

MASEN PRESENTATION



Nov 10th 2023



masen
endless power for progress

A ROYAL VISION AND A STRUCTURING ENERGY STRATEGY

UNDER THE LEADERSHIP OF HIS MAJESTY THE KING MAY GOD ASSIST HIM, THE KINGDOM OF MOROCCO LAUNCHED IN 2009 A NATIONAL ENERGY STRATEGY AIMED AT:

1 ENSURING THE COUNTRY'S ENERGY SECURITY

2 SECURING ENERGY SUPPLY

3 DIVERSIFYING NATIONAL ENERGY SOURCES THROUGH THE USE OF ALTERNATIVE AND RENEWABLE ENERGIES

4 PRESERVING THE ENVIRONMENT

5 STRENGTHENING THE KINGDOM'S ENERGY PRODUCTION CAPACITY AND LEADING THE WAY PROMISING INVESTMENTS IN ENERGY SUPPLY

THIS NEW ENERGY STRATEGY IS REINFORCED BY THE OFFICIAL LAUNCH BY HIS MAJESTY KING MOHAMMED VI OF THE MOROCCAN SOLAR PLAN, NOVEMBER 2, 2009 IN OUARZAZATE, AND THE MOROCCAN INTEGRATED WIND ENERGY PROGRAM ON JUNE 28, 2010 IN TANGIER.



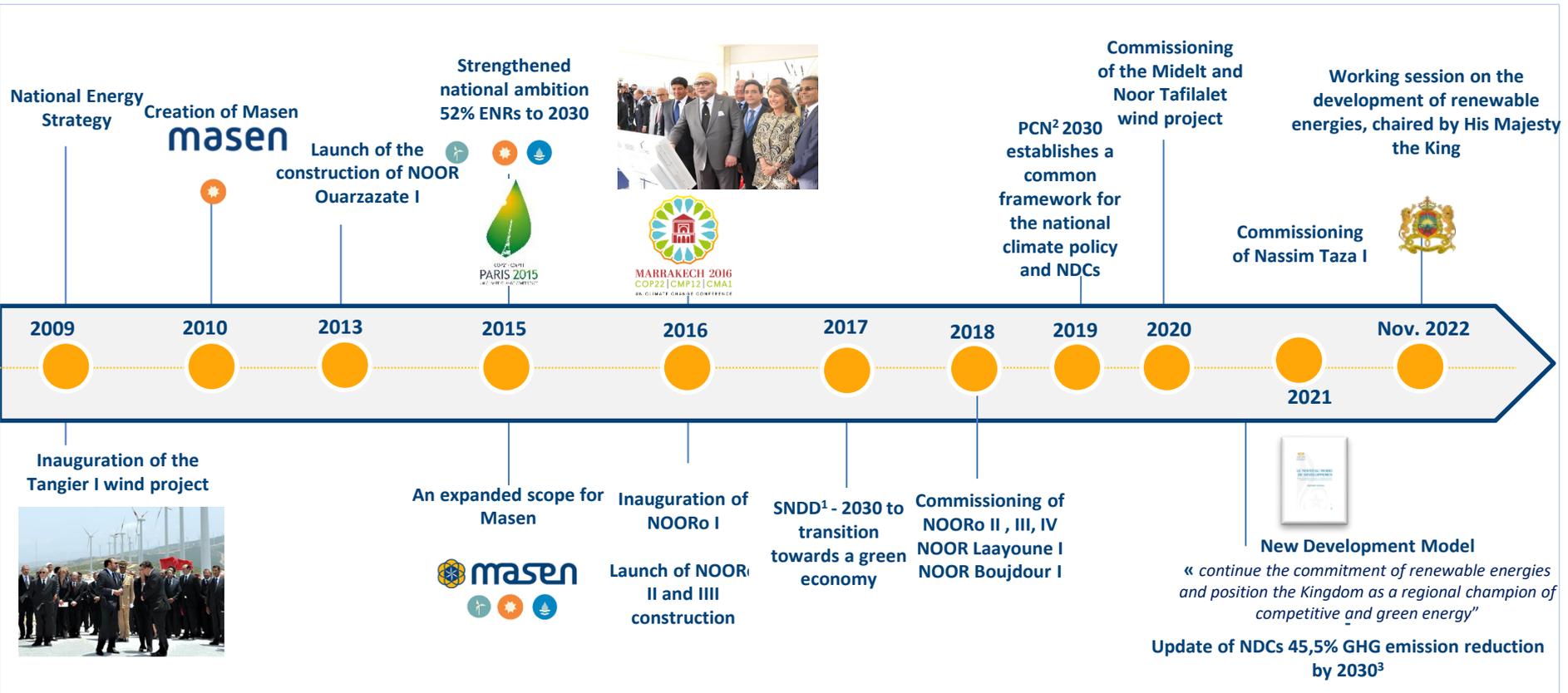
INAUGURATION BY HM KING MOHAMMED VI OF THE FIRST WIND FARM IN TANGIER AS PART OF THE INTEGRATED WIND PROGRAM



