JAPAN'S NUCLEAR POLICY: FROM NEGATION TO OPTION

Dissertation submitted to Jawaharlal Nehru University in partial fulfillment of the requirements for the award of the degree of

MASTER OF PHILOSOPHY

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CERTIFICATE

This is to certify that the dissertation entitled **"Japan's Nuclear Policy: From Negation to Option"**, submitted by me in partial fulfillment of the requirements for the award of the degree of **Master of Philosophy**, is my own work and has not been previously submitted for any other degree of this or any other university.

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We recommended that this dissertation be placed before the examiners for evaluation.

(Chairperson)

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DECLARATION

I hereby declare that the dissertation titled, **Japan's Nuclear Policy: From Negation To Option**, being submitted to the Center for East Asian Studies, **Jawaharlal Nehru University,** in partial fulfillment of the requirement for the award of the degree of **Master of Philosophy,** has not been previously submitted for any degree of this or any other university. Further, analysis and interpretations of this research are my own and I take responsibility for the same.

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July 17, 2006

Abhay Kumar
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Dedicated to

Hibakusha

(An organization of the sufferers of the atomic bombings in Japan)

CONTENTS

PREFACE

The dropping of atom bomb on two cities of Japan became a major signpost of the Japanese international politics after WWII. The whole occurrence also determined the history, politics, culture and economy of Japan. After that, anti nuclear movement and pacifism especially nuclear pacifism became a prominent part of the Japanese culture. The anti nuclear movements are both against anti nuclear and anti nuclear weapons. In that respect, Japan adopted four nuclear policy including three non-nuclear principles- not to posses, not to produce and not allow nuclear weapons on Japanese ground- in 1967-68. For security, Japan established strategic relations with U.S. and sheltered under U.S 'Nuclear Umbrella'. Japan's role in world peace and non-proliferation is invaluable in the entire cold war period.

Due to contemporary unavoidable circumstances, Japan entered into the nuclear world with so many prohibitions, only for peaceful use of nuclear energy. Earlier, Japanese nuclear program was energy intensive through BWRs. However, after a period, Japanese nuclear industry moved towards PWRs and FBRs that can be use in nuclear weapons with certain technological modifications.

The international politics in post cold war era become diverge from bipolar to Unipolar. Such instance, many rude states indulged in proliferation of nuclear weapons. On the other hand Japan is surrounded by two nuclear states (China and Russia) officially and one (North Korea) unofficially. Historically, Japan had inconsistency with all of its neighbors. Again, Japan has territorial disputes with its neighbors. In such divergence and emerging North Korea as a nuclear threat, push Japan to think beyond pacifism.

Pacifism played pivotal role in Japanese culture but, in critical circumstances many top politicians indicated less than total opposition of nuclear weapons for Japan. The then Prime Minister Nobusuke Kishi in 1957, Masayoshi Ohira in 1979 and Yasuhiro Nakasone in 1984 claimed that acquiring nuclear weapons would not be prohibited by Japan's peace constitution - providing they were used for defense not offense.

As pacifism and anti-nuclear movement become loosing its sharpness than its beginning and changing international politics jointly impelled Japan to reconsider its peace constitution. However, young generation wants to see their nation as 'super power'. The term super power often included possession of nuclear weapons.

In these circumstances, the research "Japan's Nuclear Policy: From Negation To Option" examines the question of Japan's nuclear option by attempting to review the main determinants that are related to Japan and nuclear weapons. It is assumed, as a general premise of the study, that only faithfully inquiring of international, domestic, technical and strategic factors bearing on this question can a fair appraisal be made relating to Japan's future nuclear weapon policy. It is believed that an examination of any one factor in isolation would lead to mislead conclusion that would serve more to confuse than to clarify.

In order to examine the hypothesis, the research divided into five chapters. Chapter 1 i.e. *"Introduction"*, reviews the situation of nuclear question within and outside Japan. This Chapter also included the development and present status of the Japanese nuclear issue. Further, it also included the research them of the whole research including brief introduction of each chapters.

Chapter 2 i.e. *"Atoms for Peace or War?"*, addresses the question of Japan's technical ability to build nuclear weapons from nuclear reactors. Japan's deep involvement of nuclear fuel cycle and Fast Breeder Reactors are major concern in this chapter. However, it does not include technical capability of deploying system of nuclear weapons.

Chapter 3 i.e. *"Anti Nuclear Movement In Japan"*, examines the ups and downs of anti-nuclear organization and anti-nuclear weapons organization together with civil society. This chapter also includes the various legal and international accords that become major hurdle toward the nuclearization of Japan. Japanese government efforts towards non-proliferation, disarmament and world peace also include in the chapter to analyze for clear picture of the intact anti-nuclear sentiments.

Chapter 4 i.e. *"Japan's Nuclear option"*, consider the possible nuclear option for each section of Japan. This chapter includes political willpower, technological capability and strategic benefits and their nuclear option. Political will power includes political parties position's regarding nuclear issue.

Finally, chapter 5 i.e. *"Conclusion"*, outlines the summary and principal findings of whole research.

The research, follow the guideline of School of international Studies, JNU, New Delhi, research manual for citation. Further, Japanese names are shown in Japanese style with family names first and given last but, English names appear in western style.

ACKNOWLEDGEMENT

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Abhay Kumar

Date: July 17, 2006.
Place: JNU, New Delhi.

Signature
(Abhay Kumar)

Glossary of Japanese Words used in the Dissertation

Anzen Hosho Chosa Kai - National Security Research Council

Domei -The Japanese Confederation of labor

Fukuko Kyohei- A rich country and strong military

Fukuryu Maru No.5-Lucky Dragon No 5

Gensuikin -Congress against A-and H- bombs

Gensuikyo- The Japanese Council Against Atomic & Hydrogen Bombs in 1955

Hibakusha -The sufferers of the Atomic Bombings in Japan

Hikaku Sangensuku- Three non-nuclear principles

Kakkin Kaigi- National Council for Peace and against Nuclear Weapons

Keidanren -The Federation of Economic Organization of Japan

Kokubo Bukai -National Defense Division

Nihon Heiwa Kai-Peace society in Japan

Nihon Hidankyo -Japan's Confederation of A- and H-bomb sufferers Organizations

Nikkeiren- Japan federation of Employers

Nippon Keidanren -Japan Business Federation

Rengo- Japanese Trade Union Confederation

Shi no hai- Ashes of death

Sohyo- General Council of Trade Unions of Japan

Zaibatsus -Big Business Houses

ABBREVIATIONS

AEL -Atomic Energy Law

ATRs- Advanced Thermal Reactors

BAEL - Basic Atomic Energy Law

BWRs- Boiling Water Reactors

CTBT- Comprehensive Test Ban Treaty

DPJ- Democratic Party of Japan

DSP-Democratic Socialist Party

EUROTOM- European Automatic countries

FBRs- Fat Breeder Reactors

GNP-Gross National Product

HPI- Hiroshima Peace Institute

IAEA- International Atomic Energy Agency

IRBMs- Intermediate Range Ballistic Missiles

JAEC - Japan Atomic Energy Commission

JAERI -Japan Atomic Energy Research Institute

JAI- Japan Atomic Industry

JAIF- Japan Atomic Industry Forum

JALANA - Japanese Association of Lawyers against Nuclear Arms

JARC - Japan Atomic Energy Commission

JCP - Japanese Communist Party

JDA -Japan Defense Agency

JNCDI -Japan Nuclear Cycle Development Institute

JSP -Japan Socialist Party

LDP-Liberal Democratic Party

MITI- Ministry of International Trade and Industry

NPT -Non-Proliferation Treaty

NWFZ- Nuclear Weapon Free Zone

NWFZT- Nuclear Weapon Free Zone Treaty

ODA- Official Development Assistance

PNC- Power Reactor and Nuclear Fuel Corporation

PNND- Parliamentary Network for Nuclear Disarmament

PWRs- Pressurized Water reactors

R&D- research and Development

SDF- Self Defense Forces

SDPJ – Social Democratic Party of Japan

SWU- Separated Work Unit

TPENW - Tokyo Physician for the Elimination of Nuclear Weapons

UNGA- United Notions General Assemble

UNPKO- United Nations Peace Keeping Operations

UNSC- United Nations Security Council

USAEC -United States Atomic Energy Commission

WMD – Weapons of Mass Destructions

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CHAPTER-1
INTRODUCTION

The dropping of the Atom bomb at Hiroshima and Nagasaki at the end of World War II on August 6th and 9th in 1945 respectively by US was heard all over the world and shocked nearly all who heard it. It was also an important cause of defeat and absolute unconditional surrender in World War II by Japan. Although, the nuclear attack on Japan by US and its allies gave victory in the war, but it became a matter of criticism worldwide and was considered as a "Black Chapter" in the history of war and against entire humanity. Further it also generated a widespread concern about the nuclear devastation. Subsequent to ignoring that one, not only US but other countries also indulged in nuclear race for the status of nuclear power state without caring its panic. Japan is also not an exception in such case.

Nuclear research was conducted in Japan on a very small scale during the World War II under military supervision and sponsorship[1]. But soon after the war, the US lead allied forces destroyed Japanese nuclear research completely. Restrictions were placed on the study of nuclear reactor, atomic energy and radioactivity or anything regarding nuclear. However, in November 1949, the US Atomic Energy Commission allowed Japan to receive radio isotopes for the use in medicine and biological research[2] on humanitarian ground. Except this one, during entire occupational period (1945-1952), nuclear research was almost a "Dead Issue" in Japan.

JAPAN'S NUCLEAR ISSUE: IT'S DEVELOPMENT

Soon after getting sovereignty in 1952, Japan's nuclear research and nuclear policy gained momentum. Japanese steps towards that dimension started through peaceful manners or peaceful use of atomic energy for power generation. In that direction, Japan Science Council took initiative to draw government's attention for nuclear development plans. The Council clarified that the use of nuclear energy should be limited to only

[1] Tuge Hideomi (ed), "Historical Development of Science and Technology in Japan", (Tokyo,1961), p.146.
[2] Department of State Bulletin (Washington, D.C) vol.21, no.543, November 28, 1949, p.843.

peaceful purpose and that no secrecy should be attached to the nuclear development projects. For that one, the visit of President of the Federation of Economic Organizations, Ishikawa Ichiro in January 1954 to the US was a landmark in the development of the idea of peaceful use of nuclear power. He had the opportunity to visit the US Atomic Energy Commission (USAEC) research facilities at the University of California. After return to his own country, he advocated "Atoms for Peace" for Japan. And from that initiative, A Preparatory Council for the Peaceful Uses of Atomic Energy was established in the cabinet to study the problems, and means of developing peaceful nuclear power generation. For the first time the peaceful purposes of nuclear power were included in the 1954 budget.

The Geneva Conference in August 1955 regarding peaceful use of nuclear energy was held and a number of scientists, business house's representatives, government officials, and other members represented Japan from various political parties. That Conference leaded the establishment of the Japan Atomic Energy Commission (JAEC) under the provisions of the Law for establishment of the Atomic Energy Commission in December 19, 1955.

At the international level, the US began to encourage the development of nuclear power for peaceful purpose under the title of "Atoms for Peace". However, the most important reason was the oil shock in 1973, which paved the way for Japan to arrange some alternate source for its continuous energy supply and secure its economic reconstruction.

Due to unavoidable contemporary circumstances, Japan entered in the nuclear world with many precincts and prohibitions. Regarding nuclear issue, not only single, but a number of efforts were made to put the whole ideas into the Law. Before the formation, ratification and implementation of the laws related to nuclear issues, Japan also indulged in general awareness and public concern over nuclear issues. In that dimension, the Basic Atomic Energy Law came into force in January 1956. Major emphasis was on the peaceful use of nuclear energy clearly embodied in Article I and II of the Basic Atomic Energy Law (BAEL).

According to Article I of the Basic Atomic Energy Law, "the objective of this law should be to secure energy resources in the future, to achieve the progress of science and technology and the promotion of industries by fostering the research, development and utilization of atomic energy and thereby to contribute to the welfare of mankind and to the elevation of the national living standard". Incorporated into Article II of this act was the proviso that the development and utilization of nuclear energy "be limited to peaceful purposes and performed independently under democratic management". The law further required that the data resulting from the development programs "be made public to contribute to international contribution[3].

The Japan Atomic Energy Commission (JARC), actually setup in January 1956 as a part of Prime Minister's office, was assigned the task of the planning and executing the atomic energy program, subject, of course, to the Prime Minister's concurrence. Other organizations were created in rapid succession to prosecute, in various capacities the provisions of the Atomic Energy Law. The following groups were subsequently established[4]:

1. The Radiation Council (1956), to discuss standards to prevent radiation hazard;
2. The Japan Atomic Energy Research Institute (1956), a joint government/industry endeavor for atomic research;
3. The Japan Atomic Industrial Forum (1956), an industrial body to promote peaceful uses of atomic energy;
4. The Power Reactor and Nuclear Fuel Development Corporation (PNC, 1957), a development corporation to advance power reactor and fuel capabilities;
5. The National Institute for Radiological Science (1957), setup as part of the science and technology Agency to do research into the problems of radiations hazards;
6. The Japan Nuclear Ship Development Agency (1963), established to oversee the building to nuclear-powered ships.

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[3] As quoted by John E. Endicott, "Japan's Nuclear Option Political, Technical, and Strategic Factors" (New York) Praeger Publishers, 1975, p.113.
[4] Ibid, p.113

This rather elaborate business and governmental nexus was further strengthened by the creation of the five nuclear consortia consisting of Mitsubishi Atomic Power Industries, Inc.; The Tokyo Atomic Energy Consortium; Nippon Atomic Industry Group Company, Ltd.; Sumitomo Atomic Energy Industries, Ltd.; and the First Atomic Power Industries Group. In that phase, various universities and private research laboratories reinforced this general structure, giving it a wide base for the momentum in nuclear research[5].

Since 1956, Japan has made tremendous progress in the development of her indigenous nuclear program. However, since next decade, nuclear development in Japan falls under two periods of so-called "slow-down". The so-called "era of slow-down" had roots in Japanese pacifist mindset and lack of technical capability. The persons who already participated in various peace programs, opposing anything related to nuclear. In addition, technical difficulties were other signpost in the direction of so-called "slow-down." However, by 1967 confidence was renewed and it was cleared that all hurdles had been generally overcome and a new era of substantial progress had begun. The renewed confidence included both internal as well as external factors. During the period of November 1961 to March 1965, eight research reactors were providing considerable empirical as well as theoretical knowledge regarding nuclear technology, including the first Japanese-made nuclear research reactor in 1962. It was United States who succeeded in 1966 in bringing nuclear reactors into economic competition with conventional methods; and by 1967, more than 10,000 "technical experts" in Japan had been trained.[6]

Political and economic experiences during the period of the "slow down" had their own impact on the Japanese nuclear program. An increasing dependence on oil generally and Middle East oil specifically, 1956 Suez crisis and October-November1973 oil crisis i.e. "oil shock" confirmed the necessity for Japan to seek diversification of fossil fuel sources. Coal and oil energy had other storage problem in Japan. As a solutions and alternative to those problems, Nuclear power offered an answer to Japan's power scarcity.

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[5] Ibid, pp.114
[6] Ibid, pp.114.

Through nuclear power, Japan solved all the problems that arose from 'oil shock' and maintained its sturdy power supply. The nuclear power not only provided the steady supply of power for the industrial development but also gave pace to discharge extra burden, which emerged from the international imbalance for Japan. Nuclear power also gave solution for storage problems because, it covered comparatively lower space than other traditional power plants.

The so-called era of slow down possessed its own impact in the policy-making atmosphere regarding nuclear issue. A number of decisions were taken which became as milestone in nuclear issue. These decisions lead the formation, ratification and implementation of a number of policies that changed the nuclear issue and almost soothed the Japanese nuclear stand forever.

In such direction, a major pace was provided subsequently by contemporary Prime Minister of Japan named Eisako Sato in 1967-68. Due to non-adherent of public sentiments, non-nuclear policies were adopted during the then Prime Minister ship of Eisako Sato in 1967-68i.e (1) the peaceful use of nuclear energy, (2) three non-nuclear principles i.e. not to posses, not to manufacture and not to introduce nuclear weapons on the Japanese ground, (3) the promotion of nuclear disarmament and (4) the reliance on the U.S. nuclear deterrent against international nuclear threats. These four nuclear policies were the pillar of the endorsement of nuclear disarmament and according to the national pacifist feelings. The four nuclear policy adopted by Eisako Sato and especially three non-nuclear principles showed the non-violatic and Passive nature of Japanese nuclear policy. Further it also discriminated between the peaceful and passive use of nuclear energy and vicious or negative purposes of nuclear energy.

Yet again at the institution level, a considerable pace in that direction was taken in 1967. JAEC primed an enduring wide-ranging plan that looked into the working of nuclear reactors, the energy requirement of the country over a period of twenty years and the nuclear fuel cycle policy of the government. In order to promote the goals of the plan, a body called the Power Reactor and Nuclear Fuel Corporation (PNC) was established.

The government envisioned a dual role for the PNC. First, the PNC was to plan the most effective use of nuclear power generation by sprouting not only the conventional light water reactors, but also the fast breeder reactor and advanced thermal reactors. Second, it was also entrusted with the accountability of ensuring a sturdy and steady supply of nuclear fuels.

With regards to the first task, the PNC intended and established a number of nuclear power reactors all over Japan. It also anticipated for its efforts towards building an experimental and tentative fast breeder reactor "*Joyo*" which reached criticality in 1970. A prototype fast breeder reactor called "*Monju*" was also built which started producing electricity in 1994. A plan to built prototype advanced thermal reactor "*Fugen*" was also pursued. But in July 1995, it was suspended because of outlay intensification.

The "oil shock" of 1973 compelled Japan to make efforts to utilize nuclear power on a larger scale. A new emphasis was placed on the question of developing an absolute indigenous nuclear fuel cycle. An experimental and investigational reprocessing plant was built in "*Tokaimura*" in 1975, and it started operating in 1977. As the light water reactors grew up in number, it became necessary to reprocess the spent fuel. Japan reprocessed the spent fuel in an extremely constrained way that time due to the taut opposition from the US administration under the then President Jimmy Carter who did not endorsed the reprocessing of the fuels of American origin[7]. It was only in 1988 that the US gave its assent to the use of plutonium in Japan's nuclear energy program. On the other hand, Japan already decided to send its spent fuel to Britain and France for reprocessing. In the preliminary epoch, these shipments carried undersized magnitude of plutonium. Even so, they drew the substantial attention and condemnation world wide. However, the shipment of 1.7 tons of plutonium in 1992-93 which was carried for the first time under the revised US-Japan agreement of 1988 became a major controversy. There were waves of dissent from both within and outside Japan. With the sole purpose from an economic perspective, many questioned the wisdom of Japan continuing with an

[7] Ryukichi Imai, "US-Japan Nuclear Diplomacy," in Michael Blaker, ed., Oil and Atoms: Issues in US-Japan Relations (New York: Columbia University Press, 1980), pp.61-73.

incredible exclusive and extremely menace plutonium strategy. Their condemnation was also based on the verity that most of the western countries including the US had already discarded their breeder programs due to prohibitive costs, the unavailability of plutonium in large extent, and ecological hazards.

It was in antagonism to this background that the JAEC formulated its innovative Long-range program for the development, amplification and utilization of Nuclear Energy in 1994. This was the foremost curriculum that was formulated after the crumple of the cold war structure. Reflective of the universal trends, the innovative curriculum laid trauma on the slow, but steady progress of nuclear fuel cycle projects, while strictly adhering to non-proliferation norms. It also discarded the possession of additional plutonium, reduced the potential target of installed nuclear power capacity from 53,000 MW to 45,000 MW by the year 2000, postponed the target for explicit projects, and gave up its plan to construct an instant reprocessing plant by 2010. A demonstration Fast Breeder Reactor, (FBRs) which was supposed to start operating during the late 1990s was postponed to early 2000s. In the specialty of the uranium enrichment, the earlier objective of pursuing 3 million separate work unit per year was drastically reduced to 1.5 million units per year. Responding to the universal trends, the plan tried hard to tackle the concerns of the community both within and outside Japan by maintaining equilibrium between Japan's quest for accomplishing sovereignty in fuel cycle and the safety first attitude[8].

A severe catastrophe that occurred in the "*Monju*" breeder plant in Tsuruga, Fukei Prefecture, in December 1995 gave supplementary impetus to the slow-down strategy. The industrial accident, which caused due to the sodium leakage, shook the confidence of the people in the safety measures undertaken by the government. The Japanese media gave exceptional exposure to the accident and exposed the mode of PNC, which was trying to wrap it up. The industrial accident triggered a countrywide debate not only on the need for drastically reorganizing the PNC, but more prominently, it questioned the wisdom of enduring the plutonium program itself.

[8] "AEC's Revised Long-term Program Stresses Slow, Steady Promotion of Fuel Cycle Projects", Atoms in Japan, June 1994, pp. 4-9.

Subsequent to the *"Monju"* industrial accident, civic concern for the safety measures in and around the nuclear installations grew auxiliary. The governors of Prefectures-*Fukui, Fukushima*, and *Niigata*- where nuclear power reactors were concentrated, took the lead to illustrate the attention of the government to document containing numerous suggestions for the safe conduct of nuclear reprocessing. The government responded in March in that year with a policy avowal entitled "Towards The Formulation of A National Consensus Concerning Nuclear Policy".[9] It apprehended a series of round-table discussions, involving a large cross-section of people, to improve their understanding of Japan's fuel cycle policy.

The "*Monju*" accident also provoked a prolonged discussion within the government on the potential direction that the nuclear energy policy should take. At the end of the debate that lasted for more than six years, the Ministry of International Trade and Industry (MITI) reiterated the need to pursue its nuclear fuel cycle policy with some modifications. Japan's undue reliance on West Asian oil, the increasing demand for energy from Asian countries like China, Korea, etc, and the sheer ecological constraints did not leave the country with any other alternative, but to strike nuclear energy. But at the same time the government could not disregard the concerns of the general public about the probable recurrence of serious industrial accident in the nuclear installation. It, therefore, decided to postpone the fast breeder program beyond 2030. Until such time, it would carry on its enrichment and reprocessing program internally on a commercial basis, and allowed to utilize the improved plutonium as the core constituent in the Mixed Oxide (MOX) fuel for light water reactors. However, still this "plu-thermal process" [10] evoked widespread umbrage within the countryside. In an attempt to uphold the "plu-thermal policy, the then Prime Minister Hashimoto Ryutaro met the Governors of *Fukui, Fukushima* and the *Niigata* on February 26, 1997, and asked them to fully collaborate with the government and shore up its guidelines[11]. But on March 11th, a serious industrial accident occurred in the reprocessing plant at *Tokaimura* which severely destabilized the

[9] White Paper On Nuclear Energy 1996 (AECJ, Tokyo), pp.1-4.
[10] See Appendix II on page no.122.
[11] White Paper On Nuclear Energy 1996, p 4.

pose of the government and people's conviction in nuclear fuel cycle policy of the government. More prominently, the role of the PNC came in for scathing criticism nationwide. Acceding to accepted demands for its reformation, the government appointed a commission for that purpose. It took roughly about a year for the government to push throughout the alteration. As result, on October 1st 1998, a new institution called Japan Nuclear Cycle Development Institute (JNCDI) replaced the PNC. The new institution was not given any responsibility in matters like uranium enrichment, overseas mining of uranium or Advance Thermal Reactors (ATRs) like its predecessors; it was enjoyed to regain the confidence of the citizens. The challenges it faced that time were formidable.[12]

The two industrial accidents saw more people coming out explicitly to question the perception of the administrator's policy in pursuing the risky "plu thermal" path. It is become increasingly more difficult for any electric company to find sites for setting up nuclear reactor due to the antagonistic resistance of the people. It is noteworthy to prompt that how the inhabitant of undersized town, *Makimachi* in Niigata, conducted a referendum in August 1996 and entirely discarded a proposal of the government to set up nuclear plant in that region.[13] Such trends were gaining momentum throughout the country even though there was a sharp cleavage at the level of people's perception of and umbrage against the administration with regard to the setting up of nuclear power plants. On the one hand, the habitant a midst of radiation risks as in the outlaying areas like *Fukui, Fukushima,* and *Niigata* where the nuclear power reactors are positioned and those who lived in the metropolitan cities like Tokyo and Osaka and enjoyed the power supplied by the reactors having other misapprehension. Those who exposed to radiation risks had strong grievances alongside the government's policy. In the last couple of years, the central regime had tried to redress their grievances. The government was concerned to that, if the local problems were attached to it, which would be, impossible to implements its energy ambition of 70.5 million KW by 2010.

[12] Atoms in Japan, November 1998, pp.2-3.
[13] White Paper On Nuclear Energy 1996, p.4.

As things stand now, there was no nationwide consensus on future course of fuel reprocess policy in Japan. The executive position of the JAEC was that despite the industrial accidents, the significance of the nuclear fuel recycle policy had not distorted. The commerce and industrial circles sturdily endorsed this plunk, arguing that nuclear fuel recycling requirements to be persuaded from a long-term perception. The slogan for the future must be "recycling", not just in the nuclear field but in other industries as well. The foremost undertaking for the future was how to recycle resources technically effective and more successfully. The Federation of Economic Organization of Japan (*Keidanren*) on a testimony entitled "Japan's Energy situation and problems to be solved" stresses the significance of the nuclear power as the one of the most essential and imperative pillar of the Japan's energy security curriculum. The report calls upon the government to judge the subsequent points.

a) To increase the capacity of light water reactors;
b) Implementation of measures to establish a nuclear fuel cycle focusing on the use of plutonium, such as the MOX use program, and FBR expansion; and
c) Implementation of a disposal policy for high level radioactive wastes.

On the other hand, the critics prolonged to assemble support alongside the official nuclear fuel cycle strategy. They argued on the basis of scrutiny that fuel recycling through reprocessing, which is the main advantage of nuclear power generation is worthless. The nuclear fuel cycle policy of the Japanese government is consequently at a crossroad and the consciousness of the goals of the civilian program depends on the national consensus and the government became able to build in the upcoming years.

JAPAN'S NUCLEAR ISSUE IN INTERNATIONAL REGIME

At the international level, Japan joined the International Atomic Energy Agency (IAEA) in July 1957. From the very beginning, Japan is an adherent of the IAEA's goals to endorse nonviolent utilization of nuclear energy and always worked voluntarily for the expansion of its activities. After 1955, a new era began, when Japan indulged in a number

of bilateral relations with numerous countries [14](i.e. U.K, France and U.S) to obtain enriched uranium. According to these bilateral relations, Japan imported its nuclear needs and supplying countries had right to inspect the tangible utilization of these equipments and resources. However, subsequent to a period of time, these supplying countries transferred their rights to IAEA, which determined the parameters for the nuclear safeguards for Japan. Japan acknowledged the IAEA nuclear safeguard's parameters for the sake of heavy disbursement. Japan spent about 22 percent of the safeguard application on it[15] in 1993. IAEA constantly cherished Japan for its role concerning nuclear safeguards. In other words, Japan has strictly followed the objectives and safeguard measures adopted by IAEA and supported the goals of IAEA on each steps.

Japan has long been a sturdy adherent of nuclear disarmament on a step-by-step basis. Japanese government believes that upholding and strengthening of an international non-proliferation regime is indispensable for smooth monitoring of peaceful, passive and non-violent use of nuclear energy. Japan believes that the Nuclear Non-Proliferation Treaty (NPT) consists of all the approaches. Following its admittance in the UN in 1956, Japan found it as a constructive and functional forum for putting its view on the issue. When in the late 1960s, efforts were made by the then two super powers to formulate NPT. Japan evinced significant interest in such move, and watched the development with a good deal of vigilance. It took its own time and after substantial hesitation, Japan signed the NPT in February 1970. While signing the treaty, it articulated its own anxiety on numerous imperative issues. One foremost concern of Japan was that the treaty did not exemplify "an acceptable balance of responsibilities and objectives of the nuclear and non-nuclear powers".[16] Japan argued that whereas the non-nuclear weapon states were bound under the treaty neither to assemble nor to acquire nuclear weapons,[17] there was no equivalent obligation on the nuclear weapon states. Finally, the NPT legalized the enduring distinction between five nuclear weapon state and all other states[18]. Another issue related

[14] The United Nations DISARMAMENT YEARBOOK, Volume 29:2004.pp. 29-31.
[15] Atoms in Japan May 1994.pp.13-14.
[16] Statement by the Japanese representative Turuoka Senjin before the First Committee of the General Assembly, UN, May 10, 1968 in Documents on Disarmament 1968 (Washington), pp. 309.
[17] See Appendix III on page no 130.
[18] Turuoka Senjin, op. cit. p. 311.

to IAEA safeguard was that Japan accepted IAEA inspections. Japan maintained that such safeguard should be simple in the way that did not hamper the development in the peaceful uses of nuclear energy.

After signing the NPT in February 1970, Japan took a superfluous six years to ratify it. This excessive impediment in the ratification of the treaty was caused by numerous factors. First one, the public attitude within the country was strongly alienated, the ruling Liberal Democratic Party found it delicate, complex and difficult to build a countrywide and general consensus on the issue. Secondly, China's possession of nuclear weapons caused a great deal of awkwardness and uneasiness to Japan. Third, the unanticipated shifts in the American policy arouse unfathomable vagueness in the Japanese official's circles about the trustworthiness of their security alliances with the US. Fourth, Japan's concern about North Korea's growing nuclear potency made it very clear that unless the US guaranteed Japan's security against any peripheral nuclear threat, their fears would remain unallayed. Japan had to accomplish sheltered negotiations with Washington to obtain these assurances. It ultimately ratified the NPT in 1976 after assurances from the US on the prolongation of the security alliances and on party of treatment with the European Automatic (EUROTOM) countries in matters pertaining to nuclear assessments.

Since then, there is no apparent distinguishing between the nuclear test for peaceful (passive) purposes and destructive (negative) purposes. Therefore, Japan opposed nuclear detonation and testing by each and every country. In these circumstances, various initiatives were taken by the Western countries to have the NPT extended for ever. The G-7 convention apprehended in Tokyo in 1993 endorsed their obligation to the indefinite extension of NPT. But preliminary vacillation revealed by the Japanese government in underneath the summit proclamation was surprised. One rational elucidation for its uncertainty and hesitancy was that within Japan, there were some sections who were concerned that an indefinite extension of NPT would contribute to the upholding of the special status of the nuclear weapon states and which could nullify and reverse the forecast of the overall elimination and eradication of nuclear weapons. Along with some

NGO, NPT research Association, IAEA altogether articulated their support for the indefinite extension of NPT. During 1995-96, Japan extended full support in working out a Comprehensive Test Ban Treaty (CTBT) along with US.

From the outline of Japanese accomplishment concerning nuclear issue, it is convinced that Japan is dedicated to the peaceful use of nuclear energy and against the destructive use of nuclear energy. Japan's loyalty towards non-proliferation of nuclear weapons shows that she also wants the total elimination of nuclear worldwide including nuclear weapon states. Her role in the disarmament and non-proliferation was/is appreciated worldwide.

JAPAN'S NUCLEAR ISSUE: PRESENT STATUS

Japan is still a part of IAEA and NPT. From very beginning, her dedication toward the non-proliferation of nuclear weapons is appreciated worldwide. Japan's nuclear policy i.e. (1) the peaceful use of nuclear energy, (2) three non-nuclear principles i.e. not to posses, not to manufacture and not to introduce nuclear weapons on the Japanese ground, (3) the promotion of nuclear disarmament and (4) the reliance on the U.S. nuclear deterrent against international nuclear threats, are still relevant in post-post cold war[19] era. Especially three non-nuclear principles i.e. not to posses, not to manufacture and not to introduce nuclear weapons on Japanese ground show that Japan is still an imperative performer in the nuclear disarmament.

However, in the recent period, Japan's behavior concerning nuclear issue, became a massive susceptible and query in the path of disarmament and non-proliferation. The entire occurrence of Japan's nuclear issues consist an immeasurable swing from utterly annihilation of anything regarding nuclear than her vacillation regarding the indefinite expansion of NPT. Japan's own policy towards the larger dependency on nuclear energy for its domestic and commercial use and heavily dependency on FBRs shows that Japan has enough technological capabilities[20] to make its own indigenous nuclear reactor.

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[19] The period after 9/11.

[20] See Appendix I on page no112.

Whatever condemnation and antagonism held in Japan, anti-nuclear movement raised severe concerns about the safeguard of nuclear power projects. But still, Japan adopts nuclear energy for steady power supply. It is a better and cheaper energy substitute that prohibits Japan to depend on overseas energy resources and secures its constant economic reconstructions. These are the reasons that why Japan decided in favor of development of nuclear power reactor in 1956 and its first nuclear power reactors plant started operation in July 1966. Until 2005, Japan has 55 nuclear power reactors (52 were in operation), which made third rank in number after US (103) and France (57).[21] This produced almost 47,700 MW of electricity.

THE RESEARCH THEME

Japan's nuclear policy has left profound impact on Japan's post war polity, security, foreign, defense and also economic policy. Japan adopted the nuclear policy i.e. (1) the peaceful use of nuclear energy, (2) three non-nuclear principles i.e. not to posses, not to manufacture and not to introduce nuclear weapons on the Japanese ground, (3) the promotion of nuclear disarmament and (4) the reliance on the U.S. nuclear deterrent against international nuclear threats, in 1967-68 under the then Prime Minister Eisako Sato.

From the very beginning, Japan constantly supported the IAEA goals and always welcomed the peaceful or passive use of nuclear energy. Japan's nuclear policy has great emphasis on nuclear disarmament and reliance on US nuclear deterrent against any international nuclear threat, is still relevant in the post cold war era. Japan's commitment towards NPT shows its profound inclination of nuclear disarmament.

However, after overhauling the entire scenario, one can easily find that a great shift occurred in Japan's nuclear policy from intact elimination of nuclear weapon to somehow elimination. This shift can be traced at different levels, especially the policy level and the policymaker's levels. At the policy level, we count that,

[21] Japan 2006, "Keiizai Koho Centre, Japan Institute for Social and Economic Affairs", p.98-99.

Firstly, the inordinate delay of six years in the ratification after signing of the NPT shows that Japan hesitated about the future of the NPT and somehow it gave priority to national interest than nuclear disarmament. Because, Japan wanted to first secure its economic reconstructions and steady and sturdy supply of energy without overseas oil dependency.

