CONSIDERATIONS OF SMR TECHNOLOGIES IN THE ALGERIAN ENERGY MIX

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ALGERIA STATUS

At present Algeria doesn’t have NPPs; however the country operates the following nuclear research installations:

• **Nur reactor**: 1MW, MTR-type, light water moderated pool reactor.
  
  First Operation in 1989, devoted to training and research.

• **Es-Salem reactor**: 15 MW, heavy water moderated, tank type reactor.
  
  First operation in 1992; devoted to materials testing, radioisotopes production and training of reactor operators.
USE OF NUCLEAR ENERGY

1. For electricity production

2. For sea water desalination

PROJECTED EVOLUTION OF ELECTRICAL ENERGY PRODUCTION

<table>
<thead>
<tr>
<th>Year</th>
<th>2011</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Production (GWh)</td>
<td>50968</td>
<td>63786</td>
<td>82502</td>
<td>109270</td>
<td>147648</td>
<td>240479</td>
<td>355995</td>
</tr>
</tbody>
</table>

increase rate ≈ 5% / year
NUCLEAR OPTION IN ALGERIA

- Algerian authorities did not plan to operate any NPP before 2035. However, they consider:
  - The clear demonstration brought by nuclear power as being a sustainable energy source for the production of sustainable electricity,
  - NPP potentiality for the production of large quantities of fresh water through nuclear seawater desalination,
  - The presence of natural resources of uranium in the Hoggar region (Tahaggart site),
  - The availability of basic nuclear infrastructures capable of reliably supporting the introduction of nuclear power in the country.
CONSIDERATION OF SMRs

• The consideration of SMRs by Algeria is based on their several advantages, offering solutions to relevant difficulties for the construction of NPP such as: site selection, transportation by inappropriate highway network to some sites, and lacks in the national heavy industry.

• Indeed, many actual SMRs, with their reduced power equivalent to conventional power plants, have a real ability to integrate the local electrical grid without exceeding 10% of its full capacity (which is recommended by the electricity regulator for conventional Power Plants and by the IAEA).
ALGERIA PARTICIPATION (1)

- IAEA INPRO SYNERGIES in 2013:
  Algeria participated in two subtasks
    - Scenario with SMR implementation
    - Scenarios with *non-electrical applications*

- IAEA RISC INPRO 2014-2016 (Review of Innovative Reactor Concepts for Prevention of Severe Accidents and Mitigation of their Consequences):
  Models of SMRs considered in the project: SMART (Korea), AHWR (India) and SVBR-100 (Russia)
ALGERIA PARTICIPATION (2)

• IAEA workshop «Considerations on design, technology and deployment of SMRs», Vienna, June 2014,

• IAEA INPRO dialogue forum on global nuclear energy sustainability; licensing and safety issues for small and medium size reactors (SMR), Vienna, July-August 2013,

• IAEA technical meeting: Operating Fundamentals of Pressurized Water Reactor (PWR)-Type Small and Medium-Sized Reactors (SMRs), Islamabad, Pakistan, May 2014.
SMR DEFINITION

• “Small and medium sized reactors (SMRs) include a large variety of designs and technologies and in general, consist of:
  - advanced SMRs, including modular reactors and integrated PWRs;
  - innovative SMRs, including small-sized Gen-IV reactors with non-water coolant moderator;
  - converted or modified SMRs, including barge mounted floating NPP and seabed-based reactors;
  - conventional SMRs, those of Gen-II technologies and still being deployed.

• Advanced SMRs having an equivalent electric power of less than 700 MW(e) or even less than 300 MW(e). “

(IAEA, SMR Booklet, 2014)
TYPES OF SMR

SMRs

- Heavy-water cooled SMRs
- Liquid metal cooled fast SMRs
- Gas cooled SMRs
- Light water cooled SMRs
HEAVY WATER COOLED SMRs

(H.Subki, IAEA)
LIGHT WATER COOLED SMRs

(CAREM-25, Argentina)
(IMR, Japan)
(SMART, Korea, Republic of)
(VBER-300, Russia)
(WWER-300, Russia)
(KLT-40s, Russia)

(mPower, USA)
(NuScale, USA)
(Westinghouse SMR, USA)
(CNP-300, China, People Republic of)
(ABV-6, Russia)

(H. Subki, IAEA)

Technology Assessment of SMR for near term deployment - IAEA-Tunis, 2-5 October 2017
LIQUID METAL COOLED FAST SMRs

(H.Subki, IAEA)
GAS COOLED SMRs

(H.Subki, IAEA)
SMRs CHARACTERISTICS

- Modular products
- High proportion of prefabricated parts and in-plant fabrication
- Simplification of systems
- Standardized components.
- Reduced construction time.
- Flexibility in site selection.
- Long-term storage of spent fuel.
- Analysis of acquired experience.
ADVANTAGES OF SMRs

- Possibility of installation in remote areas.
- A modular design that allowed ease construction and reduce the preparation time on site.
- Long life service of fuel (10 - 15 years)
- Simple design and high safety.
- Low cost of initial investment.
- More potential location options suitable for SMRs.
- Low operating costs and maintenance.
SOME CHALLENGES FOR SMRs

- Financing
- Competitiveness
- Supply chain
- Proliferation resistance
- Licensing and regulatory issues
THANK YOU FOR YOUR ATTENTION!