INAUGURATION BY HM KING MOHAMMED VI OF THE NOOR OUARZAZATE I SOLAR POWER PLANT AS PART OF THE MOROCCAN SOLAR PLAN

SUPPORT THE KINGDOM'S TRANSITION TO SUSTAINABLE AND INCLUSIVE GROWTH

AMBITIOUS RENEWABLE ENERGY TARGETS HAVE BEEN SET TO ENSURE THE COUNTRY'S ENERGY SECURITY, DIVERSIFY NATIONAL ENERGY SOURCES AND PRESERVE THE ENVIRONMENT



(*1) National Sustainable Development Strategy - Currently under actualization by the Ministry of Energy Transition and Sustainable Development

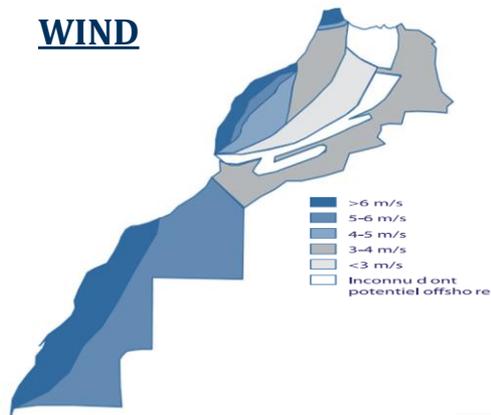
(*2) National Climate Plan

(*3) 45.5% of which 18.3% unconditional

MOROCCO – A COUNTRY WITH AN IMPORTANT POTENTIAL IN RENEWABLE ENERGY TO MEET NATIONAL OBJECTIVES

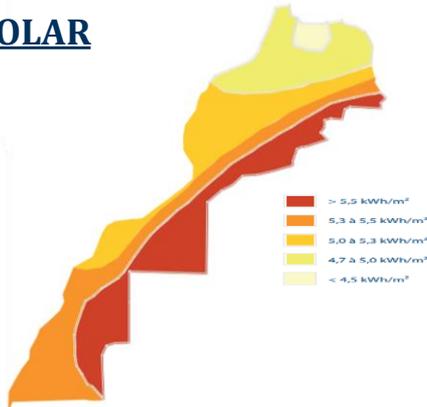
RENEWABLE POTENTIAL IN MOROCCO

WIND



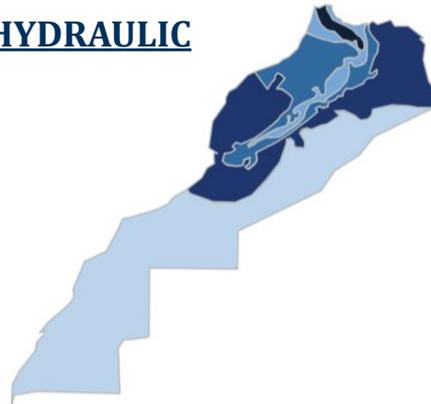
HUGE POTENTIAL

SOLAR

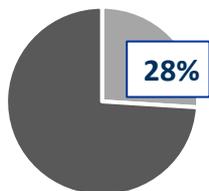


2500 kWh/m²/PER YEAR OF RADIATION

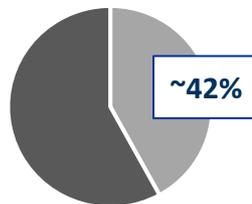
HYDRAULIC



POTENTIAL OF 3,800 MW



2008



2023



2030

An additional target of 6 GW by 2030 to be developed by MASEN

ENGAGED ACTORS TO ACHIEVE NATIONAL ENERGY TARGETS

Private actors

Law 13-09/40-19

المكتب الوطني للكهرباء و الماء الصالح للشرب
Office National de l'Electricité et de l'Eau Potable



