STATE, TECHNOLOGY AND EXCLUSION: A CRITICAL-THEORETICAL STUDY OF THE KUDANKULAM NUCLEAR POWER PROJECT

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DECLARATION

I declare that the thesis entitled "**State, Technology and Exclusion: A Critical-Theoretical Study of the Kudankulam Nuclear Power Project**" submitted by me for award of the degree of **Doctor of Philosophy** of Jawaharlal Nehru University is my own work. The thesis has not been submitted for any other degree of this University or any other university.

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Abbreviations

AERB	Atomic Energy Regulatory Board
AT	Alternate Technology
CDF	Core Damage Frequency
CFR	Compact Fusion Reactor
CT Scan	Computed Tomography Scan
DAE	Department of Atomic Energy
DMK	DravidaMunnetraKazagham
GFR	Gas Cooled Fast Reactor
HDI	Human Development Index
IAEA	International Atomic energy Agency
IEA	International Energy Agency
IGCAR	Indira Gandhi Centre for Atomic Research
INSAG	International Nuclear Safety Advisory Group
KNPP/KKNPP	Kudankulam Nuclear Power Project
LERF	Large Early Releases Frequency
LFR	Lead Bismuth Cooled Fast Reactor
MIT	Massachusetts Institute of Technology
MS University	*ManonmaniamSundaranar University*
MW	Mega Watt
NEI	Nuclear Energy Institute
NGO	Non-governmental Organization
NPCIL	Nuclear power Corporation of India limited
NSG	Nuclear Suppliers Group
OB	Organisational Behavior
OECD	Organisation for Economic Co-operation and Development
PC	Public Communication
PFBR	Prototype Fast Breeder Reactor
PHRS	Passive Heat Removal System
PRA	Probabilistic Risk Assessment

PRIS	Power Reactor Information System
PSM	People's Science Movement
PWR	Pressurised Water Reactor
QBIS	Quick Boron Injunction System
RTI	Right to Information
RY	Reactor Year
SCOT	Social Construction of Technology
SFR	Sodium Cooled Fast Reactor
TV	Television
USA	United States of America
UK	United Kingdom
U.S.NRC	United States Nuclear Regulatory Commission
VVER	VodaVodaEnergo Reactor/ VodaVodyanoiEnergeticheskyReaktor

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Chapter-1

INTRODUCTION

"Reason has always existed, but not always in a rational form. Hence the critic can take his cue from every existing form of theoretical and practical consciousness and from this ideal and final goal implicit in the actual forms of existing reality he can deduce a true reality".

-Karl Marx (Deutsch-Französische Jahrbücher, 1844*)*

The purpose of the study is to examine the uncritical acceptance of technology, especially in the realm of nuclear energy. The puzzle pertains to the exclusion of the local population from decision-making on matters of civilian nuclear technology. While technology seemingly promotes development, it alienates people for whose benefit the said technology is aimed at. An attempt will be made to understand how technology owing to its specialised status and as a form of material power constitutes the practice of statecraft. Here the case of Kudankulam nuclear power plant demonstrates an instance where nuclear technology has been thrust upon a particular location notwithstanding the perceptions of the local population. In this regard, the study that is grounded in the critical theory, undertakes an examination of the manner in which the state uses technology, nuclear technology in this case, for the purpose of furthering its interests thereby exhibiting hegemonic tendencies.

Technology is widely accepted as an agent of social change. This explanation of social change is related to the various processes of modernity, globalisation, democratisation etc. Technology in many ways can be called a scientific and industrial amalgam. In effect, technology becomes an agent, creates phenomena and culminates into a practice. It is the practice of technology that can be examined in a number of ways. This study is rooted in critical theory and makes an attempt to examine the manner in which the state uses technology to exercise dominance over its subjects thereby excluding them from expressing their concerns.

Critical theory will enable the understanding of exclusion that exists at different levels, and contribute to an understanding of the various constraints e.g. political, economical or social

which accelerate such exclusion. The idea is to understand the existence and processes of exclusion by considering the issue-area of nuclear energy. Normatively speaking, critical theory is concerned with matters of exclusion. This study engages with such a concern of critical theory by focusing upon the predicament of the local population *vis-à-vis* the construction of the nuclear power plant in Kudankulam in Tamil Nadu. The study will draw from the concepts of the critical-theoretical approach.

The extent to which the people in any given society adapt and accept technology is linked to their culture and the needs and requirements of that society. In this context, the role of the state becomes important. In its quest for material power, the state invests considerably on technological progress and promotes technological culture. It is important to note that in the domain of civilian technology, especially in the areas of energy and infrastructure, it is the state that controls decision making. As a result, civilian technology which is ostensibly introduced for the benefits of civilians remains out of the reach of civilians. This is clearly pronounced in the case of nuclear technology which is kept beyond the purview of public deliberation.

Nuclear science has progressed along with the advent of modern physics and its effects are considered life changing for the humanity. Though all forms of technology come into practice after some substantial progress in scientific development, nuclear technology is considered important as it is related to energy production through radioactive materials. Some of the widely known radioactive materials are uranium, plutonium and thorium. They are known to have unstable nucleus, because of which they release radiations to gain stability.

The nuclear issue has also been considered to fall within the ambit of security and therefore secluded from public scrutiny. States including the liberal democratic ones shield the nuclear question with great sophistication and usually under the pretext of national security. It is a matter of concern that questions of nuclear energy – in terms of rationale and implications – are not subjected to democratic decision-making even in the so-called liberal democratic states such as India. The study focuses upon this issue in greater detail.

The controversy over the Kudankulam nuclear power project in India is a case in point. The nuclear power reactor has been vehemently opposed by the local population owing to the perceived human and environmental costs. These include the concerns of the people living in

the vicinity of the plant about their safety, livelihood and the changes it will bring to their day to day life. This controversy when examined through the lens of the society expands the scope of understanding state-technology nexus on one hand as well as the technology-society interface on the other hand. The thrust on the introduction and the imposition of the nuclear technology for energy purposes by the state without any mode of public participation brings into picture, various dimensions of analysis. While the issue can be studied as a debate between the specialists and the local population, the dimension of technology also needs to be critically examined. With the concerns of nuclear technology as a safe and viable option still remaining unaddressed, it is important that for a developing state like India which relies on nuclear technology as a tool for exercising power, the debates over nuclear energy need to be examined from the vantage point of the common public.

The Kudankulam nuclear power project has been witnessing resistance from the local population since the 1980s. It is this long drawn out struggle that has rendered the protest movement in Kudankulam peculiar. The project hence was rejected by the local population right from inception itself. The issue gained importance owing to nuclear accident in Fukushima in Japan that sent shock waves in the world. The role of NGO's also became prominent as the protests were found to be directly in contrast with the developmental agenda of the government that is related to electricity, energy and urbanisation of villages. The present movement is considered as the revival of the old movement that was dormant. Subsequently, the claims given by the specialised agencies about the reactor being safe and methodologically sound has created new fears in the minds of the people as the assurances are not fool-proof.

The Kudankulam issue highlights the concerns of the local population that are largely related to their livelihood issues *e.g.* the fisherfolk community. The major issue is twofold: first is the absence of local population in choosing their preferred form of technology which will suit their livelihood and environment and second, the opinions of the experts, the technocrats, and the officials that prevail over the concerns of the local population who are denied their rights to engage in genuine democratic debates.

The study is just not about the efficacy of nuclear energy as a policy option but primarily pertains to the exclusionary tendencies that are inherent in the decision-making procedures on matters of nuclear technology. Why is that discourses on nuclear energy tend to be hegemonic

and then why is that the local population is coerced to sacrifice for the so-called 'national' cause in terms of progress and development. It is pertinent to point out that the discourse on development often hinges on the importance of electricity and energy production that is related to the process of urbanisation. Therefore, on one hand, decision-making on nuclear issues becomes hegemonic and top-down, while on the other hand this obfuscation is justified under the pretext of being technologically sophisticated, thus remaining outside the domain of wider participation. The case is well elucidated in the issue of Kudankulam nuclear power plant.

The literature on security studies is replete with works that stress upon the debates relating to the desirability of nuclear weapons. Also contestations pertaining to nuclear energy in terms of its efficiency are mentioned. The scientific fraternity portrays a positive picture about the scientific developments in the field of nuclear science and the field of international relations looks at it as an important power enhancing tool. The study makes an attempt to examine the manner in which states especially of the liberal democratic kind such as India impose nuclear technology on its population in a top down fashion. The manner in which states pursue technology in an exclusionary and top-down fashion, especially in the nuclear sphere, is not sufficiently dealt with in the literature. It is this dimension – the exclusion of the local population from matters on decision-making that this study focuses upon in greater detail.

The role of technology is generally diverse and varied. Few scholars have tried to understand technology in the context of the role it plays in the political system. Others have made an attempt to examine technology along with the effects, it produces in the social system. Attempting to conceptualise technology, Heidegger (1977) says that technology inheres in it a revealing ability. 'This revealing ability' argues Heidegger (1977) 'unravels itself through other discoveries that also uses technology and that further expedites, unfolds and unlocks…' Ogburn (1949) points out that 'inventions affect human actions'. Inventions, though made suddenly are introduced 'to be adapted into a social situation'. In the international system, a particular phenomenon is explained through a number of variables which on many accounts obscures the factor of technology. Through several illustrations, Ogburn (1949) makes a distinction between between the 'choice' of a given technology and 'inevitability' of the way a specific technology is put to use.

An attempt has been made to define technology thereby enabling an understanding of how it affects other phenomena in the society. Darby (2004) considers technology a 'rational arrangement of means and ends' for humans and 'cause and effect' for nature. Hence technology includes in it both 'perception and practice' (Darby 2004). He links technology to rationality and characterises it as being 'progressively sovereign, relatively autonomous and self referential' that points towards 'systematisation' of both human and the non-human (Darby 2004). In a similar vein, Feenberg (2010) links technology with the social sphere. Integrating the social and the technical domains, he delves on the biases of technology and provides a critical perspective from the societal framework. Technology becomes 'socially relative' rather than being rationalist (Feenberg 2010). Doppelt (2006) makes a critique on the 'inbuilt rationality' associated with technology. In his view, it is this rationality that leads to repulsion from the 'genuine political debate' and shrinks the possibility of 'authentic ethical choice' by people (Doppelt 2006). He adds that one cannot overlook the fact that specific technologies exhibit certain standards and interests which are moulded by the users of that technology, thus bringing their own interest to the forefront. In essence, he is concerned with the democratisation of technology.

Jacques Ellul (1980) brings out the difference between industrial age and the technologically equipped society by labelling the latter as 'technetronic society'. In his opinion, the term 'technological system' would very well replace the role of a capitalist system. On one hand, this technological system induces objectification while on the other hand, it will lead to a 'virtual society' owing to its abstraction (Ellul 1980). Relating technology to the modern world and ways of the world that are associated with efficiency and speed, Ulrich Beck (2006) relates the present technological system giving rise to 'risks'. He avers that just as the technological factor is considered important for industrialisation, the effect of this technological progress has made risk a normal part of everyone's life. Every individual is expected to cope with risks that arise owing to the 'rational' and 'efficient' ways of organising life (Beck 2006). Beck lays thrust on the importance of 'mathematical morality' and the 'exactness of expert thinking' to substantiate the point of risk management in the technological world. This cannot be understood unless one appreciates the social construction of risk prevalent in the society (Beck 2006).

Defining technology as 'a bundle of physical artefacts' and 'a bunch of social practices' Herrera (2006) focuses on its 'interaction capability' that gives rise to 'shared norms' in the

international system. In the context of technology and the international system, there exists a 'complex socio-technical system'. A related point is made by Winner (1978) who calls 'technology as an interdependence of major functioning components'. Further, he argues that technology becomes a complex network and serves as an infrastructure for progress. Thus an analogy of technology is made with the inanimate form of labour.

It emerges from the literature that whereas technology as one of many factors is well accepted, but technology as a critical actor is not debated enough. Having discussed the interplay between technology and society, the following sections focus upon the issue of nuclear technology in sufficient detail.

Science as a study and a knowledge system constitutes a specialised study as well as a specialised system. This specialisation is highlighted when the focus is drawn towards nuclear technology. Nuclear technology which emanates from nuclear physics almost gains a hallowed status as a field of study in the sciences. Moreover, nuclear technology can be studied along with its impact on the political and the social system. Miller (2012) points out that the fundamental issue relating to nuclear technology has been its use for dual purpose. This dual use purpose itself makes nuclear technology attractive and secretive. The crux of the argument is that states take pride in being categorised as 'nuclear powers' and justify their nuclear capabilities by citing the usefulness in terms of the civilian purpose. The rationale is that nuclear energy is environment-friendly and preferable to other modes of energy production.

In the opinion of Glaser (2012), 'nuclear technology gained its hysteria' and became salient on account of its utilities notwithstanding the economic and technical limitations. Questions of plutonium reprocessing and uranium enrichment remain a matter of concern. The issue of nuclear waste has remained a concern and the ways to deal with it has been going through debates. The literature is deficient in examining the role of the specialists, the scientists and the technocrats in the nuclear arena especially when they fail to disseminate the relevant information to the general public. Technological infrastructure and materials have some values attached to them that make then revered. This value remains unspecified by the scientific community, in the case of nuclear technology.

In 1981, the nuclear protest movement in Brokford, Germany arose due to the livelihood issues of the locals who were residing near the construction site of the nuclear reactor. In addition to the concerns that are related to the disposal of nuclear waste and the use of spent fuel, the concern was also towards how the state was implementing the mega industrial project in a non-transparent manner. This makes it amply clear that technology is primarily a state driven project to implement its own agenda (Glaser 2012).

Drawing a comparison of nuclear technology with other forms of technological artifacts like dams, highways etc where the state is an active participant in the development of such technologies, and where similar concerns of non-participation are highlighted, the case of nuclear technology can claim to gain a higher degree of secrecy and its effects are more obfuscated. While dams and highways affect the land use pattern, livelihoods and cause displacement, the case of establishment of nuclear artifact is associated with the people attuning themselves with the nuclear power plant in their neighborhood. Here, in the case of nuclear technology, therefore, technological determinism becomes more pronounced.

Commenting on nuclear technology, and the manner in which it is perceived by people, Ramana (2011) says that technology, has also to do with aversions and 'stigmatisation' He further says that there remains 'a lack of positive conditionalities in implementing the use of this technology' (Ramana 2011). Discussing not particularly about nuclear technology, but states who possess this technology as nuclear powers, Itty Abraham (2009) characterises nuclear technology as a 'techno-politico artifact' that becomes a celebration and is posed as a 'cultural object' with 'multiple meanings'. This techno-politico artifact remains ambivalent through 'divided social formations' on one hand, and by proclaiming its 'singularity' on the other hand (Abraham 2009). It thus ties the nation and the local aspirations in opposite directions.

In general, the literature dwells on the motivations that drive nuclear technology especially those that lead to weaponisation (Miller 2012). However, the political motivations that drive nuclear energy projects are not sufficiently analysed. The study seeks to probe this dimension thoroughly.

In the context of civilian nuclear technology in the Indian case, it is important to underline that the Indian state does not have a clear-cut nuclear energy policy; there is merely an overall

nuclear policy. Mishra (1999) in his work points out the legislative and international framework existing in the field of harnessing nuclear energy. He argues that the motivations of the Indian state regarding this technology have always been towards extending state ownership on the raw materials as well as on the development of this technology under secrecy and state preserve. In this regard, he cites the Atomic Energy Act 1962 of the Indian government making it clear that nuclear technology will be put for civilian and hence peaceful use (Mishra 1999). This meant that the technology is being harnessed in such a way that it prevents hazards and ensures safety from radioactive wastes and radiation generating plants. The repeated assertion of India towards using nuclear technology for peaceful purpose after the explosion in 1974 highlights that the techno-scientific motivations of explosions were overriding military motivations (Chacko 2011). The peaceful use and the scientific achievement centred around nuclear technology in India has also been highlighted by many authors like Perkovich (1999) and Abraham (2009).

The commissioning and construction of the nuclear plant in Kudankulam, Tamil Nadu became controversial. The controversy brought to the fore a range of issues that have been debated for quite some time. However, this time the issues are highlighted in a much different way – participation of locals being conspicuous. The primary concerns are directed towards the nuclear reactors, nuclear waste disposal, land acquisition and the effect on health and livelihood of the people living in the vicinity of the nuclear power plant. Additionally, the protests are challenging the state control over planning, execution and review of civilian nuclear technology.

The establishment of nuclear plants at Kudankulam and other areas like Jaitapur highlighted the aspect of technology which is directly related to the people and the way the people voice their concerns regarding the impact of this technology. Senthalir (2012) in her work has highlighted the state of emergency that existed in Kudankulam when the nuclear power plant was commissioned. She points towards the silent protests by people against state agencies. The role of the state, thus, becomes important when the peaceful use of nuclear technology is to be reviewed and evaluated.

The protest movement by the common people is dismissed as mere scaremongering by the scientists and government officials. Also, the issue of ensuring safety has not been adequately addressed. Udayakumar (2011) has questioned the viability of the Kudankulam nuclear power

plant on various accounts, primarily looking at the viability of public participation. He argues that the 'needs of many is conflicting with the needs of the few' (Udayakumar 2011). Here he pits the government and its specialised agencies against the will of the common people. In other words, the needs of the larger population in terms of power generation seem to prevail over the needs and apprehensions of the local population who reside in the vicinity of the Kudankulam nuclear power plant. Therefore the assertion of the experts could no longer be relied upon. The role of nuclear technocrats for not addressing the safety concerns of the people has come under criticism. For instance, the risk assessment of the possibility of a severe accident at the nuclear site is an area of concern. Furthermore, scholars like Ramana (2012) and Udayakumar (2011) have repeatedly raised concerns regarding the functioning of specialised NPCIL (Nuclear Power Corporation of India Limited) that is instrumental in bringing this project to fruition. What is lacking is the adequate mechanism for ensuring complete safety.

The recent Kudankulam nuclear debate emanates from India's nuclear history which was inspired by the Nehruvian vision of industrialisation and scientific development. In this regard the understanding of the importance of nuclear energy is exhibited when the Atomic energy act was introduced and passed by the parliament in 1948. The Indian Atomic Energy Act was modelled on the British Atomic Energy Act that emphasised the need for secrecy and advocated state's absolute control over nuclear materials (Malik 2010).

In addition, Malik (2010) observes that the Indian nuclear programme has repeatedly taken the tone of secrecy, harbouring in it motivations of self-reliance and technological progress of the nation. The stated objective of nuclear energy remained disguised under immense state control and lacked 'peer review and hence becoming unaccountable, and inefficient' when it came to performance evaluation (Malik 2010) The Indian quest for nuclear technology remained ambiguous and then started becoming ambivalent with subsequent strengthening of state control on nuclear industry in 1962 (Malik 2010).

The timing of the Kudankulam controversy is also of importance as it was immediately followed by the 123 Agreement between India and the United States. The questions that became important in this regard related to the issues of peaceful use of nuclear technology in India. The term civilian nuclear technology also gained prominence post- 123 Agreement. The study hence will delve upon the peculiarities of nuclear technology that makes it

specialised. The dimension of state intervention and state hegemony will come into focus since the nuclear technology is developed as an industry that gives a hallowed status to the country as a 'nuclear power'. The issue of development that is intertwined with technology as an agent and the state as a facilitator in achieving developmental goals will be focused upon in different dimensions by considering the Kudankulam issue as a case study.

It is important to highlight here that the nuclear protest movement in India has been seen in the case of Jaitapura nuclear plant as well. However, the difference lay in the fact that the Kudankulam nuclear issue has historical roots. The issue began to surface back in 1980s when the first signal towards commissioning the plant was given.

Kudankulam nuclear power plant is a voda voda energo reactor (VVER) pressurized light water cooled and moderated reactor. It is a advanced model of Russian VVER 1000 which is adopted from the basic design of V320 with enhanced safety features (NPCIL 2011b).
In the opinion of experts, the Kudankulam nuclear power plant claims such features that enable the plant safe for the environment where it is located. Few key claims are that the nuclear steam supply systems are housed in a reactor containment that would contain any discharge of radioactivity. It hence makes the reactor safe from the external hazards. The containment structure of the plant is such that the leakages are well taken care of (NPCIL 2011b). Another important feature of the Kudankulam power plant is that the primary cooling water circuit has a closed cycle. This ensures that radiations, if any, which escapes from the fuel, gets trapped in the filters and the ion-exchangers that would therefore keep the plant and the personnel safe together with finding no outlet to the outer environment (NPCIL 2011b). These technical aspects of the Kudankulam nuclear power plant make the project viable from the point of view of the experts who are specialists in the matters of nuclear technology. Their views are propagated to the larger public through varied methods thereby allowing the project to gain acceptance.

Notwithstanding, the assurances given by the experts in terms of a detailed specifications of scientific and technical details, the concerns of the local population remain intact and unaddressed. These concerns emanate from the perception of the people for whom the nuclear power reactor brings many risks and concerns.

These risks include the use of the sea water as a coolant that can affect the fishes. Similarly, the discharge of the coolant water into the sea will affect the population of the fishes. They sound as genuine concerns by the local community whose living are dependent on it, but their concerns are reduced to be of less significance by the experts and scientists. This glaring difference in opinion highlights the political impact of technology which affects different people at different level.

The report by expert group makes a mention about the harmful effects on the marine ecosystem when the coolant water from the power plant will be discharged in the sea. This discharge is expected to raise the temperature of the sea that will affect the fishes. However, these concerns are further dismissed as producing minimum adversarial affects as the ecosystem has tendencies to regenerate itself (NPCIL 2011b).

The line of reasoning exhibits the callousness of the view of experts who belittle the immediate effect on the ecosystem. In their opinion, fish being a cold blooded animal can adjust itself to changing temperature. Further they argue that the rising temperature will enhance the biological activities in the sea. (NPCIL 2011b). The repeated justification to establish the authenticity of the power project further fuels suspicion in the minds of the local population who are not familiar with the technicalities and are primarily concerned with the potential risks that are posed to their livelihood.

The chief concern of the present study is the exclusion of the local population from the matters that are technologically specialised. Technological supremacy and its relation to development is the rationale on the basis of which questions and debates are dealt with regard to infrastructure development like roadways and railways as well as the domain of agriculture and biotechnology. Notwithstanding the above mentioned arguments, the normative and critical concern relating to the exclusion of the local population cannot be overlooked. The lack of familiarity in understanding the technologically sophisticated terms could never constitute a justification for excluding the local population. Literature on exclusion amongst other category is widely identified with the tribals and the indigenous population whose liberty for using land spaces and modes of production for economy is often tinkered by state agencies in the name of technological progress.

Similar instances of exclusion are found in several other areas of impact assessment in projects of mining, building of hydroelectric projects and nuclear power projects. The case of Kudankulam is no different as the project though claimed to be safe disregards the concerns of the local population. Here the local population constitutes those people who stay in the vicinity of the power project. Hassan (2012) in his study enumerates the 'AERB (Atomic Energy Regulatory Board) code of practice on safety in nuclear power plant sitting', in which the population around the nuclear power plant should be mindful of its capacity, such as, a) no population greater than 10,000 should be within 10km of the power plant, b) no population centres greater than 100,000 within 30 km from the plant, c) the total population in the sterilized area should be small, preferably 20,000. Despite all such codes Kudankulam power plant is found to be in violation of such existing rules where Kudankulam village is located only 2-2.5 km from the power plant.

The protest against the power plant and the exclusion of the local population is also manifest when the Kudankulam nuclear power plant that requires fresh water as a coolant and as a moderator used the Pechiparai reservoir to meet its industrial needs. This reservoir located in the Kanyakumari district of Tamil Nadu is meant for meeting the needs of local population, who face conditions of drought often. The local population was not sufficiently apprised of this piece of information (Padmanabhan et al 2012). The repeated grab of spaces that are meant for the utility of the people to meet the requirements of the power plant demonstrates in great clarity the exclusionary nature that is thereby inherent in the operationalisation of the project.

The safety features of any nuclear reactor is assured by the agencies like National Power Corporation of India Limited (NPCIL), Atomic Energy Regulatory Board (AERB), Department of Atomic Energy (DAE), Bhabha Atomic Research Centre (BARC). AERB (Atomic Energy Regulatory Board) is the regulatory body that monitors the enhancement of safety mechanisms of nuclear power reactor, and ensures nuclear, industrial and radiation safety while Bhabha Atomic Research Centre (BARC) is the premier organisation that engages in research and development in the field of nuclear arena. Similarly other specialised agencies like NPCIL (National Power Corporation of India Limited) are the public sector units that are responsible for the operationalisation of nuclear plants in India. DAE (Department of Atomic Energy) is the organisation that engages in research in nuclear field. It directly comes under the charge of the Prime Minister of India.

However, as enumerated in the study by M.V.Ramana and Aswin Kumar (2010), the nuclear power plants operating in India have exhibited fallacies. They are found to be inadequate in managing issues that had occurred in the nuclear power plants and where workers had to suffer from radioactive exposure. The tendency of not taking care of the people who are unaware of the specialised techniques of operations in the nuclear power plants also highlights exclusion of local people.

The issue then boils down to the following: a) technology and the ways in which it affects the people and b) the agencies of the state that become advocates of the said technology and further prevents people from voicing their opinions on such matters. The survey of the literature makes it clear that a holistic analysis examining the interplay between statecraft and technology is conspicuously absent. The study will focus on the politics of technology, in this case, nuclear technology as it relates to the issue-area of nuclear energy. By undertaking a case study of the Kudankulam nuclear power plant, which is located in Tamil Nadu, India, the study engages with the perspectives of the local population. In other words, the opinion of the local population, which has hitherto been excluded, will be taken into account.

The study seeks to analyse the interplay between statecraft and technology. For this purpose, civilian technology in the nuclear domain is chosen. Civilian technology implies the application of technology for the benefit of the civilians. In this case, civilian technology refers to the non-military dimension of nuclear technology which is not related to weaponisation. Rather, it indicates the use of nuclear technology for applications such as nuclear energy production.

The rationale in terms of the puzzle that underlies the study is as follows: why is that local population are excluded from decision-making and participation on matters of civilian technology, especially in the nuclear arena? To address this question, the Kudankulam nuclear power project is considered for investigation. The logic for choosing Kudankulam nuclear plant could be explained. No other nuclear project in recent history has triggered such a high level of protest and resistance from the local population as it is the case with Kudankulam.
The study is primarily grounded in the critical-theoretical tradition; it is concerned with questions of exclusion, in this case, the local population from nuclear decision-making and makes a critique on the top-down imposition of technology by the state. In order to understand the reasons for such glaring exclusion of the people by the state, the study

undertakes an analysis along three possible variables, namely, specialisation, development and hegemony. The idea is to figure out which of these potential explanations is the most persuasive in understanding the exclusion of the local population. Is it the case that the local population has been excluded in the decision-making process because technology is considered to be 'specialised knowledge'? Or is it the case that they have been denied the right to deliberate on such matters owing to the logic of 'development'? It may well be the case that the exclusion of the population has to do with the hegemonic aspirations of the state in imposing nuclear technology notwithstanding the apprehensions at the grassroots. It is this mode of enquiry that the study envisages by taking the case study of Kudankulam.

The study attempts to addresses the following questions:

1) Why is that decision-making on matters of technology especially nuclear civilian technology tends to exclude the opinion of the local population?
2) What is it in nuclear technology that renders it beyond the pale of public deliberations and scrutiny?

3) What explains the construction and commissioning of the Kudankulam nuclear plant in spite of resistance by the local population?

4) Why does exclusion continue as a matter of practice in the liberal democratic states such as India?

At the beginning of the study, the following hypotheses were stated.

1) The state uses and manipulates technology selectively and strategically and if necessary, by suspending democratic decision-making, thereby hegemonising the discourse and implementing policies in a top-down manner.
2) The commissioning of the Kudankulam nuclear plant demonstrates the resolve of the state in imposing nuclear energy production notwithstanding the apprehensions perceived by the local population.
3) The persistence of exclusion especially in the area of decision-making on matters of technology in the context of India can be attributed to a fixation with achieving development at all costs thereby overriding the concerns of the local population.

At the end of the study, the following hypotheses were proved:

1) The state uses and manipulates technology selectively and strategically and if necessary, by suspending democratic decision-making, thereby hegemonising the discourse and implementing policies in a top-down manner.

2) The commissioning of the Kudankulam nuclear plant demonstrates the resolve of the state in imposing nuclear energy production notwithstanding the apprehensions perceived by the local population.
3) The persistence of exclusion especially in the area of decision-making on matters of technology in the context of India can be attributed to a fixation with achieving development at all costs thereby overriding the concerns of the local population.

Through findings, few more hypotheses can be stated. They are as follows.

4) The mediating space between the technical experts and the local people becomes increasingly technical in language and understanding, thus leading to technical submissions. Technical submissions imply the submission to authorities who control scientific institutions such as Nuclear Power Corporation of India Limited (NPCIL), Atomic Energy Regulatory Board (AERB) and Department of Atomic Energy (DAE).
5) The understanding of technology gets differentiated amongst different social groups, who give different meanings to the said technology. A sense of stabilisation regarding the understanding of the technology is achieved which primarily depends on how the state or the government acts.

The method underlying the study is qualitative. Case study technique has been used. The case chosen for analysis is the Kudankulam nuclear plant. The rationale for the choice of this case is that it clearly constitutes an outlier in terms of the long history of protests and a very high intensity in terms of the intensity of resistance displayed by the local population. Field research to the area in which the nuclear plant is located will be undertaken. Surveys will be carried out to elicit the opinion of the local population on the issue relating to the construction and commissioning of the nuclear plant. In addition, interviews will be conducted with academics, the scientific community, policy makers, officials at the national and the local level and members of non-governmental organisations especially anti-nuclear movements. Official documents, documents published by specialised agencies, media reports and books and articles in journals have been used extensively.

The thesis has been organised as below, comprising the following chapters:
Chapter two titled ‘State and Exclusion in Critical Theory’ attempts to analyse the manner in which the concepts of state and exclusion have been dealt with in the critical-theoretical tradition.

Chapter three titled ‘Protest Movements against Nuclear Energy’ attempts to look into the protest movement that has accompanied the establishment of nuclear installations in the world.

Chapter four titled ‘Technology as Specialisation’ examines whether the specialised nature of technology, in this case, civilian nuclear technology contributes to its seclusion from public participation.

Chapter five titled ‘Technology as Development’ analyses whether the narrative of technology as progress and development has led to its uncritical acceptance in the case of nuclear energy production. The manner in which the rhetoric of progress and development has unfolded in the Kudankulam case has been scrutinised.

Chapter six titled ‘Technology as Hegemony’ deals with the way in which the state uses technology for serving its political interests. In other words, technology is used as a vehicle for exclusion and the tool for hegemonic aspirations. The analysis, in this chapter, is grounded in experiences and insights flowing from the Kudankulam case.

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Chapter Seven is ‘Conclusion’ that summarises the inferences of the thesis.

Chapter-2

STATE AND EXCLUSION IN CRITICAL THEORY

Critical theory has to be understood in its deeper meanings and for that it is important to understand the relevance of any theory as well as the importance of theoretical practices that can be applied to pragmatic utility.

What is a theory? As a student, the importance of theory is well understood as an empirical reality expressed as a web of logical propositions. Theory needs a set of propositions from which further derivations can be made. These propositions are drawn from basic premises and are very important if the basic premises are few in number. Theory thus forms the fundamental basis from which derivation of authentic knowledge can be claimed. Unlike theories in science, which could span universally, social science theories are limited to more contexts and work in limited settings.

Critical theory states that knowledge is not 'neutral' but only reflects the realities of 'existing social set up' (Cox 1981). In other words, to engage with knowledge, 'neutrality is a myth', while further derivations can be made only through 'existing social order' (Horkheimer 1937). For that, the acceptance and definition of existing social order is very important. Critical theory thus claims its authentication from 'three important criterion; explanatory, practical and normative'(Horkheimer 1972:246 quoted in Bohman 2016).

Another important reason to investigate any phenomena through critical theory, is to aspire to bring some 'changes in the status quo'. The acceptance of existing structures is problematic and can lead to dogmas. Critical theory lays down the importance of questioning the present structures, in which the inequalities are imbued to a level where questioning it and changing it, seems a lot difficult. The present 'structures and inequalities imbued in the structures' can thus be altered to secure greater freedom and equality, is what critical theory aims to achieve (Linklater 1996).

