

A Study on the Economic Feasibility of Nuclear Power Caused by Fukushima Nuclear Power Accident

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1. Introduction

Due to the Fukushima accident in Japan that occurred in March 2011, safety issues of nuclear power plants as well as views against expansion of nuclear power plants, including factors such as economic feasibility, are becoming more and more widespread around the world. In this respect, it would be necessary to utilize the economic competitiveness of the generation cost calculated based on the previous power plant generation cost and the overall safety related costs taken into account after the Fukushima incident, i.e. expenses related to safety facilities, legal restrictions, environmental expenses and social expenses for the mid and long-term strategy establishment of energy.[1]

2. Methods and Results

This thesis aimed, more specifically, to calculate the generation cost, including the “the post-management cost for nuclear power plants” such as nuclear used fuel charges, allowances for decommissioning of nuclear power plants, radioactive waste disposal expenses, and the expenses for enhancing safety of nuclear power plants in Korea, in the amount of 1.1 trillion won to be incurred in the five years after the Fukushima incident, including expenses related to safety facilities, fund for the neighboring area support of nuclear power plants, research & development expenses for safety, cost on compensation and liability for nuclear damage, etc.

The year of calculation would be 2016, when all the plans of the fourth nuclear power promotion would be reflected, taking the Fukushima incident into consideration.

2.1 . The Post-Management Cost for Nuclear Power Plants

The general public, including non-governmental organizations, have been very doubtful of whether the generation cost for nuclear power plants has included the post-management cost for nuclear power plants, however, the government and Korea Hydro & Nuclear Power published a material in December 2012 that would relieve such doubts. The contents are as follows:

① The nuclear used fuel charges increased from 28 trillion won to 53 trillion won (for light-water nuclear

reactors, from 293 million won to 319 million won per bundle, for heavy-water nuclear reactors 4.14 million won to 13.2 million won)

② mid and lower level radioactive waste disposal expenses increased from 7.36 million to 11.93 million won per drum, which also reflected the interest expenses from construction investments, and

③ the allowances for decommissioning of nuclear power plants increased by large from 398.9 billion won per plant to 603.3 billion won, reflecting the inflation rate and the disposal expenses for disposal of mid and lower level radioactive waste. In all, the post-management cost for nuclear power plants increased by 4.13 won/kWh, from 5.54 won/kWh to 9.67 won/kWh.[2]

2.2 Post-Accident Expenses for Enhancing Safety of Nuclear Power Plants

A budget of 1.1 trillion won has been appropriated for five years from 2011 to 2016. Therefore, taking into account the budget up to 2016, this would affect the generation cost by 2.64%.

$$\frac{1,100,000 \times 10^6 \text{ won}}{39.11 \text{ won/kWh} \times 1,000,000 \text{ kw} \times 8760 \text{ h} \times 5 \text{ years} \times 27 \text{ plants} \times 0.9 (90\%)} = 0.0264 (2.64\%)$$

2.3 Fund for the Neighboring Area Support of Nuclear Power Plants[3]

The estimate amount of fund for the areas near the nuclear power plants has been calculated for the following five years (190,422 GWh), in comparing the annual average fund(203,610 million won) that takes into account the annual average generation(148,769 GWh) from 2006 to 2011, which comes out to 260,618 million won, and thus 1,303,090 million won for the five years. This would increase on the the generation cost by 3.13%.

$$\frac{1,303,090 \times 10^6 \text{ won}}{39.11 \text{ won/kWh} \times 1,000,000 \text{ kw} \times 8,760 \text{ h} \times 5 \text{ years} \times 27 \text{ plants} \times 0.9 (90\%)} = 0.0313 (3.13\%)$$

2.4 Research & Development Expenses

Table1 : Expected Budget in accordance with nuclear promotion plan[4]

A R E S E A	Ministry of Future Creation and Science		Ministry of Trade, Industry and Energy	Total
	Radiation (General accounting)	Nuclear power related research funds 2)	Nuclear power (Power industry fund 3)	
	328.3 billion won	10,81.4 billion won	673.6 billion won	2083.3 billion won

- 1) The average government budget increased for the recent 5 years based on the budget of year 2011.
- 2) Generation in accordance with the fifth power supply plan x 1.2 won/kWh
- 3) From the power industry funds, mid-term funding plan of nuclear power is reflected.

The amount of research & development expenses incurred by the Ministry of Future Creation and Science and the Ministry of Trade, Industry and Energy are 2.833 trillion won, therefore, the effect of this on the generation cost is 5.00%.

$$2,083,300 \times 10^6 \text{ won}$$

$$39.11 \text{ won/kWh} \times 1,000,000 \text{ kw} \times 8,760\text{h} \times 17.8 \text{ years} \times 27 \text{ plants} \times 0.9(90\%) = 0.0500(5.00\%)$$

2.5 Cost on Compensation and Liability for Nuclear Damage

The annual insurance expenses for 2012 amounted to 19,755 million won. The insurance expenses for 5 years from 2012 to 2016 would amount to 98,719 million won. This would affect the generation cost by 0.24%.

$$98,719 \times 10^6 \text{ won}$$

$$39.11/\text{kWh} \times 1,000,000 \text{ kw} \times 8,760\text{h} \times 17.8 \text{ years} \times 27 \text{ plants} \times 0.9(90\%) = 0.0024(0.24\%)$$

In this thesis, the post-management cost for nuclear power plants such as the nuclear used fuel charges, allowances for decommissioning of nuclear power plants, radioactive waste disposal expenses, and the expenses for enhancing safety of nuclear power plants, fund for the neighboring area support of nuclear power plants, research & development expenses for safety, cost on compensation and liability for nuclear damage were calculated.

The table below summarizes these expenses. The final generation cost that would be able to provide relief to the general public in Korea amounts to 47.54 won/kwh, therefore, it has been substantiated that the current generation cost would be competitive at least until year 2016.

Table2 : Expenses to be additionally reflected on the generation cost for nuclear power plants (2012 -2016)

A R E A		Amount (in million won)	Effect in percentage (%) (money Increase)	To be borne by	Others
1	The Post-Management Cost for Nuclear Power Plants		24.73% (9.67 won)	Government	43.23 won (previously borne by the government)
2	Post-Accident Expenses for Enhancing Safety of Nuclear Power Plants	1,100,000	2.64%	Korea Hydro & Nuclear Power	11.01% (4.31 won)
3	Fund for the Neighboring Area Support of Nuclear Power Plants	1,303,090	3.13%	Government	
4	Research & Development Expenses for Safety	2,083,300	5.00%	Government	
5	Cost on Compensation and Liability for Nuclear Damage	97,925	0.24%	Government and Industries	
Total			11.01% (4.31 won)		47.54 won (Currently 43.23 won + Additional 4.31 won)

* utilizing the leveled generation cost method is almost same as before

3. Conclusion

The above conclusion is premised on utilizing the leveled generation cost method, base load operation (based on a certain utilization rate), straight-line depreciation method, etc. However, this thesis would be significantly meaningful at this point where the general public, including civic groups, etc. are concerned with the economic feasibility and safety of nuclear power plant, and that even after considering the social expenses such as safety related expenses after the Fukushima incident, the generation cost of nuclear power plant still remains competitive[5].

REFERENCES

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