Topic

Macro Image of 80% Cut in GHG Emissions by 2050

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On March 4, 2016, the Japanese government presented a draft global warming countermeasures plan at a joint meeting of the Global Environment Committee, Central Environment Council, Ministry of the Environment, and the Global Environment Subcommittee, Committee on Industrial Science and Technology Policy and Environment, Industrial Structure Council, Ministry of Economy, Trade and Industry. The draft specifies a long-term target of cutting greenhouse gas emissions by 80% by 2050 in addition to measures for achieving the target of reducing GHG emissions in FY2030 by 26% from FY2013 as submitted to the United Nations.

An excerpt from the draft global warming countermeasures plan

> …, Japan, based on the Paris Agreement, will pursue a long-term target of cutting greenhouse gas emissions by 80% by 2050 while leading the international community to encourage major GHG emitting countries to reduce GHG emissions commensurate with their capacity under a fair, effective international framework in which all major countries will participate and harmonizing global warming countermeasures with economic growth.

1. Background for Japan's GHG emission reduction target for 2050

Japan's first government initiative regarding a GHG emission reduction target for 2050 was the Invitation to Cool Earth 50 as advocated by then Prime Minister Shinzo Abe in his speech in May 2007. While giving no Japanese target, Abe proposed to "halve global GHG emissions by 2050." In a speech titled "Pursuing a Low-carbon Society Japan" at the Japan Press Club in June 2008, then Prime Minister Yasuo Fukuda said: "We must aim to halve global CO_2 emissions by 2050… It is needless to say that developed countries should make more contributions than developing countries. Offering a long-term target of cutting emissions by 60 to 80% from the present level by 2050, Japan will aim to realize a low-carbon society that we can boast to the world." He thus became the first Japanese leader to offer a Japanese target for 2050.

At their annual summit in L'Aquila in July 2009, the Group of Eight major countries reaffirmed the target of halving global GHG emissions by 2050. They then supported a target for developed countries to reduce emissions by more than 80%. In this way, the 80% cut became a consensus. In November 2009, then Japanese Prime Minister Yukio Hatoyama and U.S. President

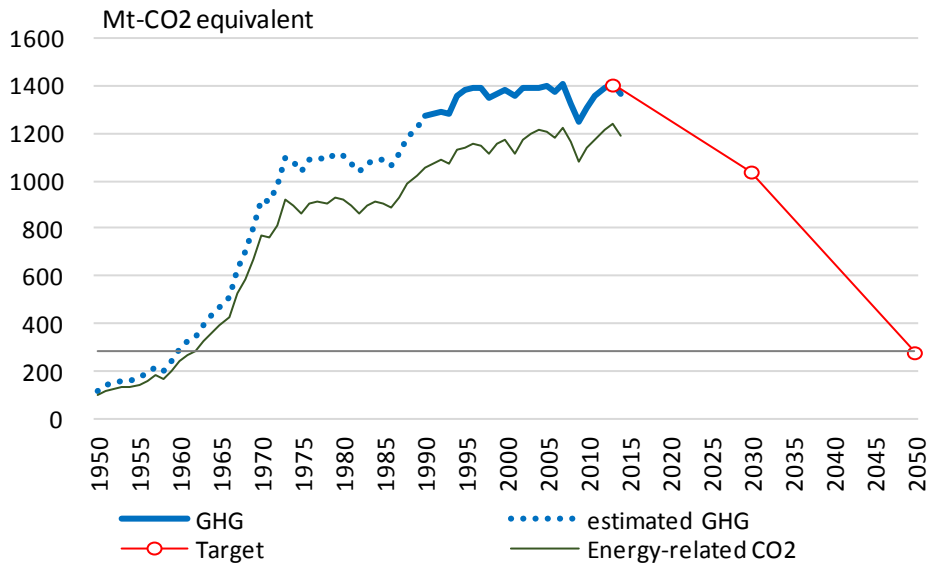
Barack Obama issued the U.S.-Japan Joint Message on Climate Change Negotiations, saying "our countries aspire to reduce our own emissions by 80% by 2050 and endorse a global goal of reducing emissions by 50% by that year." In April 2012, the then Noda Cabinet decided on the Fourth Basic Environment Plan that called for a long-term target of cutting GHG emissions by 80% by 2050.

2. 80% cut by 2050 resulting in FY1960 emission level

Given such background, it is not surprising that the recent draft global warming countermeasures plan clarifies the target of cutting GHG emissions by 80% by 2050. The problem is whether the emission reduction target is feasible. As a matter of course, it is impossible to conclude whether the target is feasible or not because more than 30 years remain until 2050. This paper depicts the image of the 80% cut by 2050 from a macro approach and looks into how easy or difficult the achievement of the target is.

