

Outlook of Nuclear Energy in Algeria

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Abstract. The recent technological advances in the field of nuclear power plant design together with the strong and continuous increase in the price of oil and gas are making the option of using nuclear energy for the production of electricity and water desalination a very attractive alternative to be included in the energy mix of many developing countries.

The recovery of the economy and the continuous increase in the demand for electrical energy together with the existence of non negligible basic nuclear infrastructures have prompted the Algerian government at considering the construction of a first nuclear power plant by the year 2022.

1. INTRODUCTION

The interests of Algeria in nuclear energy and its peaceful applications go back to the early seventies when a consistent program for training engineers and scientists in nuclear engineering was set up. Opportunity and feasibility studies for the construction of a nuclear power plant were conducted between 1975 and 1984 with the collaboration of IAEA (Austria), Lahmeyer-International (Germany), Sofratome (France) and Nucleotec (Canada). In parallel extensive efforts were made in the field of Uranium exploration and prospection.

In 1982 the 'Commission of New Energies' was created and undertook major actions that led to the implementation of basic nuclear infrastructures (nuclear research centers, research reactors, etc). The Chernobyl accident of 1986, the drastic drop in the price of petroleum and the economic recession that affected the country during the nineties strongly slowed down the progress of the Algerian nuclear program.

The recovery of the economy and the strong increase in energy demand for the production of electricity and sea water desalination gave renew of interest in the nuclear option and prompted the creation of the 'Commission of Atomic Energy' in 1996 and its subsequent merging into the Ministry of Energy and Mines in the year 2006.

The past three years witnessed very noticeable progress in major fields aimed at the energy planning and the preparation of basic tools for the introduction by the year 2022 of a first nuclear power plant in the national energy grid.

2. PRESENT STATUS

2.1. Nuclear power plant operation and construction

At present, Algeria does not have nuclear power plants in operation or under construction. The country operates however the following main nuclear installations:

- The Nur Reactor: it is a 1MW, MTR fuel, light water moderated, pool type reactor. The reactor started operation in 1989 and it is devoted for operator training and research in nuclear sciences and technology and techniques.

- The Es-Salem Reactor: it is a 15MW, heavy water moderated, tank type reactor. The reactor started operation in 1992 and is devoted to the testing of materials and radioisotopes production.
- The Nuclear Fuel Fabrication Pilot Plant: the plant started operation in 1999 and is aimed at the development of rod and plate type nuclear fuel elements.

2.2. Public Opinion

- At the present time the general public has little knowledge about nuclear energy and no serious evaluation of public opinion on nuclear issues has been yet conducted. However, spot surveys on the populations living around the existing nuclear installations indicate that the perfect safety record demonstrated by such installations and the contribution of these installations in improving education and employment conditions in the area led to a relatively good acceptance of nuclear energy.
- Specific strategies are slowly implemented for driving more public and governmental acceptance of nuclear energy (through the use of effective communication tools, the establishment of continuous and dynamic linkages with the mass media and the saturation of the various publics with desirable positive information).

2.3. Forward Plans

The clear demonstration brought by nuclear power as being a sustainable energy source for the production of clean and relatively cheap electricity and its tremendous potential for the production of large quantities of fresh water through seawater and brackish water desalination, together with the presence of non negligible natural reserves of uranium in the Hoggar region (Fig. 1) and the availability of basic nuclear infrastructures capable of supporting reliably the introduction of nuclear power in the country, have prompted the Algerian authorities to plan the operation of a first nuclear power plant by the year 2022.

In this respect several multidisciplinary working groups are now activating on:

- Energy planning issues,
- Preparation of basic tools for the introduction of nuclear power plants in Algeria,
- Implementation of nuclear seawater desalination in Algeria
- Improvement and valorization of national uranium resources

3. GOVERNMENTAL ORGANIZATIONS FOR NUCLEAR ENERGY:

3.1. *Commissariat à l'Energie Atomique, COMENA (Commission for Atomic Energy), Algerian Ministry of Energy and Mines*

- COMENA constitutes the principal governmental agency for the implementation of the national policy in matter of promotion and development of nuclear power and nuclear techniques.
- COMENA develops skills and infrastructures in nuclear fuel, in the technology of nuclear facilities and in the application of nuclear sciences and techniques for energy, health, industry, agriculture, environment

To help achieve its objectives COMENA has four research centers:

- The Algiers Nuclear **R**esearch Center (CRNA)
- The Birine Nuclear **R**esearch Center (CRNB)
- The Draria Nuclear **R**esearch Center (CRND)
- The Tamanrasset Nuclear **R**esearch Center (CRNT)

3.2. Direction de l'Energie Nucléaire, DEN (Direction of Nuclear Energy)

DEN is a newly created structure (September 2007) within the General direction of energy at the Algerian Ministry of Energy and Mines. The main role of DEN is:

- To define the national policy in matter of nuclear electricity production and to follow up its implementation
- To define the national policy in matter of nuclear applications and to follow up its implementation,
- To elaborate the regulations in the field of nuclear security and safety and to enforce their application,
- To insure the follow up of nuclear cooperation

3.3. Ministry of Higher Education and Scientific Research (MERS)

- This ministry has under its authority all public universities. A large number of these universities give specialized courses in nuclear physics and radiations.
- The USTHB University in Algiers, in collaboration with COMENA, offers a two-year nuclear engineering program for engineers graduating in physics and a two-year medical physics program for Master degree students.

