

RES4 MED

Country Profiles

RENEWABLE ENERGY SOLUTIONS
FOR THE MEDITERRANEAN



Morocco

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Abbreviations

AFD	Agence Française de Développement
ADEREE	National Agency for the development of Renewable Energy and Energy Efficiency
BOO	Build Own Operate
BOOT	Build Own Operate Transfer
CCGT	Combined Cycle Gas Turbine
CSP	Concentrated Solar Power
DSO	Distributor System Operator
EC	European Commission
EDF	Energy Development Fund
EIB	European Investment Bank
EPC	Engineering Procurement Construction
EU	European Union
FiT	Feed-in-Tariff
GDP	Gross Domestic Product
GW	Gigawatt
IPP	Independent Power Purchase
IRESEN	Institut de Recherche en Energie Solaire et Energies Nouvelles
kWh	Kilowatt Hour
MASEN	Moroccan Agency for Solar Energy
MD	Moroccan Dirham
MEMEE	Ministry of Energy, Mines, Water and Environment
MoU	Memorandum of Understanding
MW	Megawatt
ONEE	Office National de l'Electricité et de l'eau
O&M	Operation and Maintenance
PPA	Power Purchase Agreement
PV	Photovoltaic
RE	Renewable Energy
SIE	Société d'Investissements Energetiques
SPV	Special Purpose Vehicle
TPA	Third Party Agreement
TSO	Transmission System Operator
TWh	Terawatt Hour

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Abstract

From announcing a **52% renewable energy target** at COP 21 to launching the first phase of the **world's largest CSP plant** in Ouarzazate, Morocco has been making impressive headlines and has positioned itself at the forefront of the renewable energy world. Having no significant conventional energy sources of its own, Morocco is the **largest net importer of energy in Africa**. With a young and growing population and plans to continue developing and diversifying the economy, a precise and committed energy strategy was developed, with renewable energy at the very core of it.

Since 2009, Moroccan has taken important strides in developing a modern energy market, further opening up and reforming the power sector, **setting clear renewable energy targets, establishing dedicated entities to implement the national programmes and facilitating the regulatory and financial means necessary**. Despite some delays and setbacks, the Moroccan experience can largely be considered a success, reflected by the number of private and international developers and financiers already involved in the market and the number of plants currently being developed that ensure that the initial 42% of installed capacity by 2020 target is on track to be met.

Morocco benefits from strong **solar and wind energy sources** and has set out to utilise them by opening up the market through **competitive bidding processes** that have resulted in some of the lowest recorded prices in the respective technologies. Aside from contributing to new installed capacities, the developments in the energy market have had various positive impacts, attracting foreign direct investments, setting the foundations for a renewable energy manufacturing industry, creating jobs, initiating energy efficiency efforts and giving a positive and modern image of Morocco to the world.

This country profile aims to show how Morocco managed to attract the attention of the renewable energy world, demonstrating how the government's legislative and institutional efforts are changing the structure of the power sector in the country.

A **full picture of the current renewable energy market and planned projects** is given as well as a view of how it will develop over the next years as the country's renewable energy plan continues to take shape. The document provides detailed information on the regulatory framework for renewable energy (laws and regulations), the main initiatives in the energy efficiency sector and data on the main market operators active in Morocco.

1 Moroccan macroeconomic context

The Kingdom of Morocco is one of three countries alongside Spain and France to have both Mediterranean and Atlantic coastlines. Through its Atlantic coastline, which reaches past the Strait of Gibraltar into the Mediterranean, Morocco has close access to a key route for international shipping between two major waterways. To the north, Morocco also shares land borders with Spain allowing it direct access to Europe while its Eastern and Southern borders with Algeria and Mauritania respectively, connect it strongly to the Arab world and Sub-Saharan Africa.

Morocco has a population of around **34 million people** making it the 11th most populous African country and the 5th most populous in the Arab world. After a mixed economic performance in 2014, the Moroccan economy picked up again in 2015 thanks to an exceptional 2014/2015 agricultural season.

GDP growth rate is projected to have rebounded to 4.7% in 2015¹. **Inflation** has been kept under 2% reflecting the continued prudent monetary policy and the effect of the fall in international commodity prices. The **unemployment rate** has picked up slightly to 10.1%² in 2015, up from 9.6% in 2014 (The World Bank³).

Morocco's economy relies mainly on **services (52%)**, **industry (33%)** and **tourism (15%)** for its total GDP. Morocco still depends heavily on a volatile and weakly productive **agricultural sector** that while only accounting for around **14%** of GDP, **employs over 40%** of the population. In recent years, Morocco initiated major political and economic changes with a focus on **renewable energy** and **sustainable development**, with the aim of modernising and diversifying the economy.

Morocco's political landscape has been relatively stable in past decades and the adoption of a new Constitution in 2011 set the basis for a more open and democratic society, increased decentralisation, modern institutions and a renewed state of law more broadly. The current coalition government is continuing to roll out constitutional reforms and taking bold steps to **reduce the fiscal deficit**, namely through the **phasing out of fossil fuel subsidies**.

Table 1- Key macroeconomic figures as of 2015

Item	Value
Area	710.850 km ²
Population	34 M
Population Growth	1,24%
GDP	\$110 B
GDP per capita	\$3.077
Real GDP growth rate	2,4%
Inflation	0,4%
Unemployment	10.1%

Sources: World Bank, IMF, High Commission for Planning of Morocco

¹ IMF Regional Economic Outlook: Middle East and Central Asia

² IMF Country Report No. 16/38 Morocco (2016)

³ World Bank <http://www.worldbank.org/en/country/morocco/overview#1>

2 Power Sector Overview

Table 2- Power market figures

Item	Value (2015)
Electricity Demand	34.413 GWh
Electricity Demand Growth Rate (2014/15)	2,6%
Total Power Generation*	28.081,5 GWh
Total Generation Capacity	8.160 GW
Peak Demand*	5,7 GW
Peak Demand Growth (2013/14)	1,6%
Rural electrification rate	99.13%

* 2014 data

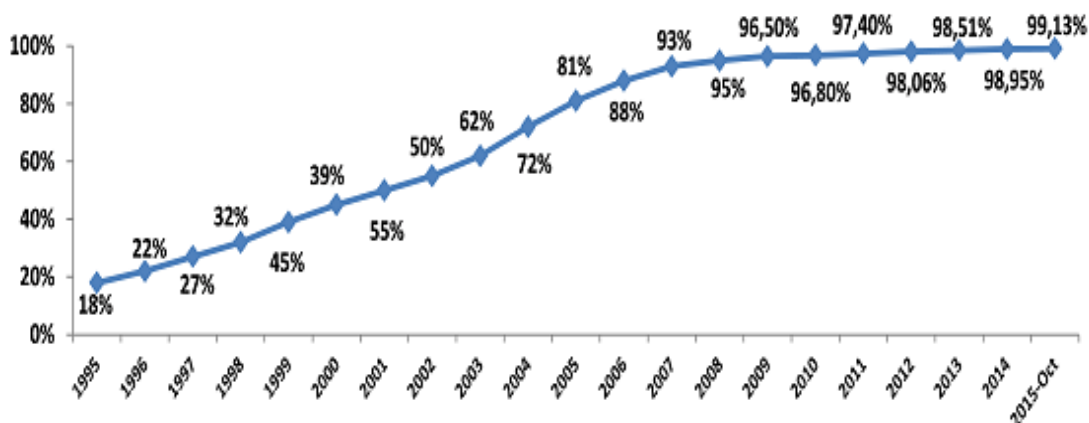
Source: ONEE, MEED

The Moroccan power sector is characterised largely by a **high degree of energy dependence**. Over 95% of Morocco's energy supply comes from abroad through imported coal, gas, oil, oil products and electricity. Given the lack of hydrocarbon sources, Morocco faces fiscal pressures as its balance of payments is disadvantaged by importing fossil fuels and its budget drained by subsidising them, in addition to the instability caused by the volatility of global energy prices.

One of the most important features of the Moroccan power sector in recent years, has been the vast expansion of the electricity network. In 1996, the government launched a 15-year rural electrification programme with the aim of increasing rural electrification to 80% by 2010- up from 18% in 1995. In fact, the programme has surpassed its targets, achieving the 80% mark in 2005, and as of October 2015, the coverage had reached 99.13% for a total investment of MD 22.4bn.

The graph below shows the evolution of Morocco's rural electrification rate since the launch of the programme.

Figure 1-Morocco rural electrification (1995-2015)



Source: Ministry of Energy, Mines, Water and Environment (MEMEE)

The huge success of the programme in connecting all of the country to the electricity network in a considerably short time is impressive and set the basis for a growing and diversifying economy, achieving steady growth year-on-year. Yet, the higher electrification levels coupled with a growing population and economy and thus higher energy demand comes with its own set of economic and environmental challenges; paving the way for the current renewable energy and energy efficiency efforts.

2.1 Legislative and regulatory framework

The Moroccan power sector has undergone a series of **reforms since the early 1990s**. Facing a serious power supply shortage, the government decided to overhaul the legal framework in place. A new amendment allowing private investment and the introduction of the **Independent Power Producers (IPPs) model** was key to this strategy. Additionally, there was an emphasis on diversifying fuel sources and **reducing dependence on oil and hydropower**, reflected by the **introduction of natural gas** into the power mix, **increasing the share of coal** and developing programmes to **encourage wind and solar power generation**.

More, there was a focus on the restructuring and improvement of the operational performance of the **electricity Company** (*Office National de l'électricité e de l'eau – ONEE*) to ensure its capability of handling new power generation technologies and energy conservation measures. In 1994, the government adopted a decree that allowed ONEE to enter into **Power Purchase Agreements (PPAs)** with independent and private power producers. In 2008, another step towards opening the power generation market was taken as private power producers were allowed to **own and operate** plants with capacities not exceeding 50 MW, selling their electricity directly to industrial consumers.

Finally, in 2009, the Moroccan government developed a **National Energy Strategy** setting clear and precise objectives. The strategy covers five key elements:

1. **Optimising the fuel mix in the electricity sector:** by reducing dependence on oil and hydropower and increasing the share of gas, solar and wind and thus having a more balanced fuel mix that is not susceptible to the volatility of oil prices and the fluctuating efficiency of hydro.
2. **Accelerating the development of energy from renewable sources, especially wind, solar and hydropower:** capitalising on the established hydropower expertise and making use of the impressive solar and wind regimes especially in light of advancing technology and lower prices.
3. **Making energy efficiency a national priority:** reducing energy intensity and benefitting from growing technology and industry to optimise ever-increasing energy consumption.
4. **Encouraging more foreign investments in the energy sector:** opening the sector to foreign capital to match the size and volume of needed investments and take advantage of experienced players in power generation while boosting the economy with higher Foreign Direct Investments (FDIs).
5. **Promoting greater regional integration:** widening and utilising the shared electricity networks with Europe (via Spain) and Algeria to further optimise distribution, costs and efficiency.

The main laws and regulations for the electricity sector are summarised in the table below. Renewable energy and energy efficiency specific laws are covered in Section 3.3.

