Value Chain Analysis of Solar Technologies and Services in the Meknes-Tafilalet Region
Foreword & acknowledgements

It is with great pleasure that we publish the “Value Chain Analysis of Solar Technologies and Services in the Meknes-Tafilalet Region”. The research in this study, conducted by the author Helene Kirémidjian has contributed to the design and implementation of activities to strengthen the value chain, including the promotion of solar heating in the hotel sector and strengthening the services sector through the creation of a regional network of installers dedicated to renewable energy, called the RESOVERT. By mapping the landscape of major players in the solar sector and by characterizing the relationship between them, this study is intended to serve any private operator, civil-society stakeholder, public partner or donor that promotes renewable energy in Morocco and in particular in the region of Meknes-Tafilalet. This work on the solar energy industry is merely one of the activities included in an ongoing effort and collaboration between several agencies to make the region of Meknes-Tafilalet the destination of choice for sustainable investment in Morocco. This document is printed on 100% recycled paper. We hope this analysis will encourage you to join us in our efforts to encourage sustainable investment in the Meknes-Tafilalet region.

Lara Goldmark
Director of the Program
USAID’s “Improving the business climate in Morocco”

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Acronyms

Environment and Energy Conservation Agency  ADEME
Moroccan Association of Wind and Solar Industry  AMISOLE
National Agency for Energy Conservation  ANME
Regional Academy of Education and Training  AREF
Renewable Energy Development Center  CDER
Clean Development Mechanisms  CDM
General Confederation of Moroccan Enterprises  CGEM
Canadian International Development Agency  CIDA
Moroccan Center for Clean Development  CMDP
Regional Investment Center  CRI
Dispositif Global de Financement Leasing  DGFL
Decentralized Rural Electrification  DRE
European Development Bank  EDB
Energy Efficiency  EE
European Environment Agency  EEA
National School of Agriculture  ENA
Energy Service Companies  ESCOS
European Solar Thermal Industry Federation  ESTIF
Global Environment Fund  GEF
Solar Results Guarantee  GRS
German Technical Assistance  GTZ
Gigawatts per hour  GWH
KfW Banking Group (Kredistanstalt für Wiederaufbau)  KFW
Thousand dirham  KMAD
Dirham  MAD
| **Department of Energy, Mines, Water and Environment** | MEMEE |
| **Mega watt** | MW |
| **New Information and Communication Technologies** | NTIC |
| **Office of Professional Training and Employment** | OFPPT |
| **National Electricity Office** | ONE |
| **Global Rural Electrification Program** | PERG |
| **National Program of Renewable Energy Development and Energy Efficiency** | PNDREE |
| **Photovoltaic Panels** | PV |
| **Pilot Program for Decentralized Rural Electrification** | PPER |
| **Mediterranean Solar Plan** | PSM |
| **United Nations Development Programme** | UNDP |
| **Renewable Energy** | RE |
| **Renewable Energy Certificate** | REC |
| **Renewable Energy Payment** | REP |
| **Renewable Portfolio Standards** | RPS |
| **Small and Medium Enterprise** | SME |
| **Tunisian Company of Electricity and Gas** | STEG |
| **Solar Water Heater** | SWH |
| **Tonne Oil Equivalent** | TOE |
| **United Nations Conference on Trade and Development** | UNCTAD |
| **Union for the Mediterranean** | UPM |
| **United States Agency for International Development** | USAID |
| **United States Dollar** | USD |
| **Value Added Tax** | VAT |
| **Peak Watt** | WP |
Executive summary

Morocco does not produce fossil fuels and as a result it depends on imports for up to 97% of its energy needs. The constant growth in demand for electricity (7.5% in 2008) is therefore a large constraint for the National Electricity Office (ONE).

However, this unfavorable energy context represents an opportunity for Morocco to develop its renewable energy sector, reduce its dependence on fuel imports, and meet its energy needs in a sustainable and independent manner. Indeed, Morocco is full of potential for renewable energy, including solar energy with 5.5 kWh/sq. m/j, or 3,000 hours of sunshine per year.

