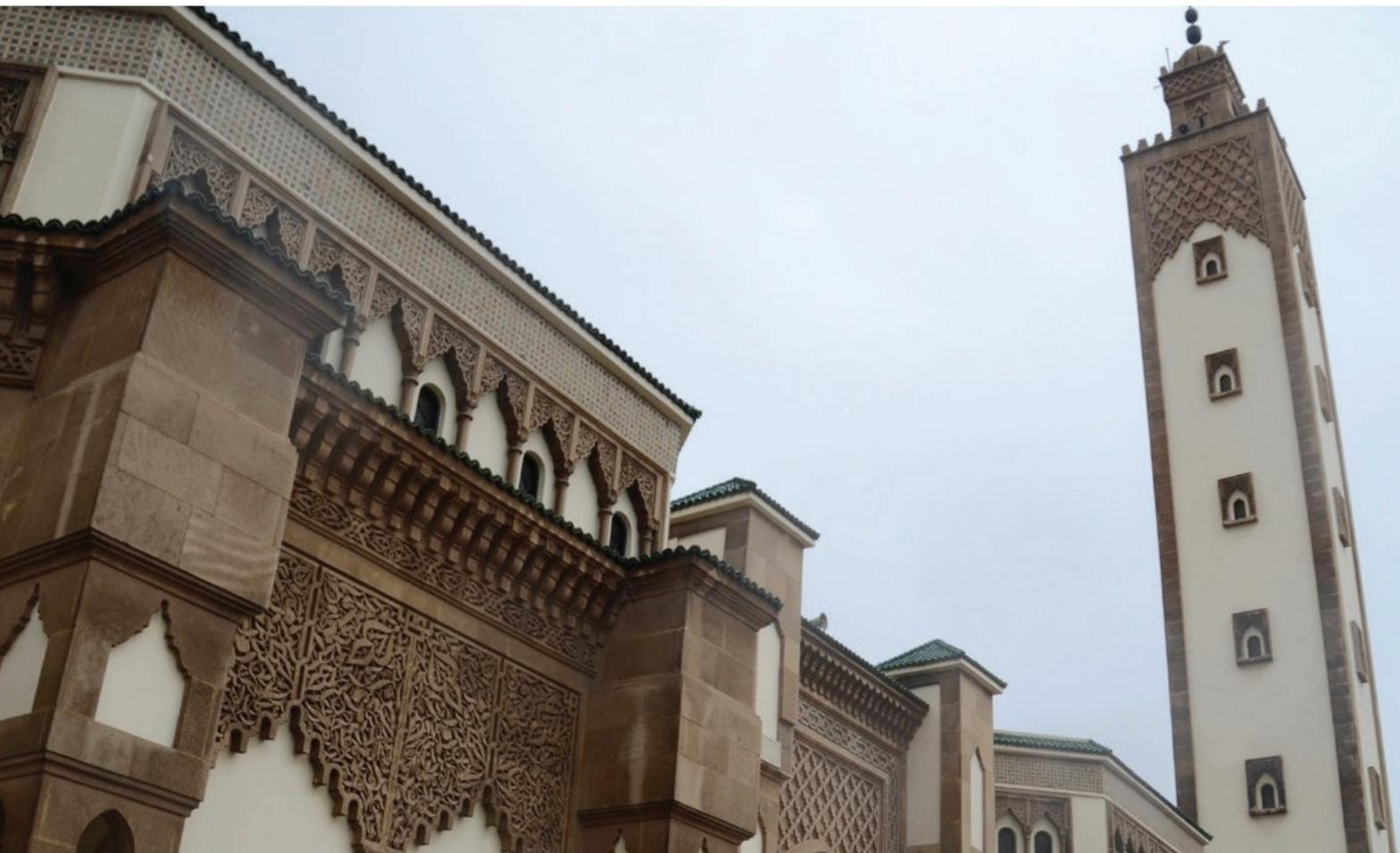




ENERGIZED

Policy innovations to power the transformation of
Africa's agriculture and food system



Morocco has made considerable progress in sustainable access to and use of energy in the agriculture sector. The pace of progress was strong between 1992 to 2013, with an increase in the electricity expansion indicatorⁱ of 10.98, thereby being above the average of 8 for Africa as a whole. Morocco also had an average agricultural value added per worker annual growth rate of 6.53 percent. In addition, Morocco scored 74 out of 100 on the RISE indexⁱⁱ in 2017 and is therefore considered a strong performer in terms of setting good national policy and regulatory frameworks

for sustainable energy access and use. Such progress is largely due to the government's institutional and programmatic commitments to enhance access to and use of energy across the country.

