Total installed solar thermal (flat plate and evacuated tube collectors)	291MW_{th}

Parameter	Score
Solar Water Heating Support Framework	1.10
National Conditions	0.93
Financing	0.38
Business Climate	0.87

a. PARAMETER I: SOLAR WATER HEATING SUPPORT FRAMEWORK

Parameter	Score	Indicator	Weight	Indicator Score (Raw)	Indicator Score (Weighted)
SWH Support Framework	1.10	SWH Targets	5%	5.0	0.25
		Financial Incentives for System Installation	8%	5.0	0.40
		SWH Loan Programs	7%	0.0	0.00
		Building Mandates	5%	5.0	0.25
		Outreach Campaigns	4%	5.0	0.20
		Subtotal	**29%**	**15**	**1.10**

SWH Targets

SCORE 5.0 / 5.0

A solar thermal target exists in Morocco. This target has been defined under the framework of the PROMASOL programme, whose objective is to have 1.7 million m² of installed by 2020. A score of 5 is assigned to Morocco for this section.

Financial Incentives for System Installation

SCORE 5.0 / 5.0

According to ADEREE[91], there are several incentives in Morocco as: a building code, tax reduction for consumers and a leasing facility, as well as grants foreseen in the near future. In addition, within the PROMASOL programme (2002-2008), some incentives were set in order to enhance solar thermal market in the country. The PROMASOL (Programme de développement du marché Maroccain des chauffe-eau Solaires) project was launched in 2002, as a joint initiative between CDER and UNDP, with the aim to boost the solar water heating market thanks to an incentive mechanism and several accompanying measures (labeling and non-binding approval issued by the laboratory CDER; VAT reduction from 20% to 14%; creation of a guarantee fund of EE&RE (FOGEER); awareness-raising programme). So, this indicator receives a score of 5.

SWH Loan Programs

SCORE 0.0 / 5.0

There are no SWH loan programs in Morocco. So, a score of 0 is given for this section.

Building Mandates

SCORE 5.0 / 5.0

Building regulations are governed by "Code d'Efficacité Energétique dans le Bâtiment." The objective is to set up the technical requirements and thermal characteristics for enery performance of buildings in the residential and tertiary sector.

Outreach Campaigns

SCORE 5.0 / 5.0

An awareness raising programme has been undertaken under the PROMASOL programme. Several others were also taken by ADEREE. So, Morocco receives a score of 5 for this section.

[91] Moroccan, country factsheet, Regional workshop for the Transformation and Strengthening of the Solar Water Heating Market in the Mediterranean, Beirut, April 2012

b. PARAMETER II: NATIONAL CONDITIONS

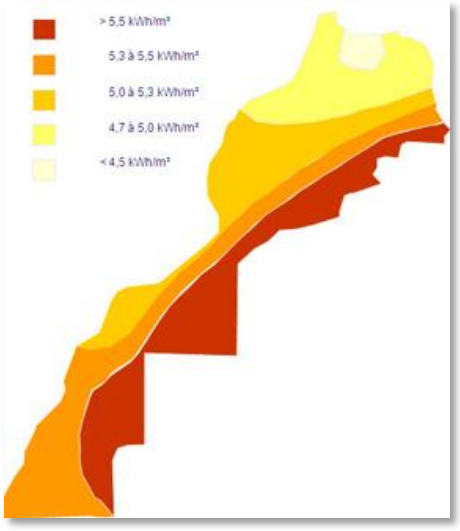
Parameter	Score	Indicator	Weight	Indicator Score (Raw)	Indicator Score (Weighted)
National Conditions	0.93	Insolation	5%	3.9	0.19
		SWH Market Penetration	4%	0.2	0.01
		Energy Consumption Growth	5%	5.0	0.25
		SWH Market Growth	4%	5.0	0.20
		Competitiveness: LCOE Comparison/Payback Period	7%	4.0	0.28
		Competitiveness: Heating Fuel Subsidy	5%	0.0	0.00
		Subtotal	**30%**	**18.1**	**0.93**

Insolation

SCORE 5.0 / 5.0

There is a high solar energy potential with a total sunshine hours ranging between 2,800-3,400 hour/year and an average annual global radiation reaching 4.5 in North to more than 5.5 kWh/m²/day in South. So, Morocco receives a score of 5 for this section.

Figure 50: Solar radiation in Morocco [kWh/m²]



Source: MASEN

SWH Market Penetration

SCORE 0.2 / 5.0

Morocco has a low market penetration, with around 9 kW_{th}/1000 people in 2012. So, Morocco gets a score of 0.2 for this section.

