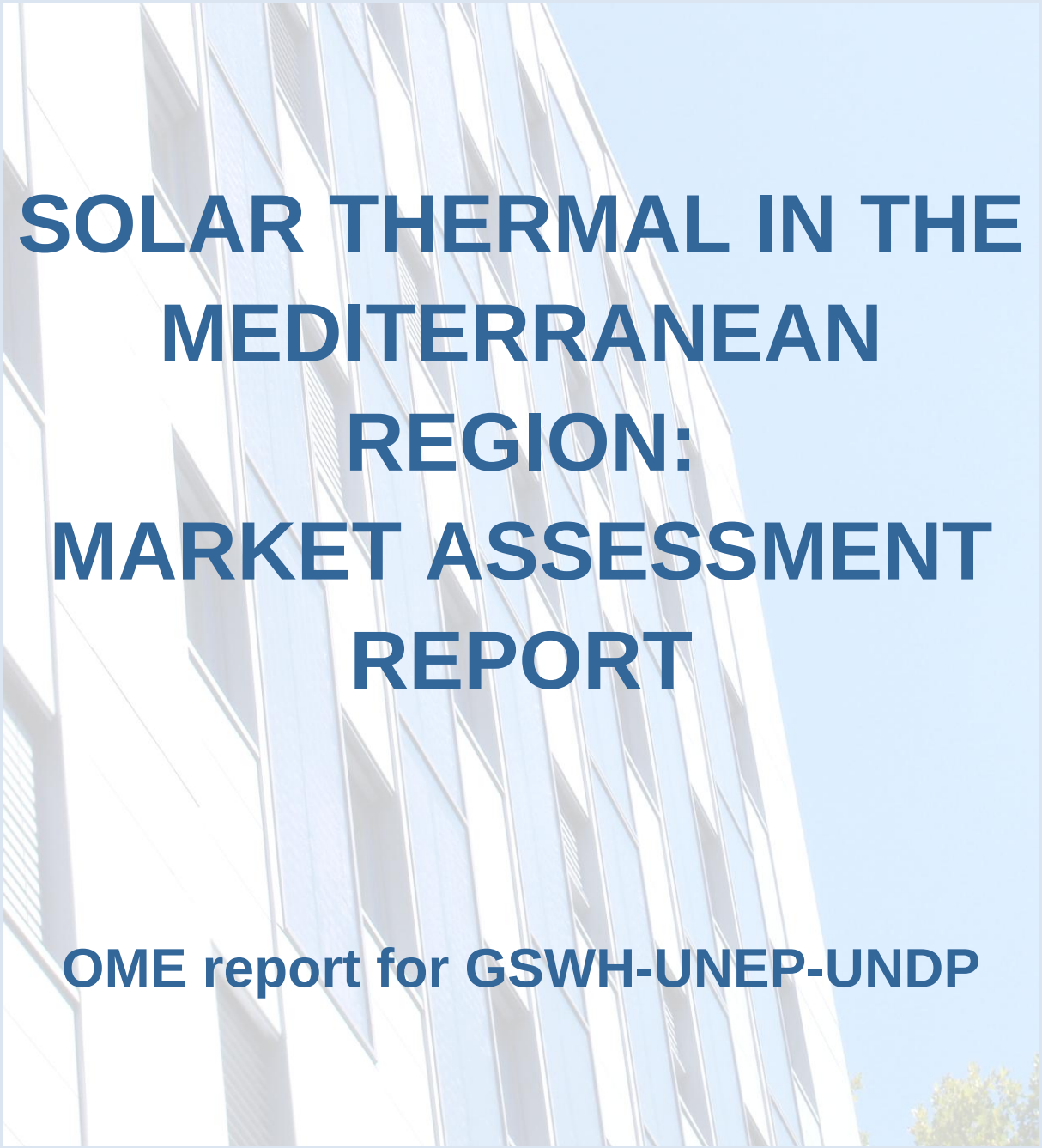


SOLAR THERMAL IN THE MEDITERRANEAN REGION: MARKET ASSESSMENT REPORT

OME report for GSWH-UNEP-UNDP

12 September 2012

Table of contents

Table of contents i

List of figures iv

List of tables vi

Acronyms vii

Units viii

Introduction 1

Geographical scope and methodology 3

1. Socio-economic and energy context 5

1.1. Demography 5

1.2. Economic situation 6

1.3. Energy 7

1.3.1. Trends in energy demand 7

1.3.2. Power generation and electricity demand 10

1.3.3. Energy prices 10

1.4. Renewable energy 12

1.4.1. Contribution to the energy supply 12

1.4.2. Contribution to the energy consumption 12

1.4.3. Contribution to power sector 14

1.5. CO_2 emissions 15

2. Solar Thermal market: regional and country analysis .18

2.1. Solar resources 18

2.2. SWH market potential 18

2.3. SWH market 20

2.4. SHIP applications 23

2.5. Certification and standards 23

2.6. Main barriers 24

2.7. Country analysis 27

2.7.1. Algeria 27

2.7.1.1. Socio-economic and energy context 27
2.7.1.2. Solar thermal legislative and regulatory framework 28
2.7.1.3. Solar water heater market 29
2.7.1.4. Main industry actors in ST field 30
2.7.2. Egypt 31
2.7.2.1. Socio-economic and energy context 31
2.7.2.2. Solar thermal legislative and regulatory framework 32
2.7.2.3. Solar water heater market 32
2.7.2.4. Main industry actors in ST field 35
2.7.3. Israel 36
2.7.3.1. Socio-economic and energy context 36
2.7.3.2. Solar thermal legislative and regulatory framework 36
2.7.3.3. Solar water heater market 37
2.7.3.4. Main industry actors in ST field 37
2.7.4. Jordan 39
2.7.4.1. Socio-economic and energy context 39
2.7.4.2. Solar thermal legislative and regulatory framework 40
2.7.4.3. Solar water heater market 40
2.7.4.4. Main industry actors in ST field 42
2.7.5. Lebanon 43
2.7.5.1. Socio-economic and energy context 43
2.7.5.2. Solar thermal legislative and regulatory framework 44
2.7.5.3. Solar water heater market 44
2.7.5.4. Main industry actors in ST field 46
2.7.6. Libya 52
2.7.6.1. Socio-economic and energy context 52
2.7.6.2. Solar thermal legislative and regulatory framework 53
2.7.6.3. Solar water heater market 53
2.7.7. Morocco 55
2.7.7.1. Socio-economic and energy context 55
2.7.7.2. Solar thermal legislative and regulatory framework 56
2.7.7.3. Solar water heater market 57
2.7.7.4. Main industry actors in ST field 59
2.7.8. Palestine 61
2.7.8.1. Socio-economic and energy context 61
2.7.8.2. Solar thermal legislative and regulatory framework 61
2.7.8.3. Solar water heater market 62

2.7.8.4. Main industry actors in ST field 62
2.7.9. Syria 63
2.7.9.1. Socio-economic and energy context 63
2.7.9.2. Solar thermal legislative and regulatory framework 64
2.7.9.3. Solar water heater market 64
2.7.9.4. Main industry actors in ST field 65
2.7.10. Tunisia 66
2.7.10.1. Socio-economic and energy context 66
2.7.10.2. Solar thermal legislative and regulatory framework 67
2.7.10.3. Solar water heater market 68
2.7.10.4. Main industry actors in ST field 70
2.7.11. Turkey 73
2.7.11.1. Socio-economic and energy context 73
2.7.11.2. Solar thermal legislative and regulatory framework 74
2.7.11.3. Solar water heater market 74
2.7.11.4. Main industry actors in ST field 76
2.7.12. Albania 78
2.7.12.1. Socio-economic and energy context 78
2.7.12.2. Solar thermal legislative and regulatory framework 78
2.7.12.3. Solar water heater market 79
2.7.12.4. Main industry actors in ST field 80
3. Conclusions 81
4. References 82
Annex I ..... A

List of figures

Figure 1: The Mediterranean basin 3
Figure 2: Population evolution (2010-2030) by region and country 5
Figure 3: GDP evolution (2010-2030) by region and country 6
Figure 4: GDP per capita evolution (2010-2030) by region and country 6
Figure 5: Primary energy demand by region and scenario, 1990 - 2030 8
Figure 6: Primary energy demand per capita by region and scenario, 2010 - 2030; and Primary energy demand per capita by country, 2010 8
Figure 7: Primary energy demand by fuel, region and scenario, 2010-2030; and Fossil fuels share in energy demand by region and scenario, 2010-2030 9
Figure 8: Fossil fuel net trade volumes and import dependence by region and scenario, 2010 - 2030 9
Figure 9: Trends in power generation by region and scenario, 1990 - 2030 10
Figure 10: Residential electricity tariffs in SWMCs and SEMCs 11
Figure 11: Renewable share in TPES by region and scenario, 2010-2030; Renewable share in TPES by country and scenario, 2010-2030 12
Figure 12: Renewables total final consumption in the Non-EU Mediterranean Countries, 2010-2030 Conservative scenario; Renewables total final consumption in the Non-EU Mediterranean Countries, 2010-2030 Proactive scenario 13
Figure 13: Sectoral consumption of renewable energy by region and scenario, 2010-2030 13
Figure 14: Installed capacity for power generation by fuel and scenario, 2010-2030 14
Figure 15: Trends in CO_2 emissions by region and scenario, 1990-2030; and CO_2 per capita by country and scenario, 2010-2030 16
Figure 16: Specific CO_2 emissions by country and scenario, 2010-2030; and Carbon intensity by country and scenario, 2010-2030 17
Figure 17: Global horizontal Irradiance (GHI) in Mediterranean area 18
Figure 18: Market deployment phases of solar thermal systems 19
Figure 19: Final energy consumption by sector and region, 2010 19
Figure 20: Solar collectors and working temperatures for different applications 20
Figure 21: Solar thermal capacity in operation in the Non-EU Mediterranean Countries in 2010 21
Figure 22: Algerian indicators 27

Figure 23: Global Horizontal Irradiation in Algeria during the seasons [spring (top left), summer (top right), autumn (bottom left), winter (bottom right)] 28
Figure 24: Egyptian indicators 31
Figure 25: Solar radiation in Egypt.....32
Figure 26: Average cost of systems in Egypt [individual, residential market] 34
Figure 27: Israeli indicators.....36
Figure 28: Jordanian indicators 39
Figure 29: Global Horizontal Irradiance in Jordan.....40
Figure 30: Average cost of systems in Jordan [individual, residential market].....42
Figure 31: Lebanese indicators 43
Figure 32: Global Horizontal Irradiance in Lebanon.....44
Figure 33: Lebanese installed solar water heater collectors' area, 2008-2011.....45
Figure 34: Average cost of systems in Lebanon [individual, residential market].....46
Figure 35: Libyan indicators.....52
Figure 36: Global horizontal Irradiance in Libya.....53
Figure 37: Moroccan indicators 55
Figure 38: Solar radiation in Morocco [kWh/m²].....56
Figure 39: Cumulative SWH surface [1994-2010, thousand of m²] - Morocco.....57
Figure 40: Average cost of systems in Morocco [individual, residential market].....59
Figure 41: Palestinian indicators.....61
Figure 42: Syrian indicators.....63
Figure 43: Global horizontal Irradiance in Syria 64
Figure 44: Tunisian indicators.....66
Figure 45: Global horizontal Irradiance in Tunisia.....67
Figure 46: Annual installation of SWH in Tunisia, 2004-2011 68
Figure 47: Average cost of systems in Tunisia [individual, residential market].....70
Figure 48: Turkish indicators 73
Figure 49: Global Horizontal Irradiance in Turkey.....74
Figure 50: Average cost of systems in Turkey [individual, residential market].....75
Figure 51: Albanian indicators - source IEA.....78
Figure 52: Albanian installed solar water heater collectors' area, 2005-2010.....80

List of tables

Table 1: Electricity tariffs in residential, tertiary, industry sector in South Mediterranean countries....11
Table 2: Solar thermal market in Non-EU Mediterranean Countries, 2010....21
Table 3: Synopsis of the main elements of the SWH market in the Mediterranean....22
Table 4: Main barriers and recommendations....26
Table 5: Main Algerian actors in the solar water heater industry....30
Table 6: Egyptian standards related to solar thermal....34
Table 7: Main actors in the Egyptian solar water heaters industry....35
Table 8: Main Israeli actors in the solar water heaters industry....37
Table 9: Jordanian Standards related to solar thermal....41
Table 10: Main actors in the Jordanian solar water heaters industry....42
Table 11: Lebanese Standards related to solar thermal....46
Table 12: Main Lebanese actors in the solar water heaters industry....47
Table 13: Moroccan standards related to solar thermal....59
Table 14: Main actors in the Moroccan solar water heater industry....60
Table 15: Palestinian standards related to solar thermal....62
Table 16: Main Syrian actors in the solar water heaters industry....65
Table 17: List of suppliers eligible to the PROSOL program in the residential sector....70
Table 18: Main Turkish actors in the solar water heaters industry....76

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
SEMCs	South East Mediterranean Countries
SWMCs	South West Mediterranean Countries
NEUMCs	Non-EU Mediterranean Countries
NEUNMCs	Non-EU North 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

Introduction

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) 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 a 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.

The main activities carried out by OME within the project so far include: i) review of the state of the art and prospects of solar thermal technologies in the Mediterranean region, ii) identification of main needs, barriers and priorities for action, iii) collection of relevant information and dissemination through the project website, conferences and other events, and iv) organisation of a regional workshop gathering public and private sector experts. In addition to the present Market Assessment report, a Solar Thermal Action Plan for Investment Promotion in the Mediterranean region is being prepared, and will be finalised by the end of 2012.

The present report complements and extends the "Initial Market Assessment Report" prepared by OME within a previous Small Scale Funding Agreement (SSFA) with UNEP in 2009[1]. Compared to the initial market assessment report, the current publication:

- update the information with 2010 and -when available - 2011 market figures, as well as new policy developments
- extends its geographical scope to include a wider set of countries
- incorporates the results of a new country-by-country analysis looking at the solar industry structure
- adds information on certification 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 South and non-EU North Mediterranean countries and draws some prospects up to 2030. Economic data are derived from the Organisation for Economic and Co-operation and Development's (OECD) Economic indicators and the World Bank's World Development Indicators 2010. For forecasts of GDP to 2015, data are taken from the International Monetary Fund (IMF) World Economic Outlook database (April 2011 and June 2011 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 demand reduction.

