Reduction Balance Table (RBT)

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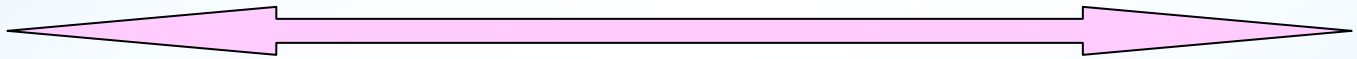
10-12, March, 2005
The 10th AIM International Workshop
At Ohyama Memorial Hall
National Institute for Environmental Studies, 305-8506, Tsukuba, Japan

Outline of RBT

Example of Result

Annual average change rate



Scenario	Change from base year (%)	Annual change rate (%/y)	Decomposition of CO_2 emission (%/y)					
			CO_2 capture and storage	Carbon Itensity	Conversion Efficiency	Energy Intensity	Activity	Residual
F4 Nuclear	−69.43	−2.34	−	−2.47	0.36	−1.90	1.70	−0.04
F4 RCogN	−69.75	−2.36	−	−2.29	0.17	−1.91	1.70	−0.03
F4 w/o N+Seq	−69.26	−2.33	−1.96	0.21	−0.42	−1.84	1.70	−0.03

Decomposition of CO_2 emission（1）

Carbon Intensity

Energy Intensity of final demand sector

$$C = \frac{C}{CS} \cdot \frac{CS}{PE} \cdot \frac{PE}{FE} \cdot \frac{FE}{A} \cdot A$$

$$= s \cdot i \cdot e_p \cdot e_f \cdot A$$

C : CO_2 including CCS, *CS* : CO_2 excluding CCS,

PE : Primary energy, *FE* : Final energy, *A* : GDP

Decomposition of CO_2 emission (2)

Decomposition of changes in CO_2 emission

$$\frac{\Delta C}{C} = \frac{\Delta s}{s} + \frac{\Delta i}{i} + \frac{\Delta e_p}{e_p} + \frac{\Delta e_f}{e_f} + \frac{\Delta A}{A} + \text{residual}$$

$\Delta s / s$: CO_2 capture and storage

$\Delta i / i$: Fuel mix

$\Delta e_p / e_p$: Energy conversion efficiency

$\Delta e_f / e_f$: Energy intensity

$\Delta A / A$: GDP

Japan's existing scenarios

Japan has the medium-term scenarios towards 2030.

* Ministry of the Environment・・
  Four socio-economic scenarios (based on SRES)
* Ministry of Economic, Trade and Industry
  Long-term energy supply and demand outlook
  (to estimate effects of some measures)
* Citizen's Open Model Projects for Alternative and Sustainable Scenarios (NGO)
  Towards a sustainable energy society

These scenarios are not the long-term scenarios and are not a scenarios for climate stabilization.

Introduction

- Japan started to develop its long-term climate stabilization scenario toward 2050 in April 2004.

- Many European countries have issued the national long-term scenarios toward 2050. Their ambitious targets of CO_2 emission reduction are aiming at a decrease of more than 50% of today's emission.

National long-term scenarios

Country	Agency	Base Year	Target Year	Reduction Target from Base Year
France	Interministerial Task Force on Climate Change (MIES)	1990	2050	CO_2 : 75%
Germany	Enquete Commission	1990	2050	GHG : 80%
	Advisory Council on Global Change (WBGU)	1990	2050	CO_2 : 80%
United Kingdom	Dept. of Trade and Industry (DTI)	2000	2050	CO_2 : 60%
	Royal Commission on Environmental Pollution	1997	2050	CO_2 : about 60%
The Netherlands	The National Institute for Public Health and the Environment (RIVM)	1990	2050	GHG : 80%
Sweden	Ministry of the Environment	1990	2050	GHG : 50-60%
Finlnad	The National Technology Agency	1990	2030	CO_2 : 20%(10-30)
Canada	Natural Resources Canada	1990	2050	GHG : about 50%

Objectives of Research

Objectives:

In order to develop Japan's long-term climate stabilization scenario, analyze the long-term climate stabilization scenario in foreign countries and the medium-term scenarios in Japan by RBT.