Critical-theoretical investigation looks for the possibility of change as the importance of present structures remain pronounced only if they can be 'reproduced indefinitely' and which critical theory disagrees to accept (Linklater 2007). These changes and the possibilities of changes are what need to be discovered in more fundamental forms through empirical investigations. Here the importance of empirical investigation will justify the relevance of theory.

Thus according to Horkheimer, Critical theory when looks at the society, questions the basic 'arrangement of the structures' but excludes itself from the 'understanding of good, appropriate, productive, valuable' as it is understood in the present form (Horkheimer 1937). The present structures as it exists, with fallacies also give its own solution to these fallacies. This knowledge creation hence cannot claim to be neutral. Critical theory will not evaluate the better functions of the organising structures but will only engage with it to understand the problems, the 'inter connectedness of the problems located within the existing status quo'(Horkheimer 1937). Critical theory looks at the society as an 'arrangement of structures' with its 'duties and functions' but the individual inside the society rather than drawing 'satisfaction from such arrangement' will question the basis of such arrangement (Horkheimer 1937).

Thus, men of critical mind are 'characterized by tensions'. Their acceptance and condemnation of the present order and arrangement of structures, go simultaneously in their critical enquiry (Horkheimer 1937). According to Horkheimer, 'organism as a naturally developing and declining unity cannot be a sort of model for society, but only a form of deadened existence from which society must emancipate itself. An attitude which aims at such an emancipation and at an alteration of society as a whole might well be of service in theoretical work carried on within reality as presently ordered'(Horkheimer 1937).

The Concept of State in Critical Theoretical framework:

Critical theory tries to build a connection with the society, by placing an individual, who is already a part of that system, in a position of recognising the tensions that form part of its existence, within the system. The twin role – one pertaining to enhancement of the performance within the system and two identifying the weak links inside the system, due to its continuing norms, seem to be a tough task. It is made possible by partly questioning or not accepting the structures of the system, and further by questioning the basis of its betterment.

State, is also a relationship between an individual and the society. State claims to supersede the common mass as the one who is a benevolent actor. Especially, thinkers like Weber have tried to bring about the 'benevolent character of the state' (Haralambos and Heald 2012). They place the organisation and its functionaries as those who are skilled to benefit the masses. Weber in fact brings out the functions of the state in the most normative outlook. He tries to assign the role of the state so as to meet the normative standards (Swedberg and Agewall 2005).

Critical theory bases itself into normative question. But these norms emanate from the fallacies of the structures, that cannot be accepted in the present form, hence a more fundamental struggle either to overcome the structure that exists or the struggle to emancipate people from bounded rationality of that structure. Here norms and normative understanding needs to be distinguished. What are norms as and when spoken of, when we talk of behaviours of the organisations? Norms are set and they standardise functions and behavior, especially, when it comes to managing organisations.

Here, when we understand state, as an organisation that is entitled to deliver functions to the people, of the society. The relation of critical theory with the state has to be evaluated in two respects- one is the normative stance, and other is the human security stance, emancipation and state structure can act contrary to each other, as the state is known to be ordered and maintain order. 'Critical theory on the other hand holds such orders in suspicion' (Horkheimer 1937).

From here, we can say that, as some critical theorists like Cox, has laid down the primary demarcation of 'critical theory from the problem-solving theory', critical theory excludes itself from all practical purposes. The thrust of critical theory lies in sticking to the normative stance (Cox 1981).

Critical theory, when speaks about the state conceptualises it to be a democratic state where voices and concerns of common people are attended to the maximum limit. Critical theory therefore talks about the transformation of the society from the ruthless capitalism to a true democratic state. In such formulations, there are striking similarities between 'critical theory and American pragmatism' (Bohman 2016) .The focus on democracy as the location for cooperative, practical and transformative activity continues today in the work of Jürgen

Habermas, as does the attempt to determine the nature and limits of 'real democracy' in complex, pluralistic, and globalizing societies (Bohman 2016). In its efforts to combine empirical social inquiry and normative philosophical argumentation, Critical Theory presents a viable alternative for social and political philosophy today. Secondly, while, considering its core normative theory— it is related to the transformation of a Kantian ethics of autonomy into a 'conception of freedom and justice in which democracy and democratic ideals play a central role' (Horkheimer 1993; Horkheimer 1972).

In its initial phases Critical Theory attempted to develop a normative notion of 'real democracy' that was contrasted with actual political forms in liberal societies. As contrast to 'false totality' in which basic needs and important interests of the people is systematically suppressed (Jay 1984), a 'true totality' offers true expressive rights for the people and move towards a true society. In this regard, democratic society would be considered as 'rational'. In democracy individuals have access to 'conscious control' of their rights and social processes that affect their daily life. To the extent that such an aim is possible at all, it required that human beings become 'producers of their social life in its totality' (Horkheimer 1972).

In facing the challenges of new social facts, Critical Theory remains a vital philosophical tradition in normative disciplines of social and political philosophy. Furthermore, this vitality is enhanced when it considers a range of democratic claims not discussed here, all of which equally challenge the fundamental frameworks of conceptions of democracy, justice, and their interrelationship: these include the 'struggles of aboriginal peoples, the disabled, women, and more' (Bohman 2016).

This critical and practical orientation gives rise to three different questions about critical social inquiry. First, does Critical Theory suggest a distinctive form of social inquiry? Second, what sort of knowledge does such inquiry provide insights into social circumstances and justify the social criticism of current ideals and institutions? Finally, what sort of verification does critical inquiry require?

Critical Theory as understood by Horkheimer

Critical theory as the theory of society is taken from Horkheimer's famous essay written in 1937 named 'Traditional and Critical Theory' (Horkheimer 1937). The nuanced

understanding of this theory can be attempted as why a theoretical activity is important. So to begin with, the possibility of any theoretical activity starts because of the existence of empirical facts and observations, together with the task of assimilation that needs to be done with the existing theory. The theoretical understanding on one hand takes care of the data, judgments and concepts as a professional activity, and also the intellectual work, takes care of 'needs and goals', the 'experiences and skills', the 'customs and tendencies', that play a part in the human existence. Thus it attempts to represent or present a picture of 'contemporary cultural totality', and that of 'differentiated, more harmoniously organized' arrangement as well (Horkheimer, 1937).

However it takes an exception to 'not deliberately lend itself to concerns which are external and alien to object but truly concentrates the problem which it meets in the wake of technical development and in this connection, itself turns up new problems and transforms old concepts where necessary-to this extent it my rightly regard the technological and industrial accomplishments of the bourgeois era as its own justification and be confident of its value' (Horkheimer 1937:).

On the other hand the human activity which has society itself as an object, the basic understanding emanates from the present understanding of any betterment that can be proposed in the existing structure. To elaborate, Andrew Linklater quotes Cox and says 'Critical theoretical methodology belongs to the radical-dialectical approach, which is used to identify forms of conflict and patterns of development which could lead to the transformation of the world order' (Linklater 1992). Critical theory on one hand gained importance, by slowly trying to understand the 'emancipation' and 'enlightenment' as being one outcome of social enquiry that tests the social constraints as well as the cultural understanding, it also remains as one important form of examination as is posed by 'postivism' (trying to test the social enquiry as objectively as possible by relying on observations and facts as much as possible). Critical enquiry also stand in contrast to the examination through' hermeneutics' that relies on 'inter subjective understanding' as well as the 'cultural understanding' revolving around human actions. (Linklater 1992).

Critical theoretical study primarily engages with the question of exclusion and inclusion. Since the state itself is an organised structure that enables performance of activities that are concentrated for the people, directed for their welfare, the question of public opinion is paramount. When a critical theoretical study engages with the embedded tendencies within the structures of the society, of which state is only a part, it tries to address the importance of

inherent exclusionary principles, which these structures are espousing. As one reading of Max Horkheimer's Critical Theory leave the impression of this theory being unconcerned about the solutions of the problems but very much concerned with the 'abuses that is carried with the way social structure is organised' (Horkheimer 1937). When Horkheimer says that the engagement itself has 'no intention, in its conscious intention or objective significance any purpose to suggest any better functioning of any element in the structure, but remains suspicious of the ways words like better, appropriate or productive is being used or understood in the present order', it means that the critical engagement is significantly contributing to the questions of how rather than what (Horkheimer 1937). On one hand Horkheimer himself characterises critical enquiry as being one laden with 'tensions' and considers 'emancipation as a valid aim of critical attitude', which can be achieved through alteration of society and which can be carried out in theoretical work, thus being of service to understanding reality as presently ordered (Horkheimer 1937). At the same time Horkheimer states that doing so, critical theoretical enquiry will lack the pragmatic character which is attached to the traditional thought of such engagement that are of 'socially useful professional activity'(Horheimer 1937).

Linklater (1996) posits that 'critical theoretical enquiry consists of three aims that posses 'normative, sociological and praxeological' method to question 'inclusion and exclusion' (Linklater 1996). For International Relations, he says that critical theoretical enquiry should start with the 'normative question of the state, proceeds to consider the sociological question of community and ends with praxeology and reforms'(Linklater 1997). This enquiry stands to question what Horkheimer originally talks about 'critical mind' where solutions suggested in the present order of the society itself cannot be trusted or relied upon. Hence Critical theory only engages with the 'tensions' that result from 'present social structure' (Horkheimer 1937).

Critical Theory and Social Enquiry

It is important to understand that how critical theory has contributed to the body of knowledge, especially since critical theory demands a place for itself when Max Horkheimer in his famous essay 'Traditional and Critical Theory' tries to chalk down how critical theory stands different from the traditional theory. At the same time, the enquiry enhances the quest for more subtle and substantive issues of society. Not only the issues, as it stand alone, but also how far the examination of such issues from the critical lens stirs the conscience of the

society. Thus, Horkheimer in his essay throughout keeps evoking the demands expected of a 'critical mind' and a 'critical attitute' (Horkheimer 1937). At the same time, critical theory gives marxism a special place for analysing exclusion practised or structurally embedded in the capitalist system. In the similar vein, all critical enquries rather social enquires rooted in critical theoretical study shall meet the expectation of analysing and portraying exclusion as an important aspect of studying society and in what forms its prevalence is justified or reinforced.

Critical theory created a space for itself from sociology and claims to 'embody both a social philosophy and an empirical sociology'(Scott 1978). Scott (1978) states that Habermas lays down an important parameter for engaging in critical social enquiry. The premise is 'knowledge constitutive interests' that attempts to amalgamate scientific methodology and social action in critical social theory (Scott 1978). Going by Habermas, there are three ways through which methodological fine-tuning for critical social theory is being achieved. They are 'technical, practical and emancipatory' (Scott 1978). Amongst these three, technical and practical knowledge are those concrete structures on which organisation like state and practices like exclusion can be based, but it is the final goal of emancipation which is the main concern of the critical theory and which is 'abstract' as it seeks to overcome the limitations that structures of society imposes on individual (Scott 1978). This to a large extent takes care of locating many social enquiries that gives rise to our understanding including that of state and exclusion as it stands today.

Further, when we refer to 'technical' interest, we refer to ways in which manipulation of nature and environment is done. The 'practical' interest is about 'understanding and developing consensus on intersubjective relations to achieve community and mutuality' (Scott 1978). Analysing through these interests, the state can be termed as an entity that exercises authority over the practise of 'technical interest' of society. It reigns supreme through various organisations to control the environment for meeting goals of prosperity and development for its citizens. Further, the departments and organisations also practise 'practical' interest through maintaining a cohesive community that works for the interest of the state.

Here politicians, bureaucrats form those community that work to further the interest of the state. While 'technical and practical' interest can be a form of manifestation for the fulfillment of the goal of state, which, at the same time excludes the goals of common people (tribals, indigeneous population, population living in remote areas and on fringes) whose

choices can be different from that of the state. The more a community tries to satisfy their needs through a self management system, the more it feels alienated from the state system as the choices get less centralised. In the similar vein, the state reduces its capacity to exert control to fulfill her practical and technical interests to reign over the territory and the population.

The emancipatory interest therefore stands distinct as it seeks to relieve the communities of inherent structural constraints, for which no escape can be immediately sought. Hence the 'subsystems' of the society are questioned on the basis of being exploitative in its endeavor of being 'rational' (Scott 1978). The most important thing to be analysed here is that while technical and practical interest comes close to the interests of the state, emancipatory interest can be used to define and understand exclusion in different forms.

Scholars like, Weber (2005) analyses the critical social theory as a Habermasian construct where he states that 'Habermas social theory is concerned with critical reconstruction of modern social and political life'. Critical analysis of the modern condition needs reconstruction before it can lead to transformation' (Weber 2005). While Kellner (1990) admits that critical theory from the Frankfurt School took a multi disciplinary approach which in one way overcomes the division in different disciplines such as political economy, anthropology, philosophy and history. Further, critical theory with its roots in normative concerns tries to visualise society and aims to capture those aspirations of human beings that tend towards freedom, and emancipation. Kellner (1990) in his article also pits critical theory against post modernist theory and finds the later more 'apolitical, hypertheoretical and hence nilhistic'(Kellner 1990). Horkheimer's attempt to bridge the gap between empirical research and broader philosophical questions lays the foundation of the social enquiry, which forms the basis of the critical social theory (Kellner 1990).

According to Andrew Linklater (2001) critical theory has traversed through three major phases and major analysis can happen in this framework. The first is emanating from the famous essay of Max Horkheimer 'Traditional and Critcal theory', that focuses on the emancipatory project related to humanity. Secondly, the understanding of the structures that, having ingrained in the functions of society practically makes it impossible for any sort of freedom from the culture of domination through the writings of Adorno's and Horkheimer's '*Dialectic of Enlightenment'* (a critique of instrumental rationality) and also blames the society to have created such. Finally, the importance of communicative action proposed by

Habermas and that takes care of all the socio-politico occurrences that are happening in the society, thus attempting a critical theory of society (Linklater 2001).

Critical theory as a valid enquiry of political questions is more closely placed to examine the question of struggles that are re-emerging in the form of clamour for greater assertion for identity. It further demands appreciation for the voices of those, whose assertions are more oriented towards the immediate needs of the population, that cannot be understood by the state structures, and hence contributes to the emancipatory projects (Linklater 2001). The concept of' 'emancipation' needs to be understood more closely and more distinctively here. Does emancipation come from those whose aim is to release oneself from the constraints that are imposed by the structures. State is also one such powerful structure, along with different organisation that works in conformity with the state. When we talk about issues of redistribution, the question of 'exclusion' is implicit in it, as the exclusionary tendencies are inherent in the structures.

Critical theory lays down two important paradigms for analysis. Any social process that is related to 'redistribution and recognition' can be analysed through two major framework being offered by the critical theorists (Scott 1978). One is the paradigm of production that is being offered by Gramsci and Max Horkheimer, while the other is the paradigm of 'communicative action' offered by Habermas (Scott 1978). Habermsian critical theory exactly tells us how critical theory responds to the quest for emancipation. Habermasian 'social theory' speaks about two kinds of formations that form an important part of human evolution, they are 'instrumental action' and secondly, 'communicative action' (Scott 1978). While the 'instrumental action leads to social labor', 'communicative action leads to social interaction' (Scott 1978). 'Social labor' and 'social interaction' are interconnected to establish the project of 'emancipation' that Habermas seeks to establish in his analysis of Critical social theory (Scott 1978).

Linking 'social labor to technical rules' and 'social interaction to social norms', (Scott 1979) analyses that the 'cooperation needed by social labor must be backed by social norm'. (Scott 1978). Habermas sees 'instrumental action in terms of strict means end relationship and strategic choice'. Instrumental action involves 'universality, specificity, neutrality and performance'. Learning process involved in instrumental action concerns the acquisition of problem solving skills, and that failure of an action indicates in competencies (Scott 1978).

‘Communicative action’ on the other hand defines consensual norms which define reciprocal behavioural expectation (Scott 1978). Such norms must be understood and must be considered as binding by the actors, and enforced through the use of sanctions. It is this intersubjective understanding and recognition that validates the norms. It is significant premise on which the ‘communicative action’ is based. Further, ‘reciprocity and mutuality of social interaction’ are the process through which the species construct the consciousness of itself as a subject. ‘Social interaction generates institutional framework, which is realised through systems like ‘family and ‘kinship’ (Scott 1978). In the similar way, Habermas calls ‘State and ‘Economy’ as the subsystem of ‘Instrumental action’ (Scott 1978). Institutionalisation, enjoying certain priority in the society, leads to instrumental action which are directed towards technical rules and such technical rules should be backed by social norms (Scott 1978).

Another important aspect of critical theory is that it is developed in opposition to the theory that was dominating the intellectual arena and that which Horkheimer calls ‘traditional theory’. In the comparison that is drawn between both the theories, Horkheimer states that while traditional theory with its thrust on quantification aimed to eulogise natural sciences, critical theory takes to social position from which the set of ideas emerge. Thus, any theory has its own roots and it is needed to be narrated in that context to reach its relevance. Thus proving that, ‘all knowledge has some purpose’, which was also pointed out by Linklater (2001).

It is very important to note here that Horkheimer draws a line between traditional and critical theory. He criticises traditional theory of reproducing that knowledge structure which itself is steeped in justifying it, making it uncritical and conformist. The blame is on modes of production, that has given prominence to exchange value structure, and abstract quantification that itself has emerged from the industrial society where mechanistic ways of existence is the demand of the society and its reproduction the only goal. The traditional theory, itself with its mechanistic bent of mind theorises such occurrences. The need of the time is to establish valid social questions that overcomes such conformist tendencies and roots the enquiries in emotion and social determination, in an autonomous manner that has been lost by the traditional theorists (Kellner 1990).

When critical theory is emerging in opposition to an already existing traditional theory and questions the existing knowledge structure on the basis of the roots from which it has

emerged, it is important to say that state is here the capitalist state. The capitalist state, uses its instrumental mechanism to reproduce the narratives in its favour. Critical theory hence will emerge as a critique of the capitalist state. In the modern world, the state itself is aspiring to be a welfare state and not oppressive as the capitalist states are visualised to be. It is important that Habermas in his book '*Between Facts and Norms'* tries to position a 'public sphere' which will be autonomous of state and economy. This 'public sphere' is what from, which the civil society claims its relevance. In this 'public sphere' lies the quest for emancipation and freedom as articulated by the Critical theory (Habermas 1961 quoted in Haysom 2011)

Understanding the Habermasian concept of 'public sphere' in his book *Between facts and norms* the public sphere is given the most prominence in creating right articulations for social issues. 'Thus this public sphere can give voice to social problems, make broad demands, articulate public interests or needs and thus attempt to influence the political process more from normative points of view than from the standpoint of the particular interests' (Habermas 1961 quoted in Haysom 2011). It is made possible only when 'public sphere contributes to strong communicative powers that performs a normative function in the democratic society, positioning itself away from the administrative machinations, when it acts as a relay to archaic communications of the society rather than being the organised public opinion of the undivided whole' (Haysom 2011).

The critical theory depicting emancipation in the embedded structures can be manifested in such spaces as they seek to be 'archaic', 'free of administrative machinations' but still bold to 'articulate needs and social problems' (Haysom 2011). Such public spheres are also tools to deal with social movements as the excluded masses gain their voices. Thus 'public sphere as a social theoretical and normative concept also serves to recontextualise the place of social movement within a critical theory of society' (Habermas 1961 quoted in Haysom 2011).

Such social movements emerge from the exclusionary tendencies that are inherent in our society. The depiction of exclusion in critical theory can be further enumerated when Cox (1981) makes the distinction between the social background from which the theoretical construct of a study can be based. Similar articulations were made by Hokheimer in his speech where he tries to distinguish critical theory as a theory that aims to 'encompass entire material and spiritual culture of humanity' (Kellner 1990).

Herbert Marcuse has spoken about the coming of fascist state in the 1930s, the time around which these critical theorists were working. Along with the valuable contribution that Marcuse made to the Frankfurt School that became the essential institute for the critical theorists, the major work of critical-theoretical studies continued from the Institute of Social Research, where Marcuse, while working in the institute tried to establish the roots and causes of Fascism. In this regard, Marcuse's contribution is towards establishing the causes for the coming in of the fascist government in Germany. He believed that the 'totalitarian state and totalitarian reason came from the structure of the existing society' (Marcuse 1964 quoted in Kellner 2001). In significant contributions later Marcuse, has devoted more analysis into totalitarian state and how people submit to the ideologies of the totalitarian state. In the analysis, Marcuse compares the liberal state with the fascist state and how liberal state makes the way for the fascist state. In both the cases , the capitalist market system works as an important support system (Kellner 2001).

Striking a major understanding for coming in of the fascist government, Marcuse stated that bourgeoisie set up and patriarchal family gives room for submission to a dominating force. His search for domination and the reasons due to which domination manifests itself are very well known through his writings. The critique of organisational culture, mass media, industrial management makes an individual nothing but submissive in attitude. Rather evaluating state through its political economy, critical theory places the Marxian analysis of economy as the basis of further investigations.

Here Marcuse questioned the Marxian analysis on two fronts -- the presence of revolutionary proletariat as well as the inevitability of capitalist crisis. Also, Marcuse analyses that state apparatuses can become pretty successful in overcoming critiques, negativity and opposition by 'integrating the working class and achieving stabilisation through state policies and development of newer methods of social control' (Kellner 2001). Marcuse linked domination to economics, politics, technology, social organisation and culture unlike the Marxian analysis that placed domination to be a function of 'capitalist relation of production and logic of commodification' (Kellner 2001).

Emancipatory Interests in Critical Theory

Emancipation is a basic social aspiration that has been spoken about in many philosophical engagements right from Aristotle to Kant. How is it different from the emancipatory project

proposed by the critical theorists. The analysis as proposed by Habermas takes departure from the project of enlightenment that was the main goal of philosophical dwellings of Kant for whom ' 'enlightenment is man's release from his self incurred tutelage. Tutelage is man's inability is to make use of his understanding without direction from another. Self incurred is this tutelage when its causes lies not in lack of reason but in the lack of resolution and courage to use it without direction from another' (McCarthy 1978).

Both enlightenment and emancipation fought against dogmatism. Seeking emancipation is a philosophical dwelling which is explained by Habermas by understanding what comprises of 'critical consciousness' (McCarthy 1978). Thus the achievement of critical consciousness is attained through 'negation', trying to 'establish one's own genesis', 'manifestation of consciousness that constitutes the history of mankind' (McCarthy 1978)., and works itself upto its present standpoint through stages of reflection'. Emancipation as perceived through Marxian theory, places importance on modes of production and forms of social labor that decide our consciousness.

Therefore the 'system of social labour' itself being drawn from the past system of labour decides how to comprehend the production or labour and become conscious of its own self in this process. (McCarthy 1978). Thus according to Habermas, Marx's analysis prepares the ground for seeking emancipation, but fails to achieve it in totality as the Marxian social theory is reduced to 'self generative act of human species to labour, which embeds in itself instrumental activity'. Here emancipation can be called upon through revolutionary struggle, as the prominence is given to the 'productive activity of the individual' and also by the 'organisation of their interaction', practiced through 'instutionalised relations of power and the cultural traditions that regulate men's interactions among themselves' (McCarthy 1978).

For the clamour for emancipatory interests as the critical quest makes it imperative, an essential component is manifested in the form of critique to the positivist approach in the knowledge production. Therefore, 'theory of knowledge became philosophy of science, reason became scientific reason, and the interest for reason was either denied or equated with the technical interest in prediction and control of objectified processes' (Mccarthy 1978). Habermas tries to open an essential area of critical reflection in the works of Marx and Hegel, by restoring the notions of comprehensive reason and the interest of reason in the 'human emacipation through incorporating his knowledge and human interests by using Freud's ideas'(McCarthy 1978).

Talking a bit about Freud's theory of civilization, the analysis of human society is dependent on the cultural milieu in which human species exist, and in this framework the elements like 'family', and other 'agencies of socialization, transforms humans from animals by transforming their instinctual behaviour through communicative actions and suppressing their libidinal and aggressive impulses into socially acceptable modes of behavior' (McCarthy 1978). The giving up of the 'libidinal and aggressive behaviour' of human beings depends on the 'level of development of the productive forces', 'organisation of their employment', and 'the distribution of the goods produced'. Thus it becomes possible to 'replace institutionalized repression of instincts by rational mastery'. This according to Freud is not only a function of technological development but also for the sustenance of a 'particular system of social labor' that further regulates 'regulations, institutions and commands that aim for the certain distribution of wealth and maintenance of that distribution' (McCarthy 1978). Habermas tries to use the Freudian idea of the way ideology is used to transform society, which is an important area for critical take as these ideologies emanate from the suppressed motives that are directed towards 'domination', or 'legitimising existing power relations', and also because these communications are completely excluded (McCarthy 1978).

Taking a cue from Freudian analysis, Habermas tries to locate critical social theory, as one 'which can be seen to belong to the self-formative process on which it reflects. It seeks to raise self consciousness to the point, where it has attained the level of critique and freed itself from all ideological delusions'. 'Critical theory pursues self reflection out of an interest in self emancipation', not freeing itself from the structures and institutions that it is critiquing in the first place, still distancing itself from the 'contemplative' or 'scientistic' way of studying human development. (McCarthy 1978).

Exclusion

Exclusion has been studied in varied forms and the major ones being the debate on haves and have nots. Exclusion is studied on the basis of few premises, one of them being the economic one, but apart from that there are many ways in which social exclusion is manifested. The social exclusion categorises exclusion on the basis of various societal differentiation. Hillary Silver (2007) points out that 'at the macro level, groups, societies, and communities may also undergo a process of social exclusion from larger collectives in which progressive isolation and a decline of solidarity give rise to new social boundaries'. Here exclusion is also talked about as social exclusion as exclusion needs to be defined keeping in mind the frame of

reference from which the alienation is seen. 'Exclusion can mean denial of access to information, resources, sociability, recognition, and identity, eroding self respect and reducing capabilities to achieve personal goals' (Silver 2007). Exclusion inheres in it a feeling of alienation which has negative fallout in terms of groups an individual is part of. Generally 'exclusion' is faced by a community or a group from a larger community or group which can exhibit domination in various forms. Critical theory engages with the idea of exclusion, in the context of Marxism that lays the foundation of class struggles. Exclusion is also taken as exclusion from the decision making which is the prerogative of the state apparatus. The dissentations centered around the exclusion of the local population from decision making when a project like Kudankulam Nuclear Power project was sanctioned in India.

Since critical theory engages with exclusion, the exclusion witnessed here could be studied in the paradigm of critical theoretical approach. Major critical theorists have tried to engage with the idea of 'exclusion' on a different note. Few theorists like Marcuse have tried to question the 'fascist state' and thus tried to touch upon the plight of the people who cannot understand the state propaganda, since the means of control is in the state apparatus. Others like Habermas have engaged with exclusion while dealing with the concepts of 'technical interests' and 'instrumental reasoning'. In a more simplistic terms, economists theorise exclusion in terms of depravity while sociologically exclusion is the loss of social prestige or social recognition based on either the work one performs or the conditionalities of birth associated in the place of existence of that person. Examples include race in western society and caste in Indian society. Therefore Hillary Silver (2007) calls 'exclusion' multi-dimensional.

Conclusion

This study is the attempt at using critical theoretical framework to contest technology. Technology has always been a political agent as well as an efficiency addition mechanism, that enables and captures human imagination. Technology, in this case nuclear technology, is attempted to be studied in many ways. But primarily as the nuclear power, the energy generation has remained a crucial factor for the growth of the community and hence the state. The critical theory paradigm of Habermas is extensively used. The concept of 'public sphere' and questions of 'deliberative democracy' helped find answers to the valid questions raised in this study. Further questioning the 'instrumental reasoning' and the 'technical interests' in the knowledge structure helps to understand the Kudankulam Nuclear protests in a better way.

Chapter-3

PROTEST MOVEMENTS AGAINST NUCLEAR ENERGY

Nuclear technology with its advent and its inception has been a discovery that has set the human imagination with awe as well as fear. The large scale devastation that it can cause when used as an explosive is still vivid in the memory of the people post second world war. The nuclear technology or the nuclear science, as it has progressed has always remained a matter of shock and awe for the common people.

It is well known, and especially since the 'Indo-US civilian nuclear cooperation agreement'. deal debate in 2005, that the large scale interest in India was directed towards the importance of having nuclear energy, for the country's progress. Nuclear energy started gaining prominence in the energy mix of a country such as India, though it remained an essential component of energy mix of western states. Nuclear energy gaining prominence was also seen as an important component of exercise of power projection, for a developing country such as India. The civil society kept engaging with the utility of including nuclear energy, especially since the experience of the western world itself has not been pleasant.

Here the comparison is how nuclear energy is being promoted as an important energy source, when even in the western world was mired in controversy and saw differences even in the scientific community. Through few case studies in Europe and America, the anti nuclear protest movement can be diagnosed through two lenses one is the interface of nuclear technology with common people, and secondly the use of nuclear technology as a power enhancing tool for the state.

Nuclear technology is considered to produce large scale energy. Brad Allenby (2005), in his article in *Bulletin of Atomic Scientist* tries to hit the chord between human and technology interface, by producing a framework. This framework distributes technology in three levels- 'Level-I includes those technology that are known to meet 'instrumental' purpose, for example 'a gun, or a vaccine.

They will meet an immediate purpose. Level-II technology is at the 'system level', the examples are that of 'unscrewed aerial vehicle conducting surveillance, which is a part of battlefield intelligence system, similarly vaccines are part of public health system.'Finally, Level-III, is the 'effect of technology on individual psychology, society, culture, economic patterns, geopolitical status. It is a large scale effect of technology that can go beyond control, at individual level as well as systems level. It is the level-III level of technology that most of the fears and risks are generally associated.

The large scale effects are those that will generally affect the environment and pattern of living or change the landscape which will be overbearing for the society for time to come. The production pattern of any society is the directive force for determining the state of economy and social constraints of a society. Thus energy production falls in this category. Energy production takes the centre stage for determining the state of economy and the well being of the society.

Nuclear energy, especially with the infrastructural needs and set up provides a pattern of technological scales that produces a service to the society along with the risks and fears that come with it. The dispute is when we weigh the service value of this technology with the fears and risks that is brings along with it. 'The technological systems such as railroads was capable to alter the existing systems, power relations, social structures, and reigning existing economic and technological systems' (Allenby 2005). He calls modern technology 'disruptive which call forth opposition by the conservative social forces and threatened economic interests' (Allenby 2005).

Nuclear Technology and Social Construction of Nuclear Technology

Nuclear Technology is more vivid in the minds of people, as something that is destructive. The use of nuclear technology as energy production also brings initially, a large cost that will be bearing upon local people who are depended upon the ecological services of the place where nuclear reactors are established. Apart from that, the recent Fukushima tragedy in Japan has increased the awareness of people regarding nuclear energy, and the detriments associated with it. Nuclear energy is produced by a process called nuclear fission. Nuclear energy is increasingly becoming an important source in the energy mix.

Evaluating world scenario, all developed countries have tried to increase the share of nuclear energy in their energy mix. From the facts available from the OECD (Organisation for Economic Co-operation and Development) website and the data released in 2013, nuclear energy used for power generation is highest in France, followed by Slovak Republic, Belgium and others (OECD). On the other hand countries like Germany and United States have a share of around 20 percent.

Here it is important to understand that when nuclear industry was being established in these countries especially in 1970s and 1980s, how the popular perception of public responded to it. Nuclear energy is also interlinked with the state and the state apparatus has repeatedly shown a soft attitude towards nuclear energy as an important ingredient of energy mix. It is being propagated as that of being safe, green and important. What makes a state advocate for nuclear energy? Is it the infrastructure that, when being established, performs a dominant culture which gives a scientists and experts the power to enter into any public awareness programme to handle an imposing structure that resembles a state structure? The advocates of nuclear energy, especially the state makes nuclear energy look daunting and imposing. On the other hand, the perceptions of common people, looks one that is filled with confusion and an awe-struck appreciation developed through media frenzy, more tilted towards celebrating the technological feat that space science and nuclear science is expected to achieve for the state.
In an interesting comment Shiv Vishvanathan (1998) calls 'nuclear energy unfit for democratic framework', along with it being non-economical and dangerous. Energy mix of any country is an important ingredient for its development and most of the communities take the case of sustainable forms of energy sources, that can create useful assets without making communities pay in terms of health and environment in the long run. In this regard, energy production and consumption needs to strike an important balance with the ecosystem and environment. The advocates of nuclear energy has gone far ahead as claiming nuclear energy as green energy or clean energy, though such categorisation remains to be tested in the framework of effect in the short run as well as long run, waste disposal and the effects that the nearby environment bears, for the effective production of nuclear energy.

