



# Mediterranean Investment Facility

**UNEP – Italian Ministry for the Environment, Land and Sea Partnership**

Building on success stories and partnerships





# Acknowledgements


Director of publication	Nick Nuttall
Coordination	Ghita Hannane, Mario Lionetti and Myriem Touhami (UNEP)
Designer	Caren Weeks
Editor	Diwata Hunziker

© United Nations Environment Programme, 2014

This publication may be reproduced in whole or in part and in any form for educational or non-profit purposes without special permission from the copyright holder, provided acknowledgment of the source is made. UNEP would appreciate receiving a copy of any publication that uses this publication as a source. No use of this publication may be made for resale or for any other commercial purpose whatsoever without prior permission in writing from the United Nations Environment Programme.

## Disclaimer

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



UNEP promotes environmentally sound practices globally and in its own activities. This report is printed on paper from sustainable forests including recycled fibre. The paper is chlorine free and the inks vegetable-based. Our distribution policy aims to reduce UNEP's carbon footprint.

# CONTENTS

List of acronyms .....	4
List of figures .....	4
Foreword .....	6
Introduction .....	8
<b>Tunisia</b>	
01 PROSOL Residential – Solar water heating project for the residential sector .....	10
02 PROSOL Elec – Solar photovoltaic project for the residential sector .....	16
03 PROSOL Industrial – Solar water heating project for the industry sector .....	18
04 PROSOL Tertiary – Solar water heating project for the service sector .....	22
<b>Egypt</b>	
05 EGYSOL – Solar water heating system facility for hotels .....	26
<b>Montenegro</b>	
06 MONTESOL – Solar water heating project for the residential and hotel sectors .....	30
<b>Morocco</b>	
07 Making the switch to efficient lighting .....	34
<b>South Africa</b>	
08 Replicating MIF's lessons learned at the city level: City of Cape Town Solar Water Heating Programme .....	38
Conclusion .....	42

Author's note: The projects are presented in chronological order of their implementation.

01

02

03

04

05

06

07

08

## References

### Publications

Chiara Trabacchi, Valerio Micale and Gianleo Frisari. (2012).  
*San Giorgio Group Case Study: Prosol Tunisia*.  
Climate Policy Initiative.

### Project documents

**ANME** (Agence Nationale de Maitrise de l'Energie). (2011).  
*Prosol Tertiaire*.

**CETMA and Italian Ministry for the Environment,**  
Land and Sea. (2007).  
*Renewable energy resources assessment, Republic of Montenegro*.

**GTZ**. (2009).  
*Solar Thermal Application in Egypt, Jordan, Lebanon, Palestinian Territories, Syria and Tunisia: Technical Aspects, Framework Conditions and Private Sector Needs, Cairo 23 – 25 March 2009*,  
Workshop report.

**Politecnico di Milano**. (2012).  
*Feasibility study for Prosol industry, industrial production of clothing in Tunisia*.

**UNEP Energy Branch**. (2011).  
*Market Transformation for Energy Efficient Lighting in Morocco*.

**UNEP Energy Branch**. (2011).  
*Enlighten initiative – Country Lighting Assessment for Morocco*.

**Viesmann Manufacturing Company Inc**. (2009).  
*Feasibility study for Montenegro*.

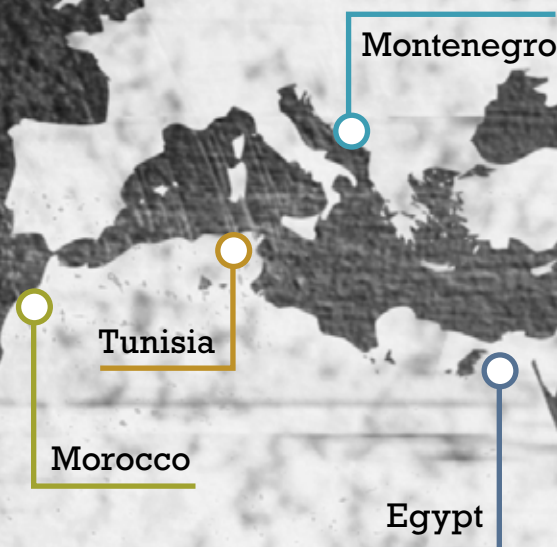
## List of figures

Figure 1	Sources of financing of SWH systems in Tunisia. . . . .	12
Figure 2	Forecast of future savings due to SWH systems . . . . .	13
Figure 3	Growth of SWH market in Tunisia . . . . .	14
Figure 4	Operating scheme of a solar PV system . . .	17
Figure 5	General hydraulic scheme of a solar thermal plant using low temperature collectors . . . . .	20
Figure 6	General hydraulic scheme of a solar thermal plant using solar concentrating collectors (parabolic trough) . . . . .	21
Figure 7	Benefits of the installation of a SWH system in Djerba beach Hotel in Tunisia . .	25
Figure 8	Solar energy share (percentage) of total energy consumption for a household in Podgorica with a SWH system . . . . .	31
Figure 9	Impact of the project on the demand for ILs and CFLs . . . . .	36
Figure 10	Market share distribution of lamps in Morocco . . . . .	37
Figure 11	Benefits of the transition to energy efficient lighting. . . . .	37
Figure 12	Map of some UNEP's end-user finance programmes around the world . . . . .	43



# LIST OF ACRONYMS

ANME	Tunisian National Agency for Energy Conservation
MIF	Mediterranean Investment Facility
CFLs	Compact Fluorescent Lamps
CO <sub>2</sub>	Carbon Dioxide
EGYSOL	Egyptian Solar Programme
EN	European Norm
FNME	National Fund for Energy Conservation
GEF	Global Environment Fund
Gt	Giga ton
GWh	Giga Watt hour
IMELS	Italian Ministry for the Environment, Land and Sea
ISO	International Organization for Standardization
kWh	Kilo Watt hour
MEDREP	Mediterranean Renewable Energy
MEMWE	Moroccan Ministry of Energy, Mines, Water, and Environment
MENA	Middle East and North Africa
MME	Montenegrin Ministry of Economy
NREA	New and Renewable Energy Authority of Egypt
ONEE	National Electricity and Water Utility of Morocco
PROSOL	Tunisian Solar Programme
STEG	Société tunisienne de l'électricité et de gaz
SWH	Solar Water Heating
TCO <sub>2</sub>	Tons of carbon dioxide
TND	Tunisian Dinara
Toe	Tonne of oil equivalent



# Foreword Achim Steiner



“Around the world, demand for energy is continuing to increase with population expansion and economic growth. Indeed, there is growing recognition that access to clean, low-carbon sources of energy is one of the key requirements for sustainable development and poverty alleviation.

Reliable supplies of energy from renewable sources will be crucial. Recognizing this, in 2002, the United Nations Environment Programme joined forces with the Italian Government to launch the Mediterranean Renewable Energy Programme (MEDREP), with the goal of creating and expanding sustainable markets for renewables in the region.

Today, with continued support from the Italian *Ministry for the Environment, Land and Sea (IMELS)*, MEDREP has evolved into the Mediterranean Investment Facility (MIF), which, through innovative financing mechanisms, has facilitated end-users' investment in renewable energies and helped bring about multiple benefits for those on low incomes.

For example, MIF's work in Tunisia alone has resulted in about 3,000 direct jobs and up to 7,000 indirect jobs have been created in the solar water heating. As well, some 500,000 m<sup>2</sup> of solar collectors have been installed, 47,000 tonnes of fossil fuels were saved, and US\$ 15 million of expenditure on liquified petroleum gas was avoided between 2005 and 2010.

The initial US\$ 2.2 million funding from IMELS has leveraged a total investment of more than US\$ 211 million. MIF is a clear example of how clean technologies can be made affordable to end-users and attractive to investors.

*The Mediterranean Investment Facility Booklet* has been published to share some of the main lessons that have emerged from the MIF experience, with the aim of supporting countries in planning and implementing renewable energy policy. In showcasing these examples, MIF demonstrates how developing countries can align domestic and international support to level the playing field between low-carbon technologies and heavily subsidized fossil fuel-based alternatives.

Renewable energy markets and policy frameworks in the Middle East and North Africa have evolved rapidly in recent years, with an increasing amount of investment and projects to harness the region's abundance of renewable energy resources. However, additional investments in clean and renewable energy are needed to combat climate change, if we are to ensure a low-carbon, resource-efficient economy.



**Achim Steiner**

*UN Under-Secretary General and Executive Director  
United Nations Environment Programme*



## Foreword **Corrado Clini**

Renewable energy has advanced rapidly in the past two decades and offers a range of new, clean and sustainable energy services. However, the wider use of renewable energy is often hampered by a number of barriers, including higher initial costs and the lack of affordable finance.

The *Mediterranean Renewable Energy Programme (MEDREP)* launched by Italy as a Type II Initiative at the 2002 World Summit on Sustainable Development in Johannesburg, has been developed to reduce the cost of renewable energy by expanding markets and creating a strong market environment for renewable energy.

In this framework, the *Mediterranean Renewable Energy Centre (MEDREC)* has been established in Tunis as the focal point of the MEDREP initiative for training, information dissemination, networking and development of pilot projects in the field of renewable energies.

Solar water heating is a mature renewable energy technology with a huge deployment potential in the Mediterranean Basin. Its large-scale diffusion will strongly contribute in reducing greenhouse gases emissions in the Region. Furthermore, the increase of the cost of fossil fuels is making this technology even more competitive in the energy market.

To overcome the existing barriers, a strong partnership with the *United Nations Environment Programme (UNEP)*, local Institutions, local financing organizations and MEDREC has been set in 2004 for the implementation of the Solar Water Heating financing mechanism in Tunisia, namely PROSOL.

The good results achieved during the first two years of PROSOL implementation prompted the Government to mandate by law, for the first time in Tunisia, a support mechanism counterbalancing existing fossil fuel subsidies. This led to the deployment of a self-sustainable market, allowing international support to phase-out from the mechanism in 2008.

