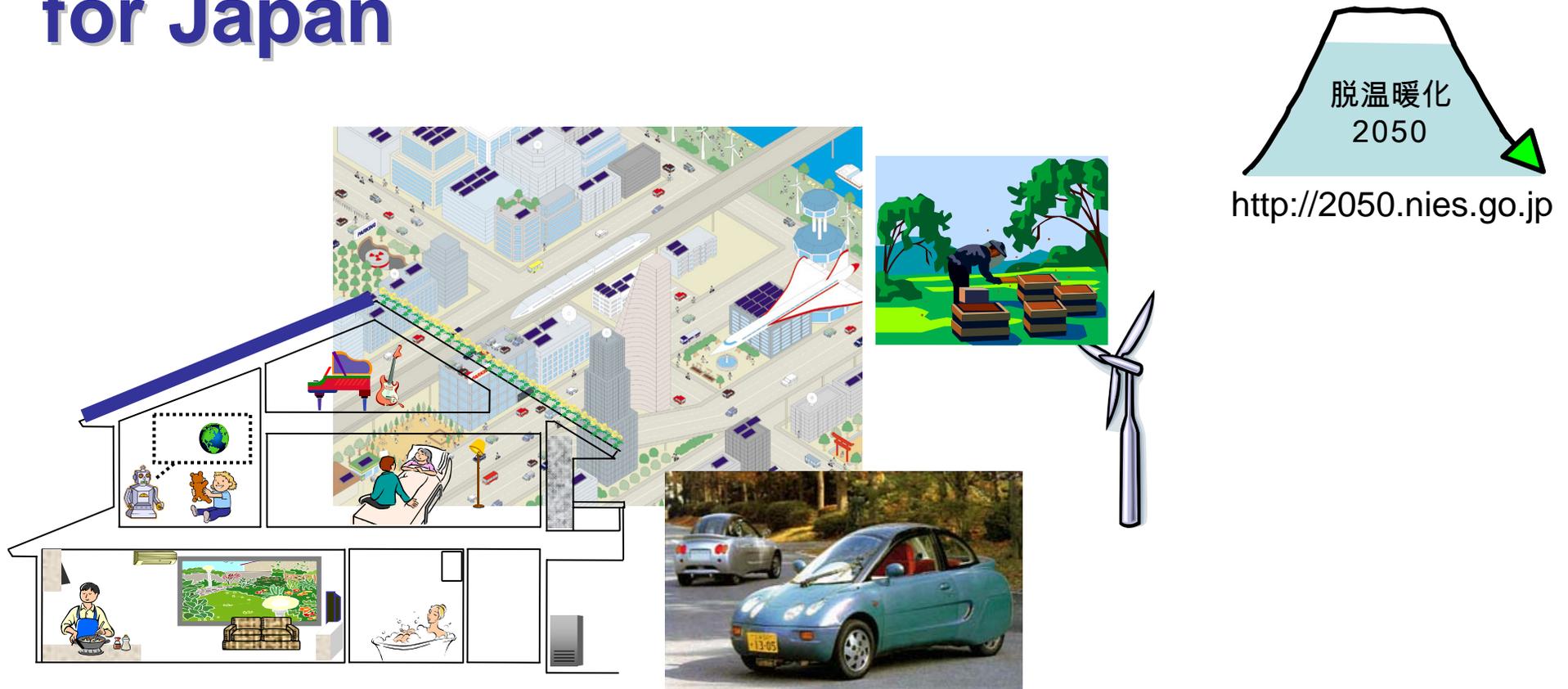


Low Carbon Scenario Toward 2050 for Japan



Mikiko Kainuma (mikiko@nies.go.jp)

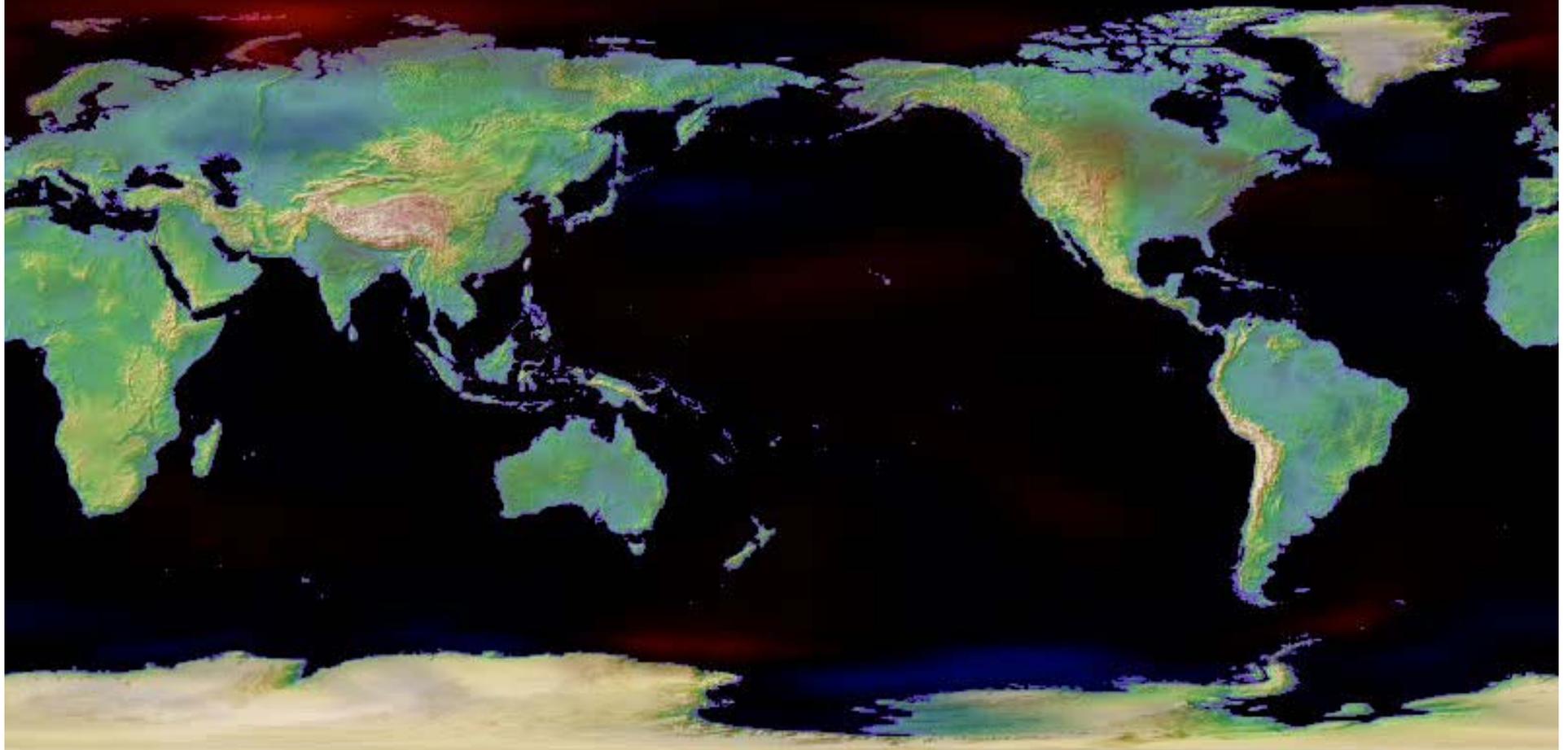
NIES (National Institute for Environmental Studies)

