

NOOR MIDELT I

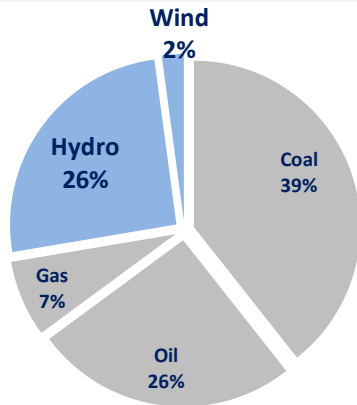


masen
endless power for progress

June 2019

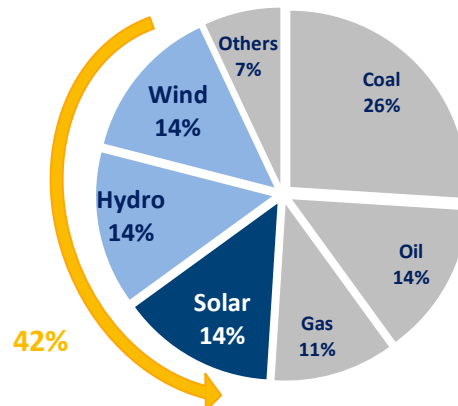
Strong will of increasing renewable energy share within the national mix by 2020 and 2030, through a roadmap of deployment based on an optimal technological mix

2009



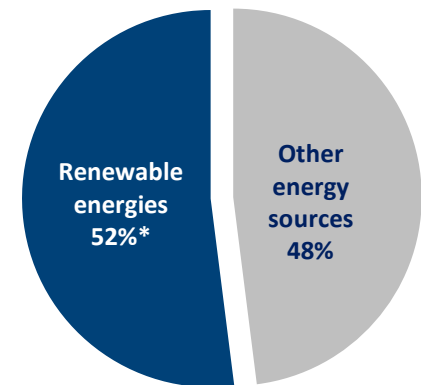
Renewable energy represented 28% of installed capacity

2020



Renewable energy will represent 42% of installed capacity

2030



Renewable energy will represent 52% of installed capacity

Morocco launched the NOOR Plan (the Moroccan solar plan), to be implemented by Masen



Development of a minimum of **2 000 MW** by 2020

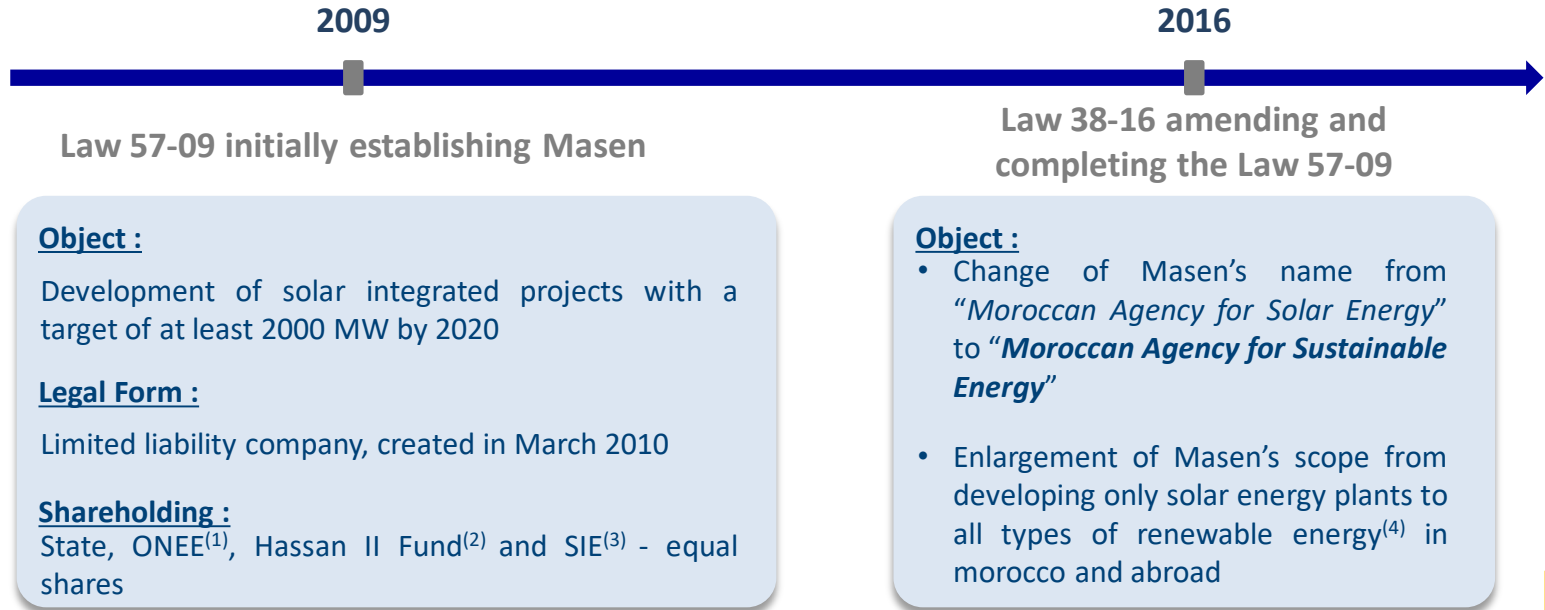
Masen will implement a minimum of **6 000 MW** of renewable energy by 2030