Law	Content
Electricity Law (1994)	Opening the electricity market to Independent Power Producers (IPPs) under 3 conditions: <ul style="list-style-type: none">– infrastructures must be owned by ONEE with production under concession;– operators must be chosen through a call for tender;– IPP must be guaranteed a contract.
Decree 1-06-15 (2006)	Requiring public institutions to award and fund projects on the base of competitive public bidding.
Self-Generation Law 16-08 (2008)	Allowing major industrial facilities to self-generate their power up to an equivalent power output of 50 MW (higher ceiling compared to the previous limit of 10MW). In this way large industrial sites are facilitated to produce their own energy

Law	Content
	locally.

2.2 Key stakeholders

Institution	Role
Ministry of Energy, Mines, Water and Environment (MEMEE)	The Ministry is responsible for the regulation of the energy sector. It is made up of three main departments; the Mining Development department, the Fuels and Energy department and the Electricity and Renewable energies department.
Office National de l'Electricité et de l'Eau (ONEE)	It is the national electricity Company ensuring transmission, distribution (55%) and generation (74%). ONEE manages the overall power demand and manages and develops the transmission network. In addition, it works on expanding rural electrification and on promoting and developing renewable energy.

In Morocco there is no National Regulatory Authority yet. According to IEA⁴, a proposal was underway on the establishment of a National Energy Regulatory Authority (ANRE) to regulate both electricity and gas markets. In November 2014, the Minister of Energy, Mr. Abdelkader Amara – during a speech on the development of large scale PV projects – confirmed that the establishment of an independent regulatory authority is one of the five main strands to achieve PV targets⁵. Yet, as of March 2016, Morocco still operates without such a body leaving **ONEE acting as both a decision maker and regulator**. Accelerating the establishment of an independent regulatory authority is key in further opening up the power market while increasing confidence, transparency and efficiency.

2.3 Market structure

The electricity market in Morocco is dominated by the **state-owned** operator **ONEE**. With the exception of renewable energy produced under the framework of **Law 13/09**⁶, ONEE acts as the **single buyer** in the sector and owns and operates an important share of the **generation capacity** (74%); however, ONEE can give concessions to private operators with purchase guarantees.

The power sector in Morocco depends on bilateral **contracts** and long-term PPAs between buyer and seller and thus there is no real time trading or a **market operator** function. Given that ONEE generates a large portion of electricity, **trading** is bypassed altogether and ONEE handles the entire chain until delivery to final customer. However, in the case of IPPs (26% of generation), a **PPA must be negotiated with ONEE** except in the case of production from renewable energy sources (RES) outside the framework of the national solar and wind programmes, under which a **PPA is agreed directly with the consumer**.

ONEE owns the complete **transmission network** and is responsible for **operating** and **expanding** the grid. The transmission grid covers the entire country (aside from a small network in the south) and is interconnected with the European and Algerian power networks. The regional power interconnections are well developed but actual electricity exchanges are fairly limited.

ONEE also owns and operates much of the **distribution network** and is the main retail supplier. Responsibility for the **distribution subsector** is divided at the Government level between the Ministry of Energy, Mines, Water and Environment (MEMEE), which has oversight over ONEE, and the Ministry

⁴ IEA-Morocco, 2014 *Energy Policies Beyond IEA Countries*

⁵ Morocco Ministry of Energy and Mines (MEMEE), Abdelkader Amara dévoile sa feuille de route pour le développement de l'utilisation de l'énergie solaire photovoltaïque au Maroc à l'occasion de l'inauguration de la Première édition du Salon International sur le Photovoltaïque: Photovoltaica, 4 November 2014, p. 5, <http://www.mem.gov.ma/SitePages/Discours/Discours%20Mle%20Ministre3nov%202014.pdf>

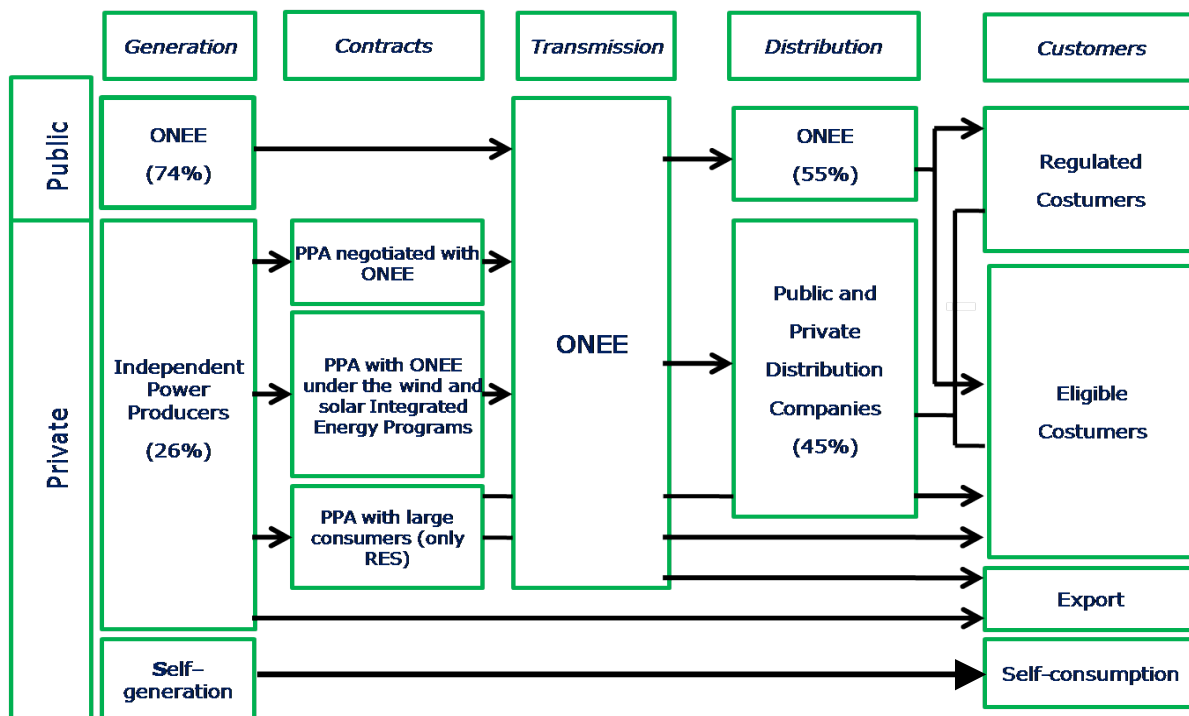
⁶ This law allows electricity to be produced and exported by any private producer as long as they utilise renewable energy sources. **See section (3.1)**

of Interior (MI), which supervises the overall performance of the public enterprises responsible for the distribution of water and electricity in large urban areas. Morocco's power distribution subsector includes seven local municipal utilities (Régies) as well as four private distribution utilities (gestionnaires délégués). Essentially, the local authority assigns to the private sector the task of investment, construction and operation to deliver electricity, water and sewerage to the municipalities through long-term concession agreements⁷. The roles of the public and private parties were defined as follows:

- The **public authority** acts as a decision maker and regulator, setting the investment programme and performance objectives for public services so as to protect the interest of consumers and the environment.
- The **private partner** must achieve an efficient and financially sustainable management of the public service, adopt a commercially-minded approach and provide the technical expertise to make the appropriate investment and operational decisions.

The figure below depicts the structure of the Moroccan power market.

Figure 2-Power market structure



Source: Enel Green Power

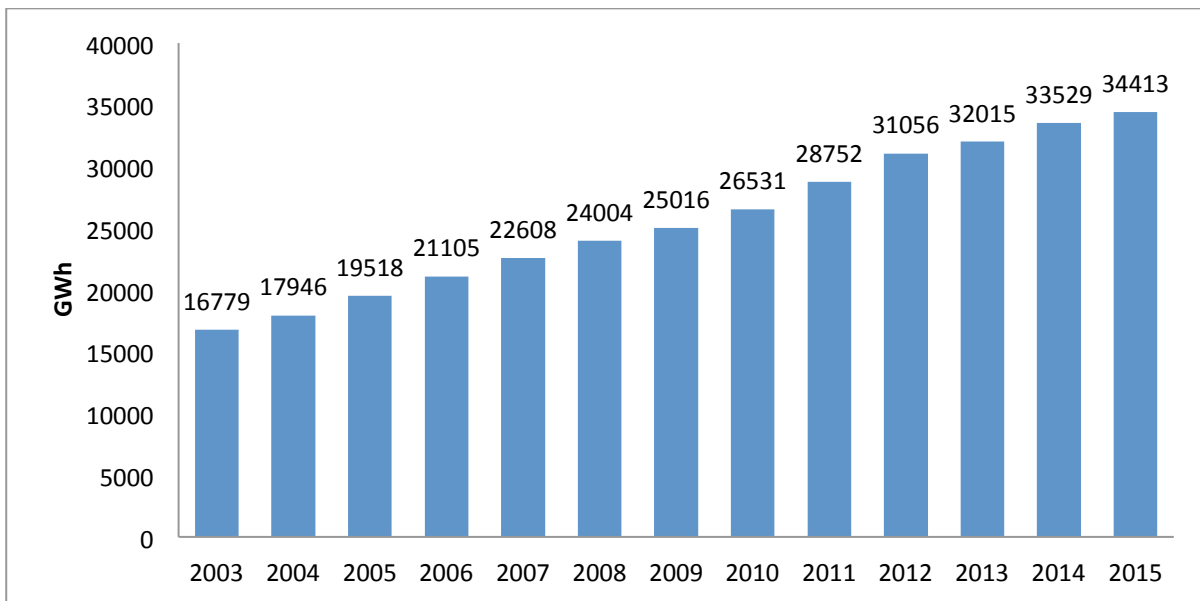
2.4 Electricity demand

Power demand in Morocco is growing rapidly, based on the drivers of a growing population, increased access to electricity, development of major infrastructure projects, urbanisation economic growth and improving standards of living. In 2015, electricity consumption totalled **34,4 TWh**, a 2,6% increase on the previous year. However, electricity demand had grown at an average annual rate of around 6,5% between 2003 and 2014. The peak daily usage was **107,6 GWh**, up 1,9% on 2013.

⁷ In 1997, the French Lyonnaise des Eaux (LYDEC) took control of the municipality owned distribution utility in Casablanca through a 30-year concession agreement.

The figure below shows the evolution of power demand between 2003 and 2014.

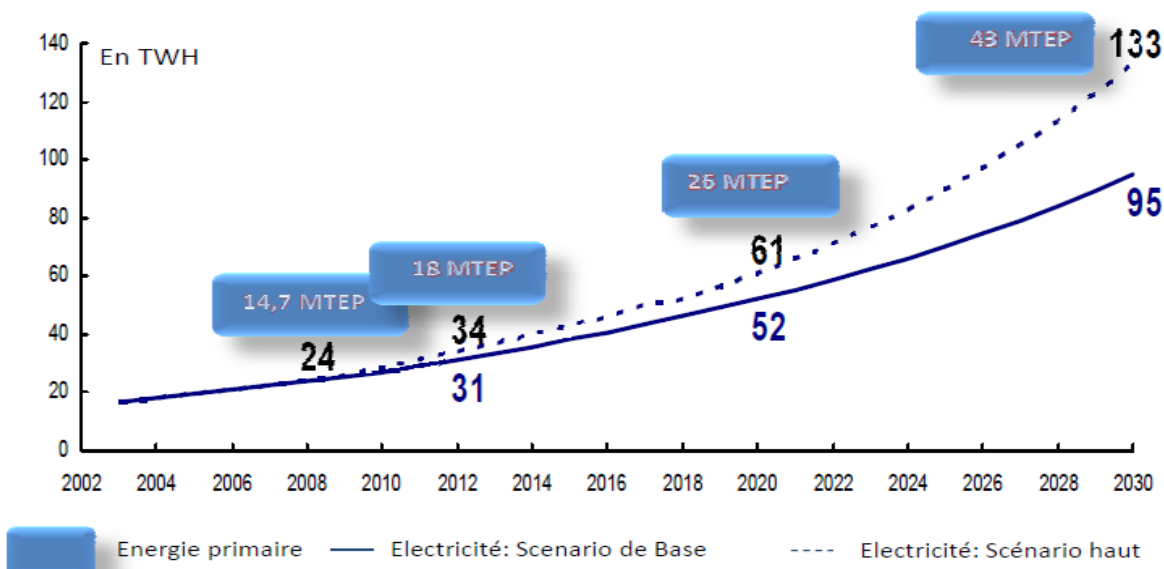
Figure 3- Power demand growth (2003-2014)



Source: ONEE

The peak demand in 2014 was recorded at 5.670 MW, up 1,6% on the 2013 peak of 5.580 MW. By the end of 2014, total installed generation capacity was **7.993MW (ONEE, 2015)**.

