

Introductory report on energy from Japanese perspective

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Lessons from Fukushima(1)

- March 2011: **Fukushima** **severe accident** in Japan:(inspection committee reports) cause irreversible loss: still many refugee
- Since the accident, the **Basic Plan for Energy and energy policies**, which rely heavily on nuclear power generation, have been reexamined. Government decided **de-dependence on nuclear**
- New basic plan and energy policy are **under debate** in the policy-making process **based on public debate**(unique in Japan)

Lessons from Fukushima(2)

- Why we promote nuclear power generation?
- **Myth of safety and the cost** of nuclear power?
- Public debate: options for the share of nuclear to the total power generation: 0%, 15%, 20~25% in 2030
- Fossil fuel-fired, **Renewables, saving energy**
- **Electricity supply/demand system** has also been reexamined
- Management of electric company: **regional monopoly, cost pricing, industrial organization**

Outline of Presentation

- [part 1] Safety/cost of nuclear power generation: debate about the choice of energy technology after Fukushima
- New formula for the estimation of the cost of generating electricity
- [part 2] energy policy/electricity system reform
- Several policy reform issues including the integration of energy/ climate change policy: cost of renewables(FIT): cost of 0%

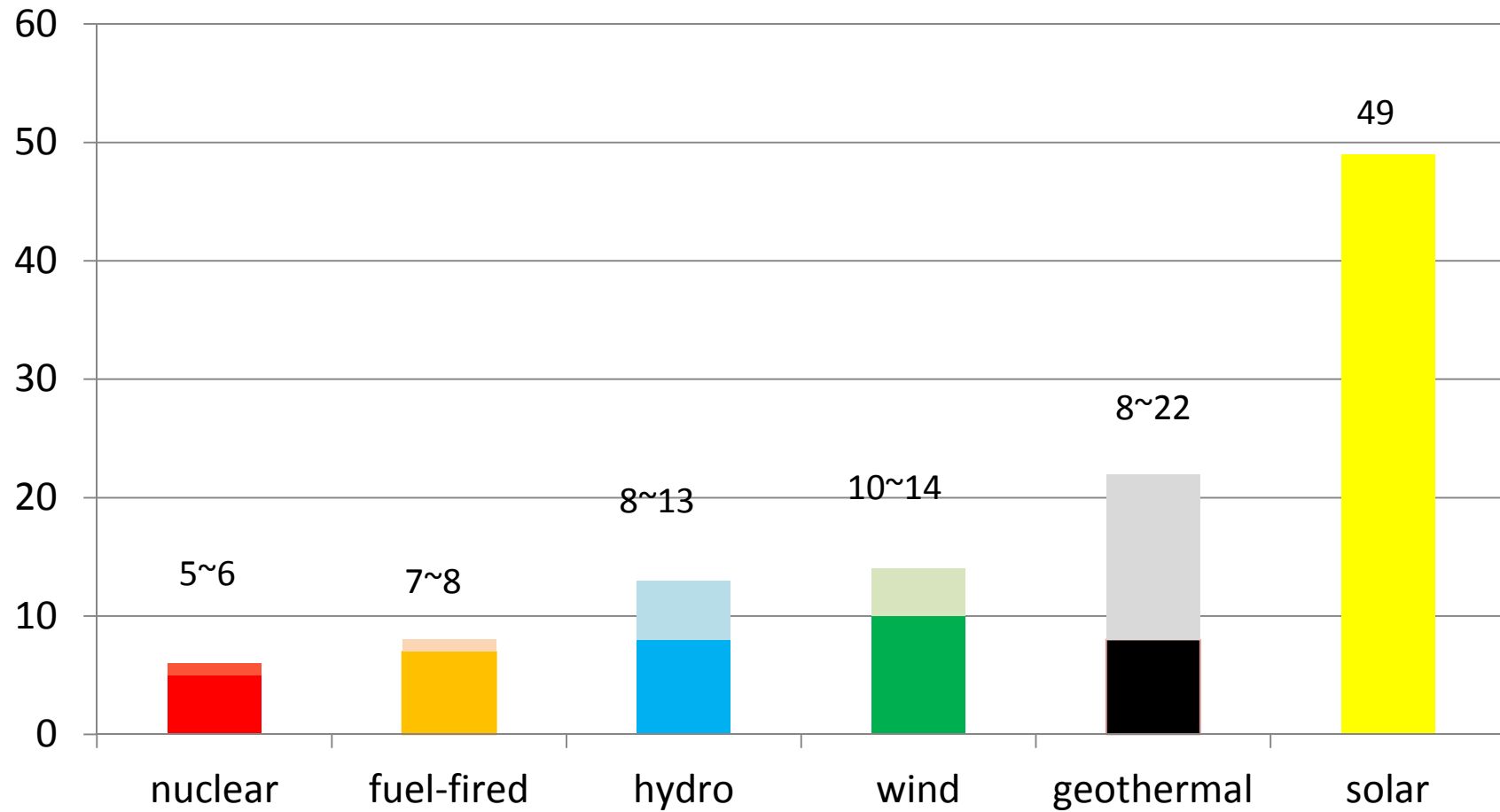
choice of energy technology

- Safety/cost of nuclear power generation
- One of the main arguments promoting nuclear power generation was that nuclear power generation is cheaper in terms of economic costs of generating electricity (safe, energy security) than other power sources
- We need to accurately estimate the costs of electricity generation for various power sources taking cost of safety into account