The solar technologies (photovoltaic and solar thermal) market has existed in Morocco for several decades. It has grown stronger over the past ten years thanks to several national programs, including Promasol for solar thermal energy and the Global Rural Electrification Program (PERG) for decentralized photovoltaic energy. Despite the governmental support for the solar industry - in the form of direct grants to providers within the framework of the PERG and technical assistance within Promasol - a large potential market remains untapped. Indeed, it is estimated that the solar thermal park could reach 440,000 sq. m in 2012 and up to 1,700,000 sq meters of solar panels by 2020, a large increased from the 240,000 sq. m in place in 2008. With regard to photovoltaic energy, the market for connecting self-produced electricity to the grid is being developed through ONE’s national program called Chourouk as well as the export of solar energy to industrialized countries under the Union for the Mediterranean (UPM)’s Solar Plan.

To enable the Meknès-Tafilalet region to attract private, foreign, or local investment in this sector, USAID’s “Improving the Business Climate in Morocco” Program conducted an analysis of solar energy value chains in Meknès-Tafilalet. This study aims (i) to highlight existing potential markets (ii) to analyze Moroccan and foreign institutional frameworks to benchmark tools fostering the development of solar value chains, (iii) to identify constraints and opportunities related to their development, and (iv) to make recommendations to improve their viability and competitiveness. The main conclusions of the study are:

(1) Incentives and institutional frameworks. Although they represent a real investment opportunity for the future, solar value chains have developed in industrialized countries in large part thanks to: direct subsidies (by offering a premium to individuals buying renewable energy equipment); indirect subsidies (tax credits); the establishment of preferential financial tools (reduced interest rates); and incentivizing or binding regulatory frameworks (a “feed-in tariff” set at a cost higher than traditionally-produced electricity, of most use in urban areas, requirements to include solar water heaters in new buildings, or other options).

Signatories of the Kyoto Protocol (and of Appendix 1) pledged to reduce their greenhouse gas emissions by 5% from 1990 levels by 2012. This may partly explain industrialized countries’ rationale for promoting technologies that have not yet reached their “break-even point”. Non-signatory countries like Morocco benefit from financial incentives through clean development mechanisms (CDM), which provide funding for projects targeting the reduction of greenhouse gases. Morocco has no commitment to reduce CO2 levels, and thus far has not established a subsidy system to promote these environmental energy sources as the majority of industrialized countries have done.

However, Morocco has some important institutional advantages. First, the Ministry of Energy, Mines, Water and Environment (MEMEE) has demonstrated clear political will to promote renewable energy and energy efficiency through its new “Energy Plan”. The plan’s objective is to increase renewable energies to 10% of the national energy balance by 2012 - in contrast to the current level of 4%. Secondly, the regulatory environment is quickly evolving with the adoption of a new law on renewable energy allowing for private production of electric energy and its sale or its export abroad; a law on energy efficiency is also being developed. Finally, an Energy Development Fund of 1 billion USD is available to promote this sector.

(2) Markets. Markets for solar thermal and photovoltaic energies are analyzed independently in this report because they differ greatly from one another:

- Solar water heaters. The market for solar thermal energy in Morocco is dominated by the individual solar water heater, which has a homogeneous customer profile. According to the CDER, in 2006-2008 an average of 76.5% of the market catered to private use by higher income home owners (those owning villas or vacation homes). Solar water heaters for collective use only represented 23.5% of the market.

Nearly all solar water heaters in Morocco are imported. There are only three local solar water heater manufac-
turers and a dozen CDER certified brands are marketed. The majority of heater-producing countries are around the Mediterranean and Europe, such as Tunisia, Greece, Spain, Turkey, Israel, and France, but also including Australia and China. Meanwhile, more and more low cost brands and products, whose origins are unknown and thus problematic, are invading the market, offering lower quality products and damaging the image of the solar industry as a whole.

Today, the Meknes-Tafilalet region has untapped market potential in the following sectors: (i) housing (6,883 new units constructed in 2007 including modern Moroccan villas, houses and buildings), (ii) tourism (currently 4,600 sq. m of solar collectors), (iii) education (currently 3,982 sq. m of solar collectors), (iv) health (currently 870 sq. m), and (v) industry (opportunity to incorporate solar water heaters into the production process).

