Modeling Mosaic World: A Japanese Perspective

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Ideal world

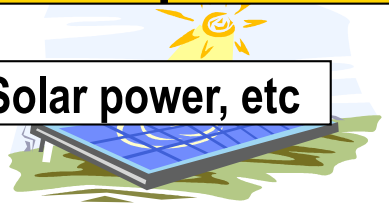
- Single carbon price
- Mitigation of cost-minimum
- Adaptation of cost-minimum
- GDP loss of mitigation <1%
- GDP loss of adaptation <1%

Real world

- Multiple carbon price
- Mitigation far from cost-minimum
  - Political pick & choose eg. PV ($1000/tCO2)
  - Security and local economy (eg. coal)
  - GDP loss of mitigation >> 1%(?)
- Adaptation far from cost-minimum
  - natural disasters unpredictable
  - loss multiplies with weak governance
  - GDP loss of adaptation >> 1%(?)

Plans of Japan – Technological Menu

Upper row: Main technologies
Lower row: Main policy measures



Solar power, etc

Cars & transportation

Houses, other buildings etc

① −4% from 2005

Solar power: 4-fold increase over present
- Purchases under Renewables Portfolio Standard (RPS) Law

Next-generation cars: 10% of new car sales
- Introduce "Top Runner Approach" standards for cars
- Preferential taxation; strengthened subsidies

Residential insulation: 70% of new residences
- Formulate energy-saving standards under the Law Concerning the Rational Use of Energy
- Preferential taxation

③ −14% from 2005

Solar power: 10-fold increase over present
- Fixed-price purchasing system
- Subsidies to promote residential solar power generation

Next-generation cars: 50% of new car sales; 20% of all cars
- Subsidies towards purchases of eco-cars

Residential insulation: 80% of new residences
- Tighten standards, expand scope of energy-saving housing
- Subsidies for buying "green" home appliances

⑤ −21% from 2005

Type A (emphasis on fiscal mobilisation)

Solar power: 25-fold increase over present
Small-scale hydro power: increase dramatically
Emphasis on LNG (reduce coal-based thermal power)
- Raise prices under fixed-price purchasing system

Next-generation cars: 53% of new car sales; 24% of all cars
Improve fuel efficiency of conventional cars
Take traffic flow measures; reinforce eco-driving
- Preferential taxation; strengthened subsidies
- Reinforce "Top Runner Approach" standards for cars

Residential insulation: 100% of new residences; 60% of all residences
Strengthening of energy-saving navigation and building energy management systems (BEMS)
- Preferential taxation; strengthened subsidies

Type B (emphasis on mandatory measures)

Solar power: 40-fold increase over present
Raise operating rates of nuclear power plants to 90% from current level of 80%
- Make solar power mandatory in all newly-built homes and existing homes above a certain size

Next-generation cars: 100% of new car sales; 40% of all cars
- Prohibit sales and disallow vehicle inspections of conventional cars

Residential insulation: 100% of new residences; 100% of all residences
- Mandatory energy-saving standards for both newly-built and existing residences

⑥ −30% from 2005

Solar power: 55-fold increase over present
- Same as in ⑤, Type B

Next-generation cars: 90% of new car sales; 40% of all cars
- Same as in ⑤, Type B

Residential insulation: 100% of new residences; 100% of existing residences to be retrofitted
- Same as in ⑤, Type B

Decrease output of energy-intensive industries (steel, chemicals, cement etc)

Carbon pricing policy (emissions trading; carbon taxes) also essential

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Comparative model run of economic impacts by 2020 Targets in Japan