- 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 country analyses of selected Mediterranean countries: Morocco, Algeria, Tunisia, Libya, Egypt, Palestine, Jordan, Israel, Lebanon, Syria, Turkey and Albania.

[1] Downloadable at: http://www.solarthermalworld.org/files/Regional%20Market%20Assessment%20report%20%28OME-Africa%20and%20Middle%20East%29.pdf?download
[2] downloadable at: www.ome.org

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:

- **South West Mediterranean Countries (SWMCs):** Algeria, Egypt, Libya, Morocco, Tunisia
- **South East Mediterranean Countries (SEMCs):** Israel, Jordan, Lebanon, Palestine, Syria, Turkey
- **Non-EU North Mediterranean Countries (NEUNMCs):** Albania, Bosnia-Herzegovina, Croatia, Montenegro, Serbia, and the Former Yugoslav Republic of Macedonia

These three groups of countries represent the Non-EU Mediterranean region (NEUM).

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 was organized in Beirut on 18-19 April 2012, gathering more than fifty experts from ten different Mediterranean countries, in addition to the representatives from UNDP, UNEP, and other international and regional organisations (IEA, RCREEE, MEDREC). The event, organised under the auspices of the Lebanese Ministry of Energy and Water, 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.

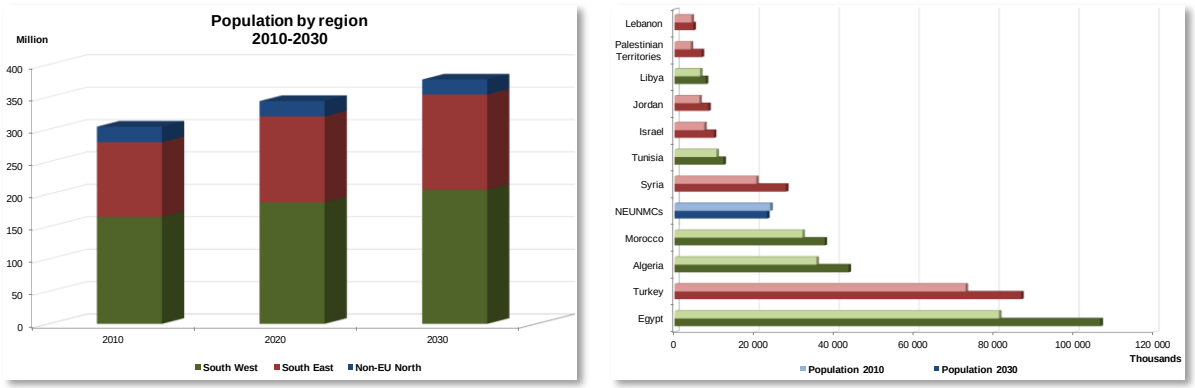
[3] See Annex I

1. Socio-economic and energy context

1.1. Demography

The population of the area covered by the present study reached around 305 Million in 2010. According to the medium variant population growth scenario of the United Nations[4], from 2010 to 2030 the population will grow up to 375 Million (+23%). Both SEMCs and SWMCs' population are expected to grow by around 25% while the population in the NEUNMCs is expected to decrease by around 3% (Figure 2).

Figure 2: Population evolution (2010-2030) by region and country



Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2010 Revision

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 28% and Turkey 23% of the Non-EU Mediterranean population by 2030.

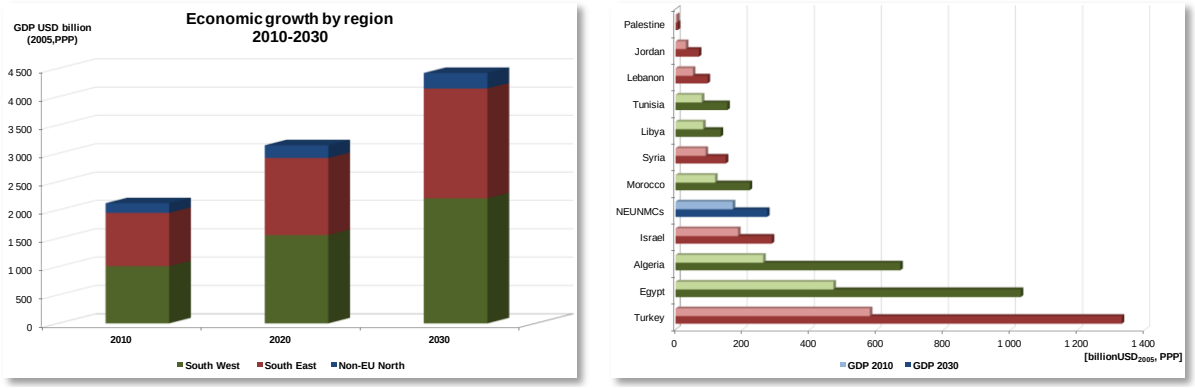
This rise of the population is accompanied by a concentration in urban areas, which increases environmental pressures and results in higher and higher energy demand. As an example, the urban population in Algeria has grown from 61% in 2000 to 72% in 2010 and is expected to reach 83% by 2030[5]. Higher 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.

[4] Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2010 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

1.2. Economic situation

Economic growth is a key determinant of energy demand. Economic growth in the Non-EU Mediterranean region (NEUM) 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 NEUNMCs 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.

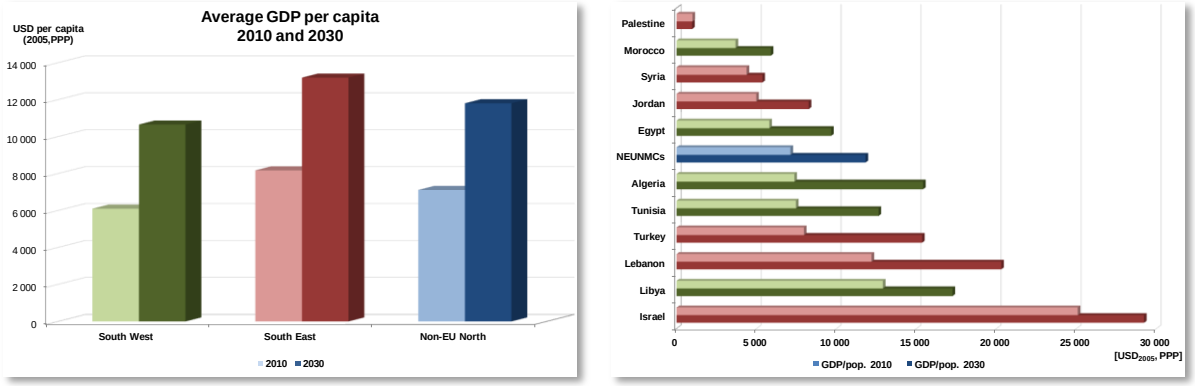
Figure 3: GDP evolution (2010-2030) by region and country



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 NEUNMCs. 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 NEUNMCs (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

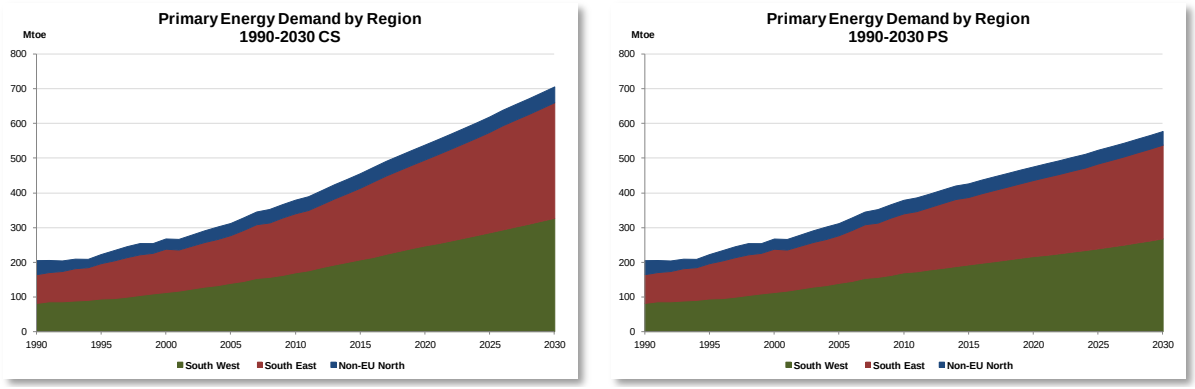
1.3.1. Trends in energy demand

Primary energy demand in the three regions amounts to 380 Mtoe in 2010. Both SWMCs and SEMCs account each for 45%. In total, Non-EU Mediterranean Countries account for about 3% of the world's primary energy demand.

Primary energy demand is driven by two determinant factors which are demographic trends and economic growth. As mentioned above, both SEMCs and SWMCs are facing rapid demographic growth combined with relatively low incomes, a rapid urbanization rate, and important socio-economic development needs resulting in an high increase of energy needs. From 1990 to 2010, SWMCs and SEMCs' energy demand grew 3.7% per year on average reaching respectively 171 Mtoe and 169 Mtoe. In SEMCs, the total primary energy supply (TPES) is expected to further grow during the next decades, reaching around 270 Mtoe (+2.4/y) by 2030 in the Proactive scenario and 333 Mtoe (+3.4%/y) in the Conservative scenario. In SWMCs, the trends are almost the same as the one in SEMCs with an energy demand reaching 268 Mtoe (Proactive scenario, +2.3%/y) and 328 Mtoe (Conservative scenario, +3.3%/y).

Non-EU North Mediterranean Countries are in a different situation. From 1990 to 2010, energy demand has remained stable from 40 Mtoe to 39 Mtoe, with a high decrease during the 90's due to socio-economic and political troubles in the region followed by an increase. The negative demographic trend expected until 2030 determines a quite stable energy demand in the Proactive scenario (around 39 Mtoe) and a slight increase of TPES reaching 45 Mtoe (+0.7%/y) by 2030 compared to 39 Mtoe in 2010 (Figure 5).

Figure 5: Primary energy demand by region and scenario, 1990 - 2030

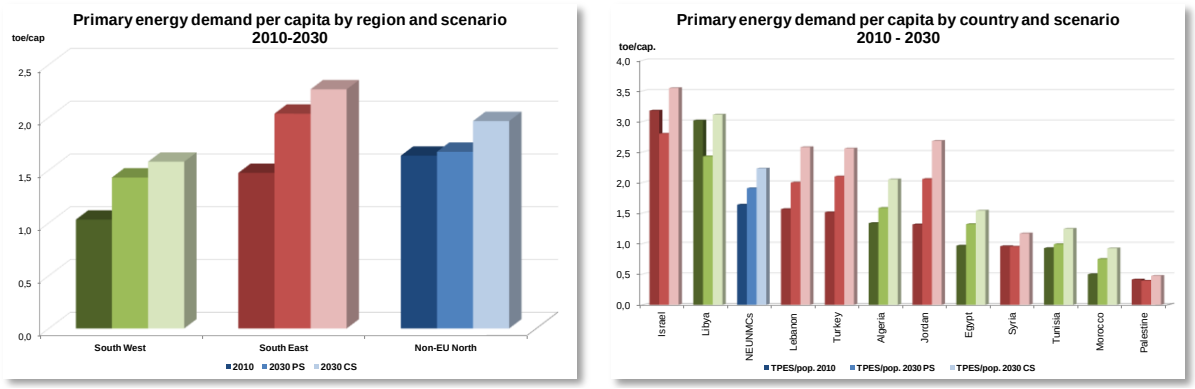


Source: OME database

In terms of per capita energy demand, Israel and Libya are the highest consumers with more than 3 toe/cap. Morocco and Palestine are the less consuming countries with less than 0.5 toe/cap.

In both scenarios, per capita energy demand shows a net increase in all regions, as a result of the change in lifestyles driven by the rapid urbanization, the large penetration of energy consuming devices and the change in transportation habits toward a road-based transport (Figure 6). Nevertheless, it is expected that more virtuous behaviours will occur, as a result of the implementation of energy efficiency and climate change related policies.

Figure 6: Primary energy demand per capita by region and scenario, 2010 - 2030; and Primary energy demand per capita by country, 2010

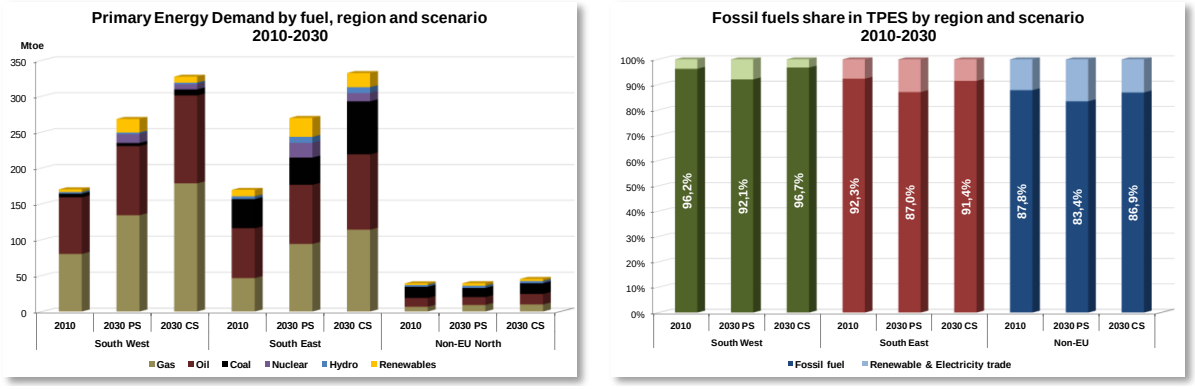


Source: OME database

Fossil fuels predominance

Between 1970 and 2010, energy trends show the increasing penetration of natural gas in the fuel mix and the relative stability of oil. In 2010, oil remained the dominant fuel, followed by natural gas. Renewable energies have made only a modest contribution to the energy mix over the past 35 years, despite a substantial increase in real terms. Oil will still remain the dominant fuel in the Mediterranean primary energy supply mix through to 2030 (regardless of the scenario considered), notably through its use in the transport sector. Nevertheless, gas and renewables are expected to increase their shares considerably (Figure 7).

