# JAITAPUR NUCLEAR POWER PROJECT


**Group Members:**

**Anamta Farooque | Adoos Khalid | Amin Rooberahan | Gandharva Shelar | Rajnesh Kumar**

**Table of Contents**

# Introduction

The global energy transition is essential to preserving our planet according to the current dilemma. This goal must be achieved with the cumulative effort of every energy user in the world. It involves several disciplines particularly involving the social sciences to have significant progress. Energy is one of the fundamental needs of human beings and it is the responsibility of government to ensure clean energy to its inhabitants. At the same time, the efficient usage of energy sets with its users. If we analyze our lives, we are heavily dependent on energy irrespective of whether we realize it or not.

In the current situation, where the world is trying to harvest cleaner resources, it should also be kept in consideration that being cleaner does not always mean ethical and moral. Ethical and moral values should be given priority while addressing energy transition. There are several driving factors in this energy transition, but this report deals with one of the cleaner but controversial sources of energy i.e. nuclear energy. With the commercialization of the first nuclear plant back in the 1950s, the energy production from nuclear power plants developed with time and currently accounts for about 10% of the world's electricity[1] (Nuclear Power in the World Today, 2024). Among other countries, the USA has the highest nuclear energy production around 772TWh. France the third largest nuclear energy producer in the world[2] (Rao, 2024) is a big player in the nuclear technologies around the world.

It is a fact that nuclear energy gives access to cleaner energy resources but public acceptance for the installation of nuclear plants has always been a major game player. Moreover, nuclear accidents like Chernobyl, Fukushima, etc have elevated global scepticism toward nuclear power plants. The fact that nuclear accidents do not have only on-time damage, instead the harmful radioactive emissions damage generations to come. Therefore, while discussing the advantages of nuclear power plants, the safety, liability, reliability, and environmental consequences should be taken into serious consideration.

This report is highlighting the controversies involved in the construction and operation of the World's largest nuclear power plant, going to be erected in the economic hub of India i.e. Maharashtra State. The report is divided into six sections, beginning with a brief introduction of the project, followed by the controversies as follows:

- Historical & Political
- Environmental
- Social
- Technological
- Liability and Judicial

# Chapter 1: Introduction to Jaitapur Nuclear Power Project

## 1.1. Background:

India is spread over an area of 32,87,263 $km^2$ ranging from the snow-covered Himalayan heights to the tropical rainforest of the south. It is the seventh-largest country in the world[3] (Chatterjee, 2020) with the highest population value of 1,428,627,663[4] (Population by Country, 2023) . With this fast-growing population along with technological advancement, India needs giant energy resources to meet its evolving energy demand.

## 1.2. Electrical Energy Mix of India:

The electrical installed capacity of India is 417GW based on both fossil and non-fossil fuel resources. Although the fossil fuel share is high almost 56.8%, the country is thriving in renewable energy as well (approximately 41.4%). The lowest share comes from nuclear power which is 1.6%[5] (Power Sector at a Glance ALL INDIA, 2023) and there are several opportunities available to shift the fossil-based share towards nuclear energy. This report focuses on one of the groundbreaking nuclear energy projects that can replace a massive share of fossil-based energy with green energy.

[1] *Nuclear Power in the World Today*. (2024, May 7)
[2] Rao, P. (2024, April 17). *The World's Biggest Nuclear Energy Producers*
[3] Chatterjee, R. (2020). *India 2020*. New Delhi: MINISTRY OF INFORMATION AND BROADCASTING
[4] *Population by Country*. (2023, Jully 16)
[5] *Power Sector at a Glance ALL INDIA*. (2023, June 12). (Government of India (Ministry of Power))

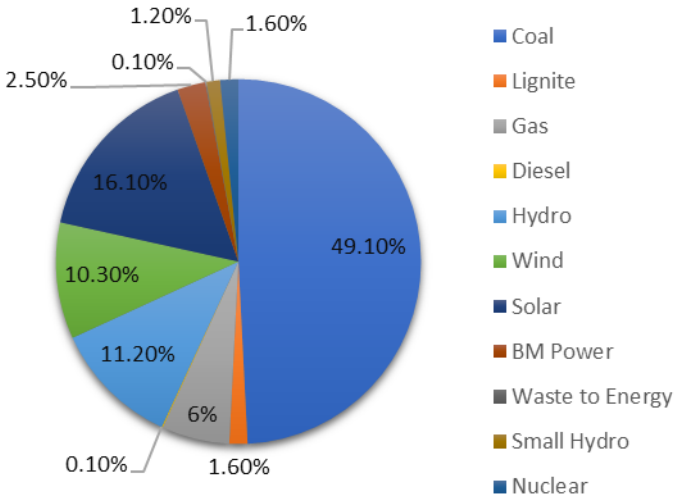


*Figure 1: Electrical Energy Mix of India*

### 1.3. Nuclear Energy in India:

Although currently India has a small share of nuclear energy production, only 1.6% of its electricity production several nuclear projects are under construction and in the planning phase. India aims to grow its nuclear share from 6.7GW to 22.5GW by 2031[6] (Nuclear Power in India - World Nuclear Association, 2024) which is an enormous increase and assures nuclear as cutting-edge technology in the energy transition of India besides renewable energy.

### 1.4. Jaitapur Nuclear Power Project:

Jaitapur nuclear power plant is a six,1650 MW European pressurized reactor (EPR) with capacity of 1650 MW each proposed to be built 400km south of Mumbai, in Ratnagiri, Maharashtra, India, as part of the civil nuclear co-operation agreement between France and India.Jaitapur nuclear power plant consist of six1650 MW European pressurized reactor (EPR) nuclear power plant proposed to be built 400km south of Mumbai, in Ratnagiri, Maharashtra, India, as part of the civil nuclear co-operation agreement between France and India.


*Figure 2: Geographical Location of the Project*

The plant will be owned and operated by India's state-owned Nuclear Power Corporation of India (NPCIL). However, the nuclear reactors will be provided by France's state-run power utility Electricite de France (EDF). The total installed capacity of the plant will be 9,900MW making it the world's biggest nuclear power facility[7] (Jaitapur Nuclear Power Plant).

[6] *Nuclear Power in India*. (2024, May 8). (World Nuclear Association)

[7] *Jaitapur Nuclear Power Plant*

### 1.4.1. Jaitapur Project History:

The site of Jaitapur was recommended to be one of the potential places for nuclear power plants back in 1985. Following this, the project timeline of Jaitapur is as follows:

- In April 2004, Areva a French state-controlled nuclear engineering firm and NPCIL conducted a joint industrial feasibility study for six, 1,000 MW light water reactor (LWR) units at the Jaitapur site.
- Later, in the same year France issued the license to upgrade 1,000MW LWR to 1,650MW EPR.
- In 2005, the government of India issued approval for the first two reactor units for the Jaitapur site.
- In 2008, a civil nuclear co-operation bilateral agreement was signed between India and France.
- In 2009, Areva and NPCIL signed a memorandum of understanding (MoU) for the first two 1,650MW EPR reactor units at the Jaitapur site. Later in the same year, the government of India approved the Jaitapur site for construction of six 1,650MW EPRs.
- In 2010, NPCIL received environmental clearance for the project.
- In 2015, EDF decided to take over Areva's nuclear reactor manufacturing business.
- In 2016, EDF and NPCIL signed the MoU for the construction of Jaitapur nuclear power station Also, EDF issued the First technical-commercial proposal for this project.
- In 2018, EDF and NPCIL signed an Industrial Way Forward Agreement for setting up six reactor units at Jaitapur.
- In 2021, EDF submitted the French binding techno-commercial offer to NPCIL for the construction of six EPRs[7]

### 1.4.2. Major Stakeholders Involved in the Project:

The project involved local as well as international stakeholders as explained in the concept map of project as follows:

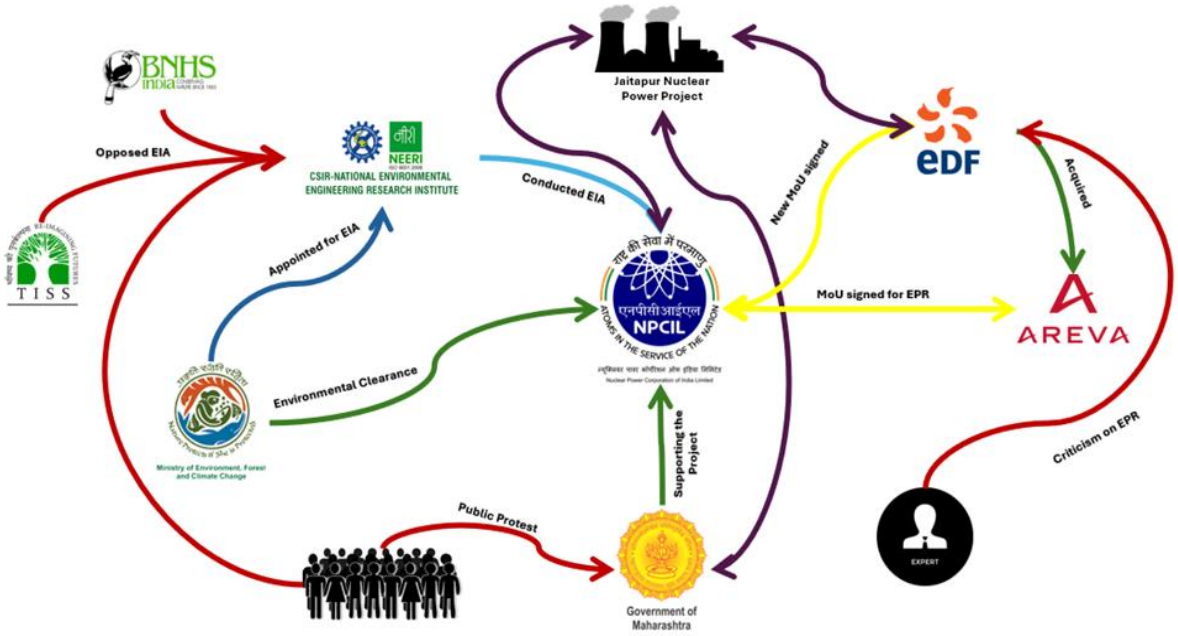


*Figure 3: Concept Map of Jaitapur Nuclear Power Project*

The project mainly links to three key stakeholders:

1. Areva
2. EDF
3. NPCIL

As Areva has already been acquired by EDF it leaves only two major players, EDF from France and NPCIL from India. Moreover, there are other commercial enterprises involved in the project for some special tasks as can be seen from the map. For instance, the National Environmental Engineering Research Institute (NEERI) which is appointed by Ministry of Environment and Forest to conduct environmental impact assessment (EIA) for the site of Jaitapur.

The concept map also shows the proponents and opponents of the project. The project has strong opposition from the public. Similarly, the approved EIA faced credibility challenges from other institutes like Tata Institute of Social Sciences, Bombay Natural History Society, etc. Interestingly, the French nuclear technology was also being questioned and criticized by different researchers and experts. All of these controversies will be discussed in detail in the upcoming sections.

# Chapter 2: History and Political Scenario

## 2.1. Tussle between the state and the centre:

India follows a federal system of government. The power is distributed among the centre (national government) with the parliamentary system headed by the prime minister and the state government with a state assembly headed by the chief minister[8] (India, n.d.). Except on the matters regarding foreign affairs, national defence, intelligence, and international trade, the state government is quite autonomous in terms of executionary power. Other than this the Judiciary is also a very important and autonomous body in the Indian democratic system, which has courts at several levels with the high court (state level) and supreme court (national level) being the important ones.

There has always been a sense of resentment in the state of Maharashtra and the people have always taken the Centre's decisions with a pinch of salt. The social unrest arises as Maharashtra, despite its significant economic contributions, receives only Rs7.7 for every Rs100 paid in taxes. Demands for additional benefits include opposition to a large nuclear power plant in the Biodiverse Western Ghats region, threatening both land and marine ecosystems vital for livelihoods of the locals. The current ruling party has its strong hold in the neighbouring state of Gujarat and is often accused of favouring their home state above the rest of the nation, this sentiment has been very strong for a very long time and was also a major factor for loss of parliamentary seats for the Bhartiya Janata Party (BJP) in the latest national elections. The Shivsena-party president also said "Those who want this project, can take it to Gujarat. If required, Maharashtra will buy power from Gujarat." (correspondant E. t., 2014)[9]

## 2.2. Political instability

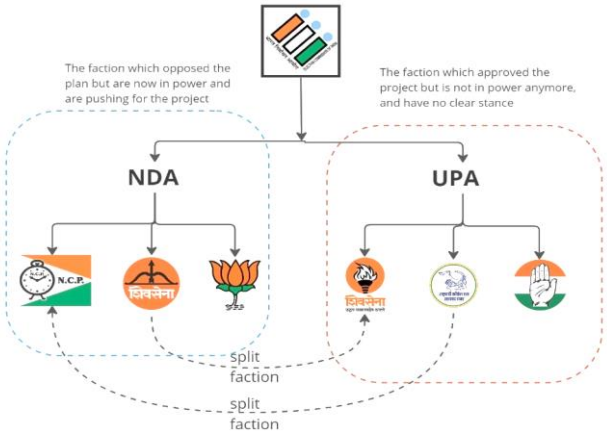


*Figure 4:Overview of Political Fractions*

After several years, with number of defections from and in all directions, party splits, and several government changes, today every political party has a mix of political leaders from both side of the spectrum. Thus, no political party has a clear stand for or against the project.

[8] National Portal of India. (2023). Governance & Administration | National Portal of India.

[9] Jaitapur project to be scrapped if Shiv Sena comes to power: Uddhav Thackeray. (2014, October 12). The Economic Times.

### 2.3. Current government's stand:

The agreement was signed on 6 December 2010 under the then government (Indian national congress (INC) led United progressive alliance (UPA) coalition, and it saw massive opposition from the national as well as regional opposition parties of BJP and the Shivsena. But the things changed in 2014, as the UPA alliance lost power and BJP came into power. The BJP led government who had opposed the plant earlier suddenly turned in favour of the project. Union Minister Jitendra Singh said the *"the fault lies with the (previous) government for not being able to convince the people of the "advantages of atomic energy"*.[10] (Yadav, 2015)

As of today, the Government is formed by NDA without BJP having a majority of its own. And it relies on its allies for the stable government and one of the allies is a faction of Shivsena. Who are traditionally opposed to the project.

## Chapter 3: Environmental Controversy of Jaitapur Power Plant

On a global level, the project is aimed to reduce the carbon emissions by more than 50 million tons annually[11] (EDF India, 2023), thus making India to be more actively involved towards the net zero goal of carbon emissions by 2050, but this chapter will shed light on the raised environmental concerns and controversies arising due to this mega power plant.

The chapter will discuss the location of the plant and its importance, highlight the environmental impact assessment of the location and the opposition to this study[19]. (Bidwai P. , 2024)

### 3.1. Konkan – "Kashmir of Maharashtra"

The gigantic Jaitapur Nuclear Power Plant will be built in the Konkan region of India. The Konkan region, often referred to as the "Kashmir of Maharashtra," is renowned for its stunning natural beauty, featuring a magical combination of mountains, undulating hills, verdant plateaus, creeks, lagoons, and infinite greenery. This region boasts rich biodiversity, including rainforests and an immense diversity of plants, animals, and marine life. Recognized as one of the world's ten "***Hottest Biodiversity Hotspots,"*** the Konkan region is home to over 5,000 species of flowering plants, 139 mammal species,508 bird and 179 amphibian species, including 325 globally threatened species. Additionally, two great peninsular rivers, the Krishna, and the Godavari, originate here. This region's ecology is so precious and unique that the idea of building a nuclear power plant here seems diabolically destructive [12] (Coalition for Nuclear Disarmament and Peace, 2011).

