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Federal Ministry for the
Environment, Nature Conservation,
Building and Nuclear Safety



Federal Ministry
for Economic Cooperation
and Development

Implemented by:



Solar Complex Ouarzazate - Morocco

Power from the desert

Morocco is a rising country: an increasing population, growing prosperity, grid connection for rural areas and new industrial locations lead to acceleration in energy demand. Up to now, the country is largely dependent on importing fossil fuels at high prices.

solar power complex named NOORo (“Noor” is Arabic for “light”, the “o” stands for Ouarzazate). The complex with its four power plants and a total capacity of up to 580 MW on an area of 3.000 ha is currently the world’s largest solar power complex. The projects will be implemented through a Public Private Partnership Structure. The public partner for this project is the Moroccan Agency for Sustainable Energy (MASEN).

Timetable

Construction works for the first power plant named “NOORo I” started in June 2013. The official inauguration took place in February 2016. The construction of

Context

The Moroccan government is pursuing an ambitious energy strategy: Until 2030, the capacities of solar, wind, and hydro energy shall be strongly expanded. The proportion of installed generation capacity based on renewable energies will therefore be 52% of the total installed capacity. This makes Morocco an international pioneer for the implementation of renewable energies. The described shift to renewable energy sources will not only contribute to the security of the country's electricity supply but also to global climate protection. As part of the Financial Cooperation with Morocco, KfW is supporting Morocco in the implementation of this plan on behalf of the Federal Ministry for Economic Cooperation and Development (BMZ) and the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB). In this context, the financing of the solar power complex Ouarzazate is a flagship project.

Project approach

Ouarzazate's surroundings with its rough gorges and plenty of sunshine already served for movie scenes in classics like “Lawrence of Arabia”, “Medicus” and “Game of Thrones”. Solar radiation intensity of more than 2.500 kWh per m² per year is extraordinarily high – an advantageous location for North Africa's first big

Project name	NOORo I - IV
Commissioned by	Federal Ministry for Economic Cooperation and Development (BMZ) Federal Ministry for Environment, Nature Conservation, Building and Nuclear Safety (BMUB)
Country/Region	Morocco
Lead executing agency	MASEN (Moroccan Agency for Sustainable Energy)





Solar field of NOORo I. Source: KfW Bildarchiv, photographer: Jens Steingässer.

NOORo II and III started mid-2015 and is expected to be completed in 2017/18. The tendering phase for NOORo IV has been concluded and the results will be published soon.

Technologies

Within the complex, three different kinds of technologies will be applied: two of the power plants are parabolic trough power plants, one is a solar tower power plant and one a photovoltaic power plant. NOORo I (160 MW) and NOORo II (200 MW) work with rows of parabolic mirrors which reflect bunched sunrays on a pipe that contains a heat transfer fluid. This process heats a steam circle which drives a conventional turbine. In contrast to these power plants, NOORo III is a 150 MW solar tower power plant. This technology concentrates the radiation energy by thousands of mirrors towards a recipient module at the top of a 240 m high tower. The absorbed thermal energy is then transferred through a steam circuit to the succeeding power block. Highlight of NOORo I-III are molten salt thermal energy storages that enable the power plants to also supply electricity during the evening hours. NOORo IV is going to be a photovoltaic power plant with ca. 70 MW capacity.

Investment Costs and Financing

Investment costs for the NOORo complex are about EUR 2.2 billion. The German contribution for the NOORo complex – BMZ, BMUB and KfW – is EUR 864 million. Out of this contribution, EUR 15 million is financed within the framework of the International Climate Initiative (IKI) and EUR 324 million in the framework of the German Climate and Technology Initiative (DKTI). Besides the German government, the European Commission, the European Investment Bank, the French Development Bank AFD, the Clean Technology Fund, the

African Development Bank as well as MASEN and a – by a tender identified – private investor contribute to the project.

Power generation costs

Within the last five years, costs for thermal solar power declined about a third. Ouarzazate's power plants will produce energy for approximately 12 Eurocent per kilowatt hour. In comparison to other power plants which are currently supplying the power demand in the evening hours in Morocco – gas and oil fired power stations – are those costs competitive.

Impact

The solar complex will generate environmentally friendly electricity for at least 1.3 million people. In comparison to conventional energy, a minimum of 800.000 tons CO₂ emissions per year will be avoided. Additionally, the country avoids the costly import of fossil primary energy like gas. Until now, Morocco is almost completely dependent on imported fossil fuels to produce power.

Desertec?

The solar complex in Ouarzazate serves as a reference to leverage low carbon and thereby climate friendly technologies of the future – not only in Morocco but also in the whole region. Although the produced energy is firstly supposed to cover Morocco's own needs, it will inspire the dream to export solar power for Europe's energy supply. Yet this idea is a vision, but Morocco is one of those countries that can further develop this vision – because chances for its own development can be seen within. Nevertheless, several parts within the political and technical framework are missing up to now.

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