

# **Burning Issue of Energy Problem after Fukushima Disaster of TEPCO's Atomic Power Stations**

Shoji Harada  
Sojo University, Kumamoto

**38<sup>th</sup> MPA-Seminar**  
**October 1 and 2, 2012 in Stuttgart**

---

## **Abstract**

Strikes of unanticipated enormous earthquake and subsequent tsunami brought unbelievable disaster in eastern Japan on March 11, 2012. In particular, collapse of cooling system of TEPCO's Fukushima atomic power stations resulted in IAEA-defined level 7 accident including heavy radiation, hydrogen explosion –induced collapse of the building of power station No.2 and No.4 and melt through of nuclear pressure vessel No.1.3.4. At an initial stage of the disaster, nobody knew precisely what happened at the power stations. According to the recent report of the national investigation committee, precise reason of the collapse of the cooling system whether it was induced by the strike of huge earthquake or tsunami is still unclear. Due to poor risk management of the government and TEPCO and closure of the precise disaster information, people became suspicious and nervous about the atomic power station. Fifty four atomic power stations have been constructed for these forty years in Japan. On last May 04, all the atomic power stations were shut down due to periodic inspection. However, restart of them became hot discussion. Although atomic power station was regarded as a powerful tool to reduce carbon dioxide several years ago, this situation after March 11 completely changed. In many countries which possess atomic power station, making a road map to develop recyclable energy is a burning issue. It should be noted that German spent about thirty years to declare atomic energy free society.

Finally necessity of succession of technology of utilizing atomic power is emphasized. Politics on depending atomic power differs in each country. Therefore, study from Fukushima disaster should be widely used to prevent from unexpected accident of atomic power station.

## **1 Introduction**

When the present author came to MPA, Stuttgart University, as a Humboldt scholarship holder, in 1979, FKS(Forschungsvorhaben Kernkraftwerksicherheit, Research project on the Safety of Atomic Power Station) Program, especially, a systematic study of strength evaluation of a thick rolled steel plate 20MnMoNi55(A508Cl3) for pressure vessel use for atomic reactor, was running. It was just after Three Mile Island accident in USA on March 28, 1979. At that time, there arose a strong citizen movement against atomic power, originated in Gorleben against construction of high-level radioactive waste repository in northern Germany, which resulted in birth of new political party, Green Party. On the entrance door to MPA, a sticker "Steinzeit nein Danke!, Stone Age, No thanks!", was put. At that time, studying renewable energy, for example, heat pump, was one of hot research topics all over Germany. It has passed three decades since then. Meanwhile, researches of renewable natural energy such as solar energy, wind energy, biomass, and so on, have been strongly promoted. At last, German government decided, after Fukushima disaster, that all the operating atomic power stations will be abolished by 2022.

The purpose of the present paper is to discuss the future first energy supply in Japan. To make discussing point clearly comparison of the energy supply between Japan and Germany is done.

## **2 Change of the primary energy supply after 1945**

Just after the end of the World War II, Japanese economy was completely broken. The Korean War in 1951 suddenly brought a special demand and revitalized Japanese production economy and recovered industrial production activity to the state just before the war by the end of 1950's. The taking off for the higher growth rate of economy at the beginning of 1960's induced gradual change of the primary energy supply from coal to oil and finished complete switching of the main energy source at the end of 1960's. Parallel to this, introduction of atomic power energy was promoted to meet the expanding demand and stable supply of electricity due to quick industrialization in 1960's.

Twice attack of oil crisis in 1970`s accelerated the change of stable primary energy supply system and increased dependency of atomic power. At that time, three national laws for promoting construction of atomic power station on completely country side were established. The low cost energy supply by atomic power seemed to contribute economic prosperity. This situation lasted until the Plaza Accord in New York in 1985. After 1985, soaring of yen and newly joining of China to the world market in 1993 promoted the transfer of manufacturing to neighboring countries. At the same time, so-called IT innovation changed the major human activity from factory-making to office work. As the results, factory-making production activity in developed countries was gradually transferred to developing countries of lower wage.