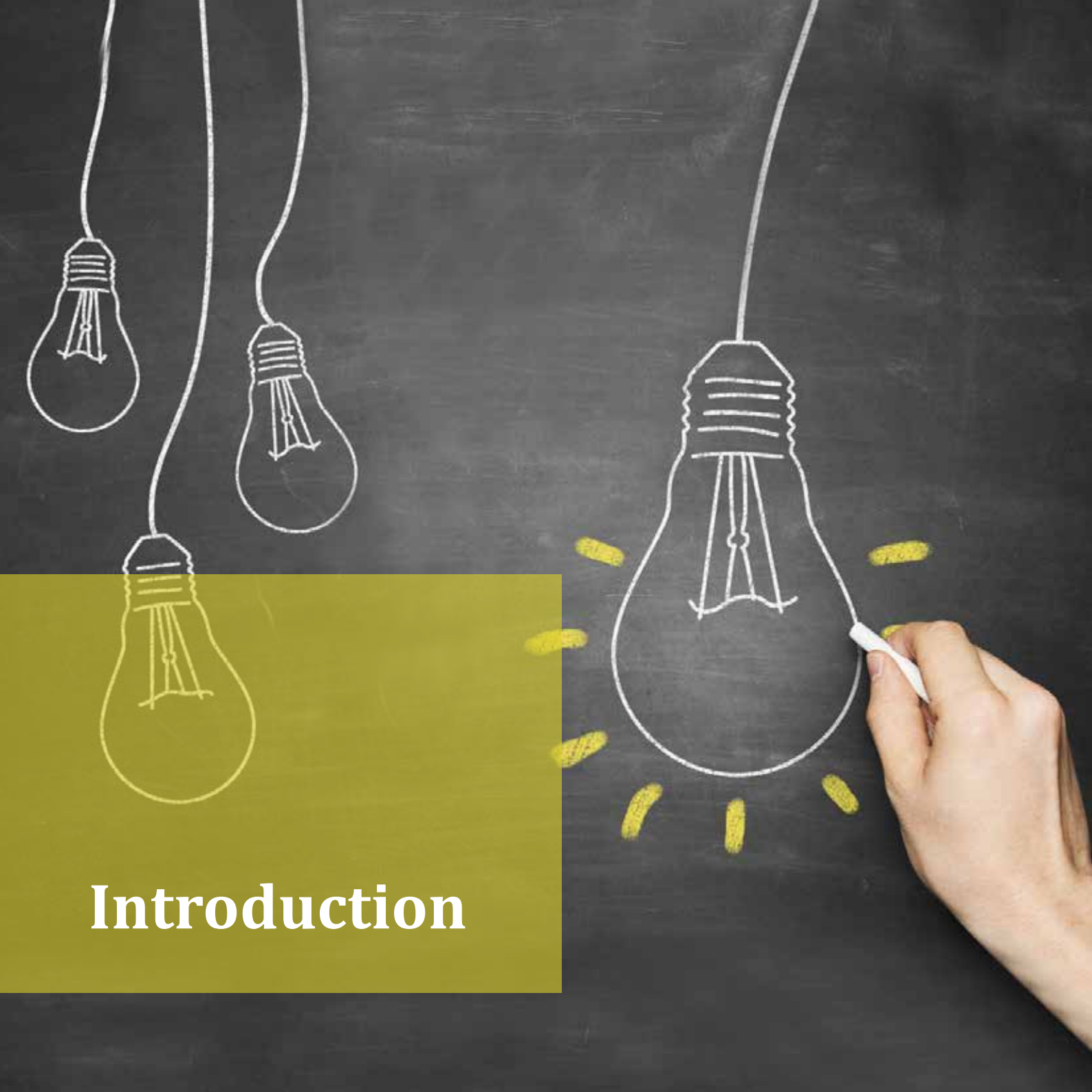
Initially implemented for residential customers, PROSOL project mobilized investments to install approximately 500,000 m<sup>2</sup> of solar water heaters. Local manufacturing capacities have been developed and expanded, resulting in market competition and diversification as well as in building potential export opportunities. The enabling environment reduced the risk associated to investments, thus lowering costs and interest rate for loans.

All these achievements enable PROSOL to stand out as a success story in the international cooperation framework on renewable energy in the Mediterranean. For this reason, the Italian Ministry for the Environment, Land and Sea decided to replicate this experience in other countries in partnership with UNEP, expanding the applications to other sectors and other technologies.



**Corrado Clini**

*Director General, Italian Ministry for the Environment, Land and Sea*



# Introduction



# Introduction

The Mediterranean and Balkan regions have a hot and sunny climate with optimal conditions for rooftop Solar Water Heating (SWH) systems. Yet, in spite of a payback of only four years, SWH can cost up to four times the totally monthly earnings of lower and middle class families. An effective financing mechanism could help overcome this barrier, but the lack of knowledge and trust of banks in such technologies hinder their development. One such mechanism is the Mediterranean Investment Facility (MIF), a joint initiative by UNEP and the Italian Ministry for the Environment, Land and Sea (IMELS).

The goal of creating and expanding sustainable markets for renewable energies in the region started in 2002 when UNEP and the Italian government launched the Mediterranean Renewable Energy Programme (MEDREP). Today, with continued support from the Italian Ministry for the Environment, Land and Sea, MEDREP has evolved into the Mediterranean Investment Facility.

The main objective of MIF is to put in place financial mechanisms to support renewable energy and energy-efficiency systems, such as SWH systems, solar PV systems and compact fluorescent lamps. It also aims to ensure the sustainability of the market by strengthening the capacity of local stakeholders. The facility uses a multi-stakeholder approach, in close collaboration with electricity utilities, policymakers, technology suppliers, installers and local banks.

The MIF project is being implemented in Egypt, Montenegro, Morocco, Tunisia and the former Yugoslav Republic of Macedonia. With the cooperation of local governments as well as public and private financial institutions, MIF implements a range of financial support mechanisms, including:

- financing incentives, such as an interest rate buy-down for SWH financing;
- a guarantee facility to secure commercial loans and lower interest rates;
- investment advisory support that helps banks or other financial institutions evaluate small- and medium-scale investments;
- guidance on creating specialized credit facilities, clean energy funds, and investment vehicles; and
- bank loan officer training and end-user awareness-raising campaigns.

MIF's PROSOL project has helped more than 165,000 Tunisian households purchase solar water heaters, including 61 hotels that were equipped with solar installation under related programmes in the same country and in Egypt. In Montenegro, MONTESOL, which is also a MIF project, aims to replicate the Tunisian experience in the residential sector with plans to expand and involve the tourism sector. Other technologies are also being promoted, such as solar PVs in Tunisia with a total capacity of 4.5 MW in about 2,000 households and the installation of 10 million efficient lamps in Morocco starting 2014.

Removing investment barriers and developing markets for renewable energy and energy efficiency is the core focus of UNEP's energy and climate finance work. MIF contributes to this effort by working with the financial sector so that banks and other institutions can create loans and other financial mechanisms that encourage householders and small businesses to invest in small-scale renewable and energy-efficient technologies.



Tunisia

**PROSOL Residential**  
Solar water heating  
project for the  
residential sector





# Tunisia – PROSOL Residential

## Solar water heating project for the residential sector

Amidst rising international energy prices and growth in national demand, the Tunisian government has been highly interested in exploiting its renewable energy potential for many years. Solar water heating policy support initiatives were created since the 1980s, which is suited to the country's hot and sunny climate. Although SWHs could potentially meet up to 70–80 per cent of Tunisia's residential hot water demand, over 70 per cent was met through heavily subsidized imported fossil-based sources (liquefied petroleum gas) at significant cost to the national budget and the environment.

The PROSOL Residential project was therefore jointly implemented in 2005 by UNEP, the Italian Ministry for Environment and the Tunisian National Agency for Energy Conservation (ANME), initially to help Tunisian households transition from water heaters dependent on fossil fuels to SWH. The project was designed to develop and sustain the SWH market and, consequently, to lead to a significant decrease of CO<sub>2</sub> emissions at the household level.

The PROSOL project addresses several challenges, such as:

- market distortions due to fossil fuel subsidies;
- a high up-front investment cost compared to water heating through traditional fuels;
- risk aversion of banks, i.e. absence of consumer credit for renewable energy investments; and
- lack of confidence in the technology (previous negative experiences of households).

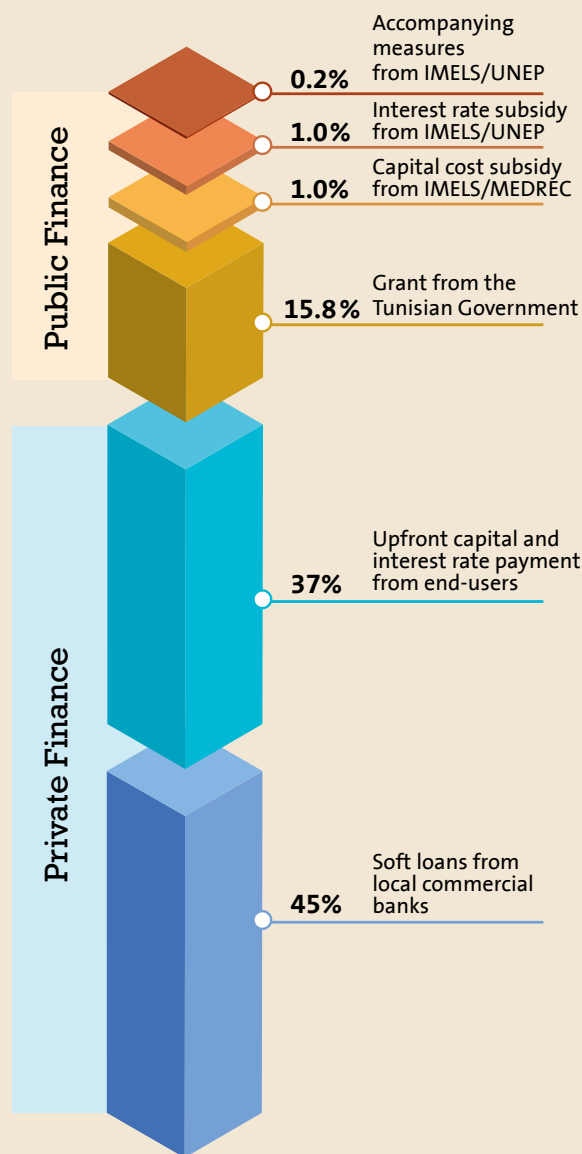
### How PROSOL Residential works

Tunisia provides an excellent example of a revitalized solar water heater market after receiving long-term financial support from the PROSOL project. PROSOL uses the following schemes to transform Tunisia's SWH market:

