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MAKE IN INDIA: AN ATTRACTIVE STEP TO BOOST THE NUCLEAR DEVELOPMENT IN INDIA

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Abstract

India in its economy is growing at a tremendous rate and nuclear energy plays a vital role in its success. It has been estimated that the primary energy consumption of India has doubled between 1990 and 2011 to nearly 25,000 petajoule (PJ). India's dependence on imported energy resources and the inconsistent reform of the energy sector are major challenges to satisfy the rising demand of current scenario. India has a vision of becoming a world leader in nuclear technology due to its expertise in fast reactors and thorium fuel cycle. Nuclear power for civil use is well established in India. As a result, India's nuclear power program has proceeded largely without fuel or technological assistance from other countries. The revolutionary campaign started in 25 sept. 2014 by our Prime Minister Mr. Narendra Modi "Make in India" has encouraged the nuclear deal and other relations with the outside world that results in growth and development of India in almost all fields including intrinsic nuclear field. In this paper, we have highlighted the importance of Make in India Campaign in the economic development via developing the nuclear field. It also analyses the expertise of different policies and programs launched by the Government of India supported by "Make in India" project.

Keywords:

Nuclear Power;
Make In India;
Nuclear Development;
Economic Proficiency;

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Introduction

Energy insufficiency is the biggest challenge for all the countries of the world, particularly India, the most populated country of the world. In India there are more than 400 million people lacking access to electricity and 700 million people depending on biomass for cooking fuel (IEA, 2010)[1].To get rid form this problem, India is having a nuclear energy, the fourth largest source of electricity. It cannot be achieved without the political support. Make in India is the gate way for nuclear development. This topic reflects directly towards the development of Indian economy. Up till now India's the political push for 'energy independency' (Planning Commission,2006)[2] is provided by the current energy supply-demand gaps and the huge increase in primary energy consumption required to meet economic growth targets of 8–10 percent in the medium term.[3] Presently India is having 21 operational nuclear reactors in 7 nuclear power plants, which have established capacity of 6780 MW[4,5] and turning out a total of 30,292.91 GWh of electricity[6]. India has also 6 more nuclear reactors which are currently under construction and are expected to generate an additional 4,300 MW

Research Methodology

The research paper is descriptive in nature and the data collected is secondary in character. The data is collected from journals, books, news papers, websites etc.

Objective:

- To study the effect of "Make in India" Policy on the economic development of India through the growth of nuclear development.
- To analyze the impact of Make in India on the policies and schemes for nuclear development.

Nuclear growth in India:

It is now predicted that India will increase their contribution in the domain of nuclear power for overall electricity generation which will enhance the capacity from 2.8% to 9% within 25 years[7].India's established nuclear power generation capacity will be amplified to 20 GW by 2020.[8]In 2009 India scored 9th position in the world ranking in terms of number of operational nuclear power reactors. Native atomic reactors include TAPS-3, and -4, both of which are

540 MW reactors[9]. India's US$717 million fast breeder reactor[10]. Since U.S.-India Civil Nuclear Agreement has been passed, it is probable that Indian nuclear power industry will undergo a significant expansion in coming years. This enable India to carry out deal of nuclear fuel and technologies with allied countries and enhance its power generation capacity considerably and India is expected to produce an additional 25,000 MW of nuclear power by 2020, bringing total estimated nuclear power generation to 45,000 MW.[11]

Risks in the area of nuclear power generation prompted Indian legislators to endorse the 2010 Nuclear Liability Act which stipulates that nuclear suppliers, contractors and operators must bear financial responsibility in case of any mishap occurring in the relevant field. The legislation addresses key issues including nuclear radiation and safety regulations, operational control and maintenance management of nuclear power plants, compensation in the event of a radiation-leak accident, disaster clean-up costs, operator responsibility and supplier liability.[12] The consequences of Fukushima Daiichi nuclear disaster took place in 2011 seen in India and the world's worst disaster of Bhopal gas tragedy was heavily covered in Dominique Lapierre's 2009 prize winning book *Five Past Midnight in Bhopal*.[13]

