

**A CRITICAL ANALYSIS OF NUCLEAR LAW WITH
SPECIAL EMPHASIS ON SCOPE OF PRIVATISATION OF
NUCLEAR POWER PLANTS IN INDIA**

A thesis submitted to the

UPES

For the Award of

Doctor of Philosophy

in

Law

By

Riju Raj Singh Jamwal

July, 2024

Supervisor

Dr. Sujata Bali



School of Law

UPES

Dehradun – 248007, Uttarakhand

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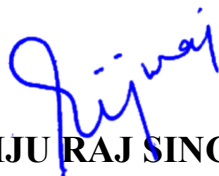
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DECLARATION

I declare that the thesis entitled “*A Critical Analysis of Nuclear Law with Special Emphasis on Scope of Privatisation of Nuclear Power Plants in India*” has been prepared by me under the guidance of **Dr. Sujata Bali**, School of Law, UPES, Dehradun. No part of this thesis has formed the basis for the award of any degree or fellowship previously.



RIJU RAJ SINGH JAMWAL

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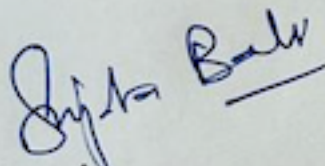
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DATE: 24th April, 2024

CERTIFICATE

I certify that **Riju Raj Singh Jamwal** has prepared his thesis entitled "*A Critical Analysis of Nuclear Law with Special Emphasis on Scope of Privatisation of Nuclear Power Plants in India*", for the award of Ph.D. degree of the UPES, under my guidance.

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ABSTRACT

India is an energy deficit country with a rapidly growing population and an equally fast-growing economy, making it imperative that the country must have self-sustaining energy security. Today, when energy is generated predominantly from coal, there is a large section of the population that still has no access to electricity or any other form of energy. Added to this is the increasingly pressing demand to take measures to combat climate change and preserve the environment. In this scenario, the need is felt for an alternative source of energy to bridge the gap between demand and supply. Nuclear energy is one source that falls within this realm of “green energy”.

Over the years, nuclear energy has shed some of the stigma attached to it and has been suggested as a good alternative requiring only professional handling of both the fuel and the waste. The nuclear power industry in India is a monopolistic one with the Central Government holding all the power over every aspect of the industry. As is seen in most monopolies a certain complacency has permeated the industry and India's civil nuclear program has not given the results envisaged. Inefficiencies and cost overruns have further compounded the issues of the Indian nuclear industry due to the nuclear apartheid India was facing. It is evident that the time is right to introduce the nuclear industry to the “LPG Program” (i.e. Liberalization, Privatization and Globalization) that has worked so successfully in other essential services industries.

With this backdrop the study looks at Nuclear Law in India over the last some decades and puts forth some pertinent questions, viz.,

- Whether private operators can take over the liabilities on an international level?
- Whether it is possible to provide insurance cover for such liabilities?
- Whether there is a need to make amendments in laws so as to allow privatization of the nuclear industry in India?
- Whether privatization would indeed be beneficial in reducing India's energy deficit? and
- Whether the nuclear regulatory regime in India conforms with international requirements and norms?

While attempting to find answers to these questions the Study analyzes the pertinent Indian legislations, international conventions, and India's nuclear energy generation regime in the context of these conventions. It also takes an in-depth look at the nuclear law regime in the other big democracy, i.e. the United States of America with reference to privatization of nuclear plants and critically analyzes this in the Indian context. In doing so the concepts focused on are nuclear power generation, safety and security, energy deficit, liability and compensation, privatization, and climate change etc. amongst others.

The Study proceeds on the hypothesis that reduction of India's energy deficit and the creation of an energy reserve would be given impetus if privatization is allowed in the nuclear industry.

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TABLE OF CONTENTS

Contents		Page No.
Declaration		i
Certificate		ii
Abstract		iii - iv
Acknowledgement		v - vi
Table of Contents		vii – xiv
Abbreviations		xv - xix
List of Appendices		xx
Chapter I		
Introduction		1-23
1.1	Theoretical Background	1-2
1.2	Statement of the Problem	2-3
1.3	Research Questions	3
1.4	Rationale and Significance of the Study	4-11
1.5	Objectives of the Study	11
1.6	Hypothesis	12
1.7	Scope of the Research – Key Concepts & Variables	12-13
1.8	Limitations of the Research	13-14
1.9	Research Methodology and Design	15-16
1.10	Mode of Citation	16
1.11	Scheme of Chapters	17-23
Chapter II		
2	Literature Survey & Review	24-30
Chapter III		
Evolution of Nuclear Technology and Law		31-93
Part I – Historical Development of Nuclear Technology		31-46
3.1	Discovery of Nuclear Elements and Other Findings	31-34
3.2	Development of Nuclear Reactors	34-35
3.3	Components of a Nuclear Reactor	35-37
3.4	Types of Nuclear Reactors	38-43
3.5	Power Rating of a Nuclear Reactor	43
3.6	Joint Initiatives and Collaborations	44-45
3.7	Lifecycle of Nuclear Reactors	45-46
Part II – Development of Nuclear Law		47-56
3.8	Development of Nuclear Law Around the World	47-56
	3.8.1 Post WW-II – Development of the Nuclear Industry	49-50
	3.8.2 Post WW-II – Development of the Nuclear Industry in the USA and the USSR	51-53
	3.8.3 Post WW-II – Development of the Nuclear Industry in Canada, France, and Kazakhstan	53-54
	3.8.4 Interim Period of Slow Down Around the World	54-56

Part III – Critical Analysis of Nuclear Law in India		57-92
3.9	Understanding the Energy Deficit in India	57-66
3.10	Nuclear Enactments	66-71
3.11	Road Map of India's Nuclear Energy Program	71-84
3.11.1	Phase I – 1944 till 1960	71-73
3.11.2	Phase I – 1944 till 1960	73-76
3.11.3	Phase III – 1974 to 1995 – 96	76-79
3.11.4	Phase IV – 1996 to May 1998	79-81
3.11.5	Phase V – 1998 to 2004	81-82
3.11.6	Phase VI – 2004 to 2014	82-83
3.11.7	Phase VII – 2014 onwards	83-84
3.12	India's Infrastructure Development vis-à-vis its Civil Nuclear Program	84-91
3.13	Conclusion	92-93
Chapter IV		
Privatization in India under Economic Reforms		95-127
4.1	Introduction	94-95
4.2	Defining Privatization	96-97
4.3	Privatization and Economic Growth in India	98
4.4	Objectives of Privatization	98-99
4.5	Privatization Laws	99-100
4.6	Other Supporting Laws	101
4.7	Change in Government Policy	101-103
4.8	Major Reasons for Privatization	103-105
4.9	Elements of Privatization	105
4.10	Advantages of Privatization	106-107
4.11	Disadvantages of Privatization	107-108
4.12	Analysis of Private Sector vis-à-vis the Indian Economy	108-109
4.13	Examples of Privatization in India	110
4.14	Private Sector Infra Investment	111-113
4.15	Scope of Privatization in the Nuclear Sector	114-116
4.16	Case Study of Impact of Privatization on Telecommunications Industry in India	117-126
3.16.1	Overview	117
3.16.2	Pre-Liberalization Challenges	118
3.16.3	Privatization of the Telecommunications Sector	119-120
3.16.4	Impact of Privatization	121-124
3.16.5	Telecommunications Industry – Then and Now	124-125
3.16.6	Net Effect of Privatization	126
4.17	Conclusion	126-127

Chapter V		
World's Largest Democracies and their Dissimilitude Civil Nuclear Programs		128-250
Part I – The United States of America		128-180
5.1	Introduction to the Nuclear Legal Regime in the United States of America	128-130
5.2	Governing Legislations	130-132
5.2.1	AEA of 1954, as amended	130-131
5.2.2	ERA of 1974	132
5.2.3	Reorganization Plan No. 1 of 1980	132
5.3	NRC Organization	133-144
5.3.1	The NRC's Regulatory Mission	134
5.3.2	Commission Structure	134-135
5.3.3	The NRC Staff	135-136
5.3.4	The (EDO)	136-137
5.3.5	Advisory Committees and Boards	138-139
5.3.6	Elements of the Regulatory Program	140-142
5.4	Licensing	143-154
5.4.1	Initial Licenses	143-145
5.4.2	License Amendments	145-146
5.4.3	Materials Licenses	147
5.4.4	License Renewal	147-148
5.4.5	Technical Reviews	148-149
5.4.6	Key Technical Documents	149
5.4.7	License Transfers	150
5.4.8	Common Questions on License Transfers	150-152
5.4.9	License Transfer Regulations	152
5.4.10	Key License Transfer Considerations	152-153
5.4.11	Environmental Reviews	153-154
5.5	Enforcement, Investigation and Sanctions	154-174
5.5.1	NRC Enforcement Program	154-156
5.5.2	Violations at Operating Plants	156
5.5.3	Antitrust	157
5.5.4	Insurance	157
5.5.5	Civil Sanctions	157
5.5.6	Civil Penalties	158
5.5.7	SDP Findings	158
5.5.8	Orders	159
5.5.9	Reactor Oversight Process	159-160
5.5.10	NRC Investigations	161-162
5.5.11	Safety Culture	162-164

	5.5.12	Protected Activities and Retaliation	164-165
	5.5.13	Reporting Wrongdoing – By Licensees, their Employers and Contractors	165-166
	5.5.14	Reporting Wrongdoing – By NRC Employees or NRC Contractors	166
	5.5.15	Hearing Process	166-170
	5.5.16	Mandatory Hearing	170-171
	5.5.17	Licensing for New Plants	171-172
	5.5.18	New Reactor Licensing Reviews	172-174
5.6		Decommissioning	174-180
	5.6.1	Assurance for Funding	174-175
	5.6.2	Cost Estimates	175-177
	5.6.3	Decommissioning Financial Assurance Methods	177-180
	5.6.4	Reporting Requirements	180
Part II – India			181-230
5.7		Development of Nuclear Law Regime in India – Critical Evaluation	181-230
	5.7.1	Constitution of India and its Implication on Treaties and Agreements	182-187
	5.7.2	AEA, 1962	187-194
	5.7.3	Regulatory Framework in India	194-204
	5.7.4	The Civil Liability for Nuclear Damage Act, 2010	205-207
	5.7.5	Liability for Nuclear Damage	207
	5.7.6	Liability of Operator	208-209
	5.7.7	Analysis and Understanding of the Civil Liability for Nuclear Damage Act, 2010 from the Perspective of the Stakeholders	209-223
	5.7.8	The Insurance Pool	223-230
Part III – Comparative Analysis			231-250
5.8		India and the World	231-236
5.9		An Analysis of the Understanding reached between India and the United States	236-238
5.10		Comparative Analysis of Nuclear Regime of India and the United States	238-244
5.11		Conclusion	244-250
Chapter VI			
Global Regulatory Regime – An Umbrella for Promotion of Privatization			251-283
6.1		Conventions on Safety	252-257
	6.1.1	Radiation Protection and Nuclear Installation Safety	252-253
	6.1.1.1	ILO Radiation Protection Convention	252

		6.1.1.2	Convention on Nuclear Safety	252
		6.1.1.3	Code of Conduct on the Safety of Research Reactors	253
		6.1.2	Emergency Response and Management	253-254
		6.1.2.1	Convention on Early Notification of a Nuclear Accident	253
		6.1.2.2	Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency	254
	6.1.3	Radioactive Waste Management and Decommissioning		254-255
		6.1.3.1	Joint Convention on Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management	254-255
	6.1.4	Environment Assessment and Protection		255-257
		6.1.4.1	Convention on Access to Information, Public Participation in Decision-Making, and Access to Justice in Environmental Matters	255-256
		6.1.4.2	Convention on Environmental Impact Assessment in a Transboundary Context	256-257
		6.1.4.3	Protocol on Strategic Environmental Assessment to the Convention on Environmental Impact Assessment in a Transboundary Context	257
	6.2	Conventions on Security (Nuclear Security and Physical Protection)		258-260
		6.2.1	Code of Conduct on Safety and Security of Radioactive Sources	258-259
6.2.2		Convention on the Physical Protection of Nuclear Material	259	
6.2.3		International Convention for the Suppression of Acts of Nuclear Terrorism	260	
6.3	Conventions on Liability and Compensation for Nuclear Damage		260-274	
	6.3.1	Timeline and Development of International Nuclear Liability Regime	260-261	

	6.3.2	Paris Convention on Third Party Liability in the Field of Nuclear Energy (as amended by protocols in 1964, 1982 and 2004)	261-265
	6.3.2.1	Amendments to make the Convention more inclusive and effective	264-265
	6.3.3	Brussels Supplementary Convention	266-267
	6.3.4	Vienna Convention on Civil Liability and the 1997 Protocol	267-269
	6.3.5	Joint Protocol relating to application of Paris and Vienna Conventions	270-271
	6.3.6	Convention on Supplementary Compensation (CSC)	271-274
6.4		The Nuclear Suppliers Group	274-276
6.5		The Non-Proliferation Treaty	277
	6.5.1	Treaty on the Non-Proliferation of nuclear weapons	277-278
	6.5.2	Treaty Banning Nuclear Weapons Tests in the Atmosphere, Outer Space and Under Water (Partial or Limited Test Ban Treaty – PTBT or LTBT)	278-279
	6.5.3	Comprehensive Nuclear Test Ban Treaty	279-280
	6.5.4	The IAEA’s Safeguards System	280-282
6.6		Conclusion	282-283
Chapter VII			
Case Study – The Kudankulam Nuclear Power Plant – A Legal Perspective			284-343
Part I			284-311
7.1		History and timeline of Kudankulam Nuclear Power Plant	284-287
	7.1.1	History	284-285
	7.1.2	Timelines	285-286
	7.1.3	List of Statutory Clearances of Kudankulam Nuclear Power Project	286-287
7.2		Construction of Kudankulam Nuclear Power Plant	287-291
	7.2.1	Three Stage Program	288
	7.2.2	Challenges	288-289
	7.2.3	Operations	290
	7.2.4	Response from Officials	290-291
7.3		Steps involved in Establishment of the Kudankulam Nuclear Power Project	291-300
	7.3.1	Site clearance for Kudankulam – 1 & 2 (KK – 1 & 2)	291-292
	7.3.2	Ministry of Environment, Forest & Climate Change (MoEFCC) and other statutory clearances	292
	7.3.3	Exclusion Zone and Sterilized Zone	293
	7.3.4	Population Distribution	293-294

	7.3.5	Effect on Marine Life and Fishing	294
	7.3.6	Radiation in the Surrounding Area	294-295
	7.3.7	Quality Assurance	295
	7.3.8	Coastal Zone Regulation (CZR)	295
	7.3.9	KK – 1 & 2 - Safety Features	295-296
	7.3.10	Seismic Considerations	297
	7.3.11	Tsunami	297
	7.3.12	Cost of the Project	298
	7.3.13	CSR Activities	298
	7.3.14	Infrastructure Development	298
	7.3.15	Health Care	299
	7.3.16	Education Support	299
	7.3.17	Support to Community at Coastal Villages	299
	7.3.18	Public Awareness Activities	299-300
7.4		Brief Details of Publications, Awareness and Communication Initiatives	300-307
	7.4.1	Press and Media Relations	300
	7.4.2	Public Communication	300-301
	7.4.3	Publications	302
	7.4.4	Multimedia/ Short Films	302
	7.4.5	Environmental Stewardship Program	302-303
	7.4.6	Opposition	303-305
	7.4.7	Opponents and their Perception of Nuclear Risk	305-207
7.5		Factors leading to Opposition of the Kudankulam Project	307-311
	7.5.1	Peoples' Protest and Resistance Campaign	307-308
	7.5.2	Repression by the State	308-309
	7.5.3	State Adopts "Divide and Rule"	309
	7.5.4	Reasons behind Opposition of Kudankulam Nuclear Power Plant	309-311
Part II			312-343
7.6		Kudankulam Case before the Hon'ble Madras High Court and the Hon'ble Supreme Court of India	312-338
	7.6.1	Tracing the Legal Trajectory of the Kudankulam Case	312
	7.6.1.1	Madras High Court Decision	313-320
	7.6.1.2	Decision of the Supreme Court of India	320-327
	7.6.2	Excavating Judicial Narratives on the Citizens, Expertise and Equitable Outcomes	327-334
	7.6.3	International Supplies, Civil Nuclear Liability and Kudankulam	334-338
7.7		Conclusion	338-343

Chapter VIII		
Conclusion and Suggestions		344-381
8.1	Research Findings	345-348
8.2	Proof of Hypothesis	348
8.3	Suggestions with Reference to Legislation	350-352
8.4	Suggestions with Reference to Insurance Pool	352-353
8.5	Suggestions with Reference to Infrastructure	353-354
8.6	Other Suggestions	354-362
8.7	Conclusion and Summary	362-381
Reference List		382-399
List of Publications		400
Bibliography		401-418
Appendices		419-428
-	Appendix 1 – List of Cases	419-420
-	Appendix 2 – List of Diagrams	421
-	Appendix 3 – Template of Questionnaire on Scope of Privatization of Nuclear Power Plants in India	422-426
-	Appendix 4 – Covering Letter to Questionnaire	427-428

ABBREVIATIONS & ACRONYMS

ACRS	Advisory Committee on Reactor Safeguards (<i>USA</i>)
ACMUI	Advisory Committee on Medical Uses of Isotopes (<i>USA</i>)
ADR	Alternate Dispute Resolution
AEA-1948	Atomic Energy Act, 1948 (<i>India</i>)
AEA-1962	Atomic Energy Act, 1962 (<i>India</i>)
AEA	Atomic Energy Act of 1954 as amended (<i>USA</i>)
AEAA	Atomic Energy (Amendment) Act, 2015 (<i>India</i>)
AEC	Atomic Energy Commission (<i>India</i>) (<i>USA</i>)
AECL	Atomic Energy of Canada Limited (<i>Canada</i>)
AEET	Atomic Energy Establishment (<i>Trombay, India – now BARC</i>)
AEFR	Atomic Energy (Factories) Rules, 1996
AERB	Atomic Energy Regulatory Board (<i>India</i>)
AERE	Atomic Energy Research Establishment (<i>UK</i>)
AESDRW	Atomic Energy (Safe Disposal of Radioactive Wastes) Rules, 1987
AEWMMH	Atomic Energy (Working of Mines, Minerals and Handling of Prescribed Substances) Rules, 1984
AGR	Advanced Gas-Cooled Reactor
AI	Artificial Intelligence
ALARA	As Low As Reasonable Achievable
AM - I	Atom Mirny
ASLBP	Atomic Safety and Licensing Board Panel (<i>USA</i>)
ASN	(<i>France</i>)
BARC	Bhabha Atomic Research Center (<i>India – erstwhile AEET</i>)
BALCO	Bharat Aluminum Company Limited
BDO	Block Development Officer
BJP	Bharatiya Janta Party (<i>India</i>)
BSC	Brussels Supplementary Convention
BSNL	Bharat Sanchar Nigam Limited
BWA	Broadband Wireless Access
BWR	Boiling Water Reactor
CAG	Comptroller and Auditor General of India
CANDU	Canada Deuterium Uranium (Reactor)
CD	Conference on Disarmament
CEA	Chief Economic Advisor
CEA	Central Electricity Authority (<i>India</i>)
CERC	Central Electricity Regulatory Commission
CIRUS	Canada-India-Reactor Uranium System
CLND	Civil Liability for Nuclear Damage Act, 2010
COL	Combined Licenses
COP	Conference of Parties
CPPNM	Convention on the Physical Protection of Nuclear Material

CRF	Central Road Fund
CSA	Comprehensive Safeguards Agreement
CSC	Convention on Supplementary Compensation
CSR	Corporate Social Responsibility
CTBT	Comprehensive Nuclear Test Ban Treaty
CZR	Coastal Regulation Zone
DAE	Department of Atomic Energy (<i>India</i>)
DGR	Deep Geological Repository
DOD	Department of Defense (<i>USA</i>)
DOE	Department of Energy (<i>USA</i>)
DOJ	Department of Justice (<i>USA</i>)
DOL	Department of Labor (<i>USA</i>)
DNFSB	Defense Nuclear Facilities Safety Board (<i>USA</i>)
DoT	Department of Telecommunications (<i>India</i>)
DPR	Detailed Project Report
DPSP	Directive Principles of State Policy
DRDO	Defense Research & Development Organization (<i>India</i>)
EAC	Environmental Assessment Committee (<i>India</i>)
EBR-1	Experimental Breeder Reactor
EDO	Executive Director of Operations (<i>of NRC, USA</i>)
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
ENEA	European Nuclear Energy Agency
EPA	Environment Protection Act, (<i>India</i>)
EPA	Environmental Protection Agency (<i>USA</i>)
EPRI	Electric Power Research Institute (<i>USA</i>)
ERA	Energy Reorganization Act of 1974 (<i>USA</i>)
ERDA	Energy Research and Development Administration (<i>USA</i>)
ESA	Electricity (Supply) Act, 1948
ESCAP	Economic and Social Commission for Asia and Pacific
ESL	Environmental Survey Laboratory
ESP	Early Site Permits
EUIP	European Union
EUROCHEMIC	European Company for the Chemical Processing of Irradiated Fuels
EURATOM	European Atomic Energy Community
FAQ	Frequently Asked Questions
FBR	Fast Breeder Reactor
FDI	Foreign Direct Investment
FNCA	Forum of Nuclear Cooperation in Asia
FNR	Fast Neutron Reactor
GALL	Generic Aging Lessons Learned
GDP	Gross Domestic Product

GEIS	Generic Environmental Impact Statement
GIC-Re	General Insurance Corporation of India
GIF	Generation IV International Forum
GOI	Government of India or Central Government
GQ	Golden Quadrilateral
GWe	Gigawatts Electric
HCI	Hotel Corporation of India Limited
HZL	Hindustan Zinc Limited
IAEA	International Atomic Energy Agency
IADA	International Atomic Development Authority
ICJ	International Court of Justice
IDRA	Industrial (Development & Regulation) Act, 1951 (<i>India</i>)
IGA	International Governmental Agreement
ILO	International Labor Organization
IMS	International Monitoring System
INDC	Intended Nationally Determined Contributions
INIP	Indian Nuclear Insurance Pool
INPRO	International Project on Innovative Nuclear Reactors and Fuel Cycles
IOCL	Indian Oil Corporation Limited
IoT	Internet of Things
IP	Internet Protocol
IPCC	Intergovernmental Panel on Climate Change
IPPE	Institute of Physics and Power Engineering (Russia)
ISL	In-Situ Leaching Plants
ITAAC	Inspections, Tests, Analyses and Acceptance Criteria
KNPP	Kudankulam Nuclear Power Plant
KSEB	Kerala State Electricity Board
LARP	License Amendment Review Procedures
LIPSP	Law on Initial Privatization of State Property, 1991 (<i>India</i>)
LJMC	Lagan Jute Machinery Company Limited
LPG	Liberalized-Privatized-Globalized
LTBT	Limited Test Ban Treaty
LTE	Long-Term Evolution
LWA	Limited Work Authorization
LWGR	Light Water Graphite Moderated Reactor
MDEP	Multinational Design Evaluation Program
MoEFCC	Ministry of Environment, Forest and Climate Change (<i>earlier MoEF – Ministry of Environment and Forests</i>)
MOSPI	Ministry of Statistics and Program Implementation
MOU	Memorandum of Understanding
MSRF	M. S. Swaminathan Research Foundation
MTNL	Mahanagar Telephone Nigam Limited
MW	Megawatt

MWe	Megawatt Electric (<i>One million watts of electric capacity</i>)
MWt	Megawatt Thermal
NALCO	National Aluminum Company Limited
NDA	National Democratic Alliance
NEA	Nuclear Energy Agency
NEERI	National Environmental Engineering Research Institute
NEPA	National Environmental Policy Act of (<i>USA</i>)
NFC	Nuclear Fuel Complex
NGO	Non-Government Organization
NIIF	National Investment and Infrastructure Fund
NPB	Nuclear Power Board (<i>India</i>)
NPCIL	Nuclear Power Corporation of India Limited
NPP	Nuclear Power Plant
NPT	Nuclear Non-Proliferation Treaty
NRC	Nuclear Regulatory Commission (<i>USA</i>)
NRX	National Research Experimental Reactor
NSG	Nuclear Suppliers Group
NSHC	No Significant Hazards Consideration
NTPC	National Thermal Power Corporation Limited
NTP	National Telecom Policy (<i>India</i>)
OECD	Organization for Economic Cooperation and Development (<i>erstwhile OEEC</i>)
OEEC	Organization for European Economic Cooperation (<i>now OECD</i>)
OI	Office of Investigations (<i>USA</i>)
OIG	Office of Inspector General (<i>USA</i>)
P-5	Permanent Members of the United Nations, viz., USA, UK, China, France and Russia
PC	Paris Convention
PHWR	Pressurized Heavy Water Reactor
PIL	Public Interest Litigation
PMANE	Peoples' Movement Against Nuclear Energy
PNE	Peaceful Nuclear Explosion
PPP	Public-Private Partnership
PSDAR	Post-Shutdown Decommissioning Activity Report
PSU	Public Sector Undertaking
PTBT	Partial Test Ban Treaty
Pu	Plutonium
PUCL	Peoples' Union for Civil Liberties
PWD	Public Works Department
PWR	Pressurized Water Reactor
RAPS	Rajasthan Atomic Power Station
RBMK	Reaktor Bolshoy Moshchnosti Kanalnyy
RKM	Route-Kilometer

RMP	Rare Materials Plant
ROP	Operating Reactor Assessment Program
RP	Reorganization Plan
RPR-2004	Radiation Protection Rules, 2004 (<i>India</i>)
RSS	Rashtriya Swayamsevak Sangh
RTI	Right to Information
SAR	Safety Analysis Report
SCWE	Safety Conscious Work Environment
SDP	Significance Determination Process
SDR	Special Drawing Right
SER	Safety Evaluation Report
SG	State Government
SMR	Small & Medium Modular Reactors
SMS	Short Message Service
SNEPP	Study of Nuclear Explosions for Peaceful Purposes
SNF	Spent Nuclear Fuel
SQP	Small Quantity Protocol
SSC	Site Selection Committee (<i>India</i>)
T & D	Transmission and Distribution
TFR	Task Force Report
TFRSEK	Task Force Report on the Safety Evaluation of KKNPP
Th	Thorium
TIFR	Tata Institute of Fundamental Research
TISCO	Tata Iron & Steel Company Limited (<i>Now Tata Steel</i>)
TNPCB	Tamil Nadu Pollution Control Board
TRAI	Telecom Regulatory Authority of India
U	Uranium
U-233	Uranium – 233
U-235	Uranium – 235
UK	United Kingdom
UN	United Nations
UNAEC	United Nations Atomic Energy Commission
UNFCCC	United Nations Framework Convention on Climate Change
UNGA	United Nations General Assembly
UPES	University of Petroleum & Energy Studies
USA or US	United States of America
USDOE	United States Department of Energy
USNRC	United States Nuclear Regulatory Commission
USSR	Union of Soviet Socialist Republics
VBWR	Vallecitos Boiling Water Reactor
VOA	Voluntary Offer Safeguards Agreement
VSNL	Videsh Sanchar Nigam Limited
VVER	Veda-Vodyanoenergeticheskyy
WiMAX	Worldwide Interoperability for Microwave Access

WNA	World Nuclear Association
WW	World War

LIST OF APPENDICES

Sl. No.	Appendices	Page No.
1	List of Cases	419-420
2	List of Diagrams	421
3	Template of Questionnaire on Scope of Privatization of Nuclear Power Plants in India	422-426
4	Covering Letter to Questionnaire	427-428

CHAPTER I

INTRODUCTION

1.1 THEORETICAL BACKGROUND

India is an energy deficit country and for its vast population it requires self-sustainable energy security. Most of the nation's population does not have the opportunity to use electricity or any other form of energy in their day-to-day existence. Availability and access to energy is considered to be an important aspect for sustained economic growth of a country (Diwan, Dr. Parag & Sarkar, Dr. A. N., 2008). India will be energy secure when there is application of energy in all the areas, irrespective of their ability to contribute to cost as well as in meeting efficiently the demand for secure, risk-free, useful, and appropriate energy in order to satisfy the varied demands and requirements at competitive costs. Today, energy predominantly comes from coal and a combination of other energy sources, including nuclear fission. There has been much debate over the greenhouse effect of the combustion of coal. Nuclear energy is a good alternative as it falls under the realm of green energy and requires only careful and professional handling of both the fuel and the waste. With an estimated population of nearly 1.43 billion in 2023 (World Bank, 2023), it is important that India have the energy security for its citizens. It has become imperative to analyze how to equate the national demand and supply of energy.

Power generation by NPPs is a viable option to mitigate this problem and it is important that the regulatory regime in India must be in sync with, not only the effort to strive for a welfare state as envisaged by the Constitution of India, but also with the changing needs of time and demands of the situation.

The nuclear law, in India, has evolved over the last few decades. The Apex Court of the Country formulated a principle on the evolution of nuclear energy and a tenet vis-à-vis balance and proportionality with regards to considerations of safety during its deliberations on operationalizing the Kudankulam NPP (Sundarjan v. Union of India, 2013). Even in the medical field, nuclear energy has been used to develop treatments that are commercially viable and have been in use with improved standards (Samuel, A. M., 1990). Further, it is evident that the energy security will enhance India's strategy on the international stage and reflect India's future international pertinence in the Sub-Continent politics (Sharma, Ashok, 2019). This has now set the platform for debates whether operation of NPPs by private players is a viable option, in the near future in line with India's Nuclear Energy Policy and Privatization Policy, within the ambit of which several essential services have been privatized and the Government has disinvested in the same (Filipovic, Adnan, 2006).

1.2 STATEMENT OF THE PROBLEM

Due to the rapidly increasing clamor for energy, and to ensure the economy's sustainability and growth, it has become imperative for India to increase the quantum of electricity generated, while at the same time guarantee that the growth does not cause environmental hazards for future generations, especially in a country that is heavily dependent on fossil fuel and imports. India urgently needs a clean and green source of energy like nuclear energy. Over the years, several industries of essential services have

been privatized and these have greatly contributed to the Indian economy by bringing efficiency and cost-effectiveness. Similarly, the privatization of nuclear power plants would be essential for fostering development and contributing to energy security. There is a gap and ambiguity between the legal ideal of nuclear law as it evolved in India since independence, current actual practice and what is economically beneficial for the country.

1.3 RESEARCH QUESTIONS

The study is intended to discover solutions to the following issues:

- (a) Whether privatization of nuclear power plants would reduce India's energy deficit?
- (b) Whether amendments in the Atomic Energy Act, 1962 are required to bring in privatization of nuclear power plants?
- (c) Whether there are insurance companies available across the globe to provide such policies that cover the liabilities for nuclear damage
- (d) If privatization is permitted, whether private operators are ready to take the liabilities which the Government of India has taken as a signatory to International Conventions.
- (e) Whether the regulatory regime in India regarding generation of power through nuclear sources is in conformation with the international requirement?
- (f) Whether the Indian Civil Liability for Nuclear Damage Act, 2010 would be sufficient to deal with the issues arising on privatization of nuclear power plants?

1.4 RATIONALE AND SIGNIFICANCE OF THE STUDY

India has traditionally been an agrarian economy with a relatively weak industrial base and a deficient energy balance. Although the first Industrial Revolution began in England in the 18th century, in India, during the pre-independence period there was limited introduction of modern technology and access to fossil fuel and electricity was restricted despite the fact that there were several Indians who had been part of the scientific renaissance. However, post-independence India witnessed a substantial promotion and encouragement of initiating economic development using modern technology. The Founding Fathers and political leaders recognized and acknowledged that India had a vast under-privileged population and energy played an important role towards raising the standard of living of the citizens of the Country. This is evident from the correlation between per capita electricity consumption under the Human Development Index and thus energy can be said to be instrumental in the annihilation of poverty, (Niti Aayog G.O.I, 2017). While energy was important, national security was equally significant and on a similar pedestal. Since the World had witnessed the horrors of World War II, which ended in the use of an unorthodox weapon made through military use of nuclear fission. Soon after India gained its independence, the Constituent Assembly was constituted and tasked with drafting the Constitution of India. During this period, it was imperative that India should not lag in the development of atomic energy. In 1948, the Parliament of India passed the Atomic Energy Act, 1948 which was for the development and research of atomic energy for peaceful purposes, the un-documented implication being it could be used for military purposes. The people of India gave themselves the Constitution of India – a moral document with an ethical vision that laid the fundamental principles of governance – to strive towards economic freedom, prosperity, and moral precepts. With the advent of globalization and neo-liberalism, India's national policies are no longer governed purely by political issues but are

developed keeping in mind the national interest vis-à-vis security, trade, foreign direct investment, energy, and mitigating climate change amongst other considerations.

A significant facet of the Indian Constitution is the DPSP. These have both aided the lawmakers, at national and state level, in promoting the welfare of the citizens and have been interpreted by the Indian Courts to be for safeguarding the fundamental rights and promotion of international commitments.

Under these Principles:

- Article 38 stipulates that the State secures societal order with the aim to promote citizen welfare.
- Article 39 contains the principles that are required to be followed by the State during the making of policies.
- Article 48A stipulates that the environment, forests and wildlife be conserved, enhanced and preserved.
- Article 51 stipulates fostering of peace and security globally (Constitution of India, 1950).

The Indian Government's bid to promote industrialization led to the Bombay Plan, which, in turn, required the intervention and regulation of the Government. Subsequently in March 1950, the Planning Commission was constituted and the IDRA, 1951 was passed with a view to empowering the Government to take important policy decisions to regulate industrial development. As a result, PSUs, or public sector undertaking(s) came to be established with a multi-pronged agenda aiming to accelerate growth in essential sectors of the economy and to generate employment in strategically important sectors. Development of essential sectors of the economy became the fundamental goal of the Government and many

restrictions were placed on private entrants. This scenario continued till 1991 when India underwent an economic crisis (Centre for Civil Society, 2002). The result of this economic meltdown was that the Government was compelled to disinvest its stake in several public sector undertakings to raise capital and had to encourage private equity participation.

Therefore, India as a country evolved from purely public undertaking to an amalgamated public-private partnership over the years.

The three primary features of the GOI's blueprint for privatization were:

- (a) Ownership of the public sector undertakings were to be transferred to private entities. The aim was to reduce the Government stake but not to eliminate it. Organizational measures were to be put in place where the control of the State in these companies was limited. However, only those entities that were loss-making and needed funding were considered under this Policy. The rationale was that private entities could provide superior operational management resulting in greater efficiencies.
- (b) The Privatization Policy found its basis in the DPSP under Article 39 of the Constitution of India. It is pertinent to mention that in the beginning of the five year plans the Government had earmarked 17 industries for the public sector where no private entity was permitted, and no private capital was involved. However, over the next few decades the number of these industries dropped to 8 and at present is limited to 4 only, viz., Transport and Railways, Mining of Atomic Minerals, Atomic Energy and Defense Equipment. It is to be noted that the Transport and Mining Sectors have been made into private or public-private partnerships which co-exist and complement each other.

(c) Further, the disinvestment process has allowed several public sector undertakings to sell their equity to the general public and/ or to private entrepreneurs for influx of new capital. To ensure higher efficiency and better financial control some undertakings allowed limited private participation in management leaving the larger responsibility of corporate governance with the Government. The Policy also brought about a change in securitization and revival of sick companies and an incentive-based market was created to improve the market economy.

India has now witnessed the vast inroads private enterprise has made into Telcom, Hospitality, Infrastructure of Surface Roads, Mining, Banking, Steel, Cotton, Medical Care and Energy. For economic development and expansion of infrastructure energy supplies play a pivotal role and India is till and energy deficient country and for its multitude of citizens and economic development mandatorily requires self-sufficiency in energy security. The predominant energy source is coal followed by a combination of renewable energy sources and nuclear fission power plants. However, coal has been much in conflict with the environment and very responsible for the greenhouse effect. The GOI has made efforts to augment the generation of electricity through atomic energy but, at present, it is not cost effective as there is no competition and efficiency. Although nuclear energy is considered green energy, it requires professional handling of nuclear fuel and nuclear waste. Even with these challenges nuclear energy is a viable option for India to bridge the distance between energy requirements and production.

Although atomic energy is yet to experience the said changes as per the Policy, unlike other countries like USA, Canada etc., where the privatization of atomic energy is under a “Delegated” category wherein the Government keeps charge of regulations and responsibilities, while the

private sector operates the product and is responsible for delivery and/ or service. In India, with nuclear medicine already managed by regulated private companies, it is natural for the energy from NPPs to be similarly privatized to achieve greater efficiencies in production and service. India has already shown the world how responsible a nation it is in terms of managing nuclear energy related enterprises. This has been underlined by the Indo-USA Agreement establishing India as a responsible partner in conducting a civil nuclear program working with full responsibility and within the mandate of the Constitution of India. Now, India has also endorsed the CSC and after having passed the CLND in 2010 (Acts of Parliament, 2010) the international commitments mandated under the Indian Constitution have been adhered to, although, there are certain concerns with respect to supplier liabilities. The Indian regulatory regime has also evolved and developed substantially while pursuing the goals for construction, operation, decommissioning etc. in accordance with stringent quality and safety standards (Smith, Tyson R. & Mohan, M. P. Ram, 2018).

Despite these developments, the Government of India, amended the AEA, 1962 as the AEAA, 2015 which was notified on 31st December 2016 and inserted by amendment in Sections 14(1A) and 14(1B) which are not based on the policy of privatization of NPPs. Under Sections 3(a) and 3(c)(iv) the GOI has, through Government Companies, the complete control with respect to NPPs with regard to production, development, usage, disposal, plans, configuration, establishment, and functioning of such plants. Under Section 2(bb) a “Government Company” has been defined as one in which not less than 50% of the ownership belongs to the GOI or the entire ownership is with specified entities and where the Central Government is empowered by the incorporation documents to constitute/ reconstitute the Board of Directors, and this effectively excludes all private entities (Acts of Parliament, 2015).

It is evident that the regulatory authority – the AERB – established through Section 27 of the AEA, 1962 is well equipped with the expertise and guidelines to design, construct, operate and decommission facilities with a nuclear complex and manage all associated tasks. The IAEA is also an organization with the capability to monitor and check all safety, operational and decommissions amongst other aspects of a NPP for India under the latest agreement. Given that the regulatory authorities in India and internationally are very well equipped to monitor, regulate, and handle any given situation the environment now is best suited for the advent of private entities. In the long run this would be in the best interests of the Nation.

Despite bold statements made by the GOI on the possibility of privation of NPPs, the Government has clearly indicated that its intent is not to privatize production of electricity through atomic energy and has monopolized the same through government companies or such entities incorporated and/ or directly controlled by the GOI.

The nuclear energy program in India is a three-stage program. The first stage was to build ‘Pressurized Heavy Water Reactors’ (PHWRs) with the fuel being U found naturally. The second was an advanced stage where the Government would set up ‘Fast Breeder Reactors’ (FBRs) and in the same facility it would be backed by plants for reusing and production of plutonium-based fuel. This was envisaged to exponentially increase the stockpile for atomic material needed for the FBR, an important part of the program. The third stage would be the fuel cycle between thorium-uranium-233 (WNA: Nuclear Power in India, 2022). This civil program is a policy adopted since 1950 and is thus deep-rooted in India. Therefore, the main goal is to boost the nuclear industry and enlarge the quantum of production of power. This must be achieved by working at 100% capacity for all the

operational facilities and establishing new installations in order to escalate production of power. This can only be achieved by creating infrastructure for additional NPPs and ensuring a continuous and well-stocked repository of reactor fuel. To increase the capacity of the nuclear industry while keeping it competitive and cost effective it is, now, imperative that the Government encourages the private sector to enter this industry, making it not only competitive but efficient also.

There has been a positive change in international perception of the India's program in this regard post the successful execution of the Indo-US Agreement for cooperation in civil nuclear programs and transfer of technology, fuel, and the agreement with IAEA. The safety and security standards are monitored by external agencies regularly in a time bound manner and India has allowed such monitoring so that the operations and production of electricity generated through nuclear power reactors are well documented and put to the highest scrutiny (Mistry, Dinshaw, 2014).

The above discussion provides a strong rationale to study nuclear law and its varied dimensions leading to the Civil Nuclear Program for harnessing electricity, how operations of NPPs can be made more competitive and efficient if the same are either privatized or with private equity and/or management – this being the primary reason for undertaking this research.

1.5 OBJECTIVES OF THE STUDY

India does not have a structured and panoramic legal framework for inclusion of free enterprise in the establishment and management of NPPs. The scope of the study would assist in identifying the gaps in regulations to facilitate operating NPPs by private operators and to evaluate the compensation laws and insurance coverage in the event of privatization. This will help us to know the proper ratification process by which to

implement the regulations in India for private players in the nuclear power industry. A comparison of the nuclear regime in the USA with a particular focus on privatization would indicate the best processes and practices to be adapted to the Indian context for better efficiency and cost effectiveness in generation of electricity through atomic energy.

The research is proposed with the following objectives:

- (1) To study and critically analyze the legislation and rules regulating the establishment of NPPs in India for generation of electricity.
- (2) To study and critically analyze the necessary provisions that are required to be incorporated in the AEA, 1962 to bring in privatization of nuclear plants.
- (3) To study the international conventions in the context of India's CLND, 2010 with a particular lens on private operators.
- (4) To study the nuclear law regime in the USA with a focus on its policy on private NPPs and analyze it in the Indian context; and
- (5) To study and analyze India's nuclear energy generation regime in the context of international conventions and protocols.

1.6 HYPOTHESIS

The research proceeds on the hypothesis that:

If privatization of the manufacture and operations of the nuclear power plants in India be permitted by law, it would reduce the country's energy deficit and progress towards energy reserve.

1.7 SCOPE OF THE RESEARCH – KEY CONCEPTS & VARIABLES

The scope of the research is to establish that privatization of establishment, setting up and management of the NPPs in India will lead to increased effectiveness and higher production and economy. It attempts to study the protocols, treaties, accords etc. on a global level with reference to safety, security and liability if NPPs are made open to the private sector in India.

There are several key concepts and variables that would be the focus of this study. The following variables are suggestive herein:

- (a) Nuclear power generation
- (b) Safety and security
- (c) Energy deficit
- (d) Polluters pay principle.
- (e) Sustainable energy systems
- (f) Liability and compensation
- (g) Privatization
- (h) Welfare
- (i) Right to life
- (j) Regulator
- (k) Radioactive waste
- (l) Climate change and the greenhouse effect.

The scope of this study covers the determination of where the contextual relevance exists, the best global practices in legislation which should be adapted to Indian law, to bridge the existing and foreseeable gap in comprehending the new era of nuclear energy regulatory laws and regime to foster a civil nuclear program with the ultimate aim of attaining energy security in India.

The study touches upon the emerging and potential concepts of privatization of NPPs with reference to India, energy security and the evolution of nuclear law with a relative context to the United States of America. The study will be confined to known and available information for proving the desired comprehension of privatization of NPPs. The research should be viewed as a platform to model the legislation to take care of Indian interests in the conduct of nuclear operations as a private business model with effective governance rather than just a robust backdrop for enactment of legislation itself.

1.8 LIMITATIONS OF THE RESEARCH

The research is subject to several limitations. These limitations are in the form of restriction of data terms as classified by government agencies, including DAE, the AEC amongst other government authorities, particularly data on existing NPPs in India. Visits to the sites of operative plants are restricted and hamper the sampling method for work culture. There have been no prior scientific studies on this subject in India as the entire industry has been a monopoly of the Central Government. Additionally, there has been the scare of proliferation which could form the foundation for laying the basis to comprehend the research problem being investigated. A need has been felt to build up a completely new information typology utilizing an exploratory rather than an explanatory research design which may result in recognizing new gaps and describe the requirement for further research.

The researcher has used several provisions of the Right of Information Act for obtaining data, but repositories of such information have taken recourse to Section 8 of the Act allowing them to withhold information on the grounds of secrecy and national security. An added limitation to this study has been the fact that in India, the nuclear industry is shrouded under

secrecy and mystery. As such the common man does not have enough factual data or knowledge to make learned choices while answering a questionnaire. Additionally, government and bureaucratic staff that may have sufficient knowledge are bound by their terms of employment and as such hesitant to attempt such questionnaires. These deterrents have added to the herculean task of gathering data for this research study.

The comparative data for other countries was necessary but such data may not be the perfect fit under the Indian scenario and may contain several potential causes of bias. While undertaking a comparative analysis of different nuclear regimes, USA in particular, the information and data is based on books, journals and information available on the Internet as it has been nearly impossible to access the US Regulatory Commission documents.

The research is further limited by the vastness of the subject. As such other aspects, being environmental impact and long-term costs of nuclear energy, have not been part of this research as they constitute a separate area of study altogether.

Limited time available for the study is inherently a limitation of any study of such a vast, unexplored topic. Research has been limited within a time frame ending on March 31, 2023.

1.9 RESEARCH METHODOLOGY AND DESIGN

The research is primarily doctrinal legal research with minimal empirical research. The researcher has also undertaken qualitative legal research for understanding the social impact on the title of the study.

(a) Nature and Type of Study

Under the doctrinal legal research, analysis was done of the legal statute, its gaps and inconsistency with the policy along with the connected and subordinate legislations to the AEA from the initial statute post-independence till the recent amendments. These statutes include the AEA, 1948, the AEA 1962 and the recently AAEA, 2015. A comparison has been made of the privatization of NPPs in USA and gaps and inconsistencies in the Indian context have been identified. The energy policy has also been examined and analyzed in order to understand the deficit in the power production capabilities and the need to privatize nuclear power.

Further, the aspect of liability law has also been analyzed with respect to NPPs to understand whether there are any inconsistencies in the Indian statute, especially in terms of the compensation mechanism.

(b) Methods of Data Collection

The method of data collection is secondary as the study has largely used data, which is available in authored textbooks, legal articles, journals, parliamentary debates relevant to this study. Data has also been collected by way of circulation of questionnaires, through emails and letters to experts in this field in India and abroad and personal interviews with the public living within the vicinity of the Narora NPP in Uttar Pradesh and workers working therein.

(c) Sources of Data

As the study is of a doctrinal nature, the sources of data are documentary sources and include both primary and secondary documentary sources. Primary sources are the legal sources of law and would be the provisions contained in various special and local legislations in India and notifications, rules, directives, mandates, etc. of several offices and departments that play a part in regulating the construction and operation of NPPs as they exist today. The secondary sources are the books and journals available in the international market, e-commerce platforms such as Amazon, library of the UPES, OECD and NEA, various publications by IAEA, NEA, OECD and DAE, reports filed by the GOI and parliamentary debates on topics related to this research. The data has also been sourced from certain repositories in the USA which are available through the internet and from books in libraries.

The data thus collected has been reviewed and summarized. Superfluous and unrequired data has been edited and/ or deleted leaving behind data easily understandable in the context of this research.

1.10 MODE OF CITATION

The American Psychological Association (APA) Citation Style has been followed in the research work.

1.11 SCHEME OF CHAPTERS

Chapter I: Introduction

It deals with the meanings of various terms and concepts as also the theoretical background to the research. India is facing a crisis of energy deficiency and the main cause for concern is the need to balance rapid growth of demand for energy with environment conservation. The fact that both are a reality is not up for debate, however, the ongoing argument is on the choice or combination of choices of the sources of energy to generate electricity. The answer could lie in nuclear energy which, if privatized, could be the cleaner and more efficient mode of energy supply.

Chapter II: Literature Survey and Review

This Chapter analyses and details earlier research and literature on the research problem of this research that has helped in comprehending its importance. This survey also shows different opinions and results related to the topic of research.

Chapter III: Evolution of Nuclear Technology and Law

This Chapter deals with the historical aspect of atomic power and touches mainly upon the evolution of nuclear laws and regulatory regimes which were established on account of the progress in technology of nuclear sciences with special reference to the Indian regime. The Author herein deemed it fit to primarily explain the genesis of nuclear sciences and technology and the legal regime shaped to regulate the same with special reference to the Indian context. Extensive research and developments in nuclear sciences resulted in the controlled use and production of radioactive elements. However, for nations such as USA, Germany, USSR and France, the desire to produce and hold nuclear weapons became even more pertinent in the wake of World War I. Scientists in these countries made all efforts to explore the “uranium-factor” which in turn led to an entire gamut of nuclear

fissions. The outcome was one of the most drastic and unfortunate events of all times – the atom bomb attacks by USA on Japan. The Chapter's first part traces the development of nuclear technology starting from the finding of radioactive elements to the evolution of reactors and NPPs. It covers the components of these reactors, the type of reactors, their technical features and collaborations and concludes with international initiatives and collaborations.

It was imperative to legislate on 'use of nuclear technology' with the advent of nuclear weapons, particularly after the gruesome and unfortunate bombing on Japan by USA in 1945. Subsequently, resulting in the then President of USA, Roosevelt's speech on "atoms for peace" and the execution of several international conventions, agreements and treaties, including the NPT. The nuclear laws were legislated with the sole purpose of ensuring non-violent use of this energy, thereby securing the health of the population, individual security and preservation of the environment. However, the growing trajectories of nuclear technology with electricity generation, the requirement of a specific international and domestic framework became crucial to sustain energy needs.

In this regard, the Chapter has been sub-divided into three sections:

Part I - outlines the historical background and technological use of nuclear energy and its transition into gradually emerging as a clean, reliable and zero emission source of energy.

Part II - examines the parallel development of nuclear laws to assist such growth. Struck with an energy impasse it becomes essential to rationally analyze the potential of radioactive substances and the validity of laws in strengthening the nuclear sector. This section deals with the advancement and transformation of nuclear law around the world tracing its path from the

Post World War II till the mid-2000s when there was an interim period of slow down across the globe.

Part III – critically analyses nuclear law in India from understanding the energy deficit to the relevant legislations and government policy. It traces the road map India has followed to reach nuclear self-sufficiency from 1944 till date.

The Chapter concludes with an overview of the risks linked with such technology, the limitations of existing laws vis-à-vis liability and compensation and the need for effective regulatory mechanisms on a domestic and global level where the industry is increasingly being privatized.

Chapter IV: Privatization in India under Economic Reforms

This Chapter traces the shifts in the Indian economy from a mixed economic structure to a liberalized one and the advent of privatization in India. It discusses the objectives of privatization, its advantages and disadvantages and the reasons why governments go the privatization route. Further, the laws covering privatization, supporting laws and changes in government policies are studied. As a comparative example a case study has been done on the impact of privatization on the Telecommunications Industry in India. The Chapter concludes with an analysis of the private sector vis-à-vis the Indian Economy and examples of privatization in India summarizing that privatization of the civil nuclear sector under the umbrella of the State's regulatory, legal, and compensatory regime, would probably be the impetus urgently needed to meet India's energy deficit.

Chapter V: World's Largest Democracies and their Dissimilitude Civil Nuclear Programs

This Chapter puts forth an in-depth comparative analysis of the nuclear regimes in two of the world's largest democracies, viz., the USA and India. It delves into the nuclear laws of both the nations from the perspective of understanding the status quo of their legal framework for nuclear energy together with an analysis of the uncommon and unexplored aspects of the study as well. The first part of the Chapter deals with the legal framework established in USA and the second part with that of India with respect to nuclear energy. The third and last part provides the comparative analysis drawing out the similarities and differences while analyzing history and development in this field over the years. The conclusion summarizes, together with the author's observations, the comparative key features, contradictions, and ambiguities prevailing in the nuclear regimes of both countries. This section also compares India with other countries in the backdrop of development of civil nuclear power. A questionnaire analysis has been compiled on the understanding between USA and India with a detailed comparison between the two countries.

The Chapter concludes with the identified shortcomings and loopholes in Indian nuclear regulatory and compensatory regime. It summarizes the advantages observed in the privatization of the nuclear power sector in USA unlike the Indian regime where the GOI has a monopolistic grip on all aspects of the civil nuclear industry. The Author also showcases the pros and cons of USA's civil nuclear regime that comprises the private sector and the government's regulatory and legal arm to show how such a set up would be beneficial to India.

Chapter VI: Global Regulatory Regime – An Umbrella for Promotion of Privatization

This Chapter deals with the framework of international nuclear law regime. It explains in depth the instruments governing nuclear laws at an international level viz., the conventions, treaties, protocols, and subsequent amendments. The instruments are briefly explained to understand their status, importance, working, effectiveness and applicability along with India's position qua these international legislations. An effort has been made to provide an overarching and complete comprehension of the laws regulating nuclear energy in this Chapter which incorporates all the instruments governing international nuclear law regime.

The Chapter concludes with the reality of the present need for nuclear development for civilian use and the need to enhance co-operation and safety with respect to nuclear energy with a view to providing a regulated arena for private players. On this global stage, an in-depth look into a typical NPP in India becomes important to gauge the relevance to India's civil nuclear program.

Chapter VII: Case Study – The Kudankulam Nuclear Power Plant – A Legal Perspective

This Chapter is written with the aim of critically analyzing the establishment of a NPP in the southern state of Tamil Nadu at Kudankulam. Part I covers the necessity of establishing the NPP together with the challenges faced by the Government and most importantly, the issues with the local masses and environmental activists on account of the ramifications of this NPP on the surrounding flora and fauna, the neighboring population and especially the impact on the water ecology. It explores the history and timeline of the Power Plant Project and the steps involved in its construction and

establishment. It also examines the Plant's safety features and details out the public awareness and communication program adopted by the Government.

Part II of the Chapter analyzes the approach adopted by the Indian Courts, viz., the Madras High Court and the Supreme Court of India, when the KNPP became a bone of contention between the local population, activists and even the State Government on one side and the scientists, technocrats, business houses and the Central Government on the other. While doing so the author has opined on the shortcomings which were left unanswered by the Courts and has explained the ramifications of the judgments and the road ahead for India in generating power from nuclear energy. The Chapter traces the legal path of the Kudankulam case as it progressed from the Madras High Court to the apex court in the country. The orders dictated by both the courts are critically analyzed and judicial narratives excavated, the expertise examined, and the equitability of the outcomes debated. A brief appraisal of the standing of the Plant vis-à-vis international supplies and civil nuclear liability is also reviewed.

The Chapter concludes with the recognition that the Government run corporations are unable to meet the unprecedented demand for energy given India's rapidly growing economy and population and the effort of the GOI to include public-private partnerships in the civil nuclear space and its willingness to have private players actively involved with the manufacture and operation of small modular reactors.

Chapter VIII: Conclusion and Suggestions

The conclusion delineates the major limitations found during the research on privatization in India/ civil nuclear liability. It focuses on the inadequacies of the legal structure in India regarding the nuclear industry, a commentary on the nuclear regimes in developed countries and in India. It also lists the findings and suggests amendments and changes going forward to make the nuclear overall structure and system in India more conducive to private participation subject to State overview that regulates safety and security while ensuring that the nuclear industry is key to the country's growth while simultaneously fulfilling its environmental obligations.

This Chapter opens with a summary of the research study followed by the findings and Proof of Hypothesis wherein it is reasoned that the hypothesis is proven. The conclusive section is devoted to suggestions for amendments that could be made in various Acts, particularly the AEA, 1962 and the CLND, 2010, together with suggested administrative, procedural and policy changes that would add tremendously to the effectiveness of India's nuclear legal regime relevant to the private sector.

CHAPTER II

LITERATURE SURVEY & REVIEW

Energy is vital to the sustained development of any economy. In a developing country like India that is facing a severe energy crisis compounded with issues related to climate change it is imperative to ensure that the demands for energy of a growing population are met and at competitive prices. The fact that the energy needs to be green energy brings forth additional challenges. It has been seen that nuclear energy could be a remedy to these issues and challenges. However, in India, the complete control of the nuclear energy sector has, historically, been with the State. It is a need of the hour that the Government loosens its tight control and, under a tight regulatory regime, allow free enterprise to participate in the manufacturing and management of the nuclear energy sector, while at the same time making certain that all issues arising from such privatization are properly and legally dealt with.

Literature review was conducted to get knowledge of the data and material available for the objective of testing the hypothesis. It is also essential to understand the concepts, theories and laws involved in the research. The research does an in-depth study of historical background of nuclear law and India's footprint therein, the technical aspects of nuclear energy, international conventions and protocols, comparative nuclear regimes, privatization of nuclear power plants and Indian laws and their interpretation in these contexts. An attempt has been made to assess the material available in this field and to draw guidance from existing literature for this research. The study of available literature has had some impact on this study.

Review and study of data, materials and literature is of greatest importance in research as it gives clarity about the nuclear regimes and law with particular focus to privatization of NPPs in India.

The initial search for data and materials was done using Student's Portal to UPES Digital Library, OECD and NEA's digital library of publications and journals and Google Scholar. The key words used for the search were '*history of nuclear energy*'. The search was narrowed down using words 'atomic energy, nuclear liability and compensation, energy security, energy deficit, privatization, Kudankulam, 123 Agreement etc. along with the key word(s).

The article "*Impact of Privatization on Economic Growth*" by Adnan Filipovic published in the Undergraduate Economic Review: Volume 2 Issue 1 Article 7 by Furman University (2005) (<https://digitalcommons.iwu.edu/uer/vol2/iss1/7/>) examines the relationship between growth and privatization from an incentive's perspective. This article demonstrates that through privatization of the public sector assets is a factor that could play a serious role in the quest for growth.

The book, "*Indian Constitution Law*" by M P Jain, Seventh Edition; Set of 2 Volumes published by LexisNexis (2017) covers the legislative changes made up to the Constitution (101st Amendment) Act, 2016 as well as the latest essential case laws from the Supreme Court of India and from various High Courts across the country. An entire chapter is reserved for the Directive Principles of State Policy wherein the issue of 'Fundamental in governance of a country' and the duty of the State to apply these principles while making a law is discussed.

“Planning Commission to NITI Aayog – Making Strategies for Transforming India” an article written by Srinivas and published by the Press Information Bureau, Government of India, Special Service and Features on 16th August 2017 (<https://pib.gov.in/newsite/printrelease.aspx?relid=170000>>) explains the evolution of the development and planning process of the regulatory policies by re-imagining the development agenda by dismantling old-style central planning. NITI Aayog is mandated to encourage cooperative federalism and evolve a national consensus on developmental goals.

The journal article, *“Op – Ed: Why Private Investors Must Fund New Nuclear Power Right Now”* by Joseph Lassiter, published in the Harvard Business School (HBS) Working Knowledge, 4th April 2018. This article researches the new generation nuclear technology as a part of a balanced, carbon-free power solution, which should be either for government or public – private partnerships.

Linkage of the growth of nuclear medicine with developments in India’s Atomic Energy Program has been researched in the article, *“Growth of Nuclear Medicine in India”* by Samuel A.M published in the journal, ProQuest, Def Sci J, Volume 40, No. 4, Oct 1990, pp 335 – 346 (<https://search.proquest.com/openview/1c95c5059830d72953678c44047fa88d/1?pq-origsite=gscholar&cbl=2028808>). Self-sufficiency in radiopharmaceuticals for both in-viva and in-vitro use has been largely achieved. The availability of instrumentation facilities in over 90 nuclear medicine centers is indicated. The activities of the Radiation Medicine Center, a pioneer institute, in the fields of diagnosis, therapy and training of personnel are summarized.

The Environment (Protection) Act, 1986 No. 29. Acts of Parliament, 1986 (India) deals with the protection and improvement of the human environment and the prevention of hazards to human beings, other living creatures, plants, and property. This Act has been read together with the relevant letter of the Prime Minister of 1981 and the Environmental Guidelines for Development of Beaches, 1983.

The Indian Electricity Act, 2003, No. 36. Acts of Parliament, 2003 (India) is an Act to consolidate the laws relating to generation, transmission, distribution, trading, and use of electricity and generally for taking measures conducive to development of the electricity industry, promoting competition therein, protecting the interests of the consumers and supply of electricity to all areas.

The Disaster Management Act, 2005 No. 53, Acts of Parliament, 2005 (India) extends to the whole of India and provides for effective management of disasters and for matters connected therewith or incidental thereto.

The Atomic Energy Act, 1948 (Repealed), No. 29, Acts of Parliament 1948 (India) and The Atomic Energy Act, 1962, No. 33, Acts of Parliament 1962 (India) is the governing legislation for all aspects of the nuclear energy sector. This Act was first passed in 1948 and later repealed and amended in 1962. Subsequently, the Atomic Energy (Amendment) Act, 2015, No. 5, Acts of Parliament 2016 (India) was approved by the Parliament.

The Civil Liability for Nuclear Damage Act, 2010, No. 38, Acts of Parliament, 2010 (India) seeks to create a mechanism for compensating victims of nuclear damage arising from a nuclear incident. This Act was passed after the Indo-US Agreement for Civil Nuclear Cooperation was signed and India became a signatory to the Convention of Supplementary Compensation.

“The US-India Nuclear Agreement” a book authored by Dinshaw Mistry and published in 2014 by Santa Printers has a study of the negotiations and outcomes thereto between the United States and India whereby a major nuclear agreement was reached that recognized India’s nuclear status and lifted long-standing embargoes on civil nuclear cooperation with India. This is a comprehensive account of the diplomacy and domestic policies behind the US-India nuclear agreement. It offers a valuable framework for analyzing additional strategic and nuclear dialogues between the two countries and with other nations. It also shows how nuclear agreements can be successfully negotiated especially when they account for domestic political influences on the agreement.

“The Handbook on Nuclear Regulatory Framework in India” (First Edition) by Tyson R Smith and M P Ram Mohan published by EBC in 2018 deals with the atomic energy regulatory structure, the responsibilities, the safety standards, and other functional processes.

“India’s Pursuit of Energy Security: Domestic Measures, Foreign Policy and Geopolitics” (First Edition) by Ashok Sharma, published by SAGE in 2019 is a comprehensive examination of the dynamics of India’s energy security policy in the domestic and international context. Over the past decade and a half, energy security has been a constant driver of India’s foreign policy. Successive Governments have emphasized it as a major concern, next in importance only to food security.

Study of the case *“Sundararajan v. Union of India, (2013) 6 SCC 620”* reveals that the Hon’ble Court held inter alia that a balance had to be struck. Nuclear energy was a viable and sustainable source of energy, and it is necessary to increase the country’s economic growth. It was also observed that India could not afford to remain a nuclear isolated nation when most of the developed nations considered nuclear to be a major source of energy for their economic growth.

Study of the case “*Union Carbide Corporation v. Union of India and Others, (1989) 2 SCC 40*”. In this matter, a Constitution Bench held that the Bhopal Gas Leak Tragedy was a horrific, industrial disaster of massive proportions and it was singular in its immensity and the havoc it caused. The Court opined that it was a terrifying testament to the degradation of man on account of technologies that were intrinsically fraught with danger. As regards the equitableness and rationality of the amount of settlement or compensation, the Constitution Bench alluded to the issues that arose when dangerous technologies were pursued for profit by large corporations. Mention was also made of developing countries succumbing to economic exploitation on account of having cheap labor resources and captive markets amongst other dimensions of such exploitation.

Study of the case “*T N Godavarman Thirumalpad (through K M Chinnappa) v. Union of India and Others (2002) 10 SCC 606*”. In their deliberations the learned judges of the Apex Court noted that it was practically an impossibility to pursue developmental activities without having a negative effect on the environment. However, projects undertaken for the benefit of the population cannot be forsaken as it is essential to maintain a balance between the larger good for mankind with the imperative need to preserve the environment. The balance, though delicate, must be kept between the two somewhat opposing interests. A project may raise difficulties for a few people but the beneficial impact on a macro scale would be far greater and the convenience and benefit to a larger section of the people has to get primacy over comparatively lesser hardship.

In conclusion, the literature on nuclear plants underscores their complex role in contemporary energy systems. While nuclear power offers significant benefits in terms of low greenhouse gas emissions and high energy density, it also presents challenges, including safety concerns, waste management, and high initial costs. Advances in reactor technology, such as Generation IV reactors and small modular

reactors, hold promise for addressing some of these issues. However, public perception and regulatory hurdles remain substantial obstacles. A balanced approach, incorporating diverse energy sources and ongoing technological innovation, will be crucial for optimizing the role of nuclear power in a sustainable and resilient energy future.

CHAPTER III

EVOLUTION OF NUCLEAR TECHNOLOGY AND LAW

PART I – HISTORICAL DEVELOPMENT OF NUCLEAR TECHNOLOGY

3.1 DISCOVERY OF NUCLEAR ELEMENTS AND OTHER FINDINGS

The genesis of nuclear sciences lies in the discovery of nuclear elements and other phenomena or findings. Uranium, the most essential discovery to nuclear energy, was discovered and identified from ‘Pitchblende’, an ore containing uranium and radium by Martin Heinrich Klaproth in 1789 AD, who named the element after the planet Uranus, which itself was recently discovered at that time. Over the years, different scientists, viz., Martin Heinrich Klaproth, Eugene-Melchior Peligot, Paul Ulrich Villard, Niels Henrik, David Bohr, Ernest Rutherford, Marie and Pierre Curie, Carl Friedrich von Weizsacker, Otto Hahn, Lise Meitner, Enrico Fermi, J Robert Oppenheimer, and Werner Heisenberg to name a few, contributed extensively to the research on Uranium-235 (U-235) and Uranium-238 (U-238) isotopes. The development of nuclear energy along with nuclear fission/ fusion, atomic bomb, atomic radiation, atomic change etc. has been a result of the following discoveries from the year 1895 to 1945:

- (i) Ionizing radiation by Eugene-Melchior Peligot in 1895.
- (ii) Accidental discovery of radioactivity by Henri Becquerel in 1896.
- (iii) Isolation of polonium and radium from pitchblende by Marie Curie in 1898. The phenomenon of radiation was named as ‘radioactivity’

- (iv) in 1896 by Pierre and Marie Curie. Radium has now come to be used actively in medical treatment.
- (v) In 1898 Samuel Prescott showed how radiation could be used to destroy bacteria in food.
- (vi) Gamma rays by Paul Ulrich Villard in 1900.
- (vii) Neutrons by James Chadwick in 1932.
- (viii) Nuclear transformations by colliding nuclei with artificially accelerated protons by Cockcroft and Walton in 1932.
- (ix) Induced radioactivity by Irene Curie and Frederic Joliot in 1934.
- (x) In 1934, Enrico Fermi discovered that neutrons could produce a much greater variety of radionuclides than protons and in the process was the first to achieve nuclear fission.
- (xi) U-235 Isotope, resulting from uranium enrichment that reduces C-238 making it more effective than the latter by Arthur Jeffery Dempster in 1935. A classical analysis of the fission process was published in 1939.
- (xii) Plutonium (also known as Element 94), produced by bombarding U-238 with alpha particles by Glenn Seaborg and colleagues in 1940.

With the discovery of x-rays, scientific journals began reporting the adverse effects from high exposure to such rays.

The research and development of nuclear elements led to further key discoveries. The atomic fission was a result of experiments by various scientists and experts conducted from the years 1938 – 39. Subsequently, working under the guidance of Neils Bohr, Lise Meitner and Otto Robert Frisch explained the process as the splitting of a nucleus into two unequal parts, as a result of neutrons being captured by the nucleus which leads to a 200 million electron volts of energy and release of additional neutrons, which could lead to a self-sustaining chain reaction causing fission in other

uranium nuclei and releasing a vast amount of energy (World Nuclear Association Library: Outline History of Nuclear Energy, 2020). The development of the atomic bomb was a result of the self-sustaining release of energy produced by the critical mass of uranium. This was later developed as a theory of chain reactions in a uranium water mixture with water to slow down the neutrons through neutron absorbing technique and limit the multiplication of neutrons to control nuclear reactions. This theory was an essential contribution to the understanding and evolution of the atomic bomb.

Earlier, radium separated from nuclear fission came to be actively used for medical treatment and destroy bacteria in food. In 1942 the focus of military shifted to building rockets while long lasting power sources were developed for submarines. Several studies and experiments by researchers like Otto Hahn, Lise Meitner, Enrico Fermi, and J Robert Oppenheimer eventually led to the development of the first nuclear weapon by the USA in 1945.

The first atomic device successfully tested at Alamogordo in New Mexico on 16th July 1945 where plutonium was used in a nuclear pile XX3. Meanwhile, UK's first nuclear reactor was built at the Atomic Energy Research Establishment (AERE), Harwell to demonstrate the viability of commercial power reactors. The simpler device consisting of U-235 was not considered for testing and was directly dropped on Hiroshima, Japan on 6th August 1945 (Wikipedia; Atomic Bombings of Hiroshima and Nagasaki, 2021). The second bomb, containing Pu-239, was dropped on Nagasaki, Japan on 9th August 1945 (Wikipedia; Atomic Bombings of Hiroshima and Nagasaki, 2021) followed by the USSR declaring war on Japan and finally resulting in the surrender of Japan on 10th August 1945 (Marcum, Wade & Spinard, Bernard I, 2019). The usage of nuclear energy shifted from

individual to military purposes highlighting the need for regulation for peaceful use.

The possibility of nuclear fission chain reactions generating energy was recognized by Heisenberg (Touran, Nick, 2013). However, in December 1951 that the USA ushered in the era of electricity generated by nuclear energy using the Experimental Breeder Reactor (EBR-1) located in Idaho, USA. The Argonne National Laboratory designed the EBR-1 and was responsible for operating it. The chain reactors produce energy when slowed down and lead to explosions when uncontrolled. Use of natural uranium in uranium machines with heavy water moderators was suggested by researchers, who probably failed to consider the delayed neutrons, which would enable control over the reactor.

With the advance and development of technology in this sector the usage of nuclear energy diversified and grew. In this regard, the Author seeks to analyze the potential of nuclear energy as a source of zero emission energy producer and the challenges surrounding it.

3.2 DEVELOPMENT OF NUCLEAR REACTORS

Nuclear reactors are units that house nuclear chain reactions to release energy at a controlled rate through nuclear fission, a process of generating heat through splitting of atoms (Office of Nuclear Energy, US, 2021). Energy thus released from continuous reactions is harnessed to heat either gas or water to get steam which is in turn used to run turbines to generate electricity. This principle of producing electricity from nuclear energy is common to most nuclear reactors. Historically, the first nuclear reactor operated naturally almost 2 billion years ago when reactions occurred in natural bodies rich in uranium deposits which were then moderated by percolating rainwater. The first natural nuclear reactor is at Oklo in West

Africa with 17 reactor sites, each less than 100KW thermal which together consumed about six tonnes of uranium (World Nuclear Association Library: Nuclear Power Reactors, 2021).

Man-made nuclear reactors were initially based on designs that were originally developed for navy ships and propelling submarines accounting for 85% of the total nuclear electricity produced around the world (World Nuclear Association Library: Advanced Nuclear Power Reactors, 2021). At present the most common and widely constructed reactors are the Pressurized Water Reactors (PWR) followed by the Boiling Water Reactor (BWR) both of which are light water reactors.

3.3 COMPONENTS OF A NUCLEAR REACTOR

The following are the components common to most nuclear reactors:

(i) Fuel

The basic and most important component in a nuclear reactor is uranium. Uranium Oxide (UO_2) fuel rods are used collectively forming an assembly in the core of the reactor. These fuel rods are made up of UO_2 pellets arranged in tubes. In addition, particularly in new reactors, neutrons are used to keep up a continued reaction. However, this is not required if the reactor is run with used fuel, which already has enough neutrons to allow the reaction to achieve the desired state when control rods are removed.

(ii) Moderator

A moderator is the material in the core of the reactor that regulates the speed of the neutrons. It slows down the neutrons when they are released from fission and also facilitates multiple fission reactions needed for generation of electricity. It is one of the most important components of a nuclear reactor and water is generally used as a

moderator. Occasionally heavy water or graphite is used as an alternative to water.

(iii) Control Rods or Blades

Control Rods or Blades are used to control the flow of neutrons as and when required. They are made up of neutron-absorbing material such as cadmium, boron etc. Nuclear reactors are run by the process of fission wherein neutrons are released immediately. However, on occasion this release is sometimes delayed, and prompt released is essential to achieve criticality in the reactor system and to enable chain reactions. Control rods or blades are inserted or withdrawn as required to attain this criticality. Some PWR reactors require special control rods or blades to maintain a low level of power efficiently. An alternative control system also exists wherein neutron absorbers like boron are used as a coolant in the core of the reactor.

(iv) Coolant

Coolants are fluids circulated in the core of the reactor to draw out the heat from it. The primary coolant is water which is used as a moderator. A secondary coolant system also exists where the water becomes steam.

(v) Pressure Vessels or Pressure Tubes

A strong, sturdy vessel which contains the core and moderator and/or coolant is called the pressure vessel. It may be in the form of a series of pressure tubes which hold the fuel around which a coolant is provided through the moderator.

(vi) Steam Generator

The coolant or moderator is used to turn the heat from the high-pressure primary circuit to steam for the turbine generators in the second circuit. This is a part of the cooling system of PWR and PHWR understood as a “heat exchanger” and similar to a motor car radiator, it transfers the heat from one fluid to another. In nuclear reactors a steam generator can be said to be a large heat exchanger.

(vii) Containment

A containment is a robust meter-thick structure made of concrete and steel that ensures that the nuclear reactors are contained in an area and are cut off from the outside world. It is designed with a dual purpose, viz., to prevent outside intrusion and to protect the surroundings from the potential damage associated with radioactive rays and accidental risks.

(viii) Fueling a Nuclear Reactor

All reactors need to be refueled at intervals of 12, 18 and 24 months when a quarter to a third of the fuel assembly is replaced. Usually, reactors are required to be shut down for the purpose of fueling so that the reactor vessel can be opened. However, there are some reactors that can be refueled without being shut down.

3.4 TYPES OF NUCLEAR REACTORS

(i) Pressurized Water Reactor (PWR)

The most found nuclear reactor is the PWR and at present there are about 300 in operation for power generation. Additionally, hundreds are used for naval propulsion. They are light water reactors that use ordinary water both as a coolant and as a moderator. The design provides for a primary cooling circuit for the flow through the core under high pressure and a secondary circuit to vaporize water as is seen in the illustration below. These reactors are known as VVER type reactors in Russia (Meshik, Alex P., 2009).