Figure 4- Forecasted electricity demand based on 2 scenarios developed by MEMEE

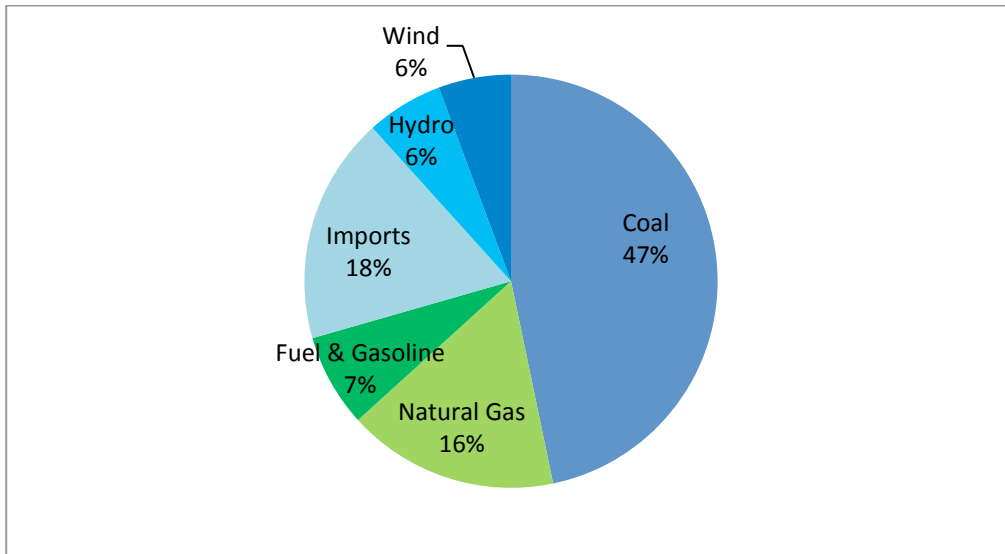


On the basis of the scenarios developed by MEMEE, it is estimated that following a conservative scenario, demand for electricity will reach **52 TWh by 2020 and 95 TWh** by 2030 (55% and 183% higher than demand in 2014). On the basis of a high demand scenario, the demand will be **61 TWh on 2020 and 133 TWh on 2030**. This means that the demand will double between 2014 and 2020 and will quadruple between 2014 and 2030. The **annual investment required** to keep up with demand growth is estimated to be about **MD 22bn (\$2,6bn)**.

2.5 Energy supply

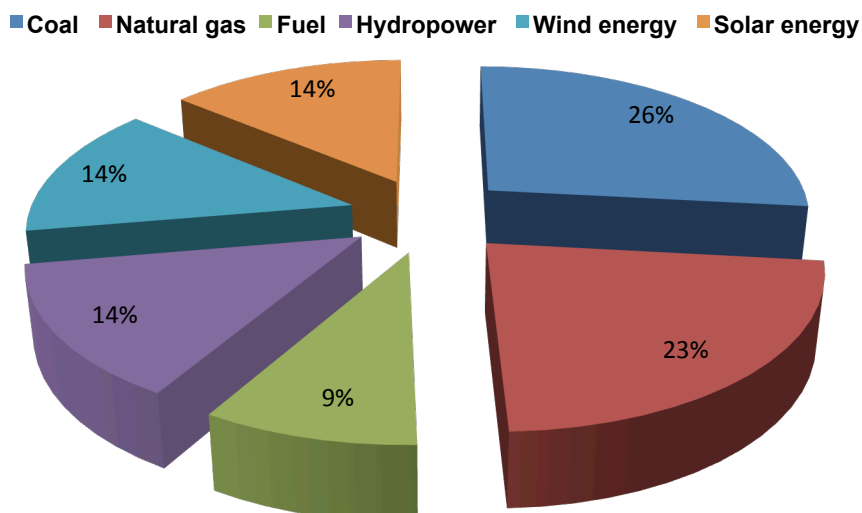
As of 2014, Morocco's total installed power generation capacity was **8 GW**. Given the fluctuations in hydropower output, Morocco **consumes more electricity than it produces**, making up the balance with electricity imports. In 2014, ONEE sold **28.825 GWh** of electricity, compared with a **demand of 33.530 GWh**. This demand was satisfied mainly through thermal production, which accounted for **23.884 GWh**; split **15.818 GWh coal**, **5.600 GWh natural gas** and the remaining **2.465 GWh** coming from **fuel and gasoline**. **Imports** accounted for **6.010 GWh** of electricity supplied while **renewables totalled 3.957 GWh**; of which **2.033 GWh** came from **hydropower** and **1.924 GWh** from **wind**. The following figure depicts Morocco's energy mix in 2014.

Figure 5- Energy supply (2014)



Morocco shares cross-border power connections with Spain and Algeria, each with a capacity of **1.400 MW**. Morocco has been importing increasing amounts of electricity from Spain in order to make up its production deficit, and also to leverage the lower cost of Spanish power compared to the marginal cost of increasing production locally. In 2014, **imports from Spain amounted to 5.834 GWh (18% of power generated)** compared with 1.000 GWh in 2005. In 2012, Morocco exported a balance of 56,8 GWh to Algeria, while in 2014 it **imported a balance of 176,5 GWh**. There are plans to increase the capacity of both connections from 1.400 MW to **2.100 MW**.

Figure 6- Projected Power Mix 2020



The figure above shows the projected power generation mix by 2020. Renewables' share in the power mix will attain 42% (solar, wind and hydropower will account for 14% each); coal will account for 26%, natural gas will account for 23% and fuel will drop to 9%. It is forecasted that the total capacity by 2020 will reach **14.285 MW**.

3 Renewable energy (RE) and Energy efficiency (EE)

This section will follow Morocco's efforts in the renewable energy (RE) and energy efficiency (EE) sectors, going through target-setting, the designated legislative and regulatory framework, key stakeholders, financing initiatives and finally the potential to be exploited.

3.1 Renewable Energy target

One of the first steps towards Morocco's efforts to promote investments in RE is the **EnergiPro** initiative launched in **2006**, which encourages industrial players to reduce their costs by producing their own energy with projects up to **50 MW**⁸. As part of this initiative, ONEE guarantees access to the national grid, and the purchase of any excess electricity produced at an incentive tariff. EnergiPro has two main benefits:

1. it allows producers to transmit electricity across the grid at a fixed cost
2. It allows ONEE to purchase RE from the private sector at 20% above ONE's peak and off-peak tariffs.

Alongside the National Energy Strategy of 2009, Morocco announced one of the most ambitious renewable energy targets in the region, aiming to boast **42%** of renewable energy sources in its total installed capacity by **2020**. This target requires **6 GW** of renewable installed capacity, split between **hydropower (2 GW), solar (2 GW) and wind (2 GW)**. During COP 21, a target of **52% of total installed capacity by 2030** was announced. The new target aims to bring hydropower up to (3 GW), solar to (5 GW) and wind to (5 GW). As of March 2016, the implementation schemes are yet to be announced.

Two public programmes were launched between 2009 and 2010 as cornerstones of the National Renewable Energy Strategy to foster the development of solar and wind capacities.

3.1.1 Moroccan Solar Programme

Launched in November 2009 and implemented by Moroccan Agency for Solar Energy (MASEN), the programme aims at developing **2.000 MW** of solar capacity by 2020, requiring an estimated investment of **\$9 billion**. The programme is expected to deliver an annual production of **4.500 GWh**, corresponding to 18% of current yearly production, targeting annual fuel savings of 1 mn (toe) and the avoidance of 3.7 mn tonnes of CO₂ emissions per year.

According to the programme, projects are developed through an IPP competitive bidding process, in which MASEN invites private developers to bid for the projects on a "build, own, operate and transfer" (BOOT) basis, supported by a 25 year fixed term PPA with MASEN.

As an off-taker, ONEE is required to buy the energy produced from MASEN at grid price through a second PPA. The government pays MASEN the difference between the two contracts, thus protecting the private developer from the volatility of energy prices. It is worth noting that MASEN is 25% owned by the state-owned ONEE and it generally takes a 25% stake in private power projects, with the developer owning the remaining 75%.

3.1.2 Integrated Wind Energy Programme

Launched in 2010 and implemented by ONEE, the programme intends to increase the wind capacity from 280 MW (in 2010) to **2.000 MW** by 2020, requiring an estimated investment of **\$3.5 billion**. The programme is expected to deliver an annual production of **6.600 GWh**, corresponding to 26% of current yearly production, targeting annual fuel savings of 1.5 mn (toe) and the avoidance of 5.6 mn

⁸ A project law is being processed to change the threshold for self production from 50 MW to 300 MW.

tonnes of CO2 emissions per year. Aside from raising wind power's share to 14% of total production, the programme intends to establish a high level of expertise and strengthen research and development so as to benefit the technological and industrial sectors.

According to the programme, projects are developed through an **IPP competitive bidding process**. Private developers are invited by ONEE to bid for the projects on a "build, own, operate and transfer" (**BOOT**) basis. The successful bidder forms a company, under the Moroccan legal framework, with ONEE, Société d'Investissements Énergétiques (SIE) and Hassan II Fund, and will be responsible for the development, financing, construction and operation and maintenance of the project. ONEE will purchase the electricity generation for **20 years**, in accordance with the **PPA** to be agreed with the project developer.

To compliment the implementation programmes, the **2010 Renewable Energy Law 13-09** set out a legislative framework for the promotion of renewable investments, establishing a procedure for the authorisation of renewable energy installations as well as production, distribution and trade; thereby opening a new market segment in which certain industrial customers are allowed to freely choose their electricity suppliers (Morocco Power Sector Transition, 2015).

3.2 Energy Efficiency target

Morocco is regarded as one of the regional leaders in energy efficiency, in terms of target-setting, facilitating the regulatory framework and developing the implementation mechanisms and programmes. The 2009 National Energy Strategy established **energy efficiency as a national priority** and upon its establishment in 2010, the Moroccan Agency for Development of Renewable Energy and Energy Efficiency (**ADEREE**) **set up an energy efficiency plan** to secure a sustainable future for the country. The **energy efficiency strategy** was published in 2013, setting energy saving objectives of **12% by 2020** and **15% by 2030**.