Law 57-09/ Law37-16



+ 6000 MW in 2030

MORE THAN 4600 MW OF RENEWABLE ENERGY PROJECTS IN OPERATION

Map of RE projects in operation

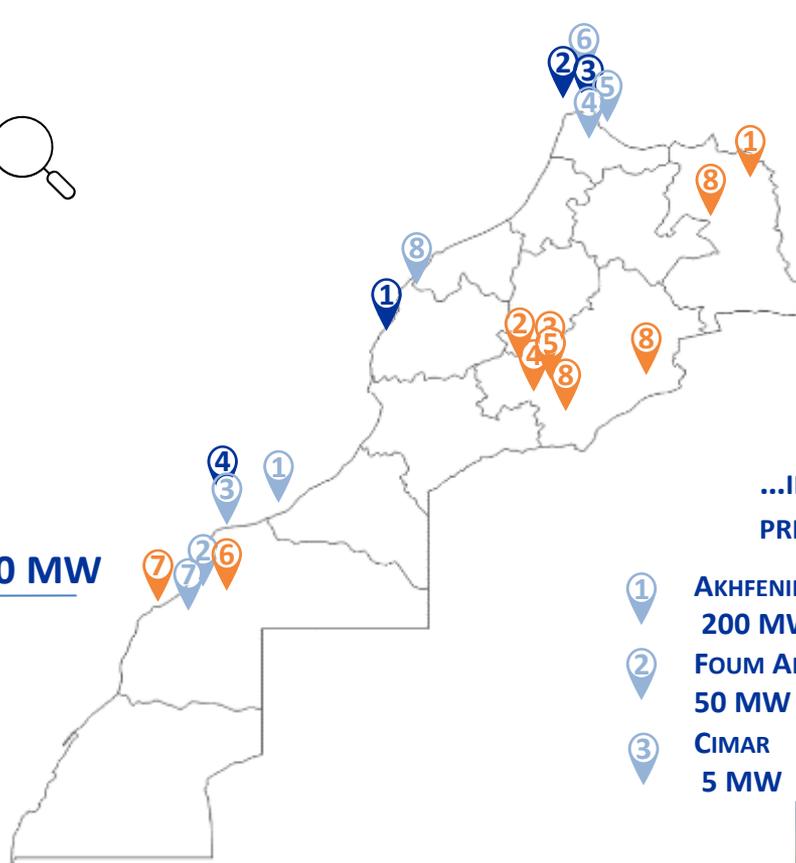
SOLAR PROJECTS – 827 MW

- 1 AIN BENI MATHAR – 20 MW
- 2 NOOR OUARZAZATE I – 160 MW
- 3 NOOR OUARZAZATE II – 200 MW
- 4 NOOR OUARZAZATE III – 150 MW
- 5 NOOR OUARZAZATE IV – 72 MW
- 6 NOOR LAAYOUNE I – 85 MW
- 7 NOOR BOUJDOUR I – 20 MW
- 8 NOOR TAFILALET (ZAGORA, ERFLOUD, MISSOUR) – 120 MW



HYDROELECTRIC PROJECTS – 1 770 MW

+ 20+ HYDROELECTRIC PLANTS ACROSS THE KINGDOM



WIND PROJECTS – 2010 MW

- 1 NASSIM AMOUGDOUL – 60 MW
- 2 NASSIM TANGER I – 140 MW
- 3 NASSIM KOUDIA AL BAIDA – 50 MW
- 4 NASSIM TARFAYA – 300 MW
- 5 NASSIM MIDELT – 180 MW
- 6 NASSIM TAZA I – 87 MW
- 6 NASSIM BOUJDOUR – 300 MW

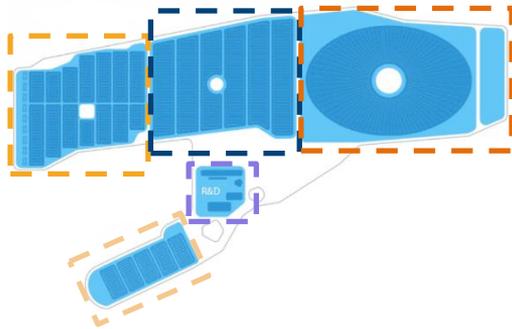
...INCLUDING 893 MW DEVELOPED BY THE PRIVATE SECTOR (LAW 13-09)

- | | | |
|----------------------------|---------------------------|----------------------------|
| 1 AKHFENIR 1 & 2
200 MW | 4 HAOUIMA
50 MW | 7 AFTISSAT 1 & 2
400 MW |
| 2 FOUM AL OUED
50 MW | 5 LAFARGE
32 MW | 8 OUALIDIA
36 MW |
| 3 CIMAR
5 MW | 6 JBAL KHALLADI
120 MW | |



FOCUS ON NOOR OUARZAZATE: A MULTITECHNOLOGICAL SOLAR COMPLEX OF 580 MW ON 3000 HA

1 SOLAR COMPLEX COMPOSED OF 4 POWER PLANTS WITH DIFFERENT TECHNOLOGIES



- == NOOR OUARZAZATE I (CSP)
- == NOOR OUARZAZATE II (CSP)
- == NOOR OUARZAZATE III (CSP À TOUR)
- == NOOR OUARZAZATE IV (PV)
- == PLATEFORME R&D

- TOTAL CAPACITY

580 MW

- RESEARCH AND DEVELOPMENT

AN R&D PLATFORM OF MORE THAN **200 HA**

- TOTAL AREA

3000 Ha, the equivalent of **3437** football fields

- SUSTAINABLE DEVELOPMENT OF TERRITORIES

142 actions/projects* MADE FOR THE BENEFIT OF THE POPULATIONS SURROUNDING THE COMPLEX.