China-Korea-U.S. Economic and Environmental Modeling Workshop

20-21 April 2006, Xia Da Du International Conference Center, Beijing, China

CCSR/NIES/FRCGC, Japan

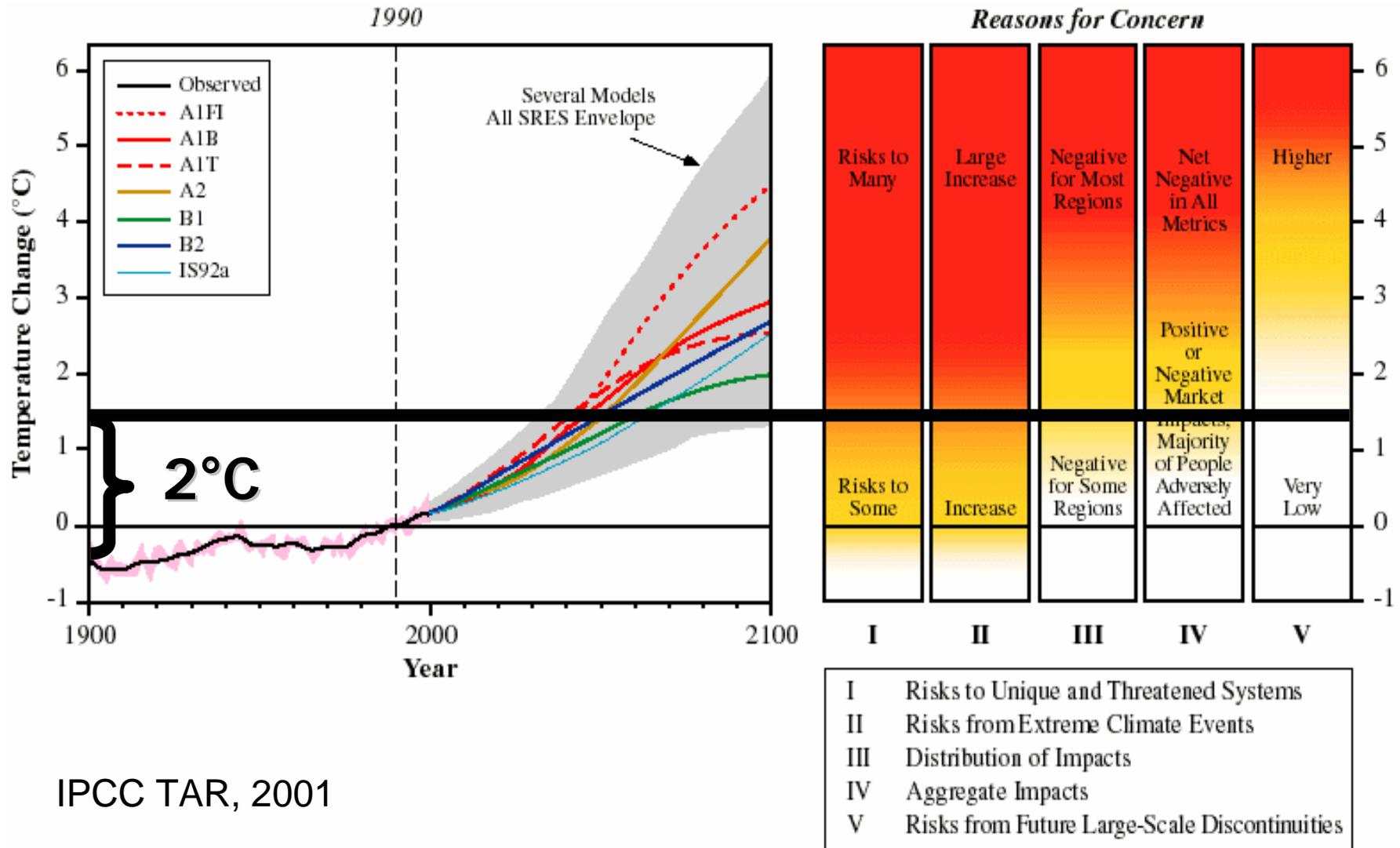
Surface Air Temperature Change



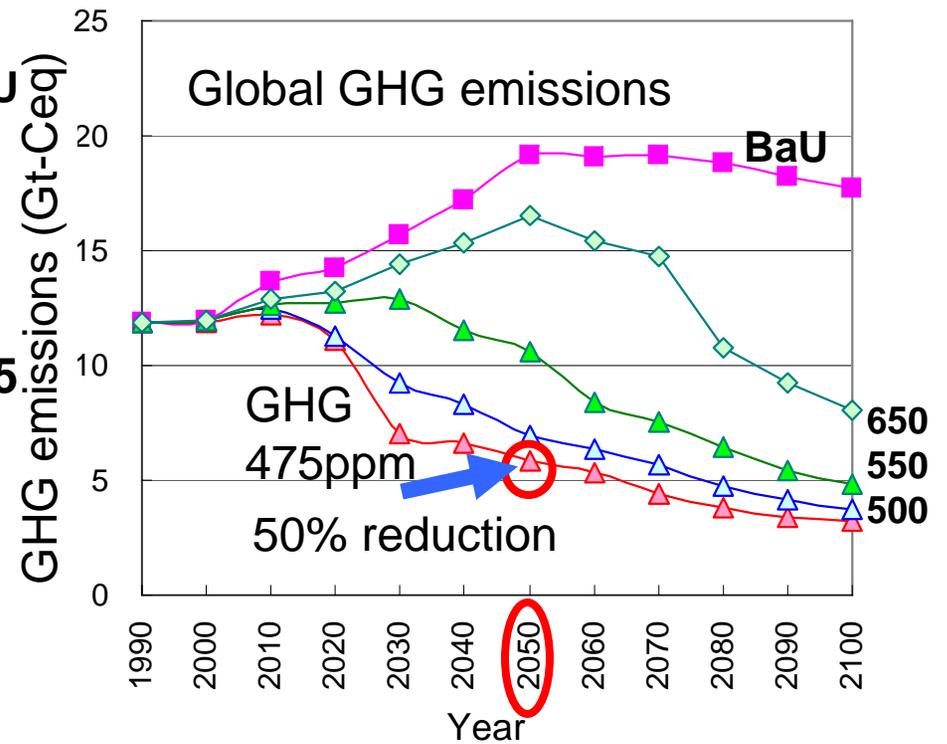
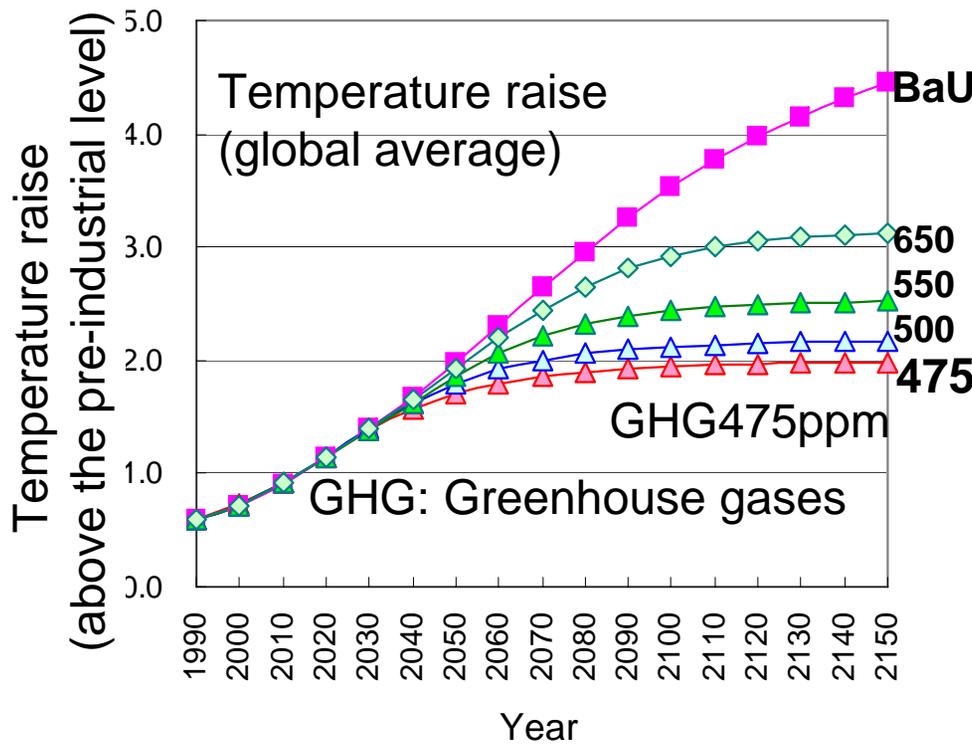
1950



To avoid serious CC impacts, it is likely to be necessary of temperature raise stabilization below 2 degree compared with pre-industrialized level



IPCC TAR, 2001



■ BaU
 ▲ GHG-475ppm
 ▲ GHG-500ppm
 ▲ GHG-550ppm
 ◆ GHG-650ppm

•It is estimated that around 50% GHG reductions in 2050 are required to control temperature raise below 2C

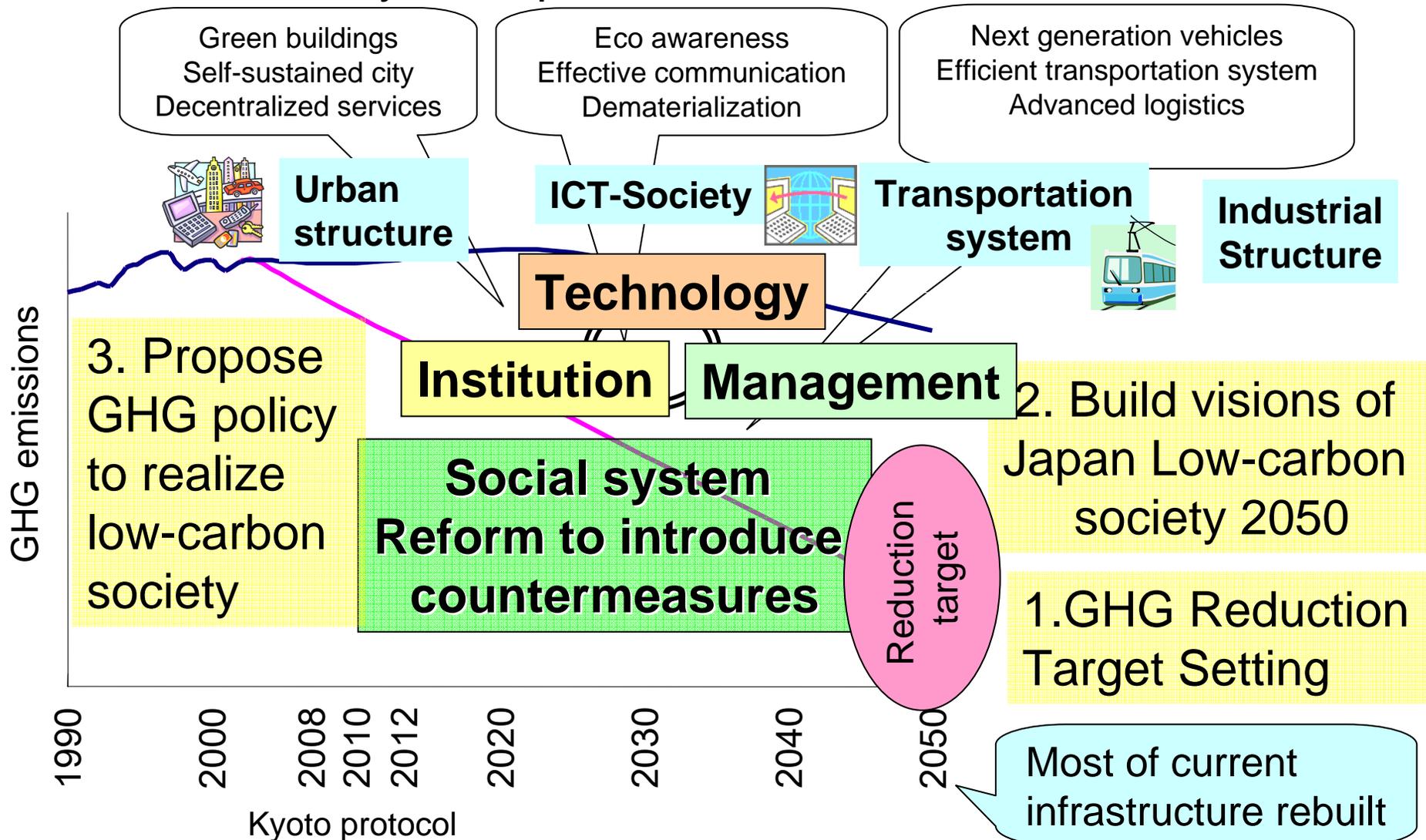
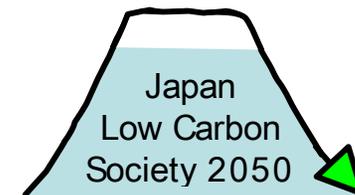
•Japan may be required more reduction (60-80%).
 Another country-level 2050 scenarios have been studied (UK 60%, Germany 80%, France 75%, and so on).

•Impacts will be occurred even in 2C temp control.
•Adaptation is necessary.

Calculated by
 AIM/Impact[policy]
 Model

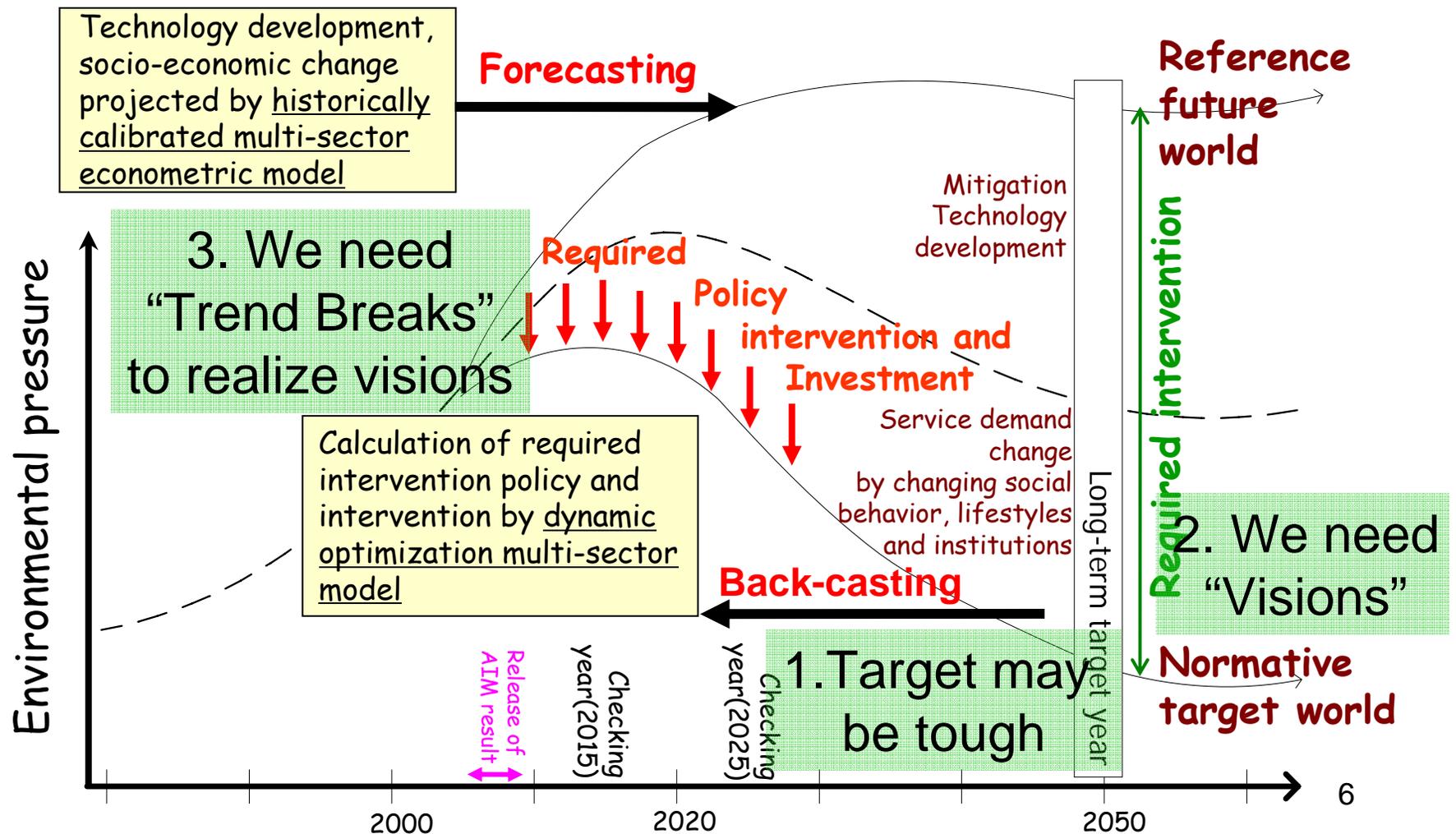
Research project on Japan Low-carbon society scenario

studied by 60 Japanese researchers



[FY2004-2006(+2years), Global Environmental Research Program, MOEJ]

Back-casting from future target world by the macro-economy and industry structure dynamics model



Depict “Japan Low carbon society 2050”

What kind of demands/services,
Japanese needs in 2050?

==

Depict living and
working style

Desired future: The society allows wider range of choice

Scenario A: Vivid, Technology-driven	Scenario B: Slow, Natural-oriented
Urban/Personal	Decentralized/Community
Technology breakthrough Centralized production/recycle	Self-sufficient Produce locally, consume locally
Comfortable and Convenient	Social and Cultural Values

Considering global relationship, energy security, other environmental problems

We do research to depict various kinds of future
qualitative and quantitative

How fast GHG emissions should reduce?

