



COUNTRY PROFILE **MOROCCO 2018**

RES4
MEDI

RENEWABLE ENERGY SOLUTIONS
FOR THE MEDITERRANEAN

Renewable Energy Solutions for the Mediterranean & Africa RES4MED&Africa

Who we are: RES4MED&Africa promotes the deployment of large-scale and decentralized renewable energy and energy efficiency in Southern-Mediterranean and Sub-Saharan African countries to meet local energy needs. Since its inception in 2012, the association gathers the perspectives and expertise of a member network from across the sustainable energy value chain.

Our work: RES4MED&Africa functions as a platform for members and partners of emerging markets to foster dialogue and partnerships, share knowledge and build capacity to advance sustainable energy investments in Southern-Mediterranean and Sub-Saharan African countries.

Our mission: RES4MED&Africa aims to create an enabling environment for renewable energy and energy efficiency investments in emerging markets through on 3 work streams:

- Acting as a connecting platform for dialogue & strategic partnerships between members and partners to exchange perspectives and foster cooperation;
- Providing technical support & market intelligence through dedicated studies and recommendations based on members' know-how to advance sustainable energy markets;
- Leading capacity building & training efforts based on members' expertise to enable skills and knowledge transfer that supports long-term sustainable energy market creation;

At the end of 2015, RES4MED members decided to expand the geographic focus to Sub-Saharan Africa in light of the huge potentials and growth opportunities for Africa's renewable energy sector.

Members: RES4MED&Africa gathers a network of 38 members from across the sustainable energy value chain including industries, agencies, utilities, manufacturers, financing institutions, consultancies, legal and technical services providers, research institutes, and academia.

Partners: RES4MED&Africa works with local, regional and international partners, agencies and organizations to pursue its mission and promote renewable energy and energy efficiency deployment in the region of focus.

ACKNOWLEDGEMENTS

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ACRONYMS

AFD	Agence Française de Développement
BOO	Build Own Operate
BOOT	Build Own Operate Transfer
CCGT	Combined Cycle Gas Turbine
CSP	Concentrated Solar Power
DSO	Distributor System Operator
Dh	Dirham (also referred to as MAD)
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
GHG	Greenhouse gas
GW(h)	Gigawatt (hour)
IPP	Independent Power Purchase
IRESSEN	Institut de Recherche en Energie Solaire et Energies Nouvelles
ISP	Integrated Solar Programme
IWP	Integrated Wind Programme
kWh	Kilowatt Hour
MASEN	Moroccan Agency for Solar Energy
MD	Moroccan Dirham
MEMDD	Ministry of Energy, Mines, Water and Environment
m/s	meter per second
MoU	Memorandum of Understanding
MW	Megawatt
NES	National Energy Strategy
ONEE	Office National de l'Electricité et de l'eau
O&M	Operation and Maintenance
PPA	Power Purchase Agreement
PV	Photovoltaic
RE(S)	Renewable Energy (Source)
SIE	Société d'Investissements Energetiques
SPV	Special Purpose Vehicle
STEP	Station de transfert d'énergie par pompage/pumped storage hydroelectric plant
TPA	Third Party Agreement
TSO	Transmission System Operator
TWh	Terawatt Hour

ABSTRACT

From announcing a 52% renewable energy target at COP 21 to launching the first phase of what was at that time the world's largest CSP plant (580 MW) under Noor Solar Power project 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, Morocco 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 programs 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, wind and hydro energy sources and has set out to utilize 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 Macroeconomic context

1.1 Geographical aspect

The considerable ethnic and cultural diversity within the Kingdom of Morocco reflects upon its particular geographical and historical traits. Influenced by centuries of conquests, migrations patterns and trade routes, it is bounded by the Mediterranean Sea to the north and the Atlantic Ocean to the west. The Gibraltar Strait marks its opening to Europe, as 14 km separates it from southern Spain. It is one of three countries alongside Spain and France to have both Mediterranean and Atlantic coastlines. Via its Atlantic coastline, Morocco has close access to a key international shipping route, connecting the two major waterways. To the north, land borders with Spain reinforces its direct access to Europe while its Eastern and Southern borders, respectively shared with Algeria and Mauritania, tie the Kingdom to the Arab world and Sub-Saharan Africa.

1.2 Historical aspect

The year 1912 marks a territorial division, as Morocco experiences a French and Spanish protectorate, with an international zone in Tangier. By 1956, its sovereignty is reaffirmed by the gain of its independence. As the preamble of its constitution highlights, Moroccan national identity encompasses the convergence of Arabo-Islamic, Amazigh (Berber) and Saharan-Hassanic cultures. This blend is further enriched by its African, Andalusian, Hebraic and broader Mediterranean influences. The latter speaks to the plurality of its national identity as well as its ability to adapt to vigorous transformations. It is worth mentioning that in 2016 Morocco reintegrated the African Union after more than 30 years of noticeable absence. The country left the Union in 1984 following a row over the status of Western Sahara. The Kingdom's readmission brings hope of peace-building over the territory as well as broader economic incentives directed to the African continent. Morocco's King Mohammed VI has been campaigning since 2016 to rejoin the continental bloc. In addressing African leaders at the AU summit in Addis Ababa, the monarch reasserted the historical ties by proclaiming: "Africa is my home, and I am coming back home."

1.3 Demographic & Socio-economic aspect

The Kingdom has a population of approximately 36 million, making it the 11th most populous African state and the 5th of the Arab world. The population is expected to increase to 40 million by 2040.

Although the country benefits from stable economic growth, the national unemployment rate remains high - 9.7 % in 2016. Unemployment particularly affects the urban populations (80.9%), youth (20.1 %) and university graduates, whose rate of unemployment is double the national average (22.5%). The United Nations Human Development Index shows that Morocco faces marked socio-economic inequalities, particularly between urban and rural areas. The latter disparity impacts the economic, social and health conditions of the population, while accelerating the rural exodus.

Since 2015, Morocco officially administers 12 regions, each one governed by a democratically elected regional council. The president of the council is responsible for carrying out the council's decisions.

1.4 Economic aspect

By the beginning of the year 2018, the national currency (dirham) is now on trading on the market. Widen the dirham's trading band is part of Morocco's plan to liberalize the economy and turn the kingdom into a financial hub. Bank Al Maghrib will also intervene through regular auctions for the dollar, and other currencies when it sees the need, according to a circular published over the weekend. This new reform will also help Morocco boost its exports, tourism revenues, as well as Moroccans living abroad remittances, which constitutes Morocco's main source of foreign currency.

The GDP per capita in 2016 is reported at \$2,800 with an average growth rate of 4.13 percent from 1999 to 2017 - reaching an all-time high of 9.30 percent in the second quarter of 2006 and a record low of 0.50

percent in the fourth quarter of 1999. Inflation has been kept under 2%, reflecting on a prudent monetary policy and the ripple effects of the fall in international commodity prices.

Despite diversification in recent years, the agricultural sector is one of the traditional pillars of the Moroccan economy. Agribusiness accounts for close to 13% of GDP and contributes significantly to local manufacturing activity and employment (40% of the workforce). As a result, the economy is more vulnerable to adverse weather conditions than other North African states. Notably, in the last decade incidences of drought increased, while the lack of investment in irrigation harms the cereal harvest, making it subject to very wide fluctuation. Drought cut the 2015-16 wheat harvest to just 2.7m tonnes from 8m tonnes in the previous year. Moroccan economy relies mainly on tertiary sector which represents 57% of its GDP. The industrial sector accounts for roughly 28 - 29% of GDP. To ensure further prosperity, Morocco is pursuing a strategy of transformation, modernisation and diversification. It aims to diversify beyond traditional manufacturing sectors i.e. textile and leather, by boosting the development of industries, such as the pharmaceutical, aeronautical and automotive. This strategy will enable it to remain an important commercial partner of the European Union (EU). In addition, a free trade agreement between the EU and Morocco came into force in 2012. The mining industry is dominated by the production of phosphates. Morocco holds approximately 75% of the world's phosphate reserves, is the second largest producer and the largest exporter in worldwide. In terms of other natural resources, the country holds almost no proven oil and gas reserves, however untapped shale resources are suspected to be found. In this context, renewable energy represents a significant opportunity. Morocco has an abundance of sunlight and wind, which can counter the country's reliance on imported fossil fuels.

1.5 Political aspect

In recent years, Morocco initiated major political and economic changes. These transformations focus on renewable energies and sustainable development, with the aim of modernising and diversifying the economy. Morocco's political landscape has been relatively stable in past decades. The year 2011 marks a political turning point following the Arab spring, as the adoption of a new Constitution sets the basis for further democratization, increased decentralisation, a modernization of institutions and broadly, a renewed state of law is propelled. In parallel, the current coalition government steadily pushes for constitutional reforms and takes bold steps in reducing the fiscal deficit, namely through the phasing out of fossil fuel subsidies. Over the past two years, the most important development in the political sphere involved reforms to the pension system to address the budget deficit - a clear dent to a comprehensive economic plan. International relations remain generally good, although the Western Sahara issue produce occasional spats with Algeria, Spain and South Africa among others.

Table 1 - Key data (2017)

ITEM	VALUE
Area	712.550 km ²
Population	35.5 m
Population Growth	1.3%
GDP	\$110 B
GDP per capita	\$3.077
Real GDP growth rate	2.4%
Inflation	0.4%
Unemployment	10.1%

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

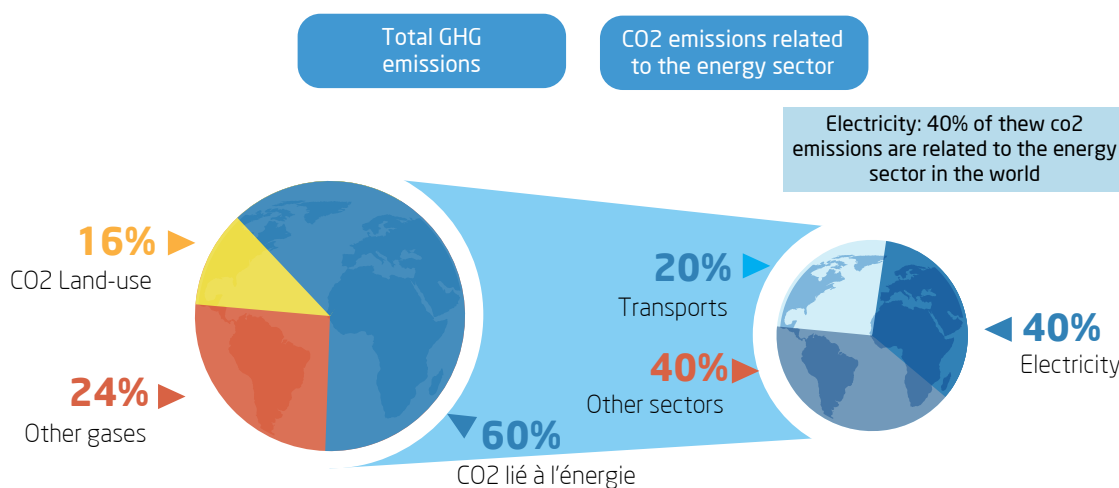
2 Global energy context

After many years of stability and long-term profitability, the utility industry faced two decades of intensive transformations, because of rapid changes that occurred at multiple levels.

During the 1990s all transition countries started with economic reforms in infrastructure services, changed the centralized organization of monopolistic infrastructure utilities and introduced market-oriented structures and public regulation. Privatization in electricity sector has been undertaken in a variety of manners but with the same goal to encourage foreign direct investment into the sector and to allow market liberalization and increasing competition.

The energy industry, which is the source of at least two-thirds of GHG emissions, climate change and other environmental impacts, has seen companies shift towards RES and sustainability across its value chain - either as a consequence of international legislation and norms, or as a strategy to capitalise on.

Graph 1 - Sources of GHG emissions by sector in the world



source: Research Institute for Solar Energy and New Energies

As a result, growth in energy-related CO2 emissions stalled completely in 2015. This was mainly due to an improvement in the energy intensity of industrialized countries, a trend bolstered by gains in energy efficiency and RE. In fact, new world records for RE, which accounted for two-thirds of all global net electricity capacity growth in 2016. This year's uncontested star is solar photovoltaics (PV), whose capacity for the first time grew faster than any other fuel. Also, an increasing slice of the roughly 1.8 trillion of investment each year in the energy sector has been attracted to clean energy, at a time when investment in upstream oil and gas has fallen sharply. The value of fossil-fuel consumption subsidies dropped in 2015 to 325 billion, from almost 500 billion the previous year, reflecting lower fossil-fuel prices but also a subsidy reform process that has gathered momentum in several countries. Three main factors contributed to this impressive success story. First, the rapid deployment and falling costs of clean energy technologies. Second, a strong government policy support, which initially began in Europe, creating a market that allowed the renewable industry to grow around the world. Third, the arrival of giant emerging country. The shift to a more services-oriented economy and a cleaner energy mix in China economies and economies of scale.

In addition, with the emergence of advanced, smarter technologies, consumers can now make more informed choices about energy usage and become energy producers and storers themselves – known as “prosumers”- resulting in a bidirectional flow of power. Prosumers usually consume, produce, and control their energy use. One of the biggest areas of opportunity to trim business operating costs is in managing energy consumption.

In fact, the utilities model is undergoing a paradigm shift with the emergence of the 3D scenario - 'decarbonisation', 'decentralisation' and 'digitalisation' - the energy industry is now faced with several new challenges. In fact, the global energy transition is gaining momentum, but traditional energy security concerns have not slipped of the agenda. Fossil fuels have had a turbulent year. Lower oil prices persist. Gas output is buoyant, but prices are low. The power sector is the largest gas consuming sector, accounting for 40% of worldwide gas demand today. Swathes of the coal industry have sought bankruptcy protection. A solid place is persisting for oil and gas in energy supply for many years to come.

Today, electricity accounts for just a fifth of total final energy demand. So, the next chapter in the rise of renewables will require multiplying their uses in the building, industry and transport sectors. For instance, new uses for renewables in industry are emerging that can open completely new markets and applications.

3 Energy context in Morocco

3.1 Overview

The Moroccan electricity sector is characterised by a high degree of energy dependence. Over 90% 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. For the electricity sector only, oil purchases account for 24 % of total imports, nearly 50 % of the trade deficits and 10-12 % of its GDP.

This dependence left Morocco rather exposed to the volatility of global energy prices. However, the recent drop in oil prices have allowed the kingdom some "breathing space" and enabled it to begin the diversification of its installed energy capacity. In recent years, Morocco has passed a series of legislations that aim to simultaneously decrease the dependence on foreign markets, phase out fuel subsidies by 2017 and increase the role of clean energy sources. We can already see a progress after recent years transitioning towards a decarbonisation of the electricity sector. This transition reduced the energy dependency ratio from 98% in 2008 to 93.3% in 2016. Moreover, renewable energies contributed for more than 13% in 2016 to meet the demand for energy, compared to 2.13% in 2008. As a result of the national energy targets and the policy framework accompanying it. The 13-09 law related to renewable energy, independent power producers (IPP) are now able to sell the produced electricity on the high voltage market. Selling on medium and low voltage is a key point of improvement for the country that is yet to be addressed.

3.2 Energy overview

Morocco's total energy consumption has reached 10 165 Kiloton of Oil Equivalent (ktoe) in 2015. Energy consumption has doubled since 2000 and is dominated by oil products, which accounts for (67.6% of TPES), followed by coal (16.1% of TPES), biofuels and waste (7.4% of TPES), and natural gas (5.7% of TPES), the use of traditional biomass is declining as access to modern fuel. The total primary energy consumption (TPEC) has increased at a rate of around 5% a year since 2004, while the per capita increase was somewhat lower at 3.6% a year mainly driven by the transport sector. Moreover, the largest consumer of energy in Morocco is the transport sector (33.2%), followed by the industry (26%), and the residential and commercial sectors (20.4%).

3.3 Electricity demand and supply overview

About one third of the total primary energy consumption is devoted to electricity generation, a 2.9% increase on the previous year. The following table sums up the key numbers characterizing the electricity market.

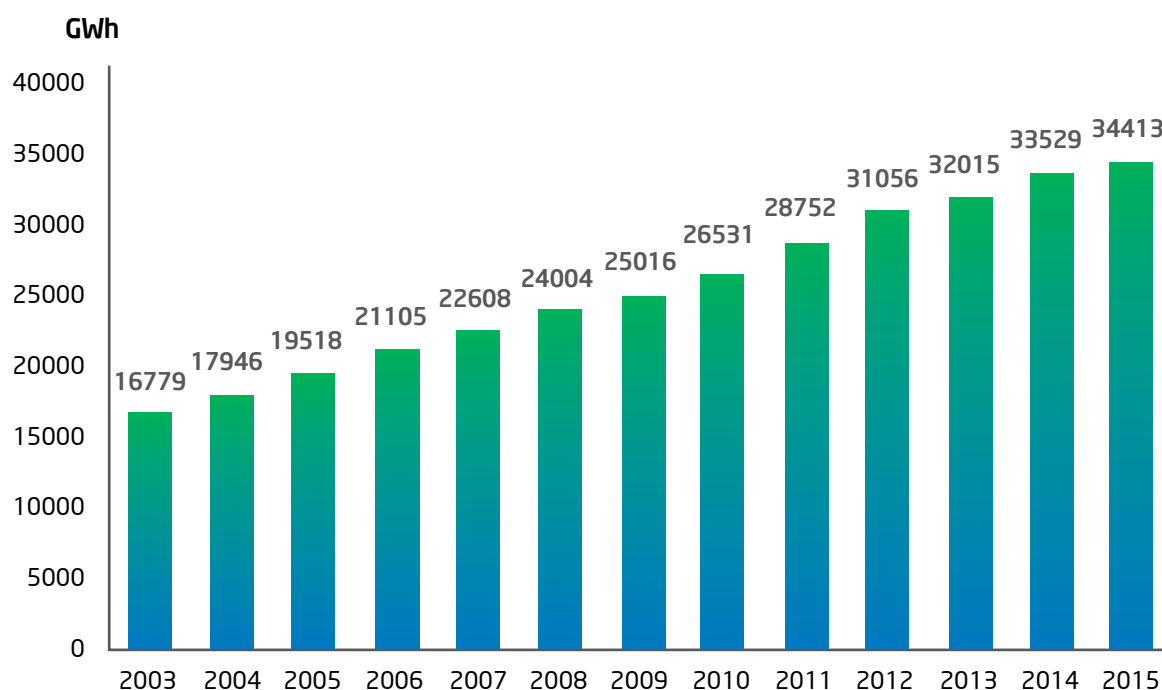
Table 2 - Electricity market figures (2016)

ITEM	VALUE (2016)
Electricity Demand	35 414.5 GWh
Electricity Demand Growth Rate (2015/16)	2.91%
Electricity Demand per capita	997.59 KWh
Total Electricity Generation	30 839,8 GWh
Total Installed Capacity	8261.7 MW
Peak daily demand	6 050 MW
Peak daily Demand Growth (2015/16)	3.2%
Rural electrification rate	99.13%

Source: ONEE (Activity book 2016)

Electricity demand in Morocco is growing rapidly (4.5% on average between 2003 and 2014), based on the drivers of a growing population, increased access to electricity through the rural electrification programme (PERG), development of major infrastructure projects, urbanisation economic growth and improving standards of living.

Graph 2- Growth of the electricity demand (2003-2015)



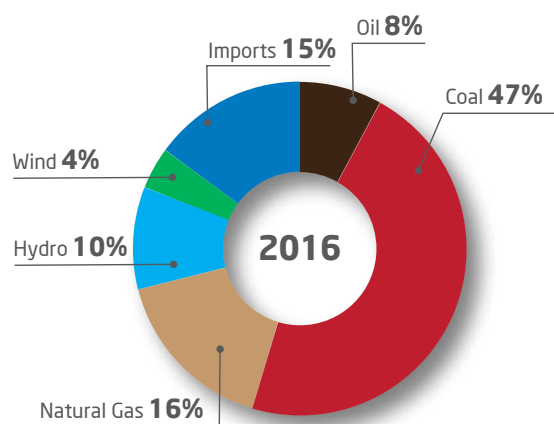
source: ONEE

The demand is satisfied mainly through thermal production, which accounted for 25 144 GWh; split roughly: 16 650 GWh coal, 5 600 GWh natural gas and the remaining 2 800 GWh coming from fuel and gasoline while renewables totalled about 5 400 GWh. However, the following graph does not represent solar energy output because of its low share accounting for less than 2% of the annual demand in 2016. The solar share exists because of the Noor I (160 MW CSP plant) which produced in 2016 about 400 GWh, while the central ASSA owned by the National Office of water and electricity (ONEE) produced 1 GWh of electricity. In addition, an estimated 279 GWh of power generated provided by solar panels kits equipped in 70 000 households spread throughout the country, under the electrification program (PERG).

Given the intermittency nature of renewables, sometimes hard to predict especially for hydropower, Morocco has been importing electricity to bridge the gap between consumption and production. The other factor is the recent excess of production from wind power sources from Spain, resulting in extremely advantageous prices that Morocco has been buying. In 2016, Morocco imported approximately 4500 GWh of electricity supplied from Spain and Algeria.

