Transitioning to a Low Carbon Society
- Effect of the Great East Japan Earthquake -

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Impacts of the Great East Japan Earthquake and Fukushima Dai-ichi Nuclear Plant Accident

On March 11, 2011, a great earthquake devastated the East Japan region. The earthquake and subsequent tsunami also cut off all power, including emergency backups, to the Tokyo Electric Power Company's Fukushima Dai-ichi Nuclear Plant, causing a critical situation. As of June 03st, the situation remains uncertain, and we can only hope for a speedy resolution and recovery. This, the biggest nuclear accident in Japanese history, will inevitably affect the country's future energy and anti-global warming policies.

Operational CGE Model – Categories

		1	2	・・・	18
1	Food				
2	Dwelling				
3	Electricity				
4	Gas				
5	Light & Fuel				
6	Water & Sewage				
7	Durable goods				
8	Heating & Cooling				
9	General furnatures				
10	Other furnatures				
11	Cloths and shoes				
12	Medical & Health				
13	Transport				
14	Automobiles				
15	Gasoline				
16	Communication				
17	Education				
18	Entertainment				
19	Other consumtions				

Decrease by Energy saving

Increased cost

Increased cost

Decrease by Energy saving

1	−200
2	200−250
3	250−300
4	300−350
5	350−400
6	400−450
7	450−500
8	500−550
9	550−600
10	600−650
11	650−700
12	700−750
13	750−800
14	800−900
15	900−1000
16	1000−1250
17	1250−1500
18	1500−

Brackets by income

1	Agriculture, forestry and fishery	20	General machinery
2	Limestone	21	Electric machinery
3	Coal	22	Automobile
4	Oil	23	Transport machinery
5	Natural gas	24	Precision machinery
6	Other minerals	25	Other manufacturing
7	Food	26	Construction
8	Textile	27	Electricity
9	Wood products	28	Gas
10	Pulp & paper	29	Heat
11	Printing	30	Water & Sewage
12	Chemistry	31	Waste disposal
13	Petroleum products	32	Commerce
14	Coal products	33	Finance & Innsurance
15	Ceramic products	34	Real estate
16	Cement	35	Transport
17	Iron & steel	36	Broadcasting
18	Non-ferrous metals	37	Service
19	Metal products	38	Governmental service
		39	service

Household consumption goods (19 categories) ⟷ **Capital goods (39 categories)**

Composite ratio of production goods in relation to consumer goods

2020 scenario settings used in this analysis

Scenario 1 No GHG reduction (standard scenario)

The standard scenario where GHGs are not reduced
GDP is assumed to increase 1.3% YOY from 2005 to 2020.

Scenario 2 Nuclear plant increase

GDP increase is the same as scenario 1. Solar power generation of 28 million kW. The six Fukushima-1 reactors are decommissioned but remaining nuclear plants are built as is. 85% of current nuclear plants are operating.

Scenario 3 Maintain nuclear plants as is

GDP increase is the same as scenario 1. Solar power generation of 28 million kW. The Fukushima-1 reactors are decommissioned and remaining nuclear plants are not build. 85% of Current nuclear plants are maintained, and 85% is in operation.

Scenario 4 Nuclear plant decrease

GDP increase is the same as scenario 1. Solar power generation of 38 million kW. The Fukushima-1 and Fukushima-2 reactors are decommissioned and remaining nuclear plants are decommissioned 30 years after completion. No nuclear plants are build, and thermal power is mainly used to make up for insufficient electricity.

Scenario 5 Nuclear plant decommission and replacement by PV

GDP increase is the same as scenario 1. Solar power generation of 280 million kW. The Fukushima-1 and Fukushima-2 reactors are decommissioned and remaining nuclear plants are decommissioned by 2016. New nuclear plants cannot be built. Solar power and thermal is aggressively used to make up for insufficient electricity from nuclear plant decommission.

