



India's Prospects as a Nuclear Power

Introduction

- In 2018, India commemorated 20 years since it conducted its five nuclear tests, known as Operation Shakti-98, and 10 year since **India - U.S Civil Nuclear Agreement** in 2008, also called as **123 Agreement**.
- India on November 5, 2018, declared that its nuclear triad, stated in its nuclear doctrine, is operational after indigenous ballistic missile nuclear submarine INS Arihant achieved a milestone by conducting its first deterrence patrol.
- Nuclear power in India delivers a total capacity of 6.7 GWe (Giga Watt Electricity), contributing about 2% of the country's electricity supply.
- India has ambitious plans to increase nuclear power generation capacity to 275 GWe by 2052. At the start of 2018, six reactors were under construction in India, with a combined capacity of 4.4 GWe.
- India has a largely indigenous nuclear power programme which is controlled by Nuclear Power Corporation of India Ltd. (NPCIL), a state-owned corporation founded in 1987.
- Because India is outside the **Nuclear Non-Proliferation Treaty** due to its weapons programme, it was, for 34 years, largely excluded from trade in nuclear plant and materials, which hampered its development of civil nuclear energy until 2009.
- Due to earlier trade bans and lack of indigenous uranium, India has uniquely been developing a nuclear fuel cycle to exploit its reserves of **thorium**.

India's Nuclear Energy Program

- India has consciously proceeded to explore the possibility of tapping nuclear energy for the purpose of power generation. In this direction **three-stage nuclear power programme** was formulated by **Homi Bhabha** in the 1950s.
- **Atomic Energy Act, 1962** was framed and implemented with the set objectives of using two naturally occurring elements Uranium and Thorium having good potential to be utilized as nuclear fuel in Indian Nuclear Power Reactors.
- The estimated natural deposits of Uranium are about 70,000 tonnes and Thorium are about 3, 60,000 tonnes in the country.

Three Stage programme

- **Stage one - Pressurised Heavy Water Reactor** uses
 - Natural UO₂ as fuel matrix,
 - Heavy water as moderator and coolant.
- In the reactor, the first two plants were of boiling water reactors based on imported technology. Subsequent plants are of PHWR type through indigenous R&D efforts. India achieved complete self-reliance in this technology and this stage of the programme is in the industrial domain.
- The future plan includes the setting up of **VVER type** i.e. **Russian version of the Pressurized Water Reactor (PWR)** is under progress to augment power generation.
- **MOX fuel (Mixed oxide)** is developed and introduced at Tarapur to conserve fuel and to develop new fuel technology.
- **Second stage** of nuclear power generation envisages the **use of Pu-239** obtained from the first stage reactor operation, as the fuel core in **fast breeder reactors (FBR)**.

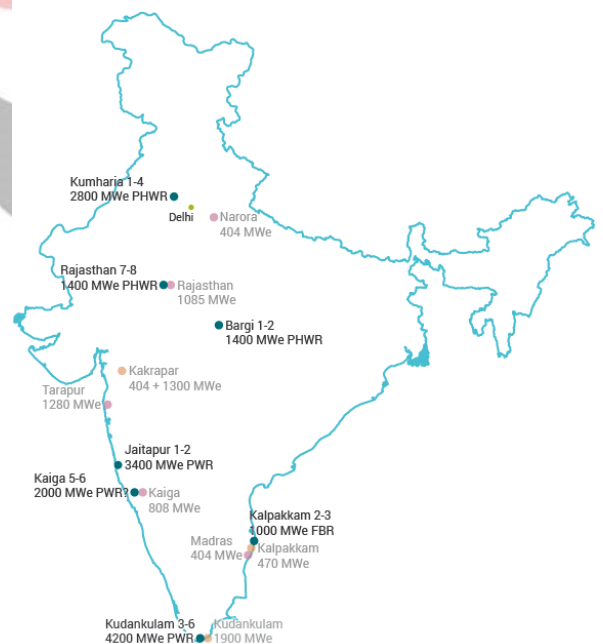
- **Third phase** of India's Nuclear Power Generation programme is, **breeder reactors** using **U-233 fuel**.
- India's vast thorium deposits permit design and operation of **U-233 fuelled breeder reactors**.

