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TURKEY's THORIUM STRATEGY:
Devising A New Nuclear Path In A Developing State

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ABSTRACT

Turkey is a fast developing country with associated needs of energy and technology. Accordingly, Turkey has recently launched its nuclear program in collaboration with Russia and Japan for the construction of two nuclear power plants based on uranium technology. On the other hand, interest in thorium technology with the prospective use of Turkey's indigenous thorium reserves has also emerged in the Turkish energy bureaucracy and academy. This study addresses the causes of Turkey's preliminary steps to devise a new nuclear path, identifies the setbacks in this endeavour, and discusses their implications with reference to Turkey's nuclear energy and technology policies.

INTRODUCTION

Turkey's energy demand is increasing very fast as it has a developing economy and an increasing population. Until very recently, Turkey's electricity demand has doubled in every 10 years approximately. As of October 2015, installed power in Turkey is around 72.000 MW.[1] However, Turkish Ministry of Energy and Natural Resources (MENR) expects that the country will have at least 500.000 GWh electricity demand with a need of 100.000 MW installed power capacity in 2023.[2] On the other hand, Turkey is a very poor country in terms of fossil fuels. As a consequence, Turkey's import dependency is 92%, 99% and 20% in oil, natural gas, and coal, respectively[3]. These figures made Turkey the sixth and the eighth biggest global importer of natural gas and coal in 2013, respectively[4].

Therefore, Turkey has increased its efforts to construct its first nuclear power plant (NPP) and signed an intergovernmental agreement with Russia in 2010 for constructing, operating and decommissioning Akkuyu NPP (4800 MW), in the city of Mersin. A similar agreement was signed between Turkey and Japan to build the second NPP in the city of Sinop, in 2013. The two projects are estimated to cost $40 billion. This amount is slightly below the cost of Turkey's one-year energy imports. Therefore, simply, if Turkey develops its own thorium-based nuclear technology, it can export both technology and thorium fuel in addition to meeting its own energy demand securely and environmentally.

THORIUM IN TURKEY

Turkey has the second largest thorium reserves after India with at least 744.000 tonnes (Table 1)[5]. Turkey's proved thorium reserves are expected to increase as they are explored more. For example, although it is known that Isparta and Malatya regions have thorium reserves, the exact amounts are not calculated yet. On the other hand, Turkey has some weaknesses in thorium policy such as unrealistic public opinion, bureaucratic hardships, and irregular R&D processes.

In order to contribute to the Turkish Thorium Strategy (TTS), a Turkish energy think-tank, Turkish Energy Foundation (TENVA), published a report entitled "Thorium in Turkey: Opportunities in Energy, Economy and Politics", in February 2015 after MENR prepared an official working document. Much before these steps, two binding decisions were taken in the Supreme Council of Science and Technology in February 2003 and March 2007 about developing thorium technology; they have yet to be implemented. Therefore, there is still a risk of interruption in the TTS. In order to decrease the risk, Turkey's thorium strategy is being integrated to its general uranium-based nuclear R&D strategy which is completely peaceful.

#	Country	Reserves (tonnes)	Global Share (%)
1	India	846.500	12,5
2	*Turkey*	*744.000 – 880.000*	*11*
3	Brazil	606.000	9
4	Australia	521.000	7,7
5	USA	434.000	6,4
-	World (total)	6.730.000	100

Table 1: Six Largest Thorium Reserves, *Source: Eti Maden*[5]

Thorium Report of TENVA

OPPORTUNITIES FOR TURKEY

The reasons for the emergent TTS are related to three main issues: Energy, economy, and politics. In energy, main motivation is to decrease the import dependency which creates huge foreign trade deficit and concerns about security of supply. Turkey's dependency upon Russian gas is 58% in general and it has also 75% dependency in primary energy usage[6]. Besides, Turkey's energy import was as high as $55 billion in 2014[7](Figure 1). With the utilisation of thorium as a viable energy resource, Turkey is expected to decrease its energy dependency and foreign trade deficit. Furthermore, exporting technology and raw material of thorium may create new trade opportunities for the country.

Politically, utilisation of thorium, first, by increasing security of supply, will diminish the strategic vulnerability that the country has in foreign policy. Secondly, Turkey, together with the other countries which have thorium reserves or technology, can take part in a new initiative such as Organisation for Thorium Exporting Countries (OTEC) or International Thorium Agency (ITA), in the long term. Thus, thorium can be used to enhance international cooperation and the distribution of global welfare equitably.

STRATEGY RECOMMENDATIONS

The TTS should be integrated to the general nuclear R&D activity, on both uranium and thorium. Turkey should develop its thorium capabilities in three fields, respectively and incrementally (Figure 2):

**Administrative Capabilities:* A Turkish Thorium Institute should immediately be established, and the country's thorium assets should be catalogued. It should be authorized to and responsible for developing the required human capital.

**Human Capital:* National human capital should be trained in graduate programs both in the country and abroad to conduct R&D projects.

**Physical Infrastructure:* High-cost projects should be avoided in the early periods, when there would likely not be enough national human capital. The ultimate physical investment is foreseen to be an essential part of international collaboration on the development of nuclear power plants on thorium technology.

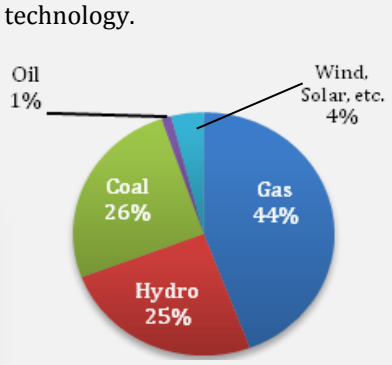

Fig 1: Breakdown of Turkish Power Generation

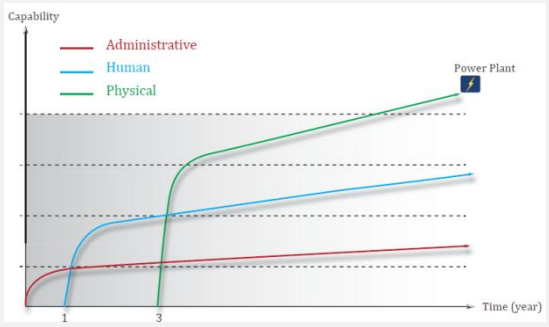

Fig 2: TTS Recommendation Graph

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