Total amount

$$\text{CO}_2 \text{ emissions} = \text{Pop} \times \left(\frac{\text{Activity}}{\text{Pop}} \right) \times \left(\frac{\text{Energy}}{\text{Activity}} \right) \times \left(\frac{\text{CO}_2}{\text{Energy}} \right)$$

Per capita activity Energy Intensity Carbon Intensity

Change rate = speed

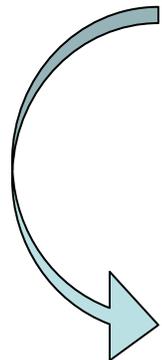
$$\text{CO}_2 \text{ emission Change rate} = \text{Pop Change rate} + \left(\frac{\text{Activity}}{\text{Pop}} \right) \text{ change rate} + \left(\frac{\text{Energy}}{\text{Activity}} \right) \text{ change rate} + \left(\frac{\text{CO}_2}{\text{Energy}} \right) \text{ change rate}$$

- 2 ~ 3 %/year - 0 . 5 %/year 1 . 5 %/year Y %/year X %/year

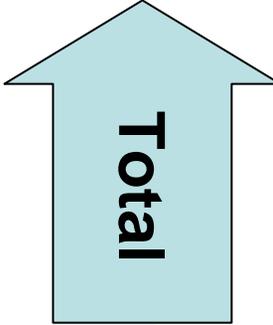
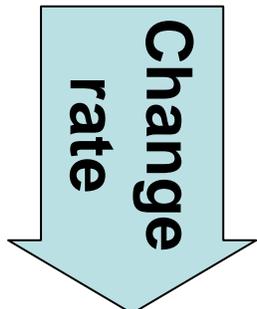
1 %/year

- 3 ~ 4 %/year 8

Maximum numbers of existing studies: - 2 %/year

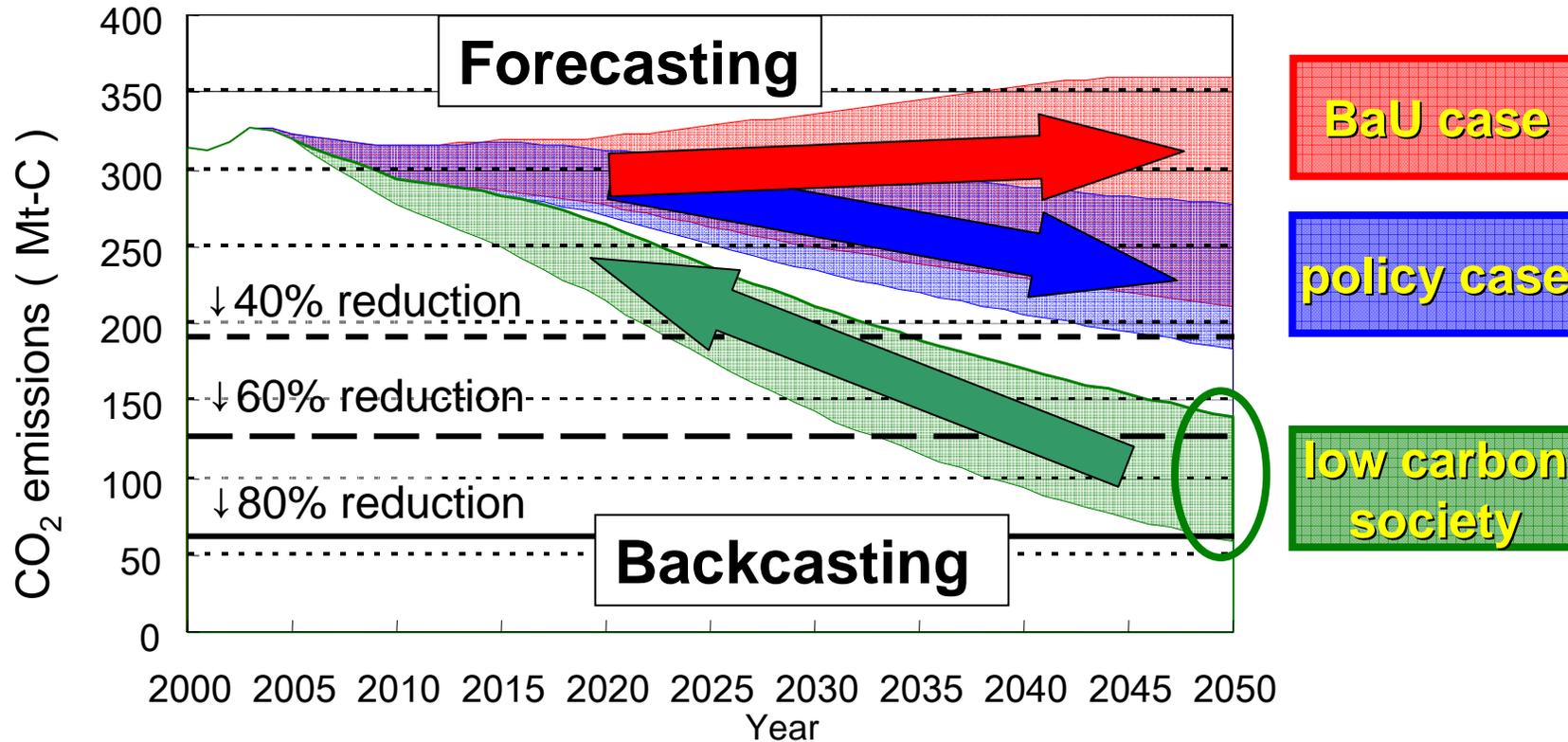


differential



integral

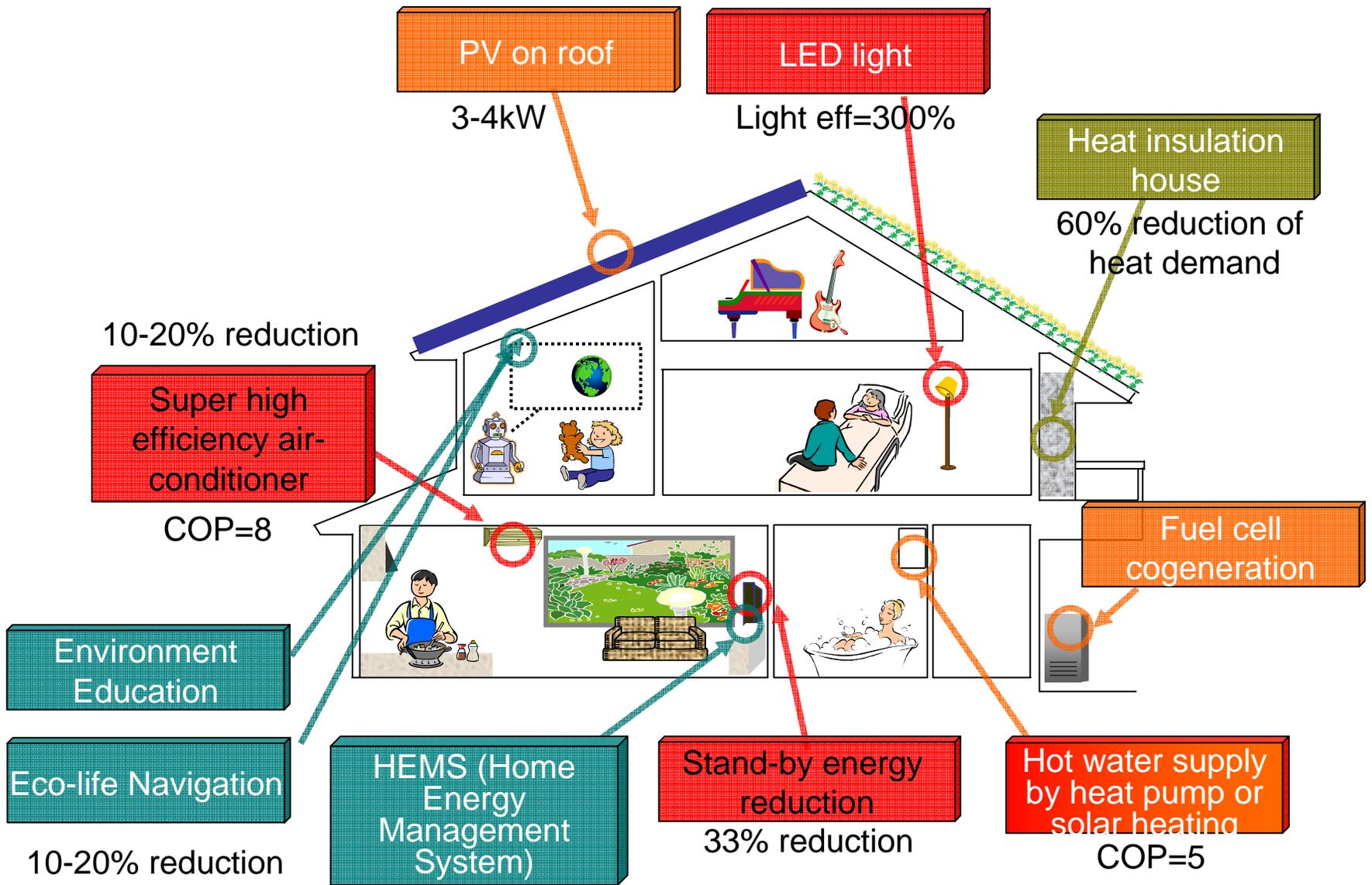
Path toward Low Carbon Society, Japan



Energy Saving devices
Energy Supply change

Urban System Change
Industry Structure Change
Information Technology
Renewable energy
Consumption Behavior

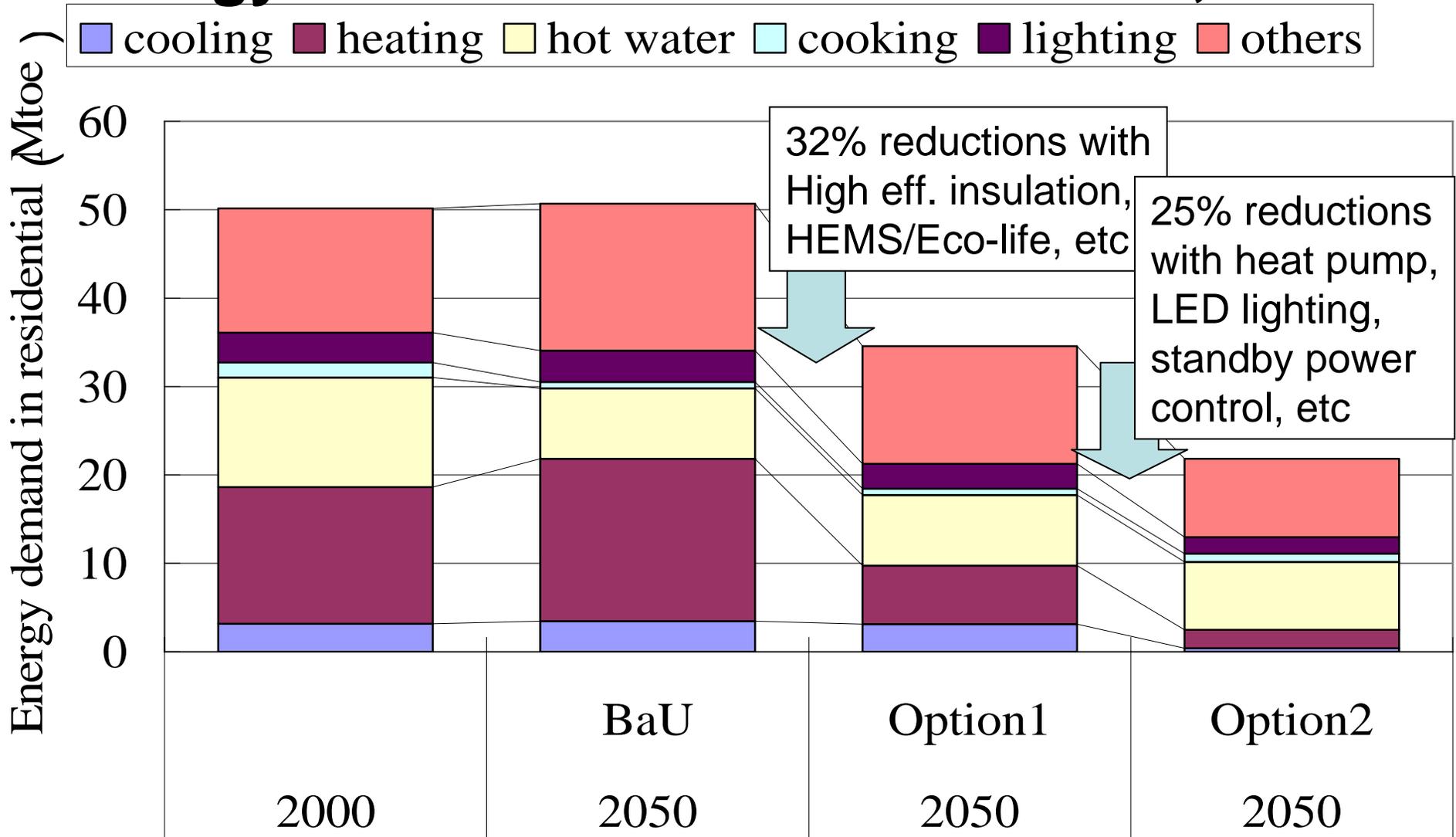
Depict Future Image: Residential sector in 2050