The present chapter deals with the reasons behind anti-nuclear power protests. It will deal with the way and issues, of nuclear power in European states, the US, Japan and South Korea, where nuclear energy is being relied upon. The anti-nuclear protests have also to do with the anti nuclear weapons protests, which were also going on in 1970s until 1980s. The civil

society groups and government were taking steps to boot for disarmament of nuclear weapons which continues till date. Colomba Peoples (2006) has coined an important term 'nutopianism' which is associated with technological optimism in using nuclear power for peaceful purpose rather than for weapon development – the optimism that nuclear technology can be effectively used for progress and development. An important issue is about the critical studies in international relations that 'relies on straightforward distinction between civil and military aspect of nuclear technology, blaming nuclear weapon solely for the nuclear international order, and at the same time overcoming or un addressing the finer issues of the constructive and destructive applications of the nuclear power within programmes of nuclear international order' (Peoples 2006).

The importance of IAEA (International Atomic Energy Agency) in propagating and helping states in using nuclear energy for peaceful purpose gives the impression of nuclear technology being deployed for noble purpose. The motives of the program 'Atoms for peace' is still debated today as the one which was expanded to enable America's presence in the field of using nuclear power in other countries so that the stakes and supremacy of the US can be preserved in the nuclear arena. An important stream of thought comes from exploring the anti nuclear movements in the European state. It is established through various studies that these movements, influenced and projected important effects on the political understanding of the situation there. They rather became more anti-state or anti-government. This enabled the people to question the motives of the state, more so in terms of their rationale in sticking around to the nuclear energy as an important source of energy.

Through the case studies of few nuclear power projects that came up in the US and Europe, the essential elements of a social movement can be established, and as any social movement, anti nuclear movements demonstrated their own vigour and importance. The anti-nuclear movements contain both the dimensions protesting against the weapons and the fallout of the nuclear energy. The case of nuclear energy can be said to be more closely associated with the cause of the local people or common people as their concerns with their existence along with their environment and ecology is at stake. An important protest that happened in this regard is the case of Whyl in South Western Germany where many local people occupied the reactor construction site at the very place.

This movement assumed greater proportion, when it was joined by protestors of France and Switzerland. This struggle became an important issue of establishing transnational dynamics in social movement. The effect of this movement is being studied in different aspect. On one hand this movement brought about large sweeping changes in the dynamics of politics and behaviour of national discourse, wherever the 'affected people' who were in the forefront of the agitation is said to be interacting with other group of people.(Milder 2014). It is also seen that all anti-nuclear movements become global in scale as the issues of transnationalism plays an important role. Hence the people involved make anti nuclear events a cause for a global fight and a global cause. Transnationalism becomes an important ingredient in these anti nuclear movements.

During the protest movement in the case of Whyl, the local people especially women showed lots of enthusiasm, energy and participation. The occupation of the reactor site and convincing the workers working at the reactor to keep away work was solely managed by women, and that is what made the local participation more conspicuous (Milder 2014). This gives an understanding that local participation here were more women enabled as they were more aware of the situation on the ground, happening nearby. In this case, the protests brought bonhomie between the people who stayed on both sides of the river, France and Germany though going through tough times in their relation converged on the issue of protests against the reactor site.

The involvement of the grassroot populace brings forth the important dimension of local issues being primarily important, for e.g. the interests of the farmer communities there who feared the loss of their crops. Similarly, the activists championing the cause of ecology as well the people who kept gath led anti nuclear movement as that which questioned the state bureaucracy (Milder 2014).

Nature of Anti Nuclear Movement

The American and European anti nuclear movements, kept emerging and vanishing. It grew strong at times and dissipated with other causes, the Asian anti- nuclear movements are more recent. It is also because the Fukushima crisis is the latest crisis that hit the public acceptance of the nuclear technology at its lowest. Also because the Asian nuclear movements have not gained popularity in the 1980s considering the overall structure in which the nuclear politics

is shaped. The crisis in Iran and North Korea, in the first decade of this century, made these two countries question the supremacy of the global nuclear global watchdog, IAEA (International Atomic Energy Agency). The nuclear awareness of these countries are completely state centric, which portrays nuclear know how only for the military purpose and therefore associated with security.

The public awareness of nuclear issues is limited. Though it is one technology that has wide public perception. Even if it comes to the case of nuclear weapon, the public opinions are manufactured by the governments in the favor of being Nuclear Power, which will make the establishment more secure. The case of anti nuclear movements, are anti weapon in the elite circles, while it becomes anti people, when nuclear technology is used for the civilian purpose, that is when nuclear technology is used for harnessing nuclear energy. The public interface with this technology is then supported by the bureaucratic elites as well as the scientific community.

An important global incident that shaped the public discourse on nuclear technology was the revelation of Abdul Qadeer racket in Pakistan in the year 2004. The war on terror was on and the western intelligence on one hand tried to gain credibility for laying threadbare the racket, which they said, they were aware of, while at the same time, the self revelation of the clandestine racket was confessed by the Pakistani Scientist Abdul Qadeer himself. The crucial support of Pakistan for Afghanistan war, allowed the controversy to die without much media bashing, though there was an expression of shock and condemnation all round, which appeared guarded.

This was one case, when one amongst the nuclear scientific fraternity was found behaving in an irresponsible manner. The scientific community across the world, also took umbrage over the fact, though most of the established organisations, governments and agencies tried to blame the other, while maintaining ambiguity regarding their own knowledge and awareness of the issue (Yourish and D'Souza 2004).

Similarly the protests against the nuclear technology have been taking shape in diverse forms. while Nuclear technology when used for nuclear energy is continuously being supported as safe while at the same time, the world leaders advocate for nuclear disarmament and express

how deadly nuclear weapons are, if used or stocked irresponsibly. The double speak has also caused double standards in the behaviour of the great powers such as the United States.

It is seen that the anti nuclear lobby is divided on the ways nuclear technology can be shunned or used. While on the other hand, nuclear technology is being propagated for peaceful purposes by agencies like IAEA (International Atomic Energy Agency), when it comes to health, agriculture and other productivity issues, the fact remains that the peaceful use, is also not divorced from the apprehensions of the common people, which is explicitly evident in the case of nuclear energy production. States such as Iran and North Korea have tried to disguise their nuclear weapon making intentions under the garb of using nuclear technology for peaceful purposes, most importantly production of nuclear energy. As President Barack Obama said in his landmark April 2009 speech in Prague:
"In our determination to prevent the spread of these weapons, rules must be binding. Violations must be punished. Words must mean something. The world must stand together to prevent the spread of these weapons"(Obama 2009), It is further continuously deliberated that the nuclear technology can be used for diversion into nuclear weapons production, marked by the Indian nuclear explosion in 1974, by using the Canada supplied reactor, and hence the establishment of the Nuclear Suppliers Group (NSG), which is membership of those countries who can engage in nuclear material commerce with each other (Kimball 2016).

The Indian specific safeguards that was initiated during the time of Bush administration for India to gain entry into NSG (Nuclear Suppliers Group), was to enable India with good non-proliferation credentials to gain access in the trade of nuclear materials after India agreed to expand its nuclear energy programme. While using nuclear technology as an energy source, the concerns of nuclear weapons do not go away.

In a subsequent development, many protestors in the Indian Kudankulam Nuclear Power Plant (KNPP) in Tamil Nadu raised apprehensions about the nuclear power plant being used for nuclear weapons production. Their concerns apart from experiencing effects on their livelihood, and environment was also about apprehensions regarding the nuclear weapons production Paliwal, Datta and Jishu 2012).

The anti nuclear war movement of 1960s and the anti nuclear energy movement of 1970s, supported by the different groups, later fought for the common purpose, and gained public

attention. The anti nuclear energy movement was more supported by the environmentalists and hence has the characteristics of social movements, the anti nuclear weapons movement gained primacy and subsequently but has been vocal and constant against the governments of the world. The three mile island incident gave impetus to the pace of the anti-nuclear energy movement (Davidon 1979). Environmentalists making a case for renewable energy to be used for electricity generation, consider it less capital intensive and more decentralised form of energy production and energy consumption. The use of water, sun, heat and vegetation are devoid of severe complexities in comparison to what nuclear technology brings. The spread of nuclear weapons cannot be divorced from the initial intentions of using nuclear technology for nuclear power production (Davidon 1979).

The anti-nuclear weapons movement assumes the shape of civil disobedience movement, as it represents resentment against the government in many ways. The government also tries to control the people's resentment by filming cases against them and criminalising them for their dissidence against the state. The example is the massive protest in Washington followed by New Hampshire in 1978, and the nuclear power construction site in Seabrook, for which 14,000 arrests took place. Thereafter, the subsequent mobilisation of people continued for shutting down the construction site. This anti-nuclear movement got the support of the labourers working in the nuclear plants and the consumers who were disgusted with the rising power price (Davidon 1979). Hence the anti nuclear movement becomes a source for venting out different forms of dissidence against the government, which converge at one platform. Since they are generally against the government that have been investing hugely in power production without being considerate about the fallout of their decision on the common people.

Any serious nuclear accident around the world, the common examples being the three mile island incident, Chernobyl incident as well as the latest Fukushima incident, have expanded the scope of studies of the after effects of the accident on the common people, health and environment as well as the way specialised agencies handle the crisis. The case of 'three mile island' similarly raised questions on the regulatory agencies as well as the state and the federal unit the government. The entire handling was dependent upon misinformation passed between different agencies (World Nuclear Association 2001).

What Drive Public Participation

For all governments around the world, the anti nuclear movements, be it against the weapons or the nuclear energy have been a cause of handling dissidence and opposition as has been witnessed across the time, for various reasons. Therefore, Joffe (1987) terms all these movements, in 1980s not being very different from those of 1950s, Chracterises them as 'cyclical upheaval'. Joffe(1987) states that every generation that rise against nuclear technology, and specifically nuclear weapons, will see a passing generation being able to live with the realities of it and eventually finding themselves too in the same loop.

Whyl Movement, in Germany and its Implications

The protest movement in Whyl, Germany continued to get widespread popularity and shook the conscience of the European governments, not only in Germany but also in other countries like France and the United Kingdom. The protest was against the nuclear reactor, and the enthusiasm of people was high to challenge the government, as one of the participants enthusiastically remarked that the 'protest against the nuclear reactor should act as a chain reaction' (Milder 2014).

At the same time, the protestors got widespread support from all quarters and assumed proportions of a strong movement across Western Europe that was taking shape due to different reasons. It stood the environmentalist's slogan of 'Think globally and act locally' (Prendiville 1994, 91-3).The scholarship on antinuclear protests starting with Whyl, have tried to look into the wide spread effect it produced in Europe and the United States. On one hand, Hughes (2014) attempts to explore the anti nuclear movement in Germany using the model of civil disobedience movement of America, though the context was different and so were the motivations.

The protests in Whyl became an important social movement which inspired people later as well and acted as a wake up call for the government authorities. The repercussions reached to the point of violence between 'the anti nuclear activists and the police, along the perimeter of the nuclear construction site', in late 1976 and 1977 (Milder 2014). The next anti nuclear protest gathering was joined in large numbers of about 60,000 across Europe in Maleville in

Southern France in 1977. These protestors aimed to occupy the "Super-phoenix" fast breeder reactor, though the French government dispelled the crowd by adopting high handed tactics of sending around five thousand troops and not shying away from using tear gas and other repressive tools to disperse the protests (Milder 2014).

The violence witnessed in the case of Maleville, decreased the enthusiasm of the people towards the anti nuclear protests and gave the governments the advantage to deal with dissidence. At the same time, the failure was taken as an inability of the people to mobilise themselves as a political unit to make a strong point to the government. Therefore Hughes (2014) explores the possibility of how the use of violence proved detrimental to the movement as the blame was put on German radicals, that acted as a spoilsport. The anti-nuclear movements in Europe, always carried in them the ability to influence the public approval or disapproval of the movement across their borders.

Kirchoff (2014) enumerates how the German nuclear energy policies influenced the Australian indigenous population as Australia is considered the hub for uranium mining and the ecological detrimental effects, it accrued to them due to uranium mining. The uranium mining not only affected the indigenous population of Australia but also, Namibia, India, Mali, Niger etc. The German policy of using nuclear energy for electricity production took a backseat, when the Green party occupied the Bundestag in 1983 and declared that nuclear energy is not safe. They raised the issue of uranium sourcing which, affect the indigenous population, as all uranium rich locations are inhabited by the indigenous population.

Further, the 'anti-nuclear movements of the 1970s and 1980s emerged as international transnational collective activist identity' (Kirchoff 2014). The 'identity was negotiated in the respective national arenas' and was 'limited to eminent personalities, thinkers and institutions'.

The scoring point of such movements was that they were able to sustain itself with widespread support even when there was no internet, or availability of instant communication (Kirchoff 2014). The case of taking uranium mining by the German Green Party thus demonstrated that the anti nuclear movement was not limited to the nuclear site places but also have to take care of associated problems and issues. The German enterprises were responsible for the global uranium mining around the world, notably Australia. Thus the anti nuclear movement in Australia was influenced by the German politics in early 1980s.

The case of aboriginal tribes in Australia made the anti nuclear movement, emerge as an ecological movement, and hence became the human rights movement to protect the rights of the indigenous people. The cooperation that forms the basis for the anti nuclear movement, has been studied in various forms and all movements in the 1960s and 1970s carried with the support of the activists from around the globe. The case of Germany and Australia are interesting since the countries are geographically located far away, and hence the scope for cooperation is challenging (Kirchoff 2014).

Conclusion

The anti nuclear protest movements bear two major points – one it gained popularity due to the transnational cooperation and secondly it was not just anti-nuclear movement, but also a ventilation to express dissidence against the government. The anti-nuclear movement can thus be traced with a history where environmentalists and ecologists did the initial work, and the trend of anti-scienticism was gaining ground.

It is known that the public perception of nuclear technology has always been that of fear, risks and less trust. The coming in of new technologies have always tried to fuel, new hopes and new fears in the minds of people, but more so in the case of nuclear technology. The devastation it caused in the second world war, always left a lasting impression on the minds of the people. The further development in the nuclear technology tried to make it more acceptable to the public about its utility, and hence the growth of lobby that started supporting nuclear technology to be used for nuclear energy generation.

Nuclear politics has been unfolding itself in many forms. The nuclear weapons have continued to show diminishing concerns with the public, as the changing times, also changed the ways in which conflicts are handled. This is the age of lone wolf attacks, the target of civilians by large scale devastating tool as the nuclear weapons is fast becoming obsolete. Therefore, the states have themselves declared the stockpiling of nuclear weapons as safety measures. The rising concern is now about the proper use of nuclear technology in the peaceful manner, for which the concerns still persist. The anti-nuclear movements, are thus social movements that have concerns of livelihood, and environment with the people. It is a pro people movement that stands against the state, and against the oppression of the technocracy and technological supremacy.

Chapter-4

TECHNOLOGY AS SPECIALISATION

Science and technology studies are emerging as an important field of study that is making important contribution to the way our world is oriented technologically. The world has depended upon technology in a way not witnessed before. Itis stated that technologies have always existed with humans, in sophisticated or non-sophisticated manner. The philosophy of science and technology is somewhere studied together, but they have drawn a distinct difference in the way philosophy of sciences addresses issues as compared to the manner in which philosophy of technology addresses issues. Philosophy of science is considered as the sociology of knowledge, or a separate study in the nuances of the ways knowledge is created and understood in the humanity. Science in claiming a separate status has tried to emancipate humanity of unreasonable belief systems, and tried to seek explanation based on logic and assumptions that can be explained further to reach a proper conclusion.

An important issue associated with science and technology is that of 'instrumental reasoning' and 'rationality' which further gives rise to technocracy, and the rule of the specialists. While rationality is taken as the positive essential for humans, the limitations of instrumental reasoning, and the rise of technocracy and specialists are increasingly being felt in the system. The loss of human face when technocracy and specialists take charge is always feared upon.
It is important to understand how technology is studied as a field of knowledge, and one way of dealing with it is to understand the role of 'social construction of technology'. Here the emphasis is on studying the 'constructivist' aspect of science and technology that is dependent upon how the 'truth of scientific facts and the working of technical artifacts are actually constructed'. Thus the actual truth is associated with the scientific facts and not the 'intrinsic properties of those facts and machines'. The artifacts and machines are thus tools that can be used to capture the truth of the scientific facts. They aim to fulfill two major goals, 'one is the way technological growth has taken place in the society, and secondly, the development of theory that looks into how it affects the society' (Bijker 2013).

The major understanding of technology comes from the criticism of 'instrumentalism' that is considered to be a factor of the technological world we are living.Here remarkable contribution is made by the author Andrew Feenberg who has tried to study 'Critical theory of Technology', that is derived from the Critical theory of the Frankfurt School, as well as the Science and Technology Studies (STS) that has been taking roots off lately (Feenberg 2013). Andrew Feenberg further says that 'critical theory of technology regards technologies as an environment rather than as a collection of tools'. These 'technological designs' gives shape to 'centerof power', and 'social values'. The said 'center of power' and the 'social values' come from nowhere but very much from these technological designs that are carrying it in them inherently. 'As an environment, technologies shape their inhabitants, and in this respect they become comparable to laws and customs' (Feenberg 2013).

Thus today, 'technological representation' is of an utmost importance, since they also represent essential aspects of humanity and it is the technological environment that serves the various interests of humanity. In the similar vein, if the technological environment does not serve the humanity well, they are changed as the outdated laws and customs. Technologies also give rise to 'controversies and protests'. These controversies and designs thus give rise to the quest for the betterment of technical designs that can cater to more of human needs and comforts (Feenberg 2013).

Now, rather than comforts, more of representation is to overcome the shackles of exclusion that is associated with the democratisation and manifestation of the political aspirations of the people. Thus, technology is espoused as an essential tool to encourage participation and democratisation. Therefore, 'struggle for technology resembles political struggles in important respects'(Feenberg 2013). Feenberg (1991) has earlier argued that political participation, of which political freedom is an essential desire, comes through seeking of more of mediation in the public sphere.This is in the present time nothing but an offshoot of 'technical decision'. The fallout of these technical decisions reduces humans to tools as well as excludes many in expressing their political aspirations.Nevertheless a part of the blame also lies in the undemocratic methods in which technologies are brought into use, which are partly responsible for the degradation of land, environment, labour and education. Giving a short glimpse of instrumental and substantive theory of technology, 'instrumental theory understands technology as a tool which helps to achieve a goal in a neutral manner. It is also taken to be indifferent to the politics in the modern world, as neutrality is understood to be

taken as an aspect of technology since it is conceived to be rational and unchangeable in different social settings. It is just a deliverable service, and therefore, technology is understood to be production enhancing, labor minimisation tool that focuses on efficiency and speed. This aspect of technology has remained constant across time and generation.

Then comes the substantive aspect of technology which is nothing but an acknowledgement of the societal changes in attitude witnessed in humanity after a particular technology became a part of their life. Hence, technology came carrying in itself an inherent value for the society. Quoting Heidegger and Ellul, Feenberg says that 'technology constituted a new type of cultural system that restructured the entire social world as an object of control' (Heidegger and Ellul). While Heidegger takes technology exhibiting control due to technical process that actually processes all resources for converting it into something substantive, Ellul calls the 'technical process' autonomous (Feenberg 1991).

Feenberg(2013) later points out that in the modern world, the 'political consensus formed is increasingly being dependent upon the available technological form of life'. The new technical designs undergoing technological up gradations in the existing usable technology is only a manifestation of the newly emerging 'social principles and social demands'; still technology is missing from the 'public sphere' as the public in present democracy can be subjected to manipulation by the agencies who practice power. Today, the exercise of authority in the governments and powerful organisations leverage technology to practice their own authority and power. Thus, technical power is an essential part of the political power, andFeenberg proposes that 'the modern societies will be able to realize their democratic values when public control of technology becomes reality'.Feenberg calls it a 'technical democracy' where technical designs are not fabricated to enhance the profits of multinational corporations or military bureaucracies but they will rather result from the 'conscious effort to orient the technological progress towards politically legitimated human values' (Feenberg 2013).

Social construction of Technology

'The social construction of technology (SCOT) is a field of study that is developed out of three different fields of studies, the science and technology studies, the sociology of scientific

knowledge, and the history of technology. These studies started in the 1970s in the USA, the UK, and the Scandinavian countries, primarily Netherlands, and was aimed at understanding the responsibilities of the scientists, the role of devastation brought by nuclear arms and harm to the environment, as well studying the risks associated with the nuclear energy' (Bijker 2013). Further the present empirical research of social construction of technology focuses on the 'modernisation of the society, politicisation of the technological culture, and the management of innovation along with the issues of intellectual property rights conflicting with the larger utility of the people'(Bijker 2013).

Bijker (2013) cites his earlier work to develop an understanding of the social construction of technology where the first step consists of 'relevant social groups', and interpretive flexibility', and where the technological artifact is known through the way the social group is taking its utility, (utility of the artifacts). These artifacts enjoy certain value attributed to them by the social groups who use them, and then these artifacts reach the second stage of the social acceptance, where these artifacts exercise dominance which finally leads to 'stabilization' and 'closure'.

The nuclear power plant and the villagers of Idinthikarai

The concept of 'stabilization and closure' (Bijker 2013) is particularly interesting as it signifies the adaptation of the people with the said technology about which they may be apprehensive in the beginning. Or to put it in other way, the technology, acting like a tool establishes its own image in front of the people who use them. 'Stabilization' seeks to forge a satisfactory relationship between the users and the said tool. The concept of 'stabilization' can be used for explaining the struggle of a person while dealing with a new smart phone, or understanding the use of a particular kitchen based appliance. But in the similar vein, the acceptance of a nuclear power plant by the local population cannot be compared to achieving 'stabilization' in the complete sense. The people working inside the nuclear power plant establish a different relationship with the nuclear technology in comparison to the people who view the nuclear power plant as an artifact located in the vicinity of their locality.

The perceptions of the local people about the nuclear power plant (the villagers near the power plant) largely remain guarded by caution, and the unending concerns about the impending problems that may visit them anytime. Similarly, for the people, who are staying

approximately eight kilometers away from the power plant, the power plant remains a matter of intense speculation. For the villagers in Idinthakarai, Koodankulam village is abreast with activities, which is dominated by the enhanced activities of the government agencies towards developing the positive picture about the power plant. The differences in the perception of the power plant by different groups also affect the social relations and social interactions amongst themselves.

Villagers like Amal and Sundari feel happy about the cause of protesting against the power plant. Their understanding of nuclear technology is limited but their apprehensions remain strong. Since nuclear technology cannot be debated on its own merit, the villagers in Idinthakarai try to link the nuclear power plant with the politics of the village, state as well as the country. The politics and social status of different people who support the nuclear power plant as well as those who oppose it, depicts the value accorded to the power plant, by them. Different people residing in the villages represent different social groups and form their own opinion about the power plant. In Idinthakarai, which was the seat of the powerful protests in 2011, the villagers largely remained skeptical to the nuclear power plant and attributed their day to day difficulties associated with the power plant. This included their concerns about the rising cancer incidents reported in their village as well as the neighboring villages and the day to day changing activities, as the management and the maintenance work intensifies near the power plant. The nuclear power plant has made their life prone to several psychological pressures that are associated with their livelihood and their life. Talking to a few fishermen near the seashore gave an impression of their difficulties which are difficult to narrate while fishing in recent times. The new dangers and the new changes are directly associated with the location of the nuclear power plant. One of the fisherman acknowledged that their fish catches are found deeper inside the sea which was not the case earlier.

Few villagers were the silent spectators to the activities of protests, as well celebrations. Despite, being aware of the dangers of the power plant and problems they are facing, few talks about the necessity of the power plant. For a section of villagers, the power plant remains suspicious and their inability of changing the course of action gives them a sense of hopelessness.

Finally SCOT (social construction of technology) gives rise to the relevance of the term ‘technological frame’ that simply brings all the social actors, using few particular

technological artifacts together, and binds them together in a loop. This is further shaped by the technological frame that has been accepted with a particular value by the social group to enhance their own social needs (Bijker 2013).

Technocracy

According to Webster Dictionary 'technocracy' means the management of the society by the technical experts (Webster Dictionary 2017). The goals of technocracy primarily rests on the effective management of the organisations, that in turn delivers goals specific or general for the given set up. Technical experts are a set of people donning the responsibility of making crucial decisions for their orgainsation as well as the task they are allotted. The 'advanced, industrailised society' accords them special importance especially with regard to the 'benefits and services' they bring to their organisations. These organised structures in their turn 'deprive individuals of independence of thoughts and autonomy and train them to accept principles for the satisfaction of their needs' (Marcuse 1964).

Agassi (1985) calls technocracy, as presenting two images of itself that are 'utterly unrelated, one is 'realistic' and other is 'naive'. 'The naive picture is of scientifically and efficiently running the society, while the realistic picture includes idea about resolution of the conflict of interests'. He further says that the technocracy can be criticised on the basis of the lack of 'moral and aesthetic value' or lack of 'good faith'.

Technocrats are the experts who can give ideas from their field of expertise, which leads to specialisation. The concept of specialisation is used simultaneously as 'professionalism' (Saul 1992). 'The word specialisation was coined in 1843 by John Stuart Mill and the word specialist by Herbert Spencer in 1856' (Saul 1992). The irony of specialisation is thus marked by focusing on 'innovations' on one hand but at the same time, the same innovations being 'bounded by the defined social structure'. This specialised discovery thus becomes 'incomprehensible to the non experts' (Saul 1992).

Though technocracy is critised for being narrow in outlook as long as the orientation is only the fulfilment of the organisational goals, it is also taken to be a positive development since the application of expertise by the so called experts gives a sense of achievement and pride. The positive aspect is highlighted by Emile Durkheim in his work *Divison of Labour in the*

Society in 1893 (Haralambos and Heald 2012).Therefore, in today's world where organisational functioning and administrative sciences are becoming essential to run a government or even corporations, the manpower development forms an essential arm of training and personnel management. Technocracy can also be called the offshoot of corporatisation, militarisation, and securitisation of the society. An important challenge associated with this form of development of organisational manpower is that the expertise developed is taken as the prerogative of that particular organisation and sharing of knowledge does not remain free; it gives rise to the concept of paying to earn the particular organisational skills. In a democratic setup the governments use the skills of different organisations and funds, to further develop such skills to implement all sorts of welfare schemes for the common people.

In simple terms,Dusek (2006) defines 'technocracy as a theory of rule by technical experts, just as democracy is rule by demos(common people), aristocracy is rule by the aristos (best), or plutocracy which is the rule by the plutos (wealthy)'. Thus technocracy here gets narrowed down to technical experts, or scientific experts while the larger area can include the experts in the field of economics, political science, sociology, medicine, law etc.It is important to understand and differentiate here that technocracy is not just manpower of scientific experts but it can be experts from any field. As technocracy tries to produce results for an organisation, it is closely interlinked to the concepts of 'rationality' and the 'scientific decision making' that forms the thrust of the utilitarian purposes an organisation seeks to meet (Dusek 2006).

In this chapter, understanding the perspectives of the scientists, in general as well as those involved in the Kudankulam nuclear power project, will reflect the understanding of the gap existing between common people and the experts. Apart from the scientists, the legal specialists as well as the economic experts play a role in big projects like the nuclear power plant.

Though organisations in their personnel training boasts of a scientific methodology of reaching decision through organisational training. This scientific method is an important study in the field of 'organisationalbehaviour' (OB) as well, where individuals are trained to use empirical methods to demonstrate their research skills for proper management of the organisation and hence the society (Schermerhorn et al 2001). The rise of organisational

productivity and the concept of ‘scientific management’ propounded by industrial management theorist Frederick Taylor haveimpacted the work culture of different places, including government to a large extent (Taylor 1947).

Here, the attempt is to understand what justifications are made for the role technocracy plays in bringing betterment to the society. The critique of reason is dealt in some measures later by thinkers of post-enlightenment phase, where ‘rationality’ and ‘scientific outlook’ was found flawed with the passing time (Saul 1992). The role of scientists is a never ending debate in the studies that include the studies of sociology of sciences. Books and debates have ensued that they raise questions upon the way ‘rationality’ is becoming irrational and how technocrats are responsible for creating a society where ambivalence is maintained in their own way of practising sciences (Cotgrove 1970). This is therefore no different from the unexplained and unverified claims of the mythological beliefs (Saul 1992). Further he says

> "Reason is a narrow system swollen into an ideology. With time and power it has become a dogma, devoid of direction and disguised as disinterested inquiry. Like most religions, reason presents itself as the solution to the problem it has created” (Saul 1992).

Further talking about the difference between the rise of reason in the West in the seventeenth and the eighteenth century, he tries to differentiate between the technocrats in the modern world and the ‘heroes of the primitive age’, where expectations are attached to them in the similar fashion. Though a difference exists in the way they function. In the present modern age a ‘technocrat acts like an ideal servant of the people – which implies that he is bereft from his irrational ambition and self interest, but as the conditions made it, a technocrat changed into a man who discovered ways to use the system with a distant contempt for the people’ (Saul 1992).

Saul (1992) further tries to compare the role of technocrats with those of the heroes of the pre enlightened era, who also inspired hope and awe in the minds of the people. He says that ‘The hero was a more complex phenomenon, who appeared unexpectedly out of the shadows of reason, drawn forward when the people showed uncontrollable impatience with the way they were being governed’. Thus governance and the injustice perpetrated by governance remained

a major goal of the heroes or technocrats to apply themselves for the betterment of the society.

Dusek (2006) attempts to set aside thinkers and tries to advocate the cause of technocracy and the ways or reasons through which it could be achieved. To begin with, Plato, tried to advocate technocracy through the precision of mathematics that would embody knowledge and hence an effective thinking to govern. 'He in one sense is for the rule by the philosophers', for which mathematics was a fundamental expertise. Understanding Plato, it would appear that the precision of mathematical knowledge could be 'applied to the forms of justice and other ethical notions', necessary for governance (Dusek 2006).

Coming to Francis Bacon (1561-1626), who advocated experimental sciences and inductive method but contested pure reasoning and philosophical speculations in comparison to the conclusions one reach through sense perception, he supported the use of inductive methodologies in jurisprudence, the role of 'deriving scientific laws by induction from observations that can be used in deriving legal maxims by induction from the legal cases' (Dusek 2006). 'Bacon stated that knowledge is power and one could command nature by obeying it' (Dusek 2006).

In the similar vein, Comte's technocracy evolved out of the 'law of three stage'. In this stage the society's belief systems changed from that of being 'religious and theological to 'metaphysical or philosophical' and then finally to that of 'positive or scientific' (Acton 1951, Dusek 2006). Thus the status of scientific knowledge lies above that of the other non-scientific forms of knowledge. Comte as a thinker propounded that technocrats not only consist of those excelling in physical sciences but also those excelling in the social sciences. In Comte's view the rule of law is based in knowledge and politics was nothing but a product of social engineering (Acton 1951, Dusek 2006).

In the above mentioned analysis, it is clear that the scientific knowledge attributes to managerial competence, which enhances number of engineers and scientists exercising influence over government decision making (Greenwald 1979). Scholars and philosophers have also tried to use precision and exactness as a measure of reaching satisfactory decisions in the issues of governance. The manpower who would take crucial decisions of management are therefore expected to embody in them this precision and aptitude, which is called

specialisation and justification of rule by the specialists. The trade off of differing attitudes and interests developed due to this specialist culture is responsible for causing 'disengagement with the public which is celebrated as well as criticised' (Porter 2009). Though the decisions are accepted because of the organisational authority to which the population is subjected to.