Secondly, Japan's major emphasis was shifted from light water reactors to heavy water reactors, Advance Thermal Reactors (ATRs) and Fast Breeder Reactors (FBRs) on the name of peaceful use. Further, plutonium is certainly the fissile material of choice for most nuclear weapons states and the official line is that "reactor grade" plutonium is not a source of proliferation concern. However, the claim that 'reactor-grade plutonium cannot be used to make nuclear weapons are simply incorrect'. Although, it can be hazardous to handle and has a less reliable explosive yield than "weapon grade plutonium", Reactor grade plutonium can be used to make bomb in the kiloton (Hiroshima) range[22]. Indeed the US exploded just such a weapon in 1962. It clearly means that Japan had nuclear technological capability to be a nuclear state from 1970s onwards.

Thirdly, the nuclear accident in *Monju* in 1995 and another reprocessing plant in *Takaimura* indicate that Japan is still backward in the reprocessing. However, Japan's continuous indulgence in the same, shows its dual character that it wants to be expertise in reprocessing of nuclear fuels. Want to be a technical expertise in nuclear fuel reprocessing indicates the hypocrisy of Japan in the nuclear issue in between disarmament and fuel reprocessing.

Fourthly, Japan's deep commitment to the plutonium economy in the region generates extraordinary attention. Japan's existing stockpiles of separated plutonium, by contrast, are already large enough for hundreds of nuclear weapons. A November 1994 report by the Japan's Atomic Energy Commission revealed that there was 4.7 tons of separated plutonium in Japan, with an additional 6 tons storage in Europe.[23]

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[22] D.Albright, "Can Civilian Plutonium be Used in Nuclear Explosive?" (Washington, DC: Federation of American Scientist), 1984.
[23] Cited in Andrew Mack, "Nuclear Programs in Northeast Asia", Proliferation in North Asia, pp.11-19.

On the other hand, policymakers also indicated time to time that Japan has adequate assets to make its indigenous nuclear weapons without overseas assistance. Further, several Japanese political leaders have expressed their views that indicated less than total opposition to the idea of nuclear acquisition. The then Prime Minister Kishi (in 1957), Ohira (in1979), and Nakasone (in 1984) claimed that acquiring nuclear weapons would not be prohibited by Japan's peace and pacifist constitution–providing they were used for defense not for offense. The former Prime Minister Eisako Sato, who also adopted the Japan's nuclear policy, stated that the three non-nuclear principles- not to produce, not to possess and not to allow nuclear weapons on Japanese soil were not immutable and could be changed.[24] In December 1994, in a private conversation with the US Ambassador to Japan, Sato went even further:

> If the other fellow has nuclear weapons, it is only common sense to have them oneself. The Japanese public in not ready for this, but would have to be educated....Nuclear weapons are less costly than is generally assumed, and the Japanese scientific and industrial level is fully up to produce them.[25]

According to Japanese perspective, the cold war international politics is now shifting in East Asia specific and worldwide in general. In the changing scenario of East Asia (North Korea nuclear program) and Japan's changing nuclear policy from total abolition of nuclear weapons to less than total abolition, shows that Japan can go nuclear and it only depends on time and circumstances.

In the context of the research on the theme **"Japan's Nuclear Policy: From Negation to Option"** aims to examine various issues associated with nuclear in Japan. This is an open-ended research, and is based on the premise that the need for interpretation of proclamation and statistics provided by diverse sources. The proposed research is an attempt to understand the ever-changing international dynamics and its impact on changing Japanese nuclear policy.

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[24] References for these various officials claim are found in The Plutonium Trade: A Troubling New Era of Proliferation (Greenpeace International), 1 March 1993.
[25] Cited in Matoya Kitamura, "Japan's Plutonium Program: A Proliferation Threat", Nonproliferation Review 3, no.2 (Winter1996) pp.13.

Although, the research "Japan's Nuclear Policy: From Negation To Option" is a open ended research which deals with the divergence of nuclear issue, but also follow the guidelines of some international theory. The whole concept of nuclear technological capability including conversion of nuclear reactors into nuclear weapons through 'criticality', strategic benefits of achieving nuclear status and political will indicate the altering temperament of Japanese traditional pacifism. Decision to become a nuclear power is likely to be reactive. Further, if Japan is willing to achieve nuclear status then that decision must be based on the "Balance of Power" or "Balance of Fear". In addition, the decision is also based on the "Theory of Realism" in international politics especially "Offensive Realism" (hegemonic position with power maximizing) or "Defensive Realism" (requisite amount of power to ensure the survival) and not according to the peaceful co-existence in East Asia in particular and worldwide in general. The research aims to critically examining the changes wrought upon the Japanese consciousness and the impact both at the level of community and at the level of the decision-making and its implication on international affairs.

In this context the research starts with Chapter I i.e. *"Introduction"* with tracing the roots of nuclear issue in prewar Japan, and then it discusses the brief history, development and present status of nuclear issue in post war Japan. In tracing the roots of nuclear issue in Japan, the research includes internal as well as external factors, which shapes the Japanese nuclear program. Then the research proceeds to examine the shift from total abolition of nuclear weapons than less than total abolition of nuclear weapons from both at the policymaking level and policymakers' level. Further it also includes the research theme and chapter summary.

The second chapter of the research, "Atoms *for Peace" or War?,* discuss the various factors regarding the nuclear technological capabilities of Japan. The research deals with the energy requirements and Japan's policies and politics of nuclear technological issue. Further, it also discusses the push and pull factors of passive or peaceful and negative or destructive use of nuclear energy. The research also includes the comparative study of nuclear policies and nuclear technological capabilities of other nuclear states.

The third chapter *"Anti-Nuclear Movement in Japan"* begins with tracing the roots of Japan's anti nuclear movements, its evolution and present status in post war era. In this research the term "the Japanese anti-nuclear movement" is used to mean the social movement against nuclear weapons in Japan, although, "anti-nuclear movement" could be used to refer to a social movement against peaceful (non-military) use of nuclear energy as well as destructive (military) use of nuclear energy. It also deals with the ups and downs of the antinuclear movement in Japan. Further, it also includes the various efforts under taken by Japanese government for disarmament of nuclear weapons. This chapter also deals with the legal hurdles and its fallout in the nuclearization of Japan. Sift in the government policy is a major issue of analysis in this chapter.

The fourth Chapter *"Japan's Nuclear Option"* looks on the nuclear option of various sections within Japan. This chapter also deals with the nuclear option of various political parties, the civil society of Japan, big business houses and the nuclear option for Japanese public. This chapter also focuses on the push and pulls factors between idealism and realism in the successful national defense policy. Further, this chapter also deals with the technological capabilities, strategic benefits, and its nuclear option for Japan. Finally, this chapter also deals with the altering nature of different sections of Japan and their nuclear option.

The fifth chapter *"Summary and Conclusion"* deals with the summary and findings of the whole research.

CHAPTER-2

ATOMS FOR PEACE OR WAR?

INTRODUCTION:

After getting the sovereignty in 1952, Japan's nuclear policy gained momentum. Due to unavoidable circumstances, Japan entered into the nuclear world with various numbers of restrictions and prohibition on the name of "Atoms for Peace". These restrictions and prohibitions hold a number of pros and cons, which affect directly or indirectly Japan's nuclear issue. Japan entered in the nuclear world for the fulfillment of its energy requirements. Japan's nuclear policy -i.e. (1) The peaceful use of nuclear energy, (2) three non-nuclear principles, (3) the promotion of nuclear disarmament and (4) the reliance on the U.S. nuclear deterrent against international nuclear threats- and Japan's Energy Act bound Japan for the nuclear non-proliferation and use of nuclear energy only for peaceful purposes. These policies and other legal and permissible hurdles were the pillar of the promotion of nuclear disarmament. The sophisticated nuclear reactors gave a pace of enough knowledge regarding nuclear technology as well as their deployment system. Aftermath, it was believed that Japan has capability to make its indigenous nuclear reactors and nuclear weapons. However, it originated a series of questions and put suspicion about the concept of Atoms for Peace that its Atoms for Peace or War?

Before, accent too much on the controversy about 'Atoms for Peace or War', it is necessary to emphasize about the Japan's nuclear capability alike- does Japan has capacity to congregate the requirements of the nuclear fuel cycle? Can nuclear fuel be processed on a multilateral basis or only concert with other nuclear powers? Does Japan has capability to convert its peaceful nuclear power technology into assembling its indigenous nuclear weapons? Does Japan has enough capability to develop nuclear weapons from its reactor grade nuclear fuel i.e. uranium or plutonium? Does Japan has enough capability to dump nuclear wastage safely? Does Japan has enough capacity to reprocess the nuclear fuel cycle? Does Japan has enough technological capability for storage and transportation facilities for the radioactive materials? Does Japan has enough

capability to deploy the nuclear weapons? Are any strategic benefits that Japan can achieve from its own nuclear weapons? Does Japan has enough political will to take decision in the favor of Japan's native nuclear weapons? These questions became the deciding factors of the Japan's nuclear issues and differentiate between Atoms for Peace and Atoms for War.

TECHNOLOGICAL CAPABILITY

The first question generated about the Japan's nuclear policy was that, does Japan have capacity to make its indigenous nuclear weapons? And the answer hides in the technological capability of the nuclear reactors. Technological Capability related to nuclear program includes two separate things (1) technological capability of every thing related to production of nuclear reactors, which is usually and straightforwardly used in the making of nuclear weapons and (2) the deploying capability of the nuclear weapons through launch vehicles or simply called warhead. Earlier, the technological capability of nuclear reactors consisted a number of stepladder including nuclear fuel cycle i.e. Mining and Milling of Uranium, Refining and Conversion of Uranium, Enrichment of Uranium, Conversion of Enriched Uranium to fuel materiel, Fabrication of reactor fuel elements, use of fuel elements in nuclear power plants, reprocessing of spent fuel and disposal of radioactive wastage. Transportation and storage of the nuclear fuel also became significant in the nuclear fuel cycle and assess the technological capability regarding nuclear. On the other hand it also swallows the different types of nuclear reactors alike PWRs, BWRs and FBRs. Secondly, the deploying system abide different types of deploying system including warhead and launch vehicles.

One major question also gave pace in the link between the technology of nuclear reactors and the technology of nuclear weapons. Simply, Does Japan have capability to convert its peaceful nuclear power technology into assembling its indigenous nuclear weapons? These are the centre questions of the technological capabilities of converting nuclear reactors to nuclear weapons.

Prior to discussing about Japan's technological capability regarding nuclear weapons, one must look at the different steps of nuclear capability that decide the technological capability of nuclear reactors program as well as nuclear weapons program. Secondly, one must also look after the shift in the policy to convert the peaceful nuclear reactors to assembling its aboriginal nuclear program. In response to the first one, it consists of a chain of the different steps regarding nuclear reactors alike-

THE NUCLEAR FUEL CYCLE[1]

Like coal, oil and natural gas, uranium is an energy resource which must be processed through a series of steps to produce an efficient fuel for generating electricity. Each fuel has its own distinctive fuel cycle. However, the uranium or "nuclear fuel cycle" is more complex than the others. To prepare uranium for use in a nuclear reactor for both power reactors and the weapons reactors, it undergoes the steps of mining and milling, conversion, enrichment, fuel fabrication, use of fuel elements in nuclear power plants, reprocessing of spent fuel and disposal of radioactive wastage. These steps make up the "front end" of the nuclear fuel cycle.

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After uranium has been used in a reactor to produce electricity, it is known as "spent fuel" and may undergo a further series of steps including temporary storage, reprocessing, and recycling before eventual disposal as wastes. Collectively these steps are known as the "back end" of the fuel cycle.

MINING AND MILLING OF URANIUM

A deposit of Uranium, discovered by geophysical techniques, is evaluated and sampled to determine the amounts of Uranium materials that are extractable at specified costs from the deposit. Uranium reserves are the amount of ore that are estimated to be recoverable at stated cost. Uranium ores can be extracting by conventional mining in open pit and

[1] See Appendix I on page no112.

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underground methods, similar to those used for mining other metals. But, Uranium is usually mined by either surface or underground mining techniques, depending on the depth at which the ore body is found. The mined uranium ore is sent to a mill which is usually located close to the mines. At the mill, the ore is crushed and ground to a fine slurry which is leached in chemical to allow the separation of uranium from the waste rock. It is then recovered from solution and precipitated as Uranium Oxide (U_3O_8). This Uranium Oxide is need to further process in fuel cycle.

Only Canada, U.S, South Africa, France, former Russia and China have demonstrated the low cost Uranium. Low-cost ores are considered to be those that can be mined by more or less conventional means and contain approximately 0.1 percent of Uranium[2]. This low cost Uranium became the base of the nuclear reactors for the power generation. The reserve stockpiles of the Uranium indicate the sophisticated capability of Uranium Mining.

Although, Japan's earlier nuclear reactor was energy intensive with insufficient natural resources of Uranium deposits to meet its requirements. It was estimated that Japan needed 7,000 tons of Uranium a year by 1980, 13,000 tons a year by 1985, and 21,000 tons of Uranium by year 1990[3]. But in that year, the confirmed reserves of Uranium were considered to be scout as 8,000 metric tons.[4] Although, it was estimated in the vision of increasing demand of energy and more important it was Uranium which has to enrich it later. U.S., Canada, and South Africa were the major supplier of Uranium for Japan at the initial phage of Japan's nuclear industry. Japan also received the uranium under the provision of IAEA. But, after the oil shocks in 1973 and 1979 and especially after the cold war period, Japan received Uranium from a number of different suppliers groups other than the earlier suppliers groups like U.K and France. Japan also received mining and milling facility from these suppliers groups. Through this way, the stockpiles of the Uranium and enriched Uranium ores become increasing day by day. The advancement of

[2] U.S. Atomic Energy Commission, News Release, August 9, 1972, p3-4.
[3] Atoms in Japan, May 1971, Supplement I, p. 12.
[4] Atoms in Japan, May 1972, p 26.

mining and milling facilities of the Uranium through the advance and nuclear weapons states indicate that Japan is now looking for the fine and enriched Uranium with advanced mining and milling facilities.

Japan is also actively engaged in a program developing Uranium resources overseas. Overseas resources has been conducted in the United States, Canada, South Africa, Australia, Somalia, Thailand, Malaysia, Niger and countries of Central and South America[5]. Other factor, in effect, retarding the development of Uranium resources is the depressed market due to Uranium surplus. The international price of the crude oil per barrel is increasing day by day. On the other hand, the price of the Uranium and the cost of the Mining and Milling of the Uranium became constant in respect to the crude oil. But vagueness of the accessibility of the Uranium led the assembling of access of Uranium.

The increasing stockpiles of Uranium/Plutonium[6] (reactor/weapon grade enriched spent fuel) say an additional story of the whole nuclear issue. A November 1994 report by Japan's Atomic Energy Commission revealed that there was 4.7 tons of separated Plutonium in Japan, with additional 6 tons storage in Europe[7]. By contrast, the intense international concern over North Korea's possible illicit diversion of Plutonium related to relatively tiny quantity between 10-15kg. Simply, the capability of mining and milling of Uranium and outsource the Uranium from a number states articulate that although, Japan has enough capability for the mining and milling of the uranium, but, Japan also outsource Uranium from other states.

CONVERSION/PROCESSING OF URANIUM

Mined Uranium ores are normally processed by grinding the ore materials to a uniform particle size and then treating the ores to extract the uranium by chemical process. The

[5] Atoms in Japan May 1971 p34, April 1972 p.46 and May 1972 p. 37.
[6] See Appendix I on page no.112.
[7] Carnegie Endowment for International Peace and International House of Japan, "The United States and Japan, and future of Nuclear Weapons (WashingtonDC, 1995) p.43.

conversion of the Uranium Oxide to Uranium hexafluoride[8] is the next process in a complete fuel cycle. It is accomplished locally in Japan at *Ningyotoge*[9]. The power reactor and Nuclear Fuel Development are engaged in developing on an intermediate scale of a complete refining process. It is anticipated that as the development of overseas resources becomes a reality, Japan will have to refine a "considerable quantity" of Uranium locally[10]. On the other hand, amount of considerable quantity of uranium is another thing that put some doubt about the government policy?

Generally speaking, the technology base to meet the future expectations enlarged demands inherent in the refining procedure is being primed and offers no concrete obstacles to Japan's nuclear development. In August 1972, it was announced that a pilot plant incorporating a new Uranium production process through the "dry methods".[11] (A dry method is the process in which Uranium is extracted by further refining through dry powder). Although, the dry methods of extracting the Uranium is considered as one of the advanced method of extraction of uranium and Japan has enough capability for uranium conversion or refining through dry methods in *Ningyotoge*. The engagement of Nuclear Fuel Development became primer in developing intermediate scale refining process. The deep concern of Nuclear Fuel Development in developing the intermediate scale refining plants indicates the government position on such issue.

ENRICHING AND REFINING OF URANIUM

The process of increasing the concentration of U^{235} in Uranium from the 0.7 percent found in its natural condition to 2 to 3 percent which is obligatory for light water reactors or 93 percent for nuclear weapons is called enriching or refining of uranium. Currently U.S, U.K, France, former USSR, and China have performed this rather sophisticated phase of this fuel cycle. Apart from the nuclear weapons states, it is believed that India, Pakistan, Israel, North Korea and Iran achieved such enriching or refining process either

[8] See Appendix I on page no 112.
[9] Atoms in Japan, July 1972, p.33.
[10] Ibid, May 1971, p. 31.
[11] Ibid, August 1972, p.47 and Genshiryoku Tsushin, July 17 1972, pp4-6.

herself or with the help of other nuclear member states. U.S and France is currently overproducing enriched uranium for power generation for peaceful means. The overproduction has resulted in a large amount of pre produced uranium and has been offered to interested countries like Japan at a fair commercial and profitable cost. By 1980, Ryukichi Imai of Japan Atomic Power Company estimated that Japan's need for enriched uranium will reach 5.3 million kilogram separated Work Unit (SWU) or 5,830 tons SWU. By 1990, the Japanese demand will rise to 13.5 million kilograms SMU and by the year 2000 to 15.4 million kilogram SMU[12]. By increasing number of nuclear reactor beyond 2000, indicates that Japan needs more enriched uranium than earlier.

The increasing demands of enriched uranium in Japan for peaceful means led to search other aspects alike to outsource the enriched uranium from other country in affordable and comparatively low cost than enriched uranium within the country. In this respect, U.S. sent a letter to the European Community, Britain, Canada, Australia and Japan in 1971 that indicated the readiness of U.S to enter into talks on the sharing of uranium enriched technology. Regarding this, in November 1972, U.S. Atomic Energy Commission (USAEC) and Japan Atomic Energy Commission (JAEC) representatives, agreed to the formation of a working group to study a joint plant[13] for the enriched uranium. Apart from that, several other paths for uranium enrichment were also opened, such as turning to new suppliers like USSR, France and possibly China. Due to cost escalation from the U.S uranium, in June 1973, a Japanese inspection mission headed by Dako Toshio and sponsored by the Japan Atomic Industrial Forum was invited to the USSR to review selected facilities. Japan was also invited to enter into a long-term contract with France to enrich uranium for Japan.[14] Other countries like Australia[15] also provided uranium as much as 50 percent of its natural uranium resources to Japan for enrichment.

[12] Atoms in Japan, March 1973, p.5.
[13] Denki Shimbun, November 13, 1973.
[14] Yomiuri, May 17, 1973
[15] Asahi, May 19, 1973.

Japan also setup medium range plant for self-sufficiency in the uranium enrichment within the country and for technological skill. For that, Japan also made recommendation to the budget for a pilot plant for the allocation for research and development. Power reactor and Nuclear Fuel Development Corporation announced that, 10 domestic built plants were being operated. Technologically, uranium enrichment and refining is very critical and significant steps in the nuclear fuel cycle. It requires the most advanced and sophisticated technology. Although, Japan had already acquired the technology of uranium enrichment and its refining in early 1970s, but due to cost escalation and lack of uranium availability within Japan, became a major factor in the outsourcing of enriched uranium from other countries. The overproduction of enriched uranium by nuclear member states like U.S, U.K, France, USSR and other non nuclear states like Australia shows the other path. Recently, China also interested to export enriched uranium to Japan.

Although, the enrichment refining and outsourcing of uranium is going on under the supervision of International Atomic Energy Agency (IAEA) and Japan Atomic Industry but it is totally against the norms of the treaty of NPT[16] and against nuclear disarmament. Secondly, Japan achieved enough capability for the uranium enrichment and refining in early 1970s. Japan also fulfills her demands through the outsourcing of enriched uranium from other countries. Currently 52 out of 55 nuclear reactors producing energy and plan for other nuclear reactors in near future is showing the future demands of the uranium and its availability either through internal enrichment plants or through outsourcing. Another uranium enrichment facility started in 1992 in the Rokkasho[17] village in Aomori prefecture indicated the government's deep involvement of uranium enrichment.

FUEL FABRICATION

Nuclear fuel fabrication is the next step in the fuel cycle. For the use of nuclear fuel, the enriched uranium must have to fabricate through other chemical and physical process in

[16] See Appendix III on page no 130.
[17] See Appendix IV on page no 136.

extremely high temperature for making it hard which is essential for the nuclear reactor. This fabricated uranium is used in the power generation for both nuclear energy for peaceful purposes and for nuclear weapons. The process of fabrication is necessary, as the enriched uranium cannot be directly used in the nuclear power reactors. In fabrication process, uranium must be heated, loaded into metal bundles and assembled as fuel elements or bundles.

The situation of Japanese fuel fabrication industry is moderately bright. Domestic makers have reached the point where Japanese fabricated fuel has almost been realized completely industrialize and self-sufficient. *Tsuruga* Boiling Water Reactors and Mihama-1 Pressurized Water Reactors are using fuel bundles fabrication in Japan. The industry is expanding with such rapidity that it is within the reason to expect the entire need of the Japanese nuclear power industry will be met by domestically fabricated fuel[18] in Japan. In recent scenario, Japan imported the raw nuclear materials from other countries due to lack of natural deposits of uranium. However, fabricates the nuclear materials in Japanese plants due to availability of access facilities of fabrication domestically. The import of raw nuclear materials from other countries and fabricate it domestically in Japanese fabrication plant clearly indicates that Japan has enough capability to fabricate the nuclear fuel. This also play pivotal role in the fabrication and final cost of uranium, which is generally used in nuclear reactors. Japan achieved the technology to fabricate low level of uranium, but still has to depend on the foreign fabrication technology for the fabrication of high level of uranium.

Japanese manufacturers have adopted the fuel fabrication technologies under licensing agreements and must therefore pay royalties to foreign firms. This tends to make the domestic products slightly more expensive than foreign imports. Cost also related to plant size. In the early 1970s, major fuel fabricators of Japan's nuclear company combined by a number of groups like Toshiba, Hitachi, General Electric of the United States, Sumitomo Electric Industries, which have the licensed agreement with the U.S based firm and the

[18] Atoms in Japan, June 1971, p.14.

Mitsubishi Atomic Power Industries in which Mitsubishi Metal Mining, Sumitomo Metal Mining and Kobe steel are the members of the agreement.[19] Under these agreements, Furukawa Electric Company of Tokyo and Sumitomo Electric Industries of Osaka formed the first Japanese owned fuel fabrication company in 1972 and the new company named the Nuclear Fuel Industry Company Limited, represents the growing technological self sufficiency and confidence of the Japanese nuclear industry in the nuclear fuel cycle.

The Japanese government's decision for a long-range program became a great effort at technological development in this field to ensure the development of domestic fuel fabrication, which became a milestone in the technological self-sufficiency and confidence in fuel fabrication. Overall, one can easily say that Japanese fuel fabrication Industries have enough technological capability to fabricate the uranium for the nuclear reactors within Japan. Further, Japan outsourced the fabricated Plutonium fuel from overseas countries.

FUEL REPROCESSING

The average life of the uranium or plutonium in a nuclear reactor is approximately three years after the fabrication of the nuclear fuel. After the three years period, the nuclear fuels become highly irradiate and contains residual fissionable materials. Even the spent fuel discharged from the nuclear reactors contains other radioactive materials that need to be reprocessed for the further use in nuclear reactors. Being too precious to be discarded, the fuel is transferred to reprocessing plants where it is dissolved in order to recover and purify the residual nuclear fuel. Radioactive wastes are also generated in the process. Simply, after a certain period of time, the spent fuel must have to purify again for further use in nuclear reactors. The nuclear fuel (materials) can be chemically separated and recovered from the spent fuel. The recovered uranium can, if an economic and institutional condition permits, be recycled for use as nuclear fuel.

[19] Ibid, June 1971, p.16.

The Power Reactor and Nuclear Fuel Development Corporation built Japan's first reprocessing plant. Japan Gasoline Company Ltd; and French firm Saint-Gobain Techniques Nouvelles were the co contractors for the plant. This reprocessing plant was established in *Tokai Mura* and has the capacity of 0.7 tons of spent fuel per day, or 210 tons per year. Another reprocessing plant has started operation in March 1992 in *Rokkasho* village in *Aomori* prefecture. [20]

There has been considerable local opposition held for the constructions of the plant by the local people and anti nuclear activists. Their claim was that the plant might reprocess nuclear fuel for military purposes. Environmentalists, anti war activists and anti nuclear activists also joined the opposition. Then Japanese government gave task to JAIF to gain the public opinion. Currently, plants in Europe are reprocessing spent fuel from utilities in Europe and Japan. But, Japan has enough technological capability for its own reprocessing plants. The task of JAIF to gain public opinion left some doubt about the government policy on such issue.

WASTE DISPOSAL

One of the existing concerns in the nuclear power field is the safe disposal and isolation of either spent fuel from reactor or, if the reprocessing option is used, wastes from reprocessing plants. These materials must be isolated from the biosphere until the radioactive contained in them has diminished to a safe level. The radioactive wastes can be disposed both at sea and on land with certain safety measures and awareness. The wastes disposal of radioactive materials through safety measures and awareness is only to avoid the hazards related to human and environment.

In Japan, disposal of nuclear/radioactive wastes is being considered both at sea and on land by JAEC. The Disposal Policy was determined by the JAERI (Japan Atomic Energy Research Institute) in 1975 and according to its policy placed radioactive wastes

[20] Nuclear Power Development in Japan, Agency of Natural Resources, MITI, March 1997.

in around a steel container, which compressed to 5 cm and then packed in concrete. Low-level wastes and high level of radioactive materials have storage facility at *Rokkaso-Mura* since 1995. A deep geological storage site has been in progress in Japan and may start operation from 2035.

As 52 out of 55 nuclear reactors are generating power for peaceful purpose, it definitely means that these power plants are also producing a quantity of nuclear/ radioactive wastes. Japan has enough technological capability for the safe disposal of the excess nuclear/radioactive wastes. Although, these nuclear/radioactive wastes generates radioactive rays for a longer period of time which is quite hazardous for human and also for the environment, but, it can be marginally decreased to the degree of its effectiveness through proper safety measures. These safety measures consists a number chemical and physical process. In the way of wastes disposal, the government and disposal plants took extraordinary safety both in the policy making process and on the implementation of these policies. The plant for making geological storage which may start operation from 2035 indicates that Japan has enough nuclear/radioactive wastes and Japanese government is keen conscious about the safe disposal of radioactive wastes.

STORAGE

Storage facility consists two types of storage. First one is interim storage in between the process of enrichment and between the fuel cycle. Second, permanent storage of the enriched uranium. After its operating cycle, the reactor is shut down for refueling[21]. The fuel discharged at that time (spent fuel) is stored either at the reactor site, commonly in a spent fuel pool or, potentially in a common facility away from reactor sites. Storage became critical because these materials are radioactive and hazardous. If the reactor site or the reactor facility is away from the site then, it became more critical for the entire unit. The spent fuel rods are usually stored in water, which provides both cooling and shielding. The process became too critical and dangerous and needs more awareness.

[21] See Appendix I on page no 112.

In case of Japan, one can see that it uses both internal and external storage of nuclear materials. Internal storage means that Japan uses domestic storage facilities for nuclear materials which would be used in near futur for the power generation by nuclear reactors. In the entire fuel cycle, it needs the storage facilities more than one time.

Succesful storage facilities within the fuel cycle indicates that Japan has enough and sophisticated storage facilty. On the other hand, Japan also uses other countries' storage facility for the surplus nuclear materials. A November 1994 report by Japan's Atomic Energy Commission (JAEC) reaveled that there were 4.7 tons of separated nuclear materials in Japan, with an additional 6 tons storage in Europe[22].

TRANSPORT OF THE RADIOACTIVE MATERIALS

Transport is an internal part of the nuclear fuel cycle. There are nuclear power reactors in operation. Japan has plan to start new nuclear reactors but uranium is viable in only a few region and few countries. Also in the course of over fifty years of operation by the nuclear industry, a number of specialized facilities have been developed in various locations around the world to provide nuclear fuel cycle service and there is a need to transport nuclear materials to and from these facilities. A transport facility is also necessary for the transport of enriched nuclear materials from the enrichment plant to nuclear reactors. Although, transport of nuclear fuel materials occur between different stages of the cycle, but occasionally materials may get transported between plants. With some exceptions, most of the nuclear fuel materials are transported in solid form. Even most of the materials used in nuclear fuel are transported several times during the cycle. Transports are frequently international, and are often over a large distance. Nuclear materials are generally transported by specialized transport container and by expert transport companies due to high radioactive risk for human and environment equally.

[22] International Peace and International House of Japan, "The United States and Japan, and the Future of Nuclear Weapons", (Washington DC, 1995), p.43.

Since the nuclear materials are radioactive, it is important to ensure that radiation exposure of both those involved in the transport of such materials and the general public along transport route is limited. Packaging for nuclear materials includes, appropriate shielding to reduce potential radiation exposure. In the case of some materials, such as fresh fuel assemblies, the radiation levels are negligible and no shielding is required. Other materials, such as spent fuel and high-level wastes are highly radioactive materials, containers are used which are designed to maintain integrity under normal transportation conditions and during hypothetical accident condition.

52 out of 55[23] nuclear reactors are generating power for peaceful purposes in Japan and have plan to make more nuclear reactors for power generation. The situation clarifies that Japan needs more nuclear materials then earlier. Due to lack of natural deposits of nuclear materials, Japan needs to outsource it from other countries. The process of outsourcing is needed a better and safe shipping services. The transportation services are also needed for the transport of enriched uranium from reprocessing plants to the nuclear reactor sites. The successful transportation of the nuclear materials at each step without any overseas interference clearly indicates that Japan has achieved adequate transportation capability. Historically, not a single accident has happened in the process of transportation and shipping also emphasize that Japan has adequate potential of transportation of nuclear/radioactive materials. It may also be considered that Japan may rely on other suppliers countries to safe transport of nuclear materials to its plants in Japan. But in vision of nuclear advancement of Japan, one can say that Japan has one of the sophisticated transportation facilities.

DIFFICULTY IN THE NUCLEAR FUEL CYCLE IN JAPAN

Generally consider that, Japan can be seen to have three major problem areas in regard to the nuclear fuel cycle. First and primary is the lack of natural deposits of nuclear fuel especially uranium. Lack of natural deposits of uranium is a fundamental problem but

[23] See Appendix IV on page no 136.

may be alleviated somewhat by the FBRs and Advanced Thermal Reactors. The prime predicament of the lack of natural deposits of uranium is solved by Japan through outsource of raw materials from other countries which have surplus uranium as natural deposits. The only thing is the cost variation from country to country and time to time. But generally the cost of the uranium does not fluctuate like crude oil price in international market or other energy resources' prices like coal and natural gas.

Secondly, the ability to enrich uranium to such an extent is necessary for the reactor grade or weapons grade reactors. The solutions to this problem hide in the research and development of enrichment of uranium. After considerable gap, Japan displays that it has enough technological capability to enrich uranium in domestic enrichment plant. A uranium enrichment plant in *Rokkasho* village in *Aomori* prefecture indicates that Japan achieves enough technological capability in uranium enrichment. Thirdly, the local opposition regarding the nuclear issue also generates the slow down to such an extent by the anti nuclear activists and by the local common people. For the solution of that problem, Japanese government has been gathering public opinion in support of nuclear issue and facilities.

BOILING WATER REACTOR (BWRs)

Boiling Water Reactors (BWRs)[24] are the most common types of nuclear reactors. It is believed to be the first generation of nuclear reactors in the series. From the very beginning, the Boiling Water Reactors are used for the power generation primarily for the peaceful purposes. Generally, it is believed that Boiling Water Reactors (BWRs) are the first steps towards the nuclearization of any country either in militaristic terms or in peaceful purposes. Many nuclear physicists believed in the early years of the development of Boiling Water Reactors (BWRs) that it could not be used in the making of nuclear reactors (militaristic use) due to its technological difficulties. However, as the development took place and the technological capabilities have no place in the management of the BWRs, it can be used in militaristic terms.

[24] See Appendix I on page no 112.

From the very beginning, Japan did not posses any technological capability regarding the development of any type of nuclear reactors. Further, Japan started its nuclear reactors program with the development of Boiling Water Reactors (BWRs) with other Pressurized Water Reactors. Japan's first Boiling Water Reactors was in Tsuruga Prefecture which started operation in March 1970. Nuclear reactors including Boiling Water Reactors (BWRs) were developed with the help of U.S. The entire nuclear reactors programs were heavily energy intensive and influenced by the "oil shock" in early and late 70s. The whole nuclear reactors programs were promoted by U.S under the title "Atoms for Peace". Simply the BWRs can be used for peaceful purposes under the proper supervision of International Atomic Energy Agency (IAEA) and according to the Treaty of Non-Proliferation (NPT).

The development of Japanese Boiling Water Reactors (BWRs) was a result of the endless effort of Japan Atomic Energy Commission (JAEC) and the United States Atomic Energy Commission (USAEC). Globally, U.S. began to encourage the development of nuclear reactors only for peaceful purposes under the title "Atoms for Peace" due to oil shock in 1970s. That time, Japan was dependent on U.S for almost all things. Crude oil was also not an exception. Although, Japan imported crude oil from other gulf countries, but oil shock in 1970s indicated that Japan should think beyond the gulf's energy resources. In addition, the result was the nuclear reactors for peaceful purposes.