The government also launched an energy efficiency programme covering four areas:

1. Residential and commercial sectors;
2. Industrial sector;
3. Transport sector;
4. Public administration.

Although Morocco is still **lacking energy efficiency targets by sector**, several energy savings measures are being executed or are in planning for administrative buildings, collective and individual housing, public companies and economic and social sectors. The MEMEE heads a **steering committee supervising the execution of the plan**, while ONEE and ADEREE are charged with implementation. In terms of legislation, the **47-09 Energy Efficiency Law** was passed in 2011 in order to increase the efficiency of energy consumptions and to allow for related cost savings through the use of solar water heaters, energy saving equipment and low consumptions light bulbs.

3.3 RE/EE regulatory framework

Law	Content
<p>Renewable Energy Law 13-09 (2010)</p>	<p>Promoting and liberalising the renewable energy sector. It allows private actors to produce and export electricity as long as they utilise RES (solar, wind, geothermal, wave, tidal, biomass, waste and biogas). It offers medium and large electricity producers the access to input their energy into the national grid.</p> <p>The law also establishes that the authorisation for the construction of solar and wind farms needs to be granted by ADEREE. In order to be entitled to produce electrical energy from RES and export it to the local market and/or through the national grid, an operator needs to obtain a</p>

Law	Content
	permission from the national authorities which can either require a simple prior notification (if capacity is between 20 kW and 2MW or a proper authorisation form (if capacity is equal to or higher than 2 MW).
Energy Efficiency Law 47-09 (2011)	Setting the criteria of “ minimum energy performance ” for appliances and electrical equipment . It also makes mandatory energy audits for companies and institutions in the production, transmission and distribution of energy, as well as the performance of an energy impact study for new construction and urban projects. It finally defines the role of energy services and facilities, and establishes technical control.
Renewable Energy Law 58-15 (2015)- Amendment to Law 13-09	Introducing a net metering scheme for solar and wind power plants connected to the high-voltage grid, and later, those connected at the middle and low-voltage. Private investors in renewable power will be able to sell their surplus output to the grid, but no more than 20% of their annual production. The exact terms and conditions of the net metering scheme will be detailed in secondary legislation. Investors in PV will also benefit from the opening of the low-voltage grid to renewable power installations.

3.4 Key RE/EE stakeholders

Institution	Role
Agence Nationale pour le Développement des Energies Renouvelables et de l'Efficacité Énergétique (ADEREE)	Established in 2010 to implement government policy aimed at reducing energy dependence, through the promotion of renewable energy and energy efficiency . In terms of renewable energy, ADEREE is responsible to make proposals concerning the regions entitled to host projects for producing electricity from wind power. In terms of energy efficiency, ADEREE set up an energy efficiency strategy that includes targets and implements projects in different sectors.
Moroccan Agency for Solar Energy (MASEN)	Established in 2010 to support the installation of at least 2.000 MW in solar power plants in the country by 2020 in the framework of the Moroccan solar plan. It is in charge of the design of integrated solar development projects , conducting the technical, economic and financial studies that are necessary to the qualification of the sites, the design and exploitation of solar projects, the complete tendering process, project management for the realization of solar projects and contributing to research and to the raising of the funding necessary for the realisation of solar projects. MASEN is set to take the lead on the development of all RES technologies in Morocco, however, the details of this transition are yet to be revealed.
Société d'Investissements Énergétiques (SIE)	Established in 2010 with the main mission of supporting national renewable energy programmes as a lender, investor or project co-developer . It owns 25% of the share capital in MASEN, and is key in planning and managing the medium-voltage network, aimed at the development of mini-photovoltaic (PV). SIE also seeks to create a financial vehicle dedicated to profitable projects that target energy efficiency, especially public buildings and public lighting.

Institution	Role
Institut de Recherche en Energie Solaire et Energies Nouvelles (IRESEN)	Established in 2011 to develop, coordinate and enhance the efficiency of research in RES, translating the national strategy into R&D projects, implementing and participating in the financing of projects carried out by research institutions and by industrialists and exploiting and popularising the results of research projects.

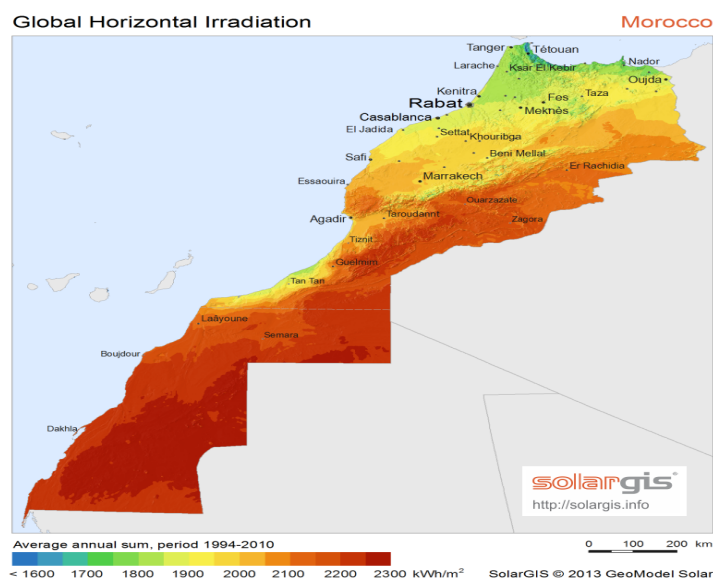
3.5 RE/EE potential

Morocco is regarded as one of the most attractive markets for the **development of renewable energy**. Given its strategic geographical position and population size, Morocco has potential to be a genuine hub for the renewable energy industry and electricity interconnections. Most of all, the great natural resource potential especially in solar and wind energy, as demonstrated in the following section, means that power producers can generate electricity at relatively low costs.

3.5.1 Solar

Morocco benefits from impressive solar energy resources. In the southern and western regions of the country, global horizontal irradiation reaches more than **2.200 kWh/m² per year**. Morocco benefits from one of the highest solar irradiance rates of any country with about **3.000 hours** of sunshine per year and up to **3.600 hours** in desert areas.

Figure 7-Global Horizontal Irradiation- Morocco



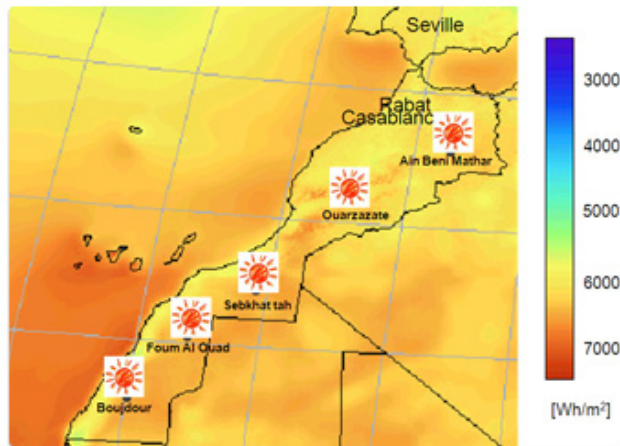
Source: Solar GIS

As shown in Figure 4 (below), the Moroccan Solar plan identified 5 main sites for solar projects:

- Ain Beni Mathar;
- Ouarzazate;
- Sebkhath Tah;
- Fom Al Oud;
- Boujdour.

Ouarzazate is home to **NOOR** mega solar complex, which will be the largest solar plant in the world upon completion in 2020 with a planned installed capacity of 580 MW.

Figure 8-Sites identified for solar projects

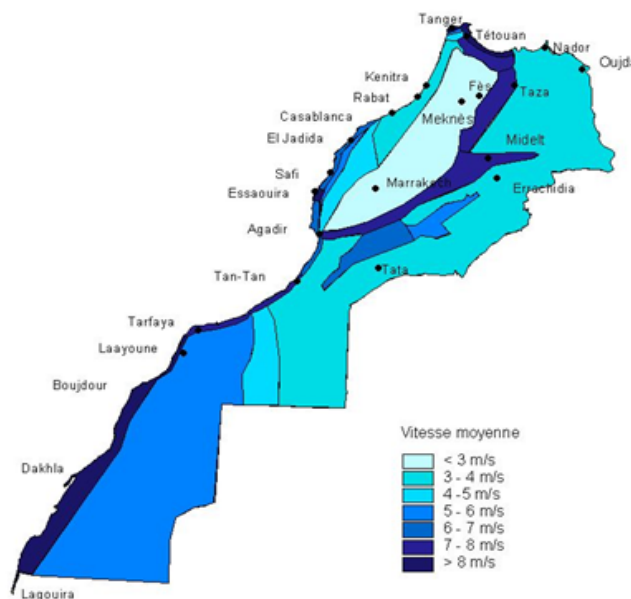


Source: MASEN

3.5.2 Wind

Morocco benefits from rich wind regimes especially along the north and south of its 3.500 km long coast. **Essaouira, Tangier and Tetouan** are especially impressive with average wind speeds between **9,5-11 m/s**. **Tarfaya, Taza and Dakhla** record wind speeds between **7,5-9,5 m/s**. According to ADEREE, total wind potential is **7.936 TWh/year** while technical wind potential stands at **4.896 TWh/year** and exploitable potential is judged to be at **25.000 MW** (ADEREE).

Figure 9-Morocco wind map



Source: Invest in Morocco

3.5.3 Energy efficiency

The potential of energy efficiency is limitless as diversifying to cleaner, more efficient fuels, renewable energies and reducing energy use and intensity can always be expanded through ever-evolving technology, dedicated government programmes and wider public awareness.

The Ministry of Environment estimated a potential **50.9 million (tCO₂/yr)** savings from energy-related ‘nationally appropriate mitigation actions’ (NAMAs), encompassing wind energy, solar energy, solar heating, low energy light bulbs, green cities and energy efficiency in buildings, industry and public lighting (IEA, 2014).

4 Current and planned projects under the solar and wind programmes

4.1 Overview of projects

As of March 2016, Morocco has 967 MW of RE capacity installed, of which 180 MW of solar CSP and 787 MW wind.

A total of 3.835 MW of RE capacity installed is under development, of which 1.395 MW of solar capacity and 1.220 MW of wind power plants.

A total of 425 MW of PV planned capacity is expected to be tendered to fulfil the RE target. (See Annex 1 for full breakdown of current, under development and planned installed capacity).

The following table aims to give a general picture of the role of the different stakeholders in the context of the solar and wind programmes. The distinction is made in terms of involvement at the three levels namely, **implementation, technical and financial support**. Given the number of **public and financial stakeholders involved** in the implementation of the solar and wind programmes, this table aims to breakdown the capacity of their contribution to each of the programmes before going onto present the specific projects.

	Solar Programme	Integrated Wind Energy Programme
Implementation	<ul style="list-style-type: none"> - MASEN Tendering the single stages of site development for projects NOOR Ouarzazate, NOOR PV I, NOOR Midelt with NOOR PV II and NOOR Tata to come. - ONEE Tendering the single stages of site development for projects NOOR Tafilalet, NOOR Atlas, NOOR Aragna (EPC structure) 	<ul style="list-style-type: none"> - ONEE Tendering the single stages of site development for all projects. - ONEE, SIE and Hassan II Fund create a project company with private project developer
Technical	<ul style="list-style-type: none"> - MASEN Development of strategic orientation (technology choice, time schedule, etc) - ONEE Transmission and distribution - ADEREE Creation of solar atlases 	<ul style="list-style-type: none"> - ONEE Transmission and distribution - ADEREE Creation of wind atlas
Financiers	<ul style="list-style-type: none"> - MEMEE, MASEN, Energy Development Fund, Hassan II Fund, International soft loans, Multilateral and development banks, Commercial banks 	<ul style="list-style-type: none"> - MEMEE, ONEE, Energy Development Fund, Hassan II Fund, International soft loans, Multilateral and development banks, Commercial banks

4.2 Solar Programme

The Moroccan Solar Plan is targeting a minimum capacity of 2.000 MW of CSP and PV by 2020, and is being implemented by **MASEN** and **ONEE** through **IPP competitive bidding projects**.

