

# Infrastructure development of Moroccan NP project. An INPRO methodology assessment

INPRO Dialogue Forum 8  
Vienna 26–29 August 2014

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# Outline

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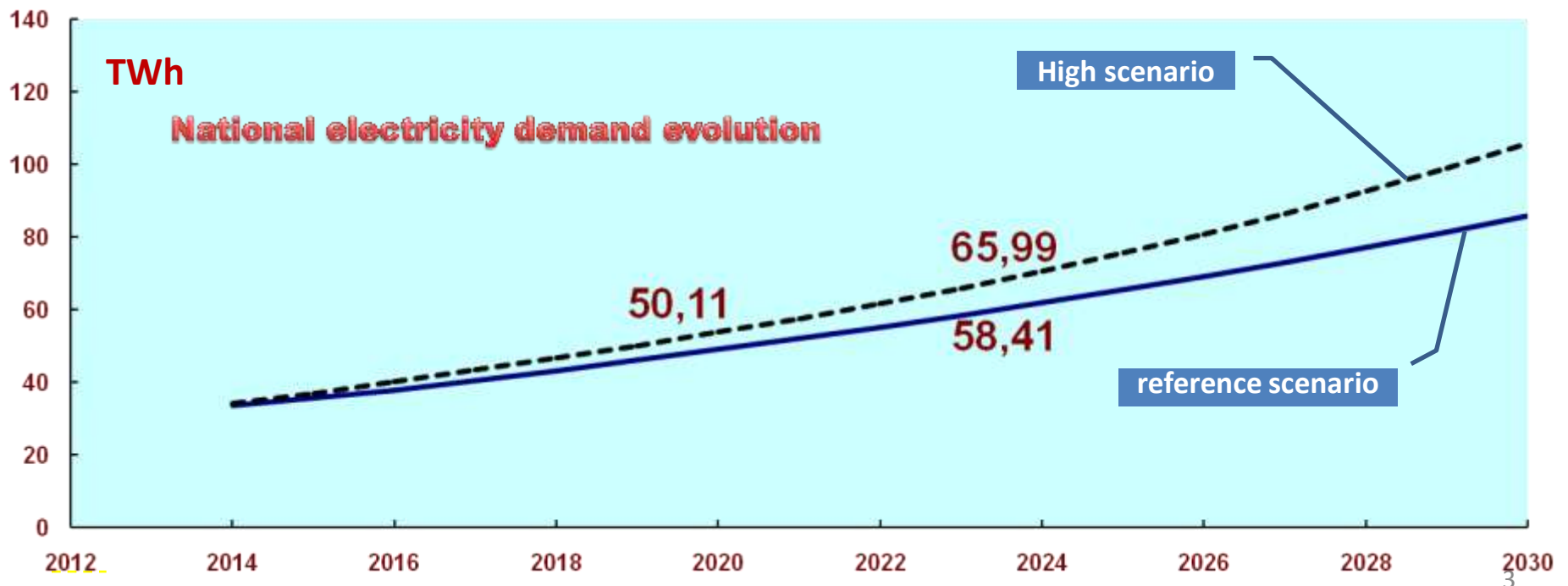
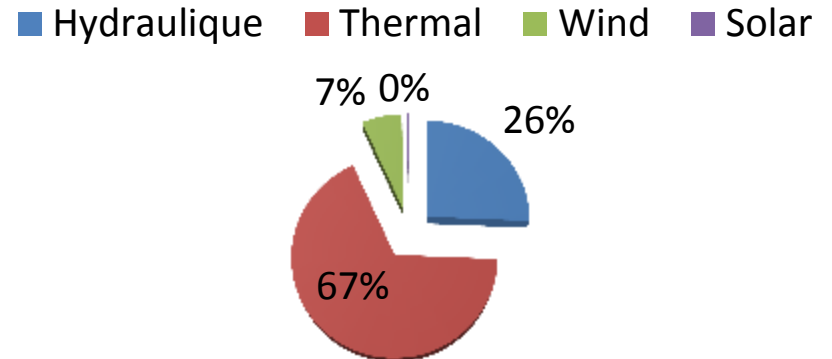
- **NATIONAL ENERGY CONTEXT**
- **CURRENT MOROCCAN N.P. P STATUS**
- **OVERVIEW OF NUCLEAR INFRASTRUCTURE STATUS N MOROCCO (INPRO METHODOLOGY)**

