ROYAUME DU MAROC

Ministère de l'Énergie des Mines
et de l'Environnement

IRESEN
Institut de Recherche en Energie
Solaire et en Energies Nouvelles

10 ans
au service de la
recherche et de l'innovation

WORKING-LEVEL DIALOGUE BETWEEN EMERGING AND DEVELOPING ECONOMIES ON COMMERCIALIZING CLEAN ENERGY INNOVATIONS

Presentation by IRESEN

Sarah DIOURI, R&D and Innovation Programs Director

Sept. 30th, 2021

CONTENT

1. IRESEN & the Moroccan cleantech innovation ecosystem
2. Infrastructure & Moroccan priority topics
3. Moroccan success stories
4. Challenges to clean energy technology innovation and investments
5. Q&A

IRESEN & THE MOROCCAN CLEANTECH INNOVATION ECOSYSTEM

Building the value chain from fundamental research, to the market

MOROCCO'S NATIONAL ENERGY STRATEGY

2009, National Energy Strategy : 42% of the total installed power capacity to come from renewable energy in 2020

→ new plants to bring the total capacity to 2000 MW of solar, 2000 MW of wind and 2000 MW of hydro by 2020.

2015, COP21: Morocco announced a further planned increase in the renewables capacity to reach 52% of the total by 2030 (20% solar, 20% wind, 12% hydro)

→ add around 10 GW of RE capacities between 2018 and 2030, consisting of 4560 MW of solar, 4200 MW of wind, and 1330 MW of hydropower capacity.

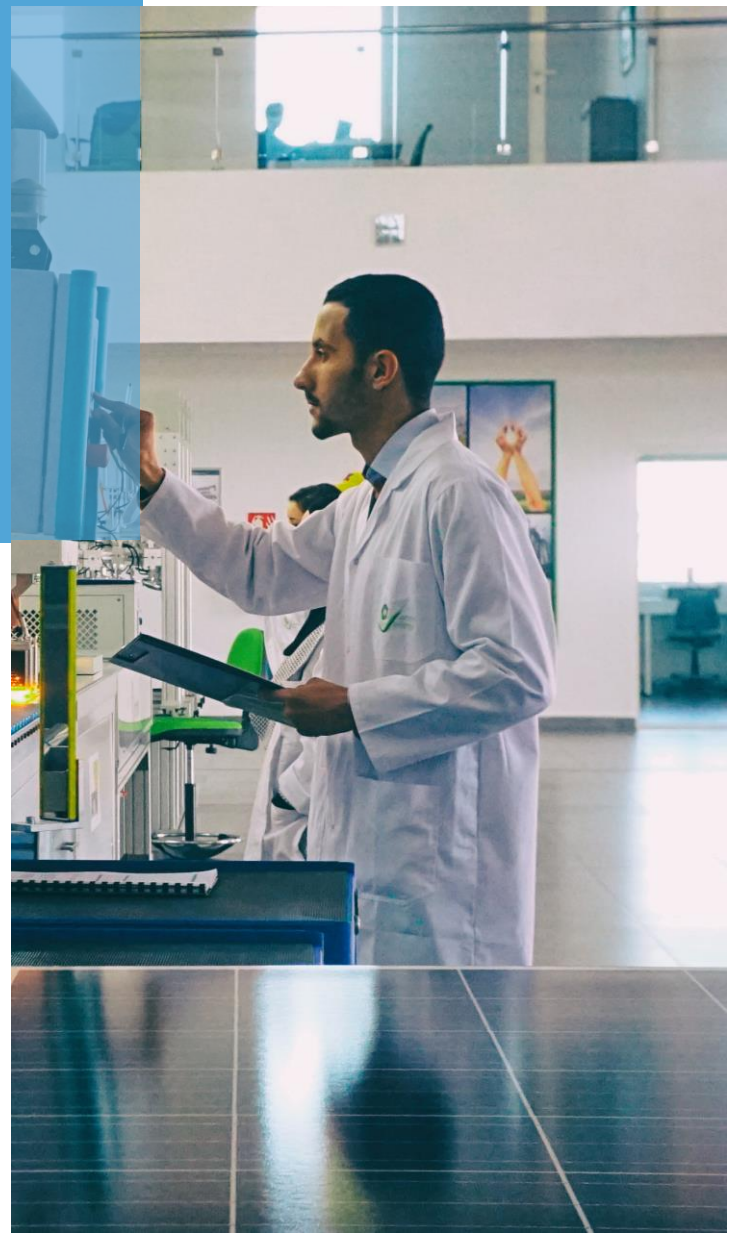
Law 13-09 on renewable energy (2010, last amended 2015):