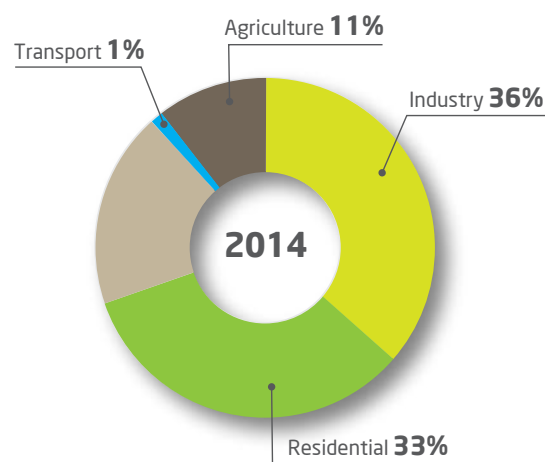
The following figures depict the consumption by primary source of electricity and by sector in 2016.

Graph 3- Consumption by primary source of energy



source: Solar Plaza, 2017

Graph 4- Electricity consumed by sector of activity

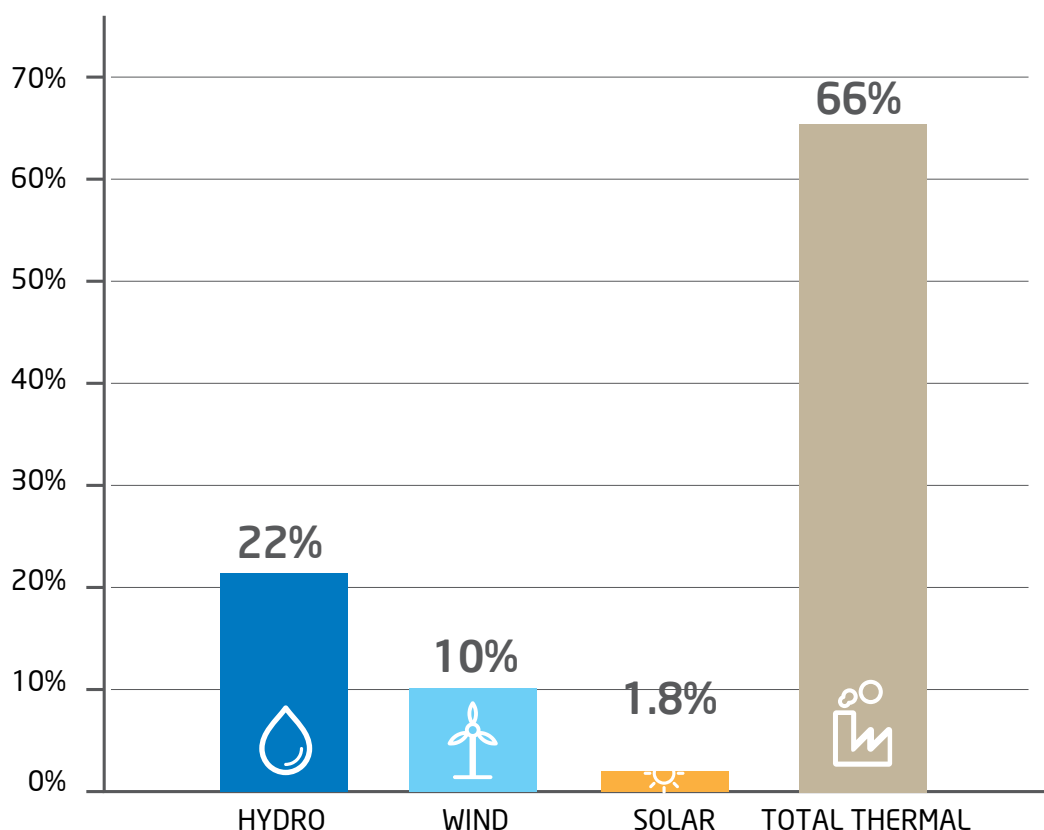


source: Solar Plaza, 2017

In 2014, the largest electricity consumers sectors in Morocco are the industrial and residential sectors, accounting for 20,082 GWh of electricity consumption, which constitutes more than two-thirds of the total electricity consumption of the country. The commercial sector and the agricultural sector are accountable for 5,368 GWh and 3,024 GWh of energy consumption whereas the transport sector only consumes 332 GWh of energy.

The following graph represents the installed capacity in 2016.

Graph 5- Installed capacity by primary source of energy (2016)



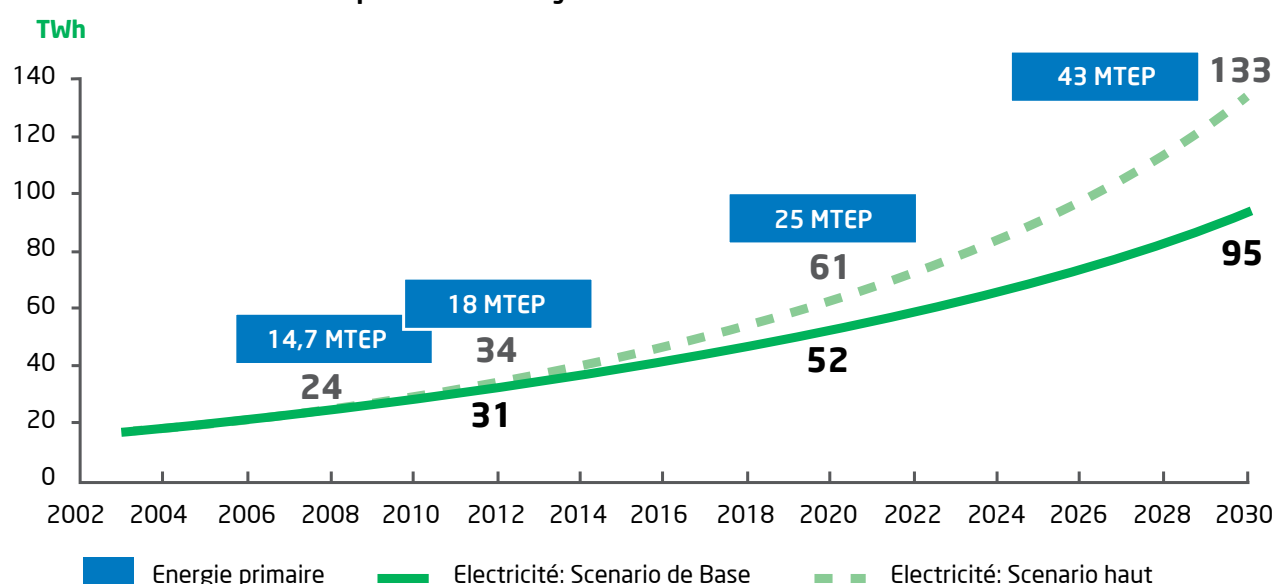
source: ONEE, 2016

Out of the 8261.7MW installed capacity in 2016 almost 5 GW is sourced from fossil fuel sources. The remaining of installed capacity is sourced from RES. The hydroelectricity is the most prominent energy source accounting for more than 1.7 GW, whereas wind and solar energy have a capacity of 820 MW and 160 MW respectively.

1. Demand forecast

On the basis of the scenarios developed by MEMDD, it is estimated that following a conservative scenario, demand for electricity will reach 52 TWh by 2020 and 95 TWh by 2030. On the basis of a high demand scenario, the demand will be 61 TWh by 2020 and 133 TWh by 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). Power demand in Morocco will be robust over the coming decade in line with an expanding manufacturing base in the country. This will bolster power demand in the market forecasting an electric consumption to average 4.1 % annually between 2017 and 2026. Within this framework, industry accounts for 40 % of consumption, followed by domestic (32%) and services (17%).

Graph 6- Electricity demand forecast based on two



source: Ministry of Energy, Mines, Water and Environment of Morocco

2. Electricity price

The electricity tariff system determines a pricing structure that varies according to level of consumption, time of day and type of meter. In 2015 the end-user price per kWh was between 5 and 17 euro cents (including 14% VAT), with most rates falling within the 6 to 12 cent range (including 14% VAT). (Moroccan-German Energy Partnership (PAREMA), Oct 2016). Since the abolishment of the numerous fuel/diesel subsidies (2013-2015), the electricity tariffs started to increase in 2015, after being maintained at their 2009 level despite the significant rise in fuel costs. The increase mainly concerns the highest tranche of consumption by low voltage consumers (+3.4%), industrial clients using medium voltage (+13 % on average) and HV and VHV clients (+6.7%) tariffs for final consumers (residential and professional). As the government seeks to reduce subsidies and therefore tariffs have increased by regional but still remain below generation costs. Rural customers have the possibility to participate in a prepaid system based on pre-paid meters. For the electrical supply, the customer can purchase the desired amounts via rechargeable cards sold for 20 MAD. The strategic aim is to guarantee a secure energy supply to all of its citizens and simultaneously reduce the country's dependence on energy imports.

Morocco's energy structure is undergoing total transformation. Aware of its potential in terms of renewable energy, Morocco aims, in the long term, to become an exporter of energy to European and African markets and has the natural resources (wind and solar energy potential and geographical situation) required to achieve this.

3.4 Market Structure

The electricity sector is still vertically integrated, but significant steps towards the liberalisation of the sector are underway. For example, the development of the national energy strategy in 2009 and on the same year the development of decisive framework laws containing provisions for the start of liberalization of the electricity market, renewable energy and energy efficiency.

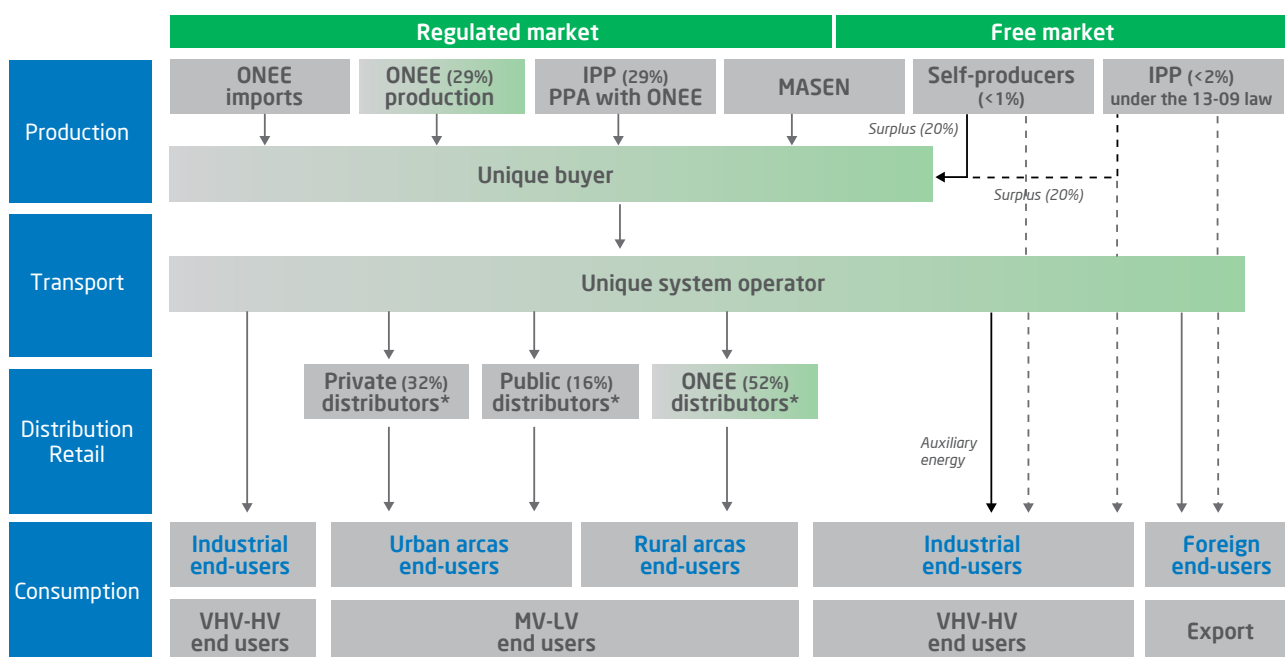
The sector is dominated by the state-owned operator: Office National de l'Electricité et de l'Eau (ONEE), which acts as a producer, distributor and retailer of the water and electric power. ONEE can give concessions to private operators with purchase guarantees and has the status of single buyer of electricity produced. Concerning the RE generation, ONEE allows to give concessions to private operators directly with purchase guarantees (private to private power transactions). The RE law allows electricity to be produced, sold and exported by any private producer as long as they utilise renewable energy sources. Therefore, there is no real-time trading or a market operator function.

Moreover, the establishment of a National Energy Regulatory Authority (ANRE) in June 2016 is a further step towards liberalization of the market. It aims to regulate both electricity and gas markets. As of December 2017, ANRE is not operating yet, and without such a body it leaves 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.

Furthermore, the ministry of Energy, Mining, Water and the Environment (MEMDD) has a responsibility to set up the energetic strategy and general framework while the ministry of interior is in charge of the supervision of the autonomous utilities of distribution.

The following illustration shows how the market is structured.

Figure 1 - Electric market structure



source: Ministry of Energy, Mines, Water and Environment of Morocco, 2016

3.4.1 Generation

The total production from ONEE power plant totals 10 563 GWh in 2016 allowing to satisfy about 29.2% of the electricity demand. In addition to its own generation facilities, ONEE has signed 10 long term PPAs with IPPs of which 6 are under operation, and 4 under construction. These include coal, gas, and RES facilities. Investment in the construction of power plants are generally made through public-private partnerships, which always involve one of the government energy agencies (usually ONEE or MASEN). Investments can, however, be wholly public (usually through the ONEE) or wholly private. The possibility of private investments was provided by the act 13-09 and it is exclusively reserved to renewables investments. The following table brings a recapitulation of the share of the different generation schemes.

Table 3 - Generation breakdown by contract scheme

Generation Scheme Contracts	Share of the generation schemes contracts
PPAs (IPP) Generation	35%
ONEE's Power Plants	29%
Electricity imports	14.5%
Private to Private (law 13-09)	2.5%
Self- Generation	<1%

Source: Africa Energy Yearbook, 2016

In Morocco funding for such projects comes from the government budgets, such as the Hassan II Fund for Economic and Social Development, the Energy Efficiency Fund (FEE), the Energy Development Fund, SIE's Renewable Energy Fund (FER) and the ONEE's own funds. Also, it receives numerous financial support from international institutions and countries, including KfW, development bank, the European Commission, the European Investment Bank, the Agence française de développement, the Clean Technology Fund, the African Development Bank, Saudi Arabia and the United Arab Emirates.

1. Independent Power Producer (IPP)

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. 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.

2. Self-generation

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 specialized arm Italgén. The project for the construction of a wind farm in Morocco was the first initiative launched by Italgén in the wind power field (2006), with the aim of contributing to meeting the local energy needs of Italcementi Group.

OFFICE CHERIFIEN DES PHOSPHATES (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

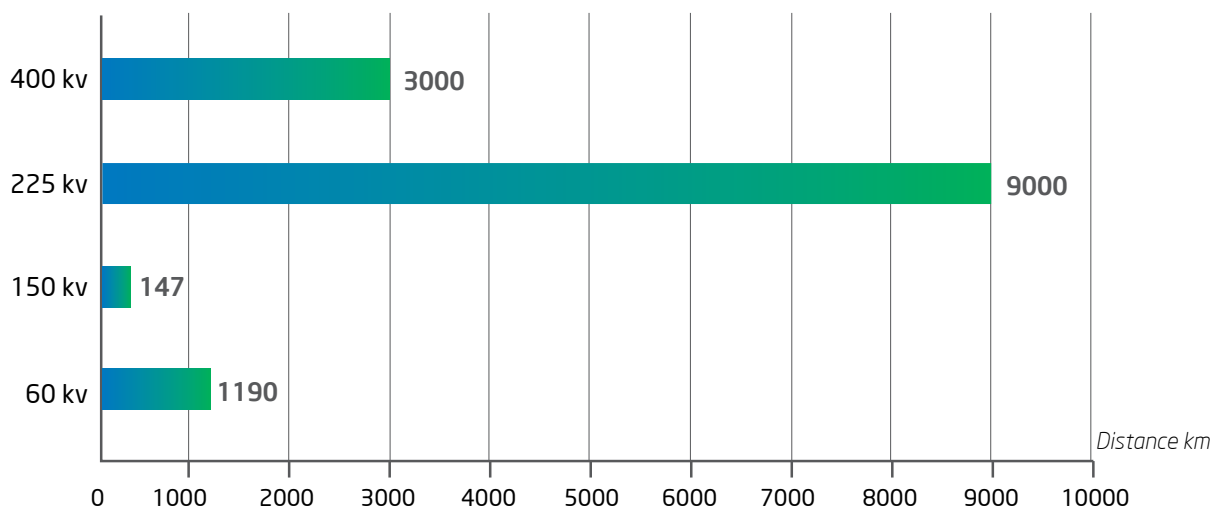
The production plant, with a capacity of 5.1 MW and a production of 16,000 MWh, was built in Southern Morocco in an area characterized by growing demand for electricity. The plant will supply electricity to a local grinding center. This initiative is expected to reduce the emission of CO₂ by about 12,000 tons per year. Italgen 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.

Phosboucraa unit based in the southern part of Morocco meets 90% of its electricity needs with wind power.

3.4.2 Transmission network

ONEE holds a monopoly on transmission, it owns the complete network and is responsible for operating and expanding the grid. The transmission network covers the entire country -aside from a small network in the south- grid (400 kV, 225 kV and 60 kV). The following graph represents the breakdown of ONEE network by very high voltage, high voltage for the transmission grid and medium voltage, low voltage for the distribution grid. While the on-grid energy diversification is of the utmost importance, those that do not have access through the national grid rely on several mini-grid and off-grid initiatives which represents 2.5% in 2015. In 2017, the reinforcement of the transmission network amounted to 12 million dhs.

Graph 7 - National electricity network



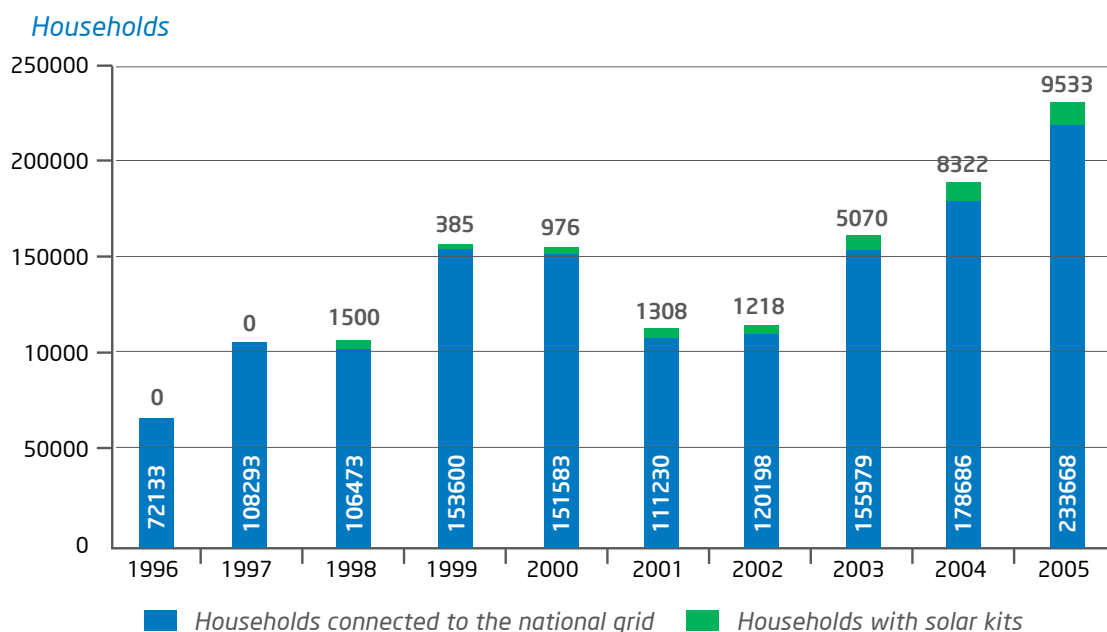
source: ONEE, 2015

1. Rural Electrification Programme (PERG)

One of the most important features of the Moroccan electric sector in recent years, has been the vast expansion of the electricity network. In 1996, the government launched a 15-year rural electrification program (PERG) with the aim of increasing rural electrification to 80% by 2010- up from 18% in 1995. In fact, the program 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 programme includes decentralized (off grid) with PV kits electrification, micro grid and regular national grid. The off-grid method of electrification is intended for villages whose cost of connection to the network exceeds the 27,000 dirhams per household due in particular to their distance from the network or the dispersion of the habitat. While the other micro grid option was to lower the height of the low voltage poles from 10.5 to 9m and later to 8m. This led to cost

reductions of 20%. Another example was to place the transformers of the poles, which led to more than 35% of cost reductions for transformers. A total of 51,559 PV systems off-grid option covering 105,000 homes are currently installed and constitutes about 2.5% of total connections achieved within the period of PERG. The graph below reflects the ration national grid and off-grid systems.

