

The Sixth Arab Forum on the Prospects of Nuclear Power for Electricity Generation and Seawater Desalination

Cairo, Egypt: 6-8 / 12/2022

Research Reactor Project in Sudan

Presented by;

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Dec 2022.

Historical Background

The IAEA and the Government of Sudan have started in **2007** the Project **SUD/0/011**, intended to support Sudan to determine the optimal energy generation mix up to the year **2030**, including the potential for nuclear electricity generation. The Project aimed to help Sudan to prepare a Strategic Report, which includes the necessary preparations for the proper infrastructures required for introducing the first nuclear research reactor.

Historical Background

When it became clear that Sudan was embarking on a nuclear program, Sudan Atomic Energy Commission (SAEC) started two initiatives steps to assist Sudan in its plan to introduce nuclear program:

1/ Encouraging Sudan University of Science and Technology (SUST) to establish a Department of Nuclear Engineering.

2/ Contacting the Ministry of Science and Technology (MST) for the establishment of a Nuclear Research Reactor.

Historical Background

SUST managed to establish the Department of Nuclear Engineering in **2009**, with admission of 30 students. The first batch of nuclear engineers was graduated in September **2014**. latterly SAEC and ME take a decision about employing this batch to support their nuclear programme.

Actions taken by SAEC

As for the Research Reactor, a **Technical Committee** formed by SAEC recommended the establishment of a low power (**30 kW**) research reactor type miniature neutron source reactor (MNSR), produced by China, and already established in Ghana, Nigeria and Syria.

A **Steering Committee** formed by the MST approved the establishment of the MNSR reactor, to be followed later on by a **5MW** Multi-Purpose Research Reactor.

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The Steering Committee prepared a concise strategic plan for the MNSR that was sent to the Government for approval and urged SAEC to contact the IAEA for technical assistance for such a reactor.

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The CNNC promised to assist in granting Sudan a loan by the Chinese Government for the purchase of the MNSR and recommended signing an Agreement between the two governments as soon as possible. (in our plan making refresh for this agreement).

A visit was conducted by SAEC team to China in 2010, and was signed with the CNNC organization (manufacturer of the MNSR).

Sudan Research Reactor Project

- SAEC prepared a Research Reactor Project Plan and submitted it to the IAEA.

The aim of the Project was to achieve the following objectives:

- Strengthening the infrastructure for nuclear science and technology in the country.
- Providing technical facilities in the form of equipment and research tools to support higher studies, research, training and applications in nuclear science and technology for the benefit of Sudanese universities and scientific research centres.

- Providing training tool for manpower required for the management, operation, safety and security of the nuclear power reactor for electricity production, where preparations for its infrastructures were already under consideration by the Ministry of Energy and Mining, in collaboration with SAEC.
- Introducing neutron activation analysis applications in several fields, including geology, agriculture, industry, medicine and environmental studies. Production of some short-lived radioisotopes for some applications, including NDT.

Proposed Research Reactor Activities

- Training of engineers, scientists, regulators and technicians on operation, utilization and maintenance of the nuclear research reactor.
- Training of engineers and scientists on the research reactor construction, on required civil works for the associated laboratories, on procurement of the MNSR reactor and on its installation and commissioning procedures.

- Training on procurement of needed nuclear capabilities around the reactor, such as tools for neutron activation analysis, experiments on safety, reactor physics and nuclear engineering.
- Training on procurement of experimental facilities for undergraduate students practical and projects as well as facilities for post-graduate studies and research.

Research Reactor Stakeholders

- Universities.
- Research centres.
- Ministry of Water Resources and Electricity.
- Ministry of Industry
- Nuclear Medicine Diagnostic & Therapeutic Centers.
- Food security, water and environment sectors.
- Mining sector.
- Oil sector.
- And others.

Stakeholders Needs

- Education and training for the different universities colleges, institutes and the research centers.
- Short and medium half-lives radioisotopes production for private and governmental medical centers
- Producing radioisotopes that used in the NDT petroleum companies.
- Neutron activation analysis NAA,
- and others.

IAEA Technical Assistance

- The IAEA sent a FFM in April 2010 under Project SUD 4008 to give guidelines and questionnaires to complement the Terms of Reference which define the scope of work that Sudan has to undertake to meet the objectives of implementing the first research reactor in the country.
- The IAEA then approved the Project SUD 1006 which included funds for training of SAEC staff in the field of research reactors.

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- Under the Project SUD 1006 the IAEA trained more than 20 members of SAEC and the Regulatory Body staff in the various fields of research reactors.
- However, the efforts for the implementation of the MNSR research reactor could not move forward as was planned.
- Various reasons could be blamed for that, mainly due to economic difficulties following the separation of South Sudan and brain drain of qualified staff.

Current Status

The work was stopped due to Sudan economical problems until the last expert mission had been held in Khartoum on Jan 2015 . And the project has been extended for one year more to finish the feasibility study. As IAEA know the changing of the general director of SAEC on March 2015, as a result of this the RR team was reformulated on April 2015, consists of 9 persons.

The work was stopped again due to political and economic status of Sudan , hopefully to re start again soon next year

Nuclear Desalination

- Nuclear desalination is defined as the production of potable water from seawater in a facility in which a nuclear reactor is used as the source of energy (thermal and/or electrical) for the desalination process.
- Desalination plants in nuclear installations are a feasible and already mature technology which can be beneficial for many regions worldwide.

Why Nuclear Desalination in Sudan?

- Red Sea is one of the 16 states of Sudan. It has an area of 212,800 km² and an estimated population of 1,482,053 in 2018. The Red Sea Coast located in the east of the state.
- Most of people there are suffering from availability of potable water; Khor Arbaat is the main source of water supply for Port Sudan City, which originates from the Red Sea Hills and empties its water into the Red Sea Coast.
- Regarding to this nuclear Desalination of red sea water is more justified to use in Sudan in order to solve the problems of potable water in this state.



Thanks