

## **S-3 Low-Carbon Society Scenario toward 2050: Scenario Development and its Implication for Policy Measures**

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### 1. Introduction

The first great step to prevent global warming was taken by Kyoto Protocol which came into effect on Feb.16, 2005. But it is necessary to reduce GHG (Greenhouse gases) emissions drastically to stabilize climate change. According to the existing research, to limit the global mean temperature increase at 2 °C from pre-industrial level, the GHG reduction target in 2050 is required to be 50% of 1990 emission level. It implies that reduction rate for Japan will be around 60-80%. A large part of social infrastructure is likely to be replaced by 2050; therefore, it would be possible to propose concrete policy packages including institutional change, technology development, and lifestyle change towards meeting the target of a low carbon society in 2050.

### 2. Research Objectives

This project (S-3) focuses on the following issues:

- 1) Long-term scenario development study to integrate environmental options consistently using simulation models (S-3-1),
- 2) Long-term GHG reduction target setting considering effectiveness and validity (S-3-2), and
- 3) Assessment of environmental options considering future socio-economic conditions in
  - a) Urban system (S-3-3),
  - b) Information technology (IT) society (S-3-4) and
  - c) Transportation system (S-3-5).

We have the above 5 sub projects consisting of research experts in those areas. We have developed socially and technically consistent middle and long-term global warming policy (Fig.1).

The figure shows probable paths towards a low carbon society in Japan which are compatible with economic development and would enhance public interest leading to social and lifestyle changes.

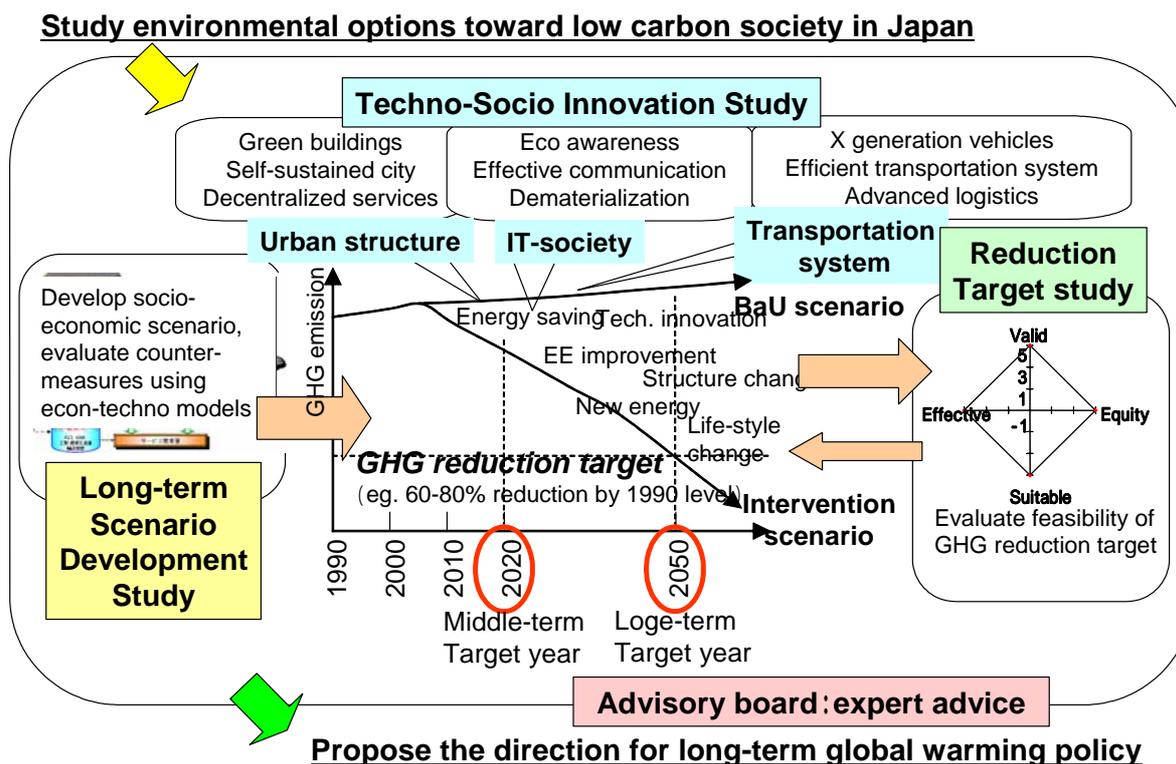


Fig.1 Research Framework of “Japan Low Carbon Society Scenarios toward 2050”