- An **innovative financial support mechanism**, which provides financial support to local householders through a combination of grants with a VAT exemption, customs duty reductions and bank loans with a reduced interest rate for repayments. The repayment of the loan is included in the regular utility bill of the state electric utility STEG (Société tunisienne de l'électricité et du gaz) which, acting as a third-party loan debt collector, may suspend electricity supply in case of delay/default in payment. Such practice lowers the risk for local banks who are willing to finance SWH projects with reduced interest rates. This arrangement also allows householders to see the financial benefits from using solar heaters since they can compare the size of the monthly instalments for the repayment of a SWH system to their earlier electricity bills.
- An **interest rate** subsidy was available during the first two years (2005 – 2006) of the programme that reduced the interest rate of the loan to 0 per cent for the final end user. However, this subsidy was removed in 2007 and since then, the interest rate of the loan has risen to 6.5 per cent per year. The Tunisian government provides a subsidy of 20 per cent of the system cost, which was initially a temporary measure funded by the Italian ministry to “prime” the market, but was later made permanent by the Tunisian government.



Figure 1. | Sources of financing of SWH systems in Tunisia



Source: UNEP, 2012.

## Who pays for what

About 82 per cent of mobilized funds come from private sources, while the remaining 18 per cent come from public sources (see Figure 1).

- An **effective awareness-raising campaign** has been launched in the country, which encourages households to install SWH systems and facilitates contact with reliable SHW suppliers and installers. Commercial banks were also informed about renewable energy investments and its associated market potential;
- An **accreditation scheme** for suppliers/installers and SWH models, as well as monitoring procedures, to ensure the quality and reliability of systems, which are important factors in stimulating and sustaining demand; and
- A **capacity-building strategy** to ensure local domestic financial institutions and technology providers develop long-term knowledge and expertise.



Installation of a SWH system in Tunisia | Source: ANME, 2011



## Results of the project

PROSOL Residential has helped more than 165,000 Tunisian households obtain SWHs for their domestic water needs, with about 500,000 m<sup>2</sup> solar collectors installed.

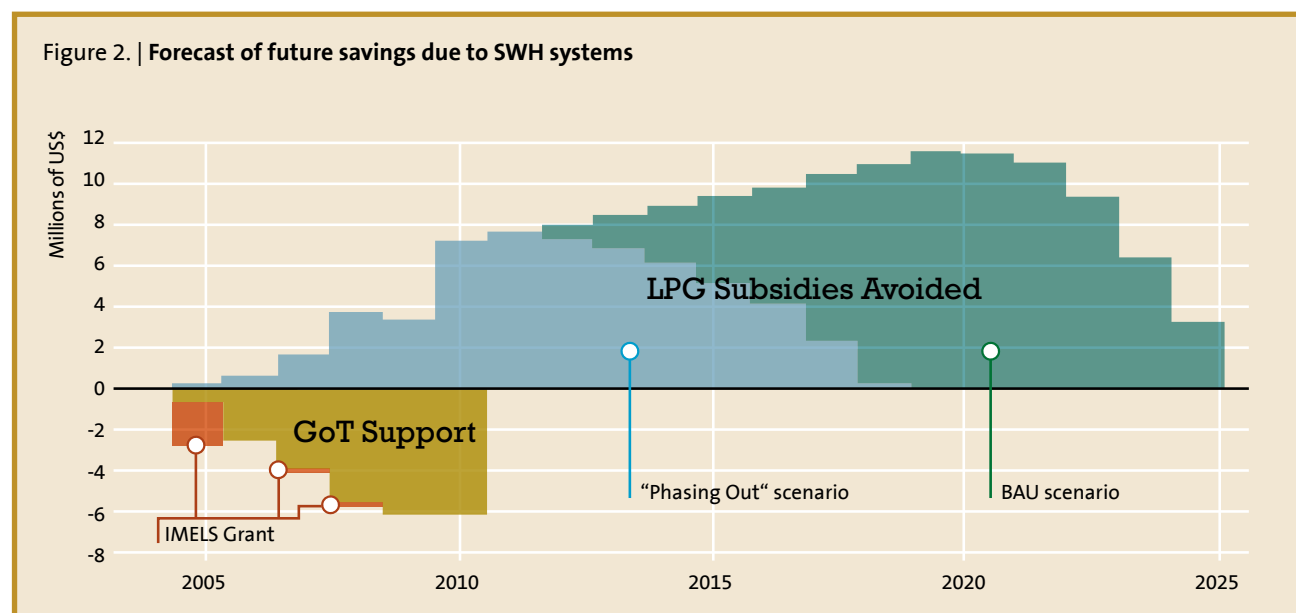
The US\$ 2.5 million initial cost of the programme has leveraged a significant investment of approximately US\$ 211 million in the period 2005 – 2012 and has turned out to be very profitable, as shown by the following figures (also see Figure 2):

- US\$ 101 million of fossil fuel subsidies are expected to be saved in 20 years (2005 – 2025), of which US\$ 15.2 million were achieved in the period 2005 – 2010.
- 251,000 toe of fuel as well over the 20 years lifespan of SWHs, leading to a reduction of 715,000 t CO<sub>2</sub>.

- US\$ 605 – 1,325 overall reductions in households' energy bills over the expected SWH's life cycle.

Furthermore, PROSOL contributed remarkably to the growth of the SWH industry, which:

- created 3,000 new direct jobs and up to 7,000 indirectly;
- connected 1,200 SWH systems installers at current statistics, against 100 in 2002; and
- established 50 SWH sales company to date, against eight in 2002.



Source: Climate Policy Initiative, 2012.

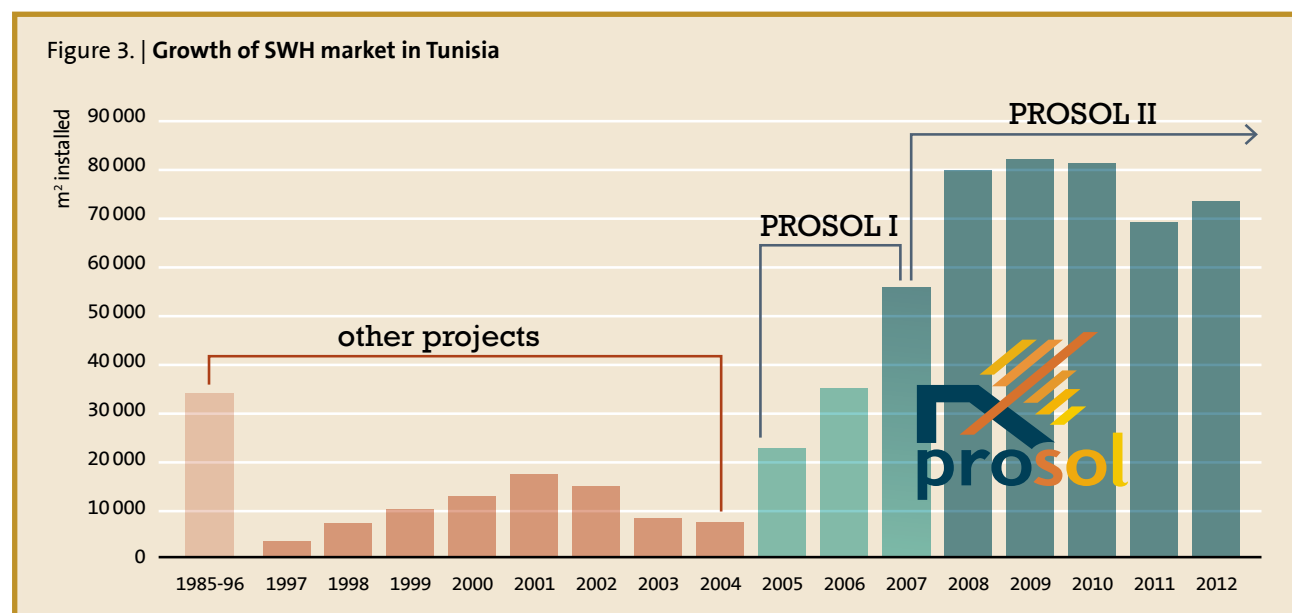
01  
02  
03  
04  
05  
06  
07  
08

## Beyond PROSOL

The PROSOL Tunisia financing mechanism stands out as an example of how international and local public support can successfully address critical demand-side barriers that are preventing the widespread deployment of a commercially viable renewable energy technology, in this case SWH, in a developing country (see Figure 3). The success of the project, which ended in 2012, has led the Tunisian government to set an ambitious target in its Solar Plan to install 900,000 m<sup>2</sup> capacity by 2016.

PROSOL's success has moved beyond Tunisia's borders. In Montenegro, which has one of the greatest solar energy potential in southeastern Europe. According to the Meteonorm database, it ranks above its neighbours, UNEP is also developing a joint programme with the government to build a

sustainable, long-term residential solar water heater market through the financing of low-interest loans and subsidizing of capital costs. In Egypt, where solar power was first adopted in the 1970s and the 1980s, UNEP has developed EGYSOL, a public-private partnership in which the service and tourism sectors benefit from a solar water heating system for hotels along the Red Sea and South Sinai.



Source: UNEP, 2012.

## → QUOTE 1

*"These projects represent the first concrete steps towards security of energy supply but also towards the protection of environment and greenhouse gas emissions reducing under the Clean Development Mechanism of the Kyoto Protocol".*

Corrado Clini, General Director, Italian Ministry for the Environment, Land and Sea, at the signing of the donor agreement between the United Nations Environment Programme and the Moroccan Ministry of Energy, Mines, Water and the Environment.