Graph 8 - Morocco rural electrification (1995-2005)



source: Office National de l'Electricité - Rapport Annuel 2005

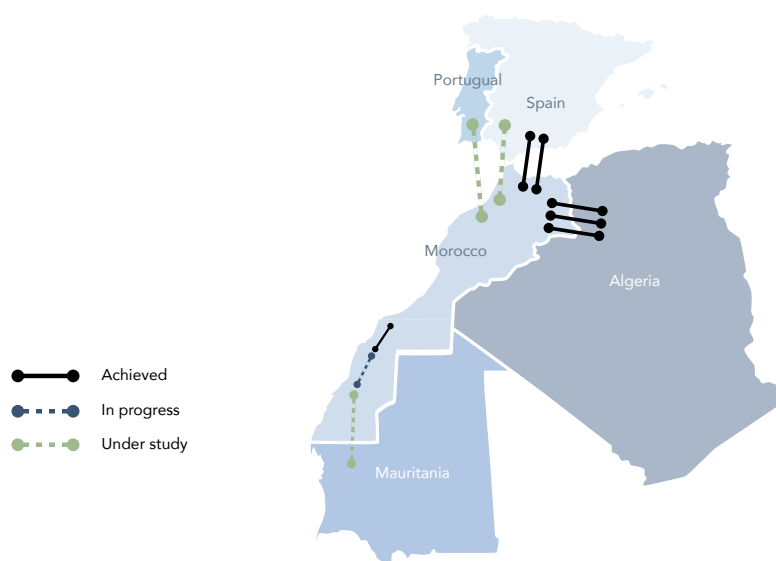
From 2005 and 2013 the ratio grid connection and solar kits is maintained around 2.5%. Indeed, the vast majority, 37,099 villages, have been connected to the grid (2,027,120 households), with a smaller but still significant figure of 3,663 villages being equipped by Solar Home Systems (SHS) (51,559 households).

Given the annual increase in electricity consumption, the greater distances between electricity generation sites (particularly in the case of major wind and solar power projects) and buyers, and the intermittency issues of the large renewable energy projects ONEE is now focusing considerable efforts on developing and modernising the national electricity transmission network. Investments amounting to around 730 million euros have been earmarked for this purpose, for the period 2014–17 alone.

2. Interconnected network

The transmission grid covers interconnections with the European grid through Spain and the Algerian power network. The following map illustrates the existing, in progress and understudy interconnection.

Map 1 - A power regional crossroad between the north and the south



Source: Africa Energy Yearbook, 2016

Morocco shares cross-border power connections with Spain through two submarine power cables. The first interconnection was commissioned in 1997 with a 700 MW (400kV) capacity and was doubled in 2006 through a second connection by the same capacity, totalling 1 400 MW. The commercial capacity represents 900 MW. ONEE has been the 4th operator in the Spanish market since 1999. A third interconnection is currently under study. At present, it is the only transmission cables linking Africa and Europe. Morocco has been importing increasing amounts of electricity from Spain in order to make up its production deficit, but also to leverage the lower cost of Spanish power compared to the marginal cost of increasing production locally (wind). The operations are carried out through the Spanish spot market

The second country Morocco shares physical and power connexion with is Algeria, with 200MW (225 kV) each. The first one was commissioned in 1988, the second interconnection was established in 1992 and the third followed in 2009. The commercial capacity reaches 1 400 MW. The regional power interconnections are well developed but the actual electricity exchanged are fairly limited. In fact, the trades are carried out in emergency cases through a contract with SONELGAZ.

With a view of increasing power links with its neighbours, including the Morocco-Portugal project that is currently under study (capacity of 1,000 MW). In addition, a third interconnection with Spain is being studied, as well as other projects with Sub Saharan countries through Mauritania. In fact, the expected Morocco-Mauritania interconnection is under study. As a first stage, Laayoune-Dakhla is on progress (400kv).

3.4.3 Distribution system

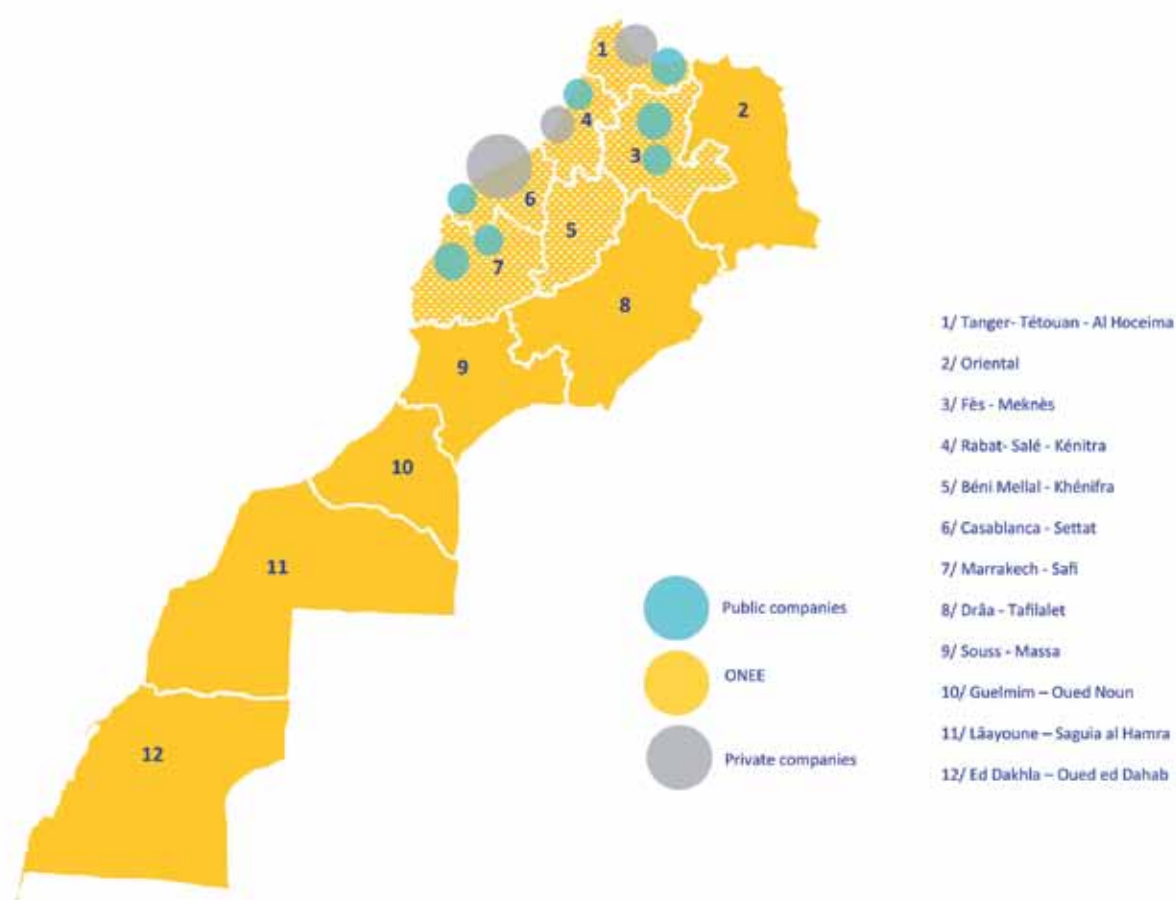
The distribution sector is managed by many actors and could be divided in three categories: Public, private and ONEE. The national office owns and operates the majority of the distribution network (52%) and is the main retail supplier. Overall, there are no retailers per se, the DSO acts as a retailer in the region of operation given the unbundling feature of the market structure. Responsibility for the distribution subsector is divided at the Government level between the MEMDD which has oversight over ONEE, and the MI, which supervises the overall performance of the public enterprises responsible for the distribution of water and electricity in large urban areas.

The power distribution subsector includes seven local municipal utilities (Régies) as well as three 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 agreements and performance objectives for public services so as to protect the interest of consumers and the environment. -

Several cities have granted concessions for their utilities. The French Lyonnaise des Eaux (Lydec) is the distribution company of Casablanca with 600 000 customers, is controlled by Suez with a majority stake of 51% (Fipar Holding 16%, RMA Watnya 16.2%, floating 16.8%; it has a 30-year concession contract since 1997. Two other private distributors are Redal (Rabat) and Amendis (Tangier and Tetouan). 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 distribution network is made up of 80 662 km medium voltage and 199 300 km low voltage line. The map below illustrates the geographical localisation of the distribution sector for medium and low voltage network.

Map 2 - Network of distribution within the 12 regions



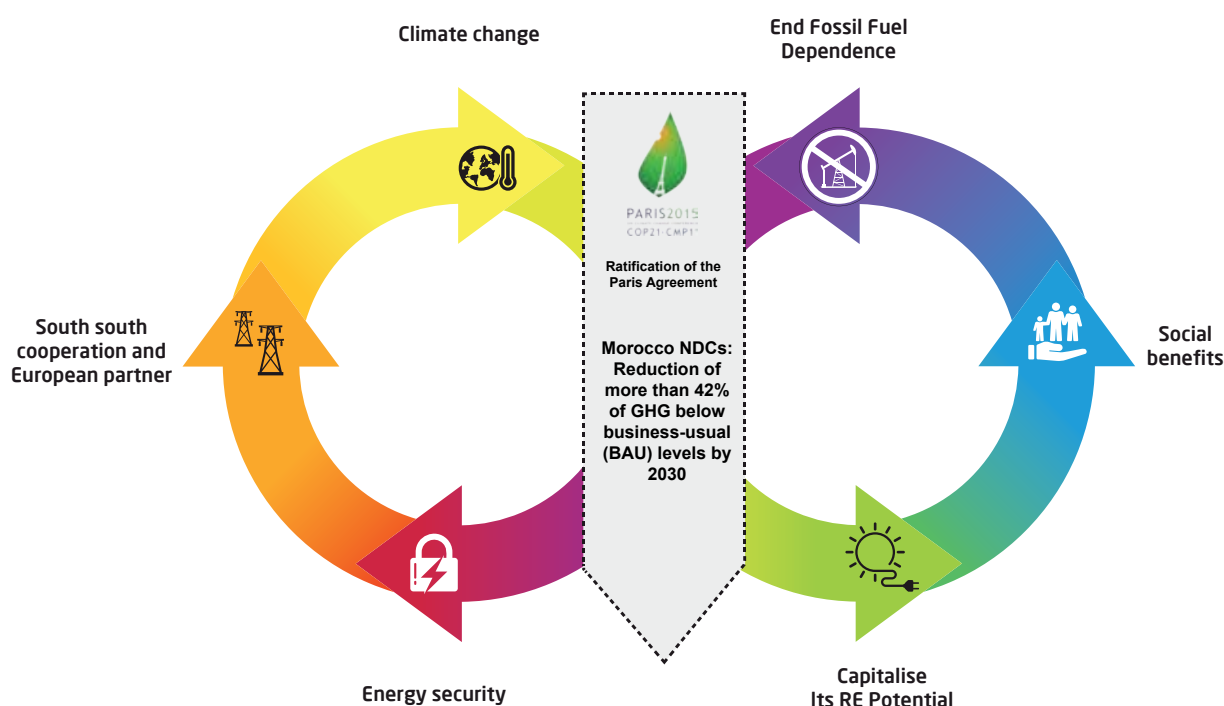
Source: ONEE workbook, 2016

4 Towards a decarbonisation

4.1 Drivers

This section will first display the key drivers that foster the transition towards the decarbonisation, followed by the national target-setting regarding RE and EE. The next section will sum up the enabling environment and conditions to achieve such targets which are the designated legislative and regulatory framework, followed by the illustration of the key institutions.

Figure 2- The six elements driving a decarbonisation of the electric sector



4.1.1 Climate change

Due to its geographical location, Morocco is strongly affected by climate change (desertification, flooding and decreasing water resources) and its vulnerability will increase in the future. For this reason, between 2005 and 2010 the government devoted 64 % of its climate-related expenditures to mitigation and adaptation. This demonstrates the measure of the climate change challenge to the country which is accentuated by various factors such as the level of awareness of the population, the legal framework. An approach adapted by territory and economic structure is necessary especially for the sectors with high dependence on water resources, such as agriculture and the coastal areas.

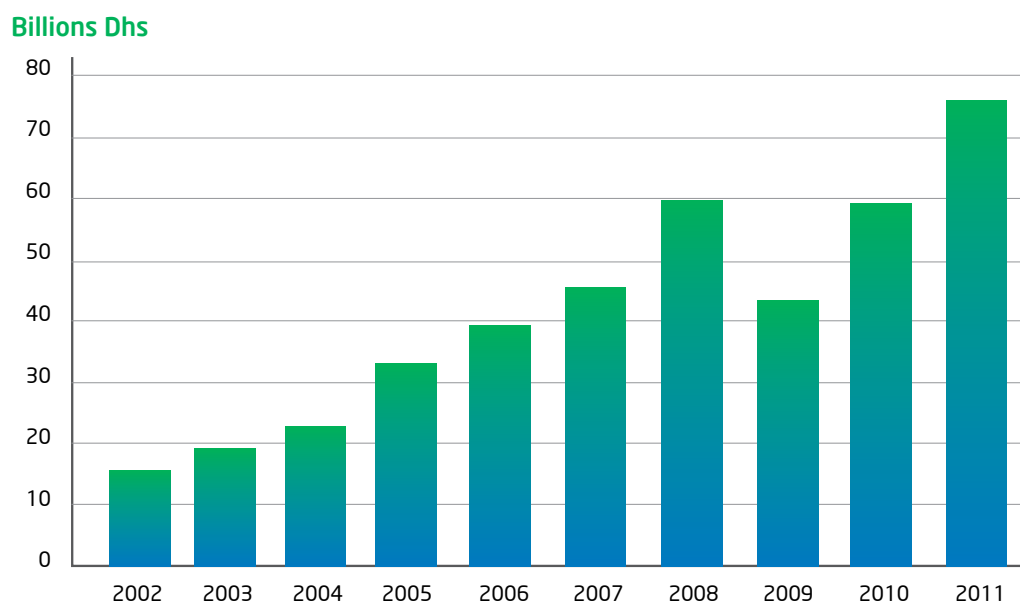
According to estimates, during the 21st century agricultural production could decline by 15 to 40 %. This entails the risk of rising food prices, an aggravation of social inequality and the destabilisation of the entire socio-economic equilibrium of the country. Added to the increase in population and forecast industrial needs, these vulnerabilities will progressively increase, impacting not only the agriculture sector, but the entire economy and stability of the nation.

4.1.2 Reduce energetic imports

Highly sensitive to exogenous shocks, Morocco dependence on fossil fuels imports has grown over the years and weighs heavily on the economic and financial equilibria of the country. The fossil fuels subsidy system

set up in 2000 is mainly concentrated on diesel, fuel and butane. In 2011, it cost Morocco 5.1 % of its GDP or Dh 41.4 billion (Euros 3.7 billion) as against nearly nothing in 2003. This ratio is considered eventually untenable for public finances. Thus in 2011, the public deficit amounted to 6.8 % or nearly the equivalent of the cost of the subsidies. This system, as underlined by a study undertaken by the International Monetary Fund in 2013 on the reform of state subsidies to fuels in Morocco, is not efficient in sustaining the living standards of the poorest. Quite the contrary, it benefits the largest consumers.

Graph 9- Oil Bill in Morocco (2002-2011)



Source: Ministry of Energy, Mines, Water and Environment of Morocco (2013)

Today, the total indexation of petrol and fuel and abolished the related subsidies. Also, the subsidy on fuel was abolished as well as that on the special fuel used for electricity production within the framework of the ONEE-Government contract. Moreover, in 2015 the liquid fuel prices obey to the free play of supply and demand. However, the government continues to subsidise the price of butane. The State assumes about two-thirds of the price of a 12kg flask. Currently the reform of the compensation system is being studied and aims to target budgetary support for needy households. These subsidies will be replaced by direct aid to the 8.5 million Moroccans living below the poverty threshold. However, the Minister of General Affairs, stated in June 2016 that the conditions for ending the butane subsidy had not yet been fulfilled. The butane amounted to nearly Dh 16 billion in 2015. In 2017, the state only continues to subsidise butane weighing on the government budget and so affecting the deficit trade balance affecting directly its GDP. Clearly being able to sustain energetically would be an outstanding advantage for Morocco.

4.1.3 Social impacts

In a country like Morocco the decentralised character of RE can especially benefit poor rural areas. Indeed, today RE technologies are giving certain and reliable access to electricity, enabling an improvement in the lives of the least developed communities. For example, in the rural community of Haouiza, 12 km from El Jadida, the installation of solar panels has enabled the powering of a water pump in a rural school. Before that the school was not connected either to water or to the grid and there were no sanitary infrastructures. The impact of water availability in the school and of sanitary infrastructure had the effect in particular of prolonging girls' enrolment up to the age 14 and thus increasing their numbers, from 25 % of total enrolments in 2010 to 48 % in 2015.

Table 4 - Expected job creation by 2020

Sectors	Jobs to be created by 2020	Growth rate (%)
CSP	6100	45.86%
PV	4700	35.34%
Biomass	1300	9.77%
Wind	1100	8.27%
Micro-Hydro	100	8.27%
RE	13300	26.55%
EE	36800	73.45%

Source: Ministry of Mines, Environment and Water of Morocco (2013)

With an unemployment rate that turns around the 10%, a majority of women, young generation and rural areas are the first affected. The other element that RE and EE bring a positive impact is the job creation. For example, Noor I alone (160 MW solar plant) has employed 1000 people during the construction phase and has created approximately 60 permanent jobs. Not only in terms of quantity and number of jobs but also bringing an expertise and new skills to the workers. The following table sums up the expectations for the job creation by sector of RE and EE. Note that the EE presents an essential opportunity in the job creation.

4.1.4 Renewable energies and energy efficiency potential

Morocco's strong dependence on fossil fuel imports seriously endangers its future energy security, weighs heavily on its economic and financial equilibria. Indeed, Morocco is scantily endowed with conventional energy resources. However, it benefits from a topography and climate which are extremely well suited to the development of RE, in particular solar and wind. The next section will display RE maps potential in Morocco followed by EE potential

Hydraulic

The nation already has a hydroelectric structure which covers basic energy needs. In 2015 installed capacity reached 1,770 MW and its hydroelectric potential is estimated at 3,800MW.

Map 3 - Hydropower potential



Wind

Morocco benefits from rich wind regimes especially along 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. The total wind potential is 7.9 TWh/year while technical wind potential stands at 4.8 TWh/year and exploitable potential is judged to be at 25 GW, of which 6 GW could be installed by 2030.

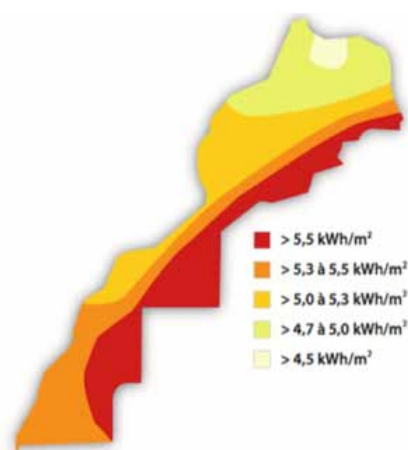
Map 4- Wind potential



Solar

Solar is certainly the leading source of RE in Morocco since its solar resources are equivalent to 20,000MW, with more than 3000 hours a year of sunshine and irradiation of 5 kWh/m²/day. Mainly 5 sites: A Beni Mathar (Oujda); Ouarzazate; Sebkhath; Fom Al Ouad; and Boujdour.

Map 5- Solar potential



Source : Société d'Investissements Énergétiques (2015) :
« Gisement solaire du Maroc »

Biomass

Morocco's large agricultural sector and the fact that a large part of the waste generated is made up of organic components are a boon to power generation from biomass and biogas. Morocco also has plans to generate bioenergy using household waste and biogas using wastewater. The aim is to strengthen the biomass sector, with a view to replacing fuel oil in the industrial sector. However, there are no national strategies in place at present to tap into this potential, although some small enterprises have already initiated operations in this field.

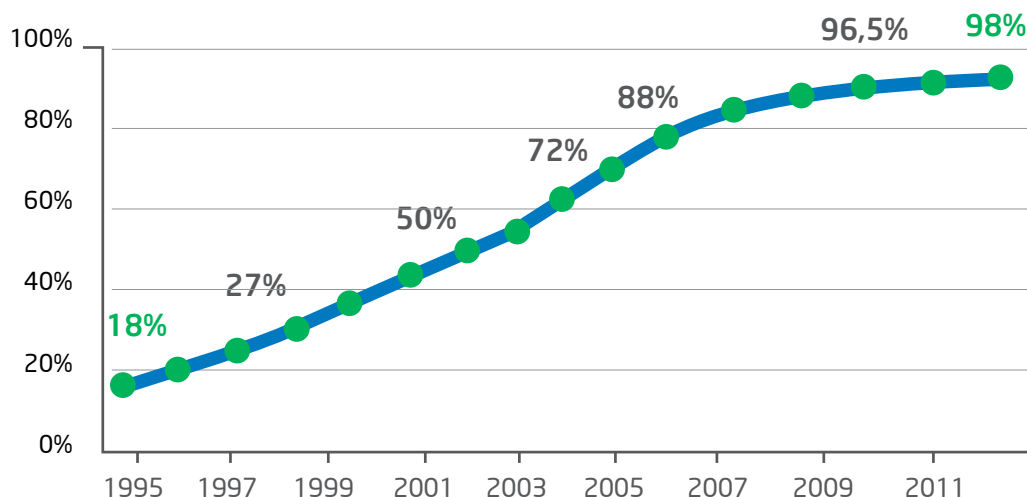
Energy Efficiency Potential

The potential of EE is limitless as diversifying to cleaner, more efficient fuels, RE 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 EE in buildings, industry and public lighting. Morocco is in fact the 14th most attractive country for RE today. It is ranked first in the MENA region and second in Africa behind South Africa according to the RE barometer « Renewable Energy Country Attractiveness Index » issued by Ernst & Young in 2016. The quality of resources is such that the price of wind and solar energy is already competitive with the price of fossil fuel based energies: prices of wind projects vary between Dh 0.31 (US\$ 0.03 cents/Kwh) for the Integrated Wind Project; Dh 0.57 (US\$0.05 cents/Kwh) at Taza and Dh 0.72 (US\$0.07 cents/Kwh) at Tarfaya. The price of thermo-solar projects at Ouarzazate vary between Dh 1,5 (US\$ 0.15 cents/KWh) at NOOR O CSP I with 160 MW and 3 hours storage and Dh 1.4 (US\$ 0.14 / KWh) at NOOR O CSP II and NOOR O CSP III with 350 MW with 8 hours storage. In comparison, the fuel fossils import price during the last ten years has been 0.97 Dh (US\$ 0.09 / KWh).

