Energy Technology Strategy

Background and Objective

Policy management and implementation based on long-term energy technology development and diffusion is necessary for preventing global warming. In the project, we analyze (1) energy efficiency policies, (2) shift from direct combustion to electricity use, and (3) low carbonization of electricity sector, and trends of the global climate change policy and the energy supply and demand in order to harmonize the prevention of global warming, the economy, energy security through electrification.

Main results

1. Renewable Energy Technology Policy

(1) Renewable energy is a high cost climate change mitigation option, and especially Photo Voltaic (PV)'s CO_2 reduction cost exceeds 100,000 yen/t-CO_2. (2)PV generation cost would be decreased no more than 12 yen/kWh (Figure 1) and the CO_2 reduction cost 44,000 yen/t-CO_2, even if we install PV up to the maximum domestic capacity (173GW) and reduce generation costs based on the learning curve methodology. In addition, the learning rates have declined in recent years. Thus we conclude that a large amount of PV installation by massive governmental support is a less cost-effectiveness policy [Y09020]. (3) We identified four direct technological progress factors, research and development (R&D), the learning effect through both in production and use processes, and spillover effects from other technology progress as a result of arranging present scientific knowledge concerning the technological progress to search for cost reduction factors of renewable and energy saving technology (Fig. 2). But on the other hand, it is difficult to paint a precise picture of the relative importance of these factors [Y09026].

2. Energy Saving and efficiency Policy

We found that the impact of Japanese Energy Conservation Law varies among firms, while many of the regulated firms were effectively encouraged to obtain basic tools for energy management by law, most of them seemed to neither make use of the tools nor start additional energy saving activities [Y09010]. We conclude that small and medium firms, even large companies, face lack of energy efficiency specialists, and remain large potentials for energy efficiency, based on the survey of three energy audit programs by ECCJ(Energy Conservation Center, Japan), NEDO, and Energy Efficiency Measures in Commercial Buildings under the Tokyo CO_2 Emission Reduction Program (Table.1) [Y09009] [Y09012].

3. International Climate Change Policy & Trends of Energy Supply and Demand

(1) The historical significance of the Copenhagen Accord observed by COP15 in 2009 is its bottom-up approach in which countries domestically determine their policies and targets to control emissions through international review, instead of the top-down approach like the Kyoto Protocol which penalizes non-compliance countries [Y09007]. (2) Although most developed countries have declared very ambicuous CO_2 reduction targets, it is unclear if their long-term emissions reductions are on track [Y09023]. (3) Concerning the long-term price elasticity of energy demand, utilized to understand the middle-term and the long-term influence of price changes, we should carefully understand the results of analyses because there is no consensus for the definition and value of elasticity.

Other reports [Y09003] [Y09013] [Y09019][Y09021] [Y09022]

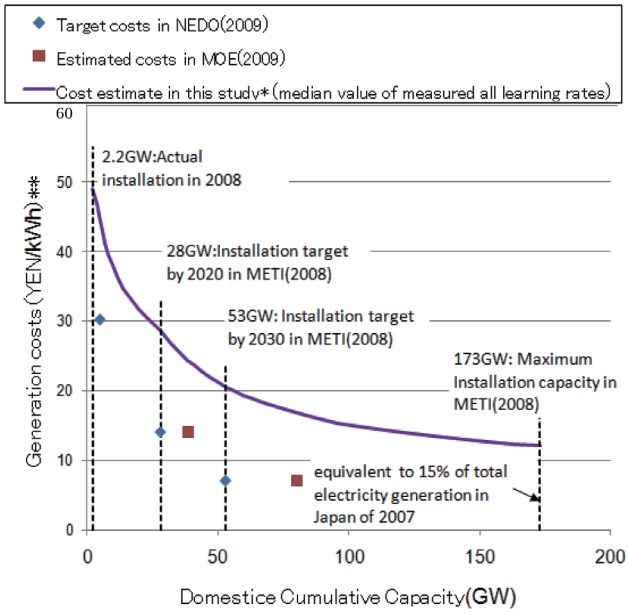

Fig. 1 Generating cost estimate in the future of PV that considers the learning rates calculated by each devices

*The estimate of learning rates: learning rates of all patterns for a period for ten years or more was measured from the price data of 1993-2008 years according to the devices of PV. Figures will be cost for future presumed when the median of each device is used.

**Generating unit price: Average power generation unit price of the life when assuming utilization rates 12%, interest rate 4%, maintenance fee 1%, and 20 life years.

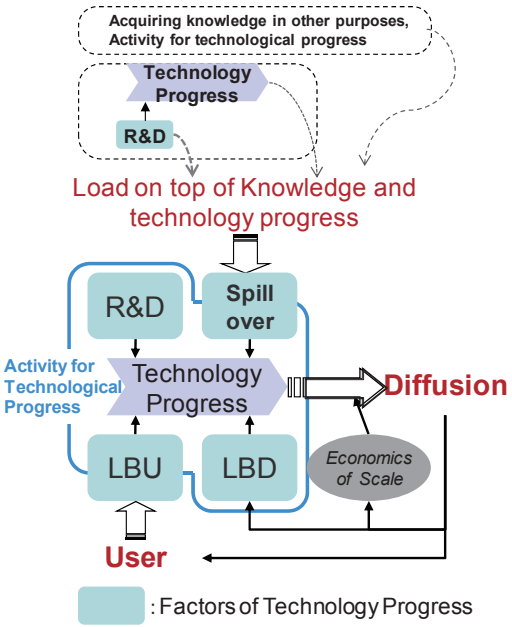

Fig. 2 Various factors of the technological progress and its surrounded structure

R&D: Research and development
LBD: Leaning by Doing
LBU: Leaning by Using
Spillover: Spread effects from technological progress for other purposes

Table.1 Cost-effectiveness of the energy audit programs by ECCJ and NEDO (average of each audit)

	Audit fees (per one audit) [a]	Efficiency equipments (per one audit)	Reduction Effects of heating and electricity expenses (per one audit) [b]	Energy Reduction Effects(per one audit)[c]	Cost effectiveness in social perspective [d]
Small and medium firms programs (ECCJ)	0.41million YEN	3.07 million YEN	4.45 million YEN	92kL	-11,000YEN/kL -6,100YEN/t-CO_2
Large firms (NEDO)	3.33million YEN	20.37 million YEN	32.26 million YEN	1,290kL	-6,600YEN/kL -3,800YEN/t-CO_2

Both the energy reduction cost and CO_2 reduction cost from the social perspective negative values are taken. This shows that the utility bill reduction convenience exceeds the execution cost and the amount of capital investment of the conservation of energy diagnosis, and CO_2 can be reduced while putting out convenience.

Notes : kL are all the crude oil equivalents (Electricity is converted as primary energy).

a: Energy Audit spending from governmental budget

b: Reduction effect (=c) × unit price of energy (25,000JPY-60,000 JPY/crude oil equivalent kL)

c: Rate of reduction amount estimate × execution (30%-46%) × achievement rate (50%) × years of continuation by proposed measures (3 years -7years)

d: (audits fee + equipments expenses- heating and electricity expenses)//reduction effect

CO_2 emission intensity: 1.7t-CO_2/crude oil equivalent kL