Moroccan Energy Outlook: Achievements and opportunities

Africa Energy Forum

Mauritius - June 21, 2018
I. Morocco, a country in development
II. Morroccan Energy strategy
III. Moroccan Hydrocarbons Sector
IV. Cooperation Morocco-Africa
I-Morocco, a country in development

Towards integrated sustainable development

1997 1999 2001 2003 2005 2007 2009 2011 2013 2015

Succession

Advisory Council on Human Rights (CCDH)
Family Code “Moudawana”
Committee of Oulémas
Equity and reconciliation instance (IER)

Law of parties
Election Code
Law on the Transfer of Nationality

Central Agency for the Prevention of Corruption
Consumer Protection Act

News Sectoral strategies:
• Energy
• Green plan
• Emergence
• Tourism
• Infrastructures

New legal and institutional frameworks

Advanced regionalization

National Initiative for Human Development (INDH)

• Reform of the Constitution
• Establishment of the Economic and Social Council

I - Morocco, a country in development
A growing energy demand

SUSTAINABLE DEVELOPMENT

- Energy
- Agriculture
- Industry
- Infrastructure
- Tourism
- Phosphate
- Housing
- Water
A Growing Energy Demand Due to Significant Economic Development

Morocco’s primary energy demand
- x2 by 2020
- x3 by 2030

Morocco’s electricity demand
- x2 by 2020
- x4 by 2030

Morocco’s dependency on imported fossil fuels around 93%
Clear Energy Strategy

Four fundamental objectives

- Security of supply and energy availability;
- Access to energy at low costs;
- Demand management;
- Preservation of the environment.

Four Strategic Orientations

- Diversified mix, optimized by reliable and competitive technology;
- Mobilization of national resources;
- Energy Efficiency;
- Regional integration.
Morocco, a model for energy transition

- **Coal**: 8,129 MW to 15,946 MW to 20,070 MW to 24,800 MW
- **Natural gas**: 15,946 MW to 20,070 MW to 24,800 MW
- **Fuel**: 15,946 MW to 20,070 MW to 24,800 MW
- **Wind**: 20,070 MW to 24,800 MW
- **Solar**: 20,070 MW to 24,800 MW
- **Hydroelectricity**: 24,800 MW

**Percentage Breakdown**

- **2015**: 32% Coal, 40% Natural gas, 2% Fuel, 14% Wind, 11% Solar, 22% Hydroelectricity
- **2020**: 32% Coal, 40% Natural gas, 2% Fuel, 14% Wind, 11% Solar, 14% Hydroelectricity
- **2025**: 32% Coal, 40% Natural gas, 2% Fuel, 14% Wind, 11% Solar, 13% Hydroelectricity
- **2030**: 32% Coal, 40% Natural gas, 2% Fuel, 14% Wind, 11% Solar, 12% Hydroelectricity
By 2020, RE will represent 42% of the total capacity

Wind
- Capacity: **2000 MW**
- Inv: $ 3.5 Million
- Annual savings: 1.5 Million TOE / year

Solar
- Capacity: **2000 MW**
- Inv: $ 9 Million
- Annual saving: 1 Million TOE / year
- MASEN

Hydropower
- Construction of **2550 MW** hydropower plants (Mdez EL MENZEL and Abdelmoumen)

Fossil fuels
- Thermal power plants under construction (2010-2015): **2X500 MW**
- Complementary projects **1000 MW** (Gas or clean coal) from 2018

Energy efficiency: 5% in 2020 and 20% in 2030
By 2030: RE will represent 52% of the total capacity

10 100 MW of additional renewable energy capacity by 2030

1. Solar: 4560 MW, 20%
2. Wind: 4200 MW, 20%
3. Hydroelectricity: 1330 MW, 12%
**Il-Renewable Energy projects**

**Solar projects – 180 MW**
- Ain Beni Mathar – 20 MW
- Noor Ouarzazate I – 160 MW

**Hydropower projects – 1769 MW**
More than 20 dams scattered throughout the kingdom

**Wind projects – 887 MW**
- Amougdoul
- Tanger I
- Torres / koudia Al Baida – 50 MW
- Tarfaya – 300 MW
- ... Including 337 MW Developed under the law 13-09