→ prioritises the development of renewable sources to promote energy security, access to energy, sustainable development, reduction of GHG emissions, reduction of deforestation, and integration of Morocco's renewable energy production with other markets

→ introduces a net metering scheme for solar and wind power plants connected to the high-voltage grid, and in the future also those connected at the middle and low-voltage level.

→ regulates the electricity sector and creates an authorisation/declaration system, depending on the capacity of the facility

→ allows the supply and export of the electricity produced to the local market and/or through the national grid and interconnections with other countries.



ABOUT IRESEN

Research Institute for Solar Energy and New Energies

Created in **2011**
By the Ministry of Energy, Mines and Environment as well as several public and private key stakeholders of the energy sector

Mission: support the Moroccan National Energy Strategy through

1 **FUNDING AGENCY**
Funding of applied research and collaborative innovation projects

2 **INFRASTRUCTURES**
Network of research and innovation platforms in green technologies

FUNDING AGENCY

Through its Funding Agency, IRESEN launches regular calls for projects to identify and finance applied research and innovation projects in the field of green technologies. The supported projects bring together scientific and industrial partners, which allows the creation of synergies and promotes the transfer of technology to industry for better integration of socio-economic factors in scientific research. First certified funding Agency ISO 9001 in Africa, the services provided to project leaders and the management method adopted by IRESEN meet international quality standards.

The Agency provides not only funding but also technological support to the selected projects, with access to expertise and pooled infrastructure, as well as administrative and logistical support, particularly for the acquisition of equipment, support for participations in training courses and scientific conferences, the allocation of scholarships to doctoral students and other services.

FINANCING AND MANAGEMENT OF FUNDS ALLOCATED TO PROJECTS

SCIENTIFIC AND TECHNICAL EXPERTISE

ACCESS TO MUTUALIZED INFRASTRUCTURE

TECHNOLOGICAL SUPPORT

SUPPORT IN BUSINESS DEVELOPMENT

CALL FOR PROJECTS

Through its Funding Agency, IRESEN launches regular calls for projects to identify and finance research and innovation projects in the field of green technologies.

APPLIED RESEARCH	INNOVATION	BILATERAL PARTNERSHIP	MULTILATERAL PARTNERSHIP	MULTILATERAL PARTNERSHIP
Green INNO PROJECT	Green INNO BOOST	INNO ESPAMAROC ENERGY	LEAP-RE Long-Term Joint European Union - African Union Research and Innovation Partnership on Renewable Energy	MI MICall20
Support for market-oriented applied R&D and the development of innovative products, processes or services	Supporting innovation and innovative project leaders who have already developed solutions in the incubation or acceleration phase	Encouragement of bilateral scientific cooperation and transfer of knowledge and know-how, through the joint development of innovative solutions	Strengthen the technical and technological capacities of national actors to produce, exploit and valorize hydrogen	Technology transfer, promotion and support of multilateral R&D&I to unlock the potential of digital transformation for sustainable energy
3 M €	2 M €	8 M €	11 M €	21 M €

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INDICATEURS 2011 - 2020

+250 MMAD

DEDICATED TO CALLS FOR PROJECTS

Through its 17 calls for projects, IRESEN is today the main funder for research and innovation projects in green technologies

+800

SUPPORTED RESEARCHERS

between university professors, doctoral students, engineers and master's & bachelor's degree students

32

REGISTERED PATENTS

Project funding has enabled value creation with more than 32 patents registered

+400

SCIENTIFIC PUBLICATIONS

The number of publications has been multiplied by 15 since the launch of IRESEN'S Calls for Projects