4.1.5 Energy security

The graph below shows the evolution of Morocco's electrification rate since the launch of the PERG program.

Graph 10- Growth of the electrification rate (1995-2015)



Source: Ministry of Energy, Mines, Water and Environment of Morocco

As stated in section III, the huge success of the PERG program in connecting all of the country to the grid 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 comes with its own set of economic and environmental challenges. While on the one hand, these policies have allowed the country to reach near 100% electrical coverage, the increase in demand has led to the raise of an already high energy imports. Thus, the RES have the opportunity to respond to the higher energy demand problematic.

Table 5 - GDP growth vs. Electricity growth

GDP Growth Average of 5%	Electricity Demand Growth Average of 6.5%
PRIMARY ENERGY	ELECTRICITY
x2 until 2020	x2 until 2020
x3 until 2030	x4 until 2020

This development contributed to a steady growth rate of 4 to 5 % a year, led to a strong boost to electricity demand. In fact, during the last ten years, and driven by the generalisation of electricity access, improved living standards and demographic growth, electricity demand in Morocco grew at 6.6 % a year with a structure increasingly resembling that of developed countries. It thus went from 15 540 GWh in 2002 to 35 414 GWh in 2016. A further 70 % increase is foreseen up to 2025.

To meet rising demand and at the same time reduce dependence on foreign countries, the government has sought to encourage as much investment as foreign as possible in new RES plants.

4.1.6 South-south cooperation

The country intends to become the 'electricity hub for North and West Africa' (ONEE). Not only in terms of electricity traded, but also capacity building and innovation. Indeed, Morocco is planning to develop an expertise in the field of energy. IRESEN is an example of R&D organisation created in order to implement innovative solutions for managing energy production and to adapt it to the Moroccan and African needs.

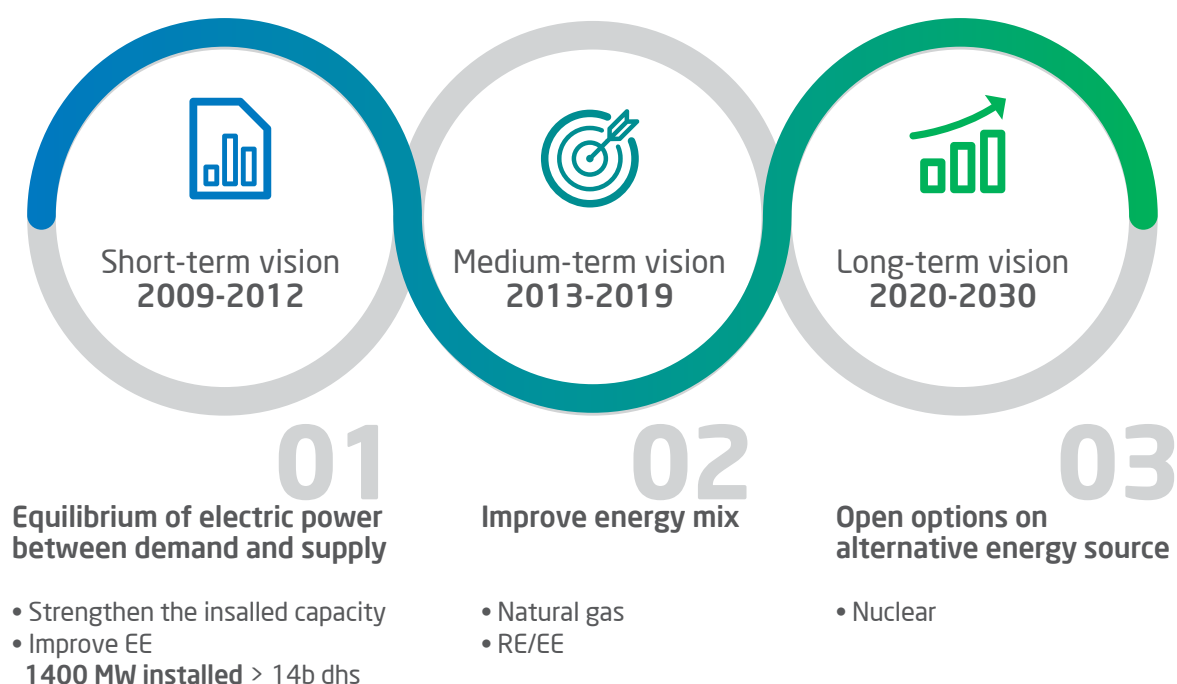
At the COP 21 summit held in Paris, His Majesty King Mohammed VI hailed Africa as the 'continent of the future'. Morocco promotes South-South cooperation as a long-term goal, seeking to establish equitable economic relations with other African countries, particularly in West Africa and sub-Saharan Africa. In order to achieve this visionary goal, various projects will be launched in the years to come to strengthen the role of Morocco as an engine of economic growth in the African continent. Since 2013 Morocco has significantly strengthened its political ties and, above all, its economic relations with numerous African countries, including Senegal, Mali, Côte d'Ivoire, Gabon, Guinea and Mauritania. In recent decades some Moroccan sectors, such as banking and services, have built up robust capacities at home, and many Moroccan enterprises are now well positioned in African markets.

Some Moroccan banks, such as Attijariwafa Bank and BMCE Bank, are already operating in various African countries, as is Maroc Telecom, which had 51 million customers in sub-Saharan Africa in 2015. The Office Chérifien des Phosphates (OCP), a publicly-owned company that produces phosphates and fertilisers, is also well established in various African markets. The ONEE too is active in a number of African countries. Its first inroads into the rural electrification market was in Senegal. As we can see, a whole range of Moroccan enterprises across a variety of sectors are now operating in North Africa and sub-Saharan Africa. For many years now, the state-owned airline Royal Air Maroc has offered direct flights to Africa's main economic centres at affordable prices. It is one of Africa's top airlines, flying to 32 destinations in 26 countries throughout the continent – an asset that should not be underestimated.

Morocco's national trade fairs and exhibitions have long had a regional scope and increasingly focus on African markets. Between 2003 and 2013 Morocco's exports to African countries increased fivefold, rising from approximately 200 million euros to around one billion euros.

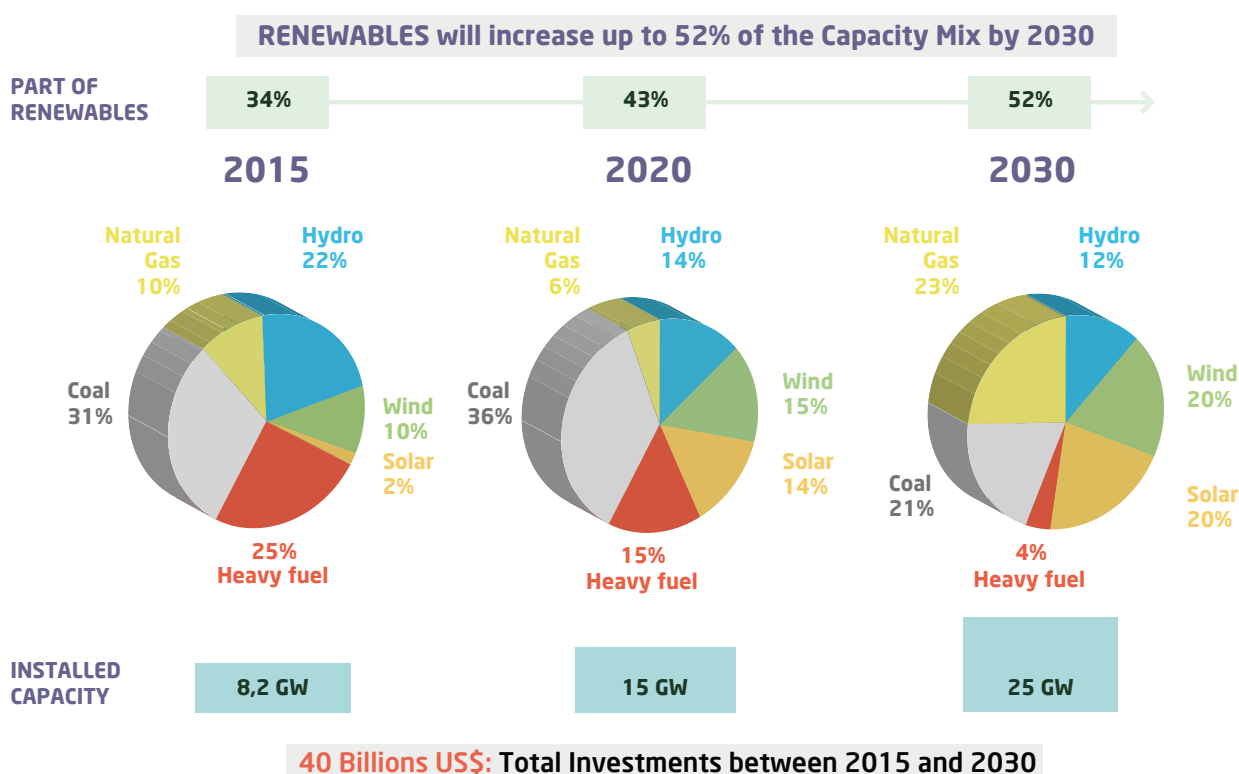
The country is reactivating its traditional trade relations with Africa, which opens up opportunities for companies seeking to enter the Moroccan market and with plans to break into other African markets. They can use Morocco as a base for their operations and also take advantage of Moroccan structures in place in other African countries.

4.2 National Energy Targets



Aware of the nation's energy stakes and the promising future of green energy sources, in 2009 Morocco planned mitigation actions under the National Energy Strategy (NES), which aims to achieve Morocco's NDC, include the implementation of an ambitious 42% target of installed electricity capacity of 6 GW from RES by 2020. The program lays down strategic directions and general conditions for the development of RE, as well as EE highlighting Morocco's desire to press ahead with the energy transition.

Graph 11 - Long term capacity mix targets



The objectives of the national programme are the following:

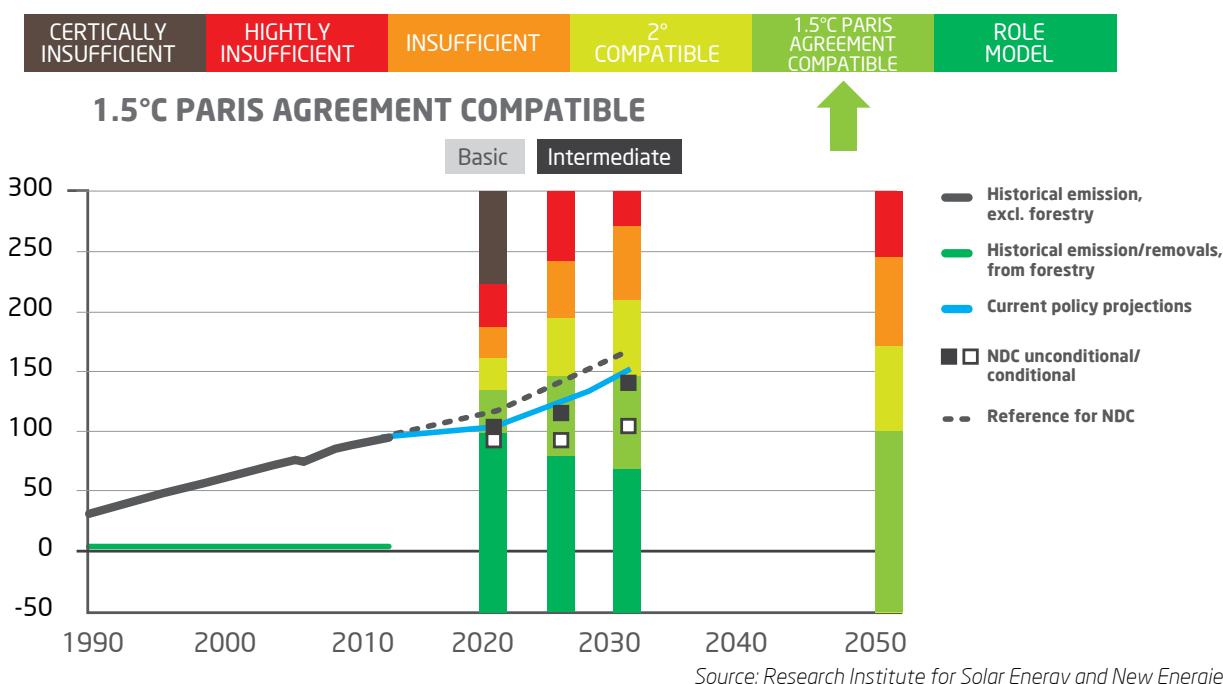
- energy security;
- access to energy at affordable prices;
- energy management;
- environmental protection

Followed by the strategy to:

- optimise and diversify the electricity generation capacity mix
- implement a drive to increase RE,
- increase awareness of the EE issues;
- promote the exploitation of national oil and natural gas deposits;
- improve the regional integration of electricity transmission network.

At the COP21 summit held in Paris, King Mohammed VI ratified the agreement and announced the next target by 2030, which will account for installed RE of 52% representing 13GW. Between 2016 and 2030, total investment for the energy sector should reach US\$ 40 billion, which according to the MEMDD will represent major new opportunities for the private sector and enable a 32 % reduction in GHG emissions by 2030. The following graph compares the compatibility between the Paris agreement target (below 1.5 C) and the national targets.

Graph 12- Comparison between the national targets with the Paris agreement



However, fossil fuels will continue to play an important role in the short term, even though it is certain that the future of the national energy mix is focused on RE. Morocco is therefore playing a pioneering role, not only at the regional level, but also on the wider international scene.

It is forecasted that the total capacity by 2020 will reach 14.285 MW and plans to install more than 10 GW of additional renewable capacities by 2030, of which 4.5 GW of solar, 4.2 GW of wind and 1.3 GW of hydropower. It is also planning to build a large infrastructure to improve imports of fossil fuels. To improve the security of supply and address low-carbon development, the country aims to reach between 15% and 20% of renewables in primary energy consumption in 2030. Regarding EE, the country also aims to reduce its energy consumption by 15% in 2030.

4.2.1 Hydroelectricity program

The increase in renewables translates into particular goals for each source over the same period of time. Hydroelectricity, a crucial element of the kingdom's energy system for many decades, is expected to reach 2,000 MW by 2020 and up to 3,100 MW by 2030. Furthermore, hydroelectricity generation in Morocco is heavily reliant on rainfall levels which makes its predictability complex. However, the country is focusing on smaller projects as well as the development of new technologies such as pumped storage hydroelectric plant (STEP)

4.2.2 Integrated wind energy (IWE) program

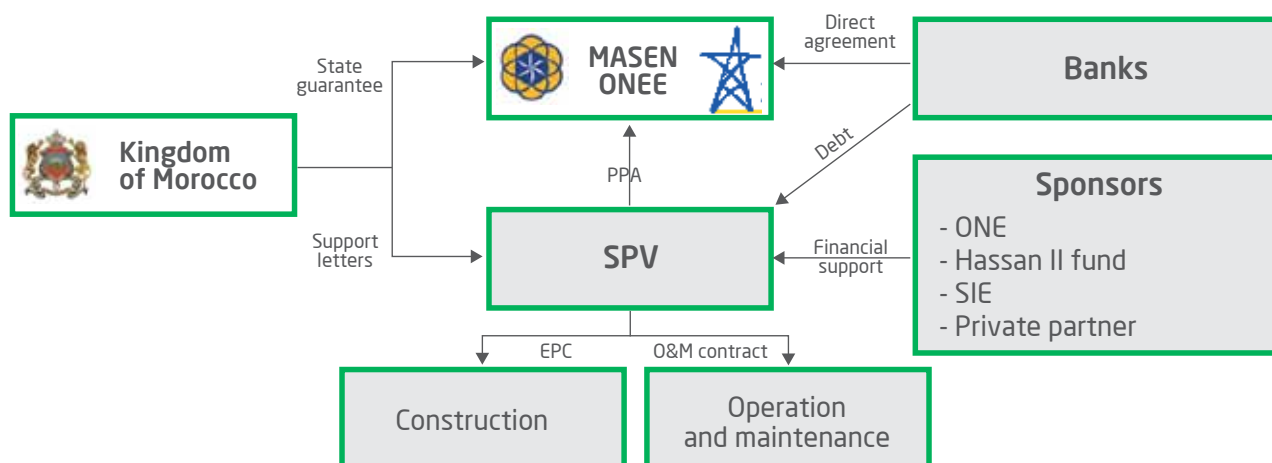
Launched in 2010 and implemented by ONEE, the programme intends to increase the wind capacity from 280 MW (in 2010) to 2 GW by 2020 and to 5 GW by 2030, requiring an estimated investment of \$3.5 billion (for the 2020 target). The programme is expected to deliver an annual production of 6.600 GWh, corresponding to approximately 19% of total electricity consumed in 2016, targeting annual fuel savings of 1.5 mn (toe) and the avoidance of 5.6 mn tonnes of CO₂ emissions per year. Aside from raising wind power's share to 14% of total production by 2020 and 20% by 2030, the programme sets the goal to establish a high level of expertise and strengthen R&D 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 Masen to bid for the projects and different options schemes are available. The successful bidder forms a company, under the Moroccan legal framework, with Masen, 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 complement 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 RE 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).

Figure 3- Scheme contract for Wind Projects



Source Norton Rose Fulbright

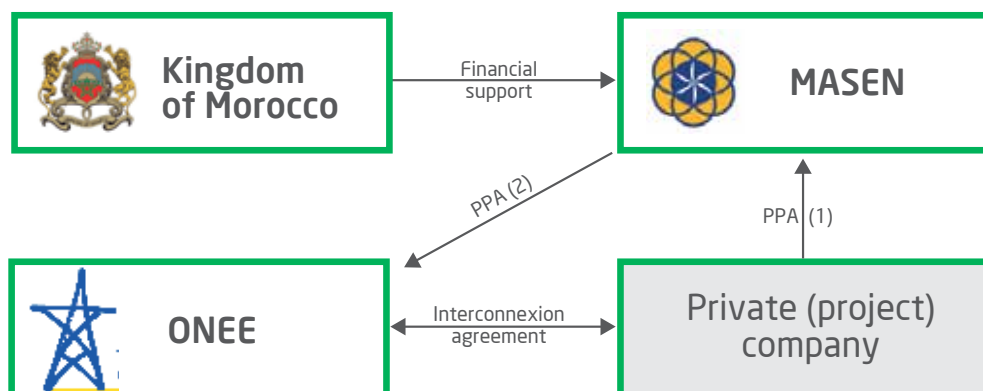
4.2.3 Solar Program

Launched in November 2009 and implemented by 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 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%. The following figure illustrates the mechanism between the different stakeholders.

Figure 4- Scheme contract for Solar Projects



Source Norton Rose Fulbright

5 Enabling context/environment

5.1 Policy Framework

Since 2009 the Moroccan energy market has been growing at an increasingly dynamic pace and is progressively opening up to private investment, particularly in the field of renewable energy and energy efficiency. The main driver enabling Morocco to realize its goal was the passing of the 'Renewable Energy Law' in 2010. This legislation allowed the development of private energy production through IPPs and granted investors to establish renewable energy projects, sell electricity directly to customers on the high-voltage market and export unutilised energy. Despite the progress, the permission of renewable energy producers to sell electricity directly to lower-voltage users has yet to be seen and thus there is still room for improvement.

LAW 94-503 (1994) RELATED TO PPA

Partial liberalization PPAs with IPPs or privately owned-producers (up to 10 MW)

LAW 54-05 (2006) RELATING TO DELEGATION OF PUBLIC WORKS AND SERVICES MANAGEMENT

This law authorizes the State or local authorities to cede administration of public services to a private entity. In general, the delegated administration essentially focuses on the following sectors: motorways, urban transport, distribution of water and electricity, sanitation and household waste collection as well as electricity production. An example is the delegated administration for the treatment and energy use of waste in Oujda granted by the Oujda municipality to the CSD- CRB company.

LAW 13-09 (2010) RELATING TO RENEWABLE ENERGIES

It was promulgated in order to liberalise and develop the renewable energy sector in Morocco. 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. Indeed, private producers can sell electricity directly to clients connected to the high voltage and medium voltage grid, mainly industrial companies. 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 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).