Residential Energy Consumption Growth

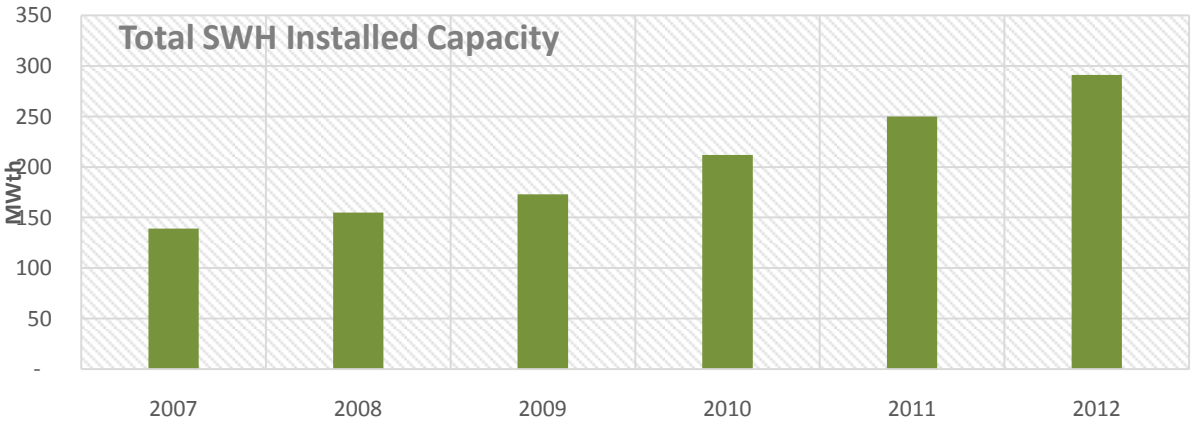
SCORE 5.0 / 5.0

Residential energy consumption has grown on average by 5% during the 2006-2011 period. It moved from 1966 Ktoe in 2006 to 2491 Ktoe in 2011. The overall score for this section is 5.

SWH Market Growth

SCORE 5.0 / 5.0

The SWH market in Morocco was given impulse with the implementation of the PROMASOL programme. The installed collector area grew from about 35,000 m² in 1998 to more than 265,000 m² in 2010. The installed capacity reached around 340 000 m^2 in 2011 and 415 000 m^2 in 2012. Nevertheless, the real balance of the programme is difficult to assess. According to ADEREE about 8,000 m² per year have been installed thanks to the programme, with the rest coming from the natural growth of the market. The average annual market growth rate during the 2007-2012 period is 16%. So, a score of 5 is given for this section.

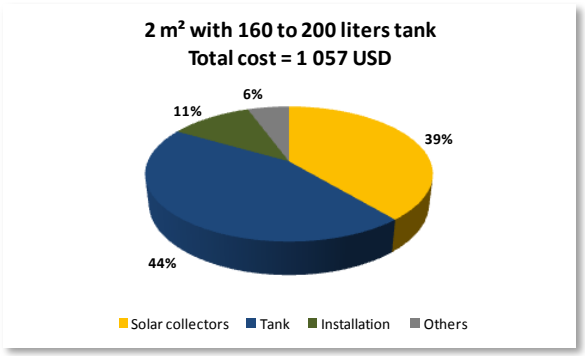


SWH Competitiveness: Payback Period

SCORE 4.0 / 5.0

According to ADEREE and AMISOLE, the average system cost for a system of 2 m² of solar panels with a water tank in a range of 160 to 200 liters is around USD 1,060. Solar collectors and tank represent more than 80% of the total cost of the system.

Figure 51: Average cost of systems in Morocco [individual, residential market]



Sources: ADEREE, AMISOLE

SWH Competitiveness: Heating Fuel Subsidy

SCORE 0.0 / 5.0

Energy in Morocco is subsidised through a Compensation Fund. The Government provides subsidies on both LPG and diesel through a system of official prices and refunds to petroleum companies to recover the wholesale price. The prices for both products are fixed by the government. The subsidy is equal to the difference between what would be the consumer price if it was the result of market forces and the government imposed price. The market prices fluctuate in line with prices on the international market. In addition, the fuel used by the Office National de l'Electricité et de l'Eau Potable (ONEE) in its fossil plants is highly subsidised. As ONEE (public entity) does not have the control on the electricity selling price (it is fixed by ministerial decree), ONEE has no means to reflect the changes in international price of commodities to the consumer. According to the Ministry of Energy, Mines, Water and Environment,[92] the total amount of subsidies dedicated to energy through the expenses of the Compensation Fund reached in 2011 around MAD 41 billion (€ 3.7 billion) and around MAD 48.2 billion in 2012.

So, given the situation of subsidies in Morocco, a score of 0 is given for this section.

c. PARAMETER III: FINANCING

Parameter	Score	Indicator	Weight	Indicator Score (Raw)	Indicator Score (Weighted)
Financing	0.68	Country Credit Rating	5%	4.0	0.60
		Access to Finance	15%	2.0	0.30
		Subtotal	**20%**	**3.5**	**0.68**

[92] http://www.mem.gov.ma/publucations/Contribution%20Energie%20%20Mines%2027-12-2011.pdf

Country Credit Rating

SCORE 1.5 / 5.0

Morocco's rate is Ba1 based on Moody's rating, and BBB- according to S&P. So, an overall score of 1.5 is given for this indicator.

