A thesis submitted to the Department of Environmental Sciences and Policy of
Central European University in part fulfillment of the
Degree of Master of Science

Adherence to the Past or Hope for the Future?:
The historical development of Japan's energy politics and its implications for future nuclear policy

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May 2014

Budapest

Erasmus Mundus Masters Course in
Environmental Sciences, Policy and Management
MESPOM

This thesis is submitted in fulfillment of the Master of Science degree awarded as a result of successful completion of the Erasmus Mundus Masters course in Environmental Sciences, Policy and Management (MESPOM) jointly operated by the University of the Aegean (Greece), Central European University (Hungary), Lund University (Sweden) and the University of Manchester (United Kingdom).

Supported by the European Commission's Erasmus Mundus Programme

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Suzuki, M. 2014. *Adherence to the Past or Hope for the Future?: The historical development of Japan's energy politics and its implications for future nuclear policy*. Master of Science thesis, Central European University, Budapest.

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No portion of the work referred to in this thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

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ABSTRACT OF THESIS submitted by:
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for the degree of Master of Science and entitled: *Adherence to the Past or Hope for the Future?:The historical development of Japan's energy politics and its implications for future nuclear policy.*
Month and Year of submission: May, 2014.

Japan's nuclear policy gained the attention of both domestic and international scholars after the Fukushima Daiichi nuclear disaster in 2011. Three years later, in April 2014, the LDP, the political party in power, released the latest energy policy aiming to re-start nuclear power plants despite the increasing opposition against it among other political parties, media, and the public. Many scholars discuss the necessity of nuclear power in Japan from economic and environmental perspectives of energy. They also identify that the interlocking relationship between bureaucracy and business in nuclear power is the reason behind Japan's adherence to it. However, there is insufficient understanding of Japan's specific drivers of energy policy and of the historic emergence and progression of this relationship that promoted its nuclear dependence. Therefore, this thesis seeks to understand why Japan still adheres to nuclear power even after Fukushima. By developing and applying a framework to conduct a historical analysis, this thesis offers insight into how the nation's energy politics developed in the last nine decades. This research identified that the interlocking relationship that has promoted nuclear power has its origin in the era of WWII and was strengthened by politicizing energy security threats over time. The ideology of energy independence also contributed to the increasing reliance on nuclear power. There is a change in Japan's energy politics observed after Fukushima and an increasing number of the public began to participate in the nation's energy debates, which shows a potential future paradigm shift in the nation's energy policy.

Keywords:
Japan, Energy policy, Energy security, Nuclear power, Fukushima

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Acknowledgements

When I was eleven, I first discovered my interest in the environment. Since then, it has been a long journey to finally arrive at this point, writing a master's thesis on energy with the hope to contribute to making this world a better place. There are countless people I feel grateful to for encouraging me, helping me, challenging me, and empowering me to reach where I am now.

First and foremost, I would like to give my sincere gratitude to my supervisor, Professor Aleh Cherp, who enthusiastically introduced me to this area of study, constantly challenged me to both expand and deepen my research focus, always fascinated me with his wisdom, and guided me towards becoming an aspiring researcher.

I also feel very appreciative of all MESPOM faculty and staff and the European Commission for their dedication to creating and maintaining this amazing master's program for its alumni, current, and future students. I would like to thank my mentor, Professor Tamara Steger, who was always there to help me through the tough first year of MESPOM. I also would like to thank Professor Naoko Tojo for her support. It was such a relief to have her as a professor and as a sempai since I was the only master's student from Japan at CEU. My gratitude also goes to Professor Thomas Lindhqvist for kindly coordinating a meeting with Professor Tojo in Lund, and especially for his brilliance as an educator. Additionally, I would like to thank my academic writing teacher, Agnes Toth, for her continual dedication to improving my writing skills.

I also would like to thank my past colleagues at SAP for the encouragement and support they gave me to join MESPOM. What I learned from you in those three and a half years of professional experience benefited my studies in all aspects, and I am very grateful that we have kept in such close contact after my rather sudden leave.

To all my friends in MESPOM and ESP, I don't even know how to properly show my gratitude for having met such amazing people as you. The time we spent together was so precious and I am absolutely sure that these memories that we made together will always shine like the North Star inside my heart, reminding me how passionate we are to protect the environment and the earth, and guiding me towards shaping my passion into a real change in this world.

Lastly, I would like to thank my family and relatives who always welcomed my return in the study breaks with a lot of food and smiles. Knowing that I will always have your support and love has kept me strong yet humble at the same time. This gratitude also goes to all the ancestors of Japan who built and maintained such a beautiful country. I respect your contribution, and I hope that I can also help my country to rise again after the recent tragedy and re-join the world as a leading nation in progressing towards a more sustainable future.

With that said, I would like to dedicate this thesis research to my grandmas, Kazuko Suzuki and Tamayo Hirotani, as to show my deepest appreciation for their understanding and support for my decision to be so far away from Japan. I also would like to give my word, in their honor, that I will dedicate my future research and effort to helping Japan maintain its beauty and spirit and to helping progress our country towards a future that the generations to come will be as proud of as I am.

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List of Abbreviations

ACE	Advisory Committee for Energy (Current ANCRE)
ACNRE	Advisory Committee for Natural Resources and Energy (Former ACE)
AEC	Atomic Energy Commission
ANRE	Agency of Natural Resources and Energy
DPJ	Democratic Party of Japan
EAF	Energy Availability Factor
ENV	Ministry of the Environment, Japan
GDP	Gross Domestic Product
GHQ	The General Headquarters of the Supreme Commander for the Allied Powers
GNP	Gross National Product
IEA	International Energy Agency
IEEJ	The Institute of Energy Economics, Japan
IIP	Index of Industrial Production
ISEP	Institute of Sustainable Energy Policies
LDP	Liberal Democratic Party
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
METI	Ministry of Economy, Trade and Industry, Japan (Former MITI and Ministry of Munitions)
MITI	Ministry of International Trade and Industry, Japan (Current METI)
MOF	Ministry of Finance, Japan
MOFA	Ministry of Foreign Affairs, Japan
NISA	Nuclear and Industry Safety Agency
NPP	Nuclear Power Plant
NPU	National Policy Unit
NRA	Nuclear Regulation Authority
PES	Primary Energy Supply

1. Introduction

1.1 Background

Japan, a nation with very limited fossil fuels, has gone through major energy security challenges over the past ninety years, during which fossil fuels have been the dominant energy sources for fueling a country's military force and developing a national economy. There have been three occurrences in Japan's modern history in which the unfortunate limited availability of natural resources posed a major disturbance to the continuity and welfare of the nation.

The first challenge, in the mid-20th century drove the country into war (Yergin 1988). The second challenge, triggered by the institutional oil embargo of the 1970s, encouraged Japan to restructure its energy system by diversifying the energy sources and the origins of imported energy resources (METI 2010, 2014). The challenge also motivated Japan to develop nuclear energy in order to reduce energy imports. During its history, external actors and events have had significant influence on the continuity of Japan's energy supply. Thus energy has been considered as a major lifeline, and the vulnerability of energy systems was closely associated with Japan's national security. Before 2011, nuclear power was considered as an ideal solution to bolster the nation's energy independence, and the government aimed to increase its capacity by more than 50% of the electricity demand by 2030 (METI 2010). It was also viewed as a climate change mitigation solution. However, this plan had gone through serious reconsiderations from the third challenge occurred to the nation, the Fukushima Daiichi nuclear disaster in 2011 (hereafter Fukushima).

Fukushima, which was triggered by the tsunami resulting from the Great East Japan Earthquake on March 11 2011, caused a severe disturbance to Japanese economy and society. It forced Japan to gradually stop all existing 54 nuclear power plants (NPPs), including the 4 destroyed in the accident, for safety inspection. As of May 2014, there is no NPP operating in Japan, which accounted for approximately 30% of the total electricity supply before the accident (METI 2014a; ANRE 2013a).

Three years have already passed since the accident, and Japan's energy strategy still remains ambiguous, particularly with respect to nuclear power. The Japanese government released its latest national energy policy in April 2014 (METI 2014) and showed its aim to restart nuclear power despite the increasing resistance to nuclear energy among citizens. The policy does not target a particular future energy mix and implies a possibility to construct new NPPs, in addition to restarting the existing ones, which further fuels the energy debates both inside and outside of the country.

The current energy discourse in Japan after Fukushima, regarding the nation's energy strategy, between the political parties, the power sector, industries, NGOs, energy experts, and the general public, often falls into a debate on the potential phasing out of nuclear power. At the same time, quite frequently, the role of renewable energy as a substitute to nuclear power has been discussed, reflecting upon the long lasting economic struggle and uprising environmentalism in Japan. Recent international literature including Hayashi and Hughes (2013) and Hong *et al.* (2013), compares Japan's pre-Fukushima and post-Fukushima energy

policies and offer various scenarios of Japan's future energy strategy. These studies revolve around the development of nuclear power in Japan during the nation's recent energy history, predominantly after the world oil crises in the 1970s. These studies and similar analyses of Japan's energy policy after Fukushima have two shortcomings.

The first one is that their arguments are often, respectively, fixated on limited aspects of energy systems, most notably, economic and environment and safety. In addition, the energy strategy of Japan is often compared with that of Germany (e.g. Iida 2008; Moe 2012; Takahashi 2012) since the two nations possess similarities in their modern history, current economic and industrial structures, yet have been taking different energy paths. The author believes that it is not only the present economic and environmental aspects that make some energy solutions more attractive to particular countries, but there are also other factors such as political and social, current and historic that can explain the configuration of energy systems.

The second shortcoming is that the recent studies on Japan's energy and nuclear policy almost always start their historical analysis only after the 1970s because that is when Japan started to invest in nuclear power as its primary energy source. However, Japan faced major energy security challenges prior to that period and consequently had gone through drastic structural changes in its political economy, particularly before and after World War II (WWII). The author believes these energy challenges and the subsequent formations of Japan's political economy have affected the nation's energy policy and will continue to do so in the future.

In order to overcome the two shortcomings of the recent studies and analyses, this thesis will analyze the diverse drivers of energy policies to identify Japan's country specific factors that affect the nation's energy policy today, particularly its nuclear policy. The author also extends the scope of this research to before WWII and analyze how these *forgotten* past national energy challenges and the subsequent changes in its political and economic structure affected the development of Japan's energy systems and formulated the concept of energy. In particular, the focus of this historical research is to examine how those developments of the nation's energy systems and the conception of energy have driven the nation to take a certain energy path at a time, and in later encouraged Japan to initiate and further developed nuclear power.

1.2 Research questions and Aims

This thesis research will be conducted with the following research question(s) in mind:

The main question is:

Why does Japan's energy policy adhere to nuclear power even after Fukushima?

The following three sub-questions were developed and utilized as bases to explore this area of studies and also as milestones to guide this thesis towards finding the answers for the main question.

- How has Japan's energy system developed in the last nine decades, in response to the national energy security challenges?

- What drove (and still drives) Japan to invest in nuclear power?
- Does Fukushima bring a paradigm shift to Japan's energy policy?

By answering the research questions, this thesis aims to **contribute to understanding national-level factors that influence Japan's energy policy, particularly its adherence to nuclear power**. Achieving this aim would allow a more informed discussion on feasible and sustainable energy pathways in the country. To complete the task, it is necessary to analyze how Japan's energy system has developed in the course of modern history. This historical analysis is critical as the current energy system of Japan is the accumulated product of the nation's past energy strategies that were taken during the respective time in order to overcome the past energy challenges.

1.3 Research Approach

To find answers to the research questions and work towards the aim, this study follows the research approach described below:

- Review the existing literature on Japan's energy policy with a focus on its nuclear policy
- Examine the existing theories that help identify the reasons why a country takes a certain path in the nation's energy development and evaluate if they are applicable to Japan
- Develop a theoretical framework and research method for this thesis
- Present the results by exploring how Japan's energy systems have developed over the last nine decades
- Discuss why and how Japan became gradually inclined to nuclear power and still adhere to it

1.4 Outline

The rest of the thesis is structured as follows.

Chapter 2: Literature Review
This chapter will review existing literature both on Japan's energy policy with a focus on its nuclear policy, and on theories that could potentially provide the answers to the research questions of this thesis. It is an aim of this chapter to demonstrate to what the author intends to make a contribution with this thesis, and to show how that can be achieved.

Chapter 3: Theoretical Framework and Method
This chapter will present a theoretical framework developed by the author from combining the theories reviewed in the previous chapter with an aid from additional scholarly sources. It explains the three core factors that influence Japan's energy policy-making and how they have co-evolved in the nation's history since the early 20th century. These factors include the vital energy systems and their vulnerabilities, the energy security threats, and the energy governance. The method of conducting the further research and analysis will be presented with data sources.

Chapter 4: Findings

This chapter presents how the three core factors evolved, while interactively influencing each other, by following the modern energy history from the early 20th century. In order to cast a light on the co-evolving nature of the factors and how they have influenced the following eras of history, this chapter will be divided into four sections by major energy threats that affected Japan's energy politics as turning points: "Era of war (1937 to 1945)", the "Era of post war and Japan's economic miracle (1946 - 1973)", the "Era after the oil crises (1974 - 2010)", and the "Post Fukushima (2011-)".

Chapter 5: Discussion

This chapter discusses how Japan's energy systems, the concept of energy, the energy governance have developed since the early 20th century. It is an aim of this chapter to show what makes the current Japanese politics to adhere to nuclear power even after Fukushima.

Chapter 6: Conclusions

This chapter presents the conclusion of this thesis. The theoretical framework utilized for this thesis will be re-addressed and the Japanese energy history from the early 20th century to the current will be revisited. The author examines if there is a potential paradigm shift of Japan's energy politics and addresses the implications for the future nuclear policy in Japan.

2. Literature Review

This chapter presents a literature review on Japan's energy policy, particularly focusing on its nuclear policy with the following three objectives: (1) present the overall picture of Japan's energy policy and its relationship with nuclear power; (2) explore the gaps in the existing research and justify the necessity of this thesis; and (3) examine existing theories dedicated to conceptualize a nation's energy policy-making and nuclear policy that could be applicable to formulate a theoretical framework for explaining Japanese energy policy (see Chapter 3).

2.1 Japan and nuclear power

This section presents the recent Japanese energy policy and its relation with nuclear power. The justification for this thesis will be given in this section, along with the gaps of existing literature identified for further research.

2.1.1 Japan's energy policy and nuclear power

The national policy documents on Japan's energy strategy and domestic and international research on the nation's energy policy invariably start with the acknowledgement that Japan is poor in natural resources and is significantly dependent on imports of fossil fuels. The latest publication from the International Energy Agency (IEA 2013) suggests that Japan was the world's 5th largest energy consumer in 2012 and currently is the world's largest importer of liquefied natural gas (LNG), the 2nd largest importer of coal, and the 3rd largest importer of crude oil. Due to the shutdown of the NPPs in Japan since 5th of May 2014, Japan currently imports 96% of its Primary Energy Supply (PES) (Toyoda 2012; ISEP 2013). This lack of domestic energy resources has always put the secured supply of energy as the nation's utmost priority of its political and economic agenda (Tanaka 2012; METI 2014a).

The energy policy of Japan has been formulated by the nation's interests in achieving the 3Es in the past (METI 2010; Valentine 2011): **E**nergy security, **E**conomic efficiency, and **E**nvironmental conservation. After Fukushima, another core element, "Safety", emerged as an additional factor to construct the nation's future energy policy. Therefore, the Japanese government defines the nation's energy policy, in the latest energy policy document released in April 2014, as "the key, which gives consideration to a safety aspect of energy (Safety), to achieve, *most importantly*, the stable supply of energy (Energy Security) with minimized economic burdens (Economic Efficiency) and at the same time, to strive to adapt to the environment (Environment)" (METI 2014a). [1]

2.1.2 Japan's energy security – the importance of nuclear power before Fukushima

The definition of energy security varies among nations, organizations, and researchers due to the increasing complexity of energy systems and different objectives and methodologies to measure the level of "security"

[1] Translated from the original wording (For the rest of the thesis, all translations are made by the author unless otherwise indicated.): "Enerugii seisaku no youkou ha, anzensei wo zentei to shita ue de, enerugii no antei kyoukyuu wo daiichi to shi, keizai kouritsusei no koujyou ni yoru teikosuto deno enerugii kyoukyuu wo jitsugen shi, douji ni, kankyou heno tekigou wo hakaru tame, saidaigen no torikumi wo okonau koto de aru."

(Cherp and Jewell 2013). For example, IEA states energy security means "the uninterrupted availability of energy sources at an affordable price" (2014a). There is also extensive research conceptualizing energy security, for instance, by risks (e.g. proposed by APERC 2007 and utilized by Kruyt *et al.* 2009), or by resilience (e.g. analysis of the power sector by Stirling 1994, 1998).

For the rest of this thesis, energy security for Japan refers to energy supply security since it is the definition utilized in Japanese government documents (See METI 2010, 2014a). Yergin (2006) also argues that, for Japan, energy security means "offsetting its stark scarcity of domestic resources through diversification, trade, and investment" since the nation's energy strategy predominantly focuses on the security of a stable supply of external energy resources. This importance of diversification, trade and investment of energy for Japan has been reiterated frequently by researchers including Toichi (2003), Tanaka (2012) and Toyoda (2012), who each emphasize the significance of the role that the Japanese government has to play in developing the national energy policy and strengthening its energy security.

These researchers also argue that the Japanese government should continuously support nuclear power as a national vital source of energy in Japan in order to reduce fossil fuel dependence and to mitigate climate change simultaneously. This is because, as many researchers argue, such as Matsuo (2012), Toyoda (2012), and Hayashi and Hughes (2013), nuclear energy has been considered as "quasi-domestic energy" in Japan to improve the nation's energy self-reliance. Almost always, the Japanese government and researchers emphasize that Japan is one of the weakest nations in terms of energy security in the world and often compare it with other developed nations, particularly with G8 members, and emphasize that Japan has the lowest self-sufficiency rate of energy among those 8 states (METI 2010, 2014a; Toyoda 2013; Hamasaki and Kanuida 2013; ISEP 2013). In 2010, only 19% of energy was procured from internal energy resources, of which nuclear power accounted for 15%. To increase the capacity of nuclear power has been considered as a solution to decrease energy imports and increase the self-sufficiency ratio of energy production, and thus improve Japan's energy security (METI 2014a; ANRE 2013a).

The governmental intervention in the development of nuclear power is recommended also by Atsumi who argues that the Japanese government should focus on "promoting energy conservation measures and further development of energy-related technologies, establishing a framework for the utilization and promotion of nuclear energy, promoting more efficient energy consumption, and reducing Japan's dependence on fossil fuels" (2007). There are also scholars who opposed Japan's governmentally supported nuclear power development even before Fukushima, including Takagi (1999), Hasegawa (1996), and Honda (2005). However, the dominant energy discourse supported the importance of nuclear power to improve the security of energy supply in Japan and the significance that the government should intervene to achieve it.

This view is observed as a typical stance of autonomists by Evans (2006), who points out that the autonomists in Japan favor strong governmental interaction with industries in promoting the securement of energy resources, particularly nuclear power. He explains that Japan's relative paucity of natural resources and its significant dependence on energy imports have fueled the fear of autonomists to rely on markets, especially after the oil crises in the 1970s, when the increase in the price of oil caused a severe disturbance to the

national political economy. Therefore, this autonomist's idea has been influential in formulating Japan's energy policy, which has adhered to nuclear power as a solution to reduce the dependence on external energy resources.

In addition, Toichi argues that Japan is the only country in the world that possesses the complete set of facilities necessary to cycle nuclear fuels, yet does not apply these technologies to nuclear weaponry, which, according to him, "has a very significant meaning in the context of international politics" (2003).

2.2 The energy debates on nuclear power after Fukushima

After Fukushima, an increasing number of researchers, both in Japan and overseas, have been attentively waiting to see what direction Japan will take on its future energy policy. Fukushima revitalized domestic and international energy studies on nuclear power and its economic and environmental advantages and disadvantages. The interlocking relationship between bureaucracy and business with vested interests in nuclear power has been identified and criticized especially after Fukushima as the "culprit" for maintaining Japanese nuclear power dependency (e.g. Moe 2012; Dewit 2011; Kingston 2013; Vivoda 2012).

However, the author believes that there is a lack of analysis of what energy means to Japan, as well as historical analysis necessary to understand why the current Japanese energy policy still seeks to retain nuclear power even after Fukushima. In this regard, the justification for this research is presented at the end of each section.

2.2.1 Affordability and sustainability of nuclear power

Since Fukushima, nuclear power has been facing fierce criticism regarding its affordability (economic perspective) and sustainability (environment and safety perspective). A number of studies have been conducted to question the necessity of nuclear power in Japan, of which the most of these often have an aim to promote renewable energy. For example, the World Wide Fund for Nature (WWF) believes that nuclear power is not a sustainable source of energy, and that Japan should begin decrease its dependence on nuclear power, with the goal of a total phase-out by the year 2040 (2011, 2014). Similarly, Greenpeace Japan (2012) supports WWF by arguing that Japan should instead invest in renewable energy since renewable energy has the potential to completely replace nuclear power. It claims that renewable capacity accounts for a 25% share in the capacity growth of electricity production worldwide from 2000 to 2010, while that of nuclear is only 2% (Greenpeace Japan 2012). Tetsuya Iida, the Executive Director of the Institute for Sustainable Energy Policies (ISEP), emphasizes the importance of building a Japan that will be fueled by 100% renewable energy-based electricity (ISEP 2013). These studies often compare the energy policies, particularly after Fukushima, between Japan and Germany and suggest that Japan should follow the example of Germany, which has successfully been transitioning from nuclear to a renewable energy-based society (e.g. Iida 2008; Dewit and Kaneko 2011; Takahashi 2012; Moe 2012; Huenteler *et al.* 2012; Greenpeace 2012).

Oshima (2010) is one of the first Japanese scholars who revealed the hidden costs of nuclear power, such as the expense of the auxiliary equipment necessary to produce and maintain nuclear power and of the R&D

investment of nuclear energy. He argues that the cost of nuclear power is, in fact, higher than that of thermal power, which contradicts what has been normally presented by the government and the energy sectors. His research was further developed after Fukushima and now incorporates the costs of externality related to nuclear power such as environmental and social (Oshima 2011, 2013). An increasing number of scholars including Takahashi (2013), Kaneko (2013), Matsuo (2012), Iida (2011) and Koide (2011) joined this "nuclear energy is actually very expensive, particularly considering the costs of externality" argument, saying that no nuclear future for Japan is both economically feasible and environmentally desirable.

As a counter-argument to those who are in favor of renewables and greener energy, the energy sector and industries that support nuclear power highlight the unfeasibility of switching the primary energy source from nuclear power to renewables. The Federation of Electric Power Companies of Japan (FEPC), the industry association of the ten regional power companies that each monopolizes a respective region of Japan, emphasizes the intermittent nature of renewable energy and the higher production and operational cost of renewables compared to nuclear power in Japan (2013). Keidanren (2013), the largest industry association in Japan, follows this argument, and reiterates that renewable energy is not yet cost-competitive compared to other conventional energies. It expresses their anxiety that the increasing deployment of renewable energy would increase the price of electricity, consequently raising the cost of business and lowering their international competitiveness. Thus, they argue that a no-nuclear future for Japan is economically unfeasible.

Recently, there has also been much literature published that compares Japan's pre-Fukushima and post-Fukushima energy policies and offer various scenarios of Japan's future energy strategy. Hayashi and Hughes (2013) argue that nuclear power will be an important source of energy in Japan in all three scenarios with different proportions of nuclear power presented in their paper, despite the severity of the accident, in order to meet the nation's climate target, announced in 2012 by the National Policy Unit of Japan (NPU). This is supported by Hong *et al.* (2013) who also assessed the economic, environmental, and safety costs of four energy scenarios that each has different proportions of nuclear, renewable and fossil fuel based energy, and concluded that nuclear energy will likely play a significant role in Japan's energy future. They emphasize that the increasing capacity of renewables in the energy mix to substitute nuclear power would put more financial burdens on Japan because their intermittent nature would require a substantial back up power supply (Hong *et al.* 2013). Vivoda (2012) also argues that Japan has no other choice but to restart nuclear power in order to save industries that have been suffering from a long-lasting recession, especially after the financial crisis in 2008. Furthermore, Vivoda is of the view that the increasing capacity of thermal power to substitute nuclear power contributed to Japan's first record of trade deficit since 1980, and will continue putting financial pressure on households and industries without nuclear power. Moniz (2011), the current United States Secretary of Energy, also highlights that nuclear has a capacity to provide relatively cheap, clean, and reliable energy compared to other sources of energy. He argues that the new regulations that will be put into place after Fukushima will contribute to make nuclear power "safer", and the industrial efforts will continue making it even "cheaper", and also claim that the operational cost and the cost of environmental externalities (e.g. carbon emissions) of nuclear power is lower compared to other types of energy.

As described in this section, research on Japan's energy and nuclear policy, particularly after Fukushima, is conducted in a way that the researchers' arguments are fixated on the economic and/or environmental and safety advantages (or disadvantages) of nuclear power. However, little has been said outside of that particular scope of interests, which can potentially explain why Japan retains nuclear energy even after Fukushima, when its affordability and sustainability became suspect. To this end, it is necessary to identify Japan's specific conditions, other than the economic and the environmental ones, which drove - and drives - the nation to pursue nuclear power.

2.2.2 An important option for the diversification of energy

Tanaka (2012), the former Executive Director of IEA, stresses the importance of nuclear power for Japan as base-load power and as a resource option to improve the nation's energy security. He argues that Japan should pursue the diversification of energy as its core strategy to improve energy security and should not rely on any single supplier. Based on this stance, he criticizes the current energy debate for being too fixated on the potential "complete phase-out" of nuclear power.

Toyoda (2012), Chairman & CEO of the Institute of Energy Economics, Japan (IEEJ), and Koyama (2013) also refer to the importance of the diversification of energy to strengthen Japan's energy supply security. Moreover, Toyoda argues for the importance of keeping nuclear power in order to continue developing the technology and fostering the human expertise of nuclear technology. Additionally, he stresses Japan's potential to contribute to the enhancement of safer construction and operation of nuclear power facilities around the world, particularly in the developing nations where the demand for electricity is increasing.

Tanaka (2012) is correct in pointing out that the domestic energy debate on the potential phase out of nuclear power has been encouraging the national and international energy studies to focus only on a limited number of aspects of energy, most notably, the economic and environmental perspectives, while disregarding other aspects such as the historical development of energy systems and politics. To this end, this thesis aims to demonstrate that a more comprehensive view on why Japan retains nuclear power is necessary.

2.2.3 Energy policy makers with vested interests in nuclear power

Vivoda (2012) and Calder (2013), among others, identified that, after the world oil crises in the 1970s, Japan's energy policy has been dominantly controlled by the Ministry of International Trade and Industry (MITI, current METI), the energy sector, and the nuclear industry. Moe (2012) demonstrates how this monopoly of energy policy-making over the last four decades has fostered a vested interest structure in Japan's energy politics and economics. He additionally identified the Liberal Democratic Party (LDP) and Keidanren as other core members in this group of vested interests and argues that these actors often collectively prevented renewable energy from increasing its capacity in the Japanese energy market.

This group of vested interests, often referred to as *nuclear village*, is frequently pointed out by many researchers including Iida (2011), Ooshima (2012), Kingston (2013), Fam *et al.* (2014), and Dewit (2011) as *the culprit* of Japan's immense dependence on nuclear power and the tiny share of renewable energy in its current energy

mix. Calder (2013) presumes that the institutional power of the nuclear village is significant and doubts that Japan will phase out nuclear power anytime soon. He also considers renewable energy as a good substitute for nuclear power in Japan and claims that "wind, solar, geothermal, and such energy forms are environmentally attractive, especially in the post-Fukushima age, and especially in a heavily populated nation such as Japan."[2]

These scholars show that this nuclear village started to emerge in the 1950s when nuclear power was introduced by the United States as the "Atoms for Peace" program and increased its power significantly in Japan's energy policy-making after the 1970s. However, they do not fully explore *why* it was established in the first place and *how* it subsequently grew so powerful. There is a weak linkage between Japan's historical energy challenges, the subsequent development of the energy systems, the concept of "energy", and the growing power of the group with vested interests in nuclear power. Therefore, it is necessary to expand the historical scope of research prior to WWII when Japan had gone through another major energy challenge and the subsequent drastic change in its political and economic structure, which drove the nation into war.

2.3 Existing theories

This section explores the three existing theories which are potentially applicable to explain Japan's adherence to nuclear power. These theories are: (1) driving forces for a nation to pursue nuclear power; (2) politicization of an energy problem as an energy security issue; (3) energy governance system of a nation with a strong central government.

2.3.1 Driving forces for a nation to pursue nuclear

Energy security and climate change are the two major driving forces for a nation to invest in nuclear development. In particular, according to Adamantiades and Kessides (2009), nuclear power plays an important role in strengthening energy security due to its potential to: (1) diversify the energy mix; (2) reduce the dependence on fossil fuel imports and provide stably priced electricity (nuclear power is more resilient to the price fluctuation of energy resources); (3) reduce greenhouse gases (GHGs) and health affecting air pollutants. Toth (2008), Lester and Rosner (2009), Jewell (2011) and Xu (2011), among others, support this argument and additionally identify a growing population and a subsequently increasing energy demand as another driving force for the development of nuclear power.

Xu in particular, argues that Japan's lack of internal energy resources is the "powerful driving force" of its nuclear development (2011). Adamantiades and Kessides also support Xu's view and demonstrate that Japan has been especially in favor of nuclear power since the nuclear fuel, uranium, is a high energy-density resource that can be easily and sufficiently stockpiled to run the nation's energy system for many years, thus mitigating a potential supply interruption. Xu also highlights that the nuclear industry is a *very* technologically intensive sector, which is another driving force for a country like Japan since the state has developed its economy by exporting products and services that require advanced technologies such as automobiles and electronics.

[2] This argument goes against the energy expert's norm that a population density and renewable development have a negative coalition, meaning low population density would be more favorable for renewable developments, pointed out specifically for the case of Japan by Scalise (2012)

Table 2.1. Main Driving Forces of Nuclear Power

Driving Forces of Nuclear Power		Theory Sources
Energy Security	Diversification of energy mix Reduction of fossil fuel imports Stabilization of the electricity cost Supplying the growing energy demand	Adamantiades and Kessides (2009) Toth (2008) Lester and Rosner (2009) Jewell (2011) Xu (2011)
Climate Change	Reduction of greenhouse gases Reduction of other air pollutants	
Economy	Development of the highly intensive technology Development of nuclear related business	Xu (2011)
National Prestige	Reputation of technological excellence Enhancement of national security	

This theory of what drives a nation to pursue nuclear power provides a beneficial insight into why Japan has developed nuclear power to improve the nation's energy security. Japan's **physical geography,** the poor endowment of energy resources, is highlighted by several researchers as a strong driving force of the nation to develop nuclear power. In addition, the population growth (**human geography**) and the subsequent increasing demand for energy in Japan during the nation's rapid economic growth in the post war era, corresponds with the emergence of nuclear power as an important source of energy, as revealed by Jewell (2011) among others. Xu's additional suggestion that economic and national prestige can be another driving force for adopting nuclear power also provides a clue to explain the strong relation (or interlocking relation) between the Japanese government and nuclear related industries.