*Figure 5: Konkan Region*

[10] ("Government behind Jaitapur Nuclear Power Plant delay: Union Minister Jitendra Yadav,", 2015)
[11] *EDF India*. (2023, 12 14), from "EDF," EDF India

[12] Coalition for Nuclear Disarmament and Peace. (2011). *"Courting Nuclear Disaster in Maharashtra Why the Jaitapur Project Must Be Scrapped,"*. Coalition for Nuclear Disarmament and Peace. (Solanki, n.d.)

### 3.2. Environmental Impact Assessment (EIA) Study:

An Environmental Impact Assessment (EIA) is a vital process used to identify, predict, and mitigate the environmental consequences of any proposed development. This systematic approach helps ensure informed decision-making by considering both the potential benefits and drawbacks of a project on the environment. The EIA process typically involves three key stages: establishing a baseline by identifying existing environmental conditions, predicting the project's impact on these conditions, and developing mitigation strategies to minimize any negative environmental consequences.

The proposed Jaitapur Nuclear Power Plant (JNPP) has undergone an EIA process to assess its potential environmental impacts. This assessment involved a three-season environmental survey to establish baseline data for various environmental components like air, water, land, biological resources, noise levels, and the socio-economic conditions in the surrounding area. The EIA assessment study was conducted by the National Environment Engineering Research Institute (NEERI) and was approved by Ministry of Environment and Forest (MoEF) of India in November 2010 with 35 conditions.

The study revealed that the Jaitapur site consists predominantly of barren land with no habitation and only 0.24 hectares of vegetation. There are no breeding sites or significant land-based activities present in the area. Additionally, there are no national parks or wildlife sanctuaries within a 25-kilometer radius of the site. The biodiversity is noted to be poor, particularly with respect to invertebrates and seaweed and there is no hazard of earthquake or tsunami in the region[13]. (Solanki, n.d.)

These findings suggest a minimal immediate ecological disruption from the project; however, concerns have been raised about the adequacy and transparency of the EIA, particularly regarding the potential effects on marine life from the heated water discharge.

### 3.3. Jaitapur Project – A threat to Unique Ecosystem:

The EIA assessment of the Jaitapur Power Plant is opposed by locals, civil groups, experts and organizations major including TATA Institute of Social Sciences (TISS), Bombay Natural History Society (BNHS) and Western Ghat Ecology Expert Panel. The major points are discussed below:

#### 3.3.1. Lack of Competence of NEERI:

NEERI's capability to conduct a comprehensive EIA for a nuclear power project has been questioned. NEERI has developed a notorious reputation for its substandard work, often favouring promoters of questionable industrial projects. Critics argue that NEERI, by its own admission, is not adequately equipped to assess the specific radiation-related hazards associated with nuclear reactors. Furthermore, the assessment was conducted for only two reactors, despite NPCIL's plan to construct six EPRs at the Jaitapur site[12]. (Coalition for Nuclear Disarmament and Peace, 2011)

#### 3.3.2. Non-Transparency of Approval Process by MoEF:

Another concern was raised on the hasty approval process of the EIA assessment. The environmental clearance for NPCIL was granted in a mere 80 days after the submission of its EIA report, a process that typically takes six months or more. The mandatory public hearing on the EIA, held in May 2010 under conditions of police intimidation, was a sham. Of the four notified villages, three did not receive the required Marathi copy of the report a month in advance, while the fourth village received it only four days prior to the hearing[19]. (Bidwai P. , 2011)

[13] Solanki, A. N. (n.d.). *Environmental Impact Assessment A brief discussion.*

### 3.3.3 No Comprehensive biodiversity Study:

A survey by the Bombay Natural History Society (BNHS) reported 1,500 species of flora and fauna in the Jaitapur area, contradicting the NEERI findings that characterized the land as barren and infertile. The TISS report on the Social Impact Assessment of the project states that, according to government records, the vast area of land to be acquired for the plant is non-productive. This includes categorization of land as '*potkharaba kshetra'* (useless/barren land) and '*warkas kshetra'* (less usable category). However, villagers dispute this categorization, stating that portions of this land are used as pastures for grazing animals. Additionally, there are large portions of land known as *'baul*' where high-quality rice is cultivated. Some of this land also includes cashew and mango orchards[14]. (Context of The Jaitapur Nuclear Power Protest, Ratnagiri Introduction., n.d.)

The BNHS highlights the project's failure to consider the rich biodiversity, including 134 rare plant species and several endangered species protected under India's Wildlife (Protection) Act, 1972. It also overlooks two major creeks, Vijaydurg and Jaitapur, and their biodiversity. Furthermore, the proximity of several sanctuaries and national parks within an 80 km radius, such as the Malvan Marine Sanctuary (56 km), Chandoli National Park and the proposed Tiger Project (80 km), Radhanagari National Park (60 km), and the ecologically invaluable and fragile Western Ghats (80 km), has not been adequately considered[15]. (Khan, 2011)

An environmental study of Ratnagiri and Sindhudurg districts by Madhav Gadgil, chair of the Western Ghats Ecology Expert Panel, sharply criticizes the government for violating environmental laws and norms in the Konkan region. Gadgil's interim report questions the rationale for establishing numerous power projects in such an ecologically valuable and fragile area. Instead, the report advocates for micro- and mini-hydel projects[12]. (Coalition for Nuclear Disarmament and Peace, 2011)

### 3.3.4 No assessment and solution for nuclear waste:

Another important concern raised about the Jaitapur nuclear project is the thermal impact of water discharged from the plant into the sea, which will be 5°C hotter than the ambient sea temperature. According to a report by the Bombay Natural History Society (BNHS), "even a 0.5°C of continual thermal stress will lead to mortality of marine species." Additionally, the BNHS has mapped 407 hectares of mangrove vegetation within a 10 km radius around the nuclear plant, highlighting the potential ecological damage in the area. However, EIA assessment failed to address these issues adequately, focusing only on immediate environmental impacts thereby overlooking critical issue of radioactive waste management and long-term storage solutions raised by the BNHS report[19]. (Bidwai P. , 2011)

### 3.3.5 No consideration of seismic vulnerability:

Jaitapur lies within a seismically sensitive region categorized as Zone IV on India's earthquake hazard map, indicating a high risk of damage. According to Greenpeace, the area has witnessed multiple earthquakes exceeding 5 on the Richter scale over the past two decades. The 1993 earthquake, registering 6.3, resulted in significant casualties, while a 2009 earthquake led to the collapse of the Jaitapur bridge. Surprisingly, these seismic risks were not factored into the site selection process and EIA assessment study for the nuclear project.

Stating all these criticisms and concerns, it is worth mentioning that the 1,600-page Environmental Impact Assessment (EIA) report prepared by the National Environmental Engineering Institute (NEERI) fails to address any of these critical environmental concerns. It disregards significant issues such as the potential for catastrophic

[14] *Context of The Jaitapur Nuclear Power Protest, Ratnagiri Introduction.* (n.d.).

[15] Khan, A. (2011, Nov). "Anti-Nuclear Movement in India: Protests in Kudankulam and Jaitapur,". *South Asia Research, 42,* 7-22.

accidents, routine radioactivity exposure through emissions and effluents, cumulative environmental impacts from multiple concurrent projects, and the local ecosystem's capacity to sustain such developments.

Despite these glaring omissions, the then Union Minister of State for Environment and Forests, Jairam Ramesh, approved the Jaitapur project with 35 conditions and safeguards. However, many of these conditions relate to studies and safeguards that should have been implemented much earlier, and some are vaguely defined. They do not effectively address the fundamental flaws and deficiencies in the project design.