Methods to estimating costs(1)

- Estimates of the costs of electricity generation for different power sources were first made in the early 1980s by the OECD/NEA
- The [2010 Energy White Paper in Japan](#) contains a figure comparing the costs of electricity for various power sources (**nuclear was the cheapest**)
- There was **some doubt** about cost of nuclear power generation **even before the Fukushima**
- Ohshima has shown **nuclear power generation is, in fact, more expensive than fuel-fired/hydro**

2010 Energy White Paper in Japan



Methods to estimating costs(2)

- Some may think that the costs of electricity generation can be quickly determined by asking the electric power companies
- Several costs which should be included are not included in the electric power company's costs
- Estimated costs of electricity generation derived from past actual electricity generation do not indicate what the costs of electricity generation for each power source will be when electricity is generated in the future

OECD/NEA/IEA Estimation Formula

- Costs of electricity generation=(capital costs + fuel costs + operational maintenance costs)/ amount of electric power generated(model pl)
- This formula is easy to understand, and there seems to be little room for questioning. However
- Parameter(useful life, operation rate of plants)
- The Projected Costs of Generating Electricity 2010report by OECD/NEA/IEA assumes 60 years(40 years in 2005) useful life and 85%(69% in Japan) operation rate for nuclear power plant

Environmental External Costs of Generating Electricity

- There are some costs that **do not fit into** the OECD/NEA/IEA formula
- **Costs of reducing CO2 emissions for fuel-fired power generation**/If electric power companies take no measures to reduce CO2 emissions, they incur no expenditure associated with their CO2 emissions/but **damage for society**
- **Environmental external costs** should be included in the formula/CO2 for fuel-fired (**2005vs2010**) /noise for wind/radioactive wastes for nuclear

Supplemental Costs of Generating Electricity

- Besides environmental external costs, there is other type of cost that the OECD/ NEA/IEA estimation fails to take into account for nuclear power generation
- Nuclear power plants are designed, constructed, and maintained only when government expenditure is made support nuclear power
- If nuclear power plants cannot be operated without such expenditure, this expenditure should be considered as part of the costs

Cost composition of each power source

- Costs of electricity generation=(capital costs + fuel costs + operational maintenance costs)/ amount of electric power generated(model pl)
- **Nuclear** power plant(**capital costs**) ▪ ▪ ▪ cheaper (longer useful life(60years vs 30years) and high operation rate(85% vs 70%))
- **Fuel-fired** power plant(**fuel costs**) ▪ ▪ ▪ cheaper (procurement cost)
- **Renewables**(**natural** including geographic and weather **conditions**)

New Formula for the Estimation of the Costs of Generating Electricity

- OECD/NEA/IEA formula
- Costs of electricity generation=(capital costs + fuel costs + operational maintenance costs)/ amount of electric power generated(model pl)
- Costs of electricity generation=(capital costs + fuel costs + operational maintenance costs + environmental costs + supplemental costs)/ amount of electric power generated(model pl)

Cost Verification Committee

- Main findings of the cost estimation (y/kwh) :
wind(ocean)8.6-23.1, wind(land)8.8-17.3,
nuclear9.0~, geothermal9.2-11.6, PV(house) 9.9-
20.0, coal-fire10.3 -10.6, LNG10.9-11.4,
gascogeneration11.5-12.0.....
- Remaining issues
- Projection of future fuel price/technological
change/mass production effect/learning curve
- How to estimate the cost of electricity generated
by nuclear power plant

Cost of countermeasures RM for severe accident like Fukushima

- **Insurance** [probability(of the occurrence of SA) \times damage + risk premium]
- Price-Andersen Law(USA)
- (**damage cost**/term for payment)/amount of electric power generated(model pl. 40years): **joint liability**(mutual aid) of electric company
- **Frequency** of **the occurrence of SA**(IAEA: 1.0×10^{-5} , Japanese performance: 2.0×10^{-3})
- Estimate of the **damage cost** of Fukushima

Cost of nuclear fuel cycle and the final disposal of radioactive wastes

- This estimate is not by our commission but by the **Atomic Energy Commission**
- Option: ① **retreatment**(all of spent fuel are **recycled**), ② **current**, ③ **direct disposal**(all of spent fuel are directly disposed at the final DS)
- ③ is cheapest(1y/kwh cheaper than ①)
- How we can manage the radioactive wastes
- Discount rate/safety300years?/**minimum**

Energy policy/electricity system reform

- [part 1] suggests that it is not easy for private company to manage the nuclear power because the cost of generating electricity by nuclear power is not so cheap but uncertain compared with the cost by fuel-fired and/or renewables including wind/geo . . .
- Competition among power sources/unbundling /user and/or consumer choice of power sources
- Stakeholders: opinion poll favor 0%option: 50%~90%, industry, municipality/state, shareholders, expert

Energy policy/electricity system reform

- 0%option generates **alternative power source** issue/fossil fuel/renewables/negawatt/DSM including energy-saving
- Fossil fuel/**more CO2/fuel cost**/electric company vs society
- **Introduction of FIT** from 1st of July, 2012/well started/cost of FIT
- Transition management towards sustainable, safe, resilient energy system