Nuclear Power plants in Operation	Nuclear Power Plants under Construction	Planned Nuclear Power Plants
▪ Rawatbhat a (Rajasthan) ▪ Tarapur (M aharashtra) ▪ Kudankula m (Tamil Nadu) ▪ Kakrapar (Gujarat) ▪ Kalpakkam (Tamil Nadu) ▪ Narora (Uttar Pradesh) ▪ Kaiga (Karnataka)	▪ Kakrapar 3&4 (Gujarat) ▪ Rawatbhata (Rajasthan) ▪ Kudankulam 3&4 (Tamil Nadu) ▪ Kalpakkam PFBR (Tamil Nadu)	▪ Jaitapur (Maharashtra) ▪ Kovvada (Andhra Pradesh) ▪ Mithi Viridi (Gujarat) ▪ Haripur (West Bengal) ▪ Gorakhp ur (Haryana) ▪ Bhimpur (Madhya Pradesh) ▪ Mahi Banswar a (Rajast han) ▪ Kaiga (Ka rnataka) ▪ Chutka (Madhya Pradesh) ▪ Tarapur (Maharas htra)

NPP Operating and Under Construction in India



Planned Nuclear Power Plants in India



Challenges

- Genuine problems of Nuclear technology includes safety and waste management. Incidents like Chernobyl, Three Mile Island, Fukushima are serious case of concern.
- Complete phase out of nuclear power generation for the fear of nuclear accident would be a wrong move. If nuclear energy is generated adhering to the highest standards of safety, there is less possibility of catastrophic accidents.
- Land acquisition and selection of location for Nuclear Power Plant (NPP) is also major problem in

the country. NPP's like kudankulam in Tamil Nadu and Kovvada in Andhra Pradesh have met with several delays due to the land acquisition related challenges.

- As India is not a signatory of NPT and NSG, nuclear supply is severely contained by sanctioned against India. This situation has changed after 2009 waiver and bilateral civil nuclear energy agreements with many countries.
- Reprocessing and enrichment capacity also required boost in India. For this India needs advanced technology to fully utilise the spent fuel and for enhancing its enrichment capacity.
- On the front of Infrastructure and Manpower needs, India has worked very hard for development of Industrial infrastructure to manufacture equipment and skill development. Many Universities and institutes provide engineering manpower for NPP.

Suggestions

To ensure the safety and security of using nuclear power there is need to:

- ensure maintenance of the skills base
- maintain continued effective safety regulation
- foster progress on facilities for waste disposal and management must be given serious consideration.
- maintain and reinforce international non-proliferation arrangements.

Nuclear Tests and Nuclear Doctrine

- In **2003**, India has adopted its **Nuclear Doctrine** of '**No First Use**' i.e. India will use nuclear weapons only in retaliation against a nuclear attack on its Territory.
- In addition with this in **1965**, India with **NAM countries proposed five points** to prevent the proliferation of nuclear weapons to UN Disarmament commission. These are:
 - Not to transfer Nuclear technology to others
 - No use of nuclear weapons against non nuclear countries
 - UN security cover to non nuclear States
 - Nuclear disarmament
 - Ban on the nuclear test
- In May **1974**, India has conducted its first nuclear test in Pokhran with the codename of "**Smiling Buddha**".
- Between 11 and 13 May, **1998**, five nuclear tests were conducted as a part of the series of **Pokhran-II**. These tests were collectively called **Operation Shakti-98**.
- According to a 2018 report by the Stockholm International Peace Research Institute (SIPRI), Pakistan has 140-150 nuclear warheads compared to India's 130-140 warheads.
- Pakistan has not stated a "no first use" policy and there is little known about its nuclear doctrine.

India's Stand on different Nuclear Treaties

- **Limited Ban Treaty:** US, UK and USSR in 1963, signed this treaty. It allows nuclear tests only underground thus, prohibits the nuclear experiments on ground, underwater and in outer space. India has also ratified the treaty.
- **Treaty on Outer Space:** Signed in 1967, it prohibits countries to test nuclear weapons in orbit or on celestial bodies like moon.
- **Nuclear Non-Proliferation Treaty (NPT):** Signed in 1968, the treaty entered into force in 1970, now has 190 member states. It requires countries to give up any present or future plans to build nuclear weapons in return for access to peaceful uses of nuclear energy.
- Three main objectives of the treaty are non-proliferation, disarmament, and the right to peacefully use nuclear technology.
- **India is one of the only five countries that either did not sign the NPT or signed but withdrew**, thus becoming part of a list that includes Pakistan, Israel, North Korea, and South Sudan.