Access to Finance

SCORE 4.0 / 5.0

Domestic credit provided by the banking sector accounted for 115% (% of GDP) in 2012, resulting in a score of 4. The interest rate has been stable during the 2010-2012 period, with around 3%, resulting in a score of 4. So, the overall score is 4.

d. PARAMETER IV: BUSINESS CLIMATE

Parameter	Score	Indicator	Weight	Indicator Score (Raw)	Indicator Score (Weighted)
Business Climate	0.87	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%	5.0	0.20
		Industry Association	4%	5.0	0.20
		Subtotal	**21%**	**21**	**0.87**

Doing Business Index

SCORE 3.0 / 5.0

Category	Doing Business Ranking
Starting a Business	39
Dealing with Construction Permits	83
Getting Electricity	97
Registered Property	156
Getting Credit	109
Protecting Investors	115
Paying Taxes	78
Trading Across Border	37
Enforcing Contracts	83
Resolving Insolvency	69

Morocco ranks 87 out of 189 in the Doing Business Index. Morocco performs relatively well on some indicators; starting a business (rank 39) and trading across border (rank 37). So, an overall score of 3 is given for this section.

Domestic Manufacturing

SCORE 2.0 / 5.0

Most of the actors acting in the solar thermal market in Morocco are integrated companies (installation, distribution and maintenance activities). It is estimated that there are 50 retailers and about 200 installers established in the market. There are also two manufacturers which are: Event Solaire Maroc SARL (German company established in Morocco: www.event-solar.com) and Giordano Maroc. In terms of MVA as a percentage of GDP, a 12.90% is recorded for 2012 (world average is 16.71%). A score of 2 is given for this section.

Product Certification

SCORE 4.0 / 5.0

Moroccan law No. 12-06 creating the Moroccan Institute for Standardization (IMANOR) came into force on 18 March 2011. The IMANOR resumes all activities performed by the Service de Normalisation Industrielle Marocaine (SNIMA), established in 1970 and placed under the authority of the Ministry of Industry, Trade and New Technologies.

Within the PROMASOL programme a non-binding label was proposed and the ADEREE (formerly CDER) was hosting two laboratories in charge of testing products and delivering the label certifying that the company's SWH system is compliant with the Moroccan norms. As of 2009, 13 brands of SWH were certified and received the label. A score of 4 is given for this indicator.

Installer Certification

SCORE 5.0 / 5.0

To b eligible for the PROMASOL programme, ADEREE requires the certification of installers. So, a score of 5 is given for this section.

Industry Association

SCORE 5.0 / 5.0

In 1987, renewable energy actors in Morocco established AMISOLE (Association Marocaine des Industries Solaires et Eoliennes - Moroccan Association of Solar and Wind Industries – www.amisole.com) to advocate their interests and develop the renewable energy industry. AMISOLE aims to have a continuous lobbying action with public players. AMISOLE is not focusing only on solar thermal matters but also on photovoltaic and wind business.

The existence of an industry association gives a score of 5 for this section.

5. TUNISIA

Summary: The SWH market in Tunisia has grown by 19% over the past five years, moving from 224 MW_{th} in 2008 to 446 MW_{th} in 2012. Tunisia's overall TechScope score is 3.62, which will be discussed in more details in the sections below in order to give greater insight into the SWH TechScope Market Readiness Assessment for Tunisia.

General Information	
Population	10 777 500
GDP	US$ 45 662 043 358
Total installed solar thermal (flat plate and evacuated tube collectors)	446 MW_{th}

Parameter	Score
Solar Water Heating Support Framework	1.45
National Conditions	0.92
Financing	0.34
Business Climate	0.72

a. PARAMETER I: SOLAR WATER HEATING SUPPORT FRAMEWORK

Parameter	Score	Indicator	Weight	Indicator Score (Raw)	Indicator Score (Weighted)
SWH Support Framework	1.45	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
		Building Mandates	5%	5.0	0.25
		Outreach Campaigns	4%	5.0	0.20
		Subtotal	**29%**	**15**	**1.45**

SWH Targets

SCORE 5.0 / 5.0

By 2016, Tunisia aims to have an installed capacity of about 575,000 m² reaching an annual solar thermal panels installed around 70,000 m² in the residential sector, 10,000 m² in the tertiary sector and 10,000 m² in the industrial sector. If these targets are met, total solar thermal capacity in operation would reach approximately 70 kW_{th}/1000 inhab., thus being higher than the level currently reached in countries like Switzerland and Denmark, which are pioneers in solar thermal technologies. Tunisia gets a score of 5 for this section.

