

MASEN and Green Hydrogen
Green Climate Fund
GPC 2022



September 2022



1 – Masen
presentation

1. Getting to know MASEN

2 – Green
Hydrogen
projects

2. Green Hydrogen at MASEN

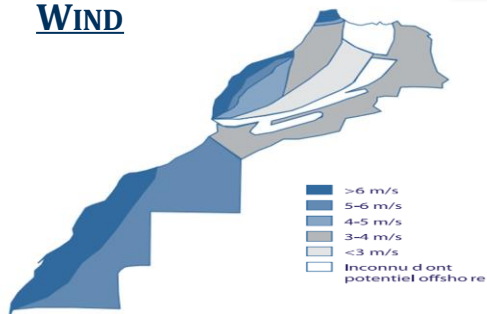
3 – Scaling-up
challenges

3. Scaling-up challenges

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

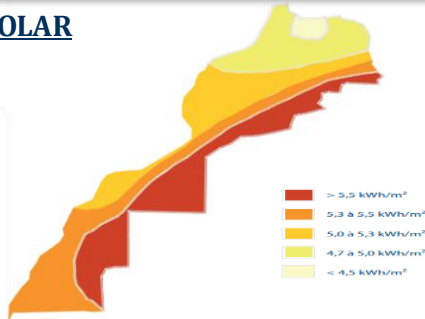
RENEWABLE ENERGY POTENTIAL IN MOROCCO

WIND



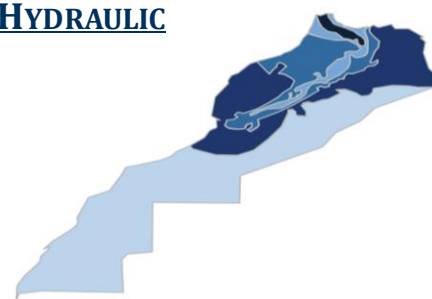
AN ESTIMATED WIND POWER POTENTIAL OF
25,000 MW

SOLAR

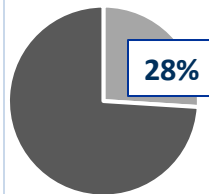


5kWh/M²/YEAR OF
IRRADIATION

HYDRAULIC



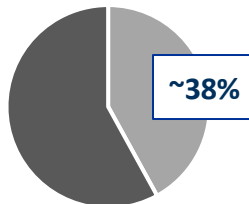
A HYDRAULIC POTENTIAL OF
3,800 MW (NORTH)



2008



2017



2021



2030

A TARGET OF an
additional
6 GW BY 2030
To be developed
by **MASEN**

ENGAGED ACTORS TO ACHIEVE NATIONAL ENERGY TARGETS

PRIVATE ACTORS

Law 13-09

*Key partner to develop **REN** projects*

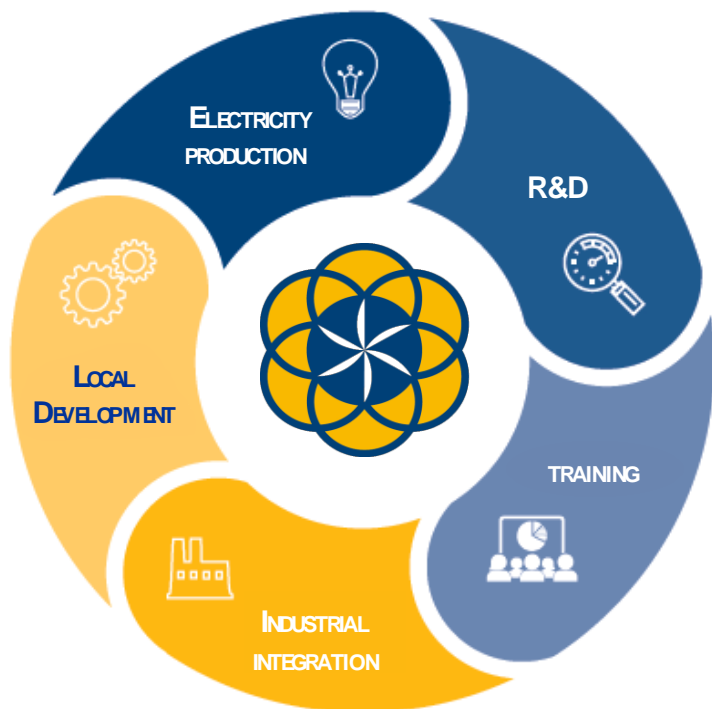
المكتب الوطني للكهرباء و الماء الصالح للشرب
Office National de l'Electricité et de l'Eau Potable