NATIONAL NETWORK OF 15+ GREEN INNOVATION LABORATORIES

+520 MMAD

FUNDRAISING

Through international cooperation and industrial fundraising

22

SUPPORTED UNIVERSITIES

UNIVERSITIES

UNIVERSITIES, IRESEN

IRESEN, UM6P/OCP ECOSYSTEM, ENTREPRISES

MASEN, ENTREPRISES

SIE, ENTREPRISES

Frequently observed types of collaborations

CNRST

IRESEN

UM6P/OCP ECOSYS, AMEE

Funding Agenncies

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2030 VISION

2011 - 2020

IRESEN 1.0

- Applied R&D centers
- Resource agency serving the applied R&D network

2020 - 2025

VALUATION CAP

- Network of applied R&D centers (+++)
- **Valorization center (+)**
- Resource agency serving the applied R&D network (++)
- **Service provider for companies (+)**

2025 - 2030

GROWTH THROUGH INNOVATION

- Network of applied R&D centers of excellence (++)
- **Valorization center (++)**
- Resource agency serving the applied R&D network (+)
- Service provider for companies (+++)

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INFRASTRUCTURE & MOROCCAN PRIORITY TOPICS

The leading network of green technology research and innovation platforms in Africa

in partnership with MOHAMMED VI POLYTECHNIC UNIVERSITY *and the support of* KOICA Korea International Cooperation Agency

INFRASTRUCTURES

The leading network of green technology research and innovation platforms in Africa

IRESEN ensures the development and implementation of a network of research, training and innovation platforms with fully equipped laboratories to pool research infrastructures and to offer multiple opportunities for synergies between the socio-economic world and the scientific world.

At the national or continental level, the establishment of these new research and innovation infrastructures gives the ability to create complementary scientific and technological platforms of excellence in different regions and covering several themes while ensuring the pooling of resources and teams and guaranteeing the adequacy between the need and the demand.

GREEN ENERGY PARK
Solar photovoltaic and solar thermal

GREEN & SMART BUILDING PARK
Green buildings, smart grids and sustainable mobility

GREEN H2A
Production of green molecules with high added value

AGRO-ENERGY-TIC VALLEY
Biomass and energy-agriculture nexus

WATER ENERGY NEXUS
Desalination and water treatment

GEP - MAROC CÔTE D'IVOIRE
Solar energy in tropical environnements

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GREEN ENERGY PARK

in partnership with

MOHAMMED VI POLYTECHNIC UNIVERSITY

and the support of

KOICA
Korea International Cooperation Agency

IRESEN
Institut de Recherche en Energie Solaire et en Energies Nouvelles

GREEN & SMART BUILDING PARK

in partnership with

MOHAMMED VI POLYTECHNIC UNIVERSITY

KOICA
Korea International Cooperation Agency

IRESEN
Institut de Recherche en Energie Solaire et en Energies Nouvelles

GEP MOROCCO-IVORY COAST

in partnership with

MOHAMMED VI POLYTECHNIC UNIVERSITY

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NEW PLATFORM

SUPPORT FOR THE NATIONAL BIOMASS STRATEGY

AGRO-ENERGY-TIC VALLEY

Agro-Energy-TIC Valley is a platform dedicated to research and development in the field of bioenergy, "agritech" and the Water-Food-Energy Nexus.

Located in one of the most important agriculture positions, it will be an essential partner for the deployment of an agricultural and agro-food sector that is even more efficient, sustainable and resilient in the face of the challenges imposed by climate change.

In addition, the **human capital** of this infrastructure will support the "**National Biomass Strategy**" and will support the private sector and local authorities in their **waste management** and **water** treatment efforts.

As the other platforms developed by **IRESEN** and **UM6P**, Agro-Energy-TIC Valley will strengthen the initial and professional training offer of the academic and research ecosystem of the **Euro-Mediterranean University of Fez**.