One important premise on which specialised or technological supremacy stands is the issue of 'rationality'. Rationality is a concept of the modern age proposed by the sociologist Max Weber, but again it is an ingredient that can add value to the life of people and organisations, just as philosopher Ellul in his book published in 1964 *The Technological Society,* proposed the use of 'techniqes' in any aspect of life bringing rationality. 'Techniques' become some sort of valueless expertise that is associated with learning and knowledge and that can adept humans to pursue better goals (Ellul 1980). Trying to understand Habermas' critical theory, McCarthy (1978) tries to construct a dichotomy between the value laden politics proposed by Aristotle and the attempts of Weber to draw distinction between valueless approaches of social sciences that claims to be rational. With the rise of modern science, the theories in social sciences are also equated to that of the natural sciences, in the approach of its derivations. It carries within it a 'predictive and technological method' of producing knowledge (McCarthy 1978). Just as the utility of 'scientific laws in a prescribed limit can be used to produce certain results, in the similar way, scientific approach can be used to manipulate and control a state of affairs' (McCarthy 1978). Scientific knowledge can be brought into use for the practical purpose and that makes the end more important, in pursuing a knowledgeable endeavour like measuring the growth of economy or understanding the trajectory of development that is brought in by the technological growth. But in choosing the end, the preference is anyways, exhibited and interests become clear, which is the reason for exclusion even in adopting the scientific methodology.

Therefore the 'modern scientific world' becomes nothing but the subjugation of the nature by the technical forces and subjugation of humans through organisational structures. 'In this system science, technology, industry and administration interlock in a circular process' (McCarthy 1978). This leads to social practices as being more practical and technical. The so-called technical approach claims the value neutrality, but in one form or the other, even in being completely scientific, a particular interest is manifested, which leads to exclusion of the others (McCarthy 1978; Porter 2009). Further Habermas quotes that 'technological

rationality' in the garb of value free approach actually leads to 'scientific dominance' and 'technical utilisation' since the non-scientific and non-technological approach is severely criticised.

'Technological rationality' is defined as techniques placed at our disposal by science for the realisation of specific goals. 'And instrumental action is rationalised in this sense to the extent that the organisation of means to define ends and is guided by technical rules based on empirical knowledge' (McCarthy 1978). The exclusionary tendencies are therefore present in the decision-making processes where the values of 'perceptions' and 'sentiments', beyond 'rationalisation' cannot testify the 'interests of life subordinated for the benefit of the sole interest in efficiency and economy of means' (McCarthy 1978).

Technology and the concept of alienation

It is important here to understand what forms of alienation an individual faces in his/her day to day life, while dealing with a technologicallyequipped society. According to Mitra(2010) it is important to 'trace the nature of alienation existing between people and the technologies surrounding them'. The technological alienation further depends upon the 'perception of technological sophistication and the level of distancing' experienced by an individual. He calls the case of 'sophistication of technology two pronged'. First is 'measurable sophistication' and the other 'perceived sophistication' (Mitra 2010). 'Measurable sophistication' is used for understanding the change, of tools employed to serve individuals, as in the case of human defence which changed from a bow-arrow system to a higher version of defence like guns. The 'perceived sophistication' is more about what an individual thinks about a particular technology. The 'perceived technology' is guided by the 'limited understanding' of the said technology. In this field nuclear, cyber and space technologies can be included.

Feenberg (1999) talks about perceptions of technology completely delineated from the intrinsic qualities of technology, which finally makes it unengaging. It implies that an individual develops an understanding of technology based on his social mores and satisfaction that individual may derive from the said technology. It also implies that the alienation due to technology is so inherent and so implicit that possible ways of addressing the level of

alienation needs to be constructed. Mitra (2010) attempts to demarcate alienation in the following three ways –

> the level of actual sophistication, the level of perceived sophistication which is directly related to the level of information about the technology, and the final alienation resulting from technology (Mitra 2010).

Taking a cue from the Heidegger's 'essentialist' approach to technology, Tabachnick (2004) offers three responses to the challenge of technology-

> 'Aggressive essentialism' that implies elimination or restriction of technology, 'moderate essentialism' implying modification and reform of relationship with technology and 'passive essentialism' that resigns itself to technology when no action can be taken against it (Tabachnick 2004).

The case of large technological structures that includes dam, roads, highways, power plants makes technology an 'unquestionable entity' (Tabachnick 2004). It makes the previously existing natural environment lose its original significance by completely sweeping away or 'concealing' its existence. Included in this 'concealment' is the loss of livelihood of the communities, the landscapes existing before construction of the roads, highways or the power plants. Technology hence 'challenges the nature' and leads to 'concealment of the essence of all other beings'. Heidegger defines 'essence' as 'the seen and the unseen character of the given object of study' (Tabachnick 2004).

The 'unseen character' thus invites modifications and sophistication further, which continue to pose new set of challenges for people. Coming to the case of nuclear power plant,Bidwai (2011) marks that 'nuclear power plant has always been resisted by the communities in their vicinity', especially because of the health and environmental costs, issues of concerns expressed by the workers of the plants as well as that by the people living close to the plants. Their issues are completely ignored by the government agencies (Bidwai 2011). On the other hand, Gramson and Modigliani (1989) talking about the perceptions of the people about nuclear plant gives importance to 'individual life histories, social interactions, psychological predispositions to the process of construction meaning'. The construction is loosely based on a 'tentative idea or an anticipatory schema' (Gramson and Modigiliani 1989). It is this construction which leads to further alienation of the people from the nuclear technology, or

gives rise to an enhanced version of the ‘perceived sophistication’ of the nuclear technology (Mitra 2010).

Gramson and Modigiliani (1989) say that in the cases of nuclear power primarily three kind of discourses affect the construction of public opinion, one is the ‘specialist discourse’ dominated by the scientists who are professionally involved in the issue and who use their experiments, writings in journals and print media to make a point. Then comes the ‘oral discourse’ dominated by the public officials, who take part in the decision making of the government as well influence them. And finally the ‘challenger discourse’ that comprise of people trying to ‘mobilise people for a collective action’. It may consist of activists, public intellectuals etc. Amongst all this, there is a ‘media discourse’ which influences the public opinion in the most powerful way. Gramson and Modigiliani (1989) calls media ‘serving a complex role’ and calls it a ‘site on which various social groups, institutions and ideologies struggle over definition and construction of social reality’ (Gurevitch and Levy 1985 cited in Gramson and Modigiliani 1989).

As the field survey in the village of Idinthakarai also suggests, the villagers accepted that their education and awareness about the Kudankulam power plant as well as the nuclear technology was mostly driven by the TV channels, especially the news reports of the Fukushima accident, in Japan in 2011. The media coverage drove them to ask bolder questions from the public authorities about their own safety. Villagers like Sundari, fighting sedition charges slapped against them complained about the negative image that the local vernacular press reported against them. Sundari was especially articulating about the Tamil newspaper which reported their resistance in a negative light. ‘The reporting was very one sided’, she complained (Sundari 2017). The media image about the resistance of the villagers against the power plant did not deter them but wrong facts hurt their enthusiasm. She said, ‘they think we are ignorant but we are not’ (Sundari 2017). Villagers like Milton, Mildredand Sundariaccepted that the resistance against the power plant has transcended many stages. ‘Now it hasbecome the case of our survival’ (Milton 2017; Mildred 2017;Sunadri 2017). Milton questioned the state agencies about their preparedness in case of nuclear accidents, since they live only seven kilometers away from the nuclear power plant.

Amal talks about the differences existing among the villagers about the acceptance of the plant, though largely they are against the operationalisation of the nuclear plant (Amal 2017).

‘The farmer community in the Kudankulam village initially accepted the power plant, thinking about the new job opportunities, but later they came with the villagers of the Idinthakarai for protests. The level of resistance and cause of protests have matured with time. The leaders have also changed’(Amal 2017).

The nuclear power plant has created new insecurities in the mind of the villagers. Talking about the rising unemployment, Amal said that, ‘few villagers tried to work inside the power plant, but failed in their attempt. Now they are jobless and dejected’ (Amal 2017).Further, they complain that ‘we sometimes get up to hear loud noise from the power plant’ (Milton 2017,Amal 2017). ‘The mock drill programmes are carried out with selective approach’ (Mildred 2017). These mock drill programmes are about the evacuation of the people residing in the nearby areas of the plant in the case of the nuclear disaster.

Being highly unappreciative of the jobs of the technocracy-government nexus,MypaJesuraj, a priest in the Tirunelveli district of Tamil Nadu,was crticising the role of NPCIL, which is trying to adopt measures for the confidence building measures in favour of the nuclear plant. He said, ‘our representations and questions to the state authorities were mocked’ (Jesuraj 2017). He was sad about the way the Tiruneveli district administration received their delegation, at the time of protests in 2011 against the power plant. PuspaRayan, a school teacher and an activist confides that, ‘none of our questions filed via RTIs (Right to Information Act) were ever accepted’ (PuspaRayan 2017). The gulf between the establishment and the general queries of the people, however, is not taken seriously by the state authorities.

On being questioned about the divide of opinion being seen as a science versus people divide, Professor Samuel Asiraj said, that ‘public science is not people’s science’ (Asiraj 2017). The science promoted by the public authorities is not what is felt by the general public. The deeply felt connection with the seas and the landscapes of the villagers residing near the Kudankulam power plant have been greatly altered by the activities of the power plant. People are living in a different attitude, since the time agitation started against the power plant. At the same time, Professor Gladstone (2017) said, ‘A number of scientists have also stood with the people who are against the plant’ (Gladstone 2017). He refused to call it a divide of the general public with the scientific community. Professor Gladstone was a member of the fact finding team of the Kudankulam power plant movement. He called the public meetings organised by the

government officials an eyewash. While Pushparayan, called the public meetings of the state officials as well as that by the NPCIL officials having no credibility due to thin attendance.

Summarising the entire state of affairs existing in the case of Kudankulam nuclear power plant, Professor SambitMallick notes, 'It can be taken as a divide of state science versus people's science' (Mallick 2017). Furthermore he categorises the middle space between the state science and the people's science as a new space that can develop the expertise to link with both. In India, the legacy of people's science movements made its presence felt especially with the 'middle class awareness of the scientific pursuits along with the harm that the technological systems bring to the social and political framework' (Varma 2002). The authors say that India has acquired the problem of 'technological dualism' or 'technological polarisation' in its quest for being recognised as a leader in science and technology development.

Varma (2002), tracing the people's science movement (PSM) in India, marks the basic underlying concept of the movement being that the 'people's problems cannot be solved from outside'. Instead the solutions should come from the people itself. The movement tried to bring and recognise many groups and communities whose livelihood issues were threatened in the name of scientific progress and development. The movement stressed that the 'link between science and society is organic and not separate' and neither is 'science a single tool for bringing social emancipation' (Varma 2002). The people's science movement rather tried to develop its own projects to 'disseminate technologies appropriate to the socio-economic environment'.

In the similar lines, the 'Alternative Technologies Movement' in the United Kingdom stirred the conscience of scientists against the genetically modified crops in the 1970s and the 1980s. King (2016) talks about 'alternate technology' (AT) and the idea of 'radical science' emerging out of the need for generating awareness amongst people through organisations like the British Society for Social Responsibility in Science. According to Elliot (2016), the term 'alternate technology' was first framed by Peter Harper in the early 1970s. The concept of AT was emerged to make the 'environment friendly' and 'socially appropriate' technologies which will be simple and encourage 'self-help usage' (Elliot 2016). They wanted to suggest alternatives to fossil fuels and nuclear power, by showing preference to modern day renewable energies. The alternate technology movement later gave rise to 'green politics'.

The organisations like ‘Friends of Earth and the ‘Greenpeace’ repeatedly focused on animal protections and highlighted the dangers of nuclear technology (Elliot 2016). The aim shifted from ‘technology for production and workplace issues’ to ‘aims for production and what was being produced’.

The question ‘what was being produced and the aim of production’ automatically gave rise to new set of demands emanating from the people. The ‘aim of production’ made the technological issues political as the ownership, production and innovation of technologies appeared interest driven. In the same process, the luddite movement also gained notoriety as well as acceptance. Luddite movement historically started in Britain in 1811-1817 against the rapid industrial expansion. Conflicting understanding of luddite movement exists but basically the word ‘luddite’ is ‘referred for someone who resists the advancing of technology’(Gregoire 2014). While luddites were violent in 1812, taking to rampage and destruction of mills, their primary concern was replacement of labor by machines, secondly the rights of ownership of the produced material. In the present form, ‘neo-luddite’ are those who are ‘fearful and distrustful of the changes brought about by technological advances’ (Gregoire 2014).

Similarly, neo luddites delve into ‘the philosophical the moral and ethical damages’ of the increasingly technological world (Pointras quoted in Grgoire 2014). Neo luddite movement has taken the issues of globalisation and environmental degradations. The case of ‘nuclear technology along with chemical, genetically engineering, television, computer technologies’ are labeled as destructive (Glendinning 1990).

Scientific Justifications- Case of Kudankulam Nuclear Power Plant (KNPP)

The Kudankulam Nuclear Power Project (KNPP) became controversial in India, around 2011-2012, the reverberations of which were felt across the world. The nuclear energy market system was closely watching India after the signing of historic Indo-US civilian nuclear cooperation agreement in 2005, by President George W Bush and the then Indian Prime Minister Mr. Manmohan Singh. The Indian government considered it historic and welcomed the participation of India amongst the few states who use nuclear energy for civilian purposes. This would enable India to participate in the high tables for nuclear commerce around the world. The engagement of India with the International organisation like (IAEA) International

Atomic Energy Agency grew as the watchdog organisation agreed to co-operate India for increasing its dependence on nuclear technology for the civilian purposes.

The ensuing debate regarding the separation of civilian and military nuclear installations dominated the Indian scientific and the military organisations, where the fear of compromise with the Indian indigenous nuclear installations was expected. The scientific community looked at it with apprehensions, as if they will be dictated by the guidelines of the international organisations and other western states (e.g the USA, the UK, France etc) who would get access to the Indian nuclear installations. At the same time, the arduous task of separation of civilian and military part of nuclear establishment left everybody guessing. The passage of the through of Indo-US civilian nuclear cooperation agreement which is also called the '123 Agreement' almost cost the then Indian government its power as the major alliance partner of the government took strong stand against it.

The tumultuous run ended with the passing of the controversial Civil Liability for Nuclear Damage Bill in the year 2010, which again left major lacuna in dealing with apprehensions of the common people, in the case of nuclear hazards or accidents. The bill was contested in sharing the damages to be paid to the public in the case of nuclear accident. The bill defines nuclear damage as one that causes 'loss of life or personal injury which includes immediate and long term health impact', 'loss of damage to property caused by the nuclear incident to the extent as defined by the central government', 'the impairment to the environment is also accounted unless it is taken as insignificant, including the loss of economic interests for the enjoyment of the environment, if incurred by the nuclear incident'(Civil Liability for Nuclear Damage Bill 2010).

The ambiguity is maintained in the case of damage to the environment, where the word insignificant has been added and the decision to be labelled insignificant is left to the whims and fancies of the central government.

Coming to the case of Kudankulam nuclear plant, the initiation of the power project, is supported in the regime of a Civil Liability Bill where people were told to be protected by this law in the case of any nuclear accident. Though the concerns of the Kudankulam Nuclear Power Plant(KNPP) have a historical background, where the contestations have been shaped and reshaped with the passing time and the occurrence of the new nuclear related incidents

around the world as well as in India. The Kudankulam power project protest claims a historical background, where the protests started at the time of the inception of this power plant. The events of the nuclear deal and the incidents of Fukushima kept shaping the public opinion further, through the media and public spirited people.

The Case of Nuclear Reactor for Kudankulam Nuclear Power Project (KNPP)

The KNPP project is boosting its image, when it comes to the reactors that will be used for the generation of the nuclear energy. The Kudankulam Nuclear Power Project is using VVER 1000 reactors. The twin VVER-1000 reactors that have been built at Kudankulam belong to family of Russian designed Pressurised Water Reactors (PWRs). The first VVER-1000 reactor was commissioned at the Novovoronezh, Russia in 1981. There are 11 VVER-1000 reactors currently operational in Russia, and seven more in countries such as Bulgaria, Czech Republic, China and Iran (Balachandran and Patil 2013).

The VVERs at Kudankulam are the modified versions of another Russian export design (V-392) with several enhanced safety features, which brings it on par with the IAEA's Generation III category of reactors. The newly incorporated safety features in KKNPP includes four safety trains instead of three, 'passive heat removal system, higher redundancy for safety system, double containment, additional shut down systems like quick boron and emergency boron injunction systems, core catcher in the unlikely event of fuel melt-down, passive hydrogen re-combiners inside the containment' etc (Balachandran and Patil 2011).

These new safety features taken into account in the design drastically improves the safety of VVER reactors at Kudankulam. The Probabilistic Risk Assessment (PRA) study conducted by the NPCIL has calculated the Core Damage Frequency (CDF) value for KKNPP Unit I as $1x10^{-7}$/RY which means the probability of serious core damage accident at Kudankulam is one in one million reactor years. Statistically, this designed CDF value increases the safety of these reactors at least by a factor of 100 compared to earlier reactor designs. Similarly, the lower quantitative value of Large Early Releases Frequency (LERF) for KKNPP as $1x10^{-9}$/RY (Reactor Year) is almost close to zero as can be meaningfully considered. Thus, one can surmise that, KKNPP is claimed to be one of the safest reactors operating in the world today. Though any technology can be used only till the time, its latest

Understanding Nuclear Technology

Nuclear Technology is the word mostly used when technology is built using nuclear energy, large quantities of energy emitted during the subatomic reactions. This technology is mainly based on radioactivity, a process in which particles or electromagnetic radiation are emerged through either integration (nuclear fusion) or decomposition (nuclear fission) of large atomic nuclei. Nuclear technology is used in nuclear reactors to generate electricity, nuclear medicine for diagnosis and treatment of certain disease, nuclear weapons for mass destruction and to some extend power space probes and submarines. Earlier history of nuclear energy dates back to 1895, for the first time X-rays were discovered by Wilhelm Roentgen. In 1896, Henri Becquerel demonstrated that the photographic plates were blackened from uranium salts, thus providing clues for α and β-rays while Paul Villard discovered γ-rays [1]. Later the term 'radioactivity' was coined by Pierre and Marie Curie for the emission of these rays. They also isolated well known radioactive elements polonium and radium. Later investigations reveal that radioactivity is due to the decay of unstable nuclei, known as radioactive decay. There are three types of radio active decay: α-decay (positive rays are emitted), β-decay (negative rays are emitted) and γ-decay (neutral particles are emitted). In α-decay, Helium nucleus $({}^{4}_{2}He)$[1]is emitted, for example,

$$ {}^{238}_{92}U \rightarrow {}^{234}_{90}Th + {}^{4}_{2}He. $$

Here, the Uranium nuclei $({}^{238}_{92}U)$is disintegrated into Thorium $({}^{234}_{90}Th)$and$({}^{4}_{2}He)$ nuclei. The difference in masses of the product and reactants is emitted as kinetic energy of the He nucleus (α-rays) by famous Einstein mass-energy equivalence $E = mc^2$. In the above case, energy released is given by E = (mass of ${}^{238}_{92}U$ – mass of ${}^{234}_{90}Th$ – mass of ${}^{4}_{2}He)c^2$.

In β-decay, electrons or positrons (particles having same mass of electrons but with a +ve charge) are emitted from the nucleus. A well known example of β^--decay is conversion of a neutron to proton

$$ {}^{14}_{6}C \rightarrow {}^{14}_{7}N + e^- + \overline{\nu_e}. $$

[1]The symbol ${}^{A}_{Z}E$ is used in nuclear science to represents isotope of elements E with atomic number Z, which is the number of protons in the nucleus and with mass number A, which is the number of protons and neutrons in the nucleus.

Where, Carbon nucleus $^{14}_{6}C$ with mass number 14 (6 protons and 8 neutrons) and atomic number 6 (6 protons) convert into Nitrogen nucleus $^{14}_{7}N$ with mass number 14 (7 protons and 7 neutrons) and atomic number 7 (protons) by emitting β-rays (e^-) and anti-neutrino ($\overline{\nu_e}$). Similarly,β^+-decay is conversion of a proton into neutron

$$^{23}_{12}Mg \rightarrow {}^{23}_{11}Na + e^+ + \nu_e$$

and, in which high energy photons are emitted. In the above example, Magnesium nucleus $^{23}_{12}Mg$ with mass number 23 (12 protons and 11 neutrons) and atomic number 12 (12 protons) gets converted into Sodium nucleus $^{23}_{11}N$ with mass number 23 (11 protons and 12 neutrons) and atomic number 11 (protons) by emitting postitron (e^+) and neutrino (ν_e).

When an excited nucleus decays to its lower energy level, a photon having energy equivalent to energy difference of states is emitted. γ -particles are neutral particles.

Nuclear technology is based on the concepts developed in understanding the inner most characteristics of an atom. Atoms weigh very less, for example the mass of a Carbon atom ^{12}C, is 1.99×10^{-26}grams. A convenient unit used in measuring the atomic masses is atomic mass unit (u, 1u=1.66×10^{-27}kg). Rutherford's α-scattering experiment demonstrates that the positive charge within an atom is concentrated on a small space, known as nucleus (of the order of femto meter, 10^{-15} m). Later experiments reveal that protons (+ve charge particles) and neutrons (neutral particles that have mass) are densely packed inside the nucleus (particles inside the nucleus are also called as nucleons). The nucleus mass is always less than the sum of individual protons and neutrons masses together. The difference in the mass of the nucleus and its constituents is called "*mass defect*". This is due to the fact that energy is needed to break the nucleus or energy is released when individual protons and neutrons come together to form a nucleus. For example, consider the mass of hydrogen isotope deuterium $^{2}_{1}H$, which is 2.014102 u [2]. A dueterium atom has one proton and one neutron in its nucleus. The sum of masses of proton (1.007825 u) and neutron (1.800665) is 2.016490 u. Thus, it appears a mass of Δm=0.002388 u is missing (mass defect). According to Einstein mass energy equivalence $E = mc^2$ an amount of delta ΔE= 0.002388 (931.49 Mev/u)= 2.224 MeV is required to break the dueterium nucleus into hydrogen atom ($^{1}_{1}H$) and a neutron. The the energy $\Delta E$is called "*binding energy*".

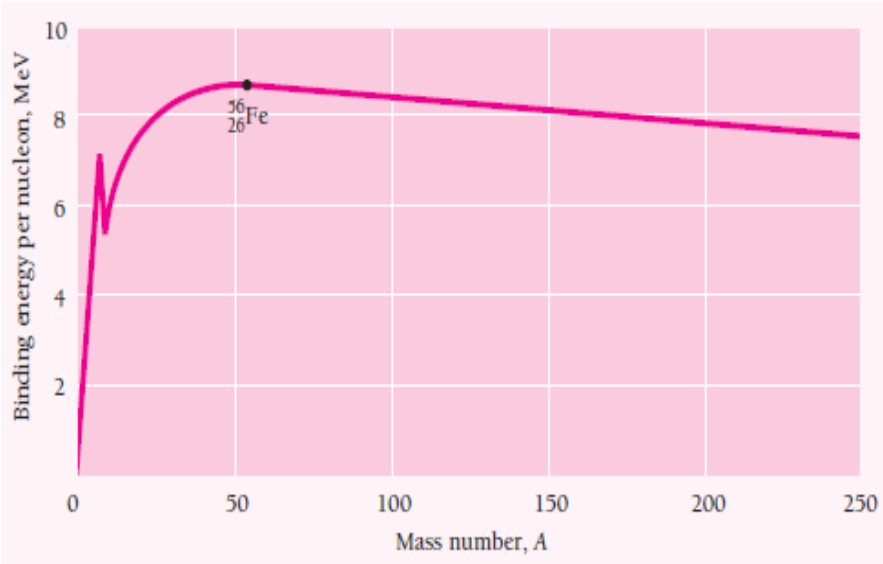


Fig 4.1. Binding energy per neucleon E_b as a function of mass number A (Weinberg 1994).

A convenient measure known as binding energy per nucleon, E_b gives more intiutive way of understanding the nuclear interactions. Fig.1 shows E_b plotted vs number of nucleons (protons and neutrons). This graph is very well known in nuclear science and many imporatant aspects of nuclear interactions can be deducted from this graph (Beiser 1997).

From Fig.1, the binding energy per nucleon increases shaprly for smaller mass number and has maximum of about 8.75 MeV for $^{56}_{26}Fe$. This indicates that the istope $^{56}_{26}Fe$ has most stable nucleus. For A>70, binding energy per nucleon is almost constant, independent of mass number. This implies that the forces acting in the nucleus are short range. When a larger nucleus, say $^{235}_{92}U$ is divided into two smaller nuclei, for example $^{114}_{56}Ba$ and $^{89}_{36}Kr$, nearly 200 MeV energy would be released in the process, since the binding energy per nucleon of $^{114}_{56}Ba$ and $^{89}_{36}Kr$ is more than that of with $^{235}_{92}U$. In a process called nuclear "fission" a larger number of nuclei with more nucleons are divided into smaller nuclei with smaller nucleons, giving rise to huge amount of energy. Similarly, when two small nuclei with A<10 are fused together to form a heavier nucleus, enormous amount of energy is released in the process since the larger nucleus has higher binding energy per nucleon (E_b). This process is termed as nuclear "fusion". It is the fundamental process by which stars generates huge amounts of energy. In this chapter, I will discuss in detail the process of "fission", which is the main process used in Kundankulam nuclear power plant and how nuclear reactors use fission to produce energy.

Nuclear Forces

Nuclear forces are the strongest forces in nature. Inside the structure of an atom, the forces that determine the motion of electron are called Coulumb forces. These are the fundamental forces acting between the charges. For example, according to Coulumb, the force acting between two charges$q_1$and $q_2$is given by

$$|F| = K_c \frac{q_1 q_2}{r^2},$$

where, K_c is Coulumb constant and $r$is the distance between the chargesq_1 and q_2. Form this it is clear that like charges repel whereas opposite charges attract each other. The nucleus is composed on positively charged protons and neutral neutrons, the protons should repel each other strongly, because of like charges according to Coulomb's force described above. This would lead to collapse of the nucleus. But atoms have stable nucleus indicate that an attracting force far greater in strength than Coulomb's force must be binding the nucleons together in the nucleus. These forces are called nuclear forces, which acting on short range of distance (10^{-15}m). This force is about 10 million times greater than the Coulumb's force and because of this energy produced per kilogram fuel by nuclear reactors is million times greater than those produce by chemical fuel such as coal and oil.

Nuclear Fission

An unstable radioactive element has unstable nucleus and decays naturally by releasing energy. The number of nuclei undergoing decay is proportional to the total number of nuclei present in the sample, given by

$$N = N_0 e^{-\lambda t}.$$

Different radioactive elements have different decay rates. For example, a common measure used for this feature is half-life. It is the time required for a radioactive element of N nuclei to decay to $\frac{N}{2}$. ${}^{238}_{92}U$has a half life of 4.5 billion years. Likewise, many radioactive nuclei have varying half-life, some may have seconds and some are millions of years, and these elements are highly radioactive, producing harmful β and γ-rays.

The natural radioactive decay is a slow process and one can enhance the decay rate of radioactive elements by bombarding them with other nucleons such as neutrons, protons and α-particles. For example, when${}^{235}_{92}U$ is bombarded with high energy neutron ${}^{1}_{0}n$, it produces an intermediate nuclei ${}^{236}_{92}U$that is highly unstable and quickly break down into smaller mass

fragments releasing enormous amount of energy. One possibility of such a reaction is depicted as

$$^{235}_{92}U + ^{1}_{0}n \rightarrow ^{236}_{92}U \rightarrow ^{144}_{56}Ba + ^{89}_{36}Kr + 3^{1}_{0}n.$$

This process is called nuclear fission. The nuclear fragments obtained through the fission are highly radioactive, which become stable by emitting β-particles. Other fission materials may require more energetic neutrons to undergo fission or in some materials fission is initiated by bombarding γ-rays or protons. The striking aspect of nuclear fission is the amount of energy released per reaction, usually it is of the order of 200 MEV (in comparison, energy released by coal burning is of few EV). Most of the energy released by fission is transferred as kinetic energy of fission fragments, which later converted into heat by surrounding material in nuclear reactors. If the kinetic energy of neutrons emitted by a fission reaction is sufficient enough to cause further reactions, it could lead to chain reactions that releases enormous amount of energy (Fig. 2) (Beiser 1997).

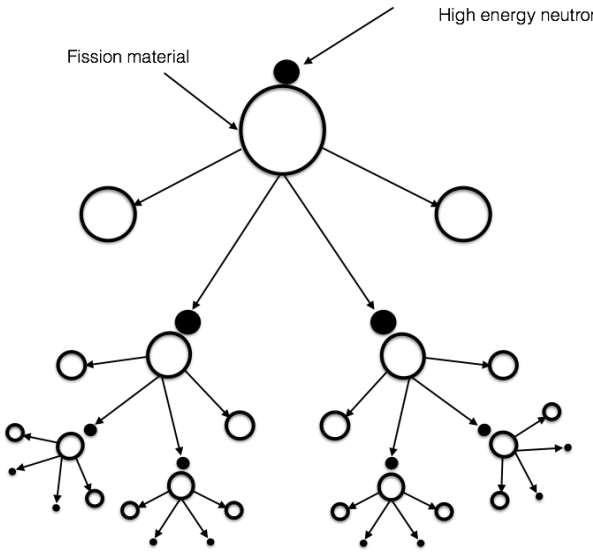


Fig. 4.2. Chain reaction: A fissionable material is bombarded with a high energy neutron that produces one fission reaction and the neutrons produced by this reaction triggers further reactions.

In nuclear reactors, the chain reaction is monitored and controlled by using other materials whereas in nuclear bombs, this chain reaction is uncontrolled and release enormous amount of energy that could lead to mass destruction.

Nuclear Reactors

Nuclear reactors produce energy efficiently by exploiting the mechanism of nuclear fission. Kundankulum nuclear reactor contains two water-water energetic reactors (VVER-1000) with a capacity of 925 MW electricity production per reactor. A schematic diagram of a nuclear reactor is shown in Fig. 3. The core of the plant contains $^{235}_{92}U$ore in the form of fuel rods or a lattice block with alternating layers of graphite which act as moderator. This assembly is known as *pile*. In order to initiate a fission reaction, the bombarding neutron must be moderate to have an optimal energy, called *thermal energy*. More energetic neutrons that are produced do not continue the chain reaction. These neutrons are needed to be slowed down for efficient energy production and the same can be achieved with the moderator, a substance that absorbs part of neutron's energy without the tendency to capture it and regulates rate of the chain reaction. The number of fission events during the chain reaction increases exponentially and can get out of hand easily that leads to explosive amounts of energy production (Weinburg 1994).

The pile is said to be *critical*, if, at any time, there is only one thermal neutron in the mix, and *supercritical*, if more than one neutron is present per fission. The high quantity of energy generated in the core is transferred to the reactor vessel, where, high pressure water is circulated. The pressure is necessary to prevent the water from boiling. This water is then pumped to the heat-exchanger to convert it to steam that later drives turbines to generate electricity (Fig. 3). The reactor is at millions of degree celsius temperature which, if cannot be removed efficiently, leads to meltdown (Mukunth 2013).

A coolant is used to absorb the heat and is drained away through pipes. Liquid and gaseous substances can be used as coolant. In the Kundankulam nuclear power plant (KKNPP), water under pressure is used as coolant and hence called pressurised water-reactors. High pressure water has high heat capacity which leads to remain as a liquid well above its boiling point. Other potential material that is used as coolant is liquid sodium.

The products that come out of fission reaction are highly radioactive and very difficult to handle. Some of these products have decay constant of few seconds to minutes and others have years. Consequently, these materials decay and emit harmful β and γ-rays. Moreover, they are present in the core of the plant which is at millions of degree celsius temperature that

poses challenges in the separation from core fuel. All the same the disposal of these nuclear wastes affect flora and fauna of the disposed surroundings. Usually, the nuclear waste is carried in a container called *repository*, a thick walled vessel with tampering material coated inside. This material does not allow neutrons and other harmful radiation from escaping to the environment. Later this repository has to be buried at a place that is void of life forms.
The radiation controversy is dealt by the scientific community The figure below. Figure 3 shows the schematic representation of a reactor.