However, these theories are limited in their explanation of Japan's recent decision to retain nuclear power even after Fukushima when nuclear power has been revealed as potentially more costly than thermal energy and renewables—the cost of nuclear power can be higher, depending on what externalities to include at what extent as described in section 2.2.1. The general public in Japan also realized that nuclear power is not as safe and less polluted as it had been claimed by the government and industries before Fukushima. Moreover, there are research findings (Iida 2011; WWF 2011) that claim that Japan is endowed with enough renewable energy to fuel its economy and society.

2.3.2 Energy problem becomes energy security issue: historical roots of today's policy

A country's energy policy is also influenced by the nation's historical energy security threats and the subsequent energy system and institutions established to overcome them.

Leung *et al.* (2014) argue that "an energy policy problem is an energy security issue if it is presented and perceived as affecting the stability (and in critical situations, the survival) of a nation, the 'functioning' and

'continuity' of the economy or the realization of 'major national values and objectives.'"[3] They suggest that "securitization agents" transform an energy policy problem into an energy security issue by representing a problem by the following three security related questions: (1) what to protect; (2) from what risks and; (3) by what means. A nation's energy system thus develops by what is *securitized* by those agents as a key national security issue and by what measures need to be taken to overcome them.

By following the framework with a focus on answering these three questions, Leung *et al.* identified that China's determined focus on the oil procurement strategy as the nation's current utmost priority of its energy policy has its rationale in the **historical energy security risks** related to oil supply, evolving an energy system that requires an increasing demand of oil, and the dominant power of national oil companies (2014).

This argument also applies to the predominant focus of Japan's recent energy policy on nuclear power to improve energy security as well, particularly considering that nuclear power has been framed as "quasi-domestic energy" by the government and industries (securitization agents). Additionally, nuclear power has continuously been stressed as *the* solution to solve Japan's root cause of its major dependence on energy imports: the nation's **geographical feature** with scarce natural resources availability, which forced the nation to face national crises in its modern history.

2.3.3 Energy policy and the governance structure of energy market

Governments tend to intervene in energy policy-making for a great number of reasons, most notably argued by Helm who suggests that "The government is a major player in the energy market – indeed, in many respects it is the dominant one" (2002). According to him, the main reasons for this governmental intervention are: (1) the energy sector is the source of considerable tax revenues; (2) the energy sector significantly relates to industrial and social developments; (3) the energy sector is a key player to achieve environmental targets; (4) the energy sector simply cannot invest in the nation's "security of energy supply" without governmental insurance since the investment in power stations and energy networks takes substantial time to be returned and the future energy market is very unpredictable for many reasons. Thus he states that "the energy market is at best an oligopoly, with a pervasive government presence (…) it owns the resources, and it taxes, regulates and subsidizes" (2002).

This theory of government and industry relations in constructing the nation's energy policy applies to the current situation of the Japanese energy market, particularly with nuclear policy, argued by Anzai (2012).

Helm also discusses the transitioning role of governments and regulatory bodies in a privatized and liberalized energy market by referring to the situation in the United Kingdom (2002). A framework to assess whether such a transition is actually happening in energy policy paradigm is proposed by Kern *et al.* (2013). According to them, a paradigm shift in energy policy can be observed if substantial changes are observed in the following four areas of energy politics; (1) interpretation of energy and how it should be governed (e.g. market oriented

[3] with reference to the securitization theory firstly proposed by Wæver (1993) and further explored by Yergin (1988), Australian Government (2009), Cherp and Jewell(2011), and Winzer (2012).

or government led); (2) policy goals; (3) policy instruments; and (4) governance institutions. Kern *et al.* argue that the increasing geopolitical risks and environmental concerns of energy were interpreted as threats to the national energy security in the United Kingdom during the 2000s and consequently transitioned the energy policy of the nation. This occurred through *politization* of energy, bringing the four areas of energy politics into the public arena as a result of several high-profile events, most importantly nationalization of energy assets in Russia.

Additionally, Helm suggests that "energy policy is both multi-faceted and context-dependent." For example, he argues that a political objective of energy diversification does not only refer to the diversification of fuel resources (2002). It differentiates among nations according to what kind of risks that needs to be diversified. He presents that for the United Kingdom, it was the risk of a coal miner's strike that threatened the country's energy security which encouraged Mrs. Thatcher to weaken the coal miners' union power as a strategy to diversify energy (risk), while France aimed to increase the nuclear power capacity as a diversification strategy in order to reduce the risk of depending on Middle Eastern oil. This argument implies that identifying and analyzing Japan's **dominant risks of the energy system** at respective times when specific energy policies were formulated is important to understand what the nation considered as a national threat. Moreover, the framework of assessing the policy transition, presented by Kern *et al.* (2013), would provide a beneficial insight into examining the potential transition of energy policy and governance that Fukushima may bring.

In conclusion, the author believe that the combination of the three theories reviewed in this and the last two sub-sections would provide a greater insight into Japan's energy policy and its increasing dependence to nuclear power in its modern history.

2.4 Conclusion

A great amount of research is now available, especially after Fukushima, dedicated to Japan's nuclear policy and the nation's future energy scenarios. However, most of these research focuses on limited aspects of energy as the base of their argument, such as economic factors or environment and safety factors. The interlocking relationship between the Japanese government and nuclear related industries is identified as *the culprit* of the modern nuclear power development in Japan. Yet little has been discussed as to why and how this particular *cozy* relationship emerged and strengthened under the influence of Japan's major energy security challenges prior to the world oil crises in the 1970s. In addition, when it is so hurriedly framed as the culprit, there is a risk of not questioning why it was established and developed as Japan's strategic decisions in order to mitigate the nation's dominant risks at each point in the history.

Energy policy-making is a complex process that varies in each nation due to the differences in the availability of energy resources, the industrial and economic structures, the level of economic development as well as in demography, landscape, and diplomacy. In that sense, this thesis explored the existing theories in order to identify Japan's potential rationale that may explain its continual investment in nuclear power. These theories address: (1) what drives a nation to pursue nuclear power; (2) how an energy problem becomes an energy

security issue and; (3) how a national energy policy is constructed and governed as a result of interaction between government and industry.

These theories individually give an insight into explaining Japan's energy policy in terms of its geographical features including the scarcity of natural resources and the great energy demand, the nation's historical and contemporary energy risks and challenges, and the government and industry relations. However, these three theories have never been examined together before in Japan's energy-policy making and the author believes that the combination of these theories provides a greater insight into Japan's energy politics in its modern history.

3. Framework and Method

3.1 Theoretical Framework

This thesis combines the three clusters of theories reviewed in the previous section to construct a theoretical framework for data collection and interpretation. Through the literature review, the author identified the following three, key factors that have affected Japan's energy policy, specifically on the policy of nuclear energy: (1) geographical factors; (2) historical and contemporary energy security threats and; (3) the government and industry relations.

Cherp and Jewell present "low vulnerability of vital energy systems" as a generic conceptualization of energy security and argue that this definition can cover a wide variety of historical and contemporary risks and objectives by defining "vulnerability" and "vital energy systems" (2013). According to their study, a vital energy system represents a critical energy system for a society to function, thus a disruption to the energy system could be a threat to the continuity of a society. They provide a rationale on why the British Empire, during the time war in the early 20th century, considered the stable supply of oil as the main energy security concern despite its tiny proportion in the energy system. They argue that oil was *the vulnerability* of the function of the vital energy system—and thereby society—, at that time. The author believes this framework can further refine the three key factors that affect Japan's energy policy into the following groups:

- Vital energy systems and their vulnerabilities
- Energy security threats
- Energy system governance

The first group of factors, "Vital energy systems and their vulnerabilities", refers to Japan's energy systems that are critical for society to function and their weaknesses that could seriously disrupt that society. For Japan in particular, vital energy systems are shaped by both physical geography, such as the availability of energy resources, and human geography, such as population growth and increasing energy demand. They create a vulnerability that is exposed to the next factor, "Energy security threats".

"Energy security threats" refers to potential, major threats to Japan's most important energy objective. When these energy threats become so severe that they require immediate political and economic action they are considered as "energy crises." In this regard, the question formulated by Leung *et al.* (2014), "[protect] from what risks?", will be kept in mind to identify what Japan perceived (and perceives) as a major threat to the nation's vital energy systems. There are three additional perspectives of energy security developed by Cherp and Jewell (2011) that a nation or a region needs to consider for mitigating those potential risks and threats: (1) "sovereignty" as in mitigating the risks of energy disruption from external actors and "intentional" actions such as oil embargo; (2) "robustness" as in reducing the risks that can be predicted to occur such as scarcity of energy resources and its subsequent uprising cost; and (3) "resilience" as in alleviating the risks that cannot be predicted to occur due to the complexity of energy systems such as political instability of energy producing nations or regions, and technological innovations. These three perspectives will also be utilized in order to

identify and analyze Japan's historical and contemporary energy security threats and the subsequent mitigation measures taken to overcome them. This factor acts as a trigger to form the next factor, "Energy system governance".

"Energy system governance" refers to the role of public authorities, often including the government in the center acting as a hub, and private sectors in energy policy-making and the interactions between them to overcome energy security threats. Those actions taken at a national level to overcome certain national threats and risks will have an influence on the formation of the next energy system, which again can be exposed to a new energy security threat later in time. For Japan in particular, the government and the energy sector have been identified as those who have dominant influences in the nation's energy policy.

These three factors: (1) Vital energy systems and their vulnerabilities; (2) Energy security threats; and (3) Energy system governance, co-evolve over time. For example, the geographical constraints of Japan affect the formation of the nation's vital energy system, which carries certain weaknesses such as dependence on energy imports. These weaknesses are vulnerable to subsequent energy security threats, be it oil embargoes or a sudden increase in the price of oil in the case of a vital energy system that is immensely dependent on imported oil. These security threats give triggers for the formation of energy system governance in order to overcome the threats, which could lead to a major transformation of the governance system if the threats are considered as *crises*. This new governance designs an energy policy to reinforce or reconstruct a new energy system for the purpose of overcoming the particular threats. This newly developed energy system also carries its specific vulnerabilities and continues this cycle of co-evolution of the development of energy systems (See Figure 3.1).

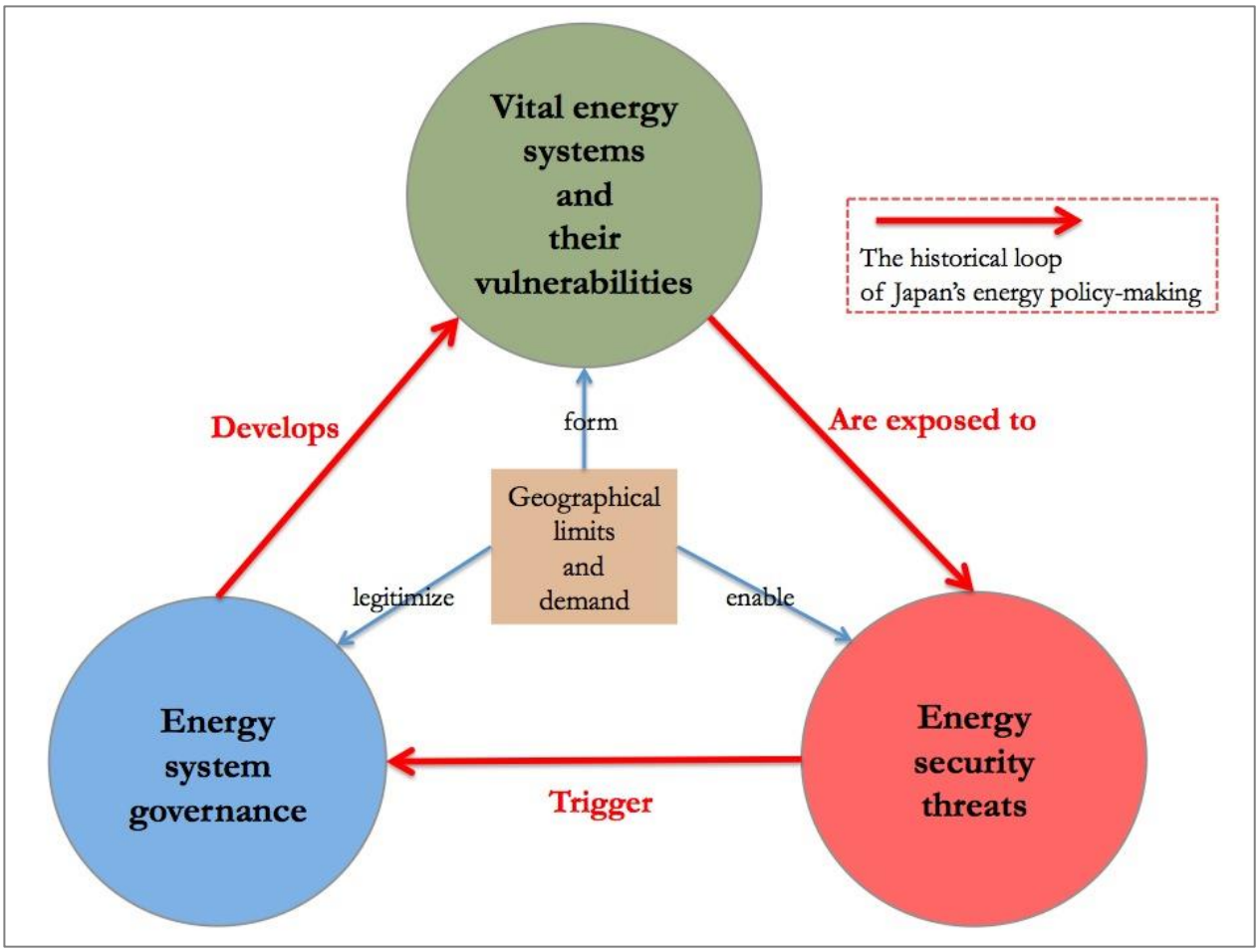

Figure 3.1. The relationship of the three key factors in Japan's energy system development
Developed by the author.

3.2 Method

This paper seeks to contribute to understanding why the Japanese government is still in favor of retaining nuclear power even after Fukushima. To achieve this aim, this research explores various energy statistics compiled by Japan and international organizations and related literature in order to examine the development of Japan's energy politics and energy systems in its modern history. This analysis is done with a focus on the three key factors developed by the author in the previous section: Vital energy systems and their vulnerabilities, Energy security threats, and Energy system governance.

There are three energy threats considered as energy crises that posed a major complication to Japan's energy security in its modern history. These energy crises are: (1) international embargos and economic sanctions against Japan in 1937-1945; (2) the (first) world oil crisis in 1973; and (3) the Fukushima Daiichi nuclear disaster in 2011. Therefore, this paper divides Japanese modern energy history into four periods according to those three energy crises as turning points. These periods are: (1) Era of war (1937 to 1945); (2) Era of post war and Japan's economic miracle (1945 - 1973); (3) Era after the oil crises (1973 – 2010); and (4) Post Fukushima (2011-). The analysis is done in chronological order for the purpose of casting light on the

relationship between the three key factors. Table 3.1 presents the divided periods for the further analysis and data sources for each section.

Table 3.1. Sections and Main Data Sources for the Further Analysis

Era	Vital energy systems and their vulnerabilities		Energy security threats		Energy system governance	
	section	Data source	section	Data source	section	Data source
1937 - 1945	4.1.1	EDMC (2014) Statistics Bureau (2012) IEA Statistics National Diet Digital Library Government websites and documents Related literature	4.1.2	EDMC (2014) Government websites and documents Political statements and speeches Corporate websites and documents Related literature	4.1.3	Governmental websites and documents Corporate websites and documents Committee proceedings Media articles Legal documents Related literature
1945 - 1973	4.2.1		4.2.2		4.2.3	
1973 - 2010	4.3.1		4.3.2		4.3.3	
2011 -	4.4.1		4.4.2		4.4.3	

After completing the analyses of the four periods, the questions posed in this thesis will be answered, which includes the main question "Why does Japan's energy policy adhere to nuclear power even after Fukushima?" and three sub-questions: (1) "How has Japan's energy system developed in the last nine decades, in response to the national energy security challenges?"; (2) "What drove (and still drives) Japan to invest in nuclear power?"; and (3) "Did Fukushima bring a policy paradigm change?". Additional framework to access a policy paradigm change, proposed by Kern *et al.* (2013), will be utilized to seek an answer for the last question.

3.3 Limitations

This paper aims to analyze the historical development of Japan's energy systems in order to explain and anticipate Japan's future nuclear energy policy. It focuses on the macro-analysis of Japan's energy policy such as the national energy strategy. It identifies influential actors for each of Japan's energy policy-making systems in the last nine decades. However, the author does not intend to comparatively evaluate each actor's individual power of influence. Moreover, these actors are limited to the Japanese government, Japanese citizens, and Japanese large corporations, although some foreign actors, especially the United States, are included when necessary.

The thesis does not consider various kinds of crude oil and different oil products such as gasoline and diesel, concentrating instead on crude oil. Moreover, the term "natural gas" includes liquefied natural gas (LNG, the primary focus of this thesis, which currently accounts for 97% of the total natural gas supply in Japan 'METI

2013'), liquefied petroleum gas (LPG), coal-based gas and other types of oil-cased gases. As for coal, the rank of coalification is ignored, thus "coal" includes all quality of coal in the following chapters.

Furthermore, renewable energy is not given a focus in the rest of this thesis, considering that the development of this energy is minimal in the Japanese energy history compared to other energy resources, which currently accounts for 1% in the nation's electricity production, excluding hydro (ANRE 2013a).

All prices of energy resources are mostly presented in Japanese Yen (JPY), unless the author thinks its necessary to present also in US Dollars (USD). This is for the purpose of taking into account the fluctuations of currency exchange rate and inflation of JPY in the last nine decades and of representing how it affected the Japanese economy and the perception of energy.

Lastly, it should be noted that the author conducted this thesis research in Budapest with very limited access to Japanese sources, particularly the historical documents prior to oil crises in 1970s, of which most of them are only stored in physical form in the libraries and archives in Japan.

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4. Findings

This chapter presents findings from exploring how Japan's energy system has developed over the last nine decades under the influences of major energy security challenges. The analysis proceeds with a focus on the three key factors identified: "Vital energy systems and their vulnerabilities"; "Energy security threats"; and "Energy system governance" in the chronological order from the "Era of war (1937 to 1945)", the "Era of post war and Japan's economic miracle (1945 - 1973)", the "Era after the oil crises (1973 - 2010)", and the "Post Fukushima (2011-)".

4.1 Era of war: (1937-1945)

"*Oil started and ended The Pacific War.*"[4] – A statement made by the Showa Emperor, the 124th Emperor of Japan (Terasaki 1995).

In the early 20th century, the dominant driver of Japan's energy policy was to secure a supply of oil in order to fuel its military functions. Japan sought external oil reserves and extended its territory over East and South East Asian countries, most notably into Indochina in 1940, which was the largest oil producer in the region. The first crisis occurred when the United States, on whom Japan depended for more than 80% of oil imports, initiated an oil embargo against Japan in 1941. The US decision catapulted Japan into the Pacific War in which Japan strengthened its imperialism and went through a drastic political and economic restructure in order to conduct a war with *very* limited resource availability.

This section first presents the energy system of Japan during WWII and explains its vulnerability and how it was perceived as a national security threat, which resulted in the concentration of political and economic power in the government and a number of quasi-statutory corporations.

4.1.1 Vital energy system and their vulnerabilities: reliance on imported oil for the military

The energy consumed in Japan in 1940—a year prior to 1941 when the official oil embargo was imposed by the United States—was roughly the equivalent of 63.3 million tons of oil (Mtoe) (Iwama 2006, 2007). Of this 63.3 million tons of oil-equivalent energy, 66% consisted of coal, 16% of hydro, 10% firewood and charcoal, 7% oil, and 0.7% natural gas (EDMC 2014). At that time, Japan was extracting coal for both domestic and industrial use (Odano and Araya 2007).

The vital energy system for Japan in this era was oil supply system, considered critical to protecting the nation's sovereignty. Although oil represented a tiny proportion of the whole energy system in Japan, it was the most important resource because it was the only energy that could fuel the military at that time (Sagan 1988). Japan did not have a domestic supply of oil, and was entirely dependent on external sources for the system to function (Research Group for the Economy of Empire 1943). So much so that more than 90% of

[4] "Nichibei sensou ha abura de hajimari abura de owatta."
For the rest of this thesis, all translations were made by the author unless otherwise indicated.

the oil consumed in Japan in 1940 came from external sources, outside the control of Japan (Iwama 2006, 2007).

Faced with the nation's significant disadvantage in oil procurement capacity, Japan was importing more oil than the actual demand before the Pacific War to form a stockpile in order to mitigate potential supply disruptions (Iwama 2006, 2007). This oil stockpiling strategy was conducted nationally and also done by the navy and the army respectively, and according to the data available, by the time Japan decided to go into war in December 1941, the nation was assumed to have stockpiled 8.4 to 9.7 million kilo liter (kℓ) of oil[5] — approximately double the amount Japan consumed in 1940. This was the first distinguished stockpiling strategy of energy resources at a national level in the world, argued by Iwama (2006, 2007).

Due to the importance of oil to the military in order to protect the sovereignty of the state, any use of oil other than for military was strictly regulated despite the increasing demand in the household sector. In 1937, the household sector recorded its highest oil consumption in Japanese national history at 4.7 million kℓ (Iwama 2006, 2007). However, after the government began to manage and control the usage of internal resources in 1938, especially those relevant to continuing the war (further explained in 4.1.3), the amount of oil allocated for households significantly decreased over time. In 1941, 2.1 million kℓ of oil was allocated to the household sector, which is the half of the amount consumed in 1937. Moreover, it was reduced to 0.1 million kℓ in 1945, 3% of the 1937 demand in the sector (Iwama 2006, 2007).

4.1.2 Energy security threats: blocked access to oil

As a country endowed with few natural resources, yet with an increasing demand to protect the sovereignty of the nation during the time of war, Japan extended its borders in East and South East Asia through military action (Sagan 1988; Banhart 1987). It aimed to gain access to and secure recourses and their supply routes, most importantly oil, to fuel the military. These militaristic actions and the invasions of neighboring countries encouraged the opponents of those actions to impose economic sanctions and embargos against Japan, led by the United States and followed by the United Kingdom and the Dutch East Indies (Sagan 1988; Banhart 1987; Research Group for the Tokyo Tribunal 1948).

On 5th October 1937, following the military conflict between China and Japan, the US President Franklin Roosevelt made his well-known "Quarantine Speech" and implied that the United States had a will of putting pressure onto what he described as aggressors against the Covenant of the League of Nations, the Briand-Kellogg Pact and the Nine Power Treaty:

> Innocent peoples, innocent nations, are being cruelly sacrificed to a greed for power and supremacy which is devoid of all sense of justice and humane considerations (…) The peace-loving nations must make a concerted effort in opposition to those violations of treaties and those ignorings of humane

[5] The different estimates of oil stock were recorded by various organizations including the National Planning Authority, the Imperial Japanese Navy, the Imperial Japanese Army, and the United States Strategic Bombing Survey, all data is summarized and presented by Iwama (2007).

> instincts (…) The peace, the freedom and the security of ninety percent of the population of the world is being jeopardized by the remaining ten percent who are threatening a breakdown of all international order and law(…)It seems to be unfortunately true that the epidemic of world lawlessness is spreading. When an epidemic of physical disease starts to spread, the community approves and joins in a **quarantine** of the patients in order to protect the health of the community against the spread of the disease.
>
> (Franklin Delano Roosevelt, 5th October 1937 with emphasis by the author, speech available at 'Miller Center 2014')

The following year in 1938, the US Department of State strongly discouraged aircraft manufacturers and exporters from selling airplanes and aeronautical equipment to Japan (Sagan 1988).

Prime Minister Fumimaro Konoe issued a statement addressing the legitimacy of Japanese military actions to secure natural resources (Asahi Shimbun 1941). His argument was that Japan sought to achieve a new order in East Asia "with an aim to establish the security of international justice, to develop the cooperative defense system, to generate a new culture, and to integrate the economies in East Asia for the purpose of stabilizing the region and contributing to the world development"(Agency of Information 1943).[6] This ideology further developed into the concept of cultural and economic unity among East Asian countries, an idea which first appeared in the governmental documents in 1940 entitled, "Greater East Asia Co-Prosperity Sphere" (Asahi Shimbun 1941; Agency of Information 1943).

As a response to the Japanese statement, the United States extended its informal embargo, thus called "moral embargo", to materials of airplane production and technical information to produce aviation gasoline in 1939 (Sagan 1988; Iwama 2007). The same year, the United States released a notification of termination of commercial treaty with Japan to remove the legal obstacles for additional embargos and economic sanctions against Japan. These US economic sanctions motivated Japan to take further steps into French Indochina in 1940, and went even further to the south in 1941, where the biggest oil reserve in Asia at the time was located (Sagan 1988; Ishii 2008; Research Group for the Economy of Empire 1943).

Japan's further invasions into South East Asia, in turn, led the United States to impose the "official" embargo of strategic commodities, including iron and steel scrap, aviation fuels, machine tools, copper, lead, zinc, aluminum and other petroleum products, on the 1st of August 1941 (Department of State 1943). Prior to that decision, the United States also froze Japanese assets, which were mainly prepared for purchasing oil for importation (Utley 2005). Additionally, the Dutch East Indies joined these embargos against Japan and blocked the trading channels of oil. Right before these embargos, Japan was dependent on the United States and the Dutch East Indies for oil imports by more than 92% collectively (Iwama 2007) in order to fuel its economy and more importantly in this era, to fuel military to protect the nation from potential colonization.

[6] "Kono shin chitsujyo no kensetsu ha nichimansi sangoku soukei he, seiji, keizai, bunka tou kakuhan ni watari gokeirenkan no kankei wo jyuritsu suru wo motte kokkan toshi, toua ni okeru kokusaiseigi no kakuritsu, kyoudoubouei no tassei, shinbunka no souzou, keizaitougou no jitsugen wo kisuru ni ari. Kore, jitsu ni toua wo antei shi sekai no shinun ni kiyo suru yuen nari."

There was a significant gap of oil production and refinery capacity between the United States and Japan when they entered into war in 1941, as can be seen in Table 4.1 and the government was believed to be well aware of the fact (Iwama 2006, 2007; Banhart 1987).

Table 4.1. Oil Production, Oil Refinery Capacity and Oil Stock of Japan and the US in 1941

	Japan	US	Japan:US
Oil Production (10,000 barrel/day)	0.5	384	1:738
Oil Refinery Capacity (10,000 barrel/day)	9	466	1:52
Oil Stock (10,000 barrel)	4,300	33,500	1:8

Data from Iwama (2006) with reference to United States Strategic Bombing Survey 1946.

Isoroku Yamamoto, the Marshal Admiral and the Commander in Chief of the Combined Fleet for the Attack on Pearl Harbor, answered to the question asked by the Prime Minister Konoe, about his opinion on the probability of winning the war. Later in life, Konoe shared this conversation in his book (Kyodo News 1968).

> If you insist on going into this war, I will show you how much damage we can bring to the enemy for 6 months or possibly a year. However, if this war continues for more than two to three years, I have no confidence in winning. (Isoroku Yamamoto, 12th September 1941)[7]

However, Japan plunged into war against the United States on 8th December 1941 with an aim to end the war as soon as possible, at least before the oil stock of Japan would run out. In fact, this war lasted for more than three years and eight months, much longer than Yamamoto assumed it to be. It ended by Japan's unconditional surrender to the Allied Powers on 15th August 1945, within a week after the two atomic bombings on Hiroshima on 6th August and Nagasaki on 9th August.

4.1.3 Energy system governance: centralized power to the government and the military

Being faced with limited natural resources including oil, the Japanese government decided to centrally control all resources that the nation had including any physical and labor resources for the purpose of conducting a war in the most effective manner. The government passed a law, entitled "National Mobilization Law", on 24th March 1938 (*National Mobilization Law* 1938; Research Group for the Economy of Empire 1943; National Diet Library 2012) and securitized[8] the potential risk of resource supply disruption as national security threats.

The first article of the law describes how influential it can be in terms of its unconditional power that the law gives to the central government for controlling any economic, social and cultural activities across the nation. It reads: "Article I: In this law, national mobilization refers to that the government carries out national control on human and material resources in order to defend the nation during the time of war 'or any incidents equal

[7] "Soreha zehi yare to iwarereba hajime no hantoshi ya ichinen no aida ha zuibun abarete goran ni ireru. Shikashinagara, ninen sannenn to nareba mattaku kakushin ha motenu."

[8] For the rest of this thesis, "securitize" refers to the act of people in power to transform a policy problem into a security issue," a theory proposed by Wæver (1993) and applied for energy politics by Leung *et al. (2014).*

to a war' by utilizing these resources in the most effective manner."[9] The second and the third articles list up all materials and types of labor that are in control under the law. The remaining 46 articles in the law enable the government to impose additional regulations *without going through votes in the parliament* but with edicts given by the emperor of Japan. These articles also describe the punishments in detail for those who do not follow the government's orders (*National Mobilization Law* 1938). Naoki Hoshino, the President of National Planning Authority when this law was proposed, said "This control law is exceptionally powerful. There are no other examples in the world today that are as exhaustive as this law. It would be much easier to see what can not be controlled by this law than trying to figure out what can be controlled" (Inose 1989)[10].

Before the introduction of this law, power industry was an open market with free competition in Japan and there were more than eight hundred power generation and distribution companies across the nation (METI 2012b). The oil industry and coal industry were also driven by a great number of private companies (JX Nippon Oil & Energy 2014a; Odano and Araya 2007). After the law entered into force, these companies were integrated into a small number of corporations that were completely monitored and controlled by the central government on production and consumption, and on every movement of human, capital, and material resources within the organizations (*National Mobilization Law* 1938; Agency of Information 1943). As for the power industry, a supplementary law introduced in 1938 forced the existing eight hundred companies to be integrated into one quasi-national company for electricity generation and transmission, and nine companies for electricity distribution throughout Japan (FEPC 2014).

As the war proceeded, Japan accelerated the centralization of political and economic power to the government, which was ruled by the military, by putting supplementary laws in force in order to further regulate industrial activities (*National Mobilization Law* 1938; Takahashi 1967). Therefore, a vertical relationship between the government and business sector was firmly built and Japan as a whole moved towards totalitarianism.

