

**S-3 Low-Carbon Society Scenario toward 2050: Scenario Development and its Implication  
for Policy Measures (Abstract of the Interim Report)**

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[Abstract]

This research envisions the future as a place in which advances in technology and urban development have transformed society in Japan. We consider paths that will lead Japan toward such a society by calculating its reduction potential using a scenario approach based on “back-casting” techniques. Global emissions of greenhouse gases must be cut to 50% of current levels in order to stabilize the climate. Because of their higher per capita emissions, major industrial countries must reduce their emissions even further. Japan must reduce its emissions by 70 to 90% of 1990 levels by 2050.

It is possible to reach a 70% reduction in CO<sub>2</sub> emissions by reducing energy demand by 40% and reducing the carbon in the supply. On the demand side, reductions are possible through improvements in efficiency. Decrease in population along with more rational use of the energy will offset the increases in energy demand in certain sectors. On the supply side, CO<sub>2</sub> emissions can be reduced by 70% through a combination of the appropriate choice of low carbon energy sources (carbon capture and storage is also considered) and improving energy efficiency. A dozen actions are proposed and their effectiveness has been studied with the use of an assessment model. The actions are expected to cover the entire 70% reduction goal. Cross-sectional and/or additional measures will enable emissions to be reduced further, but efforts in the energy demand sectors are particularly important.

In order to avoid investing in its current high carbon-emitting infrastructure, Japan must disseminate and come up with a long-term strategy that will bring about the necessary technological and societal innovations by allotting an appropriate amount of resources for intensive economy-wide changes such as the development of land, urban areas, and buildings, improvements in industrial structures, and the development of new technology.

## 1. Introduction

To avoid serious climate change impact, there is a discussion to limit the global mean temperature increase to no more than 2 deg C from current level. Then the global GHG reduction

target required in 2050 will be more than 50% of 1990 emission level. It implies that reduction rate for Japan will be around 70-90%. We need Japan low-carbon society scenarios to achieve such ambitious target. 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.

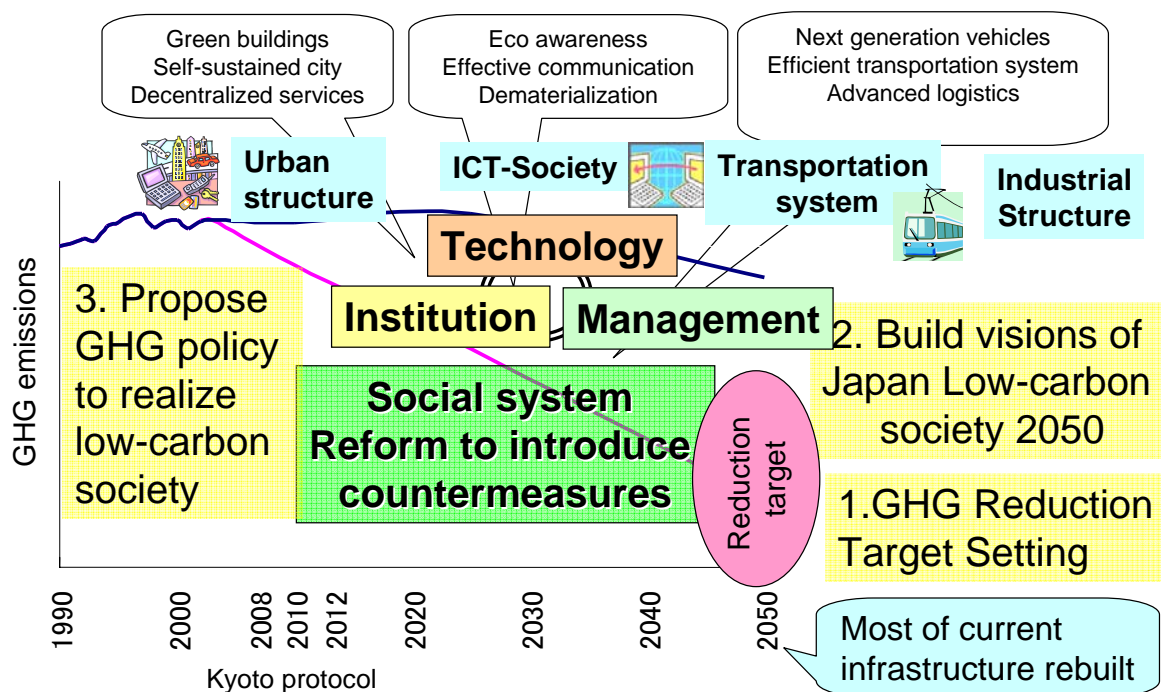


Fig.1 Research Framework of “Japan Low-Carbon Society (LCS) Scenarios toward 2050”

## 3. Research Method and Results

Our research outcomes for the FY2007 are given below. These findings are in the context

of our ultimate goal to develop Japan low-carbon society scenarios toward 2050;

- 1) We examine the “backcasting” method, which first develops emission target representing favorable LCS visions and then explores the methods and actions to achieve it.
- 2) We have developed the narrative storylines, their quantitative scenarios, and trend-breaking countermeasures in residential sector, service sector, transportation sector, industrial sector, energy supply sector, and others.
- 3) Technological and economic countermeasures for each sector such as urban, IT society and transportation were evaluated. These became input for model simulation.
- 4) We have decided to facilitate Japan–UK Joint Research Project “Developing visions for a Low Carbon Society through sustainable development”. We 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 second workshop was held in June 2007, London, and the third workshop in Feb 2008, Tokyo.