In the following section, a detailed description of the projects that both **MASEN** and **ONEE** are developing to reach the 2.000 MW target is given.

4.2.1 MASEN

Since its creation, MASEN has launched **four major tenders** to install a total capacity of **1.090 MW**. The following section covers the ongoing MASEN tenders.

- 2 separate tenders for NOOR Ouarzazate
 - Phase 1: NOOR Ouarzazate I (160 MW)
 - Phase 2: NOOR Ouarzazate II and NOOR Ouarzazate III (350 MW)
- 1 tender for Noor PV 1 (170 MW)
- 1 tender for Noor Midelt (400 MW)

These tenders are covered in the following tables, demonstrating the stage of development of each project.

Table 3- MASEN NOOR Ouarzazate solar project

Phase (Tender)	Technology	Capacity (MW)	Status	Features	
Phase 1	Noor ₀ I	CSP (parabolic trough)	160	Operational	Phase 1: Tender for prequalification issued in 2010 PPA signed in November 2012. Construction commenced in May 2013. Commissioned in February 2016. Developers: Acwa Power, Aries, TSK EPC contractors: TSK, Acciona, Sener
Phase 2	Noor ₀ II	CSP (parabolic trough)	200	Under construction	Phase 2: Tender for prequalification issued in January 2013. Awarded to consortium led by ACWA Power in January 2015. Due to be commissioned in August 2017.
	Noor ₀ III	CSP (tower)	150	Under construction	Due to be commissioned in November 2017.
Noor PV1	Noor ₀ IV	PV	70	Ongoing tender	Phase 3: Tendered as part of NOOR PV 1 (see Table 4)

Source: RES4MED

Table 4- MASEN NOOR PV 1

Phase (Tender)		Technology	Capacity (MW)	Status	Features
Noor PV 1	Noor Ouarzazate IV	PV	70	Ongoing tender	<p>Request for Qualification (RfQ) was launched in summer 2015.</p> <p>In September 2015, 37 applications submitted their proposals.</p> <p>In December, 20 consortia were qualified under an IPP scheme consisting of the design, financing, construction, operation and maintenance of the plants.</p> <p>The 20 qualified consortia include the following leading companies:</p> <ul style="list-style-type: none"> - ACWA Power - Enel - EDF - Masdar - SunPower
	Noor Laayoune		50	Ongoing tender	
	Noor Boujdour		50	Ongoing tender	

Source: RES4MED

Table 5- MASEN NOOR Midelt

Phase (Tender)	Technology	Capacity (MW)	Status	Features
Noor Midelt I	Hybrid CSP-PV	400	Ongoing tender	<p>Installed capacity of around 400 MW and hybrid technology, CSP with storage and PV.</p> <p>The site covers a surface of about 2,400 hectares, located around 25 km north-east of the town of Midelt.</p> <p>Call for Expression of Interest (Eoi) was launched in Q4, 2015.</p> <p>Issuance of RfQ expected in Q1/Q2, 2016. Issuance of first Request for Proposal (RfP) expected in Q3, 2016.</p> <p>Issuance of second RfP expected in Q2, 2017.</p> <p>Awarding of the project expected in Q3/Q4, 2017 and financial close and start of construction in Q4,2017 or Q1, 2018.</p>

Source: RES4MED

4.2.2 ONEE

To assist MASEN in reaching the 2,000 MW target by 2020, ONEE has its own PV program targeting a total capacity close to 500 MW, all using solar PV. The following table presents ONEE's solar projects under the EPC scheme.

Table 6- ONEE ongoing solar tenders

Project	Technology	Capacity (MW)	Status	Features
Noor-Tafilalet	PV	75	Ongoing tender	<p>Development of 3 Solar PV power stations with a generation capacity of 25 MW each.</p> <p>In 2014, a study on the environmental and social impacts of the project were completed as well as allocating 3 sites at Zagora, Erfoud and Missouri.</p> <p>In July of 2015, ONEE issued a tender for prequalification of EPC companies.</p> <p>Grid connection of the plants is scheduled to take place by end-2016 or beginning 2017. The World Bank, via the International Bank for Reconstruction and Development (EBRD), will extend a \$125mn loan to ONEE for the programme, while another \$23.95mn loan will be provided through the Clean Technology Fund (CTF).</p>
Noor Atlas	PV	200	Ongoing tender	<p>Expected development of 8 Solar PV power stations with a generation capacity ranging between 10-30 MW each.</p> <p>In 2014, land was allocated for the 8 different sites. Three of the plants will be sited near Tata, Tahla and Tan Tan in the south, while five plants will be located at Outat El Haj, Ain Beni Mathar, Boudnib, Bouanane and Boulmane in the east.</p> <p>A call for tender was issued in December 2014 for geotechnical studies for all 8 sites.</p> <p>Pre-qualification tender is expected in 2016.</p> <p>First PV plant expected to come on stream in 2017, with the rest of the plants to be commissioned in 2018.</p>
Noor Aragna	PV	200	Ongoing tender	<p>Projects will be located in the regions of Boumalen, Province de Tinghir, Errhamna, Essaouira and will require an investment of about EUR 250 million.</p> <p>In early 2016, it was announced that the pre-qualification phase will take place at the end of 2016 or at the start of 2017.</p> <p>Commissioning of the projects is</p>

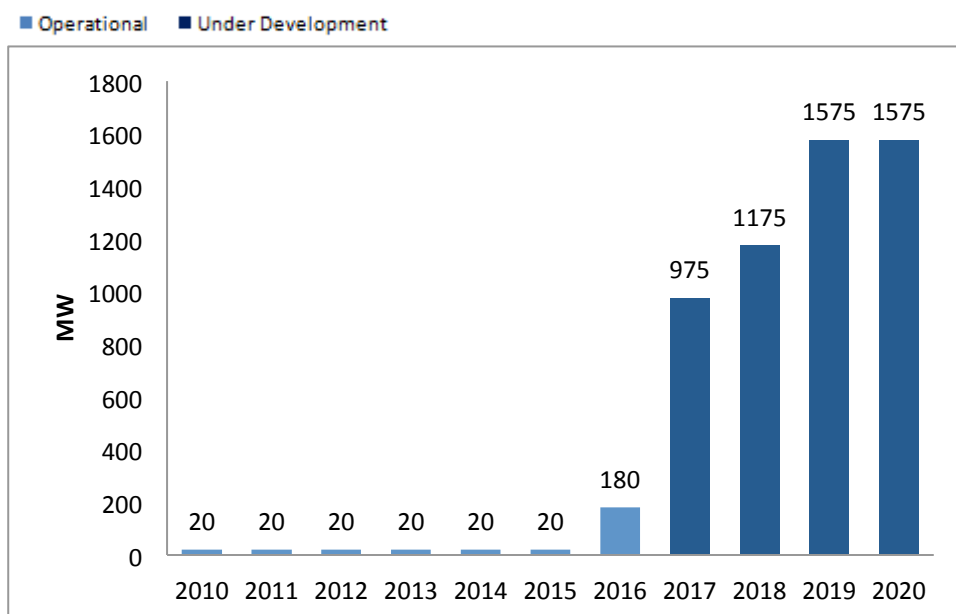
Project	Technology	Capacity (MW)	Status	Features
				<p>scheduled to start in 2018.</p> <p>The projects from this phase will be sited in the regions of Boumalen, Province de Tinghir, Errhamna and Essaouira. The constructions of the total capacity of 200 MW is estimated to cost EUR 250 million, excluding costs for studies.</p>

Source: RES4MED

4.2.3 Reaching the solar target

The projects being developed by MASEN and ONEE aim to reach 2.000 MW of solar power capacity by 2020. The figure below shows the evolution of the solar capacity in Morocco between 2010 and 2020, if the ongoing projects are completed according to plan.

Figure 10- Evolution of Moroccan solar capacity (2010-2020)



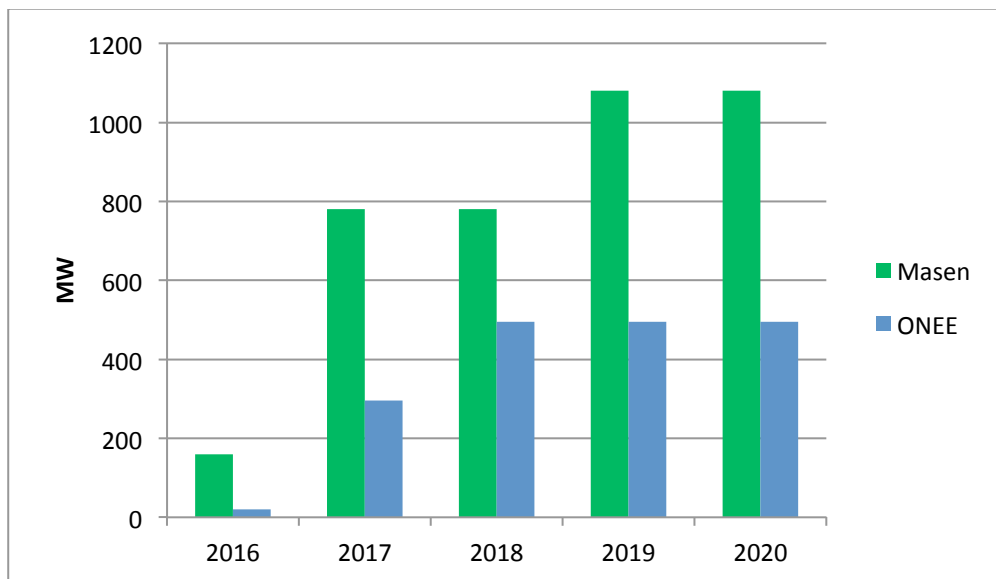
Source: RES4MED

Between **2010** and **2015**, we observe that there was **no additional capacity** installed, leaving installed capacity at **20 MW**. Given that the solar programme was launched in 2009 and MASEN was established in 2010, it is significant to note there was no capacity added until 2016, demonstrating the early difficulties in establishing the mechanisms and facilitating the environment conducive to project development. In **2016**, the **first phase of NOOR Ouarzazate (160 MW)** project was completed raising the capacity to **180 MW**. The biggest rise is expected to take place in **2017**, with a total capacity of **795 MW** expected to be installed this year through the **second phase of NOOR Ouarzazate (350 MW)**, **NOOR PV 1 (170 MW)**, **NOOR Tafilalet (75 MW)** and **NOOR Atlas (200 MW)**. In **2018**, a further **200 MW** is expected to come online, with the completion of **NOOR Aragna**. Finally, **NOOR Midelt I** is expected to add **400 MW** in **2019**, bringing total solar installed capacity to **1.575 MW**.