### 3. Research Method and Results

Our research outcomes for the FY2005 are given below. These findings are in the context of our ultimate goal to develop Japan low-carbon society scenarios toward 2050;

- 1) We did a literature survey and visited research organizations in EU countries to investigate existing emission scenarios and their countermeasures, and to identify the elements for setting a roadmap for Japan project.
- 2) We calculated the reduction target for Japan in 2050 to limit the global mean temperature increase at 2 from pre-industrial level. Simulation models showed that global GHG reduction target in 2050 is required to be at 50% as compared to 1990 level.
- 3) We developed narrative and quantitative scenarios for 2020 using simulation models and database, and came up with a research framework for low-carbon scenario development.
- 4) Technological and economic countermeasures for each sector such as urban, IT society and transportation were evaluated. These became input for model simulation.
- 5) We held Open International Symposium on “Low-Carbon Society Scenario towards 2050: Scenario Development and its Implication for Policy Measures” at Tokyo which had more than 250 participants. We have developed our research homepage; <http://2050.nies.go.jp>. These activities will increase attract more attention from stakeholders, public and others.

Outcomes from each sub-project are briefly summarized below.

### 3-1 Long-term Scenario Development Study to Integrate Environmental Option using Simulation Models (S-3-1)

Fig.2 shows the framework of S-3-1 in collaboration with other sub-projects. This sub-project has a special role to combine the results from each sub-project in consistent manner.