## → QUOTE 2

*"PROSOL aims to replace conventional energy (LPG, electricity, natural gas) by solar energy to get hot water. It thus provides a solution for reducing greenhouse gas emissions and climate change mitigation. The success of this programme is based on a public/private partnership and a significant change in the pace of achievements, which rose from 8,000 m<sup>2</sup> per year of solar collectors installed (before the PROSOL programme) to 80,000 m<sup>2</sup> per year, creating a network of industrial and installation companies that employ about 6,000 people. This success has also contributed to the decrease in state subsidies allocated to conventional energy".*

Noura Ben LAROUSSI LAZREG, General Manager, Tunisian National Agency of Energy Conservation (ANME)



01  
02  
03  
04  
05  
06  
07  
08





Tunisia

**PROSOL Elec**  
Solar photovoltaic  
project for the  
residential sector



# Tunisia – PROSOL Elec

## Solar photovoltaic project for the residential sector

The global market for solar PV has experienced strong growth since the late 90s. Indeed, the evolution of large and continuous global production of solar PV modules has allowed the industry to acquire a mature technology and a constant decrease in production costs. Given Tunisia's high level of sunlight, the country intends to benefit from the promising prospect of solar PV. Subsequently, the PROSOL Elec project was designed to accelerate and sustain the solar PV market and accordingly, trigger a significant decrease of CO<sub>2</sub> emissions at the household level.

Jointly implemented by UNEP and the Tunisian National Agency for Energy Conservation (ANME), and encouraged by the experience gained from projects in the field of rural electrification and solar water pumping by solar energy, the project seeks to develop grid-connected applications of solar PV technology on a national scale.

### How PROSOL Elec works

PROSOL Elec differs from other support programmes by targeting an important policy change and setting a regulatory and incentive framework, which:

- authorizes residential, industrial, agricultural and tertiary sectors to generate electricity using solar PV system for their own use and selling the surplus electricity produced to the electricity state utility, STEG; and

- sets up a 30 per cent capital cost subsidy with a ceiling of TND 3,000 (US\$ 1,800) per kilowatt peak power and TND 15,000 (US\$ 9,100) per solar PV system.

### An innovative financial support mechanism

In addition to fixing a policy framework, PROSOL Elec set up a financial support mechanism based on its experience that increased the market scale of SWH technology. This mechanism provided a set of incentives targeting STEG clients who wish to buy a solar PV system to partially cover their electricity needs, including a:

- 30 per cent capital cost subsidy with a ceiling of TND 3,000 (US\$ 1,800) per kWp financed by the National Fund for Energy Conservation (FNME);
- 10 per cent capital cost subsidized by UNEP;
- five-year loan granted by commercial banks using the electricity bill as a channel to recover the loan. UNEP provides an interest rate subsidy within the financial mechanism. The maximum loan amount per installation is TND 3,000 (US\$ 1,800).

### Results

Initially, the project planned to install a total capacity of 1,500 kW which would allow 1,000 households to meet their electricity needs, but it has exceeded its goals: more than 2,000 households have installed a solar PV system and the demand remains high. As a result, the PROSOL Elec project created a sustainable market and 70 eligible and active suppliers.

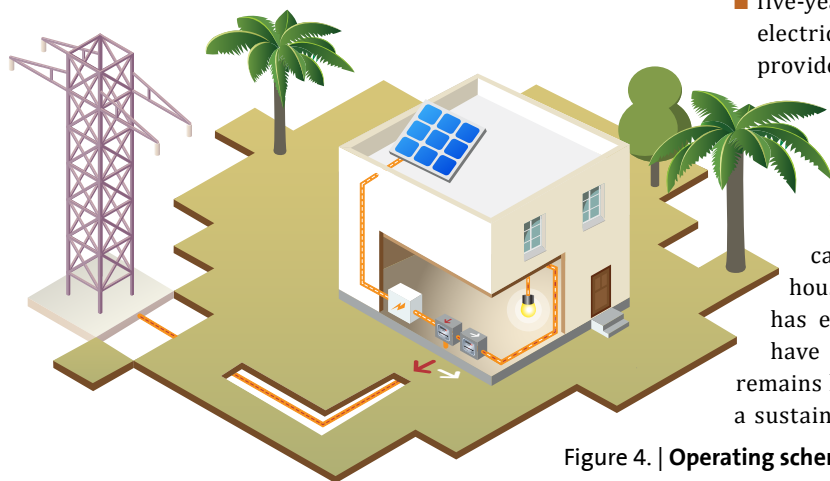


Figure 4. | Operating scheme of a solar PV system



Tunisia

**PROSOL Industrial**  
Solar water heating  
project for the  
industry sector





# Tunisia – PROSOL Industrial

## Solar water heating project for the industry sector

Industrial production requires a large amount of energy. In Tunisia, many industries, such as the agro-industrial, chemical, textiles, and paper industries, use most of the energy they consume to heat water for industrial processes. Of 227 Tunisian industries that were subjected to an energy audit, 50 per cent used large amounts of energy for this purpose. As a result, energy-dependent industries that are mainly supplied by oil and natural gas products are especially vulnerable to the rise in price of fossil fuels. It is therefore vital to explore alternative solutions such as solar thermal to heat water and contribute to the reduction of pollution and GHG emissions.

### Key facts

- Most of the energy consumed in the industry sector is thermal energy.
- As much as 50 – 60 per cent of hot water can be heated with solar energy in small- to medium-scale industries.
- A textile plant requires around 35 – 40 MWh of energy per day to heat hot water to color and/or bleach 15 tons of clothing articles. Such energy can partially be met by solar plants.

Promoting solar thermal energy in the industry has its challenges. One of these is the large range of temperatures to contend with, a factor that must be considered when choosing an appropriate solar technology. Existing SWH technologies can heat water to a relatively low temperature of 80 – 90°C. On the other hand, producing steam and other reactions under higher temperatures of over 100°C generally require solar concentration technologies that are barely emerging in the market.

In this regard, the goal of PROSOL Industrial project, which is jointly implemented by UNEP, the Italian Ministry of Environment, Land and Sea, and ANME, is to create a promotional framework for integrating solar thermal energy into Tunisia's industrial sector.

### How PROSOL Industrial works

Taking into consideration the structural and production requirements that are specific to the industrial sector, UNEP and its partners are working step by step to identify the key technological, regulatory and financial challenges that must be met.

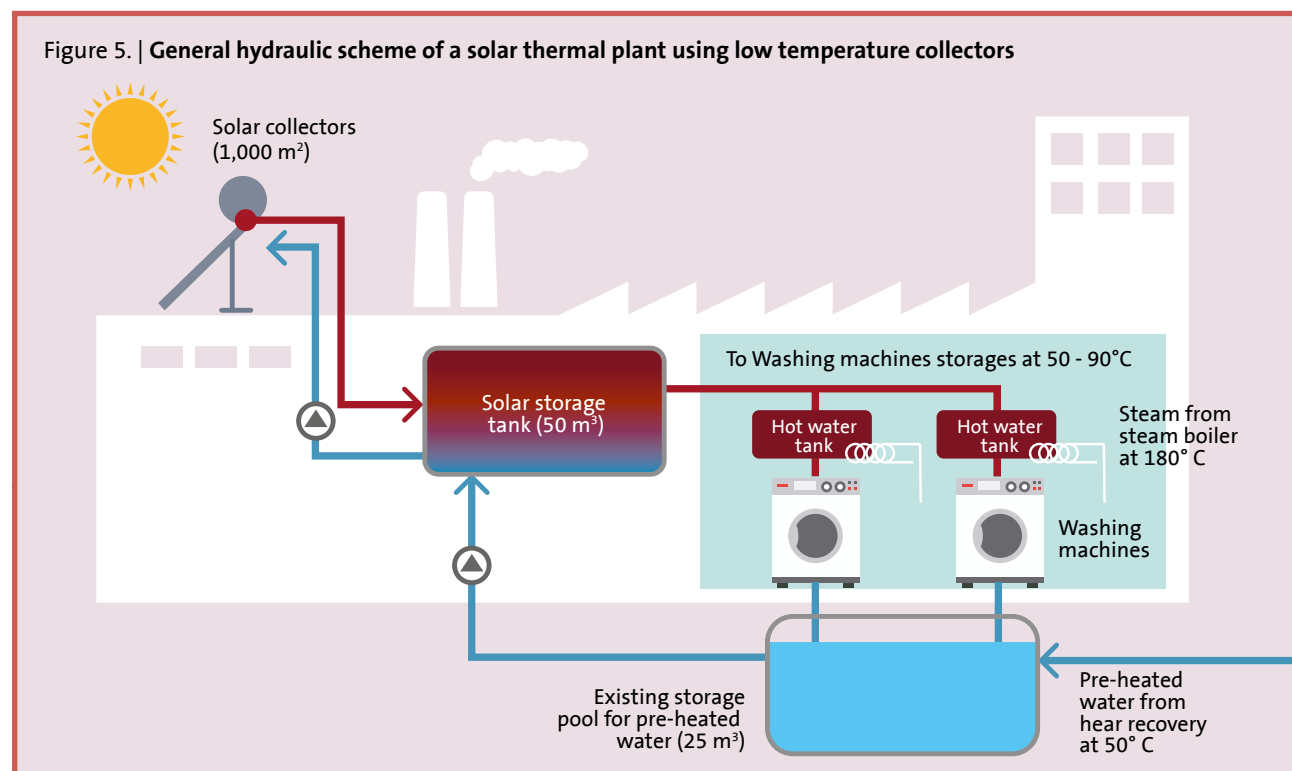
In the first phase, detailed feasibility studies were conducted in six Tunisian industries that use different process temperatures and fossil fuels (natural gas or LPG), and have different production volumes. The studies covered all related technical and economical parameters.

The results showed that the main barrier to introducing SWH technology is the low cost of natural gas due to government subsidy. Subsequently, UNEP proposed to design a framework that would make it possible to turn natural gas subsidies into solar energy incentives, thus creating more environmental and socioeconomic benefits. This is also a remarkable example of an exit strategy from a local subsidy system that has become a heavy burden on the state budget.