Measures commonly taken in each scenario of the applied general equilibrium model (2020)

① **80% of newly built houses are next-generation energy saving houses (based on 2009 standards)**

② **50% of newly sold cars are next-generation cars**

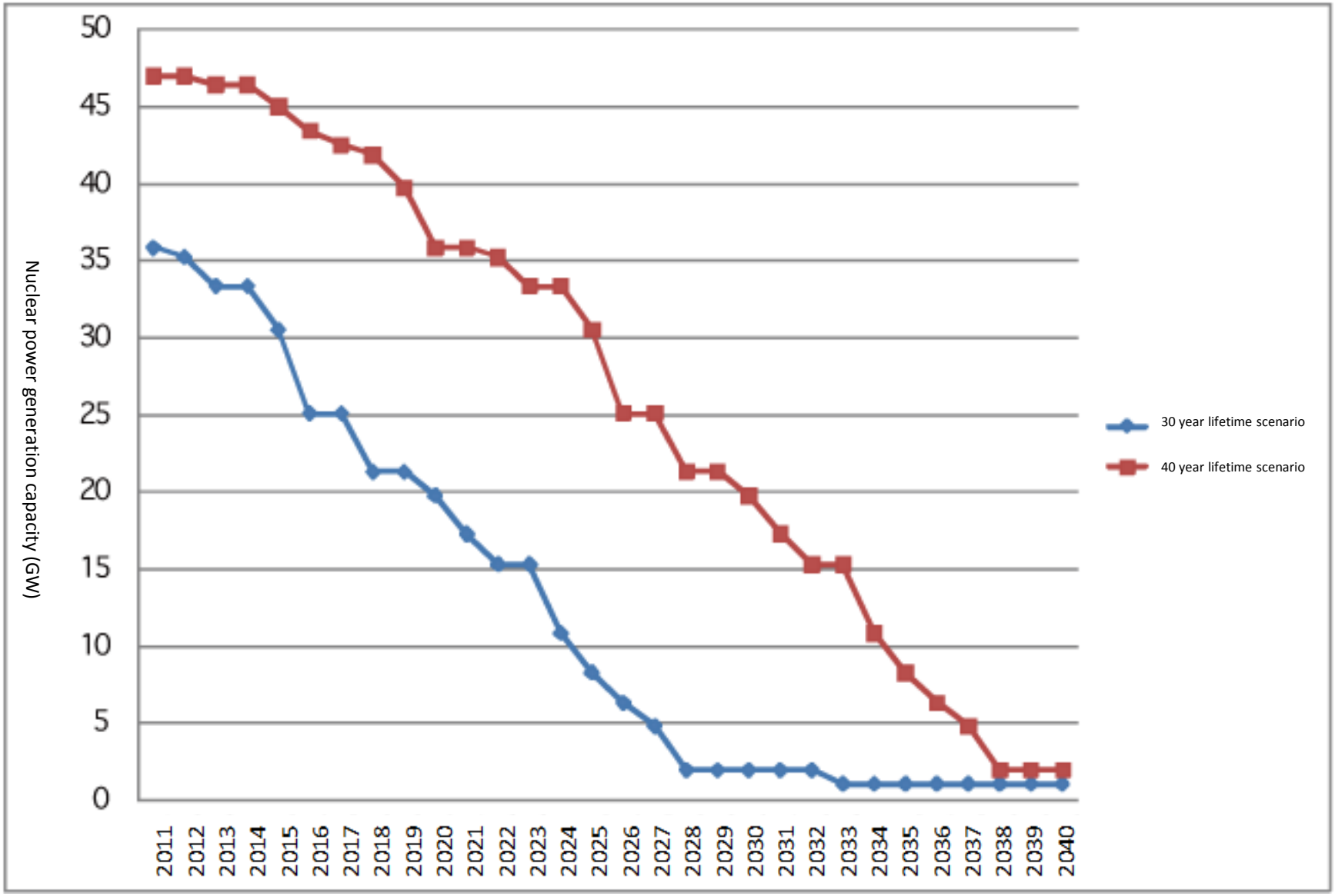
③ **Maintain top runner system for home appliances and cars**

④ **80% of fuel use of oil-related products (e.g. heavy oil) in 2005 is replaced by natural gas in the industrial sector except for the petrochemical industry**