As it is, the current plan is still **425 MW** short of reaching the 2020 target of **2.000 MW**. This deficit is expected to be filled by two MASEN projects; **NOOR PV II** (a large PV programme to be implemented on several sites) and **NOOR Tata** (a mix of CSP and PV). As of March 2016, there is no further details regarding the launch of these tenders but it is expected that they will be announced within 2016 to ensure completion by 2020 and the fulfilment of the **2 GW** target.

The figure below highlights MASEN and ONEE's respective contributions to the solar programme and the **1.555 MW** of newly added capacity between 2016 and 2020.⁹

Figure 11- MASEN and ONEE solar projects (2016-2020)



Source: RES4MED

Over the five years, MASEN contributes more to the newly installed solar capacity. As a newly established body dedicated to the development of solar projects, it is perhaps expected that MASEN would have the larger portion of solar capacity. However, given that MASEN was only established in 2010, ONEE had a solar programme of its own contributing a capacity of **475 MW**, which are rather key in reaching the 2.000 MW target. Upon adding **275 MW in 2017** and a further **200 MW in 2018**, ONEE's contribution stops after 2018 as MASEN takes full control of solar projects.

Of the **1.555 MW** newly installed capacity between 2016-2020, MASEN contributes **1.080 MW; 160 MW in 2016, 520 MW in 2017 and 400 MW in 2019**. With a further **425 MW** expected to be added to this plan (NOOR PV II and NOOR Tata), MASEN's contribution is expected to grow even further, exceeding **1.5 GW**.

4.3 Integrated wind energy programme

The Moroccan Integrated Wind Energy Programme was launched in 2010 aiming to increase the installed wind capacity from **287 MW to 2.000 MW by 2020**. The main goals of the wind programme are to raise the share of wind power to 14% of the total generation installed capacity by 2020 and support the emergence of a local wind power manufacturing capability by requiring project developers to produce a part of the components of the wind turbine locally.

Upon the launch of the programme, 720 MW of wind capacity were under development bringing total installed capacity to the 1.000 MW mark, while a further 1000 MW were planned in 5 different sites to fulfil the 2.000 MW target.

1. **720 MW** under development: Haouma (50 MW), Foug el Oued (50 MW), Tarfaya (300 MW), Akhfenir I (100 MW), Akhfenir II (100 MW), Jbel elKhaladi (120 MW)
2. **1000 MW** planned: Taza (150 MW), Midelt (150 MW), Tiskrad (300 MW), Tangier II (100 MW), Jbel Lhdid (200 MW), Boujdour (100 MW).

⁹ 20 MW of 1.575 MW installed capacity already installed before 2016.

4.3.1 First Phase

ONEE operated 200 MW of the installed wind capacity prior to the launch of the programme, and thus had relative experience in developing wind projects. Since the launch of the programme, a further 500 MW of wind capacity has been added. Under the same model, a further two projects with a combined **capacity of 220 MW** are currently under construction, taking the total wind capacity to 1.007 MW upon completion and fulfilling the 720 MW first part of the Integrated wind energy programme. (See **Annex 2** for full breakdown of installed and under construction wind capacity.)

4.3.2 Second Phase

ONEE launched another two tenders aiming to increase the installed wind capacity from **1 GW (1.007 MW) in 2015 to 2 GW by 2020**. Five new potential sites were selected for the construction of wind farms with a total nominal capacity of 1.000 MW. The first tender for Taza wind farm (150 MW) was awarded in 2012 while the tendering process for the second phase ended in March 2016 when the bidding consortium EGP-NAREVA-SIEMENS was awarded the “preferred bidder status” at the “2nd phase of the wind integrated project”, to be confirmed following the signing of the purchase agreements for the energy generated by the plants.

Projects under the Integrated Wind programme to be executed through public-private partnerships, where ONEE, SIE and Hassan II Fund are joined by several strategic partners in the wind and power generation industries. Aside from power generation, this programme aims to integrate with industrial projects through configuration and R&D efforts. The programme is divided over two tenders:

Table 7- Wind planned installed capacity

Tender	Technology	Capacity (MW)	Status	Features
Tender I Taza	Wind	150	Under construction	12 km north-west of the city of Taza. Turbines are to be installed on a total length of 24 km. Planned operation date of 2017; generating 5000 MW annually, and saving up to 400,000 tonnes of CO ₂ emissions per annum. Contract awarded to EDF Energies Nouvelles [Operator] {France}, Mitsui [Construction] {Japan}, Alstom SA [Equipment] {France}
Tender II Midelt, Tiskrad, Tangier II, Jbel Lhdid, Boujdour	Wind	850	Under development	February 2014: Tender launched to develop, design, finance, construct, operate and maintain five facilities totalling 850MW under a build, own, operate and transfer (BOOT) contract for a 20-year term; March 2016: consortium EGP-NAREVA-SIEMENS awarded the “preferred bidder status” Total power generation of 2800 MW annually, saving CO ₂ emissions of 2260000 tonnes per annum. Divided among 5 different sites, among which;

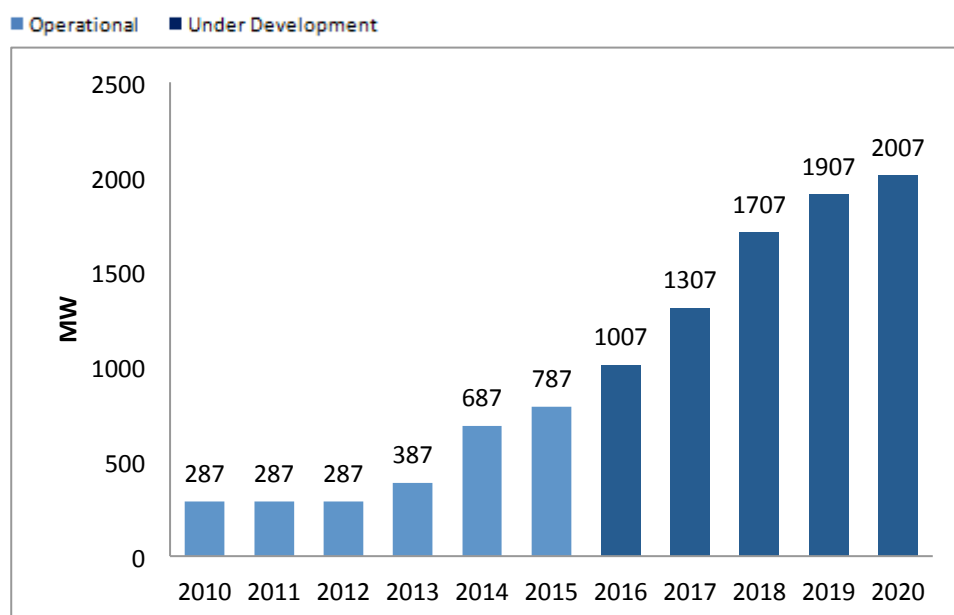
Tender	Technology	Capacity (MW)	Status	Features
				<ul style="list-style-type: none"> – Midelt, 150 MW (2017) – Tiskrad, 300 MW (2018) – Tangier II, 100 MW (2018) – Jbel Lhdid, 200 MW (2019) – Boujdour, 100 MW (2020)

Source: RES4MED

4.3.3 Reaching the wind target

The Integrated wind energy programme aims to bring the installed wind capacity up to 2.000 MW. The following table presents the evolution of wind capacity if the ongoing projects are completed according to plan.

Figure 12- Evolution of wind capacity (2010-2020)



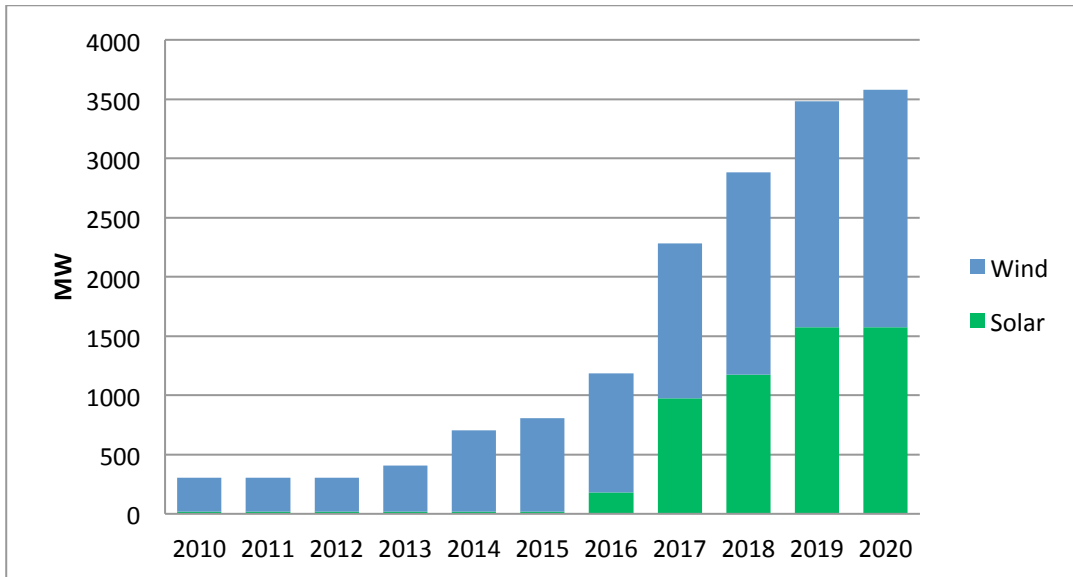
Source: RES4MED

By 2010, Morocco already had an installed capacity of **287 MW** and a further **720 MW** in the pipeline through ONEE projects. In 2013, two plants with a total capacity of 100 MW were commissioned; **Haouma (50 MW)** and **Foum El Oued (50 MW)**. In 2014, a further **300 MW** were added with the inauguration of **Tarfaya** wind farm in December 2014; the largest wind farm in Africa at inauguration. In 2015, **Akhfenir I (100 MW)** was commissioned, while a further **220 MW** are expected to be commissioned in **2016**; **Akhfenir II (100 MW)** and **Jbel el Khaladi (120 MW)**, bringing total installed capacity to just over the 1.000 MW mark. In **2017**, the first projects of the Integrated wind energy programme are expected to come into operation, adding another 300 MW to total capacity; **Taza (150 MW)** and **Midelt (150 MW)**. **Tiskrad (300 MW)** and **Tangier II (100 MW)** are scheduled to be commissioned in **2018**, making it the year with the largest new capacity (**400 MW**). **Jbel Lhdid** adds the further **200 MW in 2019**, while a **100 MW in Boujdour** should be completed in **2020** concluding the Integrated wind programme and fulfilling the **2.000 MW** target as scheduled.

4.4 Reaching the target: comparison between solar and wind capacity

The solar and wind projects currently in operation and under development exceed the 3.5 GW mark, bringing Morocco close to its 4 GW target from solar and wind energy and demonstrating great promise for the Moroccan RE market going forward. The following figure shows the evolution of solar and wind capacities since the launch of the solar and wind programmes and until 2020; the proposed year for achieving the set targets.