Efficient use
New energy

Infrastructure
Eco-lifestyle 10

Energy demand in residential sector, 2050



60% reduction by all kinds of countermeasures;
 UK “40% House”, Japan “Guideline for designing of autonomous and low emission house” -> 50% reduction

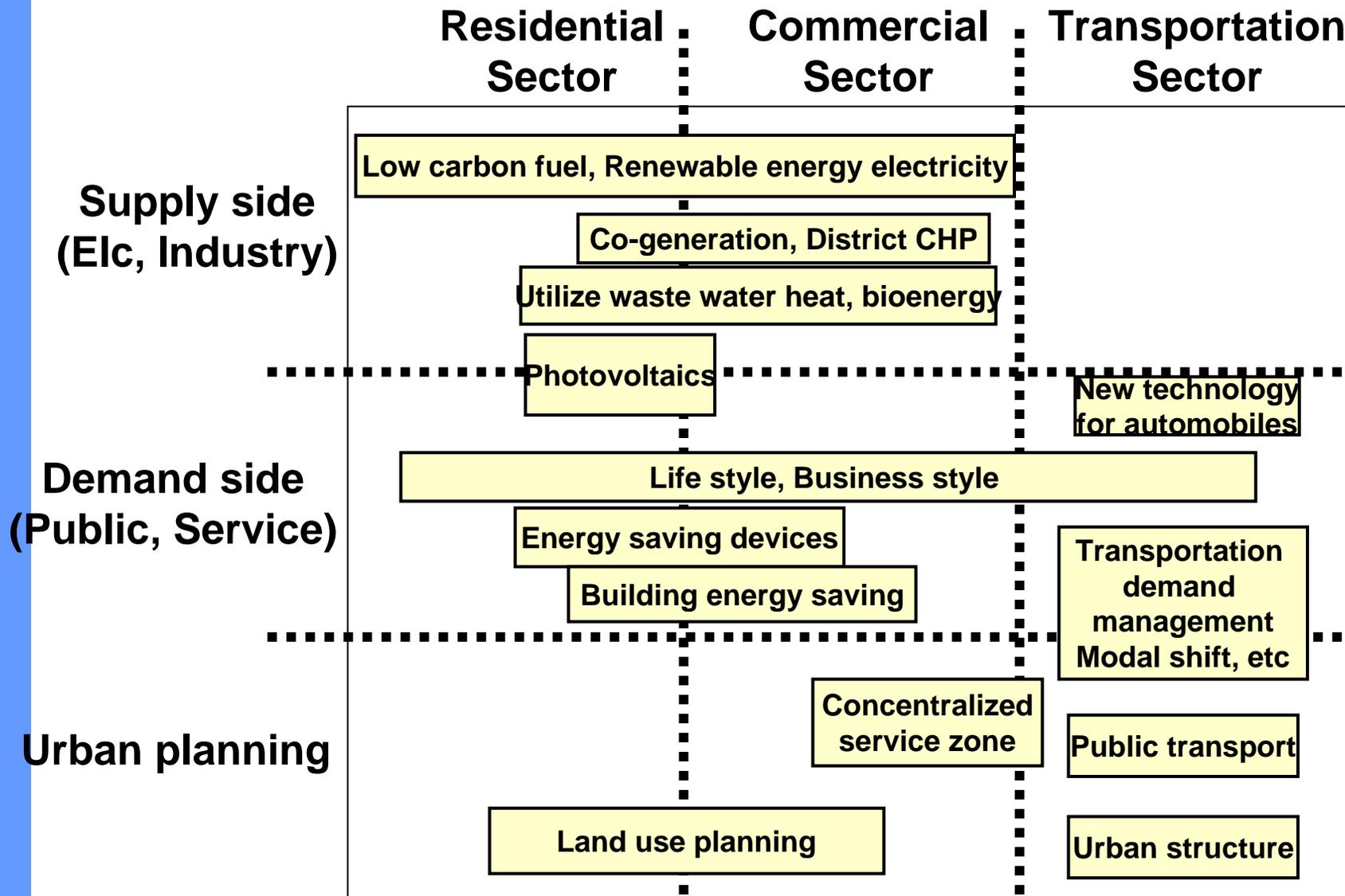


UK, February 2005
“40% House”
60% reductions

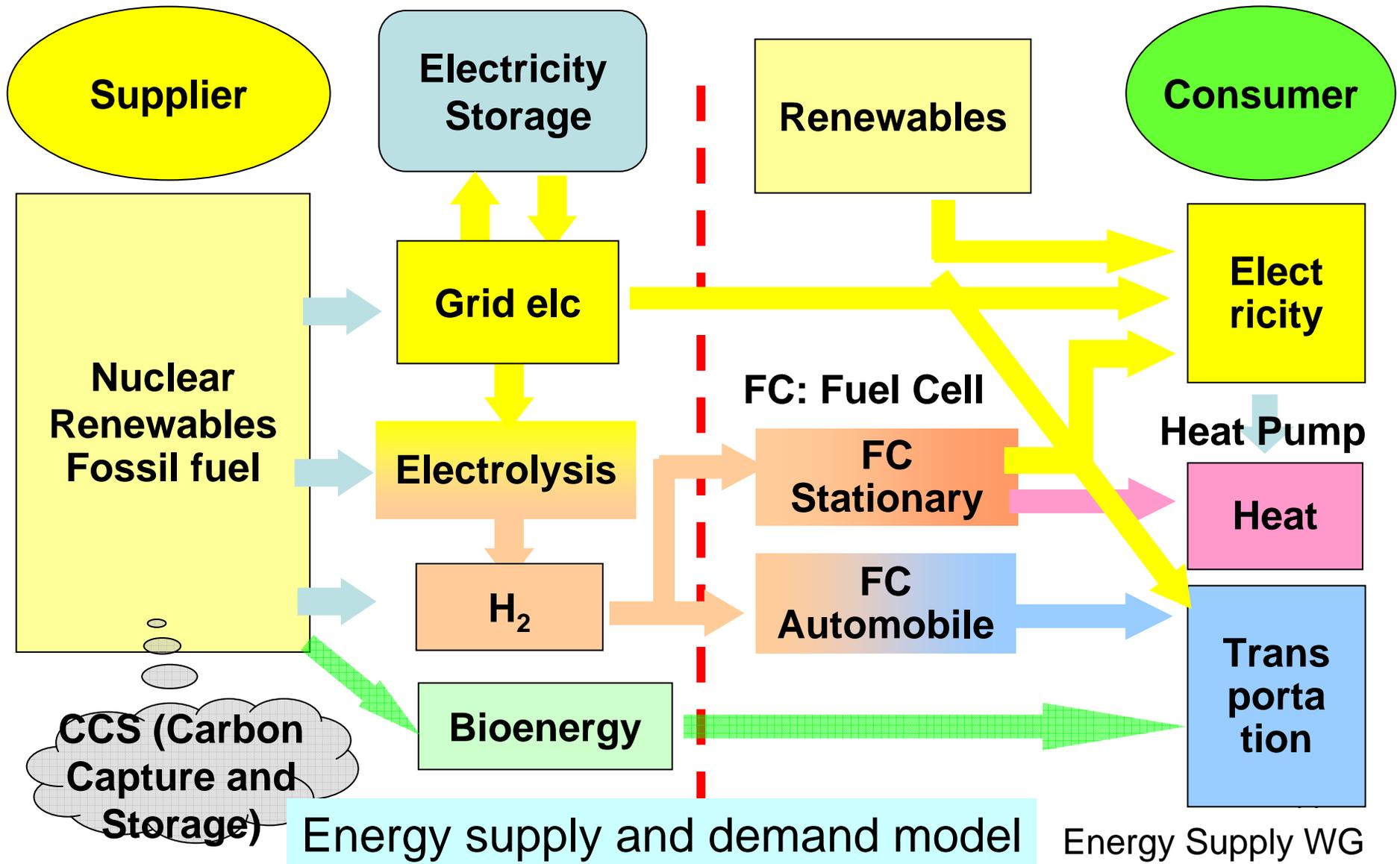


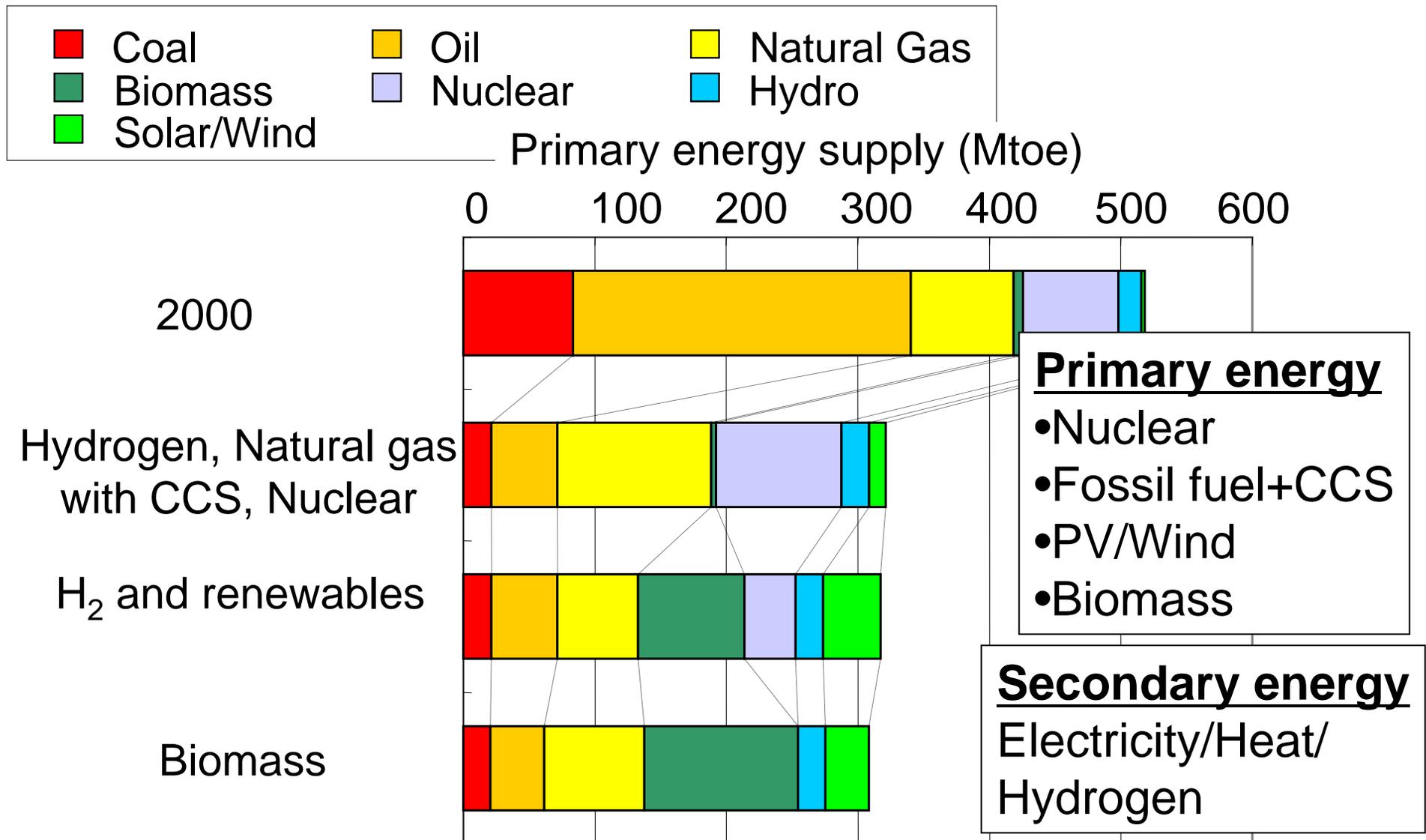
Japan, June 2005
Guidance for Self-sustained
Residential, 50% reductions¹²