NEW PLATFORM

SUPPORT FOR THE NATIONAL GREEN HYDROGEN STRATEGY

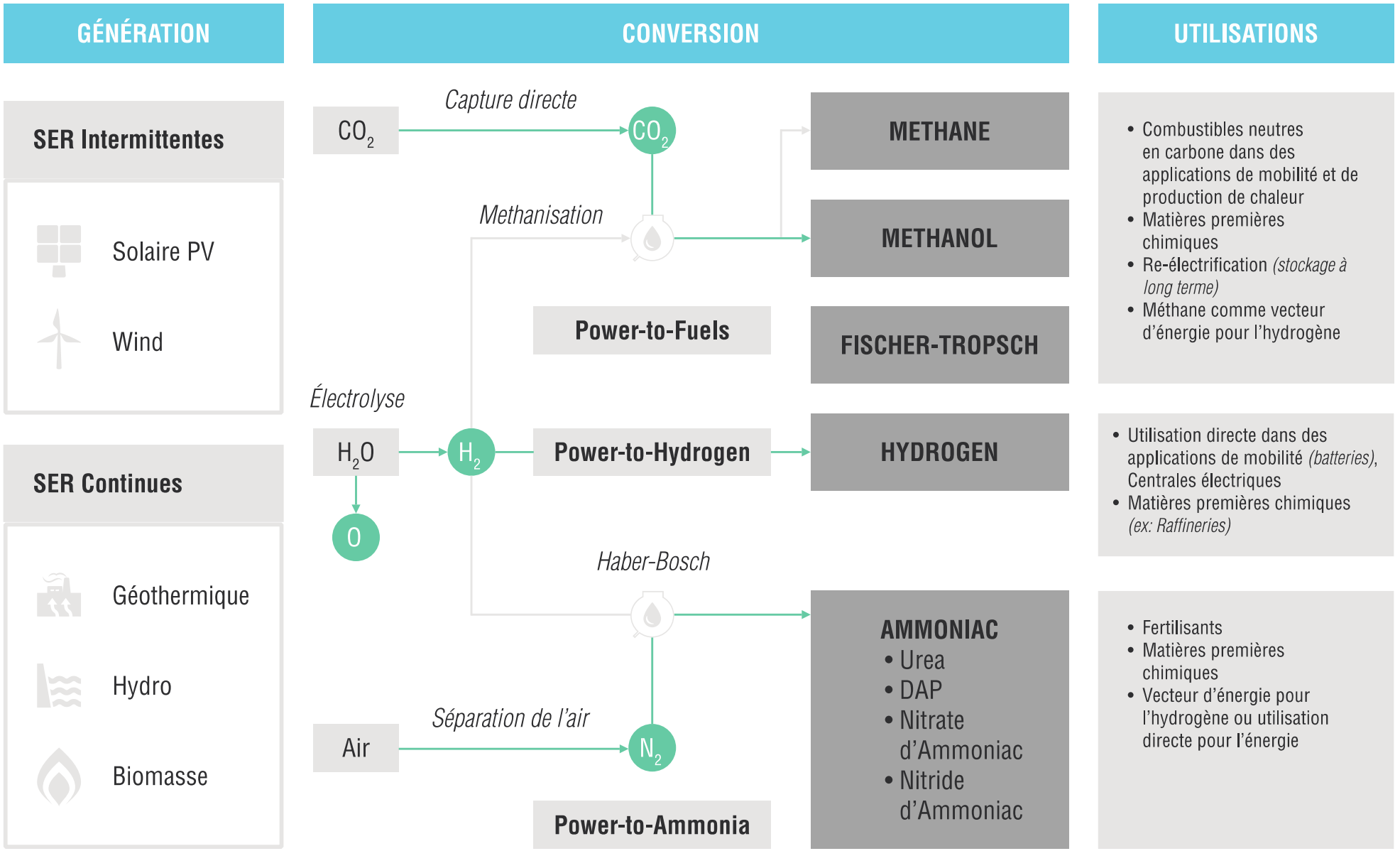
GREEN H2A

"Green Hydrogen & Applications Park" "Green Hydrogen & Applications Park" is a research platform that will play the main role in **the industrial deployment of the green hydrogen sector and its applications in Morocco**. It will allow the innovative technologies of **this promising sector of the future** to be investigated, tested, demonstrated and adapted to the local context.