Figure 7: Primary energy demand by fuel, region and scenario, 2010-2030; and Fossil fuels share in energy demand by region and scenario, 2010-2030



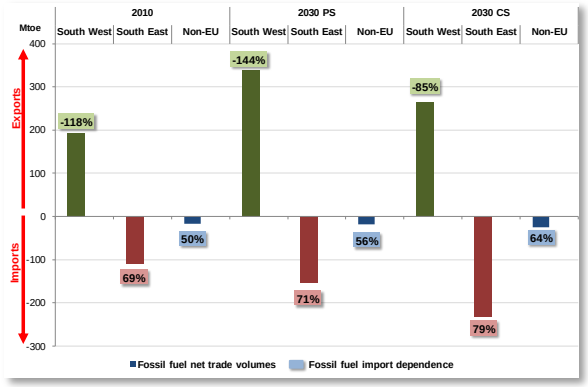
Source: OME database

On average, the SWMCs depend on fossil fuels for more than 96% in their total primary energy supply (TPES) while the SEMCs depend on fossil fuels for more than 92%. Non-EU North energy mix is also strongly depending on fossil fuels with more than 87% in their TPES. According to OME scenarios, the share of fossil fuels is expected to slightly decrease but remain important (more than 80% in all regions by 2030) (Figure 7).

High energy import dependence

In the Non-EU North Mediterranean sub-region, 50% of fossil fuels are imported. In the South East Mediterranean sub-region, around 100 Mtoe of fossil fuels are imported, equivalent to a 69% import dependence ratio, while South West Mediterranean sub-region enjoys an export capacity of 118% (Figure 8).

Figure 8: Fossil fuel net trade volumes and import dependence by region and scenario, 2010 - 2030



Source: OME database

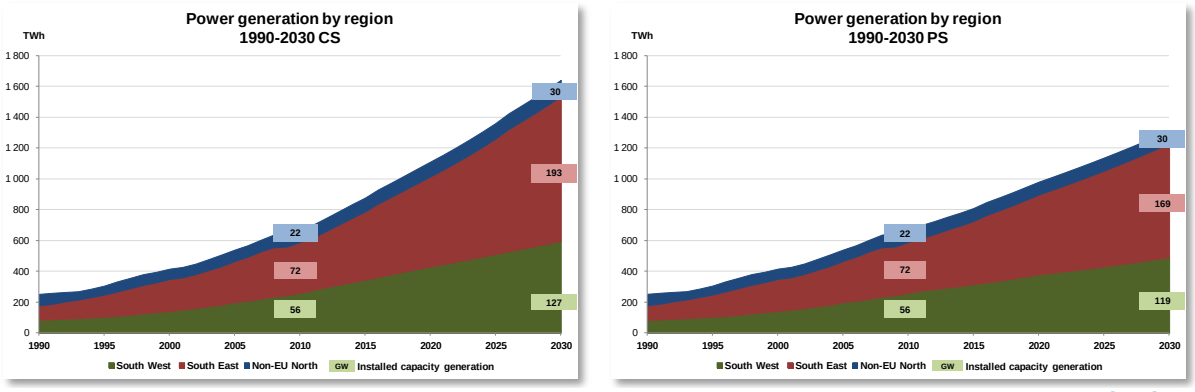
By 2030, South West Mediterranean sub-region is expected to remain exporter in both Conservative and Proactive scenarios, while South East Mediterranean sub-region and Non-EU North Mediterranean sub-region are expected to increase their fossil fuel import dependence in both scenarios (Figure 8).

While all NEUNMCs are net importers, the situation among South Mediterranean countries is varied with large exports from producing countries such as Algeria, Libya, Egypt and Syria and heavy reliance on fossil fuel imports in some neighbouring countries. By 2030, Egypt and Syria are expected to become net importers while Algeria and Libya will remain net exporters of fossil fuels.

1.3.2. Power generation and electricity demand

Electricity consumption is closely linked to economic and demographic development and thus has experienced a robust average annual growth rate of 6.2% in South Mediterranean area, especially in Turkey and Egypt (6.6% and 6.3%) from 1990 to 2010. As a result, electricity generation reaches 670 TWh in 2010 (Figure 9).

Figure 9: Trends in power generation by region and scenario, 1990 - 2030



Source: OME database

According to OME scenarios, high levels of population and economic growth in the South Mediterranean Countries will push demand for electricity, and generation should almost triple from 588 TWh in 2010 to 1,534 TWh in 2030 with an annual average growth of 4.9% in the Conservative scenario. In the Proactive scenario, the power generation is expected to double reaching 1,230 TWh in 2030 with an annual average growth of 3.8%. Therefore, the South Mediterranean would need to add new generation from 129 GW to 320 GW in the conservative scenario and to 288 GW in the proactive scenario (Figure 9). The construction of new transmission and distribution networks, and in some countries large-scale rural electrification programs, would also be needed to meet demand.

1.3.3. 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

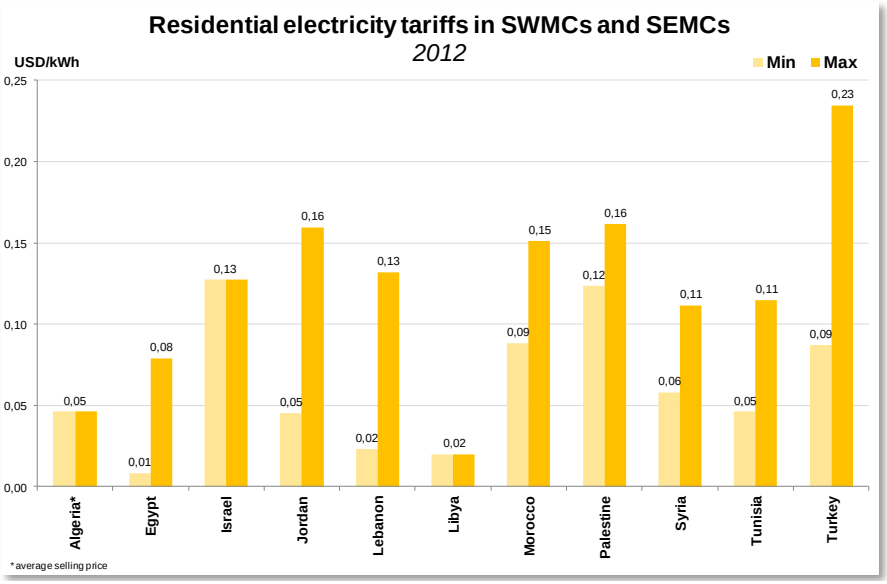
alternatives. This cost gap is particularly wide in most SWMCs and SEMCs, as energy prices are subsidised in order to guarantee access to energy for all. However, they create market distortion and undermine the growth potential of renewable energy in the region.

Table 1: Electricity tariffs in residential, tertiary, industry sector in 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*

Sources: National sources

Figure 10: Residential electricity tariffs in SWMCs and SEMCs



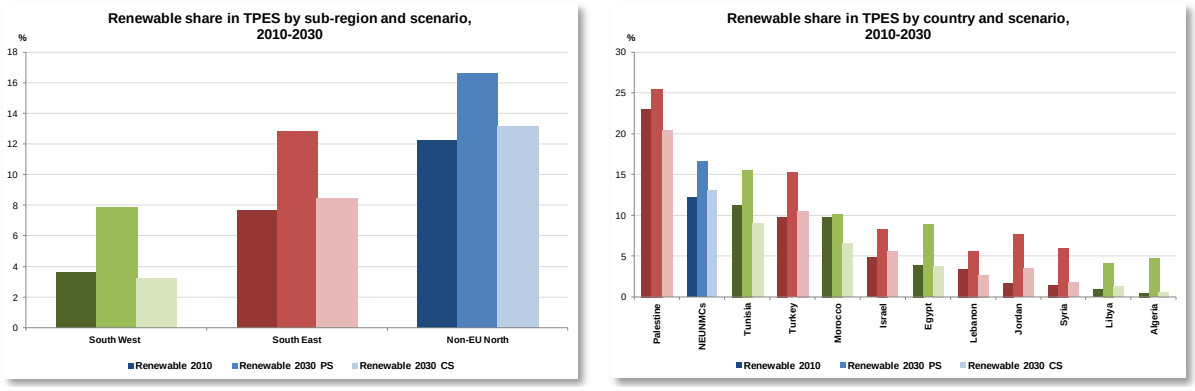
Sources: national sources (exchange rates of 1st August 2012)

1.4. Renewable energy

1.4.1. Contribution to the energy supply

Despite the abundance of renewable energy resources in the Non-EU Mediterranean Countries, their contribution to the total primary energy supply (TPES) is still fairly limited. Renewables (inc. hydro) in 2010 accounted for 3.6% of the TPES in SWMCs, for 7.6% in SEMCs and 12.2% in NEUNMCs. This share has remained more or less constant over the years, although in absolute values primary energy supply from renewables in the region doubled since the early 1970s. According to the Proactive scenario, this share is expected to grow to 7.9% in SWMCs, 12.8% in SEMCs and 16.6% in NEUNMCs (Figure 11).

Figure 11: Renewable share in TPES by region and scenario, 2010-2030; Renewable share in TPES by country and scenario, 2010-2030



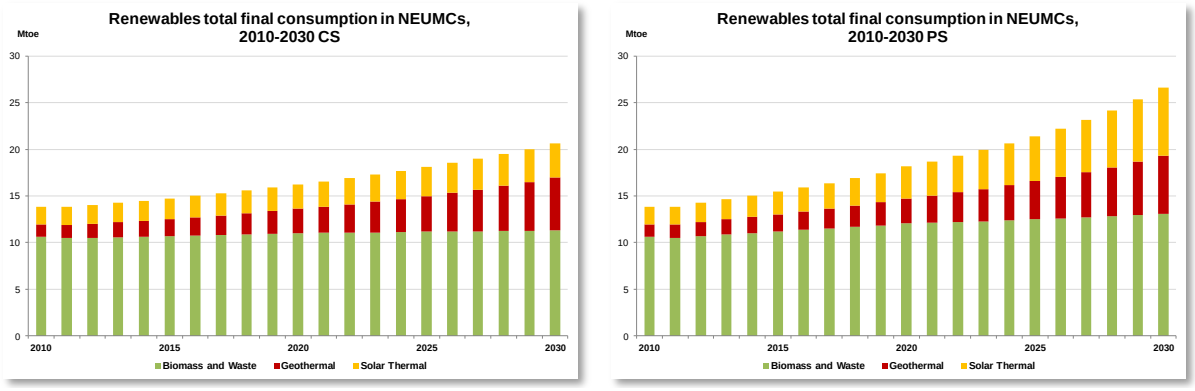
Source: OME database

In general, all countries are demonstrating rising trends in renewables. The particularly low current share of RES in the South West countries compared with the regional average stems from the under exploitation of renewables in countries such as Algeria and Libya where the contribution of RES to the TPES is negligible (less than 1%) (Figure 11).

1.4.2. Contribution to the energy consumption

Final consumption of renewable energy sources is expected to rise to 21 Mtoe in 2030 in the Conservative scenario, a 2% average annual growth, and to 27 Mtoe, 3.3% average annual growth, in the Proactive scenario. The breakdown by sources is illustrated in Figure 12.

Figure 12: Renewables total final consumption in the Non-EU Mediterranean Countries, 2010-2030 Conservative scenario; Renewables total final consumption in the Non-EU Mediterranean Countries, 2010-2030 Proactive scenario



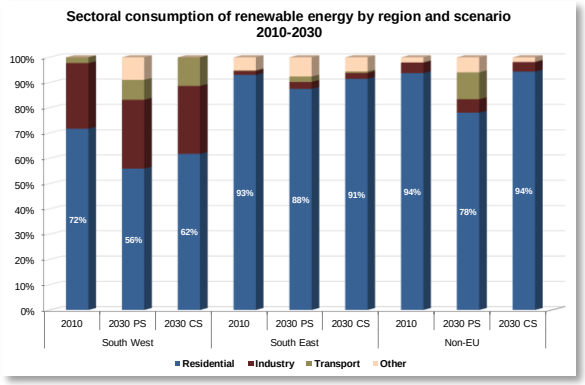
Source: OME database

In both scenarios, Biomass and Waste will remain the main contributor with more than half of the total share of renewable in the total final consumption (50% in the Conservative scenario and 55% in the Proactive scenario).

Geothermal technology shows the highest growth rate (7.4% per year on average in the Conservative scenario and 8% in the Proactive scenario). Almost all of the energy supplied by geothermal is expected to be located in Turkey. Solar thermal technologies are also expected to grow (3.4% per year on average 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.

In NEUMCs, renewables are used mostly in residential applications (about 12 Mtoe in 2010, or 88% of the total), and industry (1.1 Mtoe, or 8%), but are still under-utilised in the transportation sector (0.1 Mtoe, or 1% of total final energy consumption). It is expected that renewable energy will increase its share in final consumption by 2030, mainly in SWMCs where renewables should experience greater use in the industry sector (Figure 13).

Figure 13: Sectoral consumption of renewable energy by region and scenario, 2010-2030



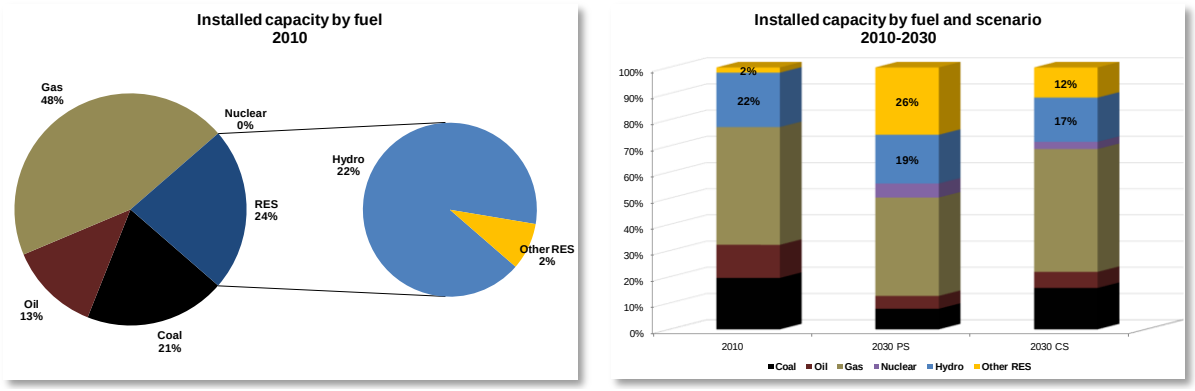
Source: OME database

1.4.3. Contribution to power sector

The installed capacity of RES (including large hydro) in NEUMCs has increased substantially over the last three decades, rising to about 33 GW in 2010 which represent 24% of the total installed capacity (Figure 14). This corresponds to about 3% of total RES capacity installed in the world[6].