Countermeasures in Urban area



Energy Supply System to achieve LCS

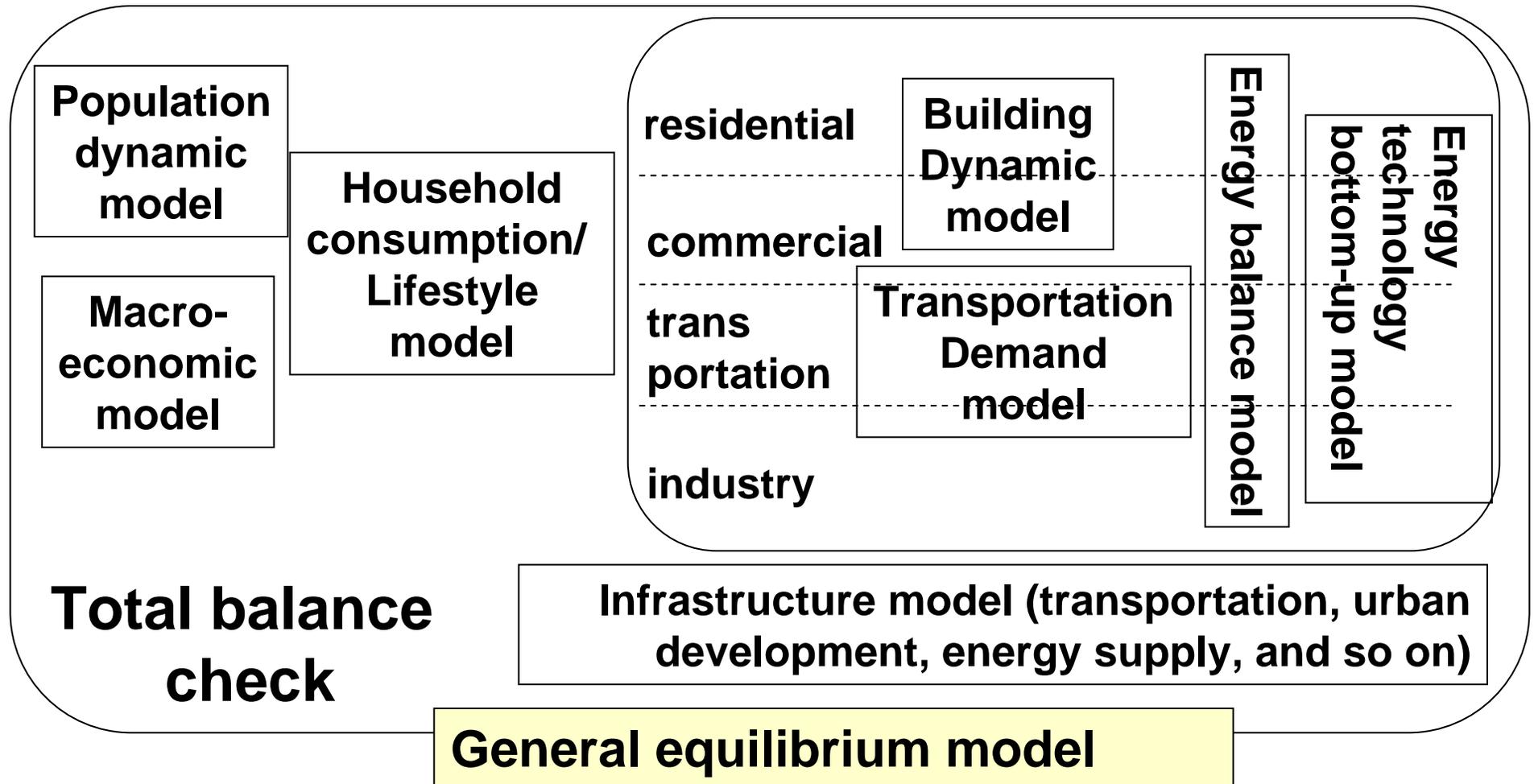




Both supply side and demand side countermeasures are required to achieve 70% CO₂ reduction by 2050

Socio-economic value

Energy value



AIM Models for 2050 scenario development
(AIM: Asia-Pacific Integrated Model)

Integrated Assessment Model for national/regional scenario making

The objects of national/regional scenario making with IAM are;

1. To support designing future societies, which satisfy prescribed environmental, economical and social targets.
2. To show feasible, concrete and plausible pathways that will reach the future societies.

The design is consistent, quantitative, feasible and plausible from the view points of technology, economy and sociality.

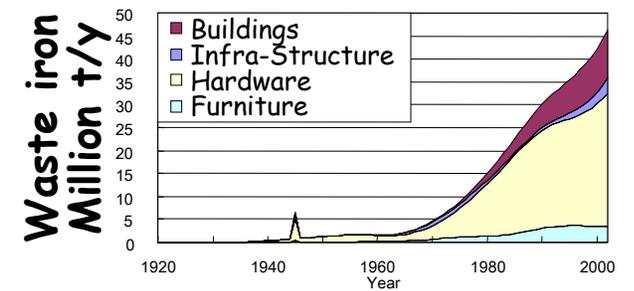
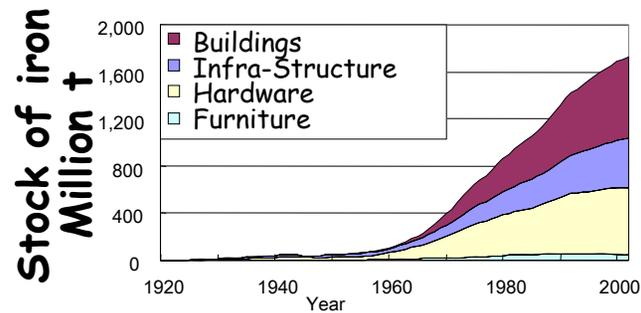
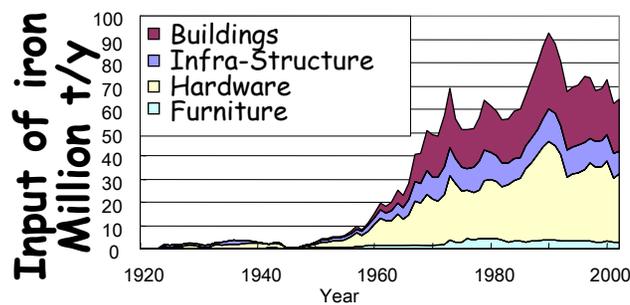
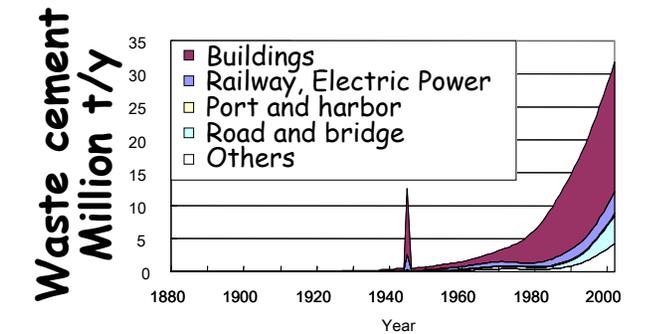
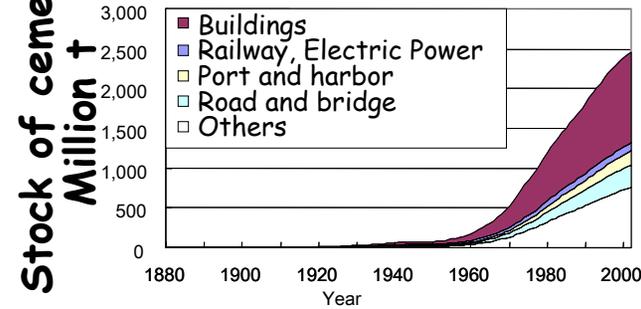
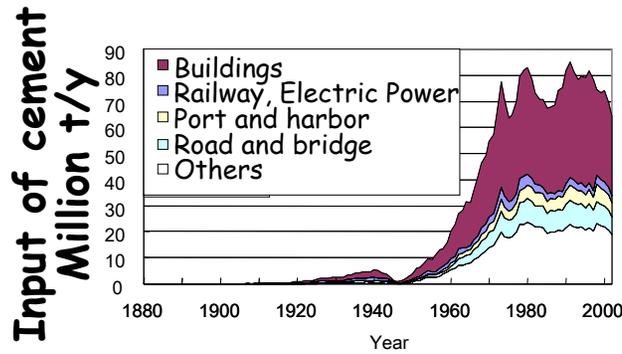
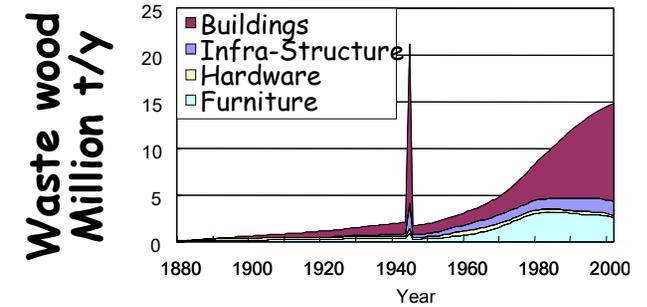
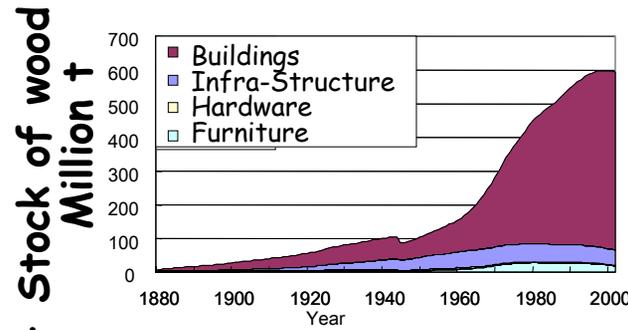
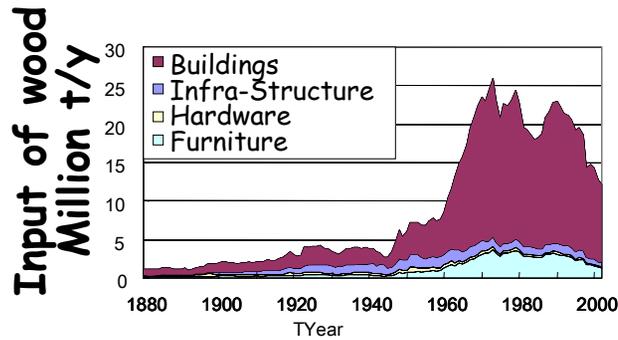
Often the designed societies are not on the BaU pathway (current trend), and in order to reach them, we need many trend breaking interventions.

Concerns and Keywords of the Future Society

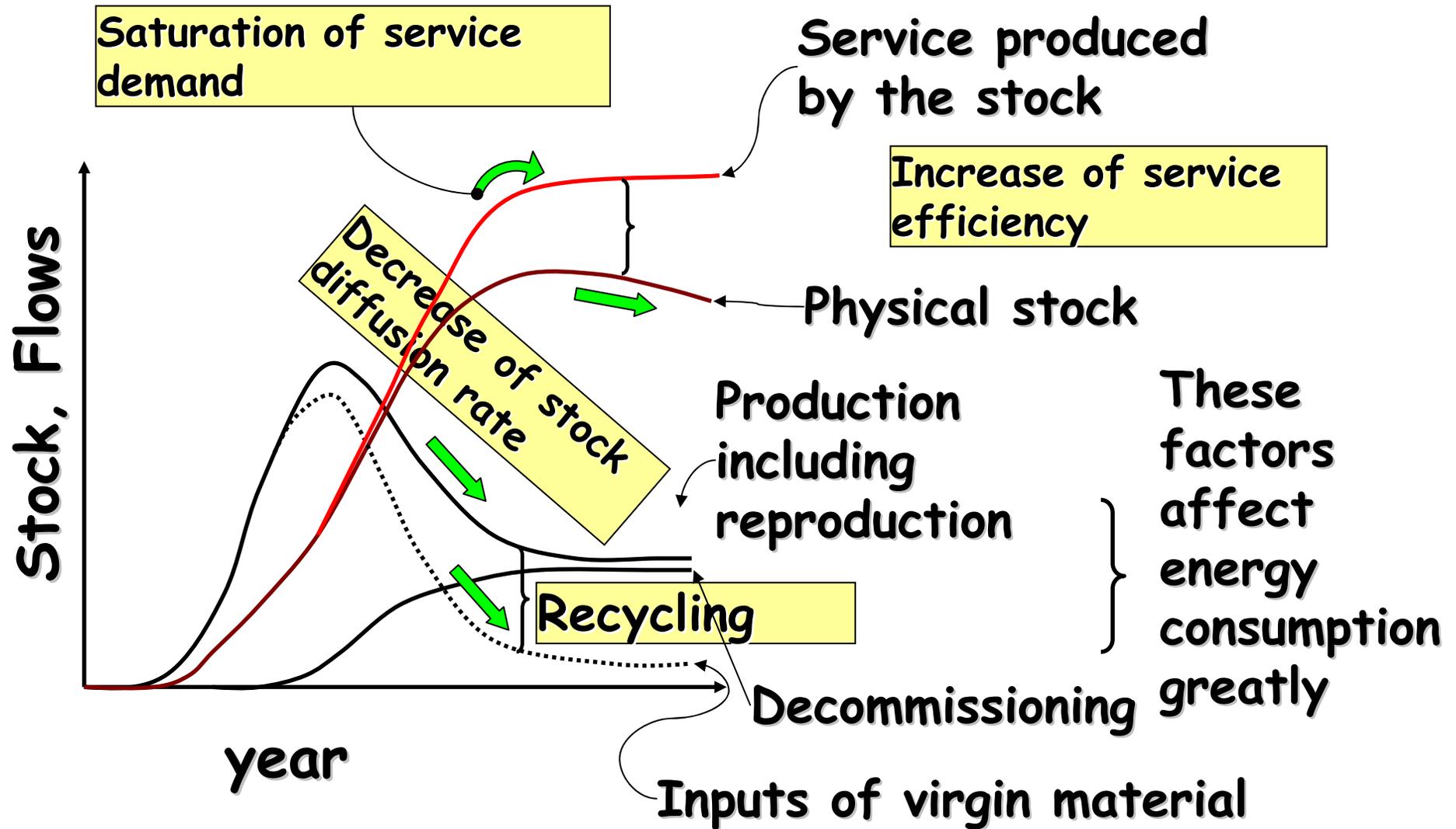
Besides technology development, the models should describe the following future trends and their impacts on environment.