Financial Incentives for System Installation

SCORE 5.0 / 5.0

In Tunisia, solar thermal has been proposed repeatedly since the 1980s as a solution to reduce dependence on imported fossil fuels. A market and technology infrastructure was developed in 1997-2001, thanks to a project financed by the GEF and the Belgian co-operation. The support mechanism was based on a 35% capital cost subsidy. By 2001, 50,000 m^2 of additional solar thermal panels had been installed, and an industry supply chain had been created. After a series of stop-and-go policies, Tunisia launched its PROSOL programme in 2005, in cooperation with the Italian Ministry for the Environment, Land and Sea and UNEP. The programme helped to revitalise the solar thermal market. The PROSOL mechanism is based, among others, on a capital cost subsidy financed by the National Fund for Energy Management (FNME) (105 € (200 TND) for the SWH collector area from 1 to 3 m² and 210 € (400 TND) for the SWH collector area between 3 to 7 m²), but also on a refundable bank loan. Following the success of the first PROSOL, follow-up initiatives have been launched in the residential, tourism and industrial sectors. The solar systems installed within the PROSOL programme in tourism sector, launched in 2009, benefit from a subsidy financed by the Fond National pour la Maîtrise de l'Energie (FNME) (30% of the investment with a ceiling 75 €/m², 70% of the cost of the study and control), but also from the funds IMELS-UNEP (10% investment with ceiling 25 €/m²; 2% bonus on the interest rate of loans; 50% of maintenance costs for two years after the supplier guarantee) and accompanied by different support measures (training, communication plan...). The PROSOL industrial, launched in 2010, is also beneficiary of a subsidy (30% of the investment with a ceiling of 75 €/m²; 70% of the cost of the study and control) financed by FNME. So, Tunisia gets a score of 5 for this section.

SWH Loan Programs

SCORE 5.0 / 5.0

In addition to grants, a loan program was established under the PROSOL initiative. A refundable bank loan was granted over 5 years by the STEG, through electricity bills (Loan amount: 230 € (550 TND), 380 €, 455 € and 575 € (1,150 TND); Interest rate : TMM+1 (6,25 %) for 2007 and TMM+1,2 for the next year). The success of this program is due to a strong support from the banking sector and a strong membership with the STEG. Tunisia receives a score of 5 for this section.

Building Mandates

SCORE 5.0 / 5.0

Building mandates exist in Tunisia and relates to new buildings. This is governed by a decree of 1st June 2009 establishing the minimum technical specifications for the saving energy consumption in residential buildings. New and renovation of buildings for business purposes are governed by Decree of 23rd July 2008, setting the minimum requirements for energy consumption in this regard. So, Tunisia gets a score of 5 for this section.

Outreach Campaigns

SCORE 5.0 / 5.0

A communication plan was developed under the framework of the PROSOL initiative. Tunisia receives a score of 5 for this section.

b. PARAMETER II: NATIONAL CONDITIONS

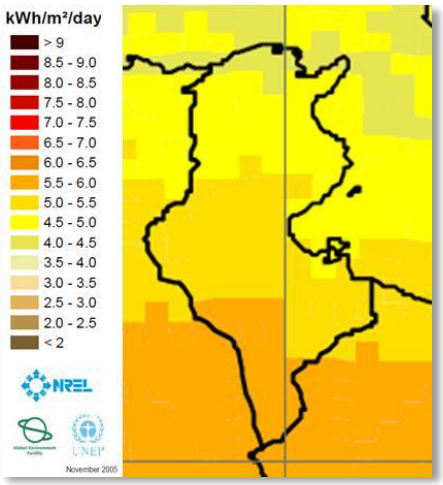
Parameter	Score	Indicator	Weight	Indicator Score (Raw)	Indicator Score (Weighted)
National Conditions	0.92	Insolation	5%	3.3	0.17
		SWH Market Penetration	4%	0.8	0.03
		Energy Consumption Growth	5%	4.7	0.24
		SWH Market Growth	4%	5.0	0.20
		Competitiveness: LCOE Comparison/Payback Period	7%	4.0	0.28
		Competitiveness: Heating Fuel Subsidy	5%	0.0	0.00
		Subtotal	**30%**	**17.8**	**0.92**

Insolation

SCORE 3.3 / 5.0

Tunisia has a good potential of solar energy. The Global Horizontal Irradiance varies from 1,600 kWh/m²/year in North coastal areas to more than 2,200 kWh/m²/year in South. A score of 3.3 is give for this section.

Figure 52: Global horizontal Irradiance in Tunisia



Source: SWERA

SWH Market Penetration

SCORE 0.8 / 5.0

In terms of market penetration, a capacity of 42 kW_{th}/1000 is in place in Tunisia. A score of 0.8 is given for this section.

Residential Energy Consumption Growths

SCORE 4.7 / 5.0

Residential energy consumption has been growing by 2 on average during the 2006-2011 period. It moved from 1867 Ktoe in 2006 to 2089 Ktoe in 2011. Tunisia receives a score of 4.7 for this section.

