# status of national nuclear energy programme IN MONGOLIA

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**Abstract**

Mongolia has a lot of potential for renewable energy. Addressing national energy security, Mongolia’s Long-term Development Policy, Vision 2050, aims to become self-sufficient in energy production and addresses nuclear energy topics. It is necessary to introduce a range of new energy sources, such as coal-fired and renewable energy sources, to meet demand and expand installed capacity to sustain economic growth and efficiently implement this policy.

Currently, Mongolia imports about 20% of its electricity supply from neighbors, and 80% of that electricity comes from domestic energy sources, such as coal (about 80%), wind (10%), solar (5.8%), and hydro (1.7%), respectively. Since the country needs to transition its energy mix into a green energy mix, the Government of Mongolia issued a joint order to establish a working group to study the possibility of using nuclear power in Mongolia.

A working group determined that, due to Mongolia's sparse population, vast landmass, and low energy consumption, the use of an SMR is a potential alternative to diversify energy sources and provide stable electricity, which is reflected in the preliminary report that covers the necessary activities and studies to be executed, including but not limited to the establishment of NEPIO and the preparation of a pre-feasibility study.

## INTRODUCTION

Nuclear power is bound to be one of the most vital clean energy sources due to increasing energy demand and curbing carbon emissions to tackle climate change despite its complications, including its cost-effectiveness compared to other energy sources and the fear of nuclear accidents like the Fukushima Daichi in 2011.

A decade ago, Mongolia was emerging as a fast-developing country in the region thanks to cooperation with investors to develop mega projects like the Oyutolgoi copper mine and the Tavantolgoi coal mine, which contribute immensely to the country’s economy, and needed to install new energy sources to meet emerging demand related to the surge in mining sectors and the country’s socio-economic development. Regrettably, no major energy sources were introduced except a few hundred megawatts of renewable energy sources into the energy mix post-Fukushima accident.

The energy sector of Mongolia consists of four independent electric power systems. Currently, Mongolian installed capacity for energy is 1.6 GWe, with 80 percent of electricity coming from domestic energy sources, including coal, wind, solar, and hydro, and 20 percent from neighboring countries. The yearly incremental rate of energy demand is about 6–7%, depending on economic development, and the country barely fills the gap. Currently, all 21 aimags and 318 soums are supplied by centralized energy sources, while 15 soums are supplied from renewable sources and other hybrid systems. Expected electricity demand is going to be 3.5 GWe by 2030, according to the Ministry of Energy. One of the key policy documents in the energy sector is a ”Program on Integrated Energy System of Mongolia” and “The Comprehensive Policy on National Development,"  where concrete short-term and long-term strategies for the development of the energy sector are guided [1]. Looking ahead, the Mongolian Ministry of Energy will be working towards conducting a well-grounded estimate and revision of the energy consumption rate, drafting an action plan based on these data, providing financial and economic opportunities to build new sources of energy supply networks, and developing energy sector, supporting the construction of new energy supply networks by the private sector, developing the legal environment of energy prices and tariffs, and developing a public-private sector partnership, developing and expanding power line networks under the review of the Government in accordance with the consumption and energy supply sources projections, and increasing the efficiency of the energy sector, providing its financial sustainability, implementing economically feasible regulations, and fully transferring the energy sector and prices to market regulations.

A study on the possibility of using nuclear power in its energy mix to address energy demand and ensure the security of energy supply in line with worldwide initiatives to overcome climate change and sustain the economic development of the globe is being conducted. Taking the nuclear power program forward is a complex issue for beginners due to insufficient knowledge, limited human resources, public awareness of radiation safety, waste management, and environmental issues that were somehow related to nuclear accidents in the past. In this regard, a constructive approach from the government is needed to implement a successful nuclear power program.

Mongolia is focusing on the potential megaprojects that will lead the country to meet its energy demands and support energy security issues. To achieve this goal, the government is seeking solutions to intensify the development of infrastructure, improve the business environment, and take other respective measures, such as improving public acceptance of the nuclear power program.

## STATE POLICIES ON NUCLEAR FIELD

The Parliament of Mongolia endorsed the State Policy on Exploitation of Radioactive Minerals and Peaceful Uses of Nuclear Energy in 2009 and subsequently adopted the Nuclear Energy Law in the same year. The state policy emphasizes the following five objectives:

(a) Exploitation of radioactive minerals;

(b) peaceful uses of nuclear energy as electricity generators;

(c) Introduction of nuclear technologies and;

(e) ensuring nuclear and radiation safety, and

(f) safeguards obligations.