		Keio Univ.	Nikkei Center		NIES
		KEO	CGE	Macro-economic	AIM/CGE
Alternative 1: +4% relative to 1990(-4% relative to 2005) , Baseline (The Alternative 1 is assumed to be 0% of GDP loss)					
Alternative 3 ▲7% relative to 1990 (▲14% relative to 2005)	GDP (real)	▲0.5%	▲0.6%	▲0.9%	▲0.5%
	Priv. Capital Spending	+3.4%	+0.1%	+2.2%	▲0.8%
	Disposable Income (per household)	▲3.1% ▲15,000 JPY	▲0.8% ▲40,000 JPY	▲0.7%	▲1.1% ▲50,000 JPY
	Energy costs (per household)	+19.7% +30,000 JPY	+17.6% +30,000 JPY	—	+13.2% +20,000 JPY
	Gasoline price	+40JPY/L	+30JPY/L	+40JPY/L	+20JPY/L
Alternative 5 ▲15% relative to 1990 (▲21% relative to 2005)	GDP (real)	▲2.1%	▲1.4%	▲2.6%	▲0.8%
	Priv. Capital Spending	+7.9%	+0.0%	+5.3%	▲0.2%
	Disposable Income (per household)	▲8.2% ▲390,000 JPY	▲1.9% ▲90,000 JPY	▲2.1%	▲2.3% ▲100,000 JPY
	Energy costs (per household)	+44.8% +80,000 JPY	+38.6% +70,000 JPY	—	+34.5% +60,000 JPY
	Gasoline price	+90JPY/L	+70JPY/L	+90JPY/L	+60JPY/L
Alternative 6 ▲25% relative to 1990 (▲30% relative to 2005)	GDP (real)	▲5.6%	▲3.2%	▲6.6%	▲6.0%
	Priv. Capital Spending	+6.6%	▲0.4%	+12.5%	▲11.9%
	Disposable Income (per household)	▲15.9% ▲770,000 JPY	▲4.5% ▲220,000 JPY	▲5.6%	▲9.1% ▲440,000 JPY
	Energy costs (per household)	+76.6% +130,000 JPY	+81.0% +140,000 JPY	—	+65.7% +110,000 JPY
	Gasoline price	+190JPY/L	+170JPY/L	+220JPY/L	+130JPY/L

Model Results – MAC for "the rest of the policy"

*1Percentage changes in the chart below indicate changes compared to the "reference case" (option ①) as of the year 2020, *not* changes compared to the present day/present conditions.

*2The results presented here are those of the Japan Center for Economic Research (JCER) running a CGE model simulation analysis, with the rate of unemployment analyzed via a macro model.

	① −4% from 2005 level	③ −14% from 2005 level	⑤ −21% from 2005 level	⑥ −30% from 2005 level
Net GDP	Reference case (against which options ③,⑤,⑥ are being compared; assumes a net GDP growth rate of 1.3% per annum)	As of 2020 **−0.6%** *(lower)*	As of 2020 **−1.4%** *(lower)*	As of 2020 **−3.2%** *(lower)*
Unemployment rate		**+0.2%** *(higher)*	**+0.5%** *(higher)*	**+1.3%** *(higher)*
Private sector capital investment		**+0.1%**	**±0%**	**−0.4%**
Disposable income		**−¥40,000 p.a.** per household	**−¥90,000 p.a.** per household	**−¥220,000 p.a.** per household
Lighting and heating expenses		**+¥30,000 p.a.** per household	**+¥70,000 p.a.** per household	**+¥140,000 p.a.** per household
Marginal abatement costs	US$35～$62/t-CO_2* *Not suitable for simple comparisons with other results, as these figures are the result of a different analytical model	¥15,000/t-CO_2 If fossil fuel prices were raised to cover this cost, the price of gasoline would rise by ¥30 per liter.	¥34,000/t-CO_2 If fossil fuel prices were raised to cover this cost, the price of gasoline would rise by ¥70 per liter.	¥82,000/t-CO_2 If fossil fuel prices were raised to cover this cost, the price of gasoline would rise by ¥170 per liter.