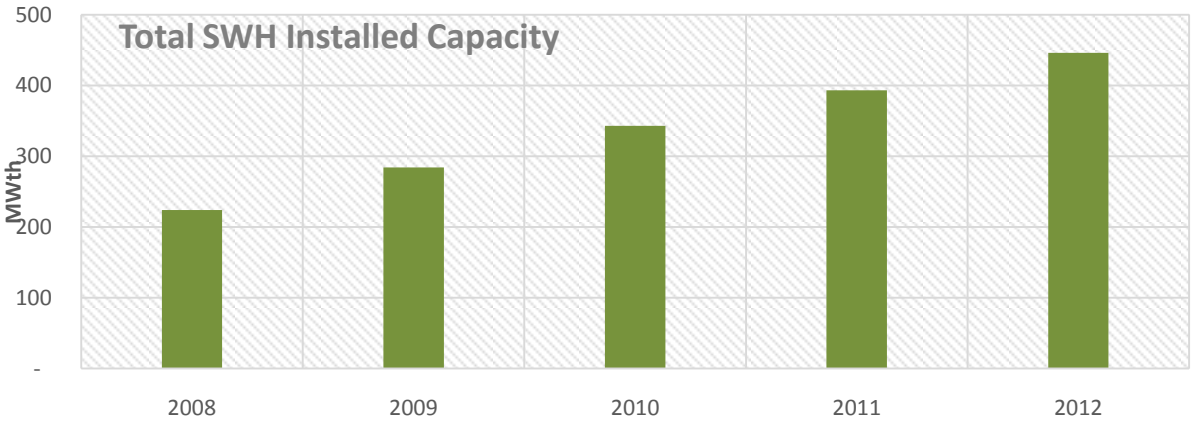
SWH Market Growth

SCORE 5.0 / 5.0

In 2011, the total capacity installed in the country amounted 561,690 m², almost reaching the target fixed for the year 2016. In the 2012, the installed capacity reached 637 010 m^2, thus over-passed the target set for 2016. The average annual market growth rate is 19% between 2008 and 2012.

Since the beginning of the PROSOL Tertiary, 2,255 m² have been installed in hotels and 2,783 m² in the other tertiary establishments. It is worth mentioning, however, that a high share of installations has been achieved without recourse to the advantages provided by PROSOL program and none of hotels took advantage of discounted interest rate loans.

A score of 5 is given for this section.

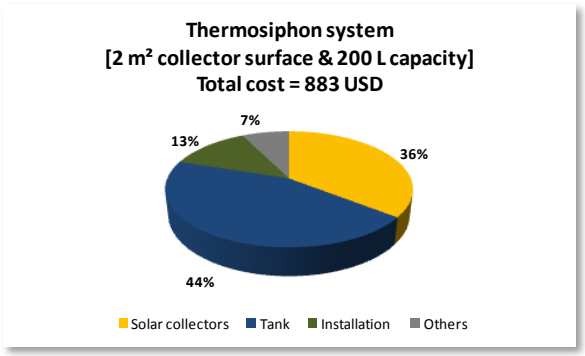


SWH Competitiveness: Payback Period

SCORE 4.0 / 5.0

According to the Agence National pour la Maîtrise de l'Energie (ANME) and the Chambre Syndicale Nationale des Energies Renouvelables (CSNER), the average system cost for a system of 2 m² of solar panels with a water tank in a range of 160 to 200 liters is around USD 880. Solar collectors and tank represent 80% of the total cost of the system. According to ANME, the payback period for the tertiary sector is 4 years. Tunisia gets a score of 4 for this indicator.

Figure 53: Average cost of systems in Tunisia [individual, residential market]



Sources: ANME, CSNER

SWH Competitiveness: Heating Fuel Subsidy

SCORE 0.0 / 5.0

According to R. Missaoui,[93] public subsidies devoted to conventional energy increased from 111 M€ in 2003 to 889 M€ in 2007. A large part of this amount is due to LPG subsidies, taking into account that LPG boilers were representing 65% of the water heater market in 2009. STEG is developing natural gas for the domestic market in order to reduce the dependence on LPG, which is highly subsidized. On average, a household composed of 4 people consumes 24 bottles of LPG a year. The total budget of LPG is around 180 TND for the household and the same for the State through subsidies. According to STEG, switching to natural gas will be 40% less expensive for the household. However, the network of natural gas is not well distributed over the country and will require investments.[94] A score of 0 is attributed to this section.

c. PARAMETER III: FINANCING

Parameter	Score	Indicator	Weight	Indicator Score (Raw)	Indicator Score (Weighted)
Financing	0.64	Country Credit Rating	5%	0.8	0.04
		Access to Finance	15%	4.0	0.60
		Subtotal	**20%**	**4.8**	**0.64**

Country Credit Rating

SCORE 0.8 / 5.0

Tunisia is rated with Ba3 according to Moody's ratings. A score of 0.8 is given for this section.

