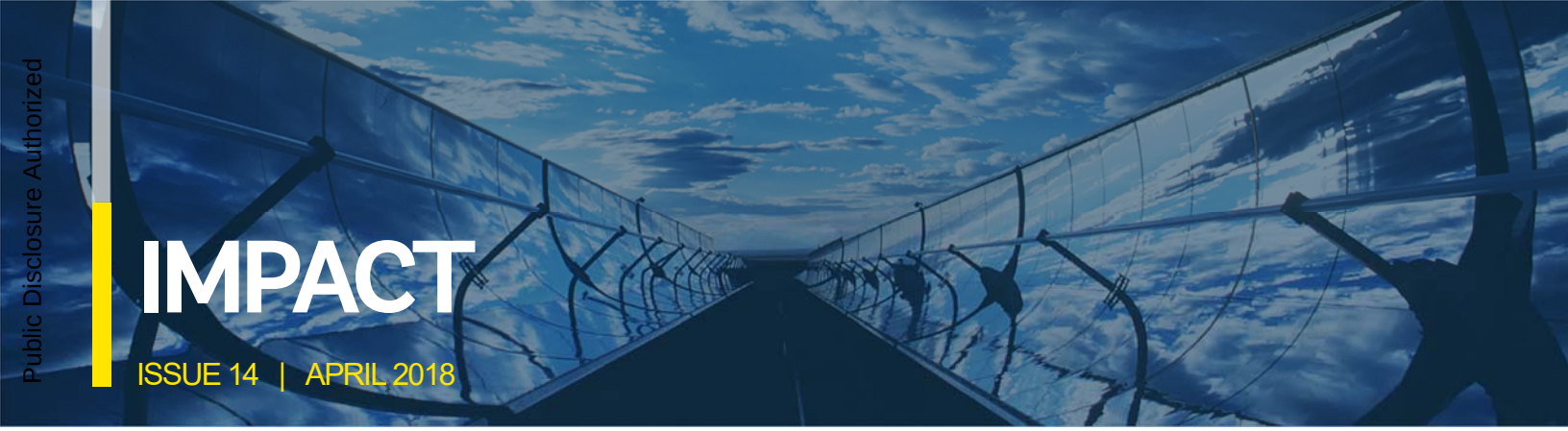

IMPACT
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BEYOND ELECTRICITY: HOW MOROCCO'S SOLAR PLANT IS BENEFITING COMMUNITIES AND WOMEN AND SHAPING THE REGION'S FUTURE

The Noor-Ouarzazate complex is one of the largest concentrating solar power (CSP) facilities in the world—so large, in fact, that it is visible from space. Its goal is to provide power to over one million Moroccans while reducing Morocco's oil consumption by about 2.5 million tons and cutting 760,000 tons of carbon emissions per year. It represents a bold step that underlines Morocco's commitment to breaking dependence on imported fossil fuels and moving toward low carbon development.

The Energy Sector Management Assistance Program (ESMAP) has provided comprehensive support to the government of Morocco since the beginning of the project. The result has been $200 million in World Bank financing and $97 million co-financing from the Clean Technology Fund (CTF) to construct the plant complex.

INVESTING IN A GLOBAL PUBLIC GOOD

CSP holds unique potential as a renewable resource that can provide flexible, reliable, utility-scale power even when the sun is not shining. However, high technology costs and limited operating examples can deter investors, especially in higher-risk emerging markets. Because development of CSP has the potential to be a global public good, the World Bank, through the CTF, financed a regional initiative to scale up CSP in five countries in the Middle East and North Africa, including Morocco. The initiative set out to reduce the high costs of CSP technology and therefore attract private sector investment.

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CONCENTRATING SOLAR POWER

Concentrating solar power (CSP) is more expensive to install than photovoltaic modules—solar panels that capture and convert sunlight into energy—but enables superior bulk energy storage. CSP works by using mirrors to focus and concentrate the sun's light, heating a liquid that then produces steam. The steam drives a turbine and generates electrical power. At the same time, the heat from the mirrors also melts a cylinder full of salt. The salt retains much of this warmth, staying hot enough at night to provide additional power.

ESMAP funding and early technical assistance were instrumental in building consensus among regional stakeholders on the way forward, establishing operational and legal frameworks, and undertaking economic analyses. Specifically for Morocco, two ESMAP studies helped to catalyze the large investment in the Noor-Ouarzazate complex.

The *Competitiveness Assessment of MENA Countries to Develop a Local Solar Industry* assessed Morocco's ability to attract private sector investment and provided recommendations necessary to develop a local solar industry.