- Akhfenir 1 & 2
  - 200 MW
- Foum Al Oued
  - 50 MW
- Cimar
  - 5 MW
- Haouma
  - 50 MW
- Lafarge
  - 32 MW
## II-2020 programming with announced national ambitions

### ER projects and installed capacity per year

<table>
<thead>
<tr>
<th>Year</th>
<th>Private</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>-</td>
<td>3 805 MW</td>
</tr>
<tr>
<td>2019</td>
<td>320 MW of private wind projects</td>
<td>4 521 MW</td>
</tr>
<tr>
<td>2020</td>
<td>36 MW of private wind projects</td>
<td>6 238 MW</td>
</tr>
<tr>
<td>2021</td>
<td>-</td>
<td>7 438 MW</td>
</tr>
</tbody>
</table>

- **NOOR Ouarzazate II** - 200 MW
- **NOOR Ouarzazate III** - 150 MW
- **NOOR Ouarzazate IV** - 72 MW
- **NOOR Laâyoune I** - 85 MW
- **NOOR Boujdour I** - 20 MW
- **NOOR Tafilalet** - 120 MW
- **NOOR Atlas** - 200 MW
- **NOOR Ouarzazate III** - 150 MW
- **NOOR PV II** – MIN 300 MW
- **NOOR Laâyoune II & Boujdour II** - 500 MW
- **NOOR Argana** - 200 MW
- **PEI 850 – 370 MW** (Tiskrad, Tanger II, Projet Eolien Taza - 150 MW)
- **NOOR Midelt I & II** - 800 MW
- **Repowering Koudia El Badia** – 100 MW

- **Private**
- **Total**
- **2018**
  - 320 MW of private wind projects
  - **827 MW**
    - 1 207 MW
    - 1 771 MW
  - **3 805 MW**
- **2019**
  - 36 MW of private wind projects
  - 1 027 MW
  - 1 723 MW
  - 1 771 MW
  - **4 521 MW**
- **2020**
  - 36 MW of private hydropower projects
  - 2 027 MW
  - 2 243 MW
  - 1 968 MW
  - **6 238 MW**
- **2021**
  - 2 827 MW
  - 2 293 MW
  - 2 318 MW
  - **7 438 MW**
**Il-Solar projects schedule**

<table>
<thead>
<tr>
<th>Project</th>
<th>Year</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>In exploitation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noor Ouarzazate I = 160 MW</td>
<td>2017</td>
<td></td>
</tr>
<tr>
<td>Ain Beni Mathar – 20 MW</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Construction</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noor Ouarzazate II</td>
<td>2017</td>
<td></td>
</tr>
<tr>
<td>Noor Ouarzazate IV</td>
<td>2018</td>
<td></td>
</tr>
<tr>
<td>Noor Laâyoune I</td>
<td>2019</td>
<td></td>
</tr>
<tr>
<td>Noor Boujdour I</td>
<td>2020</td>
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</tr>
<tr>
<td>Noor Tafilalet</td>
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<td>Noor Argana</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noor PV II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noor Midelt I &amp; II</td>
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</tbody>
</table>
Il-Noor Ouarzazate: a 580 MW complex that will be fully operational in 2018

First multi-technology solar complex with 4 plants

- **NOOR Ouarzazate I** (CSP Parabolic cylinder)
  - 160 MW in exploitation
  - Tariff: 1.62 MAD/kWh
  - Storage: ~3 hours

- **NOOR Ouarzazate II** (CSP Parabolic cylinder)
  - 200 MW in construction
  - Tariff: 1.36 MAD/kWh
  - Storage: >7 hours
  - Operational 1Q 2018

- **NOOR Ouarzazate III** (CSP Tour)
  - 150 MW in construction
  - Tariff: 1.42 MAD/kWh
  - Storage: >7 hours
  - Operational 4Q 2018