- COMMON INFRASTRUCTURES

WORK CARRIED OUT TO ACCOMMODATE THE COMPLEX:

- ROADS AND FENCES
- WATER SUPPLY SYSTEM
- DRAINAGE OF RAINWATER
- EROSION PROTECTION
- ELECTRICITY AND TELECOMS
- BUILDINGS AND LANDSCAPING



* At the end of 2019

NOOR OUARZAZATE: A MULTITECHNOLOGICAL SOLAR COMPLEX OF 580 MW ON 3000 HA (2/2)



A 580 MW SOLAR COMPLEX COMBINING DIFFERENT SOLAR TECHNOLOGIES

Noor Ouarzazate I



PLANT IN OPERATION

- *Technology : CSP trough*
- *Capacity : 160 MW*
- *Storage: 3 hours*
- *Tariff : 1,62 MAD/kWh*
- *CO2 emissions avoided: ~ 280 000 tCO2 / an*
- *Industrial integration: Target: 30% Achieved: 34.5%*

Noor Ouarzazate II



PLANT IN OPERATION

- *Technology : CSP trough*
- *Capacity : 200 MW*
- *Storage : > 7 hours*
- *Tariff : 1,36 MAD/kWh*
- *CO2 emissions avoided: ~ 380 000 tCO2 / an*
- *Industrial integration: Objective: 35% Achieved: 40.5%*

Noor Ouarzazate III



PLAN IN OPERATION

- *Technology : CSP Tower*
- *Capacity : 150 MW*
- *Storage : > 7 hours*
- *Tariff : 1,42 MAD/kWh*
- *CO2 emissions avoided: ~ 250 000 tCO2 / an*
- *Industrial integration: Objective: 35% Achieved: 42%*

Noor Ouarzazate IV



PLANT IN OPERATION

- *Technology : PV with tracking system*
- *Capacity : 72 MW*
- *Tariff : 0,46 MAD/kWh*
- *CO2 emissions avoided: ~ 87 000 tCO2 / an*
- *Industrial integration: Objective: 11.7% Achieved: 23.1%*



AN INNOVATIVE STRUCTURING SCHEME FOR THE INITIAL PROJECTS TO OPTIMIZE RISK ALLOCATION

AN INNOVATIVE SCHEME AIMED AT LAUNCHING THE DYNAMICS OF RENEWABLE ENERGIES IN MOROCCO AND WHICH IS NOW EVOLVING TOWARDS DIVERSIFIED FINANCING OPTIONS.

5 ROLES, A PLUG AND PLAY APPROACH



DIVERSIFIED FINANCING



Concessional financing for the first projects



Issuance of the first green bond in Morocco and Africa

Subscribers:



Commercial financing for the current projects under development



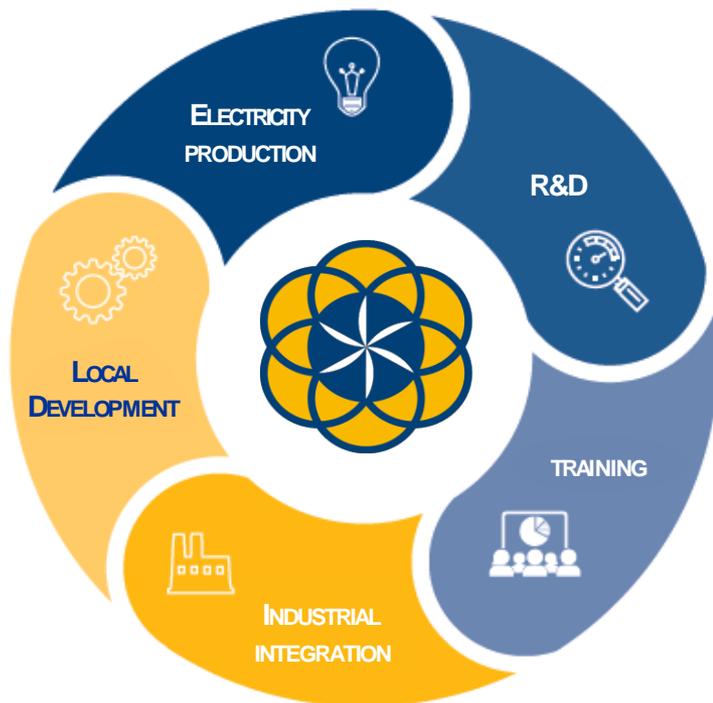
IN JULY 2021 MASEN JOINED THE +80 ENTITIES ACCREDITED BY THE GCF.

