AFRICAN DEVELOPMENT BANK GROUP

NOORo:
the largest concentrated solar power complex in Africa increases the share of renewable energy in electricity generation in Morocco

CLIMATE INVESTMENT FUNDS

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Summary

NOORo, a large-capacity concentrated thermal-solar power plant in Morocco

Commercial operation of the NOORo solar complex project in Ouarzazate will begin in February 2016.

The Ouarzazate solar complex is the first tangible development of the solar program of Morocco, also called the NOOR program. "Noor" means "light" or glare in Arabic. The NOOR program aims to produce at least 2,000 MW of electric power from solar energy by 2020. The program is part of Morocco's new 2010-2030 energy strategy which goal is to improve the country's energy security of supply to sustainably reduce the kingdom's dependence on the outside world and diversify production sources through the use of renewable energies by raising the share of these energies in the electricity mix up to 42% by 2020 compared to less than 15% currently. Eventually, NOOR will save annually one million tonnes of oil equivalent and avoid the emission of 3.7 million tonnes of CO2. It also aims to develop a local industry in renewable energies.

The complex is located 10 kilometers from the Moroccan city of Ouarzazate and will reach a capacity of 510 MW by 2018. It is a master component of solar program NOOR. This complex is called NOORo. The index "o" refers to Ouarzazate similarly to the other complexes of NOOR program (Midelt, Tata,etc) which will hold indices of their region. Once completed, the solar complex will annually prevent the emission of 762,000 tons of CO2, or 19 million tons over 25 years of its operation.

The choice of concentrated thermal solar power

The choice of thermal solar power with energy storage device has been driven by the fact that it allows a better integration of the production of solar power plants in the electricity mix through the interconnected national grid. Thus, thermal solar power plants will help cover the demand for electricity at peak hours that occur in Morocco between 5 pm and 10 pm in winter and 6 pm and 11 pm in summer.

NOORo I of the first phase of the complex is a solar power plant with parabolic troughs. It will be the largest of its kind in the world with a production capacity of 160 MW. It is equipped with a thermal energy storage device allowing it to operate at full capacity for 3 hours without sunlight (after sunset or cloudy weather). Tests prior to the commercial operation of NOORo have begun in November 2015. The plant is now fully operational.

Phase II of the Ouarzazate solar complex, whose works have already started, includes two concentrated thermal solar power plants with an overall capacity of 350 MW. These are NOORo II, a 200 MW CSP parabolic trough plant with a storage capacity of 7 hours and NOORo III, a 150 MW solar tower with a storage capacity of 7 to 8 hours. NOORo II and NOORo III plants will be operational by late 2018.

High-value added financing

The cost of the project is 2.105 billion euros. Its funding is raised through a public-private partnership (PPP) arrangement that brings together the African Development Bank, the World Bank, the Clean Technology Fund (part of Climate Investment Funds), the European Investment Bank, the KfW Development Bank, the French Development Agency, MASEN (Moroccan Agency for Solar Energy) and private operators. It also benefits from a significant grant (donation) from the European Union.

Project Overview of NOORo, Data sheet

Country: *Morocco*

Sector: *renewable energy and power generation*

AfDB Financing: ***€****365 million of which €165 million from Clean Technology Funds (CTF)*

Achievements:
Construction of three parabolic troughs for concentrated solar power plant, with a storage capacity of 3 hours (NOORo I), 7 hours (NOORo II) and 7 to 8 hours (NOORo III)

Expected impacts:
- *Reducing the energy dependency of the country through additional production of 160 MW expected by the end of 2015 for NOORo I and 350 MW by the end of 2018 for NOORo II and III NOORo*
- *Reducing 762,000 tons per year of CO_2 emissions, or 19 million tons over 25 years through NOORo I, II and III*
- *Achieving the national target of 42% of renewable energy in the country's energy mix by 2020 and developing local renewable energy industry.*
- *Creating 250 permanent jobs and 2,400 temporary jobs during the construction of Noor I, and additional jobs expected through the construction of Noor II and III.*

Transforming Morocco: shifting from import to energy production

Today, Morocco is heavily dependent on energy imports to meet its needs: 95% of resources come from abroad. With a consumption estimated at 123,000 barrels of oil per day and 560 million cubic meters of gas, Morocco is the largest importer of fossil energy in the Middle East and North African (MENA) region. Its demand for primary energy continues to grow (an average + 7.2% between 2002 and 2012). To meet the imperatives of economic growth and industrial development, this demand is expected to triple by 2030 and electricity consumption to quadruple.

Solar potential in Morocco

To overcome this strong dependence, Morocco has given priority to improve electricity production on its territory in its 2010-2030 energy strategy. This strategy is based on the Moroccan solar program, launched on November 2nd, 2009 by King Mohamed VI. It aims to increase the share of renewable energies to 42% in the electricity mix by 2020.