- **NOOR Ouarzazate IV** (Photovoltaic)
  - 72 MW in construction
  - Tariff: 0.46 MAD/kWh
  - Operational 2Q 2018
II-Wind projects under construction or development (2020 horizon)

Development of several integrated projects by 2020

TAZA Wind project

2 phases: (100 MW then 50 MW)

PEI 850

5 sites with a total capacity of 850 MW

PEI 850 M'Idelt
180 MW
Operational by 2019

PEI 850 Boujdour
100 MW
Operational by 2019

PEI 850 Jbel Lahdid
200 MW
Operational by 2019

PEI 850 Tiskrad
300 MW
Operational by 2020

PEI 850 Tanger II
70 MW
Operational by 2020

Koudia Al Baida

Repowering & extension for a total capacity of 300

Koudia Al Baida
100 MW
Operational by 2021
### II-Wind projects schedule

<table>
<thead>
<tr>
<th>Project Details</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>In exploitation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amougdoul – 60 MW</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Koudia Al Baida – 50 MW</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tarfaya – 300 MW</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Koudia Al Baida – 100 MW</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tanger I – 140 MW</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **PEI 850 – Midelt 180 MW**
  - Financial closure
  - Construction

- **PEI 850 – Boujdour 100 MW**
  - Financial closure
  - Construction

- **PEI 850 – Jbel Lahdida 200 MW**
  - Financial closure
  - Construction

- **PEI 850 – Eolien Taza 150 MW**
  - Financial closure
  - Construction
  - Construction – Phase 1
  - Phase 2

- **PEI 850 – Tiskrad 300 MW**
  - Financial closure
  - Construction

- **PEI 850 – Tanger II 70 MW**
  - Financial closure
  - Construction

- **PEI 850 – Repowering Koudia Al Baida 100 MW**
  - Financial closure
  - Construction

**A total capacity of more than 2000 MW by 2020 taking into account the ongoing development by the private sector**
## II-Progress of hydraulic projects

Nearly 1,770 MW of hydraulic projects already operational

<table>
<thead>
<tr>
<th>Project</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1305 MW of hydroelectric dams in operation</td>
<td>1,305 MW</td>
</tr>
<tr>
<td>464 MW allowing storage through STEP (AFOURER)</td>
<td>464 MW</td>
</tr>
</tbody>
</table>

A huge development potential to exploit including the commissioning of a **128 MW** cascade hydraulic complex scheduled for **2024**

<table>
<thead>
<tr>
<th>Project</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMEZDILFANE</td>
<td>62 MW</td>
</tr>
<tr>
<td>TASKDERT</td>
<td>38 MW</td>
</tr>
<tr>
<td>TAJEMOUT</td>
<td>28 MW</td>
</tr>
</tbody>
</table>

- Project cost: 1.7 Billion DH
- Feasibility study in progress
• **Estimated needs** at about 5 bcm per year and power plant feed (3.5 bcm/year);
• 2700 MW then 3500 MW of combined cycles;
• Total investment amount: **$ 4.5 billion**;
• **Construction of a LNG port**, a regasification plant, combined cycle electric cycles (2,400 MW) and a **gas pipeline connecting the gas terminal** serving Casablanca, Mohammedia, Kenitra and the northern regions, planned for 400 km;
• A draft law concerning the activities of the gas sector is being prepared in consultation with the main operators of the sector (public and private).
## ENERGY SECTOR INVESTMENT BY 2030

<table>
<thead>
<tr>
<th>Sector</th>
<th>Investment (Billion US $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RENEWABLE ENERGIES</td>
<td>32</td>
</tr>
<tr>
<td>CONVENTIONAL ENERGY</td>
<td>9</td>
</tr>
<tr>
<td>LNG- OIL PRODUCTS</td>
<td>4.6</td>
</tr>
<tr>
<td>TRANSPORT AND INTERCONNECTIONS</td>
<td>1.1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>46.7</strong></td>
</tr>
</tbody>
</table>
II-Morocco, a strong interconnection