In 1943, the National Planning Authority and the Ministry of Commerce were integrated in order to organize the Ministry of Munitions.[11] This ministry, as the name suggests, was responsible for conducting the war, thus many military officials were assigned to the important positions in the ministry (Research Group for the Economy of Empire 1943; Johnson 1982). The first minister of the ministry was Hideki Tojo, who concurrently served as the Prime Minister and the General Officer of the Imperial Japanese Army (Research Group for the Tokyo Tribunal 1948). Therefore, all the resources available in Japan that could be used for fueling the military in any way were controlled by this over-centralized government and utilized for the purpose of protecting the sovereignty of Japan (See Figure.4.1).

[9] "Daiichijyou: Honpou ni oite kokkasoudouin toha senji 'sensou ni jyunzubeki jihen no baai wo fukumu ika kore ni onaji' ni saishi kokuboumokutekitassei no tame kuni no zenryaku wo mottomo yuukou ni hakki seshimuru you jinteki oyobi butteki shigen wo tousei unyou suru wo iu."

[10] "Touseihouki toshite, sekai ni ruirei no nai tetteishita mono da. Kono houritsu de nani to nani toga tousekidekiru ka to kangaeru yorimo, kono houritu de tousei dekinaimono ga arunara, sore wo sagashita hou ga haruka ni hayai darou"

[11] This Ministry of Munitions is the former body of the Ministry of International Trade and Industry (MITI), re-organized in 1946, which reformed again in 2001 to form the Ministry of Economics, Trade and Industry (METI).

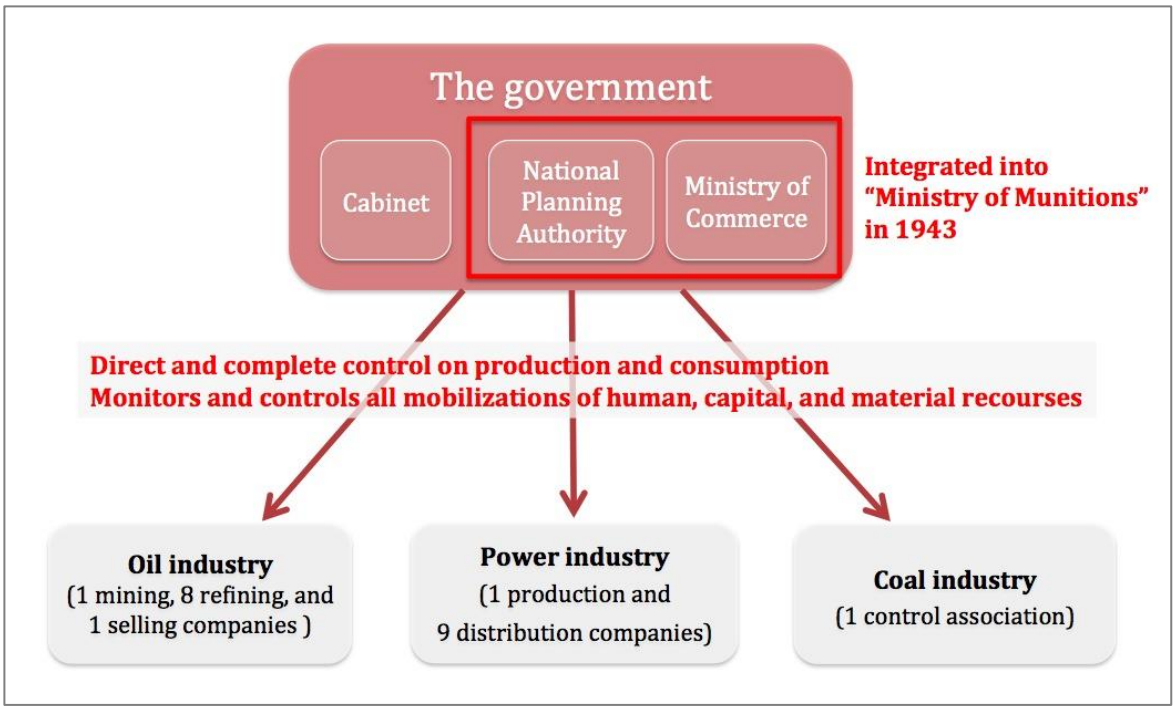

Figure 4.1. Direct and complete control over energy industries by the government
Data from JX Nippon Oil & Energy (2014a), FEPC (2014) and Odano and Araya (2007)

This centralization of political and economic power towards the war can be seen in number by the increasing flow of capital into war-related economic activities during the war. Figure 4.2 shows the comparison between these activities such as production and transportation of military supplies and Japan's Gross National Product (GNP) from 1940 to 1944, which clearly shows the increasing trend of economic activities related to war. Similarly, more and more national budget was put into military spending during this period of time. In 1944, 64% of all economic activities were conducted for fueling the military, thus were controlled by the central government and more than 80% of national budget was used for maintaining the military functions, as clearly shown in the Figure 4.3.

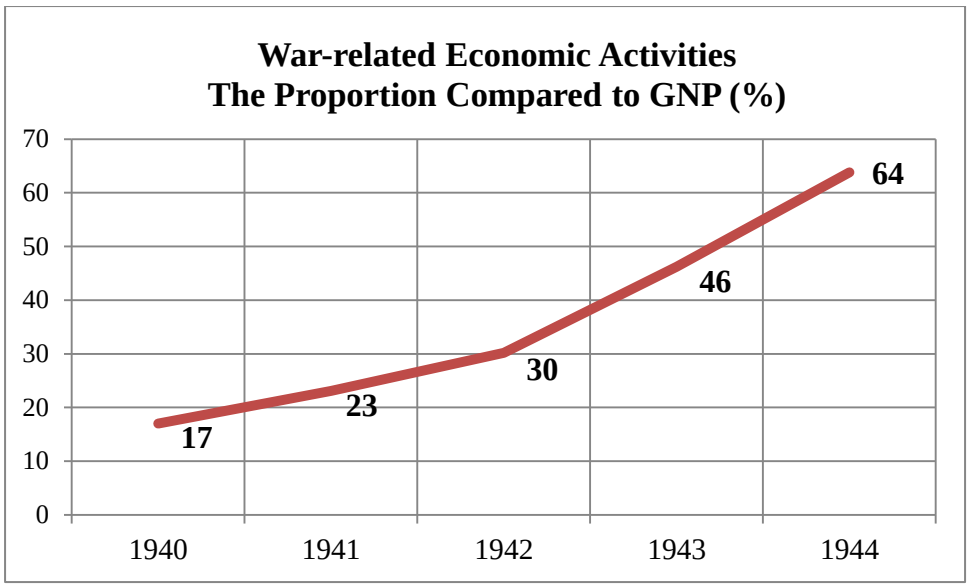

Figure 4.2. Capital flow into war-related economic activities
Data from Iwama (2007) with reference to Morimoto(2005) and Nihon Bungeisha(2002).

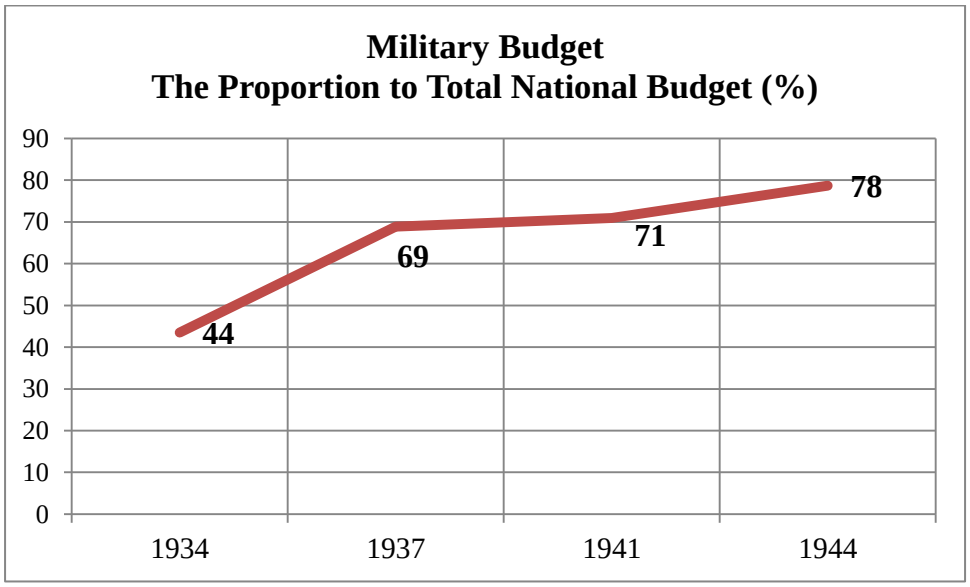

Figure 4.3. Military spending compared to the total national budget
Data from Iwama (2007) with reference to Nihon Bungeisha (2002)

In addition, the national strategic usage of oil for fueling the military can be also observed by the decreasing trend of oil used for power generation. A notable reduction can be seen after 1941 when Japan lost all the importation channels of oil because of the international embargoes (See Figure.4.4 and Figure. 4.5).

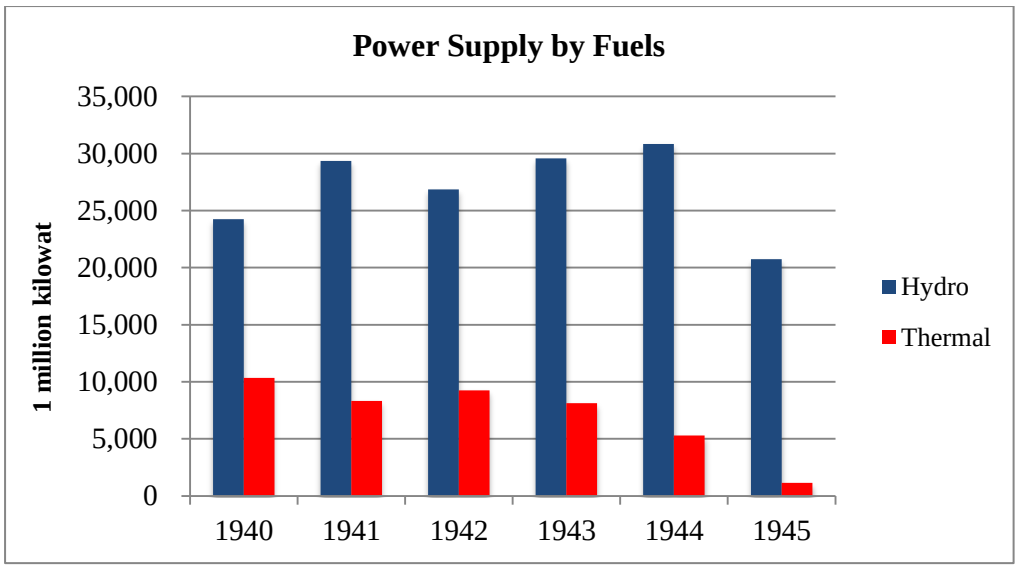

Figure 4.4. Decreasing capacity of thermal power
Data source: Statistics Bureau (2012)

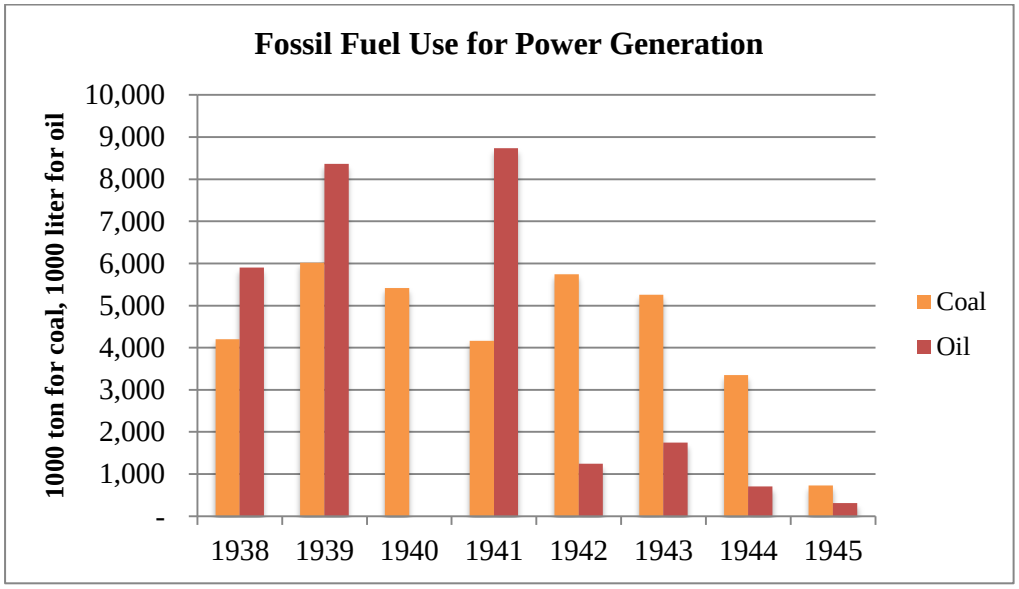

Figure 4.5. Decreasing use of oil for power generation during the era of war[12]
Data source: Statistics Bureau (2012)

This totalitarianism can be also seen in a social movement as well by advertisements and campaigns made and distributed across Japan by social activists and various types of media. Such advertisements include: "The ten million people, one shared soul to fight (Wakayama Prefecture)" [13], "Charge towards the crusade with the power of the ten million (Yomiuri Newspaper)" [14], "Fight for the Immortal Divine Land"[15].

[12] data for oil in 1940 is not available
[13] Ichiokuisshin jyuu toru kokoro
[14] Seisenhe tami ichioku no taiatari

As for electricity, it was also further discouraged in order to allocate more resources to the military. Figure.4.6 is a campaign poster encouraging the general public to decrease power consumption by showing how many fighters and tanks that could be produced if the resources for generating electricity are allocated to the military.

Figure 4.6. Campaign poster: Electric power is military power
Image source: Asahi Shimbun (1995)

4.2 Era of post war and Japan's economic miracle: (1945 - 1973)

After WWII, Japan strived to achieve an economic recovery. The Japanese government considered a stable supply of energy to be critical in order to revitalize its economy and society, which were utterly devastated after the war. The political and economic priority in the national energy policy changed from developing a coal-based economy to oil-based in this era because of the three advantages of oil: (1) fuel efficiency of oil; (2) multiple use of oil as industrial energy, transportation, and electricity fuel; and (3) increasing price competitiveness against coal. As Japan went through dramatic growth in economic development, population growth and energy demand, the dependence on oil gradually increased to the level that Japan was depending on it for 77% of the country's primary energy supply (PES) in 1973 (EDMC 2014).

This section first presents the vital energy systems and their vulnerabilities. It explains the increasing risk of the potential disruption of energy because of the significant increase in energy importation and dependence on single fuel during this time of rapidly growing economy. It also describes how this economic growth further strengthened the power of the central government over national energy politics.

[15] Shinshuu Fumetsu

4.2.1 Vital energy system and their vulnerabilities: reliance on oil to re-develop Japan

When WWII ended in 1945 with Japan's unconditional surrender to the Allied Powers, Japan had nothing but a devastated economy and infrastructure. Both the GNP and primary energy consumption in 1946 were reduced to the level of the late 1910s (EDMC 2014). In addition, the indices of industrial production, which are often used as an important indicator to evaluate the health of the Japanese economy, worsened to the level of the early 1910s (EDMC 2014). Kanno suggests that the oil stock was reduced to only 10,000 kℓ—1% of what was stockpiled before the Pacific War. In addition, two thirds of the domestic oil refinery facilities were destroyed, and the capacity of electricity production was decreased to 60% of the pre-war levels due to the US strategic bombings on the essential energy infrastructure of Japan (2001).

To rehabilitate the national economy and society, the first focus of Japan's postwar energy policy was on the re-development of the coal industry (Odano and Araya 2007). This policy was formed because coal was a resource that could be domestically obtained, unlike oil, and coal extraction could also create jobs (The Department of Economy of Asahi Shimbun 1949, Odano and Araya 2007). The nation aimed to have simultaneous growth of coal and other industries that use coal-based energy, such as steel, chemical, and power sectors, in order to mobilize the Japanese economy as a whole (MOF 1981; The Department of Economy of Asahi Shimbun 1949). However, as Japan went through dramatic growth in economic development, population, and energy demand, Odano and Araya argue that the role of coal as a primary energy resource was gradually replaced by oil because of the latter's better fuel efficiency and convenience as industrial energy, transportation, and electricity fuel. They also explain that it was the time that oil reserves in the Middle East and Africa were discovered one after another, making the price of oil more and more competitive against coal (2007). In addition, the fuel efficiency of oil against coal as industrial energy and its un-replaceable role as fuel for transportation and as raw material for chemical products encouraged Japan to reconstruct its energy system with oil as its primary energy resource. The nation called this transition "energy revolution" (ANRE 2008) in the 1960s.

Therefore, although the shares of oil and coal in PES were under 5% and more than 50% respectively until 1950, the importance of oil grew significantly and exceeded the share of coal in 1961 and accounted for 77% of Japan's PES in 1973, as shown in Figure 4.7. In addition, at the same time, oil became the dominant source of electricity supply in this era. The share of oil in electricity production increased from 1% in 1955 to 61% in 1973 (See Figure 4.8).

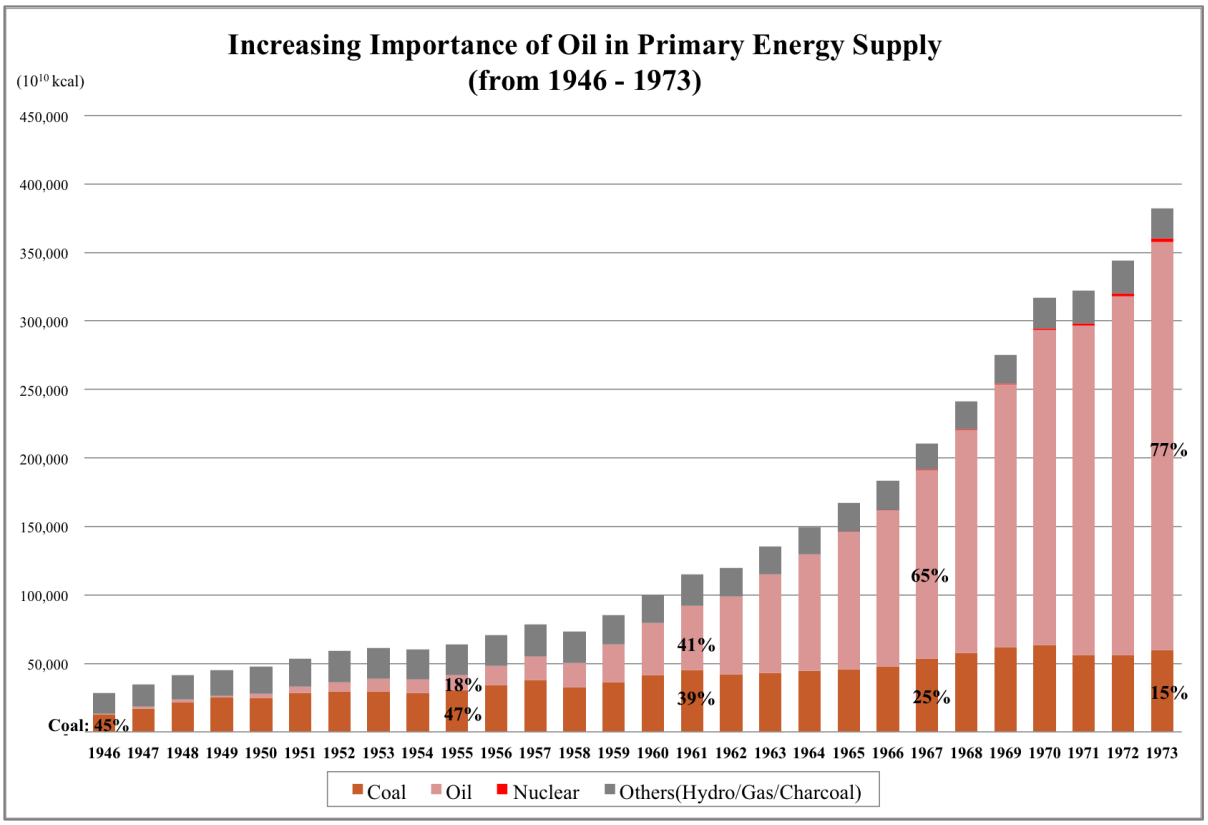

Figure 4.7. Share of oil in Japan's PES
Data from EDMC (2014), compiled and re-calculated by the author.

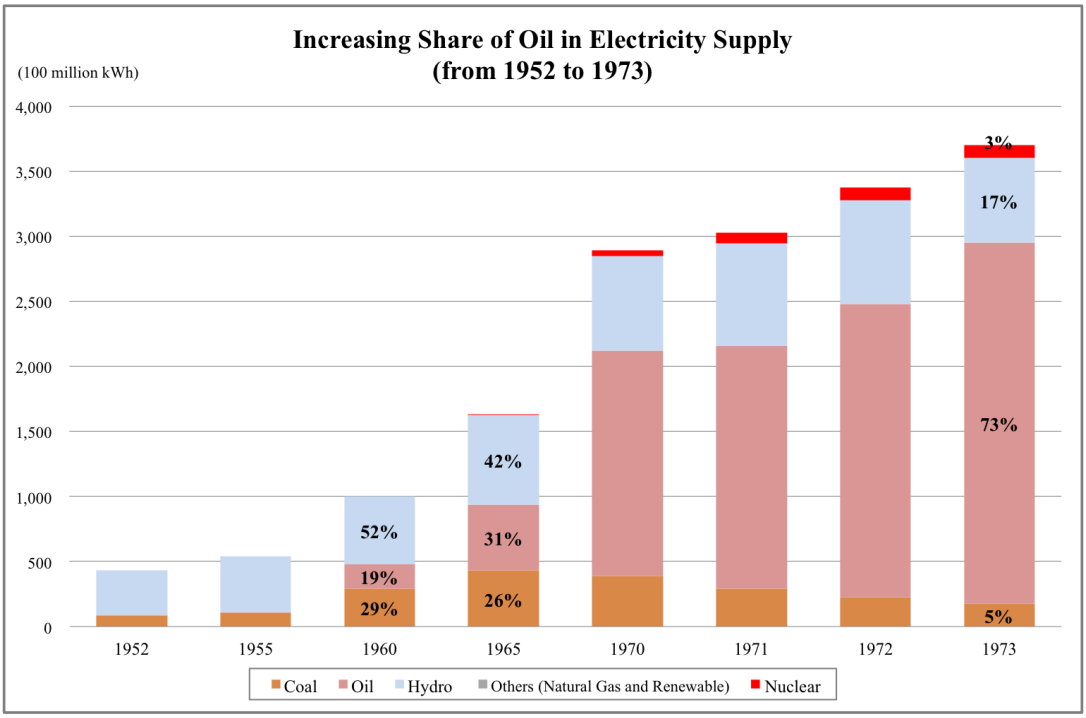

Figure 4.8. Share of oil in electricity supply
Data from ANRE (2013a), compiled and re-calculated by the author.

Therefore, during this period of the postwar economic reconstruction in Japan, oil was the most important resource for the nation to revitalize the national economy and society and to support its rapidly increasing energy demand. The vital energy systems are to fuel the economy with oil in order to meet the growing demand of transportation, industrial energy, and electricity. However, at the same time, this speed of growth contributed to expose the systems against potential supply disruption of oil. The stability of oil supply was critical to keep the Japanese companies, which were increasing its dependence on oil progressively, internationally competitive in order to drive the continual growth of the national economy.

4.2.2 Energy security threats: rapidly growing demand of energy and oil dependence

In this era, when the Japanese economy was growing at a speed that was praised as a "miracle" by foreign economists and researchers (See Johnson 1982 for details), the importance of supplying stable energy at a competitive price first appeared as the core energy strategy of the nation. In 1967, the Advisory Committee for Energy (ACE) was formed as an advisory board for the Minister of the Ministry of International Trade and Industry (MITI, former Ministry of Munitions) and published its first comprehensive energy policy of the nation in 1967, entitled "Long Term Energy Supply and Demand Outlook" (RIST 2005).[16] In that document, "the importation of cheap oil" was considered as the basis of Japan's energy policy and "the affordability, stability and independence of oil supply" was emphasized as the nation's major energy challenge (RIST 2005; ANRE 2004). The term "independence" refers to the nation's active involvement in the exploration, development and extraction of foreign oil reserves. This is to obtain an interest in those reserves and to increase the ratio of the oil produced from the reserves in which Japan holds an interest (ANRE 2004). From 1950 to 1973, the import ratio of oil increased from 90% to 99.7% in 1973 (EDMC 2014). Table 4.2 presents the rapid growth of population, GDP, GDP growth and the correspondingly increasing energy supply and its growth rate. The GDP growth and the growth of the energy supply in this time period exceeded 9.4% and 10.3% on average respectively. In order to support this fast growing economy, Japan increased the oil-based energy from 622 billion kcal in 1946 to 298,235 billion kcal in 1973, which is 480 times growth in 27 years (29% growth on average per year).

Table 4.2. Population, GDP and Energy Supply in Japan

Year	Population	GDP	GDP Growth (%)	Total energy supply (10^{10} kcal)	Growth of energy supply (%)
1946	73,114,136	111,492	9	28,357	N/A
1947	78,101,473	120,377	8	34,597	22
1948	80,002,500	138,290	15	41,307	19
1949	81,772,600	147,534	7	45,276	10
1950	83,199,637	160,966	9	47,788	6
1951	84,541,337	181,025	12	53,327	12
1952	85,808,114	202,005	12	59,226	11

[16] ACE was reorganized in 2001 and formed the Advisory Committee for Natural Resources and Energy "ACNRE" and was put under the jurisdiction of ANRE within METI.

Year	Population	GDP	GDP Growth (%)	Total energy supply (10^{10} kcal)	Growth of energy supply (%)
1953	86,981,463	216,889	7	61,580	4
1954	88,239,032	229,151	6	60,628	-2
1955	89,275,529	248,855	9	64,131	6
1956	90,171,631	267,567	8	71,105	11
1957	90,928,263	287,130	7	78,780	11
1958	91,767,079	303,857	6	73,903	-6
1959	92,641,282	331,570	9	85,861	16
1960	93,418,501	375,090	13	100,810	17
1961	94,286,810	420,246	12	115,942	15
1962	95,180,520	457,742	9	120,994	4
1963	96,155,847	496,514	8	136,566	13
1964	97,181,653	554,449	12	150,608	10
1965	98,274,961	586,744	6	168,910	12
1966	99,036,040	649,189	11	185,151	10
1967	100,195,804	721,132	11	212,386	15
1968	101,330,883	813,984	13	243,191	15
1969	102,536,079	915,556	12	277,527	14
1970	103,720,060	1,013,602	11	319,708	15
1971	106,100,243	1,061,230	5	324,790	2
1972	107,595,272	1,150,516	8	347,036	7
1973	109,103,610	1,242,932	8	385,409	11
1974	110,572,678	1,227,706	**-1.2**	384,679	-0.2

Data from EDMC (2014), MIC (2012), and Bolt, J. and van Zanden, J. L. (2013), compiled and recalculated by the author.

This skyrocketing economic growth and the subsequently increased dependence on imported oil concerned Japan before the upcoming oil crisis caused by the oil embargo of oil producing nations in 1973. This concern encouraged the nation to once again start stockpiling oil, and by the end of 1965, an amount equivalent to 43 days of the past year's (1964) consumption was stored (ANRE 2005, 2006). At the same time, Japan sought for an alternative energy source that could reduce the dependence on oil, and mitigate the risk of a potential energy supply disruption, which resulted in the nation commencing the development of nuclear power. The first NPP for commercial power generation was built in 1960 and started to run in 1966. Figure 4.7 and Figure 4.8 both show that nuclear power appeared as another energy resource to fuel Japan after 1967.

The nuclear development in the postwar era was discussed immediately after Japan signed the San Francisco Peace Treaty in 1952 when the state regained its autonomy (CAS 2013). It was the scientists, concerned about Japan's backwardness in nuclear technology which was then recognized as one of the leading fields of modern

science, that first argued the importance of the development of nuclear technology (CAS 2013). In addition, Yamamoto (2012) suggests that the weakened media control after the US lead occupation in Japan made it possible for the general public to know the details about the atomic bombings of Hiroshima and Nagasaki and the on-going suffering of the residents in those cities. He also argues that this, along with the fear of the potential world nuclear war in 1950s, built strong public resistance to the military utilization of nuclear resources. However, this was also the time when a Japanese scientist, Hideki Yukawa, received the nation's first ever Nobel prize in physics. His study was on elementary particles and, according to Yamamoto, this amazing news in the time of postwar severe economic recession in the late 1940s and early 1950s contributed to reform the national discourse to be in favor of nuclear technology in general. Politicians, scientists, and also an increasing number of the general public started to see nuclear technology as a means to re-develop Japan and its pride as a leading nation in science and in the development of the peaceful use of nuclear physics (Yamamoto 2012).

Therefore, when Eisenhower, the 34th president of the United States, made his famous "Atoms for Peace" speech on 8th December 1952, the peaceful utilization of nuclear power to help Japan re-arise as a technologically advanced nation gained increasing supports from scientists and industries who were also aware of the necessity of an additional energy source to continue its economic growth (Yamamoto 2012; CAS 2013). There was a persistent resistance among the public observed against the initiation of the nuclear program (Yamamoto 2012; Nanasawa 2008). However, the politicization of nuclear energy as critical to re-develop Japan conquered and started to form an ideology across the nation that supports nuclear energy for the economic development. This ideology to consider nuclear power as essential for continual growth became stronger after the oil crises in the 1970s and even more solid still when environmental objective was included in the nation's energy policy (See section 4.3.2).

In October 1973, following the Arab-Israel war, the members of the Organization of Arab Petroleum Exporting Countries (OAPEC) declared oil embargoes against the countries supporting Israel such as the United States and Netherlands, and announced their plan to gradually reduce oil supply and at the same time increase the price of oil (ANRE 2005; JX Nippon oil & Energy 2014a). As a result, the average price of imported oil (per kℓ) to Japan rose from 4,908 JPY in 1972 to 8,343 JPY in 1973 and to 21,203 JPY in 1974 (a 400 % increase in 2 years) (EDMC 2014). During the postwar era, due to such dramatic economic growth, Japan became the world's second largest economy by 1967 (Bolt and Zanden 2013), however, it was enabled by fueling the nation's vital energy systems with cheap oil, which was traded from 1-2 US dollars (per barrel) from 1946 to 1970 (EDMC 2014). In 1973, Japan was depending on imported oil for 99% of its total supply, of which 80% was coming from the Middle East (ANRE 2013a). Therefore this unexpected increase in oil prices caused Japan to suddenly face "skyrocketing inflation", and the nation's consumer price index rose by 23 % in 1974 (Iyoda 2010). Moreover, for the first time since the end of the Pacific War in 1945, Japan experienced a negative GDP growth of 1.2 in 1974, as clearly shown in Table 4.2. This sudden disruption reminded the country once again that relying on single resource from one region to dominantly fuel the nation could bring a serious threat to the continuity of the nation's economy and society.