Outcomes from each sub-project are briefly summarized below.

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

“2050 Japan Low-Carbon Society” scenario team published a report entitled “Japan Low Carbon Society Scenarios: Feasibility study for 70% CO<sub>2</sub> emission reduction by 2050 below 1990 level” in February 2007, in which it stated that Japan has the technological potential to reduce the emissions of CO<sub>2</sub>, which is the major greenhouse gas, by 70% by 2050 from the emission level in 1990, satisfying the required amount of energy services. The report also mentioned that to achieve the goal, the Japanese government must take strong initiatives in sharing the goals of a low-carbon society, establishing comprehensive measures and long-term plans, reforming industrial structures, and funding infrastructures to encourage private investment in energy-saving technologies and R&D of low-carbon energy technologies.

Based on analyses of scenarios, innovations such as technologies and reform programs for social systems have been studied from the viewpoint of when and how such innovations should be implemented and what kind of measures and policies are effective to realize them. A dozen actions are proposed and their effectiveness has been studied with the use of an assessment model. The actions are expected to cover the entire 70% reduction goal. Cross-sectional and/or additional measures will enable emissions to be reduced further, but efforts in the energy demand sectors are particularly important. The 70% reduction will be shared as follows: 13 to 15% in industry, 21 to 24% in buildings, 19 to 20% in transportation, and 35 to 41% in energy sectors.

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

This research addresses issues on medium to long term target-setting on climate change policy. In order to mitigate climate change, it is important to clarify a goal of mitigation activities. Last year’s G8 summit mentioned a possibility of setting a global GHG reduction target as 50%

reduction in 2050. This year we tried to identify the level and emission paths that can be implied by this target. We also draw implications of such level of target for Japan. We found that all cases showed that there is no room to increase GHG emissions after 2010, and that emission path leading to 2050 changes the level of temperature increase in 2100. Even in the case of halving global emissions in 2050, additional 1.5 deg C temperature increase is unavoidable. Therefore, adaptation is equally important as mitigation. In our cases of global differentiation, Japan needs to reduce its emission in 2050 by 72-92% from 1990 level in order to halve the world emission in 2050.

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

Carbon dioxide emissions in transportation, office and commercial and household sector have been increased significantly. Evaluation of potential reduction of carbon dioxide should be done with taking into consideration of urban activity and structure. Simple summation of reduction potential of each technology will overestimate the actual reduction in urban area, because its implementation is limited and there are interactive effects among technologies.

The research objectives are to develop the method of evaluation of potential carbon dioxide emission reduction in urban area, and to apply the developed method to cities with various sizes and in various climate conditions in Japan in 2020 and 2050. The unique method of this research is to evaluate the effect of implementing integrated technological options into actual cities for carbon dioxide emission reduction. Prediction of cities in the future target years is also included.

### (4) Integrated Measures of Technologies and Lifestyles against Global Warming

Discussed here is ICT impact on industrial structure in 2050, using a macroscopic long-term simulation model and microscopic LCA based model. The total energy consumption in Japan reduced 13,376 Peta-Joule (PJ), from 15,982PJ in 2000, and the ratio of industry sector reduced to 41% in 2050 from 47% in 2000. These results reveal that ICT impact on Industry in 2050 accelerate economic growth in service sector, which result in reducing energy consumption from industry in Japan. On the contrary, from a global viewpoint, the improvement of ICT means the amount of offshoring will dramatically increase. This leads to the radical increase of China's and India's economy, as well as an increase in global energy consumption.

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

The purpose of this study is developing transport visions towards Low Carbon Society in Japan. A vision was developed and revised to reduce transport CO<sub>2</sub> emissions by 70% in 2050 with the combination of various types of countermeasures such as promoting higher land-use densities and higher efficient vehicles suitable to each region (metropolitan-urban, metropolitan-suburban, non-metro-urban and non-metro-suburban). It was pointed that travel demand change as well as technological innovations are required to reduce transport CO<sub>2</sub> emissions considerably. The integrated plan of land-use and transport for each region in view of 40-50 years later would be required to help stakeholders preparing toward Low Carbon Society.

Toward 2020, it is critical to enhance production capacity of hybrid electric vehicles (HEVs) for providing enough number of various HEVs met to most of new car needs in short term. It is also required to keep the recent declining trend of traffic volume so as to reach 10-20% lower level than the traffic volume of 2020 estimated by MLIT.

In FY2007, we studied to revise the low carbon visions and policy-packages. Visions were extended to cover inter-regional passenger and freight transport, adjusted to fit to the demographic settings of S-3 scenarios, and revised to describe practical counter-measures and road-maps in detail to accomplish the target of Environmentally Sustainable Transports in Low Carbon Societies.

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