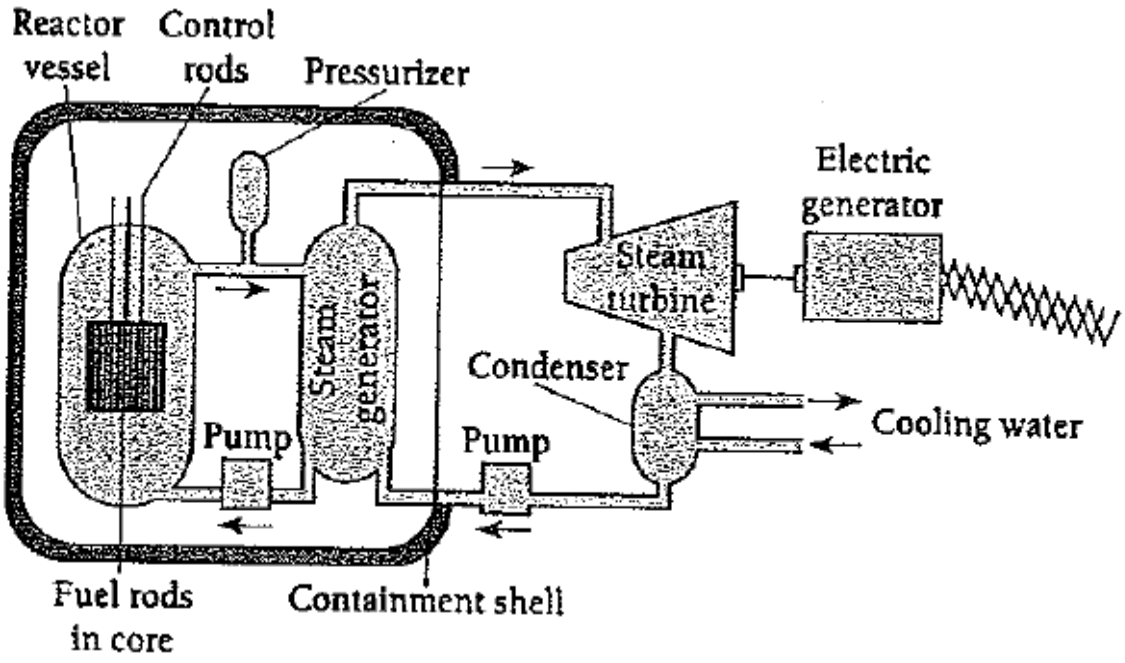


Fig. 4.3. Schematic representation of most common nuclear reactor (adapted from Alwin Weinburg 1994).

The main controversy of KKNPP arose due to the lack of consensus on nuclear waste disposal and its location at tsunami prone area. They are yet to decide a place where the nuclear waste will go and the Nuclear Power Corporation of India (NPCIL) has not disclosed any long term plans of handling nuclear waste (Mukunth 2013). It was mentioned that KKNPP has a plethora of safety measures such as passive heat removal system (PHRS) and quick boron injunction system (QBIS) which are supposed to ensure safety features for the environment (Bhardwaj 2013).

Environmental Effects

Like any big enterprise that disturbs a common life on its surroundings, the nuclear power plant construction also disturb the flora and fauna. Sometimes, manmade lakes has to be created, diverting rivers which causes many environmental effects. Though the authorities ensure effective safety system surrounding the plant, the heat generated from the reactor is responsible for the demise of aquatic life forms including fish and prawns. Especially, in the case of KKNPP, the reactor is located near to the sea, which is highly prone to tsunami. In case of nuclear disaster, it is highly impossible to evacuate 1 million people residing in a radius of 30 km around the KKNPP. The gases released from the plant contain ionized radioactive isotopes which affects the health of the people living in the surrounding areas (Udaykumar 2011).

The identification of four faulty crucial valves in reactors at Kudankulam and the arrest of Russian officials for sourcing substandard materials for nuclear equipment further fuelled opposition to the plant. The scientific justification for the overhyped negative effects on the Kudankulam Nuclear Power Plant (KNPP) is given on the basis of the successful running of the other nuclear power plants, whose environmental effects are said to be managed well, or not detrimental to the nearby population. In a notable comparison with the thermal power plants, that also generate energy, nuclear energy claims winning points because it is free from ash, or greenhouse gas, hence the pollution aspect is well taken care of in comparison to the other forms of energy, which cause pollution (Apte 2013).

At the same time nuclear energy claims exception when it comes to the effects on the aquatic life nearby the power plants, by allowing the own regenerative capacities of the fishes and other aquatic lives. The claim that the aquatic ecosystems can cope with the bad effects in the coming time, rests on the basis of laboratory results conducted on the aquatic life, which seemed to have responded for survival instincts, even after subjected to harsh conditions as increase in temperature (Apte 2013).

Apte (2013) quoting the report by Ayappan and A.K Pal (2005) which was submitted to Department of Atomic Energy(DAE), claims on the basis of laboratory results, that fishes have a behaviour of thermal avoidance as witnessed in the case of Kaiga Plant, Kalpakkam Plant, and now Kudankulam plant. The survival capacities of the aquatic life can instigate

them to move away from the adverse conditions, which is anyways implies that the aquatic system will not go unaffected.

Concerns with Radiation

The common person's understanding of radiation is not of much importance to them unless the concerns started gaining ground with the inception of the nuclear power plant. The scientific community tried to allay the fears of the exposure to the radiation by the nuclear power plants through scientific proofs and comparison to the normal radiation any human is exposed to irrespective of the geographical location. The case of Kerala is an apt illustration to high level of natural radiation due to 'monazite sand'. Apart from that, the low level of radiation prevailing in the vicinity of the power plant does not cause any damage which is beyond the natural repairing capacity of the body cells. With further laboratory proofs and scientific justifications, it has been found that there exists no threshold limit of radiation, below which radiations do not cause any damage and hence can be considered safe. At the same time, any human experimentations to check the effect of radiations on human health has not been conducted as such (Apte 2013). Thus the scientific justification lies with the fact that the 'minor increase in radiation is not set to cause any deleterious effects on the health' (Iyer 2011). The places which witness natural increase of radiation, due to geographical locations have not shown any harmful effects on the health of the nearby population.

Conclusion

This chapter was an attempt to understand the science of nuclear technology and further correlate to the Kudankulam Nuclear Power Plant(KNPP). The deadlock between the expert group and the common people is clear, as the scientific and bureaucratic technocratic group understand the power project on the basis of the measurements, calculations and proofs that deliver a defined result, while at the same time, common people, are chiefly concerned about their livelihood issues, and the immediate effects that can cause discomfort and problems to them. The environmentalism, or anti market attitude is thus evident in the protests which take the shape of questioning authorities as well as questioning technological supremacy.

The tragedy of scientific justification in all core areas lie in the fact that they maintain nonchalance to the immediate issues, which concern the local population and continue to thrust the effects of long term gains. These long term gains are nothing but a way to expand the already existing structural fallacies that have been reproduced in favor of achieving

demarcated goals for which, the said technological advancement has already been conceived. This is how a critical theoretical framework provides adequate space to question such instrumental rationality again and again. The specialised knowledge is the instrumental aspect of knowledge production.

The repeated justification and thrusting of nuclear power plant is not very different from what has been witnessed as painful fallouts of all the developmental technological infrastructures, which must have caused drastic changes to the ways in which we have reached this stage of development, that is divorced from people's consensus. The case of thermal plants, or the case of industrialisation must have been no different from experiencing the similar tumultuous process. In a similar vein, the cause for deforestation, anti dam protests or the environmental movements must have sought to achieve, very similar goals as the common people are trying to achieve, a quest to overcome instrumental rationality to coexist with the environmental and basic human needs.

Chapter-5

TECHNOLOGY AS DEVELOPMENT

Technology studies are linked to the developmental aspect in two primary ways, one is how technology can help in bringing people more closure to the developmental aspects, and secondly how new technologies help the present process of labour and production to increase efficiency and productivity. Development itself is a contested matter that has been defined and redefined in number of ways to be made more acceptable with the present situation. The dynamics and theory of development has changed increasingly with coming in of new factors and parameters. There are indicators that define the development and among which economic growth and prosperity remain a major factor that actually indicates development.

Though a holistic development is known when an individual enjoys a basket of utilities together, which include nutrition, education, political and civil liberties, choice of work and leisure. The developmental studies have become an important interdisciplinary approach where development is studied from different angles. Imbued in development is the approach of individual development, community development and further. The approach in the recent past has been pro individual development that can later take care of community development. Further the thrust has shifted to 'Sustainable development' and 'Human development'. For all this to achieve it is important to understand where does technology fit itself? Technology has been a tool for development while its role is restricted to the effect it produces in terms of enhancing efficiency and productivity. To understand the instrumental logic of technology, it is indeed a tool and an application for increasing the efficiency of the labour.

Here, concern of development can be linked with technology in two ways: technology being an indicator of economic growth and economic prosperity bringing development.Secondly, technology acting as an agent of change primarily social and attitudinal further leading to development. The changes in the society are more or less due to the technological strides that are manifested in the form of social transformation.

Here the argument of technology is primarily concerned with the use of energy that is being utilised for the purpose of bringing in other forms of development. For example development

in the form of electricity that can lead to more integration in economies around the world, and facilitate the movement of labour and knowledge through increased mobility.

Evaluating technologies that produces energy brings about economic prosperity. In this process, the reliance on raw materials for energy production like oil, coal, gases have always remained a matter of concern for the different government to enable energy security for their economies. To secure security of energy the countries try to seek sustainable technologies and sticks to a diversified energy mix. Especially in the case of India, the thrust has shifted to renewable energy sources with the issues of climate change gaining prominence. The usage of right energy mix required for a particular economy has gained prominence. In this arena, the case of nuclear energy waxes and wanes due to a number of reasons.

Before relating technology to economic growth, it is important to point out that technologies can be produced when effective amount of energy is produced to sustain the economy. Thus Energy-Technology-Economy-Development can be linked to each other. Besides, technology in the present world also leads to participation and transparency which are the core aspects of e-governance promoting government citizen interface.

Paradigms of Development

Development is 'dependent upon freedoms that an individual enjoys'. Amartya Sen (2000) has conceptualised development as the 'process of expanding real freedoms that people enjoy'. According to him, development has narrower motives when it is just focused on 'gross national product', 'rise of personal incomes', or with 'industrialisation' and 'technological advances'. They can be necessary for enhancing certain values associated with life but the actual freedom engulfs in it aspects of 'social, economic arrangements', 'political and civil rights'. Amartya Sen(2000) places technological advances as 'contributing to expansion of human freedom' but still they are only 'means or instruments to reach a larger objective', which is realisation of freedom.

Development takes place through expansion of capabilities and opportunities. Further the avoidance of deprivations such as malnutrition, starvation, morbidity, etc. further leads to quest for education and political participation. In such a development paradigm, political participation and expression of dissent is taken to be equally essential, though it remains contested on the basis of the conflictual environment that can lead to disturbance in pursuing single focused agenda of development through i.e economic growth. Thus, the 'intrinsic'

freedom is the 'preeminent' objective of development and it enables human to create other 'instrumental' freedom and both of which is necessary for development (Sen 2000). United Nations Human Development Report has suggested measures. In particular reference to Human Development Index (HDI), an assessment of development should be based on its people and their capabilities (Human Development Report, 2016). HDI estimates the average achievements in the key areas of human development, that is having a decent standard of living and a long and healthy life span (*Human Development Report,* 2016). A graphical summary from (Human Development Report, 2016) is depicted in Fig. 5.1.

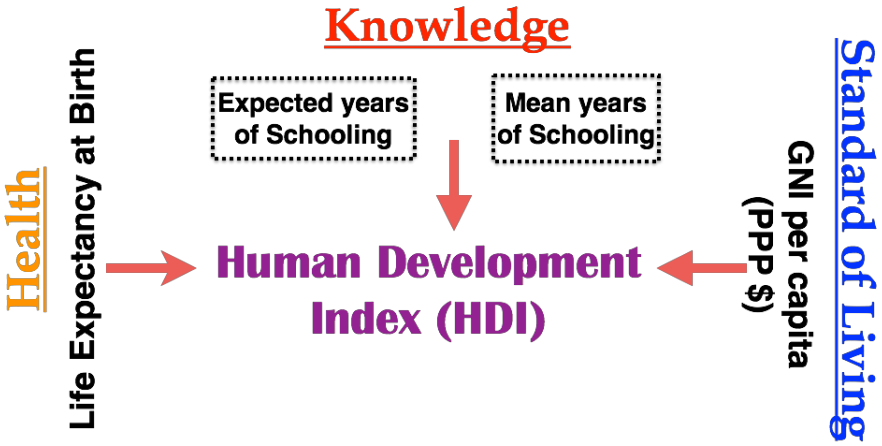


Fig 5.1: Human Development Index(modified from Human Development Report, 2016)

The political participation being one of the essential criteria for development imbues in it the ability of people to involve in decision-making processes. In this aspect, the introduction of technology on one hand gives people to experience a globalised world through communication revolution, while on the other hand it is excludes people from the decision-making processes by promoting intellectual protection and trying to shield innovation from being shared with the common people. Therefore the present mode of development is slightly shifting to decentralization and giving importance to the traditional knowledge. It manifests itself in the form of tensions between the multinational corporations promoting innovations and the importance of preserving the traditional knowledge bearers. As articulated in the goals of major global collaborations, traditional knowledge and protection of local people. The specialised knowledge in the form of medicines, patents, genetically modified seeds, in the field of agriculture, or even the advanced medical sciences are practising a form of subjugation on the people.

In this study, the role of energy is of primary importance since it is instrumental in bringing growth and productivity to the people. The sustainable sources of energy are gaining importance in the present world especially in the context of climate change, and the role it plays in the developing countries where renewable energies can be harnessed, in a cost effective way.

The rationale for investing in Nuclear Energy?

Technology plays an important role in the development of a community and the state. Thus, the sustainable form of energy harnessing ensures that the productivity of food, livestocks, minerals, industrialisation and urbanization can be handled. The harnessing of energy forms an essential and basic technological need of the society. In this context, the ways in which energy can be harnessed and utilized for all means, forms an important aspect of the state function. The essentials of sustainable goals adopted by 193 nations in the United Nations that replaces the millennium development goals keeps, 'affordable and clean energy' as one of the developmental goals along with others in which 'partnership for global development', 'life below water', 'industry, infrastructure and innovation', 'responsible consumption and production', 'sustainable cities and communities' forms other determinants of development' (World Development Indicators 2016).

All these developmental goals are interlinked to each other such that one leads to the other. The development of sustainable cities and communities is dependent upon the use of clean and affordable energy, which can further lead to responsible consumption and production, and further lead in the growth of industry, innovation and infrastructure. In a major report by the International Energy Agency (IEA) called the Energy Technology Perspective (2014), the Indian quest for nuclear energy is evident from the establishment of Atomic Energy Commission in 1948 and the further establishment of atomic energy department in 1954.

The recent thrust is on de-carbonising the energy system, so that the usage of fossil fuels are cut down and emission reduced. In a renewed effort, India is finding itself among the emerging economies where the demand for electricity is on the rise. India is trying to lower its dependence on coal, despite that, 68 percent of India's needs lie on coal with an attempt to diversify her energy needs that includes hydropower and nuclear energy. Expansion of nuclear energy is a major agenda of the Indian government, though it forms only 3 percent of

the power generation (Energy Technology Perspectives 2014). Amongst measures taken to enable reduce the dependence on carbonisation of fuel, the need for nuclear energy is also propagated as a clean form of energy, as carbon is not burnt during the production of nuclear energy, and there is no greenhouse gas emissions or air pollution as in the burning of fossil fuel based fuel. 'Several nations, including China has made nuclear power as the primary goal of expansion of their clean energy goals' (Tracking Clean Energy Progress 2016).

Further many countries are making huge investments in the nuclear reactors especially because of the efficiency of generation (III) Light Water Reactors which can also reduce the scope of accidents. While United Kingdom has designated nuclear energy as one of the low carbon technology that is enjoying guarantees for market pricing in the energy sector in order to manage climate change commitments (Energy Technology Perspective 2014). The biggest news in the year 2015 was the accident of the nuclear power plant in Fukushima Daiichi in Japan. It caused a widespread change in public perception regarding nuclear energy and brought about changes in the policies of the government regarding reduction in the production of nuclear energy. The Fukushima accident led to new set of awareness amongst people and new set of precautions, by the government about the nuclear energy. The damning questions were raised on the government agencies and the regulators that were responsible for the maintenance of the reactors. In this context, even the laws and regulations were found wanting in terms of protection they were expected to provide for the maintenance of the nuclear power plant. A Japanese parliamentary panel, delivering a 'damning verdict' acknowledged that, 'the existing regulations were found biased towards the promotion of the nuclear energy policy, and not to public safety, health and environment' (Fukushima Report 2016). As resembled from Fig. 5.2, that subsequent to nuclear reactor disaster the construction for the new nuclear reactors falls down (Fukushima Report: Key points in Nuclear Disaster Report 2016).

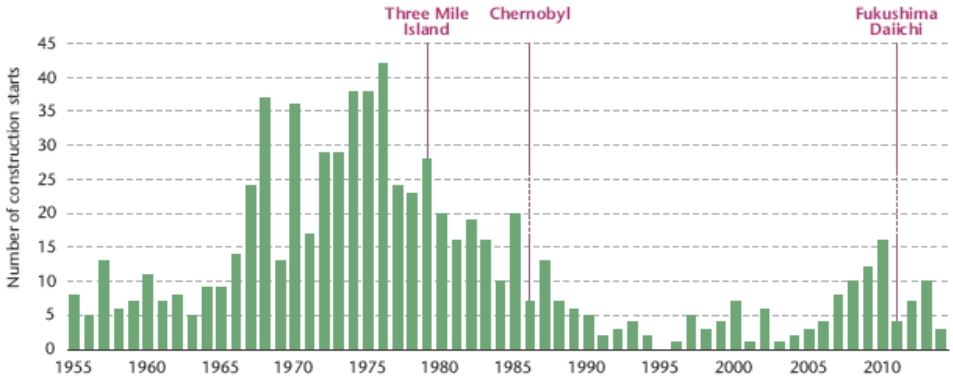


Fig. 5.2: Nuclear Reactor Construction Start, 1955-2014 (Source: Technology Roadmap: Nuclear Energy 2015, from Report of Energy Technology Perspectives from International Energy Agency (IAEA)).

Nuclear power is the largest low carbon energy in the OECD countries, and apart from that all developing countries have continued to exhibit greater interest in harnessing nuclear energy for electricity generation and fuelling their rising economic needs. The setting up of the nuclear power plant and the production of reactors itself is a capital intensive investment. Therefore the competitiveness of the nuclear power plant is maintained by innovating the structure and utility of the nuclear reactors. Governments play a major role in the ensuring a 'long term investment framework' and enabling a research environment for better equipment of 'nuclear safety', 'advanced fuel cycle', 'waste management' and 'innovative designs' (Technology Roadmap: Nuclear Energy 2015).

The concerns for the waste management in the nuclear energy form an important issue for the effective use of this energy. This is where the consultation with the local community forms abedrock for the development and effective management of the nuclear sector. There is a necessity for the training of skilled nuclear workforce, for the management of nuclear infrastructure which includes the risks associated with the handling of nuclear waste as well as training of the people in handling nuclear utilities. The use of nuclear science and technology is not only limited to power production but also found in the areas of agriculture and health. The increased use of this technology also gives rise to the increased risk factor in the ways management of this technology is done (Technology Report: Nuclear Energy 2015).

Nuclear Technology and the Public

The development of nuclear technology includes in itself the importance of engaging with the public and dissemination of the information that can be utilized for the purpose of nuclear safety. An IAEA (International Atomic Energy Agency) action plan on nuclear safety, calls upon the member states, IAEA secretariat to 'disseminate information to the public which is timely, clear, factually correct, objective and easily understandable' (IAEA Action Plan on Nuclear Safety 2011).

The thrust on nuclear information dissemination to the public is an important aspect when it comes to the dealings of the nuclear energy. This dissemination of information to the public is the space in the field of nuclear technology that gives the scope for the scientific expertise to meet the perceptions of the common people.

The scientific expertise and the technical aspect associated with the nuclear technology not only, enhances the public awareness, but also leads to developing an understanding of fear and risks associated with it, which is actually done to ensure enough manpower awareness to deal with crisis, and cases of emergencies. Such awareness programs actually lead to common people's perceptions being more fear constructed and thus may lead to developing an antipathy towards the nuclear technology for the generation of power. While nuclear power generation remains a very capital intensive industry laden adventure, the questions of the use of nuclear technology in other sector hardly raises people's concerns. It is similar to understanding that nuclear technology has an agenda which gets promoted as 'Atoms for Peace', but the level of public protests and fears related to nuclear technology as in the case of nuclear energy for power generation is actually unmatchable.

The questions of development and exclusion of people is understood here as in the case of the construction of dams, or acquisition of land that are enforced on people in the name of development. The development process being technical also excludes people, more so in the case of nuclear technology. Nuclear technology remains essential as on one hand, skill development of people working for nuclear installations forms an important requirement for the effective establishment of the nuclear power plant, but on the other hand the public information dissemination continues to create scientific mysticism around the nuclear power plants.

Public concerns about nuclear safety are amenable to influences since the local population are not well informed about the safely regulations by the concerned authorities. The surveys conducted on public opinion on nuclear energy depend highly on the context and have contrary results (Bisconti, 2016). For example, the 2016 study by Ann S.Bisconti presented the surveys conducted by three independent groups, Gallup, University of Texas at Austin and Bisconti research for Nuclear Energy Institute (NEI), which provided contrary results. Gallup survey has found that 54 % of the population in the survey opposed the nuclear energy. The downgrade of support for nuclear energy is due to the surplus energy available to USA and main concern in this context is the safety. This down grade is also attributed to the context, because the support for nuclear energy was asked before questions about environmental concerns and safety hazards.

In India, particularly, the communication between government and the public remained one way before economic liberalization. Malhotra (2016) has argued that pre-liberalization was largely influenced by government and decision makers.Public had received information through "Doordarshan" and "All India Radio", which was "heavily filtered"(Malhotra2016). This allowed government to enjoy greater influence on biasing the public opinion in their "line of thought".The "nuclear discourse" were totally dominated by the "strategic elites", influenced people from military, political and scientific strategists with access to administrative powers. She further argues that post-liberalization came with free press, maintained by private firms, and has less influence from the government provided a "two way communication" between decision makers and the public.

But the addition of news have very little content related to nuclear issues and policy making. This can be attributed to the content of the news that has been airing in the news channels which Malik and Medcaf has termed as "tabloid television" (Ashok Malik and Rory Medcaf, 2011). Despite these efforts, the local population, who witness the daily life changes surrounding the nuclear power plants, remained antagonistic to the nuclear issues.

Science, Technology and the Idea of Progress:- The case of Nuclear Technology

Progress and development are two important indicators that satisfy human endeavours and give them a sense of achievement. What constitutes these indicators? According to Daniel

Sarewitz (2013), progress is to 'address three types of primary goals, which also leads to endpoints. First is Truth, constituting an important dwelling which is achieved through 'religious insights, philosophical reasoning or scientific enquiry'. Second is 'normative ideals' that seek to improve human conditions, encompassing in it twin units-individual as well as the social aspect or the' collective good'. Individual virtues include 'generosity, tolerance, piety, self actualisation', and social includes 'social justice, freedom and equality' etc. Finally the third is the 'specific, concrete outcomes that are manifested in the form of 'qualitative metrics' (Sarewitz 2013)

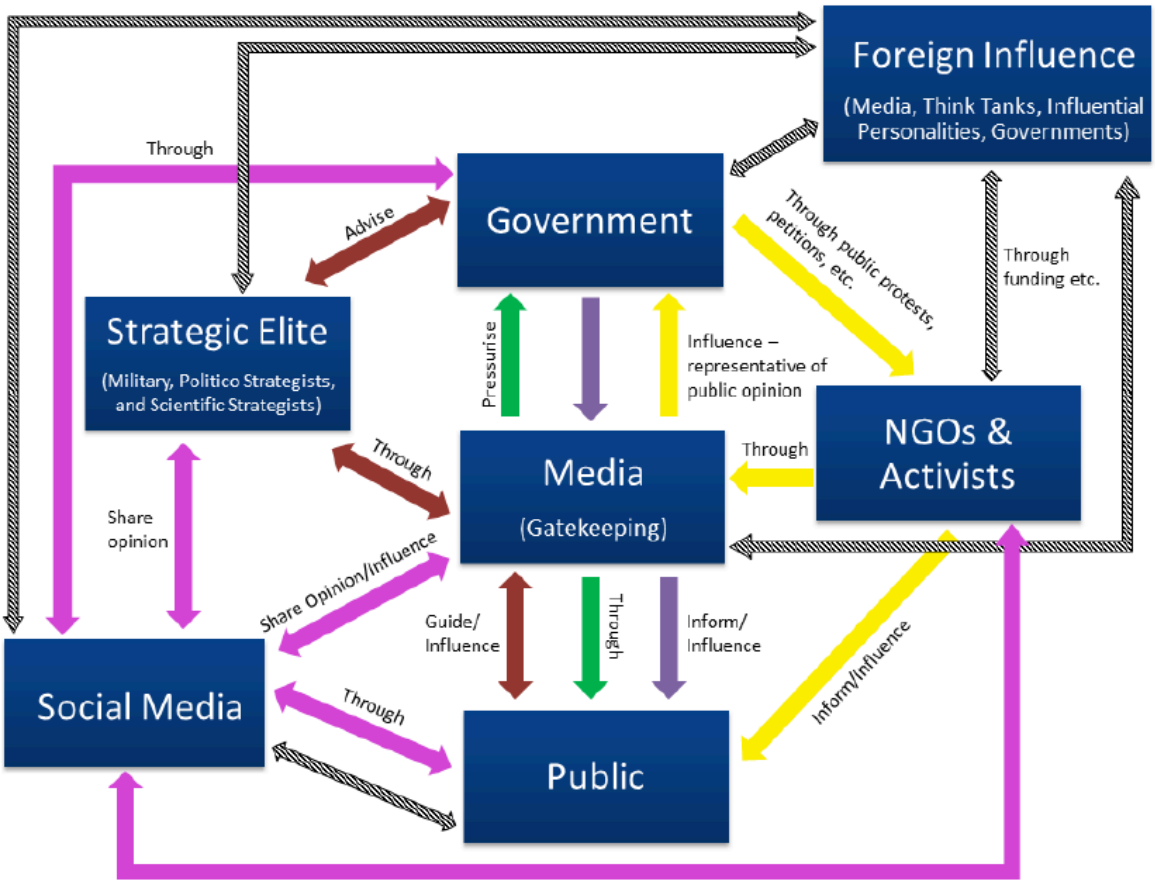


Fig. 5.3: Flow chart explaining influences in public attitudes (Source: AditiMalhotra, Assessing Indian Nuclear Attitudes, 2016).

Sarewitz(2013) makes 'Science and Technology' a parameter or a 'frame of reference' to decide the direction of the progress and technologies enjoy the benefit of demonstrating progress through fixed results that can be obtained through forced chemical or physical or biological experimentation, which are set up to understand phenomena. These fixed results are important to determine the direction of a particular goal.

Kudankulam Power Project and Exclusion

An important issue in establishing large scale nuclear power project is the exclusion of people in the decision making process, primarily due to the fears about the ways these power projects will affect their life in future, which also includes effects on their environment. Habermas in his analysis of political communication understands exclusion when the participation in the political dialogue does not treat the participants as equal (Olson 2011). This results in persuasion of one set of participants, to agree with the claims of the others set of participants. A similar case appears in the case of Kudankulam Nuclear Power Plant where the information dissemination programme conducted by the government, specialised agencies with the public fails to allay a number of public apprehensions and fails to provide proper redressal which can lead to public antipathy towards the project.

Habermas calls the failure of communicative action due to 'understandings plagued by power and inequality (Olson 2011). The Kudankulam protest movements exhibit such form of failure of communicative action where all presuppositions of deliberative democracy are jeopardised when the fishermen community is not heard enough. A long drawn battle against the project, which ensued in 1987s, kept reverberating with the cries of millions of people, who stood against the project in all forms. The occurrences of two major nuclear catastrophes, one of Chernobyl and other Fukushima continued to infuse new vigour into the minds of people who got new reasons to stand against the nuclear power project. The role of NPCIL (National Power Corporation of India Limited) has been severely criticised by the people, who have been witnessing the adamant nature of the specialised agencies in dealing with the installation of the nuclear power project (Paliwal, Dutta and Jishu 2012).

A widespread protest which has been winning people's participation not only from nearby 27 villages but also from the cities were trespassed by the police which never kept back from using state repression to answer the protests. The other crucial impact of this movement is the international workforce which has come to enable the power plant to start smoothly. The Russians, and the specialised agencies workforce, the contract laborers, as well as the Croatian experts have been involved in the commissioning of the power project immediately

even after the protest movements were on with full effort (Paliwal, ArnabPrathimDutta and LathaJishu 2012).

Reporting for the magazine *Down to Earth*, Paliwal (2012) narrates the experience of a priest who actually carried out an awareness campaign called 'Save Water, Save Life' in 1989, where he carried out a march culminating in Kanyakumari. He has been instrumental in raising the spirits of people to keep protesting against the Kudankulam power plant. The loss of livelihood is the major concern among people who belong to the fishermen community. The villagers where the protest movement was active include Idinthakarai, the place that became the rehabilitation areas for the tsunami struck people in Tamil Nadu in 2004. The power plant walls touched the rehabilitation centers, and thus invited irk of the people.

Habermas and the notion of Public Sphere

The concept of public sphere used in the critical theory study by Habermas is relevant here as a space for public awareness for creating acceptance for nuclear energy in the minds of the scientific community as well as the state organisations. The importance of public participation in matters of importance is taken as a sign of mature democracy. Habermas accords large importance to public sphere, which comes actually 'outside the state, and where society itself mandates the exercise of power and also criticizes the way power is used' (Poggi 1978). Thus public sphere commands a respectable place in a democratic society, where all individuals, who are stakeholders in the democratic decision making, participate and can articulate how 'common affairs should be ruled'(Habermas 1996).

'Public sphere is a critical concept that has legitimacy for the public authority' (1961). Tracing the history of public sphere where it served as ventilation from hegemonic tendencies of the government of the day by letting the people vent out their opinions against the established institutional hegemons. The public space gives citizens the power to give their own opinions, 'set their agendas through open communication' (Eriksen and Weigard 2003). The protest movements thus are emanating from the middle classes, and includes the 'feminists, environmentalists, anti nuclear and various counter cultural movements' and just not fight for 'social justice and the rights of the workers, but for the autonomous social spaces free from the incursions of either economic or administrative systems'(Haysom 2012). The emancipation angle is associated with the protests being either 'assertive in its desire to acquire and instantiate new legalized rights and freedoms, or ''defensive'' in its desire to

protect currently held rights and freedoms from further subvention by functional imperatives' (Haysom 2012).

Nuclear Energy Worldwide

The development of nuclear power plants around the world has been under the monitoring of the international specialised agencies such as IAEA (International Atomic Energy Agency) which has been monitoring the development of nuclear power around the world, few statistics are available here, which suggests that nuclear power is continually been supported and popularized in the Asian continent, in order to meet their climate change goals. As reported in IAEA Nuclear Technology Review, 2016, as of 31 December2015 a total of 441 reactors are functional among which USA has the maximum 99 of the reactors.

