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# SOLAR POWER PROSPECTS IN NORTH AFRICA'S SAHARA DESERT

BY PAUL MUKWAYA

## SUMMARY

- There is significant potential for generating electricity from solar power in the Sahara desert in North Africa for both domestic use and for export to Europe. The successful implementation of projects to harness solar power could improve standards of living in North African countries and Europe and lead to the creation of jobs in the manufacturing and construction sector.
- Projects to launch solar initiatives in North Africa are expensive endeavours and face several challenges currently deterring potential investors—including the reign of autocratic regimes that foster political instability; poor legal frameworks that do little to protect foreign investment; rampant corruption; and occasional threats of 'nationalizing' foreign-owned companies.

Covering nine million square kilometres and stretching across 12 countries, the Sahara desert receives an average of 12 hours of sunlight per day. Low population density, coupled with abundant sunlight, makes the Sahara desert an optimum destination for the generation of electricity from solar power.<sup>1</sup> The International Energy Agency (IEA) rates North Africa—here defined as the geographical area covering Morocco, Algeria, Tunisia and Libya—as a region that has the potential to become a major exporter of electricity generated from solar power.

The prospect of generating electricity from solar and the Sahara desert's proximity to Europe have attracted the attention of governments in North Africa and the European Union—where growing domestic energy demands, economic factors and environment concerns have triggered a search for alternative energy

<sup>1</sup> Solar Potential of the Sahara Desert with an Introduction to Solar Updraft Power Plants. Available at <http://eeeic.org/proc/papers/129.pdf>.

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sources. In Morocco, Algeria, Tunisia and Libya, studies suggest that domestic energy consumption is expected to increase because of population growth.<sup>2</sup> For instance, it is estimated that demand for electricity in these countries—from 2003 to 2050—will increase by 80 percent<sup>3</sup> with an annual growth in overall energy consumption between four and eight percent.

As in North Africa, rising demand for electricity in Europe is driven by population growth. In addition, much of Europe's capacity for generating electricity is nearing the end of its working cycle and aging transmission networks need to be replaced with modern facilities,<sup>4</sup> thus creating the impetus for governments and businesses to explore alternative energy sources to meet rapidly growing energy needs.

North Africa and Europe both stand to make significant gains from solar power from the Sahara desert through the creation of more than 200,000 jobs in the manufacturing and construction sectors. Money from solar power projects could also improve infrastructure in North Africa and earn countries in the region a new revenue stream through the export of power to Europe.

Generating electricity from solar energy is also envisaged by some countries as a long-term plan to help mitigate the negative effects of climate change. In 2000, Algeria produced 84.4 megatons of carbon emissions, while Libya, Morocco and Tunisia produced 49.7 megatons, 33.7 megatons and 21.3 megatons respectively—all contributing to concentrations of greenhouse gases. Experts believe these figures will grow rapidly as power consumption in the region increases.<sup>5</sup> In Europe, electricity from solar energy could play a key role in helping to reduce greenhouse gases by as much as 15 percent by 2020 and 80 percent in 2050.<sup>6</sup> Electricity from solar energy could also help Europe to meet its target of deriving 20 percent of its energy from

<sup>2</sup> Isabelle Werenfels and Kirsten Westphal, "Solar Power from Africa: Frameworks and Prospects," *German Institute for International and Security Affairs* (2010): 9

<sup>3</sup> Grein, M, and B.Nordell et al, "Energy Consumption and Future Potential of Renewable Energy in North Africa," *Revue des Energies Renouvelables ICRESD* (2007): 249-254.

<sup>4</sup> See Isabelle Werenfels and Kirsten Westphal, "Solar Power from Africa: Frameworks and Prospects," *German Institute for International and Security Affairs* (2010): 6

<sup>5</sup> See page 251 in "Energy Consumption and Future Potential of Renewable Energy in North Africa."

<sup>6</sup> K. Ummel and D. Wheeler, "Desert Power: The Economics of Solar Thermal Electricity for Europe, North Africa, and the Middle East," Working Paper No. 156. Centre for Global Development (2008): 1-45. Also see page 8 in "Solar Power from Africa: Frameworks and Prospects."

renewable sources by 2020. As Europe carves the way forward, similar gains could be made by North African countries.

As a first step, governments and businesses in North Africa have kick-started initiatives to harness solar power in recognition of the energy potential in the Sahara desert. Various companies are beginning to develop Concentrated Solar Thermal Power (CSP) technology to provide a secure flow of solar power for North African and European markets. Power plants that employ CSP technology use massive mirrors to collect direct sunlight which in turn is used to create heat to drive conventional steam turbines and electricity generators. Studies suggest that CSP technologies have an enormous power generating potential that facilitate the production of electricity at any time of day or season.