[93] R. Missaoui, *Energie et changement climatique, le coût de l'action en Tunisie*, Changement climatique, raréfaction des ressources énergétiques: des opportunités pour innover et entreprendre dans les énergies renouvelables et l'efficacité énergétique en Tunisie et en Méditerranée, Tunis, 2009

[94] http://fr.allafrica.com/stories/201205291346.html

Access to Finance

SCORE 4.0 / 5.0

Around 82% is the percentage domestic credit provided by the banking sector (% of GDP) in Tunisia in 2012. According to the Central Bank of Tunisia, an interest rate of 3.5% is marked for 2012. An overall score of 4 is given for this section.

d. PARAMETER IV: BUSINESS CLIMATE

Parameter	Score	Indicator	Weight	Indicator Score (Raw)	Indicator Score (Weighted)
Business Climate	0.92	Doing Business Index	5%	4.0	0.20
		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%**	**19**	**0.92**

Doing Business Index

SCORE 4.0 / 5.0

Category	Doing Business Ranking
Starting a Business	70
Dealing with Construction Permits	122
Getting Electricity	55
Registered Property	72
Getting Credit	109
Protecting Investors	52
Paying Taxes	60
Trading Across Border	31
Enforcing Contracts	78
Resolving Insolvency	39

Tunisia ranks 51 out of 189 at the global level. It ranks relatively well in terms of trading across border, resolving insolvency, protecting investors and getting electricity. The indicator related to dealing with construction permits ranks 122. A score of 4 is given for this indicator.

Domestic Manufacturing

SCORE 4.0 / 5.0

Thanks to the three PROSOL programmes, the numbers of actors in the market has increased rapidly. From 6 suppliers in 2005, there were 49 eligible suppliers as of end 2011 of which 10 manufacturers. Regarding MVA as percentage of GDP at constant 2005 prices in $US, Tunisia gets an MVA of 16.64%. So, Tunisia receives a score of 4 for this section.

Product Certification

SCORE 4.0 / 5.0

There are two testing facilities under accreditation process: the Centre Technique des Matériaux de Construction de la Céramique et du Verre (CTMCCV) laboratory and the Thermal Processes Laboratory of the Research and Technology Centre of Energy (CRTEn) in the “Eco-Park de Borj Cedria.” The accreditation is given by the Tunisian Accreditation Council (TUNAC). The National Institute for Standardization and Industrial Property (INNORPI) provides technical assistance and support for the accreditation process. Today, Tunisian standards are extensions of EN norms for solar water heating systems, which are TN-EN-12975 and TN-EN-12976. Tunisia receives a score of 4 for this indicator.

Installer Certification

SCORE 5.0 / 5.0

In order to ensure the sustainability of solar thermal market in the residential sector, the government decided to create a new label called “Qualisol” which entitles installers to operate under the PROSOL scheme. Today, 1150 installers are eligible for the PROSOL (most of them are micro-companies, 120 in 2005) and over 400 installers are qualified for “Qualisol systems.” ANME estimated that more than 7,000 direct jobs were created since the start of PROSOL. A score of 5 is given for this indicator.

Industry Association

SCORE 5.0 / 5.0

In 2003, the CSNER has been created as industrial association, which aims at building and maintaining a sustainable market in the field of renewable energy and a strong position at the national level for sector representation. Tunisia receives a score of 5 for this section.

6. TURKEY

Summary: The SWH market in Turkey has grown by 9% over the past 2 years, moving from 12 522 MW_{th} in 2011 to 13 655 MW_{th} in 2012. Turkey's overall TechScope score is 2.53, which will be discussed in more details in the sections below in order to give greater insight into the SWH TechScope Market Readiness Assessment for Turkey.

General Information	
Population	73 997 128
GDP	US$ 789 257 487 307
Total installed solar thermal (flat plate and evacuated tube collectors)	13 655 MW_{th}

Parameter	Score
Solar Water Heating Support Framework	0.00
National Conditions	1.21
Financing	0.33
Business Climate	1.00

a. PARAMETER I: SOLAR WATER HEATING SUPPORT FRAMEWORK

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

SWH Targets

SCORE 0.0 / 5.0

There are renewable energy targets for electricity generation. However, there are no solar thermal targets in Turkey. So, a score of 0 is given for this section.

Financial Incentives for System Installation

SCORE 0.0 / 5.0

In July 2011, the government raised the import tax on vacuum tubes. This new regulation significantly increases the price of a vacuum tube, and made importers move system production to Turkey. Nowadays, almost all of vacuum tube systems sold on the market today are Made in Turkey. Nevertheless, no financial incentives exist for the installation of SWH systems. A score of 0 is given for this indicator.

SWH Loan Programs

SCORE 0.0 / 5.0

There is no specific legislative and regulatory framework about solar water heating in Turkey, but an incentive is available for families living in remote areas ("forest villages"). Since 2004 around 100 000 families took benefit from an interest-free credit (covering 100% of the investment costs and to be repaid in three equal repayments). Turkey receives a score of 0 for this section.

Building Mandates

SCORE 5.0 / 5.0

Energy efficiency measures are promulgated in the Energy Efficiency Law. A national regulation exists related energy efficiency in building under the name of Standard of Thermal Insulation Requirements for Buildings (TS 825). Among the measures set up in such regulations is the obligation for application for the renewable and cogeneration system investments in buildings. So, a score of 5 is given for this indicator.