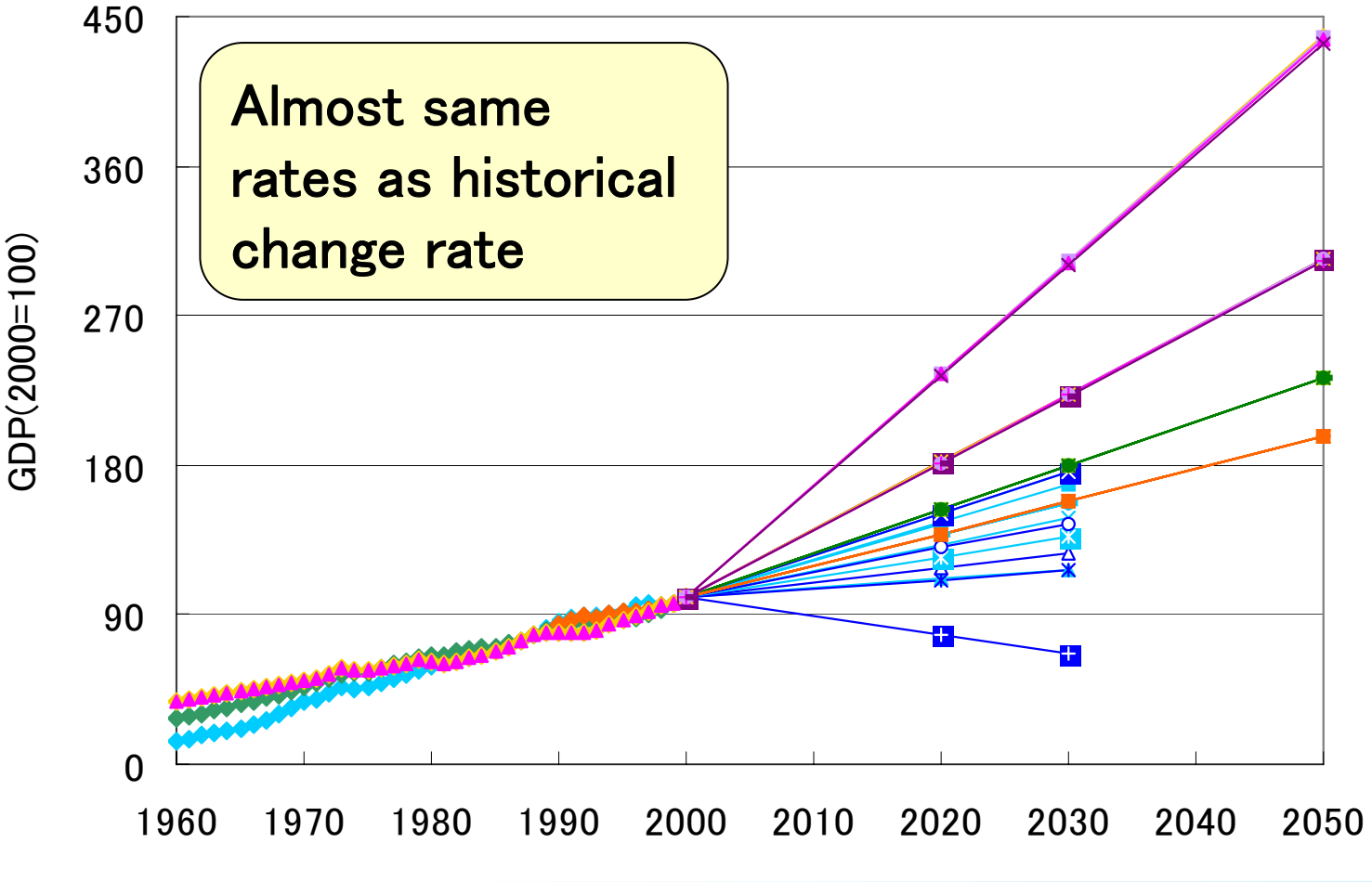
Target :