Law 57-09 / Law 37-16

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

- 5 sectors of intervention and 4 territories
- More than 150 actions led since 2010
- More than 77 000 beneficiaries



...for the development of an integrated RENecosystem



4000 MW OF REN PROJECTS IN OPERATION AND 3 600 MW IN DEVELOPMENT

SOLAR PROJECTS – 827 MW

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

HYDRO POWER PLANTS – 1 770 MW

+ DE 20 HYDROPLANTS ACROSS THE
COUNTRY

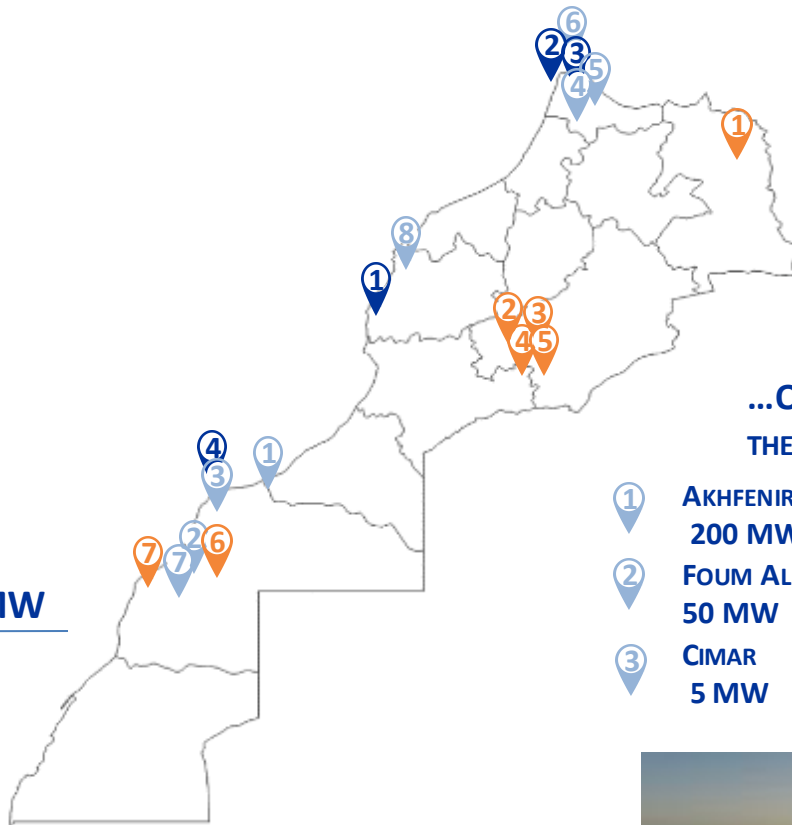


WIND PROJECTS – 1 425 MW

- ① AMOUGDOUL – 60 MW
- ② TANGER I – 140 MW
- ③ TORRES / KOUDIA AL BAIDA – 50 MW
- ④ TARFAYA – 300 MW
- ⑤ PEI 850 MIDELT – 180 MW

...OF WHICH 695 MW DEVELOPPED BY
THE PRIVATE SECTOR (LAW 13-09)

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



FUTURE REN PROJECTS : OTHER PROJECTS PLANNED



SOLAR PROJECTS



827 MW OF SOLAR PROJECTS IN OPERATION



WIND PROJECTS



1 425 MW OF WIND PROJECTS IN OPERATION



HYDRO PROJECTS



1 770 MW OF HYDRO PROJECTS IN OPERATION
MORE THAN 29 DAMS IN OPERATION AND 1 STEP

SOLAR PROJECTS (~2 500 MW)



NOOR MIDELT I
800 MW



NOOR MIDELT II
400 À 800 MW



NOOR PV II
710 MW (HORS 13-09)



NOOR ATLAS
200 MW

WIND PROJECTS (1120 MW)



PROGRAMME EOLIEN INTÉGRÉ
(JBEL HDID 270 MW; TISKRAD 100
MW, BOUJDOUR 300 MW)
670 MW



PROJET EOLIEN INTÉGRÉ – TAZA I ET II
150 MW



KOUDIA AL BAIDA REPOWERING
100 MW
EXTENSION 150 À 200 MW



AFTISSAT II
200 MW

HYDRO-POWER PROJECTS (350 MW)