Over 90% of total installed capacity is large hydro (Figure 14), with the greatest share located in Turkey, Egypt, and, to a much lesser degree, in Morocco. Small hydro and wind account for the remaining share. Geothermal energy is used exclusively in Turkey.

Figure 14: Installed capacity for power generation by fuel and scenario, 2010-2030



Source: OME database

Wind is a relatively new but growing energy source in the region. In SWMCs and SEMCs, the cumulative wind power capacity was 1.6 GW in 2009, some 95% of it is in Turkey, Egypt and Morocco. The remainder is mainly split between Tunisia and Jordan. In the next decades, wind power is expected to expand. A 90 MW wind farm is in the bidding process in Jordan, with additional 40 MW planned. Egypt (currently 545 MW) plans to install 7 GW of wind power, in pursuit of its objective to supply 20% of electricity from renewable energy sources by 2020. Libya started building its first 60 MW wind farm in 2010 and aims to develop additional wind capacity of 2 GW by 2020. Morocco (actually 464 MW installed) plans to have 2 GW of wind power capacity by 2020. Tunisia (currently 54 MW, Sidi Daoud) aims to install additional capacity of 280 MW in three different projects based on its 2011-2016 Solar Plan. Turkey reached 1.3 GW of cumulative wind power capacity in 2010, a 67% increase from 2009, and hopes to install up to 20 GW, helping the country to source 30% of its electricity generation from renewable sources by 2023.

Although benefiting from high irradiation rates, SWMCs and SEMCs are far from exploiting their solar potential. Solar photovoltaic is mainly used for decentralized rural electrification.

[6] Calculated from REN21 (Renewable Energy Policy Network for the 21st Century), Renewables 2012 Global Status Report (Paris: REN21 Secretariat, and Washington, D.C.: Worldwatch Institute). Copyright © 2012 Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH), excluding pumped storage.

Most of the capacity (63%) is installed in Morocco, followed by Egypt (20%), Algeria (9%), and Tunisia (8%). Other applications include water pumping, desalination, telecommunication, public lighting, and hybrid systems. So far, numbers of solar PV installed capacity are relatively small, and amount to 0.1 MW in Palestine, about 1 MW in Jordan, Lebanon and Syria, 1.5 MW in Libya, 2 MW in Tunisia, 3 MW in Algeria and Turkey, 10 MW in Egypt and Morocco, and more than 20 MW in Israel. This picture is expected to evolve soon. Indeed, several governments announced ambitious national plans in this field. Algeria announced its intention to install 800 megawatt peak (MWp) by 2020, and an additional yearly 200 MWp during 2021-2030. Tunisia aims to install 15 MWp of solar PV capacity in individual households, public and private buildings in addition to several installations for rural electrification and hybrid systems for pumping or street lighting.

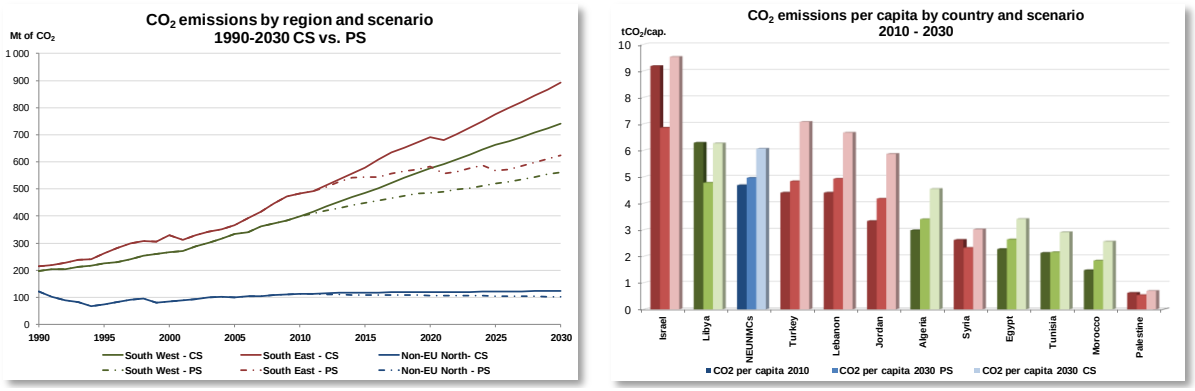
Finally, concentrating solar power (CSP) is gaining momentum in the Mediterranean region, also driven by the investment opportunities offered by multilateral endeavours such as the Desertec Industrial Initiative and the World Bank's Clean Technology Fund. In Algeria, in addition to the first hybrid solar and gas power plant of 150 MW of Hassi R'mel, two other pilot projects of 150 MW each are foreseen in 2011-2013. In its national plan announced in 2011, Algeria intends to install a total CSP capacity of 1.2 GW by 2020 and 7 GW by 2030. In Egypt, a first ISCC project with a net capacity of about 140 MW, including 20 MW of solar capacity has been built in Kuraymat. Two more CSP projects are planned: the Kom Ombo (70 MW) and the Marsa Alam (30 MW) plants. In Israel, a CSP project with two solar thermal power plants is under development at Ashalim. It has a 220 MW capacity and should be completed in 2012. Jordan has announced its intention to build 250 MW of CSP in the Ma'an development zone through private projects. A 100 MW project is currently under construction and should become operational by 2013. Morocco aims to develop 2 GW of solar capacity by 2020, according to the framework of its Solar Plan. Morocco has identified several sites with favourable conditions for CSP plants. Tunisia's national Solar Plan foresees the CSP development of about 100 MW by 2016.

1.5. CO_2 emissions

It is expected that a change in lifestyles and a high demand for goods and services will lead to an increase of per capita CO_2 emissions. Indeed, the outlook for energy-related CO_2 emissions in both the Conservative and Proactive Scenarios shows an upward trend, albeit much lower in the Proactive case (Figure 15). Projected emissions are 1.75 $GtCO_2$ in the Conservative Scenario and 1.3 $GtCO_2$ in the Proactive Scenario in 2030. This difference (more than 20% avoided CO_2 emissions in the same year) is the consequence of a more

efficient energy system and increased share of low-carbon options with renewables covering a larger portion of total primary energy supply in the Proactive Scenario as compared to the Conservative scenario. Nevertheless, CO_2 emissions in the region will remain much higher than their level in 2010: 76% higher in the Conservative scenario and 30% higher in the Proactive scenario. As explained earlier this is driven by the hydrocarbon-based supply energy system in the region in a context of increasing demand, which is expected to prevail in the coming decades.

Figure 15: Trends in CO_2 emissions by region and scenario, 1990-2030; and CO_2 per capita by country and scenario, 2010-2030

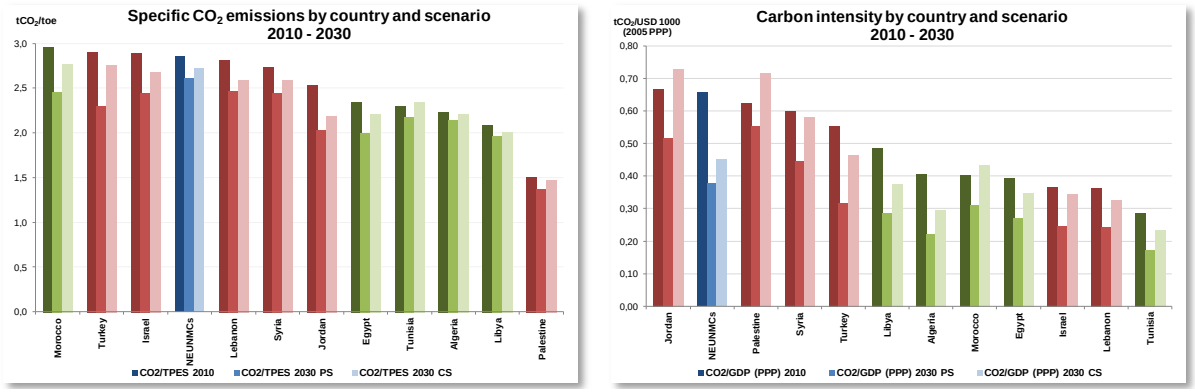


Source: OME database

In SWMCs and SEMCs, CO_2 emissions per capita are expected to continue growing although more moderately than in the past (47% and 11% for the South West according to the scenario and 46% to 2% for the South East). This is mainly driven by the high socio-economic growth and the related increase for energy demand in a present context of relative modest access to energy services. Despite these convergent trends in the two sub-regions, disparities will still exist between countries (Figure 15).

Looking at trends in specific CO_2 emissions, a slight decrease in the region is expected driven by a lower-carbon energy mix in average. NEUNMCs will engage in a decreasing trend (5% decrease between 2010 and 2030 under the Conservative scenario and 15% decrease under the Proactive scenario during the same period). Disparities do also exist between countries (Figure 16).

Figure 16: Specific CO_2 emissions by country and scenario, 2010-2030; and Carbon intensity by country and scenario, 2010-2030



Source: OME database

As for the carbon intensity, NEUMCs will record in average a decrease of its carbon intensity between 2010 and 2030 of 15 % in the Conservative scenario and 38% in the Proactive scenario (Figure 16).

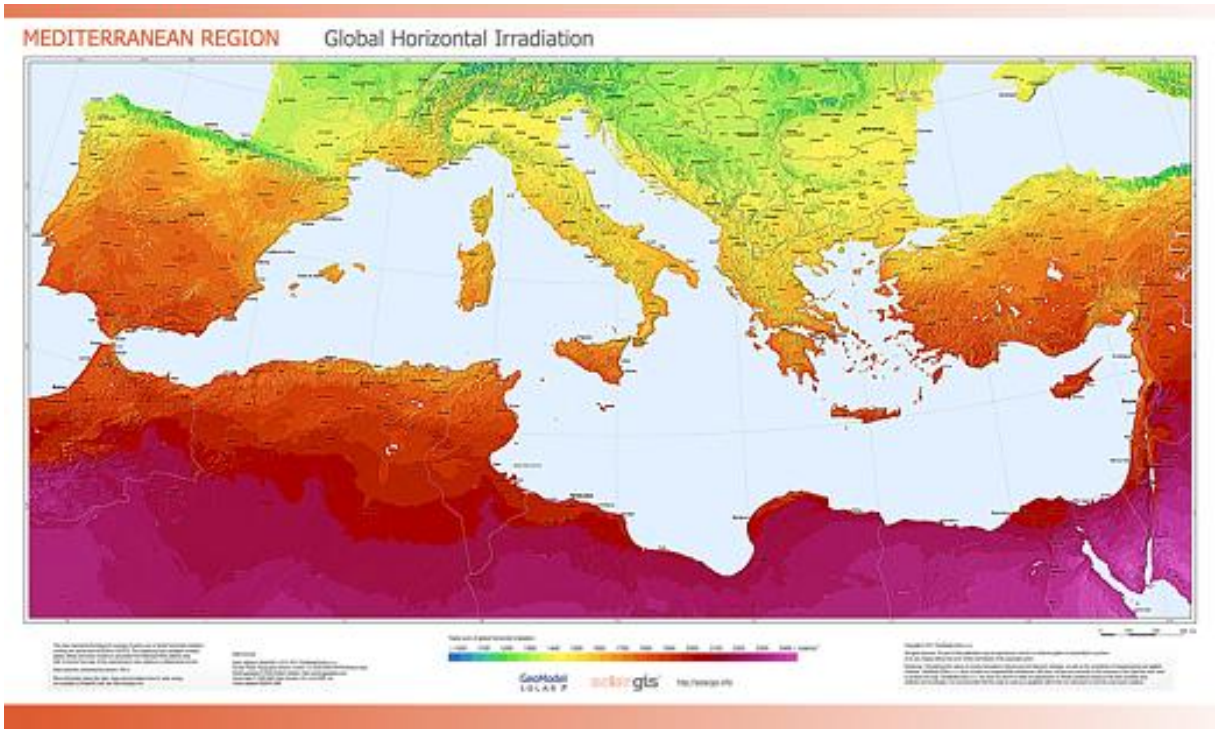
2. Solar Thermal market: regional and country analysis

2.1. Solar resources

SWMCs and SEMCs 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 17). In NEUNMCs, the potential is lower but remains very interesting, with a GHI ranging from about 900 kWh/m²/y to 1,600 kWh/m²/y in coastal areas.

Such favourable condition makes the development of solar thermal technologies particularly suitable in the region.

Figure 17: Global horizontal Irradiance (GHI) in Mediterranean area



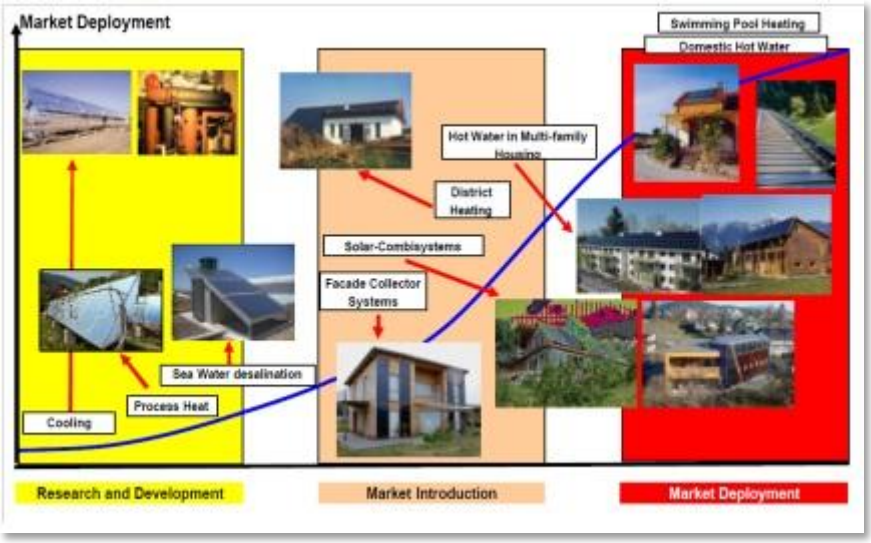
Source: PV GIS

2.2. SWH market potential

Solar thermal systems are wide-spreading at world level. Up to know 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 18).