Germany, France, United Kingdom, Japan

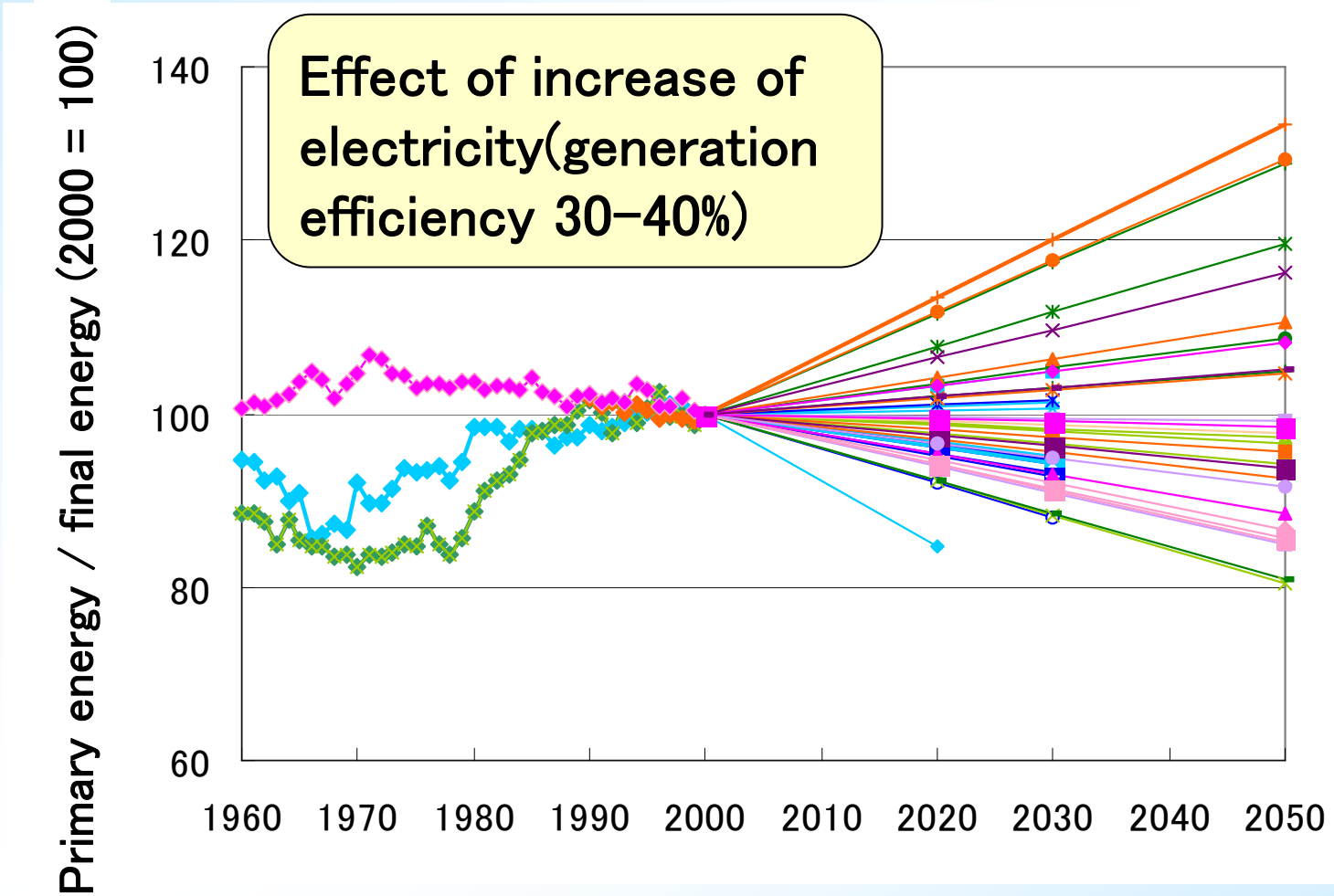
Characters of Scenarios

Agency	Scenarios	Charactors
Japan, APERC	EDSO 2002	BaU
Japan, MOE	A1、A2、B1、B2	BaU
Japan, METI	Renewables, Saving energy	Promotion of renewables or saving energy
	Nuclear high, low	Difference rate of nuclear introduction
	Economic growth high, low	Difference rate of economic growth
	Combine options	Economic growth high, saving energy, nuclear low
Japan, COMPASS	Boiled frog	BaU
	Revival	Achive goals under the present socioeconomic system
	Switchover	Socioeconomic paradigm shift toward a slow society
France, MIES	w/o Eco	BaU
	Eco w/o fuel switching	Without fuel switching, with improved energy efficiency
	Supply	Involving a supply-driven response to climate change
	Gas turb	40% gas turbines share of electricity production
	F4 nuclear	Increased nuclear development
	F4 RCogN	Combing the use of nuclear, CHP, renewables
	F4 Sequestr	Maintaining large-scale fossil fuel use + CCS
	F4 w/o N+Seq	Abandoning nuclear power + CCS
	F4 H2	Hydrogen production network using nuclear power
Germany, Enquete Commission	Reference	Continuation of the current energy policy
	Efficient Conversion	Accelerated increase of fossil fuels use efficiency, CCS
	RES/EEU Initiative	Phased out of Nuclear power, promotion of renewables
	Fossil-Nuclear Energy Mix	Construction of new nuclear power stations after 2010
UK, DTI	Baseline45、60、70	Current values of society remain unchanged
	World Markets45、60、70	Globalisation , Scant regard for the global environment
	Global Sustainability45、60、70	Strong collective environmental action

GDP


Almost same rates as historical change rate
GDP(2000=100)
450
360
270
180
90
0
1960
1970
1980
1990
2000
2010
2020
2030
2040
2050
Japan
France
Germany
United Kingdom

Primary energy / final energy



Reduction Balance Table

$$\frac{\Delta C}{C} = \frac{\Delta s}{s} + \frac{\Delta i}{i} + \frac{\Delta e_p}{e_p} + \frac{\Delta e_f}{e_f} + \frac{\Delta A}{A} + residual$$