From the first Boiling Water Reactors, which started operation in March 1970 to till May 2005, Japan has 29 Boiling Water Reactors out of 55[25] nuclear reactors. More than half of the total number of nuclear reactors clearly indicates that, Japan has enough technological capability to successfully develop and manage the Boiling Water Reactors.

Physicist claimed that BWRs had a complex design and easy to manage, but due to much larger pressure vessel than PWRs, it couldn't be used in the development of nuclear weapons. As the technological advancement took place, the size of pressure vessel can be

[25] See Appendix IV on page no 136.

mute or expand in usable size. So can be use in development of nuclear weapons. Japan has successfully running BWRs in large number and sophisticated technological capability gave pace for the molding of pressure vessel in usable size. Thus, Japan easily converts its BWRs to the developments of nuclear weapons.

PRESURRIZED WATER REACTORS (PWRs)

Pressurized Water Reactors (PWRs)[26] are one of the most common types of nuclear reactors and are widely used all over the world. PWRs belong to the family of light water reactors. PWRs are nuclear reactors that use ordinary water. Heat from PWRs has been use for heating in Polar Regions and especially Army Nuclear Power Program. Although, PWRs are generally use in power generation for peaceful purposes however, it can also be use for militaristic purposes after some modification in its construction and management. Subsequent to criticality,[27] these types of nuclear reactors are commonly act as nuclear weapons.

Japan started its PWRs program for peaceful nuclear purposes in late 60s and first PWR started in November 1970 in *Mihama, Kansai* area. As PWRs program all over the world were initially energy intensive and believe that cannot be use in military purposes or in the development of nuclear weapons, but through 'criticality' it can be use in the development of nuclear weapons. Same like that one, Japanese PWRs program was also energy intensive. Even Japanese policymakers claimed that PWRs cannot be use in defensive purposes in any circumstances even if it became technologically advance. However, most nuclear physicists now claiming that PWRs can be use in the development of nuclear weapons purely in militaristic terms through the regulation of criticality.

Japan has enough technological capability in the successful development, construction and management of PWRs. Successfully running of 23 PWRs nuclear reactors out of 55

[26] See Appendix I on page no 112.
[27] See Appendix II on page no 122.

nuclear reactors in Japan simply specify the technological efficiency in PWRs industry. Further, "criticality" regarding the nuclear reactor is a basic and initial stage to successfully operation of nuclear reactors. Without criticality, not a single step can move in the process of operation of nuclear reactors, either in peaceful purposes for power generation or purely in militaristic purposes for defensive or offensive purposes.

Although, Japan's PWRs programs started with the help of some other foreign countries due to lack of technological proficiency, but soon after a certain period of time, Japan became self sufficient in the technological capability in the successful operation of PWRs. Further, Japan claimed from the very beginning that PWRs cannot be used in the development of nuclear weapons even through 'criticality'. However, the argument is simply incorrect. Many nuclear physicists claimed that PWRs can be used in the development of nuclear weapons. After a certain sorts of modification and through criticality, the PWRs can be transferred in the development of nuclear weapons.

FAST BREEDER REACTORS (FBRs)

Fast Breeder Reactors (FBRs) are fast neutron reactors designed to breed nuclear fuel by producing more fissile materials than it consumes in the generation of power. The FBRs are one possible type of breeder reactors. FBRs use heavy water for its cooling. Thus, it is from the group of heavy water reactors.[28]

In the case of Japan regarding FBRs program, one can easily trace the roots of its origin. Till early 1980s, Japan had no intention to develop the FBRs for a completion as commercial facility, but, in the report "Nuclear Vision for the year 2000" [29] indicates the introduction of FBRs will begin in 1986 and by the year 2000, all new installations and replacement will be FBRs. In such dimension, the plan for a commercial FBR was announced in 1971. Tokyo Electric Power Company, Hitachi, Mitsubishi-Heavy Industries and Tokyo Shibaura Electric Company have prepared conceptual designs for

[28] See Appendix I page no 112.
[29] Atoms in Japan, May 1971, Supplement I, p.30.

FBR. The construction of the FBR reactor started in 1977 and the completion schedule was in 1982. From 1961 to 1994, there was a strong commitment to FBRs, with PNC as the main agency. In 1967, FBR development was put forward as the main goal of the Japanese nuclear program, along with the Advance Thermal Reactors (ATR). In this period, Power Reactor and Nuclear Fuel Development Corporation (PNC) were engaged in two development programs of FBRs. The first one was *"Joyo"*, a 50-mwe experimental FBR and second one was the 300-mwe prototype breeder *"Monju"*.

In 1994, the FBR commercial timeline was pushed out to 2030, and in 2005, commercial FBRs were envisaged by 2050. In 1999, JNC initiated a program to review promising concepts, define a development plan by 2005 and establish a system of FBR technology by 2015. The parameters are; passive safety, economic competitiveness with LWR, efficient utilization of resources reduced wastes, proliferation resistance and versatility. Utilities are also involved, with CREIPI and JAEA.

Secondly, the Japanese FBRs program contains the development of different types of FBRs like sodium-cooled, helium-cooled, lead-bismuth, and supercritical water-cooled. All involve closed fuel cycle. This work is linked with the Generation IV initiative, where Japan is playing a leading role with sodium-cooled FBRs. The JAEA 2006 budget gave a significant boost to research and development on the fast breeder fuel cycle with an increase to 34.6 billion yen.

With a number of legal provisions by PNC and budget gave noteworthy boost up in the research and development that had made possible to the development of FBRs in Japan. Although, Japan developed FBRs for the power generation for peaceful purposes and two FBRs i.e. and 'Joyo' and 'Monju' were already started operation, but it was also criticized worldwide. Further, the FBRs reactors generate enough power in comparison to other nuclear reactors, but it proved uneconomic in terms of environmental hazards.

Some lobby of nuclear physicist claim that FBRs can directly be used in the development of nuclear weapons with certain technological modifications. These simple technological modifications become not a hurdle in the transformation of FBRs to nuclear reactors. At

the same time, FBRs nuclear reactors became hazardous for environment and for the people living close to the cite of these reactors. Somehow, Japanese nuclear physicists also accept that FBRs can be transfer into nuclear weapons through 'criticality'[30]

Although Japan has enough technological capability regarding the successful construction, development and management of FBRs, but a serious accident occurred in *'Monju'* breeder plant in *Tsuruga, Fukui* prefecture in December 1995. Japanese media gave unprecedented publicity to the accident. After the *'Monju'* accident, public concern for safety measures enhanced in pacifist way. The governors of prefectures- *Fukui, Fukushima and Niigata-* where nuclear reactors are concentrated took the lead to draw the attention of the government to the growing public concern. In January 1996, they submitted a document containing several suggestions for the safe conduct of nuclear policy in future and finally, Japanese government decided to postpone the FBR program beyond year 2030.

Japanese government could not ignore the common people's sentiments towards FBRs. Due to serious accident in *'Monju'* breeder in 1995 and opposition from the common Japanese people including the media person and administration of these prefectures, Japanese government postponed the FBRs program until 2030. However, the deep commitment towards the FBRs nuclear reactors and the 'criticality' in these reactors originated doubt about the Japan's peaceful nuclear program.

CONVERSION OF NUCLEAR REACTORS INTO NUCLEAR WEAPONS

Although, Japan achieved the construction, development and management of almost all types of nuclear reactors including the capability of 'criticality' that is necessary for the transfer of the nuclear reactors into nuclear weapons. But Japan also faced problems in such dimension. These problems related in the form of public awareness and pacifist sentiments including somehow technological capability. As Japan achieved the technological capability from the extraterrestrial forces but became proficient after

[30] See Appendix II on page ni 122.

sometime. At this instant, Japan became proficient in almost all types of nuclear reactors including Boiling Water Reactors (BWRs), Pressurized Water Reactors (PWRs) and Fast Breeder Reactors (FBRs).

The transfer of nuclear reactor for peaceful purposes into the nuclear weapons for militaristic purposes either in offensive purposes or in defensive purposes is happening through 'criticality'. Japan became well known capable in nuclear reactors and criticality both. After achieving the technological capability of 'criticality', one can easily conclude that Japan has enough potential to convert its peaceful nuclear reactors for power generation into nuclear weapons.

CONCLUSION

Overview of the Japanese nuclear reactors technology indicates one thing that, although, Japanese peaceful nuclear program was heavily dependent and influenced by the external nuclear power plant initially, but now it became self sufficient. The self-sufficiency in technological potential shows in each dimension related to nuclear like nuclear fuel cycle, the nuclear reactors and the criticality.

The self-sufficiency in each stages of nuclear fuel cycle like mining and milling of uranium, conversion/processing of uranium, enriching and refining of uranium, fuel fabrication, fuel reprocessing, wastes disposal, storage and transport of the radioactive materials specify that Japan became self-reliant in the nuclear fuel cycle. Although, Japan faces various troubles in nuclear fuel cycle i.e. lack of natural resources of uranium and the technology of reprocessing of uranium, however these problems became not an obstacle in the nuclear fuel cycle as Japan resolved through outsourcing. Outsourcing of the natural resources from nuclear as well as non-nuclear member states of uranium and reprocessing technology from other nuclear states simply indicates that Japan fulfill the requirements from either domestic production or external assist.

On the other hand, the successful construction, development and management of different types of nuclear reactors like Boiling Water Reactors (BWRs), Pressurized Water Reactors (PWRs) and Fast Breeder Reactors (FBRs) emphasis that Japan has enough potential in these arenas. Fast Breeder Reactors like *'Joyo'* and *'Monju'*, simply tells the whole story that can be use in the development of nuclear weapons from nuclear reactors.

Although, Japan emphasizes that these nuclear reactors are only for peaceful purposes and it cannot be in the development of nuclear reactors. However, the above claim is simply incorrect. Most of the nuclear physicists claimed that these nuclear reactors especially, Fast Breeder reactors (FBRs) can be use in the development of nuclear weapons.

Further, through 'criticality' in nuclear physics, is the other way through which any nuclear reactors can be develop to nuclear weapons with certain technological modifications. Japan also achieved the potential of criticality and finally has ability to develop nuclear weapons.

The existing stockpiles of enriched uranium within and outside Japan also conceal the possible black narrative of nuclear. The stockpiles of uranium are under the supervision of IAEA, but less than 1 percent of total existing stockpiles of uranium can be missing by the supervisor without doubt. In addition, the 1 percent of the total stockpiles of uranium became large enough for more than ten Hiroshima range nuclear weapons.

Although, Japanese nuclear program was initially energy oriented under the title "Atoms for Peace", but the technological advancements in nuclear fuel cycle, nuclear reactors and technology to convert the nuclear reactors into nuclear weapons, existing stockpiles of uranium and deep commitment towards FBRs generate doubt about the nuclear pacifist alteration. Together these factors originate push and pull factors between "Atoms for Peace" or "Atoms of War"?

CHAPTER-3

ANTI-NUCLEAR MOVEMENT IN JAPAN

INTRODUCTION

Japan is the only country where the devastation and immense human suffering had been experienced twice due to the Atom Bomb in World War II. The bombing of Hiroshima and Nagasaki by US in World War II, did not only add black chapter in the history of war and against entire humanity, but it also generated a widespread concern about the threat of the nuclear devastation against human race. The people of Japan since then have stood always against nuclear posture of Japan, have opposed nuclearization everywhere in the world and have taken lead in the moves to free the world from nuclear menace. Any talk of contribution of Japan to the humanity will be incomplete without appreciating the priceless role of Japanese anti-nuclear movements in the global efforts towards nuclear disarmament and world peace.

Japan's anti-nuclear movement became a prominent part of the Japanese culture after WW II. Although, the anti-nuclear movement does not generate the same high level of national enthusiasm that it did during the early post war periods. Several Japanese anti-nuclear organizations as well as anti-nuclear weapons organizations existed. Some of them also emerged in the recent years. These anti-nuclear organizations played a major role in the path of disarmament especially nuclear disarmament from generating the public awareness and somehow in policymaking process at administration level concerning such issue. However, these different anti-nuclear organizations to some extent have different interests and agendas pertaining to their universal objectives of nuclear disarmament.

The nature, characteristics and activities of these anti-nuclear organizations shows their different interests and agendas. But at some extent, these organizations draw the attention of Japanese common people as well as administration to the panic of nuclear proliferation and push the world to the nuclear disarmament and nuclear non-proliferation.

In such dimension, it is necessary to focus on the nature, characteristic and role of Japanese anti-nuclear movement. The Japanese anti-nuclear movement means, the anti-nuclear sentiments and the action by the common people or organizations or any thing against the nuclear weapons. But anti-nuclear movement could not became complete without including an endless efforts also by Japanese government. Historically, Japanese government also took initiative in the total abolition of nuclear weapons from the entire world. The total abolition of nuclear weapons from the world definitely consists the non-nuclearization of Japan at any cost. In the post cold war period, a Japanese sentiment towards nuclear issue became altered and is now talking less than total abolition of the nuclear weapons for Japan. The sentiments of less than total abolition of nuclear weapons are often blamed to the changing scenario of world politics.

Some scholars also claim that Japanese pacifist constitution has no affirmative meanings in changing world politics and especially East Asian security policy. For that reason, some Gaullist nationalist scholars from Japan advocate the amendment of the Japanese pacifist constitution. The proposed constitutional amendment also relates to revision of article 9 of the Constitution. In that direction, they are arguing that, the post war constitution was imposed by alien and we should throw it. Some nationalist also wants to see their nation as "superpower". Most often, the concept of super power includes the military and economic efficiency including the possession of nuclear weapons. In such scenario, they claim by anti-nuclear movements have no space in changing dimension.

In these contexts, it is necessary to evaluate the Japanese anti-nuclear movements from its very beginning. In such cases, it is obligatory to assess some questions like- is Japan's anti-nuclear movement became loosing its sharpness than its earlier stage? Has Japanese anti-nuclear sentiments became outdated and irrelevant fashion in Japanese culture? Does Japanese anti-nuclear movement has no space in Japanese society? Does Japanese Constitution become a legal barrier in the path of becoming a super power of Japan? Why three non-nuclear principles are only a legal provision and not Constitutional? Does pacifism, especially nuclear pacifism is in decreasing order in Japan? Does world politics especially East Asian politics is forcing towards the nuclearization of Japan?

ORIGIN AND EVOLUTION OF JAPANESE ANTI-NUCLEAR MOVEMENT

Japan is the first and only country in the entire human history so far to face nuclear attack twice. The U.S occupational forces lost no time to developing a censorship policy that effectively muted public criticisms of the atomic bombings of Hiroshima and Nagasaki. These censorship policy, which itself was not discussed publicly by the occupational officials and also prohibited Japanese newspapers from publishing problems, devastations associated to atomic bombing and also regarding the scientific and medical research. As a result, Japanese people became less informed about the negative consequences of the atomic bombing during the entire occupational periods. But, the facts of horrific experiences and administration's negative consequences became public at the end of 1952. These caused repressed and reticent frustration and antagonism from the atomic bombing in common Japanese people.

In the mid 1950s, the Japanese antinuclear movement grew out into a "national movement" in the aftermath of the Bikini incident. A U.S nuclear test (BRAVO) on Bikini Atoll in Marshall Island in March 1954 exposed 290 people to the affected by the blast and some of them died due to radiations. These radiations also resulted in the death of a Japanese fisherman named Kuboyama on a fishing boat, (*Fukuryu Maru No.5*) Lucky Dragon No 5. The sickness by the nuclear fallout was called (*shi no hai*) "ashes of death"[1]. This incident made the Japanese people aware of the danger of nuclear tests, reminding them the suffering of *Hibakusha*, victims of the atomic bombings in Hiroshima and Nagasaki in 1945. It was soon after the tragic event that a nationwide antinuclear movement was born in Japan.

The first organized step to politicize this pent-up anger and frustration that pervaded Japanese society appeared in Tokyo's *Suginami* ward/district. Although the status of women in Japan during the early post war period left much to be desired, this did not deter a number of them in the *Suginami* district from participating in the grass-roots

[1] Philip Nobile (ed.), Judgment at the Smithsonian: The Bombing of Hiroshima and Nagasaki (New York: Marlowe & Company), 1995, p.122.

activities that quickly lead to the formation of Japan's anti-nuclear weapons movement. A housewives' reading group organized by peace activist Kaoru Yasui, an erstwhile nationalist who lost his professorship because of his political views, was responsible for carrying the "Suginami Appeal" throughout Japan. Tokyo's housewives carried Suginami Appeal, which fundamentally was a signature campaign demanding the elimination of nuclear weapons. Begun in May 1954, the 'Suginami Appeal' rapidly evolved into a national initiative. In less than two months, the 'Suginami Appeal' had acquired nearly 3000, 000 signatures. By August, it had evolved into a national campaign, having amassed 14,000,000 signatures. By the time the first world conference against Atomic and Hydrogen bombs was held in on August 6, 1955, the national campaign had obtained 32 million signatures, a number exceeding half of all registered Japanese voters.[2]

The signature campaign truly mirrored the Japanese society. It received support from diverse people and groups including conservatives ones. Serving as political epoxy, the national signature campaign connected a substantial part of Japanese public to the heretofore-muted appeal of the Hiroshima and Nagasaki, who for years had been pleading for the abolition of nuclear weapons.[3] The signature campaign also received support from outside Japan and generated a widespread concern about nuclear devastation worldwide.

This petition campaign against thermonuclear weapons was started in a local community in Tokyo and similar activities spread across the nation promptly. Then, on the basis of this nation-wide petition campaign, a wide range of individuals and groups including political parties, labor unions, religious groups, women's groups, student groups, local governments and so on gathered spontaneously in the cause of banning nuclear bombs and came to be organized under *Gensuikyo* (the Japanese Council Against Atomic & Hydrogen Bombs in 1955).

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[2] George Totten and Tamio Kawakami, "Gensuikyo and the Peace Movement in Japan," Asian Survey, vol.4, May 1964, pp.833-841.

[3] As cited by Anthony DiFilippo, "The Politics of Japanese Nuclear Disarmament Initiatives: Where Government Policies and Civil Society Converge and Diverge" Arms Control and Disarmament: Lessons Learned and Future Prospects, International Studies Association, Portland, Feb 2003. pp 1-18.

The formation of *Gensuikyo* (Council against A-and H-Bombs), Japan's first antinuclear weapons movement groups that served as the catalyst for the national movement. The mainstay of *Gensuikyo* was by Japan's strong socialist party, the Communist Party, the labor groups, *Sohyo* (General Council of Trade Unions of Japan) and *Domei* (the Japanese Confederation of labor). Initially the Japanese public was absolutely opposed to the existence of nuclear weapons and not concerned with the politics of political parties. But, due to ideological controversies, the Liberal Democratic Party left *Gensuikyo*. At the end of 1961, they established *Kakkin Kaigi* (National Council for Peace and against Nuclear Weapons) or, it was widely known as second *Gensuikyo*. By the end of 1963, serious problems existed within *Gensuikyo* between socialist and communist factions. The socialist opposed nuclear testing by any country, while the communist were willing to accept Soviet testing. With *Sohyo,* the Socialist Party left *Gensuikyo* and established *Gensuikin* (Congress against A-and H- bombs) in 1965. Due to that, Japanese public concern regarding nuclear has became a different ideology.

In this respect, the first World Conference against Atomic and Hydrogen bombs gave-Japan's *Hibakusha* (the survivors of the atomic bombings), which had formed groups beginning in 1954 in Hiroshima, Nagasaki as well as elsewhere in Japan- "the courage to stand up", so that people of Japan and all over the world could hear their voices. In this respect, the formation of *Nihon Hidankyo* (Japan's Confederation of A- and H-bomb sufferers Organizations) was a great achievement.

From the time of atomic bombings, the *Hibakusha* has felt a sense of deep betrayal since they received no assistances from the US occupational forces and the Japanese government. Because of many social, psychological and medical problems of *Hibakusha* had been ignoring for years by both the US occupational forces and the Japanese Government. The rise of anti-nuclear movement gave them hope to live from the first time since the bombing, which led to organizing of *Nihon Hidankyo*.

Although, the splintering of Gensuikyo altered the dynamics of Japan's antinuclear weapons movement, it did not weaken its overall momentum. While the Japanese anti-

nuclear organizations were working towards the same objectives, both the *Gensuikyo* and *Gensuikin* continued to push hard for the abolition of nuclear weapons with *Hibakusha.* With their collective efforts in general and *Hidankyo's* efforts specifically, they made possible to bringing about the law on Special measures for Sufferers in 1967[4] addition to the 1957 A-Bomb Victims Medical Care Law. Because of their collective efforts to bring about the elimination of nuclear weapons, the International Peace Bureau nominated *Hidankyo* three times for the Nobel Prize-in 1985, 1995 and 2001[5]. From the very beginning, these organizations started campaign each year for public awareness.

CIVIL SOCIETY AND JAPAN'S ANTI-NUCLEAR MOVEMENT

Still splintered, the anti-nuclear weapons movement remains an essential part of Japanese culture. In such extent *Gensuikin* and *Gensuikyo* continue to commit to their original motives to mobilizing the Japanese people for the total abolition of nuclear weapons. In such directions, *Hidankyo* experienced some success in 1994 with the limited *Hibakusha* Aid Law from which officially certified sufferers were to receive monthly medical payments of about $1,150. In that extent four major groups joined the movements for the total elimination of nuclear weapons. They were the Tokyo Physician for the Elimination of Nuclear Weapons (TPENW), The Peace Depot, The Japanese Association of Lawyers against Nuclear Arms (JALANA) and The Hiroshima Peace Institute.

The demonstration and the continuous opposition of nuclear weapons in Japan, continue to attract the large number of people. For example *Gensuikyo's* 2002 World Conference meeting in Hiroshima attracted approximately 7,000 people while *Gensuikin* drew 3,500 people.[6] Beyond this one, begun in February 1985, the appeal from Hiroshima and Nagasaki for the elimination and total ban on nuclear weapons succeeded to acquiring signatures of more than 62 million people in Japan by January 2001. By 2000-01, the appeal spread over 531 cities on 105 nations including the nuclear weapons states.

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[4] Hidankyo, "Introduction", (Policy Statement),n.d., The First Special Exhibition of Fiscal Year 2001.
[5] Nihon Hidankyo (Policy Statement), n.d. 2001.
[6] "Gensuikyo and Gensuikin Hold Conference in Hiroshima", Chugoku Shimbun Peace News, August 5, 2002.

Signature campaign for the appeal from Hiroshima and Nagasaki initiated local municipalities to sign nuclear free declarations. The number of local municipalities that signed nuclear-free declaration exceeded from 300 to 2,500 from 1980s to 2003. In 1975, Kobe adopted a resolution declaring its port as nuclear free area and it still maintains its status. Motivated by the Kobe resolution, Kochi prefecture also unsuccessfully tried to declare the same in 1999 that would deny the US warship entry into Japanese territory. However, Tokyo certified that they are not carrying nuclear weapons.

Hiroshima and Nagasaki remain the symbolic hubs of Japan's anti-nuclear weapons movement and attracted people for peace ceremonies commemorates to those people who died in the atomic bombings. An estimated 45,000 people attended the Hiroshima peace ceremony and on August 6, 2002 and 20,000 were present in Nagasaki on August 9 in the same year. While *Kakkin Kaigi, Gensuikin* and its supporter *Rengo* (Japanese Trade Union Confederation) works cooperatively. The abolition of nuclear weapons is still its principle objectives.

Hiroshima and Nagasaki continued to protest nuclear testing by any country. Hiroshima and Nagasaki both began to sending protest letters to countries that carried out nuclear tests from 1970 onwards. Until 2002, Nagasaki send 547 protest letters to government involved in any type of nuclear testing including US in 1998.

On the contrary, the Japanese Government couldn't ignore such public sentiments and adhered to non-nuclear weapon policies, and adopted the nuclear policy in then Prime Minister ship of Eisako Sato in 1967-68i.e (1) the peaceful use of nuclear energy, (2) three non-nuclear principles, (3) the promotion of nuclear disarmament and (4) the reliance on the U.S. nuclear deterrent against international nuclear threats. These four nuclear policies were the pillar of the promotion of nuclear disarmament from Japanese side. These nuclear policies still have significance in nuclear disarmament and world peace.

Therefore, it may safely be said that Japanese antinuclear activism played an important role in maintaining such a Japanese non-nuclear weapon posture, at least, officially. However, the government's attitude toward nuclear disarmament continued to be a cause of frustration for Japanese antinuclear activists and groups, because it failed to become a driving force of international nuclear disarmament contrary to their expectation. In their opinion, nuclear weapons should never be used again against humanity and should be abolished entirely. They are nothing but an "absolute evil." Such claims on nuclear weapons were well received by the public. Being aware of antinuclear sentiments widely shared by the Japanese people, the Japanese Government repeatedly appealed nuclear disarmament as an earnest desire of the Japanese people to the rest of the world.

DISARMAMENT AND THE JAPANESE GOVERNMENT

The end of cold war shaped a prospect for Tokyo that did not exist in the history. Seeking an intercontinental responsibility of some significance and already sensitive to the significance of nuclear disarmament, Tokyo proceeded to take advantage of the international environment and openly calling for the abolition of all nuclear weapons became a reoccurring premise in Tokyo's international policy agenda.

Tokyo's assessment to embrace the elimination of nuclear weapons can be traced to a speech by former PM Noburu Takeshita in UNGA special session on disarmament in 1988. In his speech, he preferred to host a U.N symposium on disarmament and finally hosted[7]. After that each year, Japan has introduced nuclear disarmament resolution to UNGA's first committee on disarmament and international security. Japan also submitted a printed declaration to the International Court of Justice arguing the use of nuclear weapons would be against the spirit of International law. Again in 1995, the then PM Tomiichi Murayama appealed for the abolition of all nuclear weapons and for the Comprehensive Test Ban Treaty (CTBT) to come into force. Foreign Minister Yohei Kono also made similar appeal in 1994[8].

[7] In Quest of a New Role: United Nations and Japan (pamphlet), Tokyo, 2000.
[8] Ministry of Foreign Affairs, international cooperation: Japan's Stance on Nuclear Non-proliferation and the Promotion of Nuclear Disarmament, Tokyo: MOFA, 1995.

Prime Minister Ryutaro Hashimoto also stressed Tokyo's incremental position on nuclear disarmament, which is that the global community should make continuous and realistic movement towards the abolition of nuclear weapons.[9] The then Foreign Minister Yukihiko Ikeda elaborated Tokyo's incremental position[10] to the seminar on nuclear disarmament after the Indefinite Extension of the NPT held in Kyoto. In July 1997, Ambassador Masahiko Koumura repeated almost exactly Tokyo's position to the UN conference on disarmament held in Sapporo, Hokkaido.

Yet, relative to the nuclear powers, Tokyo has retained a much higher level of commitment to nuclear disarmament. Reliable on its commitment, the then Prime Minister Keizo Obichi again made clear before UNGA in September 1998 about the Japanese government's interest in abolishing nuclear weapons. Further, Parliamentary Secretary of Foreign Affairs Toshio Kojima stated at the U.N. Conference on disarmament Issues in August 2001, that, Japan's non-proliferation and disarmament efforts had become an important pillar of its foreign policy.

It is true that almost ten years back, Tokyo incorporated its non-proliferation and disarmament interests into its foreign policy. The Japanese government's Official Development Assistance (ODA) reflects these interests. Tokyo responded very aggressively about China's nuclear tests in 1995 and India and Pakistan's nuclear tests in 1998 by withholding foreign assistance to these countries. However, Japan started its ODA program to China after its signing CTBT in 1996, shows Japan's commitment to the nuclear disarmament[11]. Further, the terrorist attacks on US in 2001 also compromise the Tokyo's nuclear disarmament efforts. Tokyo's incremental approach[12] towards the nuclear disarmament was metamorphosing into a retrogressive approach.

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[9] Ministry of Foreign Affairs, Statement by Prime Minister Ryutaro Hashimoto at the 51st Session of the General Assembly of the United Nations, New York, September 24,1996.
[10] Incremental position is to eliminate nuclear weapons through continuous negotiations and efforts.
[11] Ministry of Affairs, "Japan's Official Development Assistance",, Summary 1998.
[12] Incremental Approach of nuclear disarmament is to eliminate nuclear weapons through continuous negations and efforts.

Tokyo also shows its enthusiasm for nuclear disarmament in PM Koizumi's speech in UNGA in September 2002. Koizumi spoke that Japan would preserve with its work to eliminate nuclear weapons and its oratory would be doubled its efforts to bring about the early entry into force of the CTBT. However, the US did not send its delegates to the CTBT in 2001, shocked Japanese efforts toward the incremental approach of eliminating the nuclear weapons[13].

Tokyo understood very well that without the US efforts, it can not be possible to achieve its incremental approach of nuclear disarmament. Even, US administration voted against the Japan's 2001 U.N disarmament resolution, but Tokyo decided to continue its effort to the nuclear disarmament. Japan also stated that it is important for U.N Conference on Disarmament to give some additional benefit and assurance for non-nuclear weapon states that nuclear powers will not use or threat them.

NEW TRENDS IN THE POST-COLD WAR ERA

With the end of the Cold War, political and military tensions were dramatically reduced around the world. The nuclear danger became no longer looming, moving backward from the front stage of international politics. The United States and the Soviets, presently Russia, started negotiating on the reduction of nuclear armaments and made some progress in such direction. Some government agencies and non-government organizations are now seriously pursuing the abolition of nuclear weapons as a practical and feasible goal. Furthermore, at the NPT review conference in 2000, five nuclear weapon states, the U.S, Russia, the U.K., France, and China, consented to "[a]n unequivocal undertaking" "to accomplish the total elimination of their nuclear arsenals leading to nuclear disarmament to which all States parties are committed under Article VI[14]" of the treaty of the NPT. As far as Japan is concerned, the government is showing its interest in nuclear disarmament, for example, by sponsoring the Tokyo Forum for Nuclear Non-Proliferation and Disarmament, an independent panel of experts, and by submitting

[13] Anthony DiFilippo, "Bush's Nuclear Weapon Policy: Where the Rule of Law Doesn't Matter", Foreign Policy in Focus: A Think Tanks without Walls, June 26, 2002.
[14] See Appendix III on page no 130.

annually to UNGA (United Nations General Assembly) resolutions calling for the total elimination of nuclear weapons in the last few years. With the end of '1955 system' of LDP rule, an unconventional working relationship between the antinuclear movement and members of the Diet emerged. That is the birth of the Japanese branch of Parliamentary Network for Nuclear Disarmament (PNND), an international non-partisan forum for parliamentarians to share knowledge and information in order to cooperate in developing strategies for nuclear disarmament.

The worldwide anti-war movements after 9/11 have also given impetus to the Japanese anti-nuclear initiatives recently and not only common people and particularly the younger generation has come forward to uphold the legacy of Hiroshima and Nagasaki but they are also expanding the horizons of their concerns to Perpetual Peace, Human Rights and Larger Disarmament issues. Civil society initiatives like ***Hidankyo***, (Confederation of A- and H- bomb sufferers organization), Peace Now, Hiroshima World Peace Mission, No Nukes, Asia Forum are valuable speculation in this direction. Not only for non-nuclear posture of Japan, but also for their struggle for abolition of nuclear weapons from the entire world. Japanese anti-nuclear organizations were quick to oppose nuclear testing by any countries and subsequently they have been trying to inform and sensitize people in the subcontinent about dangers of a nuclear war.

The important features of the Japanese antinuclear movement have been its consistent and broad approach towards nuclear-disarmament, use of creative and largely non-confrontational methods of protest and sensitization, participation of common Japanese, NGOs, religious groups, labor organizations, women collectives and sections of parliamentarians and local governments in large numbers. Somewhere, between 75 and 80 percent of the municipalities have adopted non-nuclear disarmament declarations and support the nation's nuclear policy specially three non-nuclear principles[15], At the same time, the Japanese anti-nuclear movement has not been too much state-centric rather it has concentrated more on consolidating public opinion centering the concept that

[15] The three Non-Nuclear Principle are Not to posses, Not to Manufacture, and Not to Introduce Nuclear weapons on Japanese ground.

common Japanese people may be aware more than the policymakers. Through their rigorous efforts, the Japanese anti-nuclear activists have transformed Hiroshima and Nagasaki from symbols of devastation to symbols of peace.

The legal, internal and external hurdles that contribute in framing the characteristic of societal will regarding the nuclear issue in Japan are tremendously important and must be thoroughly evaluated in any attempt to assess Japanese nuclear policy. After a fine observation regarding the non-proliferation at policy making level and anti-nuclear movement at ground/people level in Japan, we can find a number of obstacles in the forms of institutions and provisions have major emphasis in non-proliferation of Japan and plays pivotal role in Japanese anti nuclear movement. However, the fine observation of these obstacles shows the altering nature of these obstacles and talking about the less than total abolition of nuclear weapons from the world and advocates the nuclear option for Japan. Although, the altering of nuclear pacifism not commonly talking about nuclear Japan, but undoubtedly talking about the nuclear option for Japan. Alteration in the various pacifist obstacles shows shift from pacifism to militarism and possibly nuclear option for Japan.

THE PREAMBLE AND ARTICLE 9 OF THE JAPANESE CONSTITUTION

In the sense of speaking, nuclear options for Japan, one must deal with by any proponent of nuclear weapons is the Preamble and the Article IX of the Japanese pacifist Constitution, dealing with war potentials. The Preamble and Article IX of the Constitution binds government of Japan to renounce war as a means to resolve the international disputes. The Preamble of the Japanese Constitution reads as follows:

We, the Japanese people, acting through our duly elected representatives in the National Diet, determined that we shall secure for ourselves and our posterity the fruits of peaceful cooperation with all nations and the blessings of liberty throughout this land, and resolved that never again shall we be visited with the horrors of war through the action of government, do proclaim that sovereign power resides with the people and do firmly

establish this Constitution. Government is a sacred trust of the people, the authority for which is derived from the people, the powers of which are exercised by the representatives of the people, and the benefits of which are enjoyed by the people. This is a universal principle of mankind upon which this Constitution is founded. We reject and revoke all constitutions, laws, ordinances, and rescripts in conflict herewith.

We, the Japanese people, desire peace for all time and are deeply conscious of the high ideals controlling human relationship, and we have determined to preserve our security and existence, trusting in the justice and faith of the peace-loving peoples of the world. We desire to occupy an honored place in an international society striving for the preservation of peace, and the banishment of tyranny and slavery, oppression and intolerance for all time from the earth. We recognize that all peoples of the world have the right to live in peace, free from fear and want.