Why India didn't sign the NPT?

- The quest for freedom of action in an uncertain regional strategic environment and an asymmetric international system dominated by superpowers and China drove India to not sign the NPT and hedge, and to conduct the 1974 test.
- India perceives its nuclear weapons and missile programs as crucial components of its strategic doctrine.
- India rejects the Treaty on the grounds that it perpetuates—at least in the short-term—an unjust distinction between the five states that are permitted by the treaty to possess nuclear weapons, while requiring all other state parties to the treaty to remain non-nuclear weapon states.
- One major point raised by India is that the five authorized nuclear weapons states still have stockpiles of warheads and have shown reluctance to disarmament which also angered some non-nuclear-weapon NPT states.
- For eliminating the last nuclear weapons, the nuclear weapons state requires confidence that the other countries would not acquire nuclear weapons.
- Moreover, India's pledge of not to use nuclear weapons unless first attacked by an adversary and a self-imposed moratorium on nuclear test since 1998, established its credibility as a peaceful nuclear power even without joining the treaty.
- Perceived security threats from Pakistan and Pakistan's ally China and demonstration of a nuclear weapons capability guaranteed New Delhi's ability to effectively hedge in an asymmetric international system, and a regional strategic environment where New Delhi felt largely cornered.
- Maintaining a degree of political autonomy has driven independent India's foreign policy choices. Major decisions that New Delhi took in the nuclear realm are representative of that. The grand bargain of NPT was certainly going to restrict India's policy options.
- Domestic political imperatives also dictated the timing and the rhetoric about the nuclear power.
- **Comprehensive Test Ban Treaty (CTBT)** intends to ban all nuclear explosions - everywhere, by everyone. It opened for signature on 24 September 1996 and since then 182 countries have signed the Treaty, most recently Ghana has ratified the treaty on 14 June 2011.
- The Treaty will enter into force after all 44 States listed in Annex 2 to the Treaty will ratify it. These States had nuclear facilities at the time the Treaty was negotiated and adopted.
- As of August 2011, 35 of these States have ratified the Treaty. Nine States still need to do so: China, the Democratic People's Republic of Korea, Egypt, India, Indonesia, Iran, Israel, Pakistan and the United States. India, North Korea and Pakistan have not yet signed the Treaty.

Reasons behind India's rejection to CTBT

- India has always stood by its demand for a nuclear weapons-free world but various procedural, political, and security concerns have stopped India to join the treaty.
- India's relationship with the CTBT has undergone distinct changes. In 1954, Indian Prime Minister Jawaharlal Nehru championed the cause of a nuclear test ban by calling for a "standstill" agreement. In 1993, India was among those that co-sponsored the call for a test ban treaty. However, in 1996, India's reservations about the Treaty blocked its adoption by the Conference on Disarmament.
- India, after negotiation was ready to sign the treaty provided United States should presents a schedule for eliminating its nuclear stockpile, a condition the United States rejected.
- India believed that the universal and complete nuclear disarmament should be the end goal not a mean.
- India considered, Article XIV, the entry-into-force (EIF) clause of the treaty as a violation of its right to voluntarily withhold participation in an international treaty.
- The treaty initially made ratification by states, that were to be a part of the CTBT's International Monitoring System (IMS), mandatory for the treaty's EIF. Because of this, India withdrew its participation from the IMS.
- The treaty didn't talk about the disarmament of the stocks by nuclear weapon states.
- Further, the treaty is vague on the ban of laboratory testing of nuclear weapons. It means sophisticated technology of developed countries permit them for laboratory testing and ban on field test only affect the developing countries nuclear programme.
- India's scientific community believes that accepting the CTBT would hinder India's strategic nuclear program development and the option to test must be kept open.
- On the security front, India thought that it faced uncertain dangers from Pakistan, and China,

which had conducted nuclear tests even while the CTBT was being negotiated.