	Scenario	Change from base year (%)	Annual change rate (%/y)	Decomposition of CO_2 emission (%/y)					
				CO_2 capture and storage	Carbon Itensity	Conversion Efficiency	Energy Intensity	Activity	Residual
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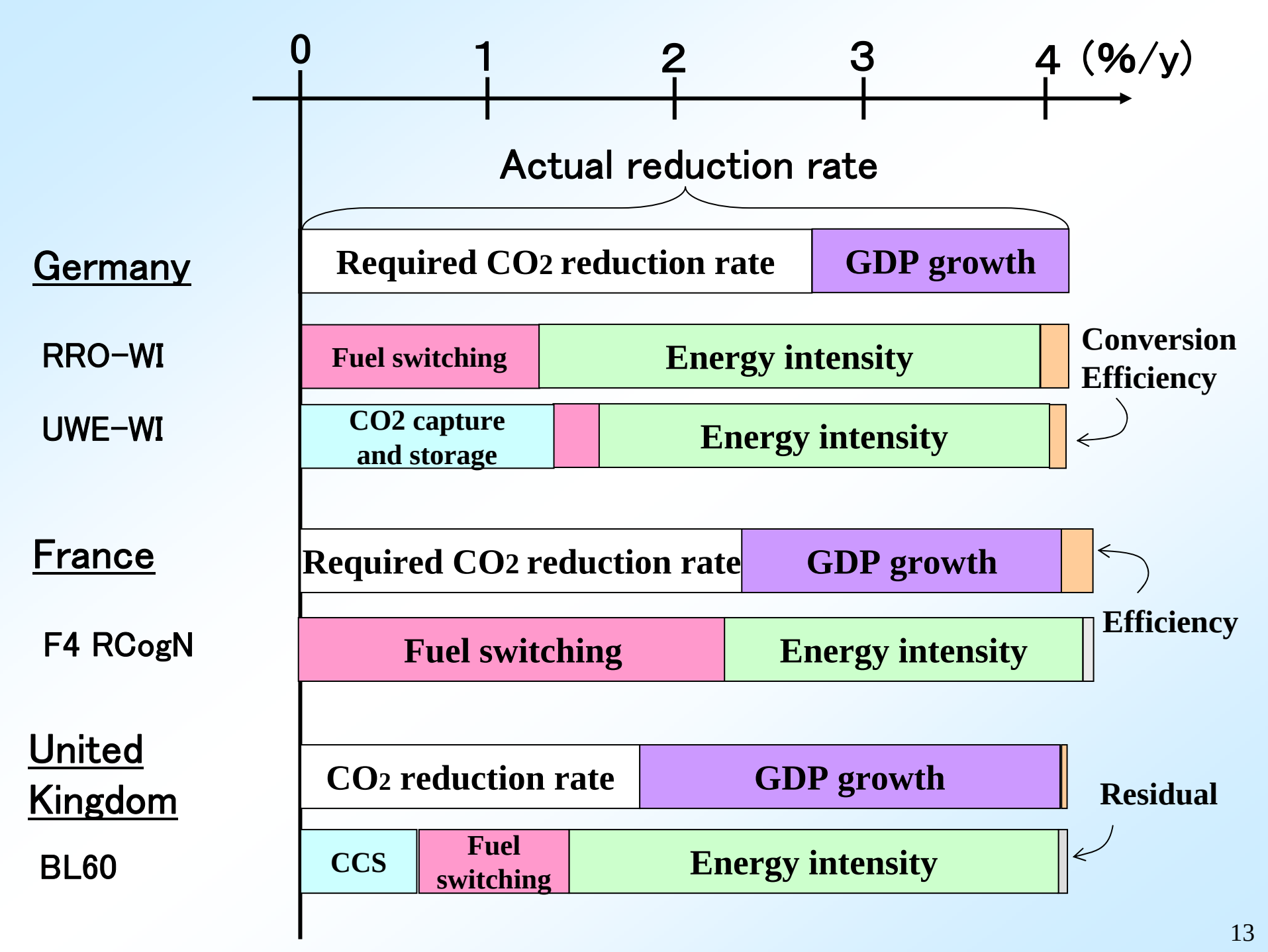
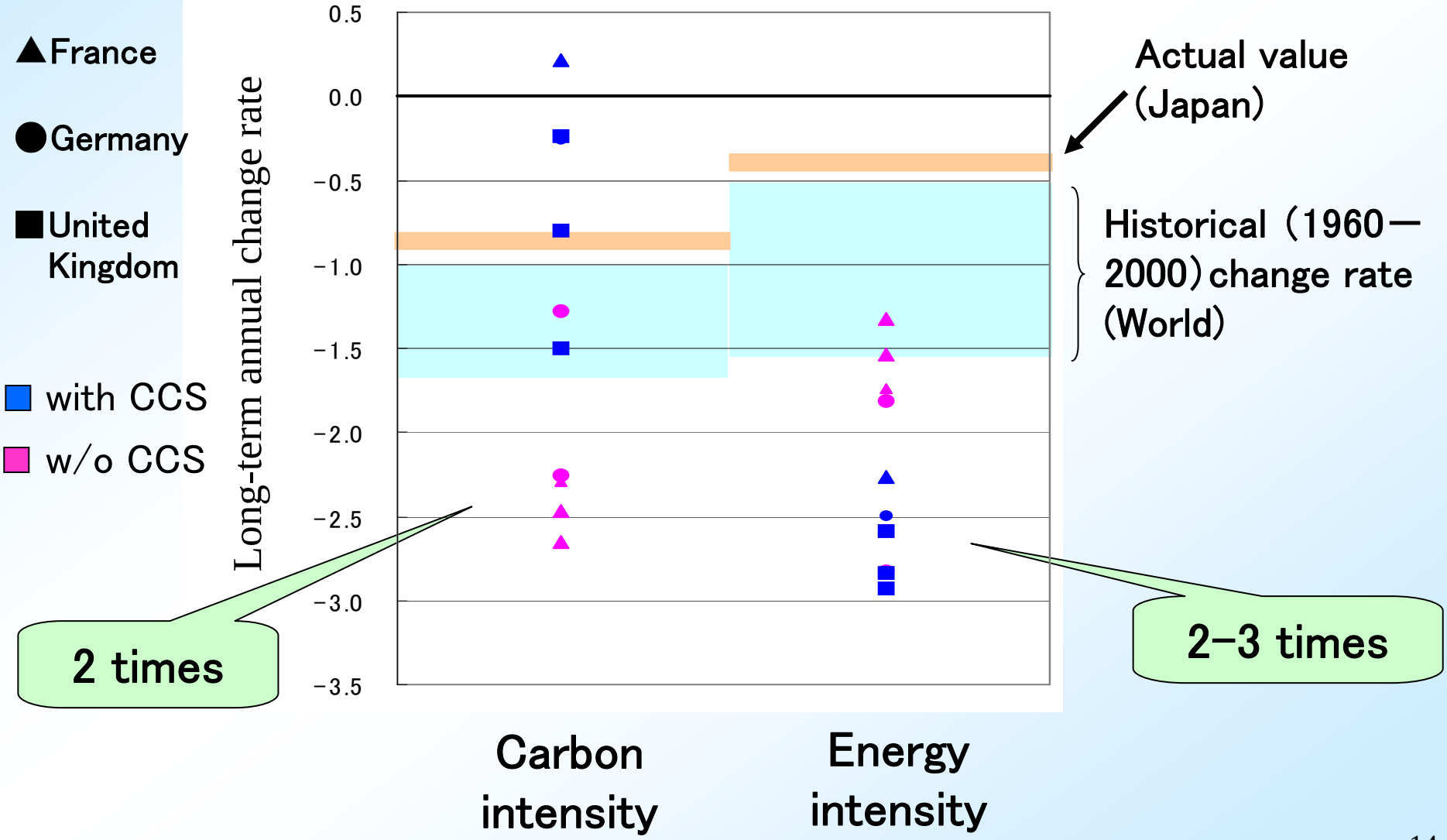
	F4 w/o N+S	−69.26	−2.33	−1.96	0.21	−0.42	−1.84	1.70	−0.03
	F4 H2	−69.01	−2.32	−	−2.65	0.51	−1.84	1.70	−0.04
Germany	UWE-WI	−75.08	−2.74	−1.35	−0.25	−0.09	−2.40	1.37	−0.01
	RRO-WI	−75.25	−2.75	−	−1.28	−0.15	−2.67	1.37	−0.02
	FNE-WI	−74.97	−2.73	−	−2.26	0.52	−2.33	1.37	−0.03
UK	BL60	−59.92	−1.81	−0.62	−0.80	0.03	−2.61	2.24	−0.05
	WM60	−59.92	−1.81	−0.28	−1.50	0.16	−3.09	2.99	−0.09
	GS60	−59.92	−1.81	−0.93	−0.23	−0.03	−2.81	2.24	−0.05