In the project's second phase, Tunisia's solar thermal potential has been determined both for low (up to 90°C) and medium temperatures (up to 250°C). The estimated national potential is about 363,000 m<sup>2</sup>, corresponding to a market value of about US\$ 210 million. The solar concentrating technology is the one with the highest potential in the medium- and long-term.

01  
02  
03  
04  
05  
06  
07  
08

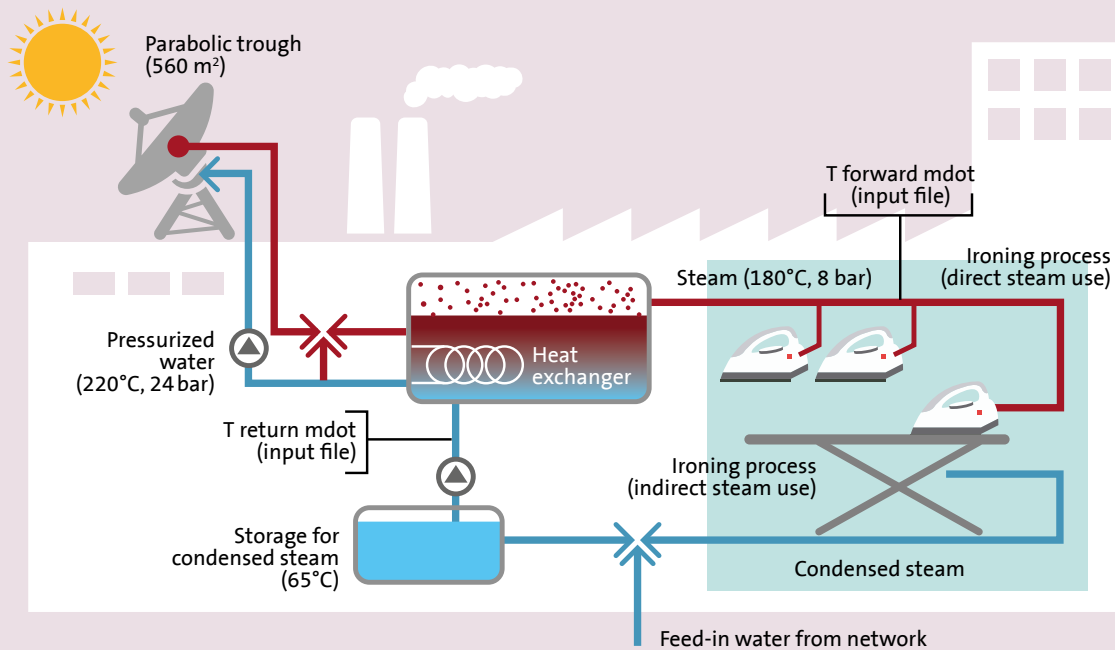
Moreover, UNEP is working to identify and design the most suitable incentive tool to promote solar thermal energy and, in consultation with local relevant authorities, prepare a proposal for the Tunisian government to integrate the identified incentive tool into the existing regulatory framework. At the same time, it also addresses the role of financial institutions in providing credit, which will create the local conditions that are conducive to implementing an effective financing mechanism.



Source: Politecnico di Milano, 2012.



Figure 6. | General hydraulic scheme of a solar thermal plant using solar concentrating collectors (parabolic trough)







Tunisia

**PROSOL** Tertiary  
Solar water  
heating project for  
the service sector



# Tunisia – PROSOL Tertiary

## Solar water heating project for the service sector

Solar thermal technologies have been evolving for over 20 years and have reached a stage of maturity. Whereas, in terms of competitiveness, the service sector remains particularly exposed to the rising price of fossil fuels, it could benefit from a viable solar thermal technology.

In order to mitigate the effect of skyrocketing oil prices on the international market and the stabilization of national fossil fuel resources, the Tunisian government has decided to implement a national energy conservation programme and develop renewable energy options. With the country's vast solar resources, amid solar radiation ranging from 1,700 kWh/m<sup>2</sup> year in the north and 2,200 kWh/m<sup>2</sup> in the south, Tunisia has sufficient solar resources to heat water and support sustainable water use.

In the wake of the success of UNEP's PROSOL programme in Tunisia, there was a significant change in the scale of SWH market for the residential sector across the country. It has led the government to launch a similar financial support mechanism that targets the service sector, called PROSOL Tertiary.

Jointly implemented by UNEP, the Italian Ministry for the Environment, Land and Sea, and ANME, PROSOL Tertiary's goal is to support the service sector (e.g., hotels, clinics, sports centres) benefit from a sustainable, renewable and clean energy that is free of charge, while limiting the use of fossil fuels.



The PROSOL Tertiary project was designed to address a number of challenges, such as:

- the banks' poor perception of market profitability;
- the service sector's lack of awareness;
- a high up-front investment cost compared to water heating through traditional fuels; and;
- lack of training for installers, SWH systems maintenance and after-sales services.

01  
02  
03  
04  
05  
06  
07  
08

## How PROSOL Tertiary works

PROSOL Tertiary is currently addressing all these issues in order to increase the diffusion of SWH systems in the service sector. The project is being implemented through three activities:

- A **financial support mechanism** that has been designed to help overcome financial barriers to adopting SWH technology. This incentive mechanism provides:
  - a grant of 50 per cent for the cost of a feasibility study, with a ceiling of US\$ 3,065;
  - maintenance costs for four years beyond the first year of the warranty;
  - a 2 per cent interest rate subsidy and help to reduce the front cost barrier by providing a 10 per cent capital cost subsidy; and
  - a 30 per cent capital cost subsidy, financed by the Tunisian National Fund for Energy Conservation.
- A **capacity building component**, which was ensured by ANME by organizing three training sessions for engineering consulting firms, solar water heater installers and hotel owners.
- A **communication campaign** designed to raise the awareness among the service sector regarding the viability of solar thermal technology. As part of this communication component, three workshops were held presenting the results of pilot projects in Tunisia.

A website ([www.prosoltertiaire.com](http://www.prosoltertiaire.com)) dedicated to the project was also created to reach and inform more people.

## Results

Thanks to PROSOL Tertiary, 36 establishments from the tertiary sector have installed collective systems totalling a surface of about 2,900 m<sup>2</sup> of solar collector, corresponding to a mobilized investment of around US\$ 1,132,000.

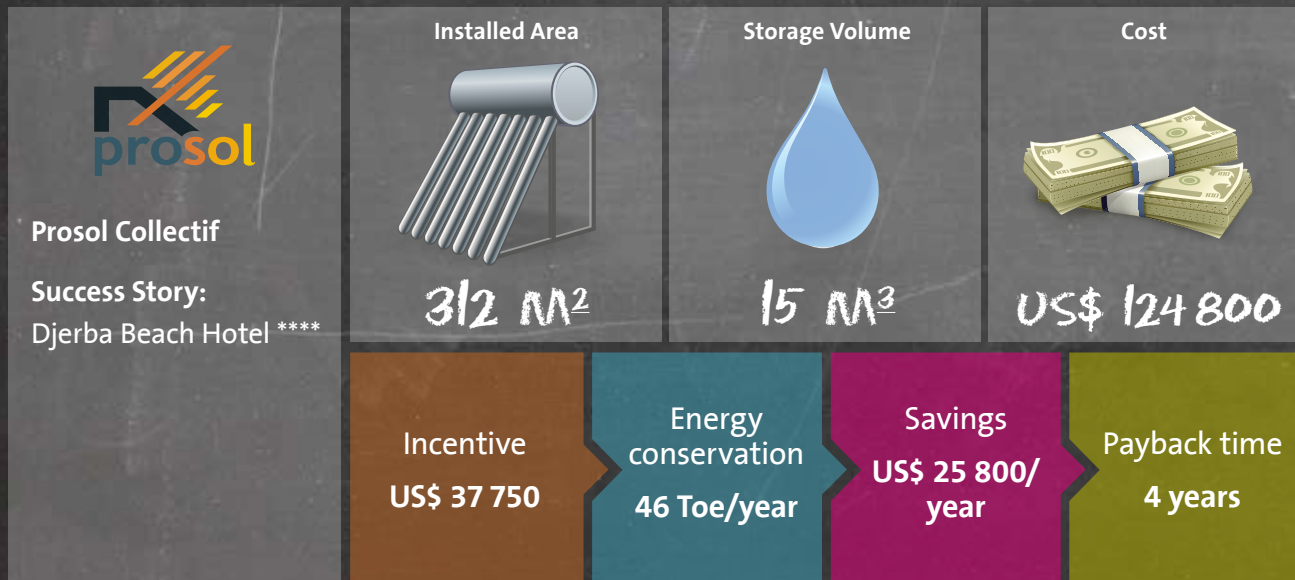






SWH system in a hotel in Tunisia | Source: ANME, 2011

Figure 7. | Benefits of the installation of a SWH system in Djerba Beach Hotel in Tunisia



Source: ANME, 2011

01  
02  
03  
04  
05  
06  
07  
08





Egypt

**EGYSOL**

Solar water heating  
system facility  
for hotels



# Egypt – EGYSOL

## Solar water heating system facility for hotels

Through the government's efforts and initiatives in the 1970s and the 1980s, Egypt became one of the first countries in the Mediterranean to employ solar power in a wide range of applications, including water heater. However, in spite of hundreds of SWH installed in rural areas, the SWH market did not develop as planned. EGYSOL was therefore created to build a sustainable long-term framework for the SWH market in Egypt.

The EGYSOL project is a public-private partnership jointly implemented by UNEP and Egypt's New and Renewable Energy Authority (NREA). The project aims to replace conventional means of heating water (LPG, electricity, natural gas) by SWH systems in the Egyptian hotel sector.

Although Egypt has a huge solar potential, SWH must face significant market development barriers, among them:

- a high up-front investment cost compared to water heating through traditional fuels;
- lack of consumer awareness campaign;
- absence of institutional support;
- lack of training for installers, SWH systems maintenance and after-sales services; and
- negative experiences with locally manufactured systems.