A COMBINATION OF PUBLIC AND PRIVATE ACTIONS TO OPTIMIZE RISK ALLOCATION RESULTING IN A SIGNIFICANT REDUCTION IN THE kWh TARIFF



MASEN: CONTRIBUTION TO THE DEVELOPMENT OF AN INTEGRATED REN ECOSYSTEM

A UNIQUE MODEL RELYING ON AN INTEGRATED VISION OF REN PROJECTS DEVELOPMENT



SEVERAL ACTIONS FOR AN INTEGRATED DEVELOPMENT

Solar Cluster

- 80 members and 300 companies connected
- Several projects incubated and financed

CLUSTER SOLAIRE



R&D

- Several partnerships
- European projects of R&D collaboration
- 1 demonstrator in operation, 1 demonstrator in construction and many others under study



HORIZON 2020

Sumitomo



Local development

- 6 sectors of intervention and 4 territories
- More than 220 actions led since 2010
- More than 100 000 beneficiaries

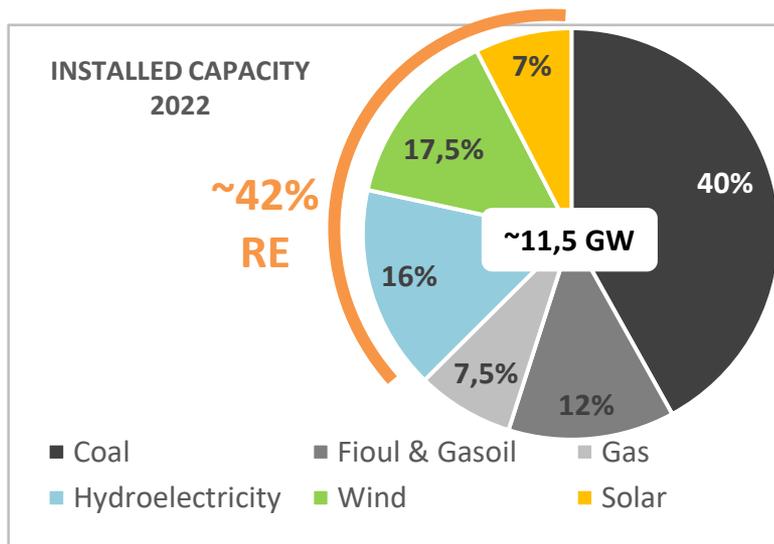


...for the development of an integrated RENecosystem



MORE THAN 4,600 MW OF RENEWABLE ENERGY PROJECTS OPERATIONAL AND MORE THAN 4,000 MW UNDER DEVELOPMENT/CONSTRUCTION

MORE THAN 4,600 MW OF RENEWABLE ENERGY PROJECTS OPERATIONAL



MORE THAN 4,000 MW IN DEVELOPMENT AND CONSTRUCTION PHASES BY MASEN *2,3



MORE THAN 2,625 MW SOLAR(*3)

MIDELT I, MIDELT II, MIDELT III, ATLAS, LAAYOUNE II, BOUJDOUR II, BEJAD, TAROUDANT, EL KALAA,,GUERCIF, OUALIDIA ,SETTAT, GUELMIM



1,703 MW WIND

BOUJDOUR, JBEL LAHDID, TISKRAD, REPOWERING KOUDIA AL BAIDA, EXTENSION KOUDIA AL BAIDA, OUNARA, NOUINOUCHE, TAZA II, REPOWERING AMOUGDOUL, TARYFAA EXTENSION, MIDELT EXTENSION, AND OTHER SITES UNDER DEFINITION.

REMINDER OF THE IMPORTANCE OF THE DEVELOPMENT OF RENEWABLE ENERGIES TO ACHIEVE THE OBJECTIVES SET DURING THE WORKING SESSIONS OF 22/11/2022 CHAIRED BY HIS MAJESTY KING MOHAMMED VI :

*"Building on its progress, Morocco should **accelerate the deployment of renewable energy** in order to strengthen its energy sovereignty, reduce energy costs and **position itself in the low-carbon economy in the coming decades.**"*

*"This includes activating the **implementation of projects under development**, as well as **enhancing Morocco's competitive advantage** to attract more domestic and foreign investment in the sector. In this regard, His Majesty the King has asked **to accelerate the realization of the three Noor Midelt solar energy projects.**"*

MASEN, AS A CENTRAL PLAYER IN THE DEVELOPMENT OF RENEWABLE ENERGIES, IS FULLY COMMITTED AND MAKES EVERY EFFORT TO ACHIEVE THESE OBJECTIVES

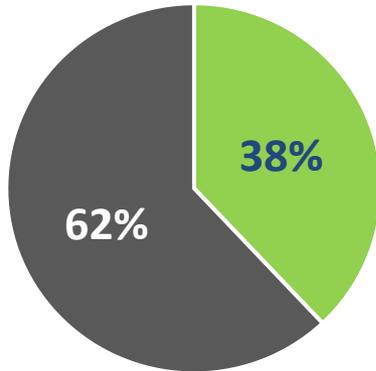
(*2) Excluding private (Noor PV II) and ONEE (pumped hydro)