In response to criticism, the minister evaded questions about the clearance process by stating that he lacks the authority to judge the necessity, economics, and safety of nuclear power plants. He emphasized that the project's advancement is driven not only by energy needs but also by strategic and foreign policy considerations. Ramesh labelled it "paradoxical" that environmentalists oppose nuclear power despite its perceived green and clean attributes, sidestepping queries about the project's potential environmental and radiational impacts[12]. (Coalition for Nuclear Disarmament and Peace, 2011)

# Chapter 4: Social Impacts

Jaitapur-Madban, about 400km from Mumbai in Maharashtra's Ratnagiri district, attracts visitors first with its sheer beauty, lush with a variety of greenery, surrounded by mountains, valleys, plateaus, lagoons, creeks, orchards, and farmlands, along with its spectacular beauty. As soon as you walk through this place, you realize that it is an exceptionally rich trove of nature, abundant with cereals, grasses, roots, legumes, herbs, and flowering trees, including those bearing fruit (especially prime varieties of the world's best-known mango, the Alphonso). It rains between 3,000 and 3,500 millimeters a year in this region. Greenery covers almost every square foot of this land. The second thing that stands out is the proliferation of posters, banners, and slogans saying "Areva Go Back," "No to Nuclear Power," and "Radiation Kills (Bidwai P. , 2011).[16]

## 4.1. Land and agriculture:

The nuclear plant in Jaitapur is expected to be built over 968 hectares and will wipe out five villages with a combined population of 40,000 (Madban, Niveli, Karel, Mithgavane and Varliwada). People in the area received land acquisition orders in 2007, and by January 2010, the government of Maharashtra had completed the acquisition of 938.026 hectares. Villager's were offered Indian Rupees (₹) 2.86 per square foot for barren land and ₹ 3.70 per square foot for cultivable land, equivalent to ₹ 125,000 and ₹ 160,000 an acre. A subsequent increase was made from ₹ 400,000 an acre to ₹ 1,000,000 an acre, with one job being guaranteed to every affected family. Even though 2,375 families have been affected by the land acquisition, only 114 have claimed compensation; the rest have refused to accept the cheques. NPCIL has labeled 65 percent of the land as barren. There are many crops grown here, such as rice, cereals, cashews, coconuts, kokum, betel nuts, pineapples, and other fruits. The local population finds this outrageous as the land is highly fertile and produces fruits in abundance (BoseTarun, 2013).[17]

Coconut groves are the reason for Madban's name on the Konkan coast. The JNPP will take over all the land of 768 landholders in Madban out of the 2,300 affected in four villages. In the lead of the protests is Pravin Gavhankar, who stands to lose 53.68 hectares. "They are saying our land is barren but every year we get some compensation from the government for crop loss. In addition, we see vast quantities of paddy here. The NPCIL is lying and is not at all transparent. We will oppose the project till the end," he says (Menon, 2010).[18]

Mango, cashew nut, coconut, kokum, and betel nut cultivation has attracted large amounts of investment. An estimated Rs 22,000 Million is generated by mango cultivation in Ratnagiri, which covers 15,233 hectares. Changes in temperature and soil chemistry can have a drastic impact on the mango crop. There are concerns that the project would result in a large loss of mangoes (Bidwai P. , 2011).[19]

[16] Bidwai, P. (2011). People vs Nuclear Power in Jaitapur, Maharashtra. Economic and Political Weekly, vol. 46, no. 8, pp. 10–14.
[17] (Tarun, 2013)). Jaitapur Nuclear Power Plant: Another Catastrophe in the Offing.
[18] Menon, M. (2010, January 23). The Hindu : Other States / Maharashtra News : Nuclear power plant opposed.
[19] Bidwai, P. (2011). People vs Nuclear Power in Jaitapur, Maharashtra. Economic and Political Weekly, vol. 46, no. 8, pp. 10–14.

*Figure 6. Standing up Idolmaker Vijay Raut holds the NPCIL document showing his land has been acquired (Ghanekar, 2010)*[20]

### 4.2. Fishing:

Fishing is the main source of income for at least 15,000 people in the area. Seven fishing villages - Sakhari Nate, Tulsunde, Ambolgad, Sagwa, Kathadi, Jambhali, and Nana I Anganwadi - will be affected by the project, according to the Maharashtra Macchhi mar Kruti Samiti. The annual fish catch in Ratnagiri district is 1,25,000 tonnes. About 40,000 tonnes of this comes from Sakhari Nate. A sizeable amount of the catch is exported to Europe, Japan, and other countries. Fish exports are likely to be affected because they might fail the stringent requirements of European "catch certificates" which demand a declaration of the location, depth, temperature, and time of fishing. Consumers in the developed countries would resist eating produce grown in the neighbourhood of nuclear reactors. Mango consignments from Ratnagiri have been rejected in Japan because traces of pesticides were found in the packaging. NPCIL and Maharashtra government officials recently tried to tempt fisherfolk in Nate, a prosperous, largely Muslim, fishing village with 500 boats, with offers of alternative jobs. They retorted, "Will you give us another Arabian Sea?" The fisheries economy generates enough income to pay unskilled workers a daily wage of ₹ 300 to ₹ 400, a rarity in India and Maharashtra. The area's fisherfolk know through people-to-people exchanges of the plight of the original inhabitants of the villages around Tarapur, the site of India's first two nuclear reactors, which is not far away. Three fishing harbours have vanished, the once-prosperous farmers have become repapers, and there has been no rehabilitation worth the name (Bidwai P. , 2011).[21]

The plant will daily release 52,000 million litres of hot water into the Arabian Sea, thus significantly raising seawater temperature. Further, Jaitapur's community leaders fear that once the project becomes operational, its elaborate security arrangements would imperil fishermen's unhindered use of the two creeks of Jaitapur and Vijaydurg. As Pravin Gavankar, President of the Sanhit Seva Samiti (Sanhit Welfare Committee), a local activist organisation opposed to the plant, said, "The village is a solace for some 650 odd Trawlers. Each trawler provides work for 12 men, which means finance for 12 families. If and when JNPP comes here, the warm reactor waters will destroy the catch and in one shot all the 12 families will be affected".

Amjad Borkar, vice-president of the forum Macchimar Kruti Samiti, says, "We posed a lot of questions in the public hearing that took place on 6 May this year about the restrictions on navigation and yield once the project starts (TEHELKA has a copy of the minutes of the meeting). But neither CB Jain nor Collector Madhukar Gaikwad could answer our questions." The problem, according to Borkar, is, "The fishermen cannot anticipate today what losses they will face five-seven years from now, and the 5,500-strong population of Nate has all of 51 hectares and the sea at our disposal. The fish is exported to Japan, Europe and other countries. What will happen when the plant starts?" (Ghanekar, 2010)[22]

### 4.3. People's Protest and Resistance Campaign:

The people of the Jaitapur region have put up brave resistance to the nuclear project right from the beginning. Initially, the opposition came mainly from Madban and other directly affected villages. But soon, fishing

[20] Ghanekar, N. (2010, Septembe 18). The nuclear park at Jaitapur will be huge, So will the human cost. Retrieved from Tehelka - India's Independent Weekly News Magazine

[21] Bidwai, P. (2011). People vs Nuclear Power in Jaitapur, Maharashtra. Economic and Political Weekly, vol. 46, no. 8, pp. 10–14.

[22] Ghanekar, N. (2010, Septembe 18). The nuclear park at Jaitapur will be huge, So will the human cost. Retrieved from Tehelka - India's Independent Weekly News Magazine

communities, mango traders, transporters, and civil society activists from the Ratnagiri district headquarters, and activists and environmentalists from Mumbai and other parts of India joined in.

On 29 December 2009, 12 January 2010, and 22 January 2010, when the government authorities visited Madban for distribution of cheques in lieu of compulsory land acquisition, the Villagers refused to accept the cheques. Government officials were shown black flags and were denied any co-operation in carrying out their activities. 72 people were arrested on 22 January 2010 when people protested against the compulsory land acquisition.