- Demographic transition: Low fertility, Aging society
- Lifestyle change: Household type changes, Empowerment of women, Affluence, Flexibility, Insecurity, Social capital loosing, Pension problem
- Transportation change: Urbanization, Modal change
- Industrial change: Weightless society, hyper-IT, globalization
- Other severe environmental constraints, such as an orientation toward recycle-oriented society

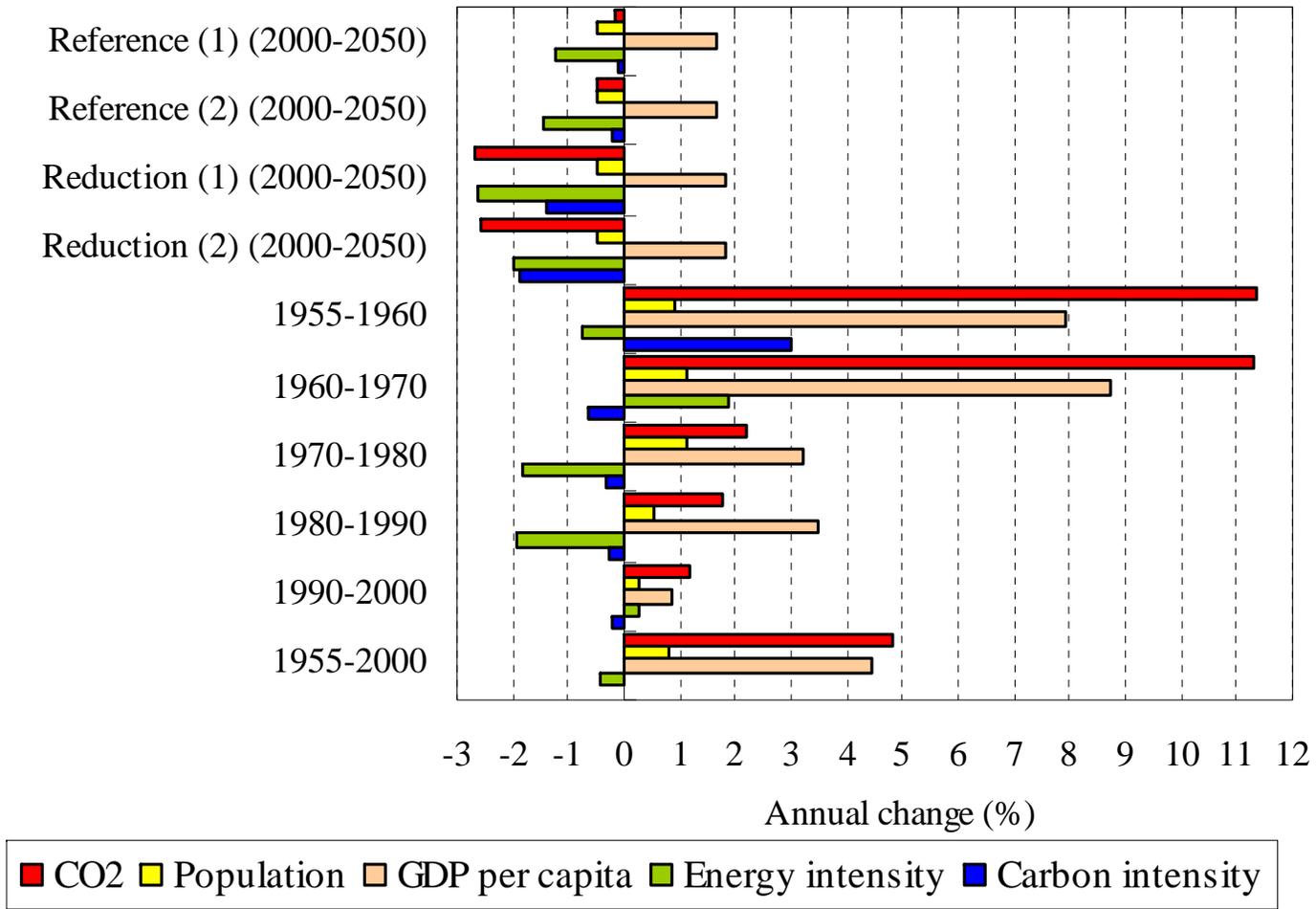
Stock dynamics - Material stock balances in Japan's society -



Stock dynamics greatly affects social energy/material efficiency



Attempts to draw low carbon society

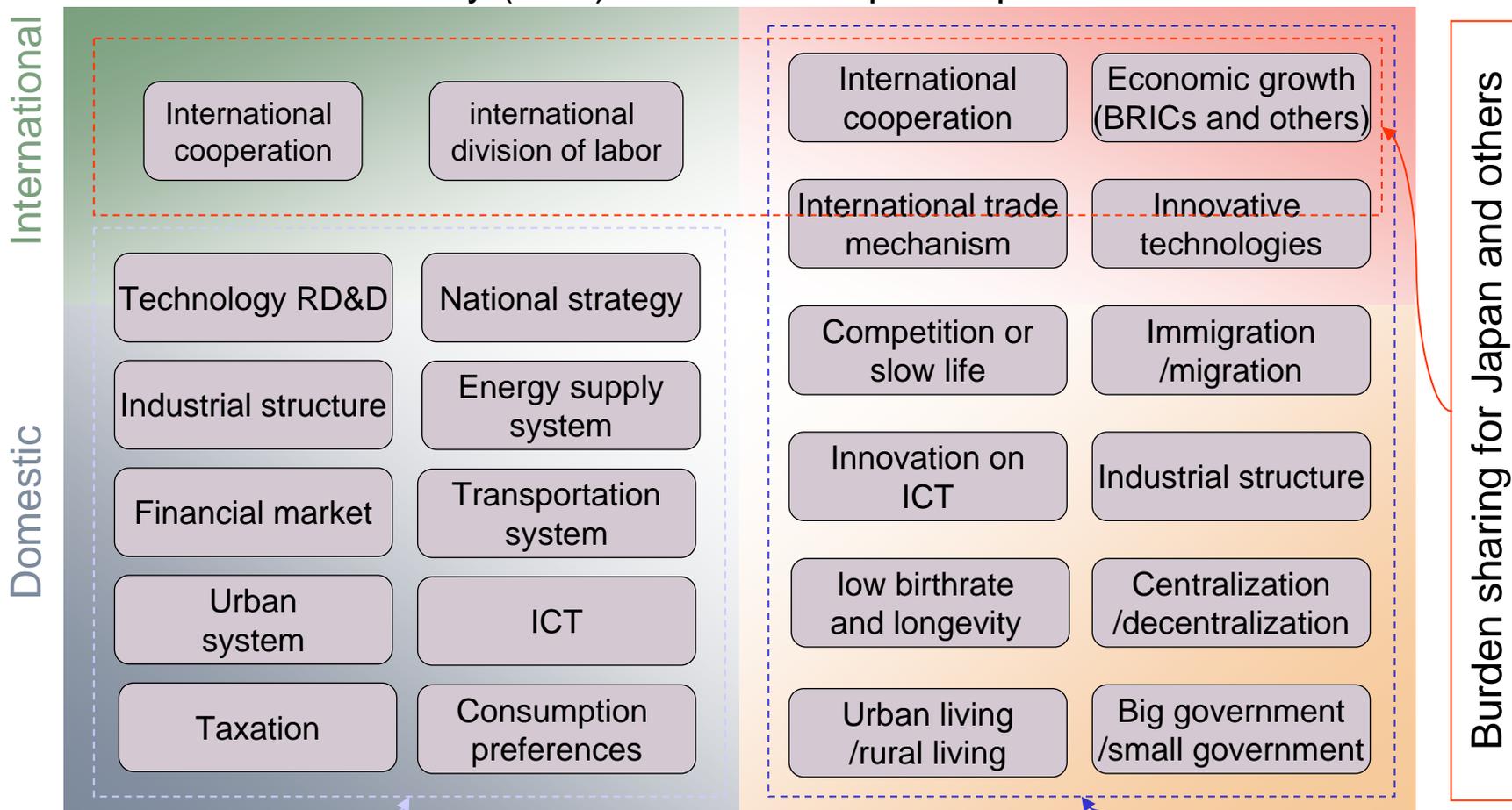


Why we need scenarios?

Main elements to decide development path and GHG emissions in Japan

Important elements to design low carbon society (LCS)

Other important elements to decide development path and GHG emissions



Investigate the direction of LCS development

Decide possible combination Given condition for LCS studies

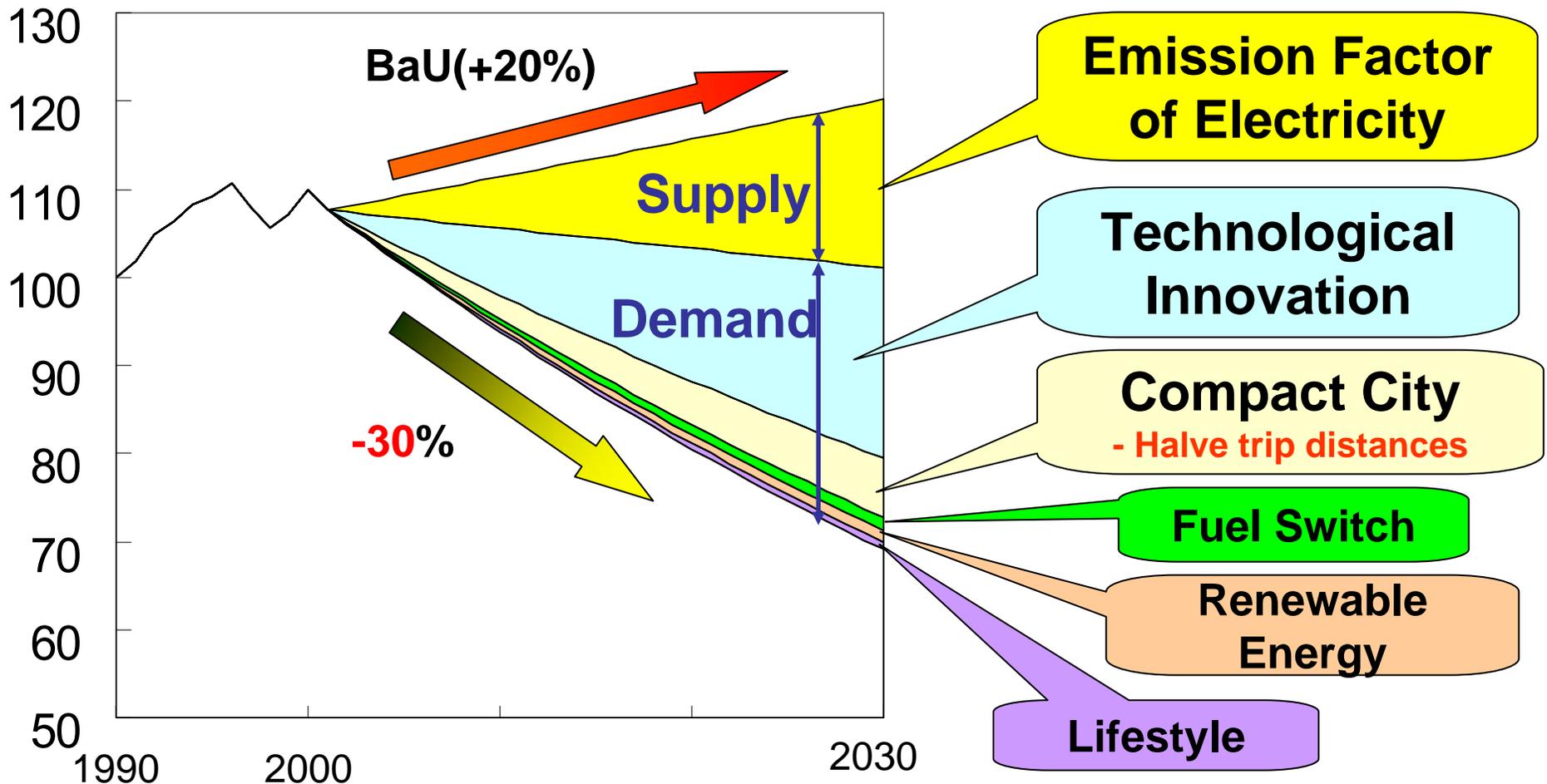


Shiga Prefecture Visions

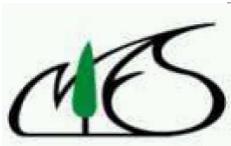


Case A

CO2 Emission Transitions (1990 level=100)