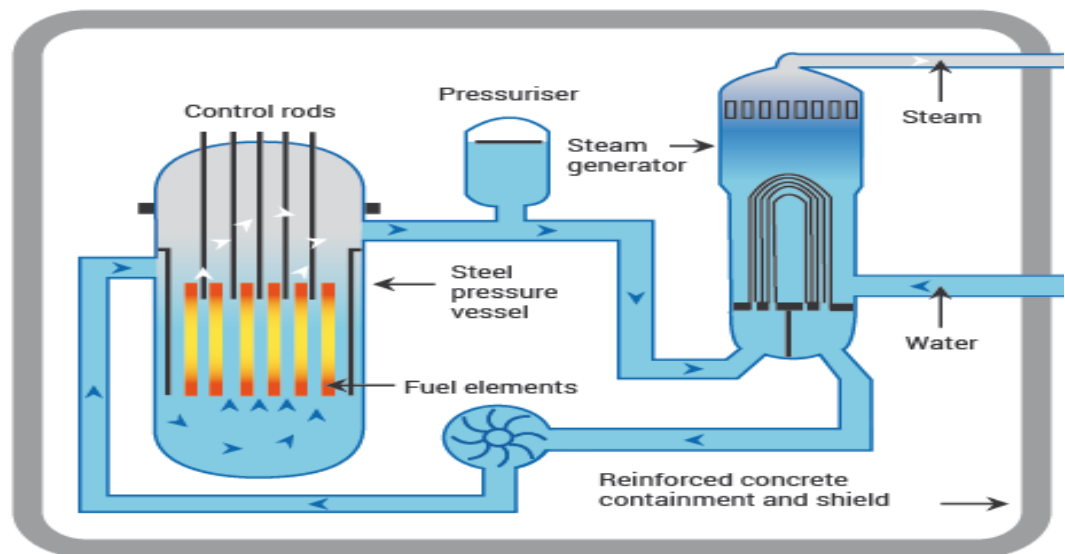


Diagram A-(2.4)

(ii) Boiling Water Reactor (BWR)

The BWR is similar in concept to the PWR with one major difference, i.e., it has a single circuit in which the water is kept at a lower pressure to enable it to boil in the core at about 285°C . About 12 – 15% of the water remains at the top part of the core in the form of steam allowing the reactor to operate with less moderation and more efficiency. This type of reactor can operate much easier in a load-following mode than the PWRs. They have steam separators or

dryer plates through which steam passes above the core to reach the turbines which are also part of the reactor circuit as illustrated below. The turbines are shielded with radioactive protection. The secondary control system restricts the flow of water passing through the core so that there is more steam at the top and minimal moderation. The cost of maintenance of the BWR is high; however, this is compensated by simplicity in design that saves costs.

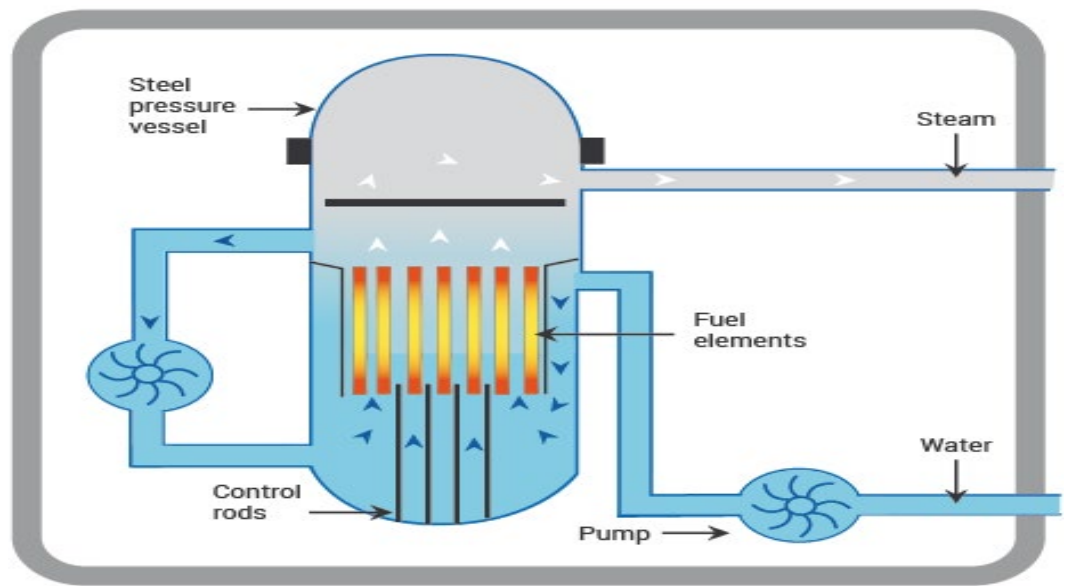


Diagram B – (2.4)

(iii) **Pressurized Heavy Water Reactor (PHWR)**

The PHWR was first developed as CANDU in Canada in the 1950s. The PHWR operates with natural uranium oxide as fuel which requires a heavy water moderator. This reactor produces more energy per kilogram of mined uranium than any other design. On the flip side it leaves more used fuel per unit of output. This reactor system is focused on enriching the moderator, i.e., water rather than the fuel for a cost trade off. Also, the pressure tube design (illustrated below) enables refueling without shutting down the reactor as the individual tubes can be isolated from the cooling

circuit. This is convenient and cost-effective though the durability of the tubes has been debated.

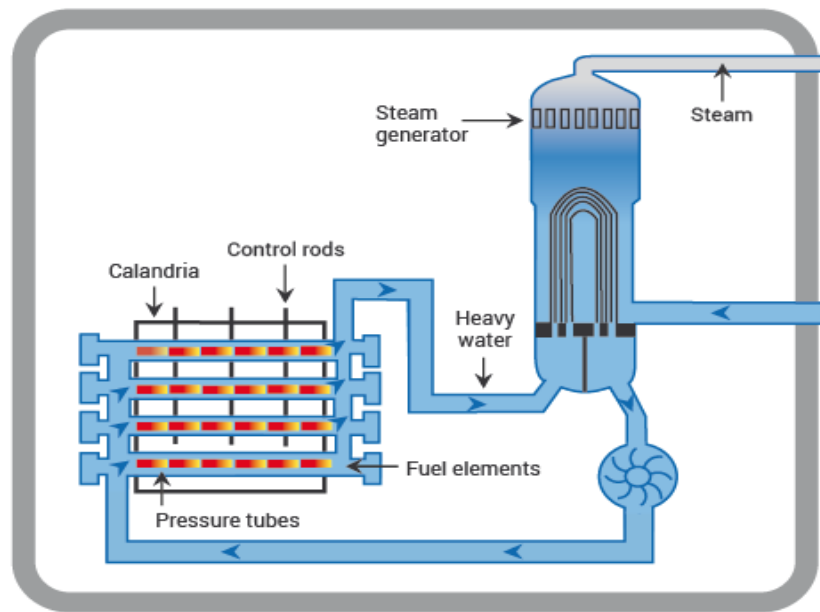


Diagram C – (2.4)

(iv) **Advanced Gas-Cooled Reactor (AGR)**

AGRs, as depicted below, are second generation of British reactors using graphite as the moderator and carbon dioxide as the primary coolant. It has an integral design with a steel and concrete vessel to hold and contain the circulating carbon dioxide through the steam generator tubes outside the core after reaching a temperature of 650°C . It has a high thermal efficiency due to the high temperatures and refueling is possible on-load.

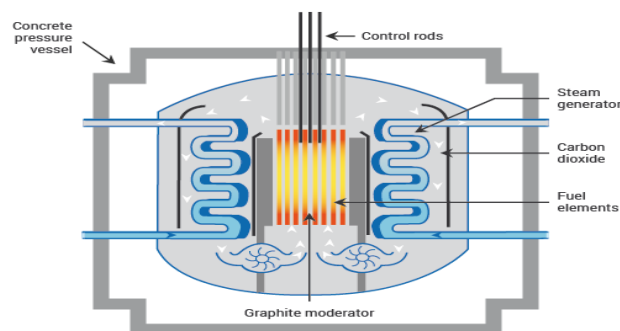


Diagram D – (2.4)

(v) **Light Water Graphite Moderated Reactor (LWGR)**

The LWGR is a Soviet design (RBMK) which was developed from plutonium producing reactors. It is run by graphite moderators employed with vertical pressure tubes and cooled by water and is similar to the BWR/ The graphite moderator is fixed leading to moderations which, accompanied by excessive boiling of water, reduces the cooling and neutron absorption, failing to inhibit the fission reaction. This may lead to a positive feedback problem and therefore these reactors were never built outside of the Soviet Union.

(vi) **Fast Neutron Reactor (FNR)**

The FNRs are reactors that operate without any moderators and utilize fast neutrons instead which in turn generate power from plutonium. Though these reactors get more than 60 times the energy from the original uranium as compared to other reactors they are expensive to build. They are likely to develop more in the coming years and it is anticipated that major reactors shall be following the FNR design. When FBRs are configured or designed in a manner to produce fissile material, i.e., plutonium, more than they consume they are referred to as Fast Breeder Reactors (FBR).

(vii) **Small and Medium Modular Reactors (SMR)**

The SMR technology dates back to the 1940's when the U.S. armed forces started research to develop various types of small reactors. These are nuclear reactors that produce 300 Mwe or less of energy as compared to the more than 1600 Mwe that modern nuclear power plants can produce (Hill, Richard, Sabharwal, KC Dipen, McDougall, KC, Andrew de Lothinere, Odtanski, Kristen & Stehlik, Vit, 2021). SMRs are an alternative that meets the need for flexible power generation for a large spectrum of users and applications.

They are deployable either as a single or multi-module plant and can be combined with alternative energy sources, including renewables (Ramana, M. V, 2015). SMRs can produce a large amount of low-carbon electricity and are widely understood as follows: (International Atomic Energy Agency: What are small modular reactors): -

“Small – physically a fraction of the size of a conventional nuclear power reactor.

Modular – making it possible for systems and components to be factory-assembled and transported as a unit to a location for installation.

Reactors – harnessing nuclear fission to generate heat to produce energy.”

(viii) **Advanced Reactors**

Reactor designs are commonly distinguished on the basis of generations. The last of the Generation I reactors (Wylfa I in UK) was shut down by the end of 2015. These reactors used uranium as fuel and graphite as the moderator. The Generation II reactors, on the other hand, used enriched uranium as fuel and water as coolant or moderator. These are in operation in different parts of the world and a good example is the present US fleet. Reactors that evolved from these were advanced reactors and are known as the Generation III reactors. These are under development in Japan, China, Russia, and the UAE and are basically the Generation II reactors with enhanced safety features. Going beyond the Generation III reactors are the Generation IV designs which tend to have closed fuel cycles that burn the actinides from the spent fuel to ensure that the fission produces only high-level waste. International collaborations are

working on seven designs of which at about five will be FNRs while two will be gas-cooled reactors.

3.5 POWER RATING OF A NUCLEAR REACTOR

The power rating of a nuclear power plant is quoted in the following three ways:

- (a) Thermal MWt – is based on design of the nuclear reactor and represents the quantity and quality of the steam it produces;
- (b) Gross Electrical Mwe – indicates the power generated from the attached steam turbine and generator. This also takes into account the ambient temperature for the condenser circuit where cooler means more electric power and warmer means less and, in both cases, rated gross power assumes certain conditions.
- (c) Net Electrical Mwe – indicates the power available to be sent out to the grid after deducting the electrical power required to run the reactor and the rest of the plant.

The relationship between these can be expressed in two ways:

- The percentage of thermal efficiency is the ratio of Gross Mwe to MWt. This relates to the difference in temperature between the steam from the reactor and the cooling water which is generally 33 – 37% in light water reactors and has reached 38% in newly developed PWRs.
- Net efficiency percentage, which is the ratio of net Mwe to MWt. This is slightly lower and allows for plant usage.

For the purpose of information, figures, items and news by the World Nuclear Association and the World Nuclear News, net Mwe is generally used for operational plants and gross Mwe is for those under construction or in the planning stage.

3.6 JOINT INITIATIVES AND COLLABORATIONS

Three significant international initiatives have been launched to define future reactor and fuel cycle technologies, all of which are looking to improve reactors. The U.S. Nuclear Regulatory Commission (NRC) and the French Nuclear Safety Authority (ASN) created the Multinational Design Evaluation Program (MDEP) in 2006 to develop novel techniques to leveraging resources and experience of national regulatory authorities examining new reactor designs. It is led by the OECD Nuclear Energy Agency and includes the International Atomic Energy Agency (IAEA). The ultimate goal of the MDEP is to create a set of international regulatory guidelines for the design of Generation IV reactors. The NRC has suggested a three-stage approach for new reactor designs, including Generation IV reactors, culminating in a worldwide design certification. So far, twelve countries have joined the MDEP, viz., Canada, China, Finland, France, India, Japan, Korea, Russia, South Africa, Sweden, the United Kingdom, and the United States of America. The UAE is an associate member and others who are likely to join are those countries that have or are planning firm commitments to build nuclear plants.

The MDEP brings together the resources of its member nuclear regulatory agencies to:

- collaborate on safety studies of nuclear reactor designs that are under construction and undergoing licensing in multiple countries; and
- investigate prospects and potential for regulatory harmonization.
- generate reports and advisory documents that are disseminated internationally outside of the MDEP membership.

The Generation IV International Forum (GIF), founded in 2001 by the United States, has identified six reactor ideas for further study with a goal of commercial deployment by 2030.

The International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO) of the International Atomic Energy Agency (IAEA) is geared at developing country specific requirements and initially included Russia rather than the United States, though the latter has since joined. It is presently supported by the IAEA's budget.

On a commercial basis, three significant Western-Japanese alliances had been established in the global reactor supply industry by the end of 2006, and another has emerged since then.

3.7 LIFECYCLE OF NUCLEAR REACTORS

Many of today's nuclear power reactors were built with a 30 to 40-year operating life in mind. However, by making significant expenditures in systems, structures, and components, operating lifetimes can be prolonged, and there are ongoing programs to do so in various nations. Approximately all the nearly 100 reactors in the United States have had their operational licenses extended from 40 to 60 years. This justifies large capital investments in modernizing systems and components, as well as the inclusion of additional performance margins. Some of them will last for even 80 years or longer. Some parts simply wear out, corrode, or degrade to a point where they are no longer useful and are required to be replaced. Steam generators are the most common and expensive of them, and many have been replaced after roughly 30 years while the reactor could potentially last for 60 years or more. This is primarily a financial decision. Smaller components are easier to repair or replace as they wear out. Pressure tube

replacement has been carried out on several CANDU reactors after around 30 years of operation.

The issue of obsolescence is a second concern. Older reactors, for example, use analogue instruments and control systems which are now being replaced by digital systems.

Thirdly, characteristics of materials can deteriorate over time, particularly of those exposed to heat and neutrons. To maintain reliability and safety, investment is required in all these areas. In addition, older plants undergo periodic safety reviews in accordance with international safety conventions and standards to guarantee that safety margins are maintained.

A key challenge is knowledge management for reactors and other facilities over their entire lifecycle, from design to building, operation, and decommissioning. This might last a century, span many nations, and involve a succession of businesses. To allow engineers to be able to work on the plant for future generations data must be made transferrable across multiple generations of software and IT systems, as well as shared with other plant operators. Added to which, over the life of the plant, significant changes may be made to the design, thus initial documentation is insufficient, and the loss of design base knowledge might have serious consequences (e.g., Pickering A and Bruce A in Ontario). Knowledge management is frequently a shared duty and is critical for successful decision-making, plant safety, and profitability. ISO15926 is a lifecycle open data standard that addresses portability and interoperability. Advanced Nuclear Technology: New Nuclear Power Plant Information Handover Guide was also released by EPRI in 2013.

PART II – DEVELOPMENT OF NUCLEAR LAW

3.8 DEVELOPMENT OF NUCLEAR LAW AROUND THE WORLD

As the World experienced its first World War, several countries proposed restrictions for the exposure of its workers to radiation. It was the beginning of the legislation to control radioactive materials and their effects, when, in 1925, the first International Congress of Radiology, held in London, considered the need for a Protection Committee, which was subsequently established in 1928 at the second Congress at Stockholm (Clarke, Roger & Valentin, Jack, 2005). Several national and international conferences and organizations followed in line, after the first International Conference on the Peaceful Uses of Atomic Energy held in Geneva in September 1955. This Conference was a vital step in the development of nuclear law. The statute of the International Atomic Energy Agency was adopted at an international conference in New York on 23rd October 1956. In July of the same year the Council of the Organization for European Economic Cooperation (OEEC), now OECD, established the Steering Committee for Nuclear Energy and charged it with setting up the European Nuclear Energy Agency (ENEA).

The European Nuclear Energy Agency consists of 18 Western European Members and 3 Associate Members (i.e., China, Japan and the United States). It has played a significant role in the creation of joint undertakings. The first was the European Company for the Chemical Processing of Irradiated Fuels (EUROCHEMIC) at Mol, Belgium. Later other international projects, such as, the Halden Experimental Boiling Water Reactor in Norway, the Dragon Reactor Project at Winfrith, UK, the Seibersdorf Food Irradiation Project in Austria, the Nuclear Data Compilation Center at Saclay, France and the ENEA Computer Program Library at Ispra, Italy were set up and executed.

One finds that a new section of nuclear law has evolved from the range of techniques used in the formation of such joint projects and through the concepts developed in their administration and those relating to the use of information derived from their operation. ENEA also has its own safeguard system, and the European Nuclear Energy Tribunal is set up to decide disputes arising out of its application. ENEA has caused its member states to adopt legislation by which premiums paid on nuclear insurance received a certain preferential tax treatment to enable insurance companies to build up their reserves at a faster pace. This demonstrated how law can contribute to the promotion of a nuclear economy.

The European Atomic Energy Community (EURATOM) was established by the Treaty of Rome on 25th March 1957 and became operative on 1st January 1958. It is a supra-national organization and has certain legislative powers, in particular in the field of health and safety. The Treaty provides for a central supply agency, thereby creating a monopoly of all fissionable materials produced in or imported into the Community. Its control functions are linked to this ownership. Further, it set up the Common Enterprises, which have certain obligations to the Community, but also enjoy certain privileges, amongst them tax benefits, which they could not enjoy under national laws. A particular activity of the Community is the exchange of information, even including secret patents.

The International Atomic Energy Agency (IAEA), founded in 1957, was envisaged as a means to guarantee adequate and equal supply of nuclear material to member states and as an instrument to safeguard the peaceful uses of nuclear power. The first objective lost its importance when it was discovered that the sources of uranium were in abundance. Nevertheless, by fostering assistance projects and by developing standards for health and

safety norms, the Agency contributed to the development of nuclear energy in its member states and to the development of nuclear law. The Treaty on the non-proliferation of nuclear weapons was an answer to the concerns of the 1960's about the increase in the number of countries with nuclear weapon capabilities. The development of international instruments focuses on nuclear safety and emergency response and assistance. International nuclear law will continue to evolve for facilitating technological development, promoting international relations, domestic politics and for guiding the course of enhancing positive utilization of nuclear energy. International nuclear law has been developed under the auspices of the IAEA. It has been instrumental in creating many treaties and conventions, as well as regional initiatives or protocols, catering to nuclear safety, security, and liability.

3.8.1 POST WW – II -DEVELOPMENT OF THE NUCLEAR INDUSTRY

The consequences of the nuclear devastation at Hiroshima and Nagasaki in 1945 had greatly inspired India's nuclear policy. In the face of the Cold War, with the USA and USSR trying to negotiate with the whole World to come to terms with a policy of arms control, India too had to define its nuclear policies in relation to the possible framework of disarmament being decided by the two superpowers. The American philanthropist and political consultant, Bernard Baruch, had presented his plan before the United Nations Atomic Energy Commission (UNAEC) in 1946, which initiated the establishment of the International Atomic Development Authority (IADA) and recommended absolute control and regulation of all atomic activities worldwide. Soon after India got its independence, the Interim Government of India, in 1948, enacted the Atomic Energy Act, 1948. The Act provided for the development and

control of atomic energy and for connected purposes where inter-alia the Central Government would take control of any industry connected with the production or use of atomic energy, including control of mining of any mineral(s) that may be used for the production or use or research of atomic energy (Acts of Parliament, 1948). The IADA would facilitate research of peaceful and constructive use of atomic energy and nuclear activity that was not dangerous would be done under license and inspection. India had not accepted the whole of the Baruch plans and Mrs. Vijaylaxmi Pandit, the Indian delegate to the United Nations General Assembly (UNGA) put forth the part of the proposal that India was agreeing to accept. India was completely against the international ownership of raw materials like uranium etc. However, it could consider the ownership of non-fissile raw materials like oil, for preventing the exploitation of national interest. India's nuclear policy was to be without adjustments and not taking any sides during the Cold War (Banerjee, Shoronoya, 2020). This was followed by the establishment of India's Atomic Energy Commission (AEC), which would determine accumulation of atomic minerals and train scientists to carry out improved research related to nuclear power and energy. In the wake of developments in the field of nuclear energy for weapons, new technologies were adopted majorly by the Soviet Union and the West. The technologies did not appear to be limited to the development of weapons only and scientists recognized the use of heat produced could be tapped for direct use or to generate electricity.

3.8.2 POST WW – II – DEVELOPMENT OF THE NUCLEAR INDUSTRY IN USA AND THE USSR

Post the second World War, the Government of the United States of America proactively supported the development of a civil nuclear program. In 1946, the U.S. Congress formed the Atomic Energy Commission (AEC). An Experimental Breeder Reactor I was constructed at Idaho under the aegis of the AEC. On 20th December 1951, electricity was generated for the first time making it a landmark occasion. In the mid-1950's the main intention of research in this field was to showcase to the world that electricity for commercial use could be generated using nuclear energy (United States Department of Energy, 1995). The first commercial electricity generation plant powered by nuclear energy was located at Shippingport, Pennsylvania. It reached its full design power capacity in 1957. Light-water reactors like in Shippingport use ordinary water to cool the core of the reactor during the chain reaction. This was the best design available at that time for nuclear power plants. Private industry became more and more involved in developing light-water reactors after Shippingport became operational.

The US Congress enacted the Atomic Energy Act of 1946 under the aegis of which the AEC was established. It also initiated the development of compact power sources that were long-lasting, and which could be used for shipping, especially in submarines (World Nuclear Association Library, November 2020). The small Experimental Breeder Reactor (EBR-I), Idaho, USA was designed and operated by the Argonne National Laboratory and was the first nuclear reactor to produce electricity. The year 1953 saw significant research and development efforts made towards nuclear power

technology in the USA. President Eisenhower proposed the “*Atoms for Peace*” program to enable civil nuclear energy development. On the other hand, work in the Soviet Union was underway at most centers be it refining existing reactor designs or developing new ones. The development was accelerated with the establishment of The Institute of Physics and Power Engineering (IPPE) in May 1946 at the then closed city of Obninsk, located 100 kms southwest of Moscow. The IPPE gave space for new operations, it modified the existing graphite moderated channel type plutonium production reactor for energy generation and delivered the World’s first nuclear powered electricity generator in June 1954.

In 1964 the first two Soviet nuclear plants were commissioned. The first being a 100 MW boiling water graphite channel reactor in Beloyarsk in the Urals and the second located at Novovoronezh in the Volga region. This was a small new design 210 MW (PWR) known as the VVER (veda-vodyanoienergetichesky reactor or water-cooled power reactor). Another reactor, graphite moderated and water cooled, was the AM-I (Atom Mirny – peaceful atom) Reactor with a design thermal capacity of 30 MW and a total electrical capacity of 6 MW. It was governed by the simple principle of the plutonium production reactors serving as a model for other graphite channel reactor designs, including the RBMK-1000 Reactors (Reaktor Bolshoy Moshchnosti Kanalnyy or high-power channel type reactor) in Chernobyl. AM-I was an active research facility for production of electricity till 1959 and for production of isotopes until the year 2000.

The USA was the first to design a fully commercial PWR of 250 MW at the Yankee Rowe Nuclear Power Station at Rowe, Western

Massachusetts. It was set up in 1960 and was operational from 1961 until 1992. Simultaneously, developments for establishing the boiling water reactor (BWR) were made in the Argonne National Laboratory. The first BWR was the 192 MWe Dresden-I Unit, designed by General Electric and set up in 1960. The first privately owned and operated nuclear reactor – the Vallecitos Boiling Water Reactor (VBWR) at Alameda County, California – was a combined effort of General Electric and the Pacific Gas and Electric Company. It remained operational from 1957 to 1963 and during this period generated about 40,000 MWh of electricity. After 1960, focus shifted to PWR and BWR with capacities of more than 1000 MW.

3.8.3 POST WW – II – DEVELOPMENT OF THE NUCLEAR INDUSTRY IN CANADA, FRANCE, AND KAZAKHSTAN

Nuclear power generation in Canada can trace its origins as far back as 1942 when the Montreal Laboratory (a British-Canadian venture) was set up under the National Research Council of Canada. It was tasked with developing a design for a heavy water nuclear reactor. This was called the National Research Experimental Reactor (NRX) and on completion would be the most powerful research reactor in the world. The Canadian Government incorporated the Atomic Energy of Canada Limited (AECL) in 1952. Canada went through a different route with the use of natural uranium fuel and heavy water as a moderator and coolant. The Canada Deuterium Uranium (CANDU) Reactor was the first such unit established in 1962, the design of which, still continues to be refined.

While France stepped in the field with its first reactor set up in 1956 which had a gas-graphite design similar to Magnox (a reactor that was designed to run on natural uranium with graphite as the

moderator and carbon dioxide as the coolant). It was followed by commercial models operating from 1959 onwards riding on a cost-effective, three successive generations strategy of standardized PWRs.

Kazakhstan has 12% of the World's uranium reserves. Its fast breeder reactor was made operational in 1972 in Aktau (MAEK-Kazatomprom) and ran through till 1999. The BN-350 with a design capacity of 135 MW produced electricity and heat to desalinate water from the Caspian Sea. In July 2006 Kazakhstan signed three nuclear joint venture agreements with Russia for new nuclear reactors, uranium production and enrichment. The first JV is for developing and marketing small and medium size reactors, the second is to set up a small uranium enrichment plant and the third is for uranium exploration and mining. In 2011 this integrated cooperation program was extended to cover uranium exploration and a feasibility study for a nuclear power plant in Kazakhstan. By the end of 2014 agreements were signed for construction of the plant using VVER reactors with a capacity of up to 1200 Mwe, fuel fabrication and nuclear waste management. Kazakhstan entered into a Comprehensive Development Program for Russia-Kazakhstan Cooperation in Peaceful Uses of Atomic Energy covering all matters related to nuclear power and fuel cycles.

3.8.4 INTERIM PERIOD OF SLOW DOWN AROUND THE WORLD

A decline in the nuclear power industry was witnessed in the late 1970's, the slowdown lasting till around 2002. This led to a period of stagnation in the industry. Even though new reactors were ordered and manufactured in the 1980's they were only a little more

in number than the reactors that were being retired. The share of nuclear power in world electricity from the mid-1980's was fairly constant and hovered around 16 – 17%. The seventies also saw the failure of completion of many reactors and consequent cancellation of orders. Gradually a drop in the uranium prices was experienced as a result of an increase in secondary supplies which led to various oil companies opting out of the race and a subsequent consolidation of uranium producers.

The first of the 3rd generation reactors was commissioned towards the end of the 1990's in Japan. The Kashiwazaki-Kariwa 6 was an advanced BWR with a 1350 MW capacity. These new reactors came to be seen as the oxygen needed to revive the gasping nuclear power industry. A major factor affecting the nuclear industry was the projected increase in demand for electricity worldwide, particularly in developing nations. However, with this was also the need for awareness of a affordable energy security as the prime requirement for countries in order to assure access to affordable energy to meet all energy demands. Consequently, the need to match the inevitable increase in energy demand gives rise to the need to limit carbon emissions to safeguard climate change concerns.

The prerequisites to meet the climate change needs as well as the energy demands coincided with the advent of the nuclear power reactors of the new generation. Finland ordered the first of the late 3rd generation units in 2004, which was a 1600 MW European PWR (EPR). Similar units were under construction in France and by the USA (Westinghouse AP 1000 units). However, developments in Europe and North America were limited as compared to plans being formulated in Asia, particularly in China and India. China was

taking a strong approach and was well on its way to building abundant nuclear power capacity by 2030. It proposed more than 100 large units supported by credible political determination, based largely on the adaptations of Western designs.

The historical background of the nuclear power industry can, therefore, be seen to date back to the early experiments and research and development of technologies in Europe which then further evolved in USA and USSR. The technological and economic strength of the former strengthened the nuclear industry followed by contributions by East Asia. The long-drawn efforts and developments have resulted in the accumulation of over 17,000 reactor-years of operations which is now said to provide a significant proportion of the World's electricity (World Nuclear Association Library, November 2020).

PART III – CRITICAL ANALYSIS OF NUCLEAR LAW IN INDIA

3.9 UNDERSTANDING THE ENERGY DEFICIT IN INDIA

Energy amounts to the largest portion of greenhouse gas emissions and thus, the production and use of energy has a massive impact on the climate change scenario. As a leading cause of climate change, the energy sector demands immediate and robust changes to comply with the global climate vision. However, the challenges of a growing energy deficit have obscured this vision. India, though well aware of the climate and energy crisis that awaits us, initially prioritized only social and economic goals as it was not obligated to contain carbon emissions, as a signatory to the UNFCCC, the parent treaty of the Paris Agreement, 2015. It also had bigger concerns involving massive poverty, widespread unemployment, scarcity of resources to meet rising demands amongst others. However, amidst a rapid population growth reaching 1.43 billion (World Bank, 2023) and being the third largest consumer of electricity (International Energy Agency, 2021), the energy sector of India demands an immediate transition towards a low carbon source of energy generation (International Energy Agency, 2019). This is also the need of the hour as the power sector accounts for nearly two-thirds of emissions, which has been more or less stable through the years, even while the overall emissions continue to increase (Nuclear Energy Agency, 2015). The greenhouse gas emissions through power generation primarily include nitrous oxide (N₂O), methane (CH₄) and carbon dioxide (CO₂) out of which the carbon dioxide accounts for nearly 70% of the greenhouse gas emissions (Nuclear Energy Agency, 2015). Other gases, such as hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆) account for less than 2% of the total at present, their emissions are, however, growing rapidly. CO₂ as a greenhouse gas emission is a result of fossil fuel combustion, mainly through coal, oil

and natural gas during the process of power generation. Coal leads to the highest amount of CO₂ emissions followed by oil and then natural gas making the task of shifting to a zero-carbon scenario difficult and inescapable. Global energy related CO₂ emissions rose by 1.70% to a historic high of 33.1 GW CO₂ in 2019 (International Energy Agency, 2021). The data over the years varies for different nations but an overall upward trend is clear. While China, India and the United States accounted for 85% of the net increase in CO₂ emissions other countries, viz., Germany, Japan, Mexico, France, and the United Kingdom showed a decline in emissions (International Energy Agency, 2019).

The Paris Agreement marked a turning point in the road towards mitigating greenhouse gases. The issues of population growth, need for modernization and development of economies to secure financial well-being continue to increase global energy demands and pose a substantial risk to sustainable development. The burning of fossil fuels and the decimation of forests to meet the demands of the energy sector not only promotes depletion of energy resources but also endangers the atmosphere with the influx of enormous amounts of greenhouse gases at an unprecedented growth rate. The energy sector, being dominated by non-renewable sources such as coal, oil and natural gas acts as the primary cause of climate change and there is a grave need to shift towards renewable and nuclear energy sources.

The requirement to submit and adapt to the Nationally Determined Contributions under the Paris Agreement made India commit to for major goals to reduce emissions, which can be achieved only through a transition from coal-based generation of electricity to a cleaner and carbon-free energy from nuclear power. The United Nations 26th Conference of Parties held in Glasgow in November 2021 where India put forward the concerns of developing countries. It also presented the five elements of India's

climate actions which included achieving a target of net zero emissions by 2070. In February 2022, Mr. Ashwini Kumar Choubey, Minister for State for Environment, Forest and Climate Change informed the Rajya Sabha that it was highlighted at the Conference that transfer of climate finance and low-cost climate technologies have become vital for implementation of climate actions by developing countries. India's stand was that the World needs mindful and deliberate utilization, instead of mindless and destructive consumption (Government of India, Ministry of Environment, Forest & Climate Change, 2022).

The failure to achieve the desired results despite of having coping mechanisms in place highlights the need to stimulate the roadmap to combat climate change especially for a major carbon emitter and a developing nation like India. At the beginning of the 21st century the global temperature rose above 0.50⁰ C. The global emissions rising rapidly increased by nearly 70% between 1974 and 2004 with there being a 24% increase between 1990 and 2004. This resulted in a 0.74⁰ C increase in global temperatures, (International Energy Agency, 2019) much higher than the 0.60⁰ C projected for the previous 100 years. The warming projected for 2005 – 2025 was calculated to be about 0.20⁰ C per decade with global mean temperature in 2100 to be between 3.70⁰ C to 4.80⁰ C (Intergovernmental Panel on Climate Change, 2014). In 2019 China is estimated to have emitted 27% of the World's greenhouse gases, USA emitted 11% followed by India with 6.6% (United Nations Framework Convention on Climate Change, 2018). The global patterns of greenhouse gases clearly indicate that the benchmark set up by the Paris Agreement is likely to be violated since an approximate rise of 1.0⁰ C of global warming above pre-industrial levels continues.

It is likely that the global temperatures will reach 1.50⁰ C between 2030 and 2052 if no drastic action is taken to control the current rate (Intergovernmental Panel on Climate Change, 2018). Further, the increase in the global surface temperature will in all likelihood exceed 1.50⁰ C by the end of the 21st century as compared to the period between 1850 to 1900 and subsequently it is expected to cross 2.0⁰ C. The global trajectory being inconsistent with the climate goals of containing the global rise in temperature to 1.50⁰ C has been recognized and a warning delivered to nations that a limit to the rise in temperatures can be maintained only through deep and effective reduction in emissions. By-products of this – such as health, food security and economic well-being – were also highlighted by IPCC (Intergovernmental Panel on Climate Change, 2018).

Nuclear energy in India gradually emerged as a source of energy and is now resorted to as a result of fast depleting fossil fuels. Nuclear energy in India took a positive shift after 2008, when the Nuclear Suppliers Group Agreement opened the gates to multi-lateral agreements for sourcing both reactors and fuel from suppliers in other countries. The civil nuclear cooperation agreements came into being with various nations followed by construction of new plants and targets set for nuclear power generation to be achieved in the future. The 2009 target of 60 GW by 2032 was increased to 63 GW in 2010 (World Nuclear Association, 2022). In 2011 more realistic targets of 27,500 MW by 2020 were set and the need to maintain viability and competitiveness in the nuclear sector was reiterated. The Indian Cabinet approved ten 700 Mwe Pressurized Heavy Water Reactors in 2017 to be fully homegrown initiatives with an investment of 700 billion rupees (World Nuclear Association, 2022).

India, with 23 nuclear reactors in operation and 7 nuclear power plants with a total installed capacity of 7480 MW, produced 43 TW of power in 2020 –

21 (IASGyan, 2021). The 12th Five Year Plan for 2012 – 2017 targeted the addition of 94 GWe during the period. It was planned that by 2032 there would be a total installed capacity of 700 GWe of which nuclear energy was to be 63 GWe in order to meet the 7 – 9% GDP growth (World Nuclear Association, 2022). One may describe India's energy policy gradually moving towards being nuclear oriented. Coal, however, remains the major energy source producing almost three quarters of the country's electricity in 2018 – 19 and in the rebound of 2021 (International Energy Agency, 2021). With fossil fuels accounting for 57.9% of the electricity generation and nuclear energy merely at 1.7%, the energy trends in India show clearly serious gaps between the climate goals and the energy policy (Government of India, Ministry of Power, 2021).

The continued dependence on coal has raised issues of severe shortage of coal (Singh, Karunjit, 2021) that has left 108 plants out of a total of 135 with alarmingly low supplies (The New Indian Express, 2021). This will inevitably lead to a worsening power situation and further increase in coal prices. The remedy to the energy crisis lies in renewable sources of energy with a specific focus on nuclear energy to achieve the twin objectives of combating climate change and beating the energy deficit. There has been considerable growth in the nuclear power sector with power plants under construction and multi-lateral agreements in the pipeline. However, the progress of the same is very slow and even though the recognition of the benefits of nuclear energy is evident its adaptation remains very gradual.

The post-2010 Civil Liability for Nuclear Damage Act, 2010 and its lack of applicability vis-à-vis international conventions with respect to introduction of suppliers' liability led to several foreign vendors shying away from investment and the Government's focus shifted back to coal. From 2015 onwards efforts were made for such development in an effort to overcome

challenges of huge investment costs, governmental policies and the time-consuming process of establishing plants, all of which have delayed growth in this sector. In March 2018, the nuclear capacity was switched to about 22.5 GWe to be achieved by 2031 as it was evident that it would be much lower than its earlier target of 63 GWe expected as per the 12th Five Year Plan. Despite numerous efforts nuclear energy still amounts to only a small percentage of the energy sector with the pace of implementation continuing to be excruciatingly slow.

While the nuclear plants construction from 2010 to 2020 was expected to reach new heights the timeline of the whole plan has now been extended. It is expected that the target goal of nuclear capacity as a part of the national energy policy shall be achieved. Further, technical discussions and meetings for the supply of reactor projects and nuclear energy parks as per sanctioned plans are yet to be achieved. India's three stage nuclear power program as envisaged by Homi J Bhabha in the 1950s is still guiding the sector to develop nuclear energy. Stage 1 works with Pressurized Heavy Water Reactors which produce Plutonium-239 as a by-product. This is utilized in the Stage II of Fast Breeder Reactors in the mixed fuel made from Plutonium-239. India remains in the second stage and the Stage III of Thorium Based Reactors based on self-sustaining thorium and uranium is yet to be achieved. Stage III of the program is being shaped through developments in technology and high-end research, largely carried out at the Bhabha Atomic Research Center (BARC) (Dulera, I. V. & Sharma, Avaneesh, 2021). The construction of Fast Breeder Reactors are long term goals which have greatly delayed the implementation of the Thorium Based Reactors. The plan itself is highly subject to technological barriers (Koshy, David, 2018). In the light of developments and as India further progresses the long road to achieve its nuclear plan, it can be said that India is now

realizing the potential of nuclear energy as a tool for combating climate change.

India's priority post-2010 has been social and economic growth. The continued importance given to coal shows the absence of realization of the seriousness of the climatic predicament and reduction of the CO₂ emissions is not at a high priority. In 2014, the then Environment Minister stated India's inability to realize the reductions in CO₂ emissions any time before the next 30 years. The Indian Government failed to set up targets prior to the 21st COP on Climate Change, Paris in 2015. However, India's position with respect to nuclear power where it sees itself as a self-reliant player actively chasing targets gives rise to the possibility of mitigating CO₂ emissions. This was supported when India ratified the Paris Agreement in 2016 followed by commitments to implement the same. India's INDC mission focused on 8 key missions that involved the Action Plan to achieve efficiency in the energy sector through adopting solar, wind and nuclear energy in the non-fossil fuel options and to achieve the target forest cover. The Government also set up a National Adoption Fund in a bid to achieve two of the three commitments and realize positive goals.

India succeeded in reducing emissions intensity by 21% and has a long way to go to reach the 2030 target reduction in intensity of 33 – 35%. Further, it is only 2% short of the target of 40% of non-fossil fuel capacity to be installed. However, India is a long way off the third target of having 2.5 – 3 billion tonnes of carbon dioxide equivalent of forest cover by 2030 and much more efforts are required to achieve this goal.

On the domestic front, India aims to install an ambitious 175 GWe of renewable energy by end of 2022 and 450 GWe by 2030. India already has 90 GWe of renewable energy representing 24% of total installed capacity.

In addition, India has some of the lowest solar tariffs globally, dropping to ₹ 2.36 (\$ 0.03)/kWh and thermal capacity has declined from 70% in 2015 to 60% in 2020. The India Cooling Action Plan at the national level and progressive acts of efficient buildings at the state levels are also instrumental in driving efforts to save energy and reduce heat trapping hydrofluorocarbons (HFCs). The Government implemented the FAME – II Scheme which provides ₹ 10,000 crores (~ \$ 1.4 billion) in moving forward with electric vehicles replacing the existing diesel/ petrol ones. \

The Net Zero by 2050, expected to be adopted by all members states to the Paris Agreement is said to be highly ambitious for India. It is set by IPCC as an extension of the Paris Agreement and aims to restrict the rise in global warming to 1.50° C by 2050 and achieve the pre-industrial levels by 2100 (IPCC, 2021). It is important to understand that the goal is considered ambitious for India despite its commitments to the Paris Agreement. According to the 6th Assessment Report of the IPCC, India has emerged as the fourth largest emitter after China, United States, and the EU (IPCC, 2021). The Report comes as a blow to India's two-fold commitment of reducing carbon emission intensity by 30 – 35% and to achieve 175 GWe of renewable energy by the end of 2022 (Ahluwalia, Montek Singh & Patel, Utkarsh, 2021).

However, India seems positive on achieving the Net Zero target by 2065 – 70 as claimed in a Report authored by Mr. Montek Singh Ahluwalia (Chauhan, Chetan, 2021), who has been named as part of a high-level advisory group formed jointly by the World Bank and the IMF to face the twin challenges of climate change and the pandemic. India's commitment to achieving Net Zero depends on various factors. While arguments are put forth for a phased program of decarbonization over the next three decades and of coal-based power generation, there are no takers for this in the

Government. Opposition to this phasing out of coal program is being based on what is cited as the “country’s development imperatives”.

The current nuclear regime in India reflects a positive approach. With 22 operational reactors having a capacity of 6780 MW and another 9 reactors of a 6700 MW capacity under construction, the Government is seeking to strengthen the nuclear power sector. In 2017 a financial sanction for 12 additional reactors, with an aggregate capacity of 9000 MW, was accorded administrative approval. This will triple India’s capacity by 2031 (GOI, Department of Atomic Energy, 2020). Capital investment is being funded by NPCIL and through budgetary support from the Government with a debt-equity ratio of 70:30. The fact that the nuclear energy sector falls solely under the authority of the Government is often criticized for limited funding and slow implementation. The 2015 Amendment to the AEA, 1962 enables the licensing of NPCIL’s joint ventures for setting up nuclear power projects and comes as a catalyst for domestic investments. The joint ventures by NPCIL formed with the National Thermal Power Corporation Limited (NTPC), Indian Oil Corporation Limited (IOCL) and National Aluminum Company Limited (NALCO) have been set up to establish more power plants.

Further, the present policy of Consolidated Foreign Direct Investment (FDI) keeps atomic energy in the list of prohibited sectors though there is no restriction on FDI in the nuclear industry as far as investment in manufacturing, supplies and other additional facilities to nuclear power plants is concerned. A recent development in 2020 opened the gates to the private sector. The private players are not authorized to operate nuclear power plants; however, the Government has opened up the utilization of nuclear energy for medicinal use, therapeutic use, irradiation for food security and for sterilization (Dixit, Rekha, 2020). The access to nuclear

energy remains limited for the private sector and does not include generation of electricity. Minority participation of the private sector in power generation through nuclear energy is an on-going debate and has been strongly recommended. A policy decision to this effect shall amplify the transition of energy from fossil fuels to a low carbon source. So far, the investment in nuclear energy has been led by the public sector in the forefront and it is time to take advantage of the expertise and potential of the private sector to better align goals and achieve results in line with global trends (Primus Partners, 2021). Though it is evident that India has realized the potential of nuclear energy as an effective tool to combat climate change it still has a long road ahead to achieve desired goals.

3.10 NUCLEAR ENACTMENTS

Introduction of atomic energy in India can be credited to the TIFR, Mumbai where there was a remarkable contribution in this field by Homi J. Bhabha, who is known as the “Father of India’s nuclear program”. He completed his double Tripos in Mechanical Sciences and Mathematics from Cambridge in 1930 and 1932 respectively and by 1935 had received a doctorate in nuclear physics and also in theoretical physics. He returned to India in 1939 and worked at the Indian Institute of Science, Bengaluru under Nobel Laureate Dr. C V Raman. He was recognized internationally after he derived the correct expression for the probability of scattering positrons by electrons, a process that is now called the “Bhabha Scattering”. His work on Compton Scattering, R-Process and on the advancement of nuclear physics is notable. He was the founding director of the AEET, Trombay now re-named in his honor as the BARC. TIFR and BARC (erstwhile AEET), where Bhabha was a director, were the mainstay of development of military usage of nuclear energy in India.

In India, the AEA, 1948, initiated the legal structure and the DAE that was formed in 1954 marked the inception of research and growth of nuclear energy as well of industrial activities required to acquire nuclear fuel. The 1948 Act visualized the formation of an AEC. The Act of 1948 was replaced in 1962. This Act basically made provision for the “*development, control and use of atomic energy for the welfare of the people of India and for other peaceful purposes and for matters connected therewith*” (Acts of Parliament, 1962). The current stage of India’s self-reliant stand is a result of years of development characterized by a wide range of technology. BARC (erstwhile AEET) initiated plans for building various reactors. The Indian AEC is the main policy making body and NPCIL has the mandate for all aspects of the plants including design, construction, commissioning, and operation. Keeping in view the provisions of the AAEA, 2015, NPCIL aims to involve other public undertakings in joint ventures (Acts of Parliament, 1962). However, the amendment still does not extend this privilege to the private sector.

Laws in India governing atomic energy have shaped over the years largely depending on need and requirement of the energy sector. The sector is governed by the Atomic Energy Regulatory Board, a body with rigorous security and regulatory measures and a system for multi-tier reviewing of all projects related to nuclear power.

Under the umbrella of IAEA and OECD, several treaties and legal instruments have come into existence. Further, laws in conformity with the global standards have been devised as per India’s commitment to the global protocols on nuclear safety and liability. The genesis of the law lies in the ‘no harm norm’, the ‘polluter pays principle’ and accountability of the State. This is backed by the Constitutional provisions. Article 51 of the Constitution, inspired by The Havana Declaration of 30-11-1939 states:

“a) Promote international peace and security; b) Maintain just and honourable relations between nations; c) Foster respect for international law and treaty obligations in the dealings of organized people with one another; and d) Encourage settlement of international dispute by arbitration.”

The Constitution of India enables lawmakers at both the Center and State level with law-making authority subject to the 7th Schedule to the Constitution of India, wherein electricity falls under the concurrent list, from which it is inferred that legislative powers for this area rests with both the GOI and SGs. On the other hand, ‘atomic energy and mineral resources’ as part of the Union List falls solely under the authority of the Central Government. Thus, nuclear energy has been kept at bay from the State authorities and private players, even though the latter are debated to be instrumental in accelerating growth in the sector.

The international agreements and treaties can only be legally binding in India if both houses of the Parliament give their seal of approval to enabling legislations as upheld by the highest Court of the country. The implementation of the treaties is the responsibility of Parliament as stated in Article-253 of the Indian Constitution. Entries in List-I of the 7th Schedule lay the foundations of the power of the Indian Parliament to pass any law necessary to carry out a treaty, agreement, or covenant at a global level, or to give effect to an arrangement or understanding entered into at a global level. Other relevant provisions are detailed in Articles 73, 245 & 246, 252, 260, 363, 372 and entries numbered 10 to 21 in the VII Schedule.

The AEA, 1962 was enacted on 5th September 1962 replacing the Act of 1948. Its objective was to evolve, advance and govern all aspects of atomic energy which would be utilized only for non-violent purposes and in the

national interest. This Act governs the path towards development of nuclear energy for its peaceful utilization and for training of scientists to enable them to carry on more intricate research for the welfare and benefit of the nation. It aims to bring within its ambit all the probable problems that could be linked with the working of nuclear energy. It also provides the standards and measures governing and controlling the radioactive substances and plants as well as the measures to prevent accidents. Keeping in mind that public safety is one of the key objectives of the Act, it assures the proper and cautious disposal of radioactive waste. It facilitates the establishment of State Electricity Boards and corporations to control and safeguard the utilization of resources to securely generate electricity while at the same time providing special provisions under which there can be proper control of radioactive substances. The Act defined '*Atomic Energy*' as the energy released from nuclei caused by any procedure inclusive of fission and fusion reactions. Further 'fissile material' has been defined to include U-233, U-235, Pu or any matter containing these elements, or any other material notified by the GOI to be a fissile material (Acts of Parliament, 1962). The control of irradiated materials is discussed under Section 16 of the Act and Section 17 deals with safeguards related to mining, treatment, storage, use and disposal of these substances. The powers of the State to manufacture, develop, consume, and unload atomic energy itself or via an entity duly authorized are detailed under Section 3. This also includes the power to declare restricted information about locations, quality of materials and arrangements for their acquisition (Acts of Parliament, 1962).

The Act of 1962 vested the GOI with the authority for growth of nuclear power whereas the DAE is responsible for the establishment and regulation of NPPs. The electrification of rural areas is a major objective towards ensuring progress of the Nation. The ESA, 1948 was transformed to lay out an establishment for generation companies under the control of the State.

The submissions of the Meckoni Committee Report of 1981 (Reorganization of Regulatory and Safety Functions) and that of the Raja Ramanna Committee 1997 constituted to review all aspects of regulatory process of nuclear installations paved the way for showcasing the immediate and requirement for an unfettered and unconstrained statutory regulatory body on the terms set by the Atomic Energy Act. The recommendations also called for ‘considerable broadening of the functions and responsibilities’ of the AERB. Despite this, the AERB has to face regular challenges in forming regulatory strategies for nuclear and radioactive facilities, maintaining nuclear and radiation safety, security standards etc.

It was as late as 31st December 2015 that an amendment was brought in the AEA, 1962 wherein Section 2(bb) which redefined ‘Government Company’ whereby other public sector undertakings could participate in operating the NPPs and in the mining or research of isotopes. However, private equity or participation in operations was still not permitted.

The atomic energy program in India follows a 3-tier system. The topmost institution was the AEC, which is the highest policy making body. Next comes the DAE which superintends research and development. Last in the hierarchy of institutions governing the sector is the AERB. The Board was constituted in 1983 as an autonomous body with the main responsibility to supervise and surveil round-the-clock all the aspects concerning safety and security in the atomic energy industry. Currently, it functions under the AEC. The major legislations governing nuclear energy in India are the

- AEA-1962
- AEMMH
- AESDRW

- AEFR
- RPR-2004.
- CLND, 2010; and
- CLND, 2011

3.11 ROAD MAP OF INDIA’S NUCLEAR ENERGY PROGRAM

It is true that India has developed into a nuclear sufficient state, such capability achieved, however, in the shadows of sanctions and restrictions. Despite sanctions and lack of international support due to its non-adherence to the Non-Proliferation Treaty, India has emerged as a nuclear power over the years. Based on the achievements this emergence can be traced under the following phases of governance.

3.11.1 PHASE I – 1944 TILL 1960

Immediately after the World War II the aftereffects of certain events had a deep lasting effect on India’s nuclear policy. These events were the establishment of the United Nations, the bombings of Hiroshima and Nagasaki and the partition of British India into an independent India and Pakistan. India’s first Prime Minister Nehru regarded the same as “crime against humanity” and was not only deeply committed to the complete elimination of all nuclear weapons, but also opposed to their manufacture and possession by any country, including India. He was against nuclear weapons on moral, political and strategic grounds. He integrated this opposition into India’s foreign policy, giving it an activist edge. He was the first World leader to call for an end to all nuclear testing following the US bombings in the Pacific in 1954. He was instrumental in founding the Non-Aligned Movement. Therefore, this period was marked by abstinence and opposition towards the manufacture, use and possession of nuclear weapons.

However, India's civil nuclear energy program under the Department of Atomic Energy also had a dual-use agenda of which even prominent figures, such as Homi Bhabha, were unaware of. In 1954 it started moving towards achieving nuclear weapon capability. Bhabha himself was not as categorically opposed to a possible future bomb as Nehru was.

On 24th July 1957, Nehru said in the Lok Sabha:

“We have declared quite clearly that we are not interested in making atom bombs, even if we have the capacity to do so and that in no event will we use nuclear energy for destructive purposes...I hope that will be the policy of all future governments.”

Just months before his death, when reports were pouring in of China's nuclear preparations, Nehru rejected the suggestion that India should follow China's footsteps and acquire nuclear weapons as a deterrent.

In 1955 work on India's first reactor commenced with British aid and a research reactor was set up with assistance from Canada. The latter was named CIRUS (Canada-India Reactor Uranium System) and the USA under President Eisenhower's "Atoms for Peace" Program agreed to supply heavy water for the same.

During this period India became relatively self-reliant and did not import nuclear fuel.

3.11.2 PHASE II– 1960 TO 1974

This phase is characterized by a certain quantum of disappointment and disillusionment with the probability of global disarmament. On the global stage, the government continued to oppose deterrence and the building of arms. However, parallelly, it geared up to obtain the capability to make nuclear weapons. At a very fundamental level the country's nuclear program went through a marked change. Homi J. Bhabha, the pioneer of India's nuclear program authorized the setting up of a plant that would re-process the radioactive remains from the CIRUS. The first Chinese nuclear test concluded on October 16, 1964. Immediately after, Bhabha claimed that India would be ready to conduct tests within 18 months. Despite this declaration, the GOI official stand did not change and the subtle shift in the nuclear program was not publicly acknowledged.

A year later, in October 1965, the then Prime Minister Lal Bahadur Shastri told Parliament:

“Despite the continued threat of aggression from China which has developed nuclear weapons, the Government has continued to adhere to decisions to not go in for nuclear weapons but to work for their elimination instead.”

The ruling party at that time itself was divided on the Prime Minister's stance on nuclear weapons, a stand that was getting increasingly difficult to maintain. The concerns of having sanctions imposed on India if it acknowledged a formal weapons program were very real. In 1965 Dr. Homi Bhabha received approval to go ahead with the only possible option, viz., “Peaceful Nuclear

Explosives” or the PNE Program. A study group – SNEPP – was set up under the leadership of Dr. Raja Ramanna.

In April 1968, Prime Minister Indira Gandhi said in the Lok Sabha that:

“[India’s nuclear] policy is framed after due consideration of the national interest, specifically with regard to national security...we do feel that the events of the last twenty years clearly show that the possession of nuclear weapons have not given any military advantage in situations of bitter armed conflict.”

She maintained that *“The choices before us involves...engaging in an arms race with sophisticated nuclear war heads and an effective missile delivery system...Such a course, I do not think would strengthen national security...it may well endanger our internal security by imposing a very heavy economic burden...”*.

The post-Nehru phase saw a gradual shift in the government policy assertions and India went from an unequivocal opposition to adopt a less rigid stance of “no bombs now”. This shift showed up during the NPT negotiations in which India had a crucial and driving part at the outset. The final draft did not give states without nuclear weapons, including India, what they had demanded, viz., greater equilibrium between the obligations and commitments of states with nuclear weapon capability and rest of the signatories. Other non-nuclear weapon states signed this watered-down version, however, India refused to do so.

India’s refusal to sign was determined by various factors, firstly, by Chinese government’s decision not to sign and secondly by its own

hesitation to bind itself to an obligation of permanently desisting from obtaining nuclear weapon capability. Thereafter, the resistance to the NPT was described as India's dissent on a matter of principle on the grounds that the Treaty was unfair, biased, and inequitable which was evident in the differing obligations for nuclear weapons states and others.

The Prime Minister, Mrs. Gandhi, saw the right set of circumstances, and grasped the opportunity to conduct the initial test, Pokhran – I in May 1974, something that the scientists from DAE had been pressurizing for. There was preparedness at the shop floor level and a hazardous pile up of plutonium from CIRUS making it the right time to proceed with such a test. Though ostensibly, this was a peaceful nuclear explosion (PNE) or, in other words, for peaceful civilian objectives only, in fact it was conducted for domestic political reasons. It is pertinent to note that, on the face of it, India continued to strongly oppose nuclear deterrence and refused to accord any legal recognition to nuclear weapons.

On 22nd May 1974, four days after the Pokhran – I test, Mrs. Indira Gandhi wrote to the Pakistani Prime Minister, Zulfikar Ali Bhutto to assure him that:

“I am aware that in popular parlance a nuclear explosion evokes and awesome and horrifying picture. However, this is because our minds have been conditioned by the misuse of nuclear energy for the development of weapons and by the use of these weapons in Hiroshima and Nagasaki. We, in India, have condemned and will continue to condemn military uses of nuclear energy as a threat to humanity.”

Mrs. Gandhi emphasized that *“it is strictly in this context that our scientists have launched on this experiment...there are no political or foreign policy implications of this test.”*

3.11.3 PHASE III – 1974 TO 1995-96

India adopted a deliberate policy of nuclear ambiguity as a result of the unfavorable aftermath of the Pokhran – I test and all work on its nuclear weapon capability was put on hold. The policy was to equivocate on India’s capability for nuclear weapons and its intention to seek a unique standing as a ‘Nuclear Threshold State’ by avowing and repudiating it at the same time. In 1974, the then Prime Minister Morarji Desai laid stress on the “peaceful” aspect of this ambiguity while giving voice to his reservation on the safety aspect of nuclear power. At this time the GOI kept itself aloof from the 1974 PNE.

In the late 1980s, due to the reported nuclear preparations being made by Pakistan, there was a belligerent and insistent demands that India should openly declare its nuclear status. Pakistan sent several proposals for regional disarmament and nuclear restraint. However, Government of India rejected all of these on the basis that India would discuss and debate on nuclear disarmament on a “global, multinational” platform and in a framework that was not discriminatory.

India’s game plan to repress the purported ‘Pakistani threat’ was to beseech the USA to pressurize Pakistan in any which way, even by using tactics such as the Pressler Amendment. On the other hand, India continued to stockpile high-grade plutonium and by the mid-

1990s approximately 300 to 450 kgs was in stock, viz., enough to make 60 to 90 fission bombs.

India became part of the Six-Nation Five-Continent Initiative for Nuclear Disarmament in 1986. Subsequently, the Rajiv Gandhi Plan for Elimination of Nuclear Weapons was drawn up and in 1988 it was presented before the United Nations. This was a gradual process, and it tested the limits of prudence and judiciousness of all Nations that were characterized as “threshold states” including India. Regardless of the effort put into it, this process was not proactively followed up on. By this time the parleying for a CTBT, which was a pioneering effort by India, reached the final stages. The Government of India held back and put forth its condition of a “time-bound” disarmament or deactivation of nuclear weapons by the P-5 Nations prior to signing of the CTBT. Effort was made to buffer the Treaty with such clauses that were progressive and reformist on the face of it. In reality, these clauses were intended to be impediments to signing of the Treaty and to lay the foundation for a denial to the test ban agreement.

On the domestic front, the Government of India was under immense duress to combat the CTBT and continue with its nuclear tests. Questions were posed asking for explanations as to why the Government was rejecting the CTBT calling it a “trap” and a “conspiracy” but at the same time acknowledging that it was still in place? Doubts were vocalized as to why the State was bearing the burden of the costs of opposing the CTBT without harvesting the gains from nuclearization.

The Indian Government headed by Prime Minister Narsimha Rao began preparations for another test at Pokhran in 1995 even though the Cabinet of Ministers was not unanimous in its decision. This was just prior to the CTBT “rolling text” coming into its eventual form. Military satellites that were launched by the United States of America discovered these preparations dissuading India from the final testing on account of the publicity and possibility of economic sanctions. It was at this time that India’s nuclear policy saw a significant and basic shift though at the macro and stated policy level no shift was visible. Before the ICJ, India put forth its fervent arguments that *“use of nuclear weapons in any armed conflict...even by way of reprisal or retaliation...is unlawful...since the production and manufacture cannot under any circumstances be considered as permitted...the threat of use of nuclear weapons in any circumstance, whether as a means or method of warfare or otherwise, as illegal and unlawful under international law.”*

In March of 1996, when the debates and negotiations on CTBT reached a feverish pitch, Mr. Salman Haider, the then Foreign Secretary, appeared before the CD and stated *“We do not believe that the acquisition of nuclear weapons is essential for national security, and we have followed a conscious decision in this regard. We are also convinced that the existence of nuclear weapons diminishes international security. We, therefore, seek their complete elimination. These are fundamental precepts that have been an integral basis of India’s foreign and national security policy.”*

However, India’s dereliction and shift from its purported undertaking of nuclear reticence and disarmament was becoming

clear. The veneer of ambiguity was wearing off. At the CD India was successful in obstructing the passage of the CTBT. However, the same was placed before the UN and was passed and signed by the GA.

Experts, politicians, and other observers, both in the Government and outside of it, became more vocal in favor of India crossing the threshold and not sitting on the fence. The right-wing commentators and political parties faced minimal opposition and they took firm hold of the anti-CTBT rhetoric.

3.11.4 PHASE IV – 1996 TO May 1998

Having yielded so much ground to hawkish positions and stoked jingoistic nationalism, New Delhi had now become a prisoner of its own devious maneuvers. The nuclear and defense establishments got hyperactive in lobbying for explosions and a policy break to permit complete weaponization.

The BJP articulated this point of view most vociferously at the political level. By 1997, its demands for overt nuclearization became insistent. Its manifesto for the February 1998 general elections promised to “re-evaluate the Country’s nuclear policy and exercise the option to induct nuclear weapons.”

Till March 1998 the BJP was the sole Indian political party to advocate nuclearization. However, the situation changed with the BJP-led coalition came to power. The coalition’s ‘National Agenda for Governance’ was an almost exact copy of the BJP manifesto. Orders were issued to the DAE, DRDO, and also to the Armed

Forces to commence preparations for conducting tests. Though these orders were issued without the consultation of the coalition partners it appeared that the only party advised of this decision was the RSS.

The strategic rationale behind the decision to carry out the tests was given by Atal Behari Vajpayee, the then Indian PM, interestingly, not to the people of India but to the President of the United States of America. Close cooperation with the USA was proposed to promote ‘the cause of nuclear disarmament’, which in itself was an erroneous acknowledgement that USA had such a commitment. The statement spoke singularly of threats from India’s neighbors, China, and Pakistan, which had increased by nuclear and missile collaborations between the two countries. No mention was made of ‘unequal global nuclear order’, ‘nuclear apartheid’ and the fact that the P-5 failed to disarm themselves.

The Government prepared a paper titled ‘Evolution of India’s Nuclear Policy’ and on 27th May 1998 laid the same before the Lok Sabha. This was an effort by the Government to defend the complete turnaround that had been taken with regard to the official stance and prior nuclear policies.

The reasoning given for going ahead with the nuclear tests were:

- It was a continuation of national policy of the “path of self-reliance and independence of thought and action”.
- Due to nuclear and missile proliferations India’s security had suffered.
- The country had become a victim to terrorism that was externally supported and was fighting a clandestine war.

- The NPT was discriminatory and was leaning towards states with nuclear weapons capability; and
- There was a great need for nuclear arms for self-defense which would ensure that the country would not be subjected to nuclear coercion.

3.11.5 PHASE V – June 1998 TO 2004

There was worldwide criticism of the tests conducted by India. On the other hand, India was now regarded by many as a de-facto member of a small nuclear group. Globally India was now perceived seriously and in doing so strengthened its diplomatic position (Varadarajan, Siddarth, 2009). The tests were considered by many to be a failure of the NPT as it had no enforcement framework. However, India's nuclear capability was completely indigenous, and it was no secret that India did not procure materials from other states. Post the tests sanctions were imposed on India by many states and tremendous pressure was brought upon for India to join the NPT and the CTBT without further delay. The implication of this would be that India would be forced to roll back its nuclear advancement. Many states (led by the USA) imposed further economic sanctions as well. Using its influence USA ensured an embargo on direct foreign aid except for humanitarian aid to India. Its stand was considered discriminatory as it was still soft in imposing sanctions on its ally, Pakistan.

While imposing sanctions, the US administration led by President George Bush, began a relook at their stand on India. India was now viewed as the balancing factor to China in the Asian continent (Smith, Jeffery R. & Warrick, Joby, 2009). After the September 11, 2001, attacks the US Government began to walk a new line in

international relations. This began a long journey to mend bridges and open a new era of diplomatic relations with India. The Indian Government did not sign the NPT or CTBT. The country had a record of “liberal democracy” and had now given evidence that it had indigenous nuclear capability and technology and had levelled the playing field. This Phase was marked by complicated and careful diplomatic negotiations. India’s civilian nuclear program was beginning to suffer due to the sanctions and a breakthrough was extremely important.

3.11.6 PHASE VI – 2004 TO 2014

In the 2004 general elections the Indian National Congress formed the Government with Dr. Manmohan Singh as the Prime Minister, who stated that “*The quest for energy security is second only in our scheme of things to food security*” (Financial Times, 2004). After several decades of isolation there was a change in the global nuclear regime when the Indo-US Declaration was signed in 2005 followed by the Indo-US civilian nuclear cooperation agreement in 2008. These efforts were viewed as the beginning of a completely revamped relationship between the two countries and a new facet was shown of the international non-proliferation efforts. The agreement covered only the civilian or peaceful uses of nuclear energy.

In 2008 itself the IAEA approved a safeguards agreement with India and the Indian Government applied to the NSG for an exemption to allow India to start civilian nuclear trade. An exemption was granted to India in September 2008 which opened the doors for India to

access civilian nuclear technology and materials in other countries. India now became the only country in the world to possess nuclear weapons without being a party to the NPT and at the same time become a partner in development of nuclear technology with full global access to nuclear trade.

3.11.7 PHASE VII – 2014 ONWARDS

In 2014, the country witnessed a change of power again when Mr. Narendra Modi of the BJP took oath as Prime Minister. He continued the work of furthering the relations with USA while at the same time made diplomatic forays to improve relations with India's immediate neighbors and the Asia-Pacific powers of China, Japan and Australia.

The Government made it clear that India's priorities and objectives were (Balachandran, Manu, 2016):

- “Neighborhood First” – priority was for an integrated neighborhood.
- Promote India's domestic development by leveraging international alliances and partnerships.
- “Act East” – work towards a stable and multipolar balance of power in the Indo-Pacific region.
- Dissuade Pakistan from supporting terrorism; and
- Promote India's representation on all aspects of global governance.

There was a radical change in India's nuclear program and the policy now was to have a “strong security culture” combined with being less defensive and more transparent. To this end the Government announced a grant of \$ 1 million for the IAEA. However, several

media reports claimed the lack of accountability and transparency and alleged exposure to high levels of radiation in mining areas.

3.12 INDIA'S INFRASTRUCTURE DEVELOPMENT VIS-À-VIS ITS CIVIL NUCLEAR PROGRAM

Infrastructure encompasses all facilities, services and activities that are essential to provide any kind of service, whether it be manufacture, operation, distribution etc. and is a support system or backbone for the development, both social and economic, of any nation, irrespective of the sector or industry. A good economic infrastructure leads to an efficient and productive economy and energy is a vital component of this infrastructure. Energy is essential for all activities – whether production or consumption, whether for agriculture or industrial purposes or for personal usage, viz., for commercial or non-commercial purposes. In fact, the level of consumption of commercial energy is an indicator of the robustness of an economy. Hence, it can be safely concluded that energy or power is one of the most critical aspects of infrastructure and essential for economic growth and welfare of a country. From this conclusion follows the fact that establishment of a good infrastructure is a must for the sustained growth of India's economy.

The development of infrastructure for the nuclear power industry is critical to ensure sustained production of energy. The framework and structure necessary for dynamic, regenerative and reliable nuclear energy program must be planned and requires long-term commitment and investment in time, institutions, operations, distribution networks, legal & regulatory framework, waste management, safety and security, finances, and human resources. For India, the combination of a booming population and exponentially growth in demand for energy, the establishment and continuous enhancement of its nuclear infrastructure is critical.

As is evident from the policies of various Governments, the goal of evolution of nuclear energy in India was to improve the quality of life and attain self-reliance in meeting energy requirements. To achieve this the requirement was careful planning, care, and commitment. Immediately after becoming independent India commenced with setting up the structure to support its civil nuclear program. With the setting up of the AEC and subsequently the DAE in 1954 the policies were put into place. Institutions and public sector undertakings were established to provide all the input and support that the nuclear power program would need. These included research and development, exploration, mining and processing of minerals, production of heavy water, fuel management, nuclear instrumentation, reactors, and enriched fuel together with development of specialized skills via human resource and training infrastructure, keeping in mind the three-stage nuclear program. In tandem, the domestic industry was hand-held and manufacturing capability evolved to reach certain quality standards required by the nuclear industry. With collaborative efforts the construction of the first PHWR went underway. After the first peaceful nuclear experiment by India a nuclear apartheid was imposed on India resulting in denial of technology and other assistance. However, this embargo had a flip side and because of the apartheid indigenization of the nuclear power infrastructure got a massive boost. The challenges of evolving Indian designs, manufacturing capability, siting, construction, heavy water development, fuel enrichment, and commissioning were met and overcome.

All aspects of NPPs from conception, establishment and management were initially a departmental activity of the DAE. In 1967, the DAE created the Power Projects Engineering Division which was given this responsibility and in 1984 this evolved into the Nuclear Power Board (NPB) with enhanced powers. However, to support the planned civil power program it

became imperative to design a framework that would facilitate raising of investments and speedy decision-making. The NPB was corporatized into NPCIL in September 1987. NPCIL was given the mandate of all facets of NPPs encompassing site selection, conceptualizing, establishment and set up, day-to-day management, maintenance, renovation, modernization, life extension and waste management. Nearly 16 years later, in 2003, the Government established another company “BHAVINI” specifically for Fast Breeder Reactors.

India is the 3rd largest producer of predominantly thermal electricity with a very low per capita consumption of which nuclear power contributes only about 3%. To expand the share of nuclear power in production of electricity and in addition to setting up of the institutional structure, the infrastructure support and conducive atmosphere is imperative. Over the years, India has made noteworthy progress in developing the required infrastructure to support its civil nuclear energy program. This includes:

- Reactor Technology – Several indigenous reactor designs were developed including those for PHWRs, PWRs and FBRs, for the purpose of generating electricity, research, and production of medical isotopes.
- Fuel Cycle Facilities – A solid infrastructure has been set up over the years for the complete fuel cycle which comprises uranium mining and milling, fuel fabrication, reprocessing and waste management. A large centrifuge plant known as the Rare Materials Plant (RMP) has been established in Rattehalli, Karnataka and an enrichment facility is planned in Chitrdurga in the same State. Nuclear Fuel Complexes (NFC) are operative at Rawatbhata, Rajasthan and Tuticorin, Tamil Nadu. These facilities play an important role in ensuring security of fuel supply.

- Regulatory Framework – In 1983, with the establishment of the AERB the regulatory surveillance of India's nuclear sector was reinforced with the Board ensuring compliance with safety standards, emergency preparedness and licensing of nuclear facilities.
- Strategic Partnerships – With the lifting of the nuclear apartheid, India has entered into collaborations and strategic partnerships with several countries and organizations with the aim of augmenting its nuclear infrastructure. Tie-ups with other nations, France and Russia being prime examples, have opened the door for transfer of technology while India's participation in international forums, conferences and conventions have promoted sharing of knowledge and best practices.

Despite the obvious advantages of nuclear power and the remarkable progress the nuclear energy sector has made, India faces several challenges and constraints in the development of its infrastructure and if it desires to take an exponential path where increase of nuclear energy in overall energy mix, these issues will have to be overcome.

Some of these challenges are briefly described below:

- Compensation and Liability Regime
The implementation of the CLND has been an ambivalent and debatable issue. The deemed ambiguity and severity of the liability framework have shown themselves to be a deterrent for foreign investment and technology transfer.

- Technological Challenge

Indigenous development of advanced reactor technologies, viz., thorium-based reactors and FBRs require sizeable investments in research and development if India is to achieve technological self-reliance.

- Training Infrastructure and Capacity Building

India has a pool of trained human resource employable in the nuclear sector. However, if the civil nuclear power program must move to the top gear a structured and relevant program must be devised for training, licensing, qualification, knowledge management and sustainable construction together with a regulatory regime for transportation of fuel, its storage, and its use.

- The Public Acceptance Challenge

Inordinate trepidation fueled by reported disasters and inaccurate information and half-truths by individuals and groups opposed to nuclear energy has raised issues of safety of nuclear plants, ill-effects of radiation on health, loss of traditional livelihoods and general environmental concerns. To overcome this the industry has to gain social trust through outreach programs which are structured, enhanced, inclusive, educative and institutionalized.

- The Nuclear Education Challenge

There is an ever-present need to provide a robust education system that builds basic awareness through exhibitions, visits to nuclear facilities etc. through a curriculum level intervention right through school level up to graduate and post-graduate level. This should include skill development, structured training, retention, and knowledge management and would result in a large base of scientific and trained human resources.

- Distribution and Transmission Challenge

As per a report by the ESCAP released in 2023, though India has made progress in the last two decades in providing access to electricity to its citizens, a significant percentage of its population is still in darkness. The Report noted that mere provision of an electrical connection was not to be considered as “electrified” if the quality and affordability of the energy service falls short on other levels that are essential to meet development needs. It is pertinent to note that even after 75 years of gaining independence, communities that are the poorest or hardest to reach or where its logistically or economically difficult to connect to the main grids are the ones who still do not have access to electricity.

At the same time as the capital investment in the nuclear program escalates, there is an pressing need to include the transmission and distribution network as an essential part of the power industry. This implies that the investment in expanding and strengthening the transmission and distribution network will be directly proportional to the investment in rest of the infrastructure. As per a draft plan proposed by the Central Electricity Authority (CEA) it is estimated that India needs substantial investment of nearly ₹ 4.75 trillion by 2027 if it must develop its transmission infrastructure, which includes lines, substations, and reactive compensation. This projection is aligned with initiatives to enhance the national transmission system in order to integrate renewable energy capacities. (India needs ₹ 4.75 tn investment in transmission infra to boost renewable energy integration by 2027, Mint + The Wall Street Journal – 26th Jan 2024)

- Balance of Demand and Supply

Given the size of India’s population and its rapid growth rate, it needs to go in for all the energy options available. At a period in time, when the

only source of power were the thermal power plants, the supply of electricity and power was constant while the demand for electricity varied. An equilibrium between both, demand and supply, was maintained through load-shedding. However, as we fast-forward to the present times, it is evident that other sources of energy have been gradually increasing their share in India's energy mix. Supply of energy from renewable sources particularly is variable and cannot be said to be always consistent. We are now faced with a situation where both demand and supply have become variable. Planned and strategic investments are the need of the hour in battery storage, pumped storage, electrolyzers etc. if the demand and supply is to be balanced.