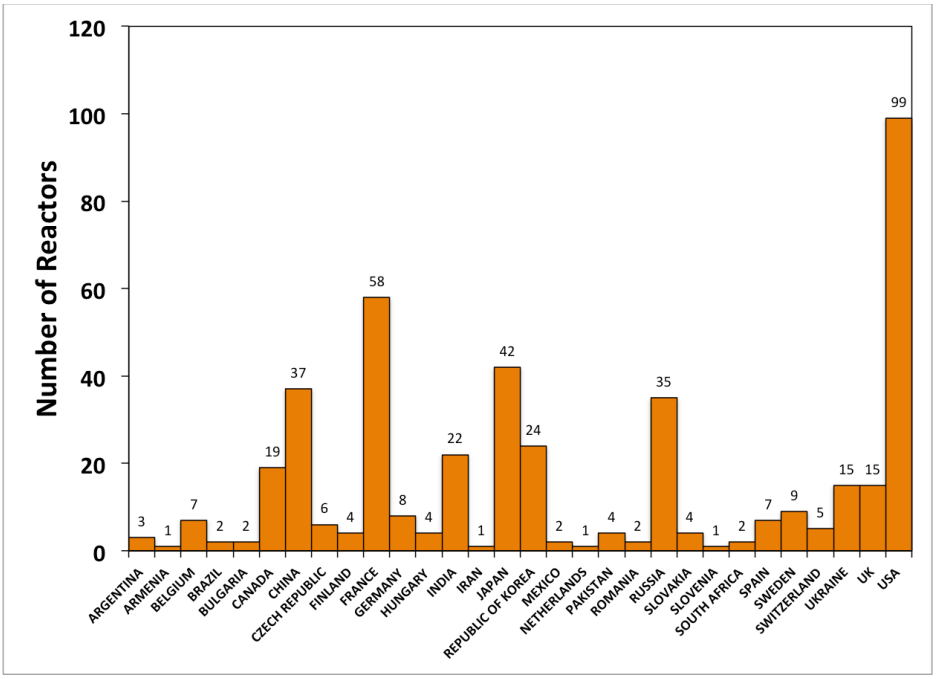
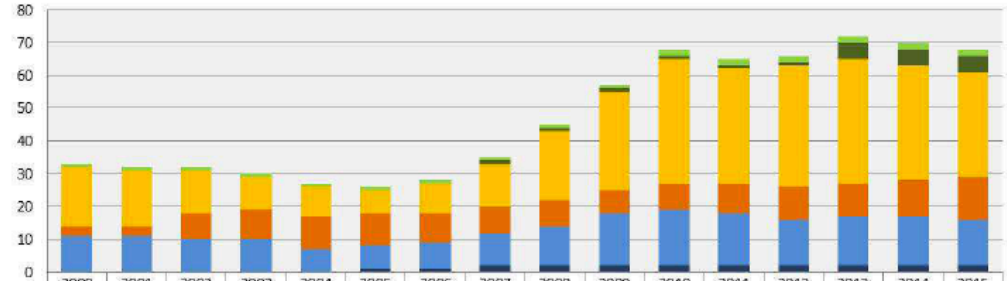


Fig. 5.4: Total Number of Operational Reactors (Source:Nuclear Technology Report 2016 quoting:http://www.iaea.org/pris).

The popularity for nuclear energy is increasing very fast. The fascination with the nuclear energy remained centered in Asia, particularly in China (Fig. 5.4 and Nuclear Technology Report 2016). As shown in Fig.5.6, the nuclear energy has been popular from last decadein the world.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
America - Latin	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2
America - Northern	0	0	0	0	0	0	0	1	1	1	1	1	1	5	5	5
Asia - Far East	18	17	13	10	9	7	9	13	21	30	38	35	37	38	35	32
Asia - Middle East and South	3	3	8	9	10	10	9	8	8	7	8	9	10	10	11	13
Europe - Central and Eastern	11	11	10	10	7	7	8	10	12	16	17	16	14	15	15	14
Europe - Western	0	0	0	0	0	1	1	2	2	2	2	2	2	2	2	2

Fig. 5.5: Number of under construction reactors by region (Source: Nuclear Technology Report, 2016).

With the growing energy needs, the production of nuclear energy is expected to increase two folds from 2014 to 2015 as mentioned in the Nuclear Technology Report of 2016 (Fig. 5.5).

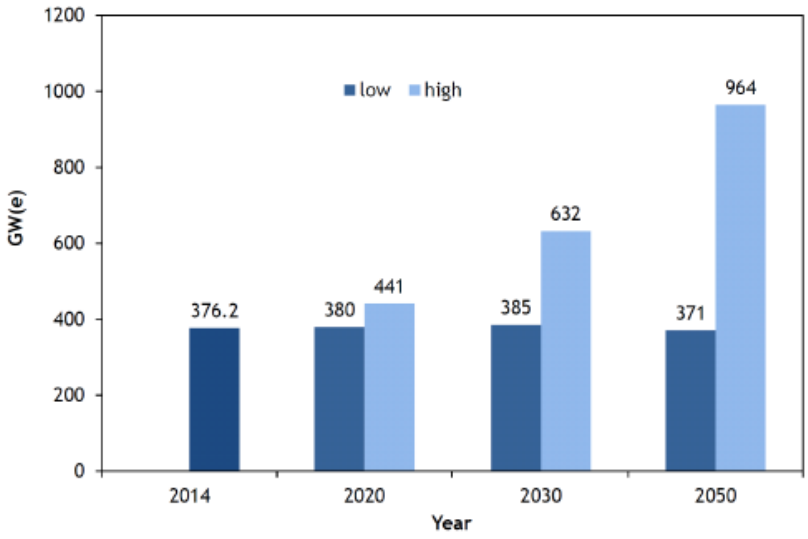


Fig. 5.6: Projected energy production by nuclear sector (Source: Nuclear Technology Report, 2016).

Apprehensions Regarding Nuclear Energy

A major apprehension expressed by the people, not only for the Kudankulam Nuclear Power Project, but also for other nuclear power projects operating in India, was about the reactor that was used. It was known that the reactors have their own limitations and have been a cause of

concern. The limitations of Prototype Fast Breeder Reactor (PFBR) are known in several cases around the world, while it is said to cause serious concerns to the ecology, environment and the human population. The anti-nuclear movement took the shape of anti-PFBR technology movement, and hence can be called anti PFBR movement. The stories of Kalpakkam, in the first public hearing held in Kanchipuram near Kalpakkam, in 2001 were mainly narrated by the affected people, comprising of the fishermen community and the local farmers who gathered there to express their apprehensions against the nuclear installations before the Kudankulam Nuclear Power Plant went into operation. The cancellation of public hearing by the local authorities previously had raised serious doubts on the intentions of the institutes such as Indira Gandhi centre for Atomic Research (IGCAR), which was carrying out research for the development of PFBR. Department of Atomic Energy hurriedly carried out public information dissemination program (Down to Earth 2016).

The antipathy has been a routine affair of the agencies and research institutes towards the public, whose concerns and apprehensions have been superseded for the scientific justification. Hence, the development process becomes elitist and exclusionary. It turns out to be the question of expertise versus knowledge of people who directly bear the brunt of any administrative stance, especially on matters where the people's opinion are to be diminished.
The question of nuclear reactors especially the case of PFBR has been cited in the Nuclear Technology Review 2016) reveals that India and China are the only two countries investing in the PFBR reactors, while all other countries have been using, other versions of reactors, including better investments in the research and development of the nuclear technology for improving the efficiency of reactors, closed fuel cycle as well as the management of radioactive wastes. The latest statistics reveals that the types of operational reactors in use comprises of 81.6% light water moderated and cooled reactor, 11.1% heavy water moderated and cooled, 3.4% light water cooled reactor and graphite moderated reactor, 3.2% are gas cooled reactors. Two are liquid metal cooled fast reactors (Nuclear Technology Review 2016).

Water cooled reactors play a significant role in the commercial nuclear power industry, across the world, accounting for 95 percent of all civilian power reactors in the world. In India the prototype fast breeder reactor has been use since 1985. While countries like Japan and South Korea have relied on sodium cooled fast reactor. While China has experimental fast reactor (CFR) to meet its power needs. South Korea is using Generation IV sodium cooled fast

reactor, along with further research and development in the reactors, Europe is using Sodium Cooled Fast Reactor(SFR), Lead Bismuth Cooled Fast Reactor(LFR), and Gas Cooled Fast Reactor(GFR)(Nuclear Technology review 2016).

While the prototype fast breeder reactors are developed under the stage two of the three-stage nuclear power programme of India, the Prototype Fast Breeder Reactor PFBR is a pool type reactor where the uranium and plutonium is used as a fuel, and the coolant used is liquid sodium (Department of Atomic Energy Annual Report 2015-16).

The technical preparedness which is the batting point for agencies such as AERB (Atomic Energy Regulatory Board), expects public to show confidence in the safety features of the nuclear power plant, however this contested in many ways by the public, who reveals their protests understands finer points of the nuclear technology that will eventually create greater risks and problems for them. The importance of public hearing and public awareness programme by the specialised agencies like NPCIL (Nuclear Power Corporation of India Limited) has to do with engaging people so as to create an aura of celebrated position science enjoys in the society. In the Annual Report 2015-16 released by the Department of Atomic Energy states that NPCIL carries out extensive and multipurpose activities for the public awareness program for the people, which includes regular interaction with the people living near the nuclear power plant.

The awareness is mainly carried out in collaboration with the media groups and includes commercials that can increase public understanding of nuclear issues, at the same time the collaboration with informative channels like National Geographic channels can lead to increase in public confidence. Though all the initiatives have still not been successful in allaying all the fears as the protest and people's awareness regarding power plant suggested. The public outreach program is carried out through seminars, exhibition and scientific meet, but again has an urban bias. The permanent nuclear galleries at the science centres, in Delhi and Chennai are aimed at increasing the awareness of the urban population. In urban areas energy remains a primary need and the nuclear power plants can be better supported. However, engaging with the rural population is more challenging, though the participation in the Kudankulam agitation, was both rural and urban and hence more encompassing.
The agitating rural population revealed that it is the awareness from the television and media that have made them question the nuclear power plant. The awareness programme from the

agencies have created double flux, while on one hand it is the attempt on the part of the specialised agencies to create awareness about the nuclear power which is very different from the public awareness created for people who reside proximate to the power plant. The seminars, scientific meets, exhibitions, even awareness through media and advertisements, create a limited awareness of the people, especially those who remain in the proximity of the power plant. The difference between urban centric awareness and the awareness to allay fears of the local population is important to understand. The fishermen community and the rural population agitating against the power plant are generally aloof from the urban acceptance created by the scientific community. Nonetheless, while the primary job of the NPCIL is to enhance the confidence of the local population.

The tussle between the agencies and the local population is to make each other aware of their respective view points. However the deadlock continues over handling the concerns of the complex technology such as the nuclear technology, and this is strengthened by the optimistic verdict handled to the agitators by the Supreme Court of India. The civil society group considered it very shocking and the verdict was denounced. The justification of the nuclear power plant was made to in terms of sustaining high economic growth and the need for energy, to ensure the growth of economy.

The development of the nuclear energy divorced from the popular will of the people is often justified by pointing out the incompetencies of the local population to participate in the decision making. The bureaucratic and the technocratic machinery take efforts to bring on board the people's consent, though the effort continues to be half-hearted and urban-centric. Technology Report- Nuclear Energy released by International Atomic Energy (IEA) in 2015 puts public acceptance as a major challenge to the development of nuclear energy in India, along with finance issues and issues of foreign vendors access to the Indian markets, as the nuclear liability law of India is considered anti market. At the same time, the nuclear energy occupies primary position in Europe and USA though phasing out has been proposed in Belgium, Switzerland and Germany. The challenges in the Europe and USA (United States of America) continued to be market oriented and guided by market fluctuations. The motivation for nuclear energy in Europe isdecarbonisation of electricity and the competitive pricing enjoyed by the nuclear energy as compared to other forms of energy (Technology Report Nuclear Energy 2015).

Public acceptance remains a key challenge in all Asian countries, such as China, Japan and South Korea including Europe. The report further estimates that India could become the third largest nuclear energy country in the world by 2040. The development of a nuclear energy market is expected to enhance international cooperation in the field of nuclear commerce (Technology Roport Nuclear Energy 2015).

The apprehensions regarding the reactor technology being used in the Kudankulam after the controversy of Prototype Fast Breeder Reactor (PFBR), used in the Kalpakkam Nuclear Power Plant, developed under stage II of the three stage nuclear programme of India, continued to get justification from the scientific lobby who are trusting the enhanced features of the Generation III reactors and whose features are comparable to the reactors used in Kudankulam. The Kudankulam nuclear reactors are called VVER, but have features developed similar to Gen III category reactors. Kudankulam is using the Russian VVER (VodaVodaEnergo Reactor), which actually means water cooled and water moderated reactor (Balachandran and Patil 2013)

Generation III reactors are developed as the latest technology with enhanced safety features, 'higher efficiency and improved fuel economy in comparison to Gen II reactors'. Apart from that, because these reactors take into account the emergency scenarioto meet the worst accidents, if any. The severe accident management includes the severe environmental emergencies, example rise in sea level, storms etc.(Technology Roadmap Nuclear Energy 2015).

The deadlock regarding reactor still persists though the expert committee which was set up post Fukushima disaster, reviewed the entire twenty operational nuclear power projects in India. The plants were given clean chit reading safety measures adopted for their maintenance. A number of meetings with the expert committee with the local population failed to allay the fears. The scientific mysticism and the thrust of technocracy are evident in this case (Sudhakar 2011). The bigger challenges emerge when converging spaces are sought between the general public and technocratic assertiveness. The figure below shows the use of generation III nuclear reactors, around the world, whose safety features are the latest used technological feat for generating nuclear energy. It is being followed by the research and development in the Generation IV nuclear reactors.

Vendor	Country	Design	Type	Net capacity (MW)	In operation*	Under construction*
AREVA	France	EPR	PWR	1 600	0	4 (Finland, France, China)
AREVA/MHI	France/ Japan	ATMEA	PWR	1 100	0	0
CANDU Energy	Canada	EC6	PHWR	700	0	0
CNNC-CGN	China	Hualong-1	PWR	1 100	0	0
GE Hitachi – Toshiba	United States/ Japan	ABWR	BWR	1 400-1 700	4 (Japan)	4 (Japan, Chinese Taipei)
GE Hitachi		ESBWR	BWR	1 600	0	0
KEPCO/KHNP	Korea	APR1400	PWR	1 400	0	7 (Republic of Korea, United Arab Emirates)
Mitsubishi	Japan	APWR	PWR	1 700	0	0
ROSATOM	Russia	AES-92, AES-2006	PWR	1 000-1 200	1	10 (Russia, Belarus, China, India)
SNPTC	China	CAP1000, CAP1400	PWR	1 200-1 400	0	0
Westinghouse/ Toshiba	United States/ Japan	AP1000	PWR	1 200	0	8 (China, United States)

Fig. 5.7: Generation III Reactors (Source: Technology Roadmap Nuclear Technology 2015).

Conclusion

Technology and in this case nuclear technology is an agent for change and development. Here, nuclear technology interfaces with the public is solely for the production of energy, though nuclear technology is venturing in the fields of agriculture and health care. The use of nuclear technology in other areas is as sophisticated as the use of other technologies which is only known through the utilities it can be put to, rather than going for understanding the nitty-gritties of the nuclear technology.

In the production of nuclear energy, being capital intensive, the role of market forces also determine the production and consumption of this technology. The people, government and corporates show their divergent interests, which gets manifested in the form of public perception about the way nuclear technology is used for energy production. The chapter focused on the energy aspect of the nuclear technology as energy is a major investment for the growth of economy, and hence the productive capacities of the community and the state, on which an individual depends for his/her satisfaction.

Nuclear energy expansion as well as the general concerns have been a prerogative of the government. Moreover, as well as the global partnerships are forged on the basis of energy needs of the respective countries. The apprehensions of the public are dealt with in few countries but nuclear energy has always been looked at with fears and concerns in mind by the common people. It makes the development process, of which, energy security is an important determinant, lopsided and exclusionary. The key questions are as follows--how far nuclear energy can be trusted to fuel growth, as well as how the development process would be considered sustainable, if nuclear energy is used.

Energy needs, development and the thrust for people's participation for management of energy sources are gaining importance, especially in the tropical countries where renewable energy systems can be harnessed in a cost effective way. The drawback of nuclear energy is that it has till now failed to emerge as a trustable people managed energy system, as it has been aspired in the case of water system management, agriculture management system. as well as giving impetus to localisation that developed in opposition to globalisation.

Chapter-6

TECHNOLOGY AS HEGEMONY

The case of nuclear technology exhibiting hegemonic tendencies can be understood in two ways. First is how the energy management policies are practised by different states and how they influence the power balance existing between them. The management of energy resources have always formed the bedrock for the development of the states as well as for different communities. The case of nuclear technology, being used as a tool by the states to establish their hegemony, as in the time of colonisation, is an example of the revisit of the hegemonic tendencies of the developed countries. Secondly, if hegemony is 'the dominance of one social group over the other', the dominance of the state, when it comes to usurping nuclear technology and imposing on people can be studied and proved. In the second chapter, as already discussed the anti nuclear movements were designated as the civil disobedience movement and dealt in a high handed manner. It even resulted in the criminalisation of dissent against nuclear energy.

The case of nuclear energy, hence becomes the imposition of the state power on common people, who in any case resent nuclear technology, for the fears associated with it. Also the state structures become dominating, in consensus with the technocratic culture that this technology espouses with it. The era of global governance, with its inherent fallacies and the negative effects of globalisation also leaves an imprint on the way nuclear energy is managed. Nuclear energy is one of many forms of energy. However in comparison to other sources of energy which contain carbon e.g coal and oil, nuclear energy is carbon free and hence is considered a green energy source. The case of nuclear energy is thus the case of capital investment, especially with regard to the reactor establishment which it entails. A study by (MIT) Massachusetts Institute of Technology (2003), the study on public perception and public attitude towards nuclear energy reveals in the context of American citizens is revealing 'large number of people are against the idea of the location of the nuclear power plant in the vicinity of their home, or at least at the distance of twenty five miles from their home'. In an experiment thereafter, sample of people were taken and divided into groups. while one group was left without information the four other groups were made aware about energy generation by different means, including nuclear and how it would affect economics, pollution and

global warming etc. It was seen that the nuclear power enjoyed support amongst people, in both the groups, with information and without information. Those groups that were provided with information, supported natural gas and nuclear source as equally important source of energy generation, but supported nuclear power more than coal and oil.

At the same time, nuclear energy requires mining of the minerals like uranium and plutonium, thorium which are radioactive elements, and has effects on the environment. Anti nuclear movement developed therefore as a part of environmental movement, which also includes the environmental effects, uranium mining will bring to the environment and the people, who reside in the region.The mining of minerals like uranium and thorium will be problematic as the natural occurring uranium and thorium are found in the land where indigenous population bears the brunt of state repression. Once these issues are clubbed together, nuclear energy becomes an energy that will use state power at different stages to actually produce nuclear energy for power generation.

The communities residing in the hilly areas, forested areas have sought independence from the rest of the world to preserve the unique milieu in which man- environment balance is maintained by them. In this regard, the major wars in the pre modern era were for land, rivers and the mineral resources. The world system post second World War and the establishment of The United Nations system have tried to establish better ways for managing the conflicts. The thrust was on building peace.

Management of resources have increasingly been decentralised in developing countries like India and the clamour for more is increasingly being felt in Latin American country that has been witnessing the exploitation of their resources by the United States of America (USA) since a long time. The geopolitics of oil resources is well known, as oil resources and its dominance enabled many countries expand their economic growth, while at the same time encouraged countries to fight to control the resources. 'The need for oil encouraged Japanese to wage wars in the 1930s'. And the '1973 Arab Israeli war led to many after effects in the world politics, including the rise in the oil prices, further the oil shock after the overthrow of the Shah of Iran in 1979' left repercussions in the world politics (Fanchi 2013). Thus at one time oil was ruling the energy resource market and finding new sources in the national energy mix for any country has seen a pressing requirement for energy at all time. We can

look at the use of nuclear energy case here too, emerging as a case of politics, but more for the sake of weapons rather than nuclear technologies being used for the civilian purpose.
Secondly, we can look at nuclear technology as any technology which post industrialisation along with the other forms of technical development and technical achievement has fallen short of achieving goals that it has set to achieve, only contributing to the repressive mechanisms of different forms and strongly embedded in the system in the structures of the society that critical theorists will call inevitably contributes to status quo and so divorced from the emancipatory project.

Technology inheres Authoritarianism, Domination

Herbert Marcuse (1964) in his book *One Dimensional Man* narrates that 'rights and liberties' which were part of the industrialised society, have increasingly lost their critical angle and have got institutionalised which cancels the very purpose for which they were fought for. In his own words 'freedom of thought, speech and conscience were the free enterprise which were awakened to save the critical quest', designed to eliminate 'obsolete materialised and intellectual culture' by more 'productive and rationale one'. But 'once these are institutionalised, they share the fate of the society, of which they had become an integral part'(Marcuse 1964).

The difference between 'authoritative and non authoritative system', has become lesser felt as the age of the consumption grows, the 'satisfaction of needs' is what matters. Similarly, the status quo gets reinforced through the curbing of 'thoughts, autonomy and the right to political opposition'. Moreover, the critical angle of the opposition is lost in the institutional management of opposition (Marcuse 1964).

Marcuse (1998) identifies technology not only as machines that workers or technicians attend to but a manifestation of the social group that directs 'its application and utilisation'. Thus technology, due to its ability to decide modes of production and imposing itself as a collective of machines, 'instruments, devices and contrivances','perpetuates behaviour patterns' and encourages 'social relationships' in such a way that it enables 'control and domination'. ' 'Technics by itself can promote authoritarianism, liberty, scarcity, as well as abundance, the extension as well as the abolition of toil'(Marcuse 1964). Marcuse through the examples of

various forms of government, be it the Third Reich of Germany or the socialistic governments enumerates that the thrust on their mechanised, and technocratic forms of management, was nothing but unleashing of the 'reign of terror', that used the 'power inherent in technology' to manipulate the different organisations be it political parties or the labour involved for varied purposes.

Secondly, any assembly of machinery as a nuclear power plant, is nothing but a set of mechanisation and rationalisation that has been achieved to establish domination of techniques over nature, as well as enable the domination of less competitive by the dominating enterprise (Marcuse 1998). Nuclear power plants thus acts as an enterprise as well as an assembly of machinery dominating social action, along with the disturbance it brings to the man environment balance. The rupture of social relations in terms of the hierarchy it enforces cause people to protest against the nuclear power.

Nuclear power is just being one of the many ways of subjugation that the mechanized world brings forth and the resentment against the nuclear power, henceforth provides the scope to over ride the hegemonic tendencies which is encapsulated in the Habermasian notion of 'public sphere'. The public protests and the public participation against the nuclear power project is filled with anti-state sentiments,which, in any way denote that the 'communicative action' has to be given space in the democratic set up (Habermas 1984 quoted in Eriksen and Weigard 2003). The concept of 'communicative action' implies that the negotiations between the two parties encourage the capacity to influence each other. The influencing mechanism is attempted as the dis-agreeing parities have different understanding of a particular situation, which can also include 'criticisable uttenrances'(Eriksen and Weigard 2003). Though the concept of democratic deliberations is found wanting in this regard as the participants, who are the local population, near the power plant are not given enough say in the matter Marcuse (1998) calls the set up of machines, and technology contributing to setting up of an apparatus that is focused on increase of efficiency and productivity and processing of commodity for the 'profitable employment'. This according to him, affects the 'rationality of all, who are served by the power of technological power', which converts the 'individual rationality into technological rationality'. The set up of apparatus may denote an organisation one works in, or the machines whose utility decides the functional mores of the individual, makes them 'technologically submissive inculcating technological rationality' in them. It is this set of conformity, an individual develops, which is used by the technocracy to rule over the

common people, and hence establish hegemony. Thus 'Man experiences a loss of freedom imposed upon him, not by a foreign rule or force but by the dictum of reason itself'.
In the similar fashion, the technocracy is also bereft of their own reason no matter how much the technocratic attitude defend the exactitudes of the apparatus they impose on the people. This apparatus is expected to be 'efficient, reasonable, as well as convenient' but the demarcation of reason based on the functioning of the apparatus is so much trusted that any repulsion against this apparatus is considered as unreasonable, and even 'irrational'. 'Rational behaviour becomes identical with a matter-of-factness, which teaches reasonable submissiveness and thus guarantees getting along in the prevailing order' (Marcuse 1998).

Paradigms of Public Understanding of Nuclear Energy:Revealing, Concealing and a quest for Scientific Understanding.

Here the nuclear energy stands as a hegemonic agent. The awareness of the energy amongst the people decides what kind of perception is shared by the public about the energy, they consume and the ecology and environment it affects. Goldblatt (2005), tries to understand the public attitude towards the energy consumption into two categories. They are the 'visibility/ invisibility devide' and the energy-revealing/socially revealing divide'. Shove (1997) says that the energy matters are disguised from the public as they are less aware how the climate change affects their energy choices. Also, this inherent issue in the energy choice leaves the public to visualise the energy management in two ways. One in which energy is seen just as the energy production and secondly, energy in the form of a function. In this category, the energy production is utilised for communication, products and services etc. The utilities of the energy in the form of products we use etc are called as the 'socially revealing' approach of understanding the energy public interface, while at the same time, the energy production simply is known as the 'energy revealing' approach (Goldblatt 2005).

The major issue regarding Kudankulam Nuclear Power plant was that the public were not allowed to voice their well deserved concerns regarding their environment, as their awareness was proved to be limited and hence, they were not taken seriously. The Kudankulam nuclear power plant protests were mainly about the livelihood and alteration of environmental conditions around the nuclear power plant. The perceptions of the villagers residing in the 5 to 10 kms radius of the power plant as the field survey suggested viewed the power plant as an exercise of the state apparatus. A villager named Amal in the Idinthakarai village of the

Tirunelveli district noted that 'nuclear energy must be good for the west but for a country like India, it means corruption'.

Professor Samuel Asiraj of M.S University, Tirunelveli linked the kudankulam nuclear power plant with the extension of the mafia and contractors domination which will further lead to corrupt practices by the government and the local politicians. He said, "thorium mining will emerge as the next big corruption scandal, in coming times may be'. Mypa Jesuraj, A priest in the Tirunelveli district, who was part of the delegation that met the then Prime Minister Manmohan Singh in 2011. He blamed the set up and attitudes of the officials who want this power plant to be operational at any cost. According to Mypa, "the youths who took part in the agitation were targeted by the police mercilessly". "The actions taken against the youth were disproportionate and without purpose", he said (Jesuraj 2017).

For few villagers of the Idinthakarai village, the controversy of the power plant is also about the corruption of the union government as they are importing the used and outdated materials from the Russian government. Amal said, "The government is so callous, the district administration is apathetic to us, what is the guarantee that the union government did it all right"? (Amal2017).

Villagers such as Celine, Milton, Mildred relate to the agitation of the Kudankulam power plant in their older version too. They stated the the power plant operationalisation was always protested, though the resistance movement showed its ebb and flow. Mildred recollected that in 1989, the power plant was understood as a thermal plant or some factory. "I did not know what is nuclear then. I and many of our fellow villagers thought it to be a factory". "A factory that is harmful and cause unemployment". Celine also said that, in 1989 the power plant agitation was strong. She recollects going to Kanyakumari for protests(Celine 2017).

Similarly Milton recollects that his mother was an active participant of the resistance movement against the kudankulam power plant. "Nuclear energy is not fit for India. The officers are corrupt and it is a big project" Milton said (Milton 2017).

The recent awareness of villagers about the nuclear technology is only government enforced, rather than it being an individual initiative. Initiatives taken by the organisations such as NPCIL(Nuclear Thermal Power Corporation of India), to create acceptability among the

people, are dismissed as being farcical. Mypa Jesuraj, calls it a futile attempt. “What do they want to show us by holding programs about nuclear energy awareness in schools and colleges”? Mypa asked. Few students are taken inside the power plant and shown few selective areas inside the nuclear power plant complex, he told. “How does entry into the nuclear power plant ensure that everything is safe”?

The idea of hegemony also evolves out of the governance structures and competing interests that the operationalisation of the power plant will bring to the place, the region and the state. Leaders like Udayakumar who became the face of the agitation and who are appreciated for the leadership in the kudankulam power plant are also viewed skeptically by many. When specifically asked, Sundari , Milton, Mildred, Celine accepted that Udayakumar has been their leader. S. P Udayakumar is a household name in Idinthikarai and the nearby villages. Though, talking to a journalist named V.V.S.Mani had a different opinion on this matter.

Charting a clear distinction between the leadership of the Kudankulam movement in the older version vis- a- vis the present version, Mani recollects that the older movement in 1989 had a committed leadership whose aim was that the power plant should not come in existence. It was against the power plant explicitly. While in the new version the resistance against the power plant veered to the power plant safety. It has become more about new guidelines that AERB Atomic Energy Regulatory Board, flouted(AERB). “It has lost the touch of the original idea, connecting to the common people”. He accused leaders like Udayakumar for playing politics toenhance his popularity(Mani 2017). The site of agitation shifted from the reactor site, in Kudankulam to Idinthakarai village about seven to eight kilometers away from the Kudankulam village. “It was also a loss as the people of Kudankulam village were pitted against the other villagers, showing resistance to the power plant by the district administration”, Mani said. (Mani 2017).

Hence, the movement which was broad-based and inspired people from different walks of life hold the feud between leaders as the reason for losing ground during the resistance movement. Professor Samuel Asiraj as well as Mr. Britto(runs an NGO in Tirunelveli), expressed sadness about the crack in the ways the resistance lost its steam. “The government authorities seemed to have made the most out of it”, Mr. Britto said. Mr. Britto further recollected that the sacrifices of the fishermen community will go waste as the nuclear power plant comes into operation (Britoo 2017).

There is a view that, the environmental awareness of the people is increasingly made more focused through discovering a more informed public-ecology-environment approach, so that the consideration of the environment is not missed. While Ramachandra Guha, accepted that anti nuclear movement in India, as in the case of Kudankulam cannot be categorised as an environmental movement. 'Nuclear issues are different from Environmental issues in India" (Guha 2016).

If this is the case , where public themselves become aware of their environmental needs and environmental protection, it is important to know that a nuclear energy takes a very different course as all public concerns about their own environment is actually overwhelming. Goldblatt (2005) reveals that the risk communication device developed in the western world in the context of the nuclear industry, is actually how the science and technology studies are percolated for the common understanding of the public that can take care of their fear factor. The flow of scientific information here takes a sharp turn from just trying to spread awareness and evoke environmental safety temperament to the conscious effort by the scientific fraternity to change the attitudes of the people, for accepting a particular form of energy, in this case the nuclear energy. It is the nuclear energy industry that has brought back the scientific endeavour for the public, to engage in the public information (PC) of the science and technology.

It is stated that in a typical public information campaign the experts approach the matter from the 'rational, scientific attitude', and suggest 'technical solutions', as well as repose faith in the technical justifications for the said energy choice, in this case nuclear energy. this enables the scientific technocracy to convince the people, using their scientific expertise but at the same time, they address the 'emotional and ignorant public' with the aim of 'palliating their negative emotions' (Kant and Midden 1995).

The public information dissemination of the 'science in the west' is depended upon the four major approaches- they are 'technical, market, justice and participatory'. It is known that in the case of technical, the decision making is divorced from the public and only encompasses the 'technical domination' over the often ill considered 'emotional public'(Kant and Midden 1995). Since it is considered that the technical rule over the emotional outburst is justified, the decision making hence remains technically sound, but exclusionary.

The case of ‘market’ makes the public information system market managed, which entails ‘the implementation of the process or technology determined by the market supported structures. The justice approach pertains to ‘equal distribution of risks based on predetermined positions and bargained position’ and that all the authorities should take responsibility along with the public, while the participatory approach pertains to the ‘information and education of the public’(Kant and Midden 1995). Though it is a quest to make people equal participant in the decision making in a democratic set of government, but becomes difficult to implement as the ‘common people generally remain excluded from the technological and scientific policy matters’ (Kant and Midden 1995).

In the case of Kudankulam Power Project, out of the four, the issue of public participation takes the form of resentment, though efforts of spreading education through different government bodies has been undertaken, primarily by the NPCIL (National Power Corporation of India Limited) and the DAE(Department of the Atomic Energy), it has been over-ridden by the technical wing of the government, which made the final calling on the matter, as is evident by the expert group report prepared by the experts and constituted by the Government of India to allay the apprehensions regarding different aspects of the establishment of the nuclear power plant in Kudankulam.

There are ways in which risks can be communicated with the public, and the ways of dealing with the risks that raise doubts in the minds of the public. First of all Renn (2004) categorises risk in three different ways ‘the first is complex but comprises of routine risks which science is capable to handle. Secondly, uncertain but non controversial risks, and finally highly contested and unambiguous risks’(Renn 2004). The three levels require the three different ways of treatment as well, which is again suggested by Renn (1991). The first case, relates to the scientific community’s capabilities with regard to facts and their discussion amongst themselves to fix the ‘probabilities and the potential damage from the risk in question’. In the second case, to deal with the uncertain but non controversial risks, requires a ‘reflective discourse’ amongst the scientific community as well as the expression of expertise of institutions in handling cases of such nature previously, as well as taking a ‘clinical approach’.