- 1 . Both **supply & demand** measures necessary to reduce CO₂ emission by 30%
- 2 . Substantial contribution of **compact city**



NIES COP11 and COP/MOP1 side event

Japan
Low Carbon
Society 2050

Global Challenges Toward Low-Carbon Economy (LCE)

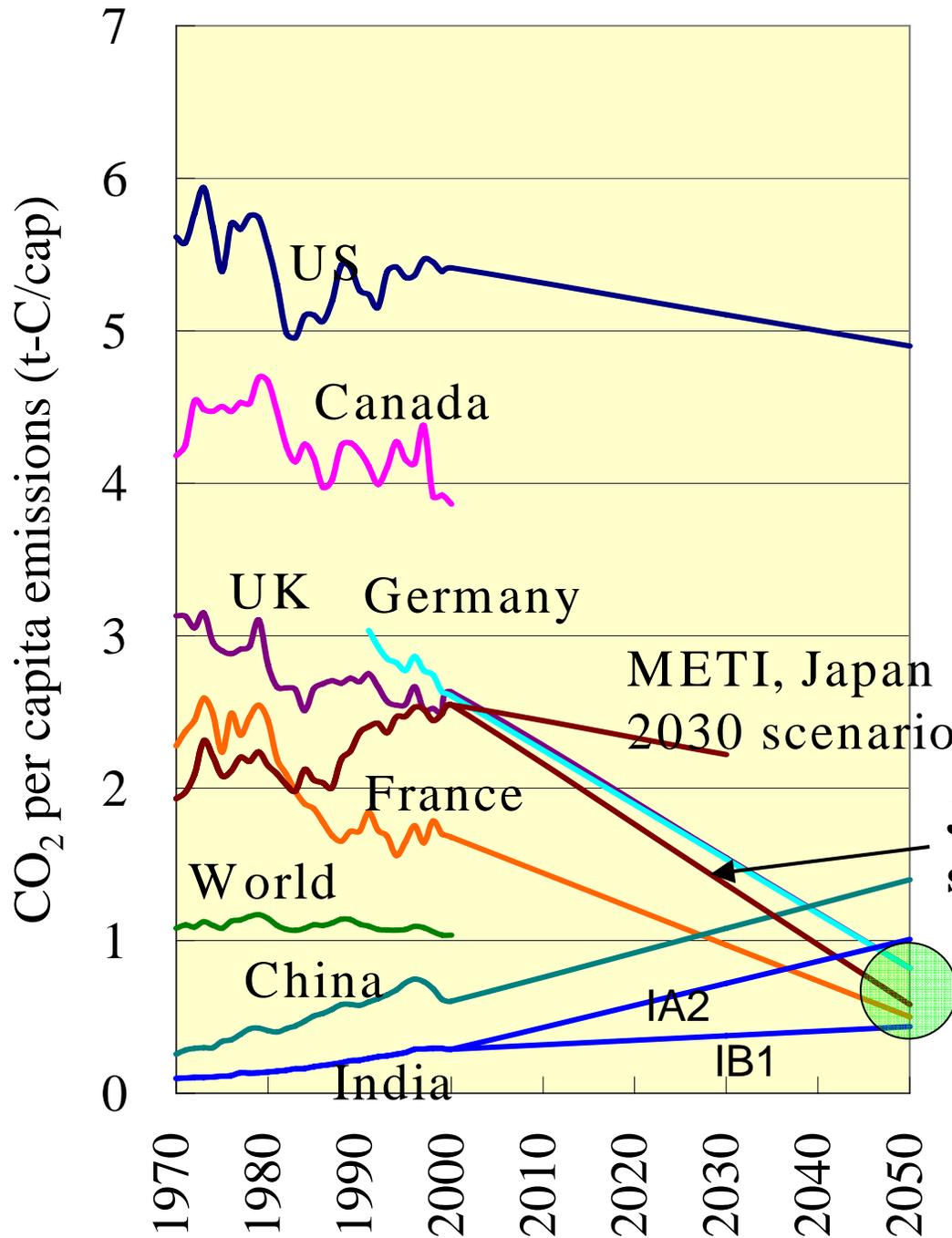
-Focus on Country-Specific Scenario Analysis-



Scenarios from 8 countries



Current per capita CO₂ emissions and Target



US: delay for tech development, global warming business

EU: Initiatives toward LCS
Japan: Need long-term vision

Developing countries: earlier guidance toward LCS is key

Japan 2050 scenario

Target for Low Carbon Economy

Open Symposium “Challenges to achieve Low Carbon Society - 1st anniversary of Kyoto Protocol -”

Organizer: Ministry of Environment,
Japan (MoEJ), Co-Organizers:
British Embassy to Japan,
National Institute for
Environmental Studies (NIES)

We had around 400 audiences.

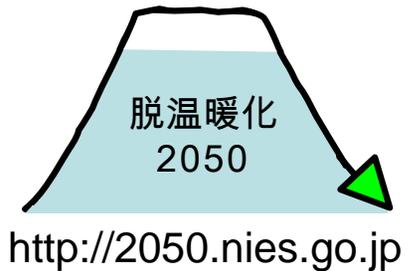
The Minister of Environment, Yuriko
Koike and the British Ambassador
to Japan, Graham Fry pressed
that we start joint research project
for challenges to achieve Low
Carbon Society (LCS).

16 February, Tokyo



Expert Workshop on Developing visions for Low Carbon Society through sustainable development

Mita Kyotokaigijo, Tokyo
June 13 - 16, 2006



Objectives: Japan and UK are jointly promoting a scientific research project “Developing visions for a Low Carbon Society through sustainable development”. They will promote studies toward achieving a **Low Carbon Society (LCS) by 2050** in collaboration, encourage other countries to engage in LCS studies, and jointly hold series of international workshops. The first workshop will be held in 2006 in Tokyo.

We appreciate your participation.

Integrated Assessment Model for national/regional scenario making (Snapshot model)

First of all, to design future quantitatively, we must describe concrete pictures of desired societies, which are feasible, and consistent with physical, economical, technological laws. To keep the consistency and feasibility, we are developing a group of models, called "Snapshot models". Example of snapshot models are:

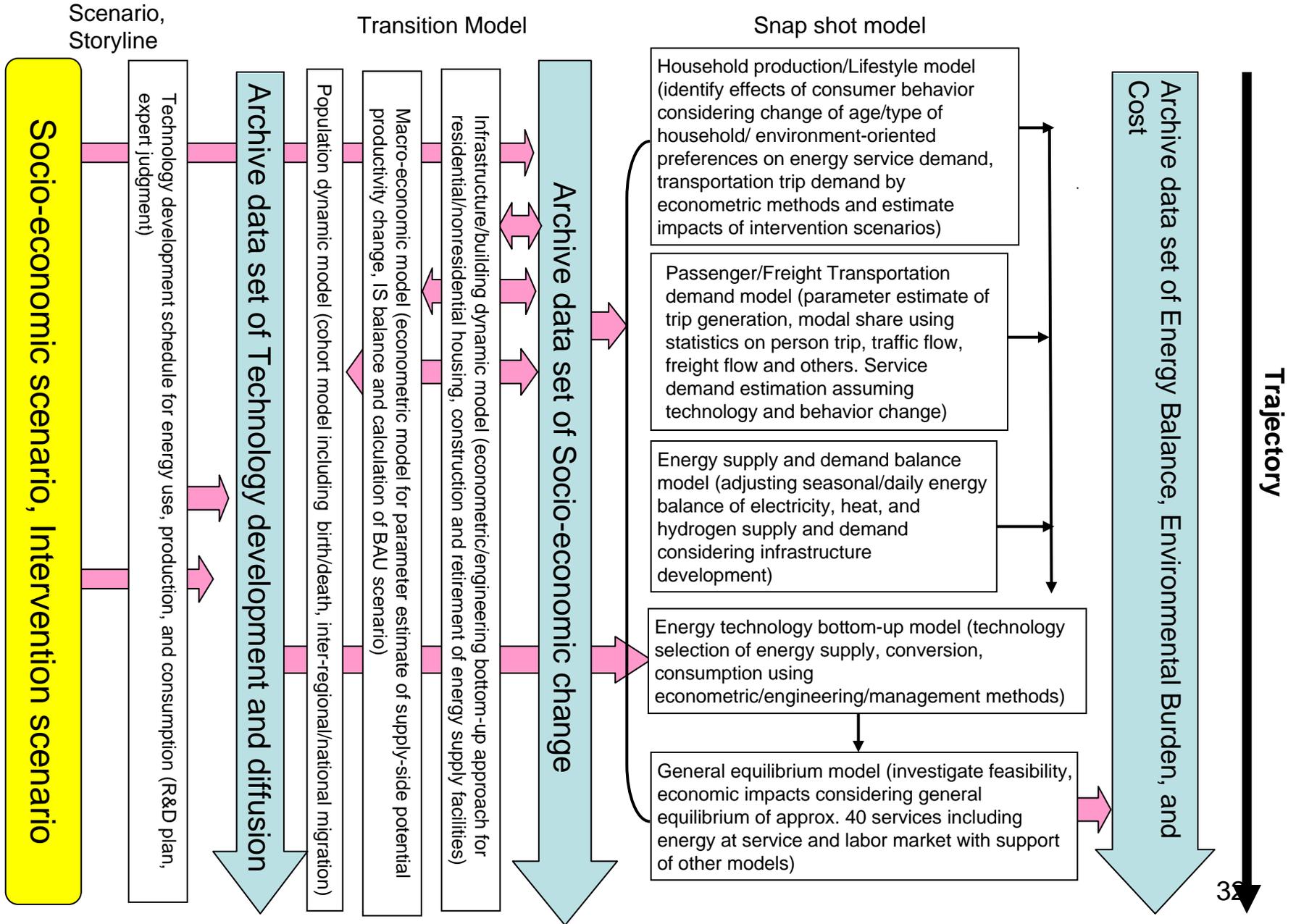
- Household production/Lifestyle model
- Passenger/Freight transportation demand model
- Energy supply and demand balance model
- Energy technology bottom-up model
- General equilibrium model

Integrated Assessment Model for national/regional scenario making (Transition model)

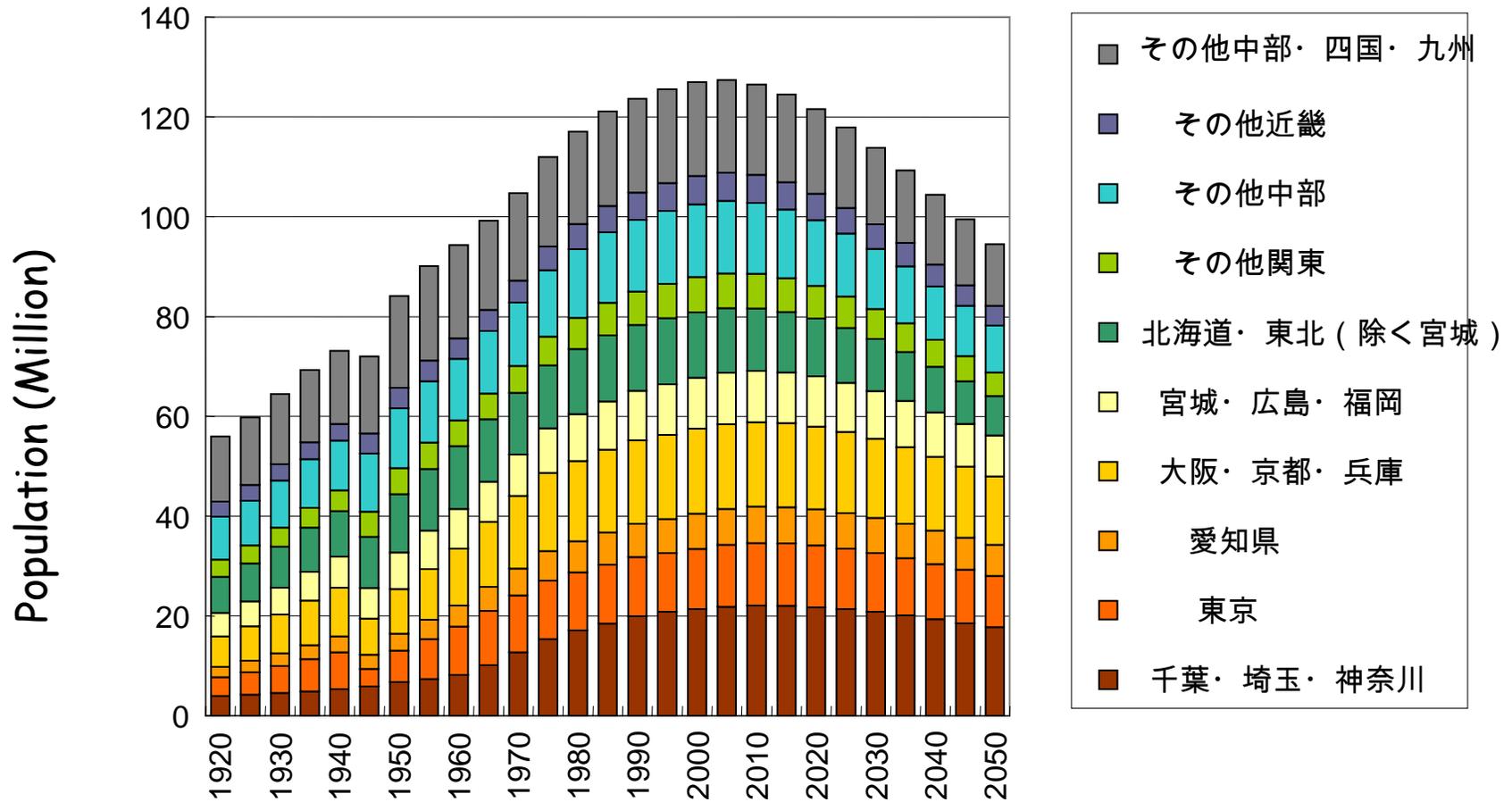
Secondly, to design pathways which leads us to future prescribed normative societies, we must design concrete schedules of trend breaking innovation processes of technology, social and economic systems and infrastructure development with some rationale. To design these schedules, we are developing a group of models, called "Transition models". Example of transition models are;