Figure 13- Current and planned solar and wind capacity (2010-2020)

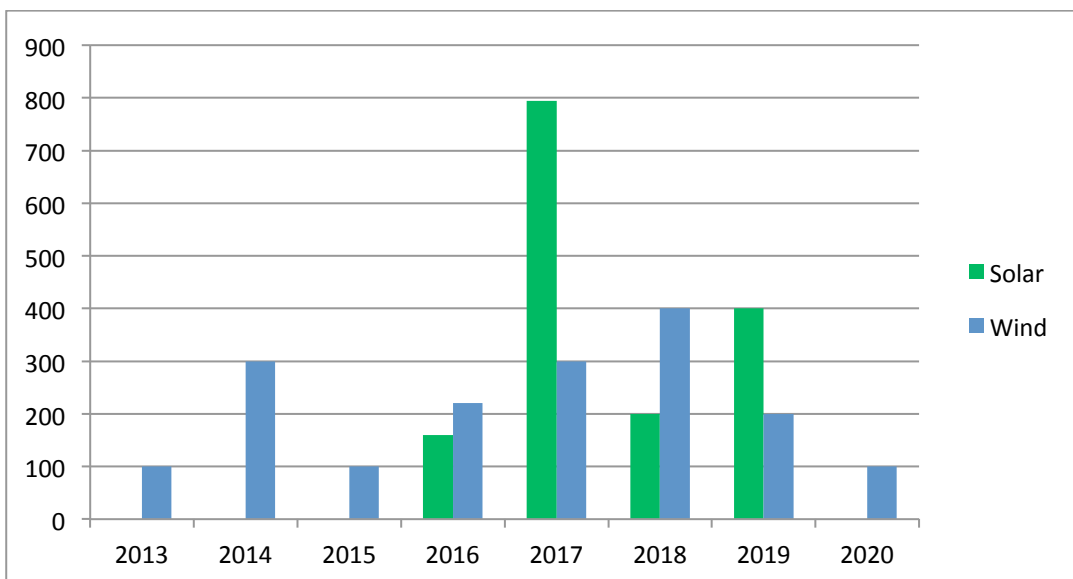


Source: RES4MED

Wind energy enjoys a head start and continues to dominate until 2017, when solar starts to catch up. By the end of the period, wind is projected to fulfil its 2.000 MW target barring significant delays, as with the ongoing Taza wind farm. If MASEN proceed with the tenders yet to be launched in due time, it is also expected to reach its target as mentioned in the previous section, bringing solar and wind to an equilibrium of 2 GW each.

The following figure shows the added capacity of solar and wind each year up to 2020.

Figure 14-Solar and wind capacity addition by year (2013-2020)



Source: RES4MED

Again, the first three years show slow progress and no new solar capacity until 2017 when the largest solar capacity is added. Given that there were already operating plants and projects in the pipeline, the wind capacity addition is generally more evenly distributed over the years, whereas the solar capacity is more concentrated in the last years with a further 425 MW expected for 2020.

Upon reaching the 2020 targets, and especially in light of the announcement of a new 52% target for 2030, it will be interesting to see how Morocco chooses to proceed in the next years with regards to the mechanisms they will utilise for the achievement of the new target. Additionally, it remains to be seen whether there will be a direction to focus more on solar due to continuous advancements in the industry globally and MASEN's growing expertise and specialisation, or rather maintain the balanced growth between both solar and wind.

4.5 Energy Efficiency projects

Before discussing specific projects, it is important to note that one of the significant measures undertaken by the Moroccan government with regards to energy efficiency is the revival of daylight time saving in 2008, after it had been discontinued in 1978. By moving the clock one hour forward in the summer months, it becomes possible to alleviate energy demand pressures especially during peak hours. In fact, by the end of 2014, a total of 29.5 GWh was saved in average power generation. More, around 27.658 tonnes of CO₂ emissions were saved.

Another vital initiative by SIE in the energy efficiency sector is the creation of one or more energy services providers dedicated to the management of energy efficiency projects in public buildings through performance based contracts. The objective is to reduce energy consumption in public buildings and drive the ESCO (energy service company) market in Morocco, while supporting international partnerships with skills transfer.

In this section, a selection of energy efficiency projects and pilot projects are presented under their specific sectors; those are public administration, industrial sector, agricultural sector and residential and commercial sector. (Further projects are presented in **Annex 3**).

4.5.1 Public Administration

Programme	Green Mosques Programme
Implementing bodies	Ministry of Endowments and Islamic Affairs (MHAI), SIE, GIZ
Features	<p>The programme aims to improve the EE of mosques by using energy-saving lighting, photovoltaic electricity generation and solar water heating, targeting significant savings for the MHAI, which pays the electricity bills of all mosques nationwide. Also, aims at raising public awareness of RE and EE and creating jobs.</p> <p>SIE implements and finances the programme with technical support from the German Cooperation GIZ. The estimated investment required is MAD 200 million.</p> <p>The programme aims at rehabilitating 15.000 mosques, starting with 1.000 in the first phase.</p>
Target	To expand the programme to include all 45.000 mosques in Morocco. A study by SIE revealed that energy consumption by mosques could be reduced by 30-40% .

Programme	Public lighting management of Marrakech
Implementing bodies	SIE
Features	<p>Optimised for public lighting and in the context of the organisation of COP22 in Marrakech, Marrakech Urban Community decided to renovate its public lighting that includes about 60,000 light points representing an annual energy bill of about MD 60 million.</p> <p>A call for expression of interest was issued in December 2015 with the purpose of choosing the operator of public lighting that will ensure the best energy performance of existing and new equipment through the SDL, upgrading, maintaining and</p>

	operating public lighting installations in the municipality.
Target	The aim of the town is to reduce at least 40 % of its annual energy consumption related to public lighting.

4.5.2 Industrial Sector

Programme	Industrial Energy Efficiency Service for Maghreb Steel
Implementing bodies	SIE. Maghreb Steel (MS)
Features	<p>MS is intending to procure comprehensive industrial energy efficiency services including industrial process improvements. The service package will encompass an entire project cycle, i.e. design, implementation, commissioning, operation & maintenance, monitoring & verification and optimisation of energy savings as well as co-financing of the investments.</p> <p>The Energy Efficiency investments will be co-financed by MS and SIE to up to 50%. The selected company will be required to finance or arrange financing for the remainder of the necessary investment needs on its own account. The energy services will be specified in sufficient detail in a second project phase.</p>
Target	The objective is to assess their interest and ability in partnering with MS and SIE to develop and implement energy cost savings measures in the framework of a performance-based energy savings contract.

4.5.3 Agricultural sector

Programme	Programme on the optimisation of energy performance in farms
Implementing bodies	ADEREE, Crédit Agricole Maroc
Features	<p>The programme targets helping farmers to reduce their energy bills through the reduction of their energy consumption and the use of RE.</p> <p>The programme aims at:</p> <ul style="list-style-type: none"> - Assessing the potentials for energy saving and renewable energy production - Increasing the competitiveness of the agricultural sector through the reduction of the energy bill - Protecting the environment through the reduction of greenhouse gas emissions <p>ADEREE started with a demonstration program in 10 farms located throughout Morocco.</p>
Results	The 10 energy audits that have already been conducted produced encouraging results: 100 tonnes of CO2 could be saved – which means 130,000KWh and MAD180,000 saved – could be saved for an initial extra investment cost of MAD140,000. This represents an average time of return on investment of 9 months.

4.5.4 Residential and commercial sectors

Programme	PROMASOL
Implementing bodies	ADEREE (previously CDER), UNDP
Features	<p>The programme aims to:</p> <ul style="list-style-type: none"> - increase supply to reduce equipment costs - improve the quality of solar-powered equipment and related services - ensure the large-scale adoption of solar water heaters through sectoral

	demonstration programs and mass media campaigns
	It is a United Nations funded initiative with the objective to double solar water heating capacity in three years to 40,000 m ² per year.
Results	<p>Since its inception in 2002, PROMASOL has cut carbon emissions by 1,3 million tonnes, and is expected to reduce around 920.000 tonnes of CO₂ a year until 2020. The programme has also increased the number of solar water heaters from about 35.000 m² of solar panels to approximately 240.000 m² in 2008.</p> <p>In terms of its social results, the programme has contributed directly to job creation through the training and certification of 200 installers and indirectly through the creation and expansion of specialised companies. It is also expected to create about 13.000 new jobs by 2020.</p>

Programme	LED lighting (Enara)
Implementing bodies	ONEE
Features	Replacing 15 million bulbs to LED lighting. The first phase aims at installing 5 million LED bulbs whereas the second phase plans to install the remaining 10 million new generation LED bulbs.
Results	By the end of 2014, a total of around 4,587 million LED bulbs were installed for ONEE customers, resulting in 182 MW energy saving in peak demand hours, equivalent to 3,3% . The share saved by the economy in accumulated energy is 450 MW , equivalent to 1,56% of ONEE's total sales in 2014.

5 Main market dynamics

5.1 RE main players

The Moroccan RE market is based on **IPP competitive bidding processes** for large-scale projects. Unlike the feed-in tariff model, installed capacities are concentrated in a relatively **low number of projects** where **competition is really high and the process is quite long**, deeming entry into the market rather difficult. In this section, a brief snapshot is given of the main established market operators in the RE market in Morocco.

Table 8- Main operators in Moroccan RE market

Company	Capacity (MW)	Pipeline	Strategic partnerships
Nareva (Morocco)	Wind – Tarfaya: 300 MW – Akhfenir I: 100 MW – Haouma: 50 MW – Fom el Oued: 50 MW Total: 500 MW	Wind – Akhfenir II: 100 MW – Integrated wind energy programme (Phase II): 850 MW	-Engie (France) -Enel (Italy) -Siemens (Germany)
Enel (Italy)	Wind -Integrated wind energy programme (Phase II): 850 MW	Solar PV -Qualified for NOOR PV 1 tender	-Nareva (Morocco) -Siemens (Germany)
Siemens (Germany)	Wind -Haouma: 50 MW -Fom el Oued: 50 MW -Tarfaya: 300 MW Total: 400 MW	Wind -Integrated wind energy programme (Phase II): 850 MW Industry Wind turbine blades factory	-Nareva (Morocco) -Enel (Italy)
ACWA Power (Saudi Arabia)	Solar CSP -NOOR ₀ I: 160 MW	Solar CSP -NOOR ₀ II: 200 MW -NOOR ₀ III: 150 MW Solar PV -Qualified for NOOR PV 1 tender	- Sener (Spain) -First Solar (USA)

Other significant players in the Moroccan market who already have plants in operation or are qualified for ongoing tenders include **EDF, Engie, Masdar, Sun Power, Gamesa** and **UPC Renewables**.

5.2 Beyond the National programmes

It is imperative to highlight some of the ongoing RE projects beyond **the solar and wind programmes** and under the framework of the Renewable Energy Law 13-09.

- **Italgen/Italcementi:** Italcementi group operates in the energy intensive cement industry, yet reducing the environmental impact of its industrial operations has been a priority for the group through its specialised arm Italgen. The project for the construction of a wind farm in Morocco was the first initiative launched by Italgen in the wind power field (2006), with the aim of contributing to meeting the local energy needs of Italcementi Group.

The production plant, with a capacity of 5.1 MW and a production of 16,000 MWh, was built in Southern Morocco in an area characterised by growing demand for electricity. The plant will supply electricity to a local grinding center. This initiative is expected to reduce the emission of CO₂ by about 12.000 tonnes per year. Italgel are currently developing two more clean energy projects in Morocco; Safi wind farm (10 MW) and Ait Baha CSP plant (3 MW) demonstrating their commitment to the market.