The implementation of the State Policy is not going as planned due to challenges related to public awareness and global energy policy trends in the past.

According to the Nuclear Energy Law, the Nuclear Energy Commission (NEC) is the head body in the nuclear energy field and is responsible for the coordination and formulation of all activities embedded in state policy, including the development of science and technology, human resources in the nuclear field, exploitation of radioactive minerals and nuclear energy applications, radiation protection and nuclear safety, and promotion of the nuclear energy field within the territory of Mongolia, as well as the implementation of international treaties and conventions on nuclear issues. The NEC issues licenses on nuclear material issues and nuclear facilities. It also adopts and endorses general nuclear and radiation safety regulations and rules on the exploitation of radioactive minerals, radiation applications, and nuclear energy, as stipulated in the Nuclear Energy Law.

Moreover, the development of the field is also stipulated in Mongolia’s Long-Term Development Policy, “Vision 2050,” which is adopted to have a better policy formulation for sustainable development goals. To narrow the long-term development policy and overcome the challenges that emerged after the pandemic, the Parliament adopted another key document, the “New Revival Policy," which focuses on 6 key areas, including the country’s energy sector. In these policies, the introduction and use of carbon-free energy sources are highlighted. To address complications and energy demand the Ministry of Energy proposed implementing 23 projects with a budget of MNT15.5 trillion in the near future to not only introduce energy sources in coal and renewables but also expand current power stations and modify and build new transmission lines.

## Activities of a working group

To fulfill the objectives of Vision 2050 and the New Revival Policy, as mentioned above, the Cabinet of Ministers issued a minute to determine the nuclear power policy and to develop a report on “The study of the possibility of using nuclear power." Based on this minute, a joint order was approved by the Minister of Education and Science, the Minister of Energy, and the Minister of Mining and Heavy Industry, with a Working Group comprising 13 organizations, including ministries, agencies, academic institutions, and research centers, in August 2022.

The Working Group completed an evaluation of 19 issues of the nuclear power infrastructure development of the International Atomic Energy Agency (IAEA) and developed a draft roadmap for the nuclear program of Mongolia in cooperation with the IAEA. It was achieved through the preparation a preliminary report that contains packaged information and suggestions regarding the actions and studies to be executed in all nuclear power infrastructure development issues and the formation of a Nuclear Energy Programme Implementation Organization (NEPIO) under the relevant authorities. Through the preliminary report, the Working Group highlighted and identified major activities where Mongolia needs to obtain support from the IAEA to evaluate and review national infrastructure, particularly in nuclear emergency preparedness, site selection, reactor technology, electric grid evaluation and expansion, waste management, HRD, and regulatory aspects. The Working Group also identified activities the organization performs themselves and with the support of other partners, finalized a preliminary report, and submitted it to the NEC’s meetings and the Council of Ministers of Energy.

In a chain of these activities, a RoadMap of Nuclear power programme was prepared under the support of the IAEA and in it the Working Group plans to complete Phase 1 in 2–3 years to obtain the political decision [2].

A strong and continuous government commitment is vital for any nuclear power program. Therefore, good planning and a roadmap, as well as a competent and powerful NEPIO with sufficient budget and support from all stakeholders, will play an important role in a successful program. The Working Group’s recommendation is to establish the NEPIO under the competent authority, possibly under the NEC, and to prepare a comprehensive report with a pre-feasibility study in 3 years, followed by a decision by the government to conclude Phase 1 of the IAEA’s Nuclear Power Infrastructure Development Milestones.

Mongolia aims to study the roles and responsibilities of operator companies, vigorous responsibility and involvement of the Department of Nuclear Radiation Inspection of the Ministry of Science and Education of Mongolia as the regulatory Body, and explore possibilities to work and cooperate in the nuclear power field to execute activities of the Phase 1.

Implementing a megaproject such as this one, requires strong government commitment, competent and skilled project leaders, active involvement of all stakeholders, effective management and coordination, as well as international cooperation.

##  CHALLENGES

There are still many challenges associated with the development of the energy sector including nuclear in Mongolia. These include the investment, old transmission lines, electricity tariffs, aging the fleet of coal-fired power stations as well as the absence of adjustment power stations in peak times, like hydroelectric power stations. To address short-term energy demand, the government is installing batteries, expanding the current energy system, and promoting private investments in coal and renewable energy sources, for example, coal-based 300MWe Buuruljuut, 450MWe Tavantolgoi (state-owned), 400MWe Baganuur, solar based 4 stations with the capacity 10MWe at 4 sites in the western part, hydroelectric 90MWe Erdeneburen and 315MWe Egiin gol project (under study).