(*3) Excluding Noor Midelt III capacity under definition

ELECTRICITY MIX: CAPACITY & ENERGY

2022

2028

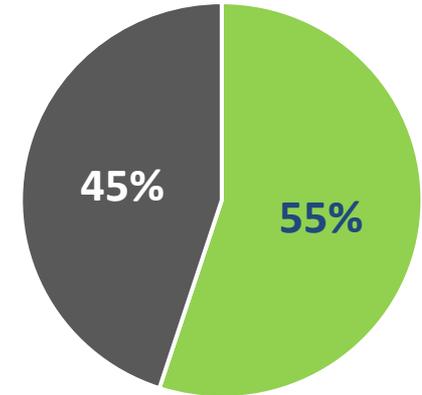


10 968 MW

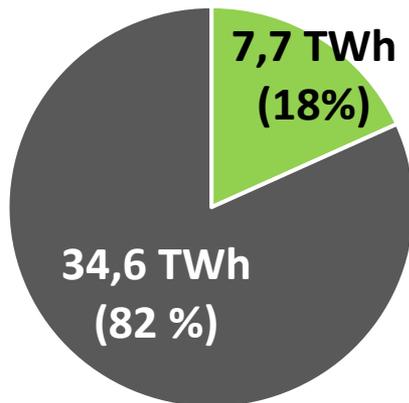
CAPACITY (MW)

Additional REN Capacity
~ 6 473 MW

TOTAL Additional
Investment
~ 7 BILLION USD



19 415 MW



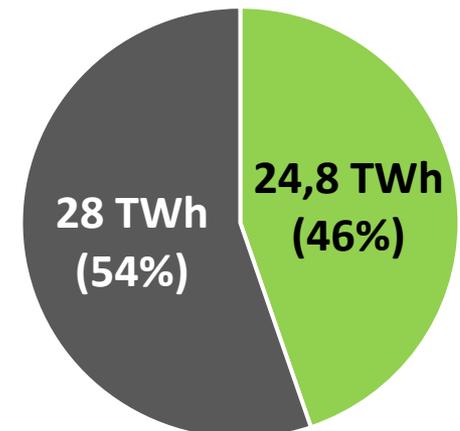
42,3 TWh

ENERGY (MWh)

Additional REN Energy
~ 15,6 TWh

Légende:

RE Others



52,6 TWh

MOROCCO'S ATTRACTIVE POSITIONING IN THE GREEN HYDROGEN ECONOMY

A PRIVILEGED POSITIONING OF MOROCCO IN THE GLOBAL HYDROGEN ECOSYSTEM AND REINFORCED BY:

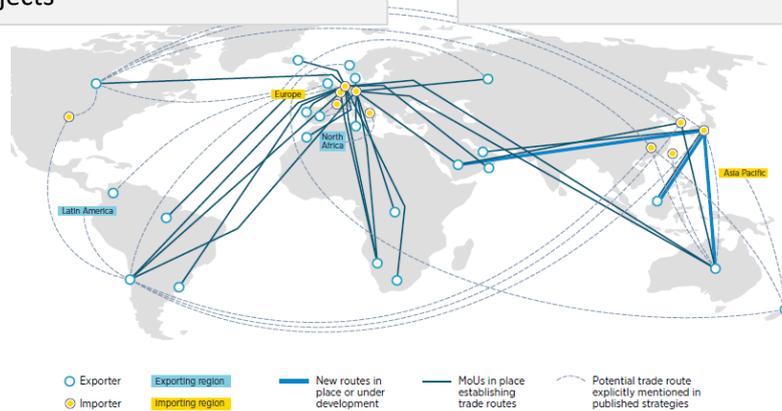
1. A PRIVILEGED GEOSTRATEGIC POSITIONING WITH MANY ADVANTAGES

- Proximity to Europe main GH2 import region
- Gas and port infrastructure connected to the Atlantic and the Mediterranean
- Significant renewable energy potential, particularly solar and wind energy
- A large renewable energy pipeline and expertise developed in the development of large scale renewable projects

2. A STRONG AMBITION OF THE KINGDOM FOR THE GREEN HYDROGEN MARKET

- A "Morocco Offer" under development: Masen's contribution to the development work alongside stakeholders
- A growing interest from national and international actors and an ecosystem that is being set up (Cluster)
- Development of first pilot and reference projects on an industrial scale

"MOROCCO HAS BEEN IDENTIFIED BY IRENA AS THE 3RD MOST COMPETITIVE DESTINATION FOR GREEN HYDROGEN BY 2050 AFTER CHINA AND CHILE"



"MOROCCO COULD CAPTURE BETWEEN 4% AND 8% OF GLOBAL DEMAND FOR GREEN HYDROGEN BY 2050"

3. A FIRST ASSESSMENT OF MOROCCO'S POTENTIAL IN GREEN HYDROGEN

Through the National Green Hydrogen Roadmap in 2021:

- Export opportunities and the existence of a local market
- At least 114,7 TWh of green hydrogen demand for the export market by 2050;
- At least 39,2 TWh of green hydrogen demand for the domestic market by 2050