The state government and NPCIL have maligned the protests by attributing them to "outside elements." However, all the five-gram panchayats (democratically elected local governing bodies) in the affected area have unanimously passed resolutions opposing the project. More than 95 percent of those whose land was confiscated have refused to take the ₹1,000,000 an-acre compensation offered. The villagers, faced with repression, practice non-cooperation by refusing to sell food and other goods to state functionaries. When the government ordered teachers to brainwash pupils into believing that nuclear power is clean and green, people withdrew their children from school for a few days. Seventy elected councillors (panchayat representatives) from 10 villages have resigned from their positions (BoseTarun, 2013)[17.]

*Figure 7. ECO CONCERNS: Villagers take out a protest march against the nuclear power plant proposed at Jaitapur in western Maharashtra (Deshpande, 2010)[23]*

### 4.4. Government Response:

A major complaint of Jaitapur's people is that state and NPCIL officials treat them as ignoramuses and fools who can be taken for granted, misled, or lied to. The state government has unleashed savage repression on the local people for opposing the project. It routinely arrests and serves notices upon peaceful protesters and promulgates prohibitory orders under Section 144 of the Criminal Procedure Code and the tough Section 37 of the colonial Bombay Police Act. Activists have had false charges framed against them, including attempts to murder. The higher judiciary, apparently afraid to question the Holy Cow of nuclear technology, tends to refuse anticipatory bail to them. An instance of such repression is a frail 70-year-old diabetic, Shriram Dhondo Paranjape, who was falsely charged with pelting stones at the police – when he could not have lifted a pebble. He was detained for 15 days. Eminent citizens who wanted to visit Jaitapur to demonstrate their solidarity with the protesters were banned.

Maharashtra's industries minister (and former chief minister) Narayan Rane, himself from Konkan, has repeatedly threatened to protest activists and warned that "outsiders" who visit the area to help them "will not come out (alive)" (Bidwai P. , 2011). [24]

According to project director, CB Jain, the villagers want higher compensation and hence they are threatening others who have accepted the cheques. In reality, there has been little effort to convince villagers that the plant is for the public good, leave alone explaining the computing of the compensation. Jain has a dismissive attitude toward the local community, saying, "Let them oppose it, they will be in a minority later. Such projects of national

[23] Deshpande, V (2010, December 5). Protest against Jaitapur nuclear plant, The Hindu.
[24] Bidwai, P. (2011). People vs Nuclear Power in Jaitapur, Maharashtra. Economic and Political Weekly, vol. 46, no. 8, pp. 10–14.

interest do not stop for a few people." As if realising that this is not politically correct, he adds: "But I respect the principles and ideas of the villagers." Too little, too late (Ghanekar, 2010).[25]

# Chapter 5: Nuclear Technology

Jaitapur nuclear power project is a cornerstone of the bilateral cooperation between India and France. With an installed capacity of around 9.9 MW, Jaitapur's huge nuclear power plant promises to light millions of households in India and creates thousands of jobs during 15 Years of construction and subsequent 60 Years of operation and maintenance of EPRs at Jaitapur[26] (EDF, 2021). However, this dream of building the largest nuclear power plant in the world is clouded due to the ongoing protests and controversies discussed in the previous chapters. Therefore, in this chapter, the Jaitapur power project will be analyzed from a technological point of view to evaluate if the technology favours this dream or is in fact another reason for the ongoing protest.

## 5.1. EPR – The proposal

On April 2021, EDF submitted the non-binding Techno-Commercial offer to NPCIL for the supply of EPR technology and undertake all Engineering and Procurement for 6 EPR reactors[26] (EDF, 2021). Following are key principles of this agreement:

- EDF will only provide the EPR technology and guarantees the performance of each of 6 EPRs under certain conditions for a certain period. EDF will also offer training services for NPCIL's operating teams. However, EDF will neither invest in the project nor take part in its construction.
- NPCIL will be responsible for the construction and commissioning of all 6 EPRs of Jaitapur nuclear power plant and for obtaining necessary permits in India.

*Figure 8: (LUDOVIC MARIN/AFP via Getty Images) Agreements related to the nuclear power plant projects*

## 5.2. EPR- The next generation of nuclear technology

EPR is a third-generation pressurized water reactor technology. The technology was designed and developed by AREVA NP and Siemens in close cooperation with EDF and German utilities[27] (AREVA, 2001). The rationale of this technology is that it is an evolution of existing nuclear reactor designs and incorporates the lessons learned from previous nuclear disasters such as Three Mile Island and Chernobyl[28] (Thomas, 2010). The developers of this technology claim that EPR offers several improvements compared to existing design such as[28] (Thomas, 2010):

1. It can withstand the most severe seismic incidents.
2. EPR features the most effective protection against abnormal events such as core meltdown.
3. EPR is comprised of four identical, independent safety systems to avoid simultaneous failure.
4. It reduces the electricity generation cost by 10%.
5. It provides improved ease of maintenance and increased availability.
6. It requires 17% less uranium and produces 14% less long-life radio elements to generate the same amount of energy.

## 5.3. EPR – Cracks in the confidence

[25] Ghanekar, N. (2010, Septembe 18). The nuclear park at Jaitapur will be huge, So will the human cost. Retrieved from Tehelka - India's Independent Weekly News Magazine

[26] (EDF, 2021). EDF submits to the Indian nuclear operator NPCIL the French binding techno-commercial offer to build six EPRs at the Jaitapur site.

[27] (AREVA, 2001), *The EPR Reactor*.

[28] (Thomas, 2010), "The EPR in Crisis," 2010.

Despite the EPR being celebrated as the solution to the nuclear industry's revival, the construction experience reveals serious concerns about its design, safety, and cost. Several design flaws are pointed out by critics of this technology[29] (International, 2011):

1. The operating system is coupled with its safety system, therefore, in case of an emergency if operating system malfunctions it can also cause issues with the safety system.
2. EPR reactors are designed to use high fuel burn-up to improve fuel economy. However, this very feature of the technology is the reason for higher toxicity in the radioactive nuclear waste, leading to larger immediate release fraction of radioisotopes.
3. It is also questionable whether it can withstand aircraft crashes into them.
4. EPR reactors are harder to build and control because of their larger size and higher requirement and stricter standards on the quality of their construction.

### 5.4. EPR – Promising technology or costly gamble?

There are only four EPRs in different stages of construction around the world, but two of them have faced severe issues arising from the ERP's design complexity. The construction of the first ever EPR commenced in 2005. The reactor is known as Olkiluoto 3 and is in Finland[17] (Tarun, 2013). After two years, in 2007, France itself decided to start construction of the second EPR known as Flamanville 3. Olkiluoto 3 was planned to be commissioned in 2009 but it was commissioned in 2022. Similarly, Flamanville 3 was planned to be commissioned in 2012 but it is now expected to be commissioned in summer of 2024. Both the projects have faced a delay of more than 12 years due to severe technological and quality control issues during the construction of the plant. For instance, both the projects faced welding issues due to the complexity of EPR. Over three thousand safety and quality control problems were detected in the case of Olkiluoto 3[17] (Tarun, 2013). Consequently, both the projects faced massive cost overruns of three to six times the original estimation[30] (l'Humanite, 2024).