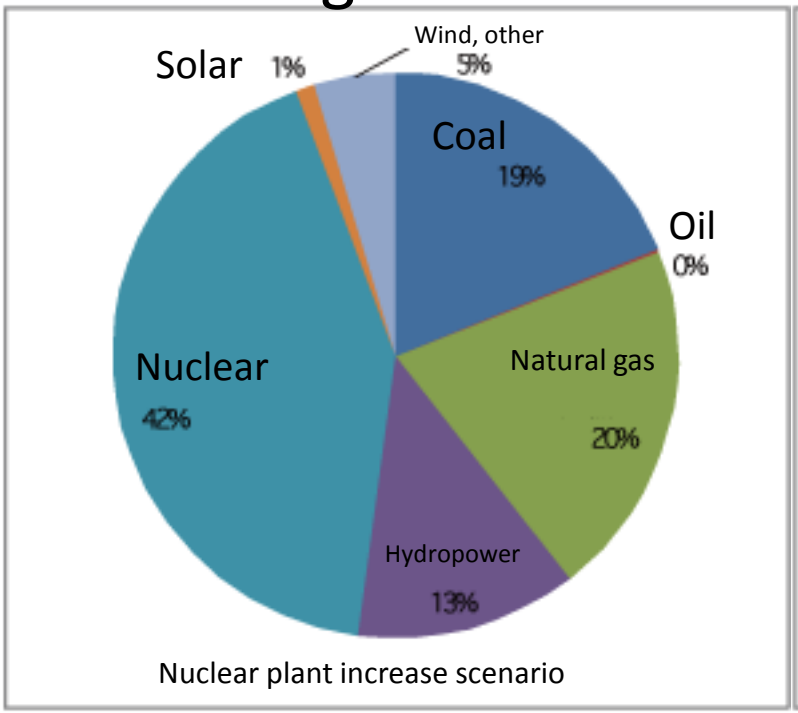
⑤ **Promotion of modal shift: CO_2 emissions of the transport sector is reduced by up to 44% through input-output analysis of distribution**

⑥ **Increase oil and coal tax revenue to about 1.5 times (tax increase of about 240 trillion yen) as global warming tax**

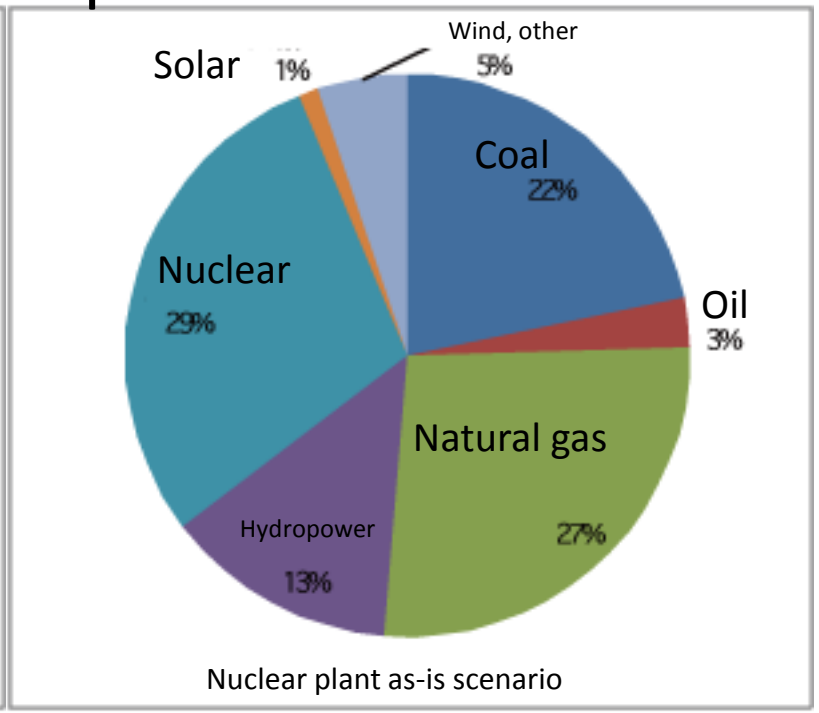
Lifetime of nuclear power and remaining capacity