0
1
2
3
4 (%/y)
Actual reduction rate
Germany
Required CO2 reduction rate
GDP growth
RRO-WI
Fuel switching
Energy intensity
Conversion Efficiency
UWE-WI
CO2 capture and storage
Energy intensity
France
Required CO2 reduction rate
GDP growth
Efficiency
F4 RCogN
Fuel switching
Energy intensity
United Kingdom
CO2 reduction rate
GDP growth
Residual
BL60
CCS
Fuel switching
Energy intensity

Comparison with historical data



Decomposition of carbon intensity(1)

$$i = \frac{CS}{PE} = \frac{\text{CO2 excluding CCS}}{\text{Primary energy}}$$

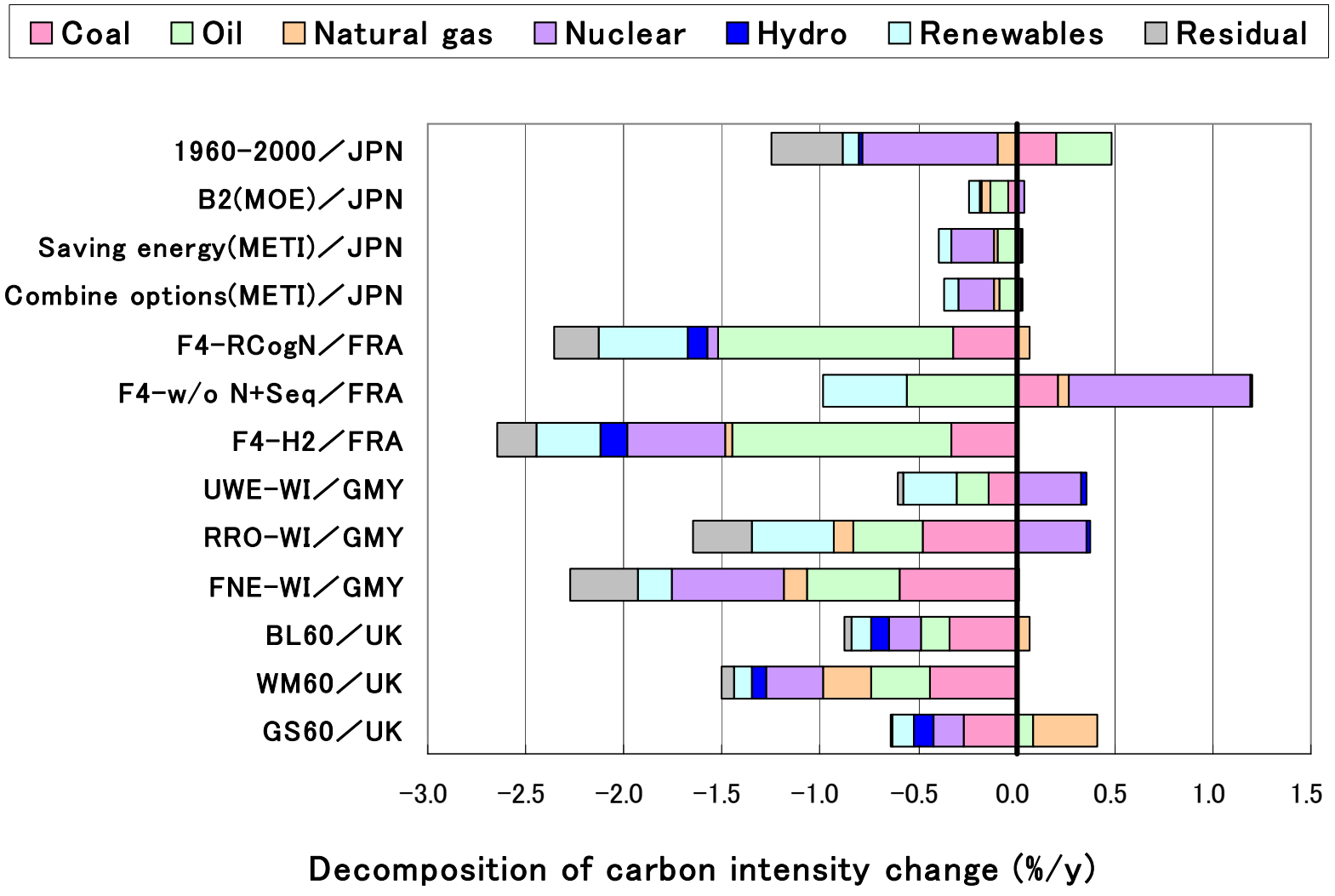
Contribution of energy type to change of CI

$$\frac{\Delta i}{i} = \sum_j \left(\frac{\Delta CS_j}{CS} - \frac{\Delta PE_j}{PE} \right) + residual$$

Increase of Nuclear・Hydro・Renewables

→ Contribution to decrease of CO_2 emission

Decomposition of carbon intensity(2)



Towards Japan's long-term scenario

<Condition>

GDP growth: 1.53%

Maximum CCS: 1.21%

CI intensity: 0.68-1.98%

The combination of CI and EI must be set up within the slash zone.