4. NATIONAL NUCLEAR POLICIES

Although Algeria is an oil and gas exporting country, acute problems raised by climate changes and the rapid depletion of fossil resources together with the quick rate of increase observed in domestic demand for electrical energy (Table-1) have prompted the government to pay high attention to the issue of energy security of the country.

Table 1. Expected evolution of electrical energy production and installed capacity

Year	2007	2012	2017	2022	2027
Production (GWh)	38223	59190	82025	104687	133610
Installed Capacity (MW)	8006	12326	16526	21092	26919

Several strategic decisions were taken:

- The opening of the electric energy market to the private sector (national and international).
- The introduction of specific taxes on environment polluting fuels (such as gas oil ...)
- The encouragement of extensive developments of renewable energy alternatives (essentially solar and wind), (FIG.1),
- The implementation of the nuclear power alternative in the energy mix of the country (both for electricity production and seawater desalination).

With respect to this last point, it expected that the base load in the national electric generating capacity, for the period 2030 – 2050, will rely on nuclear. Recent studies indicated the need to put in operation a first nuclear power plant (capacity \approx 1200 MWe) by the year 2022 (Table-2).

In order to support the program several actions are actually in progress:

- The promulgation of the 'National Nuclear Law'
- The creation of the 'Nuclear Regulatory Agency',
- The finalization of the ratification and implementation of all pertinent international and regional conventions and treaties,
- The creation of the 'Algerian Institute of Nuclear Engineering'

- Enlargement and valorization of the national potential in uranium resources,
- The preparation of an adequate national potential (industrial sectors, human resources, ...) capable of playing an optimal role in the technical definition, acquisition, construction and operation phases of the first nuclear power plant
- The increase of the awareness of the public and local authorities on nuclear issues and on the benefits obtained from the peaceful uses of nuclear energy.

Table 2: Evolution of the contribution of Nuclear power in the production of electricity

Year	2007	2012	2017	2022	2027
Total installed capacity (MW)	8006	12326	16526	21092	26919
Nuclear installed capacity (MW)	0	0	0	1200	2400
% Nuclear in installed capacity	0	0	0	6%	9%
% Nuclear in production	0	0	0	9%	14%

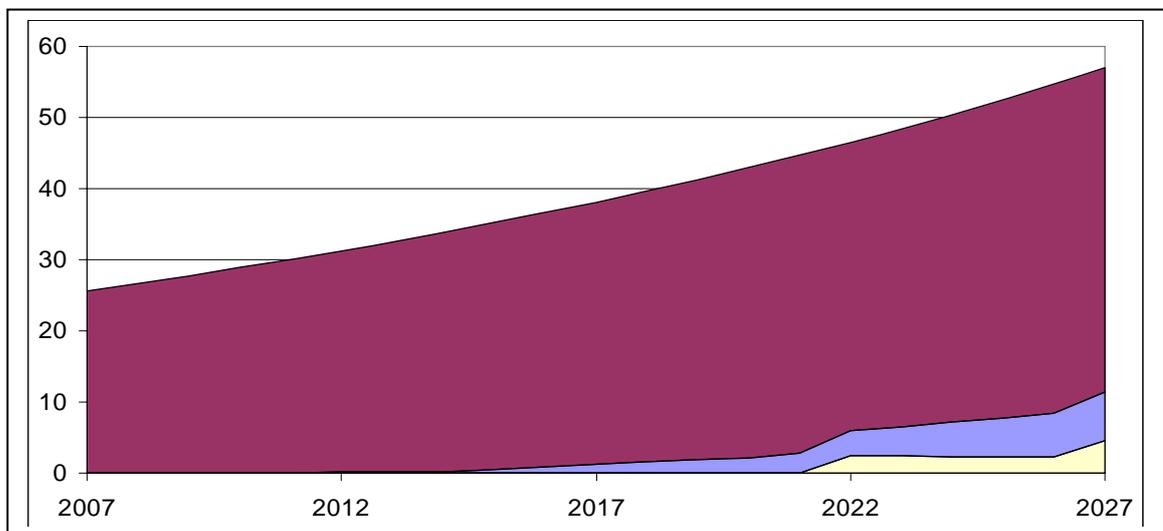


Fig. 1. Estimated contribution (in MTEP) of renewable energies (blue) and nuclear power (yellow) in the national energy mix for the period 2007-2027

5. INTERNATIONAL COOPERATION:

Algeria has the firm conviction that the international cooperation in the field of the pacific utilization of nuclear energy is the key for a successful implementation of a national nuclear power program.

In this context, Algeria has ratified or signed seven conventions in relation with non-proliferation, safeguards and nuclear safety and security issues.

Algeria has an excellent cooperation program with IAEA. Technical assistance of IAEA in various fields of importance for the introduction of nuclear power for electricity production and seawater desalination is in progress.

In addition to the collaboration agreements with its classic partners (China and Argentina), Algeria signed nuclear cooperation agreements with France, South Africa, United States...