The proposed solar energy production network is expected to connect North Africa to Europe from Spain (via Gibraltar), Greece (via Crete and Cyprus), as well as Italy (via Malta and Sicilia), and France (via Sardinia and Corsica).

This backgrounder examines two major solar energy initiatives in North Africa and the challenges facing their implementation.

## **THE SOLAR ENERGY INITIATIVES**

### **THE MEDITERRANEAN SOLAR PLAN**

Initiated in July 2008, the Mediterranean Solar Plan (MSP) is an initiative of the Union of the Mediterranean, a multilateral partnership comprising 43 countries bordering the Mediterranean Sea. Morocco, Algeria and Tunisia are full-fledged members of the Union, while Libya retains observer status. The Mediterranean Solar Plan aims to develop 20 gigawatts (GW) in electricity production capacities and achieve energy savings for countries around the Mediterranean by 2020. To reach the twin goals of 20 GW in electricity production and energy savings, the MSP aims to create a common legal, regulatory and investment strategy for countries of the Mediterranean Union and to promote knowledge transfer and technological capacities.<sup>7</sup>

Under the Mediterranean Solar Plan, solar thermal power stations will be

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<sup>7</sup> Mediterranean Solar Plan: Strategy Paper. Page 1-3.

built in Morocco, Algeria, Tunisia, Egypt and Jordan. Transmission networks from the power stations will be expanded to partner countries of the Union of the Mediterranean. The MSP action plan, finalized at the end of 2010, has identified a set of projects to be launched in a number of countries and assesses the current electricity inter-connection capacities in these countries. The MSP's long-term implementation phase will occur in 2011-2020 and is expected to be financed by the World Bank and the European Development Bank.<sup>8</sup> A master plan covering this period is expected to be unveiled in 2011.

Initial projects of the MSP will be launched in nine countries: Tunisia, Algeria, Morocco, Turkey, Syria, Lebanon, Jordan, Palestine and Israel. Tunisia is expected to undertake the lion's share of projects in North Africa—approximately 26 percent—while Algeria and Morocco will get seven and 14 percent respectively.<sup>9</sup>

### THE DESERTEC INDUSTRIAL INITIATIVE

Launched in July 2009, the Desertec industrial Initiative (DII) is the brainchild of the Trans-Mediterranean Renewable Energy Corporation, an organization established by a consortium of think tanks, the Club of Rome, and energy agencies from countries around the Mediterranean. In October 2009, the DII was legally registered as a limited liability company and by spring 2010 it had attracted a half-dozen investors, which include companies from Italy, France and Morocco.<sup>10</sup> There are currently 12 companies behind the DII planning to establish financing plans to develop solar projects in the Sahara Desert. Plans are underway to increase the number of companies to 25.

Eventually, the DII is expected to produce 15 percent of Europe's electricity needs and cover a significant portion of North Africa's electricity needs by 2050. The project will link multiple solar concentrating facilities around coastal North Africa and transmit electricity to Europe through high-voltage lines. The DII work plan calls for the establishment of an implementation

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8 Tunisiaonlinenews. Mediterranean Solar Plan: Tunisia Gets Lion's Share of Projects. <http://www.tunisiaonlinenews.com/mediterranean-solar-plan-tunisia-gets-lion%E2%80%99s-share-of-projects/>

9 Ibid.

10 See Isabelle Werenfels and Kirsten Westphal, "Solar Power from Africa: Frameworks and Prospects," *German Institute for International and Security Affairs* (2010): 7-8.

road map in 2012. The total cost of implementing the DII is estimated at €400 billion (about US\$561 billion).

## **SOLAR POWER PROGRAM CHALLENGES IN NORTH AFRICA**

The solar power initiatives in North Africa face several challenges on the financial, security, legal, and political fronts.

From a financial perspective, projects that generate electricity from solar power are extremely expensive, and may incur high capital and investment costs as shown by the US\$561 billion tag attached to the implementation of the DII. For instance, the cost of building power stations that would generate 20 GW of electricity for Europe by 2020 is estimated to be US\$136 billion. Of this amount, US\$113 will be directed toward the construction of power stations, and US\$22 billion will be used for building power lines. Additionally, the cost of building transmission networks is also high; with projections of US\$ 3 million per km for a 400 megawatt cable (Werenfels and Westphal 24-25).

In North African countries, whose participation in the solar power projects is crucial, reservations still abound regarding the division of benefits that accrue from the projects. In particular, North African countries worry that the strong emphasis on the export component of the solar projects will result in high domestic electricity prices. There is a perception that the big winners will be Western investors and electricity companies from Europe (Werenfels and Westphal 29). Because of this perception, Algeria for instance, insists that its involvement in the solar power initiatives be pegged to the participation of Algerian firms and assistance in building the projects. There are also concerns that the water requirements for cooling turbines and cleaning dust off solar panels may be detrimental to local populations because of the demands it will place on local water supplies.