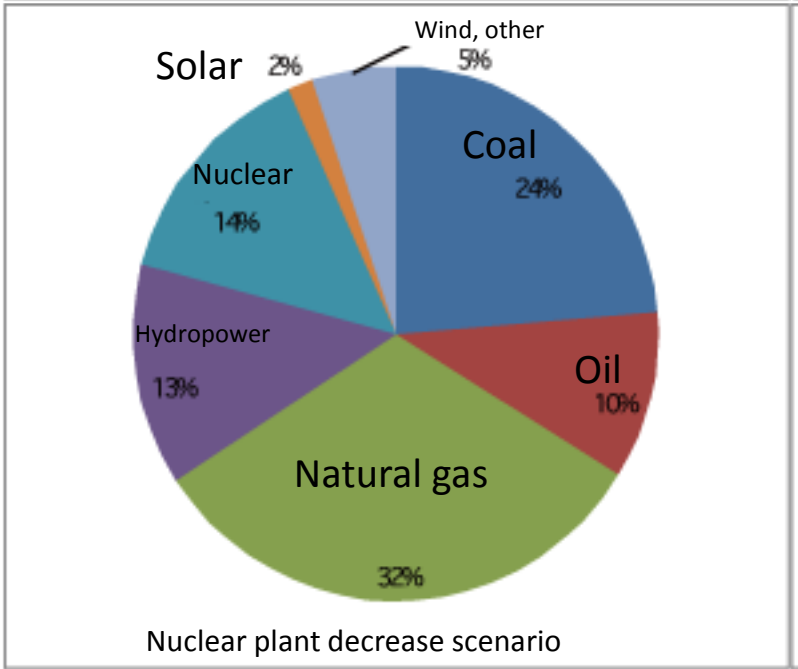
Power generation makeup in each scenario



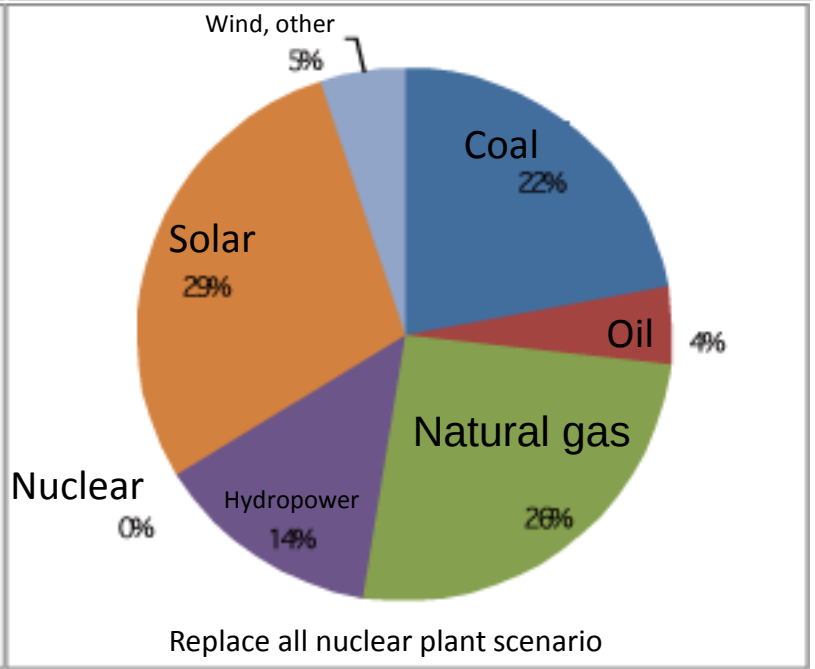
Nuclear plant increase scenario



Nuclear plant as-is scenario



Nuclear plant decrease scenario



Replace all nuclear plant scenario

Cost scenario of PV cells

（yen/W）

	2011	2015	2020	2030
Plant size	1GW/year	1GW/year	5GW/year	5GW/year
Module	150	120	100	50
BOS	200	150	100	70
Entire system	350	270	200	120