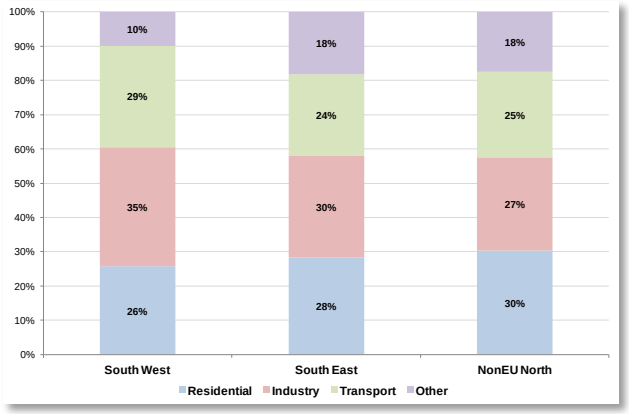
Figure 18: Market deployment phases of solar thermal systems



Source: G. Faninger, 2010

As shown in Figure 19, residential and industrial sectors represent together around 60% of the energy consumption of NEUMCs. 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.

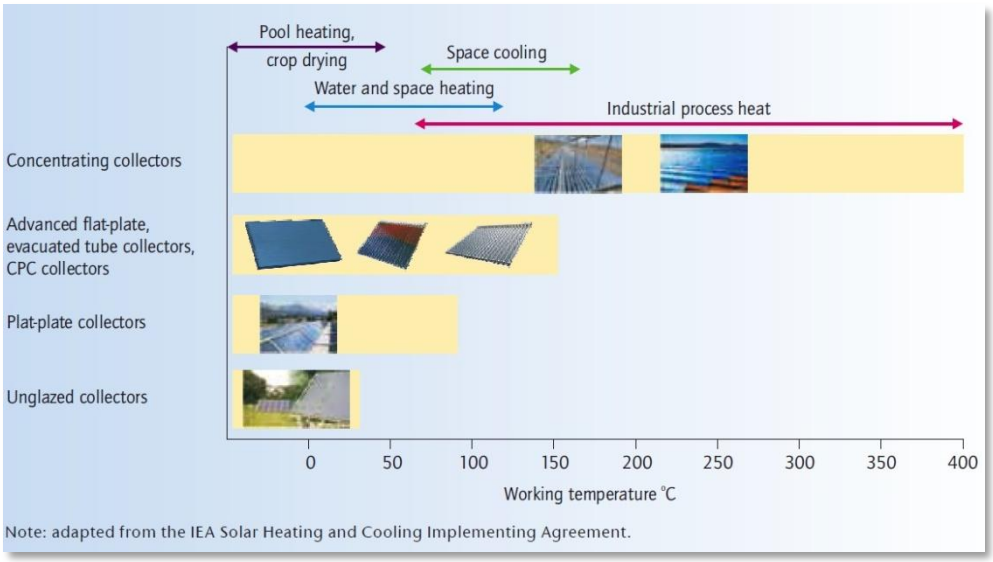
Figure 19: Final energy consumption by sector and region, 2010



Source: OME database

In 2009, the IEA reported that global energy demand for heat represented 47% of final energy use. Looking at the wide range of existing solar applications (Figure 20), 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 20: Solar collectors and working temperatures for different applications



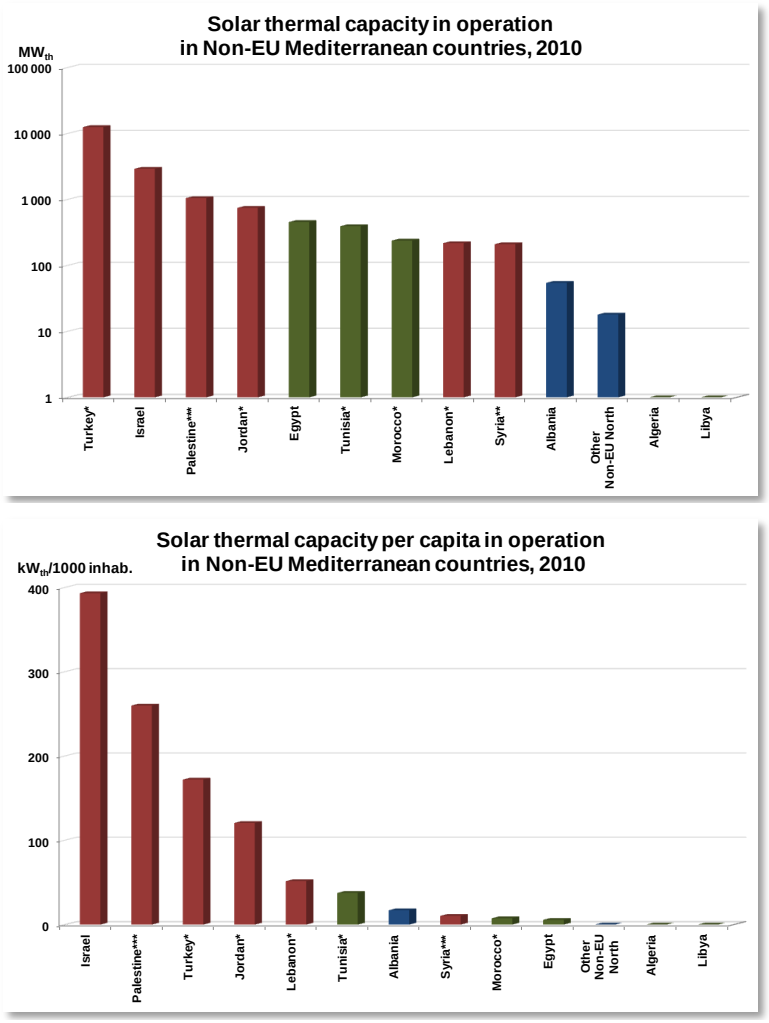
Source: IEA, 2012

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 Non-EU Mediterranean area.

2.3. SWH market

Solar thermal capacity in operation in the Mediterranean countries is displayed in Figure 14, both in absolute values and on a per-capita basis. An approximate capacity of about 19 GW_{th} is estimated for the Mediterranean area in the year 2010. This represents more than 9% of the total solar thermal capacity in operation at global level. Turkey alone hosts two-thirds of the NEUMCs' solar thermal capacity, followed by Israel and the Palestine. Together, these three countries account for around 88% 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 21: Solar thermal capacity in operation in the Non-EU Mediterranean Countries in 2010



*2011, **2008, ***2007

Sources: OME database and national sources

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 Non-EU Mediterranean Countries, 2010

Installed capacity of Solar Water Heaters (in m²), 2010		
< 300,000 m²	300,000 m² < x < 700,000 m²	> 700,000 m²
Albania Algeria Libya Non-EU North 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.

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 in chapter 2.7: Country analysis.

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	NO	NO	YES	920	Open-loop, pressureless thermosiphon (180 lit hot water, 70 lt feeding tank)
Albania (2006)	YES	NO	NO	NO	1,000	2-3 m² collector and 150-200 liter water tank

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

2.4. SHIP applications

At present, 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. 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.

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) are in the process of establishing 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 “ArSol” (Arab Solar network), 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 ArSol 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 ArSol certification of solar collectors and solar water heaters, and defines the test methods to be used to check if requirements are

fulfilled. 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 ArSol network. General Certification Scheme Rules have been developed by SWT Technologie (Germany) and SolarKey Int and were presented at the occasion of a first ArSol 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 will be sent to the Arab Ministerial Council of Electricity, to be approved by the end of 2012.

The ArSol 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.

2.6. Main barriers

Solar thermal technologies have the potential to satisfy a large share of final energy consumption. Recent 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, as shown in Figure 12, 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 ArSol initiative represents a significant step forward.

A specific barrier which is particularly relevant in the SMCs 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 SHW 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 which was raised during the regional workshop in Beirut 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

Barriers	Recommendations	Example
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 experts

2.7. Country analysis

2.7.1. Algeria

2.7.1.1. Socio-economic and energy context

Figure 22: 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

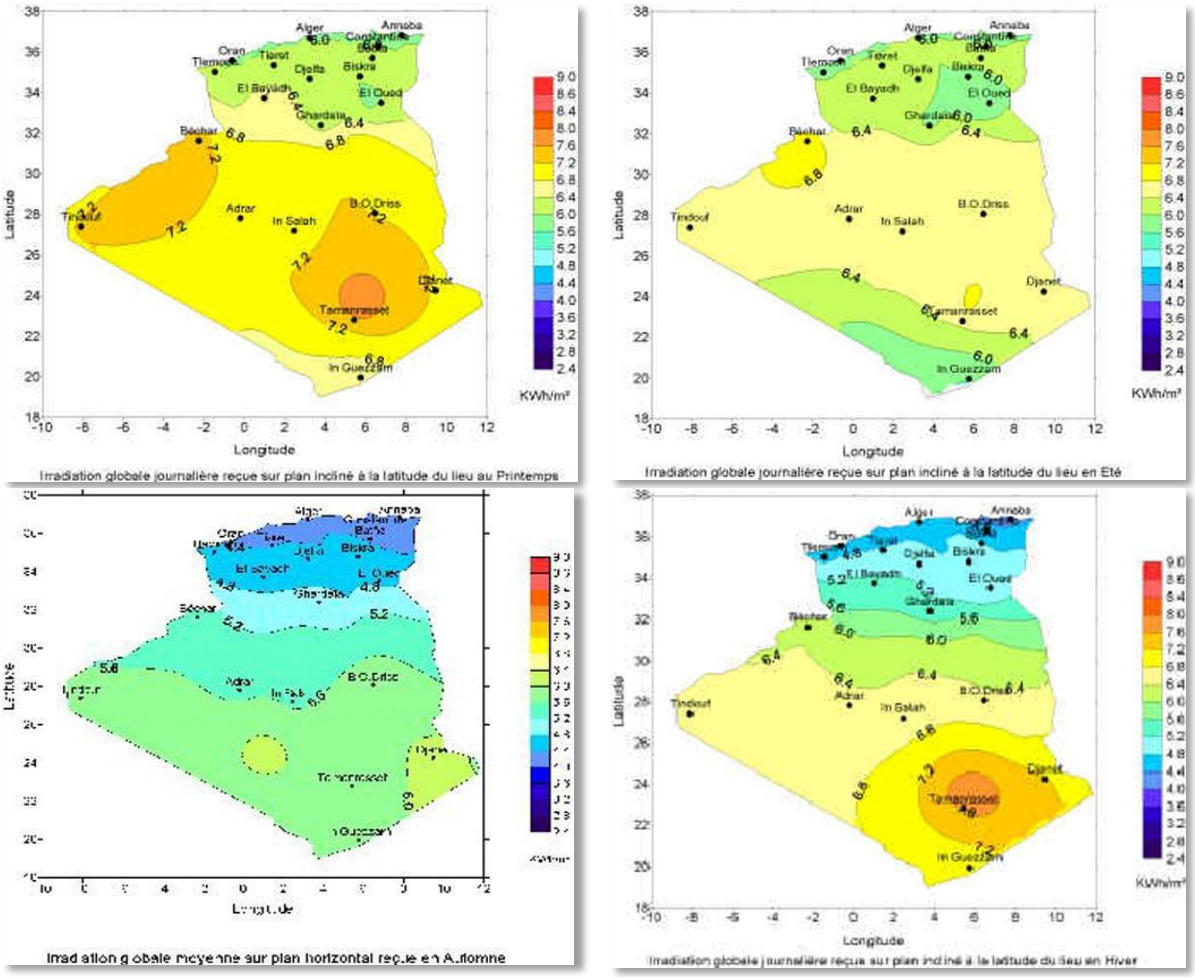
According to IEA analyses, Algeria devoted USD 10.6 billion in 2010 to energy subsidies of which USD 2.1 billion to electricity, the remaining part dedicated to fuels[7]. These grants represent, according to the same data, 6.6% of Gross Domestic Product (GDP) of Algeria, which devotes more than $ 298 per person of energy subsidies per year.

[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

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 23).

Figure 23: 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)

2.7.1.2. 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”, or “ALSOL”. 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. By 2013, studies will be launched to assess the feasibility for solar cooling technologies and choose the system best suited to the Algerian context. 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) should open soon in Bellil, in the south of Hassi R'Mel.

2.7.1.3. 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, 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 will be set up in 2012 in Algeria. The first mission of the laboratory certification of photovoltaic equipment and solar water heaters will be the approval of the state-owned equipment group

[8] http://www.dz.undp.org/Projets_Cooperation/fiches_projets/Fiche_CES.pdf
[9] http://portail.cder.dz/spip.php?article1268

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 represents around USD 820.

2.7.1.4. 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. 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
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

[10] http://portail.cder.dz/spip.php?article1268

2.7.2. Egypt

2.7.2.1. Socio-economic and energy context

Figure 24: Egyptian indicators

Socio-economics [2010]		
Population	81 121	*[Thousands]*
Urban population	43,4%	*[%]*
GDP	471	*[billion USD 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 analyses, Egypt devoted USD 19.3 billion in 2010 to energy subsidies of which USD 3.8 billion to electricity, USD 14.1 billion to oil and the remaining part dedicated to gas[11]. These grants represent, according to the same data, 9.3% of Gross Domestic Product (GDP) of Egypt, which devotes more than $ 250 per person of energy subsidies.