It is the third kind of risks that demands a larger public discourse, and a ‘world view perspective’ on ‘lifestlyes, values and fundamental tradeoffs’(Renn 1991).

It is the 'declining public trust on institutions and products of new technologies' that can complicate the level of risk and take it to different levels of treatment (Goldblatt 2005). The case of nuclear energy reactor involves all the three levels of risks and hence requires an engagement with all the three levels. It is therefore that the scientific community deliberations have been given publicity that can act as the technical justifications over the common understanding. In the case of Kudankulam Power Project, the threats of risk have been dealt in only one way, and which is the management of dissent by technical expertise.

The relationship of the nuclear power with the public is just not that of the electricity generation, but also about taking pride in producing electricity through the advanced nuclear reactors as it happened in the case of Canada. Both the nuclear research in Canada and USA was well developed, they took different reactor types to meet their divergent goals. In the case of Canada, the nuclear industry was into the private hands (Hampton 2003). Canada's tryst with nuclear energy came for a number of factors of which the advancement in nuclear technology and the uranium deposits formed a convincing case for using nuclear technology for energy generation in comparison to the coal. The private sector moved into the market and enabled the electricity industry of Canada and USA. The private sector being strong, made the nuclear industry as any industry with private motives subjugate the people for the purpose of profits (Hampton 2003).

Kudankulam Nuclear Power Plant (KNPP) is taken as a another technological feat, being justified for the goals that the industrialized society has set for itself. The the forms of subjugation is just not political but also associated with the 'technological ambivalence' that makes people 'uneasy with the rapid rate of changes that technological transformation brings to their life'. The 'social critique' develops due to this feeling of uneasiness which has to be drowned by the rational alibis of the government and technocracy (Cooper 2002). Quoting Lyotard, Cooper (2002) says that 'technology acts like a form of 'terror' that unleashes on the human mind and rather 'colonises' it.Cooper (2002) says that 'technology rather reconstitutes the meaning of the human capacities', and therefore it is essential to decide whether a particular technology should be accepted or rejected based on the constitutive framework of the technology and the social fabric it seeks to reconfigure.

Cooper (2002), in his quest for understanding technology terms it as 'Technology leading to a more abstract engagement with the world'. This argument fits well with that of the people of

Kudankulam who understand the nuclear technology that is thrust upon them. In all the attempts to enhance the public understanding of the nuclear technology, the experts try to impose their understanding. In the similar vein, the state repression through different ways makes it difficult for the people to seek help from the state authorities. For example, the understanding shared by the experts on the matter of reactor efficiency as well as the effect on the water bodies of the place where nuclear reactor is situated prevails over the common understanding of the local population.

The result that is based on experimental evidence does not convince the people to undertake the risk. The justification for the affect on the fishes that will get affected by the release of warm water into the sea, is based on the ecological balance that the fishes seeks to achieve on its own. The fishes either tend to move away from the point where warm water will be released or try to adjust their body temperatures with the sea temperatures. In both the cases, the risk of losing fish population remains, this point of view is overridden by that of the scientific community. It is this scientific antipathy that generates hegemonic tendencies by the said technology.

Similarly, the case of reactor, and the concerns about the reactor safety, the justifications are purely based on mechanised and performance oriented service delivery of the reactor, which continues to remain ambiguous for the local population to understand. Hence, their skepticism continues. In the case of public health, the radiation effect from the nuclear power plant, makes people aware about the radiations, but only making them aware that they would be living with the unnaturally occurring radiations around them, but with the assurances that it will not be harmful or, they are similar to other natural occurring radiations which are anyways present in the environment. The case of public health, no matter how much convinced through medical proofs have always left doubts with people, as it affects them psychologically more.

The prescriptions issued by the (AERB) Atomic Energy Regulatory Board, suggests that the radio nuclides that releases radioactivity in the environment, both in the air and water by the Kudankulam Nuclear Power Plant (KNPP) would cumulatively register the radiation very much similar to the radiations one is exposed to when using medical equipments, e.g. X ray or CT Scan (Iyer 2011). The radiation release and the radioactivity monitoring thus ensures that the public health is not affected by the prescribed limit of the permissible radiation due to the

nuclear power plant (Iyer 2011). The continued thrust on ensuring safety despite the feeling of risks associated with the public, allows the technical competence to rule over the perception of the common people. These concerns of health, environment and livelihood are compounded together and pose a serious challenge to the public and are pursued as the protest against the nuclear power. The stakeholders of the nuclear power also become antagonistic to the public, and thus it becomes the fight against the corporate as well as the governments. The global dimension of nuclear issue makes it transnational, and invites the world condemnation. The protest movement hence becomes a tool to contest hegemony, a tool to contest a methodology of development, and finally stands against the scientific exactness or the unconvincing rational arguments in the favor of the nuclear power plant.

Democracy and the Hegemony of Technical Decision making

The theory of hegemony is used in the context of state but the purpose of using it in the case of technology is due to two main reasons, The first is that, the state itself relies on technical competence to enhance its value and meet its goal of increasing growth, efficiency, safety and well being of her people. Secondly it is the technological determinism that shapes the people's 'attitudes, social mores' and subjugates them in conformity. As authors like Marcuse (1998) and Cooper (2002), argues that it is the technology that leads to the coming of fascism or establishing brute authority. Marcuse (1998) says that the 'training of youths', 'intensification of labour and propaganda', 'organization of bureaucracy, party and industry', are the ways in which 'the manipulation of power inherent in technology', is managed by the governments like the 'Third Reich' or the ' Nationalist Socialistic Germany'. It is how power of the state and the 'reign of terror' is sustained (Marcuse 1998).

On the other hand, Cooper (2002), argues that 'technologies allow violent fantasies. Cooper says that in the 'technologically meditated spaces and the technological globalization' makes the public 'threatened as well as empowered'. Further the argument of the author Virilio, who actually labels technology as a fundamentalism or a form of ideology that aims to dominate and 'eliminate natural vitality'. The evidences taken from the technological interferences human lives are facing in different ways, be it medical, information and communications, or even in agriculture by the technological intrusion provides a platform for the practice of 'techno fundamentalism'(Cooper 2002).

Doppelt (2006) argues that technology keeps out the 'possibility of an authentic ethical choice and political debate'. The political culture promoted by the people with technical competence does not provide the necessary space for the common people to articulate. In this case the common people are the local population who are residents of the areas near the Kudankulam Power Project. Here Feenberg (2010) argues that the democratization agenda is not complete unless there is democratization of the workplace, and the workplace with the coming of technology is completely based on expertise and technical knowhows. Therefore, modern technology stands opposed to the workplace democracy'. Apart from the technology's link to industry and politics for the realisation of goals like freedom, justice and participation, efficiency and economic growth, technology acts a modern form of hegemony. This is based on 'technical mediations of varieties of social activities', and so much so that democratisation requires 'technical changes rather than political changes'.

Feenberg (2010) has understood that in the modern era where the concepts of democracy and hegemony are not limited to the state, but has surpassed the boundaries of the physical terrain, it is now dependent on ways governance is practised. Governance with its new form in the communication age also has to ensure that technical modalities do not lead to asymmetric power distribution in terms of competence as well information. The 'democratic participation' will suffer as the 'technically meditated domains of social life' increasingly become devoid of freedom, which it seeks to establish in the first place.

'Technology therefore becomes the non social method of influencing society , the path for which is judged on competence and is unilinear in path'(Feenberg 2010). The changes in the culture and values and art forms that these technologies bring about affect society's behavior in more pronounced form but the narratives have been missing, since technologies do not allow the memories to be preserved. It rather introduces a new set of preservation of communications and reproduction of older narration of activities (Feenberg 2010).

Kudankulam Nuclear Power Project (KNPP) and the Local Narratives

Kudankulam Nuclear Power Project (KNPP) therefore, has to be evaluated on the basis of the narratives of the people, whose lives underwent changes, with the coming of the nuclear power plant in their vicinity. These narratives will enable the effective capture of the changes

witnessed in the social communicative behavior of different people located at different stage of hierarchy.

Be it the behavior of the state or different organizations in dealing with the apprehensions of the common people. The case of Kudankulam protest movement was dealt in an high handed manner, where the government accused the activists and slapped sedition charges on many. The civil society group stood up in the support of the protesting people, but the state authorities sealed the area and tried to dissuade more people from joining the protestors and motivating them more.

The protest movement, which was initially triggered by the apprehensions raised by the fishermen community, was later supported by a diverse section of population, including the youth and the urban based population. The impact of the power plant kept spreading to large scale support and even international support. The Indian media largely remained sympathetic to the cause of the local people, though the Supreme Court judgment shocked the activist group, it acknowledged the fact that the common people were harassed in the process of protests against the nuclear power plant, but still considered the nuclear power plant necessary for development.

The Supreme Court stance demonstrated that the judiciary vindicated the stand of the executive in the matter of policy decision but differed in the matter of the state dealing with the protestors. The narratives of the local population will hence throw light upon the technological domination and hegemony experienced by the people.

Chapter-7

CONCLUSION

The study of Kudankulam nuclear power plant to assess the relation of nuclear technology with the local people living near the power plant generates genuine questions about the forms of energy production that affects the day to day life of the general people. The broad question of how a person's life is affected by the location of the nuclear power plant is mainly focused upon. In this regard, the interaction with the local population provided useful insights about the understanding of the nuclear power plant.

The term nuclear also involves sophistication and thus brings alienation for the local people. It generates interest as well as apprehensions amongst the local people and people in general. The use of nuclear technology for energy generation largely remains a matter of debate. This debate is centred around the support which is extended to nuclear installations by the state apparatuses as well as the state funded scientific institutions. The urgent need to address the gap between the specialisation and the non-specialised, has been felt in the West as well as in countries like India. India has been showing greater needs for energy generation and energy production to meet its development goals, primarily based on urbanisation and increased industrialisation, driven by market-led mechanism.

Why nuclear energy becomes a choice needs to be analysed? Not only that, the interest in nuclear energy since last seventy years has gone through many phases of change. At one time, it finds favour, while at another time, it becomes a tool generating fears and expressing dissent against the government. Nuclear energy, seems to be a viable option. However, there are examples of hidden agendas and hidden interests in its promotion.

In this regard, carrying out surveys of the local population living near the Kudankulam nuclear power plant as well as those from the state agencies and the scientific organisations provided a clear contrast about the ways perceptions are formed and sustained when it comes to nuclear power plant. It also helped to understand and develop concepts like 'people's science', 'public science' and 'state science'.

In this regard, at the beginning of the study, the following questions were attempted:

1) Why is that decision-making on matters of technology especially nuclear civilian technology tends to exclude the opinion of the local population?
2) What is it in nuclear technology that renders it beyond the pale of public deliberations and scrutiny?
3) What explains the construction and commissioning of the Kudankulam nuclear plant in spite of resistance by the local population?
4) Why does exclusion continue as a matter of practice in liberal democratic states such as India?

From the questions, it is clear that nuclear technology, state and the local people are in mutual tension as they fail to arrive at a consensus. The use of technology, especially with regard to its sophistication and alienation provides a platform to delve deeper into why the sophistication happens and since, it happens, it naturally brings exclusion. On the other hand, the study conceptualises the challenges of the local population by understanding the sophistication of the technology, though the alibi of sophistication of technology is not enough to override the perceptions and constructions of the local population towards nuclear technology.

Here the large infrastructural investments for the installation of the nuclear power plant demonstrates that the modes of production bring alienation to the people, which is a Marxist analysis in certain sense. Critical-theoretical analysis provides the conceptual framework to understand the changing dynamics of the society. Nuclear technology and nuclear energy as empirical evidences to support the investigation, also reinforces the basic understanding as to how the exclusion happens. The use of critical-theoretical framework is important as it lays down clear distinctions between the constructs under which such exclusionary tendencies can be understood. The use of 'technical interests' and how 'emancipatory tendencies' are subdued through mechanisms, finds interesting explorations. The second chapter thus begins by laying down such important constructs that guide us through the thesis.

Chapter three delves into the historicity of the nuclear protest movements that can be used to understand the present resentment witnessed in the protests against the Kudankulam nuclear power plant in India. Also, the common issues that bring together the humanity despite the

constraints of time and space. The third chapter thus provides the essential components that has been guiding the relationship of the nuclear technology with the local population. The large scale demonstrations and the protests against the government forms the fundamental of this technology along with the brutal state-led actions against its own civilians.

The fourth chapter is an account of the sophistication of the nuclear technology, the rise of technocracy and organisation driven management which leads to a result oriented mechanism to achieve the goals of the human needs. This sophistication and rationality driven attitude actually drives the wedge between different sections of the society and makes the differences between the classes more glaring. In this regard, the rising need to bridge the technological gaps need to be found. These technological gaps are defined in different ways and an attempt has been made to delve into three available ways. First is the 'Social construction of technology', second is the rise of 'technocracy' and the third is the critique of 'rationality'. Finally, an attempt has been made to understand the communicative gap between the people making decisions inside the specialised agencies and the local people residing near the power plant. A glimpse has been provided conducting interviews in the village of Idinthakarai, in the Tirunelveli district of Tamil Nadu. The concept of 'public science communication' prevalent in the western system also needs to be introduced in India.

The authority to exert the demands for the inconveniences being caused to local people on the state authorities as well as the scientific organisations like (Nuclear Power Corporation of India Limited) NPCIL, (Atomic Energy Regulatory Board) AERB, Department of Atomic Energy) DAE, (International Atomic Energy Agency) IAEA etc has been looked into. The 'public sphere' is of special importance in this regard. This chapter, technology as specialisation, give the basic dynamics of the nuclear technology when used for the nuclear energy. It also moves into critical theory of technology to understand what kinds of rights are denied to local people in this advanced technological age.

The fifth chapter, technology as development discusses the trends and statistics of the nuclear energy development. The important area of interest here is how the nuclear industry itself demands investments in the research and developments for its own growth. The new challenges pertaining to nuclear industry also warrant that new developments keep happening in the nuclear industry. An analysis also includes the goals of development of an individual and the technological driven development that rests on innovations to meet the new

requirements of the new risks posed by nuclear technology. In this regard, the secrecy in which nuclear industrial lobbies work as well as the agreements between the states to conduct nuclear commerce, remains a matter of concern it produces repressive structures. These repressive structures find the state patronage easily.

The aspect of development, for a self managed community also depends upon the production of energy. The choice of nuclear energy in a locality is not a viable option as it requires trained workforce and trained specialisation to enable its sustenance. Hence in the present context , when the Government of India decided to increase its investments in the nuclear industry, the chapter can provide few leads to move on, and find the fallouts of using nuclear energy as an energy option. The Kudankulam nuclear power project, also has come under special attention as the work for reactors four and five to be used in the Kudankulam nuclear power plant, is about to be expedited by the Government of India. The choice of nuclear energy in a country like India will lead to more centralising tendencies, deprive the communities and the local population dependent on fisheries of their livelihood rights. The use of media forms an important part of the nuclear energy campaign. The Kudankulam protests were marked by the Fukushima accident the coverage of which, in the news and the media influenced the local people, and made their resolve against the power plant stronger.
The final chapter, technology as hegemony looks into how the practice and operationalisation of the nuclear power plant as a deliberate attempt by the state to keep people in control, and generate 'submissions'. The chapter on hegemony, partially deals with how state responds to the protests of the nuclear power plant and how state mechanisms become repressive. The state mechanisms aims to protect such high capital intensive projects and use sophisticated technologies like the nuclear technology to exert its own power and influence. The nuclear power plant and the institutions that work for its sustenance and development also provide an enabling condition to extend control and domination. The chapter on hegemony also tries to illustrate how the social construction of technology, from the lens of the state provides a different picture of the same technology *vis-à-vis* the local population whose interpretations about the same technology varies.

The study uses, social construction of technology on one hand, as well as the essentialist approach of the critical theorist Heidegger on the other hand to present a contrasting picture of how a particular technology is unrevealing for a section of community. Sometimes, the use of technology includes all large scale technologies, like highways, flights, ATMS (automatic

teller machine) as well as technologies that are used in the day to day life. e.g phones, computers, air conditioners etc.

The use of nuclear technology will require control of agencies and institutions, thus creating a divide between the people who operationalise the technology and the local population who though being aware about the harmful implications of the technology still need to survive in the vicinity of the power plant, with their apprehensions. The study has tried to use the Habermasian concept of 'deliberative democracy'(Habermas 1996) and 'public sphere' (Habermas 1961) to understand how the mediating spaces between the technical interests of the institutions bring about the exclusion of the common people.

The study is a modest attempt to understand a complex problem. Therefore, the open ended questions and other aspects related to the interlinking concepts of technology, exclusion, critical theory remains to be deciphered more. The question of 'public science communication' and how effective it can be made can be looked into. The critique of rationality and post-enlightenment phase also required revisiting of the motives of the institutions and the organisations again and again, which ensures that the status-quo is challenged and the purposes of exclusion are known.

The main inferences that the study proposes are as follows.

1) The state uses and manipulates technology selectively and strategically and if necessary, by suspending democratic decision-making, thereby hegemonising the discourse and implementing policies in a top-down manner.
2) The commissioning of the Kudankulam nuclear plant demonstrates the resolve of the state in imposing nuclear energy production notwithstanding the apprehensions perceived by the local population.
3) The persistence of exclusion especially in the area of decision-making on matters of technology in the context of India can be attributed to a fixation with achieving development at all costs thereby overriding the concerns of the local population.
4) The mediating space between the technical experts and the local people becomes increasingly technical in language and understanding, thus leading to technical submissions. Technical submissions imply the submission to authorities who man specialised, scientific institutions e.g NPCIL(Nuclear Power Corporation of India

Limited), AERB(Atomic Energy Regulatory Board), DAE(Department of Atomic Energy).

5) The understanding of technology gets differentiated amongst different social groups, who give different meanings to the said technology. A sense of stabilisation regarding the understanding of the technology is attained which is primarily depends on how the state or the government acts.

APPENDIX

Appendix A:

In 2008, Nuclear Supply Group (NSG) made exceptions to the trade restrictions that were imposed following 'Peaceful nuclear explosion' carried by India in 1974 (R. G. Bucher, 2009). Following this, and with the growing economic needs and also with the advent of climate change issues, India is expanding its nuclear energy program at a higher pace. Here, I will present some more statistics related to the expansion of nuclear energy worldwide and the expansion by India in particular.

As given by the data in PRIS, nuclear energy mode is gaining its popularity for energy generation worldwide with rapid rate. The fascination remained central in Asia, particularly in China (Fig. 5A.1).

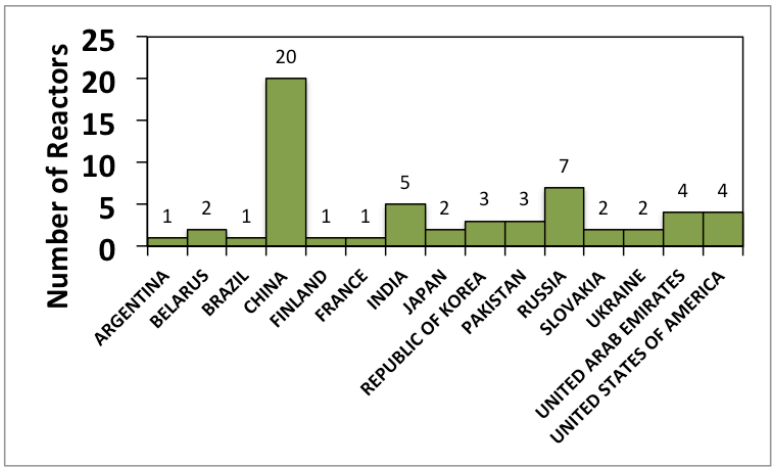


Fig. 5A.1: Nuclear reactors that are under construction (Source: IAEA Nuclear Technology Review, 2016).

Also, the electricity share of nuclear energy is also increasing with the challenges following burning of fossil fuel and coal. This share remains central in Europe with France topping the list with 72.3% (Fig. 5A.3). However, the average electricity that has been supplied to the grid from the reactors remains saturated for almost two decades (Fig 5A.2).

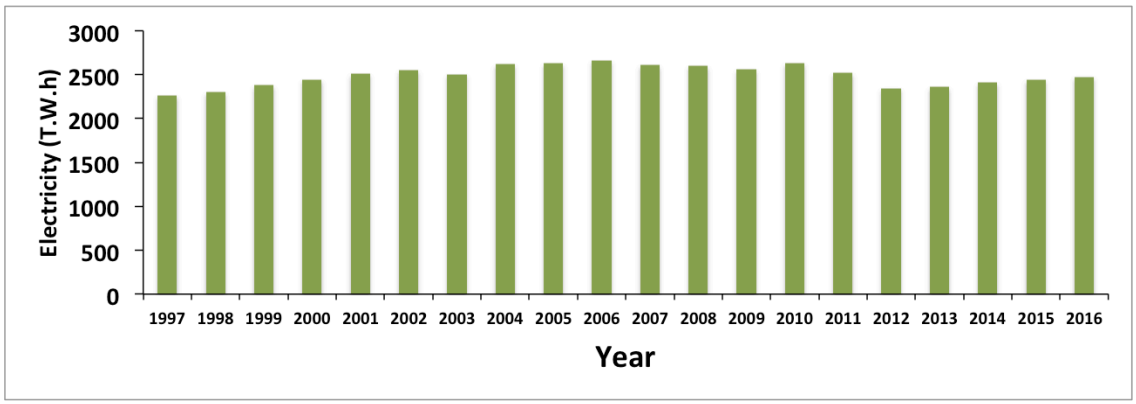


Fig.5A2: Electricity supplied to the grid from reactors in the year 2016 (Sourse: PRIS database)

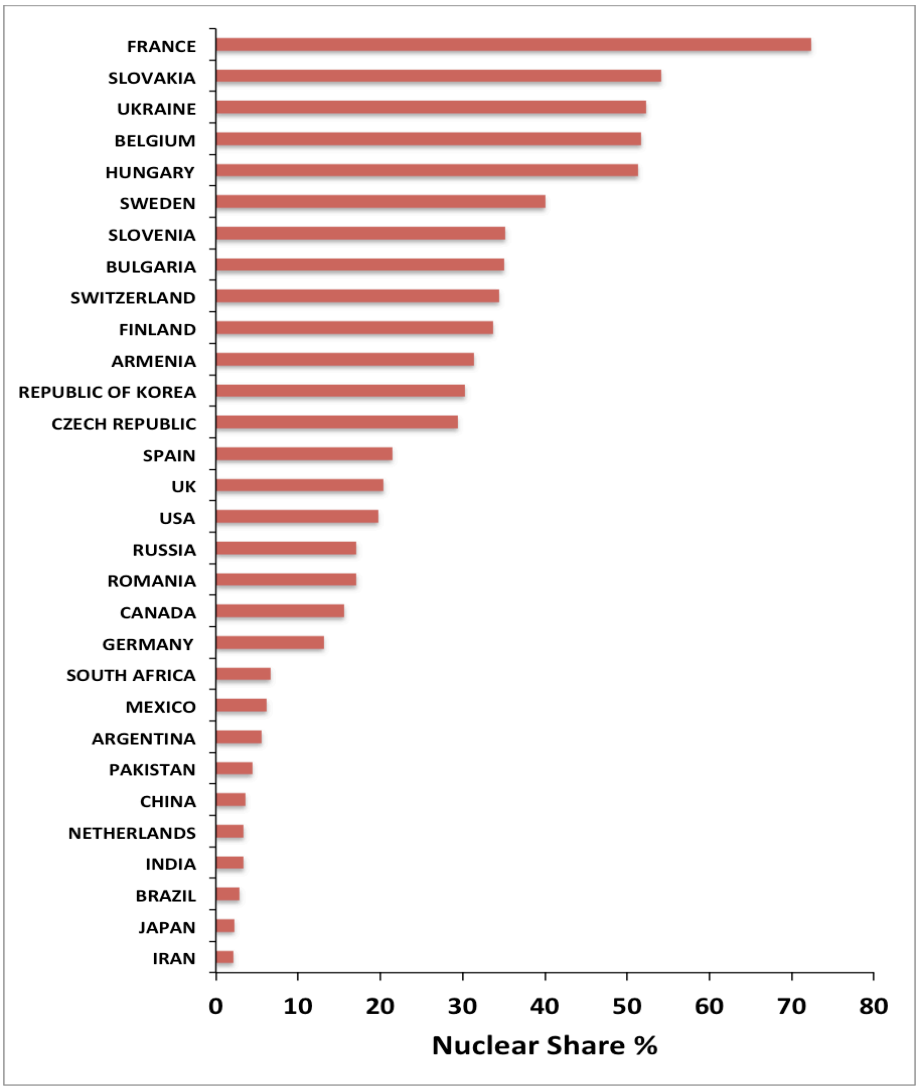


Fig. 5A.3: Nuclear Share of electricity generation in the year 2016 (Source: PRIS data base)

This saturation value for the electricity contribution from the nuclear reactors can be attributed to implementation duration of reactors in a particular year and the close of existing reactors (Fig 5A.4).

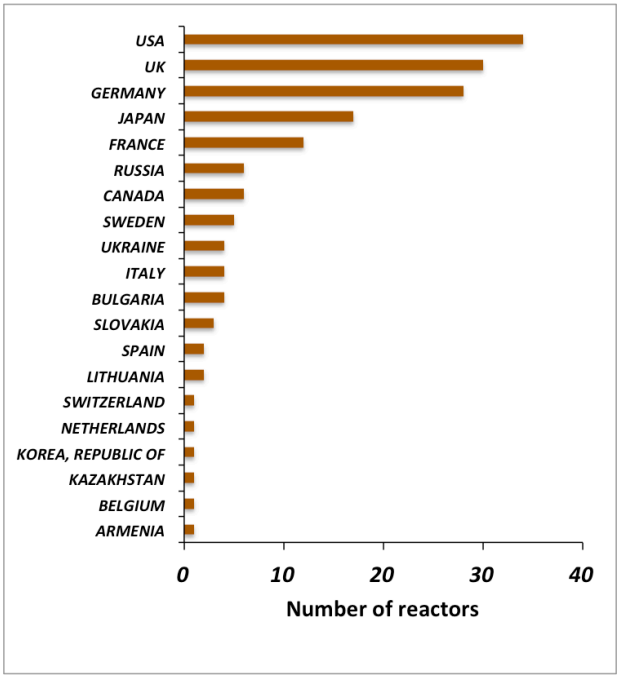


Fig. 5A.4: Number of permanently closed reactors (Sourse: PRIS database).

India's Nuclear energy Program:

India is a strategic player in nuclear energy generation in Asia. India was involved in collaboration with other nations in developing atomic based energy production for the civilian power generation. Following the 1974 'peaceful nuclear explosions', NSG was formed to regulate the misuse of nuclear technology that has been transferred to a non nuclear weapon state. The sanctions imposed by international community contributed isolation for India's nuclear technology development. As a result, India was forced to self-sufficient in developing its nuclear energy program.

Historical overview:

To combat the energy needs of the country;Atomic energy act was passed in 1948 to ensure India's nuclear energy Program. This act was subsequently replaced by Atomic energy act of 1962. Atomic energy commission (AEC) was constituted under this act to supervise Uranium

exploration and mining of other radioactive elements. To effectively implement the policies laid down by AEC, Department of Atomic Energy was established in August 1954. Dr. Homi J Bhabha envisioned India's first self-sufficient nuclear energy program in 1950s. In a seminal paper (HB Bhabha and NB Prasad, 1958), Bhabha and N.B. Prasad presented a three-stage plan for developing India's nuclear program consistent with the limited resource of Uranium and abundance of Thorium in India. The idea was to use limited Uranium to fuel Thorium based reactors that further produce U-233 required for the energy production. The following flow chart will describe the content behind three stage nuclear program (Fig.5A.5).

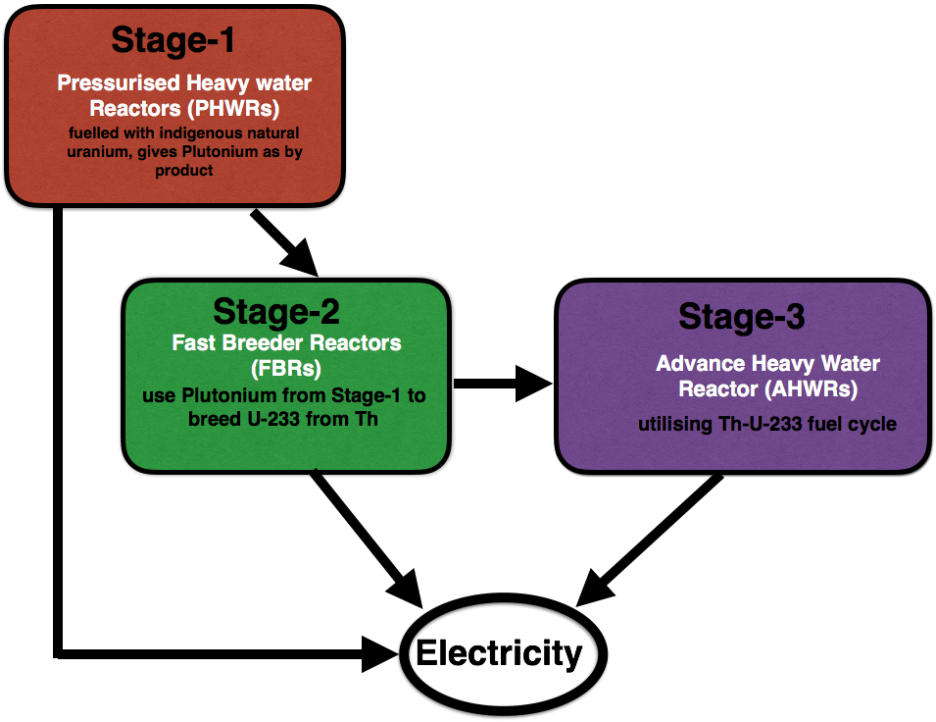


Fig. 5A.5: Three-stage nuclear program of India.

In brief, in the first stage of the program, pressurized heavy water reactors will be set up that could produce electricity and Plutonium. India has systematically calculated the amount of Uranium need to run these types of reactors. Currently there are fifteen PHWRs producing electricity of 3800 MW (R.G. Bucher, 2009). Second stage consists of fast breeder reactors that produce U-233 from Thorium blankets. The Plutonium obtained from the first stage would be utilized in these reactors. A prototype fast breeder reactor (PFBR) that was commissioned in September 2010 is expected to produce 500 MW. FBR are produce less electricity compared to PHWR. The final stage will be based on Thorium producing more U-

233 and electricity. Advance heavy water reactor (AHWR) that has been taken up recently is expected to generate 300 MW of electricity. The three-stage program described above is expected to efficiently use the available Uranium and Thorium reserves to secure the energy needs of India beyond 2050.

Nuclear Energy Organizational Structure in India:

Atomic Energy commission (AEC) or Department of Atomic Energy (DAE) is the main organizational and regulatory authority that overlook all the issues related to atomic and nuclear programs in India. The organization flow chart is shown in Fig. 5A.6. Atomic energy regulatory body that comes under AEC is an independent organization that comes directly under AEC. It was established in 1983 to regulate and ensure safety functions listed in atomic energy act. The AEC is broadly divided into the following sectors: 1. Research & development, 2. Public Sector Undertaking, 3. Industrial Organization and 4. Service and support sector. The primary aim of the research and development sector concerns development of indigenous nuclear technology and research. It also provides extra funds to other national institutes through Board of research in nuclear science (BRNS) and National board for higher mathematics (NBHM). A sub division of DAE that concerns human resource development produces necessary work force through workshops and training through Bhabha Atomic Research Centre (BARC). A recently proposed institute, called Homi Bhabha National Institute (HBNI) within DAE that can integrate research and development in various institutes and other grant-in-aid institutes of DAE. Public sector enterprise aim is to look after commissions, design, construction and operational maintenance of nuclear reactors. Nuclear Power Corporation of India Limited (NPCIL) is the main player in the construction and operations of nuclear power plants. Other organizations in this enterprise are engaged in mining and developing necessary technology for the construction of nuclear power reactors. The Industrial enterprise looks after production ofheavy water (Heavy Water Board), nuclear fuel (Nuclear Fuel Complex) and processing and sale of radioisotopes (Board of Radiation and Isotope Technology). The construction of housing/office buildings and other related issues come under service organizations such as Directorate of construction, service and estate management.

