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**Assessment of the Local
Manufacturing Potential
for CSP Projects**



ESMAP Study Highlights Concentrated Solar Power Potential in Morocco

On a bare desert plateau near Ouarzazate in southern Morocco sits what will soon be one of the largest Concentrated Solar Power (CSP) installations in the world.

The development of the 500 MW Ouarzazate I plant is a cornerstone of the Moroccan Solar Plan, an ambitious strategy by which the country aims to generate 2,000 MW of CSP by the year 2020.

CSP systems use mirrors and lenses to concentrate sunlight onto a small area. The concentrated light then acts as a heat source that can generate electricity at a conventional power plant. CSP has been identified as one of the key technologies at the heart of the energy technology revolution because of its potential to reduce greenhouse gas emissions. Moderate estimates project CSP could meet 3.8 percent of the world's power needs in 2030 and 9.5 percent in 2050.

CSP is of particular interest to utilities because of the significant potential for cost reduction from economies of scale, design improvements and diverse supply chains, as well as its thermal storage capability that increases capacity factors, reduces generation cost and contributes to grid reliability.

With its abundant sunshine, adequate water, existing technical capacity and proximity to Europe, Morocco possessed all the attributes required for CSP production. But relatively high-up front costs, an untested export market and uncertainty about job creation, technology transfer, and benefits to local businesses had impeded the establishment of a large-scale CSP industry.

"Everyone could see that Morocco possessed this incredible solar resource, but turning it into something economic and usable was challenging to everybody," said Jonathan

KEY ACHIEVEMENTS

Informed US\$ 297 million in World Bank funding for construction of Ouarzazate 1

Helped mobilize private sector support for CSP development in Morocco

Identified CSP components that can be produced by Moroccan companies



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Mustapha Bakkoury, President of the Moroccan Agency for Solar Energy (MASEN), said that while the government was strongly committed to developing CSP, it nonetheless required solid documentation of the benefits a solar energy industry could bring to the country.

“Even though we had the conviction about CSP, we needed to mobilize public and private sector support by showing that the potential for local manufacturing and long-term job creation was actually there,” Mr. Bakkoury said.

To that end, ESMAP support was mobilized by the World Bank to prepare a report evaluating the opportunities and challenges in developing local solar industries in Morocco and other MENA countries. The report’s subsequent findings were to play a catalytic role in informing the development and preparation of a World Bank loan for the Ouarzazate I plant, which was approved by the World Bank’s Board of Executive Directors in November 2011.

The World Bank’s US\$ 297 million in funding for Ouarzazate I—US\$ 200 million through the International Bank for Reconstruction and Development and another US\$97 million through the Clean Technology Fund (CTF) in partnership with the African Development Bank—in turn helped leverage a further US\$ 1.4 billion in project financing from a group of seven international lenders.

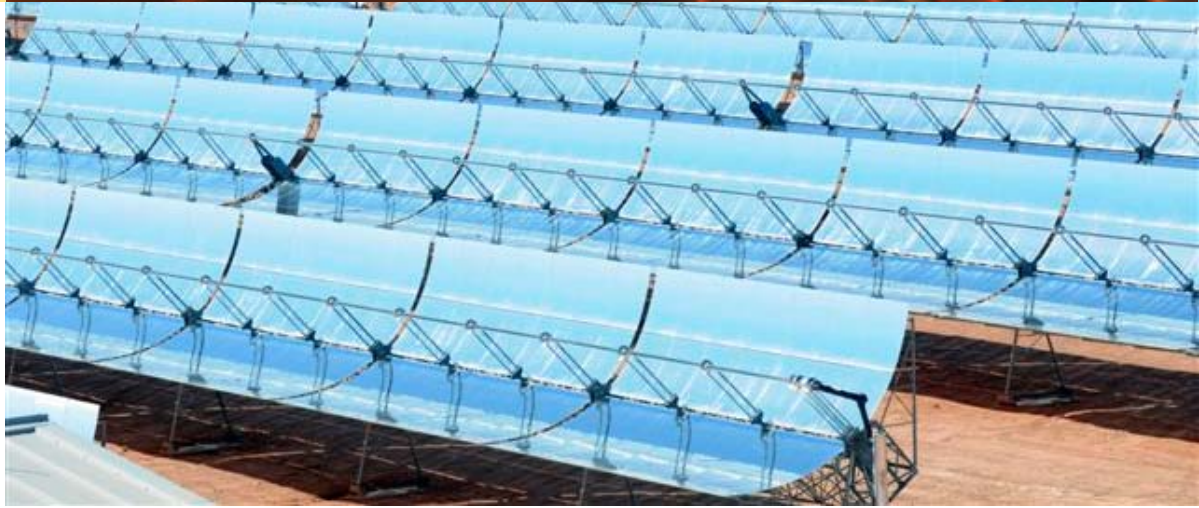
Carried out by Ernst & Young (France) and the Fraunhofer Institute (Germany), the ESMAP-funded Assessment of the Local Manufacturing Potential for Concentrated Solar Power Projects evaluated the manufacturing and other value-added impacts CSP could bring to Morocco and other MENA countries. The ESMAP study also assessed the potential for local job creation, a thematic focus Mr. Walters said stemmed from a simple fact.