- Social and Ecological Costs

Reaching full potential capacity to match the growing demand requires a certain amount of license given in terms of location, establishment etc. However, given the global concerns regarding environmental costs, unchecked expansion of infrastructure is not feasible.

- Investment Challenges

The Indian civil nuclear program has not been able to successfully scale up as planned given the roadblocks presented – such as acquisition of land for setting up a nuclear power plant, adequate finance for see through the process of construction and operationalization, consistent plant designs, non-existence of headway towards privatization of NPPs etc. The Central Government has now directed NPCIL to work with organizations like NTPC so that the combined strengths in raising funds, plant design and project management can turn around a faster rate of set up of nuclear power plants.

- Financial Viability

A proper and viable support system for construction and manufacture of plants and equipment is still in the making. Since the number of orders received per manufacturing unit are few this makes it uneconomical. In addition, nuclear projects necessitate high upfront capital costs and unduly lengthy gestation times. This makes the project financially testing. If, as is commonly seen, there are cost overruns and project delays resource allocation becomes a challenge culminating in budgetary pressure. To boost the rate of setting up of NPPs the Government is leaning heavily towards SMRs to overcome some challenges such as land, set up cost etc., while parallelly making it easier to import technology. These combined efforts will allow the nuclear energy sector to regain the share that it has lost to other renewable sources of energy.

Infrastructure and energy are the two vital enablers of economic progress, and the Government is focusing strongly on them. This is a positive indication as both are inter-linked. The energy sector is likely to account for 24% of the capital expenditure over the financial years 2019-2025 (Power Infrastructure in India , <https://www.insightsonindia.com>).

3.13 CONCLUSION

The historical background of nuclear power dates back to the experiments, research, and developments in Europe dating as far back as 1789 AD followed by similar achievements in the USA and USSR and subsequently contributions from East-Asia that strengthened the nuclear industry. It can be concluded that the genesis of Nuclear Sciences lies in the discovery of nuclear elements and other phenomena and innovations. Nuclear technology has developed over the years and its usage has widened to include, in addition to military and medical, to generation of energy, which is today the paramount objective of tapping this source of energy. WW – II

brought to light new areas of concern and the call for consolidation of a framework for civil utilization of nuclear energy. Though a slowdown in technology development has been experienced over the past few decades combined with a failure to complete nuclear projects, all countries have collectively recognized its importance and minor developments have been witnessed around the globe since the 2000s. The long-drawn struggle and development has led to an accumulated 17,000 reactor-years of operations which is said to provide a significant proportion of the world's electricity with over 400 NPPs operational across the globe.

The rising demand for energy and the depletion of energy sources from fossil fuel have further strengthened the case for nuclear energy as an instrument of combating the energy crisis while upholding climatic goals. The energy deficit in India has shaped its policy framework and continues to shape the energy outlook as it is vital to satisfy the demands of a rapidly increasing population while balancing its international commitments to battle climate change.

India's goal to become a net-zero economy by 2070 will only be achieved by a massive energy transition from fossil fuel-based technologies to other greener electricity generating technologies where nuclear energy stands out. India's expansion of its capacity for nuclear power is a positive step towards this goal. Dr. Homi Bhabha visualized a sequential 3-stage nuclear power program for India which is still as relevant as it was in inception. The program now is looking at major infrastructure development and capacity addition to support achievement of India's objective (Sekhar, B.V.S, 2022).

In addition to the goal of becoming a net-zero economy by 2070, the power sector in India will require firm commitment and continuous work to even

fulfill the energy demands of a rapidly growing economy and to achieve SDG-7 which calls for provision of universal electricity access.

In tandem with global priority areas of technology, clean energy, climate change, ocean resources, biodiversity, cyber security, industry governance, geopolitical and geo-economic cooperation, India is also looking to the emerging technologies of AI, IOT, Advanced Materials, Smart Grids, Autonomous Vehicles, Drones, Big Data Analysis, Precision Medicine and Genomics to achieve its targets and commitments.

Though technological development around the world and the fallout of WW – II resulted in establishing a nuclear law regime for proper regulation of the consumption of nuclear energy and led to the executions of several international conventions and protocols to ensure safety, security and compensation, the current roadmap envisages a framework to facilitate a carbon-free reliable generation of electricity. The risks attached with the use of nuclear technology, the limitations of ordinary civil laws in imposing liability and the need for an effective regulatory mechanism at a national as well as an international level were the main reasons for the development of nuclear law. An intensive study of the various treaties, conventions, protocols, and agreements continue to evolve and are amended with every new incident or event in the nuclear energy sector to ensure that every consequence is covered has been made in following Chapter.

CHAPTER IV

PRIVATIZATION IN INDIA UNDER ECONOMIC REFORMS

4.1 INTRODUCTION

The Indian economy witnessed complete stagnation post-independence in 1947 where economic progress was extremely slow bringing almost half the population below the poverty line. The world was divided between two opposing economic policies, viz., capitalism and socialism and it was crucial for India to determine the policy that would best for the country. The USA was a capitalist economy characterized by a strong private sector with the freedom to own resources and property. On the other hand, countries such as Russia were socialist economies where the State owned the resources and property and ownership was regulated by the State through rigid rules. India struggled between the two and after careful perusal finally opted for a mixed economic structure, borrowing features from both economies creating a system best suited to the domestic situation. Major industries were kept under control and ownership of the State while the private sector was encouraged to move forward in other areas.

Newly independent India in 1947 was primarily an agricultural nation with a fragile industrial foundation. Though the traces of the Industrial Revolution were prevalent the country was buckling under the aftermath of the freedom struggle and partition. A robust policy framework that supported rapid industrialization was the only viable solution to combat

poverty, economic stagnation, degeneration of standard of living, illiteracy and underdevelopment.

To achieve economic sovereignty the first Industry Policy Resolution was announced in 1948 on the lines of the Bombay Plan of 1944/1945. It provided for Government intervention to regulate the strategy of industrial development. As a result, the Planning Commission (Planning Commission (India) 2014) was constituted in March 1950 and the Industries (Development and Regulation) Act (Acts of Parliament, 1951) was passed in 1951. The first PM of India, Pandit Jawaharlal Nehru advocated a mixed economic structure focused on industrialization for import substitution while recognizing that industrial development per se was fundamental to the Indian economy (The Civil India). He strongly believed that a basic standard of living and modernization of the country could be achieved through an industry oriented economic policy. This caused his and subsequent Governments to have an industrial policy fraught with restrictions on the private sector. This continued till 1991 when India was in the throes of an economic crisis and the Government was compelled to raise capital to cope with the crisis.

In 1991, there was a major shift in the economic structure of India as a consequence of major stagnation and poor economic growth. The ideology shifted towards liberalization and privatization through economic reforms under Dr. Manmohan Singh, the then Finance Minister of India. Popularly referred to as the LPG reforms, these measures liberalized, privatized and globalized the Indian economy.

4.2 DEFINING PRIVATISATION

Privatization broadly means transition from State owned resources to privately owned ones and this is normally achieved through several measures including invitation to private investors, selling State owned assets etc. Privatization can be adopted through different methods including entering the stock into the open market to increase competition (Filipovic, Adnan, 2006). However, capacity of the market must be the main consideration since the risk of stagnating development and activity is very real. The state of development, level of activity, risks, investment etc. therefore are vital for the transition to privatization and the extent to which such transition should be taken.

Privatization has three main characteristics:

- (a) **Ownership** – The erstwhile public enterprises become privately owned as the ownership shifts from State to private companies. This is known as denationalization and can be completely owned or partially owned by private parties.
- (b) **Organization** – The State control over public companies becomes limited. This is done through methods such as restructuring of the enterprise, leasing out, holding company structuring etc.
- (c) **Operations** – State owned companies and organizations generally suffer losses on account of inefficiency of operations. With the entry of the private sector that seeks to maximize profits, an efficiency of operations is introduced through re-allocation of resources, development of markets and products. This efficiency and consequent growth are directly proportional to favorable political and investment risk perceptions together with increased liquidity.

Guidelines to the LIPSP, 1991 explain a “privatization transaction” as a transfer of public control and ownership from the State or from an entity

whose ultimate beneficial ownership is with the State to a free enterprise entity. sector. State control may be held directly by the GOI or its ministry, department, enterprise and corporation or indirectly through control and interest in the major assets or shares of a corporation. This implies that the private sector clearly excludes any corporation, body or enterprise that is directly owned by and the ultimate control of which rests with the government. A privatization law serves the requirement of a privatization program which represents the legal stance of the country through its key provisions, institutional framework and policies for implementation of the scheme of privatization. Additional laws support the program by providing a legal framework for preparation, implementation, operations of enterprises which acquire public ownership etc.

Privatization, explained as the transfer of State-owned enterprises or properties to private owners is a common economic tool across the globe (Pal, Deepali). This has also given rise to several debates on the superiority of the public enterprises vis-à-vis the private sectors and vice versa. Initially the discussions revolved around the size of the public sector measured by the size of government consumption that affected economic growth. Some studies have shown that privatization did not contribute to growth but did reduce some income inequality. However, other economists claim that positive growth in an economy is the result of reallocation of assets and functions from the public to the private sector (MBA Universe, 2021). Privatization has gradually been adopted by various political systems as a successful economic scheme to establish property rights, create strong individual incentives, facilitate free markets for growth, boost financial investments etc. resulting in operational efficiency, wider investments and ownership and availability of credit for the private sector (Srinivas V., 2017).

4.3 PRIVATIZATION AND ECONOMIC GROWTH IN INDIA

A shift in India's economic policy from a public-centric one to opening the market for private players took place in 1991 (Wikipedia, 1991). India was under a severe economic crisis which posed an immediate need to expand the economic ideologies to include privatization for better growth, development and modernization which was essential to secure economic sovereignty. The then Finance Minister, Dr. Manmohan Singh, introduced major and radical reforms to tackle the situation. The restrictions on the private sector were lifted and facilitation of transfer of ownership from government held corporations to private enterprises through disinvestment was operationalized. This was accompanied by liberalization of trade practices and opening of the markets to global players.

The three main characteristics of privatization are with respect to ownership, organization, and operations (Majumder, Paushali, 2018) and all were brought into play. Ownership was wholly or partially transferred into private hands through denationalization while organizational measures diluted the control of the Government in these public companies. Private companies took over the management and operations in a bid to introduce efficiency and provide better products and more effective services that the public corporations failed to provide.

4.4 OBJECTIVES OF PRIVATIZATION

The foremost reason behind adapting privatization in India has been its ability to improve services and therefore increase efficiency in operations and more effective delivery of services to the public. This enables the attainment of the social goals of development and economic sovereignty.

The Government's main objectives of introducing the LPG reforms and privatization are as follows:

- Public enterprises were often led by the objectives of the politicians and the respective Government department in charge added its own layer of complexity. This, more often than not, resulted in the absence of clarity in objectives to be achieved and affected operational performance. As a result of this, achieving efficiency in operations was one of the major objectives of privatization.
- Another objective was to introduce competition in the State dominated companies thereby shaking them out of a monopolistic lethargy. It was felt that companies could cope with competition more successfully under private ownership rather than a public one.
- Nationalized industries (Terpstra, Pieter & Ofstedahl, Abigail, 2013) proved to be loss making enterprises and privatization was the only way to eliminate the existing budget deficit and accrue fiscal benefits on the State's capital account from the sale of assets. The proceeds from the sale of large State enterprises which had more profit potential if privately run, particularly utilities like telecom and electricity, were substantial.

4.5 PRIVATIZATION LAWS

Adaptation of privatization as an economic policy is to a great extent dependent on the constitutional and legal circumstances of the country in question. India's legal system has been based on the ideal of a welfare state as laid down by the Constitution of India under the DPSP, which are said to be '*fundamental in governance of the country*' (Constitution of India, 1950). They provide that the utmost goal of the State shall be to foster the welfare of the people through securing a social structure where justice, in all its forms, viz., social, economic, and political is the governing principle for all the institutions of national life. Privatization in India has been a major steppingstone to securing this fundamental goal of the welfare State.

However, it requires to be backed by law which would authorize the sale of assets under the State's ownership. Even if a separate law for privatization was not a mandatory constitutional requirement it is beneficial for the following reasons:

- The law defines the State's ideology and objectives and also confirms its commitment to privatization.
- It amends the existing laws that stand in contradiction to the application of the policy of privatization. E.g., laws obstructing participation of the private sector in erstwhile "strategic activities".
- It creates a proper institutional framework for implementation of privatization while avoiding a 'vacuum of authority' that would result in unregulated divesting of authority.
- It allows for reconstitution and reorganization of entities financially and for the earmarking of earnings.
- It defines the modus operandi of divesting and any conditions and restraints for potential bidders.

A legal framework defines the scope and applicability of the law. It also provides for any limitations or exclusions including inflexible limitations with respect to enterprises enlisted under the program. In the absence of this, one alternative would be to follow a 'negative list' approach where all are said to be eligible to be enlisted except those explicitly excluded.

Another alternative would be to have criteria that require decisions at the top rung of the political ladder for every case or sector to decide if it can be eligible for the program.

4.6 OTHER SUPPORTING LAWS

The legal outline established for privatization is expected to firstly monitor the process of privatization of undertakings and of operationalizing the transactions and secondly, to regulate the overall legal environment which will support the newly-divested businesses to obtain easy access to land and financial resources, facilitate contracts for their supply and produced outputs and allow competition to prevail in the market with the balance State sector on an equal basis (Silk, Ko Swan, Syatauw, J. J. G & Pinto, M.C.W, 1994).

The transformation of enterprises into corporates acts as a prelude to privatization under the prevalent corporate law. Corporatization clearly and without ambiguity recognizes all assets and liabilities of the business, establishes a Board of Directors to oversee the change management, organizes the issue of shares to the Government and also enables flexibility of sale of partial interests, if so required. An important inclusion would be the procedures of liquidation and dissolution to effect sale of assets of insolvent State entities to the private sector. For public utilities, a regulatory regime is required to ensure security of public interest in output pricing and quality and to support future entries by competitors.

4.7 CHANGE IN GOVERNMENT POLICY

The economic reforms and policies introduced in 1991 brought about major changes and developments in the economic and legal framework of the country. The Government introduced four major changes which then completely transformed the public sector, viz.,

(a) Industries strictly under public sector reduced.

The First Five Year Plan had reserved seventeen industries for the public sector (The Hindu, 2016). This ensured exclusive control of

the Government over the enterprises in these industries and prohibited infusion of any private capital or control. With the advent of the new economic reforms in 1991 the number of such industries was reduced in an attempt to rescue and revive the degenerating state of public industries which were drowning in losses and were failing to provide quality services. At present, only three industries including railways and atomic energy, fall under this category (National Council for Educational Research and Training, 2015). The credit for the foundations and development for the industries that were privatized, no doubt, goes to the public sector. However, it has been the private sector that has revived them and taken them forward proving that the private sector complements the public sector, and both can co-exist. E.g., mining, air transport etc.

(b) Disinvestment

The sale of equity of the public companies to private companies and/or to the public at large is called disinvestment. This allows the influx of private capital which also brings in efficiency and financial discipline. It also saves the funds of the State for social programs and causes that demand attention, e.g., public health and sanitation. Disinvestment not only transfers the control to private hands but also shifts the commercial and financial risks to them and reduces the amount of public debt. It strengthens competition and lowers output prices benefitting consumers and industries such as telecom.

(c) Closure of Sick Units

The new reforms and policies mandated the review of all public sector units by the Board of Industrial and Financial Reconstruction. The Board was authorized to decide whether rehabilitation could save the units, or they were to be shut down based on their condition.

The workers and employees of the sick units that were shut down were, naturally, affected by such decisions (Centre for Civil Society, 2002) and were provided with a safety net against their loss of income. A Voluntary Separation Scheme and a Voluntary Retirement Scheme was set up and financed by the National Renewal Fund. However, these efforts fell short in mitigating the hardship caused to the workers due to loss of livelihood.

(d) Memorandum of Understanding

A MoU was to be signed between the Management of the Unit and the concerned Government authorities (Centre for Civil Society, 2002). This provided a chance to revive the particular public sector unit. Standards provided in the MoU were to be met by the units and failure to do so would result in a shutdown or disinvestment.

4.8 MAJOR REASONS OF PRIVATIZATION

The major causes or reasons for privatization were:

- Reducing burden on the Government
- Strengthening competition
- Improving public finances
- Funding infrastructure development
- Ensuring accountability to stakeholders
- Mitigating unnecessary interference
- Making of an efficient and effective labor force

The private sector is regulated by effective policies (Majumder, Paushali, 2018) and driven by costless bargaining, individual incentives, and power to solve problems of externalities. The private sector responds comparatively positively to incentives in the market. The public sector which lacks economic goals (Rajakumar, Dr. M, 2016) and vigor to be

driven towards profit maximization, increasing production and effective resource allocation, ultimately burdens the State with high-cost and low-income enterprises. A very significant aspect of privatization is that it effectively shifts the focus from political goals to economic goals leading to development and growth of the market economy. Down-scaling of the public sector also acts as a means to tackle poor government policies and corruption that hampers economic growth. The essence of privatization can therefore be said to be that it condenses the role of the Government while providing more scope for growth while keeping the negative impact of the State to a minimum.

Privatization has proved to be a positive instrument in improving the country's economic condition. However, it should not be taken as source of financing new government expenditures or paying future debts when it should be used to pay existing debt thereby reducing interest rates and raising investment levels. Minimizing the size of the public sector has resulted in a reduced government expenditure that goes hand in hand with a rise in collection of taxes from the private sector (Lassiter, Joseph, 2018).

Around the world privatization has been adopted using different methods based on the economic and legal condition of the country and the ideologies of the government in power. However, what has been universally observed is that brings an end to the vicious cycle of borrowing and existing in a permanent state of debt by raising profits and lowering national debt. The commonly used method for privatization is the sale of public sector enterprises to private owners. This creates ready revenue for the State in exchange for which the private owners receive incentives and the means of investing for growth and development (Goodman, John B. & Loveman, Gary W., 1991).

Another method of implementing privatization is through distribution of vouchers to the public at large which can be sold to investors or exchanged for shares in the enterprises being privatized. This method privatizes the public sector fairly quickly but does not raise substantial funds for the State.

Privatization can also take the shape of an “employee-management buyout” also known as internal privatization. The public enterprises are sold at an extremely low price to the existing management who are already familiar with the enterprise and its operations. This method does not generate much revenue for the State as opposed to the sale of PSUs but a minimal level of income is still received by the State (Mittal, Shruti, 2018). This method comes with incentives for the new investors as more often than not they do not have the resources to invest and restructure as is essential for the purpose.

One of the more notable features of privatization is the improved competitive characteristics it provides to enterprises, which invariably is beneficial to the business and therefore for the country as well.

4.9 ELEMENTS OF PRIVATIZATION

Privatization can be said to be comprised of three elements, viz.,

- **Delegation** – the State delegates a part or the whole of the PSU to the private sector.
- **Divestment** – the State surrenders or divests itself of responsibility by way of sale of the State-owned enterprise.
- **Displacement** – the State entity is gradually displaced by the private enterprise over a period of time.

4.10 ADVANTAGES OF PRIVATIZATION

For any country or economy there are several advantages of privatization the most important being increased productivity. The efficiency and productivity provided by private enterprises has invariably over-thrown State-owned enterprises. In comparison, private businesses turn in far higher profits while acting as a catalyst to the underperforming PSUs as the management level employees are usually more profit-oriented than their counterparts in the public sector.

Another huge plus in favor of privatization is that it removes all the political interferences which in turn improves efficiency and therefore the bottom line. It has been seen, far too often, that the management in the public sector works under political pressure. Very often the enterprise hires more people than needed due to this pressure ultimately burdening themselves. Through privatization a free hand is given to the management, which can now, without pressure, look at the long-term vision and goals and make the required commitments. The public sector enterprises get caught in the whirlpool of political short-sightedness that is more concerned with electoral gains in the short run.

Privatization brings about a fundamental structural change in the economic structure at the national level and paves the way for a competitive market leading to much needed growth. More private parties are given the opportunity with a far more level playing field. It also fosters development through the implementation of the best global practices to achieve a standard of quality, sustainable competition, and effective management of resources. In order to reach the leader position, the private enterprises become more and more quality and service oriented to the benefit of the public.

Post-privatization the State dominated market is ruled by the private sector resulting in positive financial growth and reduction in the country's debts and deficits. Even if there is a drop in the inflow of funds due to businesses moving out of the public ambit, the outflow of funds is halted saving State funds that can now be used for national socio-economic goals (Suman, Sanket). The targets to be achieved are invariably higher in the private sector, yielding more profits with effective and efficient production.

Initially, the probability of resistance by the employees of the PSUs is high but over a period of time with a first-hand view of the potential prosperity and growth such resistance is also dimmed. Quick and efficient services to the public raises the quality of product and service leading to an improved infrastructure for the country as a whole.

4.11 DISADVANTAGES OF PRIVATIZATION

On the flip side, though privatization offers several advantages it has some disadvantages as well. The focus of the private sector primarily is on profit maximization and not social objectives. It is left to the public sector to fulfill this objective and initiate socially viable adjustments in the event of emergencies and criticalities (Filipovic, Adnan, 2006).

In many instances, the functioning of the private enterprise lacks clarity and sometimes even the stakeholders fail to access complete information about the enterprise.

In addition to this, privatization has been viewed as the answer to curb State corruption which may, in hindsight, not be quite correct. Privatization has inadvertently become a support to corruption through lobbying and bribery (Kramer, Lindsay, 2018). Unlawful means of obtaining licenses and closing

business deals is fairly common in transactions between the Government and private bidders.

In an attempt to maximize profits private enterprises often resort to malpractices in business that erode the advantages of privatization. Examples are low quality, non-justifiable price escalations to name a few.

The investments required to hire and train staff professionally are substantial though necessary to keep staff in tune with latest business practices. The stakeholders and employees of the privatized PSUs may not be aligned with the management style of the private players and their resistance to change may affect the performance negatively.

Lastly, privatization leaves the enterprise largely bereft of government incentives and subsidies thereby causing the price to intensify during inflation and the brunt of this is borne by the public.

4.12 ANALYSIS OF PRIVATE SECTOR VIS-À-VIS THE INDIAN ECONOMY

India opted for a mixed economy where both the public and the private sector could co-exist (Civil Service India). This shift in approach from a public centric economy to a mixed one had to operate within the provisions of the IDRA, 1951 and other relevant laws. The Industrial Policy Resolution 1956 was enacted to ensure private sector enterprise fit into the framework of the social and economic policy of the State and operated in line with the laws in place. Despite the progress and growth of the public sector in the initial years post-independence, the Government recognized that the private sector was equally important, and it motivated the private sector to develop undertakings consistent with the national policy.

Since the advent of the new economic policy adopting privatization, several industries have been set up in the private sector. Consumer goods industries like cotton textiles, sugar, paper, edible oil etc. were set up in the pre-Independence period in response to market forces. These were ideal for privatization as they required less capital for establishment with a scope for high profits. Post-independence these industries were transferred to the private sector. Other industries including engineering industries were set up post-independence in the private sector. A good example is Tata Steel (erstwhile TISCO), the iron and steel industry in Jamshedpur, Jharkhand. India, in the field of consumer goods, can now be considered to be a self-reliant nation. The 1956 resolution states “*Industries producing intermediate goods and machines can be set up in the private sector*” (Seth, Tushar). As a result, several industries in the field of chemicals, like paints, varnishes, plastics etc., and those manufacturing machine tools, machinery and plants, ferrous and non-ferrous metals, rubber, paper etc. were set up in the private sector.

For India, privatization was essential to enhance the economic status. Though the PSUs had laid down the foundation of an industrial base their continued losses and inefficiencies resulted in several inadequacies (Singh, J.). These included delays in implementation of projects, inefficiency in management, poor productivity of labor, bad operational decisions resulting in cost escalation and other negative consequences. Added to this was the multiple reporting that caused the PSUs to degenerate and ultimately be declared as loss incurring or sick units.

4.13 EXAMPLES OF PRIVATIZATION IN INDIA

Privatization has come a long way in India and at present the spectrum of industries in the private sector is wide and ranges from agricultural products to mineral to the hotel industry. Notable examples of PSUs that were privatized are Lagan Jute Machinery Company Limited (LJMC), Videsh Sanchar Nigam Ltd. (VSNL), Hindustan Zinc Limited (HZL), Hotel Corporation of India Limited (HCI) (The Hotel Corporation of India Limited, 2017), Bharat Aluminum Company Limited (BALCO) (Bharat Aluminum Company Limited).

Subsequent modifications in legislations paved the way for opening the infrastructure sector to the private players. In October 1991 changes were made to allow private enterprises to enter sectors like power generation. One of the most successful privatizations has been of the telecommunications sector transitioned smoothly and by 1992 value added services were also opened to the private sector. This was followed by the introduction of the NTP in 1994 – 95 which completely opened the doors to private enterprise facilitating healthy competition in the market. This went a step further when foreign equity participation was allowed up to 49% in the case of joint ventures with foreign companies. In 1997 The Telecom Regulatory Authority of India (TRAI) was established and in 1999 – 2000 the Department of Telecom Services was made independent from the Department of Telecommunications. The two public sector service providers were corporatized in 2000 – 01 and restrictions prevailing under the government monopoly were lifted in 2002 – 03 leaving an open field for private parties (Telecom Regulatory Authority of India).

4.14 PRIVATE SECTOR INFRA INVESTMENT

Infrastructural reforms were introduced primarily to improve the conditions of roads and to create new avenues for funding of national, state and rural road construction. The vehicle to operationalize this was the Central Road Fund (CRF) created under the Central Road Fund Act (CRF) of 2000 (Acts of Parliament, 2000). The National Highway Development Project, one of the largest single highway projects in the world was funded under CRF. The project constructed 6,000 km of the Golden Quadrilateral (GQ) which connects the four metropolises of Delhi, Mumbai, Chennai and Kolkatta and also 7,300 km of the North-South and East-West Corridors.

As per the Economic Survey, 2019, private participation is essential for the infrastructural space as public funding by itself is insufficient. The survey concluded that private sector infra investment is the key to achieving a high growth trajectory (Nandi, Shreya, 2019). It highlights the need for a higher flow of capital, which can be provided by private investors, in the infrastructure space as the government's capacity for expenditure is limited and very often fails to meet galloping needs. According to the report about 7 – 8% of India's GDP should ideally be spent on infrastructure annually. This brings the required annual investment on infrastructure to approximately \$ 200 billion of which India manages to spend only half of the amount at present. Fiscal constraints limit the government expenditure making the flow of private capital crucial to growth. Private investments can facilitate a high growth trajectory for India through a powerful physical and social presence where infrastructure is concerned making India a \$ 5 trillion economy by 2024 – 25.

The Survey conducted by the Finance Ministry highlights the economic developments and reflects on the requirements to meet the medium-term goals. Krishnamurthy Subramanian, the then Chief Economic Advisor

(CEA) highlighted the real challenge with privatization “...lies in bringing adequate private investment across the country with the collaboration of public sector. along with physical infrastructure, provision of social infrastructure is equally important as these two would determine where India will be placed in the world by 2030.”

The first term of the National Democratic Alliance (NDA) rule focused on building the infrastructure including roads, smart cities, new development schemes like Saubhagya aiming at 100% electrification of households, housing for all, construction of airports in smaller cities etc. The objective was to achieve total connectivity by allocating a substantial amount of funds to infrastructure. Electrification of the broad-gauge network was another important goal, the objective being to reduce the country’s dependence on imported diesel. The Indian Railways identified a 38,000-route kilometer (RKM) to be electrified by 2021 (Government of India, Ministry of Finance, 2019).

Despite the Government’s best efforts to expand the infrastructure there were several challenges and roadblocks, viz., investments, land acquisition, environment clearances, increase in costs due to delays in implementation etc. The Economic Survey observed that the failure of the Government to meet these challenges increases the risks and results in stalled projects due to lack of funds. New policies designed to clear these roadblocks have been introduced by the Government in the last few years in order to speed up the development process. The pace of road construction has picked up due to adoption of new financial models that involve private funding along with State funds, inter-ministerial coordination and smoothening the land acquisition process (Singh, Hemant, 2019). The Survey recognized that the financing gaps in the infrastructure sector could be bridged only through public-private partnerships (PPP) and highlighted the need to focus on

institutional mechanisms and techniques for timely dispute resolution, specialized policies to strengthen the current bond market, promotion of financing through leveraging institutions like National Investment and Infrastructure Fund (NIIF), expand credit guarantee schemes etc. In addition to private participation, the Survey acknowledged that projects through partnerships with multilateral agencies were also an essential aspect.

Public-private partnerships (PPPs) (Niti Ayog, G.O.I.) act as an important instrument of infrastructure development that work as an “off-budget mechanism” since they do not require immediate cash spending by the Government. The term “Public-private partnership” has been increasingly used over the years to best identify the involvement of free enterprise in financing establishment and development of infrastructure. The main advantage of a PPP is that the government is relieved of the burden of capital investment along with the sharing of risk with the private sector. Though the goal of private players is to earn a profit, their focus is on providing competitive and quality services. Hence, value for money is the end result for the government and the consumer. It is a win-win situation for all as the private sector also recovers its investment by charging the consumer, for example, toll charges paid on expressways. However, it is important that the selection of a project under the PPP mode be done carefully, keeping in mind that financial gains must be in tandem with the social and economic impact (UN Economic and Social Commission for Asia and the Pacific, 2008).

4.15 SCOPE OF PRIVATIZATION IN THE NUCLEAR SECTOR

India's aim of autarky in nuclear energy covers exploration and mining of uranium from the fabrication of fuel and production of heavy water to designing and construction of reactors to recycling and management of radioactive waste. The country is also focusing on evolving indigenous and innovative technology to utilize its generous natural resources of Th as fuel for NPPs.

India's 3-stage nuclear power program was drawn up to essentially ensure energy self-reliance and independence as a long-term goal. This goal will be achieved by utilizing the uranium and thorium reserves found in coastal areas in the Southern part of India. This is especially so where Th is concerned since India has 25% of the world's known reserves and the scientific community in the country has estimated that 500 GWe could be produced for at least four centuries by tapping only the economically viable mining of thorium. On the basis of this plan and by extrapolating timelines for development very ambitious targets were set for achievement of milestones in the nuclear power sector. However, despite Government financing and support the nuclear power capacity in the country is still in lower single digits as a percentage of India's power generation capacity. Added to this is the fact that the sector has had its share of protests and controversies related to location, land ownership, safety and security leading to time and cost overruns. The Government monopoly with its inherent bureaucratic constraints and deficit in financing has shown that its autocratic approach has failed in achieving nuclear power targets.

Given the fast pace of development leading to an exponentially rising energy domestic demand combined with the country's dependency on oil, gas and critical raw materials for renewable technologies it is imperative that indigenously developed nuclear power plants fueled by domestic

thorium reserves be fast tracked in order to maintain the country's energy independence. The Central Government would need to introduce a new facet to its nuclear power program whereby investments in cost-effective technologies, reduction of red tape in approvals, streamlining land reforms and operationally efficient special purpose vehicles lead the charge to such independence. Given India's limited options, a competitive domestic nuclear power sector must be proactively encouraged and developed as the key to energy security.

In order to achieve the globally committed targets in its transition to clean energy, India has started looking at the development of Small Modular Reactors (SMRs) with a capacity up to 300 MW. With the already established regulatory framework and ratification of the CSC, India is well placed to look beyond Government monopoly of the nuclear power sector. In a Workshop on Small Modular Reactors held in November 2022, Dr. Jitendra Singh, holding charge as Union Minister of State (Independent Charge) - Science & Technology and for Earth Sciences and also as MoS - Atomic Energy and Space, said that the Government is now looking and exploring the options regarding private sector participation in the development of this critical technology within India (GOI, DAE, 2022). Sharing of technology and funding are crucial if commercial viability of the SMR technology has to be achieved.

Unlike conventional nuclear reactors that are built on site, SMRs with a capacity up to 300 MW are flexible in design and need a smaller footprint. These reactors with their "mobile and agile technology" are conducive to assembly line factory production. This naturally leads to substantial savings in time and costs and where there is need for uninterrupted supply of power SMRs appear to be the solution to the issue of industrial de-carbonization. The SMRs also appear to be simpler and safer as compared to larger nuclear

plants making it the perfect route for entry of the private sector into the nuclear energy industry in India.

At the UNFCCC India outlined its intention to actively scale up its clean energy capacity. However, domestic energy poverty, the Government's development agenda and the alleviation of general poverty is contingent on providing energy access to lakhs of people who, even after 75 years of independence, are not connected to the national power grid. Though different governments over time have declared nuclear power to be the solution to all problems, nothing tangible was achieved. However, with the waiver received from NSG and safeguards agreement with IAEA has opened the doors for interested foreign vendors and investors.

4.16 CASE STUDY OF IMPACT OF PRIVATIZATION ON TELECOMMUNICATIONS INDUSTRY IN INDIA

4.16.1 OVERVIEW

India's telecommunication has undergone an amazing metamorphosis over the last couple of decades. From a highly regulated, state-owned monopoly has emerged a sector that is decontrolled and competitively motivated. The GOI understood the importance of developing the telecommunication sector and that this would be important in instigating economic progress of the country. Understanding the significance of a modern telecommunication network combined with the worldwide shift to knowledge-based economics, the Government of India realized that it was essential to provide an infrastructure that would be modern, efficient and of international standards which would be central to facilitating development of the country -both economic and social. (History of Cellular Telephony in India, Cellular Operators Association of India (COAI)) To quote Mr. T. V. Ramachandra, erstwhile Director General of COAI, *"world over, telecom is accepted to be a critical infrastructure sector. It substantially impacts the efficiency, competitiveness, and growth of every other industry. In fact, international studies have shown a direct relationship between growth in tele-density and its impact on economic growth."* (The Process and Progress of Liberalization, CTMS Seminar, Dec 29, 2002 found at http://www.ctms-bharat.org/121_jan02.htm).

Given India's geographical size and that of its population, in the 1990s it was considered as one of the world's most under penetrated and underdeveloped telecommunications services market.

4.16.2 PRE-LIBERALIZATION CHALLENGES

The Indian telecommunications sector was nationalized immediately on gaining independence in 1947 as the Department of Post and Telegraph working under the Ministry of Communications. It was believed that this would guarantee universal access on demand and would allow for generation of a variety of services more cost-effectively by avoiding duplication of infrastructure. In the 1980s the Department was split into the Department of Telecommunications (DoT) and Department of Posts.

DoT, being a regulatory and legislative agency, controlled all aspects of the Telecom Industry in India and remained a government monopoly deriving its status from the Indian Telegraph Act, 1885. Its mandate included providing citizens with fixed-line services, internet, domestic and international long distance, and other value-added services. Cellular networks were a rarity and only the fixed-line services existed at the time. However, the latter was burdened by several issues because of being a monopoly under the government umbrella and with no competition and severe under investment. Subscribers to the fixed-line services had to suffer a waiting period of several months and/or years to get a connection. To make matters worse, the services were not reliable and affordable. Due to the scarcity of funds allocated the equipment was outdated and faulty. As compared to international standards the infrastructure was obsolete and the service levels not even close. (Morris, Sebastian. 2001)

4.16.3 PRIVATIZATION OF THE TELECOMMUNICATIONS SECTOR

The gigantic technological strides made worldwide forced the government to rethink its strategy for the telecom sector. Growing dissatisfaction amongst the subscribers combined with the possibility of new innovations reducing costs led the policy makers to acknowledge that it would be impossible to take advantage of these advancements without the funds and expertise of the private sector.

The telecommunications industry got its first taste of privatization in early 1986 when the Government formed two corporate entities, i.e., Mahanagar Telephone Nigam Limited (MTNL) and Videsh Sanchar Nigam Limited (VSNL). The government had an upwards of 30% stake in each of these companies while financial institutions and private stakeholders own the rest. By 1995, MTNL had taken over the task of providing basic telephone services and maintenance and upgradation of infrastructure. VSNL was the principal internet provider, and all international calls were routed through it. This remained as India's monopoly international long-distance service.

The New Telecom Policy (NPT) of 1994 was a milestone of sorts, which introduced the framework for allowing private participation in the Telecom Sector. Accordingly, the country was divided into 23 circles and a license bidding process was initiated for each of these circles. On October 1, 2000, a new corporate entity, viz. Bharat Sanchar Nigam Limited (BSNL), was established which was given the near-monopoly mandate of providing basic fixed-line services and value-added services like cellular and internet services pan-India other than in Mumbai and Delhi. Even with the foray of private

players into this sector, MTNL and BSNL continued to control most of the market -particularly fixed-line services. The private sector that had won licenses struggled with raising funds, restrictions placed on them such as on international services and the actual top-lines were far below the projected ones.

To ensure that there was a level playing field, the Government terminated the monopoly of MTNL on long-distance services, removed limits on the number of private sector operators allowed to provide end-to-end bandwidth infrastructure, allowed up to 49% foreign equity per license, new players were allowed to carry inter-circle and intra-circle traffic in mutual agreement with the fixed-line provider operating in that circle. (U.S. Department of State, “India’s New Long Distance Telephony Policy”, message reference No.5606 prepared by U.S.Embassy, New Delhi, August 14, 2000). Further DoT’s regulatory functions were transferred to TRAI – a newly created Telecom Regulatory Authority of India. DoT’s mandate was restricted to policy formulation, licensing, administrative monitoring, wireless spectrum management, research and development, validation of equipment and setting of technical standards. (Telecommunications, Embassy of India, <http://www.india-emb.org.eg/Section12E/eng117b5.htm>). The effect of all these measures was a seismic shift in the telecom industry landscape.

4.16.4 IMPACT OF PRIVATIZATION

- **Increased Competition**

Privatization facilitated a competitive market environment which had many players vying for a market share. This has resulted in welcome benefits for consumers on account of improved service quality, innovations, augmentation of new technologies and services, lower prices and enhanced value propositions.

- **Development of Infrastructure**

The private sector has been able to accomplish what the government was unable to. A substantial influx of funds by private players has resulted in a robust, modern infrastructure which has expanded network coverage and enhanced connectivity across the country covering both urban and rural areas. This infrastructure includes optical fiber networks, mobile towers, and data centers. However, private players have to some extent exacerbated disparities with the unbalanced infrastructure spend in the rural and urban areas. It is important for the private sector and the regulators to address these infrastructure gaps, improve connectivity and promote universal access to telecom services, which are vital to social development and inclusive growth.

- **Technological Advancement**

The telecom sector has indeed witnessed rapid technological advancement post privatization. Private operators have been at the forefront of utilizing ingenious solutions to meet growing demands of consumers, driving digital inclusion and socio-economic development. Some of these cutting-edge

technologies include 4G & 5G LTE, fiber-optic broadband, and internet protocol (IP) based networks. Opportunities have also been created to explore technologies such as IoT (Internet of Things), AI (Artificial Intelligence) and blockchain. By offering innovative and tailored solutions telecom operators have created additional revenue streams.

- **Revenue Generation**

Investment in the Telecom sector has triggered economic growth, created opportunities for employment and has facilitated the growth of several ancillary industries, such as manufacturing handsets. The government too has benefited from this as this sector, after privatization, from auction of spectrums, license fees, taxes etc., all of which have gone into the public coffers.

- **Digital Transformation**

With privatization, India finds itself in the midst of digital transformation and at the same time is able to leverage the Telecom infrastructure to enable e-governance, digital payments, e-commerce, and smart city initiatives.

- **Market Concentration**

Privatization in the Telecom Sector initially fostered competition. However, it also led to market consolidation where a few larger companies had significant market power. An oligopolistic market structure has emerged raising concerns about price manipulation, anti-competitive practices, barriers to new entrants etc. which may potentially limit the choice of the consumers.

- **Quality of Service**

The Telecom industry after doors were opened for private players did indeed progress by leaps and bounds. However, the reliability and consistency of telecom services is still not a given, particularly in terms of call drops, network congestion, and customer support. The infrastructure is under pressure from bandwidth intensive applications and unprecedented growth in the number of subscribers causing disruption and therefore, customer angst.

- **Digital Divide**

Private players, as expected, tend to focus on the more lucrative urban market and are more likely to ignore areas where the return on investment is lower. This has contributed to a digital divide that is a stumbling block to equitable access to telecommunication services, internet connectivity and digital literacy.

- **Regulatory Challenges**

The regulatory framework that governs the sector is under constant challenge to keep pace with the technological advancements and market dynamics. Constant oversight and intervention is required for spectrum allocation, tariff regulation and interconnection disputes to ensure a fair platform and to protect the interests of the consumer.

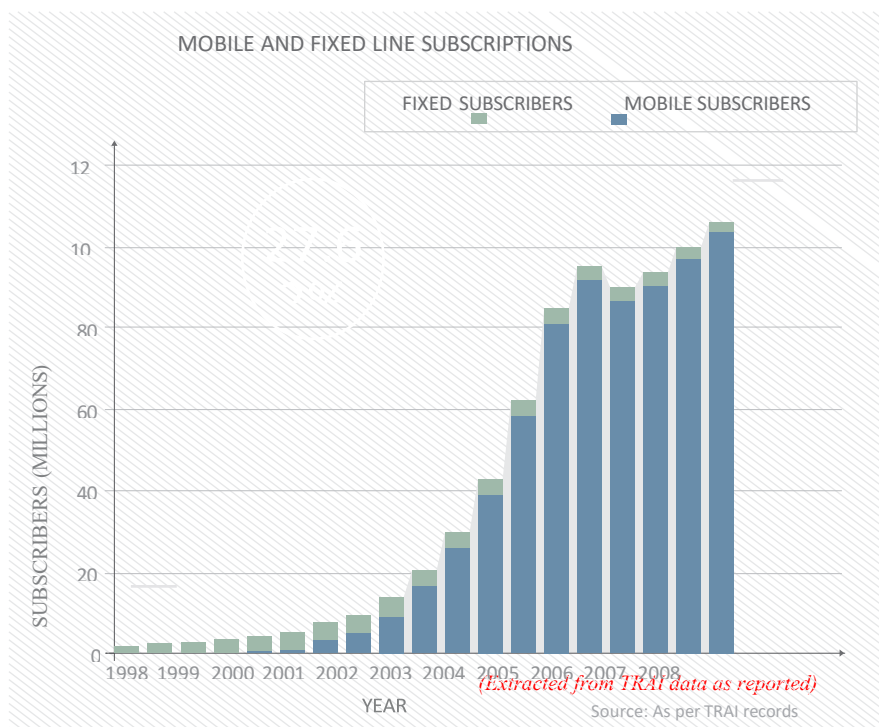
- **Cybersecurity Risks**

There is no doubt that India has been transformed by the privatization of the Telecom Sector. On the flip side, cybersecurity has become a matter of grave concern. Data

breaches, malware attacks etc. have exposed network vulnerabilities. The regulators have now an additional responsibility – to ensure stringent cybersecurity measures, compliance with data protection regulations, proactive risk management to safeguard consumer privacy and network integrity.

4.16.5 TELECOMMUNICATIONS INDUSTRY – THEN AND NOW

As per the Report “A Twenty Year Odyssey – 1997 – 2017” published by TRAI on completion of two decades of its existence, the growth of the Telecom sector in India after privatization is evident.



It is pertinent to note that the Telecommunications Sector comprising largely of private players is now focusing on:

- Green telecom aimed at reducing carbon footprint through low energy consumption.
- Expansion to the rural market, which has been supported by several government backed initiatives.
- BWA technologies, such as WiMAX and LTE. India is expected to be the 2nd largest market for 5G services in the next decade
- Commercial SMS traffic
- Internet of Things or the concept of electronically interconnected and integrated machines that assist in gathering and sharing data.
- Public Wi-Fi Networks
- Universal Service Obligation Fund to provide mobile coverage in Arunachal Pradesh and two districts of Assam.
- Satellite based Narrowband-IoT Network for fishermen, farmers, construction, mining, and logistics enterprises.
- Investment in optical fiber network.
- Mobile banking.
- Customer digital experience

Despite some reservations and downsides, the privatization of the Telecom Sector has worked heavily in favor of the industry and the consumer. India now has the 2nd largest telecom network in the world and the 2nd highest number of internet subscribers globally. Telecom penetration or tele-density has grown rapidly and now stands at 84.51%. FDI into this sector has been forthcoming and several global leaders in this industry have shown interest in setting up manufacturing facilities in India.

4.16.6 NET EFFECT OF PRIVATIZATION

Other than the Telecom sector, privatization has benefited other sectors also e.g. Banking, Air Travel, Power etc. By and large, the private players have brought in their expertise, efficiencies in operations, experience, and knowledge to provide for more cost-effective and streamlined operations. In addition, influx of investment, both domestic and FDI, have given a much-needed boost to upgradation of infrastructure and expansion.

4.17 CONCLUSION

It is increasingly becoming evident that with the unprecedented rapid growth in consumer demand the government run corporations are falling way behind. The atomic energy sector is one of the most strategic ones and traditionally has been a monopoly of the Government and has been kept shrouded in secrecy. On May 16, 2020, the Finance Minister, Ms. Nirmala Sitharaman announced the Government's decision to permit public-private partnerships in this sector leading to disbelief and raising a lot of questions. However, this opening to the private sector was limited, as the sub-sectors that were opened were already with the private sectors in small and limited capacities, e.g., sterilization of medical equipment, while the bulk of the supply rested with government corporations. According to Mr. Anil Kakodkar, the former chairperson of the AEC of India, it is imperative to involve the private sector in a big way to boost the supply chain. The recent pandemic has further fueled the demand for radioactive products for safety and therapeutic purposes presenting a ready market for products which can be manufactured and sold by private parties far more efficiently than the Government. No opening for private participation was announced in the sector of power generation.

Existing public sector undertakings like NPCIL can benefit hugely from private sector funding, expertise and efficiency if they set up partnerships with private players to install and operate nuclear plants. Given the energy deficit that India faces, it is imperative to speedily accelerate generation of clean and green nuclear power. However, to enable this the Government will have to change its existing laws to allow entry of the private companies into this sector.

Till such time as this becomes a reality the Government is cautiously looking at SMRs as an option for private participation. To compensate for large power plants the alternative is to have a cluster of SMRs leading to the question of two opposing principles, i.e., economies of scale and also of mass production. Simply put it implies that cost of building five SMRs of 200 MW capacity each will be more expensive than one 1000 MW nuclear reactor. However, SMRs can be mass produced thereby reducing costs if the demand is substantial. SMRs are expected to reduce the construction time. Additionally, the capital and space required for SMRs is far less than for a regular NPP.

Keeping the above in mind, the NITI Aayog is planning to draw up guidelines and regulations for SMRs keeping in view the safety requirements and impact on the local communities. The Government is reportedly planning to incentivize the private sector to set up SMR plants in a PPP Model in an effort to supplement the country's energy requirements. If India wants to honor its commitment to reduce carbon emissions to fifty percent by 2030 and become a net-zero emitter of carbon by 2070 it will have to accelerate its efforts for a successful green energy program and the only road to take would be involving the private sector in generation of electricity, starting with the manufacture and operation of SMRs.

CHAPTER V

WORLD'S LARGEST DEMOCRACIES AND THEIR DISSIMILITUDE CIVIL NUCLEAR POWER PROGRAMS

PART 1 – USA

5.1 INTRODUCTION TO THE NUCLEAR LEGAL REGIME IN THE USA

One-fifth of the total electricity produced in the US is estimated to be from nuclear energy, generated from about 100 licensed NPPs across the country. Of these operational reactors 65 are PWR and 35 are BWR. The nuclear power plants are by and large privately owned although a few do exist under the authority and regulation of the Government, like the Tennessee Valley Authority. About 36 reactors, primarily located in universities, are also used for research purposes like testing of new designs, in-depth analysis of components and technology and for training of personnel. Uranium, the highly potent fuel for NPPs, is abundantly available in the western part of the country and four uranium producing mills and four in situ leaching plants (ISL) have been set up to harvest it. The waste disposal mechanism is well established with low-level waste stored on-site which is periodically transferred to waste disposal facilities. Low level waste disposal facilities that are licensed are found in four locations across the country. On-site storage is reserved for high-level radioactive waste and residual used nuclear fuel until a geological depository is built. The nuclear energy industry is under the authority of the American Government, regulated through Federal legislations and administrative regulations to govern nuclear facilities.

The AEA, 1954, (Cornell University Library, 2021) is a comprehensive legislation enacted to regulate custody and usage of nuclear substances and establishments that manufacture and/or use these substances to produce energy. It was the foremost legislation and the central Federal statute governing the nuclear energy regime in the USA, though statutes other than this were also passed for the same purpose. The said legislation opened the gates to private enterprise while ending the prevailing monopoly of the Federal government over nuclear energy and related substances. It expanded the access of private industry to production and non-military use of nuclear energy while all aspects of military usage remained under the control of the Federal government.

An independent agency called the AEC was constituted to overview the peaceful use of nuclear power. AEC was later replaced by the NRC with the enactment of the ERA, 1974. Congress transferred all the licensing and other regulatory from AEC to the NRC. The other functions and responsibilities were vested with the ERDA. Subsequently the ERDA was replaced by the DOE with the passing of the DOE Organization Act, Public Law No. 95 – 91. DOE was empowered to regulate all the activities that were previously under the authority of the AEC. It is to be noted that the actions of the DOE are not subject to regulation by the NRC, except when expressly provided for by a statute.

The governing authority for the use of radioactive materials for civilian purposes rests with the NRC and any individual, business enterprise or private institution must first obtain a license from NRC to possess or use such material in the United States. However, a dual regulatory system seems to exist as the DOE, the Department of Defense (DOD) and the Environmental Protection Agency (EPA) are all authorized to regulate use of radioactive substances other than the NRC. Further, jurisdiction of the

states to regulate nuclear activities individually exists to the extent that they do not contradict the Federal legislations (Office of the Federal Register, US, 2011).

States sometimes act on areas regulated by the Federal government also. Section 274 of the Atomic Energy Act provides that a state may decide to enter into an agreement with the NRC to regulate the by-product material which then discontinues the authority of NRC over that particular material. It is important to ensure that the state programs are in compliance with the NRC standards in order to comply with this provision. Both, Federal and the state's laws may apply in areas not pre-empted by the Federal government. However, states have the liberty to adopt standards that are more stringent than Federal standards regulating the same activity.

5.2 GOVERNING LEGISLATIONS

5.2.1 AEA OF 1954, AS AMENDED (United States Nuclear Regulatory Commission, 2013)

The AEA is the fundamental US law that governs all uses of nuclear materials, whether civilian or military. For civilian purposes it makes provision for the evolution and the supervision of the varied usage of atomic substances and facilities in the US stating the policy that *“the development, use and control of atomic energy shall be directed so as to promote world peace, improve the general welfare, increase the standard of living, and strengthen free competition in private enterprise”*. As per the AEA, it is mandatory to obtain a license for all non-military usage of nuclear materials and establishment of facilities for the same. The NRC is empowered to establish and enforce, rules and benchmarks to govern these uses as *“the Commission may deem necessary or desirable in order to protect health and safety and minimize danger to life or property.”*

The Commission must adhere to the procedures and requirements of the Act, which provide for opportunities for hearings and Federal judicial review in various , circumstances, albeit under the authority given by AEA (USNRC, 2013).

The NRC replaced the earlier AEC, which was established as an authority for nuclear energy and safety, virtually overnight. Similar to AEC the NRC regulated matters such as safety, licensing and waste management. However, authority over nuclear weapons and advancement of nuclear power was shifted to the USDOE (Wikipedia: the Free Encyclopedia, 2021).

The NRC has the mandate, under section 274 of the Act, to enter into agreements with individual States. Such agreements can discontinue the regulatory authority of the NRC over some of the materials licensees in that State, including those for industrial and medical uses of nuclear materials. However, the States must display their alignment of their program regulating nuclear energy with that of the NRC. This is essential to ensure that the actions of the State shall be adequate for safeguarding public health and safety. In all cases NRC continues to hold its authority over the NPPs in the State and overall trans-border movements from the State (Wikipedia: The Free Encyclopedia, 2021).

5.2.2 ERA ACT OF 1974 (U.S. Government Publishing Office, 1974)

The NRC was formed by the ERA of 1974 or ERA. As per the AEA there was a single organization, viz., the AEC, that was in charge of the development and safety regulation of civilian applications of nuclear materials as well as of the development and manufacturing of nuclear weapons. ERA separated these roles giving the DOE the responsibility for development and manufacture of nuclear weapons, nuclear power promotion and other energy-related tasks while the NRC was held responsible for nuclear facilities and materials research and regulations. The NRC, however, has no jurisdiction over defense nuclear sites. ERA established the Commission's collegial structure, primary offices, boards and advisory groups. It clearly states that the Commission's actions are to be decided by popular vote following the rule of one man one vote. In a subsequent amendment to the Act, all employees who raise nuclear safety concerns were to be protected under the Act (U.S. Government Publishing Office, 1974).

5.2.3 REORGANIZATION PLAN NO. 1 OF 1980

Subsequent to the Three Mile Island disaster, the RP No. 1 of 1980 was finalized which augmented the regulating and managerial roles of the Chairman of the NRC. This was more so in the event of emergencies when there was a transfer of "*all the functions vested in the Commission pertaining to an emergency concerning a particular facility or materials regulated by the Commission*". Under this Plan the Commission would oversee formulation of policies, rulemaking related to policy, all orders and adjudications. The NRC also has to adhere to the procedural requirements of the NEPA while conducting its regulatory and licensing activities (U.S. Government Publishing Office, 1974).

5.3 NRC ORGANIZATION

The NRC in the US is a special government organization formed under the ERA of 1974. The mandate given to the NRC is to monitor the use of nuclear substances whether byproducts or source materials and all related activities as well. The focus of such regulation is on securing both health and safety for the public, promoting common defense and security and to safeguard the environment while overseeing the civilian use of nuclear energy (World Nuclear Association Library, 2016).

Regulation of Byproduct – Under section 11e(1) of the AEA byproduct has been described as radioactive material, other than special nuclear materials, made radioactive through exposure during radiation during the production or use of special nuclear materials. Further, as per Section 11e(2) it *“includes the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content”*. (U.S. Government Publishing Office, 1954, pp 7).

Regulation by Source Materials – refers to the element thorium and/or uranium, as long as the uranium has not been enhanced in the U-235 isotope. It also includes any physical or chemical blend of the two elements and ores containing 0.05% or more of Th, U or any combination of the two by weight. A source material would also be depleted uranium or uranium leftover from uranium enrichment (*See* Section 11z of the AEA, 1954 as Amended) (U.S. Government Publishing Office, 1954 pp 11)

Special Nuclear Material – refers to Pu, U-233, U enriched in isotope U-233 or U-235. In other words, special nuclear material may be said to be any other material that is so decided other than source material. (*See* Section

11aa of the AEA, 1954 as Amended) (U.S. Government Publishing Office, 1954 pp 11)

5.3.1 THE NRC'S REGULATORY MISSION

The NRC's regulatory activities cover oversight of reactor and material safety, reactor and materials licensing, waste management, evaluation of new applications for NPPs. The NRC's regulatory mission can be said to cover three main areas, (World Nuclear Association Library, 2016) viz.,

- **Reactors** – the commercial power plants used for generating electricity and for research, testing and training of personnel in the field of nuclear energy.
- **Materials** – all nuclear material and their uses in the spheres of medical, industry and academics including the facilities that produce nuclear fuel.
- **Waste** – the waste resulting from deactivation of facilities and that generated during transportation, storage and disposal of nuclear materials.

5.3.2 COMMISSION STRUCTURE

(US NRC. *See About NRC – Organization and Functions*)

The Commission comprises of five members all of whom are selected by the Head of State of the USA. The selection of the five commissioners is then ratified by the Senate for a 5-year term. No more than three commissioners are allowed to be selected from one political party. The members develop rules and directives controlling NPPs and materials safety, for licensing and decide allowable matters that come up before the Commission. A chairperson is elected from the body of commissioners who also also serves as the official spokesperson for the agency.

The offices listed below report directly to the Commission:

- The General Counsel
- International Programs
- Commission Appellate Adjudication
- Congressional Affairs
- Public Affairs
- Secretary

5.3.3 THE NRC STAFF

(US NRC. *See* About NRC – Organization and Functions)

The headquarters of the NRC are located in the State of Maryland. There are four offices that oversee the running of 104 NPPs and 31 non-power reactors or reactors for research and testing. They also undertake inspections, programs created as part of the regulatory process such as an enforcement program, program for emergency response specially designed for licensees. In some cases, they also oversee construction of nuclear facilities and material licenses. The NRC has inspectors permanently stationed at all the nuclear facilities that it regulates.

The four offices are located at:

- Region I office at King of Prussia, Pennsylvania oversees regulatory activities in NE part of USA except for the Callaway plant in Missouri, licensees and federal facilities for Regions I and II
- Region II office at Atlanta, Georgia oversees regulatory activities in south-eastern part of the country, the fuel processing facilities in all the Regions and construction

inspection activities for new NPPs and facilities for fuel-cycles in all the Regions.

- Region III office at Lisle, Illinois oversees regulatory activities in northern mid-western part of the country and licensees and federal facilities in the region
- Region IV office at Arlington, Texas oversees regulatory activities in western and southern mid-western part of the country as also the Callaway plant in Missouri and licensees and federal facilities in the region.

The NRC also has a NRC Technical Training Center located in Chattanooga, Tennessee that trains the staff in various technical aspects with respect to regulation of nuclear materials and facilities.

5.3.4 THE EDO

Operations and day-to-day administrative tasks of the Agency are the responsibility of the NRC's chief operating officer or the EDO. The EDO is responsible for a number of offices that manage all aspects, such as,

- The Programs for materials and environment management are run in tandem with other agencies, the SG, the tribal governments, the public at large and any other stakeholders. An attempt is made to implement the Agency's objectives the framework of these programs.
- Locating new sites for NPPs, licensing and general oversight of new commercial NPPs within the rules and regulations of the Agency

- Regulation of the operations of NPPs with a focus on safety and security of manufacturing, storage, transportation and radioactive waste management.
- Regulation of all the operations of commercial and research NPPs.
- Regulatory research covering planning, recommending, managing and implementing research initiatives.
- Enforcement of all regulations.
- Conducting criminal investigations on the basis of NRC findings or claims of wrongdoing made by persons, including discrimination against “whistleblowers”. It makes substantiated criminal case recommendations to the DoJ.
- Development of overreaching policies and management of direction for evaluating and assessing technical concerns regarding nuclear facility security, as well as serving as the agency’s contact with other agencies and law enforcement for all matters related to safeguards and security.
- Development of policies, rules, guidelines and programs that ensure preparedness in times of emergency.

5.3.5 ADVISORY COMMITTEES AND BOARDS

Several committees and boards have been set up to assist in the functioning of the NRC. A brief description of some of these is given below:

- **ACRS**

(US NRC. *See* About NRC – Organization and Functions – ACRS)

The ACRS extends autonomous expertise to the NRC covering safety and the sufficiency of such safety for all NPPs – existing and proposed. It also advises on matters of nuclear substances and management of nuclear waste. Its responsibilities include:

- To evaluate safety reports and applications for licenses and renewal.
- To extend advice and opinion on safety risks and reasonableness of standards for NPPs.
- To review specific issues related to safety for NPPs and
- To extend advice on issues of health and protection against radiation

The ACRS is unfettered and is directly responsible to the Commission. The members that are appointed include selected individuals, who are qualified with technical expertise including on safety issues. An annual report is submitted by the ACRS covering research activities and designs for naval reactors. The ACRS also advises the DNFSB (United States Nuclear Regulatory Commission. *See* About NRC – Organization and Functions – Advisory Committee on Reactor Safeguards).

- **ACMUI**

The ACMUI supports the NRC staff with advice on matters related to policy matters and issues of a technical nature resulting from the regulation of use of nuclear substances in the medical industry. The members include health care professionals from various disciplines. The responsibility of the ACMUI including commenting on additions, deletions and amendments to regulations and extending guidance in evaluation of uncommon usage of radioactive material, providing assistance in cases of licensing, inspection and enforcement and to proactively raise up key issues for attention and necessary follow up. (United States Nuclear Regulatory Commission. *See About NRC – Organization and Functions – Advisory Committee on Medical Uses of Isotopes*).

- **ASLBP**

Administrative judges form part of the ASLBP and they conduct adjudicatory hearings related to action – whether licensing or enforcement – concerning all facilities involved with production or usage of nuclear substances. Such hearings are open to all those who are directly affected by such actions. Though the judges are hired by the NRC, they are separate from the other NRC staff and have no conflict of interest where these hearings are concerned. Decisions of the ASLBP can be appealed against or petitions for review of the same can be filed with the Commission (US NRC. *See About NRC – Organization and Functions – Atomic Safety and Licensing Board Panel*).

5.3.6 COMPONENTS OF THE REGULATORY PROGRAM

The regulatory program has five key components which it continually aims to improve through risk-informed and performance-based regulations. These components are briefly described below:

- **Regulations and Guidance**
 - **Rulemaking** – Developing and amending rules and regulations that are mandatory to obtain or renew a license or certificate for anyone who wants to operate a nuclear facility or even use nuclear materials.
 - **Guidance Development** – Conceptualizing and updating documents for guidance purposes such as regulatory guides, standard review plans and Inspection Manual with a view to help licensees meet the safety standards.
 - **Generic Communications** – Disseminating information about events, requesting for information with respect to regulatory requirements etc.
 - **Development of Standards** – In cooperation with relevant organizations to develop with consensus standards for systems, equipment or materials used by the nuclear industry.

- **Licensing, Decommissioning and Certification**
 - **Licensing** – Issue of new licenses, renewals, amendments and transfer of licenses authorizing the set up or management of a nuclear facility or for the use or transport nuclear materials.

- **Decommissioning** – Ensuring safety while a nuclear facility is deactivated and reduction in radioactivity to a level so that the license can be terminated.
- **Certification** – Issuing certificate enabling manufacture of spent fuel casks, transport packaging for nuclear materials, sealed sources and devices and for operation of a gaseous diffusion plant.
- **Oversight**
 - **Inspection** – to verify that the activities are conducted as per NRC regulations to ensure public safety
 - **Assessment of Performance** – Operating facilities are assessed by review of inspection findings and performance indicators and necessary action by the Agency determined.
 - **Enforcement** – to issue sanctions to those licensees who have violated the regulations of NRC
 - **Allegations** – respond to reports of wrongdoings by licensees, new applicants and contractors or vendors of licensees.
 - **Investigations** – to investigate wrongdoings by licensees
 - **Incident Response** – Ensure readiness and maintenance of a level of capability of the NRC Headquarters Operations Center and the Regional Incident Response Centers which are the departments coordinating and monitoring NRC's response to incidents, reportable conditions, and actions of licensees so that safety at facilities is prevalent at all times.

- **Operational Experience**
 - **Events Assessment** – Review on a daily basis together with a long-term trend analysis of accidents and reportable incidents in order to determine and be prepared with the appropriate regulatory response from the Agency.
 - **Generic Issues** – to identify and resolve issues related to safety that will affect more than one nuclear facility.

- **Support for Decisions**
 - **Research Activities** – Assist the NRC through experiments, technical studies and analytics so that realistic and effective decisions are made, assess the safety aspect of potential technical issues including those involving new designs and technologies.
 - **Risk Assessment** - Support all regulatory decision making through use of risk analysis and performance insights.
 - **Performance Assessment** – In all cases of waste disposal and decommissioning to determine if performance objectives have been met by evaluating potential release of radioactivity into the environment and assessing resultant radiological doses.
 - **Advisory Activities** – to review and assess regulatory proposals by independent advisors reporting to the Commission or the EDO.
 - **Adjudication** – Conduct hearings in a legal framework to address concerns of persons affected by licensing or enforcement actions.

4.4 LICENSING

Licenses are issued for all aspects of management of commercial reactors including decommissioning. Other establishments such as fuel cycle facilities or those that handle any facet of nuclear materials, viz., possession, usage in any way whatsoever, transportation, waste management etc. also require licenses. These licenses may be general or specific. For facilities that have reached the end of their useful life, the NRC has established requirements to contain the left over radioactivity to such a low level that property can be offered for unrestricted use or with conditions post which the license can be terminated. In some cases, the NRC issues certificates instead of licenses, viz., certificate to manufacture spent fuel storage casks or packaging for transporting nuclear material.

5.4.1 INITIAL LICENSES

The two main types of licenses issued by the NRC are general licenses or specific licenses. As per regulations, a general license authorizes a person to engage in certain activities and they need not apply to the NRC nor possess a specific license document. There are several general licenses that may be issued under the NRC rules, including for transportation of licensed nuclear materials in NRC. (U.S. Government Publishing Office, 1954, pp 37).

The NRC also issues specific licenses for single applications such as operating licenses for NPPs. Approval of the first license, renewals and revisions of the license are all part of the licensing process. The potential user must apply to the NRC for an explicit license for the usage of nuclear substances or to operate a facility that uses such materials. On the basis of standardized review plans the NRC examines the application to confirm that the assumptions in the application are technically sound and that the applicant will

meet all the applicable standards. The Agency must determine that if the license is granted there is a reasonable expectation that there will be satisfactory coverage for the health and safety of the public and the issue of license will not be detrimental to general security. The NRC's decisions and reasonings are documented in the SER.

An environmental review is also conducted as required by NEPA as part of the licensing process. These requirements of NEPA are included in NRC's implementing regulation in Chapter 10 of the AEA of 1954 as amended, and they require the NRC to evaluate the environmental effects of a proposed licensing action. In most cases, an Environmental Impact Statement (EIS) is prepared as per NEPA mandate for all "*major Federal actions significantly affecting the quality of the human environment*". E.g., issue of or renewal of a license to a nuclear facility will be considered to be a "major Federal action" where an EIS is mandatory. A normal review will include critical analysis of impact to water, air, flora, fauna, rest of the environment, and historically, archaeologically or architecturally important properties. An evaluation of sum total of all impacts - economic, social, cultural and other impacts, environmental justice etc. is done together with any alternatives to the proposed action. The environmental impacts of some licensing actions or at least certain aspects of those actions may be covered in a Generic Environmental Impact Statement (GEIS). E.g., the NRC published a GEIS for reactor license renewal and for uranium recovery facilities.

The EIS starts when the applicant applies together with an environmental report. A Notice of Intent is published and at least one public "scoping meeting" organized in the affected community

allowing the public to voice its opinion and offer information. These meetings are useful in identifying concerns that should be addressed by the EIS and typically all stakeholders including State and local agencies seek participation. A draft EIS is released for public feedback and after evaluation of the same the final EIS is released.

Some licensing actions may not necessitate the completion of an EIS and a “categorical exclusion” may apply. In all cases, the NRC conducts an Environmental Assessment that should result in a “no substantial impact” determination before issue of a license.

5.4.2 LICENSE AMENDMENTS

Any amendment to a license where the license holder wishes to update the license including the technical specifications incorporated therein, may be made through an application to the NRC as per the procedural criteria for a request for amendment including request for a hearing incorporated in the Act. The Agency publishes a notification of the proposed amendment in the Federal Register. Each notice contains the NRC’s evaluation of the proposed amendment guided by NSHC standards. The notice also has a short write up on the facility in question and the amendment proposed. It then solicits for feedback from the public within a 30-day period.

If the Commission gets an explicit request for a hearing on an amendment request it will not take a final decision on NSHC. However, if a final evaluation is done the amendment will take effect immediately irrespective of the hearing. In case the Commission determines that there are major risks involved the hearing must be held before any modification.

In some situations, the standard notice process is bypassed particularly if the license has to be issued in emergency situations and swift action is imperative and shortage of time does not allow publication of notice for a 30-day period. The request may, then, be processed under the emergency conditions set forth in the Act and the amendment may be published in the media for those amendments that must be disposed of in less than a two-week time frame. Accordingly, changes may be made in certain emergency circumstances. However, an emergency situation should not have been created or caused by the applicant. The applicant must also be able to explain satisfactorily why the prevention could not have avoided the emergency altogether.

All reviews of amendment requests for technical licensing must be done as per the NRC Office Instruction LIC-101 – LARM. Additional information may be required from the Licensee to reconfirm that the decision taken was an informed, technically correct and legally defensible one.

Certain proposed amendments could require an environmental study under NEPA. Several revision requests, however, fall within one of the categorical exclusions provided. A Safety Evaluation Report is prepared at the end of the investigations. The Commission clears the amendment if it determines that the Licensee has given satisfactory confirmation that the health and safety of the public will be appropriately covered, and issue of the amendment will not be detrimental to the public and the country and its defense and security.

5.4.3 MATERIALS LICENSE

The NRC also oversees the safe usage of nuclear substances for other purposes such as medical, industrial and academic use. It also supervises recovery of U, sites for disposal of low-level radioactive waste and the closure of erstwhile operational NPPs. In addition, it is also responsible for the production of nuclear fuel for commercial NPPs, storage, transportation and disposal of waste and spent nuclear fuel. As part of its responsibility in this regard is the regulatory jurisdiction to license and regulate by-product materials, source materials and specific quantities of nuclear materials that are, on occasion, delegated to States. The NRC enters into an agreement with the Agreement State, that gives the particular State the ability to license and inspect materials used or owned inside its borders. At present there are 37 Agreement States in USA.

5.4.4 LICENSE RENEWAL

Licenses are issued for commercially generating reactors to run for up to 40 years, as approved by the AEA, and these licenses can be extended for another 20 years. The initial term of 40 years was determined based on commercial and anti-trust factors rather than technical constraints. The option to apply for the renewal for another 20 years rests with the owner of the NPP. This option may be exercised before the initial term has expired and there is no time limit within which to make such an application. In the event that a proper and complete application for renewal is submitted at least five years before the end of the initial term and at the end of this period the NRC is still examining the application then the facility or plant can keep operating until such time as the NRC completes its review. This is referred to as “timely renewal” operation and in all

other cases, the plant may be forced to shut down till the renewal decision is reached. The estimated time to renew a license is around 22 months and 30 months if an adjudicatory hearing is needed. The entire process is conducted to a plant-specific schedule that the applicant has agreed to.

5.4.5 TECHNICAL REVIEWS

The NRC created the first comprehensive program for nuclear plant aging research in 1982. A review group based on the findings of that study discovered that several aging processes could be easily controlled and did not raise any technical issues that would pre-empt NPPs from being extended in service. The first safety standards for license renewal were finalized in 1991. The license renewal regulation was amended in 1995 after demonstration programs at a few pilot plants to emphasize the importance of minimizing the negative impacts of aging while renewing a license. These regulatory adjustments were made so that critical systems, structures, and parts would continue to work as intended for the course of the 20-year extended operation period.

The NRC regulations provide for fire protection, environmental qualifications, pressurized thermal shock, anticipated transients without scram and station blackout. To demonstrate compliance with these regulations the NPP systems, structures and components that are safety related or whose failure could possibly have an impact on safety related functions must be identified. All passive and long-lived structures and components must be identified, and the applicant must satisfy the NRC that all effects of passage of time will be handled in a manner that their intended functions will be maintained over the extended term. Such assurance should cover all

integral such parts including steam generators, etc. Active surveillance, performance indicators and maintenance make detection and timely correction of harmful aging effects in active components. These procedures are necessary during the initial term and must continue in the extended term and hence active components, such as motors, diesel generators, amongst others, are not reviewed in the renewal process.

Applicants for extension of the term of the facility or plant must also identify and have ready an updated analysis for such time-limited aging. At the time the plant is made operational certain assumptions about the period for which it will be operational are integrated into the design calculations for various systems, structures and components. These must be demonstrated to be valid for the extended term also in the absence of which the impacted parts must be made a part of an approved aging management program.

5.4.6 KEY TECHNICAL DOCUMENTS

- The GALL report helps in guiding renewal of licenses. It details the reasons for concluding the adequacy of present programs.
- The standard review plan references the GALL report when it is prepared in cases of renewal. It helps in identifying those cases that require special focus during the process.
- A regulatory guide helps by providing formats and contains all the safety and other aspects that the applicant may require.

5.4.7 LICENSE TRANSFERS

Regulatory approval from the NRC is required for a license transfer under the Act. This includes direct transfers, such as, sale of a nuclear plant from one entity to another, a change in the licensed operator or shift of interest by a sleeping minority owner, and such transfers that result from setting up of a holding company that takes over an existing licensed facility. Commercial transactions involving or affecting nuclear licensees or the licensed assets or causing reorganization of nuclear licensees, such as, a restructuring due to electricity regulation, may also require NRC regulatory approval.

A license transfer consent must be obtained prior to closing a transaction. Even when a transfer of control consent is not required it is prudent to obtain a regulatory confirmation. Licensees frequently request a documented threshold determination from NRC stating that their approval is not necessary.

5.4.8 COMMON QUESTIONS ON LICENSE TRANSFERS

- **What is the meaning of a license transfer?**

A “license transfer” is a transfer of control from one legal body to another. Any such transfer cannot be effected without the consent of the NRC in writing.

- **When is a transfer request necessary?**

A transfer request will be required when significant operating control has shifted, and a substantial level of autonomy is given to the operating business. The NRC has advice documents to assist licensees in deciding whether or not to apply for such a request.

- **To whom should a licensee make a transfer request?**

The transfer request should be made to the Commission for a license transfer which will be reviewed and assessed to see if it fits specific conditions before grant of approval.

- **Do license transfers affect operations?**

Generally, license transfers include a change in corporate ownership of facilities and not the type of technical concerns that would have an influence on operations. Therefore, usually operations are not affected as the transfer or merger will, in most cases, not include plants, people, methods or policies.

- **How many types of license transfers are there?**

On account of the various corporate decisions of the licensees, requests for various types of transfer requests are made. Some licensees exit the electricity generating industry, some decide they are too small to compete effectively and are looking for partners, others establish holding companies that allows for diversification and some on the other hand establish entities as subsidiaries for various reasons including more technical focus, economies of scale etc. Yet again, licensees may seek approval for changes based on anticipated modifications. There are basically three categories of transfers – direct transfers (e.g., transfer of ownership interest), indirect transfer (e.g., establishment of holding company over the existing licensee) and complete transfer of authority and beneficial interest.