In nuclear, comprehensive comparative studies against other electricity sources such as coal and renewable energy have not been conducted yet moreover, Mongolia has no experience and knowledge in running nuclear facilities and nuclear material-related activities. On top of that, public acceptance is a key issue, followed by infrastructure, including the legal and regulatory environment linked to nuclear power, a relevant development of skilled workforce and economic capacity as well as the industrialization of the country.

Almost a hundred years have passed since the discovery of uranium and its applications to nuclear energy. Ensuring radiation safety is a crucial matter in the peaceful use of nuclear energy due to the fear of nuclear radiation that has arisen concerning WWII and major nuclear incidents. Increasing nuclear applications in line with socio-economic and energy demands means the newly discovered uranium mining deposits need to be put into economic circulation.

In recent years, besides the agricultural sectors, Mongolia is attempting to develop major mining projects for their potential benefits to economic growth, including grazing livestock. In addition, it is necessary to maintain a balanced ecology and appropriate policies at the same time.

Public perception of nuclear power became strongly negative after the nuclear accident in Japan. Accordingly, activities spreading negative messages through the media and social networking sites were vigorously conducted with the foundation of some anti-nuclear non-governmental organizations.

As per request by the NEC, the Nuclear Research Center of the National University of Mongolia conducted a public opinion survey covering 1599 citizens of the provinces of Darkhan-Uul, Orkhon, Dornod, Dornogobi, Zavkhan, and Khovd in 2015 within the framework of the implementation of state policy and observation of public opinion on the nuclear field.

According to the survey, the most reliable providers of information on nuclear energy and safety were the NEC (45% in 2011, 41% in 2015), scientists (39% in 2011, 31% in 2015), and journalists (50% in 2011, 30% in 2015). As a result, the public began to trust experts more than journalists, with the NEC being the foremost organization regarding nuclear information and awareness. In addition, at the request of the Nuclear Energy Commission, the National Center for Disaster Management surveyed 643 citizens residing near radioactive mineral deposits in the provinces of Dornogobi, Dornod, and Arkhangai in 2015. The result showed that 20.2% supported radioactive mineral mining, 27.5% opposed, 23.4% had no opinion, and the remaining said extraction is hazardous and the resources should be saved for the future. The survey also showed that the public has poor knowledge of radioactive minerals, and it was also observed that they tend to receive biased information from certain media outlets.

The general public's acceptance of radiation varies with each country. Generally speaking, no country’s policy has indeed achieved wide acceptance of nuclear energy worldwide. As for Mongolia, fear of radiation has been strongly instilled in the minds of people since the Chernobyl disaster and has been a major challenge to overcome. Even in uranium mining issues, people fear radiation-associated risks, which are different from those related to nuclear power plant accidents.

Thus, there is a substantial necessity to deliver scientific and factual information, and government policies, establish an information center, and update secondary school curricula in Mongolia.

## CONCLUSIONS

Mongolia is prospering with a rapid advancement of realization of its vast mineral resources and socio-economic development in the region and exploring the energy supply options to sustain and provide clean and affordable energy to economic development and to ensure its energy security.

Mongolia is carrying out preparatory work to launch the basic studies stipulated in the IAEA’s nuclear power infrastructure development milestones to implement Phase I. In this regard, cooperation with the IAEA as newcomer countries is essential to the development of a nuclear power program and its successful implementation.

In the beginning stage, the government of Mongolia established the Working Group to study the possibilities of using nuclear power in the country and determine a policy to implement. Under the IAEA’s nuclear power infrastructure development guidance, the Working Group studied the IAEA’s documentation and the lessons learned from the developed countries and prepared the Preliminary report which contains several topics to be considered, including a formation of NEPIO, preparation of a Preliminary Feasibility Study and executions of basic studies over the infrastructure 19 issues.

 Based on the comprehensive knowledgeable results, the excellent and tireless effort to establish NEPIO, and strong government commitment, Mongolia will be deciding on the use of nuclear power in the near future. In this regard, the economic aspects of the country, the development of infrastructure, institutional capacity, and competency, the transparency of the policy, procedures, and activities, public perceptions, and social licensing are keys to the successful implementation of projects.

## Further information

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