Government documents on the 80% cut by 2050, including the draft global warming countermeasures plan, have not specified the base year. This paper tentatively sets FY2013 as the base year in line with Japan's intended nationally determined contributions, known as INDC, which specify the target of reducing GHG emissions by 26% by 2030. GHG emissions after an 80% cut from FY2013 total 282 megatons in terms of CO_2. The level amounts to actual emissions in FY1960 (Figure 1). This means that the target would require Japan to eliminate its emission increase over the past about 55 years in about 35 years. Given that population is expected to decline with economic growth being not as high as in the past, however, the required GHG emission reduction efforts could be seen as not so painful.

Figure 1 GHG emission trend and target emissions



Source: EDMC (Energy Data and Modelling Center), "Handbook of Energy & Economic Statistics"
Note: Since there is no official statistics for GHG emissions before FY1989, emissions for these earlier years are estimated based on energy-related CO_2 emissions that account for about 80% of GHG emissions.

3. Decomposition analysis to provide image of "80% cut by 2050"

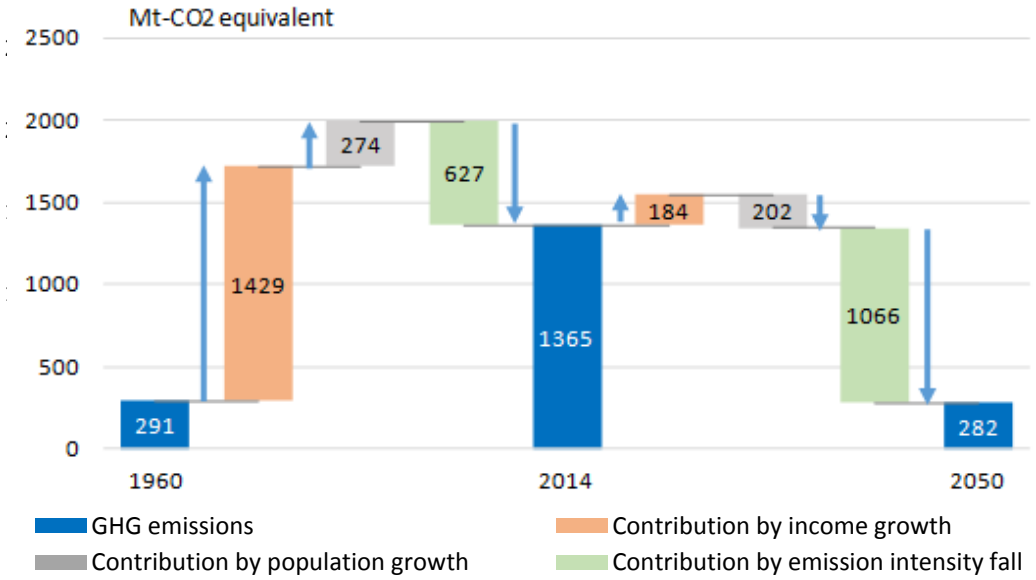
The following equation expresses GHG emissions in a manner to indicate contributions by population growth, economic growth and emission reduction efforts to GHG emission changes:

$$\text{GHG} = [\text{GHG} / \text{GDP}] \times [\text{GDP} / \text{Population}] \times \text{Population}$$

The first term on the right side shows the GHG emission intensity, or GHG emissions per real gross domestic product representing economic activities, which indicate emission reduction efforts. The GHG emission intensity has declined due to energy conservation and a switch to low-carbon energy sources. The second term represents the income level. GHG emissions increase as economic activities grow. The third term indicates that GHG emissions increase as population grows.

From FY1960 to 2014 (according to a preliminary estimate by the National Institute of Environmental Studies.,) GHG emissions increased by 1,075 megatons CO_2 equivalent, If the value is put into the equation, in may be found that GHG emissions increased by 1,429 megatons due to income growth (per capita GDP growth) and by 274 megatons due to population growth while decreasing by 627 megatons due to GHG emission intensity reduction (Figure 2).

Figure 2 Decomposition analysis of GHG emission changes



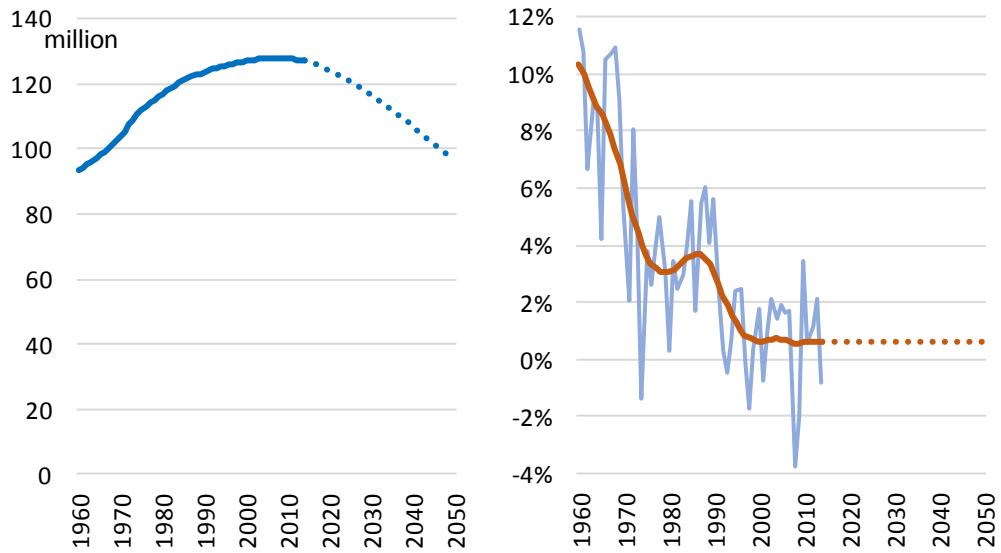
Source: Estimates by the author

Note: GHG emissions in FY2014 represent a preliminary estimate.