- **OCP:** One of Morocco's biggest industrial players and a global leader in the phosphate and phosphate derivatives market aiming to achieve complete energy independence with a generation capacity of 600 MW by 2020. Big electricity consumers (over 300 MW in capacity) are permitted to build generation capacity of their own and connect it to the grid, and OCP aims to invest in wind, solar and hydro to achieve an 'optimal mix.' Already the Phosboucraa unit based in the southern part of Morocco meets 90% of its electricity needs with wind power.

The flexibility afforded by the 13-09 Renewable energy law is clearly contributing to the boom of the RE sector in Morocco and with projects being developed under it serving industrial projects as with the examples above, it represents a clear signal that expanding the generation capacity from RES is about boosting and diversifying the economy as it is about cutting energy imports and expenditure.

Moreover, with the amendment to the law in 2015 permitting for surplus energy to be exported to the grid, it opens yet another avenue for fulfilling Morocco's growing energy needs through private projects that do not place any further burdens on the government. Further, the proposed law to increase the threshold of self-production from the current maximum of 50 MW to 300 MW suggests that there is a serious will to move towards further self-generation projects. Yet, the legislative developments of the next few months regarding the access low and medium voltage grid for Independent Power Producers, shows that the opening of those markets will require more time than initially foreseen (18/24 months at least), weakening the outlook for a quick IPPs penetration into MV-LV segment of renewable energy generation. If this trend is to be reversed, the ministerial decree expected for this year regarding both grids, should provide more visibility on the timeline for market opening, as well as reducing the length of the overall process.

5.3 Industrial initiatives

Aside from the great efforts in growing Morocco's electricity generation capacity, there is a great focus on the development of the RE manufacturing sector, turning the country into an hub for the RE industry. Job creation, inflow of FDI, technical know-how and expertise and the attraction of even further energy players are clear advantages accompanying the development of a manufacturing capability. In this section, initiatives in the wind, solar PV and solar CSP industries are presented.

5.3.1 Siemens factory

In December 2015, it was revealed that as part of the arrangements for the 850 MW tender, Siemens will construct a factory for the production of wind turbine blades in Tangier. The construction is due to start in spring 2016 with start of operations scheduled for February 2017. Siemens will invest EUR 100 million in the plant, which will have an annual output of 600 blades and is expected to create 670 jobs for locals.

A project of this scale is extremely important for Morocco, as it looks not only to fulfil its energy needs but to become a regional and international hub for the renewable energy industry, creating jobs, increasing the know-how and boosting its balance of payments through exports. Crucially, sourcing components locally further lowers production costs, attracting even more investors into the Moroccan industrial and power markets.

5.3.2 Solar Breeder - a solar industrial district

An Italian-Moroccan initiative to create a green industrial district for companies in the photovoltaics and clean tech sectors in Morocco. The main sponsor is Kenergia Srl, an Italian holding company specialised in the PV sector, holding 70% shares, with the other 30% held by Saet, Moroni&Partners,

Friem and Kenergia Sviluppo, all Italian companies specialised in different sectors of the value chain. SIE acts as a public partner having signed an agreement to co-develop and invest 35% of capital needs. Another partner is Logintek, one of the main real estate players in Morocco, which has signed a MoU to invest EUR 3.5mn in the company.

The two main developments of the Solar Breeder district are the development of a **PV modules factory** with an expected annual production of **50-100 MW of crystalline modules** and an **inverter factory** with an expected annual output of **50-100 MW of solar inverters**. Moreover, it plans to have electronic and electrical components production, SCADA manufacturing, mounting systems, storage systems area, labs and test facilities and an engineering and construction department for design, research and consultancy activities.

The project aims to exploit Italian know-how and to improve the PV market conditions in Morocco, enhancing competitiveness of the value chain within the private market and creating investments and local content for public bids. Having started the initial feasibility study in July 2014, Solar Breeder Morocco has opened its operative office in Casablanca in January 2016, starting its commercial and development activities.

5.3.3 Solar thermal collectors initiative

A consortium between Sidi Mohammed Ben Abdallah University (USMBA), state-owned SIE and local company Energypole is developing a project to develop Morocco's first locally produced solar thermal collectors. The project named Sol'R Shemsy aims to provide solar thermal collectors to meet European quality standards with a better quality-to-price ratio for the local market. In February 2016, an agreement was signed to provide funding of \$610.000 for the project, with IRESEN securing 60% of the sum.

Although there are no further details at this stage about the size and volume of production and job creation, it does emphasise Morocco's continued efforts towards growing its industrial capacity in the RE sector and especially the CSP technology through its public companies and research bodies.

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7 ANNEX 1- Capacity (Installed, Under development and Planned)

RE Installed capacity (March 2016)

Plant/Location	Technology	Size (MW)	Commissioning year
CSP plant part of (Ain Beni Mathar integrated solar combined cycle -ISCC) ¹⁰	CSP	20	2010
NOOR Ouarzazate I	CSP	160	2016
Sub-total Solar		180	
Abdelkhalek Torres	Wind	50	2000
Tetouan- Cement	Wind	32	2005
CIMAR- Laayoune	Wind	5	
Amogdoul- Essaouira	Wind	60	2007
Tangier I	Wind	140	2009
Haouma	Wind	50	2013
Foum el Oued- Laayoune	Wind	50	2013
Tarfaya	Wind	300	2014
Akhfenir I	Wind	100	
Sub-total Wind		787	
Total		967	

Source: RESAMED

RE capacity under development under the framework of national programmes (March 2016)

Plant/Location	Technology	Size (MW)	Expected year of operation
NOOR Ouarzazate II	CSP	200	2017
NOOR Ouarzazate III	CSP	150	2017
NOOR Atlas	PV	200	2017
NOOR Tafilalet	PV	75	2017
NOOR Ouarzazate IV	PV	70	2018
NOOR Laayoune	PV	50	2018
NOOR Boujdour	PV	50	2018
NOOR Aragna	PV	200	2018
NOOR Midelt I	PV/CSP	400	2019
Sub-total Solar		1.395	
Akhfenir II- Laayoune	Wind	100	2016
Jbel Khaladi- Tetouan	Wind	120	2016
Taza	Wind	150	2017
Midelt	Wind	150	2017

¹⁰ Total capacity of the plant is 470 MW, of which 20 MW of solar parabolic trough. The project cost an estimated \$300 million, of which \$187 million was provided by AfDB and \$100 million by ONEE.

Plant/Location	Technology	Size (MW)	Expected year of operation
Tiskrad	Wind	300	2018
Tangier II	Wind	100	2018
Jbel Lhdid	Wind	200	2019
Boujdour	Wind	100	2020
Sub-total Wind		1.220	
Total		3.835	

Source: RES4MED

RE planned tenders under the framework of national programmes (March 2016)

Plant/Location	Technology	Size (MW)	Status
NOOR PV II	PV	Na	Tender to be issued in 2016
NOOR Tata	PV	Na	Tender to be issued in 2016

Source: RES4MED

8 ANNEX 2- Wind projects

Wind installed capacity up to 2010 (before Integrated wind programme)

Project	Technology	Capacity (MW)	Features
Abdelkhalek Torres	Wind	50	Year: 2000 Production: 200 GWh/y average Operator: Theolia
Tetouan Cement	Wind	32	Year: 2005 Production: 115 GWh/y average Operator: Lafarge Maroc Project cost: 496 MDm
CIMAR-Laayoune	Wind	5	Na
Amogdoul-Essaouira	Wind	60	Year: 2007 Production: 210 GWh/y average Operator: ONEE Project cost: 800 MDm
Tangier I	Wind	140	Year: 2009 Production: 526.5 GWh/y average Operator: ONEE Project cost: 2,875 MDm

Source: RESAMED

Wind installed capacity since the launch of the Integrated Wind Programme

Project	Technology	Capacity (MW)	Features
Haouma	Wind	50	Completed in 2013. Siemens[Equipment] {Germany}, Nareva Holding {Morocco}
Foum El Oued-Laayoune	Wind	50	Completed in 2013. Siemens[Equipment] {Germany}, Nareva Holding {Morocco}
Tarfaya	Wind	300	Engie [Construction](50){France}, Nareva Holding [Construction] (50){Morocco} December 2014 -power generation begins at the power plant. Total cost of \$ 560mn
Akhfenir I	Wind	100	September 2014- GE will install 56 units of 1.7-100 turbines. The project is being developed by Nareva's subsidiary Energie Eolienne Au Maroc

Source: RESAMED

Wind projects under construction

Project	Technology	Capacity (MW)	Features
Akhfenir II-Laayoune	Wind	100	Developer: Nareva. Due to be commissioned in June 2016.
Jbel El-Khaladi-Tetouan	Wind	120	Developer: UPC Africa Renewables. Due to be commissioned in 2016.

Source: RESAMED

9 ANNEX 3- Energy Efficiency Projects

Public Administration

Programme	Public lighting management of the Salé Municipality
Implementing bodies	SIE
Features	This pilot project aims at equipping all the electricity poles in the city of Salé with low consumption bulbs (i.e. LED). The lighting network infrastructures will be updated and the city will roll out an operational lighting policy suiting its needs. The public lighting management and the project's operational steering will be entrusted to a SDL with delegated management calling upon high level private expertise.
Target	The objective is to dramatically reduce the energy bill of the municipality. Short term results: energy saving by about 60% and reduction of the power demand by 3 MW. More, the success of this project will be set as a milestone to be used as a reference rolled out in several cities of the Kingdom to reduce the overall energy bill of Moroccan municipalities.

Industrial Sector

Programme	Energy Audit Pilot Project
Implementing bodies	ADEREE, AfDB
Features	<p>The audits highlighted the importance of undertaking several energy efficiency measures in the industrial sector.</p> <p>The measures are divided under the categories of electricity, thermal energy and steam and compressed air cycles and include:</p> <p>Electricity:</p> <ul style="list-style-type: none"> - Optimisation of PPAs - Improvement of the power factor - Replacement of equipment with high efficiency equipments - Equipment maintenance <p>Thermal energy:</p> <ul style="list-style-type: none"> - Adjustment of boilers - Insulation of the steam cycle - Improving performance of coolers <p>Steam and compressed air cycles:</p> <ul style="list-style-type: none"> - Installation of an energy management system - Utilisation of RE for energy production (preheating and water heating, water pumping for solar roofs).
Target	<p>For the electricity measures, the energy saving potential is estimated at 15%</p> <p>For the thermal energy measures, the energy saving potential is estimated at 65%</p> <p>For the steam and compressed air cycles measures, the energy saving potential is estimated at 10%.</p>

Residential and Commercial sector

Programme	Thermal regulation in buildings
Implementing bodies	ADEREE, UNDP
Features	<p>The objective is to introduce minimum requirements in new residential and commercial buildings in order to optimise their needs for heating and air conditioning while improving their thermal comfort. The regulation includes the five following requirements:</p> <ul style="list-style-type: none">- Reduce energy consumption for lighting, water heating, heating and air conditioning of buildings- Improve the thermal and visual comfort for inhabitants- Optimise the design of energy systems- Create incentives for engineers and architects to use energy efficiency approaches when designing the buildings (ventilation, shading and orientation to the sun in order to maximise ventilation and natural lighting)- Assist in the realisation of energy audits on existing buildings
Targets	<p>The installation of internal and external thermal insulation of buildings (walls, roofs and low floors) allows for 26% energy savings on the annual electricity bill.</p> <p>The installation of insulated glazing allows for 13% decrease in heating and air-conditioning needs with costs amortised within five years.</p>