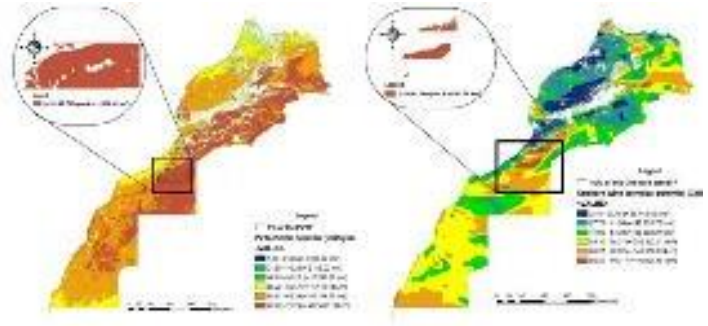
GreenH2A will be a strong link to support the academic and socio-economic world and contribute to the emergence of the sector through:

- **Technological** and decision-making support for public **policies**,
- a source of knowledge and **know-how** for the Moroccan private sector through technology **transfer tools**,
- a tool for capacity building and the **development of human capital with high added value** for the benefit of our universities and research, initial, and vocational training centers.

POWER-TO-X


GÉNÉRATION
CONVERSION
UTILISATIONS
SER Intermittentes
Solaire PV
Wind
SER Continues
Géothermique
Hydro
Biomasse
Capture directe
CO_2
CO_2
Methanisation
Power-to-Fuels
Électrolyse
H_2O
H_2
O
Power-to-Hydrogen
Haber-Bosch
Air
Séparation de l'air
N_2
Power-to-Ammonia
METHANE
METHANOL
FISCHER-TROPSCH
HYDROGEN
AMMONIAC
• Urea
• DAP
• Nitrate d'Ammoniac
• Nitride d'Ammoniac
• Combustibles neutres en carbone dans des applications de mobilité et de production de chaleur
• Matières premières chimiques
• Re-électrification (stockage à long terme)
• Méthane comme vecteur d'énergie pour l'hydrogène
• Utilisation directe dans des applications de mobilité (batteries), Centrales électriques
• Matières premières chimiques (ex: Raffineries)
• Fertilisants
• Matières premières chimiques
• Vecteur d'énergie pour l'hydrogène ou utilisation directe pour l'énergie

MOROCCO'S POSITIVE CONTEXT



HIGH RENEWABLE ENERGIES POTENTIAL

STRONG POLITICAL SUPPORT & INTERNATIONAL PARTNERSHIP

SUCCESSFUL DEPLOYMENT OF RENEWABLE ENERGY PROJECTS

GROWING R&D INFRASTRUCTURE AND CAPACITY BUILDING

INVOLVMENT OF THE INDUSTRY AND THE PRIVATE SECTOR

STRONG PROXIMITY AND CONNECTIVITY (MARITIME & GAS) WITH EUROPE

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PTX OPPORTUNITIES FOR MOROCCO

Source : World Energy Council Germany, Frontier Economics 2018 Study Fraunhofer ISI, Etude Opportunités PtX pour le Maroc, 2019

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KINGDOM OF MOROCCO
Ministry of Energy, Mines and Environment

IRESEN Institut de Recherche en Energie Solaire et en Energies Nouvelles

MOHAMMED VI POLYTECHNIC UNIVERSITY

CLUSTER GREEN H2

The World Power-to-X Summit 2021

WorldPtX SUMMIT

IS COMING TO **MARRAKECH** - MOROCCO

1-2 DEC 2021

SAVE THE DATE

www.worldptxsummit.com

PRIORITY TOPICS

SOLAR PHOTOVOLTAIC

CONCENTRATED SOLAR POWERE

SMART GRIDS

ENERGY STORAGE

WIND POWER

BIOMASS

HYDROGEN & POWER-TO-X

ENERGY EFFICIENCY

GREEN BUILDING & SUSTAINABLE CONSTRUCTION

CITY OF THE FUTURE

SUSTAINABLE MOBILITY

WATER-ENERGY-AGRICULTURE NEXUS

RESOURCE MODELING

DIGITIZATION

MOROCCAN SUCCESS STORIES

SUCCESSFUL PROJECTS

iSMART
Charging station

Charging station for electric vehicles with a power of 7 kW to 22 kW.,

SOL'R SHEMSY
Solar water heater

LIGHT'IN
Solar lighting

PV-C ROBOT
Solar panel cleaning robot

Mobile Solar Fridge
Solar fridge on a scooter

ISMART THE CHARGING STATION

The 100% Moroccan charging stations developed to support the decarbonization of the transport sector and encourage the adoption of cleaner mobility in Morocco

iSmart is a new generation of 100% Moroccan smart charging stations for professional and domestic use developed by a consortium composed of Green Energy Park, IRESEN, UM6P, the company EDEEP, and the industrial Halmes Maroc.