- **Fissile Material Cut-off Treaty (FMCT)** is a proposed international agreement that would prohibit the production of two main components of nuclear weapons: highly-enriched Uranium and Plutonium.
- An FMCT would provide new restrictions for the five recognized nuclear weapon states (NWS—United States, Russia, United Kingdom, France, and China), and for the four nations that are not NPT members (Israel, India, Pakistan, and North Korea).
- **Missile Technology Control Regime (MTCR)** is not a treaty and does not impose any legally binding obligations on Partners (members). Rather, it is an informal political understanding among states that seek to limit the proliferation of missiles and missile technology.
- The regime was formed in 1987 by the G-7 industrialized countries (Canada, France, Germany, Italy, Japan, the UK, and the United States). There are currently 35 countries that are members (Partners) of the MTCR. India has become the **35th full member MTCR** In July 2016.
- MTCR membership enables India to buy high-end missile technology, strengthen its export control regime and it supports India's bid to become the member of Nuclear Supplier Group (NSG).

India and Nuclear Suppliers Group (NSG)

- The NSG was created in response to India's first nuclear test 'Smiling Buddha' (Pokharan-I) in 1974. The NSG first met in November 1975 in London, thus popularly referred to as the "**London Club**".
 - It's a group of nuclear supplier countries that seek to contribute to the non-proliferation of nuclear weapons through the implementation of two sets of Guidelines for nuclear exports and nuclear-related exports.
 - NSG consists of **48 members**, include the **five nuclear weapon states** US, UK, France, China, and Russia. It is **not a formal organization, and its guidelines are not binding**.
 - **A non-NPT state cannot become a member of NSG which keeps India out of the group.**
 - India was left outside the international nuclear order, which forced India to develop its own resources for each stage of the nuclear fuel cycle and power generation, including next generation reactors such as fast breeder reactors and thorium breeder reactors.
 - More recently in January 2019, China has again reiterated its previous stand that India's accession to the Non-Proliferation Treaty (NPT) is pre-requisite for its membership to the NSG or else there should be a common guidelines for the membership of the non-NPT states.
 - Rejecting India's claims for NSG membership, China cited the reasons that there should be no double standards in enforcing the NPT and the international community should stick to multilateralism and promote the three pillars namely non-proliferation, disarmament and peaceful uses of nuclear energy.
 - Except China, all P5 members have endorsed India's membership of NSG based on India's non-proliferation record.
 - Pakistan has also applied for the NSG membership while being also a non-signatory to the NPT. But it has a dubious record and its credibility is very much doubtful as a peaceful nuclear state.
 - Membership of the NSG will provide India, greater certainty and a legal foundation for India's nuclear regime and thus greater confidence for those countries investing billions of dollars to set up ambitious nuclear power projects in India.
 - Though India is not a member of NPT and NSG, its track-record in observing the provisions of either body, is impeccable. NSG was able to grant a waiver to India in 2008 on the basis of its past performance, now it should have no objection to admitting the country as a member.
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- **Australia Group** admitted **India as the 43rd member on 19 January 2018**. It's an informal group that keeps a control over exports of substances used in making of chemical weapons.
 - The group membership will help India to raise its stature in the field of non-proliferation, and help in acquiring the critical technologies. It will also strengthen India's bid to gain NSG membership.
 - **Wassenaar Agreement**, established in 1996, is a group of countries which subscribe to arms export controls. It seeks to bring about security and stability, by fostering transparent practices in the process of sale and transfer of arms and materials and technologies that can be used to make nuclear weapons.

- It is a grouping of 42 countries, of which India is the latest entrant on December 8, 2017. With the exception of China, all the other permanent members of the U.N. Security Council are signatories of this arrangement.
- After joining the group India will be able easily access dual use technologies and materials and military equipment that are proscribed for non-participating members. In addition India will also be able to sell its nuclear reactors and other materials and equipment indigenously produced without attracting adverse reactions.

Way Forward

- In his presidential address at the first International Conference on the Peaceful Uses of Atomic Energy in Geneva in August 1955, Homi J Bhabha, traced the growth of the civilization, correlating it with increase in energy consumption and the development of new energy sources.
- He emphasized that the acquisition by man of the knowledge of how to release and use atomic energy must be recognized as the third epoch of human history.
- To maintain pace of development, it is important to build a constant and reliable supply chain of nuclear materials.
- The fundamentals underlying the possibility of breakthrough growth in India's civil nuclear programme are strong: political will, bilateral agreements with most supplier countries, an NSG waiver for nuclear trade, domestic human resources and capability developed in the last 30 years of nuclear power operations.
- While the political will and commitment to nuclear power remains strong, the government in recent months tried hard to secure membership in the NSG, an effort that was ultimately unsuccessful.
- It is crucial to remember that India does not need NSG membership to import nuclear technology that was already cleared through the exemption given in 2008.

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