4.2.3 Energy system governance: vertical relationship between the government and industry

The energy governance in this era went through several transitions, especially because of the changing relationship of Japan towards the United States in the period of the Cold War. The United States initially aimed to dismantle Japanese politics and economics that had encouraged the nation to get into WWII (Hosoya 1988). The state power was heavily centralized and governed by a handful of powerful actors, including the monopolized industries, and the military-influenced government at the center. However, many of these influential actors ended up remaining in the important positions in the postwar era since the objective of the United State's occupational strategy shifted from the democratization of Japan to the rehabilitation of its economy in order to develop Japan as a powerful ally against communism (Hosoya 1988; Masuo 2009).

In order to first disintegrate the militaristic centralized power in Japanese politics, the General Headquarters of the Supreme Commander for the Allied Powers (GHQ) published a policy in 1946 and prohibited those who were convicted as war criminals or identified as highly influential to the wartime decisions, including politicians and business people, to engage in public services (GHQ 1946).[17] This policy, called "purge", was over time transformed to instead expel communists, and thus re-named "red purge", since the United States feared that Japan would become a communist nation if potential communists began to fill the emptied important political and business positions (Hosoya 1988; MacArthur 1950; Souers 1948). Because of this, one after another, many of those who were expelled due to their former influence to the wartime Japanese politics and economics eventually returned to their core functions of public and business services. This change in the US occupational strategy can be seen by the example of politicians who once got purged however came back to the center of politics and even became Prime Minister in 1950s such as Ichiro Hatoyama and Nobusuke Kishi.

The GHQ also planned to dissolve the monopolistic economy of Japan, in which a limited number of conglomerates (called Zaibatsu), which grew dramatically during the wartime, were dominating the nation's economy (Masuo 2009). Therefore, for the same purpose as the original political purge, the GHQ aimed to disintegrate the centralized power of the nation's economy by passing "The Act for Elimination of Excessive Concentration of Economic Power" which came into force in 1947 (*Act for Elimination of Excessive Concentration of Economic Power* 1947). Initially, it meant to disintegrate any overly powerful economic entities, but this policy also lost its original purpose as the occupational policy changed to re-develop Japan in a timely manner to build a nation that would be a strong ally with the United States against communism in the Far East (Hosoya 1988; Masuo 2009). This policy change is clearly evident by the speech made by Kenneth Claiborne Royall in 1948, the Secretary of the Army of the United States.

> The dissolution of the Zaibatsu may present in itself no serious economic problem, but at some stage extreme deconcentration of industry (…) may at the same time impair manufacturing efficiency of Japanese industry--may, therefore, postpone the day when Japan can become self-supporting. (…)

[17] These decisions were formerly made by the Japanese government under the influence of GHQ as it was the GHQ's objective to "indirectly" occupy Japan as it was considered as more effective to restructure the nation into a democratic country.

> The men who were the most active in building up and running Japan's war machine--militarily and industrially--were often the ablest and most successful business leaders of that country, and their services would in many instances contribute to the economic recovery of Japan. (…) We realize that deconcentration must stop short of the point where it unduly interferes with the efficiency of Japanese industry. Earlier programs are being reexamined(…) We hold to an equally definite purpose of building in Japan a self-sufficient democracy, strong enough and stable enough to support itself and at the same time **to serve as a deterrent against any other totalitarian war threats which might hereafter arise in the Far East.**
>
> (Speech by Kenneth C. Royall on 6th January 1948, emphasis by the author. The whole speech is available in MOFA 1949)

This change in the political agenda of the United States affected the energy system governance of Japan as well. Before the arrival of the occupational power, the Ministry of Munitions that controlled the energy industries including coal, oil and electricity during the war period (See section 4.2.2 for details) was dissolved into the former state, the Ministry of Commerce and Industry, which was soon reformed into MITI in 1949. However, with the aim of the United States to quickly rebuild Japan and strengthen its economy to support the United States for the Korean War in the early 1950s, the monopolistic culture of those industries remained (Masuo 2009). Johnson (1982) is right in pointing out that even the firm vertical relationship between the government and business was maintained, in order to sufficiently meet the nation's objective to secure the supply of energy to support its rapidly growing economy.

The first priority in the energy development in this era was put on the development of the coal industry. The Japanese government issued a policy called "Priority Production Policy", and declared that the nation prioritize the extraction of coal as the most important national policy to reconstruct its economy (The Department of Economy of Asahi Shimbun 1949; Odano and Araya 2007; MOF 1981). In that policy, it is explicitly stated that the government directly interacts with the industry and controls the human and material resources as the state's utmost priority to increase the extraction capacity (The Cabinet Office 1946).[18] Additionally, during this period, when both materials and foreign currency were scarce, all importation became under the control of MITI with the enforcement of Foreign Exchange and Foreign Trade Control Law, thus it was the government who decided what to import at what amount (JX Nippon Oil & Energy 2014a). In the early 1960s, the energy policy soon shifted from its target on coal to the development of the oil industry, as oil was considered as a more attractive resource to fuel its economy (ANRE 2008). This direct governmental regulation in the energy sector and its influence on the energy market remained, and was further strengthened, which can be observed by a number of legislations enacted in order to develop the nation's vital energy systems with oil during this era of economic prosperity (e.g. *Petroleum Industry Law* 1962; *Electric Utility Industry Law* 1964).

In 1962, the government issued the Petroleum Industry Law. This law was to grant three rights to the Minister

[18] "Kokunai shisaku no issai wo seikitan no zousan ni shuuchuu suru. Korega tameni sekitan no zousan ni hitsuyou naru shoyoubusshi ha ikkatsu yuusenteki ni kore wo kakuho suru."

of MITI: (1) plan the amount of oil importation; (2) give permission to business entities to participate in oil refinery business; and (3) give permission to business entities to construct oil refinery facilities. Therefore, anything related to oil business, including the importation of crude oil, the capacity of production, and the price of oil, became under the control of the government.

As for the power sector, Nihon Hassouden, which was the only entity responsible for electricity generation, was targeted as an overly centralized monopoly by the GHQ, and was dissolved in 1951 by partitioning its production rights to 9 already existing regional distribution companies (METI 2012b; FEPC 2014). They were all privatized, yet regional monopolies were granted by MITI in the 9 respective areas of Japan. Additionally, these 9 companies formed an industry association, named the Federation of Electric Power Companies (FEPC) in November 1952—7 months after the enforcement of the San Francisco Peace Treaty, when the GHQ left Japan and the nation regained its autonomy (FEPC 2014). In 1964, 2 years after the Petroleum Industry Law was enforced, the government issued the Electric Utility Industry Law and introduced three governmental controls over the power industry (*Electric Utility Industry Law* 1964): (1) Regulation of market entry: anyone who conducts power business has to get an approval from the Minister of MITI; (2) Regulation of supply: electric utilities cannot refuse the supply of electricity without a reasonable excuse in each respective area and should not supply outside each service area; and (3) Regulation of supply condition: electric utilities need to obtain an approval from the Minister of MITI when they make any changes to the supply condition of electricity including the price.

The central governing system of nuclear power was also established in 1955 by enforcing the Atomic Energy Basic Law which formed the foundation of the development of nuclear technology in Japan. This law came along with supplementary laws to establish the Atomic Energy Commission (AEC) and the Atomic Energy Bureau within the Prime Minister's Office (current the Cabinet Office) of the government (CAS 2013).[19] The government's intention to directly manage the nuclear industry by means of regulations and legislations were explicitly made by Yasuyuki Nakasone, an LDP representative, when the basic law was proposed in the parliament (CAS 2013). He argued "It is the utmost priority of the state to establish necessary institutions and allocate adequate budget in order to prepare the foundation of the long term development [of nuclear energy] with cooperation of all Japanese citizens" (CAS 2013).[20] Later, Nakasone was appointed the Head of the Agency of Science and Technology and the Head of AEC in 1959. He was continuously elected as the heads of various agencies and ministries including MITI and led Japan as Prime Minister from 1982 to 1987.

Shigeru Goto, a member of the House of Representatives when the Atomic Energy Basic Law was enacted in 1955, argues that it was widely believed that the cause of Japan's reckless and aggressive war was a result first of a lack of natural resources and finally by the international resource trade embargos (2012). Therefore, he suggests that there was a shared understanding among politicians, regardless of the parties each belonged to, that energy policy should be constructed according to the state's long-term national strategy.

[19] The function of Atomic Energy Bureau was transferred to the Science and Technology Agency in 1956

[20] "Kikou teki nimo yosan teki nimo, kokka ga fudou no taisei wo motte, zenkokumin kyouryoku no moto ni, kono seisaku wo choukiteki ni susumeru to iu taisei wo totonoeru koto ga daiichi de arimasu"

The vertical relationship between the government and the energy sector, including coal, oil and power industries was maintained and further strengthened from 1950 to the late 1960s. However, the coal industry declined over time, with the number of active coal mines in Japan decreasing from 1047 in 1952 to 8 in 2008, as the national strategy transitioned to shift its nation into oil based economy and society (METI 2008). MITI maintained to act as the responsible regulatory body for the energy sector. Additionally, the Atomic Energy Commission and the Science and Technology Agency, which both formed in the Cabinet of the government, joined as an additional entity to monitor nuclear activities in Japan (CAS 2013). Figure 4.9 presents this vertical relationship between the government and the energy sector from 1950 to the late 1960s.

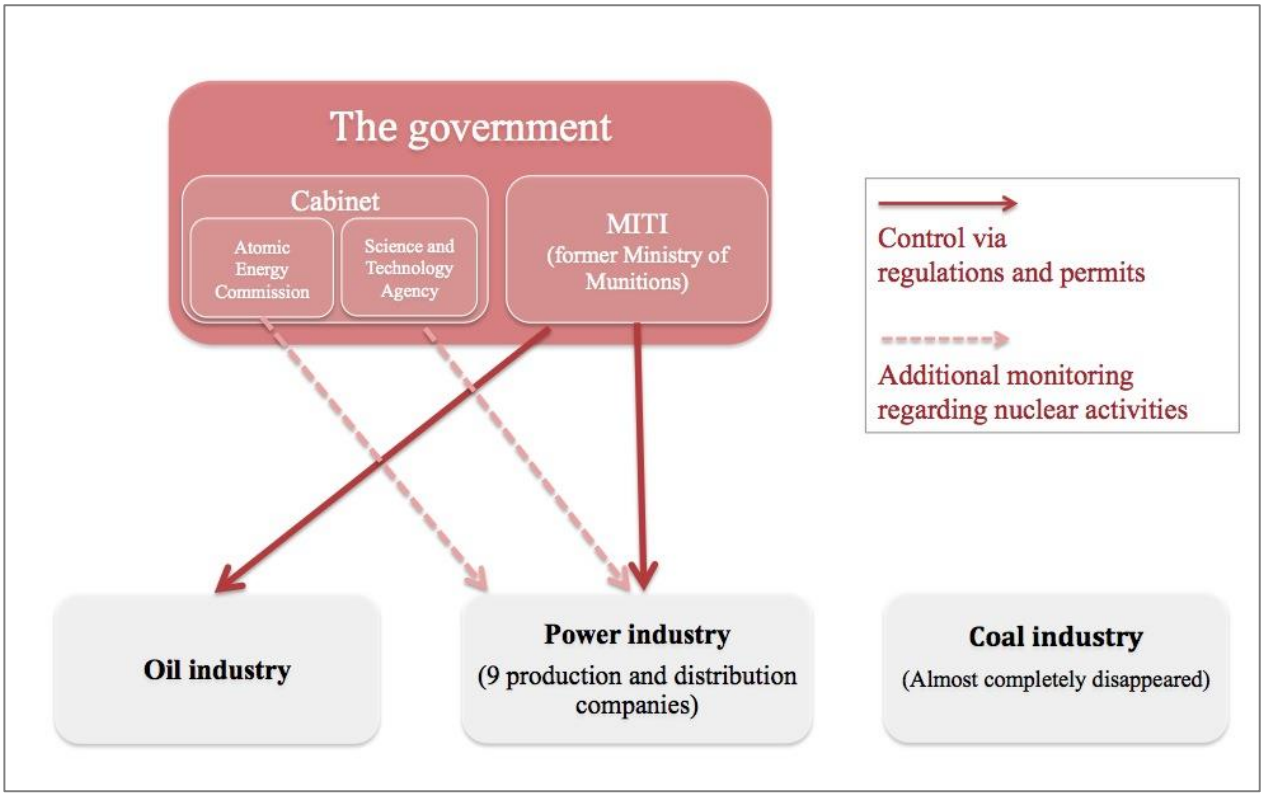

Figure 4.9. The governmental control over the energy industries in 1950-1960s
Data from OECD (2010), CAS (2013), ANRE (2008, 2004)

4.3 Era after the oil crisis in 1973: energy diversification (1973 - 2010)

The institutional oil embargos of the 1970s and the sudden increase of oil prices brought another energy crisis that reminded Japan of the two major risks of relying significantly on imported energy resources: (1) risk of dependence on one energy resource to supply a dominant part of energy; and (2) risk of dependence on a single region for any resources, especially when the predominant amount of the resources is imported from a politically unstable area. Therefore, since this energy crisis, Japan has pursued energy diversification as the nation's main measure to minimize the risk of potential energy supply disruption. In addition, nuclear power has gained more attention as a favorable energy source not only as a means to reduce the dependence on imported energy resources but also to meet the nation's climate target.

This section first explains the vital energy systems fueled by diverse source of energy and their vulnerabilities after 1973. It will then demonstrate how these diverse and complex energy systems contributed to the development of nuclear power. It will also present the increasing power of the central government and nuclear related industries over Japan's energy politics during this period of time.

4.3.1 Vital energy system and their vulnerabilities: diverse energy mix relying on imports

In order to mitigate the kind of supply disruption experienced with the oil embargoes, or other sudden increases of energy prices, Japan began to diversify the nation's energy mix with coal, natural gas, and nuclear energy (ANRE 2005; METI 2010; Lesbiel 2004). The proportion of oil in the total primary energy supply (PES) decreased from 77% in 1973 to 44% in 2010 (EDMC 2014). Even more tellingly, the share of oil in electricity generation dropped from 73% in 1973 to 8% in 2010 (ANRE 2013a). In parallel, the amount of coal, natural gas, and nuclear energy increased. Coal increased its ratio in PES from 15% (1973) to 22% (2010), natural gas increased from 2% (1973) to 17% (2010) and nuclear energy increased from 1% (1973) to 11% (2010) in Japan's PES (EDMC 2014; ANRE 2013a).

The role of nuclear energy had become especially significant in electricity generation. Nuclear power only accounted for 3% of total electricity supply in Japan in 1973; however, it gradually increased its production capacity and, in 1991, ended up producing the largest amount of electricity of any resources when it reached 28% of the total supply (ANRE 2013a). Nuclear power reached a peak of 37% in 1998, its highest point in Japanese energy history, and remained as a primary source of electricity in Japan until 2010, as clearly shown in Figure 4.10.

There was a significant increase of electricity demand in this era. Although the primary energy supply increased by 140% from 1973 to 2010, the electricity supply rose by 266% (EDMC 2014; ANRE 2013a). About the half of this growth of electricity was supplied by nuclear energy and the rest by coal and natural gas (See Figure 4.10). Accordingly, as Table 4.3 shows, the installed capacity of nuclear, coal, and natural gas were all increased. Although the actual production of electricity from oil-fired power plants decreased overtime, Table 4.3 also tells that the capacity for it remained, meaning that most of the oil power plants were ceased, but not dismantled.

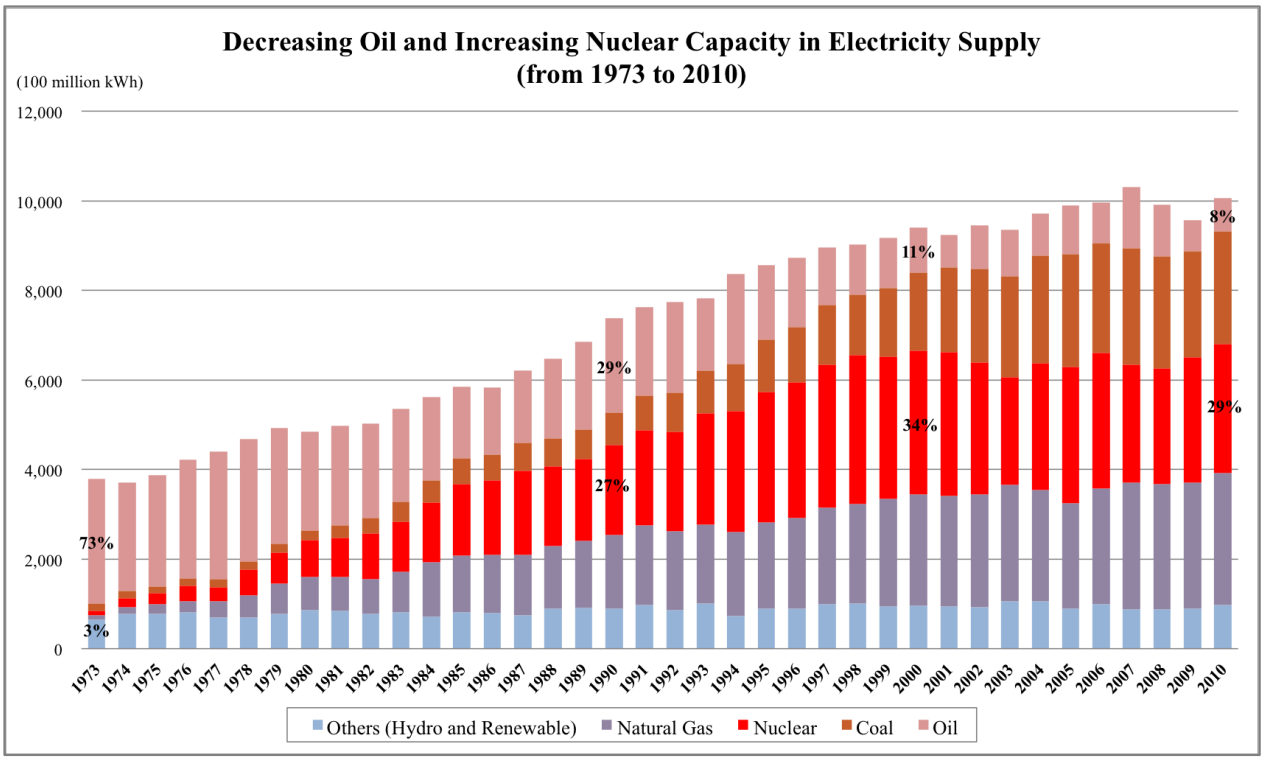

Figure 4.10. Share of nuclear power in electricity supply
Data from ANRE (2013a), re-calculated by the author.

Table 4.3. Installed Capacity of Coal, Natural Gas, Oil and Nuclear Power (Unit: 10000kW)

Year	Coal	Natural Gas	Oil	Nuclear
1973	531	250	4,889	228
1974	524	310	5,371	389
1975	487	470	5,566	660
1976	487	690	5,550	743
1977	446	1,126	5,587	799
1978	424	1,329	5,643	1,268
1979	424	1,877	5,443	1,495
1980	509	1,984	5,584	1,551
1981	582	1,984	5,894	1,608
1982	650	2,034	5,924	1,718
1983	808	2,352	5,764	1,828
1984	923	2,729	5,423	2,056
1985	994	2,869	5,379	2,452
1986	1,141	2,936	5,359	2,568
1987	1,120	3,141	5,413	2,788
1988	1,093	3,267	5,340	2,870

Year	Coal	Natural Gas	Oil	Nuclear
1989	1,150	3,437	5,351	2,928
1990	1,223	3,839	5,347	3,148
1991	1,343	3,910	5,308	3,324
1992	1,448	4,091	5,340	3,442
1993	1,578	4,190	5,334	3,838
1994	1,803	4,280	5,374	4,037
1995	2,014	4,431	5,321	4,119
1996	2,028	4,914	5,243	4,255
1997	2,191	5,248	5,252	4,492
1998	2,461	5,519	5,218	4,492
1999	2,488	5,677	5,269	4,492
2000	2,922	5,722	5,248	4,492
2001	3,050	5,880	4,988	4,574
2002	3,377	5,929	4,925	4,574
2003	3,575	6,042	4,709	4,574
2004	3,784	5,993	4,688	4,712
2005	3,767	5,874	4,662	4,958
2006	3,736	6,006	4,526	4,947
2007	3,747	5,761	4,692	4,947
2008	3,745	6,002	4,659	4,794
2009	3,795	6,161	4,617	4,885
2010	3,887	6,253	4,601	4,896

Data from ANRE (2013a), compiled and translated by the author

Though in the past, oil was the dominant fuel for Japan's vital energy systems –military, transport, industry, and electricity—some of these were now supplied by other fuels in this era. However, oil still remained as the dominant resource to fuel the transportation sector (ANRE 2013a). Various types of transportation, including heavy and light vehicles and airlines, increased in number of units in order to satisfy the growing demands of Japan's rapidly developing economy in the last four decades (See Figure. 4.11). Among all types of transportation, domestic vehicle have become a commodity among Japanese households in this era and now account for 74% of all transportation units owned in the country (AIRIA 2014). Numbers of other types of vehicles also grew significantly and subsequently increased the amount of oil consumed in the transportation sector, as shown in Figure 4.11 because oil has been and still is the dominant fuel for those vehicles (AIRIA 2014; JX Nippon Oil & Energy 2014b).

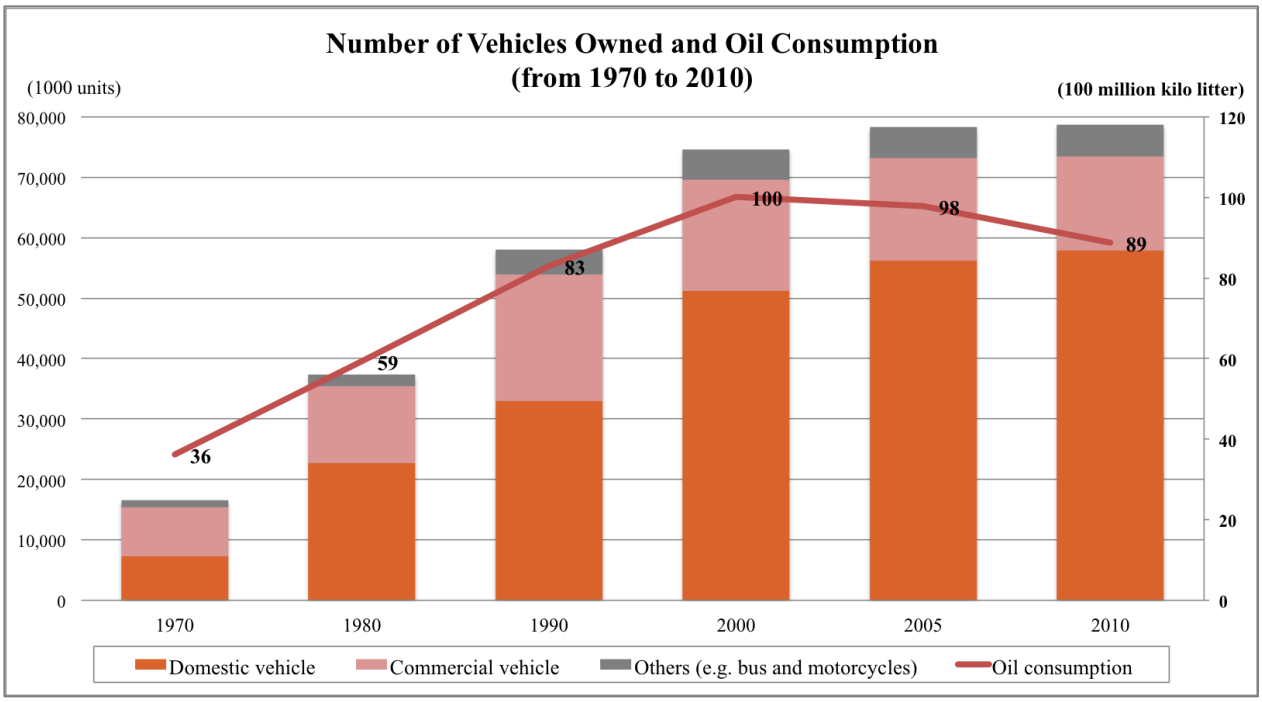

Figure 4.11. Number of vehicles and oil consumption

Data from AIRIA (2014), ANRE (2013a) and JX Nippon Oil & Energy (2014b), recalculated by the author

ANRE (2013a) explains that the reduction of the total oil consumption after 2000 is mainly achieved by improving the fuel efficiency of vehicles. There are also locally-based efforts to introduce non-oil based engine vehicles such as electric vehicles, however these only represent 3.8% of the total vehicles owned in Japan (ANRE 2013a). In addition to the function of oil as fuel for transportation, the increasing amount of oil has been used as raw material for various chemical products such as plastics (EDMC 2014). Therefore, although the transition from oil to other energy resources was made, the stable supply of oil still serves a critical function of Japanese economy and society.

Natural gas also became an important energy resource in the production of electricity, as shown in Figure. 4.10, which increased from 2.3% in 1974 to 29.3% in 2010 as the share of the total electricity supply. More importantly, natural gas has increased its share in the energy demand of the household sector and the industry sector, particularly since 1973 (METI 2013). The gas pipeline network, called town gas system in Japan, has been developed in order to substitute oil and LPG in the household sector in 1970s and 1980s. The use of town gas has also been encouraged since the 1990s, acutely in the industrial sector, in order to decrease air pollutants including SOx, NOx and CO_2 since 1990s (METI 2013).[21] Accordingly, the gas demand of the household sector increased by 1800% from 1.5 Mtoe to 26.3 MToe The industry sector reduced the oil consumption from 59.4 Mtoe in 1973 to 23.4 Mtoe in 2010, mainly by increasing the use of gas from 1.6 Mtoe to 7.8 Mtoe along with improving energy efficiency (IEA 2014b). Therefore, a stable supply of natural gas is seen as critical to reducing oil consumption and air pollution, including CO_2. For these reasons, it is expected to remain as a significant resource to fuel the household and industry sector.

[21] Town gas currently accounts for 82% of the total gas demand in Japan (Suyama 2013).

After the world oil crises, coal was re-identified as a resource that might potentially help decrease the nation's dependence on oil (Odano and Araya 2007; ANRE 2008). In fact, coal gained attention as an even more favorable resource than oil in terms of its potential to bolster the security of Japan's energy systems, both because of coal's price competitiveness and wider distribution in the world (Odano and Araya 2007; ANRE 2004). Figure 4.12 shows the increasing trend of coal in the electricity supply as opposed to the decreasing trend during the rapidly growing economic era, as observed in the previous chapter (see Figure 4.8). Some of the nation's oil-fired power plants were converted to coal-fired power, and the nation also constructed new coal-fired power plants after 1973 (ENV 2011; METI 2013). There are currently 69 coal-fired power stations in Japan, which produced 260 billion kWh in the year 2012, and boast a total capacity of 8,412MW (ENV 2011; ANRE 2013a; Kim 2013). In addition, coal remains as an important raw material for the iron and steel industry, which consumed more than 80% of all coal used in Japan in 1976 (ANRE 2013a). Although the relative proportion decreased to 37% in 2010 due to the increase of coal used for power generation, there had been almost no change in the amount of coal consumed for iron and oil production, as clearly shown in Figure 4.12. After the development of the industry in 1960s, the coal demand in the sector remained about 60-70 million tons per year. In conclusion, after oil crises, coal also became a critical resource in Japan once again, mainly in power generation and iron and steel production.

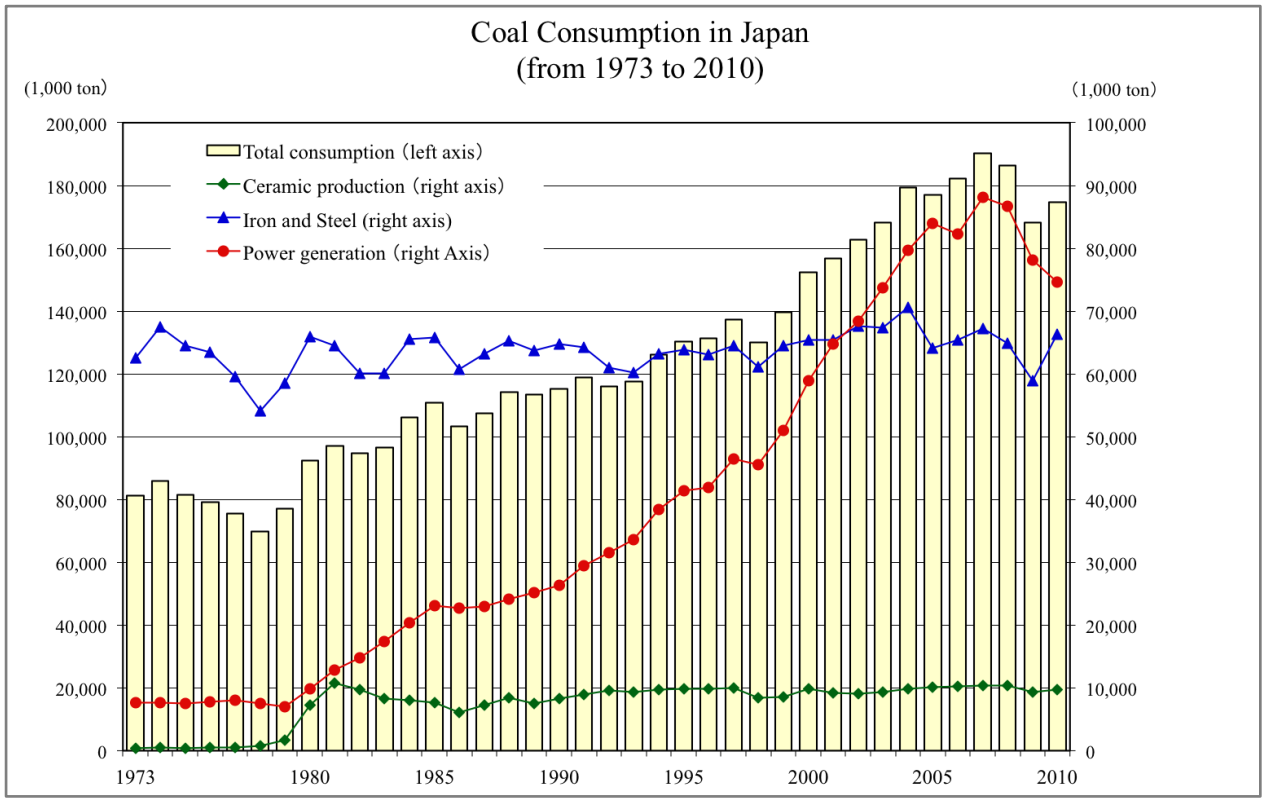

Figure 4.12. Coal consumption in Japan
Image from ANRE (2013a), translated by the author.