Electrical connection between Morocco and Portugal: (1000 MW)
- Commissioning: 1997
- Exchange capacity: 1400 MW
- Reinforcement of the line in 2006
- Commercial capacity: 900 MW
- ONEE 4th actor in the Spanish electricity market
- 3rd line under study

Electrical connection between Morocco and Spain:
- Commissioned: 1988
- Reinforcement by a line of 400KV in 2008
- Capacity: 1200 MW
- Exchange capacity: 1400 MW
- Reinforcement of the line in 2006
- Commercial capacity: 900 MW
- ONEE 4th actor in the Spanish electricity market
- 3rd line under study

Electrical connection between Morocco and Mauritania:
- Integration of West African power systems into the European network through the Morocco-Spain connection line
- Valorization of renewable energy sources in the region
- Encouraging the establishment of a regional electricity market
Morocco Hydrocarbons Sector
Hydrocarbons exploration: keys facts

- A very extended offshore domain:
  - 3,000 km coast line on the Atlantic and 500 km on the Mediterranean sea
- Large sedimentary basins of several geological and structural types:
  - Total surface area: 918,237 km² (Onshore & Offshore)
  - Total surface: 300,000 km² (to 4,000 m bathymetry), consisting of Mesozoic and Cenozoic sedimentary basins.
- But underexplored: 338 wells drilled.
- Fairly complex structural history since the Middle Jurassic breakup between the North American-African plates
- Deep objectives have not yet been tested
- Similar play concepts to Nova Scotia, West Africa and the Gulf of Mexico;
• Morocco shares analogue basins with many recent discoveries and with some of the biggest producing fields in the world.

• Continuity of the Algerian Triassic Province and the Saharan Hercynian platform in Eastern Morocco;

• Morocco is boarded by the Atlantic Meso - Cenozoic Passive Margin where big discoveries have been made (Nova Scotia and Gulf of Mexico);
Multiple proven Petroleum Systems Offshore and Onshore

- 920,000 km² of sedimentary basins with multiple identified petroleum systems ranging from paleozoïque to cenozoïque and proven source rocks;
- 800 identified prospects and leads offshore and onshore;
- More than 3000 km² Offshore domain on the Atlantic and the Mediterranean sea coastlines;
- Sedimentary basins in Morocco remain underexplored: Only 0.04 wells/100 km²;
- The prospects drilled so far showed hydrocarbon accumulations and discoveries that have proven their potential.
3 main producing fields:

- **Essaouira Basin onshore**: Meskala Gas and condensate;
- **Gharb Basin onshore**: Biogenic and thermogenic gas;
- **High Plateaus onshore (Tendrara)**: Natural gas

Multiple oil and gas shows offshore
Important Oil Shale Potential

Over 10 oil shale indications located in the Rif, the Atlas and the Southern provinces with two main fields:

- **Timahdit**: supplies evaluated at 15 billion barrels of oil;
- **Tarfaya**: supplies evaluated at 23 billion barrels of oil.

**3 MOU**: ZONATEC (Russia), GOS (UK) et GENERAL STRADE (Italy).
Shale Gas Potential

Third **largest opportunity in North Africa**

**4 Basins geologically favourable for shale gas resources:**

- Bas Draa-Zag
- Boudenib & Ouarzazate
- High Plateaux
- Tadla & Haouz

Total Gas reserves in place: **305.7 TCF**
Attractive Hydrocarbon Code and Fiscal Terms

- **Share of State interest:** 25% maximum.

- **Corporate tax:** Total exemption from corporation tax for 10 years.

- All equipment, materials, products and services required for the work are **exempt from customs duties and VAT.**

- Holders of an exploitation concession are **exempted from the tax of the patents, the urban tax.**

- **Tax exemption on the profits and dividends of the holders of an exploitation concession** and the shareholders of concessionary companies.

- **Low concession fees:**
  - Onshore and offshore at less than 200 meters of water depth: Oil 10%, Gas 5%.
  - Offshore at more than 200 meters of water depth: Petroleum 7%, Gas 3.5%.