We believe that no nation is responsible to itself alone, but that laws of political morality are universal; and that obedience to such laws is incumbent upon all nations who would sustain their own sovereignty and justify their sovereign relationship with other nations.

We, the Japanese people, pledge our national honor to accomplish these high ideals and purposes with all our resources.

And on the Other hand, Article IX reads as follows:

Aspiring sincerely to an international peace based on justice and order, the Japanese people forever renounce war as a sovereign right of the nation and the threat or use of force as means of settling international disputes.

In order to accomplish the aim of the preceding paragraph, land, sea, and air forces, as well as other war potential, will never be maintained. The right of belligerency of the state will not be recognized.

In both, the Preamble and the Article IX of the Japanese Constitution has foremost emphasis on the international peace and against maintaining all types of war potentials. Preamble and the Article IX of the Japanese constitution collectively make a pacifist-the doctrine of opposition of all wars-constitution, which is ultimately an inimitable feature among others. Only these clause and Preamble together puts the term pacifism in strong way and endorse the Japanese government to promote pacifism worldwide. The Preamble and the Article IX of the Constitution also helps to promote pacifism among people.

The Japanese pacifist constitution becomes the foremost hurdles in the nuclearization of Japan in any sense alike defensive as well as offensive. It is clearly revealed in the preamble that any war will be avoided in future through policymaking level to settle the international disputes. On the other hand, the Preamble also consists that Japanese people have determined to preserve their security and existence, trusting in the justice and faith of the peace-loving peoples of the world. The Preamble contains not only peace loving elements, but it also included the high morality and prominence like preservation of world peace, and the banishment of tyranny and slavery in the entire world. These high moral values not only generate hurdles for nuclearization of Japan, but also show the path to participate actively in establishing peace worldwide. On the other hand, paragraph II of Article IX of the Japanese Constitution again prohibits Japan to maintain any war potential. Although, it does not say anything about nuclear but obviously, nuclear weapon is the extended and advanced version of destructive war potential.

Debate about the amendment in the Japanese constitution indicates the altering nature of pacifism in Japan. Favor in the revision of the pacifist constitution by Liberal Democratic Party, Liberal Party, Komeito and Democratic Party of Japan and opposition by the Japanese Communist Party and Social Democratic Party simply indicate that Liberal Democratic Party, Liberal Party, Komeito and Democratic Party of Japan jointly can make it possible to amend the Japanese Constitution. As Liberal Democratic Party with all its alliances on the issue of constitutional amendment agree in favor of constitutional amendment, and then opposition party has become no option. Only Japanese people have right to give them option to amend the constitution or not through referendum.

THE JAPAN'S ENERGY ACT (1956)

The constitutional barriers like the Preamble and the Article IX of the Japanese Constitution give enough interpretation for non-nuclearization of Japan. But, the Atomic Energy Law (AEL) also gave enough space for formidable interpretation. Simply, the Atomic Energy Law gave provision for non-nuclear ground legally if not constitutionally. Article I of the Japan's Atomic Energy Law states that – The objective of this Law should be to secure resources in the future, to achieve the progress of science and technology and the promotion of industries by fostering the research, development and utilization of atomic energy and thereby to contribute to the welfare of mankind and to the elevation of the national living standard.

Article II of the Atomic Energy Law states that- the research, development and utilization of Atomic Energy shall be limited to peaceful purposes and performed independently under democratic management, the result therefore shall be made public to contribute to international cooperation.

It became noticeable from the reading of Article II of the Atomic Energy Law that any programs, defensive or offensive which consist the proposals to develop a nuclear capability for nonpeaceful objectives would contravene the intent of the Atomic Energy Basic Law. In simple terms, that the Atomic Energy Law gave some pace to reinterpret the Japanese nuclear issue by the Japanese officials, if they have any plan and intention for defensive as well as offensive use of nuclear energy. Article II of the Law also states that the development and utilization of the nuclear energy would be in limited way and under democratic management. Unless, Japanese government has any intentions towards the nuclearization in offensive means, then it has to make it public and also gained supports from the common Japanese people. In such dimension, it has also responsibility to arrange memorandum to the common people and achieve confidence in the referendum.[16]

[16] The amendment in the Japanese Constitution can be held according to paragraph I of Article 96 of the Constitution through referendum.

If all the things regarding the nuclear issues are not going according to the law and under the democratic manner then definitely and clearly, it shows the Japanese intension towards nuclearization. Although, Atomic Energy Law is a legal norms but Japanese government has accountability to justify it and make sure that the ongoing research related to nuclear and further use of the nuclear energy will be peaceful and under democratic manner. Further, Japanese government has also accountability to sure that Japan has no intention to use nuclear energy either for defensive or offensive.

On the other hand, Article I of the Atomic Energy Law specify that the nuclear energy should be use only for the nuclear power for the development of science and technology and industries which are the main pillar of the growth and development of the country's prosperity. It also states that the nuclear energy should be only contributed to the welfare of mankind through medicine and biological needs.

Simply, the Atomic Energy Law prohibits Japan to use its nuclear energy in any destructive use either in defensive or in offensive purposes. These laws's major emphases are on the use of nuclear energy for the welfare of mankind, for peaceful purposes and under democratic ways. However, if Japanese government has any intention to use nuclear power/reactors in settling international disputes and make its own indigenous nuclear weapon then it has also accountability to eliminate all the legal and constitutional barriers and gain people's confidence. Changing security dimension in East Asia and growing nationalism in Japan indicates that nuclear program became not a dare dream for Japan to use that one for settling international disputes.

NON-PROLIFERATION TREATY

Nuclear Weapons are, in sheer explosive power, the most destructive weapons available to the states. A single weapon, the size of a refrigerator can destroy a whole city. Defending against nuclear weapons is extremely difficult at best[17].

[17] Goldstein, Joshua S. "International Relations" (Fifth Edition), Pearson Education (Singapore), 2003, pp. 242.

Proliferation is the spread of weapons of mass destruction, nuclear weapons, ballistic missiles, and chemical or biological weapons- into the hands of more state and non-state actors. Poor states and middle powers, except nuclear weapon state, want weapons of mass destruction especially nuclear weapons with ballistic missiles capability to launch these weapons of mass destructions for securing their state boundaries from other states and non state actors in purely militaristic terms. But according to the scholars who believe in offensive realism[18], more often think that availability of weapons of mass destruction especially nuclear weapons to any state can easily help to fulfill the national interest of the state in militaristic as well as economic terms. On the other hand, non-state actors like terrorist groups, fundamentalists, guerilla warriors, and some times freedom fighter groups also want to have weapons of mass destructions for their specific interests. And the availability of weapons of mass destruction to these non states actors has other impact on the international politics, concerned state's national politics and also the entire humanity.

Non-Proliferation is just opposite to the Proliferation which originates a major hurdle in the path of Proliferation of weapon of mass destruction-nuclear weapon, ballistic missile, and chemical or biological weapons (NBC) from its very beginning to the states and as well as non states actors. The Nuclear Non-proliferation Treaty of 1968 prohibited countries other than those conducted nuclear tests in or before 1967. It also prohibits other countries to achieve nuclear status by any means. But the Treaty of Non-Proliferation is not saying strongly anything about the total elimination of nuclear weapons from the world and also became silent in that situation if any country became indulge in getting nuclear technology either for defensive as well as offensive purposes.

In varying global security perspective and instability in East Asia, the Japanese anti-nuclear movements are facing serious challenges. The government policy has almost shifted from refusal of nuclear arsenal to somehow option. The government is sometimes even turning hostile to these movements and also due to complex international situation;

[18] Offensive Realism is a concept which focuses that state should always try to increase its military capability. It also states that the capability is not depend on the comparative terms to other states.

it is facing the danger of giving way to a changed public opinion overpowered by the notion of deterrence. However, the movement has the moral strength and resilience, and the inspiration derived from unforgettable human loss in Hiroshima and Nagasaki, which would render it effective and help Japan and other parts of the world also change in realizing the need to get rid of the deadly menace of nuclear holocaust.

As we see the Japanese commitment towards the non-proliferation of the nuclear weapons from the world, then any body can easily understand the mass roots of the anti-nuclear sentiments in Japan. But now days, a debate started regarding the future of the NPT in the present scenario of North Korean and Iran's nuclear crisis. In the recent controversy and somehow failure of the NPT, some scholars advocated that NPT is now loosing its credibility to avoid spreading of nuclear weapons to more hands. They are arguing that some rough states are trying to get technology and enriched Plutonium for nuclear reactors. These rough states do not care about the future of NPT. The violation of the law of NPT by the rough states and other nuclear states originates a major peril for the future of NPT. Even some scholars also arguing, that NPT is legally limitation only for non-nuclear states and it has no influence towards nuclear weapon states.

These panic situations also give pace for the terrorist organization and other non-states actors to achieve nuclear status at any cost for their specific interests. The former situation will be terrible for the entire humanity. Some other scholars also arguing that it's better to scrap the NPT because it's loosing its credibility to non-proliferation of nuclear weapons to rough states and other non-states actors especially terrorists organizations. So it's better to scrap NPT[19] and give opportunity to all members to achieve nuclear power state at least for peaceful and defensive purposes to secure the supply of energy demands and also secure their national interests. They also advocate that in such cases, the nuclear issue became a bargain chip for middle powers. On the other hand, some optimist are arguing on the line of something is better than nothing and advocate that NPT should be necessary but it needs a revision in its format.[20]

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[19] Wesley, Michael, "It's time to scrap the NPT" Australian Journals of International Affairs Vol.59, No.3,pp283-299, September 2005.

[20] Hanson Marriane, "The future of NPT", Australian Journal of International Affairs, vol. 59, No.3, September 2005, pp.301-316.

If Japanese government has any intention to move a solitary step towards the nuclearization of Japan in the light of earlier ongoing debate that NPT is now losing its credibility and it is only vault for non-nuclear states. Also, in the vision of the earlier debate, Japanese bureaucratic movement towards in the light that international politics is self help system and each and every states has right to achieve their own interest by any means. Therefore, Japan should also gain the status of superpower and secure its interest in international sphere and secure its energy supply, which is the main pillar of the economic and industrial growth of any advanced states like Japan. In such case, Japan must leave NPT with further notice to NPT Council.

On the other hand, some observation in the media person and young generation that NPT is legal hurdles adopted by Japan itself and strong political determination will solve the entire dilemma, because according to international rule, any nation can withdraw themselves from any accords, agreements or treaty with prior notice of three months. In such cases, international community has no objection regarding any accords, agreements and treaty and any states can withdraw from any agreements with prior notice of three months. Many states have already adopted such norms many times in international arena to achieve the contemporary national interest. Therefore, if Japan moves in such direction then the NPT becomes not a major hurdle in this dimension. After securing the national interest, many countries again join the international organization to secure their national interest in future. In other words, these international accords, agreements and treaties are not become hurdles for states any more in such arena. In these respects, scholars and bureaucrats suggests that Japan should also adopt the same line for its security perspective.

THE NON-NUCLEAR PRINCIPLES

Japanese people are constantly aware of anti nuclear sentiments from its very beginning. After the Hiroshima and Nagasaki genocide, Japanese people commemorate 6th and 9th August of each year pledge to save the world from another nuclear catastrophe. Japanese government also could not ignore and disregard the common people's sentiments

regarding nuclear. In this direction, a major pace provided by the then Prime Minister of Japan Eisako Sato in 1967-68. Due to non-adherent of public sentiments, non-nuclear policies were adopted in Prime Minister ship of Eisako Sato in 1967-68 i.e. (1) the peaceful use of nuclear energy, (2) three non-nuclear principles i.e. not to posses, not to produce and not to introduce nuclear weapons on the Japanese ground, (3) the promotion of nuclear disarmament and (4) the reliance on the U.S. nuclear deterrent against international nuclear threats. These four nuclear policies were the pillar of the endorsement of nuclear disarmament and according to the national feelings.

These four non-nuclear principles adopted by then Prime Minister Eisako Sato have great emphasis in the Japanese policy making process regarding anything to the nuclear. These four non-nuclear principles clearly show the path of nuclear disarmament, peaceful use of nuclear energy and heavily dependent on US for any external nuclear threat. However, the most important among these four non-nuclear policies are the second one i.e. the three non-nuclear principles-not to posses, not to produce, and not to allow nuclear weapons on the Japanese ground.

From the very beginning of the adoption of these four nuclear policies, Japan was very aware of the anti-nuclear sentiments and also adopted the IAEA norms and policies. Japan is also advocating the IAEA peaceful programs. These all sentiments are clearly visible in the Japanese four nuclear policies and especially three non-nuclear principles. These nuclear policies show the anti nuclear sentiments of the Japanese society.

But after a period of time, the three non-nuclear principles loss its credibility and Japanese government itself violated the three non-nuclear principles. It became widespread belief that U.S. nuclear weapon has entered into Japanese territory. According to a 1975 Asahi Shimbun survey, 67% of the people believed that Tokyo had ignored the third non-nuclear principle -not to allow nuclear weapons on Japanese ground. If Japan itself can violate its three non-nuclear principles then 'nuclear Japan' cannot became a dare dream. In that scenario, if Japan has any intension regarding to the nuclear option, then it must change its nuclear policies and especially three non-nuclear

principles. In such dimension, Japan's secret permission to the entrance of U.S. nuclear weapons became a great drawback in the credibility of non-nuclear principles. Further, violation of the non-nuclear principles shows the Japan's inclination towards nuclear.

NUCLEAR PACIFISM IN JAPAN

Japan is the single nation, which suffered the devastation of nuclear weapon. The effect of the nuclear bombing in two cities, Hiroshima and Nagasaki was terrible as it killed 150,000 and injured many more and turned the entire city into ruins. The after effect of the bombing resulted the origin of nuclear pacifism in Japan. The Atom bomb survivors (*Hibakushas*) formed anti nuclear movement groups in Japan which led the roots of nuclear pacifism to oppose nuclearization of Japan as well as the world. Every year they commemorate the atomic bombing on Hiroshima and Nagasaki on 6th and 9th August and pledge to save the world form another nuclear devastation. Nuclear pacifism became more vibrant following the revelation of nuclear tests of 1954 Bikini island. Following this incident the *Gensuikyo* (Japan Council against Atomic and Hydrogen Bombs) came to existence, which holds nation wide rallies including an annual world Conference against all forms of nuclear weapons. Following the Bikini island incident opposition of nuclear armament became Japan's official strategy as the Japanese administration viewed that if the nuclear tests are conducted in its territory, the people will continuously suffer from nuclear radiation.

Nuclear pacifism in Japan strengthened when the opposition parties joined hands with the ongoing anti- nuclear movement in Japan. The Socialists blamed the ruling LDP for having desire of the Kishi cabinet to arm the SDF with nuclear weapons and presented a resolution in 1959 in the Diet against possible indigenous nuclear armament. Socialist's anger increased when Prime Minister *Kishi* told a Diet Committee that, "small atomic arms for self defense would not violate the Constitution." Prime Minister Kishi's statement stimulated nuclear pacifism's debate in Japan. Due to continued pressure from the anti-nuclear lobby, Japan in 1967 adopted three non-nuclear principles (Hikaku Sangensuku) which spelled out that Japan is not to produce, posses or introduce nuclear

weapons. Amid the debate whether Japan should join the NPT or not, the Yomiuri Shimbun conducted a nation wise survey and put the question to 3,000 respondents asking, "Whether they desire nuclear weapon for Japan"? Only 20% desired the weapon with some conditions while a majority of them resoundingly rejected the option.[21] (See Figure 1) The ongoing debate to renounce the option of nuclear weapon achieved substantial breakthrough when Sato government signed NPT in 1976. Although, nuclear pacifism has great impact on Japanese society and politics, but it was not totally against the nuclear weapons (See Figure 1)

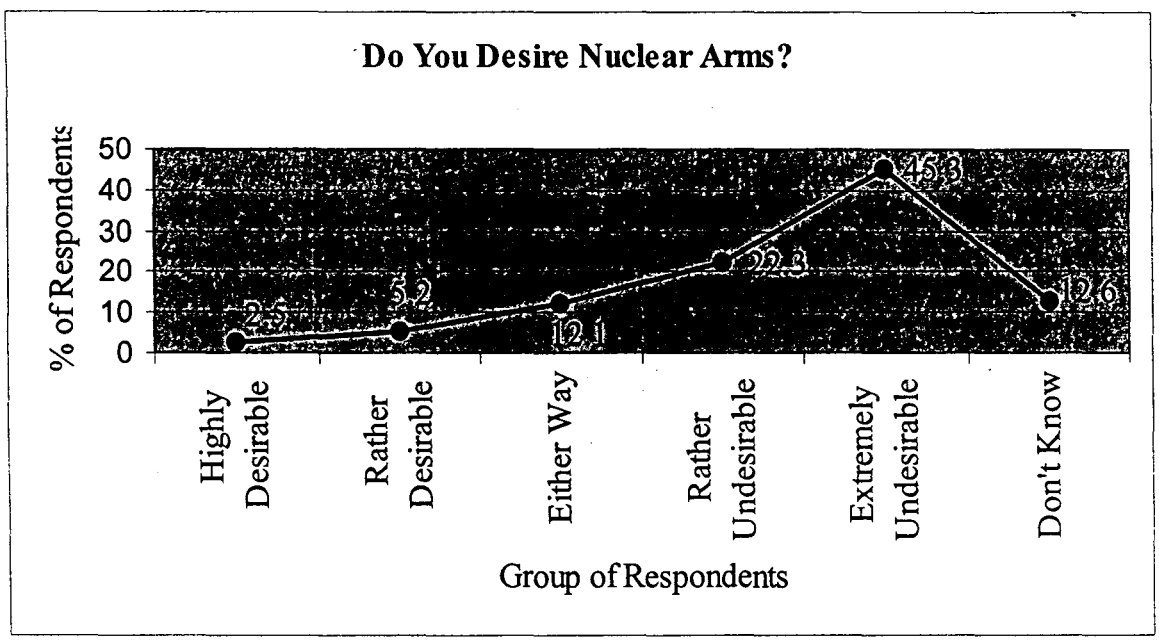

Figure 1

The nuclear pacifists lobby in Japan has been so strong that it influenced the government to adopt a policy of suspension of ODA loans, if a recipient country conducts nuclear tests and involves in WMDs proliferation. The result of this policy was visible when following the nuclear tests by China in 1995, and India and Pakistan in 1998, ODA loan was suspended. There still exists nuclear pacifism in Japan; however, it is eroding following nuclear ambition of North Korea and its recent announcement that it may

[21] The Yomiuri Shimbun, May 31,1970 as quoted in Endicott, John E. (1972) Japan's Nuclear Option: Political, Technical, and Strategic Factors. Praeger Publisher, New York p.98.

produce nuclear weapon. As a result of this Japanese are weighing nuclear option as a deterrent to the North Korean nuclear challenge.

It is fact that the pacifist movements could not continue for so long and could not achieve to alter the course of remilitarization and termination of Security treaty, but the long-term influence of pacifist movements is evident in the preservation of Article 9 of the Japanese Constitution, maintaining sustained pressure to get back Okinawa from the US occupation, the ban on the dispatch of military forces overseas, the imposition of 1% ceiling on defense spending and adoption of three non-nuclear principles, signing ratification of NPT, supporting the goals of IAEA and mass support of anti-nuclear organizations. There may be various reasons for gradual decay of the pacifist movements. But most obvious reason was emergence of new generation, who had not witnessed the devastation of war. Thus, pacifist ideas did not appeal to them that much like older generation, who has seen the war devastation. Although, the percentage and the rate against the pacifism in Japan is in small number, but has great impact.

Another reason for the decay of pacifist movement was the government's relentless pursuit for remilitarization, ignoring the exhortations of the pacifists. The emergence of nationalist leaders like Nakasone, who vociferously talked about amendment in imposed Constitution and mutual alliance with the US, was yet another blow to the pacifist's ideal to establish a peaceful and unarmed Japan. Other pace is also seen in the Prime Minister ship of Koizimi Zuniechiro. On which way, the ruling LDP change the regime for Postal Reform issue and also gain landslide victory in General Election, this shows that now Japanese people want change in all directions. May be it also change the traditional Japanese nuclear pacifist mindset?

COMPREHENSIVE TEST BAN TREATY

In the post cold war era, when East Vs West and ideological confrontations have no more space in the world politics and world became unipolar, nuclear weapon states still wanted to establish their superiority through nuclear explosion. In that situation, A

Comprehensive Test Ban Treaty (CTBT) to halt all nuclear test-explosion was signed in 1996 after the decade of stalemate. It aims to impede the development of new types of nuclear weapons. Technological advancement in the design of weapons (without needing to actually explode one), and in verification that no test are occurring-overcame the previous reluctant of the great powers to undertake this step. However, the treaty does not Take effect until signed and ratify by all 44 states believed capable of building at least a crude nuclear weapon.[22]

A severe number of states did not sign and ratified the CTBT, and conducted a series of nuclear explosion ignoring CTBT. Some countries like US voted in 1999 against rectifying the CTBT and the contrary Russia ratified it in 2000.

In fact CTBT is the subject of those countries which suppose to believe capable of building nuclear weapons. But, it would be imprecise to say that Tokyo has not attempted to uphold CTBT. When U.S. senate also failed to ratify the CTBT, Japan arranged bilateral discussion to force the early entry into CTBT with U.S itself in the U.S-Japan Commission on Arms Control, Disarmament, Non-proliferation and Verification.[23] Although, CTBT is a subject of those countries capable for the nuclear explosion, but Japan always support the goals of CTBT through cutting the ODA loans for those countries who indulge in the nuclear proliferation. Virtually, Japan do the same, but again starts ODA program for profitable benefits indicates that profit dominates pacifism and CTBT.

NUCLEAR WEAPON FREE ZONE

Nuclear Weapon Free Zone (NWFZ) is a post war phenomena that the countries of any region can collectively decided to avoid nuclear weapons from their region. The concept of Nuclear Weapon Free Zone also prohibits the concerned country to introduce nuclear weapons in the specific region. In this context, the Japanese anti-nuclear weapons

[22] Goldstein, Joshua S, "International Relations" (Fifth Edition) Pearson education, Singapore, (2003) p.256
[23] Ministry of Foreign Affairs, Japan's Efforts to Promote the Early Entry into Force of the CTBT, Tokyo, November 2002.

organizations generally support the formation of a nuclear weapon free zone in the Northeast Asia and they would like to see that Tokyo should take concrete steps to develop it.

Although, Tokyo supports the configuration and development of Nuclear Weapon Free Zone in the Central Asia as well as cover up the entire southern Hemisphere. The Japanese government advocated one in the Central Asia and cancel out the Northeast Asia Free Zone (NEANWFZ) that it is a "premature" concept.[24] Tokyo justifies its support for NWFZ in some areas but not in Northeast Asia by contending, it is not clear the geographical boundary. Even, Tokyo believes that NWFZ is unrealistic because it is not evident what would happen to a country that violates the rules of NWFZ in Northeast Asia.

Japanese government advocating about the Central Asian Nuclear Free Zone and entire Southern Hemisphere Nuclear Weapons Free Zone but not for East Asian Nuclear Weapons Free Zone emphasis the Japanese government's intent. Somehow, it also says the story of Japan's nuclear option.

U.S-JAPAN SECURITY TREATY

Japan guarantees its peace and security and defends itself against foreign invasion by building minimum necessary basic defense forces as an independent state pursuant to the spirit of its constitution, and has done on the basis of U.S-Japan Security Arrangement. In international community today, almost all country tries to secure peace and independence through its own will and power alone. But it would not, however be economically feasible for Japan to have and maintain such a defense system of its own. Further, it does not mean that, Japan should not maintain its own army. In case of Japan, 1 percent of total GDP is more than enough for budgeting the defense for Japan.

[24] Peace Depot, "Japan's Report Card on Nuclear Disarmament 2002, Annex Explanation of the Reason of Evaluation, Yokohama, Japan, March 27, 2002, pp42-43.

Apart from that one, Japan has opted to continue its bilateral alliances from 1951 when the Diet approved the Treaty for the ideals value of democracy and respect for freedom and Human Rights. The alliance entered into force in 1952. In this context, the Article 5[25] of the U.S-Japan Security Treaty provides that both countries will take joint action in the event of an armed attack on Japan. The U.S obligation to defend Japan means that those who attempt any Armed Attack on Japan would have to contend not only with the Self Defense Forces (SDF) of Japan but also the over helming military power of U.S. This would surely make potential aggressors to think twice about invading Japan knowing the U.S status of single superpower after the cold war U.S. military capability.

The provisions and Articles of the U.S-Japan Security Treaty generally prohibit Japan to maintain its own defense policy and specifically its indigenous proper military. Article 6 of the U.S.-Japan Security Treaty binds both the country for mutual cooperation in defense and granted U.S. forces to facilitate the areas in Japan for the purpose of contributing to the security of Japan as well as international peace and security in that region.[26] Although, it allows Japan to maintain minimum forces for its security. But the Treaty doesn't say anything about the nuclear threat. Although, the international peace and security also includes the use of nuclear weapons and threat to use of nuclear weapons.

From the overview of last more than fifty years of the U.S.-Japan Security Treaty, one thing concluded that the Treaty achieved its all tasks. In the last more than fifty years, both countries played a greater role in establishing peace and security in North East Asia especially. In the entire period, Japan played almost a buffer state in the East Asian

[25] Article V of the Treaty as- Each party recognizes an armed attack against an either party in the territories under the administration of Japan would be dangerous to its own peace and safety and declares that it would act to meet common danger in accordance with its Constitutional provisions and processes.

Any such armed attack and all measures taken as a result thereof shall be immediately reported to the Security Council has taken the measures necessary to restore and maintain international peace and security.

[26] Article 6 of the Treaty as- For the purpose of contributing to the security of Japan and the maintenance of international peace and security in the Far East., the United States of America is granted the use of its land, air and Naval forces of facilities and areas in Japan.

The use of these facilities and areas as well as the status of United States armed forces in Japan shall be governed by a separate agreement, replacing the Administrative agreement under Article III of the security Treaty between the United States of America and Japan, signed by such other agreement as may be agreed upon.

region. But people and some strategic analysts are thinking that too much involvement of U.S. in world affairs shows that, now U.S. wants a strategic partner rather than dependent in East Asia. On the other hand, some scholars think that, too much involvement of U.S. in the other parts of the world gave extra burden on it. In such case, U.S. may withdraw[27] itself from the Treaty. That situation would be panic for Japan to secure its security and international peace. In that situation, Japan also cannot be benefited from the U.S. 'nuclear umbrella' in any threat of nuclear weapons and threat of use of nuclear weapons against Japan. In this regard, the various political party of Japan has different opinion about the maintenance of U.S.-Japan Security Treaty. A poll conducted by the *Kabashima Ikuo* for Japan Echo in 1999 under "An Ideological Survey of Japan's Nationals Legislatures", found different opinions on the political party lines. In that poll, Liberal Party and Liberal Democratic Party were in favor of the strengthening of Japan-US Security Agreements. On the other hand, Komeito and Democratic Party of Japan were in somewhat favor of U.S-Japan Security agreements. Further, Japanese Communist party and Social Democratic Party were in totally opposition of the strengthening of the U.S-Japan Security agreements.

The poll result by Kabashima Ikuo cannot ignore at all, because this poll was responded by almost 60% of the Diet member and it has certain impact on the decision-making procedure.

Recently a shift has been seen in the U.S-Japan security agreements in nationalist groups and youngsters. Even, some nationalists scholars suggest that Japan should voluntarily throw the burden of the Treaty, regularize its proper military and be a normal country. These nationalists' scholars don't bother about the aftermath situations, especially about the future use/threat of nuclear weapons or threat to use of nuclear weapons against Japan. Practically, it is very easy to withdraw Japan from the U.S-Japan security

[27] The Article X of the Treaty shall remain in force until in the opinion of the governments of the United States of America and Japan-there shall have come into force such United Nations arrangements as will satisfactorily provide for the maintenance of international peace and security in Japan area.

However, after the Treaty has been in force for ten years, either party may give notice to the other party of its intension to terminate the Treaty, in which case the Treaty shall terminate one year after such notice has been given.

agreement according to Article X of the Treaty, but aftermath situation will be panic for Japan. The main concern is that now Japanese people are thinking beyond the U.S-Japan Security agreements and focusing on the Japanese proper military and be a normal country.

U.S NUCLEAR UMBRELLA

After getting sovereignty in 1952, Japan was very much aware of its security. For that, one Japan established strategic relationship with U.S to secure its boundaries. The relationship started with the Japan-U.S Security agreements and other peace Agreements. Further, Japan also adopted nuclear policy in 1967-68 as it reliance on the U.S. nuclear deterrent against international nuclear threats. Japan's nuclear policy and the U.S-Japan Security Agreements together lead the path of "U.S Nuclear Umbrella" for Japan in any external nuclear threat. In such case, Japan takes benefits of U.S nuclear power and enjoying the free ride through 'Passing the buck' of its nuclear responsibilities.

In such scenario, Japan need not to worry about the external nuclear threat because Japan's protecting state (U.S) is vastly stronger than threatening states (in Case of North Korea). However, "Gaullist Nationalists" and common Japanese fill panic in the lack of U.S Nuclear Umbrella. Again, emergence of North Korea as a nuclear power will become horrific for Japanese security.

Although, U.S promises[28] Japan for its security in any external nuclear threat, but Japan cannot relay indefinitely on U.S nuclear umbrella. However, Japan become worry about the situation when, U.S-Japan Security Agreement became ended. Almost, nuclear states clarified that nuclear weapons remain usable as last resorts and follow the guidelines of a *de facto* "no first use". However, Japan fill insecure in the context of North Korea's long-range missile test in 'Sea of Japan'. In this respect, nationalists advocate that Japan should keep its nuclear option open. The instability in East Asia, eroding pacifism in Japan and possible scrap of U.S nuclear umbrella become a major cause that impelled towards 'nuclear Japan'.

[28] Editorial, "U.S Promises to maintain Nuke Umbrella for Japan", Japan Policy and Politics, Nov 3, 2003.

CONCLUSION

Japan is the single country in the entire human history sofar suffers nuclear attack twice in the WW II. Aftermath, anti-nuclear movement became a prominent part of the Japanese culture. The Bikini Atoll incident by U.S. in March 1954, which became a cause of death of a Japanese fisherman and serious environment desolation aware the common Japanese people about the menace of nuclear tests. Actually, this incident boosts up the antinuclear movement. After the time being, the Japanese government and the civil society of Japan became a vigorous component of anti-nuclear movement. In this regard, the formation of various anti-nuclear groups and anti-nuclear weapons groups like *Hibakusha* (the survivors of the atomic bombings), *Gensuikyo* (Council against A-and H-Bombs), *Gensuikin* (Congress against A-and H- bombs), *Hidankyo* (Japan's Confederation of A- and H-bomb sufferers Organizations and *Kakkin Kaigi* (National Council for Peace and against Nuclear Weapons) together play as a milestone in the anti-nuclear movement.

On the other hand, Japanese government also took initiative and adopted the Japan's Nuclear Policy in 1967-68. These non-nuclear policies are (1) the peaceful use of nuclear energy, (2) three non-nuclear principles i.e. not to posses, not to manufacture and not to introduce nuclear weapons on the Japanese ground, (3) the promotion of nuclear disarmament and (4) the reliance on the U.S. nuclear deterrent against international nuclear threats. These four nuclear policies were the pillar of the endorsement of nuclear disarmament.

Not only the efforts by Japanese government and the civil society took initiative to endorse the anti nuclear movement but a number of other legal hurdles also put in the pot like the Preamble and the Article 9 of the Japanese pacifist Constitution, the Japan's Energy Act. (1956), Non-Proliferation Treaty (NPT), Comprehensive Test Ban Treaty (CTBT). Nuclear Weapon Free Zone Treaty (NWFZ), Nuclear Pacifism in Japan and the Security Alliances between the US and Japan.

Although, Japan has adopted the four nuclear policy and especially three non-nuclear principles, but an immense swing has been observed in Japan's nuclear policy. Critics and Japanese anti-nuclear organizations also rejected Japan's incremental disarmament policy, because they do not believe that nuclear powers are sincere about implementing the Article VI of the NPT. On the other hand, the whole idea of scrapping the NPT also gave some pace about the Japan's nuclear option. Japan has already violated its three non-nuclear principles, when Japan secretly permit U.S submarine to enter into the Japanese territory secretly with nuclear weapons by sanctioning its neither-confirm-nor-deny policy[29]. Simply, after a time being, Japan's anti-nuclear movement loosing its sharpness.

The more significant is the Japanese Liberal Democratic Party's decision to launch a powerful campaign within the country in favor of the reviewing the "peaceful" clause of the pacifist Constitution. The statement by Eisako Sato former Prime Minister, who adopted the nuclear policy and especially three non-nuclear principles, also showed the path for Japan's nuclear option -said that- the nuclear policy, which commit Japan not to produce or possess nuclear weapons or allow them to be deployed on Japanese soil, were not immutable and could be changed. In Dec 1994, in a private conversation with the US ambassador to Japan Sato explained that have roots of nuclear option alike-

> "If the other fellow has nuclear weapons, it is only common sense to have them oneself. The Japanese public is not ready for this, but would have to be educated...Nuclear weapons are less costly than is generally assumed and Japanese scientific and industrial level is fully up to producing them."

[29] Robert Norris, William Arkin and William Burr, "How Much Did Japan Know?" The Bulletin of the Atomic Scientists, vol.56, no.1, January/February 2000, pp11-13.

CHAPTER-4

JAPAN'S NUCLEAR OPTION

INTRODUCTION

Most analysts dismiss the claims that Japan has any nuclear ambitions/option, pointing out that successive post war Japanese government demonstrated a strong and indeed growing commitment to nuclear Non-Proliferation, and that most Japanese citizen are both anti-militarist and anti-nuclear. Moreover, since Japan is protected by security alliances with the United States and sheltered under the American "Nuclear Umbrella," it has no need to acquire its own nuclear weapons.

While this is the mainstream view, there remains real, if muted, concern among some regional security planners that Japan, at some stage, may feel impelled to "go nuclear" especially if its security relationship with the United States is to breakdown in the context of deteriorating relations with China and North Korea.