4.3.2 Energy security threats: volatile price of fossil fuels and emerging environmentalism

In this era after the oil crises, the potential threats of energy security were diverse, yet categorized into three perspectives of energy security risks: (1) sovereignty perspective: the increasing dependence on energy imports to supply the national vital energy systems. Extreme dependence on one region could provoke a severe disruption in energy supply such as by oil embargoes and price manipulation; (2) robustness perspective: the growing energy demand which is supplied with an increasing amount of energy resources whose prices fluctuate and increase based on various types of pressures, such as the depletion of energy resources and growing competition over them; (3) resilience perspective: the ability of energy systems to recover from disruptions of any nature, including uncertain factors, such as imposition of stricter environmental regulations.

The import dependence of all three fossil fuels (oil, natural gas, and coal), which had accounted for 80-90% of PES from 1973 to 2010, reached 95% in 1995 and has remained high (See Figure. 4.13). Therefore, Japanese energy security has still been exposed to various external risks of supply disruption, which includes intentional disruption of energy supply or increase in the price of energy by producing regions or increasing competition of energy resources driven by the rapidly growing economies of developing nations (ANRE 2013a; METI 2010).

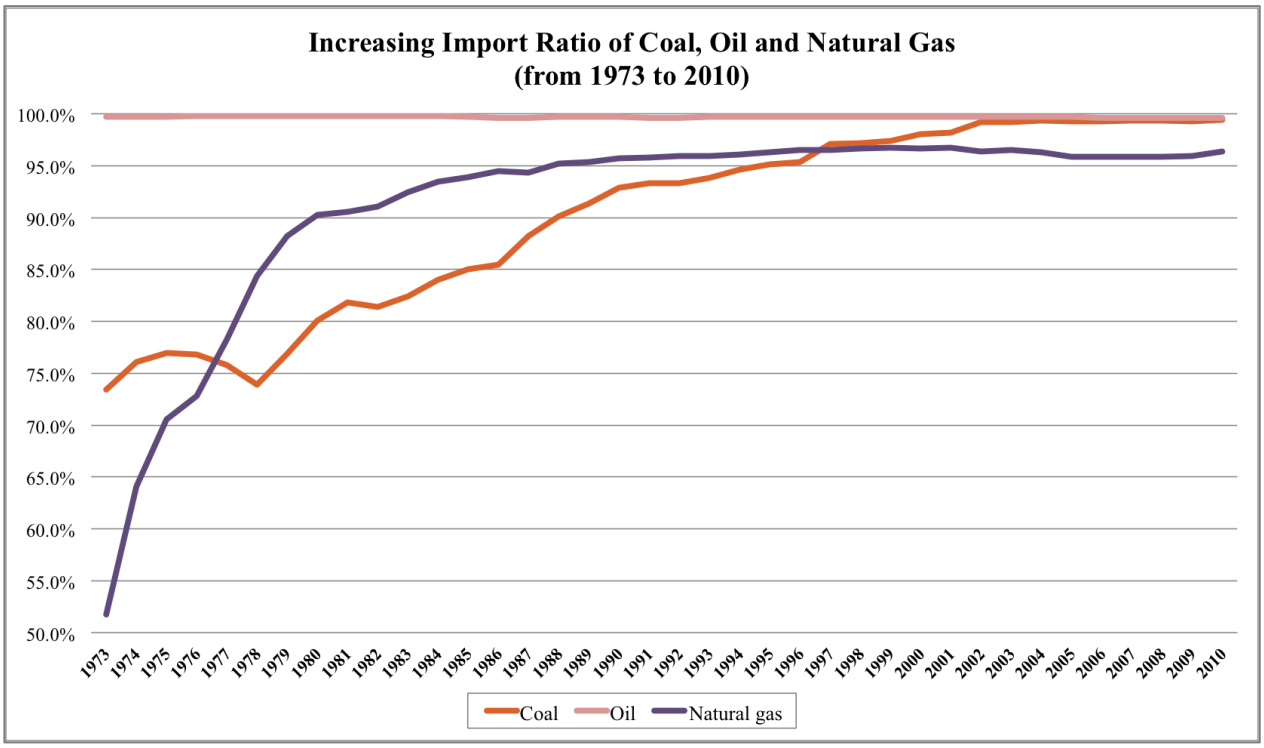

Figure 4.13. Increasing dependence on the imports of fossil fuels
Data from ANRE (2013a), compiled by the author.

In particular, oil and natural gas are immensely dependent on the Middle East. Table 4.4, Table 4.5, and Table 4.6 respectively present the amount and the proportion of imported oil, natural gas, and coal to Japan by supplying countries in 2010. 96% of oil was imported from 11 countries, with 7 Middle Eastern countries

accounting for 84%. 98% of natural gas was imported from 10 countries, among which 3 Middle Eastern countries for 22%. 98.5% of coal was imported from 6 countries, with Australia supplying 62%.

Table 4.4. Suppliers of Crude Oil to Japan in 2010

Country	Imported Amount of Oil (1000 kℓ)	%
Saudi Arabia	62,562	29%
United Arab Emirates	44,767	21%
Qatar	24,877	12%
Iran	20,944	10%
Russia	15,171	7%
Kuwait	14,938	7%
Iraq	6,986	3%
Oman	5,771	3%
Indonesia	5,123	2%
Sudan	2,535	1%
Australia	1,852	1%
Others	8,799	4%
Total	214,326	100%

Data from ANRE (2013a) and MOF (2014), compiled and recalculated by the author.

Table 4.5. Suppliers of Natural Gas (LNG) to Japan in 2010

Country	Imported Amount of Natural Gas (1 million tonne)	%
Malaysia	14.6	21%
Australia	13.2	19%
Indonesia	12.9	18%
Qatar	7.7	11%
Russia	6.0	8%
Brunei	5.9	8%
United Arab Emirates	5.1	7%
Oman	2.7	4%
United States	0.6	1%
Equatorial Guinea	0.3	0%
Others	1.4	2%
Total	70.4	100%

Data from ANRE (2014) and MOF (2014), compiled and recalculated by the author.

Table 4.6. Suppliers of Coal to Japan in 2010

Country	Imported Amount of Coal (1000 tonne)	%
Australia	117	62%
Indonesia	36	19%
Russia	11	6%
Canada	10	6%
China	7	4%
United States	4	2%
Others	3	2%
Total	187	100%

Data from ANRE (2014) and MOF (2014), compiled and recalculated by the author.

The price of oil continued to fluctuate greatly even after the oil crises in 1970s. This price fluctuation was influenced by a variety of reasons, including the continuously unstable political situation in the Middle East and the increasing demand for oil in developing nations, including past exporters to Japan such as China and Indonesia (METI 2014a). This fluctuation of the imported oil price more or less corresponds with the trend of the world crude oil price in the last 40 years, however, it has been also affected by the inflation and currency exchange rate of the Japanese yen: although 1 USD was traded for around 300 JPY in 1974, the JPY strengthened over time, with about 90 JPY being traded for 1 USD in 2010 (EDMC 2014).

In addition, as Figure 4.14 and Table 4.7 show, the prices of natural gas and coal show a correlation to the fluctuating price of oil, although the extent of correlation is higher with natural gas than coal, and coal had always stayed as the cheapest fuel. In addition, from 1975 to 1988, the coal price shows a continual decline, whereas the oil and natural gas prices fluctuated greatly. This relative stability of the coal price as compared to prices of oil and natural gas can be also observed in other periods of time, such as from 1998 to 2003, as well as from 2005 to 2007.

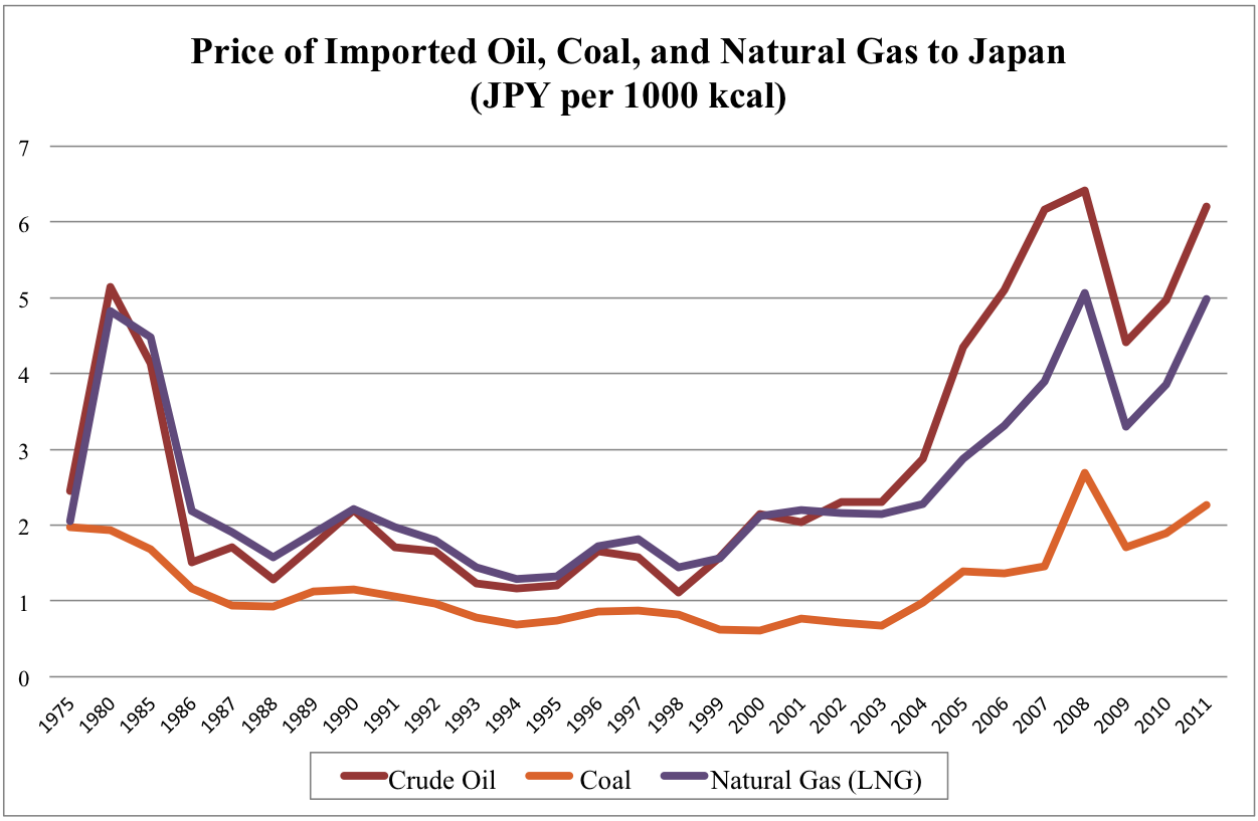

Figure 4.14. Price of imported oil, coal and natural gas to Japan
Data from EDMC (2014), compiled and re-calculated by the author.

Table 4.7. Import Price of Crude Oil, Coal, and Natural Gas

	Import Price (JPY/tonne)			Import Price (JPY/kcal)		
Year	Crude Oil	Coal	Natural Gas	Crude Oil	Coal	Natural Gas
1975	19,254	13,749	26,587	2.45	1.97	2.05
1980	40,501	13,387	62,681	5.15	1.94	4.82
1985	32,602	11,631	58,181	4.14	1.68	4.48
1986	11,879	8,031	28,448	1.51	1.16	2.19
1987	13,468	6,482	24,789	1.71	0.94	1.91
1988	10,128	6,438	20,535	1.29	0.93	1.58
1989	13,599	7,762	24,587	1.73	1.13	1.89
1990	17,284	7,931	28,729	2.2	1.15	2.21
1991	13,431	7,297	25,578	1.71	1.06	1.97
1992	12,940	6,601	23,463	1.65	0.96	1.8
1993	9,708	5,387	18,899	1.23	0.79	1.45
1994	9,231	4,739	16,754	1.17	0.69	1.29
1995	9,402	5,087	17,235	1.2	0.74	1.33
1996	13,003	5,905	22,355	1.65	0.86	1.72
1997	12,315	6,067	23,545	1.57	0.88	1.81

	Import Price (JPY/tonne)			Import Price (JPY/kcal)		
Year	Crude Oil	Coal	Natural Gas	Crude Oil	Coal	Natural Gas
1998	8,764	5,660	18,908	1.11	0.82	1.45
1999	12,355	4,278	20,306	1.57	0.62	1.56
2000	16,682	4,059	27,655	2.15	0.61	2.12
2001	15,853	5,106	28,600	2.04	0.77	2.2
2002	17,884	4,746	28,091	2.3	0.72	2.16
2003	17,815	4,500	28,024	2.3	0.68	2.15
2004	22,241	6,538	29,746	2.87	0.99	2.28
2005	33,789	9,161	37,401	4.35	1.39	2.87
2006	39,676	8,997	43,120	5.11	1.37	3.31
2007	47,904	9,512	50,873	6.17	1.46	3.9
2008	49,780	17,711	66,017	6.41	2.69	5.06
2009	34,332	11,318	43,029	4.42	1.72	3.3
2010	38,582	12,450	50,299	4.97	1.89	3.86

Data from EDMC (2014), compiled and re-calculated by the author.[22]

In addition to the increasing price of fossil fuels after the oil crises, the depletion of such resources had been recognized globally from the late 1980s and further intensified the competition among nations to secure them (Toyoda 2012; Tanaka 2012; METI 2014a). This growing competition consequently boosted the price even higher and increased the risk of potential supply disruption to Japan.

Furthermore, each of the fossil fuels began to fall into their own particular, essential role to play in fueling Japan's energy systems: for instance, oil for transportation, natural gas for heating and cooking, and coal for iron and steel production (See section 4.3.1 for details). Therefore, it became a national priority to decrease the use of such *irreplaceable* resources for electricity production, which could be substituted by nuclear power (METI 2010).

After 1973, the diversity of Japan's PES and electricity supply increased. Figure 4.15 shows the improvement in the diversity index of Japan's PES from 1973 to 2010.[23] The higher index means that the energy systems are more resilient to potential disruptions of the energy supply.

[22] The price of coal was calculated by taking the average of the prices between imported steam coal and imported coking coal to Japan. The amount of crude oil was converted from barrel to tonne by dividing by 1.176. (the conversion ratio was obtained from the Petroleum Association of Japan 2014)

[23] This is calculated by applying the Shannon-Weiner diversity index ($DI = -(p_i \ln p_i)$ to Japan's primary energy and electricity mix. (DI = Diversity Index, p_i = proportion of the energy resource in the total primary energy or electricity mix, ln = natural logarithm which has the transcendental number e (= 2.7182818….) as its base, and $\sum$ = sum of all the energy resources calculated.

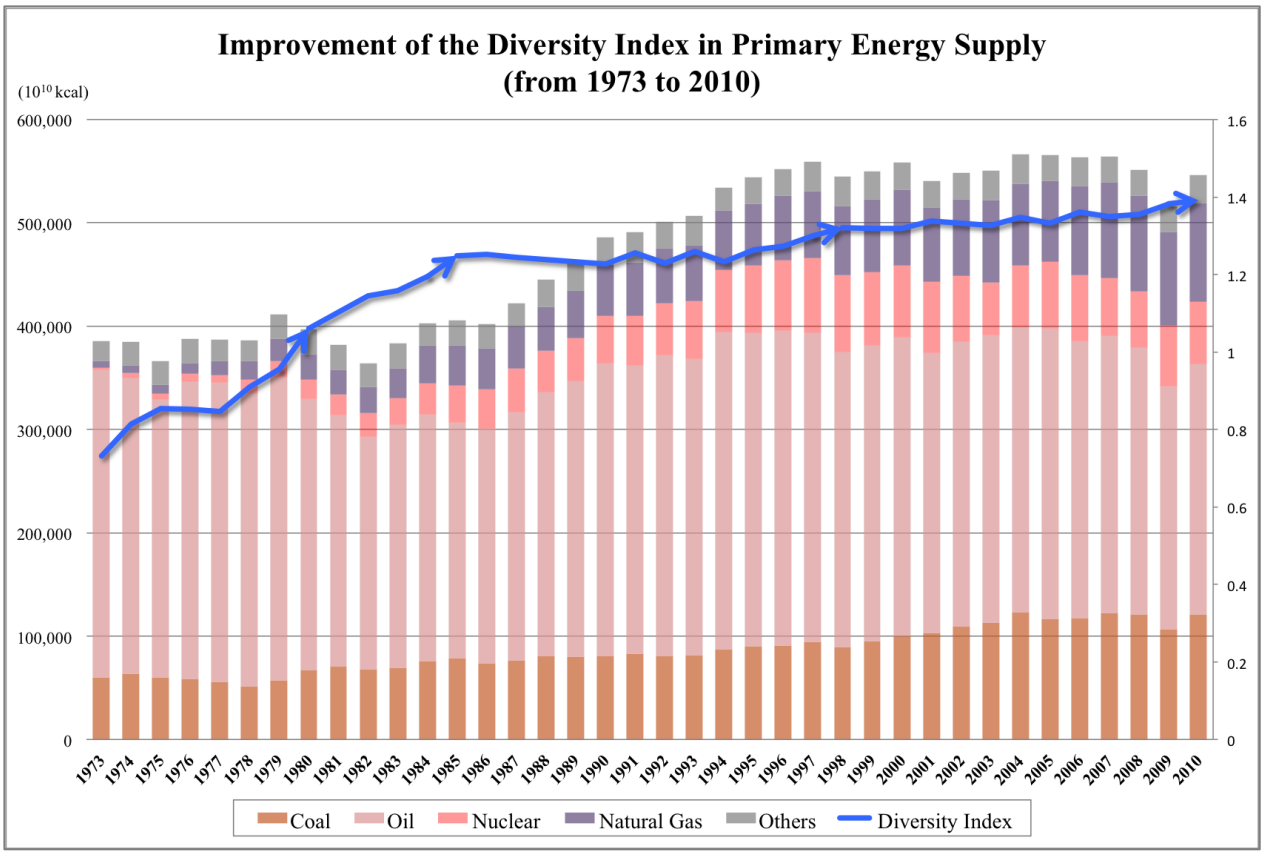

Figure 4.15. Improvement in diversity index of Japan's PES
Data from MITI (2013), the index is calculated based on the Shannon-Weiner diversity index by the author.

As for Japan's supply of electricity, the diversity index goes higher from 1973 to 1985, then stabilizes and displays a slight decreasing trend towards 2010 as shown in Figure 4.16. This decline is because the increasing share of nuclear power had diminished the evenness of energy resources used for power production. However, this unevenness does not necessarily mean that it poses higher threats to Japanese energy security since this parameter does not take into account the specific risks associated with each energy resources (Lesbirel 2004).

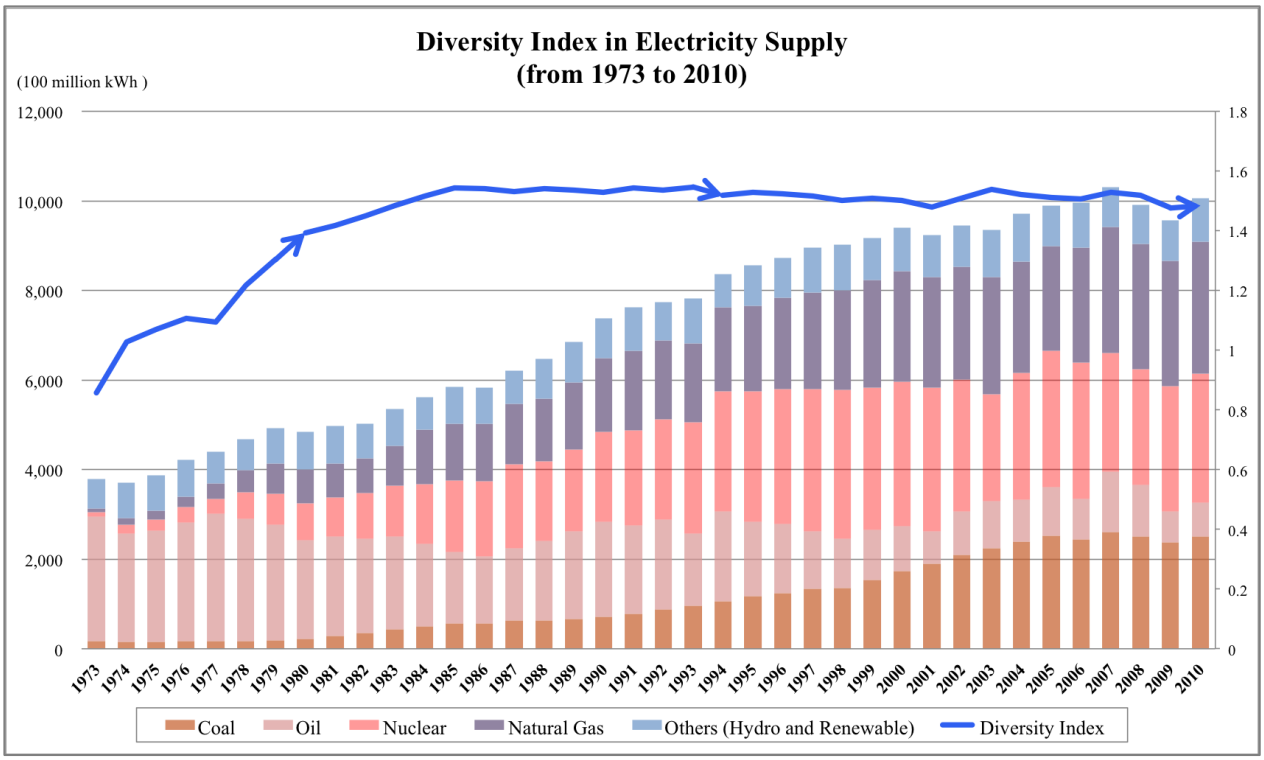

Figure 4.16. Improvement in diversity index of Japan's electricity system
Data from MITI (2013), the index is calculated based on the Shannon-Weiner diversity index by the author.

On the contrary, Japan believed that the risk of the contemporary and future potential supply disruption of uranium, the energy resource for nuclear power, was minimal compared to other fossil fuels (AEC 1977; IAE 1982; IEEJ 2010). Based on this belief, Japan aimed to increase the proportion of nuclear power in total electricity supply in order to strengthen the country's energy security as a whole. Indeed, the risk index of Japan's energy supply calculated by CRIEPI (2008) shows a significant and continual decrease in the late 1970s and the 1980s (See Figure. 4.17), when the proportion of nuclear power in the nation's PES increased from 6% to 27%.[24] In this calculation, risk index 1 represents that the nation is solely depending on the imported oil for PES, and 0 represents the country's energy demand is completely fueled by internal energy sources such as hydro (CRIEPI 2008).

[24] this risk index is calculated based on Herfindahl–Hirschman Index. It applied five different risks: (1) risk associated with the geological distribution of resources; (2) risk associated with the political and economic instability of resource holding nations; (3) risk associated with the demand and supply balance of energy traded globally; (4) risk associated with Japan's dependence on certain nations for resource importation; and (5) risk associated with the political and economic instability of the exporting nations to Japan)

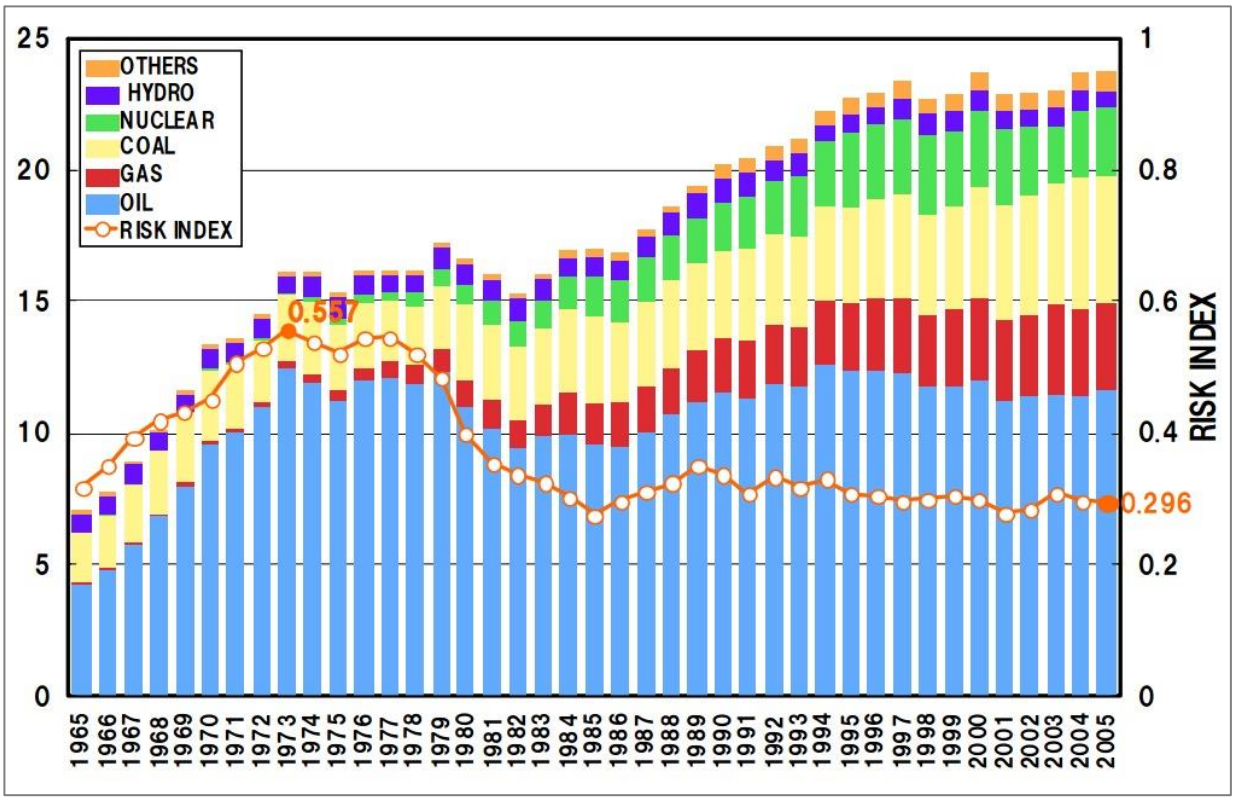

Figure 4.17. Nuclear power and decreasing trend of the risk index in Japan's PES
Image source: CRIEPI (2008), the unit for the left axis is 100 petajoule.

When decreasing greenhouse gas emissions became another political priority of Japan in the 1990s, the environmental concerns and the potential regulations became another threat to Japan's energy systems (RIST 1998; ENV 1990). In 1990, following the first assessment report released by the Intergovernmental Panel on Climate Change, the Japanese government issued a policy, "Action Program for the Prevention of Global Warming", and stated that "the nation will further promote the development and the utilization of nuclear power since it does not emit CO_2" (ENV 1990).[25] Since this moment, nuclear power has gained an increasing attention as a measure to achieve a CO_2 reduction target that does not negatively affect the nation's economy (ENV 1990; ANRE 1998; Hayashi and Hughes 2013).

4.3.3 Energy system governance: METI's regulatory power over energy industries

Japan's energy policy continued to be constructed by ACE within METI during this period, which was re-organized to the Advisory Committee for Natural Resources and Energy (ACNRE) in 2001. ANCRE consisted of less than 30 members who were all appointed by the Minister of MITI (*Act for Establishment of the Advisory Committee for Natural Resources and Energy 2000*). Therefore, the governmental influence on the energy sector was strengthened, and a firm relationship between the government, MITI, and energy-related industries was built. This is particularly the case of the close tie between the government, bureaucracy, the power sector,

[25] nisankatanso wo haishutu shinai enerugii toshite anzensei no kakuho wo zentei ni genshiryoku no kaihatsuriyou wo suishin suru

and nuclear industries because an increasing focus was put on the development of nuclear power after the oil crises in the 1970s (ENV 1990; ANRE 1998; IEEJ 2010).

As a political response to the sudden supply disruption of oil occurred in 1973, the Japanese government issued the Petroleum Stockpiling Law in 1975 to obligate private oil companies to stockpile oil in amounts equivalent to 90 days worth of national consumption by 1980 (*Petroleum Stockpiling Law* 1975; JX Nippon Oil 2014c). In addition to that, the government funded the Japan National Oil Corporation (re-organized from the former Japan Petroleum Development Corporation formed in 1967 by the 100% government funding) in 1978 to store additional 3,000 million kℓ of oil as a national stockpile (ANRE 2006).[26] The government believed that oil stockpiling is one of the most important objectives of Japan's energy security, thus the responsibility cannot be left to the private sector alone. This can be observed in the governmental documents indicating that "oil stockpiling is a core measure to strengthen the national energy security, thus the stored oil in the private sector should be considered as supplementary to the national stockpile" (ANRE 2006, 2010b). Accordingly, the target amount of national stockpile increased to 5,000 million kℓ in 1989 as opposed to the decreased amount of stockpiling obligated in the private sector (ANRE 2010b). By the end of 2012, Japan stockpiled 187 days worth of oil in total, among which 104 days worth of oil is stored as national stock, with private oil companies possessing the additional 89 days worth of oil (JX Nippon Oil 2014c).

The Petroleum Industry Law was abolished in 2001 with an aim to open the Japanese oil market in order to reduce the gap between domestic and foreign prices at that time by using market mechanism (ANRE 2013a; ANRE 2014b). In this way, the industry became open for free competition. However, the direct intervention of the government can still be observed today. For example, in 2005, within the 4 years of the abolishment of the law, when the world oil price again started to increase rapidly, the government proposed a new regulatory framework and obligated the oil companies to improve the efficiency of oil refinery capacity to a certain level by 2009 (ANRE 2005; Nakamura 2014).

Furthermore, the Minister of the Ministry of Economy, Trade and Industry (METI) (reformed from MITI in 2001) is currently the biggest shareholder of the first and second biggest oil development companies (JPEX 2013; INPEX 2013). Since these companies belong to the top tier of the industry, being responsible for the exploration, production and development of foreign and national oil reserves, there is a clear governmental aim to secure the authority of the industry.