5.4.9 LICENSE TRANSFER REGULATIONS

The following regulations govern license transfer requests:

- Public Notification – Availability of Documents and Records, Hearing Requests and Procedures for Hearings on License Transfer Application.
- Contents of applications, general information
- Ineligibility of certain applicants
- Common Standards for issuing a license.
- Reporting and recordkeeping for decommissioning planning
- General guidance for transfer of licenses
- Financial protection requirements and indemnity agreements

5.4.10 KEY LICENSE TRANSFER CONSIDERATIONS

(a) Technical Qualifications

The qualifications and competency of the transferee proposed is reviewed to confirm if the facility can continue to be operated with safety and security. This is not so vital in the case of indirect transfers where the licensee does not change technical qualifications. On the other hand, for direct transfers the review will be defined by how much the present plant employees and organization will change, especially in circumstances where there is a change of operator. The NRC relies on the provisions of the Act and guidance materials for this assessment.

(b) Financial Qualifications

Using the rules provided under the Act the NRC examines the proposed transferee's financial qualifications for operations. If the transferee is an 'electric utility' as per

established definition and standards there is no requirement to examine their financial credentials. In all other cases, the NRC will look at the sources of revenue and the facility's projected 5-year operating expenditure to see if the transferee has a realistic opportunity of maintaining the cash flow to keep the plant running safely. It is also determined whether the transferee in question has adequately satisfied the reviewers on the availability of funds at the time of deactivation for the decommissioning procedure via the Decommissioning Funding Assurance Review.

(c) Foreign Ownership, Control or Domination

The NRC must determine whether the proposed transferee is under the control of any foreigner -whether an individual or any entity. Sections 103 and 104 of the AEA ban foreign ownership or dominance of any nuclear facility. The review procedure is based on established NRC precedent and is geared towards verifying that the said foreign control does not have any sway over activities concerning safety under the license with a priority on preserving the security of the US.

5.4.11 ENVIRONMENTAL REVIEWS

In addition to the technical requirements of license renewal, the NRC's responsibilities under NEPA demand that a study of the environmental implications of the renewal. Parallel to its efforts to regulate ageing, the NRC has undertaken a separate responsibility that has been incorporated into the legislation and rules thereunder to narrow the scope of the environmental review. Certain

environmental issues categorized as ‘Category I Issues’ are generic and reviewed for all nuclear plants. The NUREG-1437 or the Generic Environmental Impact Statement for Nuclear Plant License Renewal (GEIS) evaluates the scope and impact of the renewal on environment for any nuclear plant, including impact on endangered species, cooling water system’s impact on fish, shellfish and quality of ground water. Every application for renewal must include a plant-specific addendum to the GEIS. ‘Category II Issues’ are those which are assessed on a site-to-site basis and are included in the supplement to the Statement.

As part of the NEPA process, after receiving a renewal application the NRC holds a public ‘scoping’ meeting in the vicinity of the nuclear power plant in a bid to identify environmental issues unique to that plant. This assists the NRC in determining the severity of the environmental impacts and whether a recommendation should be issued that license renewal is not feasible. These recommendations are made in a draft plant-specific supplement to the GEIS, which is open for public opinion and feedback and is subsequently debated at a public meeting. NRC publishes the final plant-specific supplement to the GEIS after consideration of the feedback.

5.5 ENFORCEMENT, INVESTIGATION AND SANCTIONS

5.5.1 NRC ENFORCEMENT PROGRAM

The Atomic Energy Act and the Energy Reorganization Act of 1974, as modified give NRC the power to enforce rules and regulations. The AEA gives NRC the authority to conduct inspections and investigations, issue orders, revoke licenses in certain instances and apply civil fines and penalties. The Debt Collection Act of 1996 annually adjusts the maximum daily civil penalty sum and at present

it is \$ 140,000. Audits, inspections, investigations and also licensee self-reporting are used to identify regulatory violations. All infractions are subject to civil penalties and willful offences may attract criminal charges.

In contrast to the standard for criminal cases where the burden of proof has to be beyond reasonable doubt the NRC adopts a preponderance of evidence standard for civil enforcement, viz., information that is of greater weight or credibility or is more likely to be current than not. On discovery of an apparent infraction, the Commission's Enforcement Policy comes into play. The Policy objectives are to emphasize the importance of following regulatory requirements and to encourage early detection and comprehensive rectification of infractions (United States Nuclear Regulatory Commission, 2018). The Policy is updated regularly and is freely available on the official website of the Commission. The NRC's Enforcement Manual details the procedure for the enforcement program in accordance with the Policy (United States Nuclear Regulatory Commission, 1990).

The Policy also covers minor violations and non-cited violations. Minor violations are those infractions of public safety or the environment which are not of Severity Level IV or violations linked to Green SDP conclusions. These usually do not warrant documentation in inspection reports. However, licensees are mandatorily required to remedy the same.

The bulk of non-minor violations are of Severity Level IV and violations connected with SDP results. These are treated as "non-cited violations" and of Severity Level IV if specific criteria in

Section VI.A of the Enforcement Policy are met. These violations are noted in inspection reports to create public records of violations but are not mentioned in the Notices of Violation. Written responses are expected from the Licensees for these violations.

5.5.2 VIOLATIONS AT OPERATING PLANTS

Violations at the operational nuclear plants are handled under one of two schemes, viz.,

- **Operating Reactor Assessment Program (ROP)**

The ROP determines the significance of the inspection findings at operating power reactors as well as their appraisal, disposition and subsequent action by the NRC. They are color coded as green, white, yellow or red depending on the severity of the risk. The severity of the ROP results is rarely assigned, and they are hardly ever subject to civil fines.

- **Traditional Enforcement**

Violations with actual safety and security consequences, that may affect the NRC's ability to perform its regulatory oversight function, and which involve willfulness or for which there are no associated SDP performance deficiencies are assigned a Severity Level from Level IV for those of more than minor concern and up to Level I for the most serious ones. A civil penalty will be assessed if the Severity Level is III or above. This procedure is used to handle material licenses.

5.5.3 ANTITRUST

Until 1999, Section 105 of the AEA required the NRC to assess license transfer petitions for antitrust implications. In the same year however, the Commission concluded that the AEA neither required nor authorized assessments of post-operating license transfer petitions.

5.5.4 INSURANCE

The NRC examines license transfer applications to ensure that the prospective transferee possesses the necessary insurance and indemnification for off-site liability claims for personal injury and property damage as required under Section 170 of the AEA. The NRC also guarantees, to the extent provided, that the transfer beneficiaries have on-site property damage insurance to help recover reactor cleaning costs after an accident.

5.5.5 CIVIL SANCTIONS

The NRC's enforcement structure features graduated sanctions with differing levels of significance, to reflect the fact that infractions affect diverse parts of the Commission's regulatory program. When a violation comes to light, the NRC evaluates the severity of the infringement on the basis of the following factors:

- Real safety consequences
- The infraction's possible safety repercussions
- The impact on the NRC regulatory program and
- The willful components, if any, of the violation

5.5.6 CIVIL PENALTIES

For civil penalties, the traditional enforcement approach is used. Civil fines and penalties are considered for infractions of Security Levels I, II and III. Different levels of civil penalties are imposed based on a combination of the following:

- Type of licensed activity,
- The type of license
- The severity level of the violation,
- Regardless of the activity area, whether the licensee has had any previous escalated enforcement action during the prior two-year period or two inspections, whichever comes earlier.
- Whether the licensee should be given credit for actions related to the identification.
- Whether the licensee's corrective actions are prompt and comprehensive and
- Whether the subject in question needs discretion in the light of all circumstances. The Enforcement Policy also provides additional guidelines on the use of discretion in enforcement.

5.5.7 SDP FINDINGS

Violations connected to white, yellow or red SDP findings are also addressed through the escalated enforcement procedure, with NOVs being issued. For these offences no severity levels are usually assigned and civil fines are rarely levied. The SDP findings, however, have consequences for the ROP Action Matrix explored later in this study.

5.5.8 ORDERS

For infractions of Severity Level - I, II and III, orders may be issued, in lieu of or in addition to civil penalties, as appropriate. The orders may be issued to alter, suspend or revoke a license, to halt and desist from a certain activity or practice or to require any other action that the NRC deems fit and necessary.

5.5.9 REACTOR OVERSIGHT PROCESS

Reactor safety, radiation safety and safeguards are the three primary and strategic performance areas for the reactor oversight process. Cornerstones reflect the critical safety features of facility operating within each key performance area. Initiating events, mitigating systems, barrier integrity, emergency readiness, public radiation safety, occupational radiation safety and physical protection are the seven cornerstones. Satisfactory performance of the licensee in these areas offers reasonable assurance of safe facility operation and the accomplishment of NRC's safety mandate. Inspection methods and performance indicators are included in each cornerstone to guarantee that its goals are met.

Inspection findings provided by the NRC inspectors and routed through the SDP together with the performance indicators (PIs) reported by the licensee are used by the NRC to evaluate plant performance. The safety significance of both PIs and inspection results is assessed and a color classification is assigned. Green inspection results, also known as the PIs, imply there is very minimal risk of harm and so have little or no influence on safety. Inspection findings or PIs that are white, yellow or red indicate a higher level of safety relevance. the findings of NRC inspections are documented in inspection reports and summarized in Facility Issue

Matrices for each plant. In accordance with Inspection Manual Chapter 0609 (United States Nuclear Regulatory Commission, 2020), inspection findings are analyzed using SDP or ‘Significant Determination Process’. PIs are reported to the NRC on a quarterly basis by the Licensees in accordance with the latest reporting guidance in NEI 99-02 – Regulatory Assessment Performance Indicator Guideline.

The NRC monitors plant performance on a regular basis. It decides on its regulatory action using an Action Matrix that specifies a range of options based on the importance of the PIs and inspection results. The NRC will only carry out its ‘baseline inspection program’ for a facility that has all of its PIs and inspection finding classified as green. In all other cases, additional inspections are conducted and other appropriate actions taken, keeping safety implications of concern at the plant as the focus. The NRC also understands that the regulatory actions required by the Action Matrix may not be suitable in unusual circumstances. In these instances, the NRC may deviate from the Action Matrix to either increase or decrease the intensity of the Commission’s action after receiving the approval of the EDO.

The Action Matrix followed is as below:

Action Matrix Summary					
Column	Column 1	Column 2	Column 3	Column 4	Column 5
Description	Licensee Response	Regulatory Response	Degraded Cornerstone	Multiple/ Degraded Cornerstone	Unacceptable Performance
Inspections	None	IP 95001	IP 95002	IP 95003	Shutdown

5.5.10 NRC INVESTIGATIONS

Through the Office of Investigations (OI) Mandate, the NRC investigates potential infractions that may entail individual misbehavior or ‘misconduct’. This is an autonomous office within the NRC. Typically, OI’s investigation concerns possible violations of the Act and regulations, viz., deliberate misconduct, employee protection/ discrimination and discrimination against employees (complete and accurate information). If the allegations of wrongdoing are proven, the licensee or the individual(s) implicated or both may face criminal charges and/or civil penalties.

OI investigates significant concerns that necessitate processes that differ from those ordinarily used in the NRC compliance inspections. These investigations involve wrongdoing, whereas ordinary NRC inspections are usually focused on whether a breach has occurred with strict reference to compliance. This raises the question of whether the infraction was a product of purposeful misconduct or not. ‘Willfulness’ can be of two types, viz., ‘planned misbehavior’ and ‘careless or reckless disregard’. Knowing that an action will be in violation of a rule or regulation, but undertaking the activity regardless is known as deliberate misconduct and these include actions performed in careless disregard of regulations. While an individual may not have been aware of the rules, he/she may be charged with willfulness if he/she clearly neglected to contemplate compliance or otherwise act in good faith.

Under the deliberate misconduct regulation, an individual who participates in purposeful misconduct faces individual punishment

from the NRC. Individual enforcement action will not be taken against an individual who shows casual disregard unless they are a licensed operator. The individual's culpability in this scenario, however, may still be prominent in the civil enforcement procedure and may be taken into account in any criminal prosecution. The element of willful disregard may also heighten the severity of the licensee's punishment.

A regular NRC violation may exist in the case of the complete and accurate information rule, regardless of whether the persons were aware that the information provided or stored in a record was incomplete or incorrect. However, if OI determines the inaccuracy or omission was known in advance, there will be an issue of falsification and hence a potential violation. Willfulness that involves a reckless disregard rather than purposeful intent, for the veracity of the information may not result in an individual civil penalty but it tends to make any NRC enforcement action against the licensee for a violation more significant.

5.5.11 SAFETY CULTURE

The NRC and the nuclear industry opine that plant safety is directly related to the working environment at nuclear power plants. This can be seen in the nuclear licensee's efforts to promote the development of a safety culture at their plants. The Commission approved the release of its Final Safety Policy Statement on 14th June 2011 (U.S. Government Publishing Office, 2011). When carrying out licensed activities, all licensees are expected to build and maintain a positive safety culture according to the Policy. Nuclear safety culture is defined by the Commission as *“fundamental principles and behaviors emerging from a collective commitment by leaders and*

individuals to prioritize safety over competing aims to assure people and the environment's protection". The Policy identifies a number of characteristics that are believed to contribute to a healthy safety culture including:

- Leadership safety values and actions;
- Identifying and resolving issues;
- Individual responsibility;
- Work processes;
- Ongoing education;
- Work atmosphere conducive to raising concerns; and
- A critical mindset.

The NRC also expects all licensees and contractors to build and maintain a Safety Conscious Work Environment (SCWE) in order to promote safety culture. Employees are to be encouraged to raise safety issues in a SCWE, and those concerns are to be swiftly examined, given the appropriate priority based on their potential for causing harm and then corrected or remedied with timely feedback to the source of those concerns and other employees. While NRC does not have a requirement mandating licensees to keep a SCWE, the Commission has made it clear that employees should feel comfortable to raise nuclear safety issues and it has updated its guidance manuals to reflect this. In 2006, the Government updated its Reactor Oversight Process to reflect the critical role that safety culture plays in facility operations. In other words, when operational or regulatory performance deteriorates, the role of a weak safety culture in the deterioration will be assessed. The NRC has also issued several documents to assist licensees in establishing SCWEs including NRC Regulatory Issue Summary 2005-18 and 2005-19:

Guidance for Establishing and Maintaining a Safety Conscious Work Environment.

5.5.12 PROTECTED ACTIVITIES AND RETALIATION

An employee's ability to raise potential safety concerns to the licensee management and the NRC without fear of retaliation, intimidation or harassment is highly valued by the Commission. According to Section 211 of the Energy Reorganization Act (as amended), *"no employer may discharge or otherwise discriminate against any employee with respect to compensation, terms, conditions, or privileges of employment because the employee (or any person acting pursuant to a request of the employee)"* engaged in protected activities. Protected activities include, but are not limited to, notification of alleged violation of this Act or the Atomic Energy Act of 1954, refusal to engage in an identified unlawful activity, testimony regarding these Acts before any Congress or court proceedings etc. (U.S. Government Publishing Office, 2021). Some examples of such activities and adverse actions are:

Protected Activity	Adverse Action
Raising an issue with a supervisor	Discharge
Initiating a work item	Transfer/ reassignment
Disagreeing with an issue resolution	Reduced pay or reduced bonus
Cooperating in an investigation	Negative performance appraisal
Raising a safety issue outside the "chain of command"	Blacklisting or non-selection
Going to NRC	Threat
Filing a DOL case	Harassment or hostile work environment

Licensees and contractors must ensure that their personnel are not discriminated against for participating in such protected activities.

Notices of violation and civil penalties can be issued to licensees and contractors who support such discrimination. Furthermore, under the Deliberate Misconduct Rule, employees of a licensee and contractor may face NRC fines for such discrimination against other employees. Individuals may be barred from participating in NRC licensed activities as part of these sanctions. NUREG-0940, a summary of significant NRC enforcement actions, is available on the official website of the NRC Office of Enforcement.

If an employee believes that submitting infractions or safety concerns to the NRC or an employer has resulted in discrimination, the said employee may file a complaint with the NRC, the Department of Labor (DOL) or other appropriate State organization. If the finding is indeed of unlawful discrimination the DOL can grant personal remedies to the affected employee while the NRC may pursue enforcement action against the employer.

5.5.13 REPORTING WRONGDOINGS - BY LICENSEES, THEIR EMPLOYEES AND CONTRACTORS

The NRC has a number of safeguards in place to ensure that people are comfortable in reporting a safety concern. These concerns include potential or actual safety issues related to the NRC's jurisdiction, such as, design, construction, operation and maintenance, radiation protection, safeguards, security, emergency preparedness, harassment, intimidation, retaliation, discrimination and wrongdoing, amongst others. The NRC's Allegation Program investigates allegations of suspected infractions and/ or wrongdoings by individuals or organizations, viz., existing licensees, applicants for a license, licensee contractors or vendors and employees of any of the above. The NRC will assess each claim to see if there is enough

evidence to justify launching of an investigation. Post such assessment the OI will then conduct their investigation. This may be in the form of an interview with the person making the allegation and review of all supporting material. Based on this, the OI assigns a priority to the case and determines whether or not to pursue it further. An employee who alleges discrimination may be offered Alternate Dispute Resolution (ADR) by the NRC wherein a mediator would meet with both the employee and employer.

5.5.14 REPORTING WRONGDOINGS – BY NRC EMPLOYEES OR NRC CONTRACTORS

The NRC’s Office of Inspector General (OIG) is responsible for investigating issues involving NRC employees or contractors. The OIG is in charge of investigating and combating fraud, waste and wrongdoings. When the OIG receives a complaint of misbehavior, fraud or mismanagement it first determines whether an investigation should be opened given its priorities and general standards. Some complaints lead to investigations while others are kept for audits and forwarded to the NRC management or, if required, to another law enforcement agency. On conclusion of an investigation the OIG compiles its report summarizing the facts discovered and copies are sent to prosecuting attorneys and NRC officials who may have an official interest in the findings.

5.5.15 HEARING PROCESS

A “Notice of Opportunity for Hearing” will be published in the Federal Register when NRC licensing actions concern nuclear reactors. Hearing requests and pleas for intervention must be heard. Members of the public must describe the nature of their interest in the planned NRC action and set forth the basis of their concerns in

the form of suggested contentions. Hearings are typically requested by persons who live or work near a nuclear facility and who believe that the proposed action raises environmental or safety concerns. Individuals, governmental agencies and private firms have spoken at NRC hearings. The challenged issues can usually be divided into two categories, viz., safety/ technical issues originating under AEA or environmental issues occurring under NEPA.

These hearings are normally conducted by a three-member panel of administrative judges from NRC's Atomic Safety and Licensing Board Panel (ASLBP). In a normal procedure the ASLBP is comprised of a qualified lawyer, who serves as the chairperson, and two technically qualified individuals. The judge's expertise is occasionally adjusted to the issues at hand in a case. The ASLBP is responsible for establishing a factual record in proceeding, analyzing it and rendering a decision based on the findings.

In exceptional circumstances, a hearing may be presided over the Commission itself. The Commission's adjudication duty is limited to hearing appeals and applications for review of a decision of the ASLBP. Assisting the Commission in these reviews is the Office of Commission Appellate Adjudication, which analyzes the cases, determines the legal possibilities for a final decision, and drafts decisions for the Commission in accordance with the latter's guidance. The Adjudicatory Docket, which houses the files for NRC's licensing and enforcement adjudications, is maintained by the Secretary to the Commission.

Hearings are held by the NRC on contested issues, including nuclear reactors, nuclear materials and nuclear facilities. Hearings is a

recourse also available to dispute civil penalties imposed for violations of NRC regulations or staff orders requiring action. The hearing procedure is governed by the NRC Rules of Practice for Domestic Licensing Proceedings and Issuance of Orders.

The NRC regulations outline several hearing procedures for various activities. The NRC uses a formal trial-like process in some matters, particularly in the enforcement arena, which is a Sub-part G hearing similar to the procedures used in non-jury Federal court proceedings. For most other areas an informal hearing process is used or a Sub-part L hearing. These areas would include initial license application for nuclear power reactors, license revisions and operator or senior operator licenses subject to 10 C.F.R. Part 55. The following are the essential elements of such hearings:

- **Standard for Admissibility of Issues**

At the time a petition for leave to intervene and/ or request for hearing is filed, it must specify contentions about the licensing that are specific, adequately supported and material to the subject matter of the proceeding.

- **NRC Staff Participation**

The NRC staff is not compelled to participate as a party in most Sub-part L hearings though they usually do. However, if the NRC staff refuses to engage, the Presiding Officer has the authority to require the concerned staff to participate on a specific topic.

- **Hearing File**

The discovery is the major difference between Sub-parts G and L. The former covers “traditional” discovery methods

such as interrogations, depositions and admissions. The NRC staff is directed to compile a hearing file that includes the application for licensing and any amendments thereto, all NRC safety, environment or other reports relating to the application and any relevant correspondence between the NRC and the applicant. Periodic “required disclosures” of pertinent documents is mandatory for all parties. Beyond the provision of a hearing file and such mandatory disclosures, discovery is prohibited.

- **Written and Oral Presentations**

While an oral hearing is the default under Sub-part L, it is possible that a written presentation and, if found necessary, a follow-up written questions posed by the presiding officer, rather than an oral hearing, will be used to hear the parties and address the issues. If the presiding officer feels that the written arguments are insufficient to clarify and settle concerns, he has the authority to enable or order the parties to make oral arguments. In practice, most hearings under Sub-part L involve written presentations followed by oral hearings where the presiding officer can question the witnesses.

- **Initial Decision**

Following the written/ oral presentations, the presiding officer writes up an initial decision on the disputed matters. This initial decision contains the findings of fact and conclusions of law.

- **Appeals and Judicial Review**

Decisions of the Licensing Board can be appealed to the Commission and further decisions of the Commission can be appealed directly to the U.S. Courts of Appeal.

5.5.16 MANDATORY HEARING

Under section 189a of the Atomic Energy Act, the NRC is required to conduct a “mandatory” hearing on applications for construction permits, COLs and ESPs for nuclear power plants. For all these applications, whether an application is contested or uncontested, the presiding officer must conduct a hearing examining certain safety and environmental matters and must approve the overall sufficiency of the NRC review before a license is issued. The presiding officer may be the Commission itself, a single member or a three-judge panel of the ASLBP.

The mandatory hearing process begins on the completion of the final Environmental Impact Statement and final Safety Evaluation Report by the NRC. It is not linked to either the design certification rulemaking or the contested hearing process described above. The Commission has determined that in the mandatory hearing –

- Presiding officers should address the specific issues in a proceeding rather than an entire proceeding, as either contested or uncontested;
- The scope is whether the safety and environmental record is adequate to support issuance of a license;
- The presiding officers should weigh the pros and cons of the proposed facility to determine if the license should be issued;
- The presiding officers should determine whether reasonable alternatives have been considered; and

- The scope of the intervenors' right to participate in the proceeding is limited to their admitted contentions implying that intervenors are barred from participating in an uncontested proceeding.

Together with the issuance of its final environmental and safety review document, the NRC is required to provide a publicly available information paper to the presiding officer focusing on areas that are unique to the facility or novel issues that arose during the review process.

5.5.17 LICENSING FOR NEW PLANTS

The NRC oversees the building and operation of new commercial nuclear power plants. Previously, the NRC used a two-step licensing process under Part 50 to award building permits and operating licenses. In 1989, the NRC introduced alternative licensing methods in C.F.R. Part 52, which featured several new forms of approvals, in order to increase regulatory efficiency and predictability. The NRC can issue standard design certificates, early site permits (ESP) and combined licenses (COL) amongst other permissions.

Standard Design Certificates - Through a technical examination and following regulation process, the NRC can certify a reactor design for 15 years. The safety issues of an essentially complete nuclear power plant design, irrespective of site location, will be addressed by the NRC during the evaluation of a design certification application. Inspections, tests, analyses and acceptance criteria (ITAAC) for the standard design must also be included in an application for standard design certification. An NRC hearing process is normally not triggered by design certifications.

Early Site Permits – Separate from an application for a building permit or combined license, the NRC can issue an ESP for approval for one or more sites. ESPs are good for 10 to 20 years and can be renewed for another 10 to 20 years. Independent of the examination of a specific nuclear power plant design, the NRC review of an early site permit application will address site safety, environmental protection issues and emergency response plans. An ESP will have the opportunity to be heard.

Combined Licenses – A combined license authorizes the facility's construction and operation in the same manner that a construction permit and an operating license does in the two-step process (Part 50). The COL application must also include the applicant's inspections, tests and analyses. A design certification and/ or an ESP can be referenced in a Part 52 application for a combined license. This approach has the advantage of preventing concerns settled during the design certification rulemaking and the ESP procedure from being revisited later at the combined licensing stage. If an ESP and design certification are not provided, the NRC conducts a technical and environmental examination of the design and the site as part of the COL review.

5.5.18 NEW REACTOR LICENSING REVIEWS

The NRC must review all nuclear power facility applications for safety and environmental reasons. An applicant must provide a Safety Analysis Report that includes the planned reactor's design detail and criteria, as well as extensive information on the location suggested. The application must also include a thorough study of the planned plant's impact on the environment. On receipt of the

application the NRC checks to see that there is enough data provided to fulfill the Commission's standards for a full examination. If approved for filing the NRC starts the technical review and the NEPA procedure. At the same time a notice of receipt of application is published in the Federal Register together with a communication of extending an opportunity to ask for a hearing, if required.

The plant design is examined to determine if it complies with all the applicable regulations, including:

- Specifications of the proposed site, which includes data on population, and reports on seismology, etc.
- Expected response to of the plant to conjectural situations and events
- Day-to-day management
- Technical qualifications to operate the plant
- Spillover of radiological effluents, into the environment; and
- Plans for handling possible emergency situations.

Post the completion of the NRC evaluation, an SER is drawn up that summarizes the proposed facility's expected effect on health and safety. A draft EIS is published for all concerned agencies, as well as for the general public to comment on. Following that, the Commission releases a Final EIS that incorporates all the feedback collected.

Each proposal to build or operate a NPP is reviewed by the ACRS, an independent organization that advises the five-member Commission on reactor safety. The ACRS evaluation begins in the early stages of the process, with several interactive meetings with the applicant at several key stages throughout the process. When the

ACRS has concluded its investigations, it gives its findings to the Commission in the form of a report to the Chairperson of the NRC.

Prior to issuing a construction permit, the applicant may be required to perform certain approved build ups at the proposed site. This is referred to as a LWA and it is done at the risk of the applicant. The final authorization is given only post verification of NEPA findings that are essential for authorizing construction and post evaluation that the proposed site is a suitable location for a NPP from the point of radiological and safety standpoint.

5.6 DECOMMISSIONING

5.6.1 ASSURANCE FOR FUNDING

The deactivation and decommission of facilities are one of the regulatory activities of NRC. This covers *“to remove a facility or site safely from service and reduce residual radioactivity to a level that permits (1) release of the property for unrestricted use and termination of the license; or (2) release of the property under restricted conditions and termination of the license.”* The decommissioning and subsequent decontamination of the facilities is done with the final aim of terminating the license.

Certain licensees, including active power reactor licensees, are required by NRC regulations to provide financial assurance for decommissioning. 10 C.F.R. Part 50 contains the general requirements for termination of licenses and for closing nuclear NPP including research and test reactors. 10 C.F.R. 50.75 in particular, lays down the guidelines on how such an assurance for funding is to be obtained, including estimating the amount of funds that will ultimately be required, preparing updates to those estimates,

defining methods to be used for collecting funds to ensure their availability when needed and specifying provisions to be included in agreements drawn up for protecting such funds.

5.6.2 COST ESTIMATES

To avoid financing deficits that could jeopardize public health and safety, it is critical to estimate the minimum amount of funds required for decommissioning funding assurance and implement procedures to provide for those amounts. In 10 C.F.R. 50.75(c) review thresholds are established for the certification or formula figures. While these certification amounts do not represent the final cost of closure for specific reactors, they do provide assurance and demonstrate satisfactory financial capability and responsibility by considering and planning for the majority of the funds required for safe decommissioning early on in the facility's life cycle and that actual expected costs are provided for prior to or shortly after a plant's termination of operations, thus establishing adequate cover that the facility will not become a public hazard and risk once it is shut down.

The guidelines to calculate the lowest threshold of funds for closure and deactivation are set out in C.F.R. §§ 50.33(k), 50.75, 50.82(a)(4), 50.82(a)(8) and 50.82(n)(9). These include:

- The amount of initial certification using either standard formula workings or an individual customized estimate of costs that must be an amount at least equal to the formula amount;
- Over the life of the facility, essential changes can be made to the amount so estimated. Specifically, 10 C.F.R. 50.75(b) mandates that the initial estimate be adjusted annually using

the equation in C.F.R. 50.75(c)(2), that covers inflation and escalation factors. Furthermore, licensees must make a biennial report to the NRC on the progress of their decommissioning funding under C.F.R. 50.75(f)(1) and (2).

- A preliminary decommissioning cost estimate to be filed at or around 5 years before the projected closure of operations. An assessment of significant factors that could possibly impact the cost to decommission together with a PSDAR is to be submitted before to or within 2 years after irreversible closure of operations. Before usage of any funds other than those stated in 10 C.F.R. 50.82(a)(8), a site-specific decommissioning cost estimate must be reported to the NRC within two years of final closure of operations, if not already provided.
- Annual updates of decommissioning expenditures and remaining funds for decommissioning and any modifications to the licensee's methods of providing decommissioning funding assurance, until it is demonstrated that the site has been decontaminated to a level that will permit license termination.
- The plan to terminate a license termination must include an "updated site-specific estimate of remaining decommissioning costs" which is to be submitted at least 2 years before the license's expiration date.
- Additional adjustments may be required during plant operation if required and site radiation surveys indicate that additional, unanticipated work to decontaminate the site will be necessary for final decommissioning.

Material licensees, including conversion, fabrication and enrichment of fuel, are also required to submit a decommissioning funding plan. For material licensees, the decommissioning funding must include a site-specific decommissioning cost estimate and a method of decommissioning financial assurance. Unlike power reactors, there is no decommissioning funding formula and materials licensees cannot use an external sinking fund.

5.6.3 DECOMMISSIONING FINANCIAL ASSURANCE METHODS

The licensee must present a statement that the specified amount of funds has been arranged. This is also called a certificate of decommissioning financial assurance. The goal here is to ensure that there is an appropriate mechanism in place to support the closure of a licensed operation if the licensee is not in a position or refuses to complete deactivation in a proper manner. The usage of designated financial instruments is one way to demonstrate decommissioning financial assurance. There are financial institutions or instruments that offer a separate account where the licensee can effectively deposit the costs or offer to obtain assistance from a suitably financially qualified source offering “defense in depth” in the event that the licensee is not able to or will not pay these costs on actual closure. This assurance must be given prior to the start of licensed activities or on receipt of licensed materials and the given assurance must be held until the license is terminated.

Under the provisions of 10 C.F.R. § 50.75(e)(1), such assurance can be given as below:

- **Payment** – Prior to commencement of activities cash or liquid assets may be deposited into an account which is separate from other assets and now in the control of the licensee or its subsidiaries and affiliates. These funds should be enough to pay, in full, all the costs at the time termination of the license and closure of operations is proposed. This can be done in various ways, such as, through a trust or an escrow account or through a government fund or certificate of deposit or deposit with government authorities or any other acceptable method.
- **Sinking Fund** – Money may be reserved on a regular basis in a fund that is established in an account separate from the other assets and not in the control of the licensee or its subsidiaries and its affiliates. It should be ensured that the total amount of funds would be enough to cover the costs at the time final termination of the license and closure of operations is proposed. However, only rate-regulated utilities and those having a non-bypassable charge for decommissioning financial commitments have access to this option as an exclusive funding vehicle. This sinking fund could be in the form of a trust, escrow account or government fund and payments could be made in the form of certificates of deposits, government deposits and deposits of securities or any other acceptable payment method.
- **Method of Assurance** – Surety bonds, letters of credit or guarantees from insurance parent companies may be used when a financial test as described is applied.

- **Obligations Arising from a Contract** – Over the course of operations and contracts, customers' obligations, the entire amount of which will supply the total amount of uncollected cash needed for deactivation.

A combination of these mechanisms or any other methods that ensures adequate funding for decommissioning equal to or greater than given by individual measures described above may be used.

The total cost of final closure of a reactor facility is influenced by several elements, including the order in which the phases of the facility are completed, the type of facility, its location, the ensuing cost of waste burial and proposal for spent fuel management. However, plans for spent fuel storage and disposal are not considered part of decommissioning even though they may affect the decommissioning costs. The NRC estimates that decommissioning a nuclear power facility will cost anything between \$ 300 to \$ 800 million. If the licensee is going through a merger or acquisition, or once the plant ceases operations, the NRC requires that licensees update the position of their assurance funds at least once in two years and every year within five years of the proposed deactivation in the case of mergers and acquisition.

The key documents in the process of decommissioning are:

- (a) The Standard Review Plan on Power Reactor Licensee Financial Qualifications and Decommissioning Funding Assurance.
- (b) The Standard Review Plan for Evaluating Nuclear Power Reactor License Termination Plans
- (c) Report on Waste Burial Charges

- (d) Consolidated NMSS Decommissioning Guidance
Financial Assurance, Recordkeeping and Timeliness
- (e) Assuring the Availability of Funds for Decommissioning
Nuclear Reactors.

5.6.4 REPORTING REQUIREMENTS

All incidents, whether emergency or not, that involve licensed materials, facilities or materials licensed under the ASP must be reported to the NRC as per regulations. Significant reporting requirements for power reactor licensees are provided for in Parts 20 – 21 and 50 of the 10 C.F.R. A selection of report-triggering events, the time frame for filing the report and how and where a report should be filed are listed therein. Additional reporting requirements applicable to power reactor licensees are set out in other NRC regulations dealing also with specific activities.

PART II – INDIA

5.7 DEVELOPMENT OF NUCLEAR LAW REGIME IN INDIA – CRITICAL EVALUATION

Under the aegis of the IAEA and the OECD, a number of treaties and other formal instruments concerning nuclear safety and liability have come into existence. International environmental law is one component of international law that is intimately tied to nuclear operations. Despite the fact that international environmental law is still relatively new, it has already created a core of essential legal concepts that apply to nuclear operations. These concepts are derived from both hard and soft law sources. As a result, states are obligated by a number of customary standards in respect to nuclear activities, in addition to official duties. Some of these concepts, such as the "no harm" norm, the "polluter pays" principle and "state accountability" are considered more substantive and more focused on outcomes. Others lean towards procedural, focusing on mechanisms such as the responsibility to intimate and invite effective public participation and debate of concepts that result in formulation of principles leading to decision-making and the "precautionary" principle. Still others, such as "good neighborliness" focus on the obligation to collaborate and combine substantive and procedural elements. However, distinguishing between substantive and procedural principles is challenging. There are also various secondary principles of customary law aimed at ensuring the safety of nuclear operations, such as concepts of protection prevention and precaution, as well as addressing the problem of trans-boundary radioactive pollution (Nanda, Ved P., 2007).

India's Constitution is the country's supreme law. Any legislative initiative policy must be consistent with the Constitutional concepts and the

Fundamental Rights established therein. Inter-government treaties, customary rules and the laws in existence at the time the Constitution was enacted, as well as post-independence legislations, are all applicable in the case of nuclear energy. (Mokshagundam, Preethi, 2015).

5.7.1 THE INDIAN CONSTITUTION AND ITS IMPACT ON AGREEMENTS AND TREATIES

The Constitutional provisions valid for the purpose of consideration of its interaction, interplay and interrelation with international law are listed as follows:

- Article 51
- Article 73
- Articles 245 and 246
- Article 253
- Article 260
- Article 363
- Article 372 and
- VII Schedule – entries 10 to 21.

Article 51 talks about ‘Promotion of International Peace and Security’. The State shall endeavor to –

- (a) Promote international peace and security;
- (b) Maintain just and honorable relations between nations;
- (c) Foster respect for International Law and Treaty Obligations in the dealings of organized people with one another; and
- (d) Encourage settlement of international dispute by arbitration.

The Havana Declaration of November 30, 1939 was the source and inspiration for Article 51 of the Constitution. It is pertinent to note that Clause ‘c’ of Article 51 refers to both ‘International Law’ and

‘Treaty Obligations’ separately. As per Professor C. H. Alexandrowicz, a lawyer and scholar of International Law, the term “international law” refers to customary international law, whereas the term “treaty obligations” refers to obligations originating from international treaties. Further, it should be noted that Article 51(c) applies the same principles to both international customary law and obligations derived from international treaties.

Article 53 covering the ‘Executive Power of the Union’ states that *“(1) The Executive Power of the Union shall be vested in the President and shall be exercised by him either directly or through officers subordinate to him in accordance with this Constitution.”* Article 253 on ‘Legislation of giving effect to International Agreements’ says *“Notwithstanding anything in the foregoing provisions of this Chapter, Parliament has power to make any law for the whole or any part of the Territory of India for implementing any treaty, agreement or convention with any other country or countries or any decision made at any International Conference, Association or other body.”* Considering both the Articles, it is noted that the executive power of the Union vests with the President of India and the he or she acts with the assistance and under the guidance of the Union Cabinet (Constitution of India, 1950).

According to Article 73, the Union’s law-making, administrative and decision-making power extends to all areas over which the Parliament may pass legislation, as well as for the exercise of any rights conferred on the GOI by any international agreement/ treaty. It is also worth noting that the executive power must be exerted to be in line with the Constitution and the applicable laws. Article 253 empowers the Parliament to enact any law necessary to give effect

to international treaties, agreements, conventions or decisions for the whole or a part of the country.

Though the Executive has the mandate for signing and ratifying international treaties, the implementation of those treaties is the responsibility of the Parliament. It is pertinent to state that, under Article 51, India pledges to “*encourage respect for international law and treaty responsibilities*”. Global treaties and agreements can only be obligatory legally in India if an enabling enactment or legislation is passed that incorporates them into the domestic legal framework and according to the Constitution. This is bolstered by the fact that India operates under influence of the Common Law system, which was adopted pre-independence and is still in use even today (Constitution of India, 1950).

In the case of Maganbhai Ishwarbhai Patel vs. Union of India, The Supreme Court of India opined that “*The effect of Article 253 is that, if a treaty, agreement or convention with a foreign state deals with a subject within the competence of state legislature, the Parliament alone has, notwithstanding Article 246(3), the power to make laws to implement the treaty, agreement or convention or any decision made at any international conference, association or other body.*” (Maganbhai Ishwarbhai Patel v. Union of India & Anr. 1970). In another case, the Constitution Bench of the Apex Court observed “*A treaty entered in to by India cannot become law of the land and it cannot be implemented unless Parliament passes a law as required under Article 253. The Executive in India can enter into any treaty be it bilateral or multilateral with any other country or countries*” (The State of West Bengal v. Kesoram Industries Ltd. & Ors., 2004). The significance of including Article 253 in the

Constitution and in List I of the 7th Schedule, was to establish, beyond a shadow of doubt, that the Parliament could pass any law necessary to carry out an international treaty, agreement or convention or give effect to any decision reached at an international forum, regardless of whether some items in List I were attracted or not. As a result, the Constitution's distribution of legislative powers between the Union and the states cannot obstruct the implementation of international law responsibilities through Parliamentary legislations. However, till such time as the Parliament passes an enactment on such treaty-making powers, the GOI may enter into treaties without restrictions.

It is significant to point out that under common law international customs are considered to be a component of municipal law except if there is a conflict between the two. In that case, the municipal law takes precedence over international law. Article-372 has upheld all pre-constitutional "laws in force" until they are amended or repealed, with the exception that such laws that were in violation of any section of the Constitution were considered void. As understood this provision stems from the fact that the continuation of "laws in force" implies that the British Common Law also continues, as that was applied by courts prior to framing the Constitution (Constitution of India, 1950).

List II deals with state powers and there are certain entries therein that have an impact on atomic energy but are not directly related to it. These are issues such as general health and sanitation (Entry 6), development of mines and minerals that are under the Union's authority (Entry 23) and certain industries that are subject to the Union's control (Entry 24). The Concurrent List III refers to matters

over which both the Centre and the states have authority with final power resting with the Union. Herein, electricity (Entry 38), forests (Entry 17A), economic planning and social forethought (Entry 20) and so on are all relevant to nuclear energy. Aside from Article 246, there is also Article 249 that allows the Union to legislate on the State List on the grounds of national importance and Article-252, which allows the Parliament to pass any enactment for a state with the agreement of the state in question. This may be embraced by other states also.

On account of the potential threat and risk, all nuclear operations, not only those related to nuclear weapons, are a cause for considerable concern. The biggest industrial disaster in the history of the world, the Chernobyl Disaster in April 1986, has warned the world that NPPs constitute a serious threat not only to the immediate surroundings, but also to distant places. The deadly disaster heightened the awareness with respect to severe ecological and health impact that an unintended release of radiation can have on a vast area (Nanda, Ved P., 2007). Given the potential risks and negative impacts nuclear energy in India is under the complete control of the Central Government. Some of the Acts and Rules relevant to nuclear energy in India:

- AEA
- AEWMMH
- AESDRW
- AEFR
- RPR-2004
- CLND, 2010
- CLND, 2011

Research and discussion hereinbelow have been restricted to the two principal governing legislations, viz., AEA-1962 and the CLND-2010 and together provide a holistic understanding of nuclear law in India.

5.7.2 AEA, 1962

The AEA of 1962 (also referred to as the ‘1962 Act’) was principally responsible for the formation and regulation of India’s nuclear regime. Although the primary goal of this legislation is to encourage the development of atomic energy, the regulatory provisions of the legislation cover a considerably broader range of activities that relate to or include radioactive substances. In other words, any substance that could be classified as radioactive, whether a mineral or any material, could potentially be covered by this law. The AEA, 1948, adopted shortly after India’s independence by the Constituent Assembly, served as a forerunner to the 1962 Act. This demonstrates the eagerness and perception with which India’s immediate political elite at that time viewed the importance of nuclear energy production and its use. The AEC was established under the 1948 legislation and in 1954 the DAE was created.

The 1948 legislation was subsequently replaced by the 1962 Act. This statute essentially establishes the “*development, control and use of atomic energy for the welfare of the people of India and for other peaceful purposes and for matters connected therewith*” (Acts of Parliament, 1962). The Act went into effect on September 15, 1962, with a goal to provide for the development, control and use of atomic energy for the benefit of the Indian people and for peaceful purposes. The Central Government is mandated by the Act to prevent dangers of radiation, safeguard the public and ensure the

safety of personnel working with radioactive materials and the waste so generated. The Center also has the jurisdiction to control nuclear research, manufacture and transportation of radioactive substances, as well as nuclear energy generation and supply.

Section 2 of the 1962 Act details the definitions of various terms, the most significant of which are:

- **Atomic Energy** – The energy liberated when an atomic nuclei undergoes process, including fission and fusion
- **Fissile Material** – U-233, U-235, Pu or any material containing these substances or any other notified material
- **Radiation Rays** – include gamma rays, X-rays and rays consisting of alpha particles, beta particles, neutrons, protons and other nuclear and sub-atomic particles, but not including sound or radio waves or visible infra-red or ultra-violet light.
- **Radioactive Substance or Material** – any substance or material that spontaneously emits radioactive emissions.

Section 3 details the general powers of the Central Government including the power to manufacture, produce, develop, use and dispose of atomic energy, either directly or through any authority or corporation established by it or a government company as well as the conduct of any research into the development and use of atomic energy. The Chairperson of the AEC has sole authority over all activities related to nuclear energy. This encompasses all nuclear research and development efforts as well as establishing facilities and operationalizing them, production of all atomic material and related equipment in India. Amongst the powers conferred by

Section 3 are the powers to declare as “restricted information” any data not so far published or otherwise made public relating to:

- (a) The location, quality and quantity of prescribed substances and transactions for their acquisition, whether by purchase or otherwise, or disposal, whether by sale or otherwise;
- (b) The processing of prescribed substances and the extraction or production of fissile materials from them;
- (c) The theory, design, construction and operation of plants for the treatment and production of any of the prescribed substances and for the separation of isotopes;
- (d) The theory, design, construction and operation of nuclear reactors;
- (e) Research and technological work on materials and processes involved in or derived from the above items; and
- (f) To declare as “prohibited area” any area or premises where work including research, design or development is carried on in respect of production, treatment, use, application, or disposal of atomic energy or of any prescribed substance (Acts of Parliament, 1962).

Section 5 gives the Central Government control over excavation or accumulation of substances containing uranium. Any such concentration must be reported to the GOI, who may restrict mining or impose terms and conditions on the mining by issuing a written notice. Disposal of uranium is done through a notification by the GOI under Section 6 of the Act. Section 8 states that an authorized person may enter any such property or premises and may conduct inspections, and hold possession for a period of not more than seven days. The GOI also has the power to compulsorily acquire mining rights under Sections 10 and 11, including the right to take over the

any land in order to establish necessary equipment, buildings, and plants.

Section 16 deals with the regulation of radioactive substances while Section 17 of the Act covers mining, treatment, storage, use and disposal safety provisions. The term “restricted information” is explained in Section 18 and includes location, processing of fissile materials, any theory, technical or other designs, construction and management of treatment plants. The Act also has provisions for controlling radioactive materials or plants generating radioactive substances or waste.

Section 20 makes it illegal for anybody not approved by the AEC to innovate and invent or to apply for IPR of anything that the AEC considers is related to atomic energy and the provisions of sub-section (5) of Section 21 allows the AEC complete control over any legal or formal arbitration. However, whenever the Government acquires any mine or part of a mine in accordance with any law, the compensation paid shall be in accordance with Section 21 and no account shall be taken of the value of uranium that may be obtained from such mine or part of such mine in determining the amount of compensation.

The authority to administer the Factories Act, 1948 is provided in Section 23 of the 1962 Act. The GOI can construct and have full ownership of any factory, whether sole or joint.

Section 24 outlines the transgressions and retribution for violating directives or regulations, which includes internment for a term up to five years, a fine or both. Power may be delegated to a SG or any

officer or authority subordinate to the SG that may be named as provided in Section 27. The GOI has the authority to adopt rules governing licensing, forcibly take over any mine, plant, business, etc. or for the transfer, possession, ownership, sale, use or disposal of materials under Section 30 of the Act.

The AEA of 1962 protects India's nuclear establishment, yet this regulatory framework is unsuitable for a civilian nuclear sector that generates power. The Government is allowed to refuse citizen's requests for information about nuclear power facilities or nuclear materials used for commercial or industrial or research purposes under the provisions of this Act. In this regard, the DAE does not willingly share details of nuclear power plant safety procedures or potential mishaps. It frequently denies requests for these details justifying their denial by quoting Section 8 and/or Section 9 of the Act. As noted, the 1962 Act is a framework law that covers a wide range of topics including usage and development of radioactive substances and Section 30 of the Act identifies the areas where rules and regulations are required for the proper implementation of the Act.

However, there are several sections in the Act which are restrictive while providing complete control to the GOI as far as nuclear energy is concerned, such as:

- Restrictive measures to contain information and prevent unapproved dissemination or use of such information.
- Declaring any location as a 'prohibited area' and installing measures to restrict or prevent unauthorized entry

- Developing rules to report any and all information on the discovery of U, Th and other prescribed substances and duly rewarding informants
- Complete authority on the extraction or concentration of scheduled substances
- Regulation of mining and prospecting for other prescribed substances through licensing and concessions such as rewards, floor prices and guarantees.
- Statutory acquisition of prescribed substances, minerals and plants
- Regulation of all manufacturing, production and distribution aspects
- Regulation of the use of prescribed equipment.
- Regulation of the storage, transportation or movement or disposal of any radioactive substance.
- Regulation of transport of such prescribed substances as are declared dangerous to development of health. Under section 17(2) of the Act the GOI may, *“as respects the transport of any radioactive substance or any prescribed substance specified by an order issued under this Act as being dangerous to health, make such rules as appear to be necessary to prevent injury being caused by such transport to the health of persons engaged therein and other persons”*.
- Controlling, supervising, and licensing the production, application, and use of atomic energy.
- Charging fees for issue of licenses;

A “prescribed substance” has been defined under section 2(g) of the Act as *“any substance including any mineral which the Central Government may, by notification, prescribe, being a substance which in its opinion is or may be used for the production or use of atomic energy or research into matters connected therewith and includes uranium, plutonium, thorium, beryllium, deuterium or any of their respective derivatives or compounds or any other materials containing any of the aforesaid substances”* (Acts of Parliament, 1962) while section 2(f) gives the definition of “prescribed equipment” as *“any property which the Central Government may, by notification, prescribe, being a property which in its opinion is specially designed or adapted or which is used or intended to be used for the production or utilisation of any prescribed substance, or for the production or utilisation of atomic energy, radioactive substances, or radiation, but does not include mining, milling, laboratory and other equipment not so specially designed or adapted and not incorporated in equipment used or intended to be used for any of the purposes aforesaid”* (Acts of Parliament, 1962).

Energy law evolved from environmental law and is intertwined with development law. There is an established set of nuclear related international laws and rules. Every nation has an obligation to structure its nuclear legislation in accordance with international law principles, both treaty and customary regulations. Development imperatives, ecological needs and people’s aspirations must be managed in tandem. The importance of Indian nuclear law has been recognized in this context. Legislation has attempted to create a balance between the benefits of a governmental monopoly in atomic energy and the necessity for private initiative in core development and environmental protection, while also taking into account worker

health and rights. However, new developments in the scientific field have increased the use of nuclear energy for therapeutic and medicinal purposes, including the preservation of food and this has posed new challenges to the existing laws which require the Government to take a very proactive role in keeping up with the developments.

5.7.3 REGULATORY FRAMEWORK IN INDIA

A regulatory framework is a vital part of the safety climate in any system and with respect to nuclear power, this helps in standardizing convoluted safety measures and looks to preempt disasters by maintaining a track of any detectable defects in design or operations of nuclear power plants. To avoid a conflict of interest it is preferable to have a regulatory system that is independent of the promoters and operators of nuclear power plants. Should there be any breaches the regulatory body should have the power and be free from pressure to take the necessary action. Therefore, it is advisable that the regulatory body be independent of both the government and the nuclear industry to allow it to make decisions that are free from commercial and political interference and based only on principles of safety.

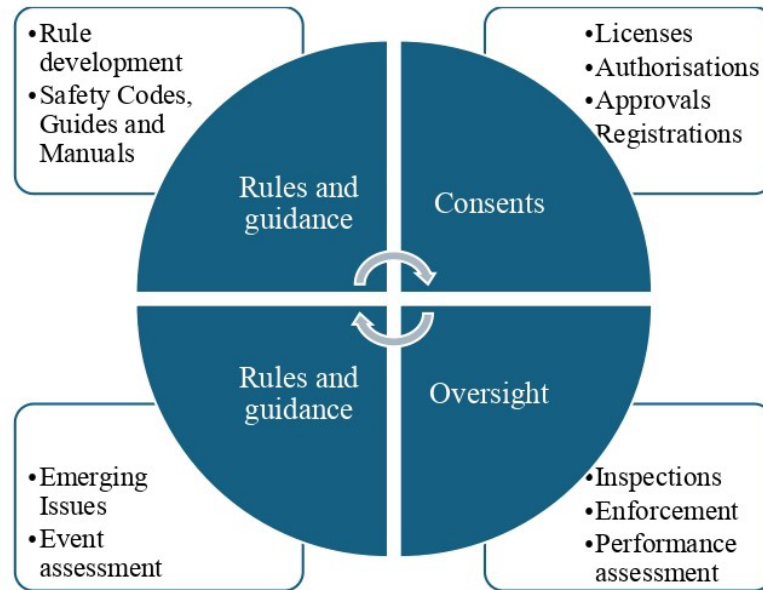
In India, however, the AERB is a government body which was established under section 27 of the Atomic Energy Act, 1962 and its regulatory authority is obtained from the rules and notifications issued under the AEA and the EPA, 1986 (Smith, Tyson R. & Mohan, M. P. Ram, 2018). In addition, the AERB administers the provisions of industry safety under the Factories Act, 1948 for all nuclear facilities in India. This covers all nuclear power plants for generating electric power and also all research and test reactors that

are used for teaching, research and training. Nuclear facilities would also include the nuclear fuel cycle and associated installations and all their processes and other associated industrial facilities.

The objectives of the AERB are:

- To see that the usage of nuclear energy and ionizing radiation does not put the country to any health risk or the environment at risk.
- It lays down the safety norms for finalizing locations and sites, the design, construction, operation and decommissioning of all nuclear and radiological facilities and all associated activities.
- It grants licenses, authorizations, approvals, registrations and certifications for different stages of construction and operation of nuclear facilities.
- It is responsible for ensuring compliance by regulatory surveillance, viz., inspections, reviews etc.
- AERB is also authorized to take required enforcement action when needed.
- It is responsible for the storage, transportation and disposal of nuclear substances and waste management as also for the decommissioning of such facilities.

The above objectives of AERB are depicted as below (Smith, Tyson R. & Mohan, M. P. Ram, 2018):



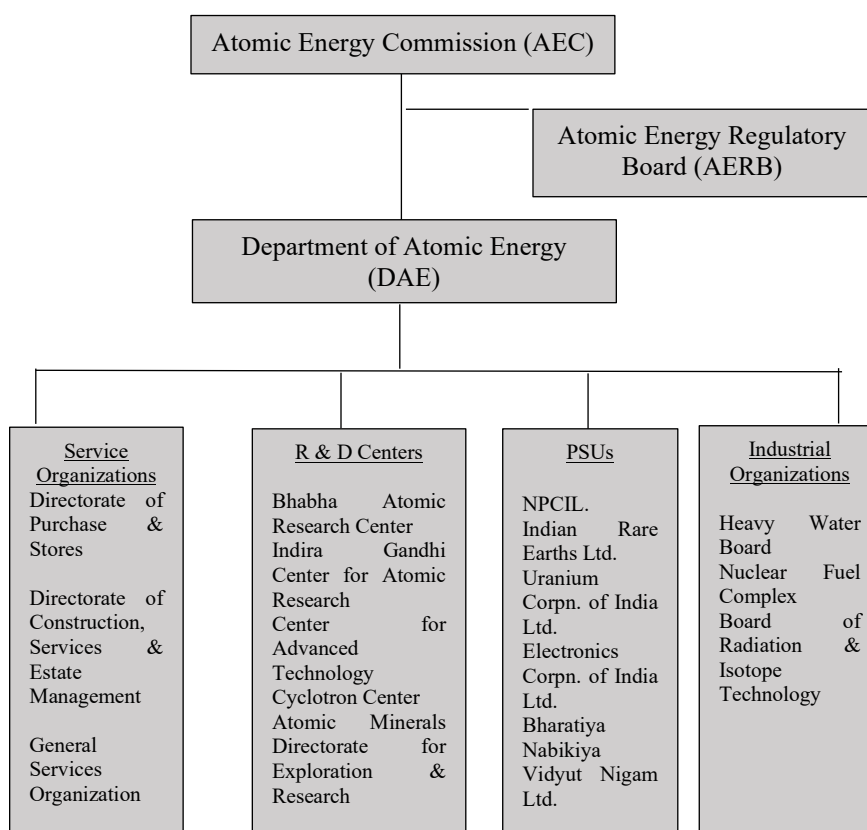
In order to fulfill its responsibilities, the AERB has established a three-pronged regulatory framework which includes:

- **Developing regulations**
AERB has established regulatory requirements and guidance documents to foster understanding of safety requirements and expectations. These are intended for the regulator, the operator and the public at large.
- **Issuing consents**
Standard operating processes have been developed for submission of applications and application of safety codes together with timelines, criteria and guidance for license applications, approvals, registrations, authorizations, certifications and assessments.

- **Inspection and enforcement**

The AERB has operationalized a systematic inspection program to ensure regulatory compliance.

The AERB, though formed under the 1962 Act is by and large an independent body working to continuously supervise the safety aspects of the nuclear energy sector in India and works under the AEC. The organizational structure of India's nuclear program is as below:



The functional team of the AERB comprises a full-time Chairperson, one ex-officio member, four part-time members and one secretary. The day-to-day operations are overseen by the Executive Director who is directly responsible for the work of two groups and five additional divisions. The heads and directors of

these divisions make up the Executive Committee who work with the Executive Director to take decisions on policy matters. Linked to the AERB is the SRI at Kalpakkam that conducts research in the safety aspects relevant to the regulatory functions of the AERB. Regional offices of the AERB have also been set up at Delhi, Chennai and Kolkatta.

Functions of the AERB

The AERB carries out a variety of functions including intra and infra-governmental coordination and these are described as under:

- **Safety Policies** – to develop policies for safety areas for all nuclear, radiation and industrial facilities that come within its purview.
- **Safety Codes, Guides and Standards** – to develop codes, guides and standards for siting, design, construction, commissioning, operation and decommissioning of all kinds of nuclear and radiation facilities.
- **Consents** – to give consents (approvals) for siting, construction, commissioning, operation and decommissioning of all nuclear and radiation facilities after conducting an appropriate safety review and assessment.
- **Compliance** – to set up a system of review and assessment, regulatory inspection and enforcement that ensures that during all stages of consenting, the regulatory requirements have been complied with.
- **Acceptance Limits** – to prescribe the limits that are acceptable for exposure to radiation and for environmental release of radioactive substances.
- **Emergency Preparedness** – to review the plans for emergency preparedness put in place at nuclear facilities and

during transport of radioactive sources, irradiated fuels and fissile material.

- **Training Program, Qualifications and Licensing Policies** – to prescribe the syllabi for safety aspects that will be used for training purposes of personnel and to review the policies for training, qualifications and licensing with respect to personnel for all nuclear and radiation facilities.
- **Public Information** – to disseminate to the public information on all significant issues of radiological safety.
- **Liaison** – to liaise with domestic and foreign statutory bodies on all safety matters.
- **Research and Development** – to facilitate R & D in all safety related areas
- **Nuclear and Industrial Safety** – to periodically review the safety aspects in all nuclear facilities
- **Safety Related Nuclear Security** – to periodically review all aspects of safety related nuclear security for all nuclear facilities
- **Notifications** – to notify the public of any nuclear incident that may occur in any nuclear facility in India as required by the CLND Act, 2010

The regulatory functions and responsibilities of the AERB have been delegated to its two groups and five divisions and directorates.

These are:

Nuclear Projects Safety Division or NPSD

The NPSD is responsible for –

- Safety reviews of nuclear projects
- Regulatory inspections for projects under construction including enforcement of compliances

- Issue of consents or licenses in line with procedures and protocols at various stages of nuclear projects
- Review of physical protection including security

Nuclear Safety Analysis Division or NSAD

The NSAD is responsible for –

- Safety reviews of all nuclear power plants in India
- Independent review to resolve safety issues of nuclear plants
- Assessment of probabilistic safety
- Analysis of deterministic safety
- Nuclear regulatory research
- Review of reactor physics

Operating Plants Safety Division or OPSD

The OPSD is responsible for –

- Licensing of operators and management staff
- Review of physical protection in nuclear plants
- Safety reviews and overview for operational nuclear power plants and research reactors including emergency preparedness and health physics
- Regulatory inspections for operating plants and research reactors including enforcement of compliances
- Periodic reviews of safety and renewal of operating authorizations
- Enforcement of AESDRW
- Coordination with International AEA for the International Nuclear Event Scale (INES) based reporting of events and for the Incident Reporting System (IRS)

- Administration of the following:
 - The Factories Act, 1948 in all DAE fuel cycle, nuclear power and other radiological facilities
 - Enforcement of radiological safety in all front-end fuel cycle facilities, DAE accelerator units and Beach Sand Minerals Facilities of India as per the AERP
 - Review of safety of the above facilities during siting, construction, commissioning and operations
 - Periodic inspections and special monthly regulatory inspections of construction projects of DAE
- Licensing of operators for front-end facilities
- Reviews of all DAE projects and plants, other than BARC facilities, related to industrial safety, fire safety and occupational health and safety.

Radiological Safety Division or RSD

The RSD is responsible for –

- Implementation of the AERP in non-DAE installations
- Enforcement of the AESDRW in non-DAE installations
- Licensing, surveillance and safety reviews of BRIT facilities and non-DAE radiation installations
- Safety during transport of radioactive materials

Resources & Documentation Division or R&DD

The R&DD is responsible for –

- Document preparation and publication
- Human resource and other research projects
- Website management
- Knowledge management
- Information technology

Siting & Structural Engineering Division or SSED

The SSED is responsible for –

- Site evaluations
- Safety criteria with respect to civil engineering in all design and construction of nuclear power plants
- Safety reviews of civil and structural engineering aspects of nuclear reactors, fuel cycle facilities, industrial and radiation facilities of DAE

Directorate of Regulatory Inspection or DRI

The DRI is responsible for –

- Integrating, harmonizing and improving the effectiveness of AERB's inspection activities
- Coordinating the safety review process for systematic collection of inputs for regulatory inspections (RI)
- Planning, organizing and coordinating all RI at facilities under the AERB including those related to safety and security, whether announced or unannounced
- Issuing RI reports, review the response, identify safety issues and forward for further review and enforcement action as required.

- Maintaining a database for all RI recommendations, observations and issues raised.
- Periodic analysis for improvement in inspections, processes and development of RI indicators
- Follow up of all pending recommendations for time-bound and effective resolution
- Mobilizing field inspection resources
- Preparation of regulatory documents particularly those related to RI
- Supporting R&DD in training and competence development for inspectors and lead inspectors
- Deliberating on phased expansion of scope of RIs to design, procurement and off-site fabrication of components for nuclear facilities
- Deployment of on-site observers at nuclear facilities
- Providing inputs regarding RI activities for annual reports, the AERB website, questions raised under RTI and in the Parliament.

Safety Research Institute or SRI

The SRI is responsible for –

- Building a knowledge base with research capability in safety aspects that will support the regulatory functions of AERB
- Conduct independent safety evaluations to assist the regulatory reviews and assessments of studies related to Nuclear & Reactor Safety, Radiation Safety, Engineering Safety and Environmental Safety.

Other than the divisions and departments the AERB has established several committees, each specialized in a unique area of expertise.

Committee members are selected from DAE units, government organizations, academic institutions and the industry and would necessarily have vast experience and be generally recognized as experts in their field. The main committees are SARCOP or Safety Review Committee for Operating Plants and SARCAR or Safety Review Committee for Application of Radiation. Other than SARCOP the committees usually have an outside member to maintain transparency.

SARCOP was established to evaluate nuclear, radiological and industrial safety in operating units including the PSUs of DAE. This Committee is responsible for the safety of the workforce, the public and the environment. It is further supported by specialist committees who conduct detailed review of matters related to their field viz., Standing Committee on Reactor Physics, Committee on Steam and Water Chemistry, Committee on Control & Instrumentation and Computer Systems and the Expert Committee on Coolant Channel Safety. Every unit or group of units, as the case may be, has a separate safety committee that is responsible for operational reviews of the unit.

SARCAR, which was set up in 1987 as the Licensing and Appellate Committee. It was restructured and renamed in 1991 and has the responsibility for setting up and overview of all rules related to radiation protection in the usage of radioisotopes in medical, industrial and research institutes.

The AERB also has several committees whose responsibilities are advisory in nature in areas such as nuclear safety, industrial and fire safety, radiological safety and occupational health.

5.7.4 THE CIVIL LIABILITY FOR NUCLEAR DAMAGE ACT, 2010

Operators of nuclear power plants are legally responsible for any damage that may occur as a result of such operations. Operator liability is based on the premise of ‘no fault’ or ‘strict liability regardless of fault’ rather than the fault principle. In most cases devastation caused by a nuclear incident will have an effect not only in the country of disaster but also in the neighboring nations. Normally, the operators of nuclear plants and facilities are held accountable to a certain extent for the damage thus caused, which they may cover through insurance. Beyond that, countries accept responsibility as the insurer of the last resort, according to international law and practice (World Nuclear Association Library, 2021). The worldwide framework of nuclear liability now consists of three important international accords, viz. The Paris Convention of 1960, the Vienna Convention of 1963 and the Protocol to Amend the Vienna Convention of 1997. Another important convention is the 1997 Supplementary Compensation Convention for Nuclear Damage of which India is also a signatory (International Atomic Energy Agency, 2010).

India has signed bilateral agreements for cooperation in the use of nuclear energy for civilian purposes with a number of countries including the United States, the United Kingdom, Russia, France and Canada. The agreement between India and France clearly specifies that India must establish a civil nuclear liability scheme to compensate for damage caused by incidents involving nuclear material and installations. Despite the fact that there are over 400 nuclear reactors in operation around the world there have been only three catastrophic nuclear reactor accidents (World Nuclear

Association, 2022). However, the damages as a result of a major accident such as Chernobyl have been extensive and disastrous (United States Nuclear Regulatory Commission, 2022). The goal of the Civil Liability for Nuclear Damage Act, 2010 was to ensure quick and adequate compensation in such catastrophic events causing widespread damage to life and property on account of a nuclear incident. The issue has also been addressed through international agreements which distill a few features to recognize the same:

- The principle of no-fault recognized (Acts of Parliament, 2010), on operators requiring them to take insurance cover or provide financial security,
- Limits on no-fault liability set in time and amount, and
- Jurisdictional barrier fixed by providing expeditious process for the distribution of compensation to victims by determining which court/ authority has jurisdiction.

On September 21, 2010 the President of India signed the Civil Liability for Nuclear Damage Act, 2010. The objective of this Act was to establish civil liability for nuclear damage and offer speedy compensation to victims of nuclear accidents through a no-fault liability regime that assigns responsibility to both the operator and the State. The Act also proposed to establish a Nuclear Damage Claims Commission and appoint a Claims Commissioner. It also stated that the Act was enacted to provide for liability in the event of a nuclear incident, as well as the “*necessity of joining an international liability regime.*” The Act covers nuclear damage that occurs beyond India’s territorial waters, in and over the exclusive economic zone, on board or by a ship registered in India, or on or by an artificial island, station or structure that is subject to Indian

jurisdiction. At the same time, it only applies to nuclear installations owned or managed by the Government of India, either directly or through any authority or corporation or a government enterprise established by it.

5.7.5 LIABILITY FOR NUCLEAR DAMAGE

The legislation and procedures regarding liability for nuclear damage are laid forth in Chapter II of the Act (Parts 3 to 8). If the Atomic Energy Regulatory Board (AERB) believes the intensity of the threat and risk is not minor, it must declare and make known to the public of a nuclear event within 15 days of its occurrence so that people can be cautious and take required precautions. However, the choice of the word ‘insignificant’ in this Section is perplexing. It allows the AERB to decide what is and what is not significant or minor or relevant as there are no pre-determined standards. If the incident involves a ‘nuclear installation’ or ‘nuclear materials’, the operator controlling the same will be accountable for the resulting ‘nuclear damage’. When there are multiple operators and the damage attributable to each is inseparable then each operator’s liability will be ‘joint and several’. Even if there are joint and several responsibilities, the overall liability of the operator must be as set forth in Section 6(2). In the event that many installations owned by a single operator are involved in the nuclear incident, the operator is individually accountable to the level set forth in Section 6 for each nuclear site.

5.7.6 LIABILITY OF OPERATOR

The liability of an operator of a nuclear facility is “strict liability” based on the principle of “no-fault liability”. The “absolute liability” principle in India states that *“where an enterprise is engaged in a hazardous or inherently dangerous activity and harm is caused to anyone as a result of an accident in the operation of such hazardous or inherently dangerous activity resulting, for example, in the escape of toxic gas, the enterprise is strictly and absolutely liable to compensate all those who are affected by the accident and such liability is not suable”*. This implies that absolute liability means that there are no exceptions to the rule. This culpability criterion was set forth and established by the Supreme Court of India in the matter of M. C. Mehta vs. Union of India (Oleum Gas Leak Case) (M.C. Mehta & Anr. V. Union of India, 1987). The nature of liability in the event of a nuclear disaster in India, however, is not specified. The Act expressly states that an operator is not liable in certain extraordinary circumstances. However, even in these circumstances, the victim will be compensated as the responsibility moves from the operator to the Central Government. These exceptional circumstances detailed under Section 5 of the Act are:

- A natural disaster grave in nature and which is of ‘exceptional character’ (M.C. Mehta & Anr. V. Union of India, 1987). Though it is clear that the disaster must be severe in nature, the phrase ‘exceptional character’ has not been defined and is subject to the discretion of the courts.
- An act of armed conflict, hostility, civil war, insurrection, or terrorism (Acts of Parliament, 2010) where the Central Government assumes liability if such act directly causes nuclear damage. This also includes nuclear damage caused to:

- The nuclear installation itself and any other nuclear installation, fully or partially constructed, on the site where the incident occurred
- Any property on the said site which is used or to be used in connection with such installation and
- To the means of transport upon which the nuclear materials involved was carried at the time of the nuclear incident.

These provisions, though aimed at preventing the operator from getting compensation for a nuclear incident caused by the operator, may go against the interests of a third party whose property is on the same site at the time of the incident. The private plant operator would also be governed by these legislations, provided the plant operator is qualified and a valid license holder in terms of the definitions in Section 2(j) and 2(m) of the CLND Act, 2010 and Sections 2(bb) of the Atomic Energy Act, 1962.

5.7.7 ANALYSIS AND UNDERSTANDING THE CIVIL LIABILITY FOR NUCLEAR DAMAGE ACT, 2010 FROM THE PERSPECTIVE OF THE STAKEHOLDERS.

(i) Why did India enact the CLND Act?

The key objective of the CLND Act has been to secure the rights of the victims by providing prompt compensation for damage caused by a nuclear incident. The liability exists as a no-fault liability and all victims are to be compensated without discrimination. The Act was also meant to facilitate in India becoming a State Party to the Convention on Supplementary Compensation for Nuclear Damage (CSC).

(ii) What are the main features of the Act?

- Compensation to victims through a no-fault regime
- Exclusive jurisdictional competence and a mechanism to provide compensation
- Channeling liability to the operator
- Limiting liability of the operator in amount and time
- Mandatory coverage by the operator through financial security or insurance

(iii) What is the CSC and how is the CLND Act linked to the CSC?

The CSC or the Convention on Supplementary Compensation for Nuclear Damage was established in 1997 with a goal to establish a global liability structure and to increase the amount of compensation available to victims of nuclear accidents. A State that has ratified either the Paris Convention of 1960 or the Vienna Convention of 1963 may join the CSC. A State that is not a signatory to either of these conventions could join the CSC if its national nuclear liability law complies with the provisions of the CSC and its Annexures that are an integral part of the CSC. India, which is not a party to neither the Paris nor the Vienna Convention, signed the CSC on October 29, 2010, based on its domestic statute, the CLND Act, and it was ratified on February 4, 2016 making it a State Party to the CSC.

(iv) Is India's CLND Act compatible with the CSC?

In terms of channeling strict/ absolute legal liability to the operator, liability limitations in amount and time, liability cover by insurance or financial security, definitions of nuclear installation, damage etc., the CLND Act complies with the provisions of the CSC and its Annexures. The CLND Act laid the groundwork for India's admission to the CSC. According to Article XVIII of the CSC the national law of a State that is not a party to either of the conventions must comply with the provisions of the Annexure to the CSC. The CLND Act is in accordance with the same.

(v) Does the Act channel the liability to the operator of a nuclear plant as envisaged under the CSC?

Yes. The operator of a nuclear installation is liable for damage as a result of a nuclear incident as per Section 4(1) of the Act. Further, Section 4(4) states that the operator's liability for nuclear installation must be rigorous and based on the no-fault liability concept. Section 8(1) requires the operator to obtain insurance or other financial security covering its liabilities before commencing operations at the nuclear site. All these clauses, together with the title of the Act, indicate and ensure that liability is severe and directed at the operator via a no-fault liability scheme.

(vi) Who is an operator?

The Act defines an operator as *"in relation to a nuclear installation means the Central Government or any authority or corporation established by it or a government company who has*

been granted a license pursuant to the Atomic Energy Act, 1962 (33 of 1962) for the operation of that installation.”

(vii) How much compensation is payable under the CLND Act?

The maximum amount of liability against a nuclear accident is provided for under Section 6(1) of the CLND Act and is prescribed to be the rupee equivalent of three hundred million Special Drawing Rights (SDRs). As the current value of 1 SDR is about ₹ 105.5658 the rupee equivalent of the prescribed compensation is ₹ 3,166.97 crores.

(viii) How much is the operator's liability?

Section 6(2) of the Act states the maximum liability of the operator to be ₹ 1,500 crores.

(ix) How is the deficit between compensation and operator's liability met?

In the event the total liability exceeds ₹ 1,500 crores calculated as per Section 7(1) of the CLND Act, the deficit or gap between this amount and the maximum compensation of the rupee equivalent of 300 million SDR is met by the Central Government. In case the liability is beyond the maximum compensation then India can access international funds under the CSC, subject to ratifying the CSC.

(x) Is there a mechanism for creating government support?

Section 7(2) of the CLND Act provides that the Central Government may establish a “Nuclear Liability Fund” by charging such amount of levy from the operators, in such

manner, as may be prescribed. The Government established the Nuclear Liability Fund in December 2015.

(xi) Could an operator be asked to pay more compensation in the future for existing contracts than what is currently provided by law?

Regarding the possibility of future increases in the compensation amount prescribed under the Act and its impact on suppliers' recourse under existing contracts, it is well established jurisprudence that a change in law cannot change the terms of an existing contract formed under the then-current law. In a court of law, a retrospective law that affects a Party's fundamental right vested under a contract would be unenforceable. In the matter of M/s Purbanchal Cables & Conductors Pvt. Ltd. vs. Assam State Electricity Board & Others, 6 S.C.R. 905, [2012], it was held by the Supreme Court that the test lies in the fact that though the government holds the power to make laws with retrospective effect, it should not act in a way that it takes away vested rights or impose illegitimate boundaries or impair existing obligations.

(xii) It is possible to claim for compensation for nuclear damage under statutes other than the CLND Act?

Section 46 of the CLND Act provides that "*the provisions of this Act shall be in addition to, and not in derogation of, any other law for the time being in force, and nothing contained herein shall exempt the operator from any proceeding which might, apart from this Act, be instituted against such operator.*" It is a general provision to preserve the application of other law, if any, with regard to the 'operator'. There is no other statute that

governs civil nuclear liability. The said Section 46 has wording that is identical to that found in the Securities and Exchange Board of India (SEBI) Act, 1992, Telecom Regulatory Authority of India (TRAI) Act, 1997, Insurance Regulatory and Development Authority Act, 1999 and The Electricity Act, 2003. This underlines the fact the other relevant laws are still in effect in their respective jurisdictions.