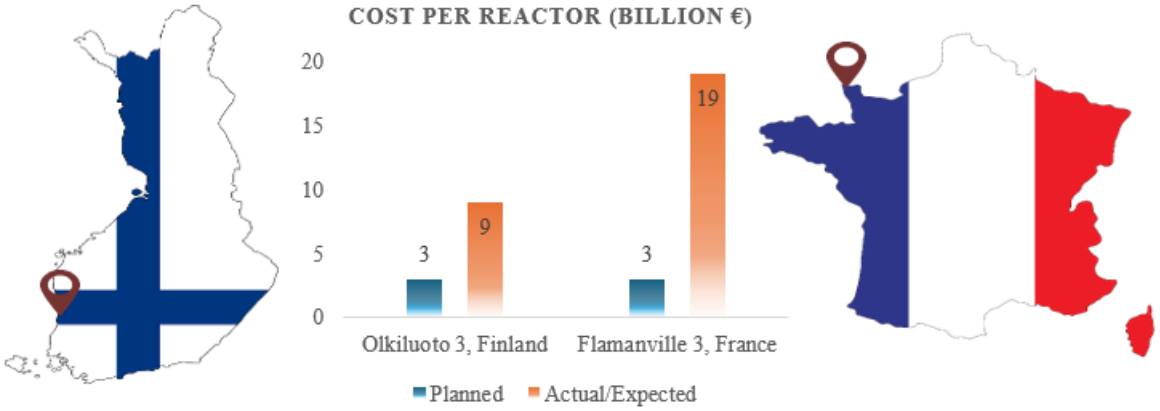


*Figure 9: Cost per Reactor in France and Finland*

### 5.5. EPR – Will India face same fate?

Whether Jaitapur will face the same fate or not remains a question. However, there are several factors such as India lacks independent nuclear safety regulator and there is also pressure to keep the project's cost low. For instance, the estimated cost per EPR in India is around 2.7 billion euros which is less than half of the estimated cost in case of Finland and France. The lower estimation of cost implies that either the cost is highly underestimated, or it does not include all the costs of the project. The argument about cheap labour does not explain this lower estimation of cost, as the major cost of the project comes from engineering equipment and heavy components. Moreover, India's nuclear program has also history of massive cost overruns, with reactors costing three to four times than originally estimated cost. Finally, India has no prior experience of construction such a huge reactor of 1650 MW[17] (Tarun, 2013). These Factors indicate that there is a possibility that Jaitapur power project might even face larger safety, construction, and cost issues.

[29] (International, 2011), "Jaitapur EPR media briefing".
[30] (l'Humanite, 2024), "Nuclear: start in Flamanville with 12 year delay and an additional cost of 15.8 billion."

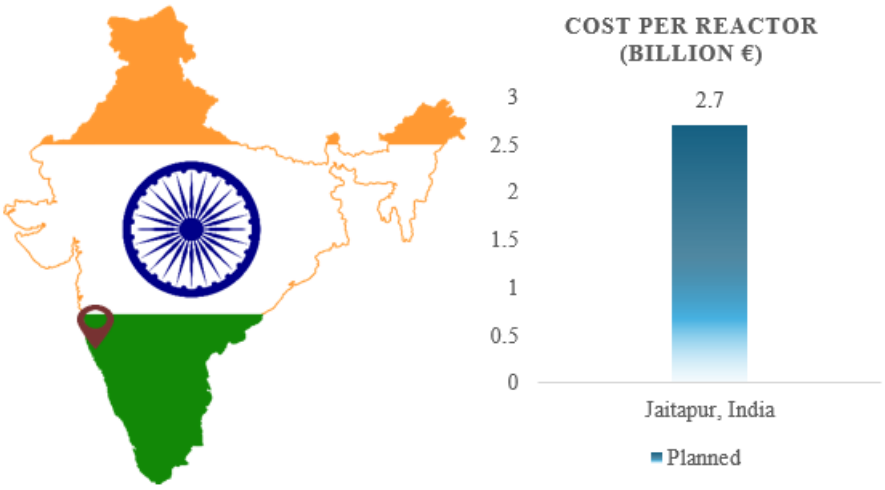


*Figure 10: Estimated Cost per Reactor in India*

### 5.6. EPR – The Roussely report

The promise of EPR being the third of nuclear technology which is cheaper to build, operate and easier to decommission has dramatically gone wrong with the construction experience of EPRs in Finland and France. These issues mainly arose from the complexity of EPR design. In October 2009, realizing the EPR was in trouble, Francois Roussely, former chairperson of EDF was asked by the French Government to evaluate the status of EPR and French nuclear industry in general. Roussely stated: *"The complexity of the EPR comes from (questionable) design choices. It is certainly a handicap for its construction, and its cost—the EPR should therefore be further optimized based on feedback from the EPRs under construction (Roussely report, 2010)."*[17], (Tarun, 2013) (Roussely report: Saving French Nuclear Industry with Outragoeus Measures, 2010).

### 5.7. EPR - Workforce and training:

**Training Schools:** The Bhabha Atomic Research Centre (BARC) Training School is the primary channel for recruiting engineers and scientists into the Department of Atomic Energy (DAE).[31] (IAEA, 2011)

**Degree Recognition:** The Orientation Course for Engineering Graduates and Science Post-Graduates (OCES) program at BARC is now recognized for awarding Master of Technology (MTech) and Master of Philosophy (MPhil) degrees.

**Recruitment Numbers:** Approximately 300 engineers and scientists are recruited annually through the BARC Training School.

**Expansion of Nuclear Education:** With the global cooperation and expansion of India's atomic energy program, universities and academic institutions have started venturing into the arena of nuclear education. Global Centre for Nuclear Energy Partnership (GCNEP) was inaugurated in January 2014, pursuant to a September 2010 government approval. It will be the DAE's sixth R&D facility. It is being built near Bahadurgarh in Haryana state, 45km from Delhi airport, and designed to strengthen India's collaboration internationally. It will house five schools to conduct research into advanced nuclear energy systems, nuclear security, radiological safety, nuclear material characterization, as well as applications for radioisotopes and radiation technologies. Russia is to help set up four of the GCNEP schools. In March 2017 the IAEA agreed to provide staff for the centre and use it for training professionals throughout the region.[31] (World Nuclear Association, 2016)

[31] Basic Principles Objectives IAEA Nuclear Energy Series Technical Reports Status and Trends in Nuclear Education No. NG-T-6.1

In August 2010 GE Hitachi Nuclear Energy (GEH) signed a preliminary agreement with India's Tata Consulting Engineers, Ltd. to explore potential project design and workforce development opportunities in support of GEH's future nuclear projects in India – notably the proposals for six ESBWR units – and around the world.[32]

# Chapter 6: Nuclear Liability and Judicial Stance

## 6.1 The Need of Liability:

Nuclear liability is a complex issue in any nuclear plant. The history of nuclear plants is full of disastrous nuclear accidents. For instance, the calamity of Chernobyl witnessed the death of thousands of people and severe suffering from the poisonous radioactive rays. The radioactive exposure was equivalent to the radiations caused by atom bombs dropped in Hiroshima and Nagasaki[33] (Cohen, 2023).In such a catastrophic incident, a major question of concern is, who will be responsible to compensate the loss of people, plant etc.? This is how, nuclear liability becomes crucial point of dialog while establishing nuclear plant.

## 6.2 Complexities in the Jaitapur Nuclear Liability:

The question of liability in the Jaitapur nuclear power plant has been a topic of discussion in India-France nuclear relations. India has its own **Civil Liability for Nuclear Damage Act (CLNDA),** which was passed in 2010 to protect the interest of victim in case of any nuclear accident. As per this law:

- Nuclear plant operators, equipment suppliers, and government agencies are liable for any nuclear accident or damage that may occur.[34] (Saraswat, 2023)
- This law poses unlimited liability on the operator in the event of a nuclear accident.
- It also gives the option to operator to turn towards the manufacturer, whether local or foreigner.[35] (Laponche, 2016)

In contrary, France has a different approach to nuclear liability. It follows its own law which is based on the **Paris and Vienna Conventions**. According to this law:

- The operator is primarily liable in case of a nuclear accident.
- The government provides financial assistance to the operator.