The gas industry, which rapidly grew as natural gas increased its share in Japan's PES from 2% to 17%, has also been dominated by three private companies, similar to the power industry, which collectively account for the market share of more than 70% (METI 2013). The Minister of METI holds regulatory power that is similar to the control on the electricity sector such as to regulate the market entry and the price of the product in the national market (*Gas Industry Law* 1954).

[26] In 2004, the Japan National Oil Corporation was reorganized once again to form Japan Oil, Gas and Metals National Corporation under the jurisdiction of METI by integrating the company with the Metal and Mining Agency of Japan.

In this era, the governance over the electricity system was conducted by a limited number of actors which includes METI as its hub as the governmental regulatory body, supplemented by the Science and Technology Agency, 10 private power companies, and nuclear industries (CAS 2013; Moe 2012; Vivoda 2012; Kingston 2013).[27] Because the Liberal Democratic Party (LDP), which continuously stayed as the political force in power from 1955 to 1994 (Moe 2012), was involved in this group (Moe 2012), this energy governance and its policy-making is a great example of Iron Triangle politics of Japan (Colignon and Usui 2001).[28] The relationship between them was further strengthened as Japan developed nuclear power as the nation's primary energy source in order to reduce the dependence on energy imports, especially that on oil, with an aim to improve the self-reliance of energy production (Moe 2012).

The financial mechanism for increasing national investment in the development of nuclear energy was built when the nation passed three laws to promote nuclear power: (1) The Law of the Promotion of Power-Resources Development Tax; (2) The Special Budget Law for Development of Electric Power; and (3) The Law for the Development of Areas Adjacent to Electric Power Generating Facilities. These three laws all came into force in 1974, a year after the 1973 oil crisis, in order to prepare the national budget to subsidize the power sector, nuclear industries, and the power plant hosting communities (RIST 2004; CAS 2013). Therefore, after 1974, there was a construction rush of NPPs with bigger capacity than previous years, and the subsidies provided from the government subsequently increased over time (See Table 4.8 and Table 4.9).

Table 4.8. Year of the Construction, the Operation, and the Capacity of Japanese NPPs

Plant Name	Start Year of Construction	First Year of Operation	Capacity (1GW)	Operating Situation after Fukushima
Tokai	1960	1966	0.17	End of operation
Fukushima Daiichi 1	1967	1971	0.46	Suspended
Mihama 1	1967	1970	0.34	Suspended
Tsuruga 1	1967	1970	0.36	Suspended
Mihama 2	1968	1972	0.50	Suspended
Fukushima Daiichi 2	1969	1974	0.78	Suspended
Fukushima Daiichi 3	1970	1976	0.78	Suspended
Shimane 1	1970	1974	0.46	Suspended
Takahama 1	1970	1974	0.83	Suspended
Fukushima Daiichi 5	1971	1978	0.78	Suspended
Genkai 1	1971	1975	0.56	Suspended
Onagawa 1	1971	1984	0.52	Suspended
Takahama 2	1971	1975	0.83	Suspended
Hamaoka 1	1971	1976	0.54	End of operation
Ooi 1	1972	1979	1.18	Suspended

[27] In 2001, the Science and Technology Agency was moved from the jurisdiction of the cabinet to the Ministry of Education, Culture, Sports, Science and Technology as a part of central government reform of Japan.
[28] Iron Triangle politics refers to the strong relationship between the political parties (especially LDP), industry giants, and the bureaucracy, that can be observed since WWII in Japan.

Plant Name	Start Year of Construction	First Year of Operation	Capacity (1GW)	Operating Situation after Fukushima
Ooi 2	1972	1979	1.18	Suspended
Fukushima Daiichi 4	1972	1978	0.78	Suspended
Mihama 3	1972	1976	0.83	Suspended
Fukushima Daiichi 6	1973	1979	1.10	Suspended
Ikata 1	1973	1977	0.57	Suspended
Tokai Daini	1973	1978	1.10	Suspended
Hamaoka 2	1974	1978	0.84	End of operation
Fukushima Daini 1	1975	1982	1.10	Suspended
Genkai 2	1976	1981	0.56	Suspended
Ikata 2	1977	1982	0.57	Suspended
Sendai 1	1978	1984	0.89	Suspended
Kashiwazaki Kariwa 1	1978	1985	1.10	Suspended
Fukushima Daini 2	1979	1984	1.10	Suspended
Takahama 3	1980	1985	0.87	Suspended
Takahama 4	1980	1985	0.87	Suspended
Fukushima Daini 4	1980	1987	1.10	Suspended
Fukushima Daini 3	1980	1985	1.10	Suspended
Sendai 2	1981	1985	0.89	Suspended
Tsuruga 2	1982	1987	1.16	Suspended
Hamaoka 3	1982	1987	1.10	Suspended
Kashiwazaki Kariwa 2	1983	1990	1.10	Suspended
Kashiwazaki Kariwa 5	1983	1990	1.10	Suspended
Tomari 1	1984	1989	0.58	Suspended
Tomari 2	1984	1991	0.58	Suspended
Shimane 2	1984	1989	0.82	Suspended
Genkai 3	1985	1994	1.18	Suspended
Genkai 4	1985	1997	1.18	Suspended
Ikata 3	1986	1994	0.89	Suspended
Ooi 3	1987	1991	1.18	Suspended
Ooi 4	1987	1993	1.18	Suspended
Kashiwazaki Kariwa 3	1987	1993	1.10	Suspended
Kashiwazaki Kariwa 4	1987	1994	1.10	Suspended
Shika 1	1988	1993	0.54	Suspended
Hamaoka 4	1988	1993	1.14	Suspended
Onagawa 2	1989	1995	0.83	Suspended
Kashiwazaki Kariwa 6	1991	1996	1.36	Suspended
Kashiwazaki Kariwa 7	1991	1997	1.36	Suspended
Onagawa 3	1996	2002	0.83	Suspended
Higashi Doori 1	1998	2005	1.10	Suspended
Hamaoka 5	1999	2005	1.38	Suspended

Plant Name	Start Year of Construction	First Year of Operation	Capacity (1GW)	Operating Situation after Fukushima
Shika 2	1999	2006	1.21	Suspended
Tomari 3	2003	2009	0.91	Suspended
Shimane 3	2005	TBD	1.37	Under construction
Ooma	2008	TBD	1.38	Under construction
Higashi Doori 1	2011	TBD	1.39	Under construction
Tsuruga 3	TBD	TBD	1.54	Waiting for construction approval
Tsuruga 4	TBD	TBD	1.54	Waiting for construction approval
Higashi Doori 2	TBD	TBD	1.39	Waiting for construction approval
Higashi Doori 2	TBD	TBD	1.39	Waiting for construction approval
Hamaoka 6	TBD	TBD	1.40	Waiting for construction approval
Kaminoseki 1	TBD	TBD	1.37	Waiting for construction approval
Kaminoseki 2	TBD	TBD	1.37	Waiting for construction approval
Sendai 3	TBD	TBD	1.59	Waiting for construction approval

Data from JNES (2012) and RIST (2010).
Compiled and translated by the author. Data is ordered by the start year of construction.

Table 4.9. Subsidies Provided to the Development of Nuclear Power (unit: 100 million JPY)

Year	General Budget	Special Budget		Total
		Subsidies for NPPs installation, operation, research, and promotion	Subsidies for the hosting communities of NPPs	
1974	667	131(total of special budget)		798
1975	699	62	112	873
1976	806	85	108	999
1977	983	116	115	1,214
1978	1,240	120	188	1,548
1979	1,700	N/A	282	1,982
1980	1,704	450	320	2,474
1981	1,780	580	353	2,713
1982	1,790	681	433	2,904
1983	1,764	747	408	2,919
1984	1,696	864	505	3,065
1985	1,820	991	578	3,389
1986	1,859	1,062	652	3,573
1987	1,833	1,088	681	3,602
1988	1,811	1,066	795	3,672
1989	1,798	1,165	915	3,878

Year	General Budget	Special Budget		Total
		Subsidies for NPPs installation, operation, research, and promotion	Subsidies for the hosting communities of NPPs	
1990	1,798	1,257	899	3,954
1991	1,826	1,319	989	4,097
1992	1,844	1,282	1,096	4,260
1993	1,892	1,363	1,258	4,513
1994	1,917	1,308	1,244	4,469
1995	2,002	1,374	1,454	4,831
1996	2,043	1,441	1,462	4,946
1997	2,033	1,430	1,445	4,908
1998	1,938	1,326	1,427	4,691
1999	1,916	1,365	1,500	4,778
2000	1,817	1,357	1,632	4,805
2001	1,732	1,385	1,722	4,839
2002	1,455	1,393	1,815	4,663
2003	1,498	1,319	1,882	4,699
2004	1,435	1,426	1,846	4,707
2005	1,361	1,521	1,843	4,725
2006	1,281	1,386	1,737	4,404
2007	1,304	1,385	1,835	4,524
2008	1,247	1,424	1,964	4,635
2009	1,159	1,455	1,943	4,557
2010	1,161	1,367	1,795	4,323

Data from Annual White Papers yearly published from AEC between 1975 and 2010, compiled by the author.

In 1974, the Agency for Natural Resources and Energy (ANRE) was organized under MITI with a mission to improve Japanese energy security by developing "alternative energy sources" (RIST 2005). In 1978, the Minister of MITI was granted the responsibility to approve new installations of NPPs and regulate the existing NPPs operations (CAS 2013). In addition, as a part of the central government reform of Japan in 2001, the Nuclear and Industry Safety Agency (NISA) was organized within the ANRE, thus the ANRE's mission became to both promote and regulate nuclear activities (CAS 2013). Figure 4.18 shows the steady increase of the number of NPPs and their production capacity after 1974 despite the increasing opposition against nuclear power among the public, although this was mostly limited to those who resided close to NPPs (Nanasawa 2008). The opposition particularly increased as a response to the Three Mile Island accident in 1979, the Chernobyl disaster in 1986, and the domestic accidents including the accident of Monju sodium leak and fire in 1995 and the Tokaimura nuclear accident in 1999 which was the first accident that caused causalities in Japan (JAER 2005; Nanasawa 2008). The Japanese *nuclear elites*, including the MITI, the mass

media, and the power sector, frequently highlighted the structural resilience, the world top-level safety standards, and the operational and management excellence of Japanese NPPs, and claimed that nothing major like the Three Mile accident or Chernobyl could ever happen in Japan (AEC 2008; Nakano 2011). The subsidies for the hosting communities exceeded the amount provided for the industries in 1995 and onwards (See Table. 4.9 for details), which suggests that the government used subsidies to help quash the increasing opposition from the hosting communities.

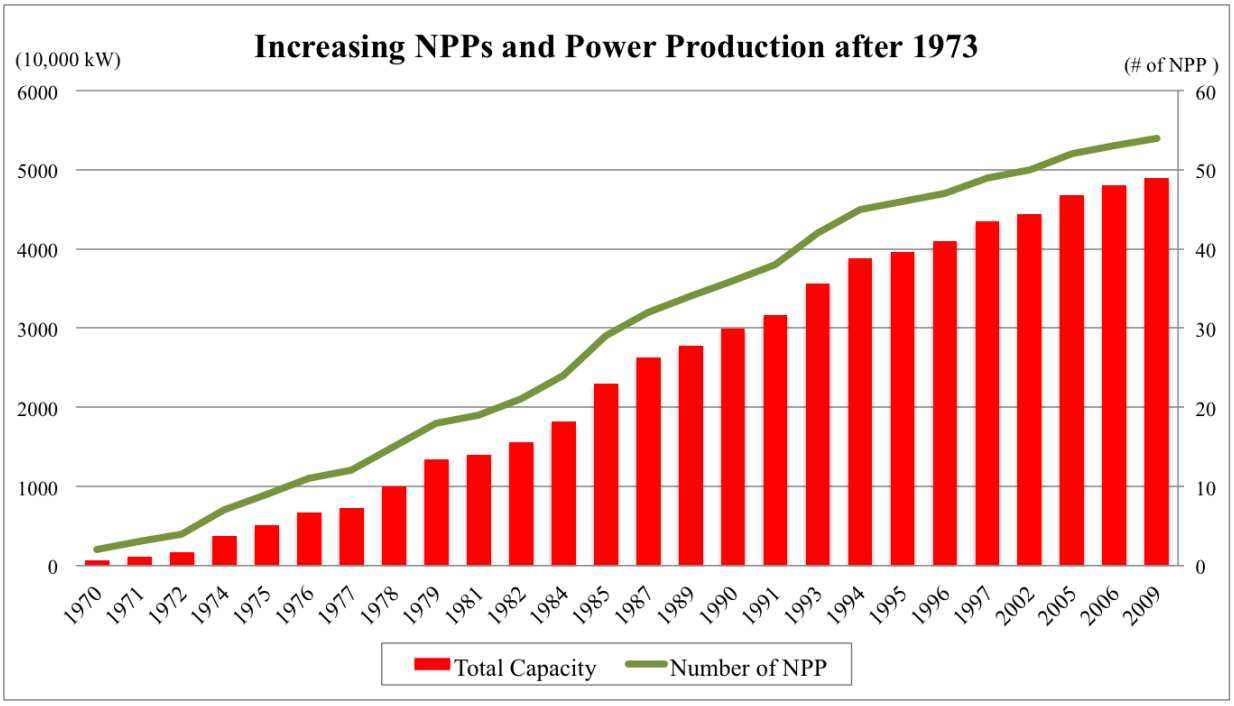

Figure 4.18. Number of NPPs and nuclear power generation
Data from JNES (2012), compiled and re-calculated by the author.

The nuclear energy and related industries grew correspondingly to the increasing energy demand of Japan in this era and the influence of the industries on the national energy policy-making got stronger. There is also a customary career path of Japanese bureaucracy that further cemented the relationship between the industry and national energy policy-making. For the ministry officials of METI, it has been a tradition to retire from METI and move to high profile positions in private corporations. Thus it is in the interest of those who work in the ministry to serve the influential sectors, for example power companies, as their "clients" (Moe 2012). In fact, Ooshika revealed that over 100 past ministry officials of METI were re-hired by nuclear-related companies and institutions in the last 60 years, and that an increasing number of this "career change" can be seen after 1973 (2011). This movement from the ministry to the power sector includes five past administrative vice ministers of METI and a head of ANRE, who all became the president or vice president of Japanese power companies after their "retirement" (Ooshika 2011).

Figure. 4.19 shows the energy availability factor (EAF) of Japanese NPPs between 1978 and 2010. EAF refers to the amount of time that a power plant is operating (thus generating electricity) in a certain period of time.

0% means there is no electricity generated during a certain period and 100% means a power plant is operating without any break. The Japanese government and the power sector had tried to increase the EAF of NPP by improving the equipment and quality management of the plants, perform possible inspection while running, or speeding up the routine inspections (AEC 1986; RIST 2008). Perhaps even more tellingly, the government published energy policies which politicized the importance of nuclear power every time after the EAF declined, which resulted in putting it back to another increasing trend (See Figure 4.19). There is no correlation between the amount of subsidies provided and the movement of the EAF. However, a number of media articles and scholars, such as Asahi (2014a, 2014b), Weekly Post (2011), Ishida (2014) and Uchihashi (1986), revealed that there was an immense amount of *off-the-book* money given to the hosting communities by power companies in order to *encourage* these communities to follow the demands of the power sector.

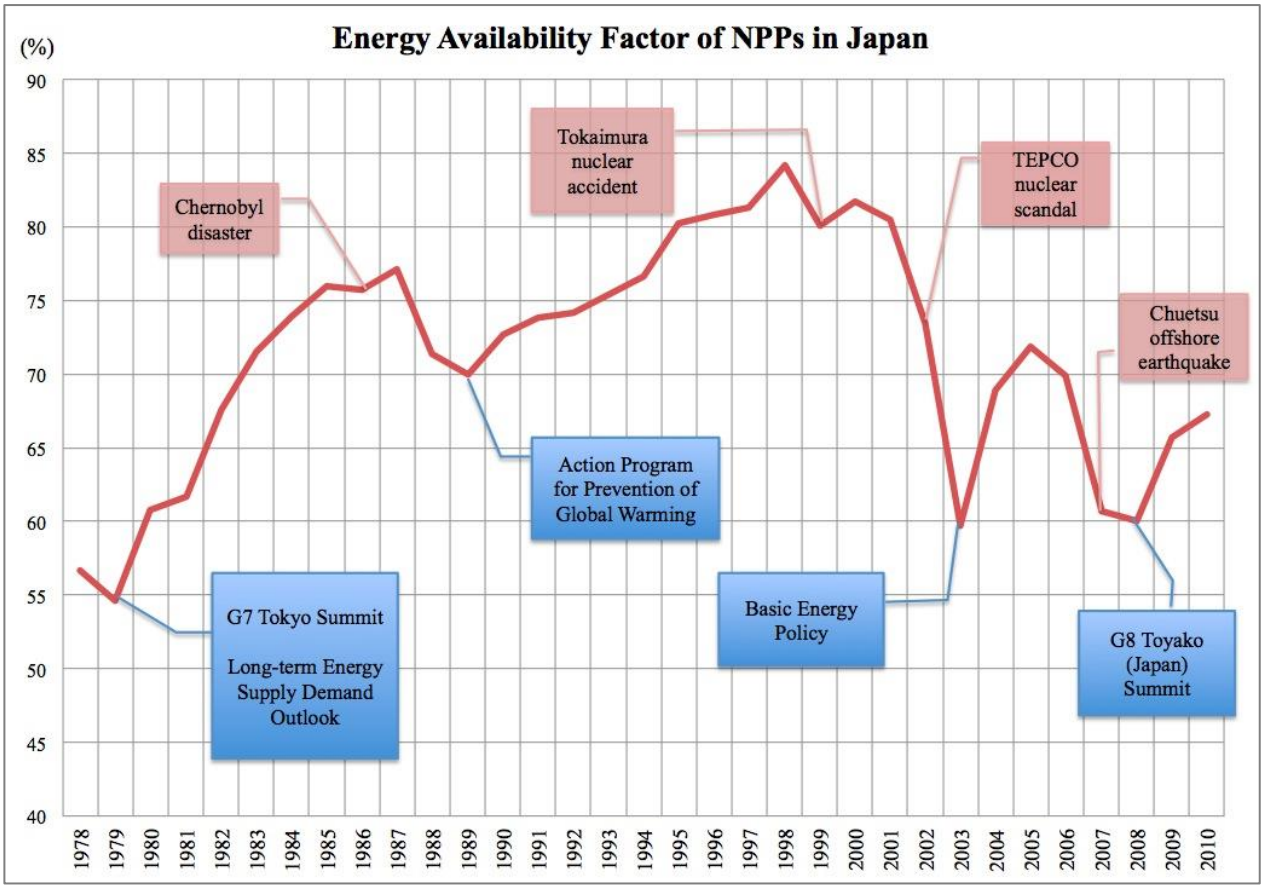

Figure 4.19. Energy availability factor of NPPs in Japan
Data from RIST (2011). The average EAF of all NPPs in Japan was used for this figure.

When the 5th G7 Summit was held in Tokyo in 1979, the declaration of the G7 leaders addressed the importance of nuclear energy. It states that "without the expansion of nuclear power generating capacity in the coming decades, economic growth and higher employment will be hard to achieve" (MOFA 2010). Two months after the declaration, the ACE issued a revised plan of the nation's energy policy and re-addressed the importance of increasing nuclear power (AEC 1979), which resulted in the steady increase of the EAF of the Japanese NPPs from 1979 to 1987.

The EAF further increased in 1990s and reached over 84% in 1998, as nuclear power had gained attention as a measure to reduce CO_2 emissions. This linking between nuclear power and climate change started when the Japanese government claimed in their policy in 1990 (ENV 1990) that nuclear power does not emit CO_2, thus the nation should pursue its further development. In 1998, one year after the nation signed the Kyoto Protocol, the government released a political statement entitled "Policy Guideline on Measures to Combat Global Warming", and further emphasized the necessity of increasing nuclear power by 150% (as compared to 1997 levels), in order to both achieve sustainable development and the nation's climate target (ENV 1998). Accordingly, ACE revised the nation's energy policy by revising the policy document, "Long Term Energy Supply and Demand Outlook", in 1998 and stated that nuclear power would be a primary measure in combating global warming (RIST 1998; Keidanren 1998).

There was a significant drop in the EAF after the year 2002 due to the emergent safety inspections of NPPs after the Tokyo Electric Power Company (TEPCO) was accused of the past cover-ups and manipulations of the safety inspection results of their nuclear facilities (RIST 2008, 2011). However, after METI (2003) issued the renewed nation's energy policy, entitled Basic Energy Policy[29] of Japan in 2003 and re-emphasized the importance of nuclear energy as a mitigation measure in order to both improve Japan's energy security and meet the nation's climate target, the EAF again went back to its past increasing trend. In this energy policy, METI stressed that the nation positions nuclear, which is a quasi-domestic source of energy, as the primary source of energy for the nation's future (METI 2003). Additionally, METI described nuclear power as key to strengthen the nation's energy security because of the following advantages of nuclear power: (1) uranium is widely distributed in politically stable area; (2) the energy intensity of uranium is very high at a level that the potential price fluctuation of uranium will not affect the price of nuclear energy (or negligible); (3) uranium is easy to stockpile; (4) it is possible to recycle nuclear fuels, thus they can be a domestic energy resource which will increase the nation's self-reliance of energy supply and; (5) nuclear power does not produce CO_2 when generating electricity (2003).

Another safety inspection after the Chuetsu offshore earthquake in 2007 decreased the level of EAF (RIST 2008, 2011). However, it soon began to rise again after 2008, when Japan led another G8 Summit in Toyako (Japan) where the G8 leaders declared (MOFA 2008) that: "A growing number of countries have expressed their interests in nuclear power programs as a means to addressing climate change and energy security concerns. These countries regard nuclear power as an essential instrument in reducing dependence on fossil fuels and hence greenhouse gas emissions" (G8 Leaders, 8th July 2008).

In June 2010, METI (2010) released its last energy policy before Fukushima and reiterated the importance of nuclear power as a measure to achieve all their energy objectives, most importantly energy security, economic efficiency, and environmental conservation. In the plan, entitled "Strategic Energy Plan of Japan", the

[29] The Japanese government passed a law called "Basic Act on Energy Policy" in 2002 and declared that the government (ANCRE in METI) should construct and publish a basic plan on the national energy which should be revised in a regular basis (at least within every three years). Accordingly, the first "Basic Energy Policy" came out in 2003, revised in 2007, and further revised in 2010.

government aimed to increase nuclear power which accounted for about 30% in 2010 to 53% of total electricity production by 2030 - from 10% to 24% in the share of the nation's PES - and announced that "the government itself will continue taking the lead in the further development of nuclear energy" (METI 2010). The construction plan for another 14 NPPs was proposed, and the nation also aimed to increase the EAF by 90% by 2030 in order to reduce the CO_2 emissions by 80% by 2050 (METI 2010; The Cabinet Office 2011). Also, the same year in 2010, METI proposed to expand the time span for routine inspections from every 13 months to 18 months and to pay higher amount of subsidies to the nuclear hosting communities with higher EAF (METI 2010; Nikkei Newspaper 2010).

Figure 4.20 illustrates the centralized power of METI as a governmental regulatory entity over the energy sector of Japan at the point of 2010. Although there were additional units organized in the Cabinet to ensure the safety installations and operations of NPPs, NISA was the practical authority of regulation over the power sector after its formation in 2001 until Fukushima (CAS 2013).

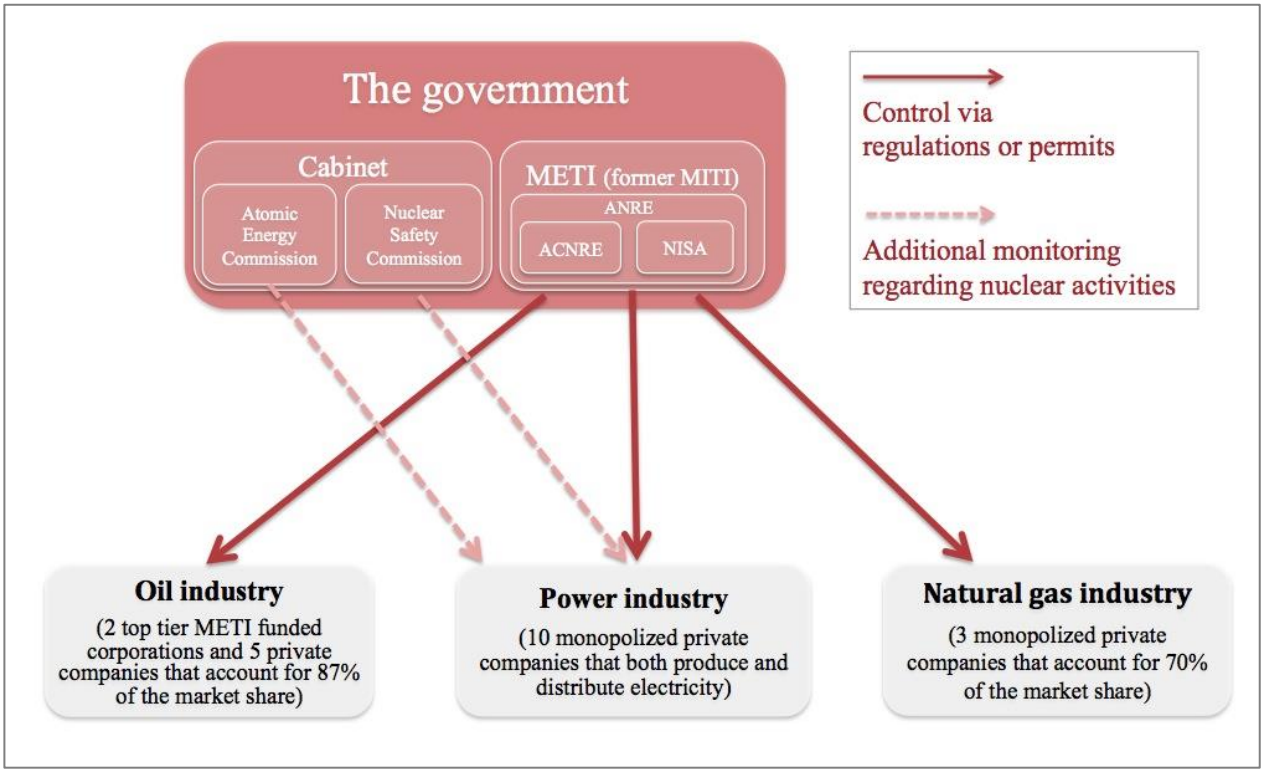

Figure 4.20. The regulatory framework of the energy industries in 2010
Data from CAS (2013), METI (2013), and JX Nippon Oil & Energy (2014c)

4.4 Post Fukushima (2011-)

The Great East Japan Earthquake and the following tsunami on 11th March 2011 caused the meltdowns in the cores of 3 reactors of the Fukushima Daiichi nuclear power plants. After the disaster, the Japanese government gradually ceased the operations of its 50 existing NPPs for safety inspections, which resulted in a serious shortage of electricity. Rolling blackouts were introduced as a mitigation measure that intentionally cut

off the supply of electricity to households and companies by regions for a certain period of time. This severely disrupted the national economy and society by decreasing the IIP and consumer spending which recorded their biggest drops in history on March 2014 -15% and 9% respectively (Shimodoi and Hidaka 2011; Tabuchi and Wassener 2011).

The public and the media started to oppose the government, the power sector, and nuclear industries for making the country nuclear dependent and for causing the disaster. The problem of the highly bureaucratic and non-transparent nature of the nation's energy policy-making, controlled by those with political and economic power, most notably METI, finally came to the knowledge of the public (Tanaka 2011; ISEP 2013). The sudden confusion concerning the nation's energy future caused by Fukushima resulted in a new energy policy released by the government in 2014, which is ambiguous in many ways including the country's future energy mix target and the role nuclear power will play.

This section describes the vital energy systems of Japan that increased the reliance on external energy resources after Fukushima, and explains the subsequently rising risks of energy dependence. It then demonstrates how the people in political and economic power securitizes this dependence as threats to the nation's continual growth of economy and industrial competitiveness, who argue that the resumption of nuclear power in Japan is critical for the nation's energy future.

4.4.1 Vital energy systems and their vulnerabilities: further reliance on fossil fuels

Since each of the imported fossil fuels serves a critical function in the different energy systems of Japan, such as oil for transportation, natural gas for heating and cooking, and coal for iron and steel production (See section 4.3.1 for details), the nation had aimed to reduce the dependence on those fuels after the 1970s by substituting them with nuclear power for electricity generation. In 2010, METI released a revised energy policy, named "Strategic Energy Plan of Japan", that planned to increase nuclear power to generate 53% of the total electricity supply by 2030 in order to increase its share in the nation's PES from 10% to 24% (METI 2010). In the document, the government claimed that the further development of nuclear power would contribute to reducing the consumption of imported oil, natural gas, coal by 85%, 52%, 57% respectively for power generation, compared to the level of 2007 (METI 2010). Raising the reliance on nuclear energy, which was considered as a quasi-domestic energy, to supply the majority of power generation was the key to securing the national vital energy systems as a whole.

However, after Fukushima, an increased amount of imported energy resources, particularly oil and natural gas, had to be consumed for electricity generation in order to substitute the sudden loss of nuclear power that decreased its share in the electricity mix from 29% in 2010 to 2% in 2012 (See Figure 4.21). In particular, oil had been continuously reduced from 74% in 1973 to 8% in 2010 in the electricity mix despite the increasing demand of electricity. However, it rebounded to 18% in 2012 (EDMC 2014; ANRE 2013a). This increase of oil in the electricity mix goes against the past energy strategy of Japan that was taken from 1973. The nation became dependent on the Middle Eastern oil once again by more than 85% since 2000 due to the decreasing amount of oil imported from China and Indonesia (ANRE 2013a). In addition, the rapidly increasing

consumption of natural gas as a substitute for nuclear power became another concern since it also increased the dependence on the Middle East by 30% by the end of 2013 (ANRE 2013a).

