Context and Objectives of the Study

oncentrated Solar Power (CSP) is a renewable energy technology which, after a period of some stagnation, has started to penetrate the energy market in recent years, particularly in Spain and the United States, but also in the Middle East and North Africa (MENA) and other regions of the world. In the MENA region, an increasing interest in CSP has appeared in the last few years, with projects under implementation in Morocco, Egypt, and Algeria. All projects currently being developed in North Africa use the Integrated Solar Combined Cycle (ISCC) configuration. ISCC plants use the output of a solar field to boost a conventional combined-cycle gas turbine plant. Projects in Egypt and Morocco have been promoted with the support of the World Bank and the Global Environment Facility (GEF) and have solar field capacities under construction, each in the range

of 20 to 30 MW. These plants are expected to be commissioned by the end of 2010.

Earlier studies of the project consortium in 2009¹ have analyzed various market and policy strategies for realizing renewable energy and CSP projects in the current market environment in the MENA region. To run CSP projects in MENA competitively in the short and medium term, a portfolio of different support schemes for CSP plants is necessary, including international support through concessional loans





¹ Ernst & Young for the EU Commission and Fraunhofer ISI for the World Bank.

۲

or revenues from solar electricity exports to Europe, combined with national incentives like long-term power purchase agreements (PPAs), feed-in tariffs, or tax rebates.

As a concrete step toward the realization of these strategies, a MENA CSP scale-up Investment Plan (MENA CSP IP)² was prepared by the World Bank and the African Development Bank (AfDB), and endorsed by the Clean Technology Fund (CTF)³ Trust Fund Committee on December 2, 2009. It is a landmark climate change mitigation program aimed at co-financing nine commercial-scale power plants (totaling around 1.2 GW) and two strategic transmission projects in five countries in the MENA region: Algeria, Egypt, Jordan, Morocco, and Tunisia (henceforth referred to as "MENA CTF" countries). The vision is for the Mediterranean MENA countries to ultimately become major suppliers and consumers of CSP-generated electricity. The MENA CSP IP is conceived as a transformational program, leading to the installation of several GW of CSP capacity in MENA by 2020 based on the 1.2 GW triggered by the MENA CSP IP. The first projects are expected to start commercial operations by 2014, and to initially supply domestic markets in MENA countries.

The MENA CSP IP is accessible to other Multilateral Development Banks (MDBs);⁴ the initiative strives to trigger further investment from the private sector in CSP technology, (through the DESERTEC Industry Initiative (DII),⁵ for example).

The proposed transformational approach to overcome market barriers is to offer the CSP industry a credible commitment that allows it to develop a largescale multi-country portfolio of projects. The driving idea behind such a commitment is the assumption that such aggregation will induce local mass production techniques that will create local added value and lower costs, and will improve performance of CSP technology and its components.

The Clean Technology Fund Investment Plan proposes CTF co-financing of \$750 million, which will mobilize an additional \$4.85 billion from international financial institutions and other sources. Approval of the CSP projects (Table 1) is scheduled by the end of 2012 to accelerate CSP development in the Middle East and North Africa up to 2020. During this study these projects have been discussed in depth with local authorities and potential companies in the corresponding countries.

² http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/MENAEXT/0,, contentMDK:22412791~menuPK:247603~pagePK:2865106~piPK:2865128~theSite PK:256299,00.html.

³ The Clean Technology Fund (CTF) invests in projects and programs that contribute to the demonstration, deployment and transfer of low carbon technologies with a significant potential for long-term greenhouse gas emissions savings (http://www.climateinvestmentfunds.org).

⁴ Multilateral Development Banks are institutions that provide financial support and professional advice for economic and social development activities in developing countries. The term MDBs typically refers to the World Bank Group and four Regional Development Banks: the African Development Bank, the Asian Development Bank, the European Bank for Reconstruction and Development and the Inter-American Development Bank Group.

⁵ http://www.desertec.org/en/.

	CTF Investment Plan*			CTF Investment Plan Update		
			CTF			CTF
Country	Project (Name)	Capacity (MW)	financing (US\$ million)	Project (Name)	Capacity (MW)	financing (US\$ million)
Algeria**	Megahir	80		Megahir	80	
	Naama	70		Naama	70	
	Hassi R'mel II	70		Hassi R'mel II	70	
Egypt	Kom Ombo	70		Kom Ombo	100	
	Marsa Alam	30				
Jordan	Ma'an Province	100		Ma'an	100	
	Mashreq CSP Transmission	-		Mashreq CSP transmission	-	
Morocco	Tan Tan	50		Ouarzazate	500	
	Ain Beni Mathar	125				
	Ouarzazate	100				
Tunisia	IPP-CSP Project	100		IPP-CSP	100	
	ELMED-CSP	100+		ELMED-CSP	100+	
				STEG-CSP	50	
	Tunisia-Italy transmission	-		Tunisia-Italy transmission	-	
Total		~ 900	750		~ 1,170	750

Table 1 List of CSP Projects in the Pipeline for CTF in MENA Region

* As approved by CTF Trust Fund Committee on December 2, 2009.