- **Exemption from concession fee** for the first 300,000 Tons of oil or 300 million m$^3$ of gas produced onshore and in shallow waters and first 500,000 tons of oil or 500 million cubic meter of gas produced deep and ultra deep offshore for each exploitation concession.
ONHYM's Partners for Petroleum Exploration and Production

19 Partners of ONHYM on:
- 99 Exploration Permits
- 3 Reconnaissance contracts
- 9 Operating concessions
Total area: 170,002.72 km²

Open acreage
MOROCCAN SUCCESS IN THE ENERGY SECTOR

The national program of rural electrification (PERG)

The Energy strategy (energy mix)

A Knowledge in the Energy Projects by PPP

Expertise In the electricity network

Interconnection with europe and maghreb

South South Cooperation

Successfull experiences to share with african brothers countries

A proven leadership to support african energy transition
MOROCCAN ENERGY PARTNERSHIP
A HUB FOR AFRICA

Political stability
Infrastructures
Capital Trust
Geographical Proximity
Cultural Proximity
Sectorial Plans
Logistic

Energy:
Demonstrated achievements
Proven success

Morocco:
A Privileged gateway
to the Sub African countries
Africa Energy Potential

- Africa oil production represents 8.6% of worldwide oil production;
- 7.6% of world Natural Gas reserves in Africa;
- Half of oil production and third of Natural Gas production are exported;
- Sub-Saharan Africa has untapped renewable resources which could deliver levels of supply in excess of domestic consumption to 2040 and far beyond.
- According to EIA, 128 GW to 377 GW of new capacity from renewables is expected to be available in Africa by 2030;
Support for the development of the renewable energy sector across national borders

10 MoU in implementation in Sub-Saharan Africa by MASEN

- Nigeria
- Senegal
- Guinea Bissau
- Ghana
- Rwanda
- Tunisia
- Egypt
- Benin
- Burkina Faso
- Guinea
- Bissau
- Senegal
- Nigeria
- Ethiopia
- Djibouti
- Tanzania
- Rwanda
- Tanzania
- Zambia
- Madagascar
A policy of cooperation extended to 11 African countries

ONEE: leading the change in Africa through partnerships

The Office develops its expertise and improve public operators’ performance in sub-Saharan Africa, so they can achieve the MDGs.

The ONEE has signed cooperation agreements with several countries:

- **Senegal**: The ONEE signed a first contract for rural electrification concession covering the northern departments of Senegal and a second concession covering the departments of Luga, Kédémer LINGUERE North and Centre of Senegal.
- **Other countries**: ONEE operates in several countries within the African continent by providing technical assistance and expertise. These include Gambia, Sierra Leone, Mali, Mauritania, Chad, Niger and Cape Verde.
- **Regional Partnerships**: Electricity Branch of ONEE is a member of several regional and international organizations including: COMELEC, UPDEA, UAPTDE, MEDGRID, OME, CIGRE, UCTE, EURELECTRIC, MEDELEC.
Cooperation ONHYM-African countries
As of 31/12/2017, there are 13 cooperation agreements signed with 10 African countries.
Structuring project allowing:

- Accelerating West African Access to Energy
- Accelerating electrification projects for the benefit of populations
- Creation of a competitive regional electricity market
- Exploitation of clean energy
- Contribution to the industrial and economic development of all countries crossed.
- Emergence of an integrated North-West African zone
Morocco Nigeria Pipeline Project

Project progress

- Faisability study finalized in June 2018
- Choice of route: mixed onshore / offshore
- Ongoing preparation of a FEED
- Involvement of crossed states and ECOWAS, with the signing of memoranda of understanding and discussions with Turtle field operators of Senegal and Mauritania, and approaching European customers who are the most important potential Off-takers;
Conclusion

What Morocco has to offer?

▸ Dynamic energy sector;
▸ Growing local energy demand;
▸ Huge opportunities of investment;
▸ Favourable and attractive terms of hydrocarbons law;
▸ An easy place to operate;
▸ A gateway to Africa, Europe and Middle East;
▸ An exciting future...