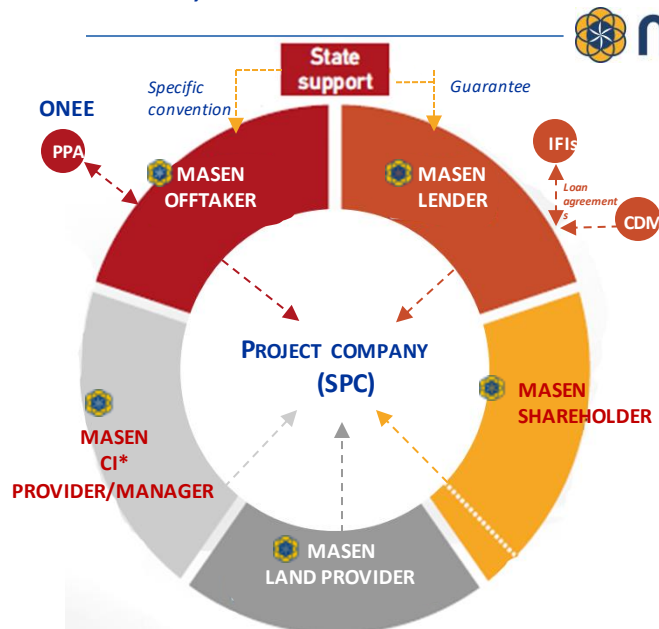
DETAILED PROGRAMING ONGOING
TO TAKE INTO ACCOUNT THE
POSSIBLE SYNERGIES BETWEEN
REN TECHNOLOGIES



