Morocco’s experience in CSP projects
1. Morocco’s Energy Strategy
2. Presentation of Masen
3. NOOR Plan achievements and projects
4. Masen’s approach: “plug & play”
5. Masen’s upcoming CSP projects: Noor Midelt Phase I
6. Conclusion
Morocco’s Energy Strategy
AN AMBITIOUS ENERGY STRATEGY HAS BEEN SET TO MEET THE MOROCCAN NATIONAL NEEDS

Energy consumption increase: ~ 6% per year
Energy dependence: ~ 95%

Objectives of the Moroccan Energy Strategy

- Securing energy supply
- Facilitation and optimization of energy access
- Rationalization of energy consumption
- Protection of the environment through clean energy

4 clear priorities

1. Diversification of energy supply
2. Development of domestic energy resources, particularly the Renewable Energy
3. Maximization of energy efficiency potential
4. Integration of regional and international energy markets
RENEWABLE ENERGIES, AT THE HEART OF MOROCCO’S ENERGY STRATEGY

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
- **Coal**: 39%
- **Oil**: 26%
- **Gas**: 7%
- **Wind**: 2%
- **Hydro**: 26%

### 2020
- **Coal**: 26%
- **Oil**: 14%
- **Gas**: 11%
- **Wind**: 14%
- **Hydro**: 14%
- **Solar**: 14%
- **Other**: 7%

### 2030
- **Renewable energies**: 52%*
- **Other energy sources**: 48%

Renewable energy represented 28% of installed capacity

Development of 2 000 MW by 2020

Renewable energy represented 42% of installed capacity

Renewable energy will represent 52% of installed capacity

*Renewable energy will represent 52% of installed capacity

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

Masen will implement 6 000 MW of renewable energy by 2030

Projects developed/to be developed by masen
Presentation of Masen
MASEN: A DEDICATED ACTOR RELYING ON A STRONG LEGAL AND INSTITUTIONAL FRAMEWORK...

**Legal Framework**

<table>
<thead>
<tr>
<th>2009</th>
<th>2016</th>
</tr>
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<tbody>
<tr>
<td>Law 57-09 initially establishing Masen</td>
<td>Law 38-16 amending and completing the Law 57-09</td>
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**Object**
- Development of solar integrated projects with a target of at least 2000 MW by 2020

**Legal Form**
- Limited liability company, created in March 2010

**Shareholding**
- State, ONEE\(^1\), Hassan II Fund\(^2\) and SIE\(^3\) - equal shares

**Institutional Framework**

1. **State-Masen Agreement (decree):** Conditions, technical requirements and guarantee of the financial equilibrium of Masen’s projects.

2. **State-ONEE-Masen Agreement:** Take or pay including terms and conditions for the purchase, supply, transport and commercialization of electricity produced.

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\(^1\) 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 Energétiques  
\(^4\) Except the assets dedicated to the stabilization of the grid
DEVELOPING PROJECTS THROUGH AN “INTEGRATED” APPROACH

In charge of the Integrated Renewable Energy Deployment
Valorizing natural resources for Morocco

**Electricity Production**
Min 52% of installed capacity by 2030

**Industrial Integration**
For a competitive industry

**Local Development**
For an inclusive development

**Research & Development and Training**
For technology improvement and qualified resources

Relying on a multi-technology approach combining technologies to provide the best answer to identified needs while optimizing the overall cost of kilowatt hour and maximizing synergies
NOOR Plan achievements and projects
MORE THAN 1500 MW OF SOLAR CAPACITY HAVE BEEN LAUNCHED IN ORDER TO ACHIEVE THE 2020 TARGET

The technologies combination is set in a way to answer identified needs while optimizing the overall cost of the kilowatt hour and maximizing synergies.
FOCUS ON NOOR OUARZAZATE COMPLEX

NOOR COMPLEX, A PROGRESSIVE DEPLOYMENT OF 580MW

NOORo III
150 MW

NOORo II
200 MW

NOORo I
160 MW

NOORo IV*
72 MW

R&D Platform

CSP Parabolic Trough

Tour CSP

CSP Parabolic Trough

(*): NOORo IV is included in the NOOR PV I program
NOORo I, IN OPERATION

Techno.  Parabolic-Trough
Capacity  160 MW
Storage  3 hours

Developer
Acwa Power Quasarate

EPC
Acciona, Sener, TSK Group

International Financial Institutions

Key dates
Commissioning  Q1 2016
NOOR II, UNDER CONSTRUCTION

Techno. | Parabolic-Trough
Capacity | 200 MW
Storage | > 7 hours

Developer

EPC

International Financial Institutions

Key dates

Effectiveness date | Q2 2015
Commissioning | Q3 2017
NOOR III, UNDER CONSTRUCTION