Quick globalization after the collapse of Berlin Wall in 1989 contributed to elevate the living standard of the developing countries. However, increase of the energy use of average people brought global warming. This phenomenon was suggested to be caused by the greenhouse gas. Therefore, reduction of carbon dioxide emission efficient to mitigate global warming was accorded in Kyoto in 1997, referred to as Kyoto Protocol, COP3) At that time, it was thought that the atomic power station without carbon dioxide emission contributes to mitigate the greenhouse gas warming. The speech by previous Prime Minister Yukio Hatoyama at UN in 2009 that Japan will contribute to reduce carbon dioxide emission by an amount of 25% by 2020, comparing with that of 1990, intended to stimulate the development of new innovative technology in renewal energy field. It is, however, to be noted that the electricity supply will, for the time being, not change drastically. The electricity power supply by atomic power station was 23.8% in 2010 in Japan. It is suspicious whether the complete switching of electricity supply from atomic energy to renewal natural energy by 2030 is possible. It is because a percentage of energy supply by renewal energy to total energy supply in 2010 was less than 2%.

After oil crisis in 1970`s, it has long been believed that the construction of atomic power stations greatly contributes to establish a strategy of basic electricity supply system. That is, atomic power stations work as a non-fluctuating basic load and a fossil-fuel power stations by coal, oil, natural gas, and so on, compensates the fluctuating load day by day and in season. Therefore, the change of supply system in future should also be considered.

However, this understanding for atomic power station completely changed after Fukushima disaster. Anti-atomic power movement arose among people and became harder and harder day by day. The government is in current under investigation of atomic power dependency of electricity supply in 2030 by means of DP (deliberative poll. That is, atomic power dependency should be different three level of 0%, 15%, 25-30%. The result reported on August 23 that about 50% of the poll stands for complete abolishment of atomic power stations by 2030. Needless to say, this result should be taken into account in decision making of the policy. However, it is also to be noted that that investigation was done only by paying attention to a single issue of atomic power dependency of total electricity generation in 2030. That means, no information of technological and scientific points of view was given. The policy of abolishing atomic power stations and switching to renewable natural energy seems to follow the policy in Germany done for past three decades. The fact that German took thirty years to realize the present state, should also be taken in account. In addition, the related conditions such as geographical features, weather, politics, economy, and so on, are different in both countries.

### **3 Electricity supply by the use of renewable natural energy**

There are many ways to use renewable natural energy such as wind power, photovoltaic, wave power farm, tidal power, OTEC (Ocean Thermal Energy Conversion), sea stream and geothermal energy. Biomass and biofuel are also renewable energy. To discuss the main portion of renewable energy attention is paid only to photovoltaic and wind power.

After oil crisis at the beginning of 1970`s, concentrated efforts to develop photovoltaic power generation has been done, in a sense of as a leader of the world until the beginning of 2000`s. However, this new technology has not prevailed all over Japan, mainly because of the poor policy. On the contrary to Japan, German succeeded in prevailing photovoltaic power generation system in a short time. In 2000, the feed-in tariff (FIT) was adopted to spread photovoltaic power generation system to general consumer and company, which resulted in sharp growth of this system. However, keeping FIT system forced general electricity consumer to pay more financial support. As the result, this FIT system showed ironical aspect. In spite of maximum 22GW photovoltaic power generation on May 25, 26, 2012, this FIT system was forced to lower the tariff. Obviously this tariff reduction quickly makes solar panel companies bankruptcy.

On the contrary, the situation of the use of renewable natural energy is rather different in Japan from that in Germany. Although two factors that Japanese electric company first succeeded in developing solar cell for photovoltaic in 1960-1970 and that the oil crisis suddenly attacked two times in 1970`s, were advantageous for spreading of that system, highly expensive facility and poor policy spoiled the prevail of the system. Quite recently, after Fukushima disaster, the photovoltaic power generation quickly became a burning issue as a most promising renewable natural energy. What is now going in Japan seems to follow what has been done for past ten years in Germany.