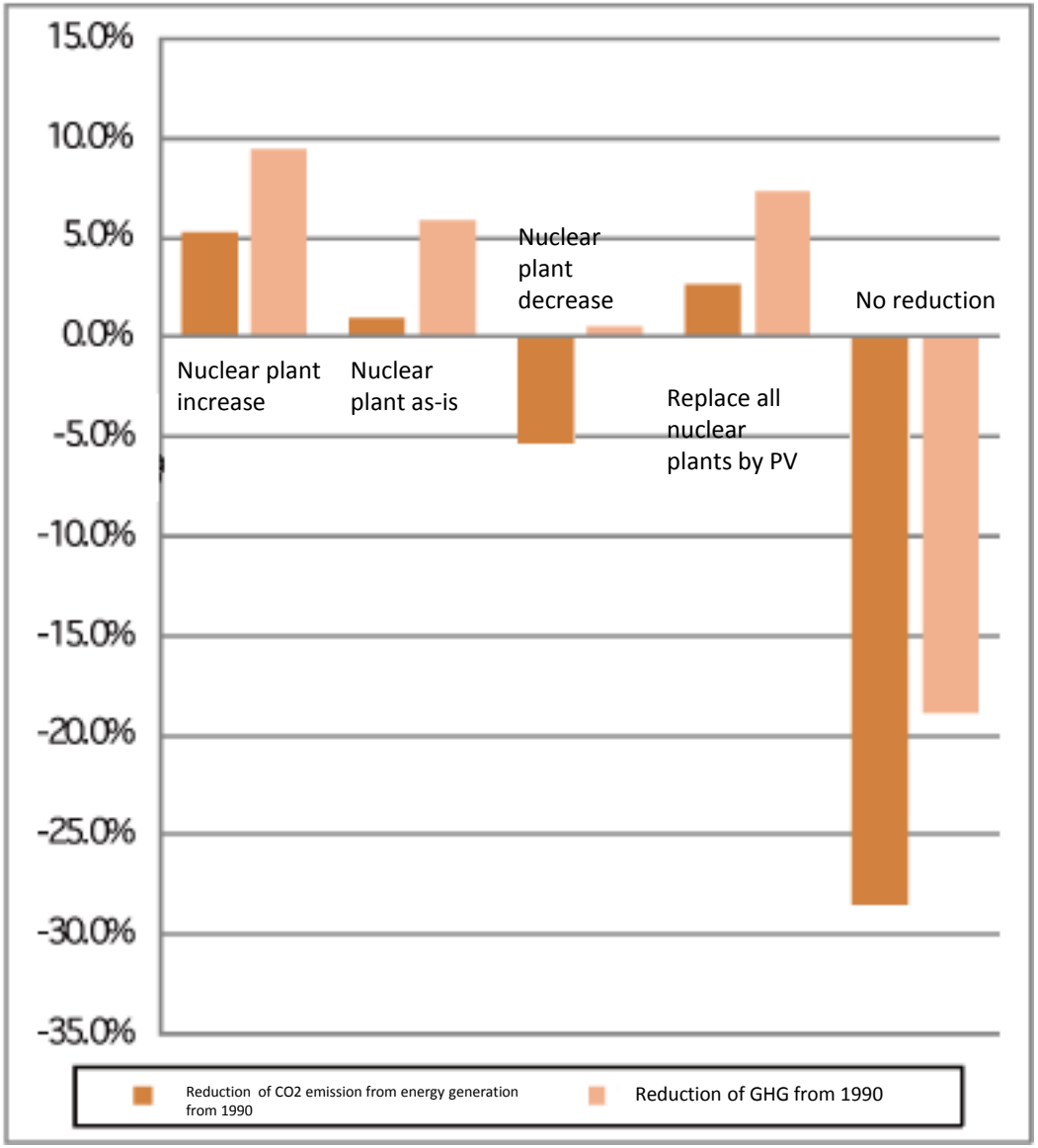
※Output per existing plant reach 1GW/year, and there is small scale merit from increasing factory size.
Further cost reduction is mainly from technology breakthroughs.
※Details of each cost reduction will be analyzed further.