### How EGYSOL works

While these barriers present a challenge, it is possible to overcome them through an adequate strategy addressing all these issues. UNEP's EGYSOL facility uses the following approaches to transform Egypt's hotel SWH market:

- An effective **awareness-raising campaign**, which focused on a variety of stakeholders through seminars, leaflets and press release, has been launched in the hotel sector. Along with encouraging hotel owners to install SWH systems, it also facilitates contact with reliable SHW suppliers and installers. About 300 hotels were targeted, 104 of which have expressed interest in SWH technology.
- A **training course** was organized for SWH suppliers and installers, as well as NREA staff, to improve technical familiarity with the SWH system. Around 50 participants took part in the training sessions.
- An **end-user financial support facility** has been designed to stimulate the use of SWH systems in the hotel sector, which includes the following components:
  - a capital cost subsidy of 25 per cent for SWH installations up to 250 m<sup>2</sup> to be granted to the SWH supplier; and
  - a decreasing maintenance cost subsidy over a four-year term (US\$ 4/m<sup>2</sup>/year for the maintenance cost component for the first two years of operation, and US\$ 3 m<sup>2</sup>/year for the remaining two years) to be granted to the hotel to ensure the long-term functionality of the installed systems.

01  
02  
03  
04  
05  
06  
07  
08





*SWH systems in hotels in Egypt*  
*Source: NREA, 2012.*

→ **Quality control and verification.** SWH suppliers who wish to participate in EGY SOL are required to follow ISO and EN standards for the solar equipment they install. Furthermore, SWH designers, suppliers and installers are required to have a certain amount of experience, defined in working years and projects executed. NREA conducts hotel visits to check the operation of the installed SWH systems, their compliance with the project's requirements, and the quality of the equipment.

## Results

Currently, 21 hotels have installed SWH systems totalling about 2,400 m<sup>2</sup> of solar collectors. In terms of funding, more than US\$ 800,000 have been mobilized, 75 per cent of which are invested by the local hotel industry.



*Training session for SWH suppliers and installers and NREA staff  
Source: NREA, 2012.*





Montenegro

## **MONTESOL**

Solar water heating  
programme for the  
residential and hotel  
sectors





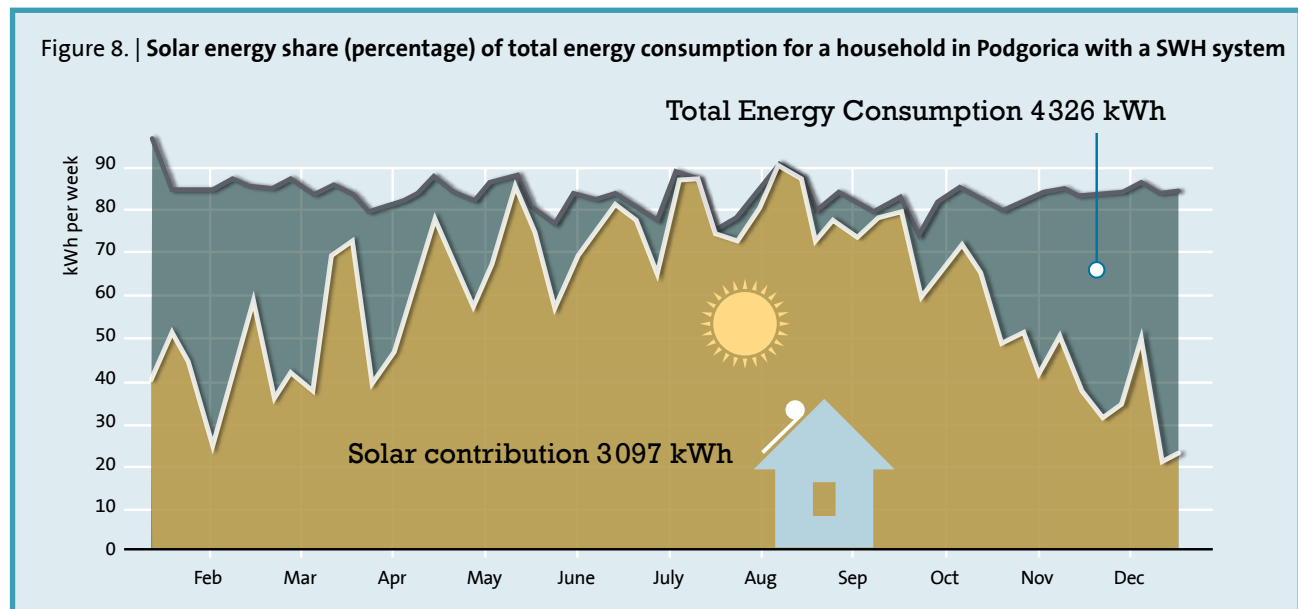
# Montenegro – MONTESOL

## Solar water heating programme for the residential and hotel sectors

Montenegro has one of the greatest solar energy potential in southeastern Europe. In spite of this exceptional situation, the country has yet to take advantage of its huge potential in terms of solar thermal energy. Indeed, while there is a supportive SWH legislative and strategy framework, the banking system of Montenegro is not adapted for consumers with low purchasing power. In this light, MONTESOL, which is a joint project of UNEP and the Ministry of the Economy of Montenegro, aims to install around 700 SWH in households, equivalent to 2,413 m<sup>2</sup> of solar collectors. The project is designed to accelerate and sustain the domestic SWH market, and thus trigger a significant decrease of CO<sub>2</sub> emissions.

The project is being implemented through four activities:

- **Technical assistance to develop a financial support mechanism**, through incentives that remove investment barriers and improve cost effectiveness;
- **Capacity-building activities** to ensure the quality of equipment and installations involving 15 eligible suppliers;
- **Awareness-raising campaigns**, including a TV spot, several TV appearance of the Deputy Minister for Energy



Source: Viessmann Manufacturing Company Inc., 2009.

Advertisement of MONTESOL  
Source: MME, 2011.



Installation of a SWH system in Montenegro  
Source: MME, 2011.



MME 2013 Energy Efficiency fair



MME 2011 MonteSol launch event

Efficiency and presentation of the MONTESOL project in various fairs. At the last Energy Efficiency Fair, in July 2012, approximately 5,000 people, including around 700 children from several elementary schools came to visit, watched the mini-series on Energy Efficiency and participated in workshops; and

- **Development of a programmatic** Clean Development Mechanism (CDM) project. The final document has been presented to the designated national authority.

### → QUOTE 3

*"The Ministry of Economy of Montenegro, in cooperation with United Nations Environment Programme (UNEP), implements the project Montesol, aimed at offering an attractive and sustainable financial mechanism for obtaining a retail loan to install Solar Water Heating (SWH) systems. Individual loans range up to € 5,000, with a repayment period of 7 years and 0% interest rate.*

*We plan to expand the project to legal entities from the tourism sector in order to create an incentive financial mechanism to a number of legal entities as well and several activities were implemented in this regard. In that way, we will create an opportunity for legal entities to participate in the project as well and use significant potential of Montenegro in terms of solar energy.*

*Montesol project is a pioneering project in the field of valorization of solar resources in Montenegro and it is an example of successful cooperation between the Ministry of Economy of Montenegro and UNEP."*

Dragica Sekulic  
Deputy Minister for Energy Efficiency



## How MONTESOL works

The financial mechanism consists mainly of establishing a concessional line of credit with two banks – NL Bank and HypoAlpeAdria Bank – who then commit to provide loans directly to end-users and enable them to purchase SWH equipment.

The incentive mechanism then provides an interest-free loan for three, five or seven years to end-users who wish to install solar panels.

MIF funds subsidize the interest rate for the entire duration of the loan. The subsidized monthly loan repayment is intended to help revive the SWH market in Montenegro and address the high upfront cost of the system. It should be noted that the subsidized credit mechanism has already successfully spread the use of SWH systems in other Mediterranean countries, such as Tunisia, through the PROSOL project.

It is likewise expected, as in Tunisia, that MONTESOL will provide a strong incentive to end-users, giving them the possibility of spreading the SWH system cost over seven years.

## Results

In Montenegro, MIF allocated US\$750,000 in 2012 to expand SWH systems in the residential sector. So far, the project has helped leverage an investment of about US\$ 420,000 from the private sector.





# Morocco

## Making the switch to efficient lighting

Phasing-out inefficient lighting is one of the most important short-term initiatives countries could undertake in combating climate change brought by GHG emissions. In Morocco, energy-efficiency (EE) programmes for domestic appliances, including lighting fixtures, have been limited, and pressure on energy resources is mounting.

Indeed, the country is facing a 6.5 per cent average annual increase in electricity consumption, representing an increase from 13,265 GWh in 1999 to 25,009 GWh ten years later, a trend driven by the residential and commercial sectors.

Lighting accounts for 30 to 40 per cent of consumer power demand in Morocco. Experts estimate that just by switching 40 per cent of households to more efficient lighting products, such as compact fluorescent lamps (CFLs), power consumption would decrease by around 20 per cent. Currently, the Moroccan lighting market is driven by incandescent lamps (ILs). About 45 million ILs are imported annually, while only 5 million CFLs are brought in.

Unfortunately, around 50 per cent of imported CFLs are of poor quality, making many Moroccan consumers wary of the technology. Moreover, the initial cost of a good quality CFL is at least six times that of an IL. As a result, these combined factors present a substantial barrier to the adoption of CFLs.

In order to address this issue, the Moroccan Ministry of Energy, Mines, Water, and Environment (MEMWE), the National Electricity and Water Utility (ONEE) and UNEP are jointly implementing the Market Transformation for Energy Efficient Lighting, a GEF project aimed at reducing GHG emissions. The project's purpose is to transform the EE lighting market by distributing CFLs and progressively phasing out incandescent bulbs in the residential, municipal, institutional, and tertiary sectors.