The discrepancies in the laws have been a point of contention between India and France. However, both parties are engaging in dialogues and negotiation to find a common ground on this issue[34]

## 6.3. Way Forward:

The unlimited liability clause poses a serious concern for France, as it would expose to huge financial risks in case of nuclear tragedy. On the other hand, India does not want any compromise in the interest of affected persons in case of nuclear incident. Having observed the restrictions involved with CLNDA, Indian government is incorporating amendments in CLNDA to provide more clarity in the issue of liability and compensation, while preserving the rights of its people. Hence, India has taken some steps in this regard to dilute the contention on liability:

1. It has created a Nuclear Insurance Pool (NIP) in 2015 to support the benefits beyond an amount equal to about $ 420 million[49][35]

The NIP is a joint initiative of the Indian government and the insurance industry, and it is managed by the state-owned General Insurance Corporation of India (GIC Re). The pool provides coverage for both property damage and third-party liability arising from a nuclear incident. The compensation is paid from a fund created by contributions from the nuclear operators, which are required to purchase insurance coverage from the pool[34].

[32] "Nuclear Power in India - World Nuclear Association," world-nuclear o (Nuclear Power in India - World Nuclear Association, 2024)rg.
[33]Cohen, J. (2023, June 6). *History's 6 Worst Nuclear Disasters*. (History)
[34]Saraswat, A. (2023, May 22). *India France Nuclear Ability and Liability: Jaitapur Nuclear Plant*. (Indian Defence Review)
[35] Laponche, B. (2016). *A NOTE ON THE JAITAPUR POWER PLANT PROJECT WITH FRENCH UTILITY EDF*.

2. Another solution is the creation of a separate liability regime for nuclear suppliers which would provide them with greater protection against liability claims[34]

Indeed, India is providing some flexibilities in CLNDA but the question is that these are administrative notification and not a legislative amendment. Hence, it may raise doubts in terms of legal certainty in India[35]

### 6.4.The Judicial stance:

Dr. Bhikaji Jagannath Waghdhare and others filed a writ petition against the Union of India and other respondents regarding the proposed acquisition of their lands for establishing a nuclear power plant. They challenged the legality of the land surveys and notifications issued under the Land Acquisition Act, 1894, arguing that the acquisition process was initiated without proper clearances and project evaluations. The Union of India, State of Maharashtra, and Nuclear Power Corporation of India Limited (NPCIL) defended the acquisition as urgent and necessary for the country's power needs, stating that all procedures were being followed.[36]

**Court's Consideration:** The High Court of Judicature at Bombay is considering the arguments, focusing on the urgency of the land acquisition and the adherence to legal requirements. The case emphasizes that urgency in land acquisition for the Jaitapur Nuclear Power Project is justified due to the accelerated need for the project, which will benefit many.

**Land Acquisition Process:** It outlines the steps taken for land acquisition, including invoking the 'Urgency Clause' and the subsequent actions by the NPCIL and state government to expedite the process.

**Urgency Clause Validity:** The court found that the urgency clause invoked for land acquisition was valid, considering the importance of the power project for public interest and the urgency writ large on the facts of the case.

**Section 6 Declaration:** The court ruled that the declaration under Section 6 of the Land Acquisition Act, published after the Section 4 notification in the Gazette, was legal and proper.

**Notification Details:** The court observed that the notification published in the Gazette contained all necessary details about the lands proposed to be acquired, and thus, it was not vague.

**Public Importance:** The court recognized the nuclear power project as of great public importance, noting that power is essential for the development process of the country and the project would benefit many people.

After this another petition was filled in the supreme court of India in October 2011, with the following concerns:

**Constitutional Concerns:** The nuclear liability law is criticized for being unconstitutional, violating Article 21 and principles of 'polluter pays and absolute liability.

**International Agreements:** India's signing of the Convention on Supplementary Compensation for Nuclear Damage is questioned, deemed a gift to the US, and criticized for conflicting with constitutional norms.

**Regulatory Issues:** The Atomic Energy Regulatory Board (AERB) is described as subservient to the Department of Atomic Energy (DAE), leading to conflicts of interest and compromised safety evaluations.

**Safety and Transparency:** The lack of transparency in nuclear safety audits and the non-disclosure of essential safety information are highlighted as concerns violating the right to information and public accountability.

**Fukushima Reference:** The petition references the Fukushima disaster to emphasize the potential hazards of nuclear power and the need for stringent safety measures. IAEA Study: Acknowledges a severe shortage of uranium worldwide, with known resources unable to meet future demand.

**India's Uranium Crisis:** Domestic supplies are insufficient, causing shutdowns and delays in nuclear power plants.[37] (BHUSHAN, 2011)

[36] B. Waghdhare and R. Desai, Dr. Bhikaji Jagannath Waghdhare vs Union Of India Through The on 13 August, 2009, vol. NO.8458 OF 2008. 2009. Available: https://indiankanoon.org/doc/1500977/

[37] (P. Bhushan, Writ Petition challenging the constitutional validity of the Civil Liability for, vol. No. 464 of 2011. , 2011)

**Safety Reassessment:** Highlights the dangers of ionizing radiation from nuclear plants, including cancer risks and genetic damage.

The Bombay High Court on March 19, 2018[38] (correspondant H. , 2018) admitted a petition challenging the environmental clearance procedure followed in issuing environmental clearance to the proposed Jaitapur Nuclear Power Plant (JNPP) at Madban, Ratnagiri.

Other than these major petitions there are a few more PILs in the court and no final decision has been announced by the courts on the case.

## Conclusion

The Jaitapur Nuclear Power Project in Maharashtra, India, represents a significant step towards India's energy transition, aiming to increase the share of nuclear energy in its electricity mix. The project, however, is mired in controversies spanning historical, political, environmental, social, and technological domains. While it promises cleaner energy and aligns with global carbon emission reduction goals, the project faces staunch opposition due to concerns over environmental impact, social displacement, and safety risks. The EPR technology proposed for the plant is advanced but not without its critics. The project's future hinges on addressing these multifaceted challenges and achieving a balance between developmental aspirations and sustainable ecological and social practices. The resolution of these issues will determine the viability and acceptance of the Jaitapur Nuclear Power Project and its role in India's energy landscape.

## References


"Government behind Jaitapur Nuclear Power Plant delay: Union Minister Jitendra Yadav,". (2015). *The Economic Times, May 15, 2015. Accessed: Jun. 17, 2024.* .

AREVA. (2001). The EPR Reactor.

BHUSHAN, P. (2011, October). Writ Petition challenging the constitutional validity of the Civil Liability for .

Bidwai, P. (2011). People vs Nuclear Power in Jaitapur, Maharashtra. *Economic and Political Weekly*, vol. 46, no. 8, pp. 10–14. JSTOR,http://www.jstor.org/stable/41151784.

Bidwai, P. (2024, June 16). *People vs Nuclear Power in Jaitapur, Maharashtra*. (Centre tricontinental) Retrieved from https://www.cetri.be/People-vs-Nuclear-Power-in?lang=fr

BoseTarun, K. (2013, January 12). *Jaitapur Nuclear Power Plant: Another Catastrophe in the Offing*. Retrieved from ritimo: https://www.ritimo.org/Jaitapur-Nuclear-Power-Plant-Another-Catastrophe-in-the-Offing

Chatterjee, R. (2020). *India 2020.* New Delhi: MINISTRY OF INFORMATION AND BROADCASTING.