- Infrastructure/building dynamic model
- Dynamic macro-economy model
- Population and household transition model

Scenario Development Processes



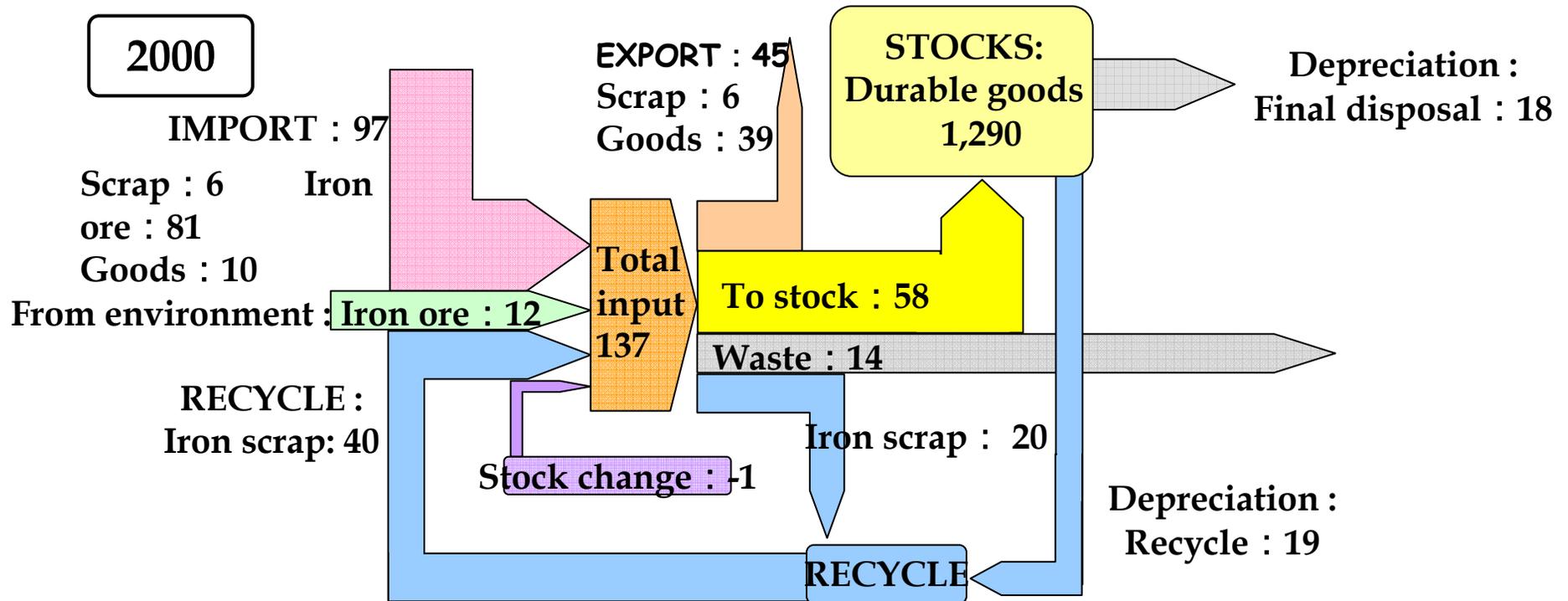
4. Output of PDM



Japan's future population

Objective of Material Stock/flow Model

With an increase of demands for goods, a lot of materials have been accumulated as durable goods in the society.



Unit : Mt

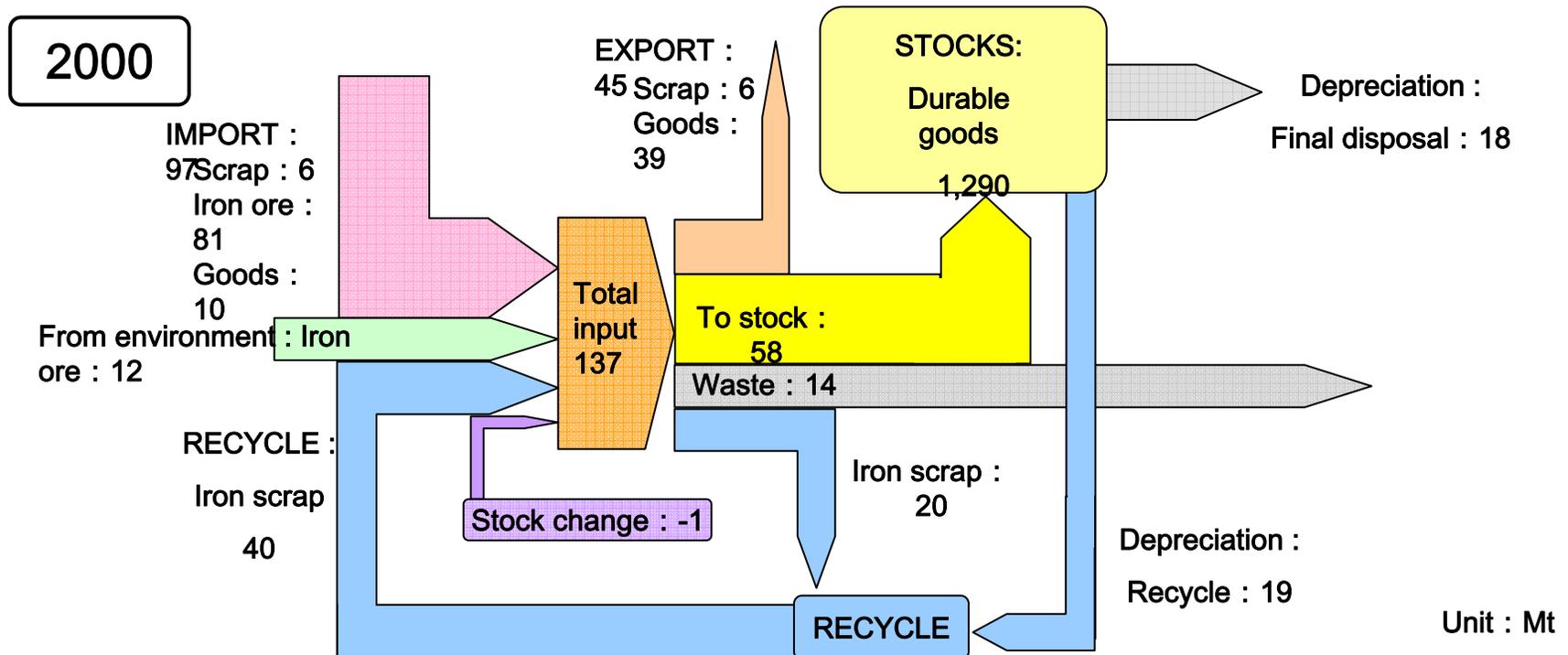
How will these stocks change in the future?

How will these stocks affect the society?

→ 3 Viewpoints; Demand, Waste generation, Resource

Objective of Material Stock/flow Model

With an increase of demands for goods, a lot of materials have been accumulated as durable goods in the society.



How will these stocks change in the future?

How will these stocks affect the society?

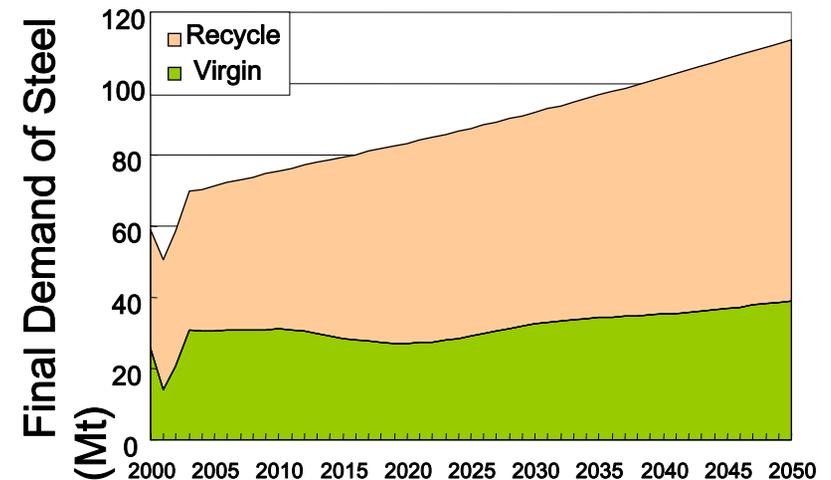
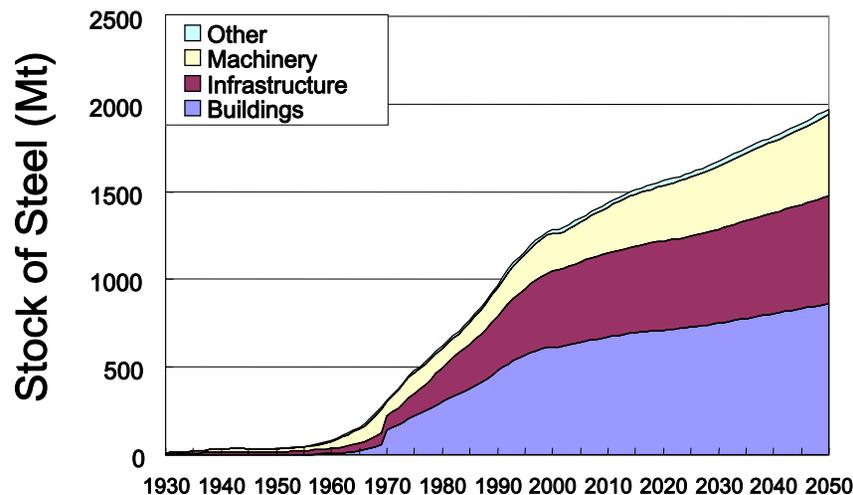
→ 3 Viewpoints; Demand, Waste generation, Resource

Example of Results (Steel)

<Condition : try run>

*Demand : (Output of AIM/Material)*material density

*75% of waste of iron is recycled.



Note :

The relationship between demand and stocks are not considered.

Japan – UK Joint Research Project

Developing visions for a Low Carbon Society through sustainable development

Objectives: Japan and UK are jointly promoting a scientific research project “Developing visions for a Low Carbon Society through sustainable development”. They will promote studies toward achieving a **Low Carbon Society (LCS) by 2050** in collaboration, encourage other countries to engage in LCS studies, and jointly hold series of international workshops. The first workshop will be held in 2006 in Tokyo.

Hosts: The Ministry of the Environment of Japan (MoEJ) and the Department for Environment, Food and Rural Affairs in the UK (DEFRA)

Organizations leading on the research:

Japan: **National Institute of Environmental Studies (NIES)**

UK: UK Energy Research Centre (UKERC) and Tyndall Centre for Climate Change Research

Workshop: The first international workshop will be held in Japan from June 14 to 16, 2006, involving researchers and governmental officials from about 20 countries, and international organizations. Prior to the workshop, a public symposium will be held in Tokyo on June 13, 2006. A second workshop will be held in 2007.

Image of input & output