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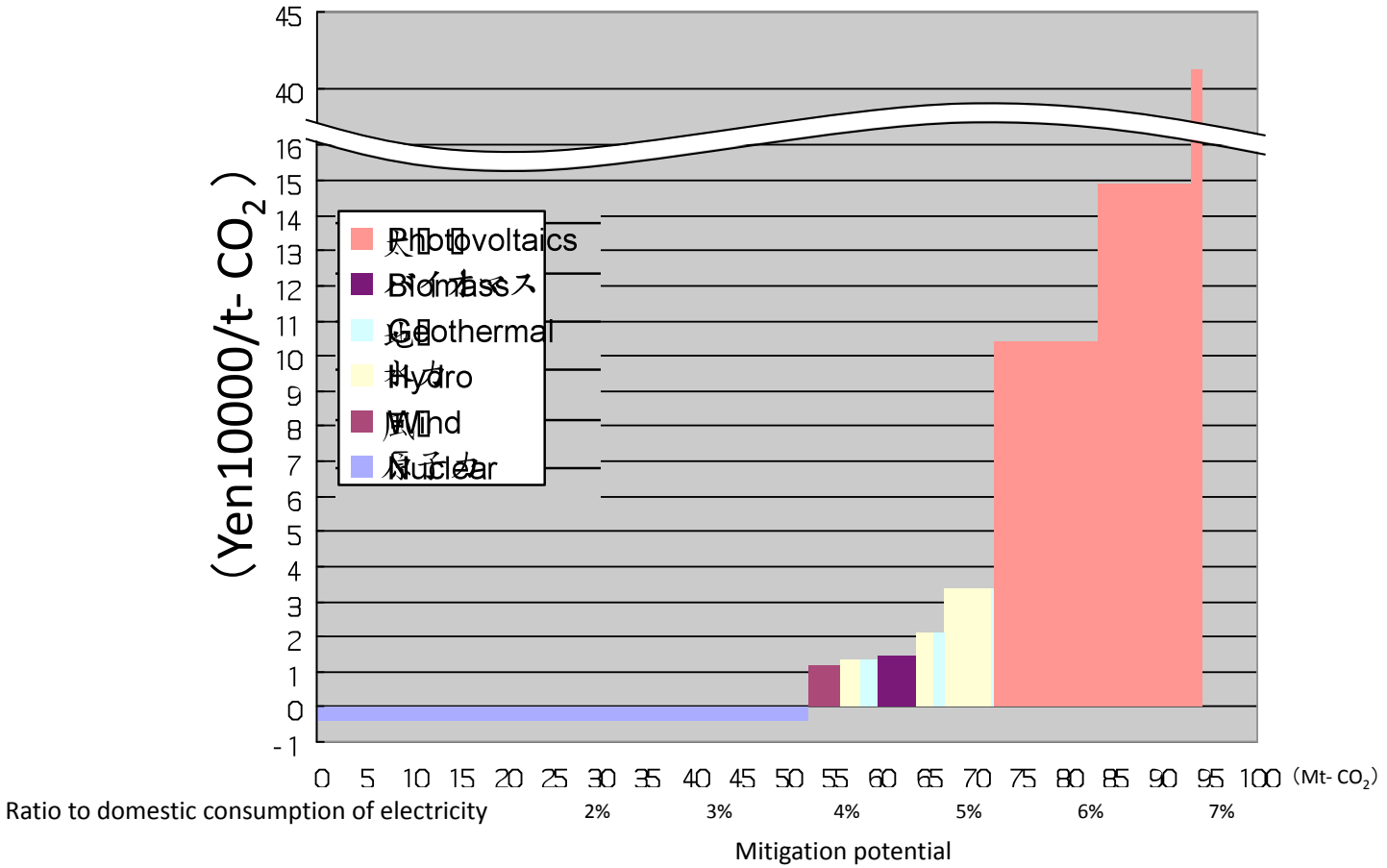
PV (& many other) costs not equal to MAC

Cost curve of zero emission power by 2030 in Japan



Source: Documents prepared for governmental committees on energy outlook toward 2030 and renewable energy policies. For more detail, please see Imanaka and Sugiyama (2009) http://criepi.denken.or.jp/jp/serc/discussion/download/09015dp.pdf