Institutional Innovations

The Ministry of Energy, Mining, and Environment (MEME) oversees overall energy policy design and implementation. The Ministry also ensures stable energy provision, defines the rules for energy markets, and manages the country's

i- This indicator is expressed in logarithm of the difference of number of Nighttime Lights pixels between 1992 and 2013.

ii- The World Bank's Regulatory Indicator for Sustainable Energy (RISE) assesses countries' policy and regulatory support for each of the three pillars of sustainable energy—access to modern energy, energy efficiency, and renewable energy. RISE classifies countries in three groups based on their score levels as strong performers (those with a score ≥ 67), middle performers (those with a score ≥ 34 and < 67), and weak performers (those with a score ≤ 33).



low-carbon transition by promoting energy efficiency and the use of renewable energy in all sectors of Morocco's economy.¹

In addition to MEME, several agencies work towards increasing overall energy access and use. The National Office of Electricity and Drinking Water (ONEE) was created in 2012, when the National Office of Electricity and the National Office of Drinking Water were merged, to promote sustainable development of water and electricity. ONEE is a public agency that owns the country's transmission network and infrastructure for electricity generation. It is the sole authorized buyer of electricity generated by other parties, including Independent Power Producers (IPPs). ONEE also oversees the import of electricity and its distribution either directly or through private and public distribution companies. The agency is also involved in the design and implementation of major structural projects.² Since the mid-1990s, ONEE aims to:

- Expand and modernize energy generation networks to improve access to electricity
- Ensure the marketing and distribution of power
- Improve the efficiency of electricity use.

To promote efficient energy use, in 2016 the National Agency for Energy Efficiency (AMEE) replaced the National Agency for Renewable Energies and Energy Efficiency, which had been created in 2010, to implement Morocco's policy on energy efficiency, to reduce energy dependence, and preserve the environment. In the agriculture sector, the agency promotes the adoption of solar-powered irrigation pumps as a means to energy efficiency and sustainable development.³

In 2010, the Moroccan Agency for Solar Energy (MASEN) was created as a limited company with public shareholders. Initially, MASEN was responsible for managing the deployment of solar energy under Morocco's solar energy plan. In 2016, however, the agency was renamed the Moroccan Agency for *Sustainable* Energy and its responsibilities were extended to cover of the use of all renewable energy technologies. MASEN promotes R&D by developing renewable energy projects and raising funds to finance them. Through renewable energy projects, MASEN aims to stimulate industrial development and job creation. MASEN also promotes training and capacity building, local development, and industrial integration to gradually build a national renewable energy industry.⁴

In 2011, the Institute for Research into Solar and Renewable Energies (IRESEN) was established as one of the main R&D and innovation bodies for energy. IRESEN is primarily a funding agency to support the government's renewable energy and energy efficiency strategies. IRESEN

identifies research priorities and projects, disseminates research findings, and promotes their effective use by businesses. It also finances and implements R&D projects. The innovation aspect has been fully operational since 2018 when IRESEN funded 20 projects under "Green INNO-PROJECT" and "Green INNO-BOOST" to develop innovative products, processes, and services in renewable energy with high commercialization potential in the national and continental markets.⁵ Furthermore, IRESEN seeks to develop a network of R&D facilities in collaboration with local universities and national and international research institutions. At the time of writing, IRESEN had established the first applied research center in Morocco – the Green Energy Park dedicated to solar technologies, including those for use in agriculture.⁶

In addition, the National Authority for Electricity Regulation (ANRE) was created in 2018 with a mandate to organize the open and competitive segment of the electricity sector. ANRE regulates access to networks, sets the tariffs for the use of transmission and medium-voltage grids, and ensures the efficient functioning of the market.⁷

Policy Innovations

Morocco has limited fossil fuel deposits, leaving it entirely dependent on imported fossil fuels for energy production. Consequently, the government faced the risks of rising costs for fossil fuel imports and the resulting high burden on public finances. Morocco has committed to improving energy efficiency in the National Priority Action Plan adopted for 2008–2012 and the 2009 National Energy Strategy. Morocco's National Energy Strategy foresees the development of the renewable energy sector to increase energy independence, guarantee energy access through secure and affordable energy supply, and protect the environment.⁸ The strategy is based on five main objectives:⁹

- Secure energy supply by diversifying fuel types and origins
- Development of renewable energy sources, especially solar and wind, as well as fossil fuels
- Overall energy efficiency improvements
- Universal energy provision and access at affordable prices
- Promotion of regional integration of energy among the Euro-Mediterranean markets through enhanced cooperation and trade with Maghreb and EU countries.