The tourism sector is seen as the most competitive sector, offering investments that can be amortized in about five years’ time based on energy savings.

Photovoltaic energy. Unlike European countries where the largest market share is the connection to national electricity system (grid-connection), Decentralized Rural Electrification (DRE) (i.e. the provision of photovoltaic panels to households in rural and isolated areas) through a national program, the PERG (1998-2008) represents most of the Moroccan market. Highly structured by the ONE, the photovoltaic market in Morocco remains “institutional” and dominated by ONE’s concessionaires within the PERG, to the detriment of local enterprises with a smaller production capacity. However, new pilot projects have emerged in 2009 in some regions of the Kingdom under the national Chourouk program (2009-2015). These activities indicate a change in ONE’s strategy, or at least a willingness to test the feasibility of linking photovoltaic energy to the grid. The potential market currently includes: (vi) the Decentralized Rural Electrification of schools and clinics, (vii) the production of solar electricity connected to the grid (ONE’s Chourouk program), and (viii) the export of solar energy to countries around the Mediterranean (especially to countries part of the Union for the Mediterranean (UPM)).

(3) The value chain. The major constraints preventing the development of both solar channels identified in this study are:

Service providers are the weakest link in chain. Service providers are typically small enterprises with less than five employees who work primarily without contracts or invoicing systems and provide limited services that often do not include marketing, counseling, after-sales service, etc. These micro enterprises do not have sufficient funds to grow their businesses, nor the proper training to extend their solar activity. Indeed, the solar energy sector is only a small proportion of their total business. Therefore, this segment of the market is stagnant and all the other links in the chain suffer the consequences: customers lack confidence in the technology and do not know who to turn to when their equipment fails; the final price and quality of the products varies from one retailer-installer to another; importers fear their image will be negatively affected by installers, who lack the loyalty of their suppliers and the professionalism required by their clients.

Difficulties of public access to solar energy products. Solar products are too expensive for the general public, which is why today the market is either focused on villa and vacation home owners for solar thermal energy, or, in a market highly subsidized by the state (ONE), for photovoltaic energy through Decentralized Rural Electrification. Moreover, there is a lack of involvement from the banking system, which does not offer financial products tailored to the purchasing power of households. In addition, advertising for such technologies is still very limited in Morocco, and poorly organized service providers do not actively market their products. Many opportunities to reach new customers are therefore lost.

Lack of a qualitative approach to solar channels. Although the CDER has developed certification for equipment and installation of renewable energies these must be strengthened both in terms of quality and use. These tools are not mandatory and do not structurally frame solar value chains in Morocco.

Reinforcement through incentive, institutional and regulatory frameworks. Morocco is changing its institutional framework with MEMEE’s new “Energy Plan” to promote renewable energy and energy efficiency in Morocco. However, financial incentives are still weak and the government’s direction, particularly regarding its position on grid connection for photovoltaic energy, still needs to be clarified.

To develop solar value chains and remove the constraints identified in this analysis, the study recommends that the following actions be taken:

(i) Improve professionalism in the services sector by developing a network for installers and service providers. The network will enable these firms to share certain costs and to benefit from in-depth trainings to address some of the failures in the value chain (storage, transport, supply/delivery, and prospecting/marketing), and to formalize their mode of operation;

33 Since this study focuses on solar technologies marketed mainly in Morocco, “concentrated” solar technologies often used for solar power plants are not included in this study.

34 In the solar value chains, service providers are companies that are normally responsible for the installation, maintenance and after-sales service of products.
(ii) Promote a development approach fostering the value chain at the local level, including through public tenders;

(iii) Carry-out awareness raising actions targeting potential customers to communicate about niche markets that already offer a return to the investor;

(iv) Develop ways to finance solar technologies adapted to the purchasing power of customers through preferential loan rates, or in collaboration with Moroccan companies in charge of electricity distribution, using electric bills as a medium to reach customers;

(v) Strengthen training in the renewable energy sector and stimulate the development of R&D in this field;