4. AN AMBITION DISPLAYED BY THE EU TO COLLABORATE WITH ITS NEIGHBOURS IN ITS ENERGY TRANSITION

- Objective to achieve carbon neutrality in the EU by 2050;
- Target to install 2x40 GW of electrolysers in the EU and the neighborhood;
- REPower EU program to reduce dependence on Russian fuels, including the import of 10 Mt of green hydrogen
- Incentive program for the development of green hydrogen

A SIGNIFICANT POTENTIAL FOR PRODUCTION AND EXPORT OF GREEN MOLECULES BY MOROCCO

>> .. Morocco's first international initiatives and collaborations <<



Morocco-Germany Partnership Agreement

10 June 2020 in Berlin
Cooperation Agreement on Green Hydrogen (PtX)

This framework agreement will enable Morocco to:

- Develop a first reference project on an industrial scale, by MASEN,
- and the establishment of a research platform on Power to X, knowledge transfer and capacity building by IRESEN.

>> Feasibility study of a green hydrogen production project in Morocco "Reference project" by Masen <<

KFW



Integrated reference project to produce green hydrogen from dedicated renewable energy plants

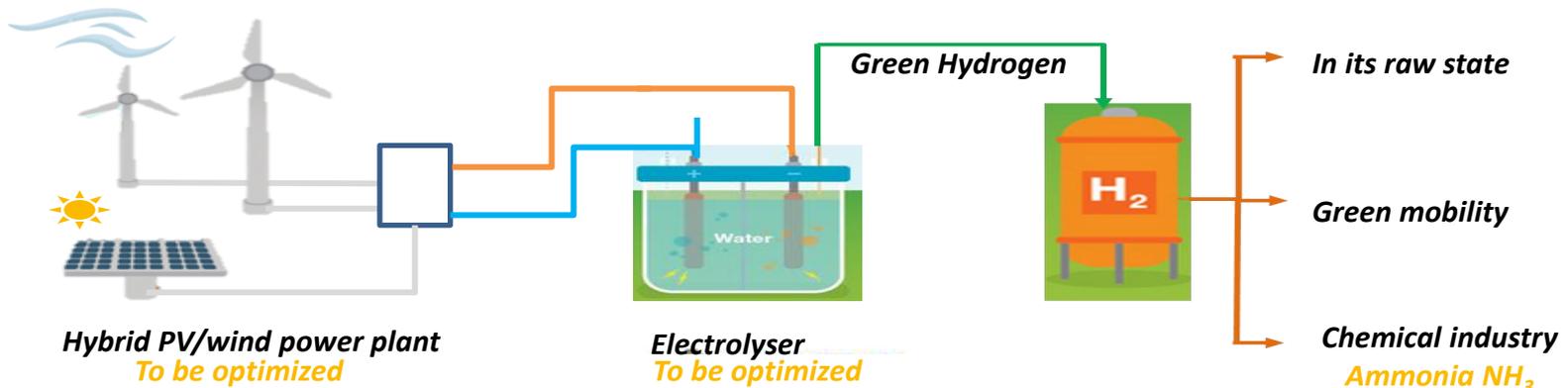
- Development of a reference project including the construction of a dedicated hybrid PV and wind power plant to supply a green hydrogen plant with an electrolysis capacity of about 100 MW.
- Preceded by the completion of feasibility studies and which are being carried out by Masen.

PROJECT DEFINITION

To benefit from the economies of scale in electricity generation → Competitive electricity costs



To produce an amount of hydrogen that can be consumed locally



OPPORTUNITIES FOR OTHER RENEWABLE ENERGY PROJECTS UNDER STUDY

FLOATING SOLAR AND OFFSHORE WIND

FLOATING SOLAR PV PROJECT



- Objective of the study: to improve the environmental impact by mitigating the evaporation of water from.
- Feasibility study carried out for a 1st project of approximately 14 MW in the Hassan II Dam (60,000 m³/y of water evaporation avoided)

OFFSHORE WIND PROJECT

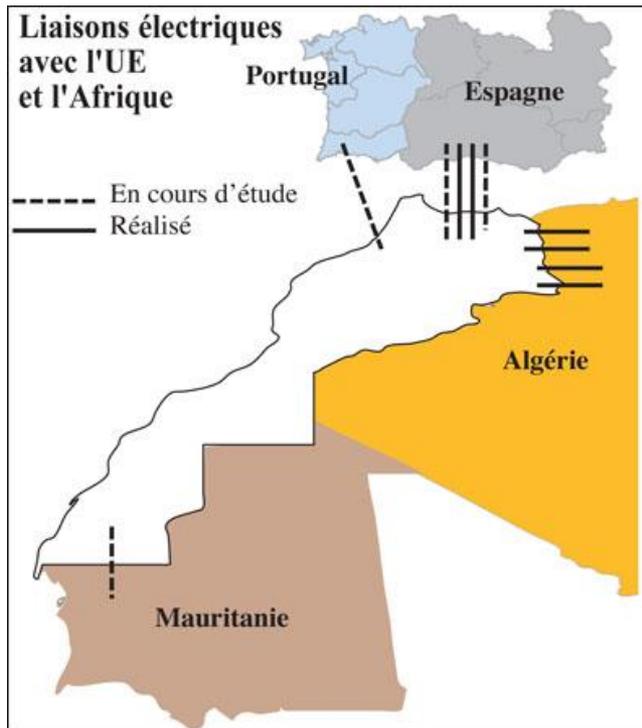


- Technical and economic feasibility study for a 1st offshore wind project

EXISTING AND PLANNED ELECTRICITY INTERCONNECTIONS OF MOROCCO WITH ITS NEIGHBORHOOD

The Kingdom is currently interconnected with Europe via Spain and Algeria, contributing to Morocco's supply-demand balance.

