



masden

endless power for progress



PRESS FILE



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1. Masen, IN WORDS AND DATAS

In order to meet increasing energy demand whilst fighting climate change, Masen is leading the way in Morocco's renewable energy sector.

Nationally, Masen is pursuing the Kingdom's goal of achieving 52% of its energy mix from renewable sources by 2030. The Masen group has developed a unique model based on 5 components: producing electricity from renewable sources, applied and pre-operational R&D backed by industrial projects, training, industrial integration and local development.

Thus, as well as producing electricity and raising the necessary funds for its projects, Masen is also endeavouring to mobilise a competitive economic fabric that efficiently harnesses existing skills and helps create new ones. Masen nurtures and encourages the development of applied and pre-operational R&D backed by industrial projects and the promotion of technological innovation. At the heart of Masen's integrated approach, this incentive to innovate is epitomised by the development of a 200 hectares on site platform at the Noor Ouarzazate solar complex. Last but not least, the real common thread running through this integrated approach is the local development strategy Masen implements. This helps the regions hosting the projects to achieve equality and sustainable growth.

Internationally, Masen aims to be the preferred partner for any country wishing to make renewable energy a priority for its socioeconomic development. Masen has already signed several partnership agreements with African countries for the development of renewable energies.



5 pillars for the integrated approach

42%

of the energy mix from renewable sources by 2020

52%

of the energy mix from renewable sources by 2030

3 priority resources: solar, wind, hydraulic

3000 MW

total minimum additional capacity by 2020

6000 MW

total minimum additional capacity by 2030

installed solar capacity by 2020

2000 MW*

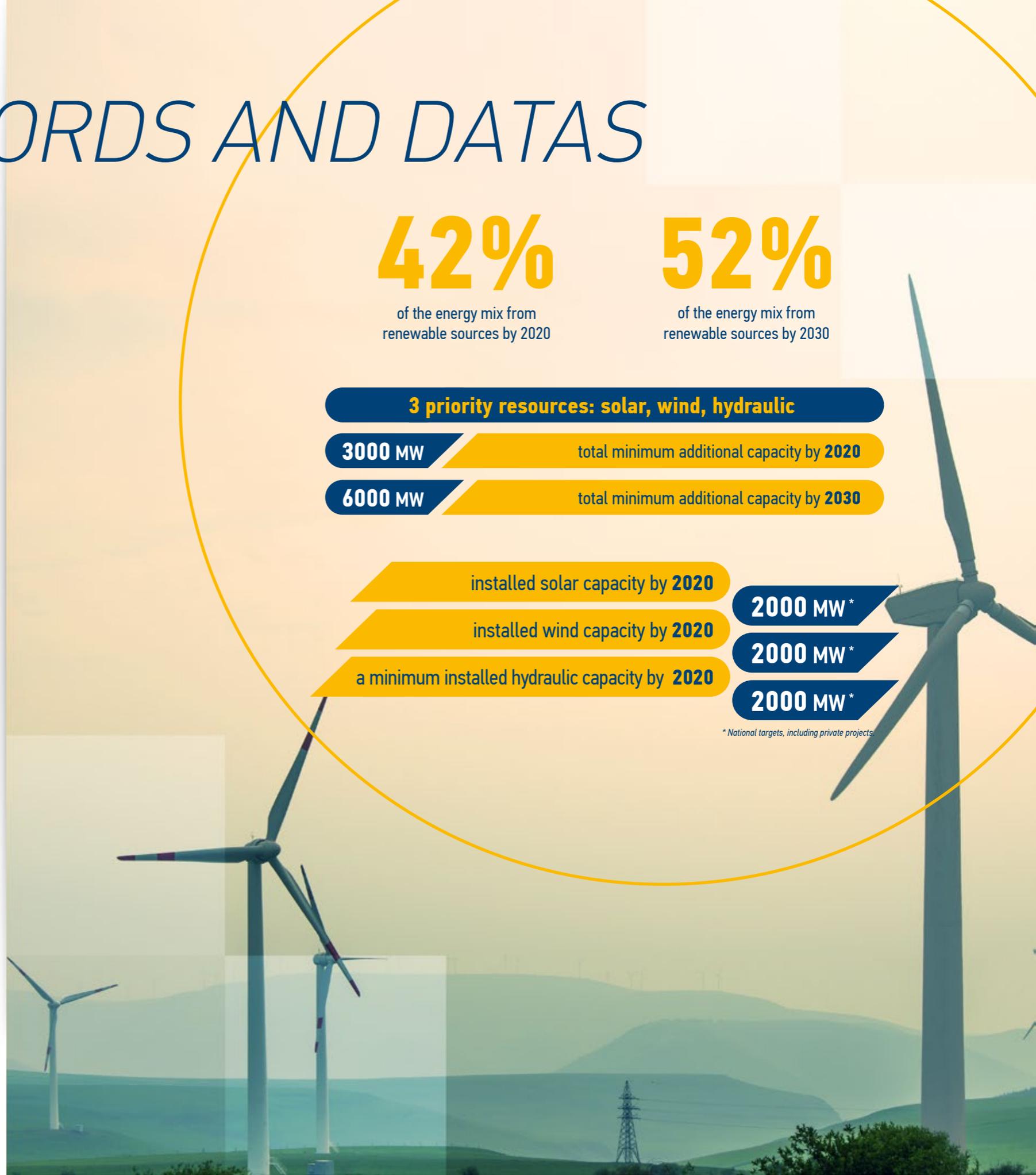
installed wind capacity by 2020

2000 MW*

a minimum installed hydraulic capacity by 2020

2000 MW*

* National targets, including private projects.





MASEN'S KEY DATES

2017

April : His Majesty King Mohammed VI launches the construction work for Noor Ouarzazate IV the last plant of the Noor Ouarzazate complex and 1st photovoltaic plant of Noor PV I.

2016

November: Award of Noor PV I projects (Noor Ouarzazate IV, Noor Boujdour, Noor Laayoune).

August: Masen's scope widened from solar energy to include all renewable sources. Masen becomes the key and integrated stakeholder for renewable energy in Morocco.

February: Noor Ouarzazate I plant opened by His Majesty King Mohammed VI. Construction work begins on Noor Ouarzazate II and Noor Ouarzazate III.

