

# Side Event: African Innovation and Industrial Development

## A. Himdi: Masen Head of Operation and Maintenance



**masen**  
endless power for progress

# Agenda

- 1 Masen: creation and achievements
- 2 Innovation: Focus on Industrial development and R&D projects
- 3 Case study: CPV and Battery Energy Storage System
- 4 Conclusions



# Highlights since MASEN creation

## Milestones

2009

- National Energy Strategy



- From 26% to 42% of RNE by 2020

2010

- Masen's founding as limited company (Solar Energy only)

- Current share capital of 2.25 billion dirhams
- 100% public owned company

2013

- Launch of the construction work of NOORo I



NOORo I

2015

- New prerogatives
- Expansion from solar energy to RNE



- New objective : 52% of RNE by 2030

2016

- Inauguration of NOORo I
- Launch of the construction work of NOORo II & III



NOORo I

NOORo II

NOORo III

## Masen's missions

- 1 Integrated development of RNE installations at the highest international standards
- 2 Contribution to the emergence of national expertise in the field of renewable energy
- 3 Development of a strong Research & development capabilities
- 4 Development of the local areas Masen operates in by following a sustainable model involving economic, human and environmental criteria

[Masen video](#)

# MASEN : Missions

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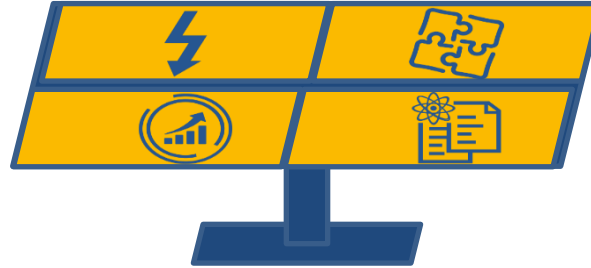
OPTIMIZED RENEWABLE  
RESOURCE VALORIZATION

## Electric production

42% by 2020 and  
52% by 2030

## Local development

For an inclusive development



## Industrial integration

For a competitive industry

## Research & development

For technological development and  
qualified resources

*An integrated vision duplicated in all our renewable energy projects*

# MASEN : 3 priority resources to reach 52% installed capacity from renewable resources by 2030

## Integrated Renewable Energy Project Development



SOLAR ENERGY



WIND ENERGY



HYDROELECTRICITY



*For a sustainable and useful electricity to the benefit of the national economy*



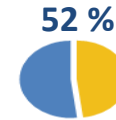
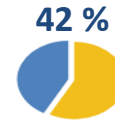
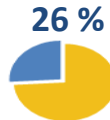
2009

2020

2030



National RNE share  
(% of the energy mix)



# NOOR Ouarzazate: a multi technologies complex



A SOLAR COMPLEX OF 580 MW COMBINING 3 DIFFERENT SOLAR TECHNOLOGIES

## NOORo I



PLANT IN OPERATION

- **Technology: CSP trough**
- **Capacity: 160 MW**
- **Storage: 3 hours**
- **CO2 emissions avoided: ~ 280 000 tCO2 / year**
- **Industrial integration: 30%**

## NOORo II



PLANT UNDER COMMISSIONING

- **Technology: CSP trough**
- **Capacity: 200 MW**
- **Storage: > 7 hours**
- **CO2 emissions avoided: ~ 380 000 tCO2 / year**
- **Industrial integration: 35%**

## NOORo III



PLANT UNDER CONSTRUCTION

- **Technology: CSP Tower**
- **Capacity: 150 MW**
- **Storage: > 7 hours**
- **CO2 emissions avoided: ~ 250 000 tCO2 / year**
- **Industrial integration: 35%**

## NOORo IV



PLANT UNDER CONSTRUCTION

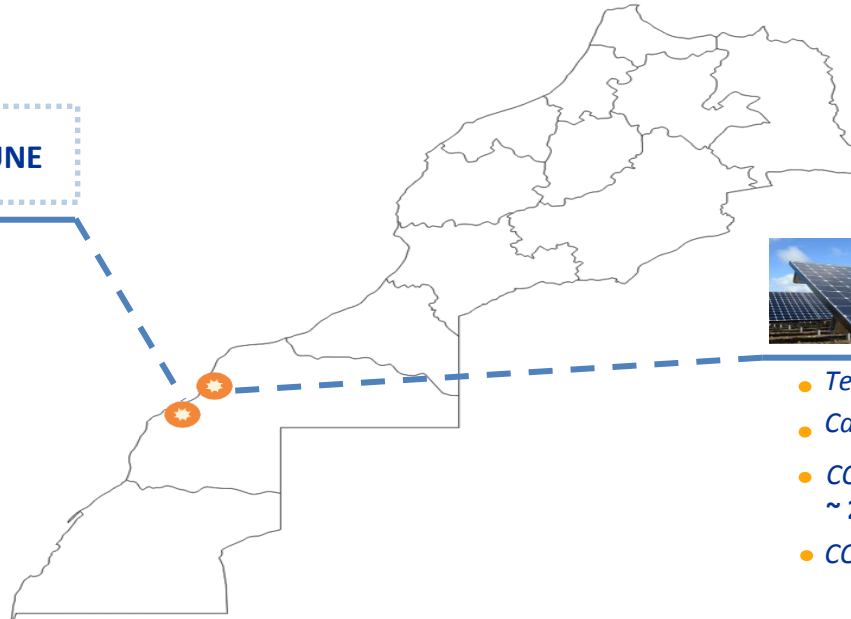
- **Technology: PV with tracking system**
- **Capacity: 70 MW**
- **CO2 emissions avoided: ~ 87 000 tCO2 / year**