# National Electricity sector

## □ ELECTRICAL SECTOR : KEY FIGURES ( 2013)

- **Electrical installed capacity : 6892 MW**
- **Interconnection (Spain, Algeria): 18% of the demand**
- **2020's projections : 14500 MW**

## Installed Capacity (MW)



## Electricity sector in the new strategy

### □ PLANNING :

- **Medium term (2010-2020):** Very ambitious program to establish about 2000 MW power from Wind energy and 2000 MW from Solar energy.
- **Long term (2020-2030) :** alternative option; nuclear power, oil shale and biomass

# MOROCCAN NPP STATUS

## ❑ FROM 1984 TO 1995 :

THE FIRST FAISABILITY STUDIES (FS) FOR THE FIRST NPP HAS BEEN REALIZED WITH THE COLLABORATION OF FRENCH CONSULTANT SOFRATOME , IAEA AND NATIONAL ORGANIZATIONS

- ✓ *after exhaustive investigations and deep studies, selection and qualification of the NPP site “Sidi Boulbra” located at the atlantic coastal between Safi and Essaouira cities , 350 km in the south of Casablanca.*
- ✓ *Exhaustive studies of all NPP aspects and preparation of BIDS documents*

## ❑ 2003-2004 : UPDATING OF THE FS BY O.N.E.E TEAM WITH THE IAEA ASSISTANCE

❑ 2007-2008 : NON BIDDING OFFERS PROCESS REALIZED BY O.N.E.E (5 MAIN NPP SUPPLIERS HAVE PARTICIPATED AND SUBMITTED OFFERS ) + PREPARATION NEW BIDS DOCUMENTS (EPC, O&M, FUEL , PPA) WITH THE ASSISTANCE OF AN INTERNATIONAL CONSULTANT

## ❑ 2010 :

- ✓ UPDATING OF THE FS BY O.N.E.E TEAM
- ✓ IAEA MISSION ORGANIZED TO EVALUATE THE NPP PROJECT INFRASTRUCTURE USING IAEA MILESTONES APPROACH (“MINI” INIR)

❑ ON GOING: SETTING UP NEW LEGAL FRAMEWORK.

## UR1- LEGAL AND INSTITUTIONAL INFRASTRUCTURE

User Requirement 1	Criteria	Indicator (IN) and Acceptance Limit (AL)	Moroccan Status
<p><b>UR1- Legal and institutional infrastructure</b></p> <p><i>An adequate legal framework should be established to cover the issues of civil liability, safety &amp; radiation protection, environmental protection, control of operation, waste management &amp; decommissioning, security and no-proliferation</i></p>	<p>CR1.1</p> <p><i>Legal aspects</i></p>	<p>IN1.1 Status of legal framework</p> <p>AL1.1: legal framework established in accordance of international standards</p> <p><b>AL1.1 = ok</b></p>	<p>✓ A new National <b>Law</b> related to Nuclear Safety and Security has been <b>established</b> and <b>promulgated</b> in the last month .</p> <p>✓ The Law cover the aspects included in IAEA Handbook of Nuclear Law and described in INPRO methodology Infrastructure book (Evaluation Parameter EP1.1.1)</p> <p>✓ Signature of many International treaties and conventions on nuclear fields (NPT, IAEA safeguards, Nuclear safety, ...)</p>
	<p>CR1.2</p> <p><i>Institutions</i></p>	<p>IN1.2: status of state organisation</p>	<p>✓ The nuclear Law forecast the establishment of an independant and unique <b>regulatory body</b> to deal with nuclear safety and radiation protection activities</p>
		<p>AL1.2: state organisation established</p> <p><b>AL1.2 = not ok</b></p>	<p><b>After the Nuclear Law promulgation</b></p>