LAW 58-15 (DEC. 2015) RELATING TO RENEWABLE ENERGY - AMENDMENT TO LAW 13-09

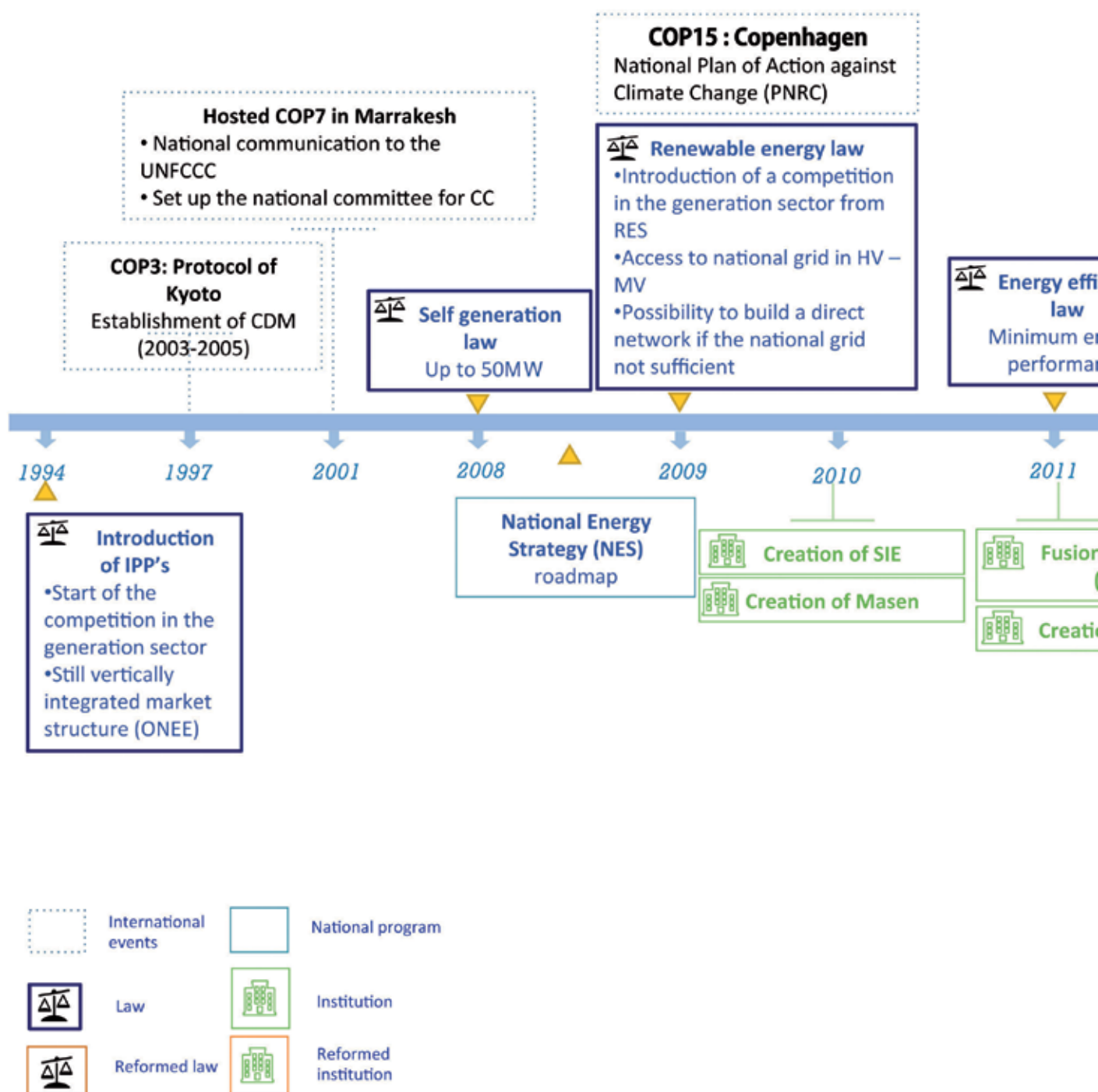
Introducing a net metering scheme for solar and wind power plants connected to the high-voltage grid, and later, those connected at the medium and low-voltage. Private investors in renewable power will be able to sell their surplus output to the grid, but no more than 20% of their annual production. 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.

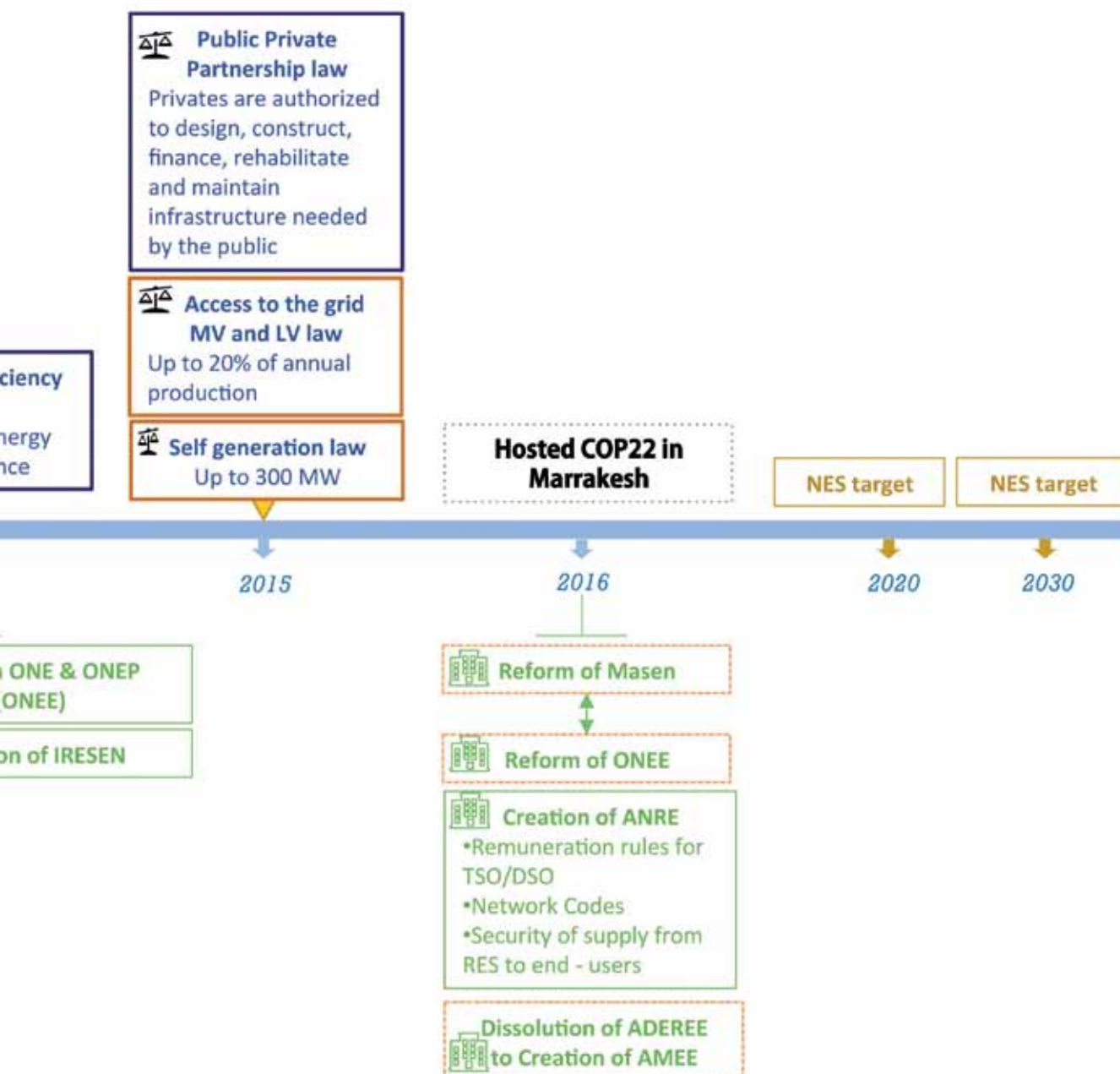
DECREE 2-15-772 RELATING TO ACCESS TO THE NATIONAL MEDIUM VOLTAGE

In application of article 5 of Law no 13-09 relating to renewable energies, the entry into force in November 9, 2015 of Decree n° 2-15-772 relating to access to the national medium voltage grid was aimed at:

- Setting access conditions and modalities to renewable energies-based electricity production installations to this medium voltage grid;
- Facilitate progressive and harmonious opening of the said grid;
- Put in place a transparent, non-discriminatory and stable framework for investors.

Figure 5- Timeline of the policy framework (1994-2030)





Source: IEA- Maroc 2014

LAW 47-09 (2011) RELATING TO ENERGY EFFICIENCY

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. Setting up of energy service companies and communication, education and awareness raising

LAW 16-08 (2008) RELATING TO SELF-GENERATION

Enables industrial installations to produce their own electricity from renewable energies on condition that this production did not exceed 50MW; that it be destined for the exclusive use of the producer; that it would not upset plans for energy supply in the area concerned; that the surplus production not used by the producer should be exclusively sold to ONEE. The modalities of connection to the national grid are established by a connection convention.

LAW 54-14 (2015) RELATING TO SELF-PRODUCTION- AMENDMENT TO LAW 16-08

Gives the possibility to national self-producers of electricity (with an accumulated installed capacity of over 300MW) to accede to the transmission network to carry energy from the production sites to consumption sites. These operators will undertake to sell exclusively to ONEE the surplus production that they have not used for their needs. The goal is to promote private production to lighten the national electric load.

LAW 86-12 (2015) RELATING TO PUBLIC PRIVATE PARTNERSHIPS

Private partners are authorised to design, construct, finance, rehabilitate and maintain certain infrastructure needed by the public sector. The PPP can offer an economic solution for the promotion and development of infrastructures needed for renewable energies.

5.2 Main institutions involved in the electricity market

Figure 6- Key institutions



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. SIE also seeks to create a financial vehicle dedicated to profitable projects

that target energy efficiency, especially public buildings and public lighting. The energy investments company represents the financial arm of the state to accompany the national development plan for renewable energies. SIE has been endowed with a capital of Dh1 billion and participates in the development of energy projects by means of partial State financing. 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).

MOROCCAN AGENCY FOR SOLAR ENERGY (MASEN)

Established in 2010, MASEN is a private company endowed with public capital. Promulgated under the law 57-09 in 2010, it was made responsible for accompanying the implementation of the large-scale national integrated solar energy project which aims to establish by 2020 renewable energies-based electricity production with a total capacity of 2,000MW. Masen's activities rest on three pillars:

- Support to the development of a strong and competitive industrial branch
- Development of strong partnerships to promote the formation of qualified resources
- Support to research and development to contribute to improving the performance of solar technologies in general.

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.

In 2016, the MASEN was restructured by the law 37-16 which amended the law 57-09, MASEN previously responsible for the implementation of the Moroccan Solar Plan, is now set to take the lead on the development of all RES technologies in Morocco with exception to STEPs and resources destined to stabilize the electricity system. This assumes that all RE assets of ONEE are transferred to Masen. This transfer will be done in a conventional framework. Given the scope of the projects in question, this will take time, but the first project transfers will be done by the first quarter of 2018.

MASEN has officially become « The Moroccan Agency for Sustainable Energy». In accordance with this bill, the agency will become an associated company endowed with a Board of Directors, responsible for the development of renewable energy power stations while ensuring guidance of studies, planning, financing, achievement, management and maintenance.

OFFICE NATIONAL DE L'ELECTRICITE ET DE L'EAU (ONEE)

Created in 1963 as a national power monopoly, the company ensures generation (at 29% of the national generation in 2016), transmission, and distribution/retail (52%). 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 (Steps and PV's end of line only). ONEE is also involved in many national energy efficiency programmes. In 2011, the law 40-09 brought together the activities of ONE and the national office for potable water (ONEP), setting up the National Office for Electricity and Potable Water. This decision aimed to optimise quality standards, costs and performance in supply of electricity and drinking water. In 2016, the law 57-09 amending law 38-16 stipulates the transfer to MASEN within the five following years of all means of production using renewable energies except for energy transfer pumping stations, infrastructures producing electricity to meet peak hour demand and to stabilising the national electricity system and renewable energies- based electricity production structures governed by Law no 13-09.

NATIONAL ENERGY REGULATORY AUTHORITY (ANRE)

In June 2016, the government published the law 48-15 relating to the regulation of the electricity sector, which from now on, will dispose of a new regulatory framework in which the attributions and responsibilities of different stakeholders in electricity transmission and distribution are clarified and institutionalised around a new independent regulatory entity, the National Authority for Electricity Regulation ANRE.

ANRE's principal missions are to set the tariffs for use of the national electricity transmission network and of usage tariffs for the medium voltage grids. ANRE also approves the code of the national electricity transmission network, including interconnections as well as rules concerning use of the said network. Besides the creation of a regulatory authority, the law sets out rules to be respected as regards electricity transport and management of medium voltage electricity grids.

With this law Morocco aims for the positive functioning of the electricity market and at giving a strong signal of independence in relation to electricity sector operators. Until now, regulation was based on ONEE, under ministerial control. However, by virtue of this law, ANRE is free from all control. This institutionalisation should also increase the attractiveness of the renewable sector to donors, sector industrialists and private investors. The operating of the entity is expected during 2018.

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. Aim to translate the national strategy into R&D projects and research to innovation (R2I) in the field of RE and EE and to ensure the implementation, financing as well as steering of research projects. Since 2012 it has launched 7 calls for projects in the fields of thermal solar, photovoltaics, wind and biomass, mobilising a budgetary allocation of Dh 125 million and selecting 31 innovative projects carried out by consortia of universities and of national and foreign companies. The number of projects submitted for calls to projects has increased each year involving a growing number of researchers and Moroccan and foreign companies in various specialisations in the field of renewable energy.

For instance, one of the projects on « Lithium-ion batteries » coordinated by Cadi Ayyad University seeks to develop performing batteries by insisting on the « materials » aspect. Electrode materials based on Moroccan mineral resources will be targeted. Another project « CHAMS1 » launched in 2013 was aimed at developing the first concentrating solar field of the innovative Fresnel type, low cost and 100 % Moroccan. These projects are within the framework of the INNOTHERM I call for projects, whose aim is to encourage researchers and industrialists in the design and realisation of innovative, 100 % Moroccan technical solutions using thermodynamic solar.

MOROCCAN AGENCY FOR ENERGY EFFICIENCY (AMEE)

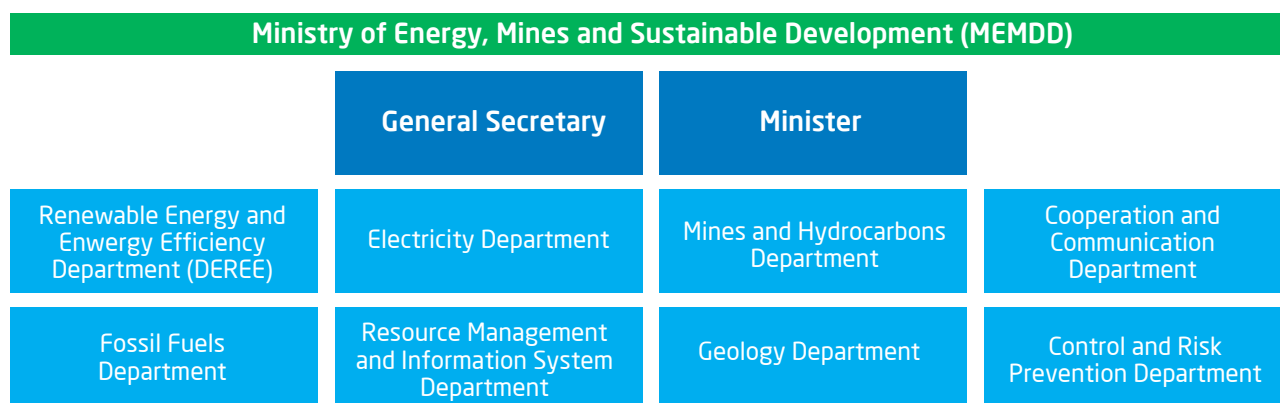
Under the law 39-16 issued in 2016 relating to the creation of AMEE, and amending the law 16-09 (2010) related to the establishment of ADEREE. This agency's missions will not concern renewable energies but will remain focused on energy efficiency.

MINISTRIES

MINISTRY OF ENERGY, MINES AND SUSTAINABLE DEVELOPMENT (MEMDD)

The Ministry is responsible for the regulation of the energy sector. As the ministry concerned with the energy sector, the MEMDD establishes the legal framework for the sector, ensures the practical implementation of the national strategy and oversees a number of subordinate departments and agencies.

Figure 7 - Organisational chart of the MEMDD



Source: Ministry of Energy, Mines, Water and Environment of Morocco

MINISTRY OF INTERIOR

Supervises the overall performance of the public enterprises responsible for the distribution of water and electricity in large urban areas

MINISTRY OF ECONOMY AND FINANCE (MEF)

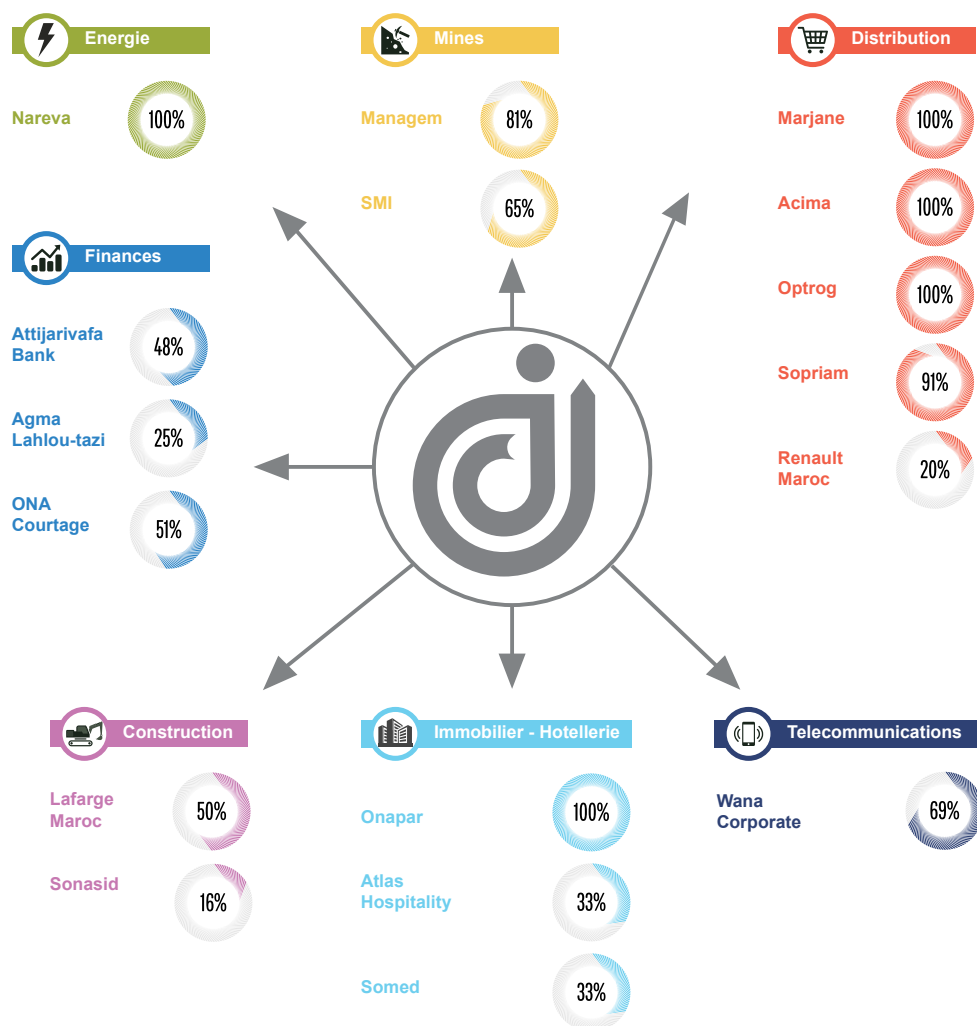
The MEF regularly publishes the latest figures and indicators for the economic and budgetary situation in Morocco, which contain important data for the energy sector. It is also the point of contact for fiscal and customs matters and responsible for the Hassan II Fund for Economic and Social Development.

Private actors

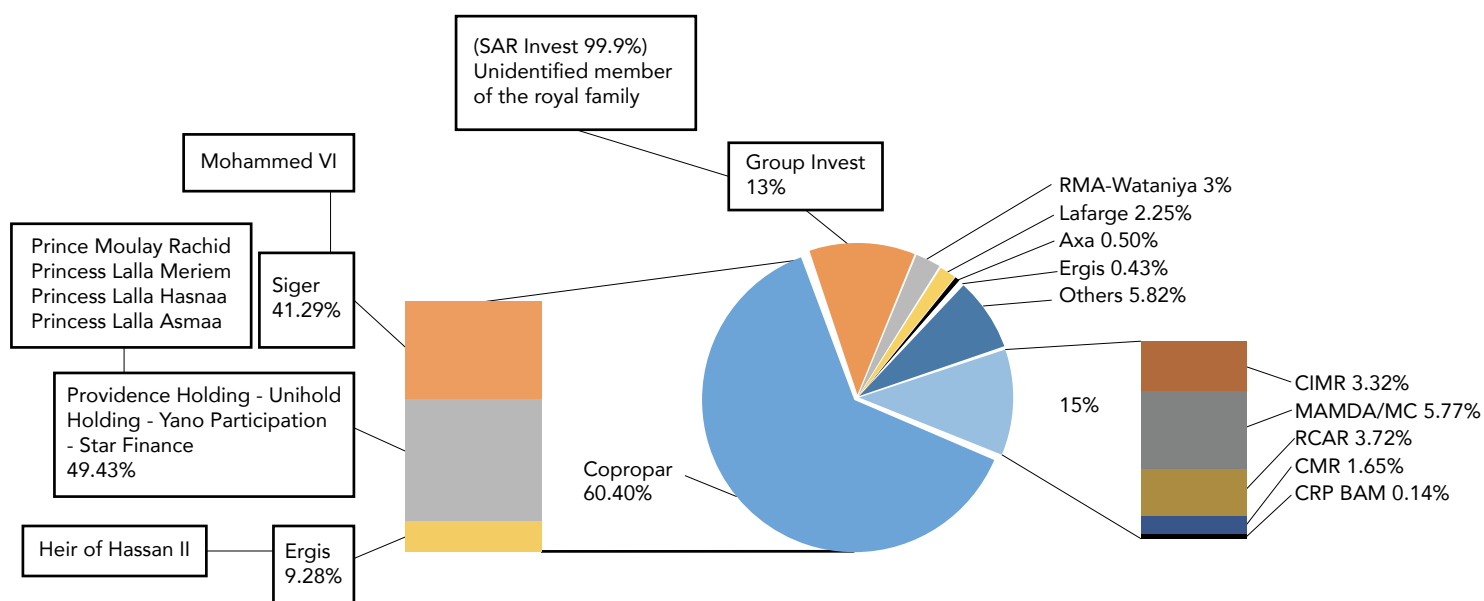
NATIONAL INVESTMENT COMPANY (SNI)

Large private Moroccan holding company mainly owned by the Moroccan royal family. The conglomerate also holds stakes in the country's largest private companies in seven sectors: AttijariWafa (Banking), Managem (mining), Nareva (energy firm), Lafarge Ciments, and Marjane (supermarket chain). SNI is adopting Pan-Africanism by investing in African countries (Cameroon, Ivory Coast, Rwanda, Gabon...). The following graph (graph 5) illustrates all the seven fields of activity of the group while the graph 6 shows SNI ownership.

Figure 8 - SNI: tentacular group



Graph 13 - SNI ownership



NAREVA

Founded in 2005, its mission is to ensure the presence of Moroccan capital, in partnership with world leaders, in the energy and environmental sectors. This structure of about thirty people currently operates in the field of electricity production of fossil fuels, RES and the management of the water cycle (desalination, transport, distribution / irrigation)

ENERGIE EOLIEN DU MAROC (EEM)

Company in which Nareva holds 75% and the remaining 25% are owned by Moroccan pension fund Caisse Interprofessionnelle Marocaine de Retraites (CIMR). The company is created for the development of wind power in Morocco.

ACWA POWER KHALLADI

The company holds at 75% by the Saudi Group Acwa Power and at 25% by the investment fund ARIF.

Associations

NATIONAL ELECTRICITY, ELECTRONICS AND RENEWABLE ENERGY FEDERATION (FENELEC)

FENELEC is a national federation created in 1997, bringing together professionals from the electricity, electronics and renewable energy sectors. It currently represents five associations, including AMISOLE, covering practically the entire sector.

MOROCCAN ASSOCIATION OF SOLAR AND WIND POWER INDUSTRIES (AMISOLE)

It created in 1987 and carries out lobbying and communication activities, organises trade fairs and exhibitions, finances the creation of clusters, conducts market studies and matches actors with each other. It also runs three renewable energy training centres. AMISOLE has around 70 members.

CLUSTER ENERGY EFFICIENCY OF CONSTRUCTION MATERIALS (EMC)

Created in 2013 and supported by the Ministry of Industry, brings together enterprises, architects, consulting firms, researchers, universities, foundations, the media and other experts who together promote innovative approaches, solutions and projects in the field of energy efficiency in buildings.

GENERAL CONFEDERATION OF ENTERPRISES OF MOROCCO (CEGEM)

Created in 1947, the CGEM ensures the representation and the promotion of the member companies acting in different sectors and of different sizes. CGEM is the representative of the private sector to public authorities and institutions. It speaks on behalf of its 88,000 direct and affiliated members and ensures a favourable economic environment for business development. In terms of the energy sector, the CGEM has the role to promote the use of RE and EE by informing companies about existing funding and subsidies. It also contributes raise awareness and inform companies on topics and initiatives, communicates on a regular basis about incentives in the context of a green tax system.

TRAINING INSTITUTE FOR RE AND EE (IFMEREE)

The main mission is to make a tangible contribution to the success of the national energy strategy by promoting skills related to RE's needs for development. The institute has been established in 2016 and is currently located the three strategic cities: Oujda, Ouarzazate and Tangier.

In this respect, IFMEREE must ensure:

- Initial training courses for technicians specializing in the RE and EE professions
- Continuing education and training sessions for employees of companies in the sector
- Participation in research work, laboratory tests, technical assistance, advice, etc.

6 Deployment of Projects

This section will follow Morocco's efforts in the RE and EE sectors. The NES supports diversification efforts in terms of primary sources as well as coping with the growing demand by investing in large projects.

During the second target (2020-2030), power mix diversification efforts will accelerate, with solar and wind energy spearheading efforts to reduce the country's reliance on oil-fired power generation. Morocco has firmly set its sights on the large-scale development of RES. A continued increase in wind and solar power electricity generation capacity is anticipated in the medium term.

In 2016, the country registered an average bid of USD30/MWh in its wind tender, which was among the lowest bids registered for wind capacity in tenders globally over the year. Furthermore, the country is also a global frontrunner in developing concentrating solar power (CSP).

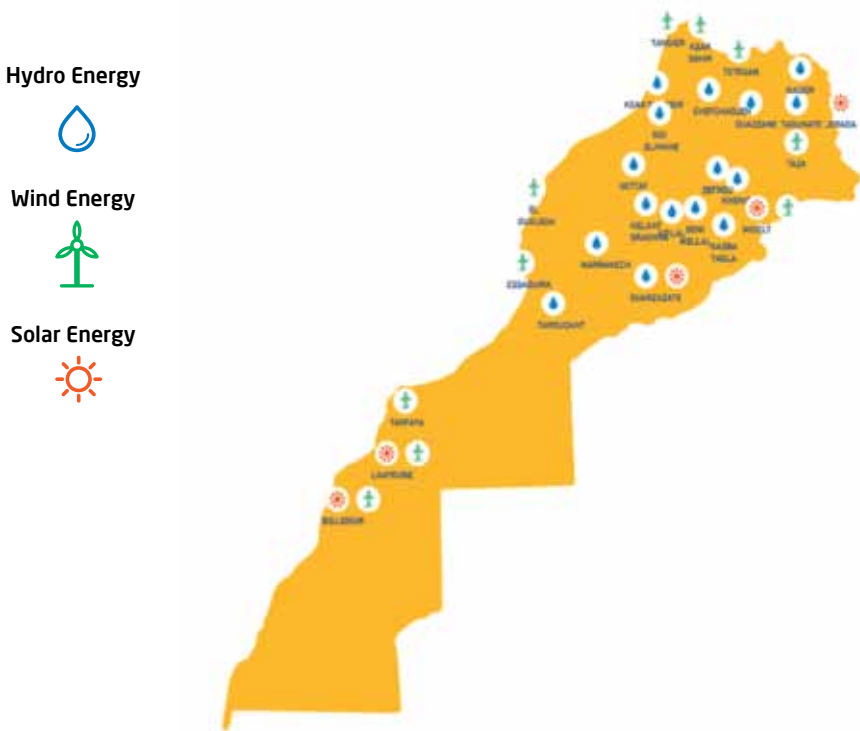
With regard to electricity generation, the implementation of current strategies is almost completely confined to large-scale projects. Conversely, in the field of EE, the emphasis is on decentralised solutions (e.g. personalised financial aid granted to industrial enterprises to enable them to modernise their facilities). Moroccan actors also now have a greater understanding of the true potential of EE. In addition to heightened public awareness about the benefits of EE improvements, Moroccan experts also report promising prospects in the country's buildings and construction sectors and in its rapidly growing industrial sector.

All these initiatives are actively encouraged at the highest level of government, and renewable energy and energy efficiency are at the top of the political and economic agenda.

The following section suggests an overview of all the projects in sight by 2020 as well as the the projects operational in the renewable energy sector, divided by wind projects, hydropower projects and solar projects. Lastly, a description of the energy efficiency projects are provided afterwards.

The following map illustrates all the renewable energy projects including the all the renewable energy projects developed or under development in Morocco.

Map 6 - Renewable energy projects planned by 2020



Source: Masen projects, 2017

6.1 Hydro Projects

Hydropower is considered a traditional component of Morocco's fleet of power plants. Indeed, they are at the origin of the electrical production. The installation of hydroelectricity generation capacity began in the 1960s during the reign of King Hassan II when a large dams policy was launched in order to strengthen the hydropower park.

Hydroelectricity projects (refer to table below) are generally carried out by ONEE, which recently identified a further 125 sites suitable for locating small or micro hydropower plants (100 kW to 1,500 kW), with a total potential capacity of around 300 MW. Note that 70% are located in the Oum Errabia.

The following table illustrates all the large hydro centrals installed in Morocco already operational.

Table 6 - Operational Hydropower plants

OPERATIONAL PLANTS	Installed Capacity	
	Bine El Ouidane	135 MW
	Afourer	94 MW
	Tanafnit El Borj	40 MW
	Al wahda	240 MW
	Allan el Fassi	240 MW
	Al Massira	128 MW
	Ahmed el Hansali	92 MW
	STEP Afourer	463 MW

source: Source: Ministry of Energy, Mines, Water and Environment of Morocco

The installed capacity in 2018 stood at 1 771 MW, and its potential is well exploited. Therefore, in the short term only the construction of small or micro hydropower plants can be expected. A regain of interest of the hydraulics came with the new energetic strategy, in particular the hydraulic micro-centrals. In the following table (figure below), all projects were installed under the 13-09 scheme where the off takers are industrial companies mainly in the construction sector and mining. The following attractive projects are developed by private electricity producers.

Table 7 - Operational hydropower micro plants

OPERATIONAL Micro PLANTS	Installed Capacity		Operation date	Developers/Operatos
	Filou	1.53 MW	2014	Energie J2 Terre
	Sidi Said	1.98 MW	2016	
	Sidi Driss	3.15 MW	2016	
	Hassan II	11.7 MW	2016	
	Asfalou	11.7 MW	2016	SGTM Energy
	Ouljet Essoltane	10 MW	2016	
	Boutferda	12 MW	2016	
	Tilougguit	12x2 MW	2016	Platinum Power
	Bas Ouender	12 MW	2017	
	Tamajout	12 MW	2017	

Source: Ministry of Energy, Mines, Water and Environment of Morocco

The target is to increase the generation capacity of hydropower plants to 3 GW by 2030. Morocco is also actively engaged in developing pumping technology (pumped storage hydropower plants), which could have a potential capacity of 6 GW. Morocco is planning on developing an additional installed capacity of hydropower of 1 330 MW by 2030.

The micro hydropower projects are totalling 100 MW of installed capacity. Moreover, Energie J2 Terre, STGM and Platinum Power are the only private companies in the hydropower business benefiting from the law 13-09. Energie J2 Terre and Platinum Power are French companies, operating the sites under a PPA of 20 years, while STGM Energy is a large Moroccan company.

Table 8 - Underdevelopment hydropower plants

		Installed Capacity	Stage in 2017
UNDER DEVELOPMENT	STEP Mdez El Menzel I	100 MW	Under development
	STEP Mdez El Menzel II	300 MW	Geological and geotechnical studies
	STEP Abdelmoumen	350 MW	Under development
	STEP Ifahsa	300 MW	Geological and geotechnical studies
	Kenitra Hydroelectric complex (3)	128 MW	Under study

Source: Source: Ministry of Energy, Mines, Water and Environment of Morocco

UNDER DEVELOPMENT PROJECTS

These projects totaling 1 178 MW of capacity installed have been development with an EPC contracts or by the private sector. It is important to note that ONEE will remain responsible for all the STEPs projects and will not be transferred to MASEN.

STEP Abdelmoumen is scheduled to be operational by the end of 2020, this project aims at meeting electricity demand during peak hours and to energy storage as well as increasing capacity integrating renewable energies of wind and solar origin and improving the stability of the electricity transmission network. The total budget is estimated at 212.6 million euros.

6.2 Wind Projects

The integrated wind programme led by the Moroccan government sets a national target of 2 000 MW by 2020 with an annual production of 6,600GWh, corresponding to 26% of current national electricity production in Morocco. In 2030, the target is to reach a 5 GW of wind capacity installed.

Three schemes are available in order to reach the national targets.

- Related to the power generation: Masen launches an international tender relying on private projects led by Nareva and international consortium.
- Related to the off takers: either Nareva's customers buy the electricity through a PPA or ONEE feed the national grid through BOOT scheme.
- Related to self-generation: the generators produce for their own energy needs.

As of December 2017, Morocco has 890 MW of wind installed. A remaining 1 356 MW wind power plants are under construction or development targeted to be fulfilling the 2020 national target. A total of 658 MW of capacity installed is developed by private companies within the framework of the law 13 - 09, the off taker

included are mainly industrials in the construction and mining sector such as LafargeHolcim Maroc, OCP, Sonasid, Ciment du Maroc, Managem, la SNEP et Air Liquide Maroc. of which 302 are operational in January 2018.

Moreover, a total of 1 400 MW of capacity installed is developed under BOOT scheme, of which 550 MW are operational. The remaining is developed through the self-generation scheme.

The following projects are divided in three tables:

First are the projects that have been installed before the integrated programme, totalling 287 MW.

Second, the first phase of the integrated programme totalling an installed capacity of 959 MW of which three of them are either under construction or under development.

Finally, the third table, summarizing the second phase of the programme, which has been issued by two distinctive tenders.

Table 9 - Wind plants in operation before the IWP

		Wind project before 2010				
		Koudia Al Baida Abdelkhalek Torrés	Amougdoul	Tanger I Dhar Saadane	CIMAR	Lafarge
DATE/TECHNICAL	LOCATION Regions	Tetouan 1/ Tanger - Tétouan Al Hoceima	Essaouira 7/ Marrakech - Safi	Tanger 1/ Tanger- Tétouan Al Hoceima	Laâyoune 11/ Laâyoune Saguia al Hamra	Tetouan 1/ Tanger- Tétouan Al Hoceima
	INSTALLED CAPACITY	50 MW (190 GWh)	60 MW (210 GWh)	140 MW (526,5 GWh)	5 MW (16 GWh)	32 MW (12 GWh)
	TECHNOLOGY	Wind Onshore	Wind Onshore	Wind Onshore	Wind Onshore	Wind Onshore
	STAGE END 2017	Operational	Operational	Operational	Operational	Operational
	CONTRACT SCHEME	ONEE BOOT PPA 20 years	ONEE BOOT PPA 25 years	ONEE BOOT PPA 25 years	Self-production	Self-production
	FINANCE MOBILISED	~42.5 million euros	~57 million euros	~250 million euros	~9 million euros	~44 million euros
	DATE OF SERVICE	2001	2007	2010	2011	2005
STAKEHOLDERS	OPERATOR	Theolia (FR) ONEE	ONEE	ONEE	CIMAR	LafargeHolcim
	SPONSOR	EDF, BNP Paribas, et GERMA	ONEE	ONEE	CIMAR	LafargeHolcim
	OFF TAKER	ONEE	ONEE	ONEE	CIMAR (80% of its need)	LafargeHolcim (50% of its need)
	DEVELOPER	Compagnie du vent	ONEE	ONEE	CIMAR	LafargeHolcim
	CONSTRUCTORS	Vestas, Sogéa/EMT, Alstom-Nexans, and Germa	Gamesa Eolica (Sp)	Gamesa Eolica (Sp) for the maintenance	Gamesa Eolica (Sp)	n/a
	FUNDERS	Consurtium lead by Crédit Agricole Théolia (FR) (30%), EIB, Proparco	KfW and ONEE	ICO (Sp) (€100m) BEI (€ 80m) KfW (€50m) and ONEE	n/a	n/a

• ABDELKHALEK TORRÉS

Launched in 2000, it is the first wind farm in Morocco. Further to the discovery of the Koudia El Baida site (between Ksar Sghir and Tetouan) where average wind speeds reach 11m/sec (nearly 40km/h) ONEE launched an international call for tenders in 1994 for a 50MW wind park according to the (Build Transfer Operate and Transfer) formula where ONEE remains owner of the park and the operator produces and sells electricity for 20 years to ONEE. A French group, the Detroit Wind Company, acquired in 2008 by Théolia, was in charge of the park's entry into service in August 2000. It produces 226GWh a year, equivalent to the annual consumption of a city such as Tetouan and comprises 84 wind turbines. The related investment amounted to US\$ 52 million. The order of magnitude of the Kwh price is around Dh 0.70 (US\$0.07). It has 91 wind turbines and an installed capacity of 50 MW which will be doubled during a change of nacelles. An extension planned will bring the total capacity of the park to 300 MW in the medium term.

• AMOUDOUL

This park, 15km south of Essaouira, produces an annual average of 200GWh with 71 turbines (60MW total power). The park was built in 18 months by the Spanish company GAMESA, selected after an international call for tender. The site was inaugurated in 2007. The related investment amounted to Dh 800 million (US \$ 52 million) and was financed by the German BANK KfW and ONEE. Object of an EPC on behalf of ONEE, a maintenance contract was concluded with GAMESA.

• DHAR SAADANE (TANGER I)

Spanish company GAMESA was also entrusted with the construction and signed a maintenance contract for the Tangiers wind park. With a length of 42kms, the park will comprise 165 wind turbines of 850kW each. Total capacity will reach 140MW with an annual production of 526.5 GWh. This installation has been constructed under a BOOT with a 20-year electricity purchase guarantee from ONEE. Costing Dh 2,750 million (US\$ 282 million) this project was financed by Spain's ICO (Euros 100 million) as well as by the European Investment Bank (Euros 80 million), KfW (Euros 50 million) and ONEE.

• LAFARGEHOLCIM AND CIMAR

Both projects have the characteristic to be under the self-production scheme.

The cement manufacturers have developed a wind farm (Lafarge) on its own to supply its cement plant in Tetouan. It was inaugurated in September 2005 with a capacity of 10 MW. A supply contract between Lafarge Maroc and Nareva has also enabled the supply of the Bouskoura plant as from 2013 and the one in Meknes as from summer 2014. The total project cost was Dh 496 million (US\$ 49.8 million). It has since been increased to 32 MW, following the self-production ceiling allowed by law. This makes it possible to cover about 70% of the electricity needs of the Tetouan plant. The total investment was 500 million dirhams.

As mentioned above, ONEE operated about 287 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 four projects with a combined capacity of 456 MW are currently under construction, taking the total wind capacity to 1 GW. Refer to the following table for full breakdown of installed and under construction wind capacity.

Table 10- Projects breakdown: the IWP Phase I - 1/2

		Integratedn Wind Programme Phase I			
		Haouma Wind Farm	Foum El Oued Wind Farm	Akhfenir I Wind Project	Akhfenir II Wind Project
TECHNICAL DATA	LOCATION Regions	Chefchaouene 1/ Tanger- Tétouan Al Hoceima	Laâyoune-Sakia El Hamra 11/ Lâayoune Saguia al Hamra	Tarfaya 11/ Lâayoune Saguia al Hamra	Tarfaya 11/ Lâayoune Saguia al Hamra
	INSTALLED CAPACITY	50 MW (190 GWh)	50 MW (202,7 GWh)	102 MW	100 MW
	TECHNOLOGY	Wind Onshore	Wind Onshore	Wind Onshore	Wind Onshore
	STAGE END 2017	Operational	Operational	Operational	Operational
	CONTRACT SCHEME	Private under the law 13-09	Private under the law 13-09	Private under the law 13-09	Private under the law 13-09
	FINANCE MOBILISED	251 m euros refers to all 3 projects			165 million euros
	DATE OF SERVICE	2013	2013	2013	2017
STAKEHOLDERS	OPERATOR	Nareva Holding (SIE)	ONEE	CIMAR	Nareva Holding (SIE)
	SPONSOR	Nareva Holding (SIE)			Energie Eolienne du Maroc / Engie (Fr)
	OFF TAKER	Reserved for Nareva clients supplying the cement works in Lafarge, Air Liquide as well as et Managem, d'Akka and Guemassa	Plant to supply power directly to partner factories PhosBoucraa, the ONEE seawater desalination plant, ONDA	CIMAR Lafarge, Samir, Managem, OCP Sonasid	Clients industriels Marocains
	DEVELOPER	Nareva Holding (SIE)			Somagec (CEGELEC)
	CONSTRUCTORS	Vestas, Sogéa/EMT, Alstom-Nexans. and Germa	EEM and Siemens (Ger)	Windhoist (UK), General Electric and Alstom	General Electric for Equip. (USA)
	FUNDERS	Equity: 800 millions de DH (75% Nareva et 25% CIMR) Debt: 2,4 milliards Attijariwafa bank, BCP et BMCI			Equity: Nareva et de la CIMR. Debt: Banque Centrale Populaire, Attijariwafa bank et la BMCI

• HAUMA, FOUM EL OUAD AND AFKHENNIR

These pilot projects are the first to enter under the framework of the law 13-09, promulgated in 2011. At the origin of this achievement, Nareva Holding launched in December 2011, the three wind farms located in Haouma, Akhfennir and Foum El Oued, totalling 200 MW of wind capacity. Since January 2013, Nareva Holding manages these three parks representing an investment of 250 million euros with 105 turbines installed. Moreover, it is expected to develop an additional 100MW to the park. Overall, the project provides 770GWh per year, equal to the consumption of the city of Agadir. Financing consists of own funds advanced by shareholders in the project company (67 million euros) and bank loans obtained.

Haouma is a mid-sized park with 22x260 tonne Siemens wind turbines and a total capacity of 50 MW. It is situated a few kilometres from Ksar Sghir, some 30 km from Tangiers. Energy produced at This plant is reserved for supplying the cement works in Lafarge, Casablanca and Meknes.

A 50.6MW park at Foum El Oued, 70km from Laâyoune entered into service in 2013. It comprises 22x80-metre-high 2.3 MW Siemens turbines with an annual output of 202.7GWh. The site will enable the direct supply of partner factories in the project: PhosBoucraa, the ONEE seawater desalination plant as well as ONDA50.

The third site is at Akhefennir entered into service in 2013 with 61 Alstom turbines and a capacity of 100MW. Today a good share of Tan-Tan's consumption is covered by this park.

The Akhefennir wind farm will produce 400 GWh per year, the equivalent of the consumption of an agglomeration of 500,000 inhabitants, or a city the size of Tetouan. The project is expected to generate 200 direct jobs during construction and around 100 workstations in operation.

Akhefennir is 100 km north of Tarfaya, the site of Haouma overlooks the TangerMed port, while Foum El Oued is adjoining the OCP facilities in the suburbs of Laayoune. The project is carried by the company Wind Energy of Morocco (EEM) owned by Nareva (75%) and CIMR (25%). The overall cost of the project is 283 million euros. In detail, the equity represents 71 million euros (75% Nareva and 25% CIMR) against 212 million euros in bank debts. The production of the park corresponds to the consumption of a city of 1 million inhabitants.

• AFKHENNIR II

The second phase of the Akhefennir II park will comprise 56 General Electric turbines doubling its capacity to 200MW. Entry into service is foreseen during 2016. In this park, as in the case of Haouma and Laâyoune, the special feature is that the electricity output is sold under private contracts (PPA) with companies such as Lafarge, Samir, Managem, OCP or Sonasid. ONEE only undertakes the electricity transport.

Table 11 - Projects breakdown: the IWP Phase I- 2/2

		Integrated Wind Programme Phase I			
		Tarfaya	Jbel El Khalladi Wind Farm	Aftissat	Oualidia
TECHNICAL DATA	LOCATION Regions	Tarfaya 11/ Laayoune Saguia al Hamra	Jbel Soundouk- Tanger 1/ Tanger- Tétouan Al Hoceima	Boujdour 11/ Laayoune Saguia al Hamra	Oualidia 6/ Casablanca Settat
	INSTALLED CAPACITY	301 MW	120 MW	200 MW	36 MW
	TECHNOLOGY	Wind Onshore	Wind onshore along with a 23 km of 225 kV power transmission line	Wind onshore along with a 400kV HV power line	Wind onshore 2 sites of 18 MW each
	STAGE END 2017	Operational	Under construction	Under development	Under construction
	CONTRACT SCHEME	ONEE BOOT PPA (20 years)	Private under the law 13-09	Private under the law 13-09	Private under the law 13-09
	FINANCE MOBILISED	450 million euros	126 million euros	370 million euros	35.5 million euros
	DATE OF SERVICE	2014	2018	2018	2018
STAKEHOLDERS	OPERATOR	ONEE	Acwa Power	Energie Eolien du Maroc (EEM)	ONEE
	SPONSOR	JV: Nareva Holding / GDF-Suez (fr), and Engie Group Tarec*	Consortium ACWA Power and UPC Renewables (Indonesia)	(EEM)*	n/a
	OFF TAKER	ONEE	85%: 3 large industrials including 2 cement manufac. The remaining 15%: ONEE	LafargeHolcim Maroc, OCP, Sonasid, Ciment du Maroc and Air Liquide Maroc.	n/a
	DEVELOPER	Consortium Nareva/ GDF Suez	UPC Renewables Acwa Power	(EEM)*	n/a
	CONSTRUCTORS	Siemens Wind Power and Siemens Maroc Somagec, Windhoist (UK) Delattre Levivier Maroc	Vestas Wind Systems (Dan)	Windhoist (UK)	InnoWind (InnoVent) Maroc
	FUNDERS	Nareva Holding and GDF-Suez (fr)	BERD* BMCE Bank of Africa ARIF Fund (Ma) 25% (RMA, BAD, BEI, SFI)	Equity: 75% Nareva et 25% CIMR Debt: Banking consortium Attijariwafa bank and Banque Centrale Populaire.	BERD*

* BERD: Banque Européenne de Reconstruction et de Développement

* Tarec: Tarfaya Energy Company

*EEM: Energie Eolienne du Maroc

• TARFAYA

Construction works for the 300MW Tarfaya wind park project started on 24 December 2012 and entry into service took place sequentially at the rate of 50MW a month, between June and December 2014. Tarfaya comprises 131 Siemens wind turbines with a production potential of 1,084GWh/year and it supplies 1.5 million households with energy which is 100 % renewable. The project, being the largest wind project at the time, contributes to 15% towards the national goal. Total project cost was Dh 5 billion (US\$ 510 million) of which Dh 1 billion were paid in by the operators of the project, Nareva (50%) and Engie (50%) and the rest by bank loans obtained. It is the only project of the IWP phase I to be under the EPC BOOT scheme. The project has created 500 direct and indirect jobs during the construction phase and more than 150 jobs during operation. In terms of recruitment, Nareva has a specific strategy "With equal skills, we favour the local candidate". The environmental component is very important. Ultimately, the Tarfaya site will reduce GHG emissions by 900KT CO₂ / year equivalent to the amount of CO₂ absorbed annually by 150 million trees.

• JBEL EL KHALLADI

Launched by ACWA Power, this project should enter into service by 2018. The site is located in Jbel-Sendoug (Khalladi) 15 km east of Tangier, on the hills near the Renault Tangier factory in Melloussa. The park will comprise a park with 40 Vestas turbines totalling 120 MW. A total investment of Dh 1.5 billion is foreseen. The Bank Marocaine du Commerce Extérieur (BMCE) and the European Bank for Reconstruction and Development (EBRD) announced in November 2015 an investment of Dh 1.34 billion (US\$140 million) in the project with equal participation. 85% of the energy produced will be sold either under short-term electricity sales contracts and to ONEE under the 13-09 scheme.

• AFTISSAT

This project of 200MW near Boujdour includes 250-kV 400 kV power line and a high-voltage substation to connect the wind farm to the ONEE substation in Laayoune via the city of Boujdour. The construction of the power line aims at strengthening the power infrastructure of the country's southern provinces and will contribute to the connection of the city of Dakhla to the national power grid. The investment cost of the project is estimated at 4 billion dirhams (\$ 394 million), of which 10% will be devoted to the construction of the power line. It will be financed by a mix of equity and bank debt. It will power 1.5 million people and prevent the emission of 700,000 tonnes of CO₂ / year and has an industrial integration rate of about 60%. Including the Boujdour park, Nareva has already led five projects bringing the total installed power under the law 13-09 to 505 MW. The investment cost of the project is estimated at 4 billion dirhams (\$ 394 million), of which 10% will be devoted to the construction of the power line. It will be financed by a mix of equity and bank debt. It will power 1.5 million people and prevent the emission of 700,000 tonnes of CO₂ / year and has an industrial integration rate of about 60%.

The second phase of the program is initiated by the launch of two tenders aiming to increase the installed wind capacity from 1 GW in 2016 to 2 GW by 2020. Five new potential sites were selected for the construction of wind farms. The first tender for Taza wind farm (150 MW) was awarded in 2012 while the second tenders ended in March 2016 when the bidding consortium EGP-NAREVA-SIEMENS was awarded as the winner bidder status.

Projects under the Integrated Wind programme are 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 following table summarize the different specificity of each project.

Table 12- Projects breakdown: the IWP Phase II

		Integrated Wind Programme Phase II					
		Tender I	Tender II				
		Taza Wind Farm	Midelt	Tiskrad	Tanger II	Jbel Lahdid	Boujdour
TECHNICAL DATA	LOCATION Regions	Taza, Al Hoceima and Taounate 1/ Tanger- Tétouan Al Hoceima	Midelt 8/ Drâa - Tafilalet	Laayoune, Boujdour and Sakia El Hamra 11/ Lâayoune Saguia al Hamra	Tangier 1/ Tanger- Tétouan Al Hoceima	Essaouira 7/ Marrakech - Safi	Essaouira and Boujdour 7/ Marrakech - Safi 11/ Lâayoune Saguia al Hamra
	INSTALLED CAPACITY	150 MW	150 MW	300 MW	100 MW	200 MW	100 MW
	TECHNOLOGY	Wind Onshore	Wind Onshore	Wind Onshore	Wind Onshore	Wind Onshore	Wind Onshore
	STAGE END 2017	Under construction	Under development	Under development	Under development	Under development	Under development
	CONTRACT SCHEME	ONEE BOOT PPA (20 years)	ONEE BOOT PPA (20 years)				
	FINANCE MOBILISED	214 million euros	~1,24 billion euros				
	DATE OF SERVICE	2018	2020	2020	2022	2022	2022
STAKEHOLDERS	OPERATOR	EDF Energies Nouvelles (Fr) and Mitsui	Nareva Holding & Enel Green Power SpA (It)				
	SPONSOR	EDF Energies Nouvelles (Fr) and Mitsui	ONEE				
	OFF TAKER	ONEE	ONEE				
	DEVELOPER	EDF EN Maroc					
	CONSTRUCTORS	Mitsui (Jap), Alstom SA for Equip. (Fr)	Siemens Wind Power (Equip) (Ger)				
	FUNDERS	African Development Bank (AfDB) (Cote d'Ivoire), European Union (Bel), European Investment Bank (EIB) (Lux), KfW (Ger)					

• TAZA

The French operator is now starting the work of the plant, after nearly five years behind the initial schedule of implementation and commissioning of the site. In fact, since its allocation to the Franco-Japanese group following an international call for tenders, the project was blocked by major difficulties in mobilizing the land necessary for its implementation. Alstom had already been chosen to equip the fleet with about 50 wind turbines. The expropriation proceedings seemed, however, endless. The site is located 12 km from the city of Taza. ONEE is the main developer of the project and is the exclusive client of the project through a 20 years PPA.

• TENDER II

As of the 850 MW project by the consortium EGP-NAVERA-SIEMEN, the project has been delayed. It is worth noting that the recent reorganisation of Masen, being at the center of the RE sector, is pushing forward the projects previously delayed.

6.3 Solar Projects

A full breakdown of current, under development and planned installed capacity projects are showed in the following tables. It aims at giving a general picture of the role of the different stakeholders as well as an overview of technical data.

Noor Ouarzazate Complex

The figure represents the Nour Ouarzazate complex, it is the first solar mega-project launched by MASEN. Covering a total of 3000 ha, its total capacity will reach 580MW by 2018. The entire complex is managed by the Saudi promoter and operator ACWA Power at a level of 95 %.

Currently the construction of the NOOR I station, the world's biggest monoturbine installation with a production capacity presently at 160MW, has attained a rate of more than 30 % industrial integration by means of resort to Moroccan companies, especially in the construction and public works sectors and of metallurgy and cabling. Overall, NOOR I mobilized over 2,000 workers, of which 85 % were Moroccan. About 250 men and women will be working directly in its management over the next 25 years. For NOOR Ouarzazate II and NOOR Ouarzazate III, MASEN aims at a local integration rate of about 35 % and the end to the isolation of several neighboring villages, the emergence of new tourism products and the international profile of Ouarzazate as a model of socio-economic development powered by renewable energies. According to the African Development Bank with NOOR II between 2,000 and 2,500 direct jobs will be created during the construction phase, 500 jobs during the operational phase, in addition to thousands of additional indirect jobs.

Table 13- Projects breakdown: the ISP Noor Ouarzazate Complex

		NOOR OUARZAZATE		
		NOOR I	NOOR II	NOOR III
TECHNICAL DATA	LOCATION Regions	Ouarzazate 9/ Souss - Massa	Ouarzazate 9/ Souss - Massa	Ouarzazate 9/ Souss - Massa
	INSTALLED CAPACITY	160 MW	200 MW	150 MW
	TECHNOLOGY	Parabolic Cylinder-CSP 3H storage	Parabolic Cylinder-CSP 7H storage	Tower - CSP 7H storage
	STAGE END 2017	Operational	Under construction 76% completion rate	Under construction 76% completion rate
	CONTRACT SCHEME	ONEE BOOT PPA (20 years)	ONEE BOOT PPA (25 years)	ONEE BOOT PPA (25 years)
	FINANCE MOBILISED	~730 millions euros	~810 millions euros	~645 millions euros
	DATE OF SERVICE	2015	2018	2018
STAKEHOLDERS	OPERATOR	MASEN and Acwa Power International (SAU)	MASEN	MASEN
	SPONSOR	TSK Solar (Sp)	MASEN	MASEN
	OFF TAKER	MASEN/ONEE	MASEN/ONEE	MASEN/ONEE
	DEVELOPER	Consortium Acwa Power - Sener	Consortium Acwa Power - Sener	Consortium Acwa Power - Sener
	CONSTRUCTORS	Acciona (Sp), Sener (Sp) and Worley Parsons for consultancy/project management (Aus)	Lahmeyer International (Ger) for consultancy/project management, Acciona (Sp), SENER (Sp), Sepco III Electric Power Construction Corp (China)	Consortium of SENER (Sp), Acwa Power International (SAU) and Acciona (Sp)
	FUNDERS	European Union (Bel) and AfDBD (Côte d'Ivoire)	Commission (Bel), Clean Technology Fund (US), AFD (Fr), AfDB (Côte d'Ivoire), World Bank (US)	European Union (Bel) and World Bank (US)

• NOOR OUARZAZATE I

Noor I is the first stage of the NOOR Ouarzazate complex. This project whose capacity could reach 160MW uses the Concentrating Solar Power technology with cylindrical-parabolic captors with a thermal storage capacity estimated at 3 hours at full power and is the only solar projects operational by the end of 2017. The project extends over a surface of about 450 ha. Construction work for the project's first solar park was officially launched on 10th May 2013 and it was inaugurated in February 2016. The price offered by the consortium reached a record low at that moment, of a tariff of Dh 1.6187 per Kwh and required an investment of €1 billion.

• NOUR OUARZAZATE II AND NOUR OUARZAZATE III

Noor I (200 MW) and Noor III (150 MW) with an estimated cost of US\$ 2 billion, was also assumed by ACWA Power. Construction work on the site officially started in February 2016.

Lastly, Noor Ouarzazate IV, is the first photovoltaïque project in Morocco for a total of 70 MW. Find more information in the following table (Noor PV I projects)

NOOR PV I Projects

This project is composed of three PV centrals totalling 177 MW of installed capacity in three distinctive sites. The program covers three plants with a total investment of about \$ 220 million. Noor PV I includes Noor Ouarzazate IV (72 MW), Noor Laayoune (85 MW) and Noor Boujdour (20 MW). Noor Ouarzazate will then total a minimum capacity of nearly 580 MW. Noor IV is the last piece of the puzzle and will bring the extra 72 MW. The Noor Laâyoune project with a capacity of 85MW is the largest photovoltaic plant of the solar plan. Once completed it will also be one of the largest photovoltaic sites in Africa.

Table 14- Projects breakdown: the ISP Noor PV

		NOOR PV I Programme		
		NOOR PV I	NOOR PV II	NOOR PV III
TECHNICAL DATA	LOCATION Regions	Ouarzazate 9/ Souss - Massa	Lâayoune 11/ Lâayoune Saguia al Hamra	Boujdour 11/ Lâayoune Saguia al Hamra
	INSTALLED CAPACITY	~ 72 MW	85 MW	20 MW
	TECHNOLOGY	PV polycristallin avec un système de tracking à un axe	PV	PV
	STAGE END 2017	Under construction	Under development	Under development
	CONTRACT SCHEME	ONEE BOOT PPA (20 years)	ONEE BOOT PPA (20 years)	ONEE BOOT PPA (20 years)
	FINANCE MOBILISED		~180 millions euros	
	DATE OF SERVICE	First quarter 2018	2019	2019
STAKEHOLDERS	OPERATOR		MASEN	
	SPONSOR		A consortium led by ACWA Power SPC (Masen 25%) SENER (Sp)	
	OFF TAKER		ONEE	
	DEVELOPER		Acwa Power	
	CONSTRUCTORS	Chint Group (China) ,	Sterling & Wilson and Shapoorji Pallonji (India)	
	FUNDERS	KfW (Ger), European Union (Bel)	Green bonds issued by MASEN and underwritten by Al Barid Bank, Attijariwafa Bank, the CMR and the SCR	

The investment in these three projects will be 81%, 81% and 77%, respectively, through loans to Masen, which, in partnership with Acwa Power, will finance and develop the Noor PV I program. Recall that to confine this program, the project will be financed by the 1st green bonds in Morocco in compliance with Climate

Bonds Initiative standards for an amount of e106m, which have been issued by Masen through private placement following the authorization of the Moroccan Authority of Capital Market (AMMC) to the following investors: Al Barid Bank, Attijariwafa Bank, CMR [Caisse Marocaine de Retraite] and SCR [Société Centrale de Réassurance. Green Bond is underwritten by a State guarantee, therefore allowing Masen to ensure an optimised interest costs involving just 10bp risk premium.

These financing operations were carried out after the consortium led by Acwa Power won the Noor PV I contract following an international call for tenders launched in 2015. The three plants will be operational by 2019. These projects are deployed by Masen, as part of a tripartite IPP scheme integrating the ONEE.

It is expected to have an additional PV complex, but no further details are provided.

• NOOR PV I

Noor PV I also called Noor Ouarzazate IV is under construction since April 2017, a loan agreement for an amount of 65 million euros was signed between Masen and the German KfW Bank for the financing of Noor Ouarzazate IV.

• NOOR PV II AND NOOR PV III

In order to carry out Noor PV II and Noor PV III projects, it has been decided that Masen, through its subsidiary Masen Capital, will have a 25% stake in Acwa Power of the entire project responsible for the design and construction of the three power plants. The two sites will generate 230 GWh a year.

Masen will also participate at a 25% stake with Nomac, which will be responsible for the operation and maintenance of the three solar sites. Masen entered for the first time the capital of the six companies responsible for the development, operations and maintenance of the Noor PV I program.

The levelized electricity tariff of USD 4.797¢/kWh (MAD 0.46/kWh) at which the contract has been awarded is one of the most competitive tariffs worldwide.

Acwa Power contracted the world's largest EPC company, and Sterling and Wilson will construct the installations by 2018.

Midelt project

The project comprises the construction of new solar installations near Midelt, a town in the centre of the country 150 km south of Fes. Covering a surface of about 2,400 hectares, the site will be developed in several phases using two technologies. First the CSP phase (thermodynamic solar power station) representing 80 to 85 % of NOOR Midelt's total capacity. Then a photovoltaic phase accounting for the remaining 15 to 20 %. Masen has revised upwards the potential capacity of the site, up to 800 MW. Note that the project Noor Midelt will be the completion of the largest solar power plant in Morocco. The financial engineering of the project should be concluded during 2018.

Table 15 - Projects breakdown: the ISP Noor Midelt

		NOOR Midelt	
		MIDELT I	MIDELT II
TECHNICAL DATA	LOCATION Regions	Zagora, Erfoud and Missour 9/ Souss - Massa	n/a
	INSTALLED CAPACITY	800 (150 MW and 190 MW per plant)	n/a
	TECHNOLOGY	Hybrid project of CSP and PV Min of 5 hours of storage	Hybrid project of CSP and PV Min of 5 hours of storage
	STAGE END 2017	Ongoing tender	Under study
	CONTRACT SCHEME	ONEE BOOT PPA (20 years)	n/a
	FINANCE MOBILISED	~1.8 billion euros	n/a
	DATE OF SERVICE	Project will contribute to the new national energetic stratetegy (2020-2030)	n/a
STAKEHOLDERS	OPERATOR	MASEN and Acwa Power International (SAU)	MASEN
	SPONSOR	TSK Solar (Sp)	n/a
	OFF TAKER	MASEN/ONEE	MASEN/ONEE
	DEVELOPER	Acwa Power	n/a
	CONSTRUCTORS	n/a	n/a
	FUNDERS	World Bank \$400m, KfW \$750m, BAD \$260m, BEI \$200m, AFD \$100m Clean Technology Fund \$50m	n/a

Noor by ONEE

The next projects are led by ONEE with the following objectives:

- Secure the power supply of the zones connected to the antenna while valuing the solar resources of the areas concerned
- Realize a program of development of PV solar power plants of an average size, totalling an installed capacity of approximately 400 MW with a corresponding investment of \$ 800 million.

This project comprising three main stages Noor Tafilalt, Noor Atlas, Noor Aragna. They are undertaken by ONEE. The operator has been assigned significant missions alongside other partners, namely the SIE, IRESEN and the AMEE. ONEE is deploying a program for the development of PV power plants of average size, 10 to 40 megawatts aiming to improve the quality of service and stabilize the network of distant regions.

Table 16 - Projects breakdown: the ISP by ONEE

		NOOR by ONEE		
		NOOR Tafilalt	NOOR Atlas	NOOR Argana
TECHNICAL DATA	LOCATION Regions	Zagora, Erfoud and Missour 9/ Souss - Massa	Tensift, Errhamna, Chichaoua and Boumalne 7/ Marrakech - Safi	Boumalen, Errhamna and Essaouira 9/ Souss - Massa 7/ Marrakech - Safi
	INSTALLED CAPACITY	~ 100 MW (20-30 MW per plant)	200 MW (20-30 MW per plant)	~ 100 MW (20-30 MW per plant)
	TECHNOLOGY	3 PV solar stations of 40 MW each located at end of network line in order to solve drop of voltage	8 small sized PV plants (10-30 MW) located at end of network line in order to stabilize the network	3-4 small sized PV plants (10-30 MW) located at end of network line in order to stabilize the network
	STAGE END 2017	Under construction	Under development	Under development
	CONTRACT SCHEME	ONEE BOOT PPA (20 years)	ONEE BOOT PPA (25 years)	ONEE BOOT PPA (25 years)
	FINANCE MOBILISED	~150 millions euros	~300 millions euros	~250 millions euros
	DATE OF SERVICE	2018	2018	2018
STAKEHOLDERS	OPERATOR	MASEN and Acwa Power International (SAU)	MASEN	MASEN
	SPONSOR	TSK Solar (Sp)	MASEN	MASEN
	OFF TAKER	MASEN/ONEE	MASEN/ONEE	MASEN/ONEE
	DEVELOPER	Acwa Power	Acwa Power	Acwa Power
	CONSTRUCTORS	Consortium of SENER (Sp), Acwa Power International (SAU) and Acciona (Sp)	Consortium of SENER (Sp), Acwa Power International (SAU) and Acciona (Sp)	Consortium of SENER (Sp), Acwa Power International (SAU) and Acciona (Sp)
	FUNDERS	World Bank (Us)	KfW (Ger), EIB (Lux) and European Commission (Bel)	European Union (Bel) and World Bank (Us)

• NOOR TAFILALT

The project is composed of 3 solar stations of 40 MW totalling an installed capacity of 120 MW located in Zagora, Erfoud and Missou. This project would avoid CO2 emissions 76,534 tons per year. It will be in operation around 2018 estimated at Euros 150 million and is almost entirely financed by the World Bank

• NOOR ATLAS

The project is planned to be located in different sites in the southern and eastern regions of the Kingdom. The commissioning of this 2nd phase of the program is scheduled for the end of 2018. Noor Atlas projects are medium-sized plants -between 10MW and 30MW- The overall investment is estimated at 300 million euros. It will comprise eight EPC plants with a total capacity of 200MW. As regards to the financing, it will be extended by the German Bank KfW, the European Investment Bank as well as the European Commission. The average annual yield of the Noor Atlas project is estimated at 320 gigawatt hours.

• NOOR ARAGNA

Project with a total installed capacity of 100 MW. The different sites are being selected by ONEE. The setting service of the PV plants is expected in 2019. They will avoid about 127,556 tonnes of CO₂ emission per year and they produce approximately 200 GWh.

Noor Tata

The Noor Tata project is now scheduled for post-2020. It will contribute to the national objective renewable energy (52% by 2030).

The projected capacity for Noor Tata is 800 MW, and will be developed with hybrid technology plants, combining CSP (thermosolar) and PV (photovoltaic) or purely solar photovoltaic (PV) plan. MASEN is qualifying the location of the different sites currently focusing on PV technology for five new solar sites as such Taroudant, Kelâa des Seraghna, Bejaâd, Guercif and El-Hajeb.

6.4 Energy Efficiency Projects

As stated the country have designed an energetic strategy in the short, medium and long term for the EE as well. On the short term (2000-2016) was designed to facilitate the equilibrium between demand and supply. Before discussing specific projects, it is important to note that one of the significant measures undertaken by the Moroccan government and ONEE 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, between the residential and professionals. Thus, the power gains reached 84 MW and the energy savings recorded 66.1 GWh, avoiding CO₂ emissions of 61 980 tonnes.

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. By the creation of ADEREE then AMEE, to help the country reach its target which is reduce electric consumption by 12% in 2020, and 15% by 2030, AMEE exclusively undertake, track and monitor projects related to the energy efficiency.

In Morocco, public lighting is the responsibility of the commune authorities, which spend a significant proportion of their budget on energy bills. They are therefore very interested in energy-efficient solutions. Under projects financed by SIE, the first steps have been taken towards renovating the public lighting system. 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.

6.3.1 Public Administration

Programme	Green Mosques Programme
Implementing bodies	Ministry of Endowments and Islamic Affairs (MHAI), SIE, GIZ
Features	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. SIE implements and finances the programme with technical support from the German Cooperation GIZ. The estimated investment required is MAD 200 million. The programme aims at rehabilitating 15.000 mosques, starting with 1.000 in the first phase.
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	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. 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 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.

Programme	The Shemsi program- Development program of solar water heaters
Implementing bodies	Promasol -ADEREE
Features	In 8 years, 160,000 m2 of solar water heaters have been installed. For 1 dirham invested in solar water heater, 4.3 dirhams are saved in butane compensation, say officials ADEREE.
Target	Part of the broader national strategy of installing 1.7 million of m2 of solar water heaters until 2020, compared to 350,000 installed today.

6.3.2 Industrial Sector

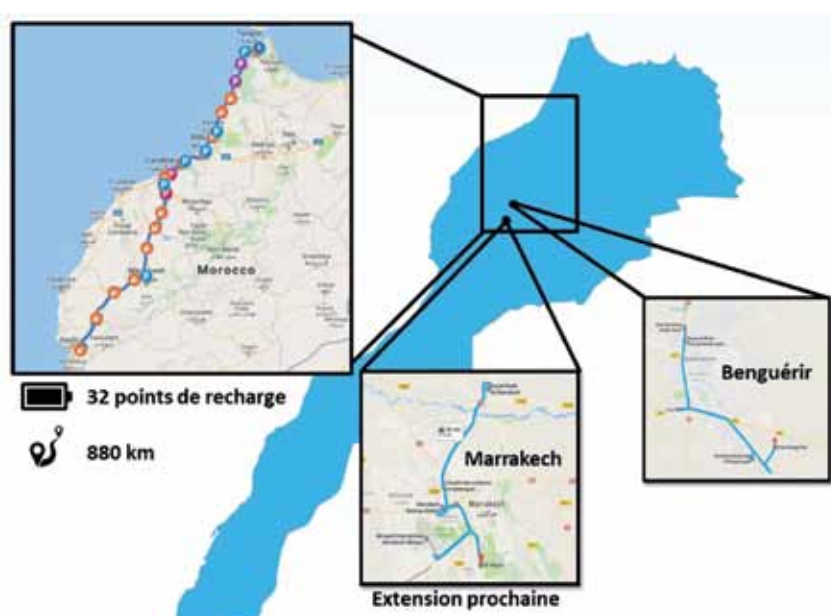
Programme	PEEI (Programme d'Efficacité Énergétique dans l'Industrie)
Implementing bodies	ADEREE/AMEE
Features	<ul style="list-style-type: none"> • There is a potential energy savings exceeding 15%; • The implementation rate of EE investments is less than 5%; • A favourable time of return on investment: less than 24 months for more than 50% of the projects.
Objectives	<ul style="list-style-type: none"> • Structuring and strengthening institutional and regulatory frameworks • Optimization of energy consumption to an estimated total saving of 2m toe • Reduction of CO2 emissions estimated at 7,594,335 tonnes of CO2 equivalent; • Job creation and development of new industrial sectors

Programme	Industrial Energy Efficiency Service for Maghreb Steel
Implementing bodies	SIE. Maghreb Steel (MS)
Features	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. 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.
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.

6.3.3 Agricultural sector

Programme	Maroc vert (2009-2013)
Features	Hydropower (STEPS) 350 MW and 450 MW projects Measures to improve land tenure of agricultural land Modifications of the strategies of irrigation Changes in agricultural practices
Results	Food Crises 2007-2008 In 2016 was one of the best harvest

Programme	Programme on the optimisation of energy performance in farms
Implementing bodies	ADEREE, Crédit Agricole Maroc
Features	The programme targets helping farmers to reduce their energy bills through the reduction of their energy consumption and the use of RE. The programme aims at: <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 ADEREE started with a demonstration program in 10 farms located throughout Morocco.
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.



6.3.4 Transport sector

Programme	Electric vehicle (EV)
Implementing bodies	IRESEN and Schneider Electric
Objective	700 000 EVs by 2030
Features	<ul style="list-style-type: none"> • Smart charging • V2G - Vehicle to grid • Autonomous driving • Fleet management <p>By 2030 more than 50% of the energy mix from RE Transportation represents 45% of the national energy consumed</p>

Programme	Green mile
Implementing bodies	IRESEN
Features	32 charging stations from Agadir to Tangier (800km) of fast and normal charging

6.3.5 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 <p>It is a United Nations funded initiative with the objective to double solar water heating capacity in three years to 40,000 m² per year.</p>
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.

Programme	Building Lightening: CEEB
Sector of implementation	Housing, education, health, hospitality industry
Features	To introduce mandatory minimum EE performance requirements in buildings, through the introduction of an EE building code in the key sectors. Regulatory framework: Assessing the current regulatory framework, sizing the Energy Efficiency Potential in new constructions and implementing a clear set of Energy Efficiency standards for new constructions; Institutional framework: Setting up an Energy Efficiency Building Code at the national level, and reinforcing compliance at the municipal level.
Results	Technical Standards: <ul style="list-style-type: none"> • Mapping of climate zones • Sustainable urban development • Equipment functioning • Energy services management in buildings • Development of energy efficiency technical standards for buildings

The public sector has undertaken many projects and programmes in order to save significant cost mainly related to public lightening but also more comprehensive projects that are region integrated projects such as Jiha Tinou.

Jiha Tinou (meaning "My Region" in Arabic and Tamazight) is a Territorial Strategy, launched in 2012 by AMEE and GIZ, with 3 pilot cities: Chefchaouen, Oujda and Agadir. In 2015, the success of the 8 years programme followed with three other cities: Marrakesh, Benimellal, and Rabat. The strategy aims to encourage local initiatives by facilitating the effective adoption of Morocco's National Energy Strategy at local, primarily municipal, levels of government. The programme applies at all sectors in a city such as infrastructure, building, industry, waste management, transport, and RE (biomass & solar mainly), these cities act as pilot project for the smart metering and smart grid.

Now that the population growth is stabilizing (1.23%) and the electrification rate is reaching the 100%, we can expect an energy intensity stagnation followed by a decrease, only if a plan for more energy efficiency program is deployed and monitored. By decoupling economic growth from the energy consumed, we can achieve energy saving much faster. Innovative and more sustainable ways of meeting our energy needs are accelerating the paradigm shift away from a world run on fossil fuels. In Morocco, 57% of the GDP is from tertiary sector, which allows an easier transition towards a decoupling.

7 Private sector Initiatives

Aside from the great efforts in growing Morocco's electricity generation capacity, there is a focus on the development of the RE manufacturing sector, turning the country into a hub for the RE industry. Job creation, inflow of foreign direct investment (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.

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. As of December 2017, the company has exported its first wind turbine blade. 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.

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 3.5 million euros 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.

Solar thermal collector's 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.

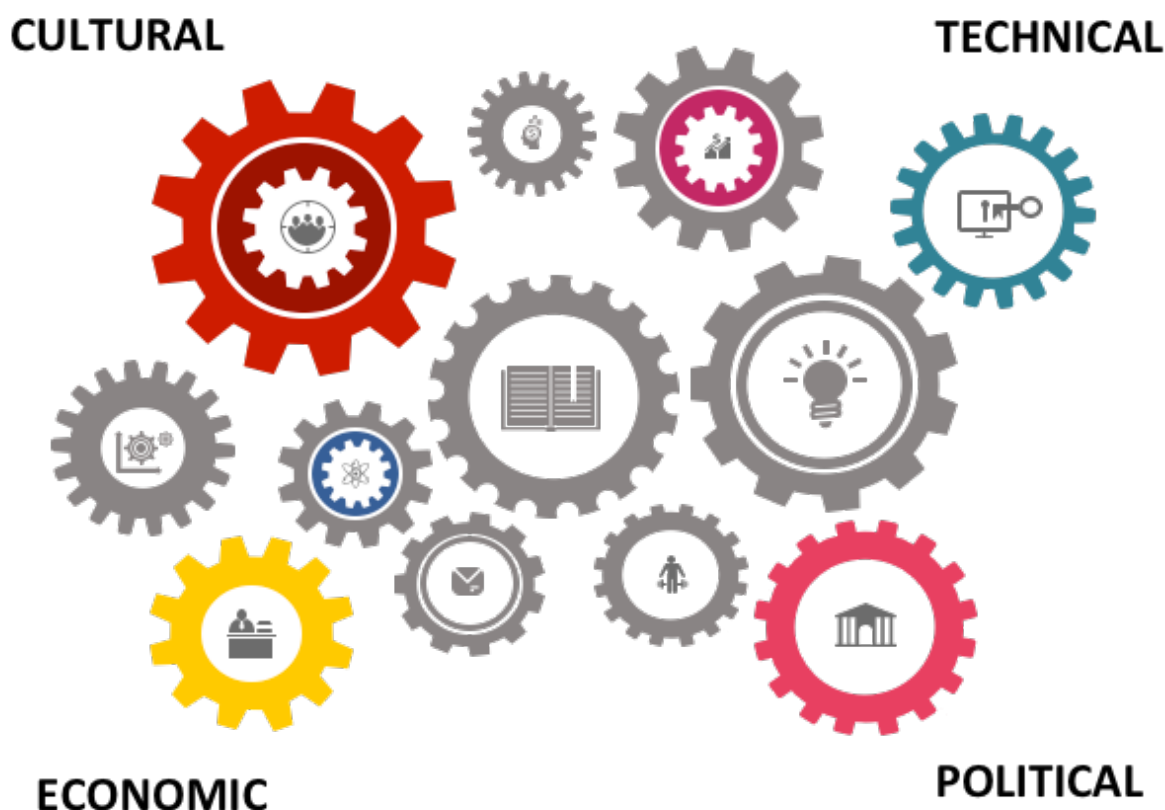
Powerex

General Electric is also present in Tangier through Powerex, a joint venture signed with Mitsubishi to manufacture high-tech semiconductor solutions for export.

We could expect more private investment being made in the future years, because of larger and energivore industries are starting to manufacture in Morocco. For example, after Renault and Peugeot, BYD ("Build Your Dreams") is the third car manufacturer to set foot in the kingdom. Eventually, the project will consist of three additional factories, one of electric batteries, the other of electric buses and trucks and the last to manufacture electric trains. All these projects will be located near Tangier, in the future "Mohammed VI City Tangier Tech", an industrial city led by the Chinese group Haite and whose creation was announced in March.

8 Challenges

It is widely recognised that all the political actions, legislative reforms and investments by the government are signs of a true commitment by Morocco to promote the deployment of RE. Indeed, Morocco is one of the first countries in Africa to bet on RE, allying economic development with respect of the environment. Today it has one of the most ambitious programmes in the region. However, major obstacles remain in the way of faster progress for RE and on a larger scale. In the following section, the main challenges are addressed.



Political challenges

Regulatory framework exclusively favouring large-scale renewable energy production installations. In Morocco, the development of renewable energies is mainly through calls for tender from ONEE or MASEN. Legislative and regulatory texts have been favouring large-scale projects without proportional support to small and medium scale producers in terms of financing and incentives. There is an absence of clear directives (decree) regarding the access for the low voltage grid.



Economic challenges

Absence of financial support in favour of small and medium-sized RE projects. The support is lacking for small and medium-sized projects which do not have available a line of credit specific to RE, nor an appropriate framework for the successful financing despite the excellent opportunities and a sizeable RE market in the country. The accessibility and capacity to pay for RE technologies remains a major obstacle for the majority of households and commercial enterprises in Morocco.

- 🎯 Favour the emergence of local projects
- 🎯 Platform for discussion to facilitate the development of innovative shared practices
- 🎯 Ensure participation of self-producers in RE based electricity
- 🎯 Build horizontal and vertical alliances with RE stakeholders

The injection of RE into the low voltage network is essential for the stabilisation of the electricity distribution network. (eg. German network)

Moreover, it is important to increase the rate of sales of surpluses, which is currently capped at 20%, and ensure that priority is given to RE having a regulatory text that specifies the purchasing price.



Technical challenges

Grid capacity and technical constraints of the transmission and distribution networks remain the main uncertainty. Risks related to revenues remain perceived modestly high as the majority of investors express a concern related to the risk of curtailment. The low market penetration of RE is explained by the lack of promoters, qualified workers and enterprises as well as maintenance staff.

The budget allocated to R&D remains far behind nations with high RE integrations. Training institutes for RE and EE are located in three cities by IFMEREE in Oujda, Tangiers and Ouarzazate.

- 🎯 Extend and improve grid infrastructure by implementing digitalized grids (eg. Oujda). In fact, flexibility must also come from measures on the side of consumers so as to optimise decentralised production and distribution and develop links between supply and demand.
- 🎯 Storage play a role in the balance of the variable share of RE
- 🎯 Extend RE to the heating/cooling and transport. Transport represents more than 40% of final energy consumption. Addressing the EV investment in the medium run is a smart move in order to reduce the country's carbon footprint
- 🎯 Develop other source of RE. Biomass resources is a cheap alternative. It has the advantage to address two aspects: waste management and RE

- 🎯 Support the involvement of small and medium sized RE projects in the energy transition.

The potential market for domestic PV systems is estimated at US\$500 million by 2025. To make such potential a reality, apart from reforms in access to the network, financing instruments are needed for private individuals as well as for small and medium-sized enterprises, such as lines of credit with preferential conditions in favour of renewable energies.

- 🎯 Open the RE market to competition
- 🎯 Set a time limit on every type of FF subsidy
- 🎯 Profound reform of the regulatory statute of micro-finance to increase the legal limit of current loans (Dh 50 000) and permit micro- credit associations to extend their activities beyond income generating activities



Cultural challenges

Policy-makers lack of knowledge of RE potential and the public's lack of awareness. Thus, the perception of risks relating to RE is biased (higher).

More attention is required by social acceptance issue. RE are principally financed by the government and international funds rather than by local private investors or regional banks. The Moroccan private sector has an unavoidable role to play in the successful conduct of an energy transition.

The energy transition is the passage from one production centralised model based on fossil fuels towards a new RE- based model which is decentralised and people-centred.

- 🎯 Strengthen understanding on RE and EE by providing awareness campaigns. Local governments play an important role in validating and accommodating RE projects. Improving their knowledge and understanding of RE solutions is fundamental to fully exploit the potential of the advantages the population can derive from RE. It is interesting to support and replicate the Jiha Tinou initiative.
- 🎯 Establish mechanisms for sharing information and exchanging RE experience amongst policy-makers.
- 🎯 Develop a social dimension within the energy transition framework. In fact, most jobs created are in construction which is not sustainable employment.

The liberalization study draws a complete analysis on the current RE market and present the strengths and weaknesses of the liberalization of the electricity sector for low and medium voltage in the country. The objective is to understand how the liberalization of the market for low and medium voltage act as a tool to foster renewable energy investments and to learn from good practices already in place in certain countries. Therefore, to determine the path to follow as well as the mistakes to avoid in order to make a successful path toward the liberalization. Moreover, it presents the impacts of such action from the perspective of all the actors throughout the supply chain and all stakeholders involved in the electricity market.

Conclusion

With the ambition to increase the share of RE in installed electricity capacity to 52 % by 2030, Morocco has become one of the major actors in the world's energy transition and on the African continent.

Morocco's RE potential is largely sufficient to respond to all the nation's needs. The smart exploitation of this potential could enable it to completely eliminate imported fossil fuels, and contribute to the environment while creating new sources of wealth and jobs.

However, this requires a deeper commitment, with the establishment of a coherent political and regulatory framework, which sets clear and essential post-2030 goals in order to ensure security of investments, mobilisation of stakeholders and allocation of resources towards a common vision.

Moreover, as Morocco's energy policy is inserted into a process enlarged to its neighbours, it must bet on regional integration of RE through electricity interconnections and the COP 22 offered a magnificent possibility to redouble its efforts and show the way.

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, 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 IPPs, shows that the opening of those markets will require more time than initially foreseen, weakening the outlook for a quick IPPs penetration into MV-LV segment of RE 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.

The success of electricity privatization is mostly dependent upon the prior sector restructuring, a transparent and effective regulatory framework and appropriate market conditions for investors to enter the market. Finally, the contribution of citizens and SMEs are essential to achieve a profound RE penetration rate.

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