This world-class program will ultimately achieve an annual production capacity of 2 GWh. This production capacity will represent 14% of the electric power expected by 2020. The program will save 1 million tons of oil equivalent (TOE) and avoid the emission of 3.7 million tonnes of CO_2 per year (equivalent to the emission of 780,000 vehicles). The total cost of the investment program is estimated at $ 9 billion dollars.

In addition to electricity production, the program includes training, technical expertise, research & development, the promotion of integrated solar industry and potentially the desalination of sea water. The Moroccan Agency for Solar Energy (MASEN), created in March 2010, is in charge of implementing the program. A limited company with public capital, Masen is owned, in equal shares, by the Moroccan State, the Hassan II Fund for Economic and Social Development, the National Power and Drinking Water Office (ONEE) and the Society of Energy Investments (SIE).

A challenge in the fight against climate change

The Moroccan Solar Program will help minimize the impacts of energy production on the environment. In the MENA region, carbon dioxide emission represents 83% of all greenhouse gas emissions in the region. They increased by almost 71% between 1990 and 2010, particularly due to the increase of electricity production.

The imminent launch of the first plant NOORo I

The development of NOORo solar complex is divided into two main phases. The first phase will be commercially launched at the beginning of February 2016.

Phase I includes:

- The construction of common infrastructure (access roads, water supply, electric systems of energy bleed, telecommunications, security…) is completed with the exception of a 225 kV line towards Tazart, expected for the end of 2016.
- The construction in PPP of the first 160 MW solar power plant called NOORo I. The plant is equipped with a thermal energy storage device of three operating hours. This capacity will increase electricity production at peak consumption hours (between 5 pm and 10 pm). Its production is estimated at 370 GWh per year.

Launched in May 2013, NOORo I construction is nearing completion. The first parabolic mirrors of the solar field were installed in March 2014. At the peak of works, more than 1,900 temporary jobs were created on the site of NOORo I.

The selection process of NOORo I developer within the framework of a PPP was made following an international tender in two stages preceded by a pre-qualification. The contract was granted in October 2012 to the consortium led by International Company for Water and Power (ACWA Power, Kingdom of Saudi Arabia) and includes Aries Ingenieria y Sistemas and TSK Electronica y Electricidad (Spain). This consortium priced its offer at 1.62 dirhams for the kilowatt/hour. (The actual prices of the kilowatt/hour set by the National agency in charge of distributing electricity - Office national de l'électricité et de l'eau potable- range between 1.41 and 1.59 regarding the consumption).

A project company called ACWA Power Ouarzazate (APO) was created, majority owned by ACWA Power (75%) and 25% by MASEN. It is in charge of the design and development of NOORo I plant, as well as its operation for a period of 25 years.

Phase 2

In January 2015, ACWA Power International consortium also won the contract to build the plants of NOORo II (200 MW) and NOORo III (150 MW).

An innovative financing structure

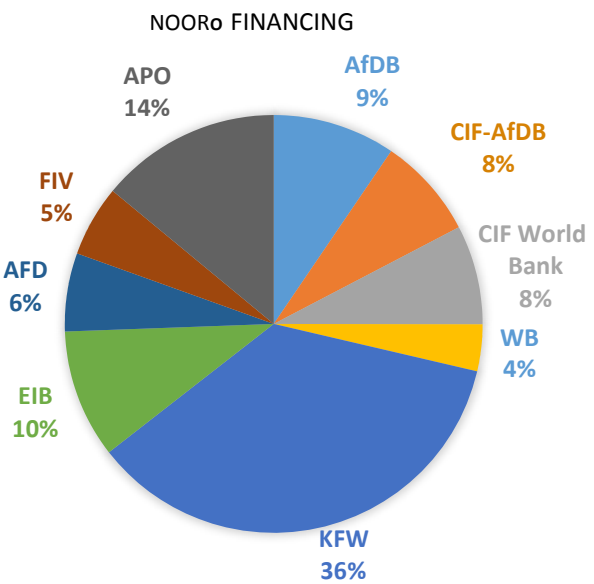
The overall project cost excluding taxes and customs duties is estimated at 2.105 billion euros. It funding is raised through arrangement.

The project uses an innovative PPP financing structure. It allows leveraging the capacities of a group of independent power producers to sell the electricity produced by the plant to the government. The financial support mechanism of the project aims to reduce the investment cost in concentrated solar energy to levels comparable to traditional technologies, and reduce the overall cost of electricity in Morocco. It should reduce the overall costs of concentrated solar energy by 3%.

The financial arrangement of the project was orchestrated by the African Development Bank and the World Bank. Besides these two international financial institutions, the funding associates the Clean Technology Fund of the Climate Investment Funds, the German KfW development bank, the French Development Agency (AFD), the European Investment Bank (EIB), the European Union, MASEN and private investors.