### How the project works

In order to support the transition towards efficient lighting, the project will be implemented through four activities:

- **Energy efficiency policy enhancement.** The project will design and implement regulations and fiscal incentives that promote CFLs and establish a roadmap for phasing out ILs, including introducing progressive taxation on IL sales.
- **Technology and standards/ CFL quality improvement.** This component will address the design and adoption of a national directive setting minimum CFL performance requirements, as well as the harmonization of existing CFL standards with international standards and best practices. Regulations for CFL disposal and recycling will also be established, as well as a mechanism for the disposal of collected ILs.
- **Generating CFL demand through consumer financing and financial support schemes:** Under the project's first phase, customers will repay the cost of their CFL through their electricity bill over 21 months. Based on feedback from the first phase and an assessment of financing mechanisms that target low-income households, another incentive will be developed in the form of a subsidy. The suggested incentive is MAD 3 (US\$ 0.35) per CFL for customers that use the proposed scheme for ILs disposal. This incentive will lower the cost of each CFL by 12.5 per cent.



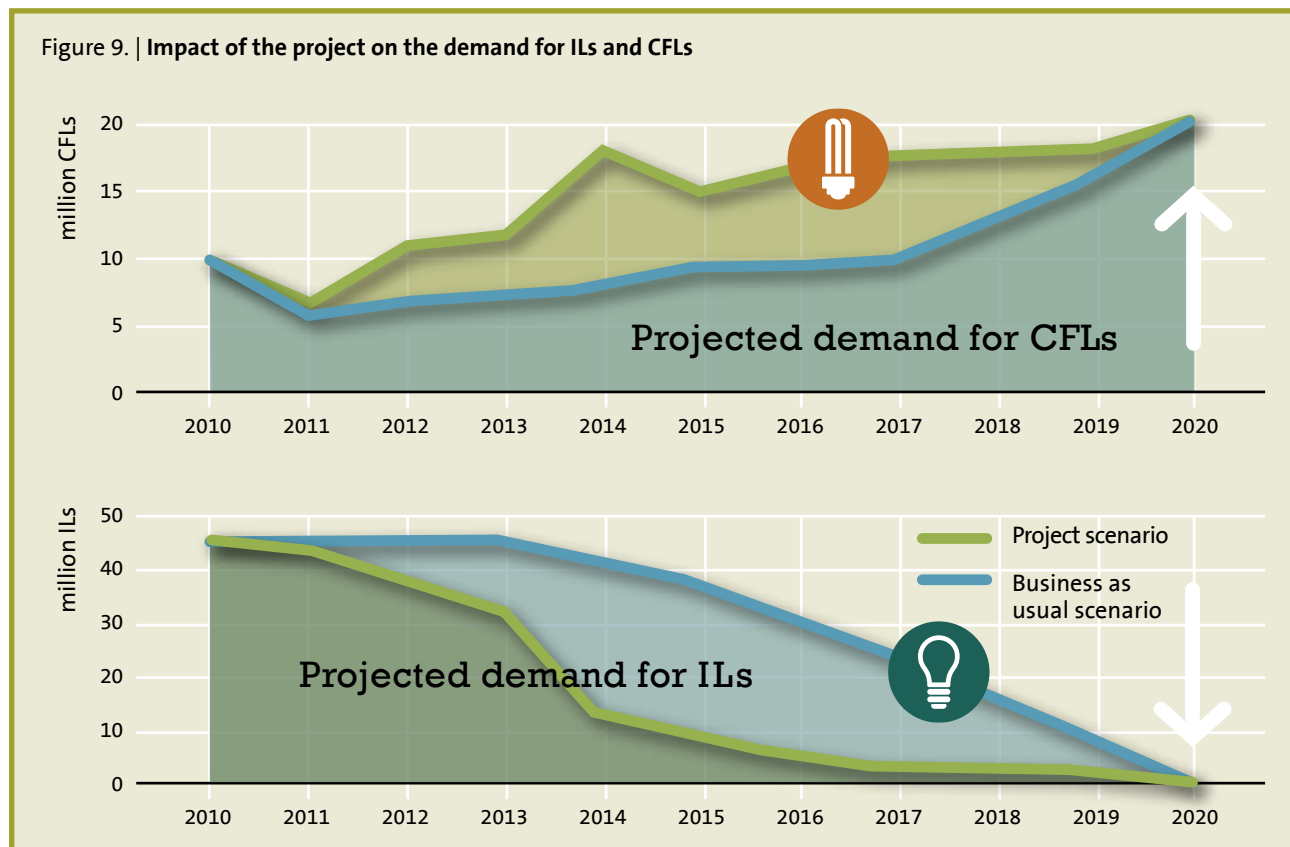


→ Information, consumers education and awareness raising. This component focuses on the need for a public awareness campaign, and adapting existing CFL mass media communication support the Moroccan government's CFL dissemination programs. Issues such as the high initial cost and CFL minimum required quality will be addressed in messages that will be frequently broadcasted in the mass media. When completed, the awareness-raising campaign's impact will be evaluated in terms of changes in public opinion regarding energy use.

## Expected results

Through the distribution of 6.35 million CFLs during the project's duration (2013 – 2015), some 2 million Moroccan households will be able to switch from ILs to CFLs. This is expected result in a direct reduction of GHG emissions equivalent to almost 2.74 million ton of CO<sub>2</sub> by the end of 2021. An additional 3.35 million CFLs will be distributed after the project ends, reducing another 1.45 million tonnes of CO<sub>2</sub> by the end of 2022.

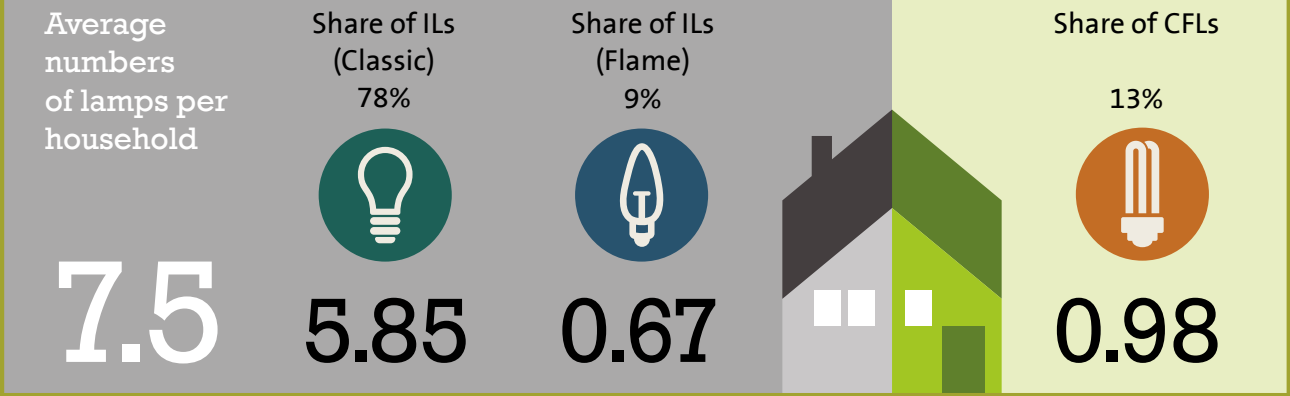
Figure 9. | Impact of the project on the demand for ILs and CFLs



Source: UNEP Project document, 2011.

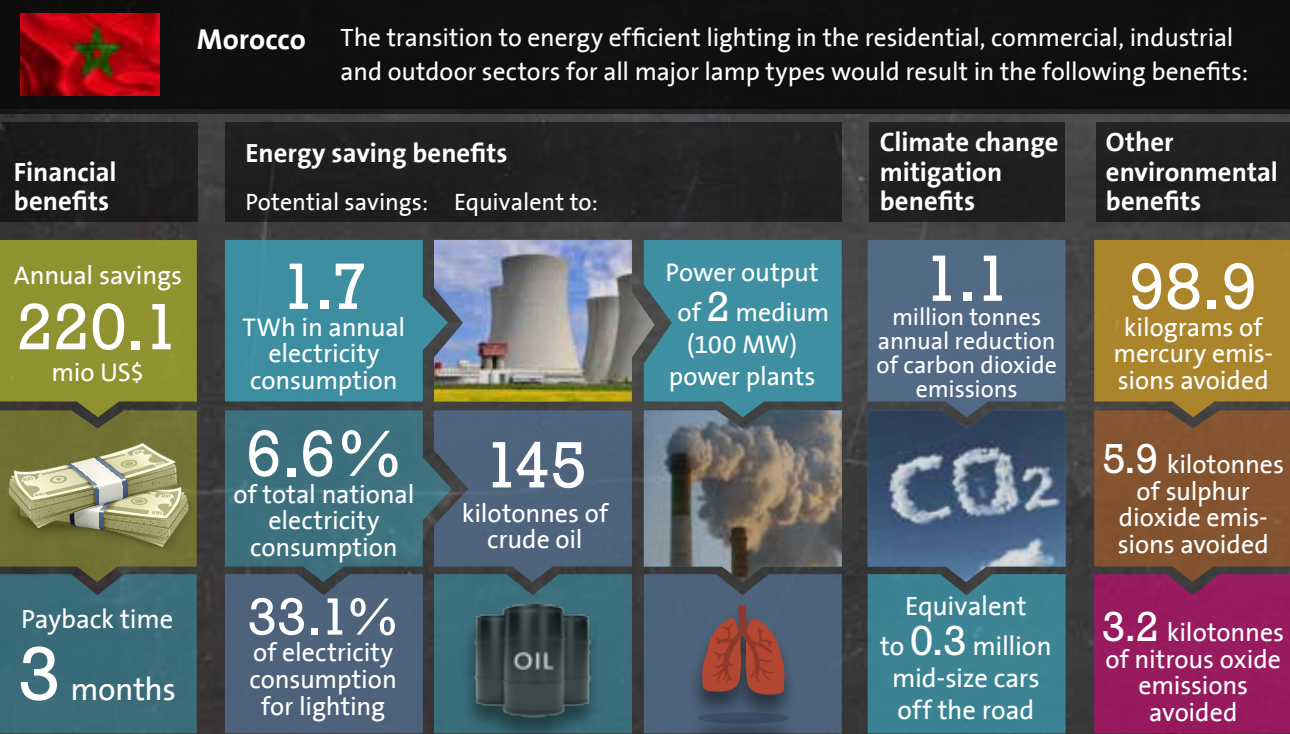


Figure 10. | Market share distribution of lamps in Morocco



Source: UNEP Project document, 2011.