Coalition for Nuclear Disarmament and Peace. (2011). *"Courting Nuclear Disaster in Maharashtra Why the Jaitapur Project Must Be Scrapped,".* Coalition for Nuclear Disarmament and Peace. Retrieved 06 3, 2024, from https://www.cndpindia.org/wp-content/uploads/2017/12/jaitpur-CNDP-report.pdf

Cohen, J. (2023, June 6). *History's 6 Worst Nuclear Disasters*. (History) Retrieved June 14, 2024, from https://www.history.com/news/historys-worst-nuclear-disasters

*Context of The Jaitapur Nuclear Power Protest, Ratnagiri Introduction.* (n.d.). Retrieved 06 2024, from https://global-uploads.webflow.com/5d70c9269b8d7bd25d8b1696/612673accf1abe4402a8a17f_Researchpaper.pdf

correspondant, E. t. (2014, october 12). *Jaitapur project to be scrapped if Shiv Sena comes to power: Uddhav Thackeray*. Retrieved from The Economic Times.: https://economictimes.indiatimes.com/industry/energy/power/jaitapur-project-to-be-scrapped-if-shiv-sena-comes-to-power-uddhav-thackeray/

correspondant, H. (2018, march 20). *HT Correspondent, "Bombay HC admits PIL on green nod to Jaitapur Nuclear Power Plant," Hindustan Times, Mar. 20, 2018.* Retrieved from Hindustan Times: https://www.hindustantimes.com/mumbai-news/bombay-hc-admits-pil-on-green-nod-to-jaitapur-nuclear-power-plant/story-vatA7lC1OIbC9EQfwmj9Z


[38] (correspondant H. , 2018)

Deshpande, V. (2010, December 5). *Protest against Jaitapur nuclear plant*. Retrieved from The Hindu: https://web.archive.org/web/20101208044841/http://www.hindu.com/2010/12/05/stories/2010120562481000.htm

Dr. Bhikaji Jagannath Waghdhare vs Union Of India Through The on 13 August, 2009, NO.8458 OF 2008 (Bombay High court august 2009).

EDF. (2021). *EDF submits to the Indian nuclear operator NPCIL the French binding techno-commercial offer to build six EPR at the Jaitapur site*. Retrieved from Available:https://www.edf.fr/en/the-edf-group/dedicated-sections/journalists/all-press-releases/edf-s

*EDF India*. (2023, 12 14). Retrieved 06 2, 2024, from "EDF," EDF India: https://india.edf.com/en/our-activities/nuclear/jnpp-the-largest-nuclear-power-plant-worldwide

Ghanekar, N. (2010, Septembe 18). *The nuclear park at Jaitapur will be huge, So will the human cost*. Retrieved from Tehelka - India's Independent Weekly News Magazine - web.archive.org: https://web.archive.org/web/20101018015358/http:/www.tehelka.com/story_main46.asp?file

https://economictimes.indiatimes.com/industry/energy/power/government-behind-jaitapur-nuclear-power-plant-delay-union-minister-jitendra-yadav/articleshow/47297574.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst. (2015, may 15). Government behind Jaitapur Nuclear Power Plant delay: Union Minister Jitendra Yadav Economic times. *https://economictimes.indiatimes.com/industry/energy/power/government-behind-jaitapur-nuclear-power-plant-delay-union-minister-jitendra-yadav/articleshow/47297574.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst*, p. 3.

*https://world-nuclear.org/information-library/country-profiles/countries-g-n/india*. (n.d.).

https://www.hindustantimes.com/mumbai-news/bombay-hc-admits-pil-on-green-nod-to-jaitapur-nuclear-power-plant/story-vatA7lC1OIbC9EQfwmj9ZL.html). (2018). Bombay HC admits PIL on green nod to Jaitapur Nuclear Power Plant. *Bombay HC admits PIL on green nod to Jaitapur Nuclear Power Plant*.

IAEA. (2011). *Basic Principles Objectives IAEA Nuclear Energy Series Technical Reports Status and Trends in Nuclear Education No. NG-T-6.1* .

India, G. o. (n.d.). *National portal of India*. Retrieved from https://www.india.gov.in/topics/governance-administration#:~:text=India%20is%20a%20Sovereign%20Socialist,constitutional%20head%20of%20the%20country.

International Atomic Energy Agency (IAEA) ISBN:978–92–0–109010–2. (2011). *Status and Trends in Nuclear Education1*. Vienna: IAEA.

International, G. (2011). *Jaitapur EPR media briefing.*

(n.d.). *Jaitapur Nuclear Power Plant.*

Jaitapur project to be scrapped if Shiv Sena comes to power: Uddhav Thackeray. (2014). *DNA*.

Khan, A. (2011, Nov). "Anti-Nuclear Movement in India: Protests in Kudankulam and Jaitapur,". *South Asia Research, 42*, 7-22. doi: https://doi.org/10.1177/02627280211054795.

Laponche, B. (2016). *A NOTE ON THE JAITAPUR POWER PLANT PROJECT WITH FRENCH UTILITY EDF*.

l'Humanite. (2024). *Nuclear: start in Flamanville with 12 years delay and an additional cost of 15.8 billion*. Retrieved from https://www.humanite.fr/social-et-economie/centrale-nucleaire/nucleaire-top-depart-a-flamanville-avec-12-ans-de-retard-et-un-surcout-de-158-milliards

Menon, M. (2010, January 23). *The Hindu : Other States / Maharashtra News : Nuclear power plant opposed*. Retrieved from web.archive.org: https://web.archive.org/web/20100123061701/http:/www.hindu.com/2010/01/18/stories/2010011856280300.htm

*Nuclear Power in India - World Nuclear Association*. (2024, may 8). Retrieved from world-nuclear org: https://world-nuclear.org/information-library/country-profiles/countries-g-n/india

*Nuclear Power in India*. (2024, May 8). (World Nuclear Association) Retrieved June 13, 2024, from https://world-nuclear.org/information-library/country-profiles/countries-g-n/india#:~:text=for%202012%2D17.-,The%20total%20nuclear%20capacity%20is%20likely%20to%20be%20about%2022.5,of%20India's%20electricity%20by%202047.

*Nuclear Power in the World Today*. (2024, May 7). Retrieved from World Nuclear Association: https://world-nuclear.org/information-library/current-and-future-generation/nuclear-power-in-the-world-today#:~:text=Nuclear%20energy%20now%20provides%20about,of%20the%20total%20in%202020).

P. Bhushan, Writ Petition challenging the constitutional validity of the Civil Liability for, vol. No. 464 of 2011. , 464 of 2011 (Bombay high court October 2011).

*Population by Country*. (2023, Jully 16). Retrieved June 13, 2024, from https://www.worldometers.info/world-population/population-by-country/

*Power Sector at a Glance ALL INDIA*. (2023, June 12). (Government of India (Ministry of Power)) Retrieved June 13, 2024, from https://powermin.gov.in/en/content/power-sector-glance-all-india

Rao, P. (2024, April 17). *The World's Biggest Nuclear Energy Producers*. Retrieved from https://www.visualcapitalist.com/the-worlds-biggest-nuclear-energy-producers/

(2010). *Roussely report: Saving French Nuclear Industry with Outragoeus Measures.*

Saraswat, A. (2023, May 22). *India France Nuclear Ability and Liability: Jaitapur Nuclear Plant*. (Indian Defence Review) Retrieved June 14, 2024, from https://www.indiandefencereview.com/spotlights/india-france-nuclear-ability-and-liability-jaitapur-nuclear-plant/

Solanki, A. N. (n.d.). *Environmental Impact Assessment A brief discussion.* . Retrieved from https://web.iitd.ac.in/~arunku/files/CVL100/EIA-Power%20plant.pdf

Tarun, K. B. (2013). *Jaitapur Nuclear Power Plant: Another Catastrophe in the Offing*. (Intercultural Resources ) Retrieved from https://www.ritimo.org/Jaitapur-Nuclear-Power-Plant-Another-Catastrophe-in-the-Offing#:~:text=As%20construction%20proceeds%20in%20Jaitapur,destroyed%2C%20jeopardising%2040%2C000%20people's%20survival

Thomas, P. S. (2010). *The EPR in Crisis.*

World Nuclear Association. (2016).

Yadav, J. (2015, 05 15). *"Government behind Jaitapur Nuclear Power Plant delay: Union Minister Jitendra Yadav,"* . Retrieved from The Economic Times: https://economictimes.indiatimes.com/industry/energy/power/government-behind-jaitapur-nuclear-power-plant-delay-union-minister-jitendra-yadav/articleshow/47297574.cms?from=mdr