The funds loaned to MASEN by financial partners are reassigned to three project companies for each of the three plants. Each project company is owned by a private consortium selected following a tender process (75%) and MASEN (25%). The latter will be the single buyer of the electricity generated by the plants.

The funding breaks down as follows:



Name	Amount (million euros)
AfDB	200
FTP-AfDB	165
FTP– World Bank	162
WB	76
KFW	754
EIB	209,5
AFD	127,5
FIV	116
APO	295
Total	2 105

CIF : Climate Investment Funds

The key role of the African Development Bank

Through its Moroccan office, AfDB played a key role in the discussions between the Moroccan government, funding partners and technical partners.

Financing instruments proposed by AfDB include a traditional bank loan (5% of total funding) and a CTF loan (trust funds for clean technologies, also 5% of funding), which is part of the climate investment funds that are very involved in Africa.

The project is part of the innovative operations of AfDB in the energy sector. The technology used (concentrated thermal solar plants of major powers with thermal energy storage capacities of more than five hours) and the financial arrangement (electricity production in PPP supported by several donors) allowed the financial institution to assert its finance engineering capacity. The solutions developed for the arrangement have enabled the institution to acquire a know-how that can be reused.

For the whole project, AfDB Group has provided € 200 million from its own resources and €165 million via CTF (part of Climate Investment Funds). These amounts break down as follows:

- For NOORo I, out of an overall investment of € 634 million, AfDB provided € 100 million from its own resources and € 75 million via CTF
- For NOORo II, out of an overall investment of € 827 million, AfDB provided € 72 million from its own resources and € 52 million via CTF
- For NOORo III, out of an overall total investment of € 644 million, AfDB provided € 28 million from its own resources and € 38 million via CTF

Showcase for the New Deal on Energy

Noor is a showcase project for the AfDB's New Deal on Energy, instituted by AfDB President Adesina to transform energy in Africa by 2025, taking the country from its current energy-poor state to a continent which is lit up and powered as the passport to economic transformation for all Africans. In addition, Noor stands to serve as an example for the world about how to create effective pathways to green economies through renewable energy.

The Catalytic Role of the Climate Investment Funds

To spur and support the phased development of the NOOR CSP complex, $435 million in concessional funding from the Climate Investment Funds Clean Technology Fund was channeled through the African Development Bank (AfDB) and World Bank.

The CIF's CSP investments are intended to establish a record of performance for CSP technology, thereby lowering perceived risk and reducing future project costs for private sector CSP investors and developers. CIF allocations are expected to contribute to projected generation capacity of 1.1 GW, or more than one-quarter of the current global CSP capacity.

The CIF played an important role in enabling NOOR's successful financial close of more than $1bn. The CIF's involvement as a lender simplified a very complex project by automatically creating a logical investment framework for government and private bodies. Ultimately financed with 80% debt and 20% equity, CIF lending helped to reduce the project's energy costs by 25%.

The low-cost debt provided by the CIF -through its Clean Technology Fund ($197 million)- and other international financial institutions reduced Phase 1 project costs by about 25 percent compared to financing available from commercial banks in the market. It contributed to a winning bid that was 25 percent lower than initial cost projections: $0.18 per kilowatt-hour (kWh) compared to $0.24 per KWh. This will help reduce strain on public finances by lowering the amount of subsidy that the Moroccan government required, from $60 million to $20 million per year.

A strong impact for local development

An opportunity for local employment

NOORo is built on the site of Tamzaghten Izerki belonging to the ethnic community of Ait Ougrour Toundout. It directly benefits the province of Ouarzazate, one of Morocco's most disadvantaged regions: the poverty rate is around 23%, the human development index is among the lowest in the country (0.371); more than two thirds of the unemployed are young people under 35 years.

The construction of NOORo I created more than 500 jobs during the 12 months of construction, local workers holding nearly 42% of jobs. Construction of NOORo II and NOORo III plants should create 1,600 direct jobs, mostly non skilled local workforce. According to the terms of tenders, developers should give priority to local workforce.

During the 25 years of their operation, NOORo II and NOORo III plants will create over 200 direct jobs and hundreds of indirect jobs.

At the national level, the project is expected to give new impetus to the development of an industrial sector in the production of solar power equipment: plant developers have been encouraged to integrate local industrial solutions into their offerings.

Integration of women

The project also includes an important component for women to strengthen their socio-economic integration in the region and promote their employability. The project deployment includes various training programs aimed at enhancing the employability of women and their social and economic empowerment. Among these actions: a partnership with the poly-disciplinary faculty of Ouarzazate (in renewable energy sector), training of women entrepreneurs in the region, training in agricultural activities (gardening, farming, and arboriculture) and providing agricultural kits.

The project also promotes women's participation in decision-making through their presence in local decision-making bodies (including women's associations with gender perspectives in the region).

Contacts

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