Regarding to wind power, the electricity generation by wind turbine continuously increased during past two decades. Total electricity actually generated by wind power corresponds to about one third of the total energy produced by renewable natural energy supply and to about one fourth of that of atomic power supply in 2010. In general, the land is almost flat everywhere in Germany. Additionally hard wind preferable to electricity generation is expected in northern Germany. Especially in five states, Niedersachsen, Berlin-Brandenburg, Sachsen-Anhalt, Schleswig-Holstein, Nordrhein-Westfalen, about 80% of total supply capacity of 27.2GWatt was constructed in these area.

Reversely in Japan, about 80% of land is covered by mountain range and wind power generation in flat area is difficult due to densely populated district. Furthermore, electricity generation in Hokkaido, far from consumer in Tokyo area, needs expensive power transmission. Therefore, construction of wind power supply slowly increased.

The total capacity of wind power electricity generation is in current only about 2GWatt. Due to handicap of narrow land preferable to wind farm and public noise problem, the government is now planning to construct offshore wind farm with a capacity of 0.8GWatt by 2030. Although the offshore type wind power supply apparently seems recommendable, because the land is completely surrounded by sea, natural disasters such as typhoon, tsunami, rough seas, should be taken into account.

From the above discussion, the conditions of utilizing wind power between Japan and Germany are considerably different. Then, this difference should be considered in making future policy of renewable natural energy.

## **4 Succession of atom technology**

Before accident of Fukushima atomic power stations, world-known fabricators of atomic power stations had already been reconstructed and become more large scale companies. The Fukushima accident made general citizen consider that the electricity generation by the use of atomic power is very dangerous. The anti-atomic power movement became in fashion and required quick switching from atomic power to renewable natural energy at many places all over the world. At the time being, attitudes for and against future use of atomic power stations are different depending on the countries. This means that it is almost impossible to completely exclude or abolish atomic power stations from the earth. Therefore, all the knowledge studied from the accidents of Three Mile Island on March 28, 1979, Chernobyl on

April 26, 1986 and Fukushima on March 11, 2012 should be succeeded to the next generation to prevent from repeating same kind of failure. What was discussed after Fukushima disaster is mainly concerned with the responsibility for this disaster and anti-atomic power movement. Both governmental and non-governmental investigation committees on the Accident of the Fukushima Nuclear Power Stations of TEPCO warned that the unexpected accident may possibly happen in case of atomic power station (improbable est possible) and the countermeasure for such case should be taken into account in designing.) The unexpected accident of melt through of the pressure vessel for atomic reactor use of the power station No.2,4 was the first experience in the world. The loss of all the electricity supply for cooling was unanticipated phenomenon and the engineers and worker, in spite of the presence of manual, didn't necessarily know how to operate the pressure vessel at emergency.

On May 4, 2012, all of 54 atomic power stations were shut down for periodic inspection. The government asked each electric power supply company to do stress test with higher safety level. Some stations were allowed to restart the power station for a while due to the shortage of electricity power supply this summer. Except them, other stations are still in rest. Switching of electricity generation from atomic power to fossil-fuel power raises electricity tariff. At this moment, it is to be said in Japan that energy supply system free from atomic power needs further discussion. In particular, experts should state their opinion understandable to general citizen. The energy policy is closely related to world-scale economic activity of Japan in future

## **5 Conclusions**

The disaster of TEPCO Fukushima atomic power stations happened beyond expectations showed many lessons to be studied. Suppose once such accident occurs and wide spread of radiation, the design of the atomic power station should be done to overcome the unexpected natural disaster and human errors. In addition, cool discussion, independent of emotion, is needed in determining future energy policy. Especially overestimated expectation of renewable natural energy of photovoltaic power and wind power should carefully be checked by considering that the renewable natural energy currently occupies only 1-2% of total energy supply and almost unlikely become one of main energy supply, instead of atomic power energy supply. As the difference of energy policy in each country makes it impossible completely exclude the atomic power supply from the earth, the atomic power supply technology and related technology should not be denied, but positively succeeded to the next generation.

Furthermore, new findings of some kinds of fossil fuel such as shell gas and methane hydrate may lower the electricity generation cost and mitigate the atomic power dependency. However, even if new types of fossil fuel were found, greenhouse gas problem would be difficult to be solved. Finally it is to be noted that future energy policy should be made by considering every related factor.