(vi) Establish a system of "taxation" on traditionally-produced energy in order to improve the competitiveness of solar technologies, which may be accomplished through a gradual reduction of gas subsidies (indexed on oil prices) so as to not penalize society’s poorest segment;

(vii) Encourage electricity production through solar energy by developing a solar incentive policy of "feed-in tariff", by setting the price of electricity produced by a solar source higher than the selling price of traditionally-produced electricity over a given period;

(viii) Require the inclusion of solar water heaters in new building plans, and prepare an adequate solar thermal product supply;

(ix) Ensure the quality of equipment and related services imported to and produced in Morocco by strengthening and increasing the use of Moroccan certification for equipment and the CDER’s certification for authorized installers.

Morocco may not have the means to implement all these recommendations at the same time. Indeed, without a policy of subsidies for solar value chains, the state cannot act immediately to influence the prices of solar equipment (through the political incentive of the "feed-in-tariff" for photovoltaic energy or price premiums for the purchase of solar water heaters). If it wishes to develop its new energy strategy Morocco must therefore find alternative ways to promote these industries, ones that require less financial investment. To stimulate demand for clean energies and to reduce Morocco’s dependency on fossil fuels while taking into account local constraints, this study offers an overview of the measures outlined above, and provides short and medium term recommendations at three main levels of analysis: the value chain, supporting markets and regulation. They are:

(i) **Strengthen the services sector** to ensure that service providers become reliable partners for local or international investors wishing to establish a business in the region or the Kingdom and to ensure that consumers have confidence in the technology;

(ii) **Develop financial products tailored to the clients’ purchasing power** to facilitate the purchase of solar products and stimulate demand;

(iii) **Reduce subsidies on fossil fuels** to improve the competitiveness of renewable energy particularly with regard to natural gas, the main competitor of solar thermal energies.
Introduction

This study on solar energy technologies in the Meknes-Tafilalet region was conducted by USAID's "Improving the Business Climate in Morocco" Program in the summer of 2008. It was undertaken to provide an overview of potential regional markets, and the organization of solar (thermal and photovoltaic) value chains. The aim is to develop business partnerships between stakeholders in the local and international supply chains and to attract sustainable investment to the region.

Indeed, this study aims to contribute to the development of a regional strategy to attract investors sensitive to sustainable development by: creating a conducive environment for investment (regulation, incentives, information on investment opportunities and markets, etc.); and developing partnerships that support the sale of solar energy technology and investment in the development of a solid and competent local industry. Thus, while providing potential investors with a portfolio of information relating to markets and local partners, this study examines the nature of commercial relationships throughout the solar-thermal and photovoltaic value chains in order to propose recommendations to improve their sustainability.

Background on the study and value chain selection

In the spring of 2007, USAID's "Improving the Business Climate in Morocco" Program undertook three regional studies to identify opportunities and constraints to private investment in seven regions of Morocco. Among them was the region of Meknes-Tafilalet, famous for its water resources, its agricultural potential, its wildlife, and its imperial past. However, the greatest potential of the region, previously known as the "water basin of Morocco," has also been associated with the most alarming constraints: the depletion of natural resources and desertification. Having recognized environmental degradation as a threat to economic growth, and wishing to attract sustainable "green" investment funds, the region is now striving to transform these constraints into opportunities: in February 2008, the region launched its sustainable investment promotion strategy.

In the fall of 2007, the Program conducted a study on the most promising opportunities of the region. The study revealed the potential of three key sectors: "organic" agriculture, ecotourism and renewable energy (including the Clean Development Mechanisms (CDM)). Relying on these results, the region, including the Regional Investment Center (RIC) in Meknes-Tafilalet which gave birth to this initiative, chose to promote the renewable energy sector by exploiting the wind, solar, biomass and biogas potential, and to focus its efforts on autonomous energy production, development of services and technologies related to renewable energy - including solar energy, energy efficiency in construction and industry - and promoting the region as an ideal host for investments related to renewable energy.

In addition to offering a variety of investment opportunities, renewable energy allows Moroccan enterprises to access supply sources of alternative energy, to cope with rising energy prices, and to maintain their competitiveness in global markets.