Over the past decade, the trade balance has been driven by the interconnection with Spain, although in 2021 and 2019 the national electricity system met domestic demand on its own, reducing the call for cross-border trade.



Two 400 kV submarine cables connect Morocco and Spain.

700 MW cable

Commissioned in 1997

Second cable of 700 MW

Commissioned in 2006

3rd cable under study

Morocco and Spain have a capacity to exchange 1,400 MW, including 700 MW of backup.

Situation of electricity exchanges* between Morocco and Spain at the end of 2021 and 2022

Morocco-Spain electricity exchanges 2021:

-0,132 TWh

Morocco-Spain electricity exchanges 2022:

1,39 TWh

3% of net energy demand (42.3 TWh)

- Morocco is also interconnected to Algeria (2x400 kV and 2x225 kV) with a trading capacity of 1,400 MW for grid stabilization (zero annual net exchange).
- Feasibility studies have also been launched for a 1,000 MW line between Morocco and Portugal.
- The planned Dakhla-Nouadhibou-Nouakchott 225 kV line would promote Morocco's integration with West Africa.

AN EXCHANGE OPPORTUNITY WITH EUROPE THROUGH THE IMPLEMENTATION OF A SUSTAINABLE ELECTRICITY TRADE ROADMAP

SET ROADMAP: SUSTAINABLE ELECTRICITY TRADE BETWEEN MOROCCO AND EUROPE



COUNTRIES:

FIVE SIGNATORY COUNTRIES:



STEERING COMMITTEE

STEERING COMMITTEE SECRETARIAT BY MASEN



PHASE I

PHASE II

PHASE III

Project scope and synthesis of previous studies

Studies implementation and identification of target markets for the exchange of electricity between the five countries

Roadmap elaboration and preparation of the implementation

PARTNERS INVOLVED IN THE PROJECT



Union for the Mediterranean
Union pour la Méditerranée
الإتحاد من أجل المتوسط



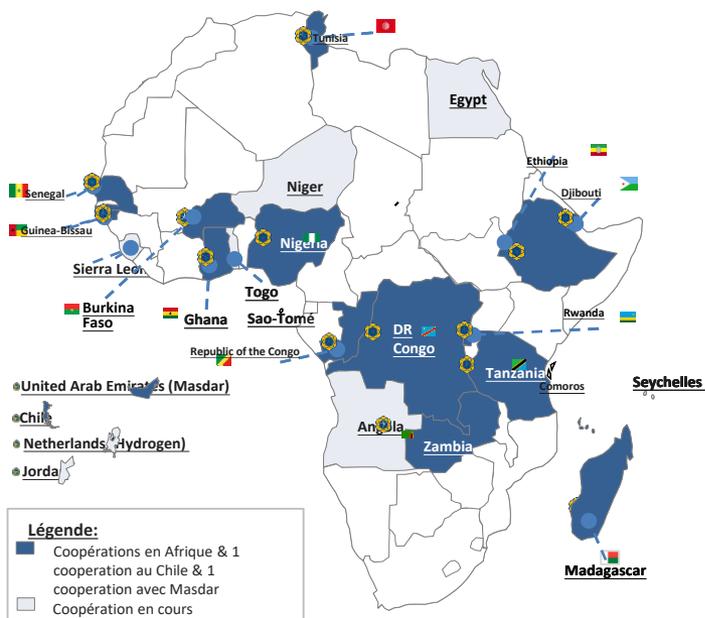
THE WORLD BANK
IBRD • IDA

Electricity transmission
System Operators
TSOs

SEVERAL ACTIONS TOWARDS THE AFRICAN CONTINENT

THE DEVELOPMENT OF ACCESS TO ELECTRICITY AND RENEWABLE ENERGIES ON THE AFRICAN CONTINENT OPENS IMPORTANT OPPORTUNITIES FOR SOUTH-SOUTH AND SOUTH-NORTH COOPERATION AND DEVELOPMENT.

BILATERAL COOPERATION



MULTILATERAL COOPERATION

ENERGY ACCESS COALITION

CLIMATE ACTION SUMMIT 2019 A RACE WE CAN WIN



DESERT TO POWER INITIATIVE

CHAIR

OWNER



MASEN-ISDB COOPERATION