Outreach Campaigns

SCORE 0.0 / 5.0

There are no outreach or communication campaigns in Turkey for promoting the use of SWH systems. So, a score of 0 is given for this section.

b. PARAMETER II: NATIONAL CONDITIONS

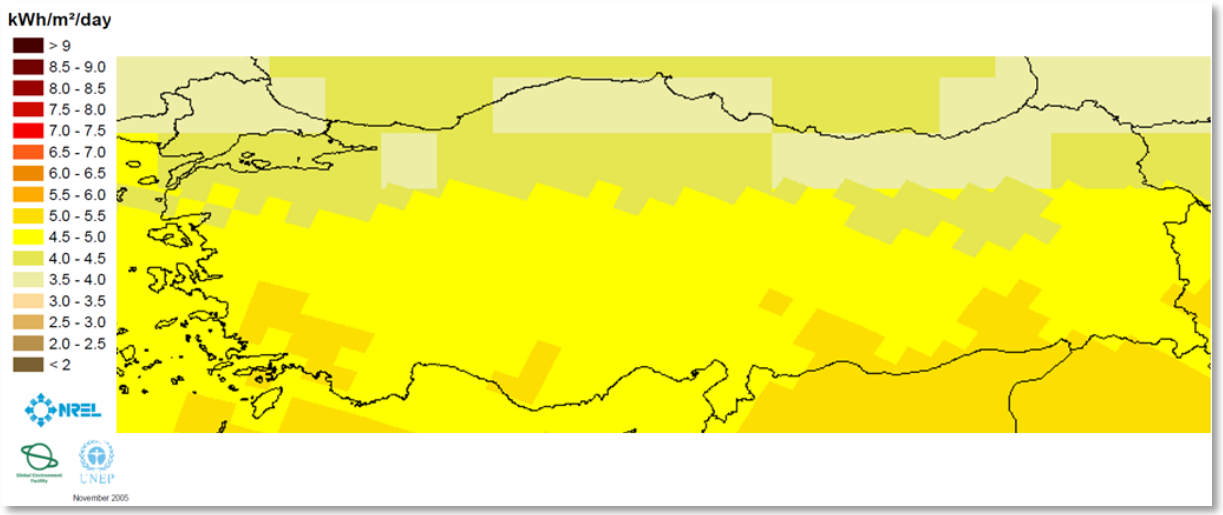
Parameter	Score	Indicator	Weight	Indicator Score (Raw)	Indicator Score (Weighted)
National Conditions	1.21	Insolation	5%	3.3	0.17
		SWH Market Penetration	4%	3.4	0.14
		Energy Consumption Growth	5%	5.0	0.25
		SWH Market Growth	4%	3.0	0.12
		Competitiveness: LCOE Comparison/Payback Period	7%	4.0	0.28
		Competitiveness: Heating Fuel Subsidy	5%	5.0	0.25
		Subtotal	**30%**	**23.7**	**1.21**

Insolation

SCORE 3.3 / 5.0

Turkey's geographical location provides the country with a large potential for solar thermal energy. The total annual sunshine duration is 2,640 hours, which amounts to 7.2 hours daily on average. The average annual solar radiation is 1,311 kWh/m² per year, equivalent to 3.6 kWh/m² per day. Turkey gets a score of 3.3 for this section.

Figure 54: Global Horizontal Irradiance in Turkey



Source: SWERA

SWH Market Penetration

SCORE 3.4 / 5.0

The main market for solar thermal applications is the residential segment with a share of 80% of the whole market in 2010, the remaining part is installed in the commercial segment. In terms of per capita, around 185 kW_{th}/1000 inhabitants is in place as of 2012. A score of 3.4 is attributed for this indicator.

Residential Energy Consumption Growth

SCORE 5.0 / 5.0

The average growth rate of residential energy consumption is 3.6% between 2006 and 2011 period. Consumption has increased from 19 892 Ktoe in 2006 to 23 528 Ktoe in 2011. Turkey gets a score of 5 for this section.

SWH Market Growth

SCORE 3.0 / 5.0

According to Ezinç Metal,[95] the total market volume for 2011 was about 1.8 Million m². The market is by far dominated by flat plate collectors that accounted for 80% of the total market. The total newly installed capacity in 2012 is 1 619 610 m2 with flat plate collectors accounting for 70% of the newly installed capacity (1 141 410 m^2 of flat plate collectors against 478 200 m^2 of vacuum tube collectors). Nevertheless, between 2007 and 2011, the share of vacuum tubes in the newly installed collector area has highly increased from 4% to 28%. The annual market turnover for 2010 is estimated around €88 Million (at manufacturer selling price of collector). Average annual growth rate is 9% between 2011 and 2012. A score of 3 is given for this section.