India has already used uranium for light-water reactors that are currently under IAEA safeguards, but has also developed other aspects of the nuclear fuel cycle to support its reactors. Development of technologies has been strongly affected by limited imports. Use of heavy water reactors also catches attention of the nation as it allows Uranium to be burnt with little to no enrichment capabilities. India has also contributed much in the development of a thorium centered fuel cycle. While uranium deposits in the nation are limited there are much greater reserves of thorium and it could provide hundreds of times the energy with the same mass of fuel. The fact that the use of thorium can only be utilized in heavy water reactors has checked the development of the two. A prototype reactor is under construction at Kalpakkam by BHAVINI - another public sector enterprise like NPCIL that would try to burn Uranium-Plutonium fuel while irradiating a thorium blanket. The use of Uranium extracted from the indigenous reservoir for the weapons programme has been separated from the power programme.

This domestic reserve of 80,000 to 112,000 tons of uranium (approx 1% of global uranium reserves) is large enough to supply all of India's commercial and military reactors as well as supply all the needs of India's nuclear weapon store. In Present time India uses 478 tons of uranium in nuclear power reactors in a year. Even if India would increases its nuclear power output (and reactor base) four times to 20 GW by 2020, nuclear power generation would only consume 2000 tons of uranium per annum. this represents a 40–50 years uranium supply for India's nuclear power reactors on the basis of data of India's known commercially viable reserves of 80,000 to 112,000 tons of uranium (note with reprocessing and breeder reactor technology, this supply could be stretched out many times over). Furthermore, the requirements of uranium for India's Nuclear Arsenal are only a fifteenth (1/15) of that required for power generation (approx. 32 tons) which means that India's domestic fissile material supply is more than the needs for it strategic nuclear arsenal. Therefore, India has sufficient uranium resources to meet up its strategic and power requirements for the expected future.[14]

Late Former Indian President A.P.J.Abdul Kalam, explained energy independence as India's first and highest priority. India has to go for nuclear power generation in a big way using thorium-based reactors. Thorium, a non fissile material is available in abundance in our country."[15] India has vast thorium reserves and quite limited uranium reserves.[16,17] The main aim of India's nuclear program is to develop an advanced heavy-water thorium cycle. The first stage of this employs the pressurized heavy water reactors (PHWR) fueled by natural Uranium and light water reactors, which produce plutonium incidentally to their prime purpose of electricity generation. The second stage uses fast neutron reactors where the plutonium has been used with the blanket around the core having uranium as well as thorium, so that further plutonium (ideally high-fissile Pu) is produced along with U-233. Almost 12 million tons of monazite resources has been identified by the Atomic and Molecular Data Unit (AMD) (typically with 6-7% thorium). In stage 3, thorium-plutonium fuels is burned in Advanced Heavy Water Reactors (AHWR)in a manner that breeds U-233 which can sooner or later be used as a self-sustaining fissile driver for a fleet of breeding AHWRs. An alternative stage 3 is molten salt breeder reactors (MSBR), which are also used as large-scale deployment.[18]On 7 June 2014, Kudankulam-1 became the single largest power generating unit in India (1000 MWe).[19]