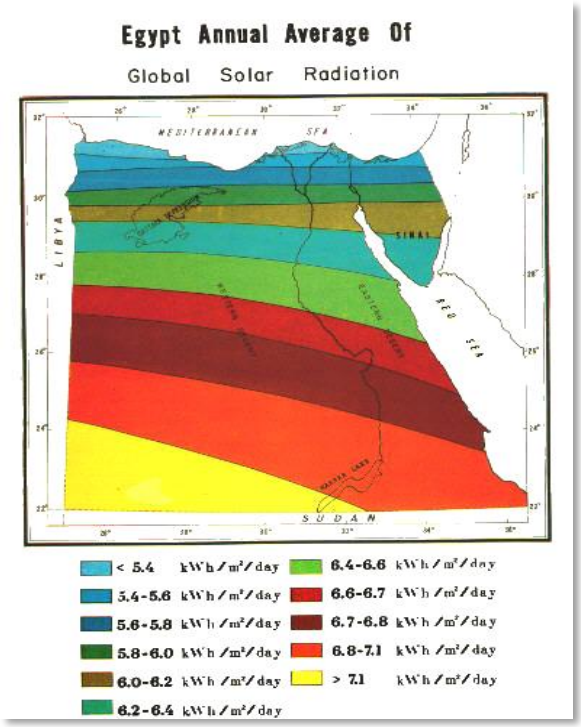
Solar energy resources

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 25). According to it, Egypt has a high intensity of global horizontal solar radiation

[11] 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

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.

Figure 25: Solar radiation in Egypt



Source : NREA

2.7.2.2. 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.

2.7.2.3. Solar water heater market

In Egypt, 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 of the most recent projects 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 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.

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 is currently being repaired due to some technical problems encountered, notably in the tracking system and the mirrors.

Market figures

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.

Table 6: Egyptian standards related to solar thermal

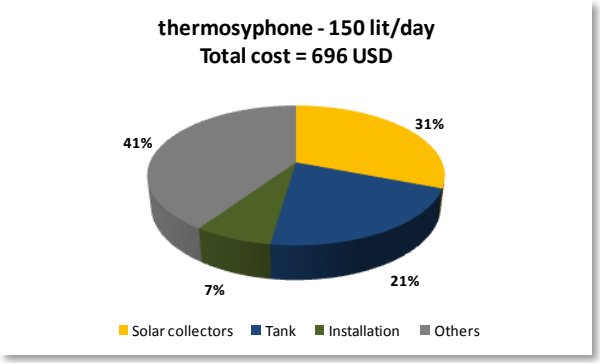
Standard number	Description
EOS-Standard for Solar Heaters	Part1: Technical Definition
	Part2: Solar Heating Systems
	Part3: Components of Solar Flat Plate Collectors
	Part4: Thermal Storage Tank
	Part5: Method of Testing to determine Thermal Performance

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



Source: NREA

2.7.2.4. 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[12].

Below some of the main actors of the solar thermal industry are reported.

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: internet

[12] 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

2.7.3. Israel

2.7.3.1. Socio-economic and energy context

Figure 27: 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%).

In 2010, the total installed capacity of renewables for electricity generation amounts to 120 MW of solar power plants.

Solar energy resources

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

2.7.3.2. 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.

2.7.3.3. Solar water heater market

Today, 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 m² 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[13].

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.

2.7.3.4. 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

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

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, internet

2.7.4. Jordan

2.7.4.1. Socio-economic and energy context

Figure 28: 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

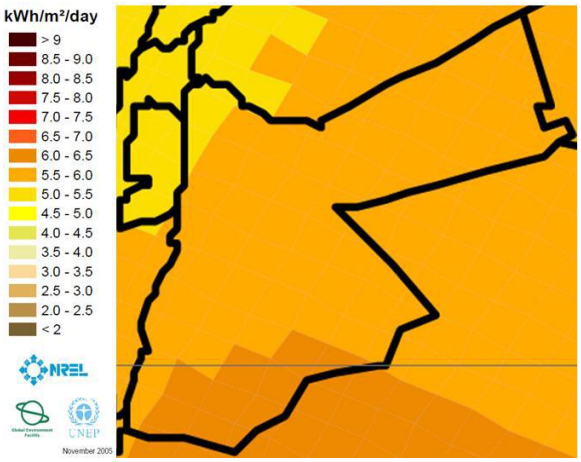
After subsidizing petroleum products for many years, the Jordanian energy system came under pressure in 2003, when it lost preferential fuel supply from Iraq. The government then implemented a series of price increases to limit the budgetary effect of the energy subsidies. Nevertheless, in 2008 the subsidy bill for energy still represented about 5% of GDP[14].

Solar energy resources

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.

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

Figure 29: Global Horizontal Irradiance in Jordan



Source: SWERA

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

2.7.4.3. Solar water heater market

The total installed collector surface reached around 1,000,000 m² 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 80% of the panels installed. Thermosyphon represent the main systems installed with a share of 80%.

SHIP applications

In the industrial sector, 111,788 m² were installed 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 than 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

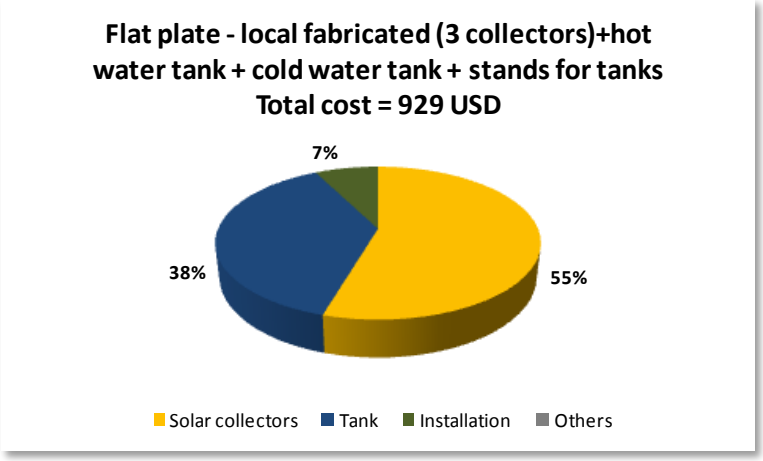
Standard number	Description
JS 394:1999	Labeling of Solar Water Heater
JS 434:1999	Flat Plate Solar Collector: Construction Requirements
JS 435-1:1999	Test Method for Solar Collectors Part 1
JS 435-2:1999	Test Method for Solar Collectors Part 2
JS 1224-1:1999	Domestic Water Heating System: Part 1
JS 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 - local 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 30: Average cost of systems in Jordan [individual, residential market]



Source: NERC

2.7.4.4. Main industry actors in ST field

There is no solar thermal industry association in the country. Hereafter, 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

2.7.5. Lebanon

2.7.5.1. Socio-economic and energy context

Figure 31: 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

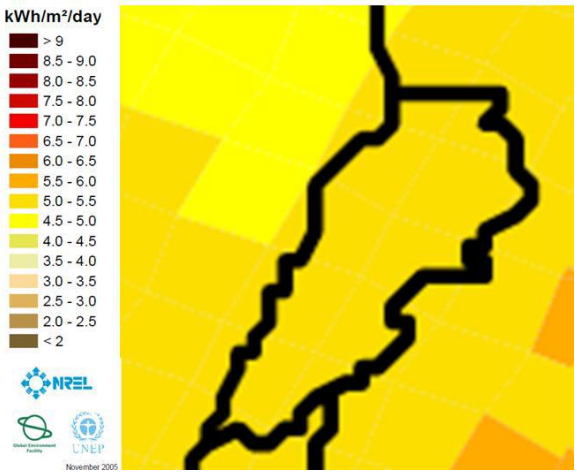
The government heavily subsidizes electricity. These grants totalled USD 1.2 billion in 2007 (17% of state expenditure) and USD 1.45 billion in 2009, representing a subsidy of USD 11.4 cents/kWh in 2007 and USD 12.7 cents/kWh in 2009[15].

Renewable energy resources

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 in June/July) and a yearly sunning period of about 3,000 hours.

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

Figure 32: Global Horizontal Irradiance in Lebanon



Source: SWERA

2.7.5.2. Solar thermal legislative and regulatory framework

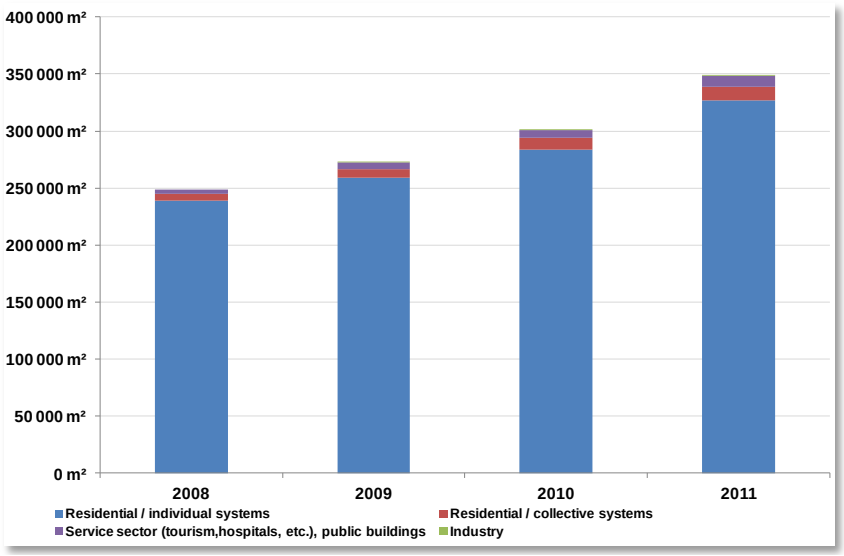
Solar water heating installations started to penetrate the market in Lebanon in the early 1990s. The market is expanding thanks to incentive mechanisms which include low interest rate credit offered by private banks. Within the GSWH initiative, of which Lebanon is beneficiary, the objectives are: 1) 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.

2.7.5.3. 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 33). 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%.

Figure 33: 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.

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 15.6 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

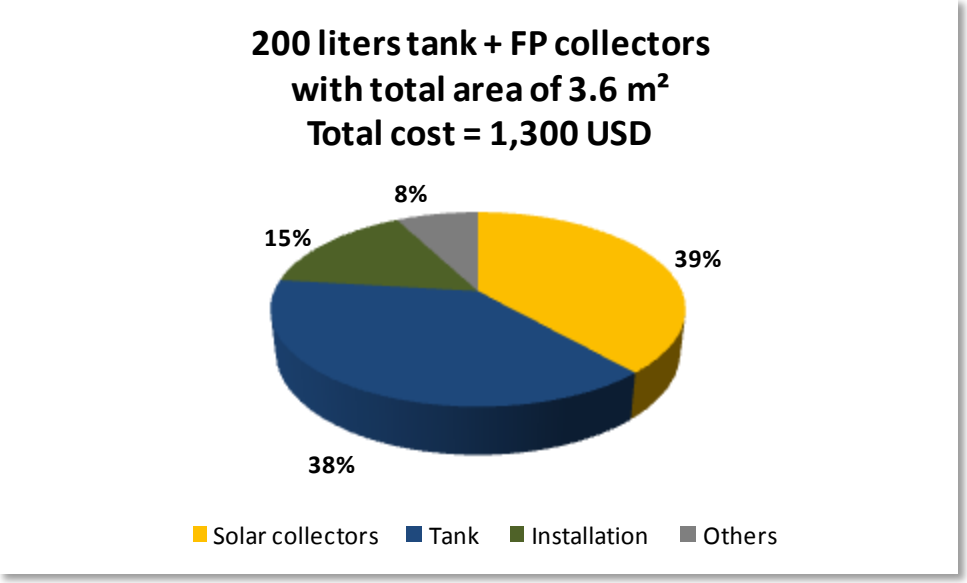
Standard number	Description
NL EN 12975 Part 1	Thermal solar systems and components - Solar collectors: General requirements
NL EN 12975 Part 2	Thermal solar systems and components - Solar collectors: Test methods
NL EN 12976 Part 1	Thermal solar systems and components - Factory made systems: General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

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



Sources: LCEC, LSES, IRI

2.7.5.4. 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 manufacturer 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: qtourch2@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 water heater	email: info@supersolarheater.com 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

2.7.6. Libya

2.7.6.1. Socio-economic and energy context

Figure 35: 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

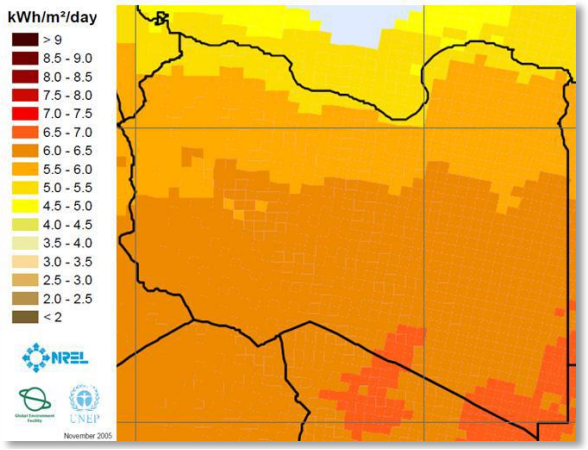
According to IEA analyses, Libya devoted USD 4.2 billion in 2010 to energy subsidies of which USD 0.8 billion to electricity, the remaining part dedicated to fuels[16]. These grants represent, according to the same data, 5.7% of Gross Domestic Product (GDP) of Libya, which devotes more than $ 665 per person to energy subsidies.

Solar energy resources

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 36).

[16] 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 36: Global horizontal Irradiance in Libya



Source: SWERA

2.7.6.2. 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 to develop 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.

2.7.6.3. 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.

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 is to finalise the contract by October 2012. Another tender is 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.