To meet all needs, regardless of where they are installed, iSmart charging stations for electric vehicles are designed to be adaptable and scalable. This first charging station is the first of a range of 5 chargers of different ranges (free-standing, wall-mounted, integrated into lampposts, 50 kW fast charging station...).

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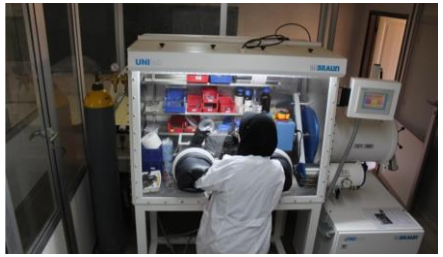
EXAMPLES OF INNOVATIVE PROJECTS



BATTERIES

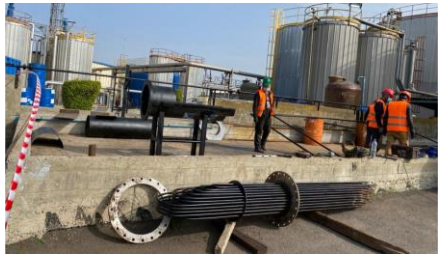
Design of the first 100% Moroccan Lithium-ion battery based on local minerals

BIO-DIGESTER

Valorization of organic effluents from paper and cardboard industries in Morocco using methanization

SOLAR FIELD CHAMS

Installation of the first 100% Moroccan Fresnel-type linear solar mirrors

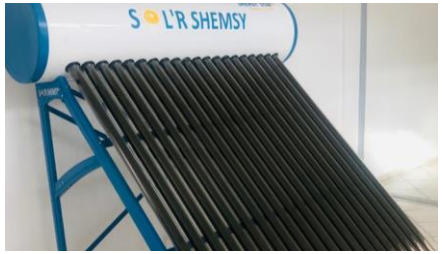


BITUMEN HEATING

Keeping bitumen storage hot using high-energy solar panels

SOLAR AIR CONDITIONING

Air conditioning processes using only solar energy



SOL'R SHEMSY

Study and design of a Made in Morocco solar water heater

SOLAR MAPPING

Installation of more than 20 photovoltaic plants in universities for the mapping of solar yield

HYBRID-BATH

Solar / biomass system for hot water and heating in hammams

EXAMPLES OF INNOVATIVE PROJECTS

AQUASOLAR

Mobile and modular brine water desalination unit combining photovoltaic and thermal solar energy

PHOSPHATE DRYING

Development of a solar flash-drying process for phosphates

SOLAR DRYER

Design, production and optimization of a food solar dryer

THERMAL HEATING

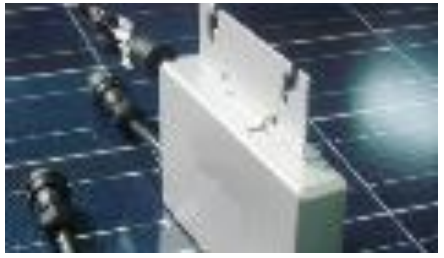
Design and storage of solar thermal energy and applications for passive heating of habitats

SOLAR PREDICTION

Prediction and monitoring of solar park production in Morocco

VERES

Solar Electric Vehicle and Electric Charging



MICRO-INVERTER

Development of a solar photovoltaic energy transfer and optimization system

MICROCSP

Grid integration and intelligent management of renewable energies through Micro CSP and PV

PV EMULATOR

Development of photovoltaic emulators for the evaluation of static and dynamic performances

BIOGAZ

Development of a biogas production system from agricultural waste

INDUSTRIAL INTEGRATION SUCCESS STORIES

Wind turbine blades manufacturing plant in Tangier (1000MW, 1 Billion MAD, 750 direct jobs).