(xiii) Can victims of a nuclear incident move foreign courts against the operator or the supplier?

The Act, specifically Section 46, does not create any grounds for victims to move foreign courts. On the other hand, it would stand in contradiction to the basic intent of the law, which is, to provide a domestic legal framework for victims of nuclear damage to seek compensation. The introduction of a specific amendment for jurisdiction of foreign courts was rejected during the adoption of the CLND Bill. This shows, without a doubt, the intention of the Act and eliminates any misinterpretation.

(xiv) Who is the ‘Supplier’ and is the ‘Supplier’ always a foreign company?

The CLND Rules define ‘supplier’ as “*a person who: (i) manufactures and supplies, either directly or through an agent, a system, equipment or component or builds a structure on the basis of functional specifications; or (ii) provides build to print or detailed design specifications to a vendor for manufacturing a system, equipment or component or building a structure and is responsible to the operator for design and quality assurance.*”

A scrutiny of this definition reveals that the supplier is “the system designer and technology owner”. As a result, NPCIL has

assumed the position of supplier or the PHWRs it is constructing, as also stated in the General Conditions of Contract. NPCIL or any other operator may look to build a reactor based on design parameters they choose, and the supplier will be a vendor who develops the system, owns the technology for building a reactor and integrates the entire reactor. The system designer and technology owner will almost always procure supplies from a variety of sources. However, he has the function or designation of supplier on behalf of all the vendors under Rule 24 and he can specify this directly in the general conditions of contract, as NPCIL has done.

(xv) Who is the supplier for spares purchased for such reactors in India that were constructed prior to the enactment of the CLND Act?

NPCIL shall assume the role of supplier for contracts with manufacturers or vendors for supply of spares, replacement equipment and components, or provision of services for any nuclear power plant constructed prior to the notification of the CLND Act, 2010.

(xvi) What is the right of recourse against the supplier and what the period for such right of recourse?

Section 17 of the Act provides that the operator of the nuclear installation, after paying the compensation for nuclear damage in accordance with Section 6, shall have the right of recourse where:

- Such right is expressly provided for in a contract in writing;

- The nuclear incident has resulted as a consequence of an act of the supplier or his employee which includes supply of equipment or material with patent or latent defects or sub-standard services; and
- The nuclear incident has resulted from the act of commission or omission of an individual done with the intent to cause nuclear damage.

The right of recourse will remain in effect for the life of the initial license obtained under the Atomic Energy Radiation Protection Rules, 2004 or the product liability period, whichever comes first. This usually remains for a period of five to seven years. As a result, the supplier's right of recourse can be used only for a limited period.

(xvii) What is the liability to the Supplier if the right of recourse is resorted to?

In the event the supplier has taken a Supplier's Policy from INIP and the same is in effect, then INIP will hold the Supplier harmless.

(xviii) What is the remedy if the time limit for exercising the right of recourse lapses?

Rule 24 specifies a duration for exercising the right of recourse. Should this time limit lapse NPCIL holds the role of supplier for contracts with manufacturers or vendors for supply of spares, replacement equipment or components, or provision of services.

(xix) What is the maximum liability of the supplier?

The maximum liability of a supplier cannot be more than the liability of the operator.

(xx) What is the view of the Indian Parliament on the question of liability in the event of a nuclear incident?

The question whether the right of recourse should be limited by Section 6 of the Act or not has been challenged time and again. An amendment was proposed in the Rajya Sabha, the Upper House of the Indian Parliament, challenging the validity of Clause 17 that provides that the right of recourse of the operator shall not be limited by the provisions of Section 6 of the Act. The question was put to motion and was ruled as negative. There is no debate on whether the right of recourse is restricted to the provisions of Section 6 as was affirmed by the Parliament.

(xxi) Is the right of recourse in the CLND Act over and beyond the Annexure to the Convention?

Sections 17(a), (b) and (c) are ostensibly in addition to the situations listed for the right of recourse provided in Article 10 of the Annexure to the CSC. However, the instances listed in Section 17(b) concern actions and issues such as product liability requirements and conditions, as well as service contracts. Typically, these are included in a contract between the operator and the supplier and is not a unique circumstance but commonplace in contracts. Therefore, this provision must be read in conjunction with and in the context of the applicable product liability agreement in the operator – supplier contract. The operator and the supplier have the option to agree on the terms of their contract based on the applicable law. The parties to a contract usually explain and describe the scope of their

obligations via warranty and indemnity terms, which is typically included in such contracts. The terms of the contract between the operator and the supplier, including the basis for recourse agreed upon by the parties to the contract, are not restricted in any way by Article 10(a) of the CSC Annexure. As a result, and in light of the foregoing, there reference to the supplier in Section 17(b) would be consistent with, rather than inconsistent with, Article 10(a) of the CSC Annexure. The law operates in accordance with the conditions laid down in the contract as agreed upon by the operator and the supplier as part of the agreement.

(xxii) How have queries of the suppliers been satisfied over the issue of right of recourse?

India has demonstrated the compatibility of the Civil Liability for Nuclear Damage (CLND) Act and the Convention on Supplementary Compensation for Nuclear Damage through contacts with government and business leaders. The mechanism of the India Nuclear Insurance Pool is also explained as part of the broader risk-management system for liability. The interlocutors are also advised of the Operator's Policy and Supplier's Policy that have been issued.

(xxiii) Has the right of recourse been included in the contractual conditions of a supplier?

Yes. This is done based on the explanation of the definition of supplier as explained in these FAQs.

(xxiv) Would it be correct to assume that the operator can exercise the right of recourse vis-à-vis the sub-vendors?

FAQ (xiv) above explains the meaning of the term ‘supplier’ wherein in the case of proposed projects, the system designer will be the provider under the CLND Act. The operator, on the other hand, would have no issue with the supplier advising its sub-vendors to purchase insurance policies for their own comfort and security. In the event of a nuclear accident the operator’s total liability would be limited to ₹ 1,500 crores.

(xxv) Does Section 17 establish a mandatory and statutory right of recourse?

The operator has a right of redress under Section 17 of the Act. While it gives the operator a substantive right, it is an enabling rather than a necessary provision. In other words, it allows, but does not require, an operator to include or exercise a right of recourse in a contract. Even though there is no legal necessity in the CLND Act for a contract to include a right of recourse, there may be policy considerations for establishing a risk sharing mechanism that includes a right of recourse. As a matter of policy, NPCIL, a government owned corporation, requires that nuclear supply contracts include clauses that provide for a right of recourse in accordance with Rule 24 of the CLND Rules, 2011. The India Nuclear Insurance Pool was established in this regard to help the operator and the supplier negotiate a right of recourse by providing a source of funding through a market-based system to reimburse third parties for damage caused due to a nuclear incident. It allows suppliers to obtain insurance to offset the possibility of recourse being brought against them.

(xxvi) Does Section 46 of the Act extend to suppliers in violation of the CSC?

Section 46 does not mention the term ‘supplier’ and the clause appears to be ‘operator’ specific. The Parliamentary debates at the time of the enactment of this Act have reaffirmed that this clause applies only to the operator and does not apply to the supplier. It is worth mentioning that the CLND Bill was passed by majority vote. The Hon’ble Members of Parliament introduced amendments to make Section 46 applicable to suppliers also. During the vote on various clauses of the Bill in both, the Rajya Sabha or Upper House and the Lok Sabha or the Lower House, the relevant amendment was put to vote and was defeated. Since there is no reference to ‘supplier; in the preceding clause it is clear that a provision which is expressly excluded from the statute cannot be read into the statute. The interpretation of every statute is to be done in accordance with the intent of the makers of the legislation, i.e., the intention of the makers as per a well-established principle of law.

(xxvii) What is India Nuclear Insurance Pool (INIP) and how does it function?

The General Insurance Corporation of India (GIC-Re), along with 11 other domestic non-life insurance companies launched the Indian Nuclear Insurance Pool (INIP) with a capacity of ₹ 1,500 crore to provide cover for liability under the CLND Act. It is a risk transfer mechanism by participating in a pool arrangement wherein the insurance providers contribute their capacity to underwrite the nuclear liability exposures through a designated policy. INIP protects nuclear operators from liability

under Section 6(2) of the CLND Act as well as suppliers under Section 17(a) and (b) of the said Act.

(xxviii) What kind of insurance policies and premiums are offered by the INIP?

INIP covers risks pertaining to the liability of the nuclear operator under Section 6(2) of the CLND Act as well as the liability of the suppliers under Section 17. The policies offered are:

Nuclear Operator's Liability (CLND Act 2010) Insurance Policy – INIP will indemnify the insured operators against their statutory liability under the CLND Act, 2010 arising out of nuclear damage resulting from a nuclear incident occurring during the term of the policy, subject to the terms, exclusions and conditions contained in the Policy.

Nuclear Supplier's Insurance Policy (Right to Recourse Only Under CLND Act-2010) – Subject to the terms, exclusions and conditions in the Policy, INIP will indemnify and hold harmless the insured against liability arising solely from the operator's right to recourse under Section 17 of the CLND Act. Pricing and premiums vary from product to product and are determined by a number of factors. When pricing for a policy, factors such as the age of the reactors, location, number of reactors, policy period etc. are taken into account. Additional considerations looked into are the contract value, duration of the cover sought, number of sub-suppliers etc.

(xxix) Has the INIP issued such Operator's and Supplier's Policies?

Yes. The Operator's Policy has been issued since 2015 while the Supplier's Policy has been issued since 2018.

(xxx) Does the insurance premium remain constant over the time limit for right of recourse?

The amount of premium normally depends on market forces. However, no dramatic change is expected from year to year.

(xxxi) Would this risk management system burden the taxpayer and increase the cost of nuclear power?

It is important to note that there is no additional cost to the taxpayer or the government. NPCIL or the operator is already required by the CLND Act to maintain financial security sufficient to satisfy its maximum liability for civil nuclear damage which is ₹ 1,500 crores. Currently, NPCIL obtains a bank guarantee for this amount and pays an annual fee for this service. A market-based international best practice is being implemented with the establishment of the India Nuclear Insurance Pool (INIP). The NPCIL takes out insurance cover of the same amount through the Insurance Pool and pays an annual insurance premium. For the first several years, the government will provide ₹ 750 crores to the Insurance Pool till such time as the insurance companies are able to sustain it on their own. The government, on the other hand, will receive a proportionate share of the premium on this sum, which will be used only in the event of a nuclear disaster. Premium payments by operators and suppliers are projected to have a minor impact on the power plant costs. Going by the experience of the 26 insurance pools

around the world the operators pay only a small percentage of the entire cost of the plant as premium.

5.7.8 THE INSURANCE POOL

An insurance pool is basically a group of insurance companies that come together to participate with fixed shares in the insurance of a particular class of business or a particular type of risk. There are several reasons for which insurance companies form a pool and some of these are:

- The risk proposed to be insured is largely unknown
- The risks proposed to be insured are small in number
- The quantum of cover required by the proposed insurance of the risk to be covered cannot be met by any one company on its own
- The risk proposed to be insured has a particularly hazardous aspect wherein traditional insurance methods do not allow coverage

All the above reasons are in fact the problems typical of insurance of nuclear risks. The sensitivity of the business and the magnitude of the potential hazards and therefore the risk all combine to make an insurance pool a very apt solution to address the issue of insurance of nuclear risk. In general, the world over, insurance pools put out their maximum insurance capacity for nuclear risks. This is irrespective whether the pool is formed to cover domestic risks only or to provide reinsurance cover to their counterparts or other insurance companies or pools in other countries.

Channeling the liability for nuclear accidents to the operator has worked well for the available insurance capacity. Further, common

account reinsurance was taken with other global nuclear insurance pools. However, all this requires a level of transparency, so that the pool members are clear that their obligation is limited to the amount of their participation in a pool and they need not look elsewhere for the same accident and there is no accumulation from other channels. This increases their commitment to cover nuclear risks much more than if they were uncertain as to their total exposure in the event of an accident. It has also encouraged several individual members to further increase their cover, probably more than for other first-class industrial risks.

The global level pooling system has also resulted in economy of costs. There are no intermediaries between a domestic pool and any reinsurance pools and their absence has resulted in a faster deployment of the maximum available capacity globally. Also, the knowledge and experience in nuclear insurance remains domestically in one body making the insurance process effective and efficient. The cost savings flow through into the premiums that are paid by the operators covered by the insurance.

The internationally for nuclear third party have five basic principles for nuclear third-party liability and compensation at both, the domestic and the international level, viz.,

- Strict liability
- Exclusive liability or legal channeling
- Compulsory financial security
- Liability limits in amount
- Liability limits in time

The third-party liability of a nuclear operator is stringent implying that irrespective of it being the operator's fault or negligence, the operator is liable. There is also no legal requirement to prove that the aftermath of an accident may be the fault of the operator. This has been done to promote the sense of security and protection amongst the public.

As per the principle of compulsory financial security the operator has to secure finances to cover any nuclear liability. This is normally serviced by the private insurance providers though other routes such as bank guarantees, the operator pooling system or self-insurance which may be taken. The minimum amount of cover is set by domestic legislation which is more often than not dependent on international treaty obligations. Over the years, this amount has been increased to account for inflation and increased responsibility of the operators. In many countries, suppliers to the NPP have exclusion or "hold harmless" clauses that redirect the liability back to the operator.

Nuclear insurance pools conduct their activities in line with certain principles:

- Risks are covered by the individual insurance capacity of all pool members and are not individually reinsured
- Reinsurance is commonly among pools and must be protected to the maximum against unknown risks and must mandatorily be transparent
- To contain costs there are no intermediaries in the reinsurance among pools
- Cost efficiency is to be maintained at both the national and international level

Insurance Pools operate on the global stage in which the players have differing constitutions, rules, regulations and procedures that are further based on the domestic economy, market and legal scenario. Given this background insurance pools cover nuclear power plants, other installations involving nuclear fuel cycles and also transport of nuclear materials. Though most are international, some insurance pools operate only within their domestic jurisdiction such as the Nuclear Insurance Association of Canada. Interestingly such pools do sometimes include members that are foreign insurance companies.

In the USA and Europe, the nuclear industry has set up insurance associations that handle the liability and damages in the case of a nuclear accident. China is not a party to any international liability convention but is an active member of the global insurance pooling system covering first-party risks and third-party liability after the fuel has been loaded into the reactor.

It is pertinent to note that the development of the nuclear industry has always been linked to the insurance industry on account of the mandatory financial security that must be provided under the third-party nuclear liability regime. Though the insurance industry has stepped up to the task in providing coverage to the nuclear industry there are still several challenges that the insurance pools face. Higher liability limits, unknown risks, inability to quantify risks, unknown costs of reinstating an impaired environment, quantum of loss of income including that from direct economic interest in usage of the environmental

resources are just some of the issues that insurance pools face while attempting to set a premium.

Nuclear energy has exploded in popularity over the last few decades, owing largely to the world community's growing concern about global warming. All international liability frameworks for nuclear damage have some aspects in common, viz., channeling liability to the operator, capping that liability and passing final duty to the government to pay the victims. Relieving the supplier of all liability in the event of a nuclear accident entails significant risks thereby reducing the provider's incentive to design safer nuclear reactors. In India's civil nuclear liability scheme, in addition to channeling liability to the operator, capping that liability and transferring final responsibility of compensation to the government, the operator has been given the right of recourse against the supplier if the nuclear incident was caused by equipment or material with patent or latent defects or substandard services supplied by the supplier. It is a significant departure from international best practices, but it is more than warranted because it holds suppliers accountable in nuclear commerce and reduces the hazards of absolving suppliers of all liability. Though it is a deviation from the global norms, India justified the making the equipment suppliers ultimately liable for a nuclear incident as it did not want a repeat of the 1984 Bhopal Gas Tragedy – a devastation that has not been forgotten.

Further, the supplier's liability is not provided under the international regime unlike India's civil nuclear liability scheme. Operators have been provided with a right of recourse against the supplier if the nuclear incident was caused by equipment or material with patent or latent defects or substandard services supplied by the supplier. However, India continues to stand in conformity to the international provisions and has complied through the Nuclear Supplier's Insurance Policy.

The liability and compensation laws in India have kept most international supplier wary and at bay. These have also been the main issues that have caused roadblocks in dialogues between the USA and India on nuclear cooperation. In order to get India's nuclear program on a fast-track, an insurance pool was found to be a fit solution to resolve these issues. It was proposed to form a Pool which would be a risk-transfer mechanism that would provide a right of recourse to both, plant operators and equipment suppliers. A market-oriented approach was suggested that would provide a corpus to be used in the event of a nuclear incident to compensate third parties for damages.

On June 12, 2015, the Indian Government formed the INIP or the Indian Nuclear Insurance Pool, comprising several Indian insurance companies, led by the General Insurance Corporation of India or GIC-Re with a core capability of ₹ 1,500 crore in terms of insurance cover under the CLND Act, 2010 (The Government of India, Department of Atomic Energy, 2016). Contributions to the Pool would come from the Insurance Companies, both private and public sector, and from the Government. The security provided by the formation of the INIP gave an impetus to the setting up of new nuclear plants. The INIP is the 27th such Pool in the world and its formation and operationalization was feasible with the reinsurance support of London-based Nuclear Risk Insurer (NRI) (Asia Insurance Review, 2015). Indian Nuclear Insurance Pool indemnifies the insured operators against their statutory liability under the CLND Act 2010 arising out of any damage from a nuclear incident that occurs during the policy period, subject to the terms, conditions and exclusions contained in the Policy.

The INIP is designed to provide third-party insurance cover to operators and suppliers under the CLND Act, 2010. In addition, the proposal is to offer a

nuclear operator's liability insurance policy as well as a nuclear suppliers' special contingency (against right to recourse) insurance policy. While in the initial stages INIP has limited itself to third-party liability cover and geographically to "cold zones" only it has plans to expand into insurance cover for property and hot zone risks or risks inside the reactor areas. It also plans to provide a mechanism for transfer of risk to plant operators and suppliers within the purview of the CLND Act, 2010. However, products offered for now are for plant operators, turnkey suppliers, and all other suppliers, and are designed particularly for Indian companies.

Setting up the INIP has many benefits for all players, the most significant being that the risk of nuclear damage and the compensation thereon is divided between the plant operators and the suppliers. A large part of this liability is covered by the Insurance Pool. On a macro level, setting up the INIP has paved the way for India to access the global pool on ratification of the CSC. Additionally, this also opens the doors to nuclear suppliers who would be more willing to do business with India. On a micro level, since both plant operators and suppliers are covered, they are more inclined to work as partners rather than combatants.

On the flip side, the INIP faces several challenges. There may be instances when the liability limit for operators that has been provided under the CLND Act, 2010 is inadequate in the event of a particularly large nuclear incident. India's liability cap is lower than some other countries and this could be an impediment for India to dip into the international pool. Another ambiguity is the ownership of the nuclear power plants. If these continue to be completely under the Central Government ownership then operator liability would be superfluous. The benefits of the insurance pool would be realized in totality only if the private sector is allowed an entry into the civil nuclear power sector. Another challenge is the possible existence of a

conflict of interest when there is a nuclear incident. The Government being a member of the Pool has the onus to pay compensation. However, at the same time, the Government also has the responsibility to ascertain the damage incurred. This conflict could create impediments in the compensation process. Another major difficulty is to put together the required funds and at present INIP has managed to achieve only the half mark target. To compound matters, there is insufficient reinsurance available and insurance companies are unable to contribute their determined share of the Pool. Lastly, it is argued that the Pool cover of ₹ 1,500 crore would be deficient while covering all the nuclear plants in India and it is possible some would be without ample insurance cover.

In conclusion, for countries like India that need to cope with the rising demand for power the key to expansion and growth of the economy could well be nuclear energy. To this end, most countries are either signatories to various international conventions or have enacted their domestic legislations to address various issues arising out of nuclear incidents. Though several nations, including India, have a definite structure for provision of compensation in the case of a nuclear incident there is a scope for improvement given the risk potential of the nuclear industry and the extent of damage that an incident can cause. Insurance cover for the industry also needs to be relooked at vis-à-vis the quantum of cover which should also account for future damages due to exposure to nuclear radiations.

PART III – COMPARITIVE ANALYSIS

5.8 INDIA AND THE WORLD

One of the most significant agreements without doubt is the one signed with the USA. India's integration into the global nuclear non-proliferation regime was given a boost by the "*growing strategic convergence between India and the US*". In 2003-04 a document titled "Next Steps in Strategic Partnership" was released and was key in solidifying recognition of India's rise in the nuclear establishment. The USA recognized that its policies needed adjustment for "greater nuclear engagement" with India and that it needed to encourage its allies to do the same. The 123 Agreement opened the doors for interaction in nuclear safety matters, collaborative research in nuclear sciences covering amongst other sectors agriculture, environment, climate change, biological research, medicine and industry, scientific exchanges, civil nuclear activities, technology transfer on an industrial or commercial scale, development of a strategic reserve of nuclear fuel to safeguard disruption of supply, supply of nuclear materials between the countries and to other countries including alternation in the form or content of such material and for supply of equipment, projects of controlled thermonuclear fusion etc.

The other significant cooperation agreement has been the one with France. Both countries have, through diplomatic exchanges and bilateral meetings, shared a strategic relationship with respect to trade and civil nuclear energy and one can safely say that France has been key in India's nuclear progress. It is pertinent to note that post India's 1974 peaceful nuclear explosion France was the only country in the world to laud the event as an indication of India's advancement in the nuclear sector. France continued its supply of fuel to the Tarapur Nuclear Plant and also openly opposed sanctions by the USA post the tests in 1998. However, France too was insistent that none of

its supply of nuclear material would be used for any future nuclear explosion. Following the waiver by NSG France was the first country to sign a civil nuclear agreement with India for the construction of six European Pressurized Reactors. The Indo-French arrangement also includes upcoming facets of nuclear energy such as agronomy, biology and earth sciences. As a result of this Agreement India became a part of the ITER or the International Thermonuclear Experimental Reactor – a megaproject of nuclear fusion research and engineering involving several nations. The two countries also signed an “Industrial Way Forward” agreement covering costs, safety issues and liability. This civil nuclear partnership with France is without doubt the most comprehensive strategic one amongst all other arrangements.

Another significant supporter of India’s nuclear program has been Russia with which India has signed several agreements, some dating back to the days when it was still the Soviet Union. Earlier these agreements concerned scientific and technical cooperation such as exchange of academics etc. After the Pokhran I test Russia agreed to supply heavy water for the Rajasthan Atomic Power Station which was earlier, prior to the sanctions, supplied by Canada. Subsequently, Indo-Russia accords were inked for the construction of a nuclear power plant with two “pressurized light water reactors”, four additional units at Kudankulam and development of new nuclear sites, viz., at least 12 in the next 20 years and joint cooperation for peaceful purposes with third countries, cooperation in the sectors of energy, nuclear medicine and processed foods. The Global Center for Nuclear Energy Partnership was set up and all future cooperation with Russia was discussed through this Center. As a partner in this sector Russia is important as being a country that has assisted in India’s civil nuclear program right through the period of nuclear isolation and recognition of this fact was given

when Russia was elevated to a special and privileged strategic partner in 2010.

The India-Japan Agreement for Cooperation in the Peaceful Uses of Nuclear Energy which was operationalized in 2017 was considered monumental since Japan has been the only country to have been targeted by nuclear attacks and to have suffered the aftermath. The agreement covers exchange of information, expertise, design and construction of reactors. However, the Agreement contains a 'Nullification Clause' whereby all cooperation is suspended if India conducts further nuclear tests which was subsequently amended to read suspension of cooperation if India breaches its pledge of no-testing to the NSG. India was the first non-NPT member to enter into a civil nuclear arrangement with Japan. It is interesting to note that this agreement would go a long way in facilitating collaboration with several major US-based nuclear equipment suppliers such as GE Energy Inc. as these companies boast Japanese investments. Japan practically has a monopoly on reactor elements such as safety components. Post the 2011 Fukushima disaster Japan's nuclear industry was in the doldrums similar to rest of the world. The arrangement with India has helped in boosting the post-Fukushima battered civil nuclear industry in Japan.

India entered into a tripartite agreement with Russia and Bangladesh to set up the Rooppur Nuclear Power Plant in Bangladesh. This Agreement was significant on several counts as it is the first nuclear reactor in Bangladesh, the first nuclear project that Russia and India have jointly undertaken in a third country, significant advancement was made on issues of liability, very high post-Fukushima safety standards were set and it underlined the acceptance by the global nuclear community of India as a responsible nuclear power. NPCIL is the Indian company responsible for construction, installation, capacity building and providing support to Russia which is the lead player for design, manufacture and supply of equipment and

construction. India's first project out of the domestic scene has proven its presence on the world nuclear stage and has at the same time supported the Government's 'Make in India' initiative by proposing manufacture of some nuclear equipment indigenously. It has also enhanced India's role in South Asia in light of the country's 'Neighborhood First' Policy while benefitting India by the realization of strategic goals such as free-transit agreement with Bangladesh reducing India's dependence on the Siliguri corridor and thereby aiding in the development of the North-East Region.

In addition to the above, other agreements were signed with Canada, Argentina, Australia, Sri Lanka, United Kingdom, Vietnam, Kazakhstan, Korea and Namibia. Though the list of nuclear cooperation agreements signed is impressive the reality India must face is that many of these have met with hurdles and some have not yet been operationalized. One of the major issues that India is battling with is the question of liability. The Indian Parliament in an effort to address this issue enacted the Civil Liability for Nuclear Damage Act in 2010 which covered victim compensation, recourse liability on suppliers and potential unlimited liabilities linked to other existing laws. However, these very aspects of the CLND Act have proved to be impediments to the operationalization of international agreements. This has had, to a certain extent, an adverse effect on India's efforts to maintain bilateral relations with supplier countries and on the domestic civil nuclear program. One of the provisions (section 17B) of the Act, has come in for a tremendous amount of opposition from other countries. This provision allows the operator who is liable to obtain compensation from the suppliers in the event of a nuclear accident and this liability can be held for an indefinite time period. This is in direct contradiction to the international nuclear civil liability conventions within the framework of which, the liability rests solely on the operator. India became a signatory to the Convention on Supplementary Compensation for Nuclear Damage causing

further concern as the domestic legal framework is at odds with the provisions of the CSC. To further address these concerns, India committed to setting up an insurance pool to provide cover to companies constructing nuclear reactors in India in the event of a nuclear accident. The outcome of the Indo-US dialogue on the question of civil liability gives complete credence to the need for innovative solutions to the civil liability issue at both the domestic level and the international level.

Till date, in the event an issue of civil liability arises, India's approach has been to take matters on a case-to-case basis and come up with solutions specific to that particular issue. In some cases, such curated solutions were necessary and imperative, such as the Rooppur agreement with Bangladesh. However, it cannot be ignored that civil liability continues to be a major challenge and it is important that India acknowledges the same, learns from experience and incorporates important learnings into practice while negotiating such agreements in the future. What would go a long way in removing concerns of supplier countries would be for India to apply the international liability framework as the domestic liability laws do not appear to have incentivized them to invest. The significance of the civil liability issue is underlined by the statement from GE Energy, a US-based corporation, "*the liability issue is the biggest remaining hurdle*" for American companies to invest in India's nuclear program as plant operators or as suppliers of equipment. The matter, though appearing simple, is sensitive and has political and legal implications with issues stemming from the 1984 Bhopal tragedy which occurred through Union Carbide, a US-controlled company.

Soon after the Bhopal incident, another industrial accident occurred in Delhi called the Oleum Gas Leak Case which was a disaster though not on the scale of the Bhopal gas leak which was incentive enough for the Supreme

Court of India to dictate laws for accidents in hazardous industries where the Apex Court held two things. Firstly, the principle of absolute liability, without negligence or fault and with exception was upheld and secondly the “deep pocket” theory was floated, meaning thereby the quantum of compensation would be directly proportionate to the capacity of the enterprise (including group or parent companies) to pay. It is apparent that any legislation regarding limiting civil liability has to be delicately handled with most viewing it as a political “sellout” and questions raised on its validity and the inevitable repercussion of a flood of litigation. While all this may push the operationalization of the international nuclear agreement to some extent, on the flip side the outcome would be a clear, unambiguous and articulate legal framework for civil liability.

5.9 AN ANALYSIS OF THE UNDERSTANDING REACHED BETWEEN INDIA AND THE UNITED STATES

What was the understanding reached between India and the United States in 2015?

During President Obama’s visit to India in January 2015, India and the United States reached an agreement on civil nuclear liability issues which was signed on January 25, 2015. The language of the Administrative Agreement was finalized with the intent to execute the bilateral 123 Agreement signed in September 2008. The intent was to enable India to move forward with commercial negotiations on the construction of reactors in India with international assistance, allowing India to realize the civil nuclear agreement’s huge economic and clean energy potential.

What was the precursor to this understanding and consequent agreement?

During Prime Minister Modi’s visit to the United States in 2014, the leaders of both countries reiterated their commitment to fully implement the Indo-

US Civil Nuclear Cooperation Agreement and established a Contact Group to facilitate the implementation of civil nuclear cooperation. The Group, which included representatives from the Ministry of External Affairs, the Department of Atomic Energy, the Nuclear Power Corporation of India Limited (NPCIL), the Ministry of Finance, the Ministry of Law & Justice and the US Government, interacted with the companies, viz., NPCIL from India and American companies Westinghouse and General Electric. The Group convened thrice, viz., on December 16 – 17, 2014 at New Delhi, on January 6 – 7, 2015 at Vienna and on January 21 – 25, 2015 at London. Based on these negotiations, the leaders achieved an agreement on the two major concerns of civil nuclear cooperation which was confirmed on January 25, 2015.

As part of the understanding has India agreed to amend its Civil Liability for Nuclear Damage Act of 2010 (CLND Act 2010) and the CLND Rules 2011? If not, is there an expectation that such amendments would be made in the future?

There is no proposal to amend the CLND Act 2010 or CLND Rules 2011.

Have the U.S. concerns over the CLND Act been resolved?

Using case law and legislative history, India clarified its stance on the compatibility of the Civil Liability for Nuclear Damage Act and the Convention on Supplementary Compensation for Nuclear Damage during the CSC meetings. The notion of an India Nuclear Insurance Pool as part of a larger liability risk management program was also suggested. Based on India's presentations and subsequent discussions, it appears that the U.S. concerns were resolved and that India's CLND statute is compatible with the CSC which India has signed and ratified.

Does India's CLND Act channel the liability to the Operator of a nuclear plant as envisaged under the CSC?

According to Section 4(1) of the Act, the operator of a nuclear installation is responsible for any damage caused by a nuclear incident. In addition, Section 4(4) states that the operator's liability must be rigorous and based on a no-liability concept. Further, Section 8(1) of the Act requires the operator to obtain insurance cover or other financial security covering potential liability before commencing operations at the nuclear site. All these provisions ensure that the liability is strictly enforced and channeled to the operator via a no-fault liability regime.

5.10 COMPARITIVE ANALYSIS OF NUCLEAR REGIME OF USA AND INDIA

Private Sector Participation

Globally the USA has the highest private sector participation in the production of civilian nuclear power. In the late 1990s the official policy and funding decisions of the Government gave a tremendous boost to civilian nuclear capacity building. Though the review process is time consuming, the Government is the main source of funding for research and development projects and has also provided for several incentives for building new facilities, including Federal loan guarantees for new plants and renewable energy projects. In direct contrast, the Indian lawmakers, vide the Atomic Energy Act, 1962, prohibited private control of nuclear power generation in the country. Subsequent amendments to the Act were made, however, such amendments allowed public sector joint ventures but still the nuclear power industry kept its doors largely closed to private sector companies. In addition, no direct foreign investment in nuclear power was allowed with the exception of the supply chain. Given India's trade isolation for over three decades, companies such as Larsen & Toubro (L&T), the largest engineering company in India, has supplied heavy components to 17

of the country's pressurized heavy water reactors. However, in matters of power generation, the Central Government, whether directly or indirectly, has complete monopoly of the nuclear industry in India.

Government Involvement

The US Government is responsible for setting the national energy goals and is heavily involved in the regulatory aspect of nuclear energy, viz., safety and environmental and also in funding for research and development of nuclear technology. Despite a high level of privatization, the US Government is more involved in the commercial aspects of nuclear power than in any other industry in the country. Some authority is also given to the states and to local governments and these have a significant impact on the framework and the economical aspect of the nuclear power industry in the U.S. An example of this is the 1976 voter referendum in California which was the reason for a prohibitory law that disallows construction of new nuclear plants in the State. The Federal Government actively encourages research and development by providing funding assistance for the same. On the other hand, India, the other biggest democracy has a policy which invites no involvement and gives no support to, in fact, actively prohibits, any private or non-government entrant into the nuclear power sector. The complete authority – whether regulatory, design, technology, construction, commissioning or operational – is with the Central Government. So much so that, unlike the USA, the individual states also have not been delegated with any authority in this industry.

Alternate Sources of Energy

The USA remains committed to the inclusion of nuclear power as an integral part of its long-term energy strategy. However, at the same time there has been great emphasis on developing alternate sources of energy and

finding economies of scale. This has resulting in the reduction of some nuclear programs.

Disposal and Storage of Waste

Spent fuel and radioactive waste generated by nuclear power plants is a health, safety and environmental hazard if not stored or disposed of in the proper manner. This remains a major issue and has been a subject of policy debate over several decades and is still not resolved satisfactorily in the US. This includes waste from civilian as well as military facilities. The Nuclear Waste Policy Act of 1982 has provided a timetable and detailed procedures for building of repositories, however, objections from States – both legal and political – have delayed the same. Individual states have the veto power on locating a waste repository within the state boundaries. India is leaning towards accelerator-driven subcritical molten salt reactor systems (ADS) which burn minor actinides. It is felt that these working in tandem would more effectively address the concerns of waste management keeping safety in mind. At present, radioactive wastes from existing nuclear reactors and reprocessing plants are treated and then stored at each site. There are two waste immobilization plants in operation at Tarapur and Trombay and one vitrification plant for waste from reprocessing. Similar to the USA, effective waste management remains an on-going process in India also. Research on final disposal of high-level and long-lived wastes in a geological repository is underway.

Public Participation and Opinion

The US Government has developed an inclusive approach to all aspects of civilian nuclear facilities wherein the public at large has an opportunity to express their concerns. This policy has borne fruit and over the last three decades public opinion is now leaning favorably towards nuclear energy.

This includes favorable opinions of people living in the vicinity of nuclear power plants.

Related Policies & Legislations

The US domestic energy policy is intricately tied up with its foreign, trade and defense policies with respect to all matters of mitigating climate change and nuclear non-proliferation of weapons. India's priority is to reduce poverty and to promote economic growth where coal is still a major source of energy. This implies that reduction of CO₂ emissions is not at present of the highest priority and in November 2022 the MEFCC made known the long-term carbon development strategy which included tripling the nuclear power capacity by 2032. Additionally, India's policies on nuclear energy are also driven by its security concerns given its regional position.

Nuclear Liability

The USA historically had not been a part of any IAEA or OECD convention for third party liability in the event of a nuclear incident. However, in 1997, being a party to the IAEA, it signed the CSC or Supplementary Convention for Nuclear Damage and ratified it subsequently. The first-tier payments under the CSC are made under the Price Anderson Act wherein each nuclear site is mandatorily required to take insurance cover provided by American Nuclear Insurers, a private insurance pool. However, uniquely to the U.S., if an incident occurs outside its territorial boundaries the nuclear suppliers would have to reimburse the Federal Government for the second-tier payout.

Indian legislations are limited to the CSC on the matters of liability and compensations in the event of a nuclear incident. India is also not a party to the international nuclear liability conventions, viz., the Paris Convention and the Vienna Convention. As all the civilian nuclear facilities are owned

and operated by the Government of India and liability issues will be the Government's responsibility. Under Indian legislations foreign suppliers potentially risked unlimited liability which did not permit them to take insurance cover. However, in 2008 the Government took a stand to take necessary steps, legislative or otherwise, to adhere to the CSC. To make good its stand the Civil Liability for Nuclear Damage Act, 2010 was passed which places responsibility for nuclear accidents on the operator and limits the total liability to 300 million SDR or "*such higher amount that the Central Government may specify by notification*" (World Nuclear Association, 2022). Beyond this amount the Government assumes the liability. The Act does not, in any way, ratify the CSC or any international treaty or framework governing nuclear liability though India signed the CSC in October 2010. The same was ratified in 2016 and is now in force in India.

The USA is not a party to any international nuclear liability convention other than the CSC, though it has deliberately adopted the principles of the Paris and Brussels Conventions. It is also the first nation which enacted a specific legislation, viz., the Price-Anderson Act of 1957, to cover public claims for personal injury, loss of life and damage to property due to a nuclear incident. This includes bodily injury, sickness, disease, loss of life, loss of or damage to property and also loss of foreseeable income from the property. If an assessment of the compensatory amount shows that the insurance pools are ill-equipped to cover the same the USA Government is committed to providing additional relief.

Similarly, India enacted the CLND Act to provide for civil liability and prompt compensation for damages resulting from a nuclear incident. It strictly imposes liability and channels the same exclusively on the operator under the no-fault liability regime. Under the Act the National Nuclear

Damage Claims Commission was also established to assess the claims. However, the Act was met with some resistance on the international playground as Sections 16 and 17 of the Act gave the operator the right to recourse making the suppliers liable. Most suppliers, naturally, were not inclined to supply to India on the grounds of violation of the CSC requirements. Post such resistance the Indian Government issued a clarification to underline that as far as the reference to “supplier” in Section 17 of the Act is concerned it conforms to rather than contradict the provisions of CSC.

Regulatory Bodies

The NRC or the Nuclear Regulatory Commission is the independent government agency that is responsible for all regulatory aspects of the nuclear industry in the U.S. This includes licensing, reactors, other facilities, transportation, disposal and storage of spent fuel etc. The Indian Atomic Energy Commission is the main policy body for all matters related to nuclear energy in India and the Nuclear Power Corporation of India Ltd. (NPCIL), a government company has the mandate for design, construction, commissioning and operation of all thermal nuclear power plants in India. The Department of Atomic Energy (DAE) encompasses research, technology development and commercial reactor operations. It also controls the Heavy Water Board for production of heavy water and the Nuclear Fuel Complex for fuel and component manufacture. The Atomic Energy Regulatory Board (AERB) is responsible for regulation and licensing of nuclear facilities in the country and its authority also extends to safety, radiation safety and industrial safety in all nuclear plants. Post the Fukushima Disaster a Council of Nuclear Safety was set up chaired by the Prime Minister to oversee policies on radiation and nuclear safety.

Other International Protocols, Conventions and Memberships

Being a nuclear weapons state, the USA is a party to the Nuclear Non-Proliferation Treaty after ratifying it in 1970. Under the NPT the U.S. has a safeguards agreement which has been in force since 1980 and this is applied to all civilian nuclear activities. India was excluded from the NPT since it acquired nuclear weapons capability post-1970 and its nuclear program has progressed largely without fuel and technological assistance from other countries. The AERB is a member of the OECD Nuclear Energy Agency's Multinational Design Evaluation Program and is an active participant in the Codes and Standards Working Group, the Digital Instrumentation and Control Working Group and the Vendor Inspection Cooperation Working Group.

5.12 CONCLUSION

Unlike the USA, the nuclear industry in India, in the past, has been largely without IAEA safeguards, though there are facility specific arrangements. In October 2009, India's safeguards agreement with IAEA became operational and all reactors were put under the India Specific Safeguards Agreement.

Since India is not a member of the NPT and did not have the full benefit of the IAEA safeguards it has been isolated from world trade by the Nuclear Suppliers' Group. However, in September 2008 a clean waiver to the trade embargo was agreed upon recognizing India's impeccable non-proliferation credentials. India has traditionally been extremely scrupulous in its endeavor to ensure that its nuclear weapons material and technology are safe-guarded against illicit or commercial export to other countries. The NSG also passed a consensus resolution to exempt India from the rule of prohibiting trade with non-members of the NPT allowing India to enter into mutually beneficial cooperation agreements with USA and other countries.

Several analysts have shed a different light on the obligations assumed after India entered into bilateral and international agreements. The Indo-US Joint Statement of 2005 is looked upon as only a statement of intent and therefore one can conclude that it does not create any binding obligation on either country. However, it laid down a framework for subsequent talks and negotiations and more importantly made it evident that if India wished to end its “*nuclear isolation*” there were obligations to be taken on that were described at length. At best, the Joint Statement could be viewed as a ‘soft’ legal instrument that clearly articulated an intent that was put down in writing. Binding obligations were subsequently created for both countries under the 2007 Cooperation Agreement or more formally known as the 2007 Agreement for Cooperation between the Government of India and the Government of the United States of America Concerning Peaceful Uses of Nuclear Energy. Though not all obligations were specific they had to be performed and could be implemented by any party “*in accordance with its respective applicable treaties, national laws, regulations and license requirements....*”. The obligations assumed by the USA were facilitating in nature including:

- an assurance of regular supply of fuel with any shortfall being met by other countries such as France, Russia and UK at the behest of the USA;
- persuading NSG members to agree to and approve of an adjustment of NSG guidelines; and
- approval of India-specific Safeguards Agreement with IAEA and others.

On the other hand, India’s obligations were specific and needed to be performed or implemented accordingly. The legal framework of the implementation process took its basis from the AEA, 1962 even though it

was policy decisions that put these processes into effect. It is pertinent to note that this Act was formulated and came into force in a completely different time and context when India was well aware of the strategic importance of nuclear energy and was struggling to develop its own scientific research base with respect to nuclear energy with an end goal of self-reliance. The Act can be said to be inward looking with specific and limited regulatory scope. The very ideas of trade in nuclear energy on a large scale and private participation in this sector were unthinkable at the time. This was very similar to the US Atomic Energy Act of 1946 which, when it came into force, was also restrictive and inward looking. It was subsequently transformed into the Atomic Energy Act in 1954 which then opened the door to private players in the nuclear energy sector in the US.

The 2007 Cooperation Agreement was instrumental in changing popular perception in India of the nuclear sector and what the regulatory regime should be. The Agreement specifically refers to nuclear trade, the obligation being to “*facilitate nuclear trade*” and “*...where appropriate, trade between third countries*”. It also required that “*industry in both the Parties needs continuing reassurance that deliveries can be made on time in order to plan for the efficient operation of nuclear installations.*” Though the Agreement includes distinct provisions on “*transfer of nuclear material.....sensitive nuclear technology, heavy water production technology, sensitive nuclear facilities, heavy water production facilities and major critical components of such facilities*”, the transfer of dual-use items which may be used for enrichment, reprocessing etc. would be governed by the respective applicable laws and policies. Given these major changes and the strides India had taken to be recognized as a nuclear power the scope of the 1962 enactment was found to be limited. Even though the preamble to the Act states that this was “*an Act to provide for the development, control and use of atomic energy for the welfare of the people of India and for other peaceful*

purposes” the definition of “*peaceful purpose*” was not clear and many felt that the military and strategic agenda of the country was very much imbedded in the Indian nuclear framework. This is substantiated by the mandate given to the DAE that was established in 1954 that refers to ‘national security.’ The broad policy mandate given to the DAE covered:

- To increase the share of nuclear power by deployment of indigenous and other proven technologies, develop FBR and thorium reactors with fuel cycle facilities;
- To build and operate research reactors for production of radioisotopes and carry out radiation technology applications in the sectors of medicine, agriculture and industry;
- To develop advanced technologies such as lasers, supercomputers etc. and facilitate transfer of this technology to industry;
- To provide support to basic research in nuclear energy and related areas;
- To interact with universities and academic institutions; and
- To support research and development of projects that were related to programs of the DAE and provide international cooperation on related areas of research.

While the mandate appears clear and evident any reference to ‘peaceful purposes’ has been avoided.

On the other hand, the 2007 Cooperation Agreement has detailed out the meaning of the phrase ‘peaceful purpose’ and this has been defined as something done under such arrangements that will not result in or contribute to the proliferation of nuclear weapons or any other nuclear explosive device. Several other obligations and respective commitments also underline the importance of ‘peaceful purpose’ such as safety and security of peaceful uses of nuclear energy, adequate protection of nuclear material,

establishment of an effective national export control regime etc. The distinction between ‘peaceful purpose’ and ‘military purpose’ was unambiguous and clear. It should be noted here that India has no legal framework, including the Atomic Energy Act, 1962, that makes such a distinction.

On doing a comparative analysis of the 1962 Act and the 2007 Cooperation Agreement the former falls short on several counts. The 1962 Act does not have any definition for a ‘reactor’ whereas the Agreement has termed it as “*any apparatus*” wherein “*...self-sustaining fission chain reaction is maintained.*” There are several such terms that are not clearly defined in the 1962 Act and if defined it is done so with no precision and accuracy. Clearly, the Act and any amendments thereto were unable to match the current interpretations and terminology in the field of nuclear energy.

While the 2007 Cooperation Agreement refers inter alia to respective treaties, laws, regulations etc. the Indo-French Cooperation Agreement on the Development of Peaceful Uses of Nuclear Energy is silent on domestic laws. The shortcomings of the 1962 Act in covering areas of nuclear trade are considered to be the basis for this silence. Instead, the Indo-French Agreement refers to provisions of the Agreement itself, to principles of international law in good faith, to the principles governing the respective policies and to respective international obligations. The reference to national laws in the case of the Indo-US agreement has also been made on account of the policy dichotomy that exists between the two countries and the respective Atomic Energy Acts. To implement the soft obligations emanating from the 2005 July Statement and the subsequent Agreement between India and the USA the existing legal framework including the Atomic Energy Act, 1962 appears to be irrelevant. This claim is supported by India’s acquiescence to negotiate a Safeguards Agreement with the

IAEA that allows for a mandatory verification process on a perpetual basis. These provisions were beyond the purview of the 1962 Act as nuclear commerce on a global scale was not visualized and hence there was no provision for effective regulation of international cooperation agreements and similar arrangements. Keeping the current scenario in mind it is important and imperative that the 1962 Act be amended to include global nuclear trade and commerce. Policies alone cannot suffice as the decisions are not based on any legislation or other precise legal source. Though section 30 of the 1962 Act provides for framing of rules and regulations which have to be approved by the Parliament and indeed, several rules have been framed based on policy decisions. However, in the present context this is a stop-gap measure and if there is to be an exponential expansion in the atomic energy sector there will be an impact on the rights and obligations of the state and its citizens and at present India does not have an effective and sufficiently articulated liability regime to address this.

Unlike the USA, the nuclear industry in India, in the past, has been largely without IAEA safeguards, though there are facility specific arrangements. In October 2009, India's safeguards agreement with IAEA became operational and all reactors were put under the India Specific Safeguards Agreement.

Since India is not a member of the NPT and did not have the full benefit of the IAEA safeguards it has been isolated from world trade by the Nuclear Suppliers' Group. However, in September 2008 a clean waiver to the trade embargo was agreed upon recognizing India's impeccable non-proliferation credentials. India has traditionally been extremely scrupulous in its endeavor to ensure that its nuclear weapons material and technology are safe-guarded against illicit or commercial export to other countries. The

NSG also passed a consensus resolution to exempt India from the rule of prohibiting trade with non-members of the NPT.

Comparing the nuclear regimes of both countries, it is evident that the USA has advanced tremendously by the joining of hands of the private sector and the government in the development of the nuclear energy industry. The regulatory functions are strictly with the US Government, there is an involvement of the public on issues and concerns thereby building a conducive environment in which this industry can thrive and the private sector brings in its management expertise, business acumen, efficiency and investments allowing the Federal Government to free its own funds for other developments. At all times the Federal Government shares its authority and powers in this respect with the State Governments going so far as to give them exclusive decision-making authority in some matters. On the other hand, India, which has its regulatory framework in place has yet to allow private players into the domestic civilian nuclear industry. In fact, the State Governments too have no powers or authority where decisions relating to nuclear energy are concerned. In doing so, the Government is losing out on not only the investments but also is bereft of the efficiencies that the private sector inherently demonstrates. Additionally, in an energy deficit developing country like India that is still battling poverty at all levels and waging war on environmental hazards and climate change, the funds that the Government will save by allowing private investments in the nuclear energy sector can be more gainfully be applied.

CHAPTER VI

GLOBAL REGULATORY REGIME – AN UMBRELLA FOR PROMOTION OF PRIVATIZATION

Any legal framework, including the legislations and conventions or any other instruments or body regarding the international nuclear law regime is established by the IAEA. It can be said that the IAEA, working under the aegis of the United Nations, defines, drafts and notifies the laws governing nuclear energy facilitating an international platform for cooperation in this field. It is also popularly known as the “*Atoms for Peace and Development Organization*” and promotes safe and peaceful use of nuclear technology. The IAEA is the central inter-governmental body for scientific and technical cooperation between nations, established to secure international peace and safety in line with the Sustainable Development Goals of the UN.

The international conventions, protocols and treaties negotiated and drawn all fall within the ambit of IAEA and all such deliberations on nuclear energy are conducted under its auspices through the Agency’s Secretariat. The Office of the Director General of IAEA serves as a depository for these instruments and the original text is held in the custody of The IAEA Office of Legal Affairs on behalf of the Director General. All states that wish to join these treaties must approach the Office of the Director General, which in turn will notify the status to all states and to the UN. These instruments cover several aspects ranging, viz., technology, safety, security and liability and the same are briefly explained below.

6.1 COVENTIONS ON SAFETY

6.1.1 Radiation Protection and Nuclear Installation Safety

6.1.1.1 ILO Radiation Protection Convention

The Radiation Protection Convention was adopted on June 22, 1960 at the General Conference of the ILO at Geneva, Switzerland. The Convention applies to all such activities where workers were exposed to radiations in the course of their work. It does not apply to radioactive material or equipment that generate limited radiations. The Convention ensures that all necessary steps would be taken by the member States to ensure protection of workers, specifically regarding their health and safety, against radiations. Every member of ILO that ratifies this Convention undertakes to enforce the same through appropriate legislation or legal means.

6.1.1.2 Convention on Nuclear Safety

The Convention on Nuclear Safety was adopted in Vienna, Austria on September 20, 1994 and came into force on October 24, 1996. Its primary objective is to regulate safety at nuclear power plants installed in the member-States. It creates obligations on the States to implement safety rules and standards at every civil facility that is related to nuclear energy. The scope of the Convention includes matters related to site selection, design and construction, operations and state of preparedness for emergencies (Wikipedia: The Free Encyclopedia, 2022).

6.1.1.3 Code of Conduct on the Safety of Research Reactors

The Code of Conduct on the Safety of Research Reactors was adopted on March 8, 2004 by the IAEA. The Code was developed when the need was felt that there had to be action taken to address safety concerns that could arise in research reactors. It applies to research reactors through their operative life from installation to decommissioning. However, it does not apply to the physical protection of the reactors or to those reactors which are used by the military. The objective of the Code is to maintain a high level of safety worldwide in research reactors through domestic measures, international cooperation and safety related technical cooperation.

6.1.2 Emergency Response and Management

6.1.2.1 Convention on Early Notification of a Nuclear Accident

The Convention on Early Notification of a Nuclear Accident is a treaty under the aegis of the IAEA whereby all States agreed to provide notification of any nuclear accident within their jurisdiction that may affect other States. This was signed in Vienna, Austria on September 26, 1986 and came into force on October 27, 1986. This Convention was adopted as a fallout of the Chernobyl Disaster in April 1986. Every State that is party to this Convention must immediately inform the IAEA and other States, who could be potentially affected, of any nuclear or radiation related accident that happens within its boundaries.

6.1.2.2 Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency

Another Convention that was in direct response to the Chernobyl Disaster was signed in Vienna, Austria on September 26, 1986, was the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency. This came into force on February 26, 1987. As per the provisions of the Convention all States agreed to provide the IAEA of all the assistance they can provide in the event of a nuclear accident in another member State. This Convention set out an international framework for cooperation between States. The IAEA as a facilitator to ensure immediate and prompt aid, support and assistance in cases of nuclear or radiological accidents and other emergencies requires all member States to notify the Agency of their experts, equipment and materials that may be used in such emergencies.

6.1.3 Radioactive Waste Management and Decommissioning

6.1.3.1 Joint Convention on Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management

The Joint Convention on Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management was signed on September 29, 1997 at Vienna, Austria and entered into force on June 18, 2001. This was the first international treaty to address the issue of management of radioactive waste at a global level. All States that sign and ratify this Convention agree to

adhere to the provisions of this Convention with respect to storage of nuclear waste and also the transport and location, design and operations of storage facilities for such waste. The Convention is applicable to all spent fuel from operation of civilian nuclear reactors and to radioactive waste caused by civilian applications as also to such waste and spent fuel from defense programs if such materials are transferred to an exclusive civilian program or declared as spent fuel. The Convention also applies to planned release of liquid or gaseous radioactive materials from facilities into the environment.

The Convention also established basic safety principles and has created a process for a “peer review” that is similar to the one under the Convention of Nuclear Safety. The implementation of the Convention is periodically and regularly reviewed.

6.1.4 Environment Assessment and Protection

6.1.4.1 Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters

The Aarhus Convention, as it is popularly known is the Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters and was signed on June 25, 1988 in Aarhus, Denmark. It came into force on October 30, 2001. This Convention gives the public rights with respect to domestic and transboundary environment,

such as regards right to information, participation in the government decision making process and easy access to justice. It is a multilateral environmental agreement created in a bid to increase transparency and institute a proper regulatory procedure to enhance environmental governance. Equally important is the principle of non-discrimination followed by the Convention wherein the transparency stands irrespective of the nationality of the applicant and the promotion of awareness and education about the environment amongst the public. The Aarhus Convention has a rights-based approach – meaning thereby that the public has a right to know and a right to live in a clean and healthy environment. Since it came into force the Convention has become a model for transparency and public participation on the international stage.

6.1.4.2 Convention on Environmental Impact Assessment in a Transboundary Context

Threats to the environment are not contained within any boundaries and it was this realization that caused States to come together and cooperate to notify and consult each other on projects that may adversely affect the environment. Out of this concern was born the Espoo Convention or the Convention on Environmental Impact Assessment in a Transboundary Context was signed in Espoo, Finland on February 25, 1991 and came into force on September 10, 1997. All States party to Convention are bound by its provisions to conduct an environmental impact assessment of specified activities

at the planning stage itself. The Convention also requires all members to inform and consult other States on all planned projects where there is expected to be a significant adverse impact on the environment which has transboundary impact. The Convention was subsequently supplemented by a Protocol on Strategic Environment Assessment and is the key to mutual cooperation to preempt damage to the environment.

6.1.4.3 Protocol on Strategic Environmental Assessment to the Convention on Environmental Impact Assessment in a Transboundary Context

This Protocol was conceived as a supplement to the Espoo Convention and signed in Kiev, Ukraine on May 21, 2003 and came into force on July 11, 2010. The objective of the protocol was to provide for protection of the environment including health by environmental and health considerations are taken into account in the development and preparation of plans and programs. The Protocol also establishes transparent and effective procedures for strategic assessment and public participation therein. It is designed to ensure that environmental and health concerns become an integral part of any program aimed at sustainable development. To accomplish the objectives all member States are required to take necessary steps, whether legislative, regulatory or any other appropriate steps, to implement the provisions in a transparent framework.

6.2 CONVENTIONS ON SECURITY (Nuclear Security and Physical Protection)

6.2.1 Code of Conduct on the Safety and Security of Radioactive Sources

The Code of Conduct on the Safety and Security of Radioactive Sources (Code of Conduct) is a non-binding instrument of the IAEA. It contains provisions that may be voluntarily implemented by signatory states. Its basic principles suggest that the States should *“take appropriate measures to ensure that the radioactive sources within their territory are safely managed and securely protected during their lifetime”* (International Atomic Energy Agency, *See Codes of Conduct*). The objectives of the Code of Conduct are to help States to:

- maintain a high level of safety and security of radioactive sources;
- establish domestic legislative and regulatory systems of control within a governance framework;
- prevent unauthorized access or transfer, theft or damage of radioactive sources; and
- prevent malicious use of radioactive sources and to minimize the consequences of any incident, accident or malevolent act pertaining to radioactive sources.

However, the Code of Conduct is not legally binding and also does not provide an exhaustive list of measures. It only proposes a legal framework and direction, suggested powers and responsibilities for a regulatory body. It also provides guidance for States on how to regulate import and export of radioactive sources and advises them to appoint a point of contact to facilitate such imports and exports. Finally, the Code of Conduct

also provides direction to States on developing their national policy and strategy for management of spent fuel and radioactive waste and on implementing options such as recycling and reuse, long term storage till disposed, return to supplier etc.

6.2.2 Convention on the Physical Protection of Nuclear Material

The main legal instrument with respect to nuclear security on an international level is the Convention on the Physical Protection of Nuclear Material (CPPNM). This Convention was signed on October 26, 1979 at Vienna, Austria under the auspices of IAEA and was brought into force on February 8, 1987. It establishes legal obligations of States with respect to the physical protection of nuclear material that is intended for peaceful purposes during the time frame of international transport. It also specifies the offences involving nuclear material that are considered criminal in nature and promotes international cooperation in dealing with such offences. The Convention was later amended in 2005 and the scope was expanded to cover physical protection of nuclear facilities and materials used for peaceful purposes in domestic usage, storage and transport. Illicit trafficking of such materials and sabotage of nuclear facilities was also listed as a criminal offence and to further promote international harmony expanded the definition of cooperation to include sharing of information and assistance in the case of sabotage. Additionally, the Convention was made binding on all States and not only those that had nuclear facilities or nuclear materials. The CPPNM and amendments thereto is till date the only internationally binding treaty for physical protection of nuclear facilities and nuclear materials used for peaceful purposes.

6.2.3 International Convention for the Suppression of Acts of Nuclear Terrorism

The International Convention for the Suppression of Acts of Nuclear Terrorism was approved by the General Assembly of the United Nations on April 13, 2005 and it was the first anti-terrorism treaty post the September 11, 2001 attacks in the United States. However, it was not the first of its kind and together with earlier treaties further promoted the rule of law and added weight to the international legal framework regarding acts of terrorism. Unlike the CPPNM it includes military nuclear facilities and materials in its scope. It also requires States to enact necessary legislations to criminalize the planning, threatening or carrying out the acts of nuclear terrorism and specifies the conditions and guidelines for establishing jurisdiction, extradition and measures of punishment. The Convention makes an exception for military activities during an exercise or armed conflict.

6.3 CONVENTIONS ON LIABILITY AND COMPENSATION FOR NUCLEAR DAMAGE

6.3.1 Timeline and Development of International Nuclear Liability Regime

The first international convention on regulating liability in the field of nuclear energy was adopted in 1960 by the European Economic Cooperation in Paris. This was concluded as the ‘Convention on Liability of Third Parties in the Field of Nuclear Energy’ under the aegis of the Organization for Economic Cooperation and Development (OECD). It is open to members of that organization and to other States, if the parties to the Convention consent to admit them. India is not a signatory nor a party to the Convention.

The objective behind the adoption of the Convention was to ensure justice to the victims suffering from the damages caused by nuclear accidents. It focused on full and fair compensation to those victims while addressing the issue of third-party nuclear liability which had not been successfully settled by the general law of tort. It also deals with providing an unhindered growth to the nuclear industry by avoiding the intolerable burden of liability. It recognized third party liability and the need for uniform laws in this regard as also for liability incurred by nuclear damage.

The Paris Convention on Third Party Liability in the Field of Nuclear Energy (Paris Convention or PC) was first adopted on 29th July 1960 to ensure adequate compensation to the public that has suffered loss and incurred damages on account of nuclear accidents. The same was opened for signatures to the nation-states on the same date and came into force on 1st April 1968. The Paris Convention was followed by additional developments, viz., the Additional Protocols of 1964, 1982 and 2004. These were adopted and opened for signatures on 28th January 1964, 16th November 1982 and 12th February 2004 respectively. The Additional Protocol of 1964 came into force with the Paris Convention on 1st April 1968 and the Additional Protocol of 1982 on 7th October 1988. The Additional Protocol of 2004 has not come into force till date.

6.3.2 Paris Convention on Third Party Liability in the Field of Nuclear Energy (as amended by protocols in 1964, 1982 and 2004)

The Paris Convention was a special and significant international instrument laying down a comprehensive framework for regulating liability for nuclear damage. It lays down laws for compensation to

the victims against the injury or loss of life and for damages caused to any person or loss of any property caused by a nuclear accident due to nuclear installations or during the transport of nuclear materials to and from installations. It does not cover damage to the nuclear installation itself (Organization of Economic Cooperation and Development, 1960).

The laws are applicable to the nuclear accidents which take place within the territory of a member state. The applicability of laws was recommended to be expanded to nuclear accidents occurring or damages suffered on the high seas as well. This was a recommendation by the NEA Steering Committee in 1968. In 1971 the Committee recommended that the Convention apply to the member states to the extent of the damages suffered even if the nuclear incident occurs in a non-member state. These recommendations were adopted by several member states of the Paris Convention (Organization of Economic Cooperation and Development, 1960).

As per Article 1 of the Convention, the law applies to nuclear installations and also to nuclear materials while being transported. For such accidents, that occur during transit, the sender bears the liability since the packaging and containment of the material falls under the responsibility of the one dispatching the nuclear material. In case the transport is inter-state where one state is not a party to the Convention, special provisions come into play and it is ensured that the operator from the member state is made liable for the loss or damage suffered.

The principles underlying the Convention guide the determination of nuclear damage compensation. It covers the sole liability principle of operators, the operator's strict liability principle, the operator's financial guarantee obligations and the operator's maximum and minimum compensation limits defined. The operator of the nuclear installation is solely responsible for damages which result from any nuclear incident which occur during installation or during the transport of nuclear material to or from that installation. Though the operator exclusively bears this burden the maximum and minimum limits have been fixed at SDR 15 million and SDR 5 million respectively. In this regard the NEA has recommended that the maximum be not less than SDR 150 million and most States have adopted the same. It is also important that the operator of the nuclear installation holds financial security or cover equivalent to its liability exposure.

A limitation period is also provided under the Convention as ten years from the date of occurrence of the nuclear incident. This implies that the right of compensation cannot be exercised after the period of ten years has lapsed. It also provides for application of compensation to be free from discrimination based on nationality, domicile or residence. The courts of the State are authorized to hear matters related to the nuclear incident followed by the compensation claims.

The Convention has undergone several amendments, mainly by way of additional Protocols which were adopted in 1964, 1982 and 2004. The 2004 Protocol came with an objective of increased liability and widened the area of damages covered to in a bid to strengthen the compensation claim system under the existing liability regime. This

was in response to the Chernobyl Disaster of 1986 when the 2004 Protocol was not yet in force.

6.3.2.1 Amendments to make the Convention more inclusive and effective

- ‘Nuclear Damage’ has been defined under Article 1(vii) which was added vide an amendment to the Convention. In addition to the loss of property or to person, the amendment provides for certain types of damages which must be treated as nuclear damage. These included economic loss arising from damages to person or property, the cost incurred to reinstate the damages caused to the environment, loss of income as a result of the impaired environment and the cost of adopting measures to prevent the accident, including loss or damages caused by such measures.
- The compensation for the victims has also been revised to provide higher amounts to recover from the damages suffered. The liability of the operator under the Paris Convention and the revised amounts are as follows:

Liability of the Operator		
	Pre-Revision	Post-Revision
Basic liability or reference amount	SDR 15 million maximum	EUR 700 million minimum
Reduced liability		
Transport	SDR 5 million minimum	EUR 80 million minimum
Low-risk installations	SDR 5 million minimum	EUR 70 million minimum

- The definition of ‘Nuclear Installations’ provided under Article 1(a)(ii) comprises of installations for the disposal of nuclear materials. This has been amended to include all such factories, reactors, facilities and installations that are in the course of being decommissioned and any other installation which contains nuclear fuel or any radioactive substance.
- The territorial application of the Convention as detailed under Article 2 was expanded by the Protocol to Non-Contracting Party States as well including its maritime zones. However, the same is subject to several conditions as provided under Article 2(ii) to (iv).
- A limitation period for claims on nuclear damages has been provided for. The same cannot be claimed after the lapse of 30 years for actions to be taken with respect to loss of life and personal injury. This time limit is extended under special circumstances only.
- Special provisions for nuclear incidents occurring in the exclusive economic zone have also been added. The risks undertaken by the coastal States in allowing maritime shipments of nuclear materials through their coastal passage was also recognized. Thus, an accident in an exclusive economic zone of a Paris Convention State also falls under the jurisdiction of that coastal State.

6.3.3 Brussels Supplementary Convention

The Brussels Supplementary Convention (BSC) was adopted on January 31, 1963. The objective was to make provision for additional funds in the event that there was a gap in the funds under the Paris Convention is based on strong financial cooperation between the States. The compensation for damages in the event of a nuclear incident. Under the BSC the funds must be provided by the State where the liable operator's nuclear facility is located and by contributions from all States party to the Supplementary Convention. However, the BSC is subject to the provisions of the Paris Convention including the definitions contained in the latter. By combining the two Conventions the minimum compensation is kept at EUR 1.50 billion in the following manner:

- First tier equal to the liability amount set under the Paris Convention to be covered by insurance or any other financial security;
- Second tier being the difference between EUR 1.20 billion and the amount in the first tier to be paid by the State in whose territory the liable nuclear facility is located; and
- Third tier amounting to EUR 300 million to be made available by other States to the Convention in a pre-determined ratio.

The geographical scope under the BSC is limited to damages in the territory of the contracting State or in some cases, to damage incurred in or above maritime areas or in or above exclusive economic zones of the contracting State. However, compensation under the BSC will be made available only to the victims in the participatory States. It may be noted that unless a State is a party to the Paris Convention it cannot be made a party to the BSC. The BSC

is linked to the Paris Convention and as such will remain in force only till such time as the Paris Convention does.

6.3.4 Vienna Convention on Civil Liability and the 1997 Protocol (International Atomic Energy Agency, 1963)

The Vienna Convention on Civil Liability for Nuclear Damage came to satisfy the need for a uniform nuclear liability regime at the global level. It was adopted on May 21, 1963 at the diplomatic conference at IAEA Headquarters in Vienna, Austria and came into force on November 12, 1977. Its official languages are English, French, Russian and Spanish.

The primary purpose of establishing this Convention corresponds with the founding principles of the 1960 Paris Convention, which is a uniform third party liability regime for nuclear damage amongst all the State Parties thus attaining uniformity among their domestic legislations. The same has been achieved by setting minimum benchmarks to ensure financial protection against damage resulting from a nuclear incident despite its usage being limited to peaceful uses. The Convention ensures conformity of the domestic laws on civil liability for nuclear damage with the provisions of the Convention. The Contracting Parties have some degree of discretion clarified in Article XVIII as “*This Convention shall not affect the rights and obligations of a Contracting Party under the general rules of public international law.*”

The scope of the Convention mirrors the goals of the Paris Convention specifically for the liability for ‘nuclear damage’ caused by a ‘nuclear accident’ occurring in a ‘nuclear installation’ or in the course of transport of ‘nuclear material’ to or from such an

installation. The application of the Convention covers damages due to radioactivity as well as occurrence of conventional origin caused due to radiation damage as provided in Article IV. However, this Convention relates exclusively to land based nuclear installations while excluding *“any reactor with which a means of sea or air transport is equipped for use as a source of power, whether for propulsion thereof or for any other purpose.”*

The founding principles of the Convention establish the provisions for liability of the operator and to secure protection and compensation to the victims against the damages suffered by them. The principles include exclusive liability for nuclear damages to the operator of the nuclear installation, viz.,

- Absolute or strict liability,
- Obligation of the operator to cover damages through financial security or insurance,
- A fixed minimum liability,
- Limited period within which to claim compensation,
- Equitable distribution of such compensation to the victims which is free from discrimination based on nationality, domicile or residence, provided that the damage was incurred within the geographical scope of the Convention,
- Exclusive jurisdiction to the courts of the Contracting Party where the nuclear incident occurred, and
- In case the incident occurs outside the territories of the Contracting Parties it falls under the jurisdiction of the courts of the Contracting Party where the operator who is liable for the incident is situated with the validity and execution of the judgments advocated by the respective competent court of all Contracting Parties.

The 1997 Protocol amended the Convention to widen the scope with respect to the quantum of liability of the operator of a nuclear installation. It also aimed at enhancing the means for securing adequate and equitable compensation. The Protocol is to be applied with the Convention and acts as an integral part of or a single text with the Convention being referred to as “1997 Vienna Convention on Civil Liability for Nuclear Damage”. However, the Protocol is open to States irrespective whether they are a party to the Vienna Convention or not. Therefore, States can consent to the Protocol without being a party to the Convention and shall be bound by the provisions of the Convention as amended by the Protocol in relation to other Contracting Parties. India is not a party to this Convention.

The 1997 Protocol covers damages despite the location and seeks to regulate the risks involved while clarifying that the Convention is applicable to nuclear installations used for peaceful purposes, excluding the incidents that occur during transportation and in non-Contracting States.

Article V of the Convention was replaced by a text of Article 7 of the Protocol wherein the liability of the operator can be limited by the Contracting States for one particular nuclear incident to not less than SDR 300 million or not less than SDR 150 million provided that, in case of excess damages, the gap shall be made available through public funds to reach the minimum amount of SDR 300 million. The Convention does not provide any ceiling limit or maximum amount as liability which can be borne by the operator. The obligation to pay also includes obligation for the operator to take insurance cover for the liability and in case the operator fails to do so, the difference in amount is to be covered by the State.

6.3.5 Joint Protocol relating to application of Paris and Vienna Conventions (International Atomic Energy Agency, 1998)

The existing Conventions were supported by the Joint Protocol, adopted and signed on September 21, 1998 at a diplomatic conference convened jointly by IAEA and NEA in Vienna, Austria. The protocol came into force on April 27, 1992 under the aegis of IAEA. Unlike the 1997 Protocol, this is open only to States that have already shown their allegiance and are party to the Paris Convention or the Vienna Convention or both. India is not a party to this Protocol.

The need for a Joint Protocol was felt by the Restricted Working Group of IAEA Standing Committee on Civil Liability of Nuclear Damage, convened in Vienna in May 1974. It was later debated and studied by the NEA Group of Governmental Experts in June 1974 and was taken forward and concluded in June 1975. A joint Working Group of IAEA and NEA was constituted to prepare a draft protocol. The focal point behind the adoption of the Convention was to strengthen treaty relations between Contracting Parties to the Paris Convention and those of the Vienna Convention. This was done by lifting the distinction between the respective Contracting Parties with respect to the operative provisions. The Contracting Parties of one Convention would be treated as Contracting Parties to the other as well and extends the territorial application of both Conventions.

This eliminates the constant conflict between the two Conventions due to the simultaneous applicability to nuclear incidents. The basic provisions regulating the territorial scope, liability of the operator, competence of the courts for jurisdiction over nuclear incidents occurring during transportation etc. of the two Conventions were

often not aligned. This Protocol ensured that exclusive applicability of one of the Conventions exist over a particular nuclear incident. The provisions clearly state which Convention is to be applied in different circumstances. The Protocol also recognized the trans-frontier damages caused by nuclear incidents. The Joint Protocol can therefore be said to be a comprehensive step towards strengthening the civil nuclear liability regime.

6.3.6 Convention on Supplementary Compensation (CSC)

The Convention on Supplementary Compensation for Nuclear Damage Liability (CSC) (International Atomic Energy Agency, 1997) is an international body specifically formed for establishing adequate compensation for the victims of nuclear damage formed under the aegis of the Director General of IAEA. The CSC was adopted on September 12, 1997 in Vienna, Austria and came into force on April 15, 2015 (International Atomic Energy Agency, 1998). It is an international nuclear liability regime set up by the IAEA to ensure a sufficient minimum amount of compensation along with steps to increase the amount through public funding, etc.

The CSC has been framed along the lines of the principles of the Paris Convention on Third Party Liability in the Field of Nuclear Energy, 1960 and the Vienna Convention on Civil Liability for Nuclear Damage, 1963. It is open, not only to the States that are signatories of the Paris Convention or the Vienna Convention but also to non-party States, provided the national legislations of those States are consistent with the CSC. Therefore, if there are no domestic laws that are inconsistent with the uniform rules on liability as laid down under the Annexure to the CSC, the non-party

States are free to adopt the Convention. The CSC was signed by India in 2010 and ratified by it in 2016 (World Nuclear News, 2016).

The CSC not only ensures adequate compensation to the victims but also aims to raise the amount of compensation provided. It was decided that the funds for this would be raised through public funding by the Contracting Parties if the national amount was insufficient to compensate the damage caused by a nuclear incident. It pertains to a regional as well as a global level cooperation to promote nuclear safety and security and it facilitates an international liability regime upholding the ethos and principles of international partnership, peace and solidarity. The Convention provides for an uniform framework to channel the liability and to speed up the process of compensating victims of a nuclear incident (International Atomic Energy Agency, 1997)

The need for a specific framework for civil liability, despite the existence of the well-formulated Paris and Vienna Conventions, was to further minimize the complexities with respect to the process of compensation. At the time, diversity prevailed between nations and the CSC successfully laid down a uniform framework obligating the States to follow a common system for minimum compensation amounts. This international liability instrument for nuclear damage compensation also included jurisdictional rules and provided for a single definition of ‘nuclear damage’. It is an open and inclusive system that allows nations to join the global nuclear liability regime without strictly being a party to the Paris and Vienna Conventions. However, it is crucial for such nations to have domestic laws on nuclear liability that are consistent with the provisions of the global liability regime.

The national nuclear liability framework of the contracting state should include the following basic principles as per the global nuclear liability regime established through the CSC and other Conventions:

- Channeling all legal liability for nuclear damage exclusively to the operator;
- Imposing liability on the operator without the need to demonstrate fault, negligence or intent;
- Granting exclusive jurisdiction to the courts of the country where the nuclear incident occurs;
- Permitting liability to be limited in amount and in time; and
- Compensating damage without any discrimination based upon nationality, domicile or residence.

It awards exclusive jurisdiction to the relevant court by way of which it covers nuclear accidents in the Exclusive Economic Zone (EEZ) also, in addition to the territory or the territorial sea of the concerned State. The system framed also includes damages caused due to loss of tourism or income related to the fishery industry. It applies to the damage from nuclear incidents resulting from peaceful usage of nuclear energy by an operator of a nuclear installation in the territory of the Contracting Party and holds the operator liable.