SWH Competitiveness: Payback Period

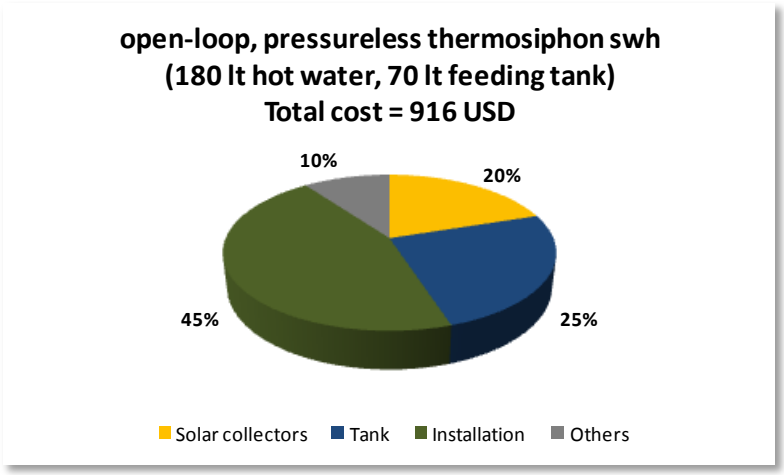
SCORE 4.0 / 5.0

According to EIE and Ezinç, the average system cost for a system of open-loop, pressureless thermosiphon (180 lt hot water, 70 lt feeding tank) is around USD 920. Solar

[95] http://www.solarthermalworld.org/content/turkey-vacuum-tubes-rise

collectors and tank represent 45% of the total cost of the system. Turkey receives a score of 4 for this section.

Figure 55: Average cost of systems in Turkey [individual, residential market]



Sources: EIE, Ezinç

SWH Competitiveness: Heating Fuel Subsidy

SCORE 5.0 / 5.0

There are no subsidies provided in Turkey. So, a score of 5 is granted for this indicator.

c. PARAMETER III: FINANCING

Parameter	Score	Indicator	Weight	Indicator Score (Raw)	Indicator Score (Weighted)
Financing	0.55	Country Credit Rating	5%	2.0	0.10
		Access to Finance	15%	3.0	0.45
		Subtotal	**20%**	**5.0**	**0.55**

Country Credit Rating

SCORE 2.0 / 5.0

Regarding credit rating, Turkey's rates are BB+ and Baa3, according to S&P and Moody's, respectively. A score of 2 is given to Turkey for this category.

Access to Finance

SCORE 3.0 / 5.0

Domestic credit provided by the banking sector (% of GDP) was 72% in 2012. Interest rate has been stable during the 2010-2012 period in around 6%. A score of 3 is given to Turkey for this section.

d. PARAMETER IV: BUSINESS CLIMATE

Parameter	Score	Indicator	Weight	Indicator Score (Raw)	Indicator Score (Weighted)
Business Climate	0.95	Doing Business Index	5%	4.0	0.20
		Domestic Manufacturing	3%	5.0	0.15
		Product Certification	5%	5.0	0.25
		Installer Certification	4%	5.0	0.20
		Industry Association	4%	5.0	0.20
		Subtotal	**23%**	**23**	**1.00**

Doing Business Index

SCORE 4.0 / 5.0

Category	Doing Business Ranking
Starting a Business	93
Dealing with Construction Permits	148
Getting Electricity	49
Registered Property	50
Getting Credit	86
Protecting Investors	34
Paying Taxes	71
Trading Across Border	86
Enforcing Contracts	38
Resolving Insolvency	130

Turkey ranks 69 out of 189 countries worldwide in the doing business index. It ranks relatively well in terms of enforcing contracts (38), protecting investors (34) and getting electricity (49). Relatively speaking, the lowest rank Turkey gets is the one dealing with construction permits as it ranks 148 out of 189. An overall score of 4 is given to Turkey for this indicator.

Domestic Manufacturing

SCORE 5.0 / 5.0

The industry is well developed with high quality manufacturing and export capacity. In terms of MVA as a percentage of GDP at constant 2005 prices in $US, Turkey has an MVA of 18.11% in 2012, which is beyond the world average (~17%). So, a score of 5 is given for this indicator.

Product Certification

SCORE 5.0 / 5.0

Today, Turkish Standards (TS) are existing norms and these are extensions/duplicates of EN norms for solar water heating systems, which are TS-EN-12975; TS-EN-12976; TS-EN-12977. Government tenders are asking for the availability of Solar Keymark certificate for

solar collectors since last 3-4 years which is encouraging manufacturers to certify their products. This results in a score of 5.

Installer Certification

SCORE 5.0 / 5.0

SWH heaters are certified. So, a score of 5 is give for this indicator.

Industry Association

SCORE 5.0 / 5.0

There is a solar energy association which is called “GUNDER”, and which is the Turkish division of the International Solar Energy Society (www.gunder.org.tr/). So, Turkey receives a score of 5 for this section.

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The Market Assessment Report covers 17 Mediterranean countries. This report extends the geographical coverage of the previous Market Assessment reports to include some Balkan countries, updates the information with 2012 market figures, when available, as well as new policy developments, incorporates the results of a new country-by-country analysis, and adds information on certification, standardization and testing systems in the reviewed countries.

The purpose of this report is to help overcome some relevant barriers which currently prevent solar water heating systems from providing a larger share of energy supply.

The report also incorporates the TechScope tool applied to 5 selected Mediterranean countries.