By 2014, Morocco had increased the share of renewable energy in its electricity generation capacity mix to 32 percent. The target for 2020 is to reach 42 percent.¹⁰



Drive for energy efficiency

Morocco's National Energy Efficiency strategy 2014–2030 has set ambitious targets for reducing final energy consumption by 25 percent by 2030. In the agriculture sector, the strategy aims to reduce energy intensity by 0.2 percent per year until 2030. Successful implementation of this strategy would create an estimated 520,000 direct and indirect jobs and increase the purchasing power of Moroccan households by 1.2 percent by 2030.¹¹ Some actions planned under the energy efficiency strategy aim to:¹²

- Raise awareness among nearly 1.4 million farmers by 2030 on good practices in the use of agricultural equipment
- Train farmers and other operators on the use of renewable energy technologies and energy efficiency practices
- Promote solar irrigation use by subsidizing 1,000 solar pumps per year by up to 50 percent (with a limit of US\$5,500)
- Establish national standards for solar irrigation installations
- Conduct mandatory energy audits and information sharing for farms greater than 100 ha, bringing the threshold to 50 ha in 2020, and to 20 ha in 2025.

Creating a private sector market for renewables growth

The increase in energy access in Morocco began in the 1990s with the partial liberalization of the electricity sector that allowed the involvement of IPPs and the implementation of large-scale electrification programs. In 1994, a law was passed allowing IPPs to produce up to 10 MW for their own use, but with the obligation to sell the surplus exclusively to ONEE at an agreed price. Due to the growing demand for electricity, another law was passed in 2008 that enabled IPPs to produce up to 50 MW of electricity with all excess power to be sold to ONEE through so-called Power Purchase Agreements. The aim was to improve overall electricity supply.¹³ IPPs have played a great role in achieving the objectives of the private sector in power generation.¹⁴

Programmatic Interventions

Morocco's rural electrification program (PERG). Under Act No. 13-09 of 2010 amended and supplemented by Act No. 58-15 in 2016, the government of Morocco allows private companies to produce electricity from renewable sources and to buy it from the market.¹⁴ The IPP model was considered a success that significantly increased the share of the private sector in power generation.¹⁵ Morocco's rural electrification program (PERG) is one



example of a large-scale program that started in 1990 and which markedly improved electricity access even in remote, rural communities that could not previously be connected to the country's main grids. PERG boosted access to electricity by providing locally adapted solutions. For each rural community, the program implemented the most viable solution among the range of off-grid options, including photovoltaic generators, small hydro turbines, wind turbines, diesel generators, and hybrid systems. Between 1995 and 2009, more than 35,000 villages were electrified, connecting nearly 1.9 million rural households to electricity. The rural electrification rate increased from 18 percent in 1996 to 97 percent by 2009.¹⁶

To achieve greater energy efficiency in the agriculture sector, a voluntary energy audit program for agricultural producers was carried out by Groupe Crédit Agricole du Maroc and AMEE between 2011 and 2012. The program quantified energy consumption and estimated the savings potential that would result from the use of more efficient equipment or the adoption of good energy practices including the replacement of fossil fuels with renewable energy. A *Practical Guide to Energy Efficiency in Farms* published by Groupe Crédit Agricole du Maroc allows producers to make informed decisions and to prioritize energy efficiency measures or renewable energy production to optimize consumption and reduce household expenditures. A public-private partnership between AMEE and the Groupe Crédit Agricole du Maroc was established to provide technical assistance to farms involved in the project.¹⁷

Fiscal incentives for renewables adoption at scale

In 2013, a National Solar Irrigation Program was launched to subsidize solar pumping over an area of 100,000 ha over three years. A subsidy of up to 50 percent of the installation

cost of solar panels was provided to farmers through the Energy Development Fund. Initially, only small farms of up to 5 ha were to benefit from the subsidy, however, the government subsequently opted to make larger farms also eligible when using localized irrigation systems that would save water resources.^{18, 19}

There is evidence of the positive impact of solar pumping on the socioeconomic situation of Moroccan farmers. An evaluation in three zones—Marrakesh, Midelt, and Tata—found that the time required for return on investment in solar pumping was between 2.7 and 3.6 years, and the increased profit margin ranged from US\$839 to US\$12,500 per hectare. The increased profit is partly due to a reduction in the irrigation systems operations and capital costs as a result of switching to solar pumping systems. This represents on average an 80 percent gain for the farmer and is equivalent to US\$740/ha/year for switching from an electrical pumping system, US\$806/ha/year for switching from a butane pumping system, and US\$950/ha/year from a diesel pumping system.²⁰

Morocco's electrification program has been extremely successful because of its focused and coordinated approach, which combines both supply and demand side solutions. The involvement of the private sector through public-private partnerships increased the share of renewable energy in the energy mix, facilitating the development of locally adopted solutions. This in turn has generated a positive impact on both the rate of electrification and agricultural growth.





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