

Exploring carbon neutral development that diverges from the developed country model: Bhutan's long-term strategies*

Research objective

Located at the southern foot of the Himalayas, the Kingdom of Bhutan is endowed with abundant hydroelectric power potential. It has not only satisfied domestic power demand with hydroelectric power alone, but also sells surplus power. Further, national policy is aligned with protection of the natural environment, and the constitution stipulates that forests must not fall below 60 percent of national land. At present, greenhouse gas emissions fall below absorption (in contrast to an estimated 2.2 million tons of CO₂



emissions in 2013, absorption by forests was 6.3 million tons), making Bhutan a carbon negative country. Bhutan has also announced its aim to be a negative net emissions country. However, these conditions may not be a permanent.

Firstly, the impacts of global warming on hydroelectric power and forest carbon absorption are issues to be raised. Approximately 900 glaciers exist in Bhutan, but reports have shown that 23% of their area has disappeared during the past 30 years. Changes in river flow brought on by future shrinking of mountain glaciers and decreased snowfall has the potential to wield serious impacts on hydroelectric power. Further, carbon absorption declines year by year along with the growth of forests, making it difficult to maintain carbon absorption over the long term.

Greenhouse gas emissions also cannot continue on the current course. Bhutan aims to have an annual economic growth rate of 10%. Combined with population increase, the country's emissions have the potential to exhibit a striking increase due to increased consumption of fossil fuels for transportation and industrial fuel use, increased heat demand for buildings and households in cold regions and conversion of forests for other land uses. That is, there are fears that over the mid- to long-term, emissions will become positive.

While in developed nations and more developed countries (MDCs), conventional infrastructure and social institutions are obstacles to the transition to low-carbon societies, Bhutan, a least developed country, has free rein to engage in transition. If Bhutan does not follow conventional emissions-intensive development pathways, leapfrog-type, non-linear development toward a low-carbon and sustainable society may be possible. Such an achievement could prove to be a valuable example of the way to climate stabilisation.

This research targets Bhutan, a country made up of mountains, forests and valley cities, and concerns the potential up to 2050 for non-linear development and carbon neutrality.



Background

The Institute for Global Environmental Strategies (IGES) with the National Institute for Environmental Studies (NIES) has been conducting field study research over a two-year period from 2015 with a budget from the Research and Information Office of the Global Environment Bureau of the Ministry of the Environment, Japan.

IGES and NIES visited Bhutan in 2015 to initiate collection of fundamental data. In 2016, utilising data collected and existing projection methods (a low-carbon scenario formulation tool called Extended Snapshot: ExSS), preliminary future projections were performed for the country's greenhouse gas emissions and absorption up to 2050. These showed the potential for the country's emissions to exceed its absorption in 2050 if additional low-carbon measures are not introduced.

In addition, repeat visits in October 2016 brought opportunities for opinion exchange on the preliminary future projections with local policy-makers and researchers. As a result, a request for promotion of research was received from the National Environment Commission of Bhutan, and an agreement on joint research was reached with local research institutes that promote climate change impact assessment and research on happiness levels in Bhutan.