The *Middle East and North Africa Region Assessment of the Local Manufacturing Potential for Concentrated Solar Power (CSP) Projects* found that CSP presented Morocco with an opportunity to generate local jobs and increase incomes, in addition to providing energy security and promoting renewable energy. CSP would create an entire industry where local manufacturers would supply specialized components and services throughout all three phases of development. In addition to economic benefits from construction and civil works, such manufacturers could also reap economic benefits by exporting CSP components.

To ensure that the valuable lessons of CSP development are captured and disseminated, ESMAP also supported various knowledge exchanges among practitioners and policy makers from across the region to learn from each other's experience with CSP.

Image Source: ©Yang Aijun| World Bank

Only two years after becoming operational, Noor-Ouarzazate I is outperforming expectations, setting an example for the rest of the region, and illustrating the value of CSP. Early results show that the plant

- Sourced 30-35% of the total project costs in local components and services
- Generated 160 MW capacity
- Impacted 347,780 direct beneficiaries
- Reduced greenhouse gases by 254,800 MT
- Returned 85% of site compensation cost, approximately US$3 million, to local communities through a pipeline of local development projects
- Contributed to the scale-up of CSP technology and subsequent verified reductions in the technology's costs.

EMPOWERING COMMUNITIES AND WOMEN

The Noor-Ouarzazate complex was not designed to merely produce electricity. It was a project for the Moroccan people and as such, it focused on creating economic opportunities for local communities and domestic manufacturing for CSP technologies. Field research carried out in 2015 found that populations in the neighboring villages are very proud of the project and its potential to improve their lives. Women appeared even more enthusiastic than men.

And they are right to be.

Women's participation in the labor force in Morocco is among the lowest in the world and in the Ouarzazate province that rate is even lower. They see the complex as an opportunity for employment, including in high-skilled, longer-term jobs.

ESMAP's study *Gender Equality in Energy Infrastructure: Lessons from Electricity Generation, Transmission, and Distribution Projects* looked at the situation more closely.

In Noor-Quarzazate's case, the study found that the local communities made choices that benefited everyone, including women and children. For example, instead of cash compensation for the land lost, which would benefit only male landowners, the community opted for investments in basic amenities and social services for all, such as draining and irrigation

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channels, drinking water facilities, community centers, and mobile health caravans. Some projects, like the construction of a dormitory for female students and sport and camp programs for children, directly and positively impact women.

While the project boosted employment opportunities, the study found that women still faced challenges in finding jobs because of inadequate qualifications and adverse gender norms in rural areas. Women represent only 4% of the CSP facility's workforce. Provisions for a safe and positive work environment for women made it possible for them to work in a range of positions within the complex, encompassing traditional activities such as catering, cleaning, and administration with some holding more technical roles in quality control and the health and safety unit, and in highly skilled positions such as topographer and welder. Without these provisions, their participation in the workforce would be even lower.

"With this bold step toward a clean energy future, Morocco is pioneering a greener development and developing a cutting-edge solar technology," **said Marie Francoise Marie-Nelly, World Bank Country Director for the Maghreb;** "the returns on this investment will be significant for the country and its people by enhancing energy security, creating a cleaner environment, and encouraging new industries and job creation."

THE NEXT PHASE: EXPORTING CSP

The second phase of the Noor-Ouarzazate complex is expected to create 11,000 new jobs. The construction for the site has already created 4,000 positions for Moroccans, ranging from low skilled work in construction to high-tech positions in engineering and management. The overall impact on Morocco's economy will be significant—estimated to be as much as US$4.6 billion by 2020.

A key component of the second phase CSP scale-up in Morocco is the creation of a viable green energy market to export the energy generated by the Noor-Ouarzazate complex to Europe. ESMAP worked with the government of Morocco to institute a regulatory framework and put in place a draft legal agreement allowing for electricity exports from Morocco to France and Germany through Spain.

BEYOND ELECTRICITY GENERATION

The project stands to deliver a lot.

Not only will it provide clean and reliable power for Moroccans, reduce their dependence on oil, and lower carbon emissions, but it is also expected to have significant gender and socioeconomic impacts.

But the Noor-Ouarzazate complex is already delivering much more—it is providing evidence for CSP as a

reliable investment and technology for electricity production; it is establishing the Middle East and North Africa as a place of tremendous potential for solar generation; and it is propelling Morocco into a regional leadership role in climate mitigation, as evidenced by the selection of Marrakech for the 22nd Session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP) in 2016.

ESMAP's support for the Noor-Ouarzazate complex has been comprehensive and has informed international efforts to finance the scale-up of CSP.

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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, the European Commission, Finland, France, Germany, Iceland, Italy, Japan, Lithuania, Luxemburg, the Netherlands, Norway, the Rockefeller Foundation, Sweden, Switzerland, and the United Kingdom, as well as The World Bank.

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