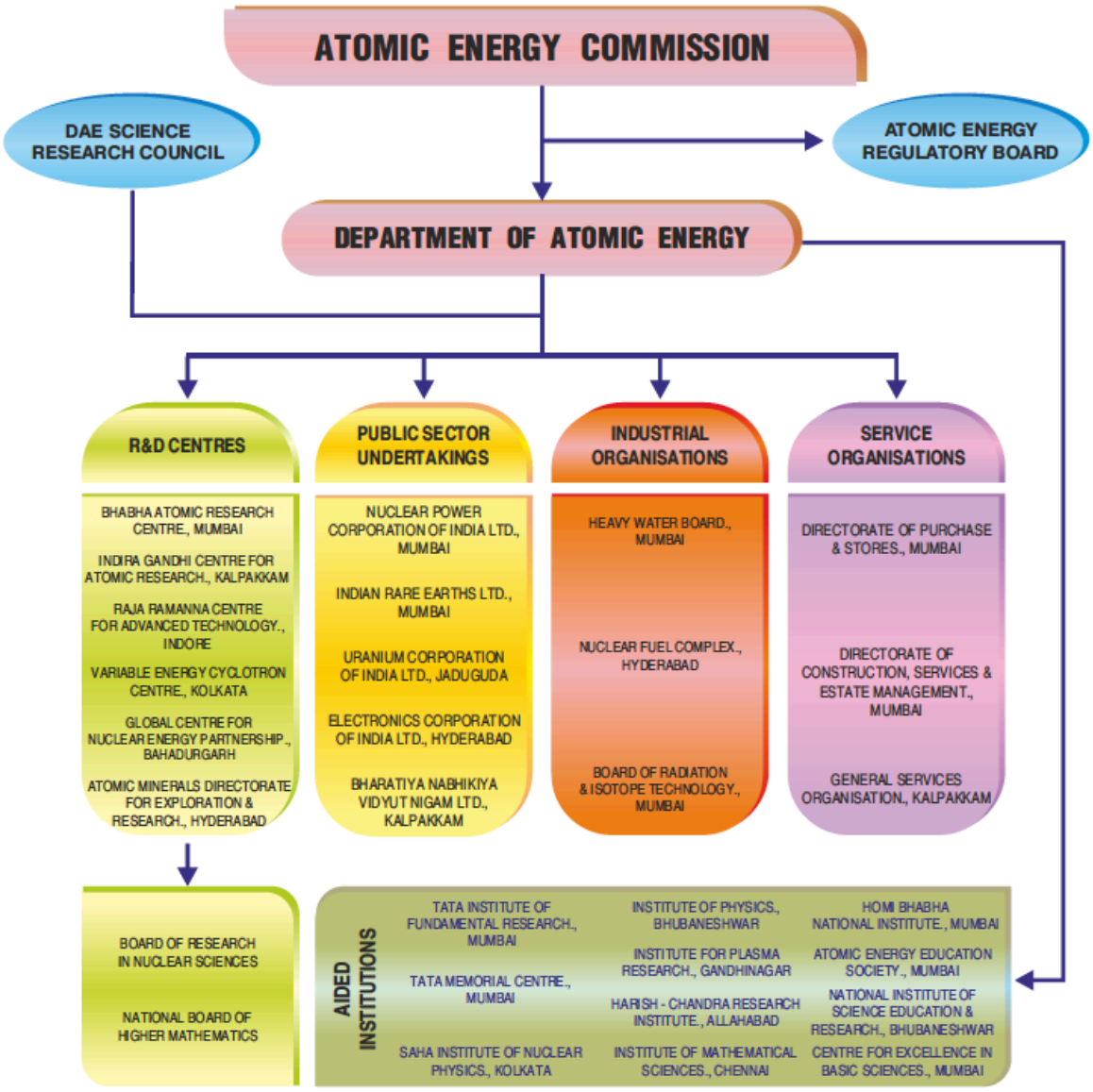


Fig: 5A.6: Atomic energy Organizational flow chart (Adopted from Department of Atomic Energy).

NPCIL was solely established in 1987 for the commission, design, construction and operations of the first stage nuclear power plants. It is currently operating 22 nuclear power plants under its supervision and expected to increase its capacity. Kundunkulum nuclear power plant, which is the core to this thesis, comes under NPCIL.

Regulations of Nuclear programs in India:

Atomic energy regulatory board (AERB) was established in 1983 to regulate and enforce safety concerns related to some of the rulesand notifications mentioned in Atomic energy (section 16, 17 and 23, Atomic Energy Act, 1962) and EnvironmentalProtection act (Section 10(1), 11(1) and 12, Environment Protection Act, 1986). It has competent power in administrating the provisions for the Factories acts concerting the industrial safety at the DAE administered units. AERB's main function is to enforce safety regulations at all nuclear facilities for radiation that can pose harmful implications for the public and the facility personnel. The organizational structure of AERB is shown in the following chart obtained from IAEA website.

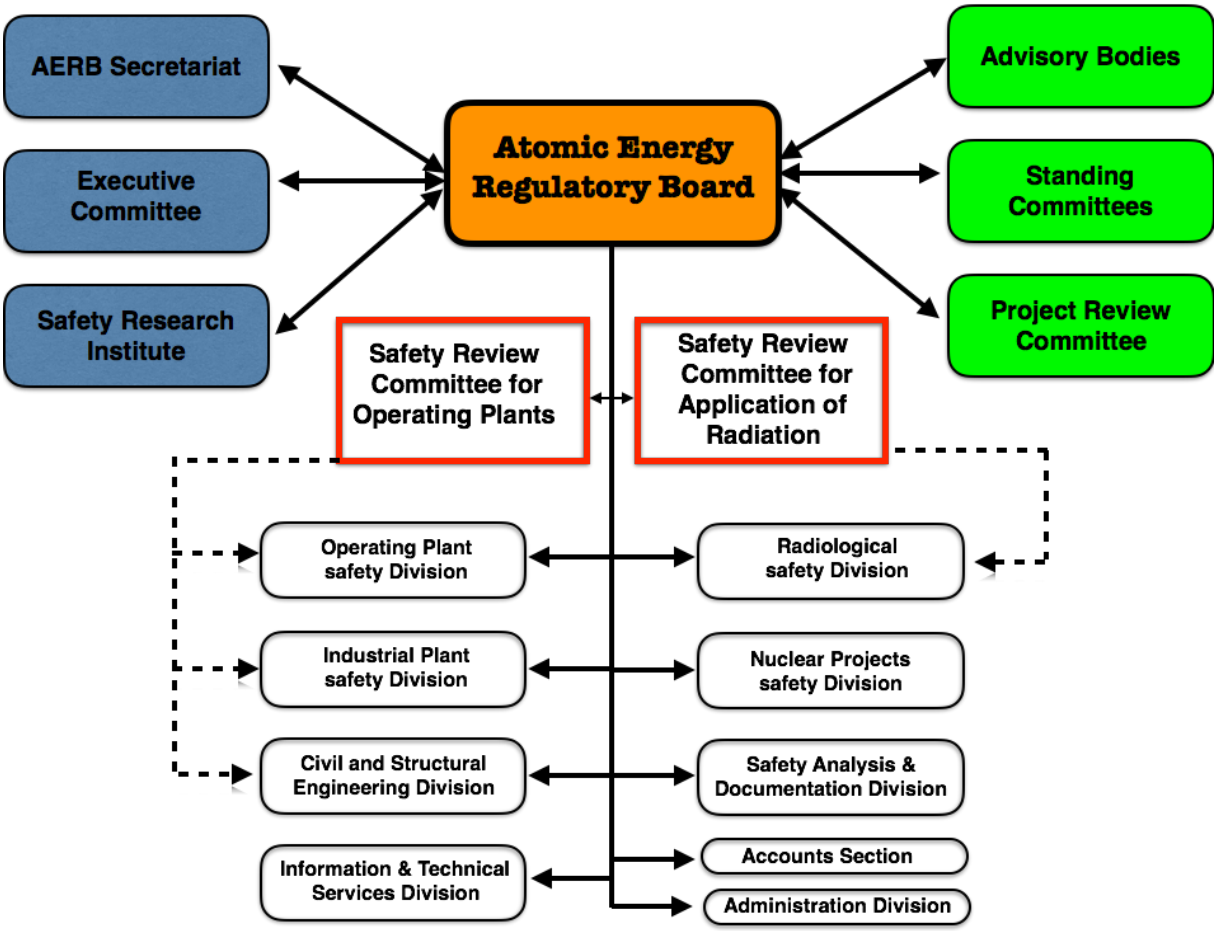


Fig. 5A.7: Organizational structure of Atomic Energy Regulatory Board (Modified from IAEA website)

The major function of AERB is to analyse and review the nuclear facilities for its hazardous effects such as radiological risks to the facility personell and the public living in the vicinity of the facility. From the commission of a project, AERB authorizes the site approval, overview the construction, operation and decommissioning. AERB role is to make sure that the nuclear facilities pose no radiological risks to the staff and public. The advisory committee of AERB assesses unit level safety through various safety division and advices AERB for its authorization.

Though AERB has been described as a regulatory authority, its powers are severely limited. In 2012 the Comptroller and Auditor general of India described AERB as " one of a subordinate office executing delegated functions of the central government and not that of a regulator" (K.S. Jayaraman, Nature News, 2012).Even after three decades of its inception, AERB does not have a prescribed safety policy and its role in surveillance of the safety measure in nuclear facilities is negligible. The CAG report has observed that 91% of radiation facilities used in medical X-ray radiography does not have linces and 85% of other radiation facilities have not been inspected by AERB(K.S. Jayaraman, Nature News, 2012). In the present framework, the AERB doesn't enjoy full autonomy and has not undergone full peer review from International Atomic Energy Agency.

Field Report

One of the major aims of the field study is to interact with the local population (villagers and intellectuals) around Kundunkulum nuclear power plant and gather their experiences, views and opinions concerning the project.Personal interviews with intellectuals who were supportive of anti-nuclear movement and the local population are summerised below.

Places of Interviews: Chennai, Tirunelveli, Tuticorin, Idinthikarai

Sample one:-
Public Intellectuals and Leaders who stood against the Kudankulam nuclear power plant.
Questions:

1) What are the major issues of protest against the power plant?
2) What are the grievances against the government?
3) Do you think the protest against the power plant is the problem of communication between the specialists, the specialised agencies and the general public?
4) How do initiatives of the specialised agencies like NPCIL helped you to reduce your apprehensions about the nuclear power plant?

Sample two:-
Local people in Idinthakarai Village.
Questions:

1) How do you see the protest against the power plant?
2) What are you fears?
3) Are you helped by the government agencies?
4) Do you think living near the nuclear power plant has made life different?
5) What are you main fears for living near the power plant?

Questions were changed according to the role of the interviewer in the Kudankulam anti-nuclear power project movement.

Interviews

Interviews from the public &intellectuals who stood against the Kudankulam Nuclear Power Project.

1. **Professor Bernard D.Sami**

   Place: Loyola College, Chennai.
   Date: 31 January, 2017
   Duration: 10Mins

Question: Do you think the protest against the power plant is the problem of communication between the specialists, the specialised agencies and the general public?

Answer: Not completely. Public intellectuals got together to create awareness about the power plant. My recollection of anti nuclear protest movement against Kudankulam nuclear power plant is also clubbed with the time we stood against the Kalpakkam nuclear power plant. Coming up of the groups like "Friends of Earth Group", helped create lots of awareness amongst the general public against the nuclear power plant. I remember youths holding cycle rally and poster competition to make people aware about the nuclear energy as safe option. The political orientation was also clear as the communists at that time, supported the power plant, it being of Russian origin. I remember the Kudankulam movement as historic. Someone somewhere will have a story about it. I was associated with the "*PoovulangimNambavgal"*.

Question: What are the grievances against the government?

Answer: The political orientation was also clear as the communists at that time, supported the power plant, it being of Russian origin. I remember the Kudankulam movement as historic. Someone somewhere will have a story about it.

2. **G.Gladston Xavier**
   Department of Social Work, Loyola College.
   Place: Chennai
   Date – 31 January, 2017
   Duration : 30 -40 Mins

Professor Xavier was part of the fact-finding team who visited the area around Kudankulam on 30 and 31 March2012 to study the impacts of the curfew imposed.

Question: What are the grievances against the government?

Answer- Kudankulam power plant was a deliberate attempt by the government to introduce exclusion of the local people. In all sorts of deliberations, in which , I myself participated, the endeavor to bridge the misconceptions were not at all taken seriously by the government. I believe that the government brutally failed in many fronts, though I will not classify it as the scientists Vs people debate but put the entire protest as " State vs Civil society" debate.

Question: How do initiatives of the specialised agencies like NPCIL helped you to reduce your apprehensions about the nuclear power plant?

Answer: None of the pleas and justifications can satisfy my concerns. These justifications of coming up with the lab reports about the survival of the fishes within a range of temperature and the nuclear reactor, being of latest technology actually was completely beyond comprehension of the common people and do not allay any of their fears about health and safety of the local people living near the power plant. The risks associated with the nuclear power plant are far higher than what has actually come to be noticed or as claimed by the government of Tamil Nadu. The closest nuclear accident in the timeline is the Fukushima nuclear accident that cannot be failed to be noticed by the people. The disaster left the people more than terrified and horrified a long time after the accident.

Question: What are the major issues of protest against the power plant?

Answer: There are three major issues according to me are:-
1) The reactor has not undergone quality test, the concerns are also about the cement that is being used for the construction work. He claimed that the material used for the construction is not up to the mark or rather the old material, thus the claim about the reactor being safe can be disputed. 2) The disposal mechanism has never been laid down or no awareness has ever been spread amongst people about the waste that will be produced. And finally 3) the exploration of the decentralised method of power production should be practiced. Finally, the investment of the time and energy for the power production is not the worth the risks with which the people have to live life long.

Question: How do initiatives of the specialised agencies like NPCIL helped you to reduce your apprehensions about the nuclear power plant?

Answer: The public hearing that was held by the administration to bring the protestors into the loop by hearing their concerns were actually creating more exclusion. Rather in the capacity of joining and actively participating in the protests of the power plant, I always wanted to know from the government, the apparatuses that were put in place to allay the fears of the people.

3. **Mr. V.V.S.Mani**

   A Journalist, and an Activist
   Chennai
   Date:2 February,2017.
   Duration: 40 Minutes

Question: How to see the protest movement and your association with the protest movement?

Answer: I was an active participant in the protest movement at the site of the Kudankulam power plant. I saw it in various phases and feel sad that it has currently waned. The present leadership of the movement should have shown some maturity to sustain it. The question was always about the illegality of the plant but now protestors have conceded their demands by agreeing to the guidelines implemented by the government. This is sad.

Question: Do you think the protest against the power plant is the problem of communication between the specialists, the specialised agencies and the general public?

Answer: Historically tracing the opposition to the power plant is actually credited to few scientists of the country who raised apprehensions about the reactor safety but the opposition could not be carried further as the communists were favoring the power plant. As well as the nuclear power plant was needed for industrialization. On name that appeared clearly was the name of G. Ramesh, a scientist at the IIT Madras.S.P.Udayakumaractually is responsible for sidelining the older generation of protestors; He is not near the motivation as the leaders of the older version of the protest movement. He even diluted the demands of the protests.

The movement right now is fractured and also various voices not found in unity. My main aim is to revive the older version of the movement. Leaders like G. Anton Gomez, Dr. C.N.Devanayakam, who was a doctor based in Chennai are badly missed. And leaders like A.S Panniselvam spearheaded the movement amongst the journalists. I myself participated in the naxalbari movement as well. Fishing community was mobilized by Gomez and the famous cycle rally is still in memory.

Question: What are the main concerns of the protestors of the Kudankulam nuclear power plant?

Answer: The old phase of the power plant protests of the local people initially supported the plant thinking that the industrialisation will bring jobs, and employment to the local people. The farmer community was supporting the power plant. The issue of Pachiperai Dam was also a part of the anti nuclear protests. On one hand the dam was giving irrigation to many farmers. The anti-Pachiperai dam, anti Kudankulam movement was rising and conspicuous was the presence of George Fernandes. The movement got bigger 1989. At different places, different conferences were held that spread awareness amongst the people about the dangers of the nuclear power plant. At that time, the main crowd puller was Mr. Anton Gomez and few other politicians including George Fernanades. The palm workers also lent their support to the anti nuclear movements encouraged by Gomez.

The older version of movement subsided, and the new version of the movement re-emerged in 2011, onwards led by S.P.Udayakumar. But Mr. Mani claims that the new project map is different from the older version. The new project map of the Kudankulam power plant played a divisive policy in which 10 distillery plants were set up but this antagonised the fishermen community for whom the fish catches would suffer after the establishment of the distillery. The protests led by Mr. Udaykumar is more about the AERB guidelines not being implemented, while the older version of the protest against the plant was about the concept of the nuclear plant itself. The site of the protest is therefore the plant itself, as well as the reactor.

Suresh, the lawyer files a petition claiming that the KNPP is illegal, filed on the behalf of PUCL. We should understand the changes witnessed when the movement went through from the older version to the newer version.

4. **Professor Samuel Asiraj,**

   M.S University,
   Tirunelveli.
   Duration: 40 - 50 Minutes

Prof. Samuel Asiraj, was an active participant in the protest against the Kudankulam nuclear power plant project and an important public intellectual who threw light on different aspects of the Kudankulam nuclear power plant, and has tried to raise the awareness of the people regarding the dangers of the nuclear plant.

Question: What were the main concerns of the people about the Kudankulam power plant?

Answer: I think the implementation of the power plant will be dangerous for the people and the environment. The concerns about the health problems, and health stresses have already startedperturbing the people in Kudankulam. The cancer cases have seen a sudden increase in the village and that is affecting the people's mobility to other places for different sorts of work.

The Atomic Energy Board has declared the nearby areas of the Kanyakumari district as the thorium mining bases. And the mining industry and the local politicians arefound indulging in corrupt practices in the time soon to come.

The farming community, who were supporting the nuclear plant without concerning about the plight of the fishing community, is a matter of concern. The Tamil Nadu government's insistence on the power plant was solely based on meeting the electricity of the state, meeting the demands of the industrial units in the state. And therefore, many farmers were shifting to the manufacturing work.

He said that the nuclear plant became essential also due to the Tamil Nadu government's needs for water for its needs and the electricity generation that will also be shared with the neighboring states like Andhra and Kerala. The government is using the benefits of the nuclear power plant to substantiate its case, but actually the cost of mining and the effects of radiations, and the other fallouts of the nuclear plant have not been deliberated upon at all. The kind of consensus and the deliberations required have actually made the plant completely obscure and daunting for the general public.

Question: Do you think the protest against the power plant is the problem of communication between the specialists, the specialised agencies and the general public?

Answer: The development paradigm based on more energy and more industrialisation should be contested. Criticising the government's outreach programs to create a sense of optimism about the nuclear plant. He said that "Public Science cannot become people's science". The public science programs like the awareness camp of the NPCIL in schools and villages, claiming that nuclear energy is safe actually never answered the questions that people had in

their mind. They were propagandist tools. The government programs included TV programs, science exhibitions and the pamphlets distribution.

The doubts about the reactors, their life and the waste that reactor itself will make of itself, the information about the safety of the reactors and the full life of the reactor, being told by the government is actually far less than the actual life of the reactor. The radioactive water being discharged in the sea, itself was pretty dangerous as well as the human habitations residing near the plant, are at severe risks. The government has rejected several RTIs filed by the public intellectuals that were concerning the power plant safety.

Question: what are the grievances against the government?

Answer: On one hand the government was educating the people about the economic prospects, and on the other hand it is the churches and the priest community who were educating people about the power plant. The state, or the government tried to entice people by saying that the churches were deliberately against the plant as they were not progressive or forward looking. It was designated as the church funded project to agitate people against the plant.

The Fukushima incident bolstered the people, and gave them good alibis against the government. It also helped the people to fight the "Foreign Funding Propaganda" by the government. The mining of the radioactive elements and the international trade that flourishes needs to be given attention too. The idea has not been talked about much. Moreover, a nuclear power plant cannot be completely delinked from the weaponisation aspects, according to him.
The public hearing that was held in 2009, in the Tirunelveli district, was mainly about the reactors in place, which were not addressed. The safety claims are about the reactor 3 and 4 which are still to start operationalisation while no discussion is being held about the reactor 1 and 2 which is already in place.

The expert committee of the AERB appeared as an external source and could not win the confidence of the people.

5. **MypaJesuraj,**
   A priest,
   Place- Tirunelveli
   Date: 4th Feb,2017.

MypaJesuraj represented the common people in the district collectorate of Tirunelveli district with their set of concerns…he was a part of the delegation that went to Jayalalitha and Manmohan Singh carrying the concerns about the Kudankulam Nuclear Power Plant.

Question: Do you think the protest against the power plant is the problem of communication between the specialists, the specialised agencies and the general public?

Answer: The meeting with the AERB experts appeared as farcical and an attempt to dismiss the concerns as unrequired. Prime minister Manmohan Singhhimself could not bring conciliation to the interaction between them and the scientific experts.

The protesting people in Idinthikarai and Kudankulam were never visited by the scientific experts, rather the outreach programs to educate people about nuclear energy was held in the Tirunelveli District, that was far away from the dissenting people.

Reflecting on few incidents, I can remember that the few college and school students were taken inside the power plant to create awareness as well as the train them to handle living near the plant. But one of the students of the Polytechnic College, posed a question about the nuclear energy, and the next day police was sent to his house….
I call this insecurity- "state and scientific terror".
The officials of the Atomic Energy Commission behaved arrogantly and do not acknowledge the concerns of the people. Atthe beginning of the protest, nuclear power site was the seat of protests, later it being guarded… Idinthikarai remained the seat of protests.

Question: What are the grievances against the government?

Answer: The Politics of the state and, the political system being corrupt, the vested interests ensure that the power plant comes into work. The youth of the area were threatened and their passports were confiscated, sedition charges put on then ensured they cannot apply for jobs or go out for work. It was the state apparatus that ensured that the unity of the movement breaks,

through various attempts. They wanted to misguide the people. The present situation is that the people are coming to terms with the acceptance of the power plant and the government has almost scored the winning point.

Note: Vaddar caste in the Koodankulam village favored the plant.

6. **Amal,**
   Resident of Idinthakarai

A resident of the Idinthikarai Village…. traditionally belongs to the fishing community but now does not depend on it directly.

Note:-Interacting with Amal, was an enriching experience. Though his father was a fisherman, but he has moved out of the business now. Talking about the nuclear power plant, he recollects that after all the claims of the safety of the plant, the mock drill programs arising in case of an emergency actually made the people more skeptical of the nuclear power plant. He also acted as a translator for other villagers who talked in Tamil.

Question: What do you think of the power plant and feel concerned about living near a nuclear power plant?

Answer: I think and am aware thatalmost all villagers dismissed the X-ray comparison and the radiations coming out of the plant that they explained to us as an unwarranted comparison. The scientific alibis can be dismissed by the people of Idinthikarai…from their simple science of living their own everyday life.The next concern was about living near the water that will be collecting the water discharged from the plant. The irradiated water will give another problem issues and harm the people psychologically by bringing a change in their environment.

Question: What are your grievances against the government?

Answer: The silence on the nuclear waste by the government agencies.Biggest concern is about staying with the awareness that the air and the water in the surrounding is containing radiations….It brings a psychological fear and tension. The plant is "a Slow Poison".

At present large number of people are residing near the power plant.Talking about the workforce working inside the power plant…. they are outsiders and still will take time to get on with the local people.

Question: What do you recollect about the protest movement?

Answer: The church was the seat of the protest. People around live under surveillance and fear that the surveillance intensifies any moment. Many people have stopped fishing and trying to look for job prospects inside the plant.The ecological harm and the loss of the water species from the sea, It is upto the fishing community to bear the brunt even further or rise up against the protest again.

The government created differences between the people of Kudankulam and Idinthikarai.
The protests made life different. People did not go for fishing or allotted night time for fishing, while the day time was reserved for expressing solidarity in the protests. They acknowledge the support lent to them by the people of other states.

The residents of Idinthikarai understood that the Tamil media was biased in covering their case. North Indian vernacular newspapers rarely carried the news about the Kudankulam despite the urgency of the matter. But apart from the media, the awareness created through the student community and the intellectual community helped us a lot. The government tried to make it appear like a Christian protest movement…inward looking and anti development, while on the hand , during the protests, people created their own funds and were helped by the family members who stay away from the village. He refutes the idea of foreign funding as completely baseless.

7. **Sundari,**
   A Resident of Idinthakarai,
   Tirunelveli
   Duration: 15 mins

The interview was translated from Tamil to English and Hindi by Satish and partly by Amal.

Note: Sundari was one of the protestors who was facing sedition charges and even went to jail for 6 months. She was accused of kidnapping the collector of the Tirunelveli district, about which she laughs at.

Question: Why did you protest against the power plant? What are your concerns?

Answer: I fear about my health and my near and dear ones, who will have to live with the radiations as a reality now. Udaykumar played a crucial role in the awareness about the power plant. Government is still hiding about many aspects about the power plant. Udayumar, Mypa, and Pushparayan are the main leaders during the protests.

I was spending day busily when the protest was on. The true voices of the people were throttled unless some students or journalists specifically come to interview us. The financial support during the protests were a mark of solidarity shown amongst the fishing community as the fishermen from Kanyakumari to Rameshwaram lent financial support to them till the time movement was going on.

8. **Milton,**
   A Resident of Idinthakarai,
   Tirunelveli
   Date: 5th Feb, 2017
   Duration: 10 mins

The interview was translated from Tamil to English and Hindi by Satish and partly by Amal.

Note: Milton is a resident of the Idinthikarai Village, now not associated with the fishing community.His main concerns were that the government should not dismiss the people's concerns as being less important. If at all, they are living near the power plant, the government should take more responsibility for their safety.

Question: Why did you protest against the power plant? What is your concern?

Answer: Nuclear Energy is not fit for India as the big projects like the nuclear projects can never be done without corruption in India. I feel more grievances with the government. The villagers are feeling a marked rise in the cancer incidents in their village as well neighboring village, though no study is conducted on the people or correlation found between their deteriorating health conditions since the power plant has become functional.

Though many people are still unsure about the functionality of the power plant. We don't know if the plant is running or not. My mother was an active participant in the 1989 struggle against the plant that was again colored as being against the Christian community. He puts the recent protests as being anti people.1989, Kanyakumari was the seat of the protests.The

people around have continued to express their apprehensions against the plant as recently as 2015 and 2016.In 2015 Annamalai church was the seat of the protest, later Idinthikarai became the seat of the protest. The protests included fasting by the people for as long as 13 days, sitting in the tents.

Note: There are about 8 to 10 villages that fall under 12 kms radius of the plant. The people from those villages also joined the protest in Idinthikaraithough the government authorities seized the movement of the people to and from the village as the protests grew.I don't know how the evacuation will be carried out in case of any emergency? Many village folks believe that the material used for the plant was actually not upto the mark, and the old material from the Chernobyl plant was being used. We actually see that the protest is still alive, as the next generation has seen the older generation struggling against the plant.

9. **Celine,**
   A Resident of Idinthikarai,
   Tirunelveli
   Date: 5th Feb, 2017
   Duration: 10 mins

Note: Celine is a 73-year-old woman, who participated in the older version of the movement as well in 1989. She recalls that Anton Gomez used to spearhead the movement, in 1989.

Question: Tell us something about the protest in late 1980s

Answer: The protest was so strong that Rajiv Gandhi had to stop the inaugural ceremony of the nuclear plant. The protest rose as " Save land, Save water, save Nation". Kanyakumari was the seat of protest then and two people were shot dead at that time.

At that time Parish priests were the leaders of the movement. The spirit of the movement was not near the older one…the old time protestors felt the spirit missing in the new generation.

The protests at different places were held for different reasons. I am emotionally attached to the protests sites. Initially, the protest site used to be Kudankulam…and laterIdinthikarai….Movement in the kudankulam was banned…

10. **Mildred,**
    A Resident of Idinthikarai,
    Tirunelveli
    Date: 5th Feb, 2017
    Duration: 5-7 mins

Question: What are your main concerns with the nuclear power plant? How do you recall the old protest movement?

Answer: I was 16 years old when I first heard and protested against the plant in 1989. And I saw the power plant coming up; it hurts my struggles and my sentiments. In 1989, we protested against the plant thinking it to be a harmful factory and not a nuclear power plant. This time I understand some aspects of nuclear technology when I joined the protests.

11. **Fisherman in the Idinthakarai village,**
    A Resident of Idinthakarai,
    Tirunelveli
    Date: 5th Feb, 2017
    Duration: 2 - 3 mins each

    (Fishermen wanted to keep their name anonymous)

Question: Do you think things have changed since the nuclear power plant came?

Answer with summarization: The fisrt fisherman was getting ready to go to the seas and confessed that they have to move deeper into the seas for the fish catch that were available in the nearby seas few years back. They acknowledged more difficulties in the coming times.

12. **Mr. Britto, Stays in Tirunelveli and runs an NGO..**
    Participated in the movement as a public intellectual,
    Tirunelveli,
    Date: 4th Jan, 2017
    Duration: 20 mins

Note: During the interview, he said that he was dissatisfied with the ways the expert committee established by the government tried to address the people's issue.
While on the side of the civil activists, MypaJesuraj and Pusparyan handled the issue of meeting the government functionaries and the specialised agencies.

Question: Do you see it as a problem in establishing an effective communication between the specialised agencies and the local people? Mr. Britto recalls the sacrificial tendency of the fishermen community and how close the Kudankulam issue is to them. Though the recent phases have seen differences coming up amongst the people. He says that though the project did not cause any immediate displacements… but it will do so in coming days. He seeks participation of the common people in electricity generation.

Answer: As the awareness amongst the people grew about the nuclear energy, the government faced greater difficulty in addressing their concerns.
Though the state slowly succeeded in dissipating the spirit of the people, by adopting different strategies to dispel the people's unity. And also put a curb on the funding of the churches by using the clauses of the FCRA…The district Administration introduced the development packages, convincing the utility of the plant to the common people. Though no new plans have been fully implemented, two levels of awareness was going on… on one hand… the NPCIL led awareness is being held… while the other form of awareness against the nuclear plant is by the students and teachers community as well as few NGOs. But all NPCIL and govt led programs were held in comfort zones, fearing retaliation from the people.

13. Pushprayan
Tuticorin**,**
Date: 6th Feb, 2017
Duration: 30 mins,
A school teacher and an activist in the Titicorin district of Tamil Nadu. Headed a delegation from the people's side to the then Prime Minister of India, Manmohan Singh and then Chief minister of Tamil Nadu, Jayalalitha,
6 February, 2017

He said that the mock drills introducing the safety measures made people more vulnerable to the fallouts of the nuclear power plant. The noise from the plant was not addressed.

Question: What were the grievances from the Government?

Answer: Gram panchayat meetings were held in August 2011, in which resolution was passed against the construction of the Kudankulam power plant. Though the government claims that the reactor used is of latest technology still the concerns about the reactor safety is priority.The next concern is about dumping of nuclear waste.

Note: He says that the information regarding nuclear issues remains unanswered.He has concerns with the material used for the reactor…the new programs proposed program for the coastal zone; this may entice the fishermen community too.Their grievances against the state is that though the claim to be going out of way to generate acceptance for this project, the endeavor appears half hearted as the officers never make an attempt to address the people or talk to them even. He says that. V.Sundar, the project head of the kudankulam actually talks to the people of the cities but never to the village people.

He also believed that Tamil Nadu government deliberately aggravated the electricity problems so that the support in the cities could grow.

Notes: The people around made me aware that the police do frisking on seeing new people visiting the Kudankulam village or sometimes the nearby areas.

The request with the Present district collector of the Tirunelveli District.M.Karunakaranabout the state's role in the Kudankulam power project was skeptically taken. Research about the issue could not be allowed, as the matter is sensitive. The scientific aspects of the nuclear power plant can be studied only with the permission of the NPCIL,DAE AND AERB.

Thanks…

KamnaTiwary,
On Field…from 29th January, 2017 to 9 February, 2017.

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