“Every single time you discussed CSP with governments, non-governmental organizations or businesses in North Africa, within 5 or 10 minutes the discussion always turned to the expected employment, manufacturing and skill development impacts beyond the power plant,” Mr. Walters said. “ESMAP went about answering these important questions in a systematic, detailed fashion.”

The ESMAP study was presented in mid-2012 at a series of workshops in Morocco and Egypt attended by representatives from national renewable agencies, the private sector, and the donor community.

IMAGES

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The study found that Morocco and other North African countries could generate substantial income and employment from CSP deployment at scale, and that sufficient capacity existed to bring immediate gains to local manufacturers tasked with supplying specialized components and services to a CSP industry.

In addition to economic benefits from construction and civil works, the report found that most CSP components could potentially be manufactured in MENA countries: mounting structures in the short term, followed by non-CSP-specific elements like piping, mirrors, and float glass in the medium term, and eventually more complex components, such as receivers.

The ESMAP study also projected that MENA countries could reap large economic benefits in the future by creating export opportunities for CSP components. For this to be possible, a regional free trade arrangement for trading renewable energy components or primary/intermediate products for renewable energy components could contribute significantly to better market integration, accelerate the development of a stable and sizable CSP market, and enlarge the regional content in future CSP projects.

The ESMAP study included the following findings specific to the development of a CSP industry in Morocco:

- That by 2015 Moroccan firms could be producing 30 percent of the components required to generate the country's CSP, a figure that could rise to 50 percent by 2020 and to 60 percent by 2025.
- That the production of 2,000 MW of CSP by 2020 could add a cumulated US\$ 4.6 billion to Morocco's economy.
- That more than 11,000 new CSP jobs—ranging from low-skilled positions in construction to high-tech positions in engineering and management—could be created by 2020.

Mr. Walters said the ESMAP study's focus on the bottom line resonated clearly with its intended audience.

"The study goes country by country, manufacturing component by manufacturing component, and our audience of mainly engineers loved it, because engineers want to be convinced by the facts," Mr. Walters said.

The study also outlined how innovative concessional financing—including support from the CTF—could bring down the high upfront investment costs of CSP, thus making the scheme more attractive to local and international investors. It also reassured potential donors that CSP would have comprehensive impacts beyond clean energy benefits and that locally produced content would not raise overall project costs.

When MASEN began a search for an operational partner to design, finance, construct, operate, and maintain the Ouarzazate I plant, Mr. Bakkoury said the ESMAP study proved instrumental in determining a local manufacturing benchmark to be indicated to bidders.

In September 2012, the Saudi Arabian company ACWA Power International was awarded the contract and formed a Public Private Partnership (PPP) with MASEN—one of only three PPPs created in North Africa in the aftermath of the 'Arab Spring'.

The development of Ouarzazate I through a PPP demonstrated the government's clear commitment to involve the private sector in the solar program. According to the PAD, "a successful completion of the transactions envisaged under the proposed project will establish MASEN as a solid partner to private developers interested in CSP/Solar development. This transformation is essential as the program requires funds well beyond the public sector financing capability."



ESMAP MISSION

The Energy Sector Management Assistance Program (ESMAP) is a global knowledge and technical assistance program administered by the World Bank. It provides analytical and advisory services to low- and middle-income countries to increase their know-how and institutional capacity to achieve environmentally sustainable energy solutions for poverty reduction and economic growth. ESMAP is funded by Australia, Austria, Denmark, Finland, France, Germany, Iceland, Lithuania, the Netherlands, Norway, Sweden, and the United Kingdom, as well as the World Bank.

The first 160 MW from Ouarzazate I is expected to come online in late 2014 and will help Morocco avoid 240,000 tons of CO₂ a year—the same as removing 80,000 cars from the road annually.

Mr. Bakkoury said the tariff from the Ouarzazate I plant is projected to be US\$ 0.19 per kilowatt/hour (kWh)—one of the lowest CSP costs in the world and significantly less than the US\$ 0.26 kWh originally envisioned.

Morocco is currently seeking to award a contract for construction of a second plant at Ouarzazate, which when completed is expected to generate 300 MW of CSP and 40 MW of photovoltaics. The Ouarzazate II project includes a pilot export component, and talks are underway between Morocco, France, Germany, and Spain about an agreement to provide subsidies so that Moroccan solar energy can compete on a level playing field with domestically produced solar energy in Europe.

Mr. Bakkoury said the ESMAP study had provided the necessary rationale to rally support for the large-scale rollout of CSP in Morocco.

“Politically, it was important for us to optimize CSP’s economic impact starting with the very first project,” Mr. Bakkoury said. “That’s why the ESMAP study was so important to us.”



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