Techno.: Tour
Capacity: 150 MW
Storage: > 7 heures

Developer
EPC

Key dates
Effectiveness date: Q2 2015
Commissioning: Q4 2017

International Financial Institutions
Green Bonds

NOOR PV I, AT FINANCIAL CLOSE

Techno. Photovoltaic (with single tracking axis)

Capacity 177 MW

Projects NOORo IV (72MW), NOOR Laayoune (85MW) and NOOR Boujdour (20MW)

Developer

EPC

Funding KfW

Green Bonds Certified by

Key dates

Effectiveness date Q1 2017

Commissioning Q1 2018

(1) KfW finances only NOORo IV
Masen’s approach: “plug & play”
DEVELOPMENT OF THE PROJECTS UNDER AN IPP – BOOT SCHEME

**Independent Power Producer (IPP)**
- Design, financing, construction, operation and maintenance of the plant

**BOOT scheme**
- Build, Own, Operate, Transfer

**Award of the projects based on costly international tender processes**

**Double PPA**
- Electricity is purchased from the developer by Masen and on-sold to the national utility ONEE
- Purchase of electricity at market price and on-sale at a fixed price exposing Masen to a gap risk

**Optimization of all the layers is key in order to reduce the tariff resulting from the tenders**
Development of integrated projects at the lowest tariff possible based on an effective risk allocation scheme and a streamlined tender process

**Reducing the costs of tenders to developers**
- Transparency of the tender processes, visibility on the timeline of execution and clear rules of procurement
- Availability of studies enabling developers to perform their due diligence and the plants designs

**Reducing the costs of funding of the projects**
- Securing the financing by Masen from different IFIs at concessional rates (thanks to the State guarantee) and on-lending such financing to the SPCs through a repackaged senior loan, whose terms and conditions are shared during the tender
- Enabling developers to sculpt their debt reimbursement profile and to structure the tariff and the debt reimbursements in 3 currencies (MAD, EUR, USD) at their convenience to match their flows and reduce the Forex risk

**Reducing the risk premium of the projects**
- Several risks, usually taken by the private party in standard PPs, are taken by the public party Masen
- Management of the Environmental and Social aspects of the site, the plants as well as the common infrastructures, in compliance with the most stringent international E&S standards

Several roles held by Masen optimizing the risk profile of the projects and leading to timing and transaction efficiencies as well as optimization of the tariff
DIFFERENT ROLES HELD BY MASEN IN ORDER TO OPTIMIZE THE RISK PROFILE OF THE PROJECTS

A proven institutional scheme involving several roles played by Masen with a clear risk allocation translated into the contractual documentation.

Masen Offtaker
- PPA #1
- Support of the State
  - Specific convention
  - Guarantee
  - IFIs
  - Loan agreements
  - Financing contract

Masen Lender
- Loan agreements

Masen CI** provider / manager
- Management Contract
  - Water, roads, security, etc.
  - Surface right deed

Masen Shareholder
- 25%
- 75%
- Shareholders agreement

Project Company
- 75%
- 25%
- Project company
- Land acquisition

Masen Land provider

Bidders are invited to mainly focus on offering value for money and the best technical solutions.
FOCUS ON FINANCING (1/2)

Key success factors

- Strong commitment at the level of the State
- Early involvement of IFIs with:
  - Deep understanding of the constraints
  - An alignment of positions on key matters as soon as possible
  - An optimization of their calendar to match to the extent possible the project’s timeline
With a sector in transition facing significant financing hurdles, the full competitive financing provided has been a game changer.

Nevertheless, the significant investment amounts required in a very short period of time and the scale up effect are still challenges faced by CSP projects.

Economy of scale and of competitive and diversified sources of energy remain key factors for CSP projects.