In order to boost the energy sector including regional and local services and related technologies, CDER has developed (in collaboration with UNDP) the Energy House program. This program and the micro-energy service providers in rural and urban areas (who promote marketing, installation, and maintenance of renewable energy equipment) are key partners for local and international investors wishing to promote their technologies through a reliable and competent interface.

With the aim to bring manufacturers and suppliers of renewable energy technologies together and to choose Meknès-Tafilalet as a priority location for investment, the program opted to carry out a study on solar energy value chains in the region, one of the sunniest in Morocco. The study aims to identify, characterize, and quantify opportunities relating to the services and technology markets associated with solar thermal and photovoltaic channels, while identifying the various elements of these chains and characterizing the nature of the commercial relationship between them.

Methodology

Value chain analyses describe the process of a selected product from production to sale to the final consumer, and the stakeholders and functions involved. This technique has been used for decades by the private sector, including in the food industry, as well as international development experts and academic researchers. The activities undertaken throughout the chain can be contained in a single enterprise or distributed among various companies. Similarly, these activities can be located in the same geographical area or dispersed in several places.

The productivity and efficiency of a value chain depends on the performance of each upstream stakeholder (producers of raw materials, components of products and services), and downstream stakeholders (distributors, transporters, retailers). On the one hand, if a link on the chain is weak, the whole chain's competitiveness suffers, and on the other hand, better organization of some stakeholders may also improve the competitiveness of the entire chain. This methodology allows us to analyze the opportunities and constraints inherent to a sector, to propose recommendations to develop these sectors, to
improve competitiveness, and to increase market share for specific stakeholders.

Traditionally, a value chain study analyzes the flow of a product, the transformation process from raw material to distribution in end markets. Given that most solar technologies marketed in Morocco are imported from abroad, however, this study is somewhat inverted: it examines the access of these technologies to local Moroccan markets. The aim is to identify the extent to which producers and technology providers can become investors, contributing to the development of the sector and strengthening local stakeholders. To this end, special attention was paid to the analysis of local markets and to the identification of opportunities for reorganizing the weaker links of the chain. In addition, because solar technologies assessed in the present study—particularly photovoltaic products—have not yet reached their full level of profitability, foreign policies and promotional tools were assessed and compared with those in place in Morocco.

Fifty qualitative interviews facilitated the data collection process. Interviews were conducted both at central and regional levels with representatives of eleven public authorities, three ONE concessionaires, nine technology importers, fifteen service providers, ten clients, and two other stakeholders—an international organization and a Moroccan association specializing in wind and solar technologies (see list—opposite).

The study began by analyzing foreign regulatory, institutional, and incentive frameworks, based on secondary sources (studies, articles and press, websites of the departments in charge of the energy sector), as well as research at the local level, which included semi-directive interviews with the MEMEE and other the authorities and agencies concerned.

The value chain analysis was then conducted starting with the most upstream stakeholders on the chain to the end markets, in order to identify the exact path of the products and services analyzed. Interviews with importing enterprises and ONE concessionaires were semi-directive and were carried out using a questionnaire to guide the discussion. Several criteria have also helped guide this inverse study: the power distribution (ability to negotiate), the intensity of vertical and horizontal collaboration, and access to information about products and markets.

The study was initially used internally by the Program in order to design interventions targeting market profitability. To this end, a group of five students from the Columbia University in New York City was invited to Morocco for a week in January 2009 in order to prioritize potential markets according to viability for the investor. The tourism sector is seen as the most competitive sector, thanks to the savings made by replacing traditional energy use by solar energy.

This period also helped to consolidate the information gathered through interviews and to present the results of the study to national and regional partners, including the Meknès-Tafilalet Regional Investment Center (RIC) and the Renewable Energy Development Center (CDER).

### Public stakeholders
- Ministry of Energy, Mines, Water and Environment (MEMEE);
- General Confédération of Moroccan Enterprises (CGEM);
- Regional Delegations of Tourism;
- Regional Delegation for Industry;
- Regional Delegation for Housing;
- Regional Delegation for Health;
- The Urban Agency of Mèknes;
- The Regional Education and Training Academy (AREF);
- Moroccan Center for Clean Development (CMPP);
- Renewable Energy Development Center (CDER);
- National Electricity Office (ONE) (national and regional).