Three photovoltaic module factories:

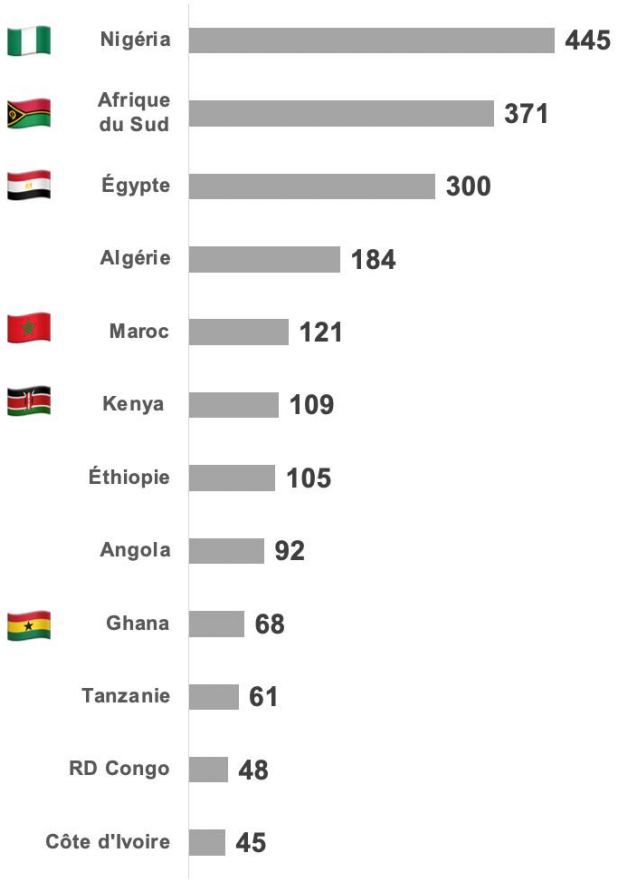
- Almaden Morocco in Tangier (250 MW - local market and exports)
- PV Industry in Skhirate (30 MW, can be extended to 60 MW)
- Cleanegy Morocco in Casablanca (15 MW).

CHALLENGES TO CLEAN ENERGY TECHNOLOGY INNOVATION AND INVESTMENTS

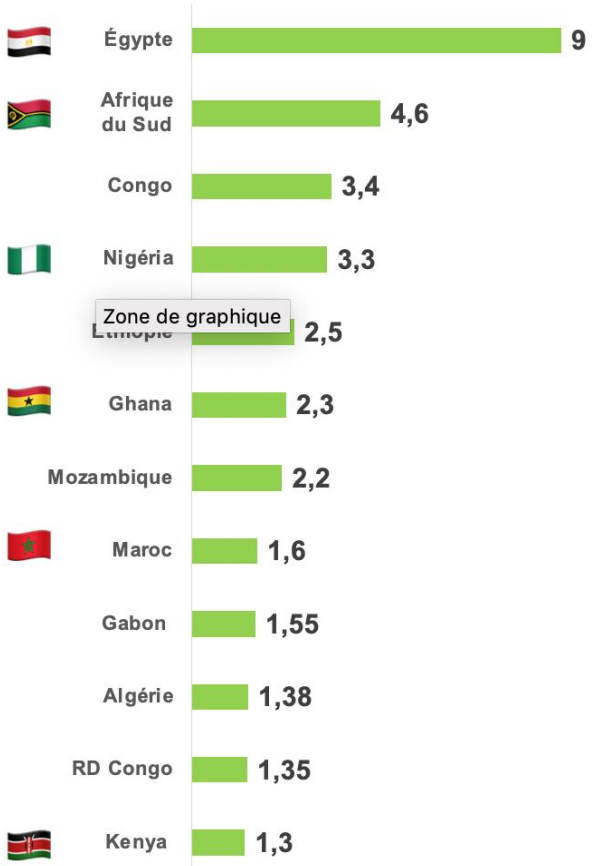
CHALLENGES

- Access to funding at all stages (R&D, seed, scale up, exist strategy for investors)
- Weakness of the innovation ecosystem
- Innovators' profiles and capabilities (need for training/coaching/capacity building, especially on the marketing side…): need for TTOs
- Integrated value chain for innovation in the green technology field
- Legal barrier (low and medium tension)

GDP (US$ milliards) 2019



FDI (US$ milliards) 2019



Investissement Startups (US$ millions) 2019

US$ 2,02 milliards

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Thank you for your attention

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