Such concerns are not without some foundation. Nuclear option for Japan is not a new phenomenon and has been discussed by the Japanese government in the past. It often argued that Japan could not rely indefinitely on the U.S. "Nuclear Umbrella" given America's continued economic decline in relative terms, and recommended that Japan should acquire a nuclear weapon capability[1] very soon in near future. This idea was not accepted in political sphere, but it indicates about 'Japan's Nuclear Option' that some officials seriously took it at a specific time.

The then Japanese Prime Minister Eisako Sato adopted the three non-nuclear principles in 1967-68, which committed Japan not to produce or possess nuclear weapons or allow them to be deployed on Japanese soil, were not immutable and could be changed, Even it is a legal provision and not Constitutional one. In Dec 1994, in a private conversation with the US ambassador to Japan Sato said-

[1] "Missile Developments," Nonproliferation review 2, no.2 (Winter1995), p.136.

> "If the other fellow has nuclear weapons, it is only common sense to have them oneself. The Japanese public is not ready for this, but would have to be educated...Nuclear weapons are less costly than is generally assumed and Japanese scientific and industrial level is fully up to producing them.[2]"

In May 2002, Chief Cabinet Secretary Yasuo Fukuda apologized for his remarks on the future possibilities of amendment of Japan's non-nuclear policy; he did it not because he thought that his comment was erroneous, but because "his comment caused unnecessary political controversy at the end of the Diet Session.[3]

Further several Japanese political leaders have expressed their view that indicated less than total opposition to the concept of nuclear acquisition. The then Prime Minister Kishi (in1957), Ohira (in 1979), and Nakasone (in 1984) claimed that acquiring nuclear weapons would not be prohibited by Japan's peace Constitution-providing they were used for defense, not for offense.[4]

All these political leaders views and somehow the role of external factors and the unhinged situation of Northeast Asia push towards the "Nuclear Japan". This idea is based on the concept of 'Defensive Realism' and self-defense and the passive/defensive use of nuclear weapons. The whole concept generates a widespread concern about Japanese nuclear policy that has much emphasis that Japan should keep its nuclear option free/open limiting that these nuclear weapons would be only for defense and not for offense. In this regard, these political leaders always were talking about the amendment of Japanese Pacifist Constitution. Although, it became an immense controversy about the parameters of defensive and offensive use of nuclear weapons. Because anyone could not draw a clear-cut line between offensive and defensive use of nuclear weapons. In fact, even it cannot be clearly differentiate between the offensive and defensive in militaristic terms.

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[2] Cited in Motayama Kitamura, "Japan's Plutonium Program: A Proliferation Threat," Nonproliferation Review 3, no.2 (Winter 1996): p.13.
[3] Nobumasa Akiyama, "Blabbing of Bluffing: Discourse over the Nuclear Option in Japan" FPO 03-A: February 12, 2003.
[4] References for these various officials claims are found in The Plutonium Trade: A Troubling New Era of Proliferation (Greenpeace International) 1 March 1993.

Discussing, about Japan's nuclear option, one needs to know about the roots of Japan's nuclear option and its changing nature and impact on the different sections of Japanese social, political economic and militaristic society. In this context, few key questions originate that can shape the prospect of Japan's nuclear policy like-is Japanese society now adopting changes in security perspective also? Are anti nuclear organizations now loosing their sharpness? Are Japanese political parties also choosing a nuclear Japan? Are *Zaibatsus* (Big Business Houses) also concurring for a nuclear Japan? Is public opinion altering pacifism in Japan? Does Japan really feel external nuclear threat to go nuclear? Does U.S-Japan Security Agreement declining day by day? These are the prime questions that will shape Japan's Nuclear Option.

TRACING THE ROOTS OF JAPAN'S NUCLEAR OPTION

Talking about Japan's Nuclear Option is not a new phenomenon and has its own roots in Japanese political history, in policymakers' approaches and of course, the appalling circumstances of Northeast Asia. Tracing the roots of Japan's nuclear option, one must know the history, development and present status of Japan's nuclear policy and its correlation with atrocious circumstances in North East Asia. It is quite accurate that Japan entered the nuclear world with so many legal limitations and exclusion for peaceful use of nuclear energy under the title "Atoms for Peace". However, after a period, Japanese policymakers', *Zaibatsu* (Big Business Houses), and the Japanese common people mindset had shown, less than the total elimination of nuclear weapons. In this regard, they were often talking about the Constitutional amendment to make the provision of proper Army for Japan and about nuclear option.

[1] Japan adopted the nuclear policy in 1967-68 i.e. (1) the peaceful use of nuclear energy, (2) three non-nuclear principles, (3) the promotion of nuclear disarmament and (4) the reliance on the U.S. nuclear deterrent against international nuclear threats. These four nuclear policies were the pillars of promotion of nuclear disarmament. But, the nuclear policy was adopted as national legal policy and not mentioned in the Constitution; hide the seeds of nuclear option for Japan. Further, Japan was one of the

last countries to sign the NPT in 1970 and finally ratified it six years later only after the U.S. promised not to interfere with Tokyo's pursuit of reprocessing capabilities in its civilian nuclear-power program. Tokyo's hesitation about the signing of NPT and ratification after a long duration i.e. six years again showed that Japan wanted some extraordinary provisions for herself, and finally Japan achieved some unique provisions by U.S. administration.[5] The special provisions by U.S. and IAEA said the story about the Japan's nuclear option.

[2] Japanese anti-nuclear weapons organizations generally supported the formation of a Nuclear Weapon Free Zone (NWFZ) in the North East Asia, which prohibits the concerned country to introduce nuclear weapons in the specific region and they would like to see that Tokyo should take concrete steps to develop it. Although, Tokyo supports the configuration and development of Nuclear Weapon Free Zone in the Central Asia as well as cover up the entire Southern Hemisphere, the Japanese government advocated one in the Central Asia and cancel out the North East Asia NWFZ that it is a "premature" concept[6]. Tokyo justifies its support for NWFZ in some areas but not in Northeast Asia due to lack of geographical clarity. Even, Tokyo believes that NWFZ is unrealistic because it is not evident as to what would happen to a country that violates the rules of NWFZ in Northeast Asia. Avoiding the concept of NWFZ by saying that it is a premature concept and North Asia has no defined boundary shows the altering distinctiveness of Japan's nuclear policy. Tokyo also raises the queries about the future of the NWFZ, if any associate state would violate the Treaty. In this regard, Tokyo discarded the NWFZ for Northeast Asia.

[3] Further, there occurred a serious accident in the *'Monju'* breeder plant in *Tsuruga, Fukui* prefecture in December 1995, and Japanese media gave unprecedented publicity to the accident. After the *'Monju'* accident, public concern for safety measures was enhanced. The governors of prefectures- *Fukui, Fukushima and Niigata*- where nuclear reactors are concentrated took the lead to draw the attention of the government to the

[5] Mack Andrew, "Proliferation in Northeast Asia", Nuclear Program in Northeast Asia, 1996, pp11-19.
[6] Peace Depot, "Japan's Report Card on Nuclear Disarmament 2002, Annex Explanation of the Reason of Evaluation, Yokohama, Japan, March 27, 2002, pp42-43.

growing public concern. In January 1996, they submitted a document containing several suggestions for the safe conduct of nuclear policy in future and finally decided to postpone the FBR program beyond year 2030.

Another serious accident occurred in a reprocessing plant at *'Tokaimura'* and once again nuclear safety measures came in for criticism. These two nuclear accidents in *'Fukui'* and *'Niigata'* prefectures become a reason for spread of nuclear awareness that's why the residents of small town, *'Makimachi'* in *Niigata,* conducted a referendum in August 1996 and rejected a proposal of the government to setup a nuclear plant in particular locality. At that time, criticism and opposition held in Japan, anti-nuclear movements raised serious concerns about the safeguard of nuclear power projects. But still, Japan adopted nuclear power plant for power supply on the name of peaceful purpose only. Tokyo mentioned that it is a better and cheaper energy alternative that prohibits Japan to depend on foreign energy resources and secures its continuous economic reconstruction. In this regard, Japan started its first nuclear power project in 1956 and its first nuclear power reactors plant started operation in July 1966. Until 2005, Japan had 55 nuclear power reactors (52 were in operation), which made third rank in number after US (103) and France (59). These 55 nuclear reactors generate 45.7million kW (Kilo Watt), which fulfill 26.9 percent of total energy needs. The total energy production through nuclear reactors is equal to 64.8 million tons of oil equivalent.[7] These statistics illustrate the prospect and potential of Japan's nuclear power policy and somehow nuclear weapons option.

[4] This issue raises one of the greatest concerns in the region about Japan's deep commitment to the Plutonium economy. Japan's existing stockpiles of separated Plutonium, is already large enough for hundreds of nuclear weapons. Responding to such concerns, Japanese officials argue that, Japan separated Plutonium derives mostly from spent power reactor fuel that is quite unsuitable for making nuclear weapons.

But, claim that the spent power reactor fuel or 'reactor grade' Plutonium cannot be used to make a nuclear weapons are simply incorrect, while it can be hazardous to handle.

[7] Japan 2006, "Keiizai Koho Centre, Japan Institute for Social and Economic Affairs", p.100-102.

Reactor grade Plutonium can be used to make Hiroshima range bomb[8]. In fact, US exploded such weapons in 1962. In November 1994, JAEC published a report that, there were 47 tones of separated Plutonium in Japan, with an additional six tones storage in Europe.

The large stockpiles of weapon grade Plutonium that will be separated in Japan's reprocessing facilities in the future have raised the question of possible diversion for destructive purposes. Even small percentage of Plutonium and could be diverted during reprocessing without detections by IAEA inspectors could rewrite another story of Japan's nuclear policy. One percent of 10 tones Plutonium would be enough for perhaps 15 Hiroshima size Atomic Bombs.[9]

[5] About energy security argument, Japan argues about it's so called FBRs, which are the core element in the plutonium economy, reduced energy insecurity because they produce more plutonium than they consume. But this capability is also, of course a real source of proliferation concern. Most industrialized countries have abandoned their FBRs program on ground of either safety reasons or excessive cost. According to one report, FBRs are 4 to 10 times more expensive than conventional nuclear power plant. Why has Japan not followed other industrialized countries in abandoning an energy production process that appears economically inefficient? But, the question is that, why Japan is reprocessing stockpiles of plutonium or nuclear fuel that has become expensive in storage within or outside country?

Technical capability not only includes the reprocessed (reactor grade or weapon grade) but also the deploying capability of nuclear weapons. According to a paper, Japan could build and deploy nuclear weapons far more quickly than any other regional power. The estimate time it would take for Japan to produce nuclear weapons may vary from a few months to a year, while the highly sophisticated Japanese space-launch program could, (if

[8] D.Albright, "Can Civilian Plutonium be used in Nuclear Explosive?" (Washington DC: Federation of American Scientists, 1984. and Bette Hileman, "US and Russia Face Urgent Decision On Weapons Plutonium", Chemical and Engineering News, June13, 1994.
[9] Mack Andrew, "Nuclear Programs in Northeast Asia", in Proliferation in Northeast Asia, pp. 11-19.

necessary) build Intermediate Range Ballistic Missiles (IRBMs) capable of carrying nuclear warheads. One possible intended consequences of Japan's acquisition of large stockpiles of plutonium might be to reinforce the message in the region. This progress in nuclear power generation through FBRs, which has already been discarded by industrialized countries, has put negative intuition and emphasis the passive to active use of nuclear power.

[6] The Japanese pacifist Constitutional amendment becomes a major issue in Japanese political sphere. All political parties are indulging in the Constitutional Amendment including almost all time ruling Liberal Democratic Party. All political parties have different political opinion. The LDP calls for a broad range of changes, including rewriting the Preamble of the Constitution. The Preamble says that, Japan should become a "nation with dignity"[10] that respects its history, tradition and culture. The LDP's central objective, however, is to rewrite Article 9. The first paragraph of the article sets forth pacifist principles renouncing war as a sovereign right and the threat or use of force as a means of settling international disputes. The second paragraph states that, to accomplish this aim, Japan will not maintain any war potential. According to the party's plan, the first clause would be kept intact. However, the second clause-which has proven far from reality-, would be revised to state the right to maintain a war potential for self-defense.[11] New Komeito calls for the inclusion of new provisions, such as those stipulating environmental and privacy rights. However, it is cautious about rewriting Article 9. The DPJ, meanwhile, says in an interim report that the government's "arbitrary" interpretation of Article 9 has created more legal problems. The JCP is dead set against any revision. The SDP takes a similar stand, stressing the need to uphold the pacifist spirit of the Constitution through the "protection" of Article 9.

The different opinion of political parties about the amendment of the Japanese pacifist Constitution shows that the amendment is a controversial issue. It is heavily based on

[10] "Constitution Remains a Major Issue" (Editorial), The Japan Times, July 7, 2004

[11] The subject and potential of self defense is varying from country to country and time to time. It can not differentiate between active and passive uses of force. The concept of war potential also includes the seed of nuclear weapons.

political decisions. The amendment of Japanese constitution will not become dare dream, if the ruling LDP will take the initiative with its political allies New Komeito, and get support by other like minded political parties, then Japan's nuclear option may be open with the elimination of Article 9 of the pacifist Constitution. In such respects, North Korea's Missile crisis in the first week of July 2006, somehow impelled nuclear Japan.

JAPAN AND THE NUCLEAR ALTERNATIVE

It is too hasty to conclude after an assessment of the unhinge situation-Japan surrounded by two nuclear states (PRC and Russia) officially and one state (North Korea) unofficially- in Northeast Asia that Japan has the intention of developing its indigenous nuclear weapons. If Japan should decide to pursue the nuclear-weapons-option, there must be three conditions to be satisfied:

1. Political Will
2. Technological Capabilities
3. Strategic Benefits

1. POLITICAL WILL

Political willpower that pushed towards a nuclear Japan consists both policymakers' perceptions and the political parties' intuitions. The leading politician's proclamation shows the shift of Japan's Nuclear Policy and clears the pace for the amendment of the Constitution and other legal barriers. These policymakers' intuitions also generate the sensitivity within the political party and leads shift in the party's decision. An overview of the leading policymakers' statement shows the changing nature of nuclear policy alike.

Several Japanese political leaders have expressed the views that indicate less than total opposition to the idea of nuclear acquisition. The then Prime Minister Kishi (in1957), Ohira (in 1979), and Nakasone (in 1984) claimed that acquiring nuclear weapons would not be prohibited by Japan's peace Constitution-provided they were used for defense, not

offence. Although, Prime Minister Eisako Sato stated about nuclear policy-who adopted the four Nuclear Policy and especially the three non-nuclear principles, which commit Japan not to produce or possess nuclear weapons or allow them on Japanese soil -were not immutable and could be changed. Even it is a legal provision and not Constitutional. Further, Eisako Sato's remarks in 1994, clearly pointed the nuclear option for Japan.

Further evidence that some leading politicians still have not ruled out nuclear option came in July 1993, when then Foreign Minister Kabun Muto, discussing the threat that Japan received from North Korea, stated that, if it comes to the crunch, possessing the will that 'we can do it'-make nuclear weapons- is important.[12] In June 1994, then Prime Minister Tsutomo Hata declared that Japan already had "the capability to produce nuclear weapons."[13]

In march 1994, the Japan Strategic Study Centre, a hawkish and influential private "think tank" chaired by leading opposition spokesperson Ichiro Ozawa and staffed by very senior retired military officers, produced a report that could only have added to regional concerns. It called on the government "to remove public fear of nuclear arms and to come up with realistic nuclear policies.[14]

Security Analysts and Former Foreign Ministry official, Satoshi Moromoto, who in November 1995, worried about the U.S.-Japan Security Alliances that nuclear option for Japan would grow if the U.S. Security commitment appeared to be eroding and stated that

> Without the U.S-Japan Security Treaty, how can we counter the three-million People's Liberation Army in China? What can Japan do if something happens in the Korean Peninsula? Without the Treaty, the only way Japan can survive is to multiply its defense budget and to develop its own nuclear capability.[15]

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[12] Robert A. Manning, "Rethinking Japan's Plutonium Policy", Journal of East Asian Affairs 9, no.1 (Winter/Spring)1995), p.121.
[13] David E. Sanger, "In face-Saving Reverse, Japan disavows any nuclear weapons." New York Times, 22 June 1994.
[14] "Hawks' Strategy Centre 'Shadow' Defense Agency," FBIS-EAS-94-137A, 14 July 1994.
[15] Centre for International Trade and Security, Non-Proliferation Export Controls (University Of Georgia) July 1995, p.1.

In May 2002, Chief Cabinet Secretary Yasuo Fukuda apologized for his remarks on the future possibilities of amendment of Japan's non-nuclear policy; he did it not because he thought that his comment was erroneous, but because "his comment caused unnecessary political controversy at the end of the Diet Session.

All these views have importance for the prospects of nuclear Japan. Therefore, these statements have some wattage in the policymaking procedure and somehow it leads to the concepts of nuclear Japan.

THE POLITICAL PARTIES AND THE NUCLEAR OPTION

The policymakers' views have great impact on the party level politics. Even it decides the party's future somehow. The political parties in Japan have their own stands about the nuclear weapons. In this context, these are different option for different parties like-

THE JAPAN SOCIALIST PARTY (JSP) AND NUCLEAR OPTION

The JSP has been a steadfast advocate of "unarmed neutrality" since the seventh Convention of the Socialist Party in 1951, when opposition to any rearmament proposals was added to as a fourth principles of peace. The other three were that Japan should (1) conclude one Peace Treaty with all its former enemies, (2) maintain neutrality, (3) neither conclude military pact with any one country, nor give military bases in Japan to any foreign countries.

The party's public vow for the election of December 1972 reflected these very early espoused principles that- We will abrogate the security concord, and while promoting diplomacy of non-militarization, peace and neutrality, we will conclude a Treaty of non-aggression and friendship between Japan with China, Soviet Union, and with unified Korea, and establishing a structure for guaranteeing lasting peace in East Asia.[16]

[16] Embassy Translation, Tokyo Shim bun, November 14, 1972

The JSP argued that after the end of WW II, conventional wars have constantly occurred, for example the Chinese Civil War, the Korean War, conflicts in Indochina, Palestine, etc.; there has been no nuclear war even in the U.S.-Vietnam War. That is unarmed neutrality cannot be realized; the Socialist Party has insisted that Japan should not possess armed forces even, but they probably have some difficulty in getting the people's support. JSP is advocating peace and non-nuclear weapons for Japan. However, the JSP does not suggest any solution and give its views, when Japan would receive nuclear threat from any countries.

THE KOMEITO AND THE NUCLEAR OPTION

The Komeito has been active on the nuclear issue from its formation in 1967. From the very beginning, the party elected 25 members that advocated world peace through pacifism and world racism (on the order of one world concept). It outlined as its objectives and achievements of total disarmament and total abolition of nuclear arms. The party's attitude towards nuclear weapons was made clear: it was to renounce the possession, experimentation, and manufacture of nuclear weapons.

When *Narazaki* from the JCP raised a question about the presence of nuclear weapons in American bases in Japan, Komeito formed a Non-nuclear Investigation Headquarter on November 30, 1971 to investigate the presence of nuclear weapons in Japan. It rapidly produced the desired controversy when Komeito councilor *Akira Kuroyanagi* charged that both nuclear weapons and poison gas were stored at Atsugi Air Base (*Kanagawa Prefecture*) and substantiated his claim by submitting pictures of grazing goats in barbed wire enclosure. (The goat off course, were seen as crude system to warn of gas leaks) The U.S. Navy replied to the charge that the goats were there to eat grass. Kuroyanagi was not deterred, neither was the Komeito, which listed this incident as one of its major success of 1971. After this, the central committee of Komeito in the respect of against nuclear issue has taken a series of actions. Some time Komeito also joined other political parties and other non-nuclear organization as anti-nuclear activists.

THE DEMOCRATIC SOCIALIST PARTY (DSP) AND NUCLEAR OPTION

The DSP was founded on January 1964 and from the initial time, it advocated the internationally inspected disarmament. At the 1962 party Conference, it was decided that DSP would encourage the completion of an agreement to prohibit nuclear weapons for West Germany, China and others because nuclear proliferation was considered a threat to world peace; and promote talks in United Nations to achieve a relaxation of tension and disarmament.[17] The party advocated a policy of minimum measures in order to defend the nation, "which included in its framework a denial of the possession of nuclear weapons". The DSP held that even though the early 1960s appeared as an age of spread of atomic and hydrogen bombs, this growth of weapons was based on misunderstanding of reality. The party noted that all disputes were being fought with conventional weapons and offered examples in the contemporary events.

Ten years later, in March 1972, the party issued a paper entitled "Establishment of a New Peace Order Strategy Towards the Reduction of Tension in an Era of Multipolarity". This paper also emphasized on the friendly relations with all its neighbors and establishment of new economic cooperation. In the relations with the United States, two principles were suggested (1) A New System of Security Guarantee and (2) Adjustment of Economic Situation.

Regarding the 2nd part of the Security Treaty, the DSP maintained that the U.S. Japanese system was based on the strategy of East-West confrontation, and was not a progressive item of the edge of multipolarity. It was seen as a contradiction of the general trends toward a "New Peace Order", and it acted as a hindrance in the friendly relations of the United States and Japan. The policy statement that called for the withdrawal of the U.S. troops and bases from Japan. Further stated, "We demand a new security guarantee that can create a new order of peace to correspond with the multipolar age".

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[17] As cited by John E. Endicott, "Japan's Nuclear Option Political, Technical and strategic Factors", Praeger Publication, New York, 1975, p.81.

Earlier in the report, the DSP had reaffirmed its desire for Japan "to maintain its special character as a non-nuclear, peace nation in the era of the 1970s. The DSP's public pledge for the 1972 election reflected its continuing pragmatic approach:

We will promote peaceful diplomacy of autonomy and peaceful co-existence and contribute to the forming of a new, peaceful order in Asia. Especially, we will strive to realize a security Treaty without military bases and stationing of forces, by revising the Security Treaty. Although DSP advocates peace and non-nuclearization of the world, but again DSP doesn't offer any proposal in the case of nuclear emergency.

THE JAPAN COMMUNIST PARTY AND THE NUCLEAR OPTION

The first publish statement of the JCP in *Akahata* after the reestablishing of the party in 1945, the theme to eliminate the militarism was apparent. However, eliminating militarism and advocating "unarmed neutrality" are two different things. In a more contemporary policy statement in 1970s of the JCP, the subject of self-defense was to be dealt with in relation to the security treaty.

> "Our proposal for abrogation of the security treaty and dissolution of the Self-Defense Forces is not because we deny the right to self defense but because American imperialism aims at invading Japan infringing on her sovereignty...the self defense forces an army that serves the U.S and oppressed the Japanese people and Japan, like any other sovereignty has a complete right to take necessary and appropriate measures to maintain the political independent that she has own".

As specific aspects of its policy, the JCP advocates the abrogation of the Security Treaty, opposition to the nuclear weapons, and dissolution of the SDF.

After the review of the various philosophers of the opposition parties, it would be beneficial to cite several examples of their activities in the past to illustrate their potential and actual effect on the other political parties including the public opinion on the nuclear issue. It has noted that when the nuclear question is concerned, the opposition parties have a significant watchdog function.

In mid November 1971, a JSP representative, Tanosuka Narazaki, charged in a meeting of the Special Committee on the Okinawa Return Agreement that he had suspicion about nuclear weapons being stored at *Twakuni* Air Base in Okinawa. He noted the six ammunition warehouse at that base were of suspicious nature, very similar to the facilities reported to house nuclear weapons in Okinawa. Maps, photographs and related documents were presented.[18]

The then Foreign Minister Takeo Fukuda replied that no nuclear weapons were at any U.S. bases in Japan and this was reported specifically covering Iwakuni, but denial by both the Japanese government and U.S. officials did not placate the Socialist organization, which has begun to mobilize at Yamaguchi headquarters. Anti-nuclear weapons rallies followed, with about 2,800 persons participating. Demonstrating that Japanese government was not taking the issue seriously. Major General Kimio Ito of the Japanese Defense Agency (JDA) was sent to investigate but he only found the conventional torpedoes. On the other hand, Narazaki was rigid that he can prove this.

Other example will serve to illustrate the kind of activities that opposition parties engaged with regard to the nuclear issue. This incident was the result of Narazaki reported to be a secret U.S. Navy telegram concerning the creation of U.S-Japanese bilateral nuclear forces. Next day, the clarification were issued by all concerning parties and said that opposition parties would use to unseat the Sato Cabinet. Aftermath, the U.S. Embassy held that the telegram was a forgery, but Narazaki already repeated that "SDF is already taking an emergency nuclearization setup.

After a time being, it was proved that it was a case of Forgery. But, Narazaki replied that "if nuclear weapons come to sprout even a little, it is our duty to warp it out". These concerns over the nuclear issue showed anti-nuclear sentiment and the decision-making at the party level. Although, it was fake but still had some anti-nuclear sentiments. The whole episode of the nuclear issue by JCP shows the strong opposition to nuclear weapons.

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[18] Asahi November 17, 1970.

LIBERAL DEMOCRATIC PARTY (LDP) AND NUCLEAR OPTION

The LDP since its foundation in 1955 had steadfastly maintained U.S alliance. Further, it had consistently advocated the delineation of U.S responsibilities. On the other hand, it also attacked the JSP position of unarmed neutrality. Regarding the nuclear question, the LDP supported the enactment of the Basic Atomic Energy Law that restricts nuclear power to peaceful uses and require that everything connected with the atomic energy program be open for public review. It had supported three non-nuclear principles articulated by the then PM Sato as well signing and ratification of the Antarctic Treaty, Outer Space Treaty and Non-Proliferation Treaty.

Before discussing too much on the party line of LDP, it is necessary to focus on the decision making process of LDP regarding defense policy and especially nuclear issue. Within the LDP, two bodies, the National Defense Division (Kokubo Bukai) and the National Security Research Council (Anzen Hosho Chosa Kai) are charged mainly for the recommendation and other security related views including others like Japan-China Diplomatic Normalization consultative council, the Foreign Affairs Council, the Special Committee on Military Base problems, the Committee of nuclear Non-Proliferation Treaty, and others. Practically, different factions within the LDP have strong hold in shaping the party's defense policy. The LDP formulations policies recommendations may go up and down according to faction's decisions within LDP.

LDP has been quite clear and consistent regarding the question of nuclear weapons for Japan. Although, different factions within LDP hold strong position in defense policy but aftermath the National Security Research Council has the responsibility in defense planning including nuclear issue. The National Security Research Council had published papers time to time which indicated the LDP's defense policy and also policy towards nuclear, but the National Research Council's decisions were influenced by the Chairperson of the body which was ruled by different factions in different time. The National Research Council emphasized in its paper that our country must take to counter the effect to the security of our nation of the Chinese nuclear threat as well as Soviet

policies and recently North Korea nuclear crisis in Northeast Asia. In any panic situation for Japan regarding the nuclear threat, the body suggested LDP to rely on 'U.S Nuclear Umbrella' in the early phase of post war period. On the other hand, some times it also suggested strong defense capability for Japan, amendment in Article 9 of the pacifist Constitution, and regularize the army. The change in the position of the National Research Council only happened due to the leadership of different factions within LDP.

Although, LDP wanted to implement the recommendations by the National Research Council, but it could not apply in all time due to factional differentiations within the LDP. The factional differences within LDP on the nuclear issue may shaped by the changing circumstances in East Asia security position and nuclear threat by neighboring countries in the region. Further, LDP always supported the strong army and defense for Japan. Although, it cannot mention about the nuclear weapons but the strong army and strong defense capabilities hold the nuclear capability also.

Although, LDP had never supported the nuclear weapons for Japan, but the LDP's top politicians and policymakers' even in the National Research Council pointed their view in favor of nuclear Japan or at least less than the total opposition of nuclear weapons for Japan. Even, the nuclear policy especially three non-nuclear principles were adopted during the leadership of LDP, but top leaders from LDP often talked about the future Japanese nuclear program. The then Prime Minister Nobusake Kishi (in 1957) was also seen as a leader of the heavy rearmament school of thought. He indicated in the Diet that defensive nuclear weapons would not contravene the Constitution. Yasuhiro Nakasone (in 1984) stated that the nuclear weapons can be introduced at the time of emergency. Masayoshi Ohira (in 1979) claimed that acquiring nuclear weapons would not be prohibited by the Japan's peace Constitution, provided they were used for defense not for offence.

Further, other officials from very beginning advocated the nuclear weapons for Japan. Hoshina an ex-vice-admiral had strongly advocated the development of nuclear weapons by Japan for use in diplomatic bargaining. Akio Doi a former general in his book the

New Strategy and Japan (1968), wrote that "for a defensive country like Japan, nuclear weapons are best". He further commented that "Japan being the third to second largest industrial nation of the world is reason enough for having nuclear weapons". Not only these but a number of other officials also advocated the nuclear weapons for Japan, but also the LDP's position of nuclear issue can be well analyzed by the party pledge regarding foreign policy and defense during the campaign for the House of Representatives in 1972 like-

> It shall be the basis of foreign policy to deepen peaceful and friendly relations with various nations of the world and secure the peace and security of our country. However, under the present situation where easing the tension is not in a stable condition, it is insufficient to ensure peace and security with diplomacy alone. Therefore, while maintaining the security treaty structure with the United States, we will possess effective defense power of our own.[19]

In this respect i.e. the effective power also contain the nuclear capability and definitely, the party policies towards nuclear issue is almost clear and negate nuclear weapons for Japan, but, top leaders wanted in past that Japan should keep its nuclear option open.

BUSINESS COMMUNITY AND THE NUCLEAR OPTION

No commentary on the domestic political environment and Japan's nuclear option would be complete without the mention of position of the business and industry with regard to this question. It has been established that there is a direct relationship and close interaction between government, political parties and business. It can be assumed that the attitude of business toward the nuclear option could play a very substantial character in the course of future policy decisions.

There are five consortia in Japan concerned with the production of equipment for the construction and operation of nuclear power reactors. These are the Mitsubishi Atomic Power Industries, The Tokyo Atomic Industrial Consortium, Sumitomo Atomic Energy Industry, Nippon Atomic Industry Group Company and the Daiichi Atomic Power

[19] Tokyo Simbun, November14, 1972.

Industry. These consortia not only add additional percent in the GNP in between 1to 3 percent but these consortia have great impact on the energy production and off course on the decision-making procedures. In 1972, the director of Japan Atomic Industry Forum (JAIF) Seinosuke Hasimoto stated that-

> Industrialists have been making detailed investigations...and after studying methods to permits nuclear proliferation, have decided to support the signing of the treaty on condition that it does not impair the nature and the application to international safeguards, nor obstruct the peaceful application of atomic energy, and that all parties to the treaty are assured to the equal rights.[20]

The nuclear power industry has gone on record, on a number of occasions, favoring ratification, and even "an earlier ratification" of the NPT and has with it's policy indicated its position with respect to nuclear weapons, it might be useful to recall some of the position taken by representative of other sectors of Japanese business and industry towards the nuclear question.

In October1969, Takeshi Sakurada, one time head of the *Nikkeiren* (Japan federation of employers) called for the revision of the Article IX of the peace Constitution with the possessing of the independent defense capabilities. However, it was not an advocacy of the nuclear weapons for Japan. In June 1971, another member of Zaikai, Mitsubishi Heavy Industries Board Chairman Fumihiko Kono commented on the nuclear question directly saying that "it is not necessary for Japan at all to arm itself with nuclear weapons. American nuclear weapons are good enough. Further Kono spoke in 1972 regarding the nuclear issue in connection with his plan to reduce the economic burden of the U.S. vis-à-vis defense cost in Japan. In reference to the nuclear question, he pointed, 'it is not all right to think about paying fees for the umbrella in the future'. Again, he indicated that he was speaking from his personal view that Japan could "pay 200 to 300 million dollars in a year as fee" but he feared that such a payment would be thought to contravene the "non possession of nuclear weapons of the government" forever.

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[20] Atoms in Japan, April 1972, p. 20.

All these up and down show the tendency of the industrial houses that from very beginning all were in favor of the nonproliferation of the nuclear weapons. But after a certain period of time some of the industrial houses were thinking about the diversion and the alteration of the Article IX of the pacifist Constitution. Even, some industrial houses indicated that paying for the security including the nuclear umbrella means ignoring the security problems and avoiding the possession of military forces including nuclear weapons at all and forever. The shift in the attitudes of the industrial community indicates the option for Japan. Although, the businesses community are aware of the energy requirements including nuclear energy for economic growth of Japan, but business houses are only emphasizing the use of nuclear energy for peaceful purposes and not for the destructive purposes.

PUBLIC OPINION AND THE NUCLEAR OPTION

It is held by some Japanese political and security critics that "nuclear allergy" was artificially created and it was nothing but a product of cold war. They argue that, it was created by propaganda, skillful manipulation of the mass media and it could bring about the elimination of the nuclear weapons.

In either case, a nuclear allergy in fact exists a conformity. This term was often used by the Japanese who were not of Japanese origin. It was first attributed to Secretary of State John Foster Dulles who reportedly said in 1954 that "Japanese have caught a nuclear allergy".[21] It is also from 1954 that the great Japanese opposition of nuclear weapons manifested itself and the cause was Fukuryo Maru incident when a Japanese fisherman named Kuboyama died on the fishing boat from the atomic fallout.[22] After that, 23 to 40 millions of Japanese people signed petition urging abolition of all atomic bombs from all over the world. These sentiments among the Japanese people were not associated with any political parties. However, the different political party's anti-nuclear stand and other

[21] Seinosuke Hashimoto, Nihon no genshiryoku, 15 nen no Ayumi (Tokyo: Japan Industrial Forum, 1971, p19.
[22] See Appendix II on page no 122.