However, the CSC has been criticized by some on the following grounds:

- The definitions provided under the Convention include twelve terms which are provided with substantially long definitions. There is a need to inculcate the concept of tort liability found in domestic legal systems and balancing it

with the uniform framework laid down for application of its key elements.

- The Convention does not include installations for military purposes as the usage of nuclear energy for peaceful purposes excludes military facilities.
- The objective of the Convention when it was drafted was an equitable distribution of compensation which would be free from any discrimination based on nationality, domicile and residence. The ‘minimum national compensation amount’ is a uniform figure for all the member states. This suggests that the courts of the State where the nuclear incident occurs are required to treat domestic/ natives and the trans-boundary victims in the same manner without regard to their nationality while allocating compensation. However, the said State is free to include or exclude damages incurred in non-member States from the first tier of compensation allocation and is only subject to the obligations it may have under the Vienna and Paris Conventions.

6.4 THE NUCLEAR SUPPLIERS GROUP (Nuclear Suppliers Group, *See About the NSG*)

The Nuclear Suppliers Group (NSG), also referred to as the Club de Londres or the London Club first came together in London in November 1975, when the nuclear related substances supplying countries grouped to contribute to nuclear proliferation. The Group has 48 Supplier States and India is not a member (Ramachandran, Shastri, 2019).

The NSG is a multi-lateral export control regime set up by countries to establish a non-proliferation of nuclear weapons. In this regard, the supplier countries came together to ensure peaceful usage of nuclear energy through

the implementation of Guidelines for Non-proliferation of Nuclear Weapons established by the Group. The Guidelines regulate nuclear-related exports of weapons and other explosive devices. The aim of the Group was to avoid nuclear proliferation while not hampering the international nuclear trade and cooperation. Based on the NSG Guidelines, what is popularly also known as the Non-Proliferation Principle, the NSG facilitates peaceful nuclear cooperation which corresponds with the international nuclear non-proliferation norms. The purpose of the NSG is to prevent destructive usage of nuclear materials, equipment and technology.

The countries that fail to comply with the principle of non-proliferation are denied the supply from the member States, of any nuclear material or nuclear related technology. States are required to follow numerous verification and safety measures along with appropriate restraints and conditions to import nuclear materials from supplier member States. It also restricts the export of items that can contribute to the proliferation of nuclear weapons (NTI)

The establishment of the NSG was a result of the 1974 explosion by India, which was built using civilian technology acquired under the Atoms for Peace Program sponsored by the United States. Subsequently, seven supplier States came together as signatories to the Nuclear Non-Proliferation Treaty (NPT) which recognized that NPT lacked the power to prevent the non-party countries like India from diverting into military use of nuclear energy instead of civilian usage.

Since 1974, the Zangger Committee, a body cooperating with the International Atomic Energy Agency (IAEA) based in Vienna, issues a list of fissile material and nuclear related goods, the exports of which requires

safeguards in the Receiving State. This Committee at present consists of 39 states including Germany.

The Zangger Committee was formed as a body working in cooperation with the IAEA to list the nuclear materials which require safeguards to be implemented in the importing States to allow the nuclear supplier states to export the same. In 1978, NSG agreed upon guidelines to regulate trade of nuclear and fissile materials based on the work of the Zangger Committee. A “trigger list” of all the materials specifically designed for nuclear use, such as reactor fuel, reactor equipment and related materials was made to ensure transfer of the listed items only if proper safeguards were implemented. It was also recognized that there was a class of materials and technology that could lead to creation of weapons-usable materials (NTI).

The Guidelines are adopted by consensus and all members adhere to the said Guidelines in order to achieve the objectives of the founders. The NSG maintains a continuous exchange of information to evaluate developments made in respect to the concerns related to nuclear proliferation. The Guidelines complement and strengthen the international instruments established for peaceful use of nuclear energy. There are two sets of NSG Guidelines, while the first covers nuclear related materials specifically designed for nuclear use the second regulates the supply of materials which have a dual use and are nuclear related items and technologies which may lead to creation of weapons. The NSG supports and complements the NPT, the Treaty for the Prohibition of Nuclear Weapons in Latin America (Treaty of Tlatelolco), the South Pacific Nuclear Weapons-Free Zone Treaty (Treaty of Rarotonga), the African Nuclear-Weapons-Free Zone Treaty (Treaty of Pelindaba) and the Treaty on the Southeast Asia Nuclear-Weapons-Free Zone (Treaty of Bangkok) (NTI).

6.5 THE NON-PROLIFERATION TREATY

6.5.1 TREATY ON THE NON-PROLIFERATION OF NUCLEAR WEAPONS

The Nuclear Non-Proliferation Treaty (NPT) (International Atomic Energy Agency, 1968) was adopted on June 12, 1968 at the United Nations, New York and came into force on March 5, 1970. The founding nations were the Russian Federation, United Kingdom and United States of America. A cornerstone of the non-proliferation regime, the foundation of the NPT are the three core elements of disarmament, non-proliferation and, the most essential one of peaceful use of nuclear energy. While the NPT came into force in 1970 the Parties voted to extend it indefinitely in 1995. A review of the Treaty is carried out every five years by all the State Parties in the form of a Review Conference to review the achievements and failures, together with the challenges faced while implementing the Treaty. The Conferences are also accompanied by Preparatory Committee Meetings held between Conference Meetings (International Atomic Energy Agency, 1970).

NPT has 91 member-states including the five nations that have declared nuclear weapons, viz., China, France, the Russian Federation, the United Kingdom and the United States. The fundamental basis for this treaty was to ensure that the nuclear weapons states endorse disarmament and the non-nuclear weapons states desist from acquiring them. It was established to ensure a world of peaceful and civilian use of nuclear energy.

The NRC has been an active participant throughout the NPT process. The export licensing of the Commission ensures that for the countries importing nuclear material and installations from the U.S.

are in full compliance with their non-proliferation obligations. It facilitates peaceful usage of nuclear technology which is also supported by a regulatory assistant program. The NRC has also assisted countries under this program manifesting a secure and safe world where nuclear energy is used for peaceful purposes only. The NRC staff serves on U.S. delegations to the Review Conference and Preparatory Committee meetings, being part of the meetings for non-proliferation and peaceful use of nuclear energy. Discussions on various issues including and revolving around civil nuclear safety, security, safeguards and peaceful uses of nuclear energy, export controls expertise and other regulatory assistance and cooperation activities, are carried out by representatives of the NRC giving the regulatory perspectives on such issues.

6.5.2 TREATY BANNING NUCLEAR WEAPONS TESTS IN THE ATMOSPHERE, OUTER SPACE AND UNDER WATER (PARTIAL OR LIMITED TEST BAN TREATY – PTBT OR LTBT)

The LTBT or the Limited Test Ban Treaty was signed on August 5, 1963 at Moscow and came into force on October 10, 1963. It prohibits tests for nuclear weapons or any other nuclear related explosion in the atmosphere, in outer space and under water. Though it does not specifically ban underground tests it does place restrictions on underground explosions if they cause "*radioactive debris to be present outside the territorial limits of the State under whose jurisdiction or control*" the tests are conducted. The parties to the Treaty agreed that the objective was to put "*an end to the contamination of man's environment by radioactive substances*". The treaty took nearly a decade to become a reality on account of strong differences in the approach to arms control and security

which were a reflection on the political relations between the States. The original parties to the treaty were the United States, United Kingdom and the Union of Soviet Socialist Republics. Their common goal was to achieve as quickly as possible agreement on *“complete disarmament under strict international control in accordance with the objectives of the United Nations which would put an end to the armaments race and eliminate the incentive to production and testing of all kinds of weapons, including nuclear weapons”*. It was further sought to discontinue all test explosions related to nuclear weapons.

6.5.3 COMPREHENSIVE NUCLEAR TEST BAN TREATY

The CTBT or the Comprehensive Nuclear Test Ban Treaty is not yet into force, nearly 27 years after it was adopted on September 10, 1996 at New York. The Treaty bans all kinds of nuclear explosions, whether for peaceful or military purposes. It has been described as the *“longest and hardest fought arms control treaty in history”* (Byjus). The Treaty has provisions for an elaborate verification system including an International Monitoring System (IMS) to detect nuclear explosions, an international infrastructure for satellite communications and an international data center that processes and disseminates information to the party States. In addition, States may request for an on-site inspection if required. To oversee the operation and enforcement of the Treaty, it establishes a Comprehensive Test Ban Organization headquartered in Vienna, Austria.

The CTBT is seen as an essential step towards disarmament and its intention is to stop the nuclear arms race. It aims at preempting and preventing environmental and health hazards caused by nuclear

explosions and at the same time restricting development of new weapons. India is not a signatory to the CTBT.

6.5.4 THE IAEA'S SAFEGUARDS SYSTEM

Safeguards are technical measures applied to verify that nuclear facilities and materials are not being misused and are not being diverted for uses other than peaceful ones. IAEA has a system of safeguards that it independently applies and all States accept these through safeguards agreements. The main goal of the IAEA Safeguards is to dissuade the spread of nuclear weapons by putting in place an early warning system to help detect any misuse of nuclear facilities or nuclear materials or technology. The measures applied by IAEA give assurance that the States are complying with their legal obligations and that nuclear facilities, material and technology is being used for peaceful purposes only. These safeguards are a vital part of the international security system and the Non-Proliferation Treaty showcases the effort to prevent spread of such weapons.

The IAEA safeguards are incorporated in legally binding agreements which are of three types:

- CSAs or Comprehensive Safeguards Agreements which are signed by the IAEA with non-nuclear weapons States that are party to the Non-Proliferation Treaty and to regional nuclear-weapon-free zone treaties;
- VOAs or Voluntary Offer Safeguards Agreements signed with nuclear weapons States that are party to the Non-Proliferation Treaty; and

- Item-specific safeguards agreements signed currently with those States that are not party to the Non-Proliferation Treaty.

Most of the safeguards' agreements signed by the IAEA have been with non-nuclear weapons States that are party to the NPT. Under the provisions of the NPT require such States to commit that they shall not produce nor acquire nuclear weapons, shall place all their nuclear materials under the IAEA safeguards and permit IAEA to verify such commitments. Additional protocols have enhanced the effectiveness of the safeguard's implantation. Measures have also been provided for more information about and inspections of all aspects of a State's nuclear fuel cycle (International Atomic Energy Agency, 2022). A State that has minimal or no nuclear material is eligible to have a SQP or Small Quantity Protocol in its Agreement that will reduce the safeguards activities in the said State.

The objective of the IAEA safeguards is to ensure compliance with the legal commitments of the States. The implementation of the safeguards is an annual one within which there are four processes, viz.,

- Collection and evaluation of relevant information to assess consistency with the State's commitment and declarations;
- Development of a safeguards approach which will decide the measures to achieve technical objectives;
- Planning, conducting and evaluation of safeguards activities to be conducted at the site and in the headquarters, identification of any inconsistency and follow up; and
- The safeguards conclusions are drawn by the IAEA based on its findings and is the end result of the safeguard implementation process. These conclusions assure the

international community that obligations are being met by the said State.

6.6 CONCLUSION

The need to promote the development of nuclear sciences on one hand and the urgency to protect the world from the dangers associated with it, brings into sharp focus the necessity and grave need for a nuclear law regime. In this regard, the international framework was set up with the objective to promote, protect and develop nuclear energy around the globe. The key document which governs the legal instruments on nuclear law is the IAEA which defines and regulates nuclear law. The international conventions discussed in this Chapter clearly reflect the efforts of the IAEA in establishing a strong legal framework to support the peaceful use of nuclear energy. Governed under the international public law, inter-governmental organizations bring together nations to act in uniformity with the duty to legislate laws to safeguard the peaceful uses of nuclear materials and nuclear installations.

The historical development of Conventions with specific objectives clarifies the goal of achieving a well-regulated nuclear law regime were established under the aegis of IAEA which itself came into existence in 1956. The 1950's can be regarded as the phase of creating institutions, 1960's was all about achieving safety standards, 1970's focused on non-proliferation, the 1990's the concentration was on harmonizing the nuclear law at an international level and in the 2000's enhanced security, development and strengthening the domestic laws in accordance with international provisions were given importance.

A number of multilateral conventions have been adopted to enhance cooperation and safety with respect to nuclear energy. The understanding

of these conventions is critical to the study of nuclear law. While the Vienna Convention on Civil Liability for Nuclear Damage and the Protocol to amend it, the Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention and the Convention on Supplementary Compensation for Nuclear Damage are liability conventions established to ensure a fixed compensation to the victims against damages from a nuclear incident. There are security and safety conventions as well formulated under the umbrella of the IAEA to further strengthen safety standards and enrich the regulatory framework of international nuclear law regime that governs establishment, liability, operations, compensation and other issues related to nuclear energy. Added to this is the use of nuclear energy is limited to civil uses only under the Nuclear Proliferation Law and its trade is restricted to the members of the Nuclear Suppliers Group.

The issue of environmental impact is another matter of grave concern as climate change repercussions are a global threat. A balance has to be drawn between economic development and progress and environmental sustainability. In India too, the courts have taken a progressive view with respect to this delicate balance and the growth of the nuclear sector as is evident from the decisions on the Kudankulam Nuclear Power Plant in South India.

CHAPTER VII

CASE STUDY – THE KUDANKULAM NPP – A LEGAL PERSPECTIVE

The Kudankulam Nuclear Power Plant is a very important development in how the courts have interpreted the economic sustainable development of the country. Therefore, understanding the legal perspective of this landmark judgement becomes imperative. This case study is an apt representation of a subject where several stakeholders were involved, viz., the public at large, the Central and State Governments, Non-governmental organizations etc. and interpretations of International conventions, the Constitution of India, Environmental and Nuclear Acts were debated. This case study of the Kudankulam Nuclear Power Plant that covers all its aspects forms an integral part of this research.

PART 1

7.1 HISTORY AND TIMELINE OF KUDANKULAM NUCLEAR POWER PLANT

7.1.1 History

Back in 1988 under the Rajiv Gandhi regime, a Memorandum of Understanding was signed between India and the Soviet Union for the construction of a nuclear plant in India. The subsequent disintegration of the Soviet Union led to a political and economic crisis and the project was consequently put on hold. The MOU was widely objected to by the USA on the grounds that the Agreement

failed to comply with the terms and conditions set by the Group of Nuclear Suppliers.

Initially it was decided that road transport would be the preferred mode of transporting the water reactor equipment from Tuticorin Port. However, post-2004 there were difficulties during transportation leading to damage. This prompted the need for a naval point along with a port and the best spot was found to be at Kudankulam in the southern part of Tamil Nadu where a small port was developed and commenced operations on 14th January 2004. This achieved the purpose of ease of delivery of oversized equipment from ships anchored at a distance of half a kilometer from the Port.

In 2007 an MOU was signed between India and Russia, followed by the visit of the Russian President Vladimir Putin's visit to India. Post discussions with the Indian Prime Minister Manmohan Singh (Government of India, Ministry of External Affairs, 2007) an agreement was reached to develop and promote nuclear energy with a view to foster a path for rapid growth.

7.1.2 TIMELINES

1988	India and Soviet Union sign the first MOU for construction of nuclear power plants in India
1990	Protests held to oppose the diversion of water from the Pechiparai Dam
1998	The hold on the project due to the disintegration of Soviet Union ends
2000	Construction of the KKNPP commences
2004	A small port constructed to ease transport constraints becomes operational at Kudankulam
2007	India and Russia sign MOU for promotion and growth of nuclear energy

2008	Four reactors at the atomic station at KKNPP proposed
2009	First project scheduled to begin in December 2009
2010	Hydraulic tests carried out at the power units and a second schedule set up for March
2011	First schedule begins in June though the main stage of equipment testing at the first nuclear power unit of Kudankulam began in mid-March. Project commissioned in April Widespread public protests in opposition to the KKNPP
2012	Second scheduled plan of operation in March (The Hindu, 2016)

7.1.3 LIST OF STATUTORY CLEARANCES OF THE KUDANKULAM NUCLEAR POWER PROJECT

1	June & December 1983	Assurance on Pechipparai Water by Public Works Department, Government of Tamil Nadu
2	September 1987 & February 1988	Clearance by Committee on Conservation of Seashore, Government of Tamil Nadu for location of Atomic Power Station at Kudankulam
3	1988-89	Environmental Committee Clearance by Environment & Forest Department, Government of Tamil Nadu
4	April 1989	500 Meters Shore Line Clearance
5	May 1989	Clearance from the Ministry of Environment & Forest, Government of India
6	July 1989	Clearance from Forest Department, Government of Tamil Nadu
7	November 1989	AERB Clearance for Site Location
8	October 2001	AERB Clearance for Site Excavation
9	22 Mar 2002	AERB Clearance for First Pour of Concreting of RAB
10	9 Apr 2002	AERB Clearance for First Pour of Concreting of RB
11	15 Jun 2004	AERB Clearance for Construction Beyond (+) 17M Elevation for RB

12	9 Sep 2004	AERB Clearance for Civil Construction of Primary Containment of KKNPP Unit-1 & 2
13	10 Mar 2005	AERB Inspection Report on Grout Efficiency of Second Mockup for Horizontal Tendon H-40
14	30 Aug 2006	AERB Clearance for Erection of Major Equipment
15	23 Sep 2006	AERB Permission to Start Grouting Operations for Horizontal Tendons in IC Wall and Dome of IC for KKNPP Unit-1 & 2
16	22 Jun 2007	AERB Clearance for Erection of Major Equipment KKNPP Unit-1 & 2
17	30 Jun 2011	AERB Clearance for Hot Run of KKNPP Unit-1

7.2 CONSTRUCTION OF KUDANKULAM NUCLEAR POWER PLANT

The Nuclear Power Corporation of India Ltd. (NPCIL) began construction of the Kudankulam Nuclear Power Plant on 31st March 2002 with an estimated target completion date of December 2007 which was later changed to March 2007. A small port was constructed at Kudankulam and made operational on 14th January 2004 to avoid damages incurred during road transport from distant ports to the site. In 2008, negotiations were underway for the construction of four additional reactors at the site with an expected capacity of 1,200 MW or 1.2 GW each aimed at bringing the total capacity of the Plant to 6,800 MW or 6.8 GW (Balasubramanin K. & Kumaran M., 2016). Construction for the 3rd and 4th units started on 29th June 2017 and for the 5th and 6th units on 29th June 2021 with estimated completion by December 2026 and September 2027 respectively (Balasubramanin K. & Kumaran M., 2016).

7.2.1 THREE STAGE PROGRAM

Stage 1

Pressurized Heavy Water Reactors (PHWR) are used, which fueled by natural UO_2 with heavy water acting as a moderator and coolant. Initially Boiling Water Reactors were used and it only after indigenous research and development that the PHWR came into existence. The former was based on imported technology while the latter were built with India's self-reliant technology. A new Russian version of the Pressurized Water Reactor (PWR), viz., VVER is under development to further enhance growth in power generation. Further, new fuel technology is being developed at Tarapur including MOX or mixed oxide fuel for the purpose of conserving fuel.

Stage 2

Pu-239, which is obtained from the first stage reactor operations is used as the core fuel in Fast Breeder Reactors (FBR).

Stage 3

This stage brought the U-233 fueled breeder reactors to the industry as a result of the vast thorium deposits, which makes the operation of U-233 reactors feasible (Dristhi IAS, 2019).

7.2.2 CHALLENGES

Safety concerns together with management of nuclear waste are the major issues associated with generation of power with nuclear energy. The same has attracted vitriolic and aggravated concerns post incidents like Chernobyl, Three Mile Island, Fukushima etc. However, simply the fear of accidents does not justify completely phasing out of nuclear energy as a source of power. What is

important and much required is the formulation of a safety regime and to ensure complete adherence to the safety measures in place. A zero-tolerance policy towards non-adherence of the highest safety standards will reduce the probability of such catastrophic accidents.

Another major challenge is selection of location and acquiring land for the purpose of building the nuclear power plant. NPPs such as Kudankulam in Tamil Nādu and Kovvada in Andhra Pradesh had to face several delays due to the concerns of land acquisition and related challenges.

India, not being a signatory to the NPT and NSG faces sanctions and therefore its nuclear supply is severely limited. However, the scenario changed after the waiver in 2009 which was followed by bilateral civil nuclear energy agreements with several countries.

Keeping pace with the technological advancement is an essential requirement and poses its own challenges with respect to reprocessing and enrichment capacity. India must fully utilize the spent fuel and must also improve technological capability to enhance its enrichment capacity.

India has worked hard to fulfill industrial infrastructure, manpower requirements, skilled development of that manpower etc. required to manufacture equipment. Various universities and institutes have contributed by providing engineering skills and manpower for NPPs in India to overcome this challenge.

7.2.3 OPERATIONS

Construction of the Kudankulam Plant was completed and it successfully attained criticality for its first reactor on 13th July 2013. Three months later it was connected to the grid and commercial operations commenced on 31st December 2014. The second unit achieved criticality on 10th July 2016 and was connected to the grid in August with commercial operations starting on 15th October 2016. A “Power Purchase Agreement” (PPA) with the NPCIL was approved for the purpose of sourcing electricity from the KNPP Project by the Board Members of the Kerala State Electricity Board (KSEB). Subsequently, Unit – 1 was shut down from June 2015 to January 2016 for refueling and maintenance and was connected to the grid on 30th January 2016. According to the statement issued on 26th January 2018 by Mr. D S Choudhary, Site Director of the Project a total of 22,800 million units of electricity had been generated by both Units 1 & 2 since the Plant began operations (Wikipedia: The Free Encyclopedia, 2020).

7.2.4 RESPONSE FROM OFFICIALS

Similar to the challenges faced and uncertainties attached to every nuclear power plant, Kudankulam too faced its quota of criticism. In this regard, officials clarified the state of affairs in support of the project. Mr. Srinivasan, Former Chairman of the Atomic Energy Commission of India, talking in support of the Plant said, *“The Fukushima Plant was built on a beach-front, but the Kudankulam was constructed on a solid terrain and that too keeping all the safety aspects in mind. Also, we are not in a tsunami prone area. The plants in Kudankulam have a double containment system that can withstand high pressure. At least ₹ 14,000 crore has been spent. If*

we don't operate the plant immediately, it will affect the economic stability of our country” (Wikipedia: The Free Encyclopedia, 2020).

The Government of India constituted a Central Panel headed by Dr. Muthunayagam, to conduct a survey on the safety features in the Plant. The survey vouched in favor of the reactors safety system. Dr. Muthunayagam was known to have said that the protesters asked for documents which were not related to the safety of the reactor.

Well known nuclear scientist and principal scientific advisor to the Government of India, Mr. Rajagopala Chidambaram, states “*We have learnt lessons from the Fukushima nuclear accident, particularly on the post-shut-down cooling system*” and went on to say that accidents like Fukushima should not deter India’s path towards achieving a safe civil nuclear program.

A similar stand was taken by the four-member Expert Panel set up by the Tamil Nadu State Government in its Report on the inspection of the safety features of the Plant. The Government, consequently, in the wake of acute power shortages, ordered in support of the Plant.

7.3 STEPS INVOLVED IN ESTABLISHMENT OF THE KNPP PROJECT

7.3.1 SITE CLEARANCE FOR KUDANKULAM – 1 & 2 (KK – 1 & 2)

The site clearance for Kudankulam – 1 & 2 was given following the protocol set up by the Government for all NPPs. The Site Selection Committee (SSC) was tasked to evaluate and analyze the feasibility of the site as per the criteria laid down in the AERB Code of Practice

on Safety in NPP Siting. This included an evaluation based on assessment of seismicity, geology, location of faults, conditions for the foundation, meteorology, risk of floods, tsunami and storms at coastal sites, excessive rains or breaking of dams, etc., proximity to airports, military installations, storage facilities for explosives etc. (NPCIL, 2011). Additionally, assessment was made of the environment including the biodiversity (flora and fauna), marine ecology etc., availability of land, water supply, demand of electricity and availability of other energy options in the area (NPCIL, 2011). Based on the report submitted by the SSC after due evaluation the GOI accorded its approval for the Project.

7.3.2 MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE (MOEFCC) AND OTHER STATUTORY CLEARANCES

Following approval of the Site, the Statutory Clearances were an essential part of the pre-project activities. Environmental Clearance from the MoEFCC was obtained for KK – 1 & 2 following an Environment Impact Assessment (EIA). However, clearance process for KK – 3 & 4 also included a public hearing as per the notification of the Ministry wherein responses of stakeholders and the expert appraisal committee of the MoEFCC were heard.

In addition, a detailed site evaluation report was submitted to the AERB which included geo-technical, seismic-tectonic, safe grade levels, analysis of meteorological and other technicalities. The AERB cleared the DPR and thereafter, in February 2001, financial sanctions were obtained.

7.3.3 EXCLUSION ZONE AND STERILIZED ZONE

An area within the radius of 1.5 km around the Power Plant (part of the land acquired for the project) is said to be the “Exclusion Zone” where no human habitation is allowed. Once the Site was finalized any population within this Zone were resettled. Surrounding the Exclusion Zone is the “Sterilized Zone” which extends between the Exclusion Zone and up to a 5 km radius from the Plant. This Zone allows the natural growth of population unlike the Exclusion Zone where only authorized personnel are allowed entry. However, restrictions have been put in place to avoid large increase in the population already rising due to the labor force in the industry. Both these zones are set up as per the AERB Code of Practice on Safety in NPP Siting.

As per the said Code an Emergency Planning Zone also exists as an area of 16 km radius around the Plant to enable planning for serious accidents, if any.

7.3.4 POPULATION DISTRIBUTION

The Plant follows the criteria for desirable population distribution as laid down by the aforementioned Safety Code of AERB wherein:

- Population centers greater than 10,000 should not be within 10 km of the Plant and centers greater than 1,00,000 not within 30 km from the Plant
- Within a radius of 10 km of the Plant the population density should be less than $2/3^{\text{rd}}$ of the State average
- The total population in the Sterilized Zone should be preferably less than 20,000 (Atomic Energy Regulatory Board, 2005).

Keeping in mind casualties experienced in the past, the Kudankulam reactors were deployed with inherent safety features as well which enhance the safety measures required to be considered to run a nuclear power plant. This strengthened the Project and avoided risks to the public beyond the exclusion zone, even in the case of a severe accident.

7.3.5 EFFECTS ON MARINE LIFE AND FISHING

Cooling water is a requisite for nuclear power plants. However, the temperature of the water discharged at the outlets being higher than the ambient temperature of water has had effects on marine life. Based on thermos-ecological studies the MoEFCC has laid down stipulations and limits within which the Plant has to operate. Following these stipulations, no adverse effect has been observed on marine life, including the fish, in areas around plants located in coastal locations. The Kudankulam project provides for fish protection through its cooling water system set up in accordance with these guidelines and this ensures that the fish are not sucked into the machines.

7.3.6 RADIATION IN THE SURROUNDING AREA

The indispensable part of building nuclear reactors is the utmost need to minimize radioactive radiations. “As Low As Reasonably Achievable” (ALARA) is the key tenet adopted to maintain the radiation far below the limits. The radiations released from the Plant amounts to only a negligible fraction of the naturally existing background radiation.

An additional safeguard to ensure limited radiation is the ESL set up at the Project Site itself even before the commissioning of the reactors. The ESL collects data from the environment, establishes a

baseline and monitors the environmental matrices even beyond the Emergency Planning Zone. History speaks for itself, that in over 40 years there has been no significant increase in radiation levels above the baseline data at any NPP site in India.

7.3.7 QUALITY ASSURANCE

The quality assurance in nuclear plants is of paramount importance and is accorded the highest attention. A Quality Assurance Manual guides the construction work and has guidelines and plans for each activity. In the case of civil construction all material is tested at laboratories and inspected by QA personnel, all of which is documented in detail along with regular quality check reviews conducted by internal audit teams of NPCIL. Kudankulam passed these stringent tests, inspections and reviews and all piping and civil works were found to be completely in line with the regulations.

7.3.8 COASTAL ZONE REGULATION (CZR)

Approval under the CZR from the Prime Minister's Office (PMO) was mandatory for Kudankulam. Clearance for Units KK – 1 & 2 was meticulously followed and obtained by NPCIL. The data and information as required for clearance by the expert appraisal committee of the MoEFCC has been submitted and approval is awaited.

7.3.9 KK – 1 & 2 – SAFETY FEATURES

The Kudankulam Project has two advanced units, viz., the Russian VVER – 1000 MW model units of Pressurized Water Reactors. They fall under the category of advanced Light Water Reactors that have been majorly developed by West European countries and

Japan. The design has evolved from the serial design of the VVER Plant of which 15 units have been operational for the last 25 years. The salient features incorporated by the Kudankulam Project to enhance safety were:

- Passive heat removal system to provide cooling for removal of decay heat;
- Higher redundancy for safety norms;
- Double containment;
- Larger numbers of control rods;
- Additional shut down systems for the reactor like second quick-acting shut-down system and quick boron-injection system; and
- Advanced instrumentation systems with advanced technology for Reactor Systems, Balance of Plant and for Plant Computer Systems (Atomic Energy Regulatory Board, 2005).

The safety systems at Kudankulam were comprehensively reviewed by NPCIL in the context of the recent nuclear accident at Fukushima and the report was made publicly accessible on the websites of NPCIL and DAE. It was confirmed that Kudankulam had taken adequate steps to withstand such extreme casualties and additional safety features were also installed, such as core catcher and hydrogen management system, to mitigate the possibility of severe accidents and enhance protection. Safety measures are also reviewed by the AERB as part of its regulatory function and the reports also made available on the websites of NPCIL and DAE.

7.3.10 SEISMIC CONSIDERATIONS

The seismic hazard associated with the Kudankulam Site is extremely low if compared to Fukushima, Japan and the Site location has been carefully selected to fall in Zone – II, the lowest seismic hazard zone in India (Wikipedia: The Free Encyclopedia, 2022). Trivandrum, being the nearest possible epicenter for earthquakes, is located 88 km north-west of the Site. Two earthquakes measuring 4.3 on the Richter Scale have been recorded here. The buildings themselves have been designed to withstand earthquakes of up to 6.0 on the Richter Scale with a peak ground acceleration of 0.15 g. However, on evaluation of the Plant based on stress values indications pointed to a capacity to withstand significantly higher peak ground acceleration of up to 0.6 g.

7.3.11 TSUNAMI

The Kudankulam Site is at a distance of 1,500 km from the tsunamigenic fault or the point where the tsunamis originate. This ensures that by the time the tsunami strikes the site it has lost its vigor and energy thereby greatly containing potential damage. This is unlike the Fukushima Site where the tsunamigenic fault was located only 130 km away from the Plant. The Kudankulam Site has survived the 2004 tsunami in the Indian Ocean when the water levels were 2.2 m above mean sea level on 26th December 2004 after an earthquake of 9.2 magnitude triggered a massive tsunami. Construction of the buildings were done with a higher floor level design, shore protection walls etc. and on higher ground than the flood rising, storm, waves or tide rise levels. Important buildings, such as the ones housing emergency power supplies, were built on even higher ground levels and are protected with double gasket leak-tight doors that prevent any water from entering the premises.

7.3.12 COST OF THE PROJECT

The project was approved with a budget of ₹ 13,171 crores. The electricity tariff was to be derived as an outcome of the market forces and in competition with other sources of energy available and is expected to remain at around ₹ 2.50 per unit. All figures for costs and expenditure were submitted to agencies such as DAE, MOSPI, Parliamentary Committees etc. who are monitoring the Project and are also available on the public domain.

7.3.13 CSR ACTIVITIES

NPCIL ensured that there was a well-structured CSR Program under the Kudankulam Project which aimed at an inclusive growth and development of the entire area including villages and community surrounding the Plant. Several initiatives in this regard have already been taken.

7.3.14 INFRASTRUCTURE DEVELOPMENT

As a consequence of the Project large scale infrastructure development has been facilitated in and around the area. This includes construction of school walls, lavatories in schools, installation of fire extinguishers, facilities for drinking water through bore wells etc., electrification and flooring for physically challenged persons, solar and sodium street lights, construction of bus shelters, buildings for mentally challenged children, Panchayat Office building at Chettikulam Panchayat amongst other developments.

7.3.15 HEALTH CARE

Regular medical camps are organized in neighboring villages for administration of vaccines, such as Hepatitis B, distribution of hearing aids for hearing impaired children etc.

7.3.16 EDUCATION SUPPORT

An educational support and nurturing programs were set up for the Government Higher Secondary School at Kudankulam and was soon extended to other nearby areas. This included provision of laboratories, ceiling fans, uniforms for children etc. A Talent Nurture Program for bright and talented children from rural or economically backward families is underway. The Atomic Energy Education Society running the program has ensured growth for such children who are selected on the basis of merit for admission into Standard 1 in the AEC School, Anuvijay Township (Atomic Energy Education Society, 2002).

7.3.17 SUPPORT TO COMMUNITY AT COASTAL VILLAGES

Disaster support and otherwise is provided to nearby coastal villages. In 2004-05 tsunami relief activities were carried out including distribution of clothes, food and essentials and mobilization to safe locations. Financial assistance was also given to purchase land for re-construction of houses.

7.3.18 PUBLIC AWARENESS ACTIVITIES

In view of the opposition from the public a need was felt to involve the common man in the Country's growth and development by putting in place a proper program for public awareness and educating the public. An awareness program on the safety features of the Kudankulam Nuclear Power Plant was initiated in the early

1990s covering the neighboring villages. Several educational institutions were visited by KKNPP teams to conduct interactive educative sessions on the Plant. For further understanding of the power station and for an in-depth study of the benefits of the Plant around 200 individuals from nearby villages such as Kudankulam, Chettikulam etc. were invited to the Madras Atomic Power Station at Kalpakkam. To further ease any misgivings their visit included interaction with the M S Swaminathan Foundation on Marine Life (Devaprakash, J., 2016). The public awareness campaign has come a long way since its inception in 2001.

7.4 BRIEF DETAILS OF PUBLICATIONS, AWARENESS AND COMMUNICATION INITIATIVES

7.4.1 PRESS AND MEDIA RELATIONS

Interactive workshops were conducted in 2001 for 150 journalists from Tirunelveli and Kanyakumari Districts followed by site visits in December 2007 in which at least 50 media personnel, including print and electronic media, actively participated. Several sessions were held regularly with the local and national press.

7.4.2 PUBLIC COMMUNICATION

- A technical debate was organized by Mr. Lal Mohan, one of the leading anti-nuclear activists from Nagercoil. The debate saw a turnout of over 100 professionals, several members of the Nature Trust and students.
- In 2001, a workshop for fishermen was organized in collaboration with the Rotary Club which saw participation of fishermen from several nearby villages.
- The Radhapuram Panchayat Union Office held a Public Awareness Seminar in 2002 ensuring active participation of

all its members, executive officers, the block development officers (BDOs), presidents and councilors (Devaprakash, J., 2016).

- Several Nuclear Plant Familiarization Programs were conducted whereby a tour of the Rajasthan Atomic Power Station (RAPS) was organized.
- Site visits and interactive sessions were organized for all neighboring villages including sessions for school children. One such discussion on safety measures was conducted in the presence of the Archbishop of Tuticorin and the Diocese team.
- In 2007, a site visit was organized for anti-nuclear activists to address their concerns regarding the safeguards adopted to avoid disasters like Chernobyl and Fukushima.
- Work with colleges and university students include an ongoing In-Plant Training/ Project Work program and interactive sessions with KKNPP officials. A permanent exhibition has also been set up at the District Science Center, Tirunelveli.
- In 2011 around 500 Tirunelveli District officials from departments ranging from Revenue to Fisheries to Fire and Rescue Personnel etc. were required to participate in a Public Awareness and Emergency Preparedness Program. In addition, 100 individuals were trained to form a Self-Help Group (SHG) to interact with locals and clear all doubts and concerns.

7.4.3 PUBLICATIONS

- “From Volga to Ganga, the Story of Kudankulam”, a book providing a comprehensive insight into the Project was published highlighting all the major technical and safety aspects;
- “Metamorphosis – The Changing Skyline of Kudankulam” is a publication highlighting the CSR activities of the Project;
- “Thiruvallar Muthu – Story of a Prosperous Village” – a publication in Tamil for better understanding of the local population;
- In addition to books published several articles were published in Nu-Power and other journals.

7.4.4 MULTIMEDIA/ SHORT FILMS

- The book “Thiruvallar Muthu – Story of a Prosperous Village” was made into an animated film showcasing true images of radiations and important features of the Plant. This was found to be the easiest and most informative manner in which awareness could be built particularly amongst the pre-literate.
- A short film in English was also made on the bio-diversity associated with Indian nuclear power plants with a special focus on KKNPP.

7.4.5 ENVIRONMENTAL STEWARDSHIP PROGRAM

The ‘Environmental Stewardship Program (ESP) is a voluntary program started by NPCIL with a goal to study the flora and fauna in and around the exclusive zones of all nuclear power plants in India. A nature club – “Pelican Nature Club” – was formed under

this program which works regularly on activities for conservation of nature. The activities of the Club include –

- Nature conservation workshops conducted from 25th to 27th September 2006 brought together 60 individuals ranging from department officials to professors and students and local volunteers and NGO members (Devaprakash J., 2016).
- Survey of wetlands and water birds conducted in February 2008 and September 2011 in and around the Plant Site.
- Regular monitoring of the birds and habitat within the KKNPP and surrounding areas
- Publication of several articles in Nu-Power and other journals highlighting the steps taken to conserve the environment around KKNPP.

7.4.6 OPPOSITION

The KKNPP was strongly opposed by the locals, fishing communities and farmers, and nuclear activists largely due to the fact that the water required for the Project was to be sourced from the Pechiparai Reservoir. To an area already facing shortage of water this raised the specter of further depletion of water reserves. This resulted in demonstrations and protests forcing shelving of the ground-breaking ceremony. This stringent opposition together with the demise of the Soviet Union, assassination of the Indian Prime Minister, Mr. Rajiv Gandhi and accusations of the USA that the project was in violation of international agreements ensured that the Project was stalled for a decade. In 1988, Russia and India revisited the agreement and Russia agreed to supply two 1000 MWe reactors for a project at Kudankulam, a coastal village in the southern state of Tamil Nadu, estimated to cost about \$ 3.1 billion and to be commissioned by 2006.

In 2001 there was a second round of protests resulting from concerns on the contaminating effect of radiations on marine life which was an essential source of livelihood for the local communities. Despite the protests another MOU was signed in 2008 for four additional reactors for the same Site. Post commissioning of the first reactor in India, Japan experienced the Fukushima disaster and the protests against the Kudankulam Project intensified (Ravi, Chaitanya & Sheoran, Nayantara, 2018). Amidst this maelstrom the stakeholders continued their efforts to persuade the Indian populace on the benefits of such a project and the measures to be adopted to curb and minimize the risks. In response, a massive protest was organized in 2011 after the Fukushima Daiichi nuclear disaster (World Nuclear Association Library, 2021). The protesters tabled their concerns and the most important one was the evacuation in the event of an accident and safety concerns for workers and the public. Mr. S P Udayakumar, of the “*People’s Movement against Nuclear Energy*” quoted emphatically that “the nuclear plant is unsafe” (Wikipedia: The Free Encyclopedia, 2020). In response, Dr. Srikumar Banerjee, Chief of India’s Nuclear Energy Program, in 2012 opined the exact opposite and stated that the Plant was “one of the safest in the world” (NDTV, 2012).

In 2011 a public interest litigation (PIL) was filed to delay the Project until all the safety measures were fully assessed. In May 2013, the Hon’ble Supreme Court of India ruled in favor of the Plant explaining that the decision was in the larger public interest on the grounds that the power plant was in the interests of the public and not against it (G. Sundarrajan v. Union of India & Ors., 2013). Work was resumed in 2012 when a large group of protesters gathered at

the work site and nearly 200 were detailed by the local police for a few hours. Supporters of the plant in the Idinthakarai village were also targeted with the improvised explosive devices. On the flip side there were some gatherings held in favor of the plant also. The Government was of the view that some foreign NGOs were responsible for the vehement protests and it was reported that three such NGOs had diverted funds earmarked for religious and social causes to the protests in violation of foreign exchange regulations.

Protestors have adopted different strategies and the most popular form of protest is the hunger strike. On 17th August 2011 a three-day hunger strike was held at the Kudankulam Site (Udayakumar, S. P., 2011). The anti-nuclear relay fast – a movement that started on 18th October 2011 – continues to this day. Other forms of protest adopted have been fishing boycotts, withdrawing children from schools, shutdown of shops, hoisting black flags, returning government issued ration cards and passing anti-nuclear resolutions at village councils on 15th of August – India’s Independence Day.

7.4.7 OPPONENTS AND THEIR PERCEPTION OF NUCLEAR RISK

The Fukushima disaster was a major setback for the growth of nuclear reactors around the World and one of the main reasons for this was the perception of nuclear risk. Instances of such perceptions resulting in a backlash are:

- Very recently the Kudankulam Nuclear Power Plant faced agitations that arose as a result of the panic caused by noises emanating from the Plant when the employees performed a “hot run” (Outlook, 2022).

- Tensions amongst the locals intensified when they were asked to cover their noses and take refuge in buildings during a mock run of response to a nuclear accident.
- The perception that radiations will destroy marine life and therefore their livelihood resulted in the formation of The Peoples' Movement Against Nuclear Energy (PMANE) by the local fishing, Nadar, Dalit and Muslim communities.
- The impossibility of speedy evacuation of the over 1 million people residing in the 15-mile radius around the plant is a perception causing major concerns.
- The locals worry that the Exclusive Zones formed for their safety and security will prevent them from casting their nets in over 70% of the area and restrict access to lands that traditionally belonged to them
- Despite assurances and reports there are safety concerns revolving around the quality of construction and waste disposal

The anti-nuclear lobby completely rejects the efforts by the government to mitigate the risks associated with nuclear power plants. They refuse to open their minds to understand the risk assessments conducted and recoil from a perceived corporate-political vision of Kudankulam overrun by large nuclear reactors. Their non-negotiable demand of complete shutdown of the reactors means going back to non-renewable sources of energy like natural gas or thermal. Their solution to protect the environment and boost the economy is the use of other sources of renewable energy such as tidal energy.

Two panels have been established both at the Central level and the State level to address the issue of increasing intensified protests that are roadblocking an already delayed project. The State panel has requested for information from the Center on the Environmental Impact Assessment, Safety Analysis Report, freshwater needs of reactors, impact of marine life and Russia's liability. However, the State panel has expressed disappointment claiming that the Center has been denying access to such information on the grounds of national security.

7.5 FACTORS LEADING TO OPPOSITION OF KUDANKULAM PROJECT

The people, in and around Kudankulam village, have been opposed to the KKNPP since its inception in 1980. The prevalent feeling is that they have been misled on the pretext of job creation, water supply schemes from Pechiparai Dam, infrastructural development etc. The anti-nuclear protest movement over the years lost some steam and it was felt that the same could survive only with the support of the local populace. In 2007 all locals joined hands with the protestors giving the movement a boost and quickly making it into a mass movement.

7.5.1 PEOPLES' PROTEST AND RESISTANCE CAMPAIGN

The PMANE spearheads the anti-nuclear protests by laying down a comprehensive stand backed by environmental concerns, safety, economic and human considerations basis which the Project is criticized. The fight has been much more than mere fear and an overreaction to the Fukushima disaster, as it is often regarded as by the officials and the media. The protests began as a trickle in the 1980s and has now shaped into a strong, organized movement centered in the village of Idinthakarai. Despite threats of arrest and

the fact that several protesters have been denied bail and are languishing in jails, these villagers have ensured that the movement is running as a mass movement within democratic principles resorting to protest methods such as hunger strikes, relay fasts and road blockades.

The movement now comprises of experts as well as locals and individuals who have participated in the public hearings as well, who have identified the problems with the Project. The Kudankulam movement is their struggle for alternative development and their fears and apprehensions cannot be cast aside. The Tamil Nadu Government has urged the Center to consider these views and to “ally the apprehensions of the people before proceeding.”

7.5.2 REPRESSION BY THE STATE

The protest movement has evolved into a mass movement led without violence or diversion of thought and belief. In order to suppress the movement, the local police went so far as to abuse the system and their power in an effort to subvert the movement. Peaceful protests, without a single incidence of violence, were termed as sedition and false cases were made of waging war against the State. Prohibitory orders were issued in the 7 km radius around the Plant and regulations reached a level where innocent people were shot and/ or went missing. More than 50,000 fabricated cases were registered and charges were levied indiscriminately under the Indian Penal Code. 3600 people were charged under section 121 (Waging War against the Government of India) and 3200 were charged for sedition under section 124A. In several cases, both parents were arrested leaving behind abandoned children and even

aged or mentally and physically challenged persons were not spared (Tarun, Kanti Bose, 2013).

7.5.3 STATE ADOPTS “DIVIDE AND RULE”

In an attempt to break the movement, the State resorted to what was quickly termed as “nucleocracy” and started to play a dangerous game with the local villagers and fishermen as the pawns. Since unity was the strength of the movement it was felt that “divide and rule” would be the best policy to break the movement. An attempt was made to create a communal divide all the while blaming the same on ‘foreign hands.’

7.5.4 REASONS BEHIND OPPOSITION OF KUDANKULAM NUCLEAR POWER PLANT

- (a) The Project lacked democratic decision making. Programs catering to the public had no provision for feedback or the public opinion and remained by and large a one-sided communication. Important reports like the EIA, Site Evaluation Study and SAR remain outside of the public domain. In addition, there was no pre-operation public hearing for the first two reactors.
- (b) The Tamil Nadu Government G.O. 828 (29.4.1991 – PWD) defines the “area between 2 to 5 km radius around the plant site as the sterilization zone” (K K. Shahina, 2012). From this one can infer that people from this area would be displaced even though officials have publicly promised otherwise.
- (c) Population of over 1 million residing in the area within 30 km radius of the Plant is not within the prescribed limits and

far exceeds the AERB stipulations. This makes speedy and efficient evacuation nearly impossible.

- (d) It is assumed that the waste from the Plant is going to be dumped into the sea endangering marine life and therefore adversely affecting the main livelihood of the locals.
- (e) The Plant emits radioactive particles, such as Iodine 131, 132, 133, Cesium 134, 136, 137 isotopes, strontium, tritium etc., into the environment. These particles settle in the air and on the sea, land, crops, cattle etc. rendering ground water and seafood harmful for consumption. Cases of cancer, mental retardation, defective births, Downs Syndrome etc. are not so rare anymore. General public health is further affected by the emissions from the Plant.
- (f) The questionable quality of construction combined with the working of an untested Russian-made VVER-1000 reactor has given rise to fear – not only amongst the locals but amongst the international community as well.
- (g) The erstwhile Minister of State, MoEFCC, Mr. Jairam Ramesh had announced denial of permission to KKNPP 3-6 as they were violating CZR stipulations. This creates the doubt whether KKNPP 1 & 2 complied with the same or not (Udayakumar, S. P., 2011).
- (h) The claim that the Site area is earthquake-free cannot be blindly relied upon. In December 2004, a tsunami caused by mild tremors resulted in flooding of the installations. Tremors were experienced on 19th March 2006 and on 12th August 2011 as well. Earthquakes, therefore, can occur and cause damage despite all precautions.
- (i) The nuclear site is also on the radar of terrorist groups as confirmed by the Government. Mr. Mullappally

Ramachandran, Minister of State for Home recently said “the atomic establishments continue to remain prime targets of the terrorist groups and outfits” (Udayakumar, S. P., 2011).

- (j) The issue of liability is unclear and in a grey area. Russia insists that the International Governmental Agreement (IGA), signed between the two nations in 2008 precedes the liability law and therefore NPCIL has the sole liability for all claims of damages as per Article 13 of the IGA (The Times of India, 2013). This is contradiction to the Indian Liability Law.
- (k) The disaster in Fukushima on 11th March, 2011 has made the world aware of the massive extent to which nuclear reactors can be damaged and cause damage. Natural disasters are unpredictable and nothing can be done to fully overcome the inherent dangers. Highly industrialized nations like Germany have already decided to close their NPPs in a phased manner while USA and Russia have not built any new reactors since the Three Mile Island and Chernobyl disasters.
- (l) The states of Kerala and West Bengal have taken a clear stand against nuclear energy and have decided to not host any nuclear projects.
- (m) On 26th September 2006 during a visit by Dr. Abdul Kalam to the Site safety concerns were raised when an employee was seriously injured when he fell down from the roof (Sudhakar, P., 2011).

PART II

7.6 KUDANKULAM CASE BEFORE THE HON'BLE MADRAS HIGH COURT AND THE HON'BLE SUPREME COURT OF INDIA

7.6.1 TRACING THE LEGAL TRAJECTORY OF THE KUDANKULAM CASE

The project originally planned in 1988 was given effect to only after the disintegration of USSR under the additional agreement signed with Russian in 1998. Meanwhile, environmental clearances were procured, Environmental Impact Assessment conducted, and approval obtained from the TNPCB along with completion of other formalities. Subsequent to the disaster in 2011 the TFR on the evaluation of the safety aspects of KKNPP recommended seventeen steps as an abundant precautionary measure before the second stage commissioning of the project in May 2011. Despite the adaptation of all possible security measures a Public Interest Litigation (PIL) was filed in 2011 at the Madras High Court. The decision of the Madras High Court was then subsequently challenged in the Supreme Court of India. The latter upheld the decision of the High Court. Although the facts of the case and the final decision of both the Courts was substantially the same there was a difference in the judicial cartography applied on the four issues formulated, which were, selection of material facts, identification of legal issues, consideration of epistemic resources for the purpose of evidence and the determination of equitable solutions. The two judgements are discussed and analyzed separately in detail below in order to understand the difference in judicial interpretation applied.

7.6.1.1 Madras High Court Decision

Altogether eight petitions were filed challenging the KKNPP on different grounds. Four of the petitions opposed the commissioning of the Project based on regulatory failures while one of these was filed by PUCL and it challenged the very existence of the Project itself. Two petitions (G. Sundarrajan v. Union of India & Ors., 2013) stood against the resistance movement directed at Mr. Udayakumar, the head of the People's Movement Against Nuclear Energy (PMANE) and took an adversarial position against those who indulged in violent activities to curb the protests. It also held that PMANE and Mr. Udayakumar were liable under the National Security Act, 1980. The last two petitions (G. Sundarrajan v. Union of India & Ors., 2013) prayed in favor of the Project asking for immediate opening of the KKNPP Units 1 & 2 in order to meet the electricity demands of the nation.

The first two petitions were filed by Mr. G Sundarrajan challenging the commissioning of the Project in Tamil Nadu (G. Sundarrajan v. Union of India & Ors., 2013). Grounds for the petitions were that there was a need to have an independent review of the Project by experts who were free from government control and the project specifications were changed post the EIA clearance, a public hearing to be conducted and full compliance with the TFRSEK was required.

The second Petitioner was the People's Union for Civil Liberties (PUCL) (G. Sundarrajan v. Union of India & Ors., 2013) that opposed the establishment of the KKNPP on the grounds of threat to the safety of people residing in and around the area, risks of accidents, health hazards and loss of their livelihood. The petitioner claimed that the Project was commissioned illegally by hiding necessary opinions and non-compliance of the stipulations of AERB. It contended that several clearances were obtained on false grounds. The Court distinguished the contentions as review of the Project and others against the establishment of the Plant.

The third petition was based on an RTI request dated 2nd April 2012 claiming that the inspection of KKNPP and verification of safety measures was not undertaken and the Project had not been granted the consent to operate as required by the TNPCB. This is a mandatory requirement to be obtained prior to initiating operations in a power plant.

The fourth petitioner (G. Sundarrajan v. Union of India & Ors., 2013) was a practicing advocate whose plea was to deny permission to commission the KKNPP until such time that medical facilities and safety concerns were completely verified keeping in mind public safety.

The respondents in these cases were the DAE representing the Union of India, the Ministry of Environment and Forests (MoEF) now the MoEFCC, the

AERB, NPCIL, the District and Police administrations of Tirunelveli District.

The writ petitions were first filed in the Madras High Court and then upon dismissal appealed in the Supreme Court (G. Sundarrajan v. Union of India & Ors., 2013). The dismissal was upheld by the Apex Court deciding in favor of the Plant. The constitutional validity of the CLND, 2010 was also challenged and upheld by the Supreme Court of India.

The case of the Respondents was based on four premises standing in favor of KKNPP –

- The project was set up with advanced technology which was more efficient than the nuclear plants of Chernobyl and Fukushima. It had gone through all the safety procedures and was built with measures to combat challenges faced by existing nuclear plants.
- The mandatory conditions of regulatory bodies like MoEF, TNPCB and AERB were all complied with including emergency procedures to combat sudden accidents.
- The Project involved a huge amount of public funds and involved agreements with third parties. It was not a unilateral step taken which could be retracted. Cancelling the Project would not only result in massive losses it would also deprive the country of a renewable energy source at a time when it was already hit by an energy crisis.

- The decision was a policy one which would not normally be open to public or judicial scrutiny as it could greatly affect the economic development of the nation.

However, arguments delegitimizing the Petitioners personally (Anuradha Bhasin v. Union of India, 2020), (Anindita v. Pranab Kumar Mukherjee, 2017), (Suraz India Trust v. Union of India, 2017) was undermined by the Court stating that a PIL is not to be understood as an attempt to attain private gain and used the '*Doctrine of clean hands*' to refuse to admit frivolous petitions or dismiss pending petitions (Subash Kumar v. State of Bihar, 1991), (Ashok Kumar Pandey v. State of West Bengal, 2004), (Dattaraj Nathuji Thaware v. State of Maharashtra & Ors., 2005). Subsequent to filing of counter affidavits by the Respondents, DAE and NPCIL, the Court held that personal attacks in absence of direct conflict of interest diverted attention from the challenge at hand and undermined the PIL system.

Factual findings of the High Court revealed that the Supplementary Agreement signed in 1998 was a prolongation of the original document and not a new one and was therefore governed by the new regulatory framework. While accepting the need for a safe structure the Court discarded the contentions regarding modernization. The Court relied on the opinions of government agencies like AERB and "outside" experts like NEERI and MSRF and held that lack of safety concerns by the KKNPP were unsubstantiated

contentions. Thus, the Court was, *prima facie* satisfied with the safety measures adopted by the Project and relied upon the two regulatory bodies, AERB and TNPCB, to ensure that the safety standards were maintained.

The Court further accepted the argument that the action of the State should be protected from public scrutiny since this was a policy decision stating that “*interference by the Court in the policy decisions which are of basic importance and public importance for the benefit of the public is opposed to the public interest itself.*” (G. Sundarrajan v. Union of India & Ors., 2013). Thus, it appeared that the Petitioners were not acting in favor of public interest whereas it was the responsibility of the State to take care of its citizens.

The demand for a public hearing was also rejected on the grounds that “*public hearing can at the most be for rectification of possible defects and not for the purpose of abandonment of the project. In this view of the matter, we totally disapprove of the contention raised by M/s Nagasaila and T Mohan opposing the project itself.*” (G. Sundarraja v. Union of India & Ors., 2013).

It is not common for Courts to express such strong disapproval of public opinion and what was surprising was that the Court did not delve into the merits of the case and blindly relied on the regulatory bodies working under government control. The prayers of PUCL which

should have been analyzed basis evidence provided were rejected at face value and the agreements made by the State were placed outside the purview of judicial intervention.

In retrospect, the framing of issues does indeed reflect the preference given to some issues over others. The issues framed were as follows:

“...Whether the KKNPP started by the Government of India through the NPCIL has all required confirmations as per various statutory provisions, so as to enable the project to proceed further.”

The list did not include the petition of PUCL for withdrawal from the Project revealing the power the Court wields in a PIL case. Another crucial fact ignored by the Court was the non-compliance of the conditions laid down by AERB and TNPCB with respect to the ‘consent to establish’ approval and ‘consent to operate’ order both of which were not taken. This pertinent information was obtained by means of a RTI response dated 2nd April 2012 at the request of a fisherman. TNPCB claimed this information was outdated and since NPCIL has submitted a letter confirming full compliance of all requirements. The fact of the matter was that NPCIL applied for compliance on paper only during the pendency of the case when the RTI response caught them on the wrong foot. However, the Court continued to rely on these agencies with respect to concerns associated with KKNPP and held “...as it is seen in the voluminous

reports of various authorities like AERB, MOEF, Environment Impact Assessment, it is not known as to how the Court can substitute its own view, for the reason that the Court is neither an expert nor competent to make a scientific study of recommendation, when once prima facie we are satisfied that the safety measures have been adequately taken.”.

The contentions of PUCL that these regulatory bodies were not independent organizations and that they would be inherently biased was not given much consideration by the Court. No independent experts were relied upon and the reports submitted by the State Government was also under sealed cover and neither the petitioners nor the public were privy to its contents.

The two major rulings that were a setback for the petitioners were that nuclear disasters were accepted as preventable accidents and that acceptance of expert opinions and reports from the State under sealed cover thereby preventing the petitioners from challenging any point. The judgement also quoted text from the reports of the Committees set up post the Chernobyl and Fukushima incidents to assess the damages and causes for the same. However, what was ignored was the indications in these reports for the need of transparency and full disclosure of information in the public domain.

The Court, however, did make note of the developmental activities like primary health care centers etc., carried out

by the Project through the KKNPP Neighborhood Development Scheme and directed the Government to enhance and extend the schemes to education, infrastructure, healthcare and fishing to benefit the locals. On the flip side, the risk to the resident population was not completely discarded and in the light of equitable outcomes the Court suggested a compensatory framework for the people affected, however inadvertently, by providing a means of approach to better healthcare, education, better infrastructure and standard of living.

7.6.1.2 Decision of the Supreme Court of India

Petitions were filed in the Supreme Court challenging the decision of the Madras High Court (G.Sundarrajan v. Union of India & Ors., 2013). The judgement delivered by Justice Radhakrishnan and Justice Dipak Mishra provided separate concurring opinions. The opening line of the judgement states *“India has 20 nuclear reactors, in place, and the world over about 439, but people still react emotionally, for more reasons than one, when a new one is being established.”* This reflects a presumption about character of people which naturally resists and fears new technological changes for several reasons including lack of education and information on which the Apex Court based its judgement on the safety and environmental concerns arising out of KKNPP and its operations.

With respect to the establishment of the Plant it was held that it fell outside the purview of the Court as it was a result of an international agreement between Russia and India. Therefore, the petition challenging the very agreement was not considered by the Court. However, the Court stated that *“Lot of scientific literatures, expert opinions, etc. have been produced before us to show its dangers, harm it may cause to human health, environment, marine life and so on not only on the present generation but on future generation as well.”* Yet the Court refused to consider the plea challenging the Government’s decision to establish the KKNPP, since it held that it *“cannot be questioned before this Court being part of national policy”* (G.Sundarrajan v. Union of India & Ors., 2013).

The focus of the Court was on two issues, viz., whether safety requirements were adequate for the security of the public and whether the environment was facing adverse effects due to the Plant operations as per the concerns put forward. In addressing the question of adverse effects on the environment the Court also considered the management of SNF which was to be retained by India as opposed to the initial decision to transport it back to Russia. There were no plans for building a Deep Geological Repository (DGR) to store the SNF which itself has a long life with effects on the environment. This was completely ignored by the State agencies as well as the AERB.

In the light of its own findings, the Court held that “*We are of the view that these issues have to be dealt with by the experts in the field, evidently without much delay. The AERB Safety Code on “Management of Radioactive Waste” of 2007 does not deal with the requirements of DGR.....Research is on to handle SNF in DGR which, in the near future, let us hope, would be a reality, but that shall not deter us in holding up of such a project which has been established in KKNPP in implementation of India’s nuclear policy*” (G. Sundarrajan v. Union of India & Ors., 2013).

Despite the material facts presented in favor of the appellants, the Court leaned towards the economic argument presented by the State and hesitated to break the limits of judicial scrutiny. It relied on arguments in support of nuclear energy and accepted that it is the only future hope for the energy sector in India given that it is safe, clean and reliable. The Court also agreed with the notion that nuclear energy has proven to be an essential requirement in order to maintain economic growth and development of the nation while ignoring the points holding a contrary position in this regard (Bidwai, Praful, 2014).

With regards to the safety concerns the Court took into consideration the extensive review and research conducted by AERB, NPCIL and regulatory bodies like MoEFCC and TNPCB. It found the measures taken to be adequate and exhorted the respondents to continuously

review the same. It also upheld the direction of the Madras High Court to actively engage the local populace in offsite emergency exercises. According to the Court this would “*make them understand that the project is part of the national policy, participatory in nature and hence we cannot remain a nuclear isolated nation.*” (G. Sundarrajan v. Union of India & Ors., 2013).

The presumption that the general public is ignorant towards the growing needs of the nation and the benefits of technology, specifically nuclear, and are therefore by and large resistant to change is a form of benign paternalism and also a cover up on the State’s failure to involve the people. It cannot be ignored that public view and feedback is an essential part of democratic society. A middle ground is essential in order for the country to progress where proper steps are taken to ensure public awareness allowing the citizens to form informed opinions. This also attracts the doctrine of ‘*parens patriae*’, which is widely invoked by Indian appellate courts, that implies a parent-child relationship between the State and its citizens who must acknowledge state responsibilities as their own.

The Supreme Court of India, after delving into the factual matrix and having satisfied itself of the steps taken by KKNPP to address safety and environment concerns, upheld the decision of the Madras High Court. The decision also included compensatory jurisprudence by providing ex-ante piecemeal benefits to the victims or

people exposed to risk through CSR activities. The Court directed for the formation of a compensatory framework to safeguard concerns regarding displacement and harm to the livelihood even though these matters were not directly dealt with. However, it is pertinent to note that CSR is completely at the discretion of the project developer and the direction of the Court is therefore reduced to mere advice or suggestion to KKNPP as an expression of equitable solution. The Court also observed that there was need to gain the support of those opposing the Project by striking an equilibrium. This strategy enabled the Court to create a glimmer of credibility for the developmental activities which would be akin to rights being replaced with the promise of charity. However, calling it charity would be wrong as it is the responsibility of the State to secure all the rights of individuals majorly the basic right of livelihood and socio-economic justice for all.

The Court based on the idea of public interest on restrictive pragmatic grounds stating that “...since the production of nuclear energy is of extreme importance for the economic growth of our country, alleviate poverty, generate employment, etc. While setting up a project of this nature, we have to have an overall view of larger public interest rather than smaller violation of right to life guaranteed under Article 21 of the Constitution.” Further it was also held “Public money running into crores and crores of rupees have already been spent for the development, control and use of

atomic energy for the welfare of the people and hence, we have to put up with such 'minor inconveniences', 'minor radiological detriments' and 'minor environmental detriments' in our lives because the benefits we reap from KKNPP are enormous..."

The justification provided by the Court was economic in nature and its decision was based on the grounds that the nation was in the grip of an energy crisis and nuclear plants were established only in the larger interest of the public. The focus was more on the justifications than on the apprehensions and the resistance of the public was undermined terming it as an uninformed reaction to change. This was apparent as the Court upheld that *"....apprehension, however legitimate it may be, cannot override the justification of the project. Nobody on this earth can predict what would happen in the future and to a larger extent we have to leave it to destiny. But once the justification test is satisfied, the apprehension test is bound to fail. Apprehension is something we anticipate with anxiety or fear, a fearful anticipation, which may vary from person to person."*

As regards environmental safety the Court had framed the following question: *"whether NPCIL, the project proponent, while establishing KKNPP, had obtained all necessary environmental clearance and other requisite permission from all the authorities?"*

The Court found the environmental safeguards to be up to the mark relying solely on the reports of government agencies. Facts in support of the petitioners were negated. For instance, the EIA notification 1994 was said to be 'not applicable' to the KNPP as the environmental seal of approval for the project was given in 1989. Further, as per the EAC recommendations in 2008 and 2009 that environmental clearance for Units 3 & 4 respectively had to be obtained. Keeping in view all the public concerns of safety, livelihood, radiation, effect on marine life, displacements and rehabilitation the clearances were granted by the EAC. The Apex Court was of the thought that as the expert bodies were satisfied with the measures adopted there was no scope for judicial review. However, it did make directions for continuous and more stringent monitoring by the regulatory authorities.

Justice Dipak Mishra's concurring opinion highlighted the paramount importance of public safety going so far as to identify it as the main concern of the Court, particularly in the wake of calamities like the Bhopal Gas Tragedy. Though the Court did not order closure of the project since substantial compliance was proven and accepted, his decision exhorted all regulatory authorities and NPCIL to enhance security and ensure a safe environment for public safety. His opinion, however, was not dismissive of the apprehensions of danger.

The judgement of the Supreme Court of India upheld the decision of the Madras High Court with the difference that it did not consider the appellants to be acting in private interest. The public nature of the petitions was recognized in the light of genuine concerns of the public including safety of life and environment. Further, the Court urged the State to withdraw all the criminal cases filed against the protesters who were found to be acting in public interest and reiterated the necessity to educate the public and keep them aware of the developments in the nation.

7.6.2 EXCAVATING JUDICIAL NARRATIVES ON THE CITIZENS, EXPERTISE AND EQUITABLE OUTCOMES

The *Kudankulam Case* was filed as a PIL. It is often observed that the motives of litigants of a PIL are questioned on the grounds of not holding genuine interest of the public in mind. While the PIL was admitted in the Madras High Court and subsequently the appeal was also accepted in the Supreme Court the respondents repeatedly made statements on the genuineness of the motives of the petitioners. This was the case despite both Courts having found significant public interest in the pleas to be allowed. The credentials and intentions of the petitioners were questioned in the arguments of the respondents and in an attempt to intimidate the petitioners several defamatory allegations were levied.

The judgement of the Madras High Court fails to discuss whether there was any evidence tabled to support or deny such allegations. However, the Supreme Court recognized the nature of the petitions to be in the interest of the public emphasizing the need to secure the

rights of the petitioners through a compensatory framework, stringent monitoring of safety measures and withdrawal of criminal cases against the protesters.

It is important to give thought to the question of why such underhand methods of defamation and character assassination were resorted to. It appears to be an effort to delegitimize the legal challenge posed by the petitioners. It is surprising to note that these allegations were also used by the Madras High Court in its judgement to draw support to decisions made in favor of the respondents. Such use of allegations in the text of a judgement is well against public interest when the very petition is admitted as a PIL.

The Supreme Court, on the other hand, while upholding the decision of the Madras High Court carefully stood in contrast and recognized the need to protect public interest while stating that, *“True it is, the prayer is for the total closure of the plant and the Court has not acceded to the said prayer but his noble effort is appreciated to put forth the grievance of the local people and the necessity of the adequate safety measures as is perceived.”* (G. Sundarrajan v. Union of India, 2013). Further the Court also made a plea to the district administration that *“endeavor should be made to withdraw all the criminal cases filed against the agitators so that peace and normalcy be restored at Kudankulam”*. The protests were, thus, regarded as genuine concerns by the Court and the petitioners were also recognized as acting solely in the public interest without any bias or personal motive.

It should be noted that both the Courts held different stands on how the public is to be viewed. The public was first viewed as

uninformed and irrational though it was later recognized that their concerns were genuine. Reliance was placed on the State to fulfill the role of a parent as inferred from the repeated weightage given to the role of education and to public knowledge and awareness in handling the protests. Both the Courts agreed on the necessity of the nuclear facilities and the establishment to make the local population aware of the advantages to be had from nuclear technology and recognize and resolve their apprehensions concerning safety by interactive involvement in drills to gain their confidence.

The promotion of nuclear energy and the establishment of a nuclear regime was regarded as crucial. The voice of the State was taken as the only legitimate representation of the larger good of society. Keeping in view the large public investments made and money poured into developing the nuclear industry it was concluded that it was in the interest of the public that the project continue and the country reap its benefits. It is presumed that the Court was led by the understanding of Bentham's ideal of legislators, "as those enlightened beings, who were elected to represent their idea of what is in the public interest for their electorate and legislate accordingly, rather than directly represent their electorate's interests" (Bentham, Jeremy, 1789).

The pros and cons of arguably hazardous technologies, such as nuclear energy, genuinely poses a threat to the public and it cannot be said that the public is not capable of raising its voice just because their representatives are the true protectors of their interests. Protests usually start at the ground level as the persons at the grassroots are the ones most affected. Given the ruling of the Court, we may say that risk faced by a smaller faction of people can be justified by the

larger good to the rest of the population. The potential risk was further sought to be underplayed by usage of descriptive such as fear, apprehension, anxiety, ignorance etc. and therefore proven to be subjective and not a public hazard that should be legitimately addressed.

Though the concerns on potential risk were marginalized, the need to secure the life, health, livelihood, development, education and environment of the protesters was recognized. The Supreme Court laid stress on the CSR activities to be undertaken stating that “*CSR is much more when the proponent sets up NPPs, thermal power plants, since every step taken for generation of energy from such hazardous substances, is bound to have some impact on human beings and environment, even though it is marginal.....this Court in Banwasi Seva Ashram v. State of UP allowed the construction of NPP in a displaced forest area, but ordered inter alia that every family of forest dwellers be provided with a housing plot of specific dimensions elsewhere, that health, education, sanitation services and the like, be provided there, as part of CSR.*”

Though the two-pronged ruling of the Court seemed contradictory, the Supreme Court carefully indicated the equitable solution to the argument in question. The nature of the activity is hazardous but in response it proposed corporate philanthropy to mitigate the burden and ensure that basic requirements of the local population is effectively delivered. This, however, appears as an unjust compromise only justified by larger public interest.

Both, the Madras High Court and the Supreme Court reiterated the principle of judicial deference by relying on sealed reports by

government agencies rather than independent opinions thereby denying the petitioners the opportunity to challenge expert findings. The results of State actions were protected from judicial scrutiny and the Court acted within its sphere and did its best to secure the safety of the protesters. It is pertinent to note that the CAG and the Parliament's PAC had censured this and recommended an independent nuclear regulator in India (Lok Sabha Secretariat, 2013). Blindly relying on experts who themselves are "interested parties" compromises the ability of the Court as an open platform, where, as a general rule all witnesses can be cross-examined by all litigants. This is all the more necessary in cases where the potential for environmental hazard is disputed (Argentina v. Uruguay, 2010).

The blanket protection to the State created an imbalance between litigants especially when the narratives of risk and public safety were at cross-purposes. In the long run the judgement will have a dampening effect on litigants who act in the public interest but fail due to the supremacy of the State.

It is important at this point to highlight the judicial cartography resorted to by the Court in this case and the role it played in shaping public debate on nuclear energy. Judicial cartography is the combination of selection and framing of issues, attention to or discarding of material facts, choice of resources for evidence and the judicial interpretation of all the material put together. The duty of the judiciary is to uphold equitable justice that leads to an equitable outcome through true representation of all materials and evidence provided. In the case of KKNPP the denial of space to question and re-assessment of the reports tarnished the principles of equity and justice. Though the Court's decision in favor of the respondents may

hold good while directing the State to ensure security it has left the question open as to whether the State will indeed act in accordance with these directions. What may very well be needed is judicial scrutiny to ensure that the State is acting in accordance with the law and the directions of the Court.

Interestingly, the law provides codes for professional ethics in the best interest of the client. In an adversarial trial process in common law nations advocates argue while the judge acts as a neutral arbitrator. The judgement is pronounced basis interpretations, precedents and principles. However, a PIL challenges the existing rules of locus standi by allowing anyone to approach the court to seek social justice. With the steep rise in such cases the courts have started to use their discretion in admitting PILs which are marked by certain attributes (Bhuwania, A., 2016). These being:

- Due to non-compliance of judgements and orders the courts have resorted to the writ of mandamus, time and again, to keep cases pending to allow itself to oversee enforcement of orders. An example is the *Godavarman Case* (T. N. Godavarman Thirumulkpad v. Union of India & Ors., 1996) - one the longest running environment case in the world – went on for two decades in the Supreme Court.
- The inherent powers of the court under Article 32 allow admission of a PIL. The scope of Article 32 has been expanded to the extent that legal issues in addition to the ones identified by the petitioner may also be included. For instance in the *Godavarman Case*, the petitioner, Mr. T N Godavarman, sought intervention from the court to check the felling of timber in the State of Tamil Nadu. This was found to be a national issue not restricted to one state and

the court included aspects of forest governance in the petition. This subsequently led to the enactment of a legislation, viz., the CAFMPA Act, 2016. In another case, a recent PIL filed by Mr. Harsh Mander on the condition of detention centers for foreigners in the State of Assam the scope of the petition was enlarged to address the deportation of illegal migrants as well (Venkatesan, V., 2019).

- The role of Amicus Curiae in a PIL holds significant importance in the Supreme Court. Its findings support the Court in framing and selection of issues, analysis of evidence, material facts to be considered and suggests equitable outcomes.
- The court attempts to strike a balance with an equitable outcome keeping in view the needs of both parties. In the case of KKNPP the Court had to pave the way for the rights and protection of the petitioners while being bound by the authority and responsibility of the State to act for the larger good of the public. As a restituted form of justice the Court relied on monetary benefits through a compensatory framework for victims and strengthened security in the form of reparative relief to the ones who suffer at the cost of the nuclear plant.

The above attributes sometimes act against the petitioners and undermine their concerns, often silencing their voice as it happened in the *Kudankulam* case. The Madras High Court regarded the allegations made by the petitioners as not in the interest of the public at large. In a PIL the court is a sui generis entity with enormous discretionary powers and limited procedural rules of conduct. Hence, abuse of this discretion is not surprising. This misrepresentation of the intents of the petitioners in this case could

be regarded as a derogatory ascription by the Court on the litigants which denied them their basic rights and reduced them to mere subjects of the State under the garb of state paternalism. The judiciary, however, is the highest temple of justice and knowledge. It is its duty to secure the rights of the litigants in all its means building a strong moral case against misrepresentation. The Court at the *de minimum* must seek to undertake this duty and review all the materials and adjudicate based on the origin of the PIL and all the factors leading up to it. It should be noted that the concept of a PIL developed and evolved in India as a tool of relief in order to make justice more accessible to the common man. The aim was to strengthen the principles of social justice and to allow victims to secure their rights through self-representation in the court of law.