+ 6000 MW en 2030

MASEN: AN INNOVATIVE SCHEME TO OPTIMIZE RISK ALLOCATION

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 WHICH RESULTS IN
A SIGNIFICANT REDUCTION IN THE kWh TARIF.**

REN APPLICATIONS FOR A DECARBONIZED ECONOMY

A VALORIZATION OF RENEWABLE ENERGIES THROUGH THE DEVELOPMENT OF APPLICATIONS TO MEET VARIOUS NEEDS

WATER TREATMENT



PRODUCTION OF HEAT AND COOLING



OFF-GRID ELECTRICITY



GREEN HYDROGEN



ELECTRIC MOBILITY

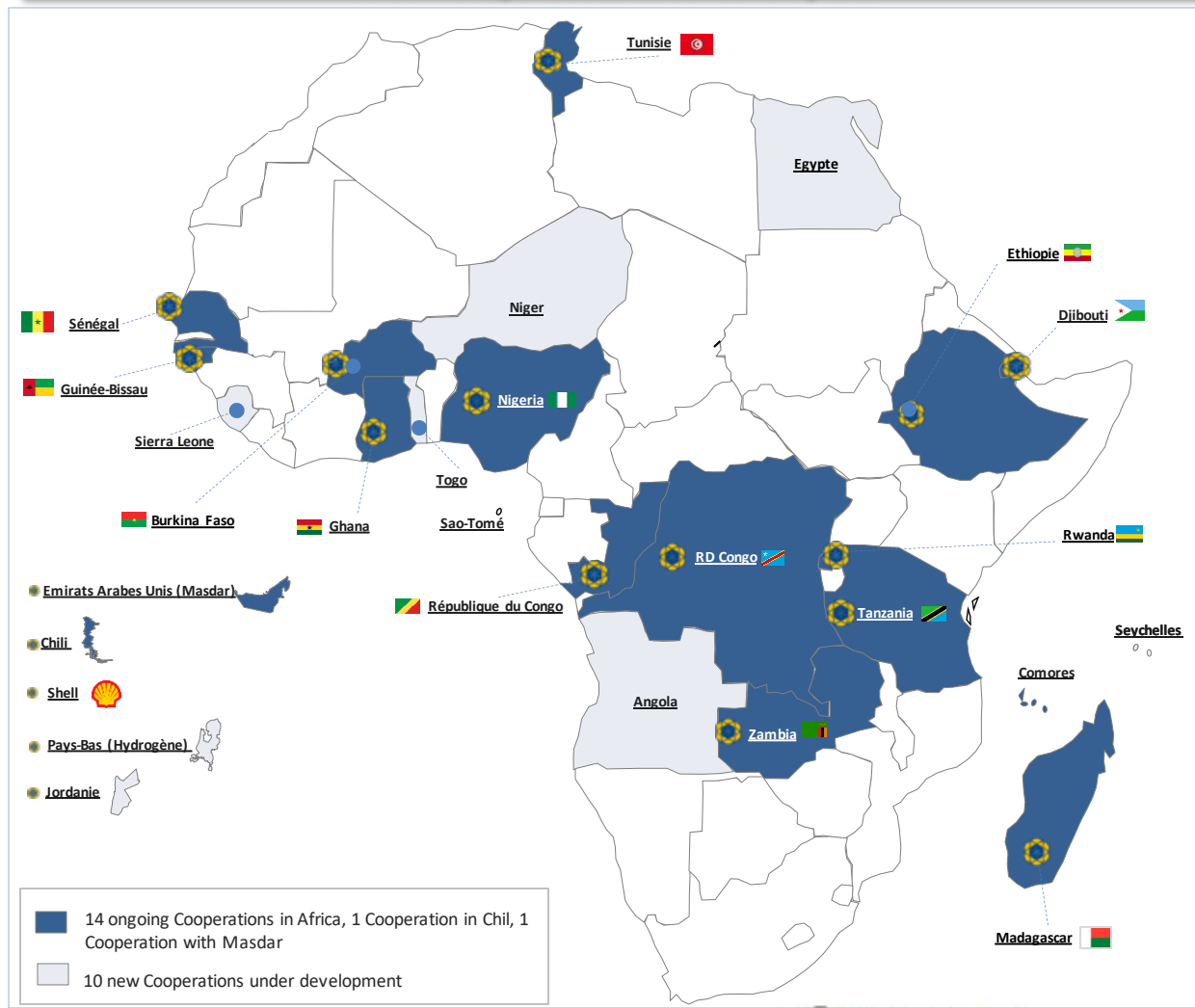


WASTE TO ENERGY



ACTIONS INITIATED BY MASEN IN SEVERAL SUBSAHARIAN COUNTRIES

14 ongoing Cooperations in Africa, 1 Cooperation in Chil, 1 Cooperation with Masdar and
10 new Cooperations under development



Areas of Cooperation

Know-how exchange

Capacity reinforcement

Technical assistance

Co-Development

REFERENCE PROJECT

- Produce, convert and commercialize locally &/or export Green Hydrogen.
- Grant for the preparatory studies of the reference project : Signature of the contract end of 2020
- Feasibility on-going studies include 3 studies:
 - ✓ Energy storage & other potential applications
 - ✓ FS of the green hydrogen /derived product factory
 - ✓ FS of the Hybrid PV/Wind power plant



LA CIGOGNE PROJECT



masen



Port of
Rotterdam

- MOU signed end 2020
- Produce, convert export and commercialize Green Hydrogen, from Morocco to Rotterdam in the Netherlands, by 2025/2026 and scaling up to industrial scale before 2030.
- Feasibility study to be undertaken