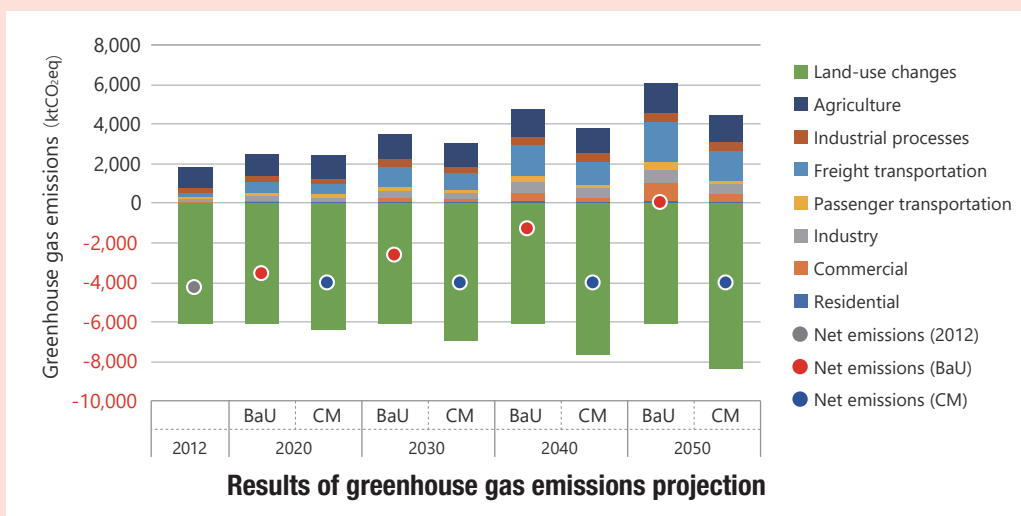
* This brochure was created based on the Ministry of the Environment's "2016 Commissioned Work on the Promotion of International Low-carbon Research".

Results of future projection of greenhouse gas emissions and absorption in Bhutan

The Extended Snapshot (ExSS) tool was applied to project greenhouse gas emissions through 2050 for two types of scenarios, the BaU (Business as Usual) scenario and the CM (Countermeasure) scenario. For the projections, first common values for socioeconomic changes such as population, number of households, GDP and industrial structure were set for both scenarios referring to Bhutan's statistics and plans, such as the National Accounts Statistics 2015 and the 11th Five Year Plan. Next, for the BaU scenario, no changes were assumed for the energy efficiency of machinery on the energy demand side, transportation mode share and land use. Meanwhile for the CM scenario, improved energy efficiency of machinery,

increased proportion of buses in transportation mode share and increased managed forest area was assumed based on implementation of low-carbon measures.

Projection results show that in the BaU scenario greenhouse gas emissions will exceed absorption in 2050, changing into positive emissions. Although hydroelectric power will remain the major energy source, due to an increase in transport demand, petroleum consumption will increase over 8 times that of 2012. In contrast, while greenhouse gas emissions in the CM scenario will increase, sustainment of negative net emissions up to 2050 becomes possible,



based on suppression of emissions compared to the BaU scenario using low-carbon measures and an increase in carbon sequestration from 2012. The measure most contributing to reductions in the CM scenario is forest management, which accounts for over half of reduction amounts compared to the BaU scenario.

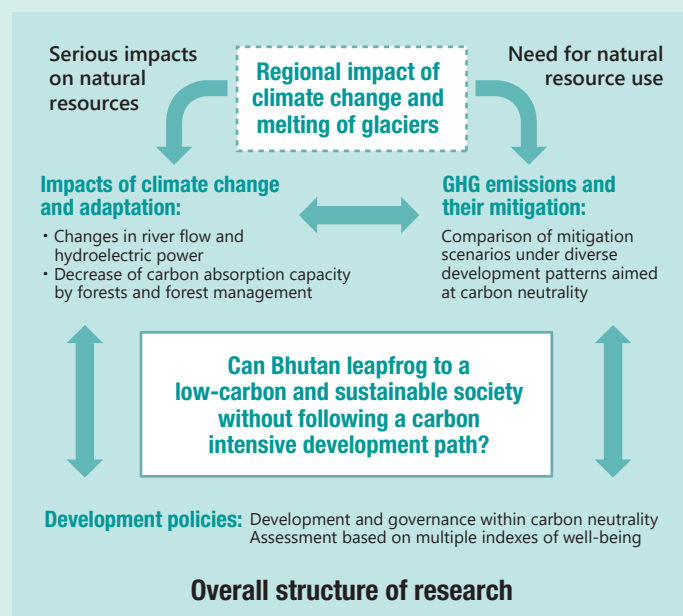
Although at present projections