Conventional energy

Renewable energy

Projects developed/to be developed by masen

Legal framework :



Institutional framework :

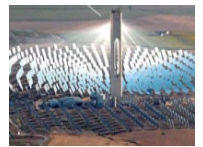


(1) ONEE: Office National de l'Électricité et de l'Eau, the national utility
 (2) Hassan II Fund for Economic and Social Development
 (3) Société d'Investissements Énergétiques
 (4) Except the assets dedicated to the stabilization of the grid



**NOOR OUARZAZATE
COMPLEX,
A GRADUAL
DEPLOYMENT OF
580 MW**

NOOR₀ III
150 MW



CSP Tower

NOOR₀ II
200 MW

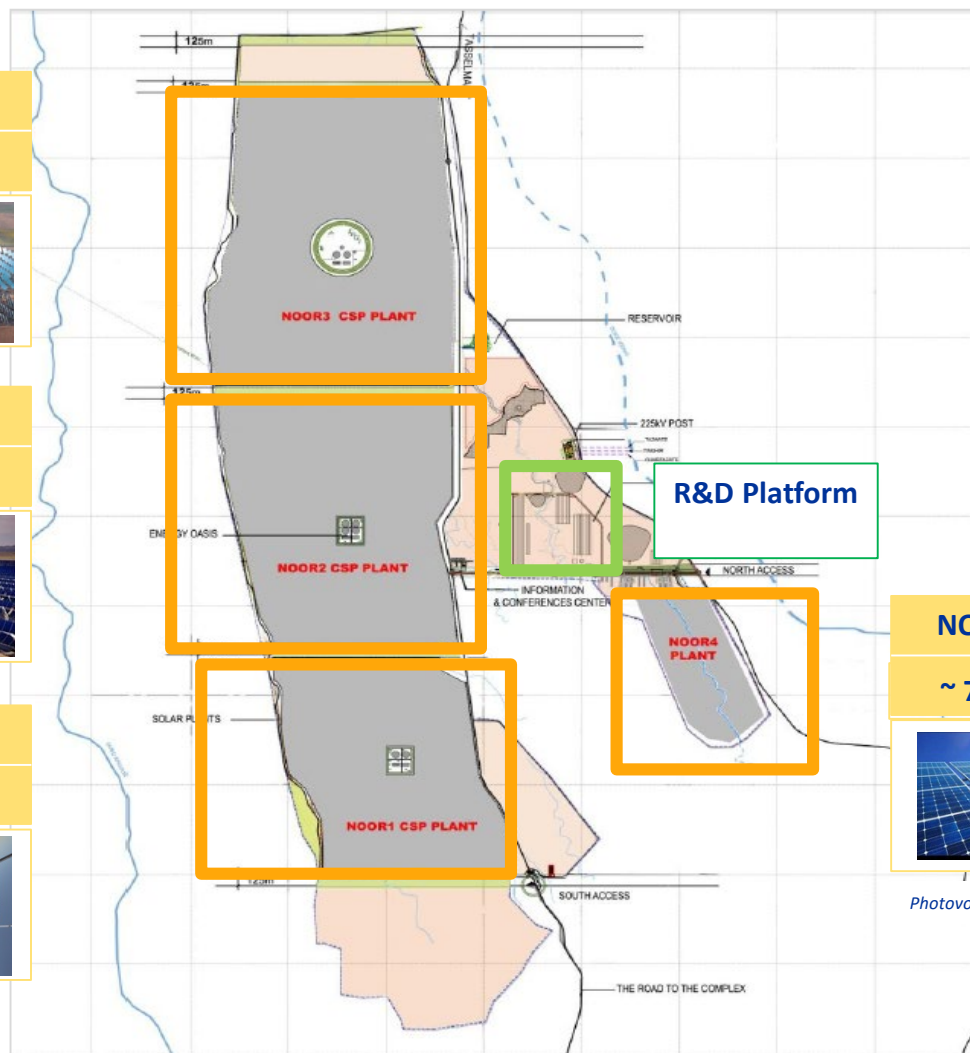


CSP Parabolic Trough

NOOR₀ I
160 MW



CSP Parabolic Trough



NOOR₀ IV
~ 70 MW



Photovoltaic

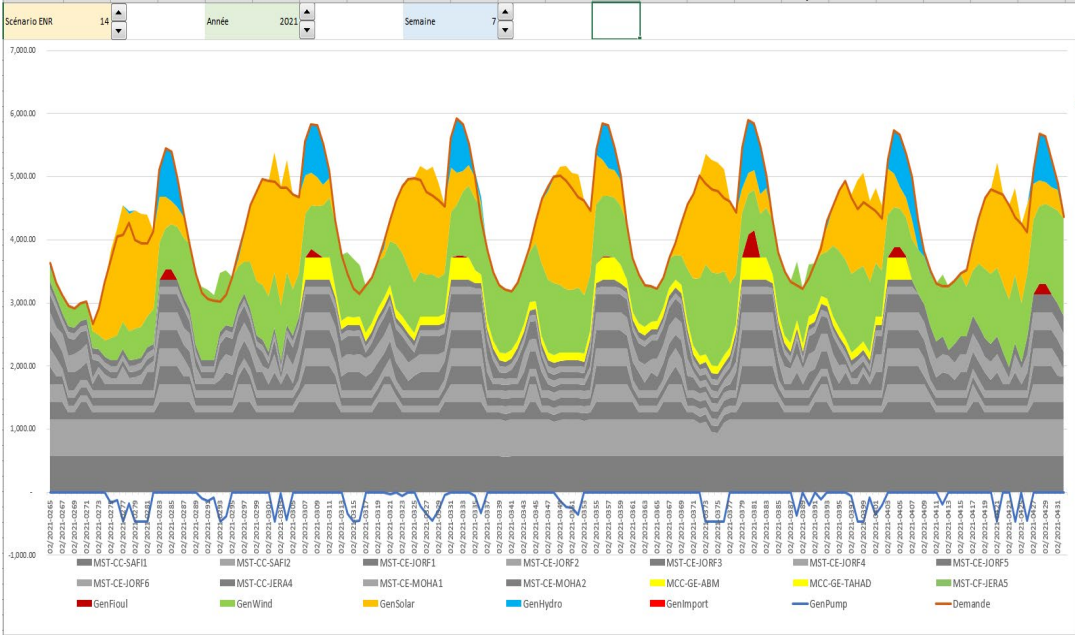
Solar and wind plants are in direct competition with conventional baseload power plants

Current Grid Management :

Renewable intermittent generation is being enforced in conventional system without any grid strategy



We will have to curtail renewables or baseload power plants having a huge impact on cost