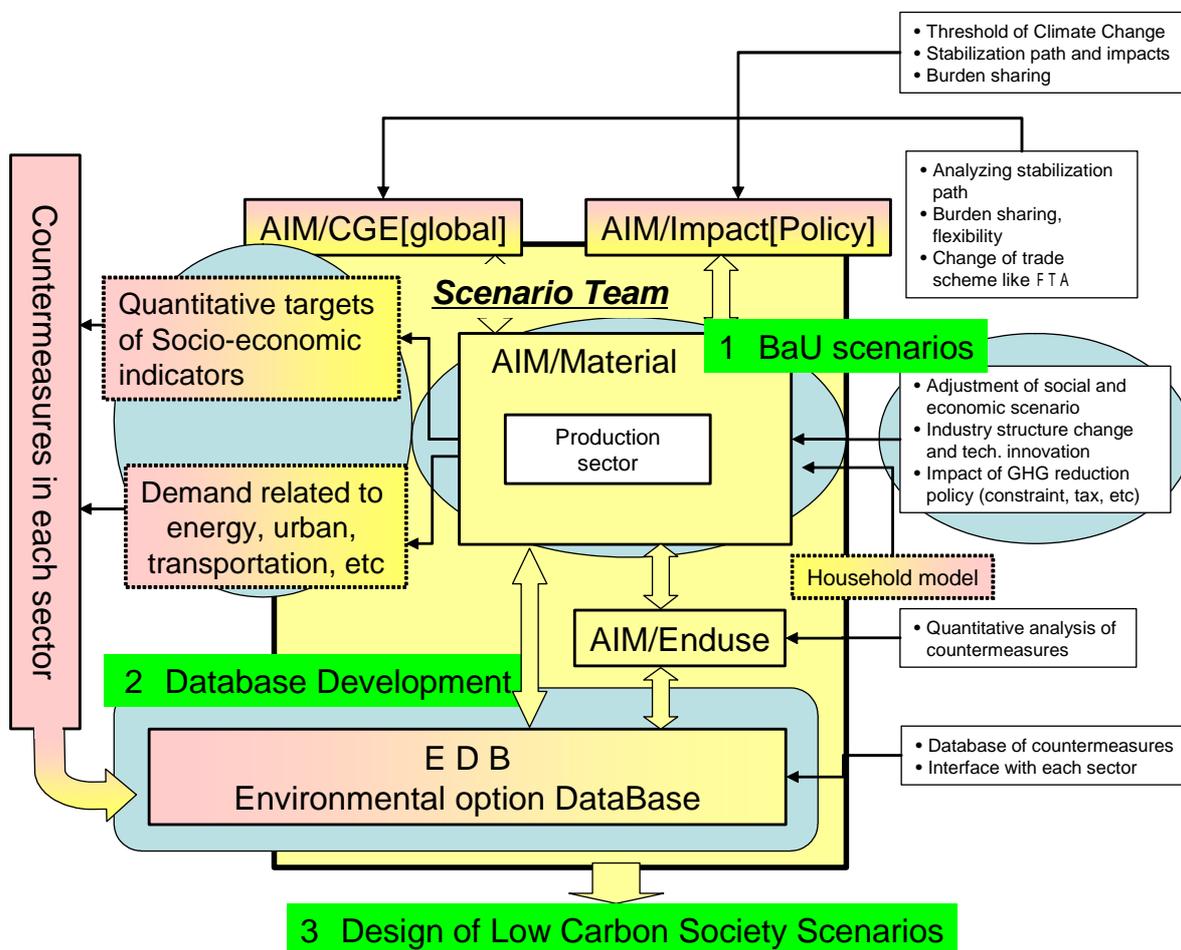


Fig.2 Research framework of this sub-project (scenario team)

Narrative and quantitative scenarios toward 2020 have been developed as per the following process;

- 1 ) Develop narrative storylines
- 2 ) Develop quantitative BaU scenarios
  - Identify scenario driving forces
  - Carry out analysis using quantitative models (Economic Top-down model for Japan)
- 3 ) Develop 2020 Intervention scenarios
  - Collect environmental options (EDB)
  - Assume diffusion rate of each environmental option

### 3-2 Multi criteria evaluation of long-term scenario and policy on climate change (S-3-2)

This research project addresses issues on medium to long term objective-setting for climate change policy. It includes looking into ongoing international debate on mid to long-term objective setting and criteria for evaluating long-term scenarios. Our research also includes analysis of probable emission reduction pathways and their implications for Japanese target. It turns out from current year's analysis that, according to the existing research, Japan's GHG emission target in 2050 shall be 80-90% less than 1990 level to limit the global mean temperature increase at 2 from pre-industrial level. In comparison to growing number of countries setting national mid to long-term targets, skepticism also exists in setting international targets.

### 3-3 Effects of introducing countermeasures for carbon dioxide emission reduction in urban area (S-3-3)

Carbon dioxide emission is compared for the cases with and without countermeasures in various cities in 2020 and 2050. Scheme of evaluation of carbon dioxide is shown in Fig.3. Based on geographical information system (GIS) data, energy consumption and electricity generation in building sector, photovoltaic sector, district heating sector, transportation sector were modeled. Electricity generation model can convert energy saving or generation effect into carbon dioxide emission reduction on hourly basis. Developing a methodology was the main target in this year. Among various cities, Utsunomiya was chosen as the main target city.