7.6.3 INTERNATIONAL SUPPLIES, CIVIL NUCLEAR LIABILITY AND KUDANKULAM

Another aspect adding to the already convoluted public debate around the Kudankulam project is the question of civil nuclear liability. In case of an accident at Kudankulam with offsite implications it has been established that Russia would not hold any responsibility towards the victims or for damages incurred. Even though the agreement signed between India and Russia is not available in the public domain it is reported that Russia has indemnity from the nuclear liability, if any. Hence, this implies that all the liability shall fall on the Indian Government for any accident arising from Kudankulam Sites I & II. A similar situation is expected for Site III & IV as well. Apart from the specifics that may exist in the Kudankulam case, the international practice with respect to civil nuclear liability has been operative since 1998 with India,

China and Russia being notable exceptions. Three types of laws exist under this liability, viz.,

- (a) Domestic nuclear liability laws
- (b) International civil liability instruments under OECD
- (c) International civil liability instruments under IAEA

The domestic laws were first formulated in USA and Canada and gradually adopted by other nations. Today, India too is governed by a proper legal framework with legislations for the purpose of laying down the civil nuclear liability principles. The Paris Convention on Third Party Liability in the Field of Nuclear Energy, 1960 is a widely acclaimed international instrument established under the auspices of the Organization for Economic Co-operation and Development (OECD). The Vienna Convention on Civil Liability for Nuclear Damage of 1963 established under the auspices of the IAEA is another important convention. While the OECD treaty is confined regionally the IAEA treaty is global in its application. These instruments have a common thread and are divided into two parts:

- (i) The absolute liability of the operator and
- (ii) The liability channeled exclusively to the operator

China's framework on this issue was put in place in the 1980s only when the French raised the issue of third-party nuclear liability in case of accidents, during the negotiations with Daya Bay Nuclear Project. The matter was taken up by the State Council and an Official Reply Relating to Third-Party Liability (Guo Han, 1986, No. 44) was made. This acts as a legal regulation and the basis of third-party nuclear liability issues in China and was inspired by the

international conventions and in tandem with them laid down the following three principles:

- (i) The Principle of Absolute and Exclusive Liability;
- (ii) The Principle of Limited Liability; and
- (iii) Rights of Recourse

In respect of “Rights of Recourse” it also stated that “*if nuclear damage is caused by a third party’s intentional act or omission, the liable operator only will have a right of recourse against that third party.*”

Russia faced a similar situation in the 1980s, when in the absence of any nuclear liability law, Germany, during negotiations for a nuclear cooperation agreement, demanded an assurance to exempt German suppliers from any liability arising out of any accident at any of the facilities where German supplies were used. This was in line with international conventions and Russia provided the assurance in the form of an undertaking. However, the undertaking had a special clause which stated that “*the exemption clause will not apply once the legislation has entered into force in the Russian Federation, which is in accordance with the provisions of the Vienna Convention and the Joint Protocol on the Application of the Vienna and Paris Conventions, or with the provisions of another relevant international legal instrument to which Germany is a party.*” Russia signed the Vienna Convention in 1996 but ratified it only in May 2005 and therefore had to provide a similar undertaking to France in 2000.

In 1998 Rusatom, a Russian company started negotiations with NPCIL for the supply of two Russian VVER reactors for Kudankulam. This was of immense importance to India since Russia

agreed to assist India in its nuclear program disregarding the opposition by NSG. India had no nuclear liability laws at that time and the issue of nuclear liability was raised by the Russians and they demanded an undertaking similar to the one given by them to Germany. This was part of the supplementary agreement of 1998 where it was assured that Russia was exempt from any civil nuclear liability.

The NSG was amended in 1998 but it continued to prohibit India and China to be nuclear suppliers and also restricted any form of nuclear commerce for India. The traditional suppliers of uranium also withdrew from the list of suppliers to India and India was hard-pressed to procure fuel for the Tarapur I & II reactors. Despite strong opposition from the NSG community Russia came to India's rescue. The only country willing to trade with India was Russia and therefore India was compelled to agree to all the conditions laid down by Russia. The Government of India agreed to exempt Russia from all nuclear liability keeping in view the national interest and in consideration of various factors.

Gradually, trade, commerce and agreements to give effect to the target of the nuclear energy program gave shape to the legal framework in India as well. In July 2005 a nuclear deal was signed with the USA and by 2007 the entry of India into the NSG was under process when a Memorandum of Intent on development and cooperation in construction of additional NPP units at the Kudankulam site and on construction of Russian designed NPPs at new sites in India was signed between India and Russia (Balachandran, Dr. G, 2012). The agreement was formalized in September 2008 when NSG finally lifted the restrictions on India. It

is pertinent to note that even by 2008 India lacked a specific nuclear legislation. The first draft of “Civil Liability for Nuclear Damage Bill 2009” was formulated in June 2009. Russia demanded the undertakings as earlier for additional units and the same was agreed to by India.

7.7 CONCLUSION

Learnings from Kudankulam have shown that the relationship gap between the public and the State with respect to its developmental ventures can be reduced drastically with better understanding of public safety vis-à-vis need for development, the State’s responsibility to cater to public needs and better communication between the State and its citizens. As in this case, an essential measure to ensure public support would have been planned and meaningful campaigns to disseminate knowledge and information. It was of paramount importance to convey to the public the safety measures taken so that the misgivings were laid to rest. Additionally, independent reports, surveys and investigations carried out by regulatory bodies contribute significantly in understanding the true status of such power plants and these reports must be available for public consumption. It is the democratic right of the public to question the actions of the State as it is the responsibility of the State to convince the public. In fact, transparency in this regard would satisfy the section of the public that doubts the operations. However, it is the responsibility of the public also to realize the necessity of the State’s actions to deal with the economic and energy crisis and not to blindly oppose every move without understanding the need and implications of such projects. Protests without a base would only delay the nation in achieving its goals and further push it under the weight of poverty and underdevelopment.

The Indian political leadership and a large section of the scientific community have been stressing on the urgent need to construct nuclear plants to cater to the country's rapidly growing need for development and therefore energy. The compelling need to strike the right balance between public safety and security and preserving the environment on the one hand with growth of power plants on the other. It is also important to identify who the actual risk bearers are and who are the risk-benefactors of this technology. In the ongoing dispute of KKNPP, the urban middle class and elites profiteering from the project appear to be the risk-benefactors while the protestors, largely comprised of local fishermen, workers, NGO activists, guardians of the environment etc., the risk bearers.

Ulrich Beck, a German sociologist, suggested that science provides the tools to comprehend the risks based on the risk in society. He argued that risk-generators are typically at the top of the social hierarchy while the risk-bearers are at the bottom. This mirrors the class-based society where capital is replaced with risk, both of which are distributed unequally. Similar to capital it is now risk that is fast encompassing science and political risks (Petryana, Adriana, 2011). The tensions between the State, stakeholders of the project and the local risk-bearers is clearly a result of lack of transparency. The standoff faced over the Kudankulam project is a lesson on not to proceed when constructing a NPP. The mechanisms adopted brought to the surface the worst fears of the public and the steps taken for speedy execution were in vain as the process was stalled repeatedly by massive protests. The KKNPP failed to fully address the concerns of the risk-bearers and did not give them an opportunity to table their views and opinions.

In addition to public awareness and participation, compliance with conditions, limits and restrictions laid down by international regimes or

domestic laws is a must. However, in the instant case this was not fool-proof as the AERB is a regulatory body and does not govern independently. The Supreme Court also, in its judgement, merely directed the AERB and DAE to enhance and maintain safety functions in accordance with guidelines of IAEA without addressing the fact the both AERB and DAE are State-run organizations and the possibility of their opinions being biased is high. Dr. E A S Sarma, former Secretary of State, in an open letter to the Prime Minister expressed his concern regarding the techno-commercial agreement between India and EDF-Areva citing the safety issues persistently dogging the EDF reactors. He backed his stand giving examples of Finland and France, both of whom have shut down their reactors built by EDF due to safety concerns.

The judgement of the Apex Court also demands analysis and scrutiny with respect to the issues left unaddressed. The most crucial one was the plea for an independent assessment for the power plant to review the standards maintained and clearances obtained. However, the Court focused on the environmental violations vis-à-vis the Environmental Impact Assessment and Coastal Regulation Zone notifications and thereby limited the security issues to be dealt by AERB and DAE who were then directed to act in terms of the provisions of IAEA. The State secrecy was maintained where the safety issues were concerned and the Court reiterated that it was the task of experts. The contentions against the environmental hazards were accepted by the Court basis reports and claims of the government run agencies. The concerns of the protesters were termed as “policy issue” that therefore denied the litigants the space to question the technical aspects of the project. It was the understanding of the Court that it is the State that alone has a right to pursue technological changes for the public good and that these changes are for the public good. However, the stand held by the Court can be argued to be falling beyond the realm of democratic society which empowers its

citizens to question all of the State's actions. This serves as an unhappy precedent where litigation in the interest of the general good is substantially removed from public debate, discourse, deliberation and response. The State has time and again failed in securing the needs of the public and denial to access information further violates the principles of democracy.

The argument to consider the alternate sources of energy which are equally clean and reliable should be taken into account when NPPs are debated. Other sources can be explored also when, in over 60 years of industrialization and modernization, nuclear energy has reached a contribution of merely 3% of the total electricity generation (Sharma, Shankar, 2015). On the other hand, in India, renewable sources of energy provide more than 10% of the total electricity and some large hydro projects deliver up to 22%. On the flip side electricity generation from hydro and wind projects do also pose an equal risk of devastation to the environment. Therefore, phasing out nuclear plants to completely rely on hydro and wind is also not feasible – especially keeping the rapidly growing demand for energy. It is also pertinent to mention that efficiency of transmission and distribution (T&D) plays an important role. In India, for every 100 MW of electricity generated almost 40% is lost due to inefficient T&D (Niti Aayog G.O.I., 2020) while in industrialized nations like Sweden, the T&D loss is less than 7%. If India were to reach an efficiency of 90% the country would require only 60 power plants of the size of Kudankulam thereby greatly reducing investment and risks.

Apart from the risks of radiations, two more issues surfaced from the project at Kudankulam, viz. the issue of water supply which had to be drawn from the Pecheiparai Reservoir and the issue of waste discharge at significantly heated water into the sea/ ocean. The project promised better water supply schemes thereby raising concerns amongst the farmers on the potential

shortage of water. This caused the farming community to stand solidly with the anti-nuclear movement with the conviction that the issue of water would get further degraded on account of KKNPP (Srikant, Patibandla, 2009). On the other hand, the local fishermen anticipated a loss of livelihood – the main occupation of the locals being fishing – as the waste discharged into the sea was highly dangerous for marine life including fish.

The Kudankulam anti-nuclear movement is not a flash-in-the-pan movement of protestors. It is a coming together of different groups from varied backgrounds and geographies who have stood strong since the very inception of the project in 1980. They are not ignorant and include educated gentry like professors, teachers, lawyers, activists, media personnel including journalists, fishermen and farmers who understand the threat of being displaced and losing their livelihood and youth who are members of various political parties.

The project has been perceived as a centralized power generating system that is alienating the locals while threatening their source of livelihood and their lives itself, while imposing the State's action on them leaving no scope for participation. The anti-nuclear movement seeks a decentralized system that will conserve the environment while ensuring that the voice of the people is heard and their safety and security is protected. In a manner of speaking, it can be regarded as the Gandhian notion of development that is less moved by technological advancements and more by the people at the grassroot level.

We can conclude that the local population at Kudankulam regarded the development process of the nation as a degradation process for themselves. The State conveniently ignored the issues of displacement and the cascading effects on livelihood and continued to stress on justifications of the

effectiveness of the plant to overcome safety concerns. Till the time the movement was small and non-violent the State made attempts to educate the public on the development plans. However, once the transition to a violent protest was made stringent measures were used by the State to kill the movement under the garb of maintaining law and order.

According to D L Sheth, political scientist and philosopher, such movements reflect the failure of institutional politics (Sheth, D. L. 2006). A major aspect of institutional politics is development and the movement standing against the development in the context of displacement and harming livelihood is a failure in itself. The only way to successfully execute a developmental plan is to bring people within the umbrella of development rather than alienating them. The Kudankulam project, even now, must truly protect the rights of the people and ensure alternative livelihood and development plan for them otherwise the progress it has achieved will be nullified by the loss incurred.

CHAPTER VIII

CONCLUSION AND SUGGESTIONS

This doctrinal research has been undertaken with the objective of studying and critically analyzing the present legislation that regulates the construction and operation of NPPs in India, the provisions that would be required to be added to allow privatization of these power plants and to do an analytical study of India's nuclear energy generation regime in the context of international conventions and protocols. Also included in this research is a study of these conventions, particularly related to liability and compensation, vis-à-vis private operators together with a comparative analysis with the nuclear law regime in the USA.

The research proceeds on the hypothesis that privatization of the manufacture and operations of the NPPs would reduce the energy deficit and progress towards energy reserve and intends to shed light on solutions to following related and critical questions:

- Whether privatization of nuclear power plants would reduce India's nuclear deficit?
- Whether amendments in the Atomic Energy Act, 1962 are required to bring in privatization of nuclear power plants?
- Whether there are insurance companies available across the globe to provide such policies that cover the liabilities for nuclear damage?

- If privatization is permitted, whether private operators are ready to take the liabilities which the GOI has taken as a signatory to International Conventions?
- Whether the regulatory regime in India with respect to the nuclear power generation is in conformation with the international requirement? and
- Whether the Indian Civil Liability Act, 2010 would be sufficient to deal with the issues arising from the privatization of NPPs?

During the course of the research and study there have been certain findings that have shed some light on possible solutions to these questions.

8.1 RESEARCH FINDINGS

- Rising incomes and substantially improved standards of living have made India the 3rd largest consumer of energy after China and the USA. The country has the largest and fastest urbanization in the world and with the rapidly growing economy and massive push to industrialization, it is expected that India will be the most populous country with the highest energy demand by 2040. The percentage of annual increase in energy demand is expected to touch double digits in 2024. In 2022-23, the electricity consumption in India is expected to be 7 – 9% higher than the previous year with the highest usage by Industry, followed by domestic and then agricultural. (CERC, 2023, Report on Short-Term Power Market in India, 2022 – 23),
- In tandem with the phenomenal increase in energy demand the supply of power has also increased over the years. However, India is still in the deficit as far as energy goes.

- In 2022-23 it is estimated that the major source of energy supplied is thermal as can be seen by the table below:

Energy Source	Estimated Share
Thermal Energy	74.25%
Hydro Power	9.98%
Solar Energy	6.28%
Wind Energy	4.42%
Nuclear Energy	2.82%
Bio Power	0.99%
Small Hydro Power	0.69%
Other Sources	0.41%
Bhutan Imports	0.16%
Total	100.00%

(CERC, 2023, Report on Short-Term Power Market in India, 2022 – 23)

Given the pressures of climate change, environmental concerns, and India's global commitments to reach net-zero emissions by 2070 it is evident that the dependence on fossil fuels is much too high.

- Nuclear energy which has a miniscule share in the total supply of energy is a clean and green source of power that supports reduction of emissions, which in turn supports India's climate change commitments. Given its advantages, nuclear energy must play a major role in the energy mix of the country together with other renewables thereby reducing extreme dependency on fossil fuels.
- Even the courts in India have encouraged the growth of nuclear energy while maintaining a balance with environmental conservation.
- Over the years India has indigenously developed nuclear technologies and reasonably self-reliant. This has been partly due to the nuclear

apartheid that India faced post its peaceful nuclear testing and credited to the research and development of highly competent scientists.

- The nuclear program that India follows is a three-stage program which is most suited to the country as thorium is an abundant resource in India. The first stage involves the PHWR, the second involves FBR and the third involves Advanced Heavy Water Reactors.
- The nuclear power industry, however, is a closely guarded one with the Central Government having a monopoly on all its aspects. It is the policy maker, regulator, controller, operator, and supplier.
- During the liberalization, privatization, and globalization reforms of 1991 the roadmap for disinvesting of public sector undertakings was drawn up. Significantly, since then it has been seen that most industries opened their doors to the private sector, but the nuclear power industry is still a state-controlled industry with no private participation.
- The NSG has now waived off the signing of the NPT Treaty for India due to its non-proliferation policy and India is now a member of the NSG.
- Post the removal of the nuclear apartheid, India entered into several collaboration agreements, the most significant one being the Indo-US Agreement, following which there were changes in the government policy for the nuclear industry.
- The compensatory law was enacted, and India signed the CSC Convention.

- The regulatory regime is now in place in terms of safety, security, and monitoring by the IAEA.
- As per international norms, India has formed an insurance pool to provide cover for payouts in case there is a nuclear incident.

8.2 PROOF OF HYPOTHESIS

The hypothesis is proved because undisputedly if the atomic laws in India are amended to allow private participation in the nuclear power sector, there will be an increase in power generation and upgradation of infrastructure at the same time India would be fulfilling its obligations towards minimizing the climate change phenomena under the Minimum Determined Program. This would substantially reduce energy deficit and most definitely, India would progress towards an energy reserve. However, the privatization of power generation through NPPs will not totally eliminate the energy deficit and may not provide complete energy security because of the rapid rising growth in population which is already estimated at 1.42 billion which would be another area of study as energy is directly proportionate to the demand on the population of an emerging nation like India.

8.3 SUGGESTIONS WITH REFERENCE TO LEGISLATION

There is thus a necessity to amend the various provisions under the AEA 1962 and the CLND, 2010 to permit the privatization of NPPs in India.

Suggested changes could be made in the following sections:

The Atomic Energy Act, 1962

Section 2 (bb)	“Government Company” means a company in which (i) not less than fifty one percent of the paid-up share capital is held by the Central Government; or (ii) the whole of the paid-up share capital is held by one or more of the companies specified in sub-clause (i) and which, by its articles of association, empowers the Central Government to constitute and reconstitute its Board of Directors; <i>Suggested that Section 2 – Definitions and interpretation should include the definition of non-government companies including private companies and foreign companies</i>
Section 3(a)	General Powers of the Central Government – Subject to the provisions of this Act, the Central Government shall have the power – to produce, develop, use and dispose of atomic energy either by itself or through any authority or corporation established by it or a government company and carry out research into any matters connected therewith;
Section 3(b)	to manufacture or otherwise produce any prescribed or radioactive substance and any articles which, in its opinion are, or are likely to be, required for, or in connection with, the production, development or use of atomic energy or such research as aforesaid and to dispose of such prescribed or radioactive substance or any articles manufactured or otherwise produced;
Section 3(bb)	(i) to buy or otherwise acquire, store and transport any prescribed or radioactive substance or any articles which in its opinion are, or are likely to be, required for, or in connection with, the production, development or use of atomic energy; and (ii) to dispose of such prescribed or radioactive substance or any articles bought or otherwise acquired by it,

	either by itself or through any authority or corporation established by it, or a Government company;
Section 3(c)	to declare as “restricted information” any information not so far published or otherwise made public relating to – (i) the location, quality and quantity of prescribed substances and transactions for their acquisition, whether by purchase or otherwise, or disposal, whether by sale or otherwise; (ii) the processing of prescribed substances and the extraction or production of fissile materials from them; (iii) the theory, design, construction and operation of plants for the treatment and production of any of the prescribed substances and for the separation of isotopes; (iv) the theory, design, construction and operation of nuclear reactors; (v) research and technological work on materials and processes involved in or derived from items (i) to (iv)
Section 3(d)	to declare as “prohibited area” any area or premises where work including research, design or development is carried on in respect of the production, treatment, use, application or disposal of atomic energy or of any prescribed substance;
Section 3(e)	to provide for control over radioactive substances or radiation generating plant in order to – (i) prevent radiation hazards; (ii) secure public safety and safety of persons handling radioactive substances or radiation generation plant; and (iii) ensure safe disposal of radioactive wastes;
Section 3(f)	to provide for the production and supply of electricity from atomic energy and for taking measures conducive to such production and supply and for all matters incidental thereto; either by itself or through any authority or corporation established by it or a Government company; and
Section 3(g)	to do all such things (including the erection of buildings and execution of works and the working of minerals) as the Central Government considers necessary or expedient for the exercise of the foregoing powers.
	<i>Suggested that Section 3 be amended to include reference to non-government or privately held companies</i>
Section 23	Administration of Factories Act, 1948 –

	Notwithstanding anything contained in the Factories Act, 1948 (65 of 1948) the authority to administer the said Act and to do all things for the enforcement of its provisions, including the appointment of inspecting staff and the making of rules thereunder, shall vest in the Central Government in relation to any factory owned by the Central Government or any authority or corporation established by it or a Government company and engaged in carrying out the purposes of this Act.
	<i>Suggested that the provisions of this section should be made applicable to the private sector NPPs with an independent regulator</i>

The Civil Liability for Nuclear Damage Act, 2010

Section 1(4)	It applies only to the nuclear installation owned or controlled by the Central Government either by itself or through any authority or corporation established by it or a Government company. <i>Explanation.</i>--For the purposes of this sub-section, "Government company" shall have the same meaning as assigned to it in clause (bb) of sub-section (1) of section 2 of the Atomic Energy Act, 1962 (33 of 1962). <i>Suggested that the Act be amended to include the private sector also such that applicability of the Act extends to private sector in addition to the Government controlled entities.</i>
Section 2 (j)	“nuclear installation” means – (A) any nuclear reactor other than one with which a means of transport is equipped for use as a source of power, whether for propulsion thereof or for any other purpose; (B) any facility using nuclear fuel for the production of nuclear material, or any facility for the processing of nuclear material, including re-processing of irradiated nuclear fuel; and (C) any facility where nuclear material is stored (other than storage incidental to the carriage of such material). “Explanation” – For the purpose of this clause, several nuclear installations of one operator which are located at the same site shall be considered as a single nuclear installation;

	<i>Suggested that Clause (C) of this section be made applicable to the private sector also</i>
Section 2(m)	“operator”, in relation to a nuclear installation, means the Central Government or any authority or corporation established by it or a Government company who has been granted a licence pursuant to the Atomic Energy Act, 1962 (33 of 1962) for the operation of that installation <i>Suggested that the definition of “operator” should be expanded to include the private sector which should then be permitted by the Central Government to operate a nuclear power plant.</i>

8.4 SUGGESTIONS WITH REFERENCE TO INSURANCE POOL

Creating the Indian Nuclear Insurance Pool, the 27th of its kind in the world, was a major step forward in India’s civil nuclear power program. However, nearly eight years after its formation the INIP is still floundering and has not been able to achieve its full potential. There are certain observations and suggestions that could ensure a proper cover for nuclear liability for plant operators and suppliers alike.

- The INIP should be strengthened with additional funds so as to be equal to the liability as prescribed by the CLND Act.
- An awareness and promotional program be undertaken to persuade insurance companies to join the Pool, including those in the private sector. In addition to the influx of funds this will help in making the risk transfer mechanism more durable.
- A similar program for garnering reinsurance support, whether domestic or international, would go a long way in providing a sense of security to the INIP and the insured parties while at the same time spreading the risk.
- An in-depth analysis and review of the liability caps vis-à-vis the plant operators and suppliers, keeping international best practices and standards as the benchmark, should be conducted periodically to ensure that there is adequate cover for potential nuclear damages.

- Since insurance cover should ideally be for the private sector it is extremely important that the effectuality of the regulatory bodies be enhanced, and their reach expanded to effectively cover enforcement. This will ensure that the nuclear plants in India abide by the safety and security standards and guidelines, both domestic and international.
- The ambiguity and uncertainties in the legal provisions should be removed and clear guidelines should be laid out on the applicability and implementation of the CLND Act, 2010.
- The nuclear industry in India should look to collaborations with other countries and proactively get involved in international level forums and groups. This will allow India to dip into the world knowledge data bank, share and in return take advantage of best practices and technical proficiency etc. allowing for efficiently tackling nuclear issues.
- Lastly, a determined effort has to be made to promote public awareness of INIP in addition to nuclear liability, safety, and emergency plans. A level of transparency would greatly raise the trust and confidence levels of the general public.

8.5 SUGGESTIONS WITH REFERENCE TO INFRASTRUCTURE

Infrastructure development in the nuclear energy sector is a complicated undertaking which mandates synergetic efforts from policy makers, regulators, industry participants and stakeholders and the public at large. India's road to nuclear self-sufficiency has been distinguished by remarkable achievements and significant challenges. However, by addressing the regulatory, technological, and socio-economic stumbling blocks and by espousing innovation and collaboration, India can achieve its

goal of a robust and sustainable nuclear energy infrastructure that contributes to development of the nation and energy security for it.

Policy reforms are essential to smoothen the regulatory procedures and processes. The liability aspects must be relooked at so as not to deter private entrants into this sector. Tax or other incentives should be offered which in turn will encourage investments and funding and therefore facilitate development of infrastructure.

India has now entered into several strategic partnerships. These should be worked on to take advantage of transfer of the latest technologies, enter into joint ventures for research and development and for shoring up capacity including knowledge-based capacity such as best practices and safety standards amongst other things. It is important to have a continued commitment towards innovation, research, and development in order to develop an infrastructure that is cost-effective, uses the most advanced technologies and provides a sustainable nuclear solution. In addition to collaborations for supply of fuel and technology it is important that the government proactively supports cooperation and collusion between Indian scientists and research institutions with their counterparts in other countries.

8.6 OTHER SUGGESTIONS

Reviewing and periodic assessment of India's nuclear program and policies is important keeping in mind the country's short term and long-term strategy. However, though commitments have been made and assurances given India is still teetering on the edge of an energy crisis. Given the shortage of natural resources including inadequate hydrocarbon reserves combined with the slow pace of reforms, poor distribution systems and sub-standard infrastructure has contributed greatly to India's energy insecurity. Keeping politics and strategy aside, it is all-important that the entire power

and energy sector be restructured and looking at India's obligation with regard to environmental hazards and climate change, clean and renewable energy sources need to be tapped. Large investments and greater operational efficiency are the need of the hour and this can be achieved only by opening the doors to private players. This will need a paradigm shift from a monopoly of supply to a judicious mix of private and public participation if India is to achieve efficiency in all aspects of the energy sector. In fact, the delay in operationalizing the various nuclear agreements may well be a boon in disguise for India if the Government puts the time to good use by reviewing and amending, as required, the domestic legal regime which should include a cost-benefit analysis and an energy balance sheet.

In conclusion, India's nuclear policy needs to be developed further. The shroud of secrecy over India's nuclear energy program at least must be lifted and, in its place, put in a system and regulatory regime that is autonomous, transparent and accountable. To ensure development and distribution of cleaner, more efficient energy that effectively addresses the environmental implications of energy consumption it is imperative to have a nuclear policy that clearly broadcasts civilian and peaceful use of nuclear energy.

It is the author's contention that the above findings and suggestions would assist the policy makers in making the nuclear policy more realistic rather than idealistic. This will, no doubt, result in an energy secure India emerging as a leader in clean, green and environment friendly policies and technologies.

Robust planning is required in the areas of legislation, regulatory licensing and on setting up national outfits to support privatization. To achieve this goal the Government has to organize infrastructure in areas such as fuel fabrication, fuel storage, reprocessing, waste management, waste repositories and decommissioning. Till now, many of these aspects have been treated as in-house problems of the DAE. It goes without saying that

many of these aspects are anchored to BARC, the national nuclear research center. The implications of separating the civil and strategic nuclear activities in the country is necessitated by the recent international agreements. There is need for a relook the nuclear program and deep-dive analyses and the necessary structural changes would have to be made.

As per the AEA, 1962 all nuclear operations are under the control of government/ government agencies/ companies. With the opening up of atomic energy operations and plans on capacity enhancement of nuclear power, it is desirable to induct private sector units in areas such as NPP erection and operation. Similar to other industries, e.g., telecommunications, this will bring in a healthy competition. However, while encouraging a competitive market there are other aspects of this industry that require careful planning and structuring which includes waste management, safeguards and safety, fuel storage etc. Increase of nuclear electricity capacity as visualized by the Government will require changes in the legal regime to allow for private participation in this sector, which in turn will bring in efficiency in operations and healthy competition essential for growth. Given the nature of the nuclear sector and its strategic implications there are several aspects of privatization of the sector that need to be looked into such as the need for regulation and also a certain operational control in areas such as the back end of the fuel cycle, radiation safety and safeguards. Unlike the USA, where private participation is allowed in the front and back end of nuclear power production, it may be prudent for India to allow private entry only in nuclear power reactor installations and operations for the present. The back-end operations could be through a national Government supported network the cost of which can be shared by the nuclear reactor operators. If, however, India follows the same path as the USA where installation and operation is given to the private sector the domestic laws will have to be amended accordingly. A

comparative study of the relevant legislations of the USA and India would provide a good basis and guide for amendments in the Indian AEA.

According to the provisions of the India's AEA, 1962 the GOI has a monopoly of every aspect of the nuclear sector including mining for uranium and thorium, setting up nuclear plants, generating power etc. This monopoly is held by the Government directly or indirectly through government companies. As per the present Act, "*Centre has the exclusive power to produce, develop, use and dispose of atomic energy either by itself or through any authority or corporation established by it or a government company and carry out research into any matters connected therewith.*" So far as the Government has the monopoly of this sector all issues were dealt with internally and by citing secrecy clauses the Government could do away with transparency even for instances where the operations were civilian in nature. However, a combination of globalization, liberalization, international agreements and the proposed private participation in the nuclear sector transparency will become essential and the issues will become global and trans-boundary. To incorporate this evolution of the nuclear sector the present legislation needs to be amended and updated or new and relevant legislation needs to be enacted. At present, the norm appears to be issuance of circulars and notifications as and when issues arise or the requirement is felt and in the absence of the necessary legislation and a long-term vision this will lead to more complications in the short run. An apt illustration of this practice of perceived solutions leading to further problems is the Gazette notification issued by the DAE in 2006 with respect to nuclear exports. On account of the Indo-USA agreement discussions that were taking place it was felt that such a notification was necessary wherein the term 'nuclear explosives' is specifically mentioned. However, the existing Act has no reference or mention to such a term. Therefore, to avoid inconsistencies and contradictions it is imperative that the Act be amended accordingly.

Despite the obvious need for amendment of the Act of 1962, the Government has been sending out mixed signals. Some purported suggestions are that no change is required and all such advocates of 'no change' must keep in mind that should the Government keep status quo and retain monopoly of the sector with only possible sub-contracts for the private sector, the financial and operational burden on the PSUs and other governmental agencies will be tremendous. Given the pressure there is bound to be inefficiency, cost overruns, lack of accountability and transparency resulting in India losing all the gains it has accumulated in this sector.

These issues amongst others should be studied and considered by expert groups and/ or committees and through the public forum. As this process will be time-consuming and will invariably have to go through several levels and channels it is important that the same be commenced immediately. Despite there being some dissenting voices, it bodes well for the sector that by and large that several in the government circles have taken cognizance of the situation.

One of the key issues that is taking prominence as the argument in favor of privatization becomes more stringent is the matter of compensation for nuclear damage and therefore the underwriting or insurance cover for such damage. While the Government has the monopoly, it is de-facto the sole underwriter for all nuclear related damages. However, the scenario post-entry of the private sector will be completely different and before such entry the matter of damages and rehabilitation must be looked into and resolved within the provisions of the CLND Act. It is pertinent to note here how this aspect of privatization is dealt with under the USA nuclear regime. While private operators are licensed to run nuclear power stations and even back-end operations they do not have the responsibility for the safety of waste storage and associated risks. However, the USA regulations mandate that

the facility that generates the waste is responsible for reimbursement of the cost of disposal of such waste.

Another significant point to be kept in mind is IPR and patent rights which have no mention in India's Atomic Energy Act. According to experts, if India goes forward with export of its own reactors IPR issues of breach and/or violation would arise for matters such as zirconium for cladding of fuel or the fact that certain components used in domestic production are or seem to be copies of components that are under worldwide patents.

In 1998 India pierced the veil and made its entry into the global Nuclear Club which fact needs to be reflected in its Atomic Energy Act. This need was underlined during the Indo-US negotiations for nuclear cooperation when the USA, which was supported by its own Atomic Energy Act, quickly amended the same to allow for nuclear commerce with India, the same could not be said for the domestic legislation in India. This resulted in a sensitive political situation for India where making such amendments was appearing to be difficult but it was argued that this was a situation that should have been anticipated and pre-empted. It is appropriate to note that though international agreements have recognized India as a nuclear weapon state the AEA, 1962 has no mention of the same. In fact, the preamble of the Act of 1962 states that the application of atomic energy shall be used solely for 'peaceful purposes' and for the 'welfare of the people of India and for other peaceful purposes.'

The AERB was constituted in 1987 and was made responsible for all regulatory and safety functions for all nuclear activities in India. However, after 1998 when India was recognized as a nuclear weapon state the need was felt to segregate the control of safety in the nuclear sector between strategic and civilian applications. To this end, the regulatory control for all BARC facilities was handed over to a separate council outside of the purview of AERB. The BARC Safety Council was established in 2000 vide

a notification issued by the DAE but this separation of responsibility has not been incorporated in the 1962 Act. Ambiguity on the bifurcation, which is basis institution rather than application, could potentially result in disastrous consequences as operations of an operating plant under BARC would be outside the purview of AERB even if the application is civilian in nature, viz., medical or industrial. In the current regime all back-end operational responsibilities of the nuclear fuel cycle are with BARC. Given the commitments given by India under the Indo-US nuclear cooperation agreement this separation will have to be done. However, currently several aspects of the nuclear fuel cycle have evolved interdependently and even though India has discussed and committed to separate civil and strategic facilities it is a task easier said than done. For example, the technical application of waste management, including spent fuel, rests with BARC and questions have been raised on how this would be managed by private operators post separation. Another concern is radiation safety the responsibility of which is with BARC for all nuclear operations. This creates problems if the current setup remains as BARC has been kept out of the purview of safeguards. This supports the arguments of advocates of changes and enhancements in India's regulatory set up to include regulatory compliance inspections, safety evaluations etc. for the proposed privately operated facilities.

Therefore, issues such as back-end of the nuclear fuel cycle, radiation safety, regulatory surveillance, fuel production et al are firmly intertwined with BARC facilities and these would have to be assessed and reorganized when the Indian nuclear power sector reaches its commercial peak.

In this respect, the US AEA of 1954 as amended over the years is far more comprehensive and its provisions cover practically all the aspects discussed above. All regulatory powers of the NRC flow from this Act as also all the safety aspects of defense related applications and the authority of the Defense Nuclear Facilities Safety Board which has been constituted under

the Act and has under its purview all the defense nuclear facilities that are beyond the authority of the NRC.

As opposed to the US Atomic Energy Act of 1954 the Indian Act of 1962 is framed differently. As it was enacted in the early stages of India's nuclear program it gives the Government sweeping powers in activities such as mining, control of radioactive materials and generally in all matters of the nuclear sector. However, it deals with power production and safety in a very brief manner stating that the Government be authorized to do the "*needful to achieve the objectives including safety of operations.*" Regulatory requirements do not find a mention under this Act. Various establishments and setups are formed via government notifications that are issued as and when the need is felt. The Government has derived this power under Article 27 of the Act and it is with this authority and means that the AERB, which is comparable to the NRC, was formed in 1987. Similarly the BARC Safety Council which is somewhat analogous to the Defense Safety Board in the USA, was set up in 2000, the difference being that the BARC Safety Council has under its purview all BARC facilities that includes civilian facilities run by it in the public domain.

There are other areas that are unclear such as transportation of radioactive materials connected with nuclear operations which have implications in the event of an accident. The US Act has incorporated provisions to deal with such emergencies, however, the same are not clearly incorporated in the Indian Atomic Energy Act of 1962.

All of the aforementioned issues require for a comprehensive review and thereafter appropriate action in the form of amendments to the Act of 1962. To conclude, the critical legislative aspects that need focus are regulatory control, safety, safeguards, national level infrastructure for fuel fabrication, fuel storage, reprocessing, waste management, decommissioning and compliances. Proactive and detailed planning is the need of the hour given

that India is in the process of signing several international agreements for the nuclear sector in order to take a quantum leap in this field.

8.7 CONCLUSION AND SUMMARY

Due to the rapidly growing population and subsequent rising demand of energy in India, it has become necessary for sustainability and growth to increase the quantum of electricity generated in tandem with ensuring that the growth does not cause environmental hazards for the future generations. This becomes more important for a country like India which is heavily dependent on fossil fuels and import of resources. Amidst rising energy costs, and a growing population that is consuming increasingly more and more energy, controlling the growth-rate of population and increasing energy efficiency has now come forth as one of the key solutions as an answer to reduction of carbon emissions. Machineries that can perform better with lower power are, therefore, crucial to overcoming today's greatest challenges.

Over the past few decades with disinvestments by the Indian Government, several industries in the essential services sector have been privatized. Where earlier the Government was actively involved now private participation is permitted, bringing with it efficiency in operations and cost reductions resulting in significant contribution to the country's economy. Based on this, it is therefore concluded that subject to the regulation of the security and safety aspects, the introduction of the private players into nuclear power generation would be crucial to fostering development and growth of the energy sector.

There is a significant gap and ambiguity between the legal ideal of nuclear law as it evolved in India since independence, the current actual practice and what is economically beneficial for the country. The nuclear policy of

India was, until a few years ago, a closely guarded secret as it was intricately connected with the National Security Strategy of the Government. The concept of the country's nuclear policy, in its entirety, is so elusive that no one can say for certain that a particular policy is the best and an infallible one. In the unpredictable international stage of power politics, the unimaginable is known to occur rendering carefully thought through and well-planned policies redundant. However, India's nuclear policy has kept pace with the changing Governments though with a common thread of attaining self-sufficiency in the country's nuclear program and development of these programs indigenously.

Since attaining independence, India has formulated a host of policies and legislative frameworks to regulate and develop indigenous nuclear reactors, reprocessing facilities, uranium mining and fuel fabrication, effective waste management and civil liability laws.

While India has consistently strived towards attaining self-sufficiency as far as its civil nuclear program is concerned, it has, at the same time, always promoted and supported the values of peaceful co-existence and non-alignment and this is reflected in its foreign policy. The present times are a period of strategic uncertainty which has ramifications from the perspective of the country's national security. The tentative path of nuclear technology that India adopted was shaped, equally, by a utopian vision of a nuclear-free world and persistent pressure from scientists to develop the technology for peaceful purposes.

More recently, the matter of India's membership to the NSG has been the focus of public and media attention, particularly post the signing of the Indo-US Nuclear Agreement in 2008. For the present Government, this is the single most crucial priority as far as its foreign policy goes. The

importance attached to the membership is clear by the efforts the Government is making to garner support from other countries in its bid for membership to the NSG. Unconditional support has come in from countries like Switzerland and Mexico, who had initially opposed the unique waiver made in favor of India by the NSG in 2008. USA which has the most influence, while supporting India, is unwilling to go the extra mile on India's account, unlike its actions in 2008. Added to this, India has been unable to sway smaller states that are holding fast to their moral high-ground while it can be safely assumed that China, who is part of the consensus seeking group, will veto India's membership unless Pakistan is also made a member at the same time. The strategic aspects of NSG membership in South Asia can neither be ignored nor underestimated. The stand taken by China is that membership of the NPT is a pre-requisite to becoming a member of the NSG and in the event only India is made a member of the NSG it would result in an imbalance in nuclear arms in South Asia on account of India's nuclear weaponization program. However, these contentions do not stand scrutiny. The NSG was established post the peaceful nuclear explosion of Pokhran I conducted by India in 1974. The intent and purpose of the NSG, which is not an international treaty, is very different from that of the NPT. It is a group comprising *"nuclear supplier countries that seeks to contribute to non-proliferation of nuclear weapons through implementation of two sets of guidelines for nuclear exports and nuclear-related exports"*.

As India seeks to expand its nuclear power generation in a big way and make an entry into world trade in the coming years, it is keen to become a member of the NSG and other regimes such as the Wassenaar Agreement and the Australia Group that control nuclear trade. Although in 2008, a unique waiver was granted to India, it did not open significant avenues for civilian nuclear trade with other countries. India did, indeed, enter into

agreements with several countries including Russia, France, UK, USA, Kazakhstan, Australia and Japan. However, obtaining a membership of the NSG will provide a legal basis for India's civil nuclear program, greater certainty and, therefore, increased confidence for other countries that are investing billions of dollars in nuclear power projects in India. A happy by-product would be India's increased clout and international political, economic, military and strategic profile. This is in tandem with India's desire to enter the elite group of international rule-creating nations rather than being relegated to a rule-adhering one. To achieve all of this it is imperative that India gets due recognition and an undisputed place in the NSG inner circle.

On 7 June 2016, India became a member of the MTCR of which all 34 members are also members of the NSG, hence assuring India of their support in its bid for membership to the NSG.

India has persistently stuck to its program of developing nuclear energy for civilian use since independence. The development and security of the nation is directly proportional to energy self-sufficiency and this has been recognized by the Government at the policy making level. The matter has become critically important as it is apparent that India is not energy secure and its vulnerability in this regard will impact the foreign policy and have domestic repercussions as well. In order to continue to fuel the growing economy and to take its Human Development Index to the highest level, India requires substantial amount of energy and that too on a large scale. Given the scale of energy demand India is a huge enough energy market that can have a major escalatory effect on prices of fossil fuels. In the scenario of fast depleting fossil fuels combined with the relentless increase in global warming and subsequent effect on the environment, nuclear

energy can be seen as a light at the end of the tunnel as far as solutions to the energy crisis is concerned in the near future.

Nuclear power is a clean and green source of energy that generates electricity sans emissions of pollutants associated with fossil fuels, which includes greenhouse gases like carbon dioxide and methane, harmful particulates, nitrogen dioxide and Sulphur dioxide. Reduction of these pollutants will go a long way in alleviating global warming while simultaneously mitigating environmental hazards such as acid rain and reducing innumerable deaths caused by the combustion of fossil fuels. In addition, the energy contribution of nuclear power is almost 20 percent and the share of hazardous waste generated about 5 percent. It is pertinent to note that newer designs for nuclear plants could substantially reduce or eliminate the hazardous waste issue.

Given the above advantages, exploiting the Indian energy market through nuclear energy appears to be an attractive proposition. It must also be kept in perspective that India has graduated in terms of nuclear technology and that geo-politically it was not a threat to nuclear vendors around the world. On the contrary, there is an opportunity to enhance the strategic balance in the region and for the frontrunners of nuclear technology to enter a lucrative market.

Though India's nuclear program is evolving continuously it is severely constrained by the shortage of natural uranium. On the flip side, India has large reserves of thorium, considered to be the world's highest. Thorium is naturally occurring and non-fissile and can be converted into fissile material or more specifically uranium-233. Indian scientists made the usage of thorium in place of uranium as the foundation on which India's civil nuclear program was based, keeping in mind that the program had to be one that

minimized the requirement of natural uranium. In 1954, Dr. Homi Bhabha, the father of India's nuclear program, conceptualized a 3-stage progression for the program. The primary objective was to take advantage of the abundant thorium reserves which could be used in reactors that were specially designed to use U-233 produced from Th-232 or irradiated thorium.

In terms of technology India made significant progress, however, it fell short in terms of meeting the country's expectations or demand for energy, which were critical in the context of a fast-growing economy and population. The reactors in operation at the time were achieving new performance benchmarks but shortage of uranium supply led to loss of capacity. Though mining work commenced at several locations there was an inevitable crisis in the supply chain in the short-term. This was the post-independence era when general public euphoria was at a peak accompanied by a certain satisfaction and pride that the country was technologically ready leading to a high level of expectation on the quantum and availability of electricity. It was therefore disappointing that shortage of uranium was the weak link in the path to development. As a stop gap solution, the best that could be done was to reconfigure the operative reactors to function at a lower level of power with increased uranium use-efficiency. This was done so that NPCIL could sustain itself until the supply issues were resolved and alternate and long-term solutions could be pursued. To bridge the demand-supply gap for energy the only recourse was to look at imports. The indigenous uranium was low grade and the reserves insufficient to sustain the nuclear program if the estimated power requirements as projected were to be maintained. Of all the import options available, the import of uranium appeared to have the most advantages. The quantity involved was small and uranium was essential to the 3-stage domestic nuclear program if India was to pursue the uranium recycling in breeder reactors. It was thought to

initially import a limited quantity which would resolve long-term energy needs by leveraging indigenous fuel recycle capability without further import of energy. It was with this intention that the Indian Government opened dialogue for civil nuclear cooperation with the United States.

The agreement with USA has been crucial to paving the way to receiving the latest technology for modernization of the nuclear trade establishment in India while at the same time allowing India access to the much-needed natural uranium for its PHWRs. The cooperation between the two countries was mutually beneficial as the possibility of meeting India's growing energy demands became a reality while the US Government fulfilled its desire to enter into a new strategic partnership with India. For India, it was the end of decades of nuclear apartheid allowing import of latest technologies from around the world. Though mutual doubt and skepticism was the prelude to signing the agreement, the positive conclusion was seen world over as a highly significant and important development for India given the backdrop of energy requirements, international diplomacy and politics. The door opened for India to move onto the global platform as a major power and be instrumental in shaping the architecture of Asian security.

The US Government acknowledged India as a responsible nuclear state with advanced technology and an impeccable non-proliferation record thereby blurring the reality that it could not be recognized as a *de jure* nuclear weapon state. India was given the same benefits as other acknowledged nuclear weapon states and became the world's de-facto sixth nuclear power. There was subsequently an inflow of fuel and technology resulting in enhancement of India's capacity to develop and build an indigenous military program without signing the NPT. However, there are certain conditions and obligations that prohibit India from testing of any type of

nuclear weapon and if not fulfilled all future supplies and technology transfers will cease. In addition, the Indian nuclear program would have to be bifurcated into military and civilian programs and 14 reactors were to be placed under the IAEA safeguards. This implies that starting with 65 percent of Indian reactors and possibly leading up to 90 percent, would be open for IAEA inspections to ensure that nuclear material and technology was not diverted or misused as opposed to the earlier 9 percent. India also committed to continuing its unilateral moratorium on nuclear testing, to negotiating a multilateral FMCO Treaty and to non-transfer of sensitive technology to other countries.

While meeting the overall economic and strategic objectives of both India and the USA, the cooperation agreement served to bury differences and opened a new era of strategic partnership between the two countries. There is close cooperation now between the world's two largest democracies in several crucial areas, such as, the fight against terrorism, prevention of nuclear proliferation, environment protection, energy security, protecting vital sea lanes, promoting democracy etc. As is evident the fallout of such cooperation would only be positive and the impact on the global system beneficial.

In its bid to augment its nuclear energy program, India is proactively pursuing international cooperation and to this end, has signed agreements and MoUs with Argentina, Canada, France, Kazakhstan, Magnolia, Russia, UK, USA, South Korea, Australia and Japan.

A key indication of energy security is confirmation from energy-importing countries of regular imports of energy. An effective foreign policy sustains this and at the same time finds new trade partners and friendly supporters to

enhance supply of resources and ensure that India's position on the global stage.

Another important aspect to be scrutinized in India's nuclear progress are the challenges vis-à-vis international nuclear liability regimes. Nuclear incidents of Three Mile Island, Chernobyl and Fukushima combined with the emergence of new powers, e.g., India, China and UAE, in the international nuclear energy sector have compelled a relook at the existing nuclear liability principles. It is clear that for the growth of nuclear energy that is publicly acceptable the establishment of a robust nuclear liability regime is essential. Due to the shortcomings of a global liability regime that addresses the needs for increased compensation and expansion of the geographical scope for claims on an international level, some states are incorporating the concept of liability in their domestic legislations independent from the global liability regime. India too, with its aggressive plan for growth of nuclear energy, in 2010 enacted the Civil Liability for Nuclear Damage Act which challenges several facets of the principles laid down internationally for nuclear liability. This was an effort to give effect to the international obligations that the country had assumed. This was despite the fact that India is not a party to any multilateral liability convention or regime. However, it is felt that this Act may not be consistent with Indian laws.

The CLND fixes the liability for compensating the victims of a nuclear incident or accident on the operator of the concerned nuclear facility and has kept the cap of such compensation at \$ 10 billion. Any damages over and above this amount are the responsibility of the Government up to 300 million SDR. Since the Atomic Energy Commission has the monopoly of nuclear operations in India this provision is applicable to the GOI only. From the Indian standpoint, the law makers tried to ensure that the spirit of

both, national jurisprudence and the international principles of nuclear liability were adhered to. However, critics of this legislation argue that it is inconsistent with the international principles of nuclear liability and popularly it is section 17(b) of the impugned Act that comes into their focus. According to the said section, the operator has the right to recourse, meaning thereby, that the operator can seek compensation from the suppliers or employees of the suppliers. This covers supply of defective equipment, material or sub-standard services. This is in stark contrast with the international principles contained in the Convention on Supplementary Compensation for Nuclear Damage where the responsibility is fixed on the operator who, however, has no right to recourse. The Indian Government faced flak and criticism for the strict nature of this law which, it was argued, would put the Indian industry at a disadvantage compared to the multinationals.

The reverberations of the nuclear incident at Fukushima Daiichi in 2011 left the world shell-shocked and safety concerns became paramount. India too, reacted proactively and committees were established to study safety concerns with respect to India's nuclear facilities and program. However, the reported trauma, damages and loss of property and life of the disaster caused an environment of apprehension and fear which resulted in the environmentalists and local populace condemning establishment of new NPPs with Kudankulam being the prime example.

There are other considerations and requirements in the global context that are also found to be inadequate, the prime example being transparency. The Government's earlier stand of complete secrecy with respect to nuclear energy will have to shift to accommodate the inevitable entry of private players in the civil nuclear energy sector. It is strongly argued that the key to development in this sector is to allow the civil nuclear energy sector to

enter the public domain while, due to security reasons, the military and strategic aspects continue under the blanket of secrecy. India is firmly on the path to becoming a strong and influential world leader and now has increased transparency on the domestic legal front. The time has come for the same standard to be applied to the nuclear energy sector and for clarity in legal terms.

Perhaps the most significant change that needs to be made to the nuclear regime in India is that the state-centric approach will have to cease. The 1962 Act vests the Central Government with the sole authority and responsibility of development of nuclear energy in India. Subsequent amendments in 1987 did allow for public sector participation, however, there was no significant loosening of the Government's hold as all the public sector units concerned are government-owned. In reality, the Government continues to have complete monopoly on production, development, usage and disposal of atomic energy, mining, acquisition, manufacturing, identification and disposal of uranium and other radioactive sources needed for generation of nuclear energy. In fact, as per law if any radioactive source is discovered the same will automatically vest with the Government who also has the power to "*prohibit the manufacture, possession, use, transfer by sale or otherwise, export and import and in an emergency, transport and disposal of any radioactive substance*". There is also reference to measures to be taken for those who indulge in any of these activities without informing the Central Government.

Under these circumstances and given the nature of this industry in its present avatar, the present Atomic Energy Act, 1962 (as amended) is not sufficient for privatization of NPPs in India. While India has accepted and is accommodating the obligations flowing out the international agreements and MoUs it has entered into, the need of the hour is to put in a domestic

legal regime that is more responsive, viable and effective and which provides for active participation of the private sector. It should be such that nuclear commerce, including the possibility of private participation, is facilitated without any compromise as far as safety, environment and liability is concerned thereby addressing public concerns. A well-structured legal framework is important to meet these requirements. This study has detailed and critiqued the existing regulatory regime in India and the author is concluding the study with suggestions for amendments to the existing framework to reach a possible improved regulatory regime including nuclear liability.

It must not be taken that any suggestions of amendments and revisions to the 1962 Act in any way reduce the significance of the Act. On the contrary, these amendments would strengthen the legislation while curtailing the policy space in the nuclear energy sector. Clarity and legal articulation will allow for recourse to appropriate remedial measures. If the policy measures and formulations are not backed by such legal articulation the efficacy of the execution of obligations arising out of agreements in this regard would be considered to be inadequate. On the domestic front too, this will provide a measure of assurance and predictability to those engaging in nuclear commerce.

In fact, as India begins a new era by ending its 'nuclear isolation' all basic legal and regulatory requirements will have to be revisited. There are several self-serving reasons for the world to end India's nuclear apartheid, the primary one being economic. For instance, the Indo-US Agreement has given the US nuclear industry a new lease of life. India's growing global influence combined with the relatively higher growth rate of its economy make it an attractive market proposition. Experts have also argued that by ending India's isolation in the nuclear energy sector it can be indirectly

linked to the global non-proliferation regime through various bilateral arrangements. Irrespective of the reason for entering into Agreements stressing on energy security and for ending the isolation it cannot be ignored that there is a bigger agenda relating to several global issues. If India has legal clarity and articulation in the nuclear energy sector the delinking of the related international obligations from global agendas of certain stated interests can be facilitated.

There are indications that the Government is attempting to bring about changes in its legal and regulatory framework with respect to the atomic energy sector. A thorough revision and amendments, as suggested, if made to the 1962 Act, would transform the existing legislation into something more binding and definitive.

The Indian Nuclear Civil Liability Law of 2010 would also provide the compensatory provisions for private NPPs in India in case of a nuclear incident or accident.

The special status accorded by the NSG and Cooperation Agreement with USA opened the door for India to negotiate a Safeguards Agreement with the IAEA. Thereafter the country's civil nuclear facilities were separated from its military facilities and the former were put subject to IAEA safeguards and inspections. India also conceded that a unilateral moratorium would be placed on nuclear testing and there would be no nuclear proliferation. It is pertinent to note here that India has never been accused of nuclear proliferation. In exchange of these concessions from India, the NSG comprising 45 countries granted a special waiver to India allowing it to enter into the world nuclear trade. This development was special and one of its kind and successfully ended India's nuclear apartheid and made it the only country in the world with nuclear weapons which is

allowed to carry on nuclear trade and commerce despite not being a party to the NPT.

At present though India has 23 reactors in operation and there are about 8 reactors in various stages of construction. The Government has also given administrative approval and financial sanction for an additional 12 nuclear power reactors of which 10 are indigenous. It is expected that by 2031 on progressive completion of these projects the nuclear capacity of India would reach 22480 MW. An ‘in-principle’ sanction has also been accorded for 5 new sites for locating NPPs in the future. With entry into the global arena India represents a tremendous business opportunity of several million dollars. With such an ambitious program India will need to focus on fast breeder reactors given the fact that the indigenous uranium reserves are severely limited and FBRs reduce the requirement for uranium by approximately two-thirds thus making these projects commercially viable.

While maintaining a focus on FBRs India is also looking at thorium-based reactors. The absence of large uranium reserves is more than compensated by reserves of thorium that account for 25% of the known thorium reserves in the world. India has been indigenously developing a nuclear fuel cycle based on thorium and the Government has projected meeting about 30% of the country’s electricity demand through thorium by 2050. This will reduce dependence on fossil fuels also and contribute to India’s efforts to combat climate change. Experts suggest that given the inherent safety, reactors of similar designs can be set up in cities as well. 62 such reactors are under development and are expected to be operational by 2025. India is the “*only country in the world with a detailed, funded, government-approved plan*” to focus on nuclear power based on thorium. The objective is to become energy-independent based on the ample thorium resources that are expected to successfully meet India’s economic ambitions.

In addition to amendments to the legal regime India will have to make substantial improvements in issues such as construction timelines of new reactors. Analysis of data from the IAEA shows that India takes more than twice the number of years to build and commission a nuclear reactor as compared to China.

While from a security perspective India nuclear energy program is not viewed as a significant risk by the world and civilian nuclear plants will not change that stance. However, it is extremely important that India enter into cooperation arrangements with Western states to enable building of safe and well-maintained nuclear facilities. Given the issues faced resulting from the Ukraine war, India has been described as a “*very crucial*” partner in supporting global energy security. The U.S. Assistant Secretary for Energy Resources, Geoffrey Pyatt, on his visit to India in February, 2023 observed that “*the business model of the civil nuclear industry is changing*” and that the U.S. Government had “*made a huge commitment to small and marginal reactors which could be particularly suitable to the Indian environment as well.*” Pyatt, who had earlier worked on the Indo-US Agreement opined that “*The U.S.-India energy and climate agenda is one of the most important that we have anywhere in the world*”. The objective of his visit to India was to strengthen the bilateral energy partnership between the two countries and to include the “Quad” projects within this partnership. “Quad” is a working group focused on cooperation of countries in the Indo-Pacific region and includes Japan and Australia.

Francois Le Scornet, Senior Consultant with Carbonexit Consulting, France observed that “*the Indian government is indeed pushing nuclear particularly strongly and the current plans may lead to tripling the nuclear power generation capacity in the next 10 years...despite this impressive*

increase in capacity, nuclear would only represent a small fraction of the Indian power mix and renewables are also expected to boom during the same period.”

However, India does not wish to diversify its energy sources and at the same time has aspirations to become a world leader in nuclear technology and to this end it must put to good use its expertise in fast reactors and thorium nuclear fuel cycle. India has already developed uniquely the latter and experts are certain that India is indeed progressing just so. It is envisaged that with foreign participants the Indian Government will insist on the transfer of technology and indigenously manufactured plant and equipment with a view that these joint ventures will cater to the domestic and global demand.

Nuclear commerce is already underway in India which is one of the fastest growing markets in the world and is an economy that is hungry for energy and presents massive opportunities. Post-waiver by the NSG, India has signed nuclear cooperation agreements for peaceful means with several countries.

All over the world the nuclear power industry is staggering and has not realized its potential, largely due to the NPP accidents, absence of strong policies and the general anti-nuclear perception. However, over the years it has been recognized that nuclear power is a clean and green source of energy and therefore an area of investment not only for governments but also for private players. However, for the nuclear industry to develop the safety of nuclear power generation facilities is of paramount importance. The industry worldwide is walking a tightrope balancing requirement to meet growing energy demands while addressing all issues on nuclear radiation and safety. Technological advances have paved the way for an

increase of safety in operations in the nuclear energy sector which is one of the key contributors to growth of the nuclear industry.

One of the leverages used by the advocates of the nuclear industry is environmental concern. Sufficient quantum and uninterrupted supply of energy is a given for an economy to grow. However, traditional sources of power, such as fossil fuels are also one of the largest contributors to emission of anthropogenic greenhouse gases resulting in damage to the environment and hazards of climate change. Nuclear energy is a source that can contribute accord reduction of these hazards and is being actively nurtured by several nations a viable option to satisfy the clamour for energy.

Post World War II there has always been an adverse public perception of the nuclear industry and in some ways, this will continue to remain a challenge. However, gradually there has been a shift in public opinion from 'anti' to 'pro-nuclear'. While this is a welcome shift for the nuclear industry, there are still some serious and justified concerns regarding proliferation of nuclear weapons, nuclear waste disposal, environmental damage and emission hazards.

Given the varied issues and concerns regarding the nuclear industry, international bodies are playing an increasingly important role in controlling and regulating the industry.

In addition to support of international regulatory bodies and international cooperation the domestic regime is equally, if not more, important in the development of the nuclear power industry. Key factors such as safety and the security for nuclear facilities depend heavily on the internal environment of a country and for the efficient working of the nuclear facilities, domestic challenges on all fronts, viz., safety, security, waste management and legal

must be addressed. It is vital for nuclear countries to ensure proper management of the domestic environment for nuclear facilities so that it is conducive for the development of the nuclear industry.

For India, especially post the Fukushima disaster, authorities are looking at fool-proof ways in which nuclear power assets can be secured. The lack of transparency in the regulatory regime has to be revisited and amended. Independent regulators would have to be appointed to ensure that guidelines and regulations are being followed. Concerns that are raised include the fact that AERB does not possess enough authority to oversee safety and security, lack of a comprehensive safety policy, absence of formal set of procedures for decommissioning nuclear reactors, poor inspection frequency, almost non-existent communication channels between the Government and the public etc.

The State has then to question itself in the light of security issues and the fundamental principle of state sovereignty, on the essential concepts that are found in certain components of the nuclear field, such as the positioning of the competent authority, the protection of information, transparency or the place of the operator. In the field of nuclear energy, especially under civil nuclear energy, it is imperative for the State to take into account multiple components when it considers setting up a nuclear facility. Preventing any risk of unacceptable consequences for the population and the environment is one of the fundamental that a State must take into consideration at all times. The main components to be kept in focus are nuclear safety, radiation protection and peaceful use of nuclear activities and nuclear safety including prevention of theft and misappropriation of nuclear material. India is a signatory to the CPPNM. These are security measures that have been put in place with a dual purpose of meeting international objectives while at the same time work as a guideline for the member States. Initially,

these form part of a national approach to protect the citizens and environment relating the same to the domestic context.

It is important for us to understand the risk acceptance associated with nuclear power. The establishment of a nuclear security regime will, therefore, be an essential part of managing threats and risks. As a rule, the lower the risk a State is prepared to accept, the higher is the level of protection and therefore higher the cost. The economies of nuclear power facilities must take this into account. Nuclear security is primarily a matter for the State as it imposes unusual constraints that may not be feasible for private players to handle. Even if the responsibility for nuclear safety, prevention of pollution and environmental risk is given to the operators the security aspect will always require resources from the State.

There are several challenges faced in operationalizing the civil nuclear agreements that India has entered into with other countries. Being a non-signatory to the NPT there is some hesitation in unqualified acceptance of India into the global non-proliferation regime on account of its nuclear weapons program and its tense relations with Pakistan. Although India was granted a unique waiver by the NSG some roadblocks remain that inhibit complete realization of its civil nuclear cooperation with the global nuclear community.

Another major challenge that India faces is the repercussions of the aftermath of the Bhopal Gas Tragedy of 1984. The ongoing debate on the domestic nuclear liability law was colored by the verdict of the Supreme Court on the gas tragedy and affected all such future discussions and debates. There was a virulent reverberations and popular demands to cease establishment of civil nuclear plants as the compensation provided for the victims of the gas tragedy was inadequate and miniscule compared to the

suffering endured. Even after several decades the question of liability remains a thorn in the side of all existing and future agreements for civil nuclear trade. The compatibility of India's domestic liability laws and the applicability of international legal frameworks in this regard is questionable and this is a challenge for India.

Intricately linked with the liability issue is the issue of safety of nuclear and non-nuclear materials. After the Fukushima disaster a major concern internationally is the threat of potential nuclear disasters in India. In fact, the concerns amongst others have filtered through to the domestic front also resulting in sometimes violent protests. Safety and security issues have become so paramount that some of the developed countries have started looking beyond nuclear energy. However, India does not have the luxury of choice given the pace of development and rapidly growing energy demands. The only option for India is to give the highest priority and importance to development of safety mechanisms, take a frontrunner position on this on the global nuclear playground. In addition to laying down guidelines, regulations and setting safety, security and compensation mechanisms, India must also alleviate public concerns of the domestic population and of other nuclear supplier countries as well. Clear articulation of civil nuclear engagement and security policies would go a long way in addressing the concerns regarding India's nuclear program.

For sustained growth, India needs to focus on domestic nuclear sector management including nuclear waste management, policies and implementation of measures to curb radiation emissions and their effects, awareness building and nuclear knowledge management. A safe nuclear power industry can well be the answer to India's problems on energy security, environmental damage, and hazards of climate change.

REFERENCE LIST

- Acts of Congress (1954). *The Atomic Energy Act of 1954 as Amended*. Public Law 83-703 (USA). (pp 23) Retrieved on May 24, 2021 from <https://www.nrc.gov/docs/ML1327/ML13274A489.pdf#page=23>
- Acts of Parliament (1948). *Atomic Energy Act, 1948 (Repealed)*. No. 29 (1948) India. Retrieved from http://www.commonlii.org/in/legis/cen/num_act/aea1948144/
- Acts of Parliament (1951). *The Industries (Development & Regulation) Act, 1951*. No. 65 (1951) India. Retrieved from https://www.indiacode.nic.in/bitstream/123456789/6826/1/a-1_-_industries_act1951.pdf
- Acts of Parliament (1962). *Atomic Energy Act, 1962*. No. 33 (1962) India. Retrieved from https://www.indiacode.nic.in/handle/123456789/1413?sam_handle=123456789/1362#:~:text=India%20Code%3A%20Atomic%20Energy%20Act%2C%201962&text=Long%20Title%3A,and%20for%20matters%20connected%20therewith.
- Acts of Parliament (2000). *The Central Road and Infrastructure Fund Act, 2000*. No. 54 (2000) India. Retrieved from <https://www.indiacode.nic.in/bitstream/123456789/1931/1/A2000-54.pdf>
- Acts of Parliament (2010). *Civil Liability for Nuclear Damage Act, 2010*. No. 38 (2010) India. Retrieved from https://www.indiacode.nic.in/handle/123456789/2084?view_type=search&sam_handle=123456789/1362
- Acts of Parliament (2016). *The Atomic Energy (Amendment) Act, 2015*. No. 5 (2016) India. Retrieved from https://www.barc.gov.in/about/ae_amend_2015_0116.pdf
- Ahluwalia, Montek Singh & Patel, Utkarsh (2021). Getting to Net Zero: An Approach for India at CoP-26. *Center for Social and Economic Progress*, September 29, 2021. Retrieved from <https://csep.org/working-paper/getting-to-net-zero-an-approach-for-india-at-cop-26/>
- Anindita v. Pranab Kumar Mukherjee (2017) SCC Online SC 71
- Anuradha Bhasin v. Union of India (2020). SCC Online SC 25
- Argentina v. Uruguay (2010), *Pulp Mills on the River Uruguay*, Judgement I.C.J. Reports 2010 (pp 14)

- Ashok Kumar Pandey v. State of West Bengal (2004), 3 SCC 349
- Asia Insurance Review (2015), *Asian News: India Nuclear Insurance Pool Launched*. July 2015. Retrieved from <https://www.asiainsurancereview.com/Magazine/ReadMagazineArticle?aid=36609>
- Atomic Energy Education Society (2002). *Atomic Energy Central School, Kudankulam – 627120*. Retrieved from <https://www.aecs-kudankulam.ac.in/english-about>
- Atomic Energy Regulatory Board (2005). *AERB Safety Guide*. No. AERB/NPP/SG/S-8, October 2005. Retrieved from <https://www.aerb.gov.in/storage/images/PDF/CodesGuides/NuclearFacility/NPPSiting/4.PDF>
- Balachandran, Dr. G. (2012). *Kudankulam Nuclear Power Plant and Civil Nuclear Liability*. Manohar Parrikar Institute for Defence Studies and Analyses, November 9, 2012. Retrieved from https://www.idsa.in/issuebrief/KudankulamNuclearPowerPlantandCivilNuclearLiability_BalachandranPatil_091112
- Balachandran, Manu (2016). *Narendra Modi explains how he runs India's foreign policy*. Quartz India June 28, 2016 (pp 9) Retrieved from <https://qz.com/india/717459/narendra-modi-explains-how-he-runs-indias-foreign-policy>
- Balasubramanian K. & Kumaran M. (2016). *Risk Analysis of Radiation Exposures and Sudden Meltdown Condition in Nuclear Power Plant in Kudankulam of Tamil Nadu*. American-Eurasian Journal of Scientific Research. 11(2) 2016 (pp 79-92). Retrieved from [https://idosi.org/aejsr/11\(2\)16/2.pdf](https://idosi.org/aejsr/11(2)16/2.pdf)
- Banerjee, Shoronya (2020). *Atomic Energy Act, 1962*. Retrieved from <https://blog.ipleaders.in/atomic-energy-act-1962/>
- Bentham, Jeremy (1789). *An Introduction to the Principles of Morals and Legislation*. Oxford:Blackwell, 1789
- Bharat Aluminium Company Limited, *About Us*. Retrieved from <https://www.balcoindia.com/about-us/about-company/>
- Bhuwania, A. (2016). *Courting the People: Public Interest Litigation in Post-Emergency India*. Cambridge University Press.21

- Bidwai, Praful (2014). *Between ambition and reality: India's Nuclear Power Programme*, Henrich Boell Foundation, April, 6, 2014. Retrieved from <https://in.boell.org/en/2014/04/07/between-ambition-and-reality-indias-nuclear-power-programme>
- Byjus. *Comprehensive Nuclear Test Ban Treaty – CTBT*. Retrieved from <https://byjus.com/free-ias-prep/comprehensive-nuclear-test-ban-treaty-ctbt/>
- Centre for Civil Society (2002). *India Before 1991: Stories of Life under the License Raj*. Retrieved from <https://indiabefore91.in>
- Centre for Civil Society (2002). *India Before 1991: Stories of Life under the License Raj – 1991: Economic Reforms*. Retrieved from <http://indiabefore91.in/1991-economic-reforms>
- Cellular Operators Association of India (COAI). *History of Cellular Telephony in India*. Retrieved from <http://www.coai.com/telephny.htm>
- Central Electricity Regulatory Commission (2023). *Report on Short-Term Power Market in India, 2022-23*. Retrieved from https://cercind.gov.in/2023/market_monitoring/Annual-2022-23/Chapter-I/AR-22-23_Chapter1.pdf)
- Chauhan, Chetan (2021). India an achieve net zero carbon emissions target by 2065-70:Study, *The Hindustan Times*, September 19, 2021. Retrieved from <https://www.hindustantimes.com/india-news/india-can-achieve-net-zero-carbon-emissions-target-by-2065-70-study-101632076022693.html>
- Civil Service India, *Privatisations and India Economy Growth (Analysis of the Private Sector with reference to the Indian economy)*. Retrieved from <https://www.civilserviceindia.com/current-affairs/articles/privatisation-and-india-economy-growth.html>
- Clarke, Roger & Valentin, Jack (2005). A History of the International Commission on Radiological Protection. *Health Physics*. June 2005-88(6) (pp 717-732)
- Comptroller Auditor General of India (2005) *Report 5 of 2005 (Commercial) – Telecom Sector Profile*. Retrieved from http://httpscag.gov.in/uploadsold_reportsunionunion_compliance2004_2005Commercial_AuditReport_No_5Telcom_sector_profile.pdf
- Constitution of India, 1950. Art. 38, 39, 48A and 51, Part IV,
- Cornell University Library, 2021, Retrieved from https://guides.library.cornell.edu/citing_us_gov_docs/lawsStatutes#:~:text=by%20the%20Office%20of%20Law,the%20text%20of%20the%20law.

- Dattaraj Nathuji Thaware v. State of Maharashtra & Ors. (2005) 1 SCC 590
- Devaprakash, J. (2016). *Visit KKNPP – an initiative for public understanding of nuclear power*. Current Science Vol 111 No. 2, July 25, 2016 (pp 246-247). Retrieved from <https://www.currentscience.ac.in/Volumes/111/02/0246.pdf>
- Diwan, Dr. Parag & Sarkar, Dr. A. N. (2008). *Energy Security* (pp 91-165). Delhi: Pentagon Press
- Dixit, Rekha (2020). Privatisation of Atomic Energy Sector: A Step in the Right Direction. *The Week Magazine*. May 17, 2020. Retrieved from <https://www.theweek.in/news/sci-tech/2020/05/17/privatisation-of-atomic-energy-sector-a-step-in-right-direction.html#:~:text=The%20Union%20government%27s%20move%20to,Research%20Centre%2C%20cannot%20alone%20cater.>
- Drishti IAS (2019), *India's Prospects as a Nuclear Power*. Drishti IAS: Science and Technology. April 15, 2019. Retrieved from <https://www.drishtiias.com/to-the-points/paper3/india-s-prospects-as-a-nuclear-power>
- Dulera, I. V. & Sharma, Avaneesh (2021). Shaping Third Stage of Indian Nuclear Power Programme With High Temperature Thorium Reactors. *Bhabha Atomic Research Centre Newsletter*. January – February Newsletter, (pp 22-26)
- Embassy of India, *Telecommunications*. Retrieved from <http://www.india-emb.org/Section12E/eng117b5.htm>
- Filipovic, Adnan (2006), Impact of Privatization on Economic Growth, *Undergraduate Economic Review*. Furman University. 2(1), Art. 7. Retrieved from <https://digitalcommons.iwu.edu/uer/vol2/iss1/7/>
- Financial Times (2004), *Prime Minister Dr. Manmohan Singh's interview*. November 5, 2004. Retrieved on February 26, 2023 from <https://www.mea.gov.in/interviews.htm?dtl/4554/prime+minister+dr+manmohan+singhs+interview+with+financial+times>
- Goodman, John B. & Loveman, Gary W. (1991) Does Privatization Serve the Public Interest? *Harvard Business Review*. 11-12 (1991). Retrieved from <https://hbr.org/1991/11/does-privatization-serve-the-public-interest>
- Government of India, Department of Atomic Energy (2016). *Launching of Nuclear Insurance Pool*. Press Release ID: 137276. Press Information Bureau, Government of India. March 3, 2016, Retrieved from <https://pib.gov.in/newsite/printrelease.aspx?relid=137276>

- Government of India, Department of Atomic Energy (2020). *Investment in Atomic Energy*. Press Release ID: 1655136. Press Information Bureau, Government of India. September 16, 2020. Retrieved from <https://pib.gov.in/PressReleasePage.aspx?PRID=1655136>
- Government of India, Department of Atomic Energy (2022) *Statement of Union Minister, Dr. Jitendra Singh: India taking steps for development of Small Modular Reactors (SMR)...* Press Release ID: 1879298. Press Information Bureau, Government of India. November 22, 2022. Retrieved from <https://www.pib.gov.in/PressReleasePage.aspx?PRID=1879298>
- Government of India, Ministry of Environment, Forest & Climate Change (2022). *India's Stand at COP-26*. Press Release ID: 1795071. Press Information Bureau, Government of India.. February 3, 2022. Retrieved from <https://pib.gov.in/PressReleasePage.aspx?PRID=1795071>
- Government of India, Ministry of External Affairs (2007). *On the visit of Prime Minister to Russia (11 – 12 November 2007)*. MEA Press Releases. November 6, 2007. Retrieved from <https://www.mea.gov.in/press-releases.htm?dtl/3535/On+the+visit+of+Prime+Minister+to+Russia+11+12+November+2007>
- Government of India, Ministry of Finance (2019), *Extract from Economic Survey 2018-19 presented by the Union Minister for Finance and Corporate Affairs, Smt. Nirmala Sitharaman in Parliament*. Press Release ID: 1577023. Press Information Bureau, Government of India. July 4, 2019, Retrieved from <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1577023>
- Government of India, Ministry of Power (2021). *Power Sector at a Glance ALL INDIA*. January 20, 2021. Retrieved from <https://powermin.gov.in/en/content/power-sector-glance-all-india>
- Government of India, Ministry of Statistics and Programme Implementation (2022). *Energy Statistics India -2022*. Retrieved from https://www.mospi.gov.in/sites/default/files/publication_reports/Energy_Statistics_22/Energy%20Statistics%20India%202022.pdf
- G. Sundarrajan v. Union of India, (2013), 6 SCC 620 (India Sup Ct. 2013). Retrieved from <https://main.sci.gov.in/judgment/judis/40374.pdf>
- Hill, Richard, Sabharwal KC, Dipen, McDougall KC, Andrew de Lotbiniere, Odyński, Kirsten & Stehlik, Vit (2021). *Why Small Modular Reactors Will Shape The Future of Nuclear Debate*. Retrieved from <https://www.whitecase.com/insight-our-thinking/why-small-modular-reactors-will-shape-future-nuclear-debate#article-content>

IASGyan, 2021, Nuclear Power, August 5, 2021, Retrieved from [https://www.iasgyan.in/daily-current-affairs/nuclear-power#:~:text=Today%2C%20India%20has%2023%20nuclear.in%20India%20\(1%2C382%20TWh\).](https://www.iasgyan.in/daily-current-affairs/nuclear-power#:~:text=Today%2C%20India%20has%2023%20nuclear.in%20India%20(1%2C382%20TWh).)