** Algeria's intentions vis-à-vis CTF financing are currently unclear, and the earmarked funds may be reallocated.

In order to further disseminate CSP technology, a solid local foundation is needed in developing countries because—unlike other renewable energy technologies such as photovoltaic (PV) or wind energy—its potential is more limited in many of the major developed countries. To facilitate the establishment of such a basis for CSP it is necessary that the countries perceive a benefit from the technology for their economic development. MENA could become home to a new, high-potential industry in a region with large solar energy resources. When the CSP scale-up program is implemented, it could serve the local market demand.

At the same time, the program could also serve other countries in the region (through development of "local champions"), and improve existing markets in Southern Europe, the United States, and elsewhere. If the CSP market increases rapidly in the next years, the region could benefit from significant job and wealth creation as well as from sufficient power supply to satisfy a growing demand, while the world's renewable energy sector would benefit from increased competition and lower costs in CSP equipment manufacturing. ۲

There are many factors that combine to make local manufacturing in MENA countries a transformational opportunity:

- MENA CSP is well placed to benefit from the massive scale-up of concessional climate financing envisaged under the United Nations Framework Convention on Climate Change (UNFCCC) and recently reaffirmed by the Copenhagen Accord. The CTF allocation for MENA CSP could be the seed money for a financing scale-up. This would greatly help the economies of scale in CSP manufacturing, which would allow CSP to become one of the first competitive 24/7/365⁶ renewable energy technologies.
- MENA CSP is central to the high-level political agreement between MENA and the European Union to make solar energy trade a fundamental pillar of MENA-EU economic integration, and therefore presents a major opportunity for MENA to earn export revenue.
- MENA CSP could be key to the realization of the EU's GHG emissions reduction and energy security objectives. The April 2009 EU Renewable Energy Directive, with its provisions for the import of renewable energy to achieve the mandatory renewable energy targets of EU member states, is an important step in that process, as are the Desertec Industry Initiative and the Transgreen/Medgrid Initiative.
- The political initiative of the Mediterranean Solar Plan may act as an umbrella for initiatives such as Desertec or others at a bilateral level.
- MENA's oil-producing countries are embarking on CSP investment programs to liberate oil and gas from the power sector for higher value-added uses and exports, while providing long-term potential for CSP energy exports.
- The MENA CSP IP could benefit from the recent Cancun agreements, which have opened the way for a much larger funding frame. The climate conference of Cancun agreed on a Green Climate Fund of \$100bn a year of climate funding from 2020 that will be generated from a «wide variety of sources, public and private, bilateral and multilateral, including alternative sources.» This could include a range of mechanisms, such as auctioning of carbon credits and levies on international aviation and shipping.

This combination of factors could give MENA a unique advantage as a global location for CSP production and, while creating demand for installed capacity, it could strongly drive local manufacturing.

The World Bank has mandated Ernst & Young, the Fraunhofer Institute for Solar Energy Systems (ISE), and the Fraunhofer Institute for Systems and Innovation Research (ISI) to investigate the potential for local manufacturing in the MENA region, which is the most promising area for its development due to the excellent solar conditions and the proximity to the potential export market for solar electricity in Europe. The main objectives of this study, "Assessment of the Local

⁶24 hours a day/ 7 days a week/ 365 days a year.

Manufacturing Potential for Concentrated Solar Power (CSP) Projects" for the World Bank, are as follows:

- The study should provide an overview of manufacturing processes for key CSP components as well as a cost analysis for CSP components and systems and for CSP plants as a whole, including the potential for cost reduction.
- It should further assess the potential in the MENA region for building and developing a CSP component- and equipment-manufacturing industry, focusing on Morocco, Algeria, Tunisia, Egypt and Jordan (i.e., those countries that have already submitted CSP projects for financing by the CTF (see Table 1), but with a broader view to the MENA region.
- An action plan should be proposed to develop the potential of locally manufactured CSP components in the existing industry and of new market entrants.
- Finally, the study should analyze potential economic benefits of developing a CSP component manufacturing industry and CSP manufacturing at the construction site of new CSP plants.

Analyzing the manufacturing processes of CSP components and systems provides a suitable basis for understanding the effects, including possible industrial development, that the CSP Scale-up Initiative will create in the MENA region. Other markets for renewable energies have already been shown to create local industry in the new innovative field of renewable energies; for example, the photovoltaic industry in Germany or the wind industry in Denmark. Emerging countries like China and India are also playing an interesting role by boosting their own renewable-energies industries. India, for example, is creating a powerful local wind industry, (with new jobs and economic benefits for the country), that supplies the home market as well as the international wind power market.⁷ A similar development in the MENA region could be promoted by the action plan for CSP projects and their local manufacturing, as discussed in this report.

()

⁷ Lewis & Wiser, 2007