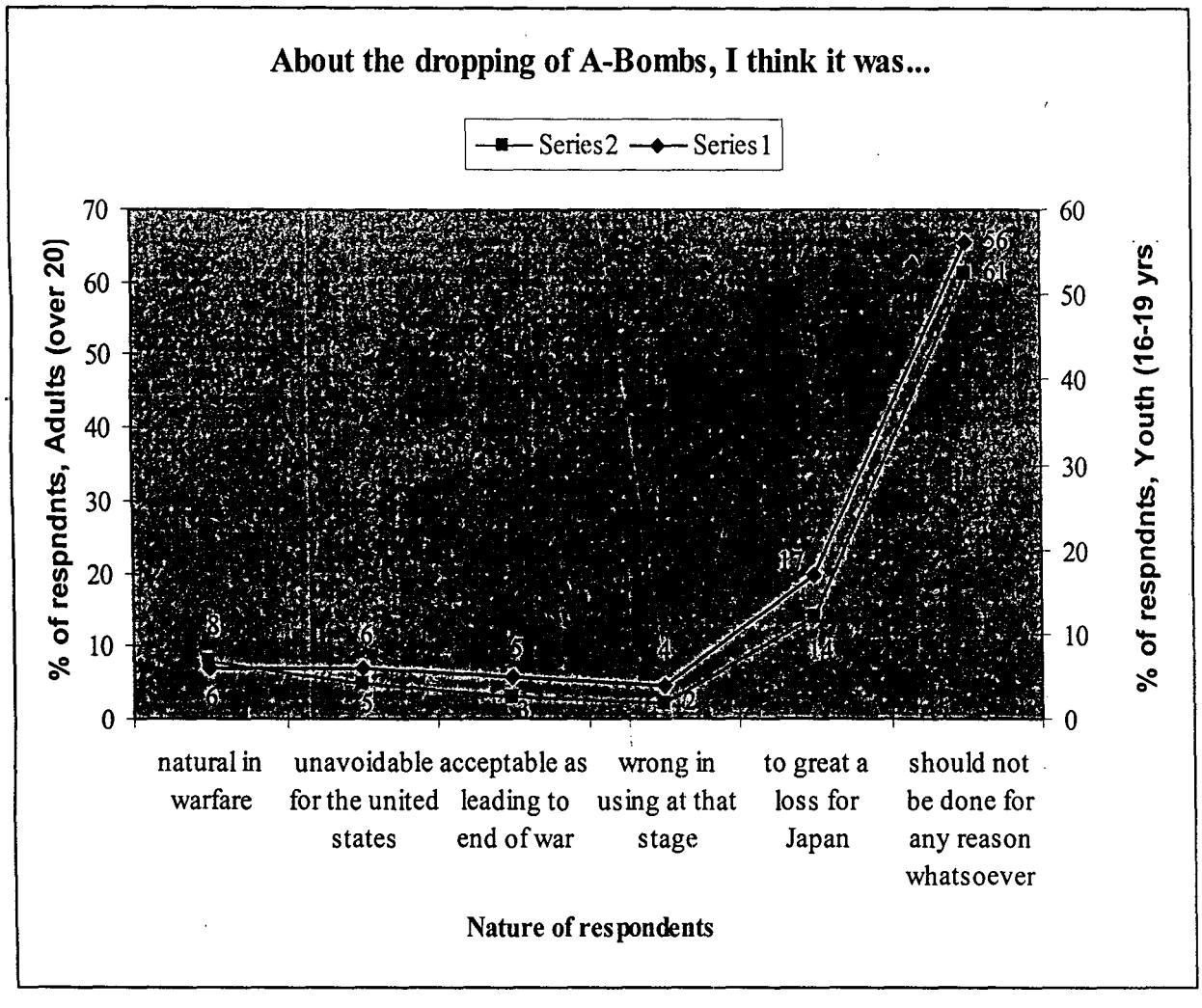
anti-nuclear organizations actions provoked the Japanese anti-nuclear sentiments and provided a strong base against the nuclearization of any country especially Japan.

In Asahi poll of May 10, 1954, a total of 2,498 individuals were asked if they supported the attitude of the then foreign Minister Okazaki, who stressed cooperation with the U.S. H-bomb test in order to defend the security of liberal democratic countries. The poll abstained only 11 percent in favor while 55percent replied in negative manner.[23]

In the year 1955, a survey conducted by the Yoron Kagaku Kyokai (Scientific Public Opinion Association), respondents were asked, what do you think about the Atom bomb testing? 82 percent of the respondent replied that the government should request its discontinuation, and 12 percent replied that it is inevitable[24].

By the period 1955-56, the Japanese attitude toward the nuclear weapons had been recorded in several newspaper polls and by other opinion analysis groups. Again, in 1970, Mainichi conducted a poll almost after the 25 years of the incident. In that, survey almost half of the respondents were in favor that nuclear weapons should not be used in future war. Again a poll conducted in July 1957 reflected the same high degree of opposition when asked "Do you think every kind of A- and H-bomb test should be prohibited" some 87 percent respondents felt they should be, and only 5 percent thought they should not be limited.[25]

[23] Allan B.Cole and Naomichi Nakanishi, eds., Japanese Opinion Polls with Socio-Political Significance 1947-1957 (Medford, Mass.: Fletcher School of Law and Diplomacy, Undated), p. 704.
[24] Ibid, p.72.
[25] Ibid, p. 763.



Note: Series 1 indicates Youth and the series 2 Adults

*Source: Yomiuri, June 19, 1970.

It is interesting to note the "generation gap" in last response of 'A' and 'B' which is of greater significance is the percentage who felt atom bomb should not be used "for any reason whatsoever". This kind of sentiment is not limited to the man in the street but can be seen in that time based on the far more reasoned analysis, even in the Defense Agency, Chief Kubo stated-

> Even if we receive a nuclear attack some day...we should surrender to such foe. What is important not how to win but how to settle a war. Defeat with many people alive is...more valuable than victory without a living creature.[26]

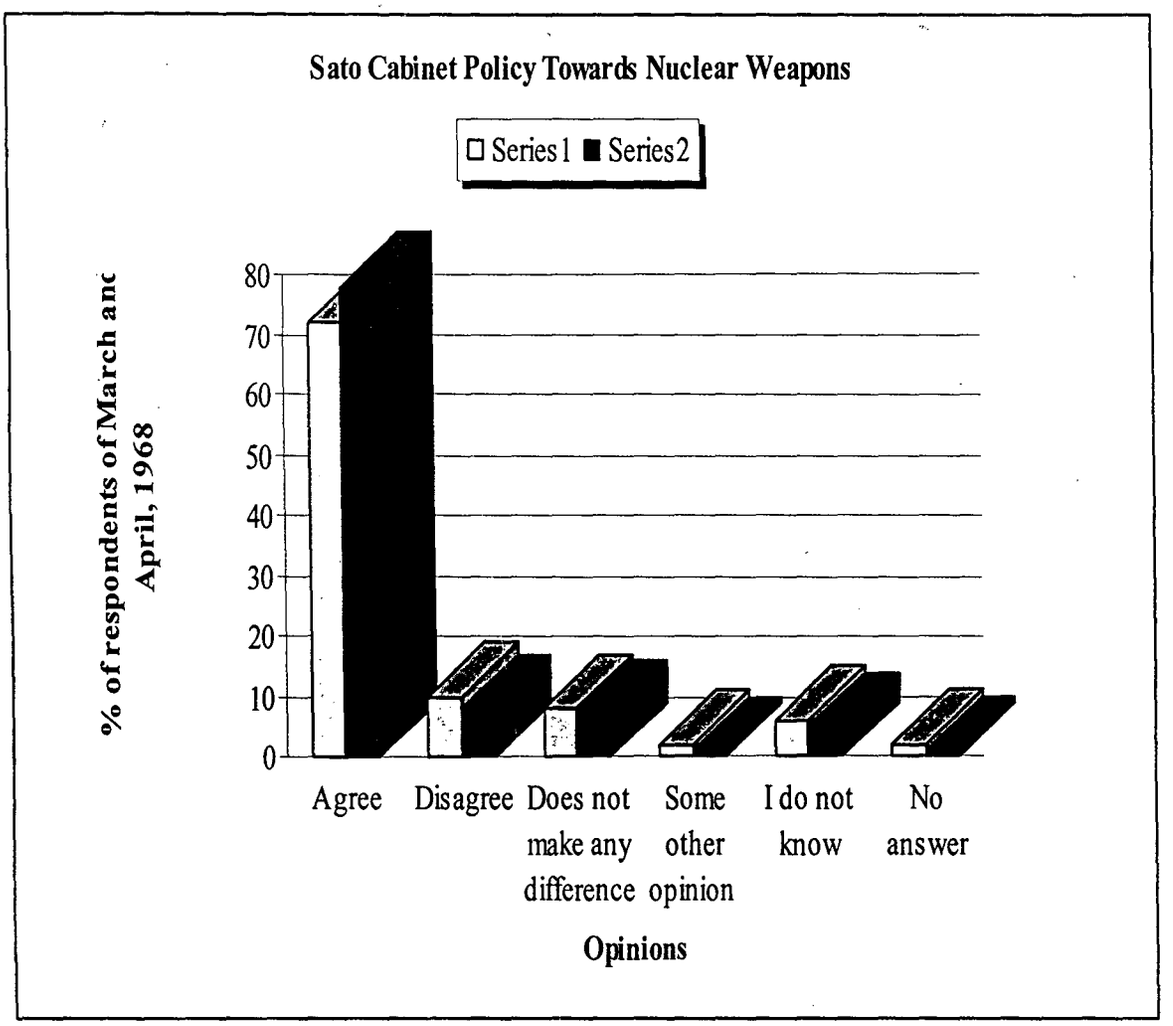
[26] Mainichi Daily News, May 27, 1972

Kubo expressed his view in the Diet that nuclear weapons do not offer a valid action for Japan in military sense, and he therefore, opposed them for military use. As might be expected, this attitude was not universally accepted, especially among the defense officers and they prefer that Japan should have most modern weapons including nuclear weapons.

Additional indicators of accumulative antagonism on the part of mass opposition on the part of the public to nuclear weapons can be seen in the following polls concerning Japanese reaction to the controversy in the return of Okinawa, growing consciousness of Chinese nuclear capability and non-nuclear policy of Sato government.

The Yomiuri Shimbun conducted a poll in 1968 that directly asked the respondents to indicate their attitude towards the return of Okinawa with nuclear bases. In the result, only 3 percent favored and 66 percent opposed that one. 20 percent thought that it was inevitable and 11 percent gave "don't know" answers. Thus, only 3 percent of the total respondents actually favored the continuation of nuclear bases on the main Ryukyu Island, but at least 23 percent were prepared for acquisition.

In a two-part survey that conducted in the last half of March and early April of 1968, the Yomiuri asked the following questions that the Sato Cabinet had made clear its basic policy in relation to nuclear weapons and the atomic bombs etc. Saying 'Japan will not possess, not allow introduction of and not produce nuclear weapons'. Do you agree or disagree with the policy? Replies were reflected in the table. Acceptance of non-nuclear policy of Sato Cabinet in both March and April indicated the public sentiments of Japan. It also indicated that respondents were not politically motivated and show the deep commitment of Japanese people for non-nuclear Japan.



Note: series 1 reflects March and 2 reflects April in

* Source: Yomiuri, April 22, 1968.

On the other hand, respondents who disagreed from the Sato Cabinet on non-nuclear were also in minor number but they at least indicated the nuclear posture of Japan.

In December 1968, the Asahi arranged a Survey and asked the question "should Japan have nuclear armaments", answer were grouped by "right now", "sooner or later", or "should not". In this poll of 1968, 21 percent of the respondents indicated that Japan should have nuclear weapons and 66 percent answered negatively. In the two part survey conducted by Mainichi on the 12th and 29th of May 1969, the result shown was as follows-

Age group/ Options	Right now	Near Future	Sooner Or Later	Total
20s	2	17	25	44
30s	2	15	25	42
40s	3	16	28	47
50s	2	18	32	42
Over 60s	3	17	30	50

Table-1

* Source: Mainichi, May 12, 1969.

The average answer for right now was near about 2 percent , in the future 16 percent, sooner or later 27 percent, which produce 45 percent of the total respondents indicated that Japan should have nuclear weapons and 46 percent were in opposition. In addition, rests were responding, as Japan should not acquire nuclear weapons. Although, the percentage in favor of nuclear Japan and against the non-nuclear Japan were almost half, indicates that, Japanese public sentiments towards non-nuclear Japan became altering and some how they were psychologically prepared for the nuclear Japan from early 1970s.

Again, the Mainichi survey further indicated that graduates of colleges were less inclined to think that Japan should have nuclear weapons than non-college graduates.

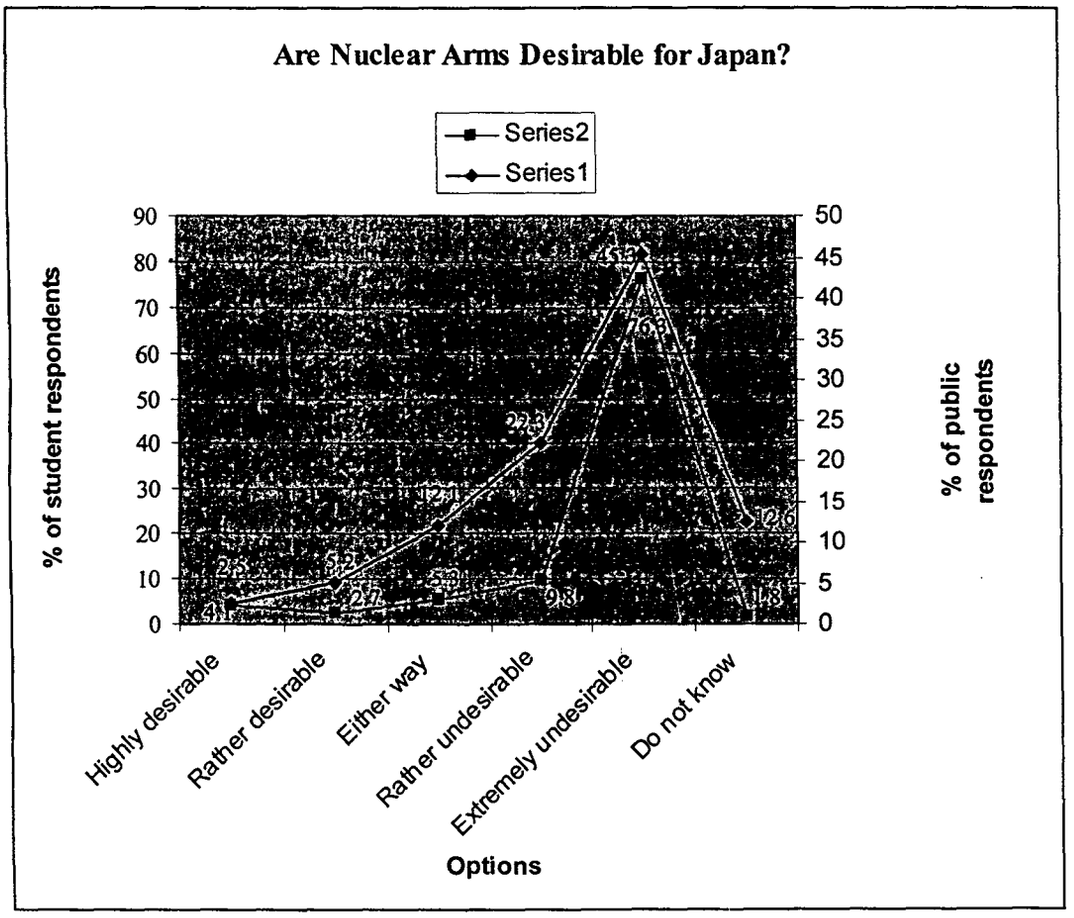
Age group/ Options	Now	Soon	Sooner Or Later	Total
Middle school	2	18	28	48
High School	1	16	29	46
College/University	3	14	21	38

Table-2

In that survey, most of the respondents were not in favor of nuclear Japan then, but almost half number of respondents was in favor of nuclear Japan in future. Although, they were less than half number, but it shows the altering nature of non-nuclear Japanese sentiments.

In December 1969, the Yomiuri Shimbun questioned some 2,357 people and received answer from 78.6 percent. The question of this survey concerned the possible reintroduction of nuclear weapons into Okinawa after that island has been returned to Japan; the respondents were asked, if the government of Japan should refuse the entry or permit the entry of such weapons if asked by the United States. 70 percent replied that entry should be denied, 10 percent recommended that permission be guaranteed, and 20 percent were undecided. Again 70 percent indicated an anti-nuclear policy, while 10 percent called for the policy to permit the introduction of nuclear weapons.

In a national poll conducted by Yomiuri among 3,000 men and women released on May, 1970, the subject of this poll integrated with various issues including "Do you desire nuclear weapons for Japan?" Again, Yomiuri conducted a poll among the Tokyo University graduates and asked the same question and the result was different.



Although, the students from Tokyo University and the Japanese people both were common for poll regarding nuclear weapons were highly undesired for Japan. But their views became different on the other responses in the percent.

A Mainichi survey of May 3, 1972 asked do you think or do not think that Japan should have nuclear armaments. There were 3,015 voters chosen, and recovery rate of 74 percent. The answer of this poll showed the party preferences of the respondents and was particularly valuable from that respect.

Other survey was conducted by Sankaei Shimbun regarding the public opinion on the nuclear question of 1,000 people. The result of this survey appeared on November 25, 1972. The poll queried its respondents about the "possibility of nuclear armament 10 years from now" those indicating that Japan would have such weapons numbered 42 percent.

It would appear, from an assessment of the polls available to this researcher, that two specific types of question concerning nuclear weapons had been asked. One question has been quite delimited, asking the respondent only about the desirability of nuclear weapons for Japan or for this option on the three non-nuclear principles. In polls of this kind, the respondents had been fairly consistent over 60 percent of those who answered negatively has been registered. This question allows the respondent a 'moral option' and the depth of the nuclear allergy shows through.

The second type of question, however, introduces latent policy consideration when the question was "should Japan have nuclear weapons"? The Chinese and Korean nuclear threat which caused a "strong feeling of nuclear threat" for 46 percent of the respondents had registered that some feeling of threat on march 27, 1970 on the part of 78 percent of the respondents, a higher figure identical of the Yomiuri poll in 1968. Thus when the respondent were asked, if Japan should have nuclear weapons/option, it was possible that the context of the international politics is introduced. Therefore, answer in a more

nationalistic manner. This approach produced such a higher degree of 45 percent in Mainichi poll in 1969.

NEW TREND AND NUCLEAR OPTION

Japan faced a seer alter in the political party members position on the nuclear issue. A Mainichi Survey of May 3, 1972 asked, "Do you think or do not think that Japan should have nuclear armaments?" In addition, in that survey, reaction was alike-

Reaction	Should arm immediately	Should arm in near future	Should do sometime or other	Absolutely not arm itself
LDP	3	16	31	45
JSP	2	10	19	65
Komeito	4	11	13	68
DSP	4	6	28	61
JCP	1	3	12	80
None	1	8	17	67
Total	2	11	22	58

Table-3

* Source: Mainichi, May 3, 1972.

In the survey including the legislatures of the Diet members from both the houses and other members of political parties, indicate that almost half of the political party's members were in opposition for nuclear weapons for Japan. On the other hand, a very tiny number of respondents were in the favor of nuclear weapons for Japan either immediately or in near future.

Another survey carried out by Yomiuri Simbun including members of both houses of the National Diet in late 1998 shade some light on the views. Some 60 percent of all Diet members responded to the survey, which covered their positions on various policy issues. The legislators were in almost total agreement across party lines on the issue of nuclear

arms. Just 17 respondents of 431 who gave their opinion on Japan's possession of nuclear arms-a mere 4 percent stated that they were in "favor" or "somewhat" in favor of this idea. The data shows the breakdown of responses by political parties. The Liberal Party and Liberal Democratic Party's Diet members were in favor of nuclear arms for Japan. It is clear that whatever contention there might on other issues. Japan's legislators agreed over-whelmingly that Japan should not seek these weapons; a consensus that remains unchanged to this day, (when this survey done i.e. in 1998).

Further, a survey conducted by "An Ideological Survey of Japan's National Legislators",[27] indicated the party line of all political parties regarding nuclear issue in 1998. In that case, the Komeito, the Japan Communist Party and the Social Democratic Party were totally opposed the views of possession of nuclear weapons for Japan. Democratic Party of Japan was near to the total opposition, while Liberal Party and Liberal Democratic Party stand for "somewhat opposed" nuclear weapons for Japan.

The small number of respondents have expressed their views from different political parties on the possible nuclear weapons for Japan. Democratic Party of Japan, Liberal Party and Liberal Democratic Party "somewhat opposed" of the nuclear weapons for Japan indicated the less than total elimination of nuclear weapons. However, the ruling Liberal Democratic Party also became was somewhat opposed to nuclear weapons said another story of Japan's nuclear issue. In that survey, the "somewhat opposed" by the Liberal Party, Liberal Democratic Party and the Democratic Party of Japan altogether can change the nuclear issue entirely .

The above-mentioned survey in two different times can draw clearly the political party's position on nuclear issue that after a long duration, the legislatures still think that nuclear weapons are necessary for Japan. Although, they were minor in number, but, it indicate the changing political mindset. It also indicated that the supporters were from all political parties and they supported strong army for Japan. Acquiring nuclear weapons for

[27] Kabashima Ikuo, "An Ideological Survey of Japan's National Legislatures," Japan Echo, vol 26, no.4 (August 1999), p.11.

any country is heavily depends on the political will and Japan is not an exception in such a case. Further, the political will to achieve nuclear weapons for Japan is altering from entirely negation to option.

The nuclear option also includes the technological capability of all things related to nuclear. The nuclear technological capability consists of two different things (a) the technological capability related to nuclear reactors and use of that technology for nuclear weapons and (b) the deploying capability of the nuclear weapons including warhead or rocket launchers. (The chapter is not discussing the technological capability of deploying system of nuclear weapons). Further, the technology of nuclear reactors and weapons again consist two separate things. (a) The technology of nuclear fuel cycle including different stages of nuclear fuel cycle like mining and milling of uranium/nuclear fuel, conversion/processing of uranium, enriching and refining of uranium, fuel fabrication, fuel reprocessing and wastes disposal of radioactive materials and (b) The different types of nuclear reactors that easily produce energy and it can be used in power generation for both peaceful purposes and some how for defensive or offensive purposes in regulated way. Although, storage and transport facilities of the radioactive materials are not a part of the nuclear fuel cycle but these two technical facilities also play an important role in the nuclear fuel cycle and finally the nuclear reactors.

In the case of Japan, it achieved almost all the technological capability regarding the nuclear fuel cycle and its various stages. If Japan faces any difficulties on any stages of nuclear fuel cycle then Japan has to import the raw materials from other countries like U.S, Australia, U.K. France, Canada and other countries. On the other hand, Japan should also outsource the technological from other countries in very limited way, but most of the stages of nuclear fuel cycle are successfully accomplish by Japan from indigenous technological capabilities.

In the case of nuclear reactor, Japan also achieved the technology of construction, development, management, production and safe allocation of various nuclear reactors like

Boiling Water Reactors (BWRs), Pressurized Water Reactors (PWRs), Fast Breeder Reactors (FBRs) and Advance Boiling Water Reactors (ABWRs). The technology of these nuclear reactors can be easily used in the power generation for peaceful purposes as well as in the formation of nuclear weapons for destructive purposes. Japan also accepts that it has enough technological capability in the nuclear reactors for its successful power generation.

Although, Japan claims that these nuclear reactors cannot be used in making the nuclear weapons, but this claim is simply incorrect. Actually, even IAEA and other nuclear countries states that the technology of nuclear power generating reactors can be easily used in making nuclear weapons.

After overview of the entire situation regarding nuclear capabilities, one can easily conclude that Japan has enough technology for nuclear weapons. In such circumstances, if Japan is looking for nuclear weapons option, then it only takes time and not the technological capability at all.

STRATEGIC BENEFIT AND NUCLEAR OPTION

Japan's pacifist constitution, non-nuclear policies especially non-nuclear principles and support of the Non-Proliferation Treaty (NPT) regime often offered a strong anti-nuclear base when one talks about nuclear Japan. Japan has enough capabilities to develop nuclear weapons from reactor grade nuclear fuel. Prior to emphasize on the strategic benefits for nuclear Japan, one should lay emphasis on security set-up in East Asia. It is true that Japan is bound by the two nuclear weapons states Russia and China officially and one state North Korea unofficially. Japan still maintains the U.S-Japan Security Agreement and adopts the 'U.S. Nuclear Umbrella' in case of any nuclear threat. In such circumstances, what are the strategic benefits for nuclear Japan?

Japan has technological capabilities to develop nuclear weapons from reactor grade nuclear fuel. However, if Japan decides to be a nuclear state, then the decision is heavily

base on the concept of "Balance of Power" or "Balance of Fear". In both cases, Japan cannot attain any tangible achievements. On the other hand, the U.S-Japan Security Agreement gives enough space in securing its national interests.

CONCLUSION

If Japan should decide to pursue the nuclear option, there must be three conditions to be satisfied: technological capabilities, strategic benefits and the political will to possess nuclear weapons. As mentioned earlier, Japan has enough technological capability to develop nuclear weapons from reactor grade nuclear fuel (plutonium or uranium). Secondly, different political parties of Japan have different opinion regarding nuclear issue. These political parties not only support the non-nuclear posture of Japan, but also supports strong army and strong defense policy. Somehow, some political members accept nuclear option for Japan in worst condition. On the other hand, some top politicians indicate less than total opposition of nuclear Japan.

Thirdly, Japanese policymakers emphasize the strategic benefits of nuclear Japan that it creates the "Balance of Power" or "Balance of Fear" in East Asia. Through this aspect, Japan definitely can achieve its national interests or will be in condition of bargain. But historically, the balance of power or balance of fear does generate some solution of the problems except the cold war between the concerned countries.

If Japan utilize its nuclear program for peaceful purposes and other research and development in medicine and Biotechnology, then it is acceptable. However, one cannot draw a clear-cut line between the peaceful use of nuclear energy and defensive use of nuclear energy. That situation will again create panic in East Asia

CHAPTER-5

SUMMARY AND CONCLUSION

Japan is the only country in the world to face the nuclear devastation twice in World War II. It became a cause of Japan's defeat and unconditional surrender in World War II. Since then, anti-nuclear movement has become a prominent part of the Japanese culture. However, on same time Japan's nuclear research and policy also originated. Soon after getting sovereignty in 1952, Japan's nuclear research and nuclear policy gained momentum.

Japan used to conduct nuclear research also in prewar days under the supervision of military, but allied forces destroyed the Japan's nuclear research absolutely. Soon after getting sovereignty in 1952, Japan's nuclear policy gained momentum. In the early phase of sovereignty, allied forces also gave permission for the nuclear research only in such areas as medicines and biotechnology. Apart from that one, anything related to nuclear became "dead issue" in Japan. In post war period, Japan entered in the nuclear world due to unavoidable circumstances with a number of constitutional and legal hurdles. Japan entered in the nuclear world for its energy security with provision that nuclear energy would be used for peaceful purposes not for defensive use and transparency would be maintained. Simply, the constitutional provisions compelled Japan to make every activities relating to nuclear aspect public and transparent.

The after effect of the bombing resulted in the origin of nuclear pacifism in Japan. That nuclear pacifism led to form anti nuclear movement groups in Japan to oppose nuclearization of Japan as well as such moves elsewhere in the world. They every year commemorate the atomic bombing on Hiroshima and Nagasaki on 6th and 9th August and pledge to save the world form another nuclear catastrophe. After that, anti-nuclear movement and anti-nuclear weapons movement became a prominent part of the Japanese culture. In these period, a number of anti-nuclear groups actively criticized the nuclear explosion by any country in the world. These anti-nuclear groups like *Hibakusha* (the victims of the atomic bombings), *Gensuikyo* (Council against A-and H-Bombs), *Sohyo*

(General Council of Trade Unions of Japan), *Domei* (the Japanese Confederation of labor) *Kakkin Kaigi* (National Council for Peace and against Nuclear Weapons), *Gensuikin* (Congress against A-and H- bombs) *Nihon Hidankyo* (Japan's Confederation of A- and H-bomb sufferers Organizations), became a prominent part of the Japanese culture.

Although, these anti-nuclear groups faced internal conflicts on the Russian nuclear issue, but their ultimate goal of world without nuclear and world peace, became a significant step toward the nuclear free world and world peace.

On the other hand, due to pressure from the anti-nuclear and anti-nuclear weapons groups, Japanese government adopted the non-nuclear policies under the Prime Minister ship of Eisako Sato in 1967-68 i.e. (1) the peaceful use of nuclear energy, (2) three non-nuclear principles i.e. not to posses, not to manufacture and not to introduce nuclear weapons on the Japanese ground, (3) the promotion of nuclear disarmament and (4) the reliance on the U.S. nuclear deterrent against international nuclear threats. These four nuclear policies were the pillar of the endorsement of nuclear disarmament and according to the national popular feelings. The four nuclear policy adopted by Eisako Sato and especially three non-nuclear principles showed the non-violatic and Passive nature of Japanese nuclear policy. Further, it also discriminated between the peaceful and passive use of nuclear energy and negative purposes of nuclear energy.

Again, Japan also made provisions of peaceful use of nuclear energy through Basic Atomic Energy law. The I and II Article of Basic Atomic Energy Law states that nuclear energy can be used for peaceful purposes and every thing will be made public. Supervision of IAEA plays pivotal role in the peaceful use of nuclear energy. The Non-Proliferation Treaty (NPT), and Comprehensive Test Ban Treaty (CTBT), became significant posture of the Japanese anti-nuclear sentiments. U.S-Japan Security Agreement provides Japan a strong base for "Passing the Buck" of its security problems to U.S. The "U.S. Nuclear Umbrella" to Japan gives a strong framework against the international nuclear threat and nuclearization of Japan in future.

After certain period of time, the pacifist movements could not continue for so long and could not achieve to alter the course of remilitarization and termination of Security treaty, but the long-term influence of pacifist movements is evident in the preservation of Article 9, maintaining sustained pressure to get back Okinawa from the US occupation, the ban on the dispatch of military forces overseas, the imposition of a 1% ceiling on defense spending and adoption of three non-nuclear principles. There may be various reasons for gradual decay of the pacifist movements. However, most obvious reason was emergence of new generation who had not witnessed the devastation of war, thus pacifist ideas did not appeal to them so much.

On the other hand, in early years of sovereignty, Japan faced energy crisis for its industrial development and reconstruction, and nuclear energy became the alternative source. U.S also promoted nuclear energy under the title "Atoms for Peace". The term 'Atoms for Peace' refers the nuclear power for peaceful purposes. Oil shocks in early and late 70s also compelled Japan to look beyond the unconventional method of energy and beyond the gulf oil. Thus, Japan adopted the nuclear energy for energy requirements. After a certain period, Japan started its nuclear program with the help of other nuclear member countries. Initially, Japan faced technological difficulties in each step of its nuclear fuel cycle and the successful management of different types of reactors. However, Japan achieved the technological capability of different stages of nuclear fuel cycle like mining and milling of uranium, conversion/processing of uranium, enriching and refining of uranium, fuel fabrication, fuel reprocessing, wastes disposal, storage and transportation of the radioactive materials including the management of Boiling Water Reactors (BWRs), Pressurized Water Reactors (PWRs) in 1970s and also the Fast Breeder Reactors (FBRs) till 1990s. Technically, the nuclear fuel cycle and nuclear reactors are important for the nuclear weapons. Both can also be use in the formation and management of the nuclear weapons through achieving the "criticality" of the nuclear reactors. Simply, Japan achieved the technological capability of nuclear reactors including nuclear fuel cycle and the management of nuclear reactors in 1970s. Further, Japan achieved the "criticality" in nuclear reactors in 1990s, which is necessary for the nuclear weapons from nuclear power reactors.

As long as the pacifist movement loosing its sharpness, the "Gaullist Nationalism" arises in Japan. There may be diverse reasons for steady crumble of the pacifist movements. However, most obvious reason was the emergence of new age group who had not witnessed the catastrophe of war and nuclear devastation, thus pacifist thoughts did not appeal to them so much. Another reason for the decay of pacifist movement was the government's relentless pursuit for remilitarization, ignoring the exhortations of the pacifists. The emergence of nationalist leaders like Nakasone in 1980, who vociferously talked about amendment in the pacifist Constitution created a nationwide concern about the nationalism and remilitarization. Not only "hawks" of Japan like Nakasone, but also a number of other leading politicians proclaimed less than total opposition of nuclear weapons for Japan. Due to emergence of "Gaullist Nationalism", public sentiments also alter the pacific movements because they want to see their country, not only economic super power, but "super power" including the top politicians, bureaucrats, think tank, and media persons. Although, the term super power also consists the possession of nuclear weapons, thus nationalists demands the possession of nuclear weapons. Top politicians including Prime Minister Kishi (in 1957), Ohira (in 1979), and Nakasone (in 1984) claimed that acquiring nuclear weapons would not be prohibited by Japan's peace Constitution-providing they were used for defense, not for offense. Simply, as the anti-nuclear movements looses its sharpness, each section of the Japanese society is looking for remilitarization through amendment in Article 9 of the Japanese pacifist constitution and make Japan a normal state with clear nuclear option.

In order to pursuing nuclear option, Japan must fulfill three conditions technological capability, strategic benefits and political willpower. Subsequent to an assessment of the Japan's nuclear issue, one must conclude that Japan certainly has one of the most advance and sophisticated nuclear programs in the world and is engaged in the recycling of nuclear spent fuels through which large amounts of plutonium could result in. Some nuclear scientists also estimate Japan as one of the countries with the most advanced capability in nuclear physics and technology. Japan can produce nuclear weapons from reactor grade plutonium. Further, Japan as also accepted that it has enough scientific capabilities on the each steps of nuclear fuel cycling including nuclear reactors.

Although, adequate capability in fuel cycle and enough plutonium/nuclear fuel reserve in overseas (JAEC revealed that there were 4.7 tons of separated plutonium in Japan with additional 6 tons storage in Europe in 1994) say the whole story about the Japan's sophisticated nuclear fuel cycle. Further, successful construction, development and management of different types of nuclear reactors again shows the sophisticated nuclear reactors in Japan. These nuclear reactors can be used in the development and construction of nuclear weapons. The only thing that is required in the replacement to nuclear reactors for power generation to nuclear weapons is the control of "criticality" in nuclear reactors. Through controlling the criticality, any nuclear reactors can act as nuclear weapons. Successful operation of nuclear reactors like Boiling Water Reactors (BWRs), Pressurized Water Reactors (PWRs), Advance Boiling Water Reactors (ABWRs) and Fast Breeder Reactors (FBRs) indicate that, Japan has capability over 'criticality'. In simple terms, Japan has technological capabilities in successfully managing of nuclear fuel cycle and nuclear reactors both. (Here, the Dissertation will not touch upon the details of deploying capability of nuclear weapons like warheads or launch vehicles).