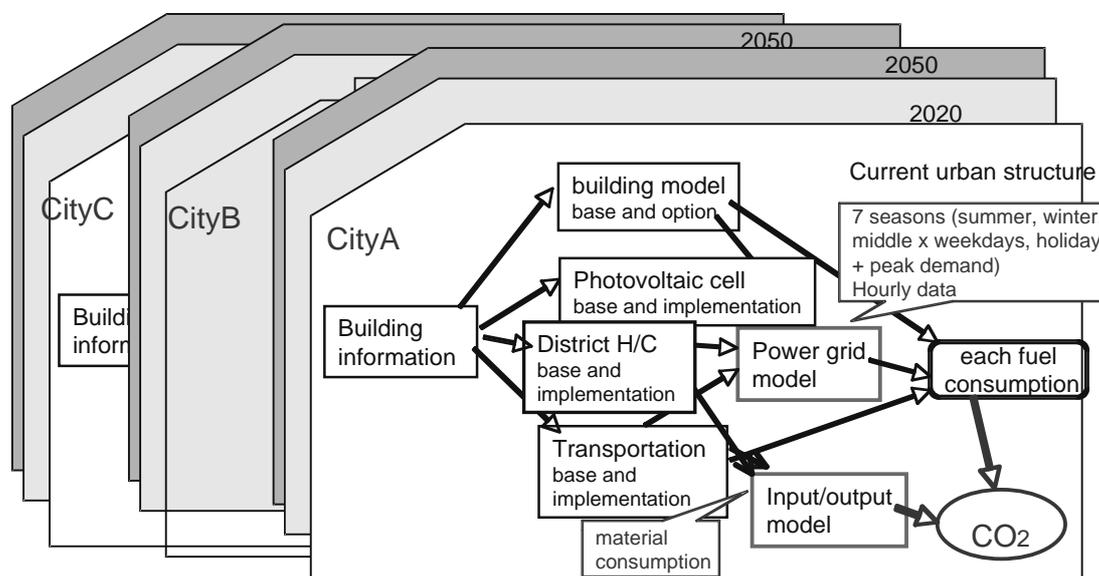


Fig. 3 Flow diagram of evaluation of carbon dioxide emission in urban area

### 3-4 Integrated Measures of Technologies and Lifestyles against Global Warming

#### - Eco-design of ICT (Information Communication Technology) Society - (S-3-4)

This sub-project described the influence of ICT diffusion on environmental problems. There is no doubt that ICT can make a large contribution for solving environmental problems. In particular, following two contributions are noteworthy. First, ICT enables dissemination of

information to people about environmental problems from various points of view. This would encourage people to take-up an environmentally conscious lifestyle. Second, ICT removes the restriction of “distance”. This would cause large changes in urban structure. It may be possible to develop a new society which minimizes movement of goods, resources and people.

To analyze the impact of ICT in the year 2050, we have to think beyond the above results, because the progress of ICT will be too rapid to forecast the state of technologies and its diffusion in society. To start with, we draw a clear vision of a networked society, which many people desire strongly, for achieving low carbon emissions.

### 3-5 Long-term CO<sub>2</sub> reduction strategy of transport sector in view of technological innovation and travel demand change (S-3-5)

It can be said that hybrid vehicles should be the most feasible and promising technology to mitigate CO<sub>2</sub> emissions toward 2020. Construction of alternate fuel stations is one of the key issues to popularize fuel cell vehicles. To reduce CO<sub>2</sub> emissions in 2020 under 1990's level, EST (Environmentally Sustainable Transport) 2020 [HV+DM] scenario is developed by adding demand management (DM) to prevailing hybrid vehicles (HV) scenario. It requires doubling of production capacity every year from 2005 to 2010 achieving a production of 4 millions hybrid cars per year covering most of Japanese domestic passenger car demand.

For developing 2050 scenarios, group interviews were held to obtain rough sketch of the situations of society, economy, urban form, transport, energy system and environment in 2050. There are various visions on the probabilities of the exhaustion of oil, dissemination of fuel cell vehicles and possibility of natural/simple lifestyles. For travel demand change, the feasibilities of such kind of counter-measures were examined in case studies. Automobile CO<sub>2</sub> emissions and the populations of all local governments were aggregated and classified, according to the belonging metropolitan area, the province level and the population size. Using this framework, total national reduction in emissions by change in travel demand can be estimated. This is done by extrapolating the CO<sub>2</sub> reduction in regional case studies to the national level.

## 4. Discussions

In this FY 2005, we developed the narrative storylines, their quantitative scenarios, and environmental options especially in urban system, IT society and transportation system till 2020. We have also simulated the required GHG reduction for Japan.

In FY 2006, we will investigate the scenarios for 2050 with back-casting method. Japan 2050 future images with 60-80% GHG reduction will be finalized. The development path considering economic impact, technological possibility, institutional and lifestyle change will be simulated objectively and consistently. Thus, we have a challenging and fruitful research task for the next