How will each factor contribute to GHG emission changes through 2050? Let's look into population for which projections are more stable than for other factors. Japan's population has entered a downward trend and is well expected to continue declining. The National Institute of Population and Social Security Research has projected that Japan's population in 2050 would decline by 24% from FY2014 to a level around that in 1965 (the left side of Figure 3). Economic growth over the coming 30 yeas is not easy to project. Here, therefore, the past economic growth trend is extended into the future to project future economic growth. A trend excluding annual fluctuations indicates that per capita GDP growth has remained rather stable at 0.6% since 2000 (the right of Figure 3). Given various policies to accelerate economic growth, the growth could follow a trend that could be different from the past one. Here, however, the per capita GDP growth of 0.6% is used to project future income levels as a base for discussion[1].

[1] Under this projection, GDP would peak out and turn downward around 2025, posting an average 0.2% contraction through 2050. This projection is thus pessimistic. Under a more optimistic projection, the GHG emission intensity as discussed later may have to be reduced further.

Figure 3 Population outlook (left) and per capita GDP growth (right)



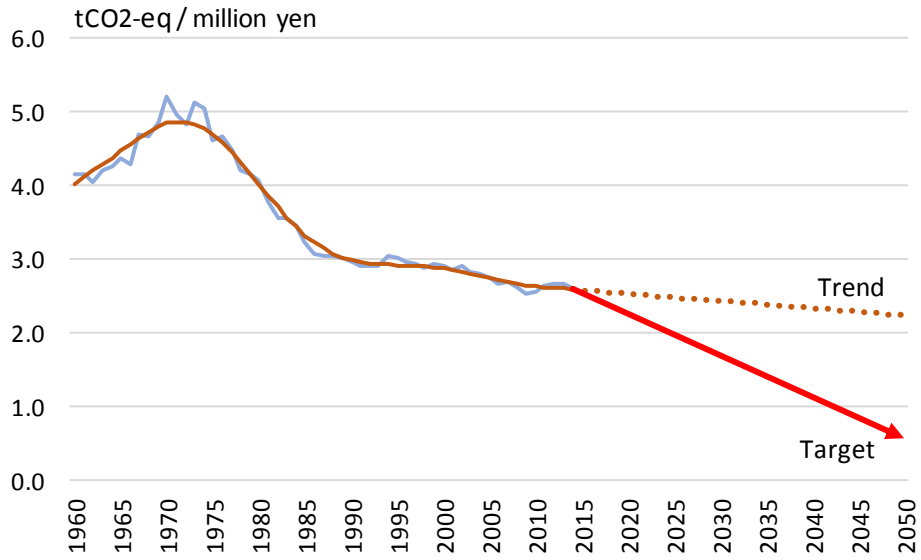
Sources: EDMC (Energy Data and Modelling Center), "Handbook of Energy & Economic Statistics" National Institute of Population and Social Security Research, "Population Projections for Japan (estimated in January 2012) (Median birth (death) estimates (population closed to migration))"

If the population decline's contribution (reducing GHG emissions by 202 megatons CO_2 equivalent) and the income growth's contribution (increasing GHG emissions by 184 megatons) are calculated, the GHG emission intensity fall's contribution to the 80% cut by 2050 may be computed as a residue. In this way, the intensity may have to be reduced by 1,066 megatons (Figure 2). On an annual average basis, the intensity may have to be reduced by 29.6 megatons per year, 2.5 times faster than 11.6 megatons per year for the past.

4. Conclusion

The GHG emission intensity dropped sharply in the 1970s including two oil crises (Figure 4) due to progress in energy conservation and a switch from oil to natural gas and nuclear energy for power generation. However, the decline has clearly slowed down. Although specific paths and measures to achieve the target of reducing GHG emissions by 80% by 2050 are left for future consideration, Japan may be forced to make far more emission reduction efforts than in the past. It is clear that achievement of the 80% cut by 2050 would be impossible under the present economic and social structure and the past trend of technological development. At present, no one can conclude whether it is possible or impossible for Japan to achieve the target over the next more than 30 years. However, the macro image given in this paper may lead people to understand that Japan will have to make considerably great efforts to achieve the target.

Figure 4 Trend of GHG emission intensity



Source: Estimates by the author