Secondly, if Japan exercises the nuclear option, then it will definitely satisfy at least a minimum sort of national interest. Strategically, nuclear option for Japan will give better bargaining position in international forums to achieve national interests especially from the point of security perspectives. The panic situation in East Asia and external nuclear threat push Japan towards nuclear option. Japan is circled by three nuclear weapons states; two of them i.e. Russia and China are officially while North Korea is unofficially nuclear state. Historically, Japan had conflict with these nuclear weapons states and has territorial disputes with almost all of its neighbors. This pitiable circumstance in East Asia often generates panic situation of nuclear threat. Although, U.S-Japan Security Agreement in general and U.S. "Nuclear Umbrella" in exceptional situation, generates the "Balance of Power" in East Asia. The security situation will turn more critical if any party withdraws oneself according to the Article X of the U.S-Japan Security Agreement. The condition without the U.S Nuclear Umbrella will generate the nuclear horror among the Japanese nationalists and policymakers including common Japanese people.

Expanding global role of United States leads to the notion that U.S now wants a strategic partner rather than a dependent in East Asia. Although, Japan enjoys the status of "free ride" by U.S however, this situation will be appropriate for any nation to relay indefinitely on the military capability of an alien country. Even a common person does not believe in "Passing the Buck" (shifting the responsibility) of national security to the military capability of other nation including nationalist. The opposing view of 'Passing the Buck' shows the path of self-sufficiency in defense and finally leads the nuclear option for Japan. The self-sufficiency in defense, including the nuclear option will give the status of strategic partner of U.S in East Asia that became a prime strategic benefit for Japan in international politics.

Further, the emergence of North Korea as a nuclear power and withdrew itself from the NPT generates the nuclear crisis in East Asia. Added to North Korea's long-range nuclear missile test, the pitiable condition will engender the nuclear threat for Japan and for world peace and for entire humanity. These circumstances again boost up the Gaullist Nationalism in Japan and they are now talking about the less than total abolition of nuclear weapons for Japan. Simply, they are looking for the nuclear option for Japan.

On the other hand, few nationalists want greater role for Japan in United Nations so that Japan can achieve the permanent seat in the United Nations Security Council (UNSC). For the sake of permanent seat in UNSC, they want greater role United Nations Peace Keeping Operations (UNPKO). For that, they want amendment in the Article 9 of the pacifist Constitution and a regular army for Japan. The amendment in Article 9 of the Japanese constitution and a regular army of course include the story of nuclear option.

The concept of Gaullist Nationalism leads the path of "super power". The Gaullist Nationalists want their nation as a super power in all directions excluding economic self-sufficiency. The concept of super power includes the possession of nuclear weapons so that a nation is in better bargain position in international politics. For a better role in world politics including permanent seat in UNSC, they are now seeking for nuclear option for Japan.

Nationalist claims that even the developing countries like India and Pakistan achieved the status of nuclear weapon and Israel, North Korea and Iran are pursuing to achieve the nuclear weapon status to fulfill their national interests. In that circumstance, the international community is not doing too much against them. So, why Japan should not achieve the nuclear weapon status? Thus, Japan can achieve its national interests in better ways.

Further, nationalist claims that nuclear option for Japan will definitely generate a stable "Balance of Power" in East Asia. This Balance of Power in nuclear terms certainly erodes the nuclear threat and leads the situation of "Peaceful Co-existence" in East Asia. That Peaceful Co-existence engenders the nonviolent and diplomatic relations among the East Asian countries together with the self-sufficiency of Japan in militaristic terms.

Thirdly, the political will also alters the anti-nuclear sentiments. Political will include the top politicians, policymakers, think tanks, bureaucrats and various pressure groups are often talking about the less than total abolition of nuclear weapons from the world. The Prime Ministers like Kishi (in1957), Ohira (in 1979), and Nakasone (in 1984) claimed that acquiring nuclear weapons would not be prohibited by Japan's peace Constitution-providing they were used for defense, not for offense. The comments by the top politicians like Prime Minister say the whole story about the nuclear future. Contemporary Prime Minister Eisako Sato, who adopted the Japan's Non-nuclear Policy in 1967-68 including the three non-nuclear principles also claimed about the nuclear option for Japan.

Further, the defense planners, think tanks, and bureaucrats as well as public opinion, survey and reports indicate preference for a regular army with nuclear option. Although, the percentage of Legislatures (according to a Japan Echo, Vol. 26, no. 4, August 1999) who wanted Japan as a nuclear weapon state is very low, however, it pointed out the nuclear option for Japan in near future. The public opinion also alters the traditional pacifist sentiments. According to survey, different age group shows different percentage. However, the percentage became high comparatively high in young generation.

Although, the survey by different agencies including the legislatures of the Diet and common people show less percentage for nuclear option, but it generates a widespread concern about nuclear future for Japan. The political parties including the all time ruling Liberal Democratic Party (LDP) also indicate less than opposition of nuclear weapons for Japan. In such circumstances, the nuclear option for Japan became not a dare dream with its traditional ally, the Komeito.

Although, Japan has enough sophisticated technological capability of nuclear fuel cycle, nuclear reactors and criticality of conversion of nuclear reactors into nuclear weapons including some sorts of strategic benefits with political will, but Japan also faces some legal difficulties in nuclear option. The Preamble, Article 9 of the Japanese pacifist constitution, the Basic Atomic Energy Law domestically and the Non-Proliferation Treaty (NPT), Comprehensive Test Ban Treaty (CTBT), International Atomic Energy Agency (IAEA) safeguard measures and U.S-Japan Security Agreement internationally became legal barrier in the nuclear option for Japan.

Proviso, Japan is looking for exercising nuclear option, then must be abolishing the legal hurdles domestically as well as internationally. The constitutional amendment is necessary for the eradication of legal barriers that leads the path of referendum by the common Japanese people. (Common Japanese people can hold constitutional amendment according to Article 96 of the constitution through referendum). Common Japanese, especially young generation is now favoring strong nation with strong economy and strong army. They prefer remilitarization and a nuclear option for Japan. Further, the international legal norms and treaties are not going to create a predicament because any party of the international treaty can withdraw itself with the prior notice of three months (One year in the case of U.S-Japan Security Agreement) and became free from the treaty. Earlier, so many countries withdrew themselves from the various treaties. Thus, international treaties are not going to become a huge legal hurdle in the path of nuclear option for Japan. However, it became a widespread concern of criticism about the alter of traditional anti-nuclear sentiments and pacifism that guide the remilitarization self-sufficiency of nuclear technology.

Although, Japan fulfills all sorts of minimum technological potential, strategic reimbursement with altering pacific political will power for sake nuclear option, however, is it rational to achieve nuclear weapon status to achieve national interests?

Conditionally, it becomes justified the peaceful nuclear power for energy resources in any country if it is under the IAEA supervision including adequate transparency that no one can misuse the nuclear power capability in defensive purposes. However, it became too complex to draw a clear-cut line between peaceful use of nuclear energy and defensive use of nuclear energy. Further, it is true that nuclear energy is providing better alternate than conventional source of energy like crude oil and natural gas. Secondly, it also takes less space than conventional source of energy, which became important for the country like Japan. However, the after effect of the nuclear reactors became too hast because it radiates radioactive rays for years, even more than the whole life of nuclear reactors. These radioactive rays are hazardous for human and environment both.

Strategically, the possession of nuclear weapons for Japan originates the "Balance of Fear" rather than "Balance of Power" in East Asia. Although, the nuclear option will give better bargaining position to achieve national interests in international sphere, but possession of nuclear weapons cannot be justified for the country like Japan that faced the nuclear catastrophe twice in history.

On the other hand, Japanese policymakers, nationalists and realists believe that there is no central authority in international politics and each state has responsibility to achieve their own national interests. Nationalists and realists believe in the concept of H.J.Marganthau's "Realism", that international politics is a concept of interests define in terms of power and has less meaning with idealism. They believe in "Offensive" (hegemonic position with power maximizing) or "Defensive" (requisite amount of power to ensure the survival) realism rather than peaceful co-existence and pacifism. In view of this idea, they emphasize "Historical Realism" (any course of action for necessary to ensure political survival by state) and emphasis nuclear option for Japan.

Steadily, political favoring including public opinion and politicians' less than total opposition of nuclear weapons indicate the concealed nuclear desires. The remarks by Prime Ministers from time to time indicate the nuclear weapon option for Japan-providing they were used for defense and not for offense purposes. This clarification is nothing but the nuclear option for Japan.

External and internal forces are pushing towards nuclear Japan. Nuclearization of Japan may also provide better bargaining position in international sphere, but nuclear weapons are nothing but an "absolute Evil". Each country should take concrete step in favor of non-proliferation of nuclear weapons and promote world peace through "No Nukes". In favor of non-proliferation and non-nuclearization of Japan, one time Defense Agency, Chief Kubo stated-

> Even if we receive a nuclear attack some day...we should surrender to such foe. What is important not how to win but how to settle a war. Defeat with many people alive is...more valuable than victory without a living creature.[1]

[1] Mainichi Daily News, May 27, 1972

APPENDIX-1

THE BASIS OF MAKING OF NUCLEAR REACTORS/WEAPONS

A nuclear reactor produces and controls the release of energy from splitting the atoms of certain elements. In a nuclear power reactor, the energy released is used as heat to make steam to generate electricity.

The principles for using nuclear power to produce electricity are the same for most types of reactor. The energy released from continuous fission of the atoms of the fuel is harnessed as heat in either a gas or water, and is used to produce steam. The steam is use to drive the turbines that produce electricity (as in most fossil fuel plants). On the other hand, these nuclear can be also use in formation of nuclear weapons with certain modifications.

In the process of nuclear reactors or nuclear weapons, two technological processes are necessary, (a) nuclear fuel cycle and (b) successful management of nuclear reactors.

(a)NUCLEAR FUEL CYCLE

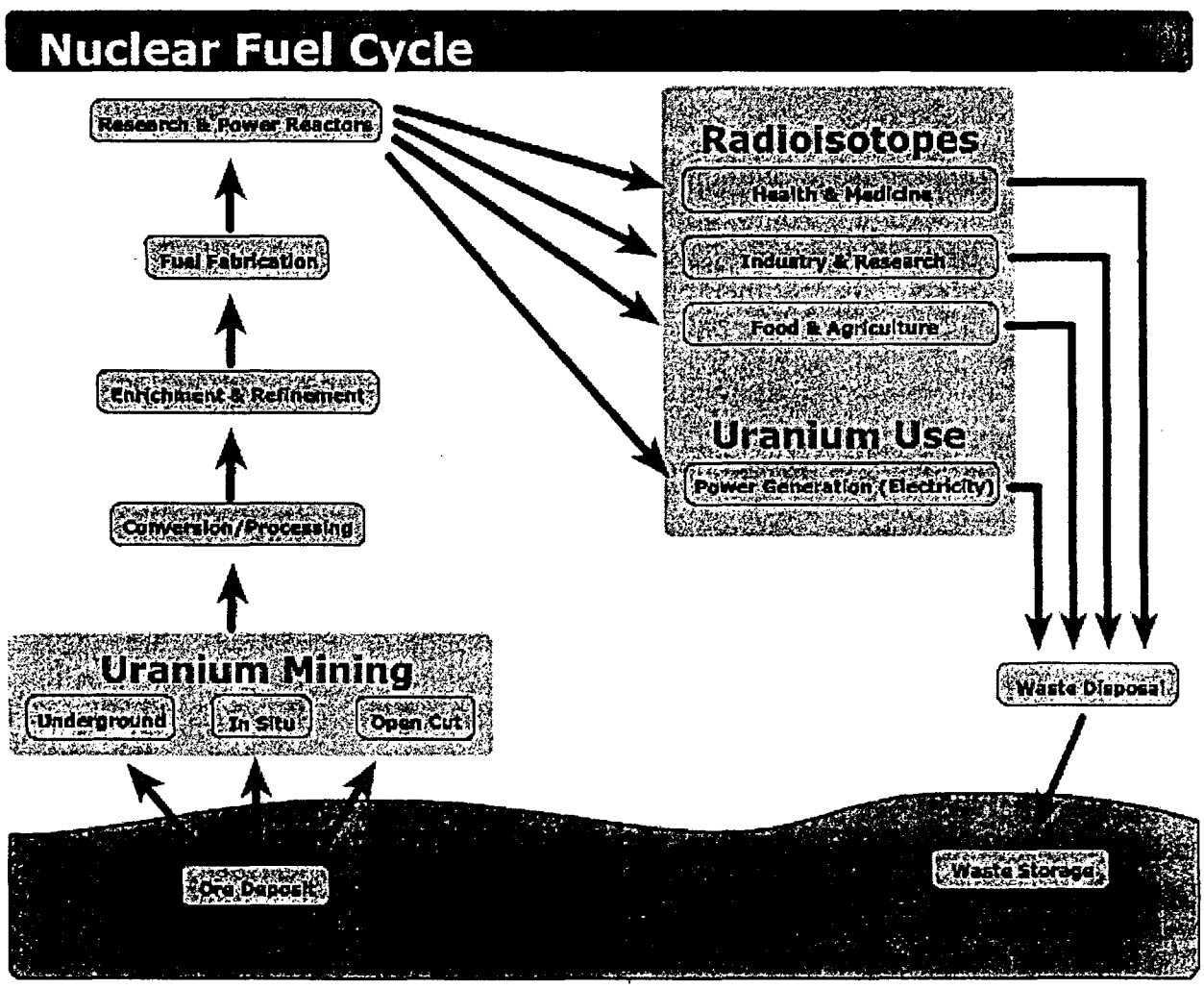
Like coal, oil and natural gas, uranium is an energy resource that must be processed through a series of steps to produce an efficient fuel for generating electricity. Each fuel has its own distinctive fuel cycle. However, the uranium or "nuclear fuel cycle" is more complex than the others. To prepare uranium for use in a nuclear reactor for both power reactors and the weapons reactors, it undergoes the steps of mining and milling, conversion, enrichment, fuel fabrication, use of fuel elements in nuclear power plants, reprocessing of spent fuel and disposal of radioactive wastage. These steps make up the "front end" of the nuclear fuel cycle.

After uranium has been used in a reactor to produce electricity, it is known as "spent fuel" and may undergo a further series of steps including temporary storage, reprocessing, and recycling before eventual disposal as wastes. Collectively these steps are known as the "back end" of the fuel cycle.

Exploration

A deposit of uranium, discovered by geophysical techniques, is evaluated and sampled to determine the amounts of uranium materials that are extractable at specific costs from the deposit. Uranium reserves are the amount of ore that are estimated to be recoverable at stated costs. Uranium in nature consists primarily of two isotopes, U238 and U235. (The numbers refer to the atomic mass number for each isotope, or the number of protons and neutrons in the atomic nucleus. Naturally, occurring uranium consists of approximately 99.28% U238 and 0.71% U235. The atomic nucleus of U235 will nearly always fission when struck by a free neutron, and the isotopes is therefore said to be a fissile isotopes.

The nucleus of a U238 atom on the other hand, rather than undergoing fission when struck by a free neutron, will nearly always absorb the neutron and yield an atom of the isotope U239. This isotope then undergoes natural radioactive decay to yield Pu239, which like U235 is a fissile isotope. The atoms of U238 are said to be fertile, because, through neutron irradiation in the core, some eventually yield atoms of fissile Pu239.



Mining

Uranium ore can be extracted through conventional mining in open pit and underground methods similar to those used for mining other metals. In situ leach mining methods also are used to mine uranium in the United States. In this technology, uranium is leached from the in-place ore through an array of regularly spaced wells and is then recovered from the leach solution at a surface plant. Uranium ores in the United States typically range from about 0.05 to 0.3% uranium oxide (U_3O_8). Some uranium deposits developed in other countries are of higher grade and are also larger than deposits mined in the United States. Uranium is also present in very low grade amounts (50 to 200 parts per

million) in some domestic phosphate-bearing deposits of marine origin. Because very large quantities of phosphate-bearing rock are mined for the production of wet-process phosphoric acid used in high analysis fertilizers and other phosphate chemicals, at some phosphate processing plants the uranium, although present in very low concentrations, can be economically recovered from the process stream.

Milling

Mined uranium ores normally are processed by grinding the ore materials to a uniform particle size and then treating the ore to extract the uranium by chemical leaching. The milling process commonly yields dry powder-form material consisting of natural uranium, "yellowcake," which is sold on the uranium market as U_3O_8.

Uranium conversion

Milled uranium oxide, U_3O_8, must be converted to uranium hexafluoride, UF_6, which is the form required by most commercial uranium enrichment facilities currently in use. A solid at room temperature, UF_6 can be changed to a gaseous form at moderately higher temperature of 134°F (57°C). The UF_6 conversion product contains only natural, not enriched, uranium.

U_3O_8 is also converted to ceramic grade UO_2 for use in reactors not requiring enriched fuel, such as CANDU. The volumes of material converted directly to UO_2 are typically quite small compared to the amounts converted to UF_6.

Enrichment

Nuclear fuel cycle begins when uranium is mined, enriched and manufactured to nuclear fuel (1) which is delivered to a nuclear power plant. After usage in the power plant the spent fuel is delivered to a reprocessing plant (if fuel is recycled) (2) or to a final repository (if no recycling is done) (3) for geological disposition. In reprocessing 95% of spent fuel can be recycled to be returned to usage in a power plant (4) The concentration of the fissionable isotope, U^{235} (0.71% in natural uranium) is less than that required to sustain a nuclear chain reaction in light water reactor cores. Natural UF_6 thus, must be enriched in the fissionable isotope for it to be used as nuclear fuel. The different levels of enrichment required for a particular nuclear fuel application are specified by the customer: light-water reactor fuel normally is enriched up to about 5% U^{235}, but uranium enriched to lower concentrations also is required. Enrichment is accomplished using some one or more methods of isotope separation. Gaseous diffusion and gas centrifuge are the commonly used uranium enrichment technologies, but new enrichment technologies are currently being developed.

The bulk (96%) of the byproduct from enrichment is depleted uranium (DU), for which there are few applications; the United States Department of Energy alone has 470,000 tonnes in store .

Fabrication

Nuclear fuel fabrication is the next step in the fuel cycle. For the use of nuclear fuel, the enriched uranium must have to fabricate through other chemical and physical process in extremely high temperature for making it hard, which is essential for the nuclear reactor. This fabricated uranium is used in the power generation for both nuclear energy for peaceful purposes and for nuclear weapons. The process of fabrication is necessary, as the enriched uranium cannot be directly used in the nuclear power reactors. In fabrication process, uranium must be heated, loaded into metal bundles and assembled as fuel elements or bundles.

For use as nuclear fuel, enriched UF_6 is converted into uranium dioxide (UO_2) powder which is then processed into pellet form. The pellets are then fired in a high temperature sintering furnace to create hard, ceramic pellets of enriched uranium. The cylindrical pellets then undergo a grinding process to achieve a uniform pellet size. The pellets are stacked, according to each nuclear core's design specifications, into tubes of corrosion-resistant metal alloy. The tubes are sealed to contain the fuel pellets: these tubes are called fuel rods. The finished fuel rods are grouped in special fuel assemblies that are then used to build up the nuclear fuel core of a power reactor.

The metal used for the tubes depends on the design of the reactor - stainless steel was used in the past, but most reactors now use Zirconium. For the most common types of reactors (BWRs and PWRs) the tubes are assembled into bundles. These bundles are then given a unique identification number, which enables them to be tracked from manufacture through use and into disposal.

Transport of Radioactive Materials

Transport is an integral part of the nuclear fuel cycle. There are nuclear power reactors in operation in several countries but uranium mining is viable in only a few areas. Also, in the course of over fifty years of operation by the nuclear industry, a number of specialized facilities have been developed in various locations around the world to provide fuel cycle services and there is a need to transport nuclear materials to and from these facilities. Most transports of nuclear fuel material occur between different stages of the cycle, but occasionally a material may be transported between similar facilities. With some exceptions, nuclear fuel cycle materials are transported in solid form, the exception being uranium hexafluoride (UF_6) which is considered a gas. Most of the material used in nuclear fuel is transported several times during the cycle. Transports are frequently international, and are often over large distances. Nuclear materials are generally transported by specialized transport companies.

Since nuclear materials are radioactive, it is important to ensure that radiation exposure of both those involved in the transport of such materials and the general public along transport routes is limited. Packaging for nuclear materials includes, where appropriate, shielding to reduce potential radiation exposures. In the case of some materials, such as

fresh uranium fuel assemblies, the radiation levels are negligible and no shielding is required. Other materials, such as spent fuel and high-level wastes, are highly radioactive and require special handling. To limit the risk in transporting highly radioactive materials, containers known as spent nuclear fuel shipping casks are used which are designed to maintain integrity under normal transportation conditions and during hypothetical accident conditions.

In-core fuel management

The core of a reactor is composed of a few hundred "assemblies", arranged in a regular array of cells, each cell being formed by a fuel or control rod surrounded, in most designs, by a moderator and coolant (water in most reactors).

Because of the fission process that consumes the fuels, the old fuel rods must be changed periodically to fresh ones (this period is called a cycle). However, only a part of the assemblies (typically one fourth) are removed since the fuel depletion is not spatially uniform. Furthermore, it is not a good policy, for efficiency reasons, to put the new assemblies exactly at the location of the removed ones. Even bundles of the same age may have different burn-up levels, which depends on their previous positions in the core. Thus the available bundles must be arranged in such a way that the yield is maximized, while safety limitations and operational constraints are satisfied. Consequently, reactor operators are faced with the so-called optimal fuel reloading problem, which consists in optimizing the rearrangement of all the assemblies, the old and fresh ones, while still maximizing the reactivity of the reactor core so as to maximise fuel burn-up and minimise fuel-cycle costs.

This is a discrete optimization problem, and computationally infeasible by current combinatorial methods, due to the huge number of permutations and the complexity of each computation. Many numerical methods have been proposed for solving it and many commercial software packages have been written to support fuel management. This is an on-going issue in reactor operations as no definitive solution to this problem has been found and operators use a combination of computational and empirical techniques to manage this problem.

On-Load Reactors

Some reactor designs, such as CANDUs or RBMKs, can be refuelled without being shut down. This is achieved through the use of many small pressure tubes to contain the fuel and coolant, as opposed to one large pressure vessel as in PWR or BWR designs. Each tube can be individually isolated and refuelled by an operator-controlled fuelling machine, typically at a rate of up to 8 channels per day (out of roughly 400) in CANDU reactors. On-Load refuelling allows for the problem of optimal fuel reloading problem to be dealt with continuously, leading to more efficient use of fuel. This increase in efficiency is partially offset by the added complexity of having hundreds of pressure tubes and the fuelling machines to service them.

Interim Storage

After its operating cycle, the reactor is shut down for refueling. The fuel discharged at that time (spent fuel) is stored either at the reactor site, commonly in a spent fuel pool or, potentially in a common facility away from reactor sites. If on-site pool storage capacity is exceeded, it may be desirable to store the now cooled aged fuel in modular dry storage facilities known as Independent Spent Fuel Storage Installations (ISFSI) at the reactor site or at a facility away from the site. The spent fuel rods are usually stored in water, which provides both cooling (the spent fuel continues to generate decay heat as a result of residual radioactive decay) and shielding (to protect the environment from residual ionizing radiation), although after a period of cooling they may be moved to dry cask storage.

Reprocessing

The average life of the uranium or plutonium in a nuclear reactor is approximately three years after the fabrication of the nuclear fuel. After the three years period, the nuclear fuels become highly irradiate and contains residual fissionable materials. Even the spent fuel discharged from the nuclear reactors contains other radioactive materials that need to be reprocessed for the further use in nuclear reactors. Being too precious to be discarded, the fuel is transferred to reprocessing plants where it is dissolved in order to recover and purify the residual nuclear fuel. Radioactive wastes are also generated in the process. Simply, after a certain period of time, the spent fuel must have to purify again for further use in nuclear reactors. The nuclear fuel (materials) can be chemically separated and recovered from the spent fuel. The recovered uranium can, if an economic and institutional condition permits, be recycled for use as nuclear fuel.

Spent fuel discharged from reactors contains appreciable quantities of fissile (U^{235}, Pu^{239}), fertile (U^{238}), and other radioactive materials, including reaction poisons (the reason the fuel had to be removed). These fissile and fertile materials can be chemically separated and recovered from the spent fuel. The recovered uranium and plutonium can, if economic and institutional conditions permit, be recycled for use as nuclear fuel.

Mixed oxide, or MOX fuel, is a blend of reprocessed uranium and plutonium and depleted uranium which behaves similarly (though not identically) to the enriched uranium feed for which most nuclear reactors were designed. MOX fuel is an alternative to Low enriched uranium (LEU) fuel used in the light water reactors which predominate nuclear power generation.

Currently, plants in Europe are reprocessing spent fuel from utilities in Europe and Japan. Reprocessing of spent commercial-reactor nuclear fuel is not permitted in the United States due to nonproliferation considerations. However, the recently announced Global Nuclear Energy Partnership would see the U.S.form an international partnership to see spent nuclear fuel reprocessed in a way that renders the plutonium in it usable for nuclear fuel but not for nuclear weapons.

Waste disposal

One of the existing concerns in the nuclear power field is the safe disposal and isolation of either spent fuel from reactor or, if the reprocessing option is used, wastes from reprocessing plants. These materials must be isolated from the biosphere until the radioactive contained in them has diminished to a safe level. The radioactive wastes can be disposed both at sea and on land with certain safety measures and awareness. The wastes disposal of radioactive materials through safety measures and awareness is only to avoid the hazards related to human and environment. Current plans call for the ultimate disposal of the wastes in solid form in licensed deep, stable geologic structures. One method for making the waste from power reactors less likely to cause an ill effect to humans, and to make the disposal cheaper is to reprocess as per above.

(b) Nuclear Reactors

Apart from nuclear fuel cycle, successful management of different types of nuclear reactors are also important. Different types of nuclear reactors consists PWR, BWR, FBR, and many more. However, Japan has only these three. These nuclear reactors are made up of different types of components but all these components are same in almost types of nuclear reactors.

There are several components common to most types of reactors:

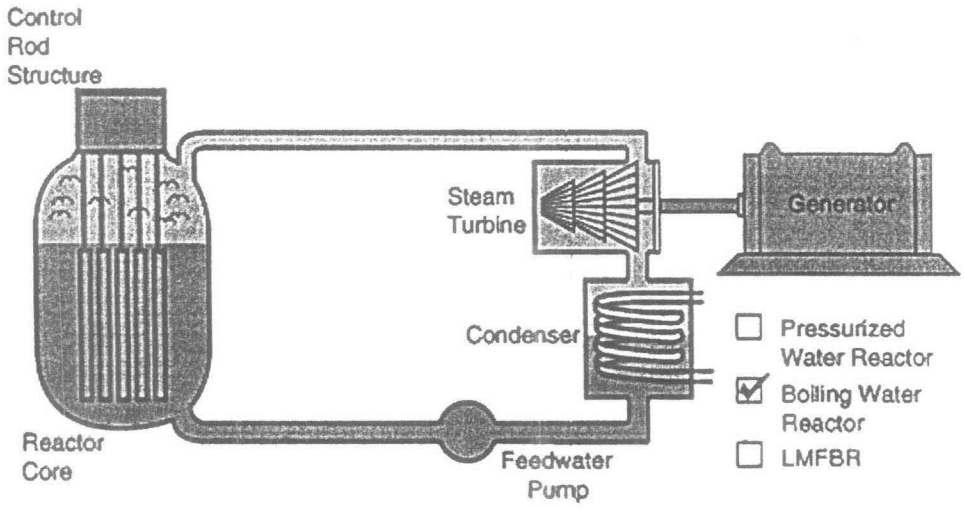
Fuel- Usually pellets of uranium oxide (UO_2) arranged in tubes to form fuel rods. The rods are arranged into fuel assemblies in the reactor core.
Moderator-This is material, which slows down the neutrons released from fission so that they cause more fission. It may be water, heavy water, or graphite.
Control Rods- These are made with neutron-absorbing material such as cadmium, hafnium or boron, and are inserted or withdrawn from the core to control the rate of reaction, or to halt it. (Secondary shutdown systems involve adding other neutron absorbers, usually as a fluid, to the system.)
Coolant- A liquid or gas circulating through the core so as to transfer the heat from it.
Pressure vessel or pressure tubes- Either a robust steel vessel is containing the reactor core and moderator, or a series of tubes holding the fuel and conveying the coolant through the moderator.
Steam Generator-Part of the cooling system where the heat from the reactor is used to make steam for the turbine.
Containment- The structure around the reactor core, which is, designed to protect it from outside intrusion and to protect those outside from the effects of radiation or any malfunction inside. It is typically a metre-thick concrete and steel structure.

There are several different types of reactors as indicated in the following table. The working of nuclear weapons is two types. Fission weapons (Atomic bombs or A-bombs) are simpler and less expensive than Fusion weapons (also called thermonuclear bombs, hydrogen bombs, or H-bombs).

The most common types of nuclear reactors[1] are as follow, which are generally used in the power generation as well as for the destructive purposes. Some of them are alike-

(I) Boiling Water Reactors (BWRs)

Boiling Water Reactors is a light water reactor designed to used in some nuclear power stations.



In the boiling water reactor, the same water loop serves as moderator coolant for the core, and steam source for the turbine. In the boiling water reactor (BWR), the water which passes over the reactor core to act as moderator and coolant is also the steam source for the turbine. The disadvantage of this is that any fuel leak might make the water radioactive and that radioactivity would reach the turbine and the rest of the loop. A typical operating pressure for such reactors is about 70 atmospheres at which pressure the water boils at about 285° C. This operating temperature gives a Carnot efficiency of only 42% with a practical operating efficiency of around 32%, somewhat less than the PWR.

Advantage of BWR is simple configuration and no stem generator heat exchangers on the other hand disadvantage of BWR is much larger pressure vessel than other nuclear reactors of similar power with correspondingly higher cost.

(II) Pressurized Water Reactors (PWRs)

Pressurized Water Reactors are nuclear power reactors that use ordinary water for three tasks: as the primary coolant, the secondary coolant, and for neutron moderation. They belong to the family of light water reactors.

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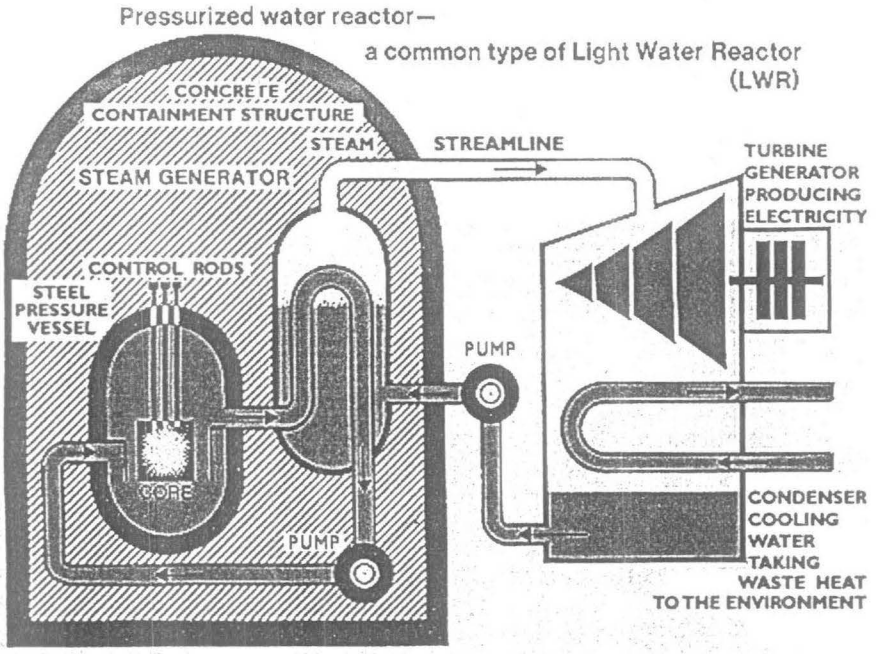
[1] As coated by Addinal Eric and Henry Ellington, "Nuclear Power in Perspective", Kogan Page, London, 1982, pp24-43.



In the pressurized water reactors, all the components are used like gas-cooled reactors. The PWR uses ordinary light water as both a coolant as a moderator. Because ordinary water absorbs neutrons to a significant extent, the uranium oxide fuel has to be enriched Until, it contains between three and four percent of U235. The wall of the container is in between 15-20 centimeter thick made by steel. The coolant/moderator is heated by the core and the pumped at high pressure to steam generators, where it boils water in separate circuits to produce steam.

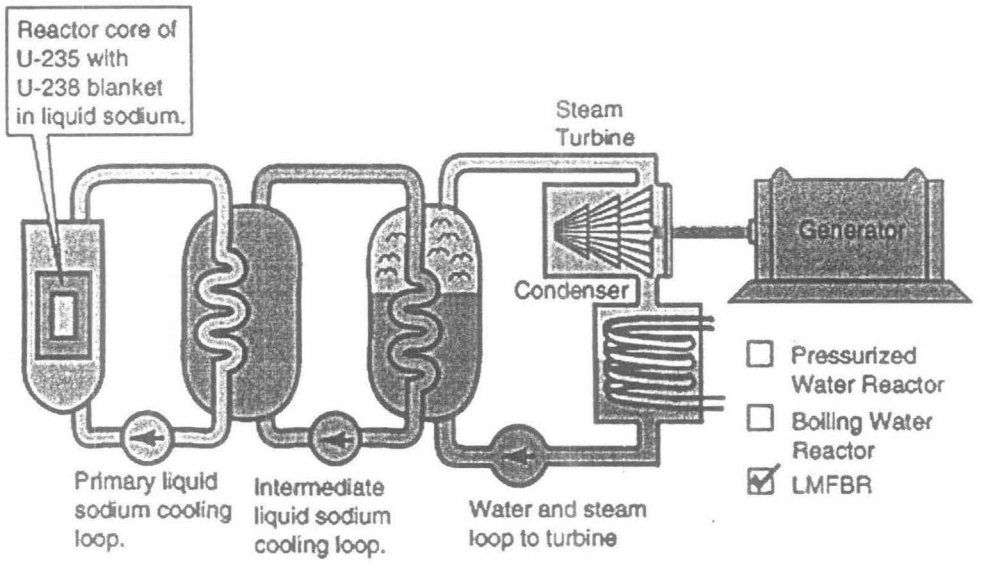
In the pressurized water reactor (PWR), the water which passes over the reactor core to act as moderator and coolant does not flow to the turbine, but is contained in a pressurized primary loop. The primary loop water produces steam in the secondary loop, which drives the turbine. The obvious advantage to this is that a fuel leak in the core would not pass any radioactive contaminants to the turbine and condenser.