On the security front, there are two key areas of concern. Firstly, sceptics argue that centralized solar energy facilities, including transmission lines, may be targeted by militant Islamic movements in North Africa. Secondly, investors are concerned about the security of their investments, pointing to high levels of corruption and cumbersome bureaucracies and judiciaries that are not independent. Additionally, the enactment of legislation that impedes

foreign investment is another hurdle. A handful of governments in the region have previously threatened to “nationalize” foreign investment projects.<sup>11</sup>

An additional area of concern for investors and European governments centres on political stability in North Africa. Many North African countries are ruled by authoritarian regimes that lack legitimacy, and are encumbered with substantial demographic and socio-economic challenges. Social unrest and a propensity to revolt are two issues that threaten stability as witnessed early this year in Tunisia, when mass pro-democracy demonstrations, lasting several days, shutdown the country’s economy and forced the president to cede power and flee the country. Elsewhere in Libya this year, mass anger at the regime has resulted in social unrest that borders on civil war with detrimental effects for the economy. For instance, oil production has been disrupted and some facilities have been bombed. Morocco and Algeria too, witnessed mass demonstrations calling on regimes in both countries to enact democratic reforms. These civil unrest situations have all had negative effects on the economies in these countries and are a major source of concern for foreign investors.

In North Africa and Europe, there’s a strong home lobby that supports domestic solar power production. These supporters argue that solar production makes sense because it pumps cash into local economies, cuts down on costs and reduces transmission issues. In Germany, where the domestic solar industry is growing and enjoys government subsidies, outsourcing solar power production to North Africa is seen as a threat that will ultimately undermine home-grown solar power production.<sup>12</sup> Similar sentiments have been echoed in Algeria and the United Kingdom.

## WHAT THE FUTURE HOLDS

The question as to whether the huge solar power potential in North Africa will be exploited is one that looms large for the region and may determine its economic success or failure. Key issues of concern centre on the national energy policies of North African governments, which currently favour a mix of several energy sources. For instance, while solar forms a small

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11 According to Werenfels and Westphal, since 2006, Algerian investment laws have been moving in a direction that leaves foreign investors at a disadvantage. Regarding nationalization, Libyan leader Muammar Gaddafi has repeatedly threatened to nationalize the oil and gas sector in his country.

12 Capacity is expected to exceed 23 GW in 2020 and reach 90 GW in 2050.

but growing component of North African governments' energy planning strategies, gas still remains central in Algeria, Libya and Tunisia while coal holds a dominant position in Morocco. Additionally, there is a strong interest in nuclear power across the region—a prospect that could potentially dim focus on the incentives of solar power. In oil-rich countries such as Libya and Algeria there is a push to maintain the status quo because of the fast profits currently accruing from oil sales.

In Europe, geopolitical perspectives are shifting in favour of closer and integrated economic ties with countries in the Mediterranean, including Morocco, Algeria, Tunisia and Libya. As well, there is a move towards reducing the EU's reliance on Russian gas<sup>13</sup> and the exploration of alternative and environmentally-friendly energy sources. European countries are likely to continue pursuing the solar initiatives in North Africa. In order for the solar initiatives to succeed, however, there is need for a common ground on the financial, political, regulatory and legal fronts in North Africa and Europe.

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<sup>13</sup> The EU currently relies on Russia for 38 percent of imported natural gas. Reliance on Russian gas will rise to 50-60 percent in the next 20 years if the EU doesn't adopt alternative energy policies. Russian gas is transported to Europe via a pipeline that runs across Ukraine. In 2006 and 2009, following tensions with Ukraine, Russia shut off gas exports to the EU, resulting in a public outcry that forced EU leaders to reconsider Europe's energy security. This has initiated a debate about weaning the EU of Russian gas.

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The Africa Portal is an online knowledge resource for policy-related issues on Africa. An undertaking by the Centre for International Governance Innovation (CIGI), Makerere University (MAK), and the South African Institute of International Affairs (SAIIA), the Africa Portal offers open access to a suite of features including an online library collection; a resource for opinion and analysis; an experts directory; an international events calendar; and a mobile technology component—all aimed to equip users with research and information on Africa’s current policy issues.

A key feature to the Africa Portal is the online library collection holding over 2,500 books, journals, and digital documents related to African policy issues. The entire online repository is open access and available for free full-text download. A portion of the digital documents housed in the library have been digitized for the first time as an undertaking of the Africa Portal project. Facilitating new digitization projects is a core feature of the Africa Portal, which aims to improve access and visibility for African research.

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