（Reference：Estimated plant construction scenario

	2011	2015	2020	2030
Cumulative installation	4GW		38GW	80GW

Source: Koichi Yamada, LCS

Simulation using applied general equilibrium model: result 1

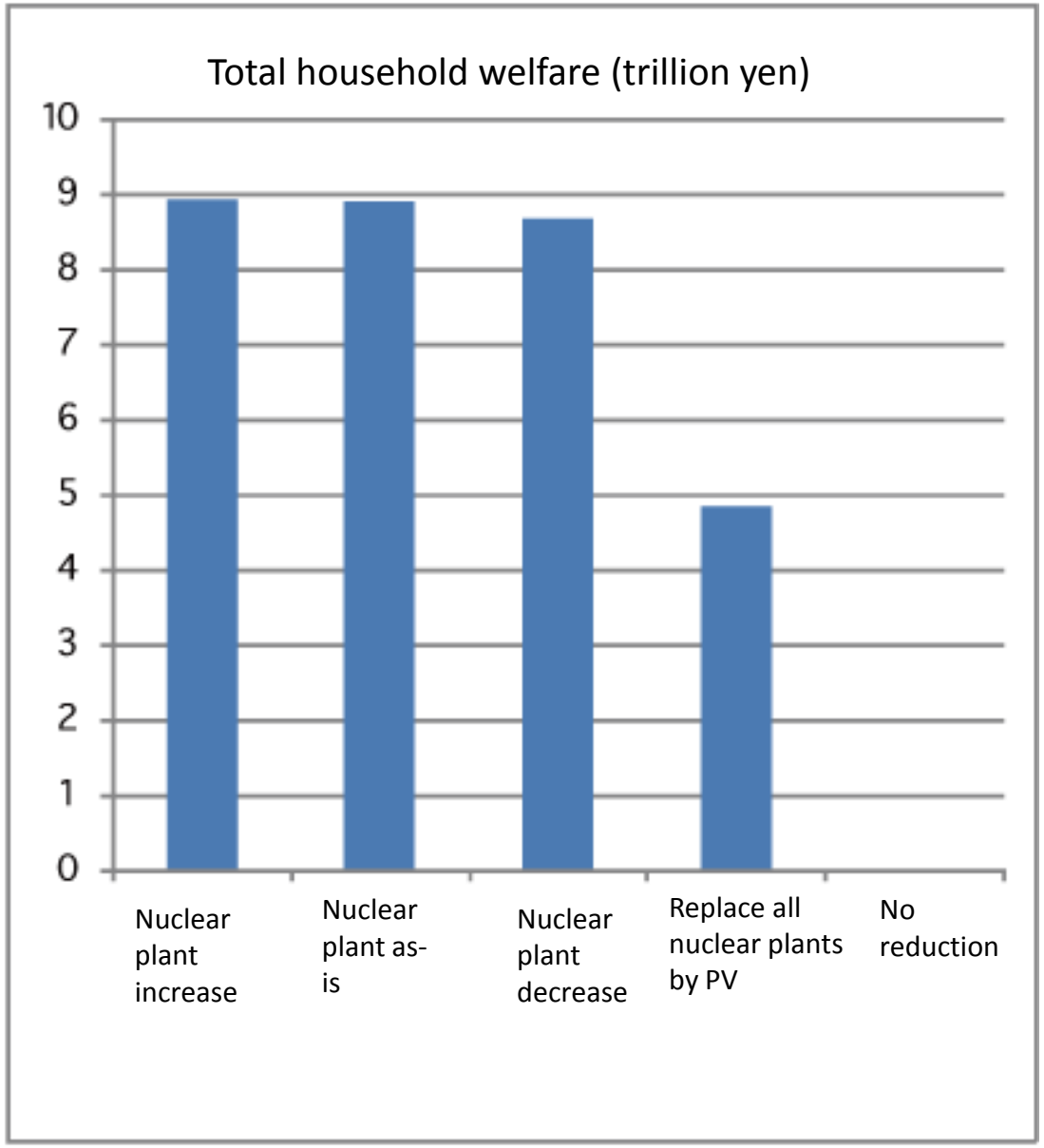


The effect of the recent accident on CO_2 reduction is huge because of decrease in the operation rate of existing nuclear plants and delays in construction of new plants.

The difference in amount of CO_2 emission from energy generation between nuclear plant increase and decrease cases compared to 1990 is about 10.6%.

Reduction of GHG and CO_2 emission from energy generation

Simulation using applied general equilibrium model: result 2



Total household welfare in each case (trillion yen)

The effect of the recent accident on welfare because of decrease in the operation rate of existing nuclear plants and delays in construction of new plants is large. (There is about 4 trillion yen difference between nuclear plant increase and replace all nuclear plants by PV scenarios.)

However, the ultimate scenario to replace all nuclear plants by PV results in higher welfare of the population compared to the no GHG reduction scenario.

Low carbon policies after the Tohoku earthquake
—The effect on nuclear power—

(1) Not constructing further nuclear plants and decreasing operation rate of existing plants because of the Tohoku earthquake has profound effect on the CO_2 emission in 2020. This analysis showed about 10.6% difference in CO_2 from power generation compared to 1990.

(2) Effect of energy and low carbon policies on household utility was evaluated. Household utility was most increased by an increase in efficiency of products related to final demand such as home appliances, and policies to accelerate promotion of energy saving and creating products was found to be important. This result holds regardless of how nuclear power is used.

(3) The Tohoku earthquake and accidents in the Fukushima-1 nuclear plant would almost certainly force changes in energy and low carbon policies. However, the long-term goal to aim for stable supply of energy and carbon reduction would not change. The government's goal to for 25% reduction of GHG compared to 1990 should be revised to scratch. Low carbon policies based on power and energy savings should be implemented in the short term. Mid-term policies should be based on promotion of technology and systems that benefit both the environment and economy, and the core would be energy savings and use of new energies.