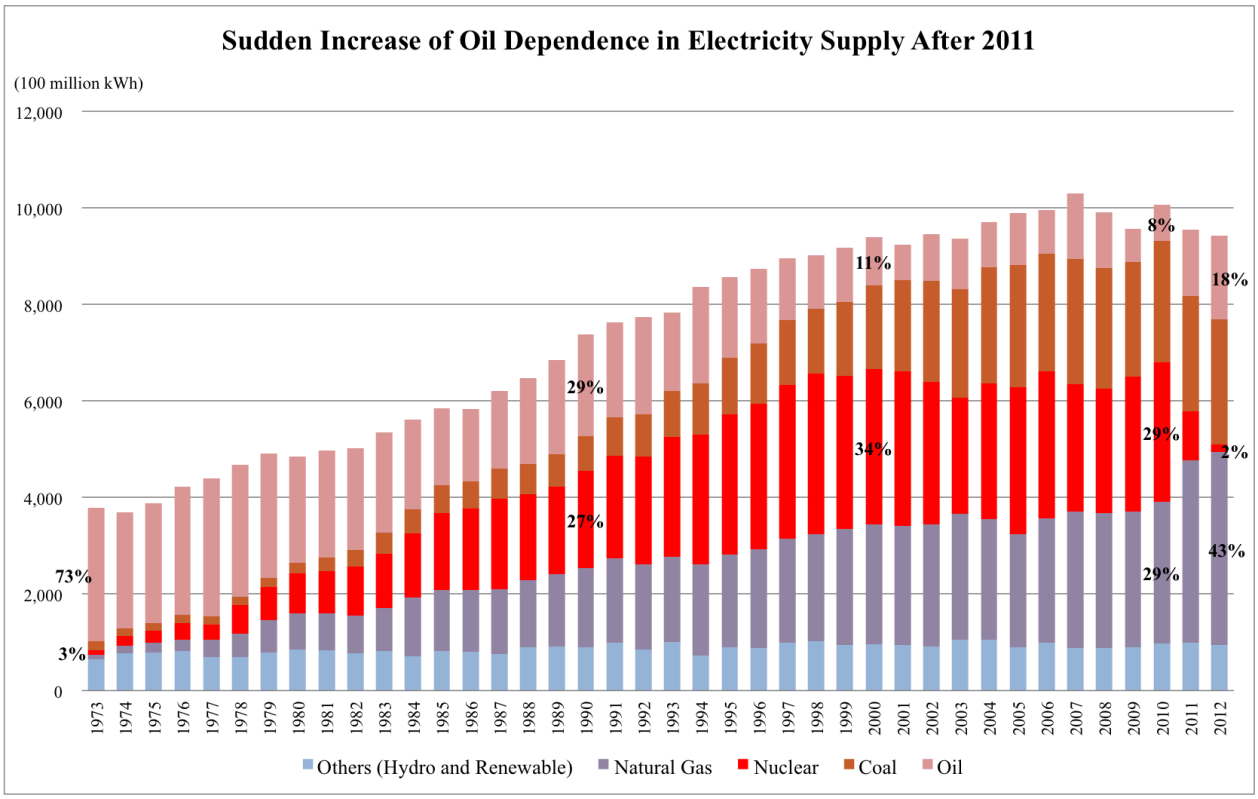

Figure 4.21. Electricity mix of Japan, sudden increase of oil and natural gas
Data from MITI (2013), re-calculated by the author.

4.4.2 Energy security threats: increasing energy price and capital loss

With the loss of nuclear generated power since Fukushima, which accounted for 11% of the nation's PES in 2010 (EDMC 2014), Japanese energy systems have been predominantly fueled once again by imported fossil fuels. Nuclear energy finally fell to 0 as a percentage of the energy mix when the last NPP in operation was shut down in May 2012 for safety inspection. For the first time in 42 years, there was no nuclear power fueling the nation's energy systems[30]. As a result, the self-reliance ratio of energy declined from 20%[31] to 4% (ANRE 2013a). This can be observed in the decrease in the DI level of the nation's electricity mix to those comparable to the early 1980's (See Figure 4.22). This decrease in the DI also negatively affected that of Japan's PES (See Figure 4.23).

[30] Two NPPs in Fukui Prefecture resumed their operations in July 2012, however ceased once again for safety inspection in September 2013.
[31] This includes nuclear power, as Japan considered it as quasi-domestic resource since the fuels can be recycled and reused after importing its raw material, uranium.

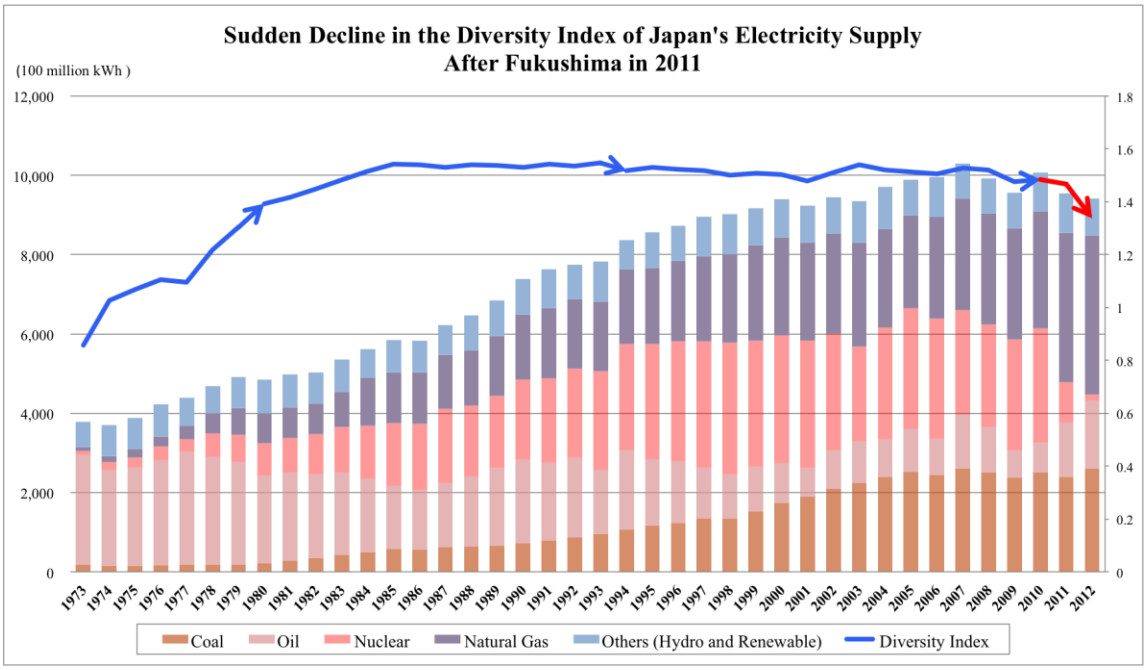

Figure 4.22. Decline in diversity index of Japan's electricity system
Data from ANRE (2013a), calculated based on the Shannon-Weiner diversity index by the author.

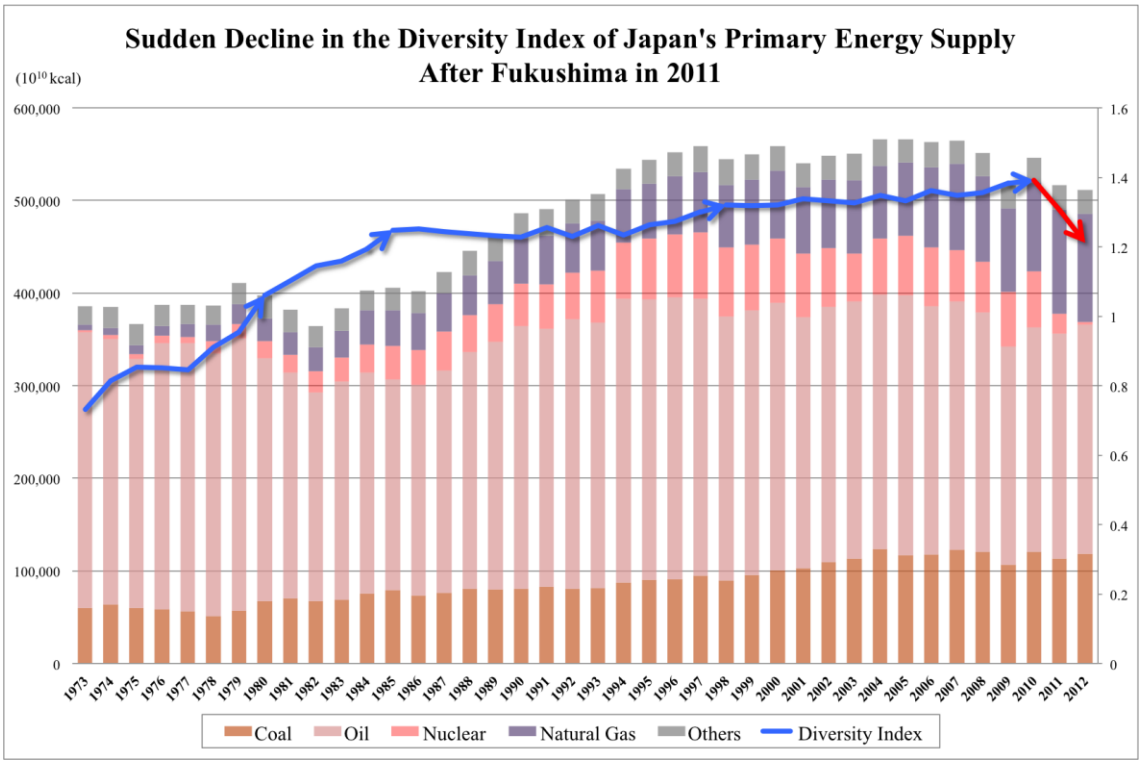

Figure 4.23. Decline in diversity index of Japan's PES
Data from ANRE (2013a), calculated based on the Shannon-Weiner diversity index by the author.

Japan supplemented the loss of nuclear power by oil and natural gas power, which collectively increased their share of electricity production by 24% from 2010 to 2012. In 2013, Japan depended on the Middle East for

83% of its oil supply and 30% of its natural gas (ANRE 2013a). According to ANRE (2014a), approximately 80% of the total oil supply goes through the Strait of Hormuz, and 65% of total natural gas supply passes through either or both the Strait of Hormuz and the Strait of Malacca today. These straits have been considered internationally as choke points that could impede the supply of energy resources due to the geopolitical instability in the regions (Tanaka 2012). Therefore, the increasing shares of oil and natural gas imports that pass through these choke points bring higher risks of disruption to Japan's energy security. Figure 4.24 shows the high disruption risk that is associated with the Strait of Hormuz for the oil importation of East Asian countries including Japan in the last four decades (METI 2010).

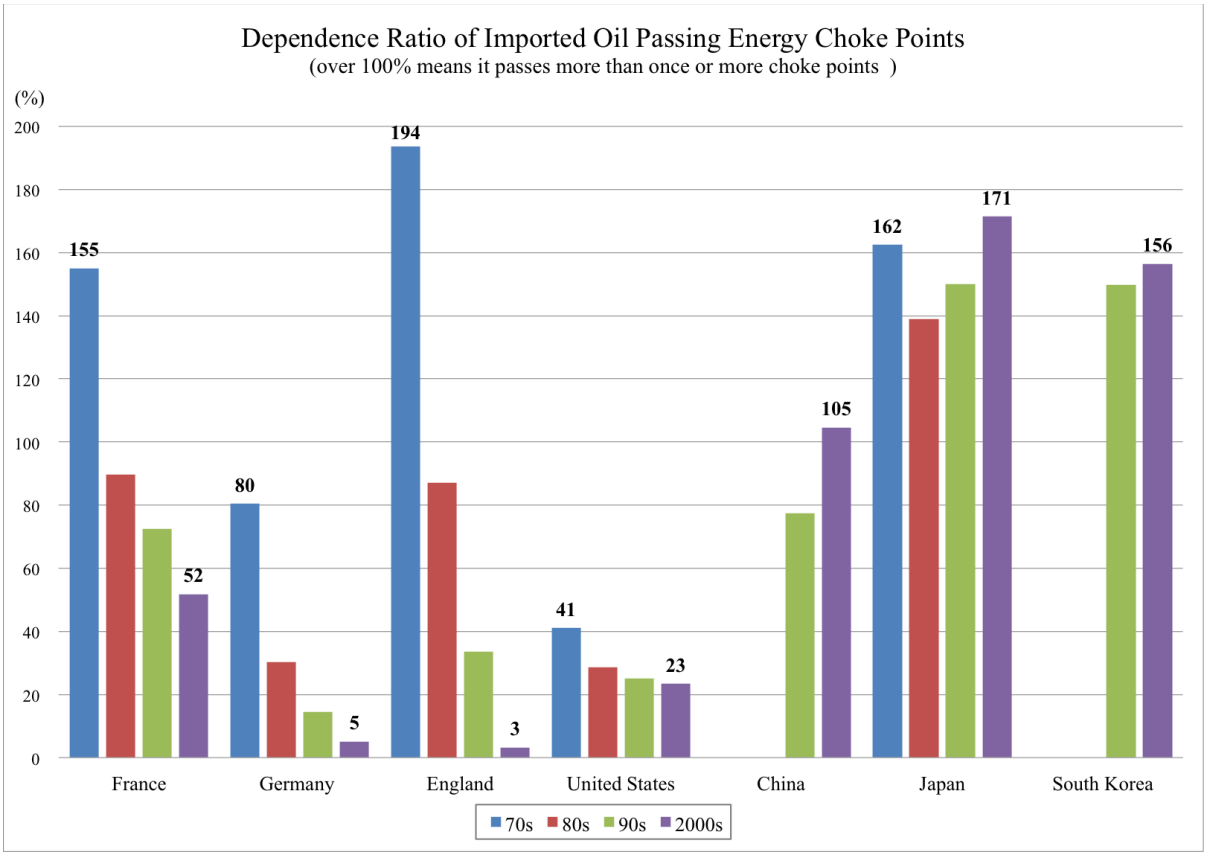

Figure 4.24. Dependence ratio of imported oil passing the energy choke points
Original figure from METI (2010), translated by the author.

In addition, both the prices of imported oil and natural gas have been rising almost constantly since 1998, as seen in Figure 4.25 (the sudden decline in 2008 was triggered by the world financial crisis); thus, this increased consumption of the imported resources to substitute nuclear power has not only weakened Japan's energy security but also increased the price of electricity by 13% between 2010 and 2012, from 16.70 JPY/kwh to 18.85 JPY/kwh (EDMC 2014).

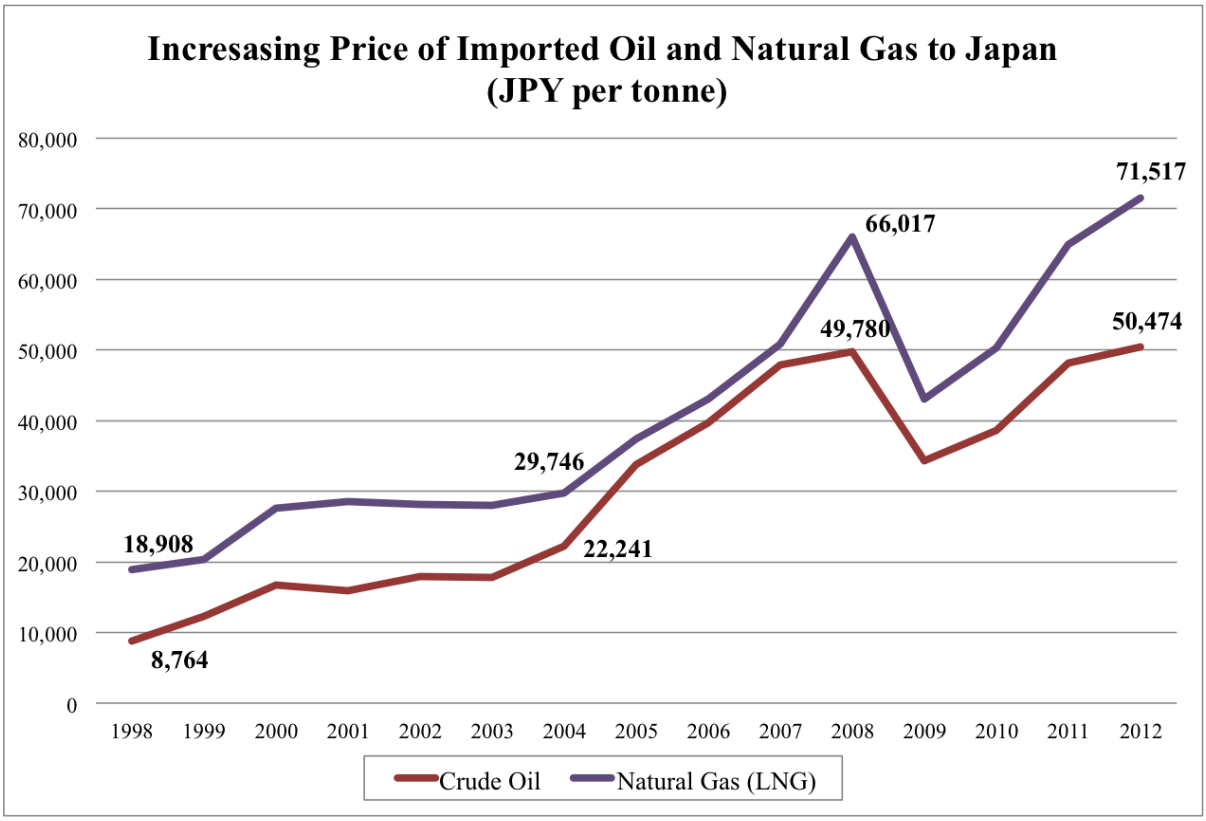

Figure 4.25. The imported price of crude oil and natural gas
Data from EDMC (2014), compiled and re-calculated by the author.[32]

This increasing amount of imported oil and natural gas has also contributed to an immense loss of national capital. In 2011, for the first time in 31 years after the oil crises, Japan recorded a trade deficit of approximately 2.6 trillion JPY (equivalent to 33 billion USD) [33] partially due to the increasing demand of the imported fossil fuels. The amount of trade deficit further increased to 7 trillion JPY (85 billion USD)[34] in 2012 and 11 trillion JPY (116 billion USD) [35] in 2013 (MOF 2014).

4.4.3 Energy system governance: stubbornness of nuclear village

After Fukushima, as the government and Mitsubishi Research Institute suggested, the nation's energy policy-making was suddenly opened to the general public in contrast to the prior way which had been conducted behind closed doors within the government since the pre-war period (NPU 2012; MRI 2012). The Democratic Party of Japan (DPJ), which was the political party in power during and immediately after the disaster, released a national energy policy in 2012 entitled "Innovative Strategy for Energy and the Environment" (NPU 2012). In the document, the DPJ first argued that

[32] The amount of crude oil was converted from barrel to tonne by dividing by 1.176. (the conversion ratio was obtained from Petroleum Association of Japan 2014)
[33] Conversion ratio 1USD= 78.84 JPY (the yearly-average Telegraphic Transfer Selling 'TTS' rate)
[34] Conversion ratio 1USD = 80.82 JPY (the yearly-average TTS in 2012)
[35] Conversion ratio 1USD = 98.65 JPY (the yearly-average TTS in 2013)

> The nation's new energy strategy should not be 'a strategy that is constructed by a handful of people.' It has to be the one that is formulated through 'the discussion among all citizens' while the government and the general public listen to every stakeholder's opinion, concern, and desire, and understand sincerely that there are various arguments among us. (NPU 2012)[36]

The DPJ highlighted that the nation's energy policy-making had been a relatively unknown area where only a limited number of politically and economically influential actors were involved (NPU 2012). With an aim to change that, the DPJ conducted surveys and held forums to gather public opinion regarding the nation's future nuclear policy and constructed what they called the "Green Energy Revolution." It aimed the complete phase out of nuclear power by 2040, claiming that it was the demand of the general public and planned to replace it with renewable energy (NPU 2012). The plan barely referred to any other energy systems except the electricity system, and hardly described any concrete nor feasible measures for achieving the zero nuclear power future, which was fiercely criticized, particularly from politicians of other political parties and industries (NPU 2012; METI 2010; Keidanren 2013).

Three months after the DPJ released its energy policy, the LDP took over the political power by winning the lower house election in December 2012 and disregarded the DPJ policy by saying "we need to construct a energy policy in a responsible manner" (METI 2014a). In July 2013, the LDP also won the upper house election and regained its political power both in the upper and lower houses for the first time since 2007 (RIETI 2013).

On 11th April 2014, three years and a month after Fukushima, the LDP leading government published a new energy policy, and aimed to restart NPPs after meeting the safety requirements that were described by METI as more stringent than ever (METI 2014a). This policy reiterates Japan's poor endowment with fossil fuels and the almost 100% dependence on energy imports, which was claimed as the root cause of the vulnerabilities of the nation's energy security. It also refers to the recent trade deficit of the nation and accused the increasing dependence on the imported fossil fuels after the termination of NPPs as its root cause (METI 2014a).[37] The government argued that the increasing fuel costs due to the loss of nuclear power have weakened Japanese energy security and economy, and these costs are responsible for the national capital loss of approximately 3.6 trillion JPY (equivalent to 37 billion USD) in 2013 (METI 2014a)[38]. Recovery from the national recession since the world financial crisis in 2008 was mentioned, and the policy emphasized that a stable and low cost energy was essential to keep improving the economic condition. The dependence ratio on imported fossil fuels was stressed as higher than the level of 1973, which was also marked as the cause for the

[36] Kono aratana enerugii senryaku ha "hitonigiri no hitobito de tsukuru senryaku" deha nai. Naniyori mo mazu, seifu to kokuminga, hitori hitori no iken, fuan, negaini kyoshin ni mimi wo katamukeai, samazama na shuchou wo fukaku rikaishiaukoto de sakutei sareru, "kokumintekigiron de tsukuru senryaku' de nakereba naranai.

[37] Genshiryoku hatsudensho ga teishishita kekka, shinsaimae to kurabete, kasekinenryou no yunyuu ga zouka surukoto nadoni yori nihon no boueki shuushi ha akajihaba wo kakudai shitekiteiru.

[38] Conversion ratio 1USD = 98.65 JPY (the yearly-average TTS in 2013)

increasing energy costs and the growing CO_2 emissions.[39] The document also states that the higher energy price of Japan compared to the United States negatively affects the international competitiveness of Japanese companies. After reiterating that the increasing dependence on oil and natural gas importation weakened the nation's energy security, the policy explains that the world's highest safety regulations have been enforced after Fukushima, and describes the role of nuclear power as one of Japan's most important energy sources (METI 2014a).

NISA, the main governmental regulatory body of nuclear activities organized under the jurisdiction of METI, was questioned about its effectiveness by the public since METI was also in the position for promoting the development of nuclear power in addition to regulating it (CAS 2013). Therefore, the government moved the function from METI to the Ministry of the Environment (ENV), and reorganized the Nuclear Regulation Authority (NRA). In addition, the Nuclear Safety Commission, which previously belonged to the Cabinet, was abolished and the function was moved to the NRA as well with an aim to integrate the distributed and parallel regulatory authorities of nuclear activities into one entity in order to strengthen the security framework of NPPs operations (CAS 2013). Figure 4.26 presents the current energy governance with a focus on the power sector and nuclear activities.

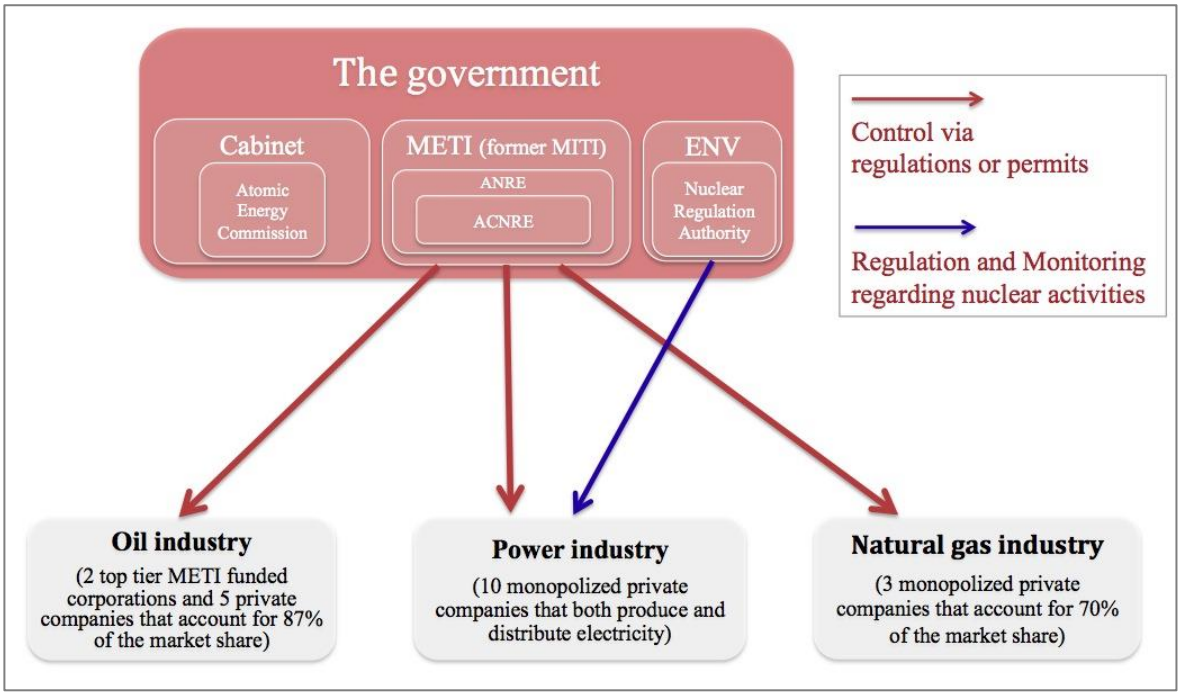

Figure 4.26. The governmental control over the energy industries as of May 2014
Data from *CAS (2013), ANRE (2014), JX Nippon Oil (2014c), METI (2012b)*

The opposition against nuclear power among the public is no longer limited to the hosting communities of NPPs. An increasing number of people have begun to participate in energy debates across the nation, and this

[39] Japan opted out from Kyoto Protocol regime in 2012 and abandoned its previous CO2 reduction target. Additionally the government and declared in COP 19 in Warsaw that the nation now aims for a 3% increase by 2020 as compared to 1990 levels.

growing interest among the public in the national energy politics are reflected in the fact that eleven out of the thirteen political parties in Japan currently emphasize the complete phase-out of nuclear in the coming decades as one of their important policy targets (LDP 2013; JRP 2013; DPJ 2013; New Komeito 2013; Your Party 2013; JCP 2013; Yuinotoh 2014; Seikatsu 2013; SDP 2013; Shinto Daichi 2012; NRP 2014; Itokazu 2014). Even with the Tokyo gubernatorial election, held in February 2014, focus was given to a candidate's stance in the potential nuclear phase-out policy, although there are no nuclear facilities in the area (Guardian 2014; Toyo Keizai 2014). Martin (2014) points out that this governor's race, which focused on the candidates' view on nuclear power, was further reinforced when Junichiro Koizumi, the former Prime minister of Japan, publicly argued "This is a (political) battle between the group that says Japan can develop without nuclear power, and the group that says it is necessary for growth" (Asahi Shimbun 2014c, 2014d).

A number of articles from freelance journalists and weekly magazines have exposed the collusive relationship among Japanese politicians, bureaucrats, and the power sector (Noguchi 2012; Asahi Shimbun 2014a, 2014b) and have criticized the monopolized and over-protected market of the power industry in addition to Ooshika (2011). However, most of well-known Japanese mass media including newspapers and TVs except Asahi Shimbun in its English version, have not engaged in this raising opposition against nuclear power among the public (Takahara 2011; Kodera 2014). This may be because of the fact that they have a strong financial relationship with the power sector, and that the government traditionally and still powerfully restricts and censors the national media, as argued by Takahara (2011), Kodera (2014), and Nanasawa (2008).

As a response to the increasing opposition among the public, ANRE published a policy document in 2013, entitled "A Basic Policy for the Reform of Electricity System", and aimed to liberalize the market by abolishing the regulations on market entry and on electricity price and separating the roles of electricity generation, transmission, and distribution by 2020 (ANRE 2013b; METI 2014b). In order to accomplish these aims, ANRE argues "In order to make absolutely sure that the electricity supply will be secured at any time, it is essential to further strengthen the monitoring system of the power industry by establishing a new regulatory entity within the government" (2013b).[40] Therefore, it is very likely that the energy governance over the power sector continue to be conducted by the very powerful central government, which has maintained and further strengthened its power since the late 1930s.

This chapter explored the historical development of Japan's energy politics with a focus on the three key factors that dominantly affect Japan's energy policy: "Vital energy systems and their vulnerabilities", "Energy security threats", and "Energy system governance". It described how these factors co-evolved since the late 1930s in order to mitigate the national energy challenges that were often perceived as crises. Next chapter revisits this history and analyses how it contributed to the current adherence of Japan's energy politics to nuclear power. It then seeks for the signs of a potential paradigm shift in energy policy-making and addresses the implications for the future nuclear policy of Japan.

[40] Kinkyuu ji oyobi heiji ni okeru antei kyoukyuu kakuho tou ni banzen wo kisu tame, gyousei soshiki no arikata wo minaoshi, ninengo wo medoni, dokuritsusei to koudo na senmonsei wo yuusuru aratana kiseisoshiki heto ikousuru.

5. Discussion

This chapter discusses the findings and presents answers to the research questions of this thesis. The main question is "Why does Japan's energy policy adhere to nuclear power even after Fukushima?" There are three sub-questions developed to gain a better understanding of Japan's energy policy-making in order to find an answer for the main question, which will be reviewed in the following sections.

5.1 The development of vital energy systems and the concept of energy

This section explores the development of Japanese energy systems and of the concept of energy in the last nine decades in order to answer the first sub-question of the thesis: "How has Japan's energy system developed in the last nine decades, in response to the national energy security challenges?"

There is a persistent ideology in Japan that makes its society clannish and insular (Hall 1997; Pyle 2008; Itoh 1996). This ideology of independence from foreign influences and of protectionism over *the purity* of the race has been observed by scholars in Japanese policies on labour, immigration, education, diplomacy, and economy (Itoh 1996; Hall 1997; Pyle 2008; Chung 2010). Japan is an island country, naturally isolated from foreign nations. The nation also exclusively limited international trade or any interaction with foreigners, and *closed* the country for more than two hundred years since the early 17th century (Itoh 1996). This isolation policy was broken when the United States paid a surprise visit with military ships and forced the nation to open in 1886, aiming to incorporate Japan in the western trade market (Itoh 1996). The fear of potential colonization and dependence on outsiders grew among people, and the nation decided that it was utmost political priority to rapidly industrialize and militarize the country to protect its sovereignty.

In the early 20th century, this fear of losing sovereignty had grown to the point that the nation was wholly united not only by law but also by mentality for total war. The function of the military became vital to the continuation of the society, thus the military-led government considered oil as a lifeline of national security and went after external oil reserves. When international economic sanctions were introduced against Japan in the 1930s and oil embargos in 1941, the nation plunged into war with a very limited amount of stockpiled oil for a fight that eventually lasted three years and eight months. The war took a heavy toll on Japan as people gradually lost access to daily necessities including lights and food. This historical memory of being dependent on an external energy resource that is critical to the nation's continuity, and the looming possibility of being suddenly cut off from those supply routes, strengthened the sense that a stable supply of energy is directly linked to national security and their survival. At the same time, energy and natural resources became a constant reminder of the national dependence on outsiders.