## UR2- INDUSTRIAL AND ECONOMIC INFRASTRUCTURE

User Requirement 2	Criteria	Indicator (IN) and Acceptance Limit (AL)	Moroccan Status
<b>UR-2 INDUSTRIAL AND ECONOMIC INFRASTRUCTURE</b>	CR2.1 Funding of infrastructure	IN2.1: Funding needed for the infrastructure of NPP project EP2.1.1: Industrial EP2.2.2: Government  <b>AL2.1 = ok</b>	<ul style="list-style-type: none"> <li>✓ There are some strong local industrial who are expected to participate in the NPP project if political decision is made (civil engineering, electrical, ..)</li> <li>✓ The government is expected to participate to fund infrastructure (under Turnkey or BOT project model)</li> </ul>
	CR2.2 NPP size	IN2.2: Nuclear facility size  <b>AL2.2 = ok</b>	<ul style="list-style-type: none"> <li>✓ the NPP size is expected to be between 1000 and 1200 Mwe/unit</li> <li>✓ The national grid could support this power</li> <li>✓ The grid is interconnected with Spain and Algeria</li> </ul>
	CR2.3 sitting	IN2.3: Process of sitting  <b>AL2.3 = ok</b>	<ul style="list-style-type: none"> <li>✓ The process of choosing and qualification of NPP site is already done (Sidi Boulbra site is qualified ). The site could withstand more than four NP units under the requested safety requirements.</li> </ul>
	CR2.4 Support infrast	IN2.4: Availability of infrastructure to support owner/operator <b>AL2.4 not ok</b>	Difficult to evaluate at this phase of the project
	CR2.5 Added value	IN2.5 Added value of NPP to society <b>AL2.5 = ok</b>	<ul style="list-style-type: none"> <li>✓ Expected to have added values (more labour work and jobs creation, raise the life of local communities, secure electricity supply,..)</li> </ul>

## UR3- POLITICAL SUPPORT AND PUBLIC ACCEPTANCE

User Requirement 3	Criteria	Indicator (IN) and Acceptance Limit (AL)	Moroccan Status
<p><b>UR-3: POLITICAL SUPPORT AND PUBLIC ACCEPTANCE</b></p> <p><i>Adequate measures should be taken to achieve and maintain public acceptance of NES being planned or in operation to enable government policy commitment to support the project</i></p>	CR3.1 Public information	IN3.1: Information on NPP provided to public  <b>AL3.1 = not ok</b>	✓ <b>The strategy of public information and acceptance is forecasted in the duties of the future National Safety Authority (Nuclear Law)</b>  <b>Not yet established</b>
	CR3.2 Public acceptance	IN2.2: Participation of public in decision making process  <b>AL3.2 = not ok</b>	✓ <b>Not yet established</b>
	CR3.3 Survey of Public acceptance	IN3.3: Public acceptance of NPP  <b>AL3.3 = not ok</b>	✓ <b>Not yet established</b>
	CR3.4 Policy support	IN3.4: Government policy regarding NPP  <b>AL3.4 = not ok</b>	✓ <b>Not yet established</b>
	CR3.5 Political environment and investor risk	IN3.5: Long term commitment to NPP  <b>AL3.5 = not ok</b>	✓ <b>Not yet established</b>