**Masen is exploring several financing means:**
- **Green Climate Fund:** Masen is on the process of getting accredited.
- **Top-up financing** through the valorization of green energy in particular through incentivizing carbon pricing mechanisms.
- **Private financing,** which is expected to become more involved as the KWh tariff decreases and the concept becomes more proven. Masen has issued in November 2016 the first Green Bond in Morocco (~€100m) under competitive terms.
NOOR OUARZAZATE: A SUCCESS STORY FOR THE TARIFF...

With one of the lowest prices of electricity per kilowatt-hour for the CSP technology ever achieved worldwide

**Thanks to**
- IFIs support and competitive financing terms and conditions offered
- A transparent and competitive bidding process outcome that had outreached all expectations of key players in the solar market
- A decrease in the costs with a peak price reduction of ~16% for NOORo II and ~12% for NOORo III compared to NOORo I

**Dropping prices**
An even more competitive price for NOORo II and NOORo III in comparison to NOORo I considering
- Higher storage hours: 7 to 8 hours
- Reduction in water consumption: use of dry cooling

Tariffs will continue on their decreasing trend thanks to the continuous drop of CSP costs
... AND FOR THE LOCAL DEVELOPMENT

2 main advantages should be noted

**Industrial Integration**
- Rate of industrial integration: 32-35% resulting in approximately 8 billion MAD being invested locally
- New industrial activities have been launched in Morocco such as the manufacturing of torque tubes
- Thousands of jobs provided during the construction phase and hundreds during the O&M phase

**Local development**
- Focus on 3 main axes:
  - Territories’ opening up (e.g. construction of the road Tasselmante - 14 km)
  - Improving the population’s social environment (e.g. participation in the creation of the Young Promoter House (800 beneficiary young promoters, creation of 30 companies)
  - Optimization of territories’ infrastructures (e.g. reconstruction of the water line of Tasselmante village)

As a public party, Masen has the opportunity through the development of these integrated projects to leverage the effects of the private party’s actions and to create synergies through coordination with other public stakeholders
Masen’s upcoming CSP projects:
Noor Midelt Phase I
NOOR MIDELT: COMPLEX MAIN CHARACTERISTICS

1. INFRASTRUCTURES

- Water: Hassan II dam (14 km from the site)
- Grid: Mibandlen substation under extension to 225 KV (10 km from the site)

2. SURFACE AREA

- Flat land of a total surface area of 3153 Ha
- Accessible site located 30 km from national road RN13

3. SOLAR RESOURCE

- Measured solar irradiation:
  - DNI: 2359 kWh/m²/yr
  - GHI: 2096 kWh/m²/yr
- Accessible site located 30 km from national road RN13

4. ACCESSIBILITY

- Feasibility studies confirmed that the site selected is suitable for CSP and PV Projects
NOOR MIDELT : INSTITUTIONAL AND FINANCIAL SCHEME

An IPP program (covering the design, financing, construction, operation and maintenance of the plant) developed through a cost-effective approach

**NOOR Midelt program innovative technical configuration**

**Number of plants**
- Two hybrid solar power plants

**Technologies**
- Hybrid CSP – PV
  - CSP : Parabolic trough or Tower
  - PV : all mature technologies are considered (c-Si; mc-Si; Thin Film; CPV)

**Capacity**
- CSP gross capacity between 150MW and 190MW per plant
- Installed PV\(_{DC}\) capacity to be optimized by the Bidder
The Capex is estimated at this stage at 1 bn€ per project

In-principle interest from key partners to contribute to NOOR Midelt program to cover the overall financing needs for the project
A two stages tender process is considered for NOOR Midelt Phase I to take into account the complexity of the contemplated technical configuration.

- **To sound the market**
  - Call for expression of interest
  - Q1 2016

- **To pre-select**
  - Pre-qualification
  - Q3 2016

- **To select and award**
  - Request for Proposals
  - Stage 1
    - Technical offer
  - Stage 2
    - Amended technical offer
    - Financial offer
  - Q2 2017
  - Q1 2018

- **To sign and close**
  - Signing of contractual documents with the project company incorporated by the selected bidder.
  - Fulfillment of all conditions precedent to financial close
  - Q2 2018
  - Q4 2018
Conclusion
A long term sustainable vision

making it possible for countries benefiting from key assets to follow the path of a green growth

investing for the future to face strong and direct climate change issues

sharing its experience with similar countries in particular sub-Saharan African countries

Momentum to show that it is possible to develop a country through win-win partnerships while driving a region and preserving the future of our children