Intergovernmental Panel on Climate Change (2014) *AR5 Synthesis Report: Climate Change 2014*. Retrieved from <https://www.ipcc.ch/report/ar5/syr/>

Intergovernmental Panel on Climate Change (2018). *Special Report – Global Warming of 1.5°C*. 2018. Retrieved from <https://www.ipcc.ch/sr15/chapter/spm/>

Intergovernmental Panel on Climate Change (2021). *Sixth Assessment Report*. August 9, 2021. Retrieved from <https://www.ipcc.ch/assessment-report/ar6/>

Intergovernmental Panel on Climate Change (2021). *FAQ Chapter I*. Accessed and retrieved on October 7, 2021 from <https://www.ipcc.ch/sr15/faq/faq-chapter-1/>

International Atomic Energy Agency. *Codes of Conduct*. Retrieved from <https://www.iaea.org/topics/codes-of-conduct>

International Atomic Energy Agency. *What are Small Modular Reactors (SMRs)?* Last accessed on June 26, 2021. Retrieved from <https://www.iaea.org/newscenter/news/what-are-small-modular-reactors-smrs>

International Atomic Energy Agency (1963). *Vienna Convention on Civil Liability for Nuclear Damage*. Adopted on May 21, 1963. Last accessed on June 26, 2021. Retrieved from <https://www.iaea.org/topics/nuclear-liability-conventions/vienna-convention-on-civil-liability-for-nuclear-damage>

International Atomic Energy Agency (1968). *Treaty on the Non-Proliferation of Nuclear Weapons (NPT)*. Adopted on June 12, 1968. Last accessed on June 26, 2021. Retrieved from <https://www.iaea.org/publications/documents/treaties/npt>

International Atomic Energy Agency (1970). *Information Circular on Treaty on the Non-Proliferation of Nuclear Weapons*. April 22, 1970, INFCIRC140. Retrieved from <https://www.iaea.org/sites/default/files/publications/documents/infcircs/1970/infcirc140.pdf>

International Atomic Energy Agency (1997). *Convention on Supplementary Compensation for Nuclear Damage*. Signed on September 12, 1997. Last accessed on June 26, 2021. Retrieved from <https://www.iaea.org/topics/nuclear-liability-conventions/convention-supplementary-compensation-nuclear-damage>

- International Atomic Energy Agency (1998). *Information Circular on Convention on Supplementary Compensation for Nuclear Damage*. July 27, 1998, INFCIRC567. Retrieved from <https://www.iaea.org/sites/default/files/infcirc567.pdf>
- International Atomic Energy Agency (1998). *Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention*. Signed on September 21, 1998. Last accessed on June 26, 2021. Retrieved from <https://www.iaea.org/topics/nuclear-liability-conventions/joint-protocol-relating-to-application-of-vienna-convention-and-paris-convention>
- International Atomic Energy Agency (2010). *India signs Convention of Supplementary Compensation for Nuclear Damage*. October 27, 2010. Retrieved from <https://www.iaea.org/newscenter/news/india-signs-convention-supplementary-compensation-nuclear-damage>
- International Energy Agency (2019) *Global Energy and CO₂ Status Report*. March 2019. Retrieved from <https://www.iea.org/events/global-energy-co2-status-report>
- International Energy Agency (2021). *Global Energy Review, 2021 – Assessing the Effects of Economic Recoveries on Global Energy Demand and CO₂ Emissions in 2021*. April 2021. Retrieved from <https://www.iea.org/reports/global-energy-review-2021>
- International Energy Agency (2021). *India Energy Outlook 2021 (World Energy Outlook Special Report)*. Retrieved from <https://www.iea.org/reports/india-energy-outlook-2021>
- International Atomic Energy Agency (2022). *IAEA Safeguards Glossary*. Retrieved from https://www-pub.iaea.org/MTCD/Publications/PDF/PUB2003_web.pdf
- Jain, Vishal & Mishra, Dr. Swati (2018). *A Study of the Impact of Privatization on Indian Telecom Industry*. International Journal for Innovative Research in Multidisciplinary Field. Vol 4 (5). May 2018. Retrieved from www.ijirmf.com
- Kaur, Dr. Gurmanpreet (2016). Nuclear Energy Law in India: An Analysis of Environmental Perspective. *Articles Section of Manupatra.com*. (pp 39-45). Retrieved from <http://docs.manupatra.in/newsline/articles/Upload/A4A3C2EC-3ADC-4524-BCB5-EE0F6350C5A3.pdf>
- Koshy, David (2018), *Developments in India's Three-Stage Nuclear Program*. Coursework for PH241, Stanford University, March 23, 2018. Retrieved from <http://large.stanford.edu/courses/2018/ph241/koshy1/>

- Kramer, Lindsay (2018), *Advantages & Disadvantages of Privatization*, Bizfluent, October 26, 2018. Retrieved from <https://bizfluent.com/info-8166130-advantages-disadvantages-privatization.html>
- Lassiter, Joseph (2018). *Op-Ed: Why Private Investors Must Fund 'New Nuclear' Power Right Now*. Working Knowledge – Business Research for Business Leaders, Harvard Business School. April 4, 2018. Retrieved from <https://hbswk.hbs.edu/item/op-ed-why-private-investors-must-fund-new-nuclear-power-right-now>
- Lok Sabha Secretariat (2013). *Activities of the Atomic Energy Regulatory Board, Nineteenth Report of the Public Accounts Committee*. 15th Lok Sabha, Public Accounts Committee. December 9, 2013.
- K. K., Shahina (2012). *First Strike*. Open the Magazine, September 20, 2012. Retrieved from https://openthemagazine.com/features/india/first-strike/#google_vignette
- Majumder, Paushali (2018). *Privatisation in India - A Detailed Study*. Toppr March 27, 2018. Retrieved from <https://www.toppr.com/guides/commercial-knowledge/government-policies-for-business-growth/privatization-in-india/>
- Maganbhai Ishwarbhai Patel v. Union of India & Anr., 3 SCC 400 (India Sup. Ct. 1970), AIR 1969 SC 783
- Marcum, Wade & Spinard, Bernard I (2019), Nuclear Reactor, *Encyclopedia Britannica*, Retrieved on February 17, 2021 from <https://www.britannica.com/technology/nuclear-reactor>
- MBA Universe (2021). *Privatization of Public Sector in India: A Right Step or Selling Family Silver?* February 26, 2021. Retrieved from <https://www.mbauniverse.com/group-discussion/topic/business-economy/privatization-of-indian-economy>
- M. C. Mehta & Anr. v Union of India, AIR 1987 SC 1086 (1986, Sup. Ct., India)
- Meshik, Alex P. (2009). The Workings of an Ancient Nuclear Reactor. *Scientific American*. (Oct 2005). Retrieved from <https://www.scientificamerican.com/article/ancient-nuclear-reactor/>
- Mistry, Dinshaw (2014). *The US-India Nuclear Agreement: Diplomacy and Domestic Politics* (pp 9-32). New Delhi: Cambridge University Press
- Mittal, Shruti (2018). Positive Impact of Privatisation on Indian Economy, *International Journal of Advance Research and Development*. Vol 3 Issue 7 2018 (pp 110-113). Retrieved from <https://www.ijarnd.com/manuscripts/v3i7/V3I7-1191.pdf>

- Mokshagundam, Preethi (2015). *Is Indian Nuclear Law in Conformity with the Constitution and International Law?* SSRN Products and Services. June 19, 2015. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2620138
- Morris, Sebastian (2001). *The India Infrastructure Report - 2001: Issues in Regulation and Market Structure*. India – A Bird's Eye-View. Investindiatelecom, retrieved from <http://www.investindiatelecom.com/brouchure/brouchure.htm>
- Munni, Shaik; Nagarjunareddy, Madireddy and Sindhuja, Badugu (2017) *Impact of Privatization on Telecommunication*. International Journal of Management and Applied Sciences. Vol 3(4), April, 2017. Retrieved from <http://iraj.in>
- Nanda, V. P. (2006). *International environmental norms applicable to nuclear activities, with particular focus on decisions of international tribunals and international settlements*. Denver Journal of International Law and Policy. December, 2006, 35 (1) (186 – 7) (pp 49-50). Retrieved from <https://www.informea.org/en/literature/international-environmental-norms-applicable-nuclear-activities-particular-focus>
- Nanda, Ved P. (2007). *International Environmental Norms Applicable to Nuclear Activities in Updating International Nuclear Law* (Ed. Heinz Stockinger, Jon M. Van Dyke, Michael Geistlinger, Sarah K. Fussek & Peter Machart) (pp 185-203). Intersentia 2007.
- Nandi, Shreya (2019). Private Sector Infra Investment is key to achieving a high growth trajectory. *Livemint*. July 5, 2019. Retrieved from <https://www.livemint.com/budget/economic-survey/private-sector-infra-investment-is-key-to-achieving-a-high-growth-trajectory-1562268697922.html#:~:text=According%20to%20the%20survey%2C%20India,product%20on%20infrastructure%20every%20year&text=Private%20investment%20into%20building%20a,trillion%20economy%20by%202024%2D2025>.
- National Council for Educational Research and Training (2015). *Economic Reforms Since 1991*. 2015-16(20/01/2015). Retrieved from <https://ncert.nic.in/ncerts/l/keec103.pdf>
- NDTV(2012) Retrieved from <https://www.ndtv.com/article/south/kudankulam-one-of-safest-reactors-lanka-s-fears-unfounded-india-s-nuclear-chief-196617>
- Niti Ayog G.O.I. *Public Private Partnerships*. Last accessed on March 10, 2023. Retrieved from <https://www.niti.gov.in/verticals/ppp>

- Niti Ayog G.O.I. (2017). *Draft National Energy Policy* Version 27.06.2017. Retrieved from https://niti.gov.in/writereaddata/files/new_initiatives/NEP-ID_27.06.2017
- Niti Aayog G.O.I. (2020) *India 2020: Energy Policy Review*. January 1, 2020. Retrieved from <http://www.indiaenvironmentportal.org.in/content/466630/india-2020-energy-policy-review/>
- NTI, *Nuclear Suppliers Group*. Last accessed on May 26, 2021. Retrieved from <https://www.nti.org/education-center/treaties-and-regimes/nuclear-suppliers-group-nsg/>
- Nuclear Energy Agency (2015). *Nuclear Energy: Combating Climate Change*. NEA No 7208 – 2015. Retrieved from <https://www.oecd-nea.org/upload/docs/application/pdf/2019-12/7208-climate-change-2015.pdf>
- Nuclear Power Corporation of India Limited (2011). *Know About Kudankulam NPP: Facts on Kudankulam Project NPP*. NPCIL/ED(CP&CC)/2011/M/September 18, 2011. Retrieved from https://www.npcil.nic.in/WriteReadData/userfiles/file/Facts_on_KK_Project.pdf
- Nuclear Suppliers Group. *About the NSG*. Last accessed on June 26, 2021. Retrieved from <https://www.nuclearsuppliersgroup.org/en/about-nsg>
- Office of the Federal Register, US (2011), *A Guide to the Rule Making Process*. Retrieved from https://efaidnbmnnnibpcajpcgclefindmkaj/https://www.federalregister.gov/uploads/2011/01/the_rulemaking_process.pdf
- Office of Nuclear Energy, US (2021) *Nuclear 101 – How Does a Nuclear Reactor Work?* Last retrieved on March 29, 2021, from <https://www.energy.gov/ne/articles/nuclear-101-how-does-nuclear-reactor-work>
- Organization of Economic Cooperation and Development (1960). *Convention on Third Party Liability in the Field of Nuclear Energy (Paris Convention)*. Adopted July 29, 1960 as amended on January 1, 2022. Retrieved from <https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0038>
- Outlook (2022). *Doom Under These Domes?* Outlook Magazine, 2022. Retrieved from <https://www.outlookindia.com/magazine/story/doom-under-these-domes/278934>
- Pal, Deepali. Retrieved from <https://www.economics.discussion.net>

- Pandey, Dr. Anjaney & Surti, Mustafa (2014) *Indian Telecommunication Industry – An Overview* IJLTEMAS, Vol III Issue V, May 2014. Retrieved from www.ijirmf.com
- Petryana, Adriana (2011) *Chernobyl's Survivors: Paralysed by Fatalism or Overlooked by Science?* Bulletin of the Atomic Scientist. 67(2), 2011.
- Planning Commission (India) (2014). *In his first Independence Day Speech in 2014, Prime Minister Narendra Modi announced his intention to dissolve the Planning Commission.* Retrieved from [https://en.wikipedia.org/wiki/Planning_Commission_\(India\)#:~:text=The%20Planning%20Commission%20was%20an,Year%20Plans%2C%20among%20other%20functions.&text=In%20his%20first%20Independence%20Day,to%20dissolve%20the%20Planning%20Commission.](https://en.wikipedia.org/wiki/Planning_Commission_(India)#:~:text=The%20Planning%20Commission%20was%20an,Year%20Plans%2C%20among%20other%20functions.&text=In%20his%20first%20Independence%20Day,to%20dissolve%20the%20Planning%20Commission.)
- Primus Partners (2021). *Strengthening Energy Security: Developing Pipeline Infrastructure in India.* Retrieved on October 7, 2021 from <https://www.assochem.org/assets/images/Strengthening%20Energy%20Security.pdf>
- Rajakumar, Dr. M. (2016). *Pedagogy of Economics.* North Caroline, USA: Lulu Press Inc.
- Ramachandaran, Shastri (2019). Opinion: Why India Doesn't Need NSG Membership. *Outlook.* June 24, 2019. Retrieved from <https://www.outlookindia.com/website/story/india-news-opinion-why-india-doesnt-need-nsg-membership/332880>
- Ramana, M.V. (2015). *The Forgotten History of Small Nuclear Reactors.* IEEE Spectrum. April 2015. Retrieved from <https://spectrum.ieee.org/the-forgotten-history-of-small-nuclear-reactors>
- Ravi, Chaitanya & Sheoran, Nayantara (2018). *Varying Perceptions of Nuclear Risk in the Debate over India's Kudankulam Nuclear Power Plant.* Research Gate. August 2018. Retrieved from https://www.researchgate.net/publication/326990419_Varying_Perceptions_of_Nuclear_Risk_in_the_Debate_Over_India%27s_Kudankulam_Nuclear_Power_Plant
- Samuel, A. M. (1990). Growth of Nuclear Medicine in India. *Defense Science Journal.* 40, 335-346
- Sekhar, V. S. (2002). Nuclear Power in India

- Seth, Tushar, *Role of the Private Sector in the Economic Development of India*. Economics Discussion. Retrieved from <https://www.economicsdiscussion.net/essays/role-of-private-sector-in-the-economic-development-of-india/2116>
- Sharma, Ashok (2019) *India's Pursuit of Energy Security: Domestic Measures, Foreign Policy, and Geopolitics* (207). Delhi: SAGE Publications Private Limited
- Sharma, Shankar (2015). *Integrated Power Policy*. Beluru Sudarshana, February 17, 2015. Retrieved from https://issuu.com/beluru/docs/integrated_power_policy-finalbookve
- Sheth, D. L. (2006), *Micro-movements in India: Towards a New Politics of Participatory Democracy*. Retrieved from <https://www.ces.fe.uc.pt/emancipa/research/en/ft/futurodemocracia.htm>
- Silk, Ko Swan, Syatauw, J. J. G & Pinto, M. C. W (1994). *Asian Yearbook of International Law*. Brill. Vol 4 (1994). Retrieved from <https://library.oapen.org/handle/20.500.12657/38063>
- Singh, Hemant (2019). New Economic Policy of 1991: Objectives, Features and Impacts. *JagranJosh*. October 14, 2019. Retrieved from <https://www.jagranjosh.com/general-knowledge/new-economic-policy-of-1991-objectives-features-and-impacts-1448348633-1>
- Singh, J. *Privatisations of the Public Sector in India (For and Against Arguments)*. Economics Discussion. Retrieved from <https://www.economicsdiscussion.net/india/privatizations-of-public-sector-in-india-for-and-against-arguments/6509>
- Singh, Karunjit (2021). *Explained: Why the Coal Shortage is Choking Thermal Power Plants*. The Indian Express, October 14, 2021. Retrieved from <https://indianexpress.com/article/explained/india-coal-shortage-explained-7555184/>
- Smith, R. Jeffery & Warrick, Joby (2009), A Nuclear Powers' Act of Proliferation, *The Washington Post*, November 13, 2009 (pp10). Retrieved from https://isis-online.org/uploads/isis-reports/documents/Response_Khan_Statements_9Dec2009.pdf
- Smith, Tyson R. & Mohan, M. P. Ram (2018). *Handbook on Regulatory Framework in India* (Intro.) Delhi: Eastern Book Company
- Srikant, Patibandla (2009). *Koodankulam Anti-Nuclear Movement: A Struggle for Alternative Development*. The Institute for Social and Economic Change –

- Working Paper 232. Retrieved from <http://www.isec.ac.in/WP%20232%20-%20P%20Srikant.pdf>
- Srinivas, V (2017). *Planning Commission to NITI Aayog: Making strategies for transforming India*. Press Information Bureau, Government of India. August 16, 2017. Retrieved from <https://www.pib.gov.in/newsite/printrelease.aspx?relid=170000>
- Subash Kumar v. State of Bihar (1991), 1 SCC 598
- Sudhakar, P. (2011). *Kudankulam Plant Safe: Kalam*. The Hindu, November 6, 2011. Retrieved from <https://www.thehindu.com/news/national/tamil-nadu/kudankulam-plant-safe-kalam/article2603911.ece>
- Suman, Sanket, *Privatisation in India: Case for and against*, Economics Discussion. Retrieved from <https://www.economicsdiscussion.net/india/privatisation/privatisation-in-india-case-for-and-against/12895>
- Suraz India Trust v. Union of India (2017) 14 SCC 416
- Tarun, Kanti Bose (2013). *Kudankulam Nuclear Power Plant: Nucleus of Disaster*, Ritimo, June 12, 2013. Retrieved from <https://www.ritimo.org/Kudankulam-Nuclear-Power-Plant-Nucleus-of-Disaster>
- Telecom Regulatory Authority of India, *History*, Retrieved from <https://www.trai.gov.in/about-us/history>
- Telecom Regulatory Authority of India (2012). *Telecom Sector in India – A Decadal Profile*. June 8, 2012. Retrieved from <https://www.trai.gov.in/sites/default/files/201304121052403536675NCAER--Report08june12.pdf>
- Telecom Regulatory Authority of India (2017). *A Twenty Year Odyssey 1997 – 2017*, March 29, 2017. Retrieved from https://www.trai.gov.in/sites/default/files/A_TwentyYear_Odyssey_1997_2017.pdf
- Terpstra, Pieter & Ofstedahl, Abigail (2013), *The Difficulty of Defining Adaptation Finance*. World Resource Institute. October 3, 2013. Retrieved from <https://www.wri.org/insights/difficulty-defining-adaptation-finance>
- The Civil India, *Maharatna, Navratna, Miniratna Companies*. Retrieved from <https://www.thecivilindia.com/pages/psu/ratna-companies.html>
- The Hindu (2016). *Manmohan Singh's 1991 Budget: The day that changed India forever*. The Hindu July 24, 2016. Retrieved from

- <https://www.thehindu.com/business/Economy/25-years-of-reforms-tracking-Indias-journey/article60529192.ece>
- The Hindu (2016), *The Story of Kudankulam: From 1988 to 2016*. August 10, 2016. Retrieved from <https://www.thehindu.com/news/national/The-story-of-Kudankulam-From-1988-to-2016/article60528215.ece>
- The Hotel Corporation of India Limited, 2017. *Annual Report 2016-17*. (pp 69). Retrieved from <https://efaidnbmnnnibpcajpcglclefindmkaj/https://www.centaurhotels.com/financials/16-17.pdf>
- The Times of India (2013). *Controversy over nuclear liability law ahead of PM's US visit*. Times of India, September 19, 2013. Retrieved from <https://timesofindia.indiatimes.com/india/controversy-over-nuclear-liability-law-ahead-of-pms-us-visit/articleshow/22754560.cms>
- T. N. Godavarman Thirumulkpad v. Union of India & Ors. (1996). WP (Civil) No. 171/96, Judis.nic.in (pp1-6)
- Toppr. *Government Policies for Business Growth: Privatization in India*. Retrieved from <https://www.toppr.com/guides/commercial-knowledge/government-policies-for-business-growth/privatization-in-india/>
- Touran, Nick (2013), *History of Nuclear Energy*. Retrieved from <https://whatisnuclear.com/history.html>
- The New Indian Express (2021). *India Stares at Power Crisis with Coal Stocks Down to Days*. October 8, 2021. Retrieved from <https://www.newindianexpress.com/nation/2021/oct/08/india-stares-at-power-crisis-with-coal-stocks-down-to-days-2369194.html>
- The State of West Bengal v. Kesoram Industries Ltd. & Ors. (2004 – Civil Appeal No. 1532 of 1993)
- Udayakumar, S. P. (2011). “*Thirteen Reasons Why We Do Not Want the Koondakulam Nuclear Power Project*”. DiaNuke.Org August 25, 2011. Retrieved from <https://www.dianuke.org/thirteen-reasons-against-the-koodankulam-nuclear-power-project/>
- Udayakumar, S. P. (2011). *The Koodankulam Struggle*. Citizens Nuclear Information Center, 2011. Retrieved from https://cnic.jp/english/newsletter/nit149/nit149articles/02_Koodankulam.html

- United Nations Economic and Social Commission for Asia and the Pacific (2008). *A Primer to Public-Private Partnerships in Infrastructure Development*. 2008. Last accessed on July 24, 2021. Retrieved from https://www.unescap.org/ttdw/ppp/ppp_primer/03_advantages_of_ppps_to_governments.html
- United Nations Framework Convention on Climate Change (2018). *India – Second Biennial Update Report to the United Nations Framework Convention on Climate Change*. December 31, 2018. Retrieved from <https://unfccc.int/sites/default/files/resource/INDIA%20SECOND%20BUR%20High%20Res.pdf>
- United States Department of Energy (1995). *DOE/NE-0088 - The History of Nuclear Energy*. Retrieved from <https://www.energy.gov/ne/articles/history-nuclear-energy>
- United States Nuclear Regulatory Commission (1990). *Enforcement Manual*. June 1990. Retrieved from <https://www.nrc.gov/about-nrc/regulatory/enforcement/guidance.html#manual>
- United States Nuclear Regulatory Commission (2013) *Nuclear Regulatory Legislation*, September, 2013, NUREG-0980, Vol. 1, No. 10, Retrieved from <https://efaidnbmnnnibpcajpcglclefindmkaj/https://www.nrc.gov/docs/ML1327/ML13274A489.pdf>
- United States Nuclear Regulatory Commission (2018). *NRC Enforcement Policy*, May 15, 2018 (pp 6). Retrieved from <https://www.nrc.gov/docs/ML1813/ML18138A138.pdf>
- United States Nuclear Regulatory Commission (2020). *NRC Inspection Manual Chapter 0609*. November 9, 2020. Retrieved from <https://www.nrc.gov/docs/ML2026/ML20267A146.pdf>
- United States Nuclear Regulatory Commission. *About NRC – Organization and Functions*. Last accessed on May 24, 2021. Retrieved from <https://www.nrc.gov/about-nrc/organization/commfuncdesc.html>
- United States Nuclear Regulatory Commission. *About NRC – Organization and Functions – Advisory Committee on Reactor Safeguards*. Last accessed on May 24, 2021. Retrieved from <https://www.nrc.gov/about-nrc/organization/acrsfuncdesc.html>
- United States Nuclear Regulatory Commission. *About NRC – Organization and Functions – Advisory Committee on Medical Uses of Isotopes*. Last accessed on May 24, 2021. Retrieved from <https://www.nrc.gov/about-nrc/regulatory/advisory/acmui.html>

- United States Nuclear Regulatory Commission. *About NRC – Organization and Functions – Atomic Safety and Licensing Board Panel*. Last accessed on May 24, 2021. Retrieved from <https://www.nrc.gov/about-nrc/organization/aslbpfundesc.html>
- United States Nuclear Regulatory Commission. *About NRC – How we Regulate – Enforcement – Enforcement Policy*. Last accessed on May 24, 2021. Retrieved from <https://www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html>
- United States Nuclear Regulatory Commission. *About NRC – How we Regulate – Enforcement – Enforcement Guidance*. Last accessed on May 24, 2021. Retrieved from <https://www.nrc.gov/about-nrc/regulatory/enforcement/guidance.html#manual>
- United States Nuclear Regulatory Commission. *Backgrounder on Chernobyl Nuclear Power Plant Accident*. Last updated March 2022. Retrieved from <https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/chernobyl-bg.html>
- U.S. Government Publishing Office (1954). *Govinfo – COMPS 1630*. September 8, 2023 (pp 7) Retrieved from <https://www.govinfo.gov/content/pkg/COMPS-1630/pdf/COMPS-1630.pdf>
- U.S. Government Publishing Office (1954). *Govinfo – COMPS 1630*. September 8, 2023 (pp 11) Retrieved from <https://www.govinfo.gov/content/pkg/COMPS-1630/pdf/COMPS-1630.pdf>
- U.S. Government Publishing Office (1954). *Govinfo – COMPS 1630*. September 8, 2023 (pp 37) Retrieved from <https://www.govinfo.gov/content/pkg/COMPS-1630/pdf/COMPS-1630.pdf>
- U.S. Government Publishing Office (1974). *Govinfo – Public Law: Statute – 88*, October 11, 1974, (pp 1233). Last accessed on May 24, 2021. Retrieved from <https://www.govinfo.gov/content/pkg/STATUTE-88/pdf/STATUTE-88-Pg1233.pdf>
- U.S. Government Publishing Office (1980). *Govinfo – Statute – 94*, 1980, (pp 3585). Last accessed on November 22, 2022. Retrieved from <https://www.govinfo.gov/content/pkg/STATUTE-94/pdf/STATUTE-94-Pg3585.pdf>
- U.S. Government Publishing Office (2011). *Govinfo – 2011-14656 - Federal Register/Vol. 76, No. 114, June 14, 2011*. Retrieved from <https://www.gpo.gov/fdsys/pkg/FR-2011-06-14/pdf/2011-14656.pdf>

- U.S. Government Publishing Office (2021). *Govinfo – COMPS 1634* March 25, 2021, Section 211 (pp 11-12). Retrieved from <https://www.govinfo.gov/content/pkg/COMPS-1634/pdf/COMPS-1634.pdf>
- Varadarajan, Siddharth, (2009). The Reality is that India will remain outside the NPT. *The Hindu*, October 6, 2009 (pp 11). Retrieved from <https://www.thehindu.com/opinion/columns/siddharth-varadarajan/The-reality-is-that-India-will-remain-outside-the-NPT/article16855691.ece>
- Venkatesan, V. (2019). *The NRC Case: The Supreme Court's Role*. The Frontline Weekly Magazine, October 11, 2019
- Wikipedia: The Free Encyclopaedia (1991). *1991 Indian Economic Crisis*. Retrieved from https://en.wikipedia.org/wiki/1991_Indian_economic_crisis
- Wikipedia: The Free Encyclopaedia (2020). *Kudankulam Nuclear Power Plant*. Retrieved from https://en.wikipedia.org/wiki/Kudankulam_Nuclear_Power_Plant
- Wikipedia: The Free Encyclopaedia (2021). *Atomic Bombings of Hiroshima and Nagasaki*. Retrieved on February 17, 2021 from https://en.wikipedia.org/wiki/Atomic_bombings_of_Hiroshima_and_Nagasaki
- Wikipedia: The Free Encyclopaedia (2021). *Nuclear Energy Policy of the United States*. Retrieved on May 24, 2021 from https://en.wikipedia.org/wiki/Nuclear_energy_policy_of_the_United_States
- Wikipedia: The Free Encyclopaedia (2021). *Atomic Energy Act of 1954*. Retrieved on May 24, 2021 from https://en.wikipedia.org/wiki/Atomic_Energy_Act_of_1954
- Wikipedia: The Free Encyclopaedia (2022). *Earthquake Zones of India*. Retrieved from https://en.wikipedia.org/wiki/Earthquake_zones_of_India
- Wikipedia: The Free Encyclopaedia (2022). *Convention on Nuclear Safety*. Retrieved from https://en.wikipedia.org/wiki/Convention_on_Nuclear_Safety
- World Bank, 2023. Data bank: Population Estimates & Projections; India, 2023. Retrieved from <https://databank.worldbank.org/source/population-estimates-and-projections#>
- World Nuclear Association Library (2016). *Nuclear Legislation in OECD and NEA Countries: United States (2016 Update)*. Retrieved from https://www.oecd-nea.org/jcms/pl_24255/nuclear-legislation-oecd-and-nea-countries-united-states-2016-update

- World Nuclear Association Library (November 2020). *Outline History of Nuclear Energy*. Retrieved from <https://www.world-nuclear.org/information-library/current-and-future-generation/outline-history-of-nuclear-energy.aspx>
- World Nuclear Association Library (March 2021). *Nuclear Power Reactors* retrieved from <https://www.world-nuclear.org/information-library/nuclear-fuel-cycle/nuclear-power-reactors/nuclear-power-reactors.aspx>
- World Nuclear Association Library (April 2021). *Advanced Nuclear Power Reactors* retrieved from <https://www.world-nuclear.org/information-library/nuclear-fuel-cycle/nuclear-power-reactors/advanced-nuclear-power-reactors.aspx>
- World Nuclear Association Library (2021). *Liability for Nuclear Damage*. March 2021. Retrieved from <https://world-nuclear.org/information-library/safety-and-security/safety-of-plants/liability-for-nuclear-damage.aspx>
- World Nuclear Association Library (2021). *Fukushima Daiichi Accident*. Retrieved from <https://www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/fukushima-daiichi-accident.aspx>
- World Nuclear Association Library (2022). *Nuclear Power in India*. 2022. Retrieved from <https://www.world-nuclear.org/information-library/country-profiles/countries-g-n/india.aspx>.
- World Nuclear Association Library (2022). *Safety of Nuclear Power Reactors*. March, 2022. Retrieved from <https://world-nuclear.org/information-library/safety-and-security/safety-of-plants/safety-of-nuclear-power-reactors.aspx#:~:text=The%20main%20safety%20concern%20has,resulted%20in%20a%20core%20melt.>
- World Nuclear News (2016). *India joins Nuclear Liability Convention*. February 5, 2016. Retrieved from <https://www.world-nuclear-news.org/Articles/India-joins-nuclear-liability-convention>

LIST OF PUBLICATIONS

1. **Scrutiny of Atomic Power: The Public Lens**
Published in Volume 10, 2023 of the NIU International Journal of Human Rights ISSN: 2394-0298

2. **The Essence of Atomic Legal Framework in India: An Investigative Outlook**
Published in Vol – XXIII, No – 1, January – June – 2023 of the South India Journal of Social Sciences, ISSN: 0972-8945 (Print) (UGC Care Listed Journal)

3. **Atomic Power for Sustainable Economy**
Published in Volume No. 78 (February) 2024 69 of the Journal of the K. R. Cama Oriental Institute, ISSN: 0970-0609 UGC Care Group I Journal

BIBLIOGRAPHY

STATUTES AND REGULATIONS – INDIA

1. The Atomic Energy Act, 1948
2. The Atomic Energy Act, 1962
3. The Atomic Energy (Working of Mines, Minerals and Handling of Prescribed Substances) Rules, 1984
4. The Atomic Energy (Safe Disposal of Radioactive Wastes) Rules, 1987
5. The Atomic Energy (Factories) Rules, 1996
6. The Atomic Energy (Amendment) Act, 2015
7. The Constitution of India
8. The Central Road and Infrastructure Fund Act, 2000
9. The Civil Liability for Nuclear Damage Act, 2010
10. The Civil Liability for Nuclear Damages Rules, 2011
11. The Disaster Management Act, 2005
12. The Environmental Guidelines for Development of Beaches, 1983
13. The Environment (Protection) Act, 1986
14. The Factories Act, 1948
15. The Guidelines to the Law on Initial Privatization of State Property, 1991
16. The Industry Policy Resolution, 1948
17. The Industries (Development and Regulation) Act, 1951
18. The Indian Electricity Act, 2003
19. The Radiation Protection Rules, 2004
20. The Right to Information Act, 2005

STATUTES AND REGULATIONS – OTHERS

1. The Atomic Energy Act of 1954 (*USA*)
2. ILO Radiation Protection Convention of 1960 (*United Nations*)
3. Brussels Supplementary Convention (*IAEA*)

4. Treaty Banning Nuclear Weapons Tests in the Atmosphere, Outer Space and Under Water (Partial or Limited Test Ban Treaty) of 1963
5. The Atomic Energy Act of 1954 as Amended (*United States of America*)
6. The Nuclear Non-Proliferation Treaty
7. Energy Reorganization Act of 1974 (*USA*)
8. Convention on the Physical Protection of Nuclear Material of 1979 (*IAEA*)
9. Reorganization Plan I of 1980 (*USA*)
10. Department of Energy (DOE) Organization Act (*USA*)
11. Convention on Early Notification of a Nuclear Accident of 1986 (*IAEA*)
12. Convention on Assistance in the Case of a Nuclear Accident to Radiological Emergency of 1986 (*IAEA*)
13. Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters of 1988 (*IAEA*)
14. Convention of Nuclear Safety of 1994 (*IAEA*)
15. Joint Convention on Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management of 1997 (*IAEA*)
16. Convention on Environmental Impact Assessment in a Transboundary Context of 1991 (*IAEA*)
17. Comprehensive Nuclear Test Ban Treaty of 1996
18. Vienna Convention on Civil Liability for Nuclear Damage and the 1997 Protocol
19. Convention on Supplementary Compensation (*IAEA*)
20. Protocol on Strategic Environmental Assessment to the Convention on Environmental Impact Assessment in a Transboundary Context of 2003 (*IAEA*)
21. Paris Convention on Third Party Liability in the Field of Nuclear Energy (as amended by Protocols in 1964, 1982 and 2004) (*IAEA*)
22. Joint Protocol relating to application of Paris and Vienna Conventions
23. Code of Conduct on the Safety of Research Reactors of 2004 (*IAEA*)
24. Code of Conduct on the Safety and Security of Radioactive Sources (*IAEA*)

25. International Convention for the Suppression of Acts of Nuclear Terrorism of 2005 (*IAEA*)

BOOKS

1. Energy Security by Parag Diwan & A N Sarkar, pp 91-165 (1st Ed. 2009)
2. India's Pursuit of Energy Security: Domestic Measures, Foreign Policy and Geopolitics, by Ashok Sharma 207 (1st Ed. 2019)
3. Indian Constitutional Law by M P Jain, Set of 2 Volumes (7th Ed. 2017)
4. Directive Principles State of Policy, Part IV of the Constitution, Constitution of India 1950 by M P Jain (8th Ed. 2018)
5. The US-India Nuclear Agreement, Diplomacy and Domestic Politics by Dinshaw Mistry pp. 9 – 32 (1st Ed. 2014)
6. The Handbook on Nuclear Regulatory Framework in India by Tyson R Smith and M P Ram Mohan (1st Ed. 2018)
7. Nuclear Reactor by Wade Marcum & Bernard I Spinrad (Sept. 2019)
8. History of Nuclear Energy by Nick Touran
9. The Handbook on Nuclear Legislation in OECD and NEA Countries, Published by OECD (2016)
10. Gurmanpreet Kaur, Nuclear Energy Law in India: An Analysis of Environmental Law Perspective, JLJ (2016)
11. Chaitanya Ravi and Nayantara Sheoran, Varying Perceptions of Nuclear Risk in a Debate over India's Kudankulam Nuclear Power Plant
12. Jeremy Bentham; An Introduction to the Principles of Morals and Legislation, (Oxford: Blackwell 1789)
13. A Bhuvania, Courting the People: Public Interest Litigation in Post-Emergency India (2016)
14. Dr. G Balachandran, Kudankulam Nuclear Power Plant and Civil Nuclear Liability, IDSA
15. Shankar Sharma, Integrated Power Policy, CNDP

16. Asian Yearbook of International Law (Eds. Ko Swan Silk, J. J. Syatauw and M. C. W. Pinto) (1994)
17. NCERT, Economic Reforms Since 1991, Unit III – Liberalization, Privatization and Globalization
18. Dr. M Rajakumar, Pedagogy of Economics (2019)
19. Divan S and Rosencrantz A; Environmental law and Policy in India (IRD Ed.) Oxford University Press

ARTICLES/ JOURNALS/ REPORTS/ NEWSPAPER REPORTS/ OTHER SOURCES

1. Samuel AM, Growth of Nuclear Medicine in India, 40, ProQuest 335-346 (Oct, 1990)
2. Filipovic, Adnan (2006), Impact of Privatization on Economic Growth, Furman University; Undergraduate Economic Review, Vol 2; Issue 1, Article 7
3. V Srinivas, Planning Commission to NITI Aayog – Making Strategies for Transforming India, Press Information Bureau, Government of India (Aug 2017)
4. Joseph Lassiter, Op – Ed: Why Private Investors Must Fund New Nuclear Power Right Now, Harvard Business School Working Knowledge (April 2018)
5. Relevant letters of 1981 of Prime Minister of India
6. Center for Civil Society (2002)
7. Outline History of Nuclear Energy, World Nuclear Association
8. Alex P. Meshik, The Workings of an Ancient Nuclear Reactor, Scientific American (Jan 2009)
9. White and Case, Why Small Modular Reactors will shape the future of Nuclear Debate, (June 2021)
10. M V Ramana, The Forgotten History of Small Nuclear Reactors, (April 2015)

11. Roger Clarke and Jack Valentin, A History of the International Commission on Radiological Protection, Health Physics, Vol. 88, Issue 6, pp 717-732 (June 2005)
12. History of Nuclear Energy, DOE/NE/008
13. World Nuclear Association, Exploring the Nature of the Atom, History of Nuclear Energy (November 2020)
14. World Nuclear Association, Outline History of Nuclear Energy
15. India Energy Outlook 2021, World Energy Outlook Special Report, (February 2021)
16. International Energy Agency, Global Energy and Carbon Dioxide Status Report (2019)
17. Nuclear Energy Agency, Nuclear Energy: Combating Climate Change (2015)
18. International Energy Agency, Global Energy and Status Report 2019
19. Press Information Bureau, India's Stand at COP-26
20. IPCC, 4th Assessment Report: Synthesis Report – Climate Change (October 2014)
21. India's Second Biennial Update Report to the United Nations Framework Convention on Climate Change (December 31, 2018)
22. IPCC, Special Report on Global Warming of 1.5^o C (2018)
23. World Nuclear Association, Nuclear Power in India (May 2022)
24. Global Energy Review 2021: Assessing the Effects of Economic Recoveries on Global Energy Demand and CO₂ Emissions in 2021 (April 2021)
25. Government of India, Ministry of Power, Power Sector at a Glance (January 20, 2021)
26. The Indian Express; Explained: Why is Coal Shortage Choking Thermal Power Plants? (October 7, 2021)
27. The New Indian Express; India Stares at Power Crisis with Coal Stocks Down to Days (October 8, 2021, 12:03 pm)

28. Dulera, I. V. and Sharma, Avaneesh; Shaping Third State of Indian Nuclear Power Programme with High Temperature Thorium Reactors; BARC Newsletter, (376) (22-26) (2021)
29. David Koshy, Developments in India's Three-Stage Nuclear Programme, Stanford University Winter (2018)
30. IPCC, FAQ Chapter I
31. IPCC, 6th Assessment Report (August 9, 2021)
32. Center for Social and Economic Progress; Getting to Net Zero – An Approach for India at COP-26
33. Hindustan Times; India can achieve net zero carbon emissions target by 2065 – 70: Study; (October 9, 2021)
34. Department of Atomic Energy; Investment in Atomic Energy
35. IAEA Safeguards Introductory Leaflet
36. Ved P. Nanda, International Environmental Norms – International norms applicable to nuclear activities, with particular focus on decisions of international tribunals and international settlements; Denver Journal of International Law and Policy; Vol 35 No 1 pp 186-7, 49-50 (December 2006)
37. Media Center, Ministry of External Affairs, Government of India; On the visit of Prime Minister of Russia (November 11-12, 2007)
38. Story of Kudankulam: From 1988 to 2016; The HINDU (August 10, 2016)
39. Science and Technology, Drishti, IAS; India's Prospects as a Nuclear Power
40. Nuclear Power Corporation of India Limited, NPCIL/ED/(CP&CC)/2011/M/; Facts on Kudankulam Project; (September 18, 2011)
41. Guide No. AERB/NPP/SG/S-8, Site Considerations of Nuclear Power Plants for Off-Site Emergency Preparedness
42. Current Science, Visit KKNP – An Initiative for Public Understanding of Nuclear Power, Vol 111, pp 246 (July 25, 2016)

43. Kanti Bose Tarun, Kudankulam Nuclear Power Plant: Nucleus of Disaster, Ritimo (June 12, 2013)
44. Shahina K K, First Strike, Open the Magazine (September 20, 2012)
45. S P Udayakumar, Thirteen Reasons Why We Don't Want the Koodankulam Project, DiaNuke (August 25, 2011)
46. Shining Post India; Nuclear Controversy Awaits Indian PM at US (September 25, 2013)
47. P Sudhakar, Kudankulam Plant Safe: Kalam, The HINDU (November 6, 2011)
48. Bidwai, Praful; Between Ambition and Reality: India's Nuclear Power Programme (April 6, 2014)
49. Lok Sabha Secretariat, Activities of the Atomic Energy Regulatory Board, Nineteenth Report of the Public Accounts Committee, 15th Lok Sabha, Public Accounts Committee (December 9, 2013)
50. V Venkatesan, The NRC Case: The Supreme Court's Role, The Frontline Weekly Magazine (October 11, 2019)
51. India 2020, Energy Review Policy, IEA
52. Adriana Petryana, Chernobyl's Survivors: Paralyzed by Fatalism or Overlooked by Science?, 67(2) Bulletin of the Atomic Scientists, 2011
53. Patibandla Srikant, Koodankulam Anti-Nuclear Movement: A Struggle for Alternative Development? Working paper 232, The Institute for Social and Economic Change, Bangalore
54. D L Sheth, Micro-movements in India: Towards a New Politics of Participatory Democracy
55. The Civil India; Maharatna, Navratna, Miniratna Companies
56. Deepali Pal; Economics Discussion
57. MBA Universe, Privatization of Indian Economy
58. Commercial Knowledge, Toppr; Privatization in India
59. Peter Terpstra, World Resource Institute

60. The HINDU; Manmohan Singh's 1991 Budget: The Day That Changed India Forever (July 24, 2016)
61. India Before 91; 1991: ECONOMIC REFORMS
62. Careeranna, Daily GK Update
63. Paushall Majumder, Privatization in India – A Detailed Study, Toppr Bytes
64. John B. Goodman & Gary W Loveman, Does Privatization Serve the Public Interest, Harvard Business Review (1991)
65. Shruti Mittal, Positive Impact of Privatization on Indian Economy, 3(7), Int. J. Advanced Res. & Dev., 110 2018
66. Sanket Suman, Privatization in India: Case for and Against, Economics Discussion
67. Lindsay Kramer, Bizfluent
68. Civil Services India, Analysis of the Private Sector with reference to the Indian Economy
69. Tushar Seth, Role of Private Sector in the Economic Development of India, Economics Discussion
70. J Singh, Privatizations of Public Sector in India (For and Against Arguments), Economics Discussion
71. Shreya Nandi, Private Sector Infra Investment is Key to Achieving a High Growth Trajectory; Livemint (July 5, 2019)
72. Hemant Singh, New Economic Policy of 1991: Objectives, Features and Impacts, Jagran Josh (October 2019)
73. Dr. Suresh Srinivasan, Budget 2018: What India needs is privatization, not mere disinvestments, Business Today (January 31, 2018)
74. Ankit Panda, Shifting Nuclear Stands in South Asia: Understanding India's Counterforce Temptations, The Diplomat: Read the Diplomat, Know the Asia-Pacific (April 23, 2019)
75. Nuclear Power Plant Information, International Atomic Energy Agency, URL accessed on June 12 2006

76. Hindustan Times, India's 20th Nuclear Power Plant Goes Critical (November 27, 2010)
77. The Economist; Nuclear Power: When the Steam Clears; (March 24, 2011)
78. Manupatra, Nuclear Power in India: The Road Ahead
79. Abraham M, Right of Recourse – Interpretation under Civil Liability for Damage Liability Rules, 2011, (November 19, 2011)
80. Cherian J., Safety Last, The Frontline, 2719, pp 98-100 (2010)
81. Currie, EJ. D, The problems and gaps in the nuclear liability conventions and an analysis of how an actual claim would be brought under the current existing treaty regime in the event of a nuclear accident; Dener Journal of International law and Policy; 35(1), pp 85-127 (2008)
82. Curtis L, India's Flawed Nuclear Legislation Leaves US-India Partnership Short, The Heritage Foundation, (July 24, 2012)
83. DIE (2005) Joint Statement on India-USA-China Nuclear Cooperation
84. Dilshit S, US Wants IAEA to Vet Indian Liability Law, The Hindu (July 20, 2011)
85. Gopalakrishnan A, Why the Nuclear Liability Rules Need to be Modified, DNA (December 5, 2011)
86. National Disaster Management Authority (2009); National Disaster Management Guidelines – Management of Nuclear and Radiological Emergencies
87. Grover, R B and Chandra S; Scenario for Growth of Electricity in India; Energy Policy, 34, pp 2834-2846
88. Structure of the FNCA; Forum for Nuclear Cooperation in Asia (October 16, 2012)
89. DAE Website – Press Releases and FAQs on CLND
90. Parliamentary Debates on Nuclear Energy and Atomic Energy Liability
91. Venkatesan J, Supreme Court to Examine Constitutional Validity of Nuclear Civil Liability Law, The HINDU (May 25, 2012)

92. Varadarajan S, This is No Way to Write a Law, The HINDU, (February 17, 2011)
93. Varadarajan S, Turn the Nuclear Bill from Liability to Asset, The HINDU, (January 19, 2011)
94. The HINDU, Raise Cap in Nuclear Liability Bill to Rs. 10,000 crores: Left (August 24, 2013)
95. Srinivasan, M R; A Liability for our Nuclear Plans, The HINDU (October 15, 2012)
96. Ramachandran R; A Suppliers Deal? Frontline, 27(24) (2010)
97. Ramachandran R; Limiting Liability; Frontline, 28(25) (2011)
98. Sengupta A and Ambast S; A Dangerous Recourse? A Critical Reread at Section 17 of the Civil Liability for Nuclear Damage Act, 2010; Journal of International Nuclear Law, 3(4), 292-307 (2012)
99. Rajagopalan, R P and Purushothaman, U; Role of the Indian Political System in Shaping India's Nuclear Policy; International Journal of Nuclear Law, 3(4), 246-258 (2012)
100. The HINDU, India's Liability Law Not in Line with International Norms: US, (December 30, 2013)
101. Pelzer, N; The Indian Civil Liability for Nuclear Damage Act, 2010 – Legislation with Flaws? International Journal for Nuclear Power, 50(1), PTI (2012)
102. Parliament of India, Department related Parliamentary Standing Committee on Science and Technology, Environment and Forests 2010, 212111 report "The Civil Liability for Nuclear Damage Bill, 2010".
103. OECD/NEA, Nuclear Operator: Liability Amounts and Maximum Security Limits
104. MEA; Frequently Asked Questions and Answers on Civil Liability for Nuclear Damage Act, 2010 and related issues

105. McRae, B; The Convention on Supplementary Compensation for Nuclear Damage – Catalyst for a Global Nuclear Liability Regime; Nuclear Law Bulletin, 17, 36 (2011)
106. Matveev, A; The Russian Approach to Nuclear Liability; International Journal of Nuclear Law; 1(3), 270-286 (2006)
107. Lok Sabha (2012) Nuclear Liability Act, Unstarred Question No. 2012.
108. Lok Sabha (2011) New Rules for Civil Nuclear Liability, Unstarred Question No. 110
109. Lok Sabha (2010) Private Sector Participation in Nuclear Power Sector, Starred Answer No. 413
110. Jigeesh, A. M.; Govt. pulled up for diluting Civil Nuclear Liability Rules; Business Line (August 28, 2013)
111. Greenpeace; Soli Sorabjee Opinion on Civil Nuclear Liability (June 25, 2010)
112. Gruendel, R. J. & Kini, R. E.; Through the Looking Glass: Placing India's New Civil Liability Regime for Nuclear Damage in Context; Vudleur Law Bulletin, 1189, 45 – 60 (2012)
113. Hariharan, A; India's Nuclear Civil Liability Bill and Suppliers' Liability: One Step Towards Modernizing the Outdated International Nuclear Liability Regime; William & Man Environmental Law and Advocacy Review; 30(1), 223-255; (2011)

WEBSITES/ SEARCH ENGINES

1. <http://digitalcommons.iwu.edu/uer/vol2/iss1/7/>
2. <http://pib.gov.in/newsite/printrelease.aspx?relid=170000>>
3. <https://search.proquest.com/openview/1c95c5059830d72953678c44047fa88d/1?pq-origsite=gscholar&cbl=2028808>
4. <http://www.indiabefore91>
5. <https://www.world-nuclear.org/information-library/country-profiles/countries-g-n/india.aspx>

6. <https://www.world-nuclear.org/information-library/current-and-future-generation/outline-history-of-nuclear-energy.aspx>
7. https://en.wikipedia/wiki/Atomic_bombings_of_Hiroshima_and_Nagasaki
8. <https://www.britannica.com/technology/nuclear-reactor>
9. <https://whatisnuclear.com/history.html>
10. <https://www.scientificamerican.com/article/ancient-nuclear-reactor>
11. <https://blog.ipleaders.in/atomic-energy-act-a962/>
12. <https://www.world-nuclear-org/information-library/current-and-future-generation/outline-history-of-nuclear-energy.aspx>
13. <https://www.pib.gov.in/PressReleasePage.aspx?PRID=1795071>
14. <https://www.ipcc.ch/sr15/faq/faq-chapter-I/>
15. <https://www.pib.gov.in/PressReleaseIframePage.aspx?PROD=1655136>
16. <https://www.assochem.org/uploads/files/1622832032.pdf>
17. <https://www.legistify.com/indiankanoon/atomic-energy-act-1962/section-24-offenceand-penalties/>
18. <https://www.ntiindex.org/story/the-iaea-code-of-conduct>
19. <https://legalinstruments.oecd.org/public/doc/199/199.en.pdf>
20. <https://www.iaea.org/topics/nuclear-liability-conventions/vienna-convention-on-civil-liability-for-nuclear-damage>
21. <https://www.iaea.org/topics/nuclear-liability-conventions/joint-protocol-relating-to-application-of-vienna-convention-and-paris-convention>
22. <https://www.iaea.org/topics/nuclear-liability-conventions/convention-supplementary-compensation-nuclear-damage>
23. <https://www.iaea.org/sites/default/files/infcirc567.pdf>
24. <https://www.world-nuclear-news.org/Articles/India-joins-nuclear-liability-convention>
25. http://www.fnca.mext.go.jp/english/about/e_aboutinca.html
26. <https://www.nuclearsuppliersgroup.org/en/about-nsg>
27. <https://www.outlookindia.com/website/story/india-news-opinion-why-india-doesnt-need-nsg-membership/332880>

28. <https://www.nti.org/learn/treaties-and-regimes/nuclear-suppliers-group-nsg>
29. <http://www.thehindu.com/todays-paper/ip-national/supreme-court-to-examine-constitutional-validity-of-nuclear-civil-liability-law/article3004778.ece>
30. <http://www.thehindu.com/opinion/lead/article592116.ece?homepage=true>
31. <http://www.thehindu.com/opinion/lead/article458314.ece?homepage=true>
32. <https://www.iaea.org/publications/documents/treaties/npt>
33. <https://www.iaea.org/sites/default/files/publications/documents/infcircs/1970/infcirc140.pdf>
34. <https://www.byjus.com/free-ias-prep/comprehensive-nuclear-test-ban-treaty-ctbt/>
35. <https://www.iaea.org/topics/>
36. <https://www.nrc.gov/docs/ML1327/ML13274A489.pdf#page=23>
37. https://en.wikipedia.org/wiki/Nuclear_energy_policy_of_the_United_States
38. https://en.wikipedia.org/wiki/Atomic_Energy_Act_of_1954
39. <https://www.govinfo.gov/content/pkg/STATUTE-88/pdf/STATUTE-88-Pg1233.pdf>
40. https://en.wikipedia.org/wiki/Reorganization_Plan_No_1
41. https://www-oecd-neo-org/jcms/pl_24255/nuclear-legislation-in-oecd-and-neo-countries-united-states-2016-update
42. <https://www.nrc.gov/about-nrc/organization/commfuncdesc.html>
43. <https://www.nrc.gov/about-nrc/organization/acrsfuncdesc.html>
44. <https://www.nrc.gov/about-nrc/regulatory/advisory/acmui.html>
45. <https://www.nrc.gov/about-nrc/organization/aslbpfuncdesc.html>
46. <http://www.ne.gov/about-creatory/enforcement/enforcepol.html>
47. <http://www.regor/about-nre/regulatoryenforcement/guidance/manual.html>
48. <https://www.manupatra.com>

49. <https://www.mea.gov.in/press-releases.htm?dtl/3535/On+the+visit+of+Prime+Minister+to+Russia+1112+November+2007>
50. <https://www.thehindu.com/news/national/The-story-of-Kudankulam-From-1988-to-2016/article14564027.ece>
51. <https://www.drishtiiias.com/to-the-pints/paper3/india-s-prospects-as-a-nuclear-power>
52. https://www.npcil.nic.in/WriteReadData/userfiles/file/Facts_on_KK_Project.pdf
53. <https://aerb.gov.in/storage/images/PDF/CodesGuides/NuclearFacility/NPP Siting/4.PDF>
54. <https://www.currentscience.ac.in/Volumes/111/02/0246.pdf>
55. <https://www.world-nuclear-org/information-library/safety-and-security/safety-of-plants/fukushima-daiichi-accident.aspx>
56. <https://www.foe.org.au/peoples-movement-against-nuclear-energy-india>
57. <https://www.ndtv.com/article/south/kudankulam-one-of-the-safest-reactors-lanka-s-fears-unfounded-india-s-nuclear-chief-196617>
58. <https://main.sci.gov.in/judgment/judis/40374.pdf>
59. <https://www.ritimo.org/Kudankulam-Nuclear-Power-Plant-Nucleus-of-Disaster>
60. <https://openthemagazine.com/features/india/first-strike/>
61. <https://www.dianuke.org/thirteen-reasons-against-the-koodankulam-nuclear-power-project>
62. <https://shiningindiapost.com/nuclear-controversy-awaits-indian-pm-at-us.html>
63. <http://www.thehindu.com/todayspaper/ipnational/raise-cap-in-nuclear-liability-bill-to-rs-10000-crore-left/article569571.ece>
64. <http://thehindu.com/opinion/lead/a-liability-for-our-nuclear-plans/article3997102.ece>

65. <http://thehindu.com/news/interenational/indias-liability-law-not-in-line-with-international-norms-us/article4153366.ece>
66. <http://www.prsindia.org/uploads/media/Nuclear/SCR%20Nuclear%20Liability%20bill.pdf>
67. http://www.oecd-nca.org/law/2014_table_liability_coverage_limits.pdf
68. <https://www.thehindu.com/news/national/tamil-nadu/kudankulam-plant-safe-kalam/article2603911.ece>
69. <http://www.greenpeace.org/india/en/publications/open-letter-from-greenpeace/soli-sorabjee-opinion-on-civil-nuclear-liability>
70. <https://in.boell.org/en/2014/04/07/between-ambition-and-reality-indias-nuclear-power-programme>
71. https://idsa.in/issuebrief/kudankulamNuclearPowerPlantandCivilNuclearLiability_BalachandranPatil_091112
72. https://issuu.com/beluru/docs/integrated_power_policy-finalbookve
73. https://niti.gov.in/sites/default/files/2020-01/IEA-India%202020-In-depth-EnergyPolicy_0.pdf
74. <https://www.isec.ac.in/WP%20232%20-%20P%20Srikant.pdf>
75. <http://www.ces.fe.uc.pt/emancipa/research/en/ft/futurodemocracia.htm>
76. <https://www.thecivilindia.com/pages/psu/ratna-companies.html>
77. <http://www.economics.discussion.net>
78. <https://www.mbauniverse.com>
79. <https://www.toppr.com/guides/commercial-knowledge/government-policies-for-business-growth/privatization-in-india/>
80. <https://www.governments-private-sector>
81. <https://www.thehindu.com/business/Economy/Manmohan-Singhs-1991-Budget-the-day-that-changed-India-forever/article14505003.ece>
82. <https://www.ncert.nic.in/ncerts/1/keec103.pdf>
83. <http://www.indiabefore91.in/1991-economic-reforms>
84. <https://www.careeranna.com>

85. <File:///C:/Users/BF146TX/Desktop/PHD/PrivatizationinIndia-ADetailedStudy-TopprBytes.html>
86. <https://hbr.org/1991/11/does-privatization-serve-the-public-interest>
87. <https://www.economicsdiscussion.net/india/privatisation/privatisation-in-india-case-for-and-against/12895>
88. <https://bizfluent.com>
89. <https://www.civilserviceindia.com>
90. <https://www.economicsdiscussion.net/essays/role-of-private-sector-in-the-economic-development-of-india/2116>
91. <https://www.economicsdiscussion.net/india/privatisations-of-the-public-sector-for-and-against-arguments/6509>
92. http://www.airindia.in/writereaddata/Portal/FinancialReport/1_266_1_annual-report-of-hotel-corporation-of-india-limited.pdf
93. <https://www.trai.gov.in/about-us/history>
94. <https://legislative.gov.in/sites/default/files/The%20Central%20Road%20Fund%20Act%202000.pdf>
95. <https://www.livemint.com/budget/economic-survey/private-sector-infra-investment-is-key-to-achieving-a-high-growth-trajectory-1562268697922.html>
96. <https://www.jagranjosh.com/general-knowledge/new-economic-policy-of-1991-objectives-features-and-impacts-1448348633-1>
97. <https://pib.gov.in/PressReleasePage.aspx?PRID=1879298>
98. <https://www.businesstoday.in/union-budget-2018-19/decoding-the-budget/budget-2018-privatization-disinvestments-business/story/269113.html>
99. <https://thediplomat.com/2019/04/shifting-nuclear-stands-in-south-asianunderstanding-indias-counterforce-temptations/>
100. https://en.wikipedia.org/wiki/Kudankulam_Nuclear_Power_Plant
101. <http://www.nuclearfriendsfoundation.com/pdf/FactsonKudankulamNuclearPowerProject.pdf>

102. <http://www.hindustantimes.com/india-news/bangalore/India-s-20th-nuclear-power-plant-goes-critical/Article1-631532.aspx>.
103. http://news.bbc.co.uk/1/hi/uk_politics/7179579.stm
104. <http://www.nuclearfriendsfoundation.com/nuclearArticle-kalam-may-play-kudankulam-pacifier.aspx>
105. <http://thehindubusinessline.com/industryandeconomy/govt-pulled-up-for-diluting-civil-nuclear-liability-rules/article3832551.ece>
106. <http://www.dialogue.ias.ac.in/article/22295/judicial-cartography-in-public-interest-litigation-in-india-re-reading-the-kudankulam-case>
107. <http://www.nuclearfriendsfoundation.com/people-speak-nuclear-detailspolitics-killing-indias-nuclear-power-dreams.aspx>
108. <http://www.npcil.nic.in/main/AboutUs.aspx>
109. <http://www.deccanchronicle.com/channels/nation/south/Kudankulam-nuclear-row-seige-continues-even-expert-dismisses-safety-fears-061>
110. <https://www.world-nuclear.org/gallery/maps.aspx>
111. http://pibmumbai.gov.in/English/PDF/E2012_FR39.PDF
112. <http://docs.manupatra.in/newslines/articles/Upload/EDB9D14A-E2D8-483D-8BF8-238E0BE7ED06.pdf>
113. <https://www.mondaq.com/india/energy-law/775048/whittling-down-of-strict-liability-for-suppliers-under-the-nuclear-power-sector>
114. http://www.cstep.in/drupal/sites/default/files/2019-07/CSTEP_RR_Nuclear%20power%20in%20India_2008.pdf
115. <http://nuclearlaw.wordpress.com/2011/11/19/right-of-recourse-interpretation-under-civil-liability-for-damage-liability-rules-2011>
116. <http://www.heritage.org/research/reports2010/03indias-flawed-nuclear-legislation-leaves-us-india-partnership-short>
117. <http://www.daemcinq=node/01>
118. <http://www.dnaindia.com/analysis-comment-why-the-nuclear-liability-rules-need-to-be-modified-1021411>
119. <http://greenpeace.org/india/en>

120. http://www.www.pubidea.org/MTCD/publications_PDF/Pub1279_web.pdf
121. www.trai.gov.in
122. www.mospi.gov.in
123. www.cercind.gov.in
124. <https://en.wikipedia.org/wiki/>
125. <https://www.google.com/search/>

APPENDICES

APPENDIX 1

LIST OF CASES

1. Sundarajan v. Union of India, (2013) 6 SCC 620
2. Union Carbide Corporation v. Union of India and Others, (1989) 2 SCC 40
3. T N Godavarman Thirumalpad (through K M Chinnappa) v. Union of India and Others (2002) 10 SCC 606
4. Magnabhai Shwarbhai Patel v. Union of India (1970) 3 SCC 400; AIR 1969 SC 783
5. State of West Bengal v. Kesoram Industries Ltd. and Others; 2004 Civil Appeal No. 1532 of 1993
6. M C Mehta v. Union of India (Oleum Gas Leak Case) AIR 1987 SC 1086
7. Purbanchal Cables and Conductors Pvt. Ltd. v. Assam State Electricity Board & Others, 6 S.C.R. 905 [2012]
8. Writ Petitions (MD) Nos. 1823 and 2485 of 2012
9. Writ Petitions (MD) Nos. 14054 and 14172 of 2011
10. Writ Petition No. 24770 of 2011
11. Writ Petition No. 8262 of 2012
12. Writ Petition No. 13987 of 2012
13. Writ Petition No. 22771 of 2011 in Madras High Court
14. Writ Petition (C) No. 264 of 2011
15. Anuradha Bhasin v. Union of India (2020) SCC Online SC 25
16. Anindita v. Pranab Kumar Mukherjee (2017) SCC Online SC 71
17. Suraz India Trust v. Union of India (2017) 14 SCC 416
18. Subash Kumar v. State of Bihar (1991) 1 SCC 598
19. Ashok Kumar Pandey v. State of West Bengal (2004) 3 SCC 349

20. Dattaraj Nathuji Thaware v. State of Maharashtra & Others (2005) 1 SCC 590
21. 2012 SCC Online Mad 3331
22. Banwasi Seva Ashram v. State of UP
23. Argentina v. Uruguay (Pulp Mills on the River Uruguay); Judgement, I.C.J. Reports 2010, p 14

APPENDIX 2

LIST OF DIAGRAMS

#	Particulars	Diagram No.	Page No.
1	Pressurized Water Reactor (PWR)	A – (2.4)	37
2	Boiling Water Reactor (BWR)	B – (2.4)	38
3	Pressurized Heavy Water Reactor (PHWR)	C – (2.4)	39
4	Advanced Gas-Cooled Reactor (AGR)	D – (2.4)	39

APPENDIX 3

TEMPLATE OF QUESTIONNAIRE ON THE SCOPE OF PRIVATIZATION OF NUCLEAR POWER PLANTS IN INDIA

Name of Company/ Individual	_____
Type of Company	_____
Country of Operation	_____
Industry	Choose an item.
Name of Representative (Optional)	_____
Designation (Optional)	_____
E-mail (Optional)	_____
Telephone/ Mobile (Optional)	_____

Notes:

DEFINITION OF NUCLEAR LAW - In the light of these basic factors, nuclear law can be defined as the body of special legal norms created to regulate the conduct of legal or natural persons engaged in the activities related to fissionable materials, ionizing radiation and exposure to natural sources of radiation. This definition comprises four key elements – first as a body of special legal norms, nuclear law is recognized as a part of general national legislation, while at the same time comprising different rules required by the special nature of the technology. Second, the element of regulation incorporates the risk–benefit approach that is central to managing activities that present both hazards and advantages for social and economic development. Third, as with all legal regimes, the special legal norms relate to the conduct of legal persons, including commercial, academic, scientific, and governmental entities, as well as of individuals. The fourth element focuses on radioactivity (produced through the use of fissionable material or ionizing radiation) as the defining feature justifying a special legal regime. (Handbook of Nuclear Law IAEA 2013).

“ENERGY” means any form of energy derived from Fossil fuels, Nuclear substances of materials, Hydroelectricity and includes electrical energy or electricity generated from renewable sources of energy or biomass connected to the grid;(Sec.2h, The Energy Conservation Act 2001).

“NUCLEAR INSTALLATION means and includes Civil Nuclear Power Plant/Facility where All aspects of the use of nuclear energy for power production, including the siting, design, construction, commissioning, operation and decommissioning of power reactors and the entire nuclear fuel cycle, the mining and processing of radioactive ores, through the enrichment of nuclear material and the fabrication of nuclear fuel, to the management of spent fuel and radioactive waste; (Handbook of Nuclear Law IAEA 2013)

“OPERATOR” in relation to a nuclear installation, means the Central Government or any authority or corporation established by it, or a Government company or corporation established by it or a Government company who has been granted license pursuant to the Atomic Energy Act 1962 for the operation of that installation; (Sec.2m The CLND Act 2010).

“PRIVATIZATION” occurs when a government-owned business, operation, or property becomes owned by a private, non-government party. Privatization also may describe a transition that takes a company from being publicly traded to becoming privately held. This is referred to as corporate

privatization. It aims to promote competition, efficiency, and innovation by allowing private companies to operate in sectors that were traditionally under state control, such as generation and transmission of electricity, telecommunications, transportation, and other utilities.

Using a scale of 1 to 5, where 1 means “Strongly Disagree” and 5 means “Strongly Agree”, please select the appropriate numerical given along the side of the statement/ assertion to depict the extent to which you/ your employer company agrees with the said statement:

(1. Strongly Disagree 2. Disagree 3. Neutral 4. Agree 5. Strongly Agree

S.No.	Statement	1	2	3	4	5
A	Evolution of Nuclear Technology and Law – the Indian Context					
1	India’s control over the development of atomic energy is monopolized by the Government undertakings, which is not cost-effective.	☐	☐	☐	☐	☐
2	The Government does not share data of the capital cost incurred in construction and in operation of a nuclear power plant/ installation/ undertaking operated by a Government controlled company.	☐	☐	☐	☐	☐
3	The rising demand for energy and the depletion of energy from fossil fuel and its uncertainty has strengthened the case for development of nuclear power as an instrument of combating the energy crisis while upholding climatic goals.	☐	☐	☐	☐	☐
4	India’s rising population has made the country energy deficit and therefore an urgent progress is required towards increase in generation of electricity keeping in mind the commitment of reducing the greenhouse effect.	☐	☐	☐	☐	☐
5	Electricity generated through fossil fuel needs to be the priority to deal with, by reducing its use, as this is giving rise to high AQI levels in the country.	☐	☐	☐	☐	☐
6	Essentially, with rising population, India needs to have a power generation policy where the fuel used to generate electricity has a low or nil carbon emission like, renewable energy, as of wind, solar, nuclear power, hydro etc.	☐	☐	☐	☐	☐

B Privatization of Nuclear Power Plants in India

- 7 The Central Government has disinvested in almost every sector, including defense, as per the Disinvestment Policy, but civil nuclear power plants are yet to be disinvested due to secrecy. ☐ ☐ ☐ ☐ ☐
- 8 The public sector undertakings were probably required post-Independence in 1947 but they soon lost their significance due to slow economy and restrictions on the private sector, primarily due to lack of competition, huge capital cost and inefficiency. ☐ ☐ ☐ ☐ ☐
- 9 Privatization was introduced during the 1991 era for better growth, development, and modernization, which was essential to secure economic sovereignty. ☐ ☐ ☐ ☐ ☐
- 10 The generation of electricity from renewable sources, including wind, solar, hydro etc. have been privatized. However, these require large displacement of area and rehabilitation of villages while the output is not so efficient as there is great dependence on natural conditions. ☐ ☐ ☐ ☐ ☐
- 11 Nuclear power is a viable resource for sustainable electricity generation where there is no dependency on natural conditions with low carbon emissions. However, a strict safety and security policy has to be adopted. ☐ ☐ ☐ ☐ ☐
- 12 Essentially, India needs to introduce operation of small modular reactor power plants under the Privatization Policy which would be regulated by the Government and monitored by the International Atomic Energy Agency. ☐ ☐ ☐ ☐ ☐

C Civil Nuclear Power Program

- 13 The USA has had a successful and efficient nuclear power generation regulatory regime with the highest standard of safety, security, and efficiency since they are operating almost 100 power plants across the country. ☐ ☐ ☐ ☐ ☐

- 14 The USA Government has made its civil and military programs separate from each other; therefore, they were able to promote privatization of nuclear power plants. ☐ ☐ ☐ ☐ ☐
- 15 India's nuclear program was legislated under the Atomic Energy Act, 1948 followed by the Act of 1962 but the civil and military programs were regulated under the same regulatory regime. However, recently there have been changes by the IAEA according to the Inspection Agreement but very little is known about these changes due to national security which is equally important and necessary. ☐ ☐ ☐ ☐ ☐
- 16 Public perception about the nuclear program for civil use in India, especially generation of electricity is getting acknowledged throughout the country, particularly in the light of increased pollution and energy deficit that the country is facing. ☐ ☐ ☐ ☐ ☐
- 17 India is a signatory to the Convention on Supplementary Compensation, however, the civil nuclear liability law passed by the Indian Parliament neither complies in terms of channeling the legal liability nor insures the operator. ☐ ☐ ☐ ☐ ☐
- 18 The Government of India has increased its nuclear power plant site selections and has announced privatization of the nuclear sector in India as the Government policy is to increase the share of nuclear sources in the total power generation of the country. ☐ ☐ ☐ ☐ ☐
- 19 The Insurance Pool consortium will be able to cover the nuclear power plants which are duly licensed by the Central Government and operated by the private sector provided the law permits privatization. ☐ ☐ ☐ ☐ ☐
- 20 Nuclear power plants can be categorized as a green source since they have low carbon emissions. ☐ ☐ ☐ ☐ ☐
- 21 The energy sector in India has been lagging behind and has not expanded in line with the growth in population and development of the economy in ☐ ☐ ☐ ☐ ☐

spite of the mixed source energy policy where emphasis is on renewable energy.

The questionnaire contains 21 multiple choice questions under 3 sub-headings, which uses a scale from 1 to 5 where 1 means “Strongly Disagree” and 5 means “Strongly Agree”. Request you to fill the questionnaire using the following link:

https://docs.google.com/forms/d/e/1FAIpQLSfYgVtenVTIRiYwMN-RE-Ias0zZMXZV419IK2fFDewhQfmdMw/viewform?usp=sf_link

The questionnaire may be completed before March 31, 2023

APPENDIX 4

COVERING LETTER TO QUESTIONNAIRE

I am presently doing research on the topic “*A Critical Analysis of Nuclear Law With Special Emphasis on Scope of Privatization of Nuclear Power Plants in India*”.

As you are aware that given the increasing pollution levels, climatic changes, increasing concerns regarding greenhouse effects combined with India’s fast-growing economy and population, the country is facing an energy crisis. Lakhs of people still have no access to continuous power and electricity. The traditional fossil fuels used are rapidly depleting as well as adding to the environmental crisis. The world is looking to other sources of energy that are clean and green and the most efficient of these is nuclear energy. However, the Central Government has a monopoly of the nuclear energy sector in India of which the public has little knowledge of as all information is kept confidential. As is with most public sector undertakings the efficiency and quantum of output of the same is called to question. It is being increasingly debated that the doors of the civil nuclear energy sector be opened to private players. In this scenario it is imperative that the legal regime in India be examined and analyzed with a view to determine if the same is ready for such privatization, hence this research. The researcher is of the view that privatization in some respects would be beneficial to the country provided the Government sets up a regulatory and legal regime that would ensure that safety and security issues are well monitored.

The Researcher wishes to collect data from the officials and public at large in understanding their viewpoint and perceptions of nuclear power generation in India. It would help in assisting a citizen’s point of view and general awareness about the program with respect to nuclear power plants in India and abroad.

The Researcher gives assurance that the data collected from the individuals will be **KEPT CONFIDENTIAL**. The research work will **NOT DISCLOSE** the name of the Company or of the individuals who answer this questionnaire.

If the respondent has any queries, the Researcher can be contacted at (+)(91)9811504933 or at rijurajj@gmail.com.

A CRITICAL ANALYSIS OF NUCLEAR LAW WITH SPECIAL EMPHASIS ON SCOPE OF PRIVATISATION OF NUCLEAR POWER PLANTS IN INDIA

by Riju Raj Singh Jamwal

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