

S3-5 The Low Carbon Scenario for Japan

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1. Backcasting approach to design a low carbon scenario (LCS) for Japan

The backcasting approach has been used to quantitatively investigate the pathways required to achieve a LCS by 2050. Unlike forecasting, which involves drawing up a future image by identifying and analyzing measures which are available at present, backcasting involves drawing up a target image (vision) and then investigating measures required for achieving that vision. This approach is effective when the target is tough and trend-breaks and innovations are required to achieve it.

Among the most important steps of this approach we could highlight the following:

- 1) to envision the direction of future Japanese socioeconomic structure towards 2050 within a certain range,
- 2) to quantify behavior of people and households (how people spend time, what services will be needed), design of city and transportation (what kinds of city and houses people live in, how people travel), and industrial structure (estimation of the structural changes by a multi-sector computable general equilibrium model) for each scenario, and to estimate energy-service demand for each scenario (for instance, the volume of cooling [calories], hot water supply [liter], crude steel production [ton], and transportation demand [ton-km, passenger-km]),
- 3) to calculate energy services demand, while satisfying the CO₂ emission reduction target that supports the estimated socioeconomic activity in each scenario; to explore the appropriate combination of energy services demand, end-use energy technology (air conditioner, thermal insulation, boiler, steel plant, hybrid car, etc.), types of energy supply and energy supply technologies, based on the consideration of the available volume of energy supply, its cost-efficiency and its political feasibility; to identify the types of energy demand and supply technologies as well as their shares, and finally,
- 4) to quantify the primary and secondary energy demands and the amount of resulting CO₂ emissions.

2. Designing visions for Japan

Possible pictures of future Japan and corresponding pathways towards the LCS have been discussed by experts from various fields. Two scenarios, A and B, have been developed. The features of Scenario A can be described as active, quick-changing, and technology oriented society. On the other hand, Scenario B is a calmer, slower, and nature oriented society. Changes in social indicators and various assumptions made in both scenarios are within the ranges of existing major studies of Japanese future society projections. An important finding is that 70% CO₂ emission reduction by 2050 below 1990 level could be achieved, both in scenario A and scenario B, under acceleration of research, development and deployment of new technologies. However the type of new technologies is different in the two scenarios.

Effective countermeasures in the scenario A are energy efficiency options in demand-side, such as implementation of energy efficient appliances in the industrial, residential, commercial and transportation sectors, and fuel-switching options from conventional energy sources to low-carbon energy sources, such as nuclear power and hydrogen. In scenario B, the use of low-carbon energy, such as biomass and solar energy, in demand-side would result in drastic reductions of CO₂ emissions.

Although CO₂ reductions by sector vary according to the scenario, both scenarios share many technology options. These options involve no-regret investments, which reduce the energy costs and are profitable. Research and development activities for such technologies yield desirable outcomes for society. The technology options that take long periods of time for implementing such as hydrogen, nuclear power, and renewable-based energy systems, require early, well-planned strategies with consideration to uncertainties.

3. Role of a dozen of actions to reduce CO₂ emissions

In order to achieve the goal of 70% reduction by 2050,

innovations such as technologies and reform programs 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.

A dozen actions are as follows:

- 1) Comfortable and Green Built Environment: Design and dissemination of passive buildings with efficient use of sunlight and other technologies such as insulation and ventilation that hold in heat of space heating and cooling;
- 2) Anytime, Anywhere Appropriate Appliances: By means of equipment rental, alleviate initial cost burden of high-efficiency equipment, and boost the provision of services without ownership of material goods;
- 3) Promoting Seasonal Local Food: Agriculture will go low-carbon by accommodating people who want to eat in-season produce grown outdoors;
- 4) Sustainable Building Materials: Forestry businesses will progress through active use of wood in buildings, furniture, fittings, and the like, securing carbon sinks, and having long-term forestry policy;
- 5) Environmentally Enlightened Business and Industry: Businesses aiming at creating and operating in low carbon market and supplying low carbon and high value-added goods and services through energy efficient production systems;
- 6) Swift and Smooth Logistics: Networking seamless logistics systems with supply chain management, using both transportation and ICT infrastructure;
- 7) Pedestrian Friendly City Design: City design requiring short trips and pedestrian (and bicycle) friendly transport, augmented by efficient public transport;
- 8) Low-Carbon Electricity: Supplying low carbon electricity by large-scale renewables, nuclear power and CCS-equipped fossil (and biomass) fired plants;
- 9) Local Renewable Resources for Local Demand: Enhancing local renewables use, such as solar, wind, biomass and others;
- 10) Next Generation Fuels: Development of carbon free hydrogen- and/or biomass-based energy

supply system with required infrastructure;

- 11) Labeling to Encourage Smart and Rational Choices: Publicizing of energy use and CO₂ costs information for smart choices of low carbon goods and service by consumers, and public acknowledgement of such consumers; and
- 12) Low Carbon Society Leadership: Human resource development for building “Low-Carbon Society” and recognizing extraordinary contributions.

4. The advantage of early action

Early action could lead to cost-minimizing way to achieve LCS for Japan. Early actions are advantageous mainly due to the following four reasons: (1) Technologies have learning-by-doing effects: additional cost for reducing CO₂ emissions will decline as the technologies spread, (2) If actions are delayed, learning-by-doing effects may not work sufficiently, resulting in increase in the total investment required to achieve a low-carbon society, (3) Infrastructure cannot be built immediately, making it difficult to switch suddenly to a low-carbon society just before 2050, and (4) The future technological development has several uncertainties: if the development of a crucial technology falls behind schedule at this moment, it may not be able to spread as expected and CO₂ emission target may not be achieved; however, early action creates possibility for spreading alternative actions for the LCSs in case such a situation should come.

5. The mid-term Japanese target of GHG emissions reduction

Japan’s mid-term target was announced by Prime Minister Hatoyama on September 26th, 2009. The target is 25 percent reduction from the 1990 level by 2020. There are several mitigation options to meet the long-term target.

There are mainly four sets of countermeasures to achieve the target of 2020: carbon pricing, enhancement of top runner, visualization of countermeasure activities, mechanism to enhance technology development and deployment. Technologies could be categorized into three: technologies with negative abatement costs, technologies whose marginal abatement costs are under certain low level, and technologies with high cost which require appropriate policy measures. Different countermeasures are adopted to introduce different categories of technologies. These could be combined to achieve Japanese mid-term target.