STUDIES AND PARTNERSHIPS TO SEIZE GREEN HYDROGEN OPPORTUNITIES

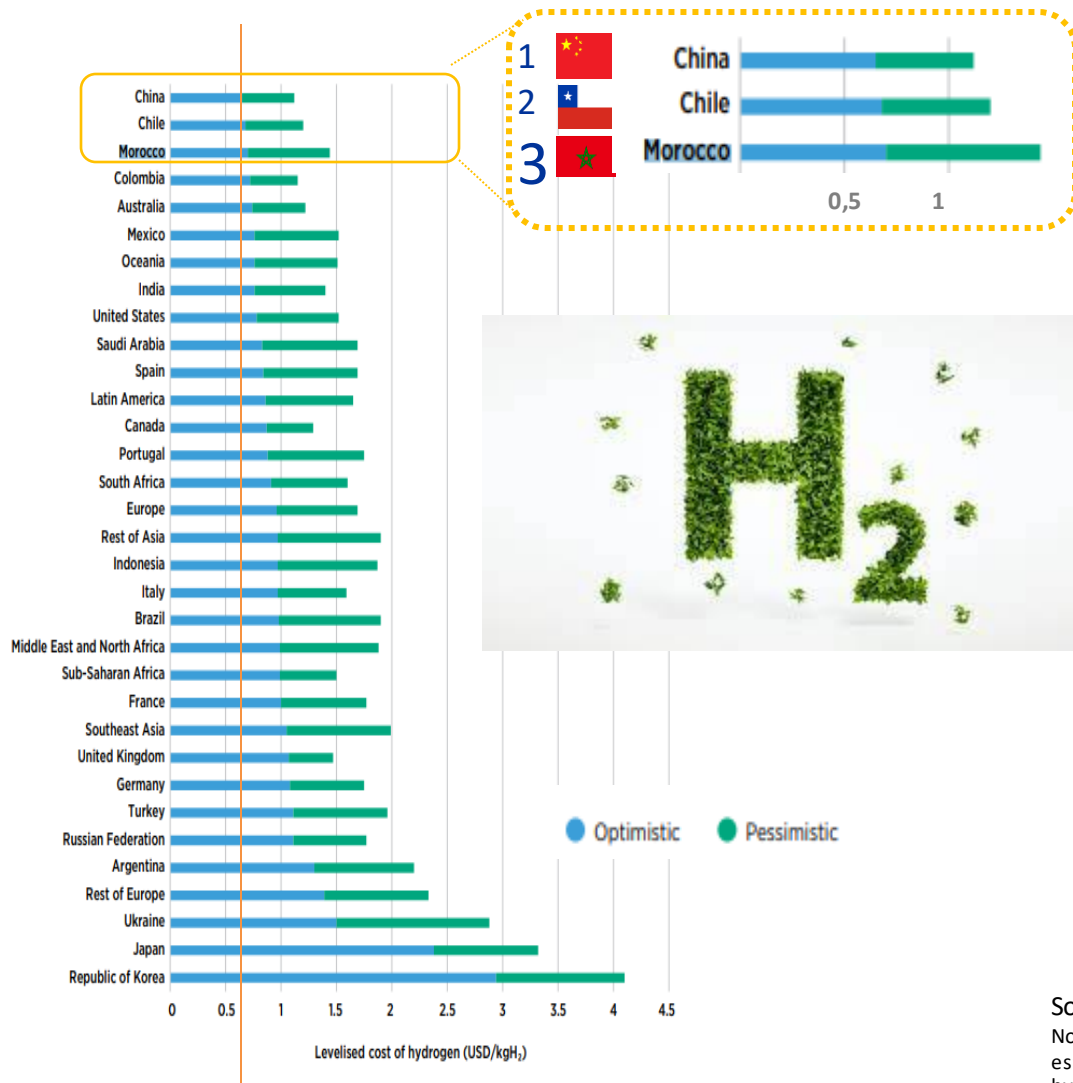
Contexte of the Studies

- The strategy and monitoring entity, in coordination with the Technical department, have carried out analyzes on the green hydrogen market with case studies, and are currently working on the development of an optimization model as well as analysis of green hydrogen investment opportunities in Morocco.

Partneships developement

- Masen signs NDAs with different partners interested investing in green hydrogen in Morocco to explore such opportunities.

MOROCCO'S STRONG POTENTIAL FOR THE PRODUCTION, CONSUMPTION AND EXPORT OF GREEN MOLECULES



LEVELISED COST OF HYDROGEN RANGE IN 2050 DERIVED FROM SUPPLY-DEMAND ANALYSIS (USD/KGH₂)

MOROCCO IDENTIFIED AS ONE OF THE 6 COUNTRIES WITH THE STRONGEST POTENTIAL FOR THE PRODUCTION AND EXPORT OF HYDROGEN AND GREEN DERIVATIVES, GIVEN ITS ASSETS AND POTENTIALITIES BY SEVERAL INTERNATIONAL ENERGY AGENCIES

MOROCCO EXPECTED TO PROVIDE WORLD'S 3RD CHEAPEST GREEN HYDROGEN BY 2050 AFTER CHINA AND CHILE

THE KINGDOM COULD CAPTURE 4% TO 8% OF THE GLOBAL POWER-TO-X MARKET.

Source: IRENA, 2022

Note: LCOH derived from supply-cost curves of individual countries and regions based on their estimated hydrogen demande for 2050. Water availability for electrolysis is considered in the hydrogen supply-cost curves.

HYDROGEN OASIS: THE NEXT STAGE FOR GH2 MARKET PENETRATION AND GROWTH

GH2 MAIN DEPLOYMENT STAGES:



TECHNOLOGY READINESS MARKET RAMP-UP

Maturity of relevant
technologies

National strategies &
policy priorities for GH2

MARKET PENETRATION

Low REN costs

Larger scale Electrolysers'
manufacturing capacities

Enabling regulation
Green certification/ norms
& Standards

GH2 reference projects

GH2 Ecosystems
Valleys/Oasis*

MARKET GROWTH

Established GH2
ecosystems
and supply chains

GH2 traded as a
commodity

Net-zero decarbonized
sectors

*HYDROGEN OASIS: INTEGRATED AND LARGER-SCALE PROJECTS, INCREASINGLY COVERING THE VALUE CHAIN, PREPARING THE TRANSITION TO THE "HYDROGEN ECONOMY"



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