## UR4- HUMAN RESSOURCES

User Requirement 4	Criteria	Indicator (IN) and Acceptance Limit (AL)	Moroccan Status
<p><b>UR-4: HUMAN RESSOURCES</b></p> <p><i>the necessary HR should be available to enable all responsables parties involved in NPP to achieve safe, secure and economical operation of NES during its lifetime</i></p>	CR4.1 HRs	IN3.1: Avaibility od adequate HR to establish & operate NES	
		EP4.1.1: Educational and Training for Manpower nedded in NPP  <b>AL3.1: partialy ok</b>	<p><b>No specific nuclear energy diplomas are established in schools and universities. Only basic baground in nuclear physics in some universities.</b></p> <ul style="list-style-type: none"> <li>✓The Nuclear Research Center of MAAMORA (managed by CNESTEN) based on TRIGA Mark 2 Research Reactor have a fully equipped laboratories (environment, radioprotection, ...)</li> <li>✓The CNESTEN give training in radiation protection at African level with IAEA collaboration (AFRA)</li> </ul>
		EP4.1.2: adequate staff in nuclear institutions  <b>AL3.1: partialy ok</b>	<p><b>There are around 100 professional scientists and engineers having background in variety of areas related to nuclear power and nuclear techniques (the majority have diploma from abroad)</b></p> <ul style="list-style-type: none"> <li>➤ National Utility O.N.E.E (NPP team of 8 staff, some PhD and some engineers)</li> <li>➤CNESTEN (more than 170 scientist and technicians)</li> <li>➤Ministry of Health (staff responsible of radioactive sources control)</li> <li>➤Ministry of Energy and Mine (a few staff who deal with nuclear regulation, IAEA collaboration)</li> </ul>
		EP4.1.3: attractiveness of NP sector for future employees	✓ <b>not yet established</b>

## UR5- MINIMISATION OF INFRASTRUCTURE

User Requirement 5	Criteria	Indicator (IN) and Acceptance Limit (AL)	Moroccan Status
<p><b>UR-5: MINIMISATION OF INFRASTRUCTURE</b></p> <p><i>the necessary HR should be available to enable all responsables parties involved in NPP to achieve safe, secure and economical operation of NES during its lifetime</i></p>	<p>CR5.1 Personnel</p>	<p>IN5.1: Manpower needed for operation&amp;maintenace</p> <p><b>AL5.1: not ok</b></p>	<p>✓ not yet . But this aspect is linked to the degree of automatisisation of the chosen reactor technology and also to the owner organisation and project management (BOT contract is a likely to be more interesting for this aspect)</p> <p>✓ Hire for externe Maintenance and Heavy maintenace compagnies</p>
	<p>CR5.2 prefabrication</p>	<p>IN5.2: extent of components prefabrication</p> <p><b>AL5.2: not ok</b></p>	<p>✓ not yet. It depend on reactor technology (for example, the Gén III AP-1000 reactor is an interesting choise with regard to modular prefabrication aspect)</p>

## UR6- REGIONAL AND INTERNATIONAL ARRANGEMENTS

User Requirement 6	Criteria	Indicator (IN) and Acceptance Limit (AL)	Moroccan Status
<p><b>UR-6: REGIONAL AND INTERNATIONAL ARRANGEMENTS</b></p> <p>regional and international arrangements should provide options to enable a country to minimize the infrastructure investment</p>	CR6.1: options to reduce insitustional infr astructure	IN6.1:	<p><b>It depend on National policy (the size of NPP : 2 units or NPP multi units program ? ) and also the Project Organisation and Management model (tunkey ? BOT ?)</b></p>
	CR6.2: options to reduce industrial infr	IN6.2:	
	CR6.3: options to reduce social political infra	IN6.3:	
	CR6.2: options to reduce HR	IN6.4:	

## CONCLUSION

- Morocco presents proven strengths, including adherence to international commitments, the establishment of a new Nuclear Law , the availability of updated feasibility studies and Bids documents (EPC, O&M, Fuel, HMOC, PPA), the availability of a qualified site, electrical interconnexion with Europe, the existing of experienced nuclear research reactor center, ..etc.
- However, there are some gaps in infrastructure to support the development of a NPP, mainly the establishment of more strengthen human resources strategy, the development of public adherence to the project, the level of local industry involvement and localisation, ...etc.
- For some INPRO UR, it is difficult to quantify precisely the Acceptance Limit at this phase of the project because more details are not known yet , but just Planned
- A **INIR** Mission is planned to be organized in Morocco in 2015. The Moroccan “NEPIO” (called CRED) is working at the elaboration of the INIR input report.
- **Although the INPRO or Milestones Approaches give to MS a valuable indicators/criteria’s for the development of their first NPP, we shall not consider these criteria's as to see whether we pass a “test” ....**

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**Thank You**