### Private stakeholders
- ONE concessionaires: Isophoton, Sunlight Power, Temasol;
- Importers: Sococharbo, Noor Web, Atcoma, First Metal, Calpark, Batitherme, Phototherme, Giordano Maroc, Energy Poles;
- Fifteen service providers, including a dozen Maison-Energie;
- Ten clients: households, hotels and hospitals.

### Other
- Moroccan Association of Wind and Solar Industry (AMISELE); 
- United Nations Development Program (UNDP).
Part I • Moroccan energy policy and development tools for the solar energy value chains

This section presents background information on Morocco’s energy policy and the new Moroccan energy strategy, which is for the first time clearly oriented towards promoting energy efficiency and renewable energies. This section also provides an analysis of other major policies and financial tools used in countries where solar channels are the most developed, as well as supporting regulations and activities in Morocco.

I. Morocco’s energy strategy

As a non-fossil fuel producer, Morocco depends on imports for up to 97% of its energy needs (4). Commercial energy consumption remains relatively low, amounting to 14.7 Million Tonnes Oil Equivalent (MTOE) (5) in 2008, nearly 0.46 TOE/capita/year, despite a sustained increase in consumption averaging 5% per year from 2000 to 2007 (6).

According to statistics from the Ministry of Energy, Mines, Water and Environment (MEMEE) (7), Morocco’s energy invoice amounted to 70.6 billion dirham (MAD) in 2008, and has nearly tripled since 2002 (from MAD 19.1 billion). Regarding power consumption, average annual growth is 7.5%, with 24,002.8 net gigawatt-hours (GWH) of electricity used in 2008. This increase in the Moroccan energy bill is partly due to the increase in oil and gas prices. Indeed, up to 58% of national energy needs are satisfied by petroleum products (8). It is also interesting to note that about 70% of the electricity consumed comes from imported coal and fuel (9).

In order to offer affordable prices to consumers, the Moroccan government massively subsidizes energy imports. For oil, subsidies amounted to MAD 10.7 billion in 2007, and for gas they were 3.7 billion MAD in 2005 (10). Hence, the government, and more specifically the Caisse de Compensation, must bear any increase in the price, since the changes are generally not passed on to consumers.

Faced with this level of dependence on the outside world and fluctuations in energy prices, Morocco must increase efforts to diversify its sources of energy and to enhance its national resources, particularly through the promotion of renewable energy (hydraulic, wind, solar and biomass).

In a clear sign that Morocco is moving towards renewable energies, His Majesty Mohammed VI spoke to this issue during the Fête du Trône celebration on July 30, 2008: “The issue of energy also arises as a fundamental problem that must be addressed through a vision for the future. The aim is to ensure the security of energy in our country, to diversify sources of domestic energy using green alternatives, and to ensure rational use of the latter” (11).

Morocco has huge potential in renewable energy. According to the MEMEE, this potential is about 6,000 megawatts (MW) for wind power. Indeed, Morocco has 3,500 km of coastline with regular winds blowing at an average speed of 8 to 11 meters per second. For solar energy, the potential of Morocco amounts to 5.5 kwh/sq. m/day, that is 3000 hours of sunshine per year. In terms of hydraulics, 200 usable sites were identified. Biomass also has great potential in Morocco and a study is planned for 2009 to measure the biomass potential that can be converted into energy.

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(4) Among neighboring countries exporting energy to Morocco are: Algeria, Spain, Saudi Arabia, China, South Africa and Eastern Europe.
(5) Tonne oil equivalent (TOE) measures how many tons of oil would be consumed to provide the amount of energy required.
(6) Liaison Energie-Francophonie No. 78, “Transforming the energy constraint into an opportunity: the case of Morocco”, p. 85.
(7) MEMEE’s website.
(9) http://www.jeuneafrique.com/Article/LIN08068lonesnoisne0/-choc-petrolier-ONE-economies-d-energie-L-ONE-soustension.
(11) Excerpt from the speech of His Majesty King Mohammed VI on Throne Day (July 30, 2008).