Figure 11. | Benefits of the transition to energy efficient lighting



Source: Enlighten initiative, 2012.



## **South Africa**

Replicating MIF's  
lessons learned at the  
city level: City of Cape  
Town Solar Water  
Heating Programme





# South Africa

## Replicating MIF's lessons learned at the city level: City of Cape Town Solar Water Heating Programme

The Mayor of the City of Cape Town officially launched the Residential Solar Water Heating Program on 4 November 2013. The City wishes to encourage local residents to move towards greater use of sustainable energy by installing High-pressure Solar Water Heaters (SWH) to assist in the national need for more efficient use of electricity to help reduce peak loads and avoid power shortages. To this end, UNEP provided technical expertise to design a programme to encourage the installation of SWH by residential property owners.

### Heating up a Lukewarm Market

Comparatively, the cost of SWH in South Africa is significantly higher than in other countries. For example, South African SWH systems cost three times more than in Turkey, and eight times more than in Cyprus. This elevated cost can be largely explained by the fact that the market is small and lacks visibility and long-term prospects for suppliers. In general, the price of SWH is overinflated because of a lack of economies of scale.

The City of Cape Town Solar Water Heating Programme attacks the problem from two angles. On the one hand, it offers support to service providers, allowing them to better understand and expand the market and establish consumer confidence. On the other hand, the programme sets up a financial scheme that permits SWH users to simultaneously pay off the equipment in monthly instalments and benefit from savings on their electricity bill. Once the SWH system is paid off (generally in five to seven years), savings will be even more significant. Moreover, as national electricity tariffs increase, so will consumer savings, making the SWH solution to heating water even more attractive. In the programme's first five years, the city aims to establish a strong SWH market with reliable service providers and products, and boost the local SWH supply industry so that it can compete in national and international markets, with a goal of 140,000 SWH systems installed in Cape Town by 2017.



### UNEP has provided technical and financial support to the city:

- To develop and structure a financial support mechanism by working with banks and other lending institutions to make instalment finance and bulk funding more available for financing products and the industry itself. Partner banks are Standard, FNB, Absa, Nedbank, Capitec, IDC and some specialized SWH finance institutions such as Solar Credit, which has accessed bulk funding through the IDC at preferential rates.

01  
02  
03  
04  
05  
06  
07  
08



- The introduction of retail lending into the financing solution allows these institutions to use their own billing and collection facilities and to operate through a direct debit system. A second option has been agreed by the city in the event that some applicants may wish to use its billing and collection service. UNEP is also helping to develop tender documents for SWH suppliers, selecting appropriate SWH system equipments, and setting up quality control procedures as well as technical and monitoring systems.

Out of the 31 service providers who applied, 20 have been accredited.



→ To develop a public awareness and educational campaign that describes the technology and answers typical consumer questions. The advertising campaign focused on the following message:

The city has:

- removed the hassle of finding the right provider.
- removed the confusion of conflicting information.
- got institutions that will finance the purchase.

To relay this message, the following communication tools were developed in collaboration of the city of Cape Town:

- Allowing accredited service providers (ASP) to use the city's logo for advertising purposes
- Radio and print media advertising
- Flyers enclosed to the electricity bills
- A city website focusing on the programme with links to the accredited service provider



Accreditation emblem



## Simple, hassle-free and affordable. Get a solar water heater today.

Call a qualified solar water heater installer. The City has ensured that only service providers who've met our stringent requirements have been accredited. The City has even worked with the banks and other financing companies to ensure that the purchase can be financed with no up front costs. There is also a rental option from one of our accredited service providers. So you no longer need to deal with the hassle or confusion of finding the right guy for the job or figuring out how to pay for your solar water heater. Together, we can now all use the renewable energy of the sun to save electricity. Visit [www.savingelectricity.org.za](http://www.savingelectricity.org.za) or send an email to [swh.info@capetown.gov.za](mailto:swh.info@capetown.gov.za) for more information.

**Get your piece of the sun today.  
Get a solar water heater installed.**



Flyer enclosed to the electricity bill

# CONCLUSION

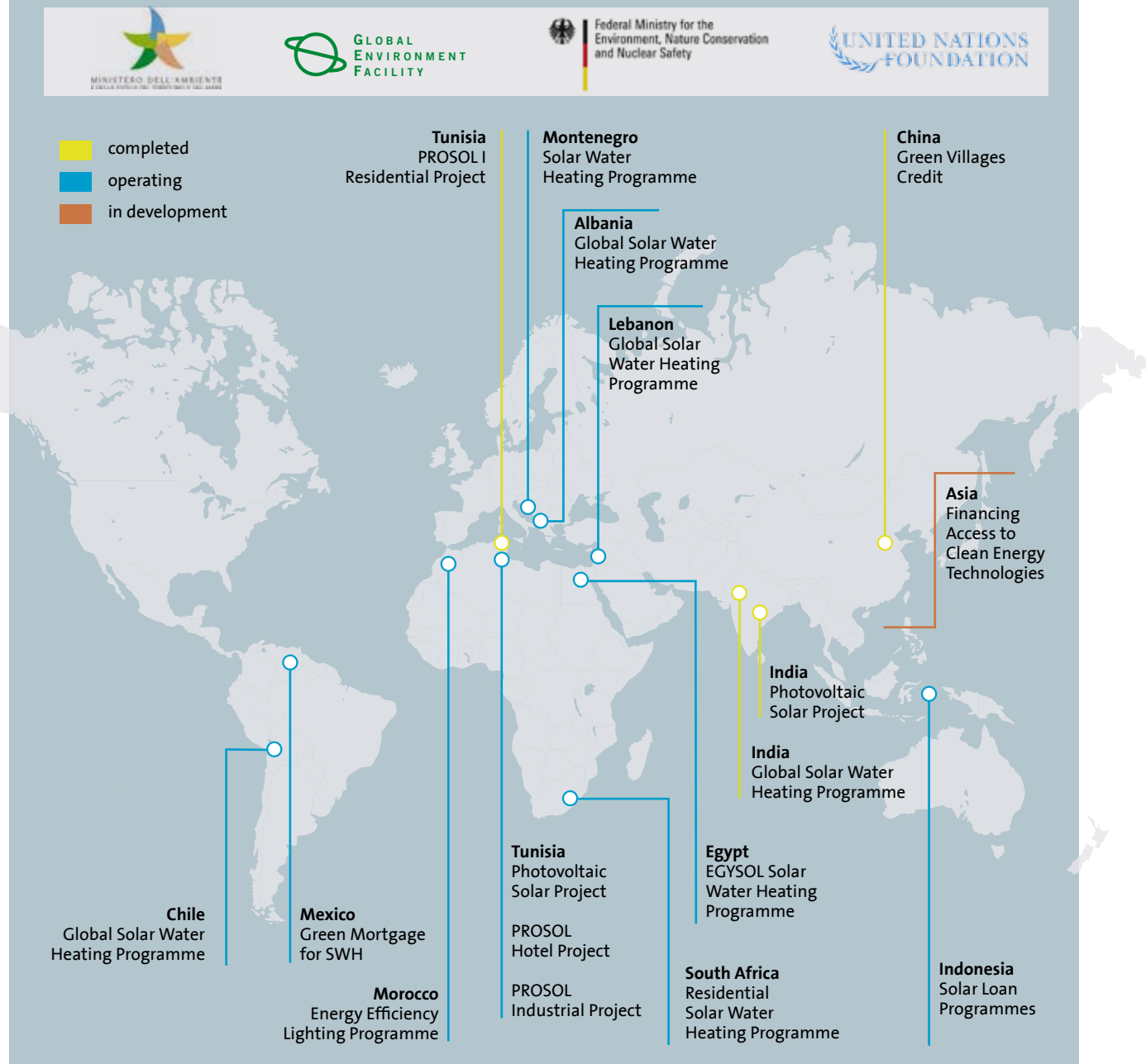
Several MIF-initiated projects turned into success stories. Indeed, the PROSOL project has helped more than 165,000 Tunisian households purchase solar water heaters, and 61 hotels have already been equipped with solar installation between the two ongoing programmes in Tunisia and Egypt. In Montenegro, the ongoing MONTESOL project aims at replicating the Tunisian experience in the residential sector with the perspective of expanding it to the tourism sector. Other technologies are also being promoted, such as solar PVs in Tunisia with a total capacity of 4.5 MW in about 2,000 households and efficient lighting with 10 million efficient lamps targeted to be installed in Morocco starting 2014.

With the aim of creating optimal conditions for testing and scaling up new markets for sustainable low carbon development, UNEP is continuously striving to involve governments and the private sector in a joint effort. Indeed, the involvement of an international organization proves to be effective in raising awareness about the market potential on both the demand and supply side.

Based on the MIF experience, there are two key issues to address in order to develop a sustainable market for a clean technology. The first one concerns the high up-front cost that deters end-users, which could be overcome through an effective financing mechanism that provides an initial incentive and loans with low interest rates. The second key issue deals with pricing distortions due to fossil fuel subsidies. This usually requires a policy change to through new laws and incentives in favour of clean technologies, and implies a major role by governments inspiring investor confidence.



Figure 12. | Map of some UNEP's end-user finance programmes around the world



Source: UNEP, 2014.



**www.unep.org**

United Nations Environment Programme  
P.O. Box 30552 Nairobi, Kenya  
Tel.: ++254-(0)20-762 1234  
Fax: ++254-(0)20-762 3927  
E-mail: [uneppub@unep.org](mailto:uneppub@unep.org)



For more information, contact:

United Nations Environment  
Programme Division of Technology,  
Industry and Economics  
Energy Branch

15, rue de Milan  
F - 75441 Paris CEDEX 09  
France

Tel: + 33 1 44 37 14 50

Fax: +33 1 44 37 14 74

[www.unep.org/energy](http://www.unep.org/energy)