Make in India: an allure for nuclear agreements with other nations

A civil nuclear agreement has been signed by India in 2016 with Argentina, Australia, Canada, France, Japan, Kazakhstan, Mongolia, Namibia, Russia, South Korea, the United Kingdom and the United States.[20] The India has been granted the permission to access civilian nuclear technology on 6th September 2008 by the 48-nation NSG.[21] India the only known country with nuclear weapons which is not a party to the Non- Proliferation Treaty (NPT) but is still permitted to carry out nuclear trade with the rest of the world.[22] The nuclear agreement with USA led to India issuing a Letter of Intent for purchasing 10,000 MW from the USA but this is hindered by liability concerns and a few other issues. According to the Experts India's nuclear liability law discourages foreign nuclear companies. In case of any mishap, this law works as a boon to the victims who can seek for the compensation of the damages from plant suppliers. It has "deterred foreign players like General Electric and Westinghouse Electric, a US-based unit of Toshiba, with companies asking for further clarification on compensation liability for private operators".[23] Russia agreed with India regarding establishing of two VVER 1000 MW reactors (water-cooled water-moderated light water power reactors) at Koodankulam in Tamil Nadu in 1988.[24] In 2008, the agreement also caters additional four third generation VVER-1200 reactors of capacity 1170 MW each.[25] India was assisted by Russia in designing a nuclear plant for its submarine. In 2009 Russia denied to curbs on export of sensitive technology to India but in 2009 India signed an accord with Russia that provides freedom to India to proceed with closed fuel cycle including mining, preparation and reprocessing of the fuel.[26,27] France was the first country to sign a civilian nuclear agreement with India, on 30 September 2008 when Nuclear suppliers Group agreed to allow nuclear exports to India[28] during the visit of the French President Nicholas Sarkozy to India in December 2010 framework agreements were signed for the setting up two third-generation EPR reactors of 1650 MW each at Jaitapur, Maharashtra by the French company Areva. This deal provides the setting of a pair of six planned reactors and supply of nuclear fuels for 25 years. Construction is doubtful to start before 2014 because of rigid issues and difficulty in sourcing major components from Japan as India is still out of Nuclear Non-Proliferation Treaty.[29] A crucial civil nuclear agreement was signed on 15 June 2009 during the visit if former prime minister Manmohan Singh to Mongolia between India and Mongolia for the supply of uranium to India. This makes Mongolia fifth nation in the world to seal a civil nuclear pact with India. In the department of atomic energy of the two countries MOU was signed by the

senior officials on "development of cooperation in the field of peaceful uses of radioactive minerals and nuclear energy".[30]

Five agreements were signed between India and Namibia when the president Hifikepunye Pohamba's was on five-day visit to India on 2 September 2009 which allows uranium from African country. Namibia is the fifth largest producer of uranium in the world. The Indo-Namibian agreement in peaceful uses of nuclear energy allows for supply of uranium and setting up of nuclear reactors.[31]

India also signed an agreement with Argentina on 14th October 2009 in New Delhi on civil nuclear cooperation and nine other pacts to establish strategic partnership. the agreement was signed by Vivek Katju, Secretary in the Ministry of External Affairs and Argentine foreign minister Jorge Talana. Both India and Argentina have mutually agreed to boost their commercial and technical fields and to improve their relations for the endless time.[32,33]

On 28 June 2010, the then prime ministers of India and Canada had signed on civil nuclear cooperation in Toronto. It enables India to expand its nuclear market as it was allowed to access Canada's nuclear industry and also fuel for indigenous reactors. Canada, The largest exporter of uranium[34]and their heavy water nuclear technology are exported to the operating units(CANDU) in the most of the countries like India, Pakistan, Argentina, South Korea, Romania and China. This agreement was finalized on 6 November 2012which became the gateway for the import of uranium from Canada.[35]

The current government of India led by the Prime Minister Narendra Modi gave new initiatives to the nuclear field. One of the effective step is the "Make in India" policy that boosts the nuclear relationship with other nations. Some of the positive steps to boost up the nuclear development occur in the field of power generation. The current prime minister of India sheer Narendra Modi signed an agreement with the Australian prime minister tony abbot in Delhi on 4 September 2014 to start the uranium trade between two countries. Australia, world's third uranium producer agreed for the uranium export to India for civil peaceful uses.[36,37] Another civil nuclear agreement was signed by our prime minister with the prime minister of UK David Cameron on 12 November 2015.[38]

To fulfill the electricity demand of our country the another step that is supported by Make in India Campaign is that our prime minister Mr. Narendra Modi agreed to sign a new nuclear

cooperation agreement with Japan in November 2016. This was seen by Japanese nuclear power builders as compensation to their Fukushima Daiichi nuclear disaster, and it is expected to build 20 new reactors in next decade.[39]

Conclusion

India with the huge population and increasing demand of electricity generation, it has signed many agreements with other countries. Make in India is the vista to meet our demands. Nuclear energy is the everlasting technology by which we can come up from our inefficiencies. Make in India is a platform for India to be the electricity supplying country in the near future.

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