2.7.7. Morocco

2.7.7.1. Socio-economic and energy context

Figure 37: 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 31 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 an heavy impact on the energy bill, which represents a large portion of the country's budget[17] 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 (see box "Focus on LPG subsidies") and diesel

[17] About 66 Milliards DH in 2010 according to Ministry of Energy and Mines, http://www.mem.gov.ma

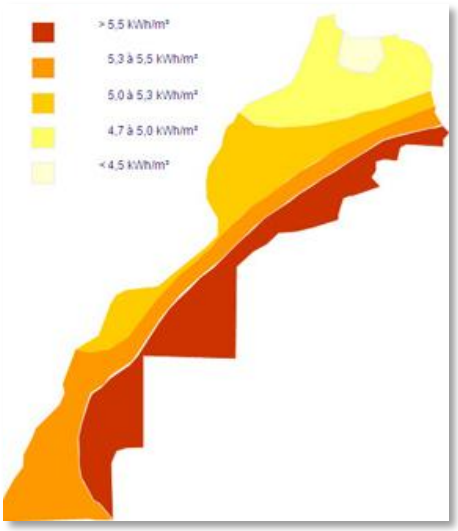
through a system of official prices and refunds to petroleum companies to recover the wholesale price. The prices for both products are fixed by the government, at 3.3 DH per kilogram for LPG and 7.5 DH per kilogram for diesel. The subsidy is equal to the difference between what would be the consumer 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 ONE (public entity) has not the control on the electricity selling price (it is fixed by ministerial decree), ONE 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[18], 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).

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 38).

Figure 38: Solar radiation in Morocco [kWh/m²]



Source: MASEN

2.7.7.2. Solar thermal legislative and regulatory framework

According to ADEREE[19], 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

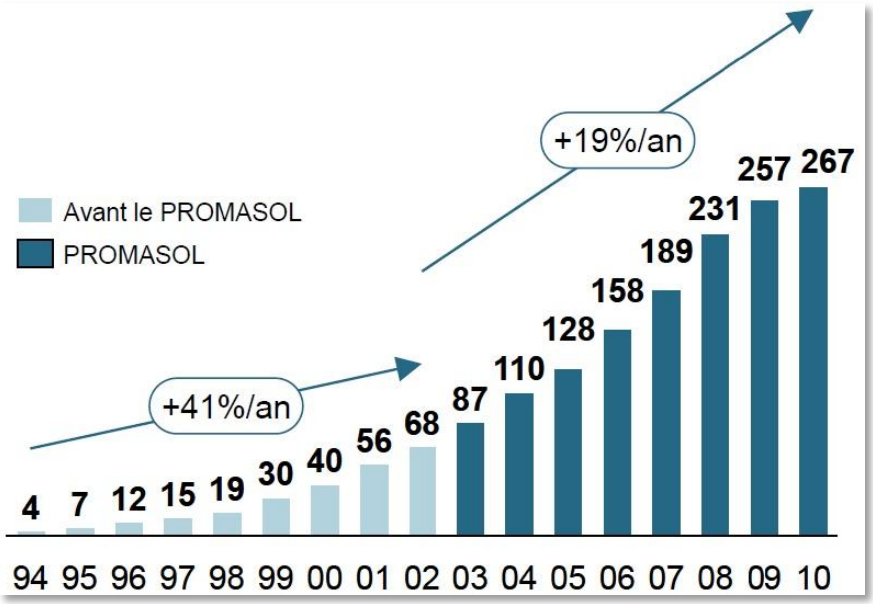
[18] http://www.mem.gov.ma/publucations/Contribution%20Energie%20%20Mines%2027-12-2011.pdf
[19] Moroccan, country factsheet, Regional workshop for the Transformation and Strengthening of the Solar Water Heating Market in the Mediterranean, Beirut, April 2012

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[20] 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.

2.7.7.3. 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 39). 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.

Figure 39: 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).

[20] Former ADEREE

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.

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

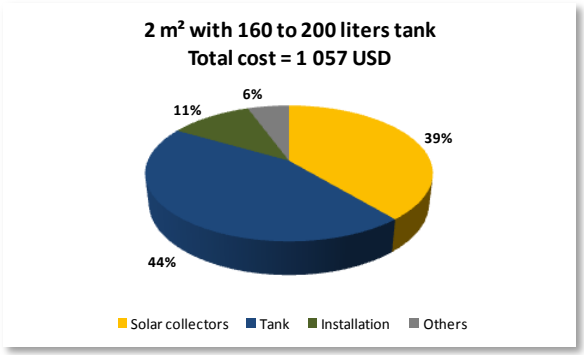
Source: H.Salloum, presentation at Regional Solar Thermal Workshop, Beirut 2012

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



Sources: ADEREE, AMISOLE

2.7.7.4. 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 establish 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

2.7.8. Palestine

2.7.8.1. Socio-economic and energy context

Figure 41: 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 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.

2.7.8.2. Solar thermal legislative and regulatory framework

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

2.7.8.3. 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[21].

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 around 400€.

2.7.8.4. 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.

[21] 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

2.7.9. Syria

2.7.9.1. Socio-economic and energy context

Figure 42: 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

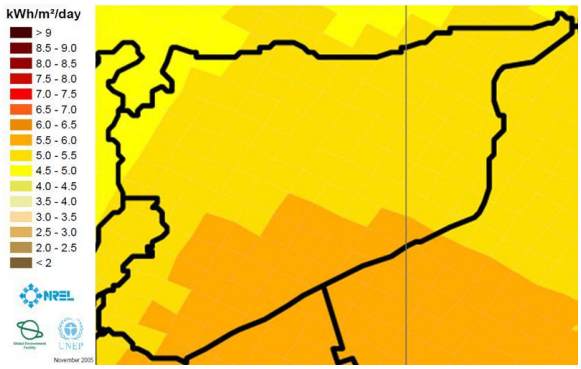
According to the Middle East Economic Survey, Syria spent $3 billion on petroleum product subsidies in 2010. Syria had announced a long-term plan to phase out these subsidies, but the onset of political turmoil in 2011 in Syria forced a delay in these plans.[22]

Renewable energy resources

Syria is has an average GHI of 4.4 kWh/m²/d in the mountains to 5.2 kWh/m²/d in the desert regions (Figure 43). The annual sunshine hours vary in a range from 2,800 to 3,200 hours.

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

Figure 43: Global horizontal Irradiance in Syria



Source: SWERA

2.7.9.2. 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. 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.

2.7.9.3. 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 m^2, one third installed during the last three years, due to the fact that fossil fuels were no longer easy available than during the last decades[23].

Certification and standards[24]

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

[23] 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

[24] 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

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 **€**[25].

2.7.9.4. 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 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

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

2.7.10. Tunisia

2.7.10.1. Socio-economic and energy context

Figure 44: 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 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[26], 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 than 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

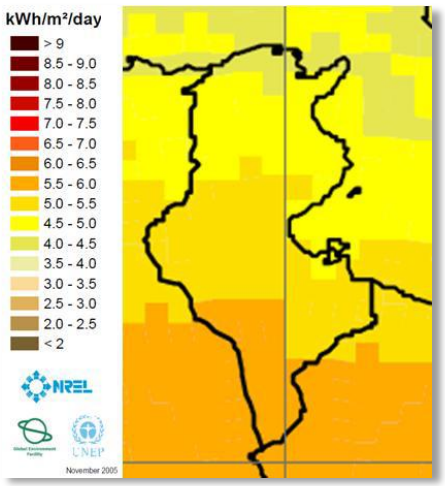
[26] R. Missaoui, *Energie et changement climatique, le coût de l'action en Tunisie*, Changement climatique, raréfaction des ressources énergétiques: des opportunités pour innover et entreprendre dans les énergies renouvelables et l'efficacité énergétique en Tunisie et en Méditerranée, Tunis, 2009

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[27].

Solar energy resources

Tunisia has a good potential in 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 45).

Figure 45: Global horizontal Irradiance in Tunisia



Source: SWERA

2.7.10.2. 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 m² 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

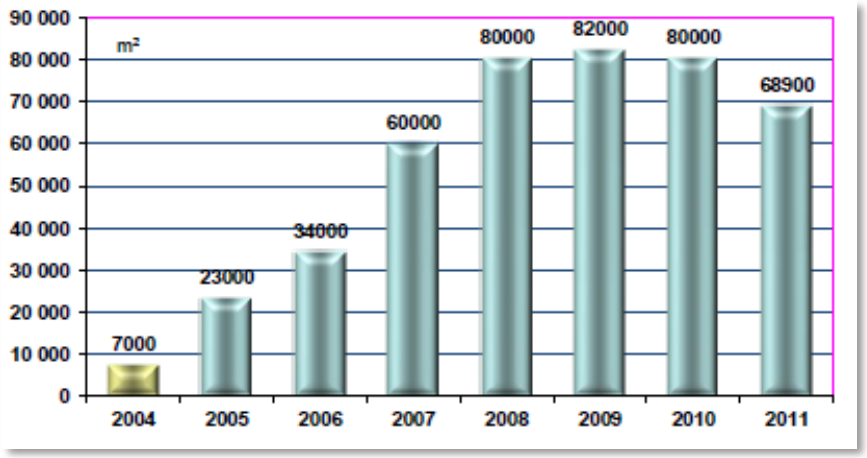
[27] http://fr.allafrica.com/stories/201205291346.html

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.

2.7.10.3. 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 46). 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.

Figure 46: 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 back 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 will start in August 2012 and will 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 than 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

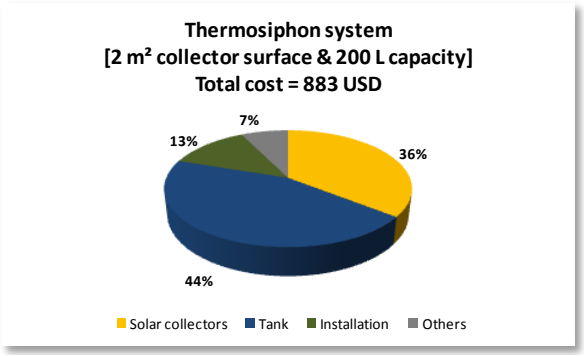
Thermal Processes Laboratory of the Research and Technology Centre of Energy (CRTEn) in the “Eco-Park de Borj Cedria”. The accreditation is given by the Tunisian Accreditation Council (TUNAC). The National Institute for Standardization and Industrial Property (INNORPI) provides technical assistance and 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 47: Average cost of systems in Tunisia [individual, residential market]



Sources: ANME, CSNER

2.7.10.4. 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 to the PROSOL (most of them are micro-companies, 120 in 2005) and over 400 installers are qualified for “Qualisol systems”. ANME estimated than 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

2.7.11. Turkey

2.7.11.1. Socio-economic and energy context

Figure 48: 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.

Energy subsidies

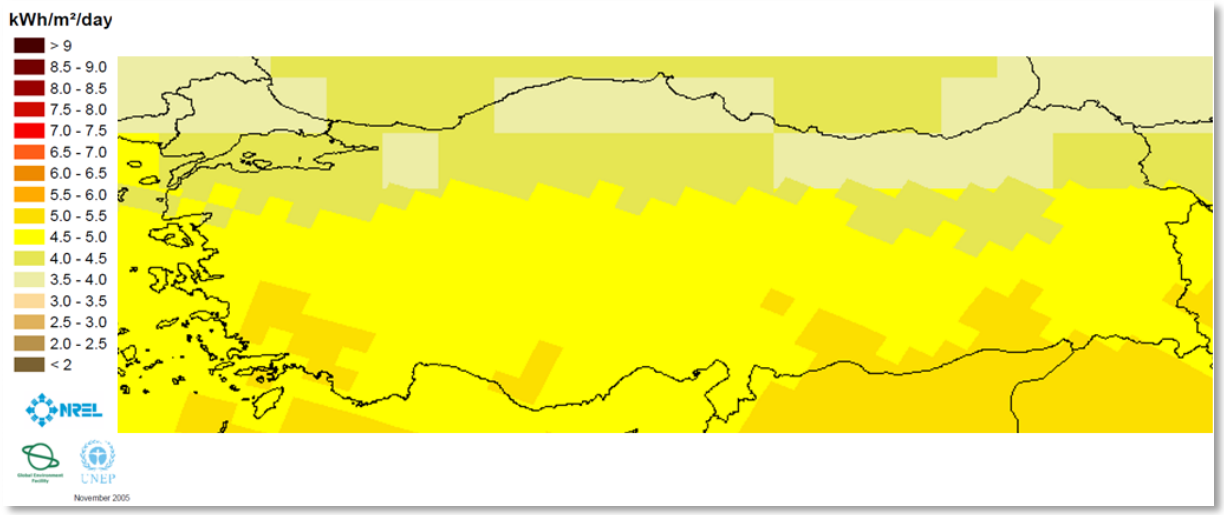
In 2008, USD 398 million of subsidies were granted to Turkish Hard Coal Enterprises[28]

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.

[28] International Energy Agency, *Energy Policies of IEA Countries, TURKEY 2009 Review*, 2009

Figure 49: Global Horizontal Irradiance in Turkey



Source: SWERA

2.7.11.2. 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 a 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

2.7.11.3. Solar water heater market

In Turkey, 18 millions m² have been installed without any incentives. 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 laundry29.

Market figures

According to Ezinç Metal[30] , 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. 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

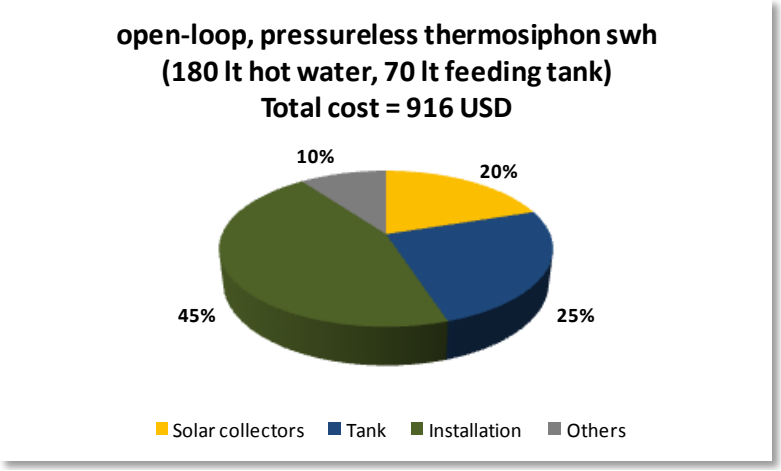
Today, Turkish Standards (TS) are existing norms and these are extensions/duplicates of EN norms for solar water heating systems, which are TS-EN-12975; TS-EN-12976; TS-EN-12977.