# NOOR Laayoune and NOOR Boujdour: Under construction



## NOOR LAAYOUNE

- **Technology:** PV with tracking system
- **Capacity:** 80 MW
- **CO2 emissions avoided:**  
~ 104 000 tCO<sub>2</sub>/year
- **COD:** 2018



## NOOR BOUJDOUR

- **Technology:** PV with tracking system
- **Capacity:** 20 MW
- **CO2 emissions avoided:**  
~ 24 000 tCO<sub>2</sub>/kWh
- **COD:** 2018

# Focus on MASEN R&D projects

## Masen's missions

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- 1 Integrated development of RNE installations at the highest international standards
- 2 Contribution to the emergence of national expertise in the field of renewable energy
- 3 **Development of a strong Research & development capabilities**
- 4 Development of the local areas Masen operates in by following a sustainable model involving economic, human and environmental criteria

*Masen's missions are designed to be applied on a continental and international scale*

### Thereafter

- What are Masen R&D missions ?
- Presentation of Ouarzazate R&D platform
- What are the current and future projects in partnership?



# Research & development of capabilities

## Applied and pre-operational R&D backed by industrial projects

### Masen R&D missions

#### Identifying and promoting

the interests of domestic and international manufacturers and institutions who want to test prototypes at the pre-production stage in our dedicated platforms



#### Adapting

Rethink REN innovative products with intended environment in mind

Cooperative approach to innovation to ensure best possible outcome under operational conditions

#### Nurturing

The renewable energy ecosystem

### Differentiating elements of Masen R&D

Masen R&D

- **Offers** an accelerated path for **industrialization** of applied renewable energy R&D
- **Adopts** a **market pull** approach where market opportunities are the driver for innovation effort
- **Gives** “**real operating conditions**” demonstration environment and offers a network of exposition sites covering most African renewable energy sites production conditions
- **Creates** **self-sustaining job creating** industrial opportunities pipe for innovative solutions

# Research & development of capabilities Ouarzazate R&D platform

## Main characteristics



High solar irradiance  
(DNI > 2,600 Kwh/m2/yr)



240 hectares situated within the 580 MW NOOR Ouarzazate solar complex offering all common infrastructures (road, utilities, telecoms, etc.) and grid connection availability



Desert-like and real operational and meteorological conditions



Dedicated Masen's personnel



SUMITOMO and JICA R&D projects



SUMITOMO  
ELECTRIC



# MASEN, SUMITOMO, JICA PARTNERSHIP

1

CPV and Si-PV Demonstration System in Ouarzazate

- **Capacity** : 20 KW
- **Realization by**: SUMITOMO (constructed in August 2015)
- **Financing by**: JICA



The following parameters were monitored

- Generation per area
- Seasonal variation
- Meteorological data
- Materials behavior

Following positive results, a 1MW CPV plant was built as joint demonstration project btw MASEN and SEI

2

CPV plant in Ouarzazate R&D platform

- **Capacity** : 1 MW
- **Realization by**: SUMITOMO (Inauguration by Nov 2016)
- **Financing by**: Joint project MASEN/SEI (5M\$)
- Connected to the grid

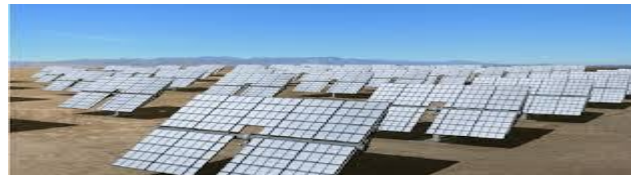


Innovative improvements are being implemented to improve:

- Cleaning time
- Tracking precision
- ....

3

O&M carried out by MASEN and data shared with SEI



Promising results of CPV technology that is suitable for many African locations. Storage is needed to adapt it to area without grid connection

# MASEN, SUMITOMO AND UNIDO PARTNERSHIP

## BESS Project

Design, Supply, Installation of a battery energy storage system (BESS) on 1MW CPV plant



- **Technology:** vanadium flow battery (VFB)
- **Capacity :** 125kW/4hrs
- **Realization by:** SUMITOMO
- **Financing by:** Japan government trough UNIDO

## Objectives

- Demonstrate an innovative VFB system (vanadium flow battery). This system will be integrated into a renewable energy plant (1 MW CPV) and the energy produced from storage will be used for specific needs
- Possible applications: Electricity shifting, Hydrogen generation, Desalination, Mobility
- Identify local supply chain and develop Moroccan skills needed to manufacture and maintain this type of system
- Export/knowledge sharing opportunities
- Development of smart and off grid solutions for remote and grid-less areas especially in Africa

# Conclusions

- MASEN presents a unique value proposition to innovation partnership
- The convergence of contributions and competencies between complementary partners creates perfect conditions for accelerated path to demonstration and market access
- The success of initial projects is creating opportunities for more
- The widening of MASEN perimeter of renewable technologies opens further collaboration opportunities
- The international funding is essential for the advancement of RNE technologies to market



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