In the post war era, oil became a dominant supplier of energy once again to revitalize the devastated economy and society after the war. The economy grew at a speed that was praised as a miracle and the GDP increased by almost 10% every year between 1946 and 1973. This rapidly growing economy also required massive increases in the energy supply. Japan consumed 480 times more oil in 1973 compared to 1946, in order to supply the increasing energy demand of industries, transportation, and household. This economic growth was

suddenly interrupted when the suppliers once again intentionally disrupted the oil supply. This hostile action of energy suppliers reminded the nation of the historic tragedy when the limited and restricted supply of energy threatened the state's sovereignty and the daily lives of the citizens. During this era, the stable supply of energy was linked to the national economic growth and the stability of society. In order to mitigate the risks of potential disruptions deriving from the immense dependence on external energy resources, the nation initiated the development of nuclear power hoping that it would bring potential energy independence, which the nation strongly desired. Already in the 1950s, nuclear energy was associated with the most advanced science and technology, which the nation considered as a means to re-develop its national pride as a leading state in modern science.

Since the oil crises in the 1970s, the nation pursued the diversification of energy in order to prevent potential disruptions of energy supply from threatening the critical functions of the nation's continuing economic growth. This also revealed that the contemporary energy systems were no longer supplied by a single energy resource, but rather fueled by different energy resources. For example, oil has been vital to the transportation sector, natural gas has been essential to industries and to households for cooking and heating, and coal has been important for iron and steel production. Since these imported fossil fuels have been so essential and seemingly irreplaceable for the given sectors, Japan sought to reduce their use in electricity generation by deploying nuclear energy.

The growing energy demand accompanying Japan's economic development can be particularly observed in the electricity demand that increased by 266% between 1973 and 2010. Accordingly, the import dependence of oil, natural gas, and coal exceeded more than 95% in 1995 and onwards. Japan perceived the continuously fluctuating and increasing prices of energy resources, further pressured by the inevitable depletion of the resources and the growing demand of the ex-suppliers now competing in the market, as a threat to the Japanese economy's international competitiveness. The linkage between the continual growth of the economy and the presence of a stable energy supply has been firmly asserted, and the nuclear elites who emerged in national politics and economics in the 1960s politicized nuclear power as a savior to stabilize and to decrease the price of energy in order to bolster the industrial competitiveness in the era of globalization.

Then, suddenly, the hope for nuclear power that was attributed to Japan's national security, pride, and economic prosperity was extinguished by Fukushima. Compared to the oil crises in the 1970s when the price of energy spiked yet remained available, this disaster impacted and frightened the industries and the citizens, as Japan lost about 30% of its supply of electricity. This shock was so severe that it literally flipped the coin and suddenly nuclear power was seen as Japan's national insecurity, shame, and economic burden among an increasing number of the general public. This sudden anger against nuclear power led the discussion on Japan's future energy to be fixated on the complete phase-out of nuclear power, claiming that it was neither good for the economy nor for the environment. However, Japan's energy systems have been built with imported fossil fuels and nuclear power since the post war era, thus the immediate phase out of nuclear means that the nation would be again completely dependent on external suppliers. The risk of this immense dependence and its potential harm to the economy was already recognized by the government, which

highlighted the immediate increase of electricity prices and the mounting trade deficit after shutting down all NPPs in May 2012.

An increasing number of people started to view renewable energy as a potential substitute for nuclear power. However, as of 2013 it only accounts for 1% of the share of electricity production, and as learned from the oil crises, the transitions of energy systems require decades to accomplish. Furthermore, the linkage between energy and the environment is not yet firmly established. It suddenly became a part of the energy policy in the 1990s. However, the initial purpose was to legitimize continuing investment in nuclear power, and did not make any solid connection with a transition into a renewable-based low carbon society. Instead, new coal and natural gas fired plants were constructed and the CO_2 emissions steadily increased even before Fukushima (See Table 5.1).

Table 5.1. CO_2 Emissions from the Power Sector Between 1990 and 2012

Year	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008	2010	2012
Electricity Production (1 billion kwh)	738	774	836	873	902	937	945	971	996	992	1,006	941
CO2 emissions (1 Mt CO)	290	299	319	309	292	321	341	353	362	387	373	478

Data from METI (2014a) and NIES (2014), compiled by the author.

5.2 The centralized political and economic power

This section addresses the second thesis sub-question: "What drove (and still drives) Japan to invest in nuclear power?" It also presents the historical transition of Japan's energy politics, which became a field of a limited number of people in political and economic power deciding everything, who frequently securitized energy policy as national security and energy security issues in order to maintain and further strengthen their positions in the national energy politics.

For the purpose of continuing the war by maximizing the allocation of existing limited material and human resources to the military, almost everything became under the control of the central government when it passed the National Mobilization Law during WWII. This law legitimized the centralization of political and economic power to the Japanese government in the name of defending national sovereignty. The central government, in particular the Ministry of Munitions, was granted every right and power to control the mobilization of all available resources including capital, war related materials, and labor. The government also integrated a number of energy business entities into only a few organizations so that it could control them better. This was the first creation of Japanese over-centralized politics with an extreme power in bureaucracy and the monopolized energy economy ruled by a limited number of actors. National politics including energy politics became a field where a handful of people in political and economic power could decide anything without public voting. In this era, this was done within the Ministry of Munitions that was controlling 64% of all economic activities and 79% of the national budget in 1944.

This over centralized power in the Ministry of Munitions and the industrial monopolies in the energy sector remained after the post war era, which was deeply influenced by the US political decision to rapidly re-build Japan as an ally against communism rather than democratizing the nation's politics and economy. The Ministry of Munitions was reorganized to MITI, yet it kept the regulating power over the small number of energy companies which were privatized but allowed for monopoly.

Since the oil crises in the 1970s, MITI further strengthened its power to control the energy politics of Japan. This can be observed by a series of regulatory frameworks created against the energy industries including the oil, gas, and power sectors. At the same time, MITI pursued the further development of nuclear power, using political rhetoric such as "to secure a stable supply of energy for sustainable growth" in the 1970s and the 1980s. Additionally, since 1990, the government started to securitize nuclear power as a measure to decarbonize energy systems while maintaining economic growth. Accordingly, an increasing amount of annual subsidies were provided for nuclear power development, with a 613% increase in 2010 compared to 1974 when the energy tax was first introduced, in order to construct more NPPs, to raise their output, and to gain more public support for nuclear power. In total, the power sector, nuclear related industries, and NPP hosting communities collectively received 13.6 trillion JPY (137.8 billion USD) between 1974 and 2010.

Figure 5.1 shows the timescale for the construction of NPPs, their collective capacity, and the amount of subsidies provided by the Japanese government. The construction and the capacity growth of NPPs had peaked after the oil crises in the 1970s and 1980s, and were not affected by the Chernobyl disaster in 1986. The Japanese nuclear elites, including MITI, the mass media, and the power sector, emphasized that Japanese NPPs are far more resilient and safe regarding the structure of the plants, in addition to the operational and managerial excellence of the Japanese experts inside, thus asserting that nothing like Chernobyl could ever happen in Japan (AEC 2008; Nakano 2011). After these periods, the number of new NPPs constructed decreased rather significantly, although nuclear energy started to be publicized as a mitigation measure against climate change by the government and industry. However, the amount of subsidies continued to increase even in this period and the subsidies provided to the hosting communities exceeded the amount provided for the industries in 1995 and onwards (See Table 4.9). This was a political response to ensure the continual operation and growth of nuclear power when the opposition was increasing due to nuclear related accidents and TEPCO's scandals in the late 1990s and early 2000s. It also echoes METI announcing their plan in 2010 to provide subsidies based on not the capacity of NPPs but on the actual production of electricity generated by them to the hosting communities in order to encourage the NPPs to be constantly operational.

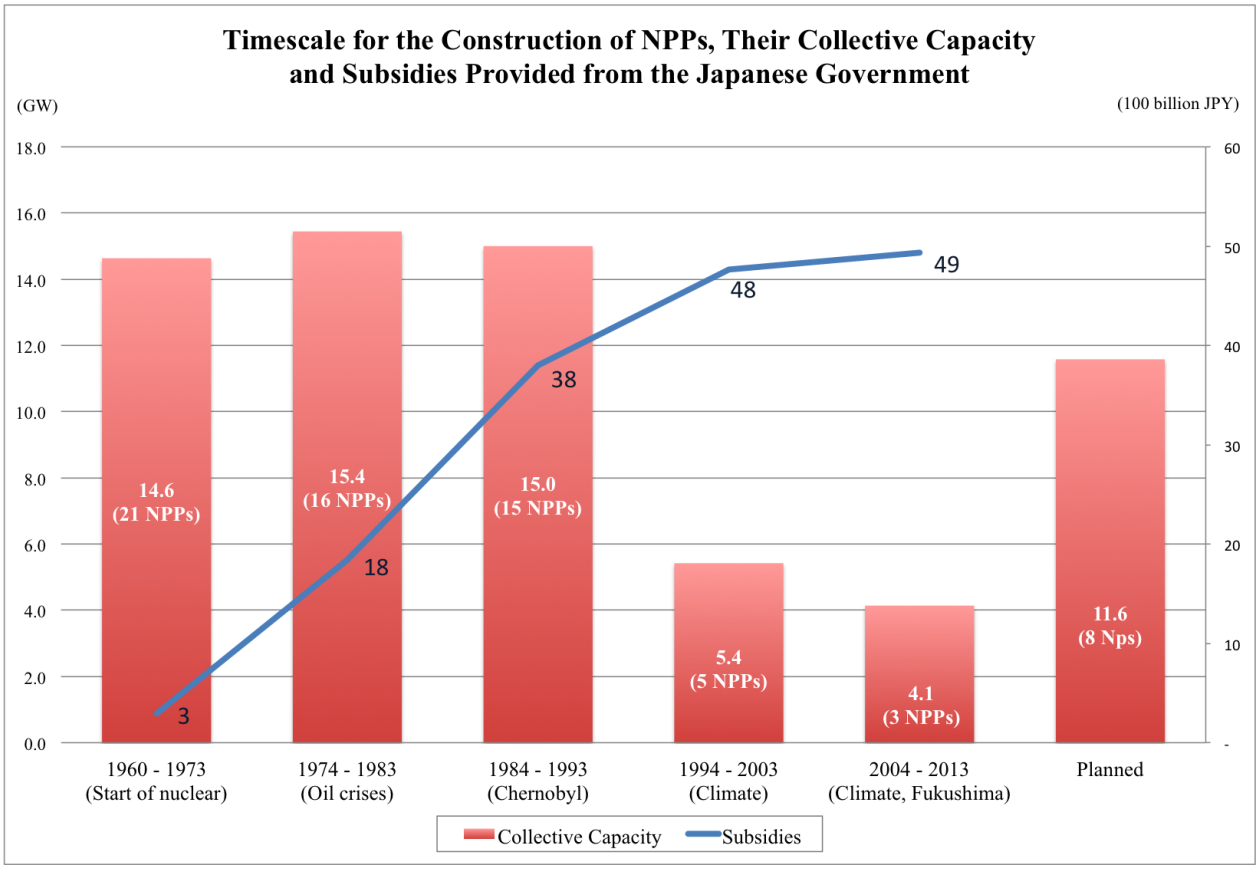

Figure 5.1. Timescale of construction of NPPs, their collective capacity, and subsidies provided
Data from JNES (2012) and RIST (2010), compiled and re-calculated by the author.

The close ties between the government bureaucracy and the nuclear related industries including the power sector can be also observed in the increasing number of former ministry officials who retired from METI and afterwards were welcomed to join the former "client" nuclear related companies and institutions as executive board members (Moe 2012). There is a positive feedback loop among the nuclear elites, both in bureaucracy and business, which sequentially reinforces their influence on the nation's energy politics by securitizing nuclear power as *the* national measure in order to improve energy security. For example, the nuclear elites in the government prioritize nuclear power and provide subsidies for its development. Then the industries construct more NPPs or raise their output, which in turn makes them wealthier and more influential. The influential industries then try to strengthen their relationship with the bureaucracy who later put more money in the industry, which again increases the power of the industries. At the same time, the hosting communities of NPPs joined the circle of nuclear elites and chronologically increased their dependence on NPPs for getting subsidies or securing employments (Nakano 2011). Figure 5.2 shows that NPPs in Japan are located in rural areas and most of the communities accepted more than two NPPs to be constructed to get more subsidies. For example, the Fukushima Prefecture obtained the total of 270 billion JPY in subsidies for its ten nuclear power plants between 1974 and 2009, which was used for building roads and bridges, constructing and maintaining schools, an airport and hospitals or maintaining the sewerage system (Atsunobu 2012; Fackler and Onishi 2011).

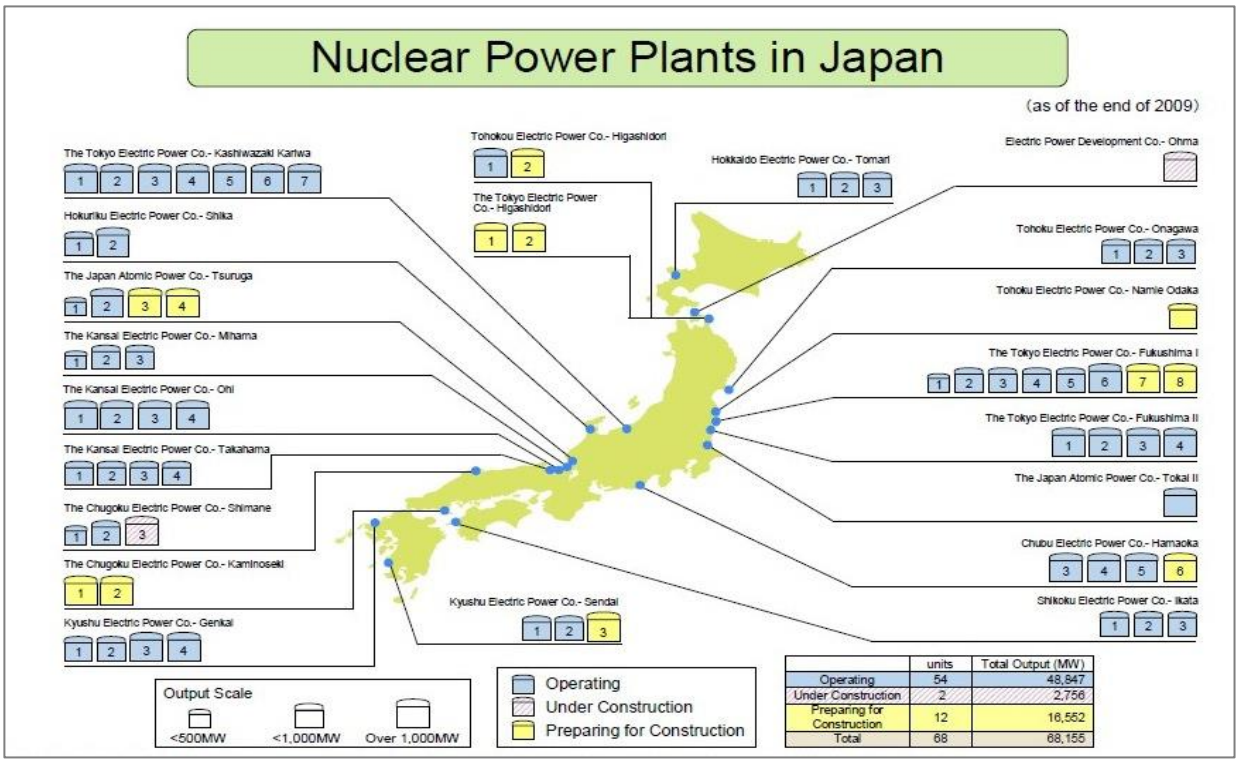

Figure 5.2. Nuclear power plants and their locations in Japan in 2009
Image from Global Nuclear Fuel (2009)

This political and economic dependence on nuclear power also indicates that the co-evolving nature of the three key factors that affect Japan's energy policy-making, (1) Vital energy systems and their vulnerabilities, (2) Energy security threats, and (3) Energy system governance, does not only go in one direction, as illustrated in Figure 3.1. However, it goes in the opposite direction from the perspective of people in power (See Figure 5.3). For example, the vital energy system fueled by nuclear energy gives power to METI and nuclear-related industries as seen in the growing nuclear energy market as well as the increasing nuclear power related subsidies. These people in power develop and utilize ideologies such as "sustainable growth" or "energy independence" to securitize a certain energy threat, such as import dependence, to further encourage the energy system to be more nuclear dependent, which then gives additional power to them.

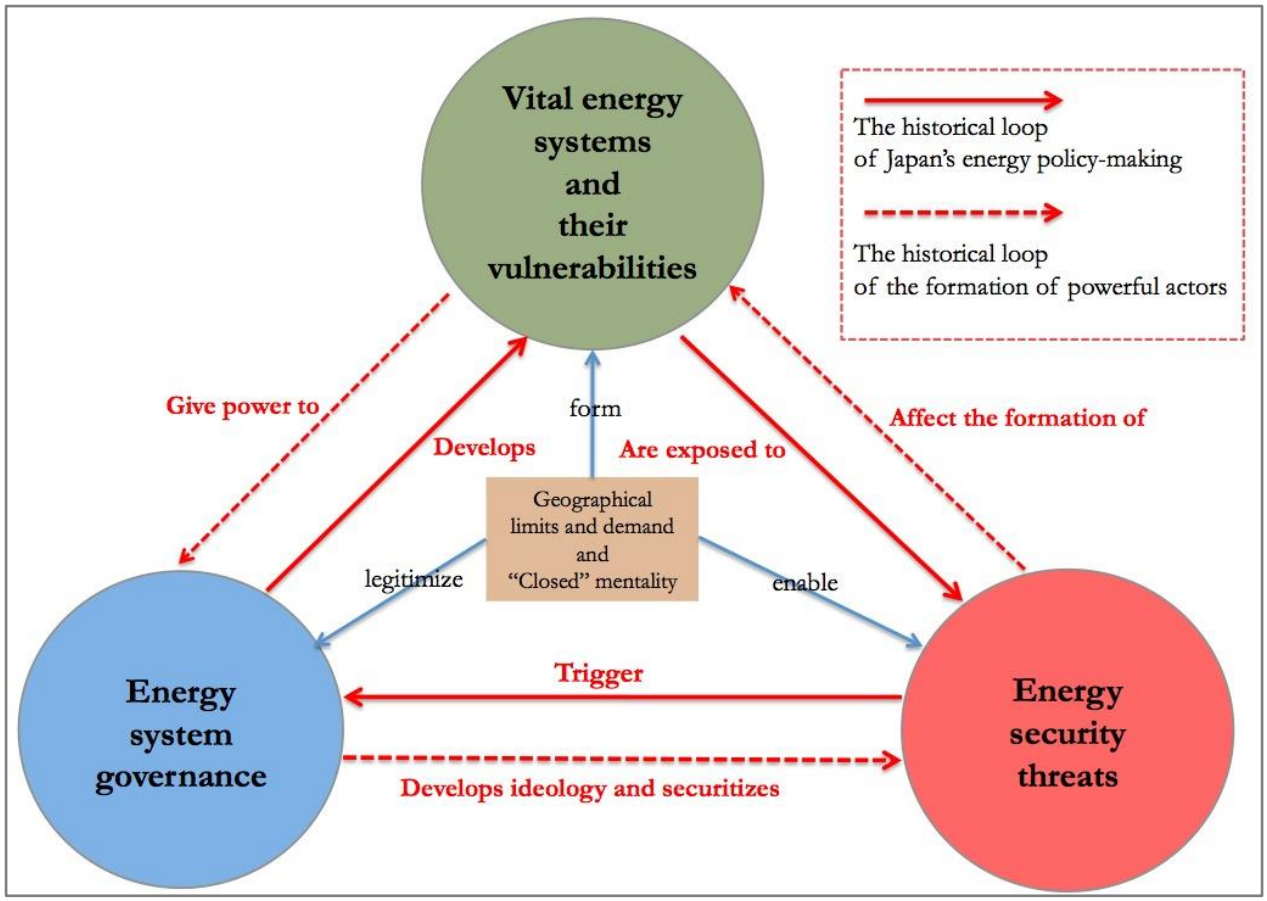

Figure 5.3. Positive feedback loop in Japan's energy politics
Developed by the author.

Therefore, Fukushima must have immensely agitated those people who were protecting each other's interest in the nuclear business by controlling the national energy politics with political power and capital influence. The stubbornness of people with political and economic power to adhere to nuclear power is still active and *very* influential on developing the nation's energy strategy or national politics in general, represented by the complete turn back policy of the LDP with regard to the nation's nuclear policy. The latest energy policy asserts that the trade deficit of 2013 was due to the increasing fuel cost to substitute nuclear power (METI 2014a). However, this is a large exaggeration of numbers since the increase of 3.6 trillion JPY for additional fuel cost only makes up 31% of the total deficit recorded by MOF in 2013, as rightly pointed out by Saito (2014). It might take time and effort to break this chain of autocracy in Japan's energy politics since the political and economic power has been concentrated to a limited number of people since WWII. In addition, the nuclear elites built a firm relationship in the 1950s and 1960s, which was further reinforced by the positive feedback loop after the oil crises between the 1970s and the 2000s.

5.3 The implications of Fukushima to Japan's future energy policy

This section summarizes the previous two sections, and answers the last thesis sub-question of this thesis: "Does Fukushima bring a paradigm shift to Japan's energy policy?"

As discussed in the previous sections, the stable supply of energy has been Japan's utmost political and economic priority since the early 20th century. If in the pre-war era this was particularly related to military fuels, in the post-war era this also related to transportation, industrial energy and electricity. In addition, the economic development and the continuous growth of industrial competitiveness have always been the focus of Japanese politics (Johnson 1982; Moe 2012).

The government regulated the energy market, seeing energy politics and economics as state business, because of their strong association with national security and with the nation's long-term economic development plan. Although the intention of using market mechanisms can be observed, as in the case of opening the oil market in 2001, METI was always the dominant regulatory entity in Japanese energy economics. The national energy policies, including energy mix targets, were developed by ACE (current ANCRE), first organized within MITI (current METI) in 1967, which consisted of less than 30 members who were directly appointed by the Minister of METI. After Fukushima, the DPJ tried to open this closed community to the public. However, the door was once again closed to outside opinion as soon as the LDP came back to political power in 2012. As a result, the latest energy policy was again formulated within ANCRE and came into force by the agreement in the Cabinet by the LDP Ministers in April 2014.

There are no substantial changes yet, according to the framework of Kern *et al.* (2013) [41], which can be observed after Fukushima with regard to a potential paradigm shift of Japan's energy politics. However, a groundbreaking movement has started and an increasing number of political parties and the general public has begun to raise their voice against the current nuclear energy regime, particularly after the DPJ revealed its strong bureaucratic nature with vested interests in national energy policy-making, and tried to make a change. Resistance against nuclear power was seen in the NPPs' hosting communities in the past, however it never became a political subject as a major focus for national election or even the Tokyo gubernatorial election. Accordingly, freelance journalists and magazines have begun to reveal the unhealthy nature of the interlocking relationship between the government, METI, and nuclear related industries one after another, although the majority of Japan's national mass media still keep their mouth shut, perhaps because of the pressure from the nuclear industries and the government (Nanasawa 2008; Takahara 2011; Kodera 2014).

Nonetheless, the power of the nuclear regime is very resistant. The latest energy policy, released in April 2014, was constructed again within the closed community of METI. Although the policy now claims to prioritize "safety" for national energy policy (METI 2014a), and the government accordingly moved the regulatory power over nuclear activities to the jurisdiction of ENV from METI, this may only be a political gesture in order to legitimize the resumption of currently non-operating NPPs. Indeed, nuclear power is still described as an "important base load power source of the nation" in the latest policy "in order to strengthen the national energy security with the minimized economic burdens" (METI 2014a). Even though the policy does state that "Japan will aim to reduce the dependence on nuclear power," there are no concrete numbers in the policy to show a commitment to dependence reduction or the deadline for it (METI 2014a). In the policy, it is

[41] They argue that a paradigm shift in energy policy can be observed if substantial changes are observed in the following four areas of energy politics; (1) interpretation of energy and how it should be governed (e.g. market oriented or government led); (2) policy goals; (3) policy instruments; and (4) governance institutions.

even implied that the nation may construct new NPPs depending on the "appropriate proportion of electricity that nuclear power should generate" (METI 2014a), and the plans for the construction of eight new NPPs are indeed only suspended, not abolished. In addition, the reform policy of the power sector was proposed by ANRE in 2012, however it is still unknown how much it can be actually implemented, considering the potential resistance from the very powerful power sector.

Therefore, whether the recent boom of energy debates among Japanese politicians and the general public can make a substantial change in the nuclear energy paradigm is still uncertain. However, considering that energy politics has been a field in which a limited number of people in political and economic power decided everything behind closed doors for the last nine decades, this is certainly the start of a change worth following.

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6. Conclusions

The aim of this thesis was to provide a comprehensive view of Japan's energy policy-making in order to gain a better understanding of the nation's latest energy policy that still adheres to nuclear power even after Fukushima in 2011. Three sub-questions were developed in order to provide a greater insight into Japan's energy policy-making: (1) "How has Japan's energy system developed in the last nine decades, in response to the national energy security challenges?"; (2) "What drove (and still drives) Japan to invest in nuclear power?"; and (3) "Does the Fukushima disaster bring a paradigm change to Japan's energy policy?"

The author recognized that Japan's geographical features, poor endowment with energy resources and increasing energy demand, along with the *closed* mentality of its people, forms the bottleneck of the three key factors that have had the most dominant influence on the nation's energy policy since the early 20th century. These key factors are: the nation's vital energy systems and their vulnerabilities; energy security threats; and energy system governance. The theoretical framework was developed in order to examine the co-evolving nature of these factors. In contrast to the recent studies focusing on the policy transitions after the oil crises in 1970s, this thesis expanded the historical analysis to prior to WWII when Japan encountered its first major energy security threats. This was for the purpose of analyzing how this historical period affected the development of the nation's energy systems, the concept of energy, and governance system and created the roots of the current formation of Japan's energy politics.

Through the historical and contemporary analysis conducted in the thesis, the author also identified that the co-evolving nature of the three factors does not affect one another in only one direction, but also in the opposite direction from the perspective of people in political and economic power. Vital energy systems and their vulnerabilities are exposed to energy security threats, which in turn triggers the formation of some kind of energy system governance which then develops a new energy system in order to overcome the threats. At the same time, vital energy systems formed by the actors in power gives them the power to conduct energy governance. These people in power develop and utilize ideologies such as "sustainable growth" or "energy independence" to securitize a certain threat to further formulate the energy systems in a way that again maintain or give additional power to them (See section 5.2 and Figure 5.3 for details).

The potential loss of sovereignty of the nation in the early 20th century encouraged Japan to centralize political and economic power to the government, in particular to the Ministry of Munitions and a limited number of quasi-national corporations. The function of the military was politicized as *vital* to the continuity of society and the government maximized the allocation of oil and war resources to it by passing the National Mobilization Law. This centralization of power was maintained as a means to re-habilitate the national economy. Furthermore, the rapidly growing economy and the increasing energy demand bolstered the powerful governance of MITI over the energy industries in the 1950s and 1960s. By this time, the historical memory of the potential disruptions of energy resources formed a concept of energy associated very closely with national security and economic growth. The nation initiated the development of nuclear power in the early 1950s with a view of nuclear power as a potential way out of being immensely and increasingly depending on external energy resources. This notion of energy as critical for the sovereignty of the nation and

the continual development of the national economy was further strengthened after the oil crises in the 1970s, which resulted in the acceleration of the increasing deployment of nuclear power and the formation of the nuclear elites in bureaucracy and industries.

As demand for electricity continuously increased from 1973, the amount of energy tax revenues increased, of which most was flowing into the development of nuclear power. The power industry gained a progressively influential power over national energy politics as the growth of the electricity market and the retired ministry officials who used to regulate the industry moved into important positions of power companies and nuclear related corporations and institutions. The relation between national politics and industries was firmly built with a shared ideology of reinforcing industrial competitiveness and strengthening energy security by developing nuclear power. Therefore, the last energy policy developed by METI in 2010 before Fukushima, which aimed to increase the share of nuclear power in the electricity production from 30% to 53% by 2030, was an expected outcome of the shared ideology. The government securitized nuclear power as a means to reduce the overall fossil fuel dependence of the nation by substituting their roles in electricity generation, since all other fuels were *vital* and thus irreplaceable in their respective energy systems, for example, oil in the transportation sector, natural gas in the household and industrial sector, and coal in iron and steel production.

However, this cozy relationship between the government, METI, and nuclear related industries and the non-transparent nature of the national energy policy-making suddenly came into the public knowledge after Fukushima. An increasing number of people started to participate in the energy debates by asserting the irresponsibility of the government and the industries for the nation's nuclear power dependency. Energy became a political issue used in electoral campaigns. Fukushima triggered not only the immense loss of energy but also the desire among the public to be included in the energy policy-making since it finally became in everyone's interest to have a say in potential measures to fill the gap of the abruptly lost energy, which has negatively affected the daily lives of every citizen.

The stubbornness of the institutional power which controlled the nation's energy policy for the last nine decades is still present, with METI at its core and dominant power over national energy politics. The latest energy policy, published in April 2014, was still formulated within METI without voting in the parliament but instead agreed between the LDP Ministers, thus not sufficiently reflecting on the increasing opposition against nuclear power among the public. It will take time to democratize Japan's energy policy-making, however, the process has finally started. There is no significant change observed yet that could be labeled as a policy paradigm shift. However, for the first time in Japan's energy history, the general public raised its voice and more and more politicians and media have turned to support the public.

Energy policy is a very complex field that is associated with national security, sustainable growth and now climate change. It may be more complicated for Japan because of the fewer options of internal energy resources, the closed mentality of people, the international reputation as a technologically advanced nation, the expected political role in the Asia Pacific region, and the growing power of neighboring nations, particularly China. Potentially, everything can be an influence to shape a nation's energy policy. However, this paper demonstrated that it is more beneficial to look into what is prioritized or securitized in a national energy

policy to get a greater insight into what might actually happen in its future energy path. For example, climate change is not given as much priority as potential loss of international competitiveness of industry to shape Japan's energy policy today. A transition in energy systems is often exposed to another threats, be it predictable or unpredictable, observed in Japan's modern energy history. Thus, it is expected for the Japanese government, industry, and the public to each take responsibility and display leadership in reshaping the Fukushima experience into beneficial knowledge and expertise for the development of a more energy-secured future on a national, regional and global scale.

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