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.

Figure 50: Average cost of systems in Turkey [individual, residential market]



Sources: EIE, Ezinç

[29] Kadirgan, F. (2011). Solar Energy Use for Sustainable Development in Turkey, World Sustainable Energy Days, 2-4 March 2011, Wels.
[30] http://www.solarthermalworld.org/content/turkey-vacuum-tubes-rise

2.7.11.4. 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

2.7.12. Albania

2.7.12.1. Socio-economic and energy context

Figure 51: Albanian indicators - source IEA

Key Indicators		Compound Indicators	
Population (million)	3.16	TPES/Population (toe/capita)	0.54
GDP (billion 2000 USD)	5.88	TPES/GDP (toe/thousand 2000 USD)	0.29
GDP (PPP) (billion 2000 USD)	18.16	TPES/GDP (PPP) (toe/thousand 2000 USD)	0.09
Energy Production (Mtoe)	1.25	Electricity Consumption / Population (kWh/capita)	1768
Net Imports (Mtoe)	0.48	CO_2/TPES (t CO_2/toe)	1.57
TPES (Mtoe)	1.72	CO_2/Population (t CO_2/capita)	0.85
Electricity Consumption* (TWh)	5.58	CO_2/GDP (kg CO_2/2000 USD)	0.46
CO_2 Emissions ** (Mt of CO_2)	2.70	CO_2/GDP (PPP) (kg CO_2/2000 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 3.2 Million in 2009. 52% of people 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 which is imported.

The renewable energy predominant in the country is hydropower which represents almost the entire national power generation in 2009 (99%). Only one thermal power plant is in operation, with 97 MW installed capacity.

Energy subsidies

Energy prices are subsidies 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.

Solar resources

According to radiation measures 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.

2.7.12.2. Solar thermal legislative and regulatory framework

In May 2012, a roundtable discussion was organized in Tirana to launch the draft 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.

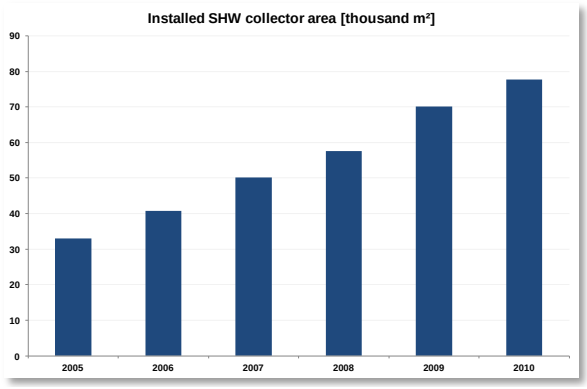
The draft RES Action Plan for Albania and other RES legislation to promote solar energy are provided in the frame of the "Country Programme of Albania under the Global Solar Water Heating Market Transformation and Strengthening Initiative". Indeed, Albania is also a beneficiary country of the "Global Solar Water Heating (GSWH) Market Transformation and Strengthening Initiative". The aim of the project within the initiative is to facilitates 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.

2.7.12.3. 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 (Figure 52). A previous market survey carried out in 2006[31] estimated that 55% of the installed capacity in 2005 was installed in the service sector (hotels etc.), the remaining installed in the residential sector.

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

Figure 52: Albanian installed solar water heater collectors' area, 2005-2010



Source: OME elaborated from IEA-SHC's data

Market figures

The flat collectors were estimated to account for about 99% of the total installed area, the evacuated tubes for 1%[32]. The combisystems used for both heating and hot water preparation were estimated to account for about 9% of the total installed area in 2005[33].

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.

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.

2.7.12.4. Main industry actors in ST field

The market review conducted in early 2006 identified 6 local companies in Albania that supply solar thermal equipment. 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.

[32] 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
[33] Market Analysis for the Solar Water Heating – Albania, Energy and Environment for the Sustainable Development Center (EESDC), April 2006;

3. Conclusions

The Mediterranean region is endowed with a significant market potential and could become a frontrunner in the development of solar water heating and cooling technologies in several use applications. Experiences in the solar thermal market date back to the early 1980s and most Mediterranean countries have built enough knowledge, both under the technical point of view and with respect to the institutional, regulatory and market frameworks. Despite significant progress in some countries the solar thermal market is however still facing many challenges which prevent its development beyond current growth rates. These include: high investment costs compared to conventional energy technologies, the lack of harmonised standards and certification schemes to ensure the product quality, unclear allocation of roles and responsibilities among different agencies at the institutional level, low public awareness. A particularly relevant obstacle in many Mediterranean countries is represented by the subsidies to fossil fuels, which create market distortion and decrease the competitiveness of renewable energy technologies. Another significant drawback is the lack of systematic statistics on the solar thermal market and industry, and the very limited return on experiences. Even in those countries where a well developed market and industry infrastructure are in place (e.g.: Jordan, Syria, Turkey), access to data is difficult and experiences are not sufficiently documented.

The regional workshop organised by OME in Beirut 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 13 selected countries. 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.

4. References

Agueniou S., *Compensation : 52 milliards de DH en 2011, jusqu'où ira-t-on?,* www.lavieeco.com, December 2011

Allali B., *Case Study - PROMASOL: Democratizing access to Solar Water Heaters*, UNDP, 2011

Bennouna A., *Solar thermal market in Morocco, its impacts and the role of AMISOLE*, Regional workshop for the Transformation and Strengthening of the Solar Water Heating Market in the Mediterranean, Beirut, April 2012

Centre de Développement des Energies Renouvelables, *Thermokad, un chauffe-eau solaire algérien,* 19 mai 2011, http://portail.cder.dz

Centre de Développement des Energies Renouvelables, *Un laboratoire pour l'homologation des équipements photovoltaïques et de chauffes-eau solaires,* 21 octobre 2011, http://portail.cder.dz

Cottret N., *D1.1: Initial Market Assessment Report,* 2011

Country factsheets, Regional workshop for the Transformation and Strengthening of the Solar Water Heating Market in the Mediterranean, Beirut, April 2012

Energy Institute Hrvoje Požar, *Croatian National Report*, TRANS-SOLAR Project, January 2009

Faninger G., "The potential of Solar Heat in the future energy system", IFF- University of Klagenfurt, Austria

International Energy Agency (IEA), "Technology Roadmap - Solar Heating and Cooling", OECD/IEA, Paris, 2012

Ksouri S., *Tunisia Solar Thermal Program "PROSOL",SOLAR PROCESS HEAT*, Regional workshop for the Transformation and Strengthening of the Solar Water Heating Market in the Mediterranean, Beirut, April 2012

Louafi N., *Promotion du chauffe-eau solaire en Algérie-* Programme ALSOL, Bulletin_020_06.pdf, www.aprue.org.dz;

Menichetti E.: "*Solar thermal in the Mediterranean region: State of the art and analysis of experiences*" paper presented at the Fifth European Solar Thermal Energy Conference, 20-21 October 2011, Marseille

Menichetti E.: Renewables for heat - solar thermal, in: "*Mediterranean Energy Perspectives 2011*", Chapter 6: Renewable Energy, OME publication, December 2011

Menichetti E. and Cottret N., *Current and future perspectives of solar thermal in the Mediterranean region: The role of knowledge management and networking to accelerate market transformation*, GEM n°9, June 2012

Mezzour S., *SHEMSI, Programme national de développement des Chauffe-Eau Solaires (CES)*, Regional workshop for the Transformation and Strengthening of the Solar Water Heating Market in the Mediterranean, Beirut, April 2012

Ministère de l'Energie, des Mines, de l'Eau et de l'Environnement; Direction de l'Observation et de la Programmation, *Statistiques énergétiques*; Mai 2012

Ministère de l'Energie, des Mines, de l'Eau et de l'Environnement; Direction de l'Observation et de la Programmation, *Contribution des secteurs de l'énergie et des mines dans l'économie nationale 2007-2010,* Décembre 2011

Ministère de l'Energie et des Mines, *Bilan des réalisations du secteur de l'Energie et des Mines – 1962 -2010*; Edition 2011 ;

Ministère de l'Energie et des Mines, *Bilan énergétique national de l'année 2010*; Edition 2011 ;

Ministère de l'Energie et des Mines, *Programme des énergies renouvelables et de l'efficacité énergétique,* Mars 2011 ;

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

Moretta S., *Main barriers and enabling factors for the development of a sustainable solar thermal market in the Mediterranean region: analysis of MEDREC experience*, Regional workshop for the Transformation and Strengthening of the Solar Water Heating Market in the Mediterranean, Beirut, April 2012

Observatoire Méditerranéen de l'Energie (OME), *Regional workshop report*, May 2012 (available at: http:www.solarthermalworld.org)

Observatoire Méditerranéen de l'Energie (OME), *Mediterranean Energy Perspectives 2011*, 2011

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;

Société Tunisienne du Gaz et de l'Electricité, *Rapport Annuel 2010*

Weiss W. and Mauthner F., *Solar Heat Worldwide – Markets and Contribution to the Energy Supply 2010*, IEA SHC programme, May 2012

Weiss W., Solar Heat for Industrial Applications: Potential, Framework Conditions and Build Examples, Melbourne, November 2010.

World Bank, Sustainable Development Department Middle East and North Africa Region, *Reforming Energy Price Subsidies and Reinforcing Social Protection – Some Design Issues.*; July 2008

World Bank, International Bank For Reconstruction And Development, *Program document for a proposed loan in the amount of €75 to the kingdom of morocco for an energy sector development policy loan*, Report No. 37350-MOR, May 2007

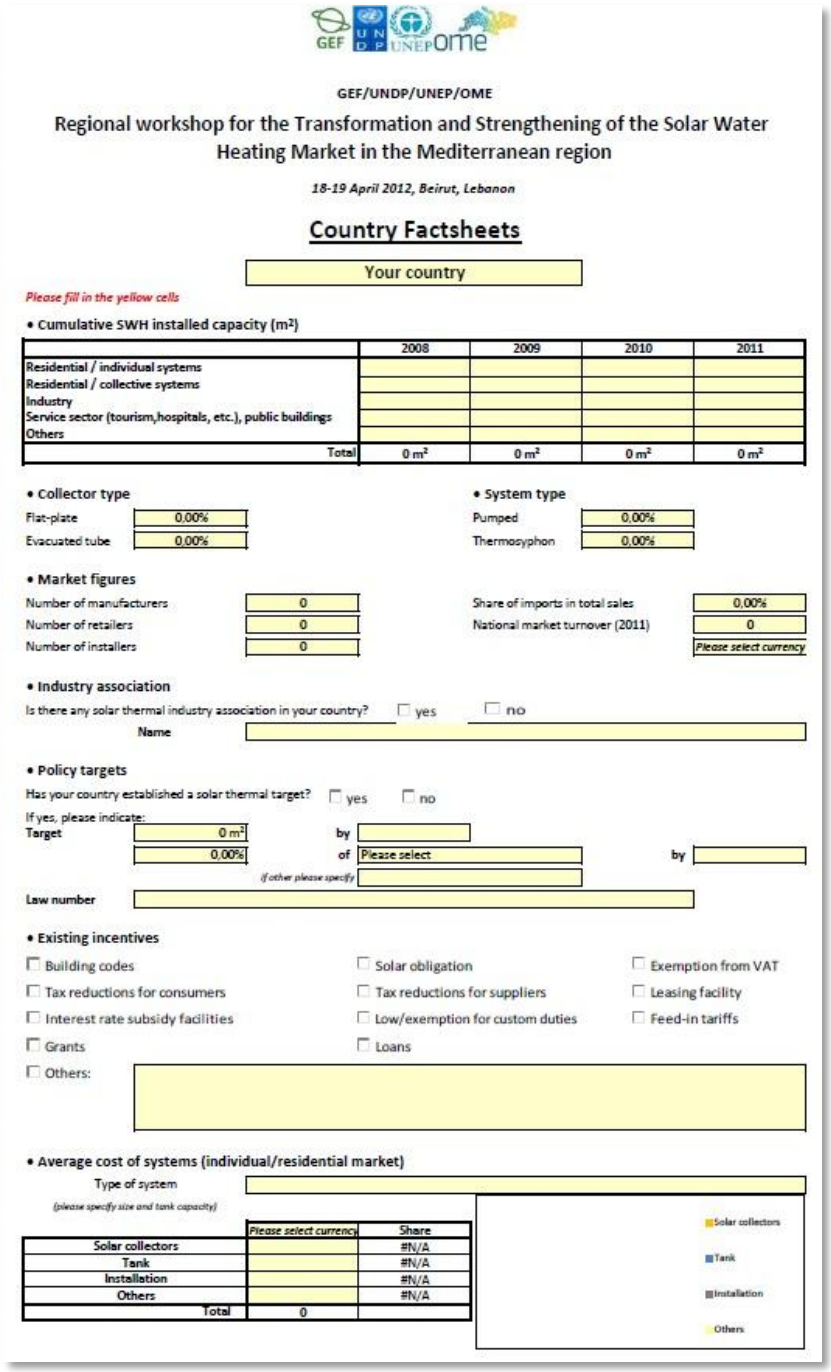
Websites

- http://www.aderee.ma/
- http://www.alibaba.com
- http://www.almee.org/
- http://www.amisole.com/
- http://www.anme.nat.tn
- http://www.aprue.org.dz/
- http://www.csner-tn.com
- http://www.dz.undp.org/
- http://energy.gov.il/English/Pages/Default.aspx
- http://energy.sourceguides.com/businesses
- http://www.iea.org/subsidy/index.html
- 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/
- http://portail.cder.dz
- http://www.steg.com.tn/

- http://www.undp.org.al/
- http://www.yegm.gov.tr/english/solar/solarTurkey_e.html

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
Number of retailers 0
Number of installers 0

Share of imports in total sales 0,00%
National market turnover (2011) 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

***O**bservatoire **M**éditerranéen de l'**E**nergie*

105 rue des Trois Fontanot,

92000 Nanterre, France

Phone: +33(0) 170 169 120

Fax: +33(0) 170 169 119

ome@ome.org