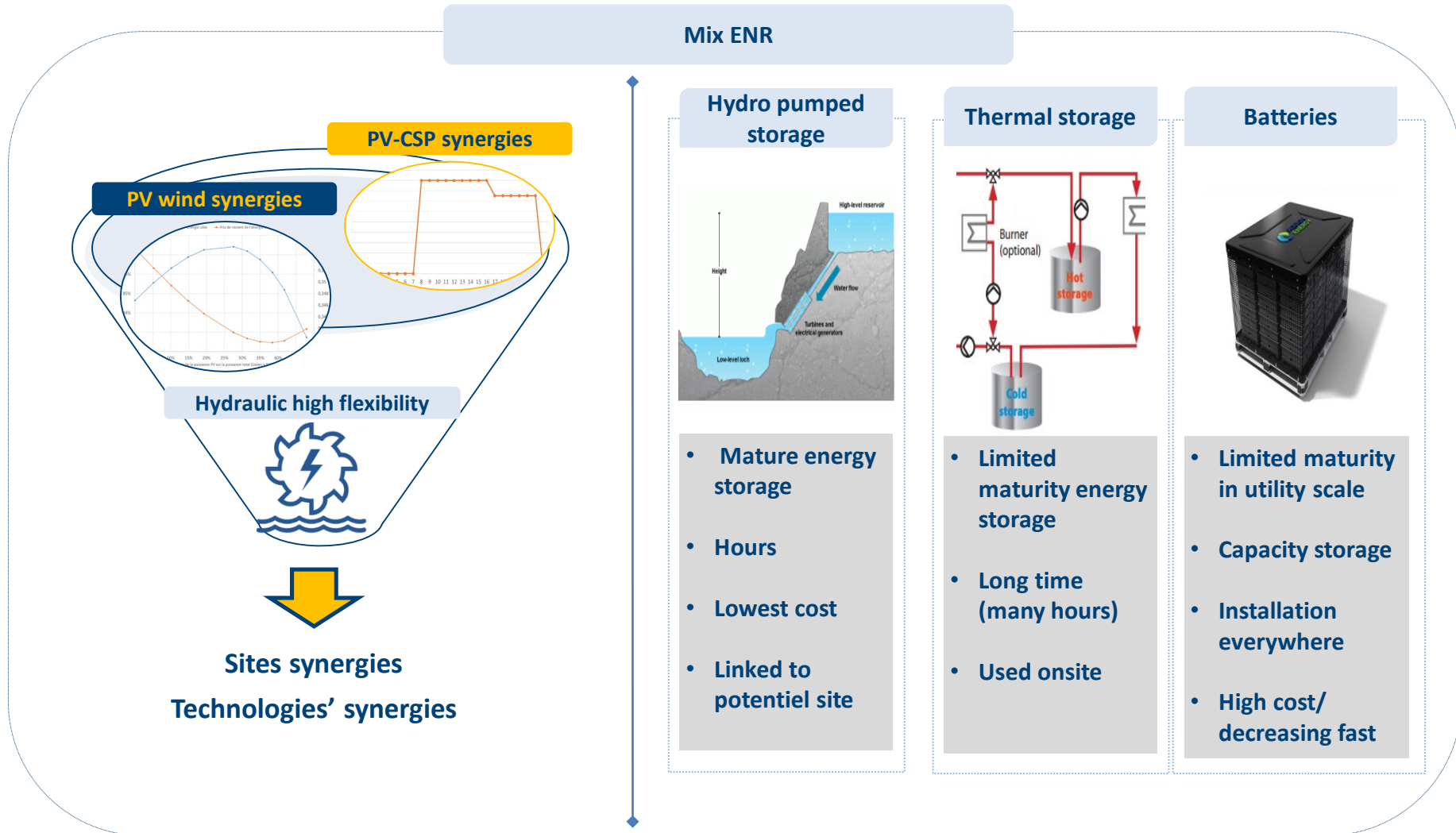


A new energy mix shall be developed based on:

Synergies between renewables



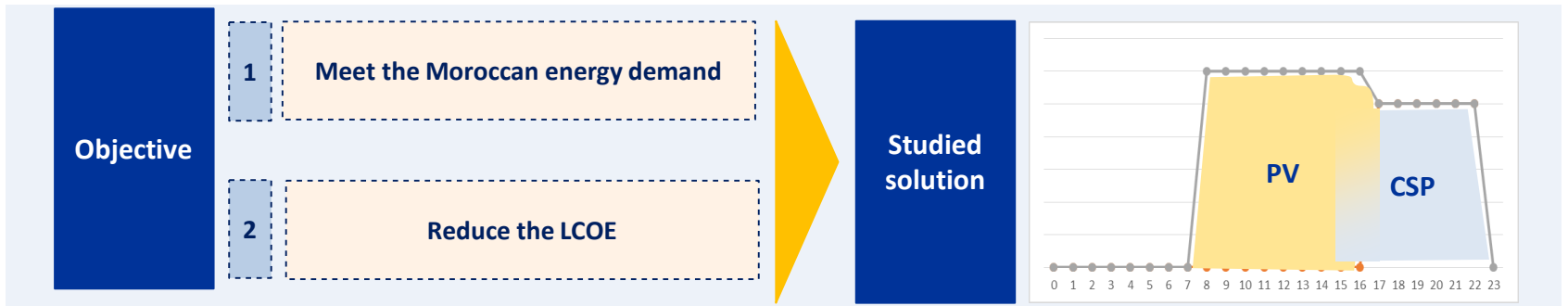
Storage technologies



Mix renewable technologies to maximise useful energy and storage to guarantee capacity



NOOR Midelt : a CSP-PV hybrid power plant a project developed in accordance with this vision



Main characteristics of the studied Solution

Operating Mode

Hybrid solution combining PV and CSP :

- PV operated during day
- CSP operated mainly during evening
- Minimum 5 hours storage capacity
- 25 % energy to be generated during peak hours

Capacity

- The PV_{AC} capacity represents $1.20 * CSP$ gross capacity.
- The PV_{DC} capacity represents $1.4 * PV_{AC}$ capacity.

Peak hours tariff of 68 Cents of MAD/ kWh (about 6,2cEuro/kWh)

Average tariff of 60,4 Cents of MAD/ kWh (about 5,5 cEuro/kWh)

⇒ The solution could compete with coal

To check if the proposed approach respond to demand, the next steps will be :

1. **Define the optimal Wind/PV mix to be developed by 2030 to maximise useful energy for grid at lower cost**
2. **To launch Noor Midelt II to confirm the results of Noor Midelt I while opening to other storage technologies such as batteries**
3. **To launch a baseload renewable power plant with storage ensuring 90 % capacity factor (Capacity Factor of Coal or Nuclear power plants) replacing a coal power plant**



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QUESTIONS