2015

Late 2015: Construction of all joint infrastructure for the Noor Ouarzazate facility.

Launch of the selection process for Noor PV I (Noor Ouarzazate VI, Noor Boujdour and Noor Laayoune).

2014

June: Creation of the Cluster, a platform that aims to develop synergies between stakeholders in the renewables sector in Morocco such as institutions, companies and R&D/Training.

2013

Launch of the selection process for Noor Ouarzazate II and Noor Ouarzazate III.

May: Construction work begins on Noor Ouarzazate I, launched by His Majesty King Mohammed VI.

2012

May: Launch of the Solar Atlas, developed by Masen, an essential tool for accurately evaluating solar potential and its spatial and temporal distribution on a large scale.

2011

Launch of the selection process for Noor Ouarzazate I.
Start of joint infrastructure construction for the Noor Ouarzazate complex.
Implementation of the integrated approach for developing solar projects.

2010

March: promulgation of the law establishing Masen, the Moroccan Agency for Solar Energy.

2009

December: Mustapha Bakkoury appointed Masen's President of the management board.

November: His Majesty King Mohammed VI launches the Noor Solar Plan (with the goal of achieving a minimum of 2,000 MW by 2020).

2. *Masen, MOROCCAN AGENCY FOR SUSTAINABLE ENERGY*

With wide-ranging powers, Masen is making the development of renewable energy a priority.

The Masen Law 37-16 of August 2016, the law 39-16 amending the ADEREE law 16-09, and the law 38-16 amending and supplementing the second article of Royal decree no. 1-63-226 of 14 Rabiaa I 1383 (5 August 1963) establishing the ONEE (National Office for Electricity and Potable Water) have fundamentally reformed the institutional landscape in which the company operates and have established the present Moroccan Agency for Sustainable Energy. Masen remains a private Moroccan company with public capital funding. This overhaul of the institutional framework for the renewable sector has definite benefits: it promotes synergy between the various stakeholders and ensures consistency across renewable energy projects. As a key player in the renewable energy sector, Masen is responsible for ensuring this consistency.

The new legislative framework for 2016 also helps to establish a clearer scope of action, to consolidate the relationship between Masen and the ONEE from both institutional and operational standpoint, and also to define the scope of each of the stakeholders.

Lastly, these changes maximise Masen's negotiating power with the various stakeholders in the value chain, especially internationally, and enable it to lay the foundations for international cooperation on energy matters.