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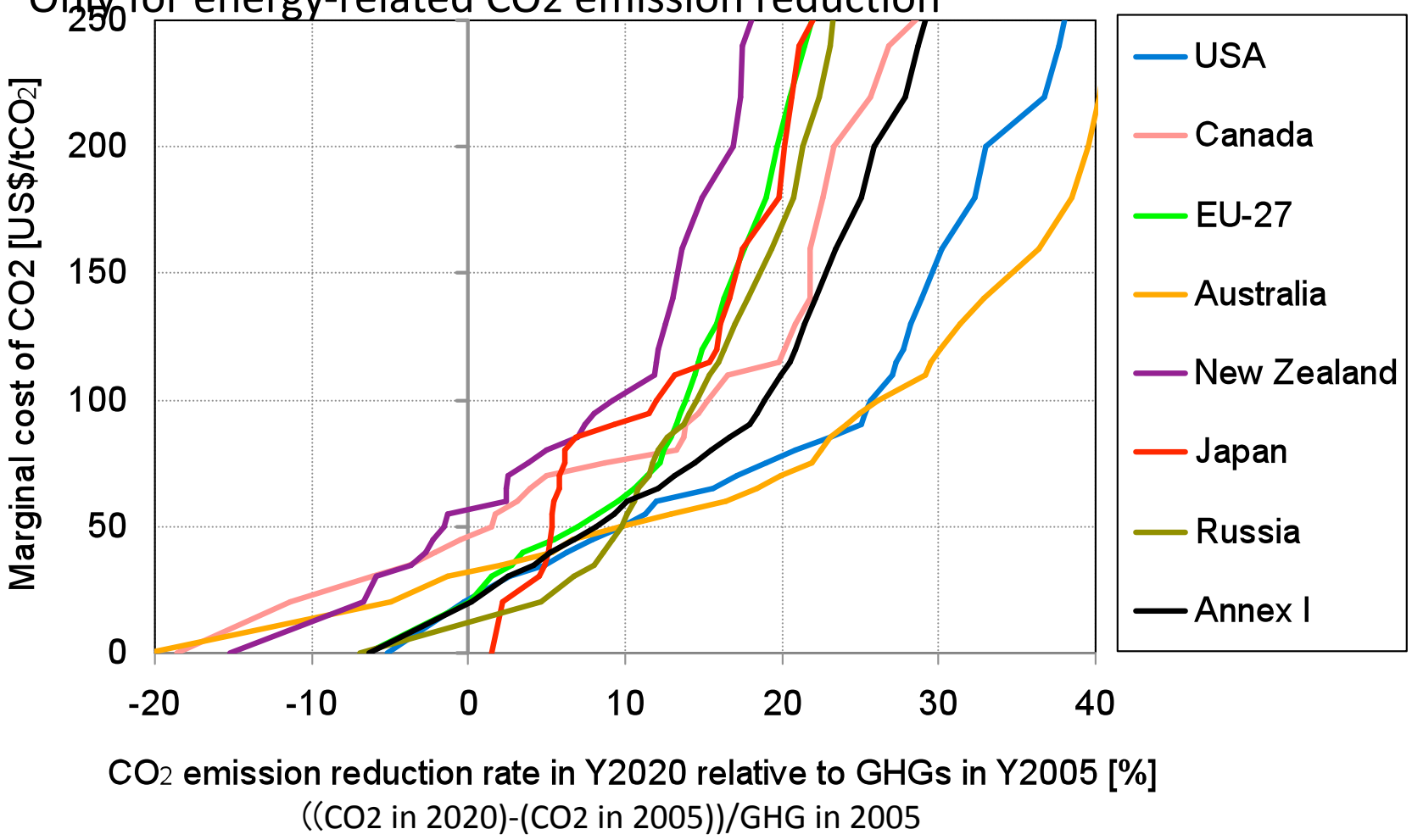
MAC curve useful for international comparison

Only for energy-related CO_2 emission reduction



However, mitigation at the minimum cost of aggregate global MAC curve would be far from the real world's actions.

Conclusion

- Modeling real world is possible

  - e.g. Japanese comparative model run for 2020 target.

- I wish modeling of real world

  - of the global mitigation

  - of adaptation of a country (& globe)

- To understand the real costs of climate change to the economy.

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