Another advantage is that the PWR can operate at higher pressure and temperature, about 160 atmospheres and about 315 C. This provides a higher Carnot efficiency than the BWR, but the reactor is more complicated and more costly to construct.

(III) Fast Breeder Reactors (FBRs)

The fast breeder reactors (FBRs) are fast neutron reactors designed to breed fuel by producing more fissile than it consume. FBRs use heavy water for its cooling. Thus, it is from the group of heavy water reactors. The FBRs are breeder type of reactors have two design.

(a) Loop Type- In which the primary coolant is circulated through primary heat exchangers external to the reactor tank.
(b) Pool Type- In which the primary heat exchangers and circulators are immersed in the reactor tanks.



FBRs usually use a mixed oxide fuel core group up to 20% plutonium dioxide (PuO_2) and atleast 80% Uranium dioxide (UO_2). The plutonium used can be from reprocessed civil or dismantled nuclear weapons sources. Surrounding the reactors core is blanket of tubes containing non-fissile uranium-238 which, by capturing fast neutrons from the reaction in the core is partially converted to fissile plutonium 239, which can then be reprocessed for use as nuclear fuel. No moderator is required for the reaction processed well with fast neutrons. Early FBRs use metallic fuel, either highly enriched uranium or plutonium.

FBRs typically use liquid metal as the primary coolant, to cool the core and the heat the water used to power the electricity generating turbines. Sodium is the normal coolant for the large power station, but Lead and Nak have both been used successfully for smaller generating rigs. Some early FBRs used Mercury. One advantage of mercury and Nak is that they are both liquid at room temperature, which is convenient for experimental rigs but less important for pilot or full-scale power stations.

Although, the nuclear fuel cycle and different types of nuclear reactors (described here) are the basis of the construction of nuclear reactors for power generation, but these can also be used in the development of nuclear weapons with certain technological modifications. Through, "criticality", these nuclear reactors for power generation can act as nuclear weapons. Earlier, it was believed that BWRs could not be used in the development of nuclear weapons, but now it possible. On the other hand, PWRs and FBRs can be directly used in the development of nuclear weapons.

APPENDIX-II

TEXT RELATED TO THE NUCLEAR RECTORS/WEAPONS[1]

ALTERNATIVE ENERGY

Any of various renewable power sources to use in place of fossil fuels and uranium.

Fusion devices (see nuclear fusion) are believed by some to be the best long-term option, because their primary energy source would be deuterium, abundant in ordinary water. Other technologies include solar energy, wind power, tidal power, wave power, hydroelectric power, and geothermal energy. The amount of energy in such renewable and virtually pollution-free sources is large in relation to world energy needs, yet at present, only a small portion of it can be converted to electric power at reasonable cost.

BOILER

Apparatus for converting a liquid to vapor.

A boiler consists of a furnace in which fuel is burned, surfaces to transmit heat from the combustion products to the water (or other liquid), and a space where steam (or vapor) can form and collect. A conventional boiler burns a fossil fuel or waste fuel; a nuclear reactor may instead supply the heat. There are two types of conventional steam boiler. In a fire-tube boiler, the water surrounds the steel tubes through which hot gases from the furnace flow; easy to install and operate, fire-tube boilers are widely used to heat buildings and to provide power for factory processes, as well as in steam locomotives. In a water-tube boiler, the water is inside tubes, with the hot furnace gases circulating outside the tubes; water-tube boilers, which produce more and hotter steam, are used in ships and factories. The largest are found in the central-station power plants of public utilities; other large units are used in steel mills, paper mills, oil refineries, and chemical plants. See also steam engine.

CHAIN REACTION

Process yielding products that initiate further processes of the same kind.

Nuclear chain reactions are a series of nuclear fissions initiated by neutrons produced in a preceding fission. A critical mass, large enough to allow more than one fission-produced neutron to be captured, is necessary for the chain reaction to be self-sustaining. Uncontrolled chain reactions, as in an atomic bomb, occur when large numbers of neutrons are present and the reactions multiply very quickly. Nuclear reactors control their reactions through the careful distribution of the fissionable material and insertion of neutron-absorbing materials.

[1] The text from various part of Encyclopedia Britannica.

COOLING SYSTEM

Apparatus used to keep the temperature of a structure or device from exceeding limits imposed by needs of safety and efficiency.
In a mechanical transmission, the oil loses its lubricating capacity if overheated; in a hydraulic coupling or converter, the fluid leaks under the pressure created. In an electric motor, overheating causes deterioration of the insulation. In an overheated internal-combustion engine, the pistons may seize in the cylinders. The cooling agents customarily employed are air and a liquid (usually water), either alone or in combination. In some cases, direct contact with ambient air (free convection) may be sufficient, as in cooling towers; in other cases, it may be necessary to employ forced convection, created either by a fan or by the natural motion of the hot body. Cooling systems are used in automobiles, industrial plant machinery, nuclear reactors, and many other types of machinery. See also air conditioning, heat exchanger.

CRITICALITY

In a nuclear reactor, splitting of U235 isotope occurs by neutron impacting it which, in turn, produces more neutrons. If the rate of production of new neutrons form the above process is less than the rate of loss of neutron through other means, then the reactor is called "sub critical" and will not lead to a chain reaction, essential for generation of electricity. When the rate of production exceeds the rate of loss, the amount of neutron produced will grow exponentially, and continuous heat generation would take place. At this stage, the reactor is said to have achieved "criticality".

FALL OUT

Descent of radioactive materials from the atmosphere to the earth.
Radioactivity in the atmosphere may arise from natural causes such as cosmic rays as well as from nuclear explosions and atomic reactor operations. The explosion of nuclear weapons leads to three types of fallout: local, tropospheric, and stratospheric. The first, intense but relatively short-lived, occurs as larger radioactive particles are deposited near the site of the explosion. Tropospheric fallout occurs when the finer particles enter the troposphere, and it spreads over a larger area in the month after the explosion. Stratospheric fallout, made of fine particles in the stratosphere, may continue years after the explosion, and the distribution is nearly worldwide. Many different radioisotopes are formed during a nuclear explosion, but only long-lived isotopes (e.g., cesium-137, strontium-90) are deposited as stratospheric fallout.

GRAPHITE

Or plumbago; or black lead; Mineral allotrope of carbon.
It is dark gray to black, opaque, and very soft. Its layered structure, with rings of six atoms arranged in widely spaced horizontal sheets, gives it its slippery quality. It occurs in nature and is used (mixed with clay) as the "lead" in pencils as well as in lubricants, crucibles, polishes, arc lamps, batteries, brushes for electric motors, and nuclear-reactor cores.

HALF LIFE

Interval of time required for one-half of the atomic nuclei of a radioactive sample to decay (change spontaneously into other nuclear species by emitting particles and energy), or the time required for the number of disintegrations per second of a radioactive material to decrease by one-half.

Half-lives are characteristic properties of the various unstable atomic nuclei and the particular way in which they decay. Alpha decay and beta decay are generally slower processes than gamma decay.

HEAVY WATER

Or deuterium oxide; Water composed of two deuterium atoms and one oxygen atom, chemical formula D2O.

Ordinary water from most natural sources contains about 0.015% deuterium oxide; this can be enriched or purified by distillation, electrolysis, or chemical processing. Heavy water is used as a moderator in nuclear power plants, slowing down the fast neutrons so that they can react with the fuel in the reactor. Heavy water is also used in research as an isotopic tracer for chemical reactions and biochemical pathways. Water with tritium (T2O) rather than deuterium may also be called heavy water.

INTERMEDIATE RANGE NUCLEAR WEAPON

Class of nuclear weapons with a range of 620-3,400 mi (1,000-5,500 km).

Some multiple warheads developed by the Soviet Union could strike several targets anywhere in Western Europe in less than 10 minutes. The U.S. could send a single nuclear warhead from central Europe to Moscow in less than 10 minutes. Both were regarded as offensive, first-strike weapons. U.S.-Soviet arms-control negotiations (1980-87) led to the intermediate nuclear forces (INF) treaty, signed by Mikhail Gorbachev and Ronald Reagan, to completely remove and dismantle these and shorter-range weapons.

NEUTRON

One of the constituent particles of every atomic nucleus except ordinary hydrogen.

Discovered in 1932 by James Chadwick (1891-1974), it has no electric charge and has nearly 1,840 times the mass of the electron. Free neutrons undergo beta decay with a half-life of about 10 minutes. Thus, they are not readily found in nature, except in cosmic rays. They are a penetrating form of radiation. When bombarded with neutrons, various elements undergo nuclear fission and release more free neutrons. If enough free neutrons are produced, a chain reaction can be sustained. This process led to the development of nuclear power as well as the atomic bomb. Neutron beams produced in cyclotrons and nuclear reactors are important probes of matter, revealing details of structure in both organic and inorganic substances.

NPT
officially Treaty on the Nonproliferation of Nuclear Weapons.; International agreement intended to prevent the spread of nuclear technology, signed by the U.S., Britain, the Soviet Union, and 59 other countries in 1968.

The three major signatories agreed not to assist states lacking nuclear weapons to obtain or produce them; the non-nuclear signatories agreed not to attempt to develop them, and in exchange were promised assistance in developing nuclear power for peaceful purposes. France and China, both nuclear powers, declined to ratify the treaty until 1992, and some nuclear powers, including Israel and Pakistan, have never signed. In 1995, when the treaty was due to expire, it was extended indefinitely by a consensus vote of 174 countries at the U.N. See also Nuclear Test-Ban Treaty.

NUCLEAR ENERGY
Or atomic energy; Energy released from atomic nuclei in significant amounts.

In 1919, Ernest Rutherford discovered that alpha rays could split the nucleus of an atom. This led ultimately to the discovery of the neutron and the release of huge amounts of energy by the process of nuclear fission. Nuclear energy is also released as a result of nuclear fusion. The release of nuclear energy can be controlled or uncontrolled. Nuclear reactors carefully control the release of energy, whereas the energy release of a nuclear weapon or resulting from a core meltdown in a nuclear reactor is uncontrolled. See also chain reaction, nuclear power, and radioactivity.

NUCLEAR FISSION
Division of a heavy atomic nucleus into two fragments of roughly equal mass, accompanied by the release of a large amount of energy, the binding energy of the subatomic particles.

The energy released in the fission of one uranium nucleus is about 50 million times greater than that released when a carbon atom combines with oxygen atoms in the burning of coal. The energy appears as kinetic energy of the fragments, which converts to thermal energy as the fragments collide in matter and slow down. Fission also releases two or three free neutrons. The free neutrons can bombard other nuclei, leading to a series of fissions called a chain reaction. The energy released from nuclear fission is used to generate electricity, to propel ships and submarines, and is a source of the vast destructive power of nuclear weapons.

NUCLEAR FUSION
Process by which nuclear reactions between light elements form heavier ones, releasing huge amounts of energy.

In 1939, Hans Bethe suggested that the energy output of the sun and other stars is a result of fusion reactions among hydrogen nuclei. In the early 1950s American scientists produced the hydrogen bomb by inducing fusion reactions in a mixture of the hydrogen

isotopes deuterium and tritium, forming a heavier helium nucleus. Though fusion is common in the sun and other stars, it is difficult to produce artificially and is very difficult to control. If controlled nuclear fusion is achieved, it might provide an inexpensive energy source because the primary fuel, deuterium, can be extracted from ordinary water, and eight gallons of water could provide the energy equivalent to 2,500 gallons of gasoline.

NUCLEAR MEDICINE
Medical specialty using radioactive elements or isotopes for diagnosis and treatment of disease.

A radioisotope is introduced into the body (usually by injection). The radiation it emits, detected by a scanner and recorded, reflects its distribution in different tissues and can reveal the presence, size, and shape of abnormalities in various organs. The isotopes used have short half-lives and decay before radioactivity causes any damage. Different isotopes tend to concentrate in particular organs (e.g., iodine-131 in the thyroid). Radioactive substances are also implanted to treat small, early-stage cancers. This yields a slow, continuous dose that limits damage to normal cells while destroying tumor cells. See also computed axial tomography, diagnostic imaging, positron emission tomography, radiation therapy, radiology.

NUCLEAR PHYSICS
Branch of physics dealing with the structure of the atomic nucleus and radiation from unstable nuclei.

A principal research tool of nuclear physics is a high-energy beam of particles, such as protons or electrons, directed as projectiles against nuclear targets. By analyzing the directions and energies of the recoiling particles and any resulting nuclear fragments, nuclear physicists can obtain details of nuclear structure, the strong force that binds nuclear components together, and the release of energy from the nucleus.

NUCLEAR POWER
Energy produced by nuclear fission of heavy atomic nuclei.

About one-third of all electric power worldwide now comes from nuclear power plants. The navies of many countries include nuclear-powered warships; almost half of U.S. combat warships are nuclear-powered. Most commercial nuclear reactors are thermal reactors. Two types of light-water reactors in use throughout the world are the boiling-water reactor and the pressurized-water reactor. In the liquid-metal fast-breeder reactor, fuel is utilized 60 times more effectively than in light-water reactors. See also nuclear energy.

NUCLEAR REACTOR

Device that can initiate and control a self-sustaining series of nuclear-fission reactions.

Neutrons released in one fission reaction may strike other heavy nuclei, causing them to fission. The rate of this chain reaction is controlled by introducing materials, usually in the form of rods that readily absorb neutrons. Typically, control rods made of cadmium or boron are gradually inserted into the core if the series of fissions begins to proceed at too great a rate, which could lead to meltdown of the core. The heat released by fission is removed from the reactor core by a coolant circulated through the core. Some of the thermal energy in the coolant is used to heat water and convert it to high-pressure steam. This steam drives a turbine, and the turbine's mechanical energy is then converted into electricity by means of a generator. Besides providing a valuable source of electric power for commercial use, nuclear reactors also serve to propel certain types of military surface vessels, submarines, and some unmanned spacecraft. Another major application of reactors is the production of radioactive isotopes that are used extensively in scientific research, medical therapy, and industry.

NUCLEAR WEAPON

or atomic weapon; or thermonuclear weapon; Bomb or other warhead that derives its force from either nuclear fission or nuclear fusion and is delivered byan aircraft, missile, or other strategic delivery system.

Nuclear weapons are the most potent explosive devices ever invented. Fission-dependent devices break heavy-element nuclei down into fragments; fusion devices fuse hydrogen nuclei at high temperatures to form helium nuclei. The destructive effects include not only the actual blast but also blinding light, searing heat, and lethal radioactive fallout. See also atomic bomb, Hiroshima, hydrogen bombs, Manhattan Project, MIRV, Nagasaki, neutron bomb, Nuclear Test-Ban Treaty, START.

NUCLEAR WINTER

Environmental devastation that some scientists contend would probably result from a nuclear war.

The basic cause, as hypothesized, would be huge fireballs created by exploding nuclear warheads, which would ignite great fires (firestorms). Smoke, soot, and dust would be lifted to high altitudes and driven by winds to form a uniform belt encircling the Northern Hemisphere. The clouds could block out all but a fraction of the sun's light, and surface temperatures would plunge for as much as several weeks. The semidarkness, killing frosts, and subfreezing temperatures, combined with high doses of radiation, would interrupt plant photosynthesis and could thus destroy much of the earth's vegetation and animal life. Other scientists dispute the results of the original calculations, and, though such a nuclear war would undoubtedly be devastating, the degree of damage to life on the earth remains controversial.

PLUTONIUM

Radioactive (see radioactivity) metallic chemical element, chemical symbol Pu, atomic number 94.

A member of the actinide series of transition elements, it is the most important Trans uranium element because of its use in certain types of nuclear reactors (see nuclear power) and in nuclear weapons. It is found in nature only in traces produced by natural neutron irradiation in uranium ores. It is produced by neutron irradiation of uranium-238. Plutonium is a silvery metal that tarnishes in air; it is warm because of energy released in alpha decay. Its isotopes, all radioactive, are highly toxic radiological poisons (see radiation injury) because they give off alpha particles and are specifically absorbed by bone marrow. Though potentially lethal, its toxicity has frequently been exaggerated.

RADIOACTIVE SERIES

Any of four sets of unstable heavy atomic nuclei that undergo a series of alpha decay and beta decay until a stable nucleus is achieved.

The natural series are the thorium series, the uranium series, and the actinium series. These are headed by naturally occurring species of unstable nuclei that have half-lives comparable to the age of the earth. The fourth set, the neptunium series, is headed by neptunium-237, which has a half-life of 2 million years. Its members do not occur naturally but are artificially produced by nuclear reactions and have short half-lives.

URANIUM

Chemical element, rare earth metal of the actinide series (with many transition element properties), chemical symbol U, atomic number 92.

A dense, hard, silvery-white metal that tarnishes in air, it is isolated from such ores as pitchblende. Until the discovery of the first Trans uranium element in 1940, uranium was believed to be the heaviest element. Radioactivity was discovered in uranium by A.-H. Becquerel. All its isotopes are radioactive; several have half-lives long enough to permit determination of the age of the earth by uranium-thorium-lead dating and uranium-234-uranium-238 dating. Nuclear fission was discovered in 1938 in uranium bombarded with neutrons, and the self-sustaining nuclear chain reaction, the atomic bomb, and the generation of nuclear power followed. Uranium has various valences in compounds, some of which have been used as colors in ceramic glazes, in light bulb filaments, in photography, and as dyes and mordants.

WEAPON SYSTEM

Any integrated system for the control and operation of a specific type of weaponry.

Weapons are usually divided into two categories, strategic and tactical. Strategic weapons strike at the seat of an enemy's military, economic, and political power, targeting cities, factories, military bases, transportation and communications networks, and seats of government. Nuclear weapons are part of strategic weapons systems. Tactical weapons are designed instead for offensive or defensive use at relatively short range; for example, guided missiles are intended as antiaircraft and antitank weapons, or other weapons used in aerial and naval combat. Only a few nations operate strategic weapons systems; tactical weapons systems exist in almost every country.

APPENDIX III

THE TEXT OF TREATY OF NON-PROLIFERATION[1]

1. Signed at London, Moscow and Washington on July 1st 1968.
2. Entered into force on March 5th 1970.
3. Depositaries: UK, US, and Soviet governments.

The state concluding to this Treaty, hereinafter referred to as the "Parties of the treaty".
Considering the devastation that would be visited upon all mankind by a nuclear war and the consequent need to make every effort to avert the danger of such a war and to measure to safeguard the security of peoples.

Believing that the proliferation of nuclear weapons would seriously enhance the danger of nuclear war,

In conformity with resolution of the United Nations General Assembly calling for the conclusions of an agreement on the prevention of wider disseminations of nuclear weapons,
Undertaking to co-operate in facilitating the application of International Atomic Energy Agency safeguards on peaceful nuclear activities,

Expressing their support for research, development and other efforts to further the application, within the framework of the International Atomic Energy Agency safeguard system, of the principle of safeguarding effectively the flow of source and special fissionable materials by use of instruments and other techniques at certain strategic points,

Affirming the principle that the benefits of peaceful applications of nuclear technology, including any technological by-products which may bi derived by nuclear-weapon State from the development of nuclear explosive devices, should be available for peaceful purpose to all Parties to the Treaty, whether nuclear weapon or non-nuclear weapon states,

Conceived that, in furtherance of this principle, all Parties to the treaty are entitled to participate in the fullest possible exchange scientific information for, and to contribute alone or in co-operation with other state to, the further development of the application of atomic energy for peaceful purposes,

[1] U.S. Arms Control and Disarmament Agency, Documents in Disarmament. 1968, Washington D.C.1969. pp.461-467.

Declaring their intension to achieve at the earlier possible date the cessation of the nuclear arms race and to undertake effective measures in the direction of nuclear disarmament,

Urging the co-operation of all sates in the attainment in this objective,

Recalling the determination expressed by the parties to the 1963 Treaty banning nuclear weapon tests in the atmosphere, in outer space and under water in its Preamble to seek to achieve the discontinuance of all tests explosions of nuclear weapons for all time and to continue negotiations to this end,

Desiring to further the easing of international tension and the strengthening of trust between States in order to facilitate the cessation of the manufacture of nuclear weapons, the liquidation of all their existing stockpiles, and the elimination from national arsenal of nuclear weapons and the means of their delivery pursuant to a Treaty on general and complete disarmament under strict and effective international control,

Recalling that, in accordance with the charter of the United Nations, States must refrain in their international relations from the threat or use of force against the territorial integrity or political independence of ant States, or in any other manner inconsistent with the Purpose of the United Nations, and that the establishment and maintenance of International peace and security are to be promoted with the least diversion for armaments of the world's human and economic resources,

Have agreed as follows:

Article I

Each nuclear-weapon state party to the Treaty undertakes not to transfer to any recipient whatsoever nuclear weapons or other nuclear explosive devices or control over such weapons or explosive devices directly, or indirectly; and not in any way to assist, encourage, or induce any non-nuclear weapon State to manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices, or control over such weapons or explosive devices.

Article II

Each non-nuclear-weapon State Party to the Treaty undertakes not to receive the transfer from any transfer or whatsoever of nuclear weapons or other nuclear explosive or of control over such weapons or explosive devices directly, or indirectly; not to manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices; and not to seek or receive any assistance in the manufacture of nuclear weapons or other nuclear explosive devices.

Article III

1. Each non-nuclear-weapon State Party to the Treaty undertakes to accept safeguards, as set forth in an agreement to be negotiated and concluded with the International Atomic Energy Agency in accordance with the statute of the International Atomic Energy Agency and the Agency's safeguards system, for the exclusive purpose of verification of the fulfillment of its obligations assumed under the Treaty with a view to preventing diversion of nuclear energy from peaceful uses to nuclear weapons or other nuclear explosive devices. Producers for the safeguards required by this article shall be followed with respect to source or special fissionable material whether it is being produced, processed or used in any principle nuclear facility or is outside any such facility. The safeguards required by this article shall be applied on all Source or special fissionable materiel in all peaceful nuclear activities within the territory of such state, under its jurisdiction, or carried out under its control anywhere.
2. Each State Party to the Treaty undertakes not to provide: (a) source or special fissionable material, or (b) equipment or material especially designed or prepared for the processing,, use or production of special fissionable material, to any non-nuclear- weapons State for peaceful purposes, unless the sources or special fissionable material shall be subjected to the safeguards required by this article.
3. the safeguards required by this article shall be implemented in a manner designed to comply with article IV of this Treaty, and to avoid hampering the economic or technological development of Parties or international co-operation in the field of peaceful nuclear activities including the international exchange of nuclear material and equipment for the processing, use or productions of nuclear materials for peaceful purposes in accordance with the provisions of this Article and the principle of safeguarding set forth in the Preamble of the Treaty.
4. Non-nuclear-weapon States Party to the Treaty shall conclude agreements with the International Atomic Energy Agency to meet the requirements of this either individually or together with other States in accordance with the Statue of the International Atomic Energy Agency. Negotiations of such agreements shall commence within 180 days from the original entry into force of this Treaty. For state depositing then instruments of ratification or accession after the 180 days periods, negotiations of such agreements shall commence not later than the date of such deposit. Such agreements shall enter onto force not later than eighteen months after the date of initiations of negotiations.

Article IV

1. Nothing in this Treaty shall be interpreted as affecting the inalienable right of all the Parties to the Treaty to develop research, production and use of nuclear energy for peaceful purposes without discrimination and in conformity with Article I and II of this Treaty.
2. All the Parties of the Treaty undertake to facilitate, and have the right to participate in, fullest possible exchange of equipment, materials and scientific and

technological information for the peaceful use of nuclear energy. Parties to the Treaty in a position to do so shall also co-operate in contributing alone or together with other states or International Organizations to the further developments of the applications of nuclear energy for peaceful purposes, especially in territories of non-nuclear-weapon State Party to the Treaty, with due consideration for the needs of the developing areas of the world.

Article V

Each Party to the Treaty undertakes to take appropriate measures to ensure that, in accordance with this Treaty, under appropriate international observation and through appropriate international procedures, potentials benefits from any peaceful applications of nuclear explosions will be made available to non-nuclear-weapon State Party to the Treaty on a non-discriminatory basis and that the charge to such Parties for the explosive devices used will be as low as possible and exclude any charges for researches and development. Non-nuclear weapon State Party to the Treaty shall be able to obtain such benefits, pursuant to a special international agreement or agreements, through an appropriate international body with adequate representation of non-nuclear-weapon States. Negotiations on this subject shall commence as soon as possible after the Treaty enters into the force. Non- nuclear-weapon State Party to the Treaty so desiring may also obtain such benefits pursuant to bilateral agreements.

Article VI

Each of the Parties of the Treaty undertakes to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament under strict and effective international control.

Article VII

Nothing in this Treaty affects the right of any group of states to conclude regional treaties in order to assure the total absence of nuclear weapons in their respective territories.

Article VIII

1. Any Parties to the Treaty may propose amendments to the Treaty. The text of any proposed amendment shall be submitted to the Depositary Governments which shall circulate it to all Parties to the Treaty. There upon, if requested to so by one-third or more of the Parties to the Treaty, the Depositary Government shall convene a conference, to which they shall invite all the Parties to the Treaty, to consider such an amendments.
2. Any amendment to this Treaty must be approve by a majority of the votes of all the Parties to the Treaty, including the votes of all nuclear-weapon States Party to the Treaty and all other Parties which, on the date the amendment is circulated,

are members of the Board of Governors of the International Atomic Energy Agency. The amendment shall enter into force foe each party that deposits its instruments of ratification of the amendment upon the deposit of such instruments of ratification by a majority of all the parties, including the instruments of ratification of all nuclear-weapon State Party to the Treaty and all other Parties which, on the date the amendment is circulated, are members of the Board of Governors of the International Atomic Energy Agency. Thereafter, it shall enter into force for any other Party upon the deposit of its instrument of ratification of the amendment.

3. Five years after the entry into force of this Treaty, a conference of Parties to the Treaty shall be held in Geneva, Switzerland, in order to review the operation of this Treaty with a view to assuring that the purpose of the Preamble and the provision of the Treaty are being realized. At intervals of five years thereafter a majority of the Parties to the Treaty may obtain by submitting a proposal to this effect to the Depositary Governments, the convening of further conference with the same objective of reviewing the operation of the Treaty.

Article IX

1. This Treaty shall be open to all States for signature. Any State which does not signed the Treaty before its entry into force in accordance with paragraph 3 of this Article may accede to it at any time.
2. This Treaty shall be subject to ratification by signatory States. Instruments of ratification and instruments of accession shall be deposited with the Governments of the United Kingdom of Great Britain and Northern Ireland, the Union of Soviet Socialist Republic and the United States of America, which are hereby, designated the Depositary Governments.
3. This Treaty shall enter into force after its ratification by the Sates, the Governments of which are designated depositories of the Treaty, and forty other States signatory to this Treaty and the deposit of their instruments of ratification. For the purpose of this Treaty, a nuclear-weapon State is one which has manufactured and exploded a nuclear weapon or other nuclear explosive device prior to 1 January, 1967.
4. For States whose instruments of ratification or accession are deposited subsequent to the entry into the force of this treaty, it shall enter into force on the date of the deposit of their instruments of ratification or accession.
5. The depositary Governments shall promptly inform all signatory and acceding States of the date of each signature, the date of deposit of each instrument of ratification or of accession, the date of the entry into force of this Treaty, and the date of receipt of nay request for convening a conference or other notice.
6. This Treaty shall be registered by the Depositary Governments pursuant to the Article 102 of the Charter of the United Nations.

Article X

1. Each Party shall exercising its national sovereignty have the right to withdraw from the Treaty if it decide that extraordinary events, related to the subject matter of this Treaty, have jeopardized the supreme interests of its country. It shall give notice of such withdrawal to all other Parties to the Treaty and to the United Nations Security Council three months in advance. Such notice shall include a statement of the extraordinary events it regards as having jeopardized its supreme interests.
2. Twenty five years after the entry into the force of the Treaty, a conference shall be convened to decide whether the Treaty shall continue in force indefinitely, or shall be extended for an additional fixed period or periods. This decision shall be taken by a majority of the Parties to the Treaty.

Article XI

This Treaty, the English, Russian, French, Spanish and Chinese texts of which are equally authentic, shall be deposited in the archives of the Depositary Governments. Duly certified copies of this Treaty shall be transmitted by the Depositary governments to the governments of the signatory and acceding States.

Appendix-IV

Nuclear Reactors Operating In Japan

Reactors	Type	Net capacity	Utility	Commercial Operation
Fukushima I-1	BWR	439 MWe	TEPCO	March 1971
Fukushima I-2	BWR	760 MWe	TEPCO	July 1974
Fukushima I-3	BWR	760 MWe	TEPCO	March 1976
Fukushima I-4	BWR	760 MWe	TEPCO	October 1978
Fukushima I-5	BWR	760 MWe	TEPCO	April 1978
Fukushima I-6	BWR	1067 MWe	TEPCO	October 1979
Fukushima II-1	BWR	1067 MWe	TEPCO	April 1982
Fukushima II-2	BWR	1067 MWe	TEPCO	February 1984
Fukushima II-3	BWR	1067 MWe	TEPCO	June 1985
Fukushima II-4	BWR	1067 MWe	TEPCO	August 1987
Genkai-1	PWR	529 MWe	Kyushu	October 1975
Genkai-2	PWR	529 MWe	Kyushu	March 1981
Genkai-3	PWR	1127 MWe	Kyushu	March 1994
Genkai-4	PWR	1127 MWe	Kyushu	July 1997
Hamaoka-1	BWR	515 MWe	Chubu	March 1976
Hamaoka-2	BWR	806 MWe	Chubu	November 1978
Hamaoka-3	BWR	1056 MWe	Chubu	August 1987
Hamaoka-4	BWR	1092 MWe	Chubu	September 1993
Hamaoka-5	ABWR	1380 MWe	Chubu	January 2005
Higashidori-1 Tohoku	BWR	1067 MWe	Tohoku	December 2005
Ikata-1	PWR	538 MWe	Shikoku	September 1977
Ikata-2	PWR	538 MWe	Shikoku	March 1982
Ikata-3	PWR	846 MWe	Shikoku	December 1994
Kashiwazaki-Kariwa-1	BWR	1067 MWe	TEPCO	September 1985
Kashiwazaki-Kariwa-2	BWR	1067 MWe	TEPCO	September 1990
Kashiwazaki-Kariwa-3	BWR	1067 MWe	TEPCO	August 1993

Kashiwazaki-Kariwa-4	BWR	1067 MWe	TEPCO	August 1994
Kashiwazaki-Kariwa-5	BWR	1067 MWe	TEPCO	April 1990
Kashiwazaki-Kariwa-6	ABWR	1315 MWe	TEPCO	November 1996
Kashiwazaki-Kariwa-7	ABWR	1315 MWe	TEPCO	July 1997
Mihama-1	PWR	320 MWe	Kansai	November 1970
Mihama-2	PWR	470 MWe	Kansai	July 1972
Mihama-3	PWR	780 MWe	Kansai	December 1976
Ohi-1	PWR	1120 MWe	Kansai	March 1979
Ohi-2	PWR	1120 MWe	Kansai	December 1979
Ohi-3	PWR	1127 MWe	Kansai	December 1991
Ohi-4	PWR	1127 MWe	Kansai	February 1993
Onagawa-1	BWR	498 MWe	Tohoku	June 1984
Onagawa-2	BWR	796 MWe	Tohoku	July 1995
Onagawa-3	BWR	798 MWe	Tohoku	January 2002
Sendai-1	PWR	846 MWe	Kyushu	July 1984
Sendai-1	PWR	846 MWe	Kyushu	November 1985
Shika-1	BWR	505 MWe	Hokuriku	July 1993
Shika-2	BWR	1358 MWe	Hokuriku	March 2006
Shimane-1	BWR	439 MWe	Chugoku	March 1974
Shimane-1	BWR	789 MWe	Chugoku	February 1989
Takahama-1	PWR	780 MWe	Kansai	November 1974
Takahama-2	PWR	780 MWe	Kansai	November 1975
Takahama-3	PWR	830 MWe	Kansai	January 1985
Takahama-4	PWR	830 MWe	Kansai	June 1985
Tokai-2	BWR	1056 MWe	JAPC	November 1978
Tomari-1	PWR	550 MWe	Hokkaido	June 1989
Tomari-1	PWR	550 MWe	Hokkaido	April 1991
Tsuruga-1	BWR	341 MWe	JAPC	March 1970
Tsuruga-1	PWR	1115 MWe	JAPC	February 1987
Total: 55 reactors		**47,700 MWe**		

Japanese Nuclear Reactors under Constructions

Reactors	Type	Net Capacity	Utility	Construction Start	Operation*
Tomari-3	PWR	866 MWe	Hokkaido	2003	2009
Shimane-3	ABWR	1375 MWe	Chugoku	December 2005	12/2011
Total-2		**2241MWe**			

Japanese Nuclear Reactors Planned or on Order

Reactors	Type	Net capacity	Utility	Construction Start	Operation
Fukushima I - 7 & 8	ABWR	1380 MWe	TEPCO	2007	2011-12
Ohma	ABWR	1383 MWe	EPDC	2006	2012
Tsuruga-3&4	APWR	1538 MWe	JAPC	2007	2014-15
Higashidori-1&2	ABWR	1385 MWe	TEPCO	2008 & 10	2014 & 16
Higashidori-2	ABWR	1385 MWe	Tohoku	2011	2016
Namie-odaka	BWR	825 MWe	Tohoku	2011	2016
Kaminoseki 1 & 2	ABWR	1373 MWe	Chugoku	2009 & 12	2014 & 17lxciw459
Total (11)		**13,407 MWe**			
Monju	Prototype FBR	246 MWe	JAEA	operated 1994-95, awaiting restart	

BWR - Boiling Water Reactor
PWR - Pressurized Water Reactor
ABWR - Advanced Boiling Water Reactor

*Latest announced commercial operation. Shika-2 started up May 2005.

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