MASEN LAW 37-16 OF AUGUST 2016

Masen is now responsible for:

- Identifying, designing and scheduling integrated projects
- Evaluating renewable energy resources
- Developing renewable energy projects with all the attendant activities: from qualifying sites to the design, the structuring and raising of funds, the construction of power plants and their related infrastructure as well as their operation and maintenance
- Carrying out related activities that contribute to the local development of areas that are home to projects, to Research and Development in the renewable sector, to the development of competitive industrial sectors and to the creation of specialised training programmes
- Developing projects to generate energy other than electrical energy, which will help contribute to the development of other energy sources using renewable resources, such as heating or cooling or even sea water desalination
- Carrying out promotional, awareness-raising and advisory activities

Masen's geographic scope has also been broadened, as all these activities may be conducted on a continental and international level.

Masen is present across the entire value chain for the development of renewable energy. Law 37-16 clarifies, strengthens and also broadens Masen's scope across certain links in the chain.



3. *Masen, LEADER OF MOROCCO'S RENEWABLE ENERGIES*

Masen's expertise currently ranges from solar to wind and hydropower. Soon, it may include the development of any other type of renewable energy deemed relevant for our country. This diversity is a strength, as it makes Masen the preferred contact for all stakeholders in Morocco's renewable energy sector. It also allows Masen to draw maximum benefit from the mutually complementary nature of these types of energy and identify, among all these types of energy, the technology that is best suited to the needs of the national grid.



Hydropower

Masen's role is part of the operating program of Morocco's dams, the building of which began in the 1960s.

More than 40 of Morocco's 148 dams have been built in the last 15 years.

In Morocco, the share of hydropower (current installed capacity is 1,770 MW) is expected to increase to at least 2,000 MW by 2020.



B - Wind

Electricity-generating wind farms are generally installed along the Kingdom's coastline.

Morocco's target is to achieve an installed capacity of 2,000 MW in 2020.

The national wind project (to this day, 7* windfarms in total) will make it possible by 2020 to save 1.5 million TOE by 2020, equivalent to 5.6 million tCO₂.

**including private projects*



C - Solar

Masen supports the development of an integrated and competitive Moroccan solar energy sector, initiated through the deployment of the Noor solar plants across the Kingdom.

The Noor Solar Plan is aiming for a capacity of 2,000 MW by 2020. The projects will generate important investments by 2020.

Solar energy will prevent the emission of 3.7 million tCO₂ of greenhouse gases by 2020.

2000 MW per renewable energy source by 2020 is the first tier that Morocco, largely through Masen, is committed to achieving, with the aim of raising the share of REN in its energy mix to 52%.



D - Other renewable energies

Masen is in charge of developing any other energy proven relevant for the country.



NOOR OUARZAZATE I

With the opening of Noor Ouarzazate I in February 2016, Morocco reached a major milestone in harnessing its solar energy resources on a large scale.

Innovative technology: parabolic troughs

For Noor Ouarzazate I, Masen uses solar thermal technology with parabolic troughs (a type of Concentrating Solar Power).

The advantage of CSP, which is real investment in the future, is that it meets the specific needs of national consumption (and thus meets the ONEE's needs): indeed, **CSP technology allows electricity to be stored, offsetting the intermittent nature of solar generation.**

Noor Ouarzazate I has a 3-hour storage capacity and helps cover the Kingdom's peak electricity consumption after sunset. As this technology is in development, it offers real opportunities for industrial integration.

● A unique Public-Private Partnership (PPP) model

With the aim of providing the most competitive clean electricity, Masen has so far developed its projects using a long-term PPP scheme (Public-Private Partnership) based on the IPP model (Independent Power Producer). This institutional structure helps frame the relationship between Masen, the ONEE and the project company* and optimises the allocation of risks, whilst ensuring the cost per kWh is kept to a minimum.

Furthermore, an international tendering process helps to select the developer who is able to build a power plant to the highest international standards with competitive tariffs. Other criteria are taken into consideration by Masen when selecting a developer, including technical expertise and financial security.

Acwa power, a Saudi developer, led the consortium for Noor Ouarzazate I, by offering a record low price, with a tariff of 1.62 MAD/kWh.

This price was reduced to respectively 1.36 MAD / kWh for Noor Ouarzazate II and 1.42 MAD / kWh for Noor Ouarzazate III.

* Project Company or Special Project Company (SPC): Structure dedicated to the implementation of a given project, in this case, a REN project for Masen. The majority of the SPC is owned by the contractor of the project. This company is required to own the plant throughout the Power Purchase Agreement (PPA) within the framework of a BOOT (Build, Own, Operate, Transfer).

● An ambitious electricity generation target

The electricity produced by Noor Ouarzazate I will be distributed across the entire national grid, thanks to enhancements of the network operated by the ONEE. **The plant offers a capacity of 160 MW, equivalent to the consumption of about 600,000 residents.**

● Considerable environmental benefits

Noor Ouarzazate I helps avoid **nearly 280,000 tCO₂/year in emissions**, significantly contributing to Morocco's targets for reducing its greenhouse gas emissions.

● The project has a local presence

The Noor Ouarzazate I project is also very much part of its local area. More than 2,000 women and men, **more than 30% of whom were locals**, were heavily involved in building a plant to the highest international standards. And another one hundred or so women and men will be directly involved in operating as well as maintaining the plant in the years to come.

For the other projects of the Noor Solar Plan, industrial integration remains a priority. For Noor Ouarzazate II and Noor Ouarzazate III, its percentage exceeds the percentage of Noor Ouarzazate I, to reach 35%.

More plants from the the Noor Plan

The Ain Beni Mathar project, developed by the ONEE, was opened in 2010. It is home to a solar thermal combined cycle power plant with a capacity of 20 MW spanning a 160 hectare site.

The Noor Solar Plan will develop even further in future. Noor Ouarzazate II, with a capacity of 200 MW, and Noor Ouarzazate III, with a capacity of 150 MW, are the future projects currently under construction in Ouarzazate. Delivery is scheduled for late 2017/early 2018. Overall almost 1.5 billion euros have been secured to finance Noor Ouarzazate II and III.

A fourth plant, Noor Ouarzazate IV, in Ouarzazate, which is scheduled for 2018, will provide a capacity of 72 MW. This plant will not use CSP technology, but photovoltaic (PV). The finance agreement for Noor Ouarzazate IV was signed during COP22 between Masen and KfW. Other PV plants are planned at Laayoune and Boujdour, with an installed capacity of 85 MW and 20 MW respectively. During COP22, contracts were signed for the purchase and sale of electricity from the three Noor PV I program plants (Noor Ouarzazate IV, Noor Laayoune and Noor Boujdour).

Finally, 25 km northeast of Midelt, around 3,000 hectares have been set aside for CSP and PV technologies. The pre-qualification phase is underway for the development of one or more hybrid CSP/PV power plants with a minimum installed capacity per plant of 400 MW.

4. Masen, A CROSS-CUTTING EXPERTISE

With its unique operating model, Masen can offer a range of multidisciplinary skills and expertise to benefit its integrated projects. Specific professions support each step of the development of renewable energy facilities to form a comprehensive and consistent chain: from identifying and designing electricity production units to constructing the infrastructure needed to connect sites, as well as applied and pre-operational R&D backed by industrial projects and project funding.

Identifying, designing, and programming electrical generation units based on renewable energy source



Evaluation of renewable energy resources



Carrying out advance studies needed to qualify a site



Design, production, operation and construction of those installations (or oversight of such activities)



Contributing to mobilizing the funds needed for the construction of REN installations



Building the infrastructure needed to connect the sites to the various national networks (roads, electrical, water and telecommunications)



R&D AT MASEN

BACKGROUND

The Masen R&D platform was built on a roughly 200 hectare site, in the heart of the Ouarzazate solar complex.

Its purpose is to improve the level of maturity of existing solar technology. This test platform thus provides Moroccan and international researchers and manufacturers with actual operating conditions in which to test and validate innovations and prototypes resulting from applied and pre-operational R&D backed by industrial projects.

In the long term, the idea is to create an ecosystem that is conducive to innovation, with Masen right at its heart, forging links between the worlds of research and industry, thus helping to create value through groundbreaking applied and pre-operational R&D backed by industrial projects activity.

3 QUESTIONS FOR SAMIR RACHIDI, R&D PROJECT MANAGER AT MASEN

What does your day-to-day job involve?

 We establish research partnerships based around solar technology projects. These partnerships result in applied and pre-operational R&D backed by industrial projects that the team manages on a day-to-day basis. We ensure these projects always maintain a strong link between the research and industry ecosystems.

What are the benefits of Masen's R&D policy?

 Masen works on applied and pre-operational R&D backed by industrial projects, working closely with solar industry manufacturers. The aim is to enhance expertise and capacity

in Morocco's solar sector. In this case, it involves research centers and Moroccan industry who carry out applied and pre-operational R&D work and/or build prototypes or technology demonstration units within our platform, working with international partners. An example of this is the successful trial we had of the 1 MW concentrating photovoltaic (CPV) demonstrator with our Japanese partner Sumitomo. They contracted the Moroccan company JetEnergy to manufacture metallic structures, install panels and undertake all construction work on the mini plant. Beyond this, the project was also an opportunity for MASclR, a public Moroccan research center located in Rabat, to become competent in the packaging procedure for the multi-junction cells that are a feature of this CPV technology. JetEnergy and MASclR were both able to enhance their skills in their own areas of expertise through genuine technology transfer, and demonstrating the Moroccan stakeholder's ability to establish itself in technology sectors with high added value.

What technology will Masen be testing next?

 Masen is a player that doesn't set itself any limits in terms of the choice of technology, especially when it comes to applied and pre-operational R&D backed by industrial projects. To date, the demonstration models installed on the Masen R&D platform relate to photovoltaic technology, concentrating photovoltaic and concentrating solar thermal. **Other planned projects look into the sustainability of the materials used in CSP plants, the sea water desalination using solar solutions, energy storage and reducing water consumption in CSP plants, whether used for cleaning the mirrors in solar parks or for cooling down the thermodynamic process.** The applied and pre-operational R&D backed by industrial projects at Masen, especially through the Ouarzazate R&D platform, is intended as an innovation space open to all technologies of demonstrable benefit for our country's future.

5. *Masen*, FOR AN INTEGRATED DEVELOPMENT

As well as producing electricity from renewable sources, the purpose of Masen's integrated model is to establish strong and competitive renewable energy ecosystems. Masen is striving to create a competitive economic fabric that efficiently harnesses existing skills and helps create new ones. That is why Masen is involved in local development activities in the regions where its projects are based, and assists scientific innovation through its applied and pre-operational R&D backed by industrial projects strategy.

Its goal is to transform natural power into power for progress.

A photograph of several wind turbines in a green field under a blue sky with clouds. The turbines are tall and have three blades each. The field is lush green with some trees in the background. A yellow curved line is overlaid on the image, separating the text on the left from the text on the right.

FOCUS THE CLUSTER

Masen worked towards the establishment of the **Cluster**, one of its key strategic partners today.

The primary purpose of this participatory platform is to **develop a competitive industrial sector in the field of renewable energy in Morocco.**

To achieve this, the Cluster specifically aims to:

- create a network of national stakeholders in the sector, notably by bringing together fields of research and companies around collaborative initiatives that aim to develop industrial renewable energy projects ;
- create a technological environment and synergies that help the development of these projects;
- contribute to strategic thinking and to the definition of clear operational objectives that are shared by the entire community ;
- foster progress that enables businesses who are members of the Cluster to become more competitive, and increase their domestic market share and conquer new markets both regionally and internationally ;
- offer and develop any form of support, advice and assistance services for the project owners ;
- promote the Cluster, as well as the products and services of its member companies, both nationally and internationally.

THE LOCAL DEVELOPMENT

Masen provides a basis for local development around its projects. Masen's challenge is to create a positive development dynamic, boosted by the energy projects it designs. Since its creation, Masen has invested more than 68 million dirhams through a proactive local development strategy based on three components:

- 1. Opening up areas by establishing infrastructure and basic facilities.** For example, 33 douars (settlements) in the rural community of Ghessate were supplied with drinking water thanks to the ONEE network, among others. An 18.5km road built by Masen now provides access to 4 douars in the same locality by linking them up to the national highway. Solar street lights have been set up near the area's schools;
- 2. Improving the population's social environment** through support activities in healthcare and education;
- 3. Developing and revitalising the regions** to stimulate local employment, support economic activity and help boost the regional economy. For example, Masen's help in providing local support for the development of sustainable, revenue-generating agricultural practices has benefited more than 2,000 farmers in Ghessate.

In Ouarzazate, several targeted projects are ran to benefit local populations including:

- The annual **medical caravan** in the commune of Ghessate, combined with day visits to Ouarzazate's provincial hospital ;
- **Supplying the students with equipments to facilitate the access to educational institutions, and help reduce school drop-out rates.** Masen has provided pupils with vehicles for transport to and from school, mountain bikes suited to the difficult terrain, and has provided schools with supplies and equipment. Masen also encourages academic excellence by awarding grants for living expenses and scholarships to bright students from underprivileged families in Ouarzazate;
- **To ensure social inclusion among the region's children,** spring and summer holiday camps are organised each year as well as educational workshops for the children. Masen holds environmental awareness sessions aimed at local pupils, teachers and community organisations;
- **Sponsorship of social, cultural and sporting events (Morocco Solar Festival, the Ouarzazate Ultra Marathon, etc.);**
- And finally, **Support in developing sustainable, revenue-generating farming methods.**

THE NGO AGRISUD INTERNATIONAL

In partnership with the NGO Agrisud International, Masen ran a support program for agricultural development in villages in the commune of Ghessate, a province of Ouarzazate. In its pilot phase, from 2014 to 2016, the program reached no fewer than 949 beneficiaries from 119 local families.

The partnership with Agrisud International is focused on improving technical capabilities and providing direct support for the commune's small farmers: to increase their agricultural output, secure their production environment and guide them towards sustainable and environmentally-friendly farming.

On the ground, this support initiative has resulted in some very encouraging and tangible achievements. As such, in July 2016:

- new practices have been adopted: increase of 88% in livestock farming, 76% in market gardening and 100% for arboriculture (apples);
- production has increased: +21 % in the numbers of sheep, the output of apples has almost doubled;
- family incomes have increased: 8,200 to 9,300 MAD of additional annual income per family.

+21% **x2**
in the number of sheep the output of apple production has doubled

Agrisud International is a French NGO that has been fighting against poverty and for food security for the most disadvantaged populations since 1992.

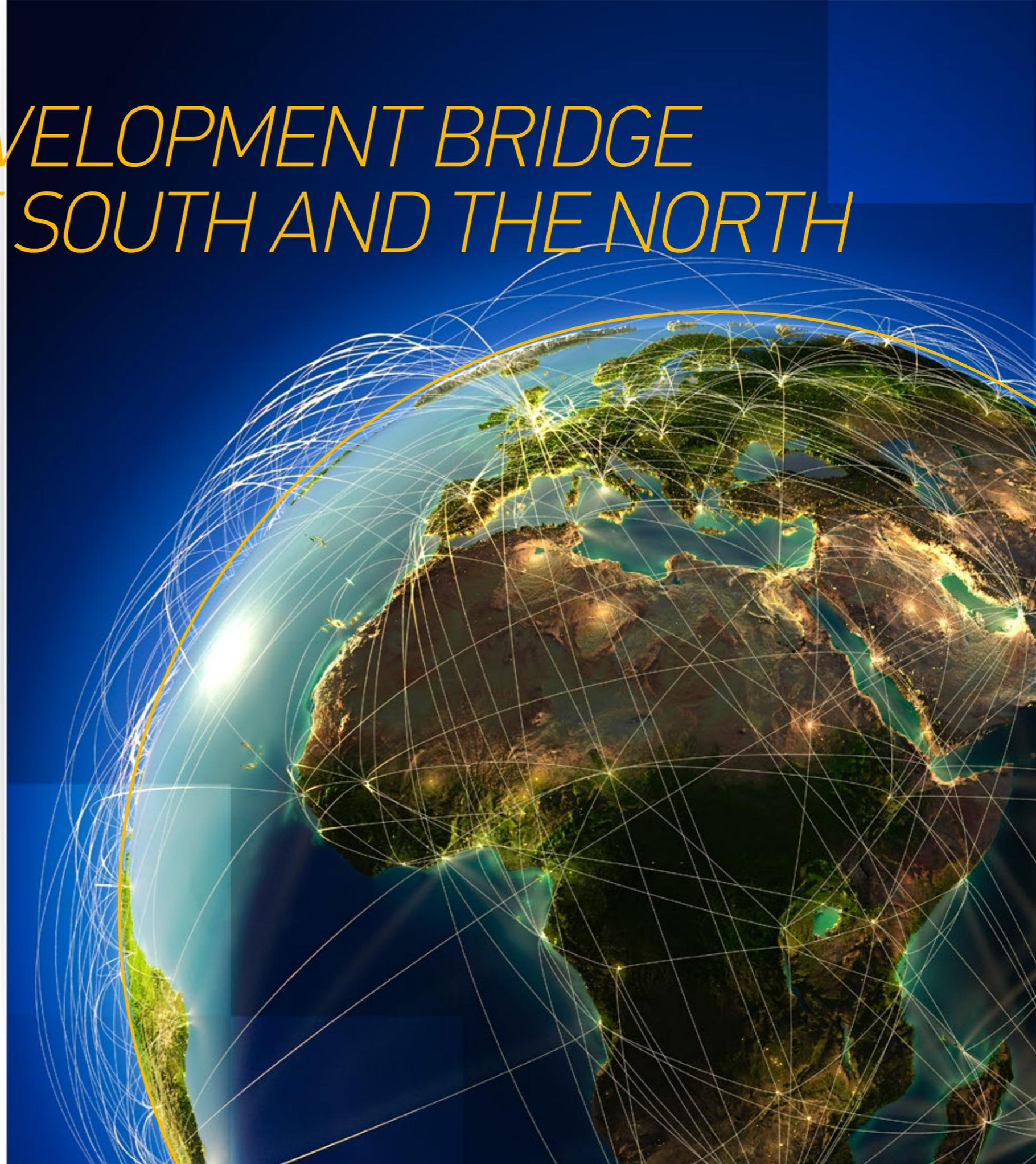
6. *Masen, A DEVELOPMENT BRIDGE BETWEEN THE SOUTH AND THE NORTH*

The energy situation in Africa involves a limited electricity generation portfolio and increasing demand. Morocco's expertise in renewable energy, as developed by Masen, is therefore useful to meet the challenges Africa faces.

Thanks to its strategic geographic location, strengthened by electrical transit infrastructure developed with Spain and Algeria, and by project studies with Mauritania and Portugal, Morocco serves as a regional interconnection platform between North Africa and Europe.

The Kingdom hopes to create opportunities for exporting its clean energy to the North and its expertise in harnessing renewable energy to the South. In this regard, during COP22 Masen signed a **major agreement for exchanging electricity with Europe (SET Roadmap)**. Masen also signed **memorandums of understanding with several African countries**, such as Senegal, Tunisia and Guinea-Bissau. The Royal visits to Africa also brought agreements with many African countries: Tanzania, Madagascar, Ethiopia, Nigeria and Rwanda.

These partnerships concern support for the development of renewable energy **by sharing knowledge and expertise**, similar to the partnership signed with Djibouti in Marrakech in November 2016.



7. Masen AT COP22

COP22 was a chance for Masen to discuss advances in the field of renewable energy:

- the Group showcased its innovation in the field of climate funding when it took part in various major events organised at COP22 (such as Energy Day and SIF, etc.);
- the Masen Pavilion was home to many side events (<https://goo.gl/010aHz>) during the 2 weeks of COP22, where wide-ranging and technical themes (such as evaluating resources through the Solar Atlas of Morocco, discussions about synergies between technologies or the financing model) or more strategic matters (south-south cooperation, development through renewables) were discussed;
- to promote innovation, a prize-giving ceremony was organised by the Cluster. For its 3rd edition, the Cluster's FT2M (Fast Track To Market) initiative rewarded the most innovative projects in the renewable energy sector;
- lastly, highlighting Masen's increasing international reach, several agreements were signed with countries

from Africa, Europe and even Latin America. Masen also signed a roadmap with Germany, Portugal, Spain and France, in the presence of the European Commission, for the trade in clean electricity between Morocco and Europe. Masen was appointed Secretary for the Steering Committee for the project (SET Roadmap). Based on the results of this roadmap, the parties involved will pave the way for an implementation agreement, to be signed at the COP23.

Furthermore, a broad partnership between Masen and CORFO, the Chilean Economic Development Agency, was also signed. This partnership will enable Morocco and Chile to strengthen their links to achieve their renewable energy goals, through the exchange of expertise and know-how in R&D, industrial activities and even the development of renewable energy projects.

Lastly, with regard to Africa, Masen has signed a partnership agreement with ANER, Senegal's National Renewable Energies Agency. This agreement provides for an exchange of experience to strengthen capacity and for the creation of a renewable energies cluster in Senegal. Masen has also signed an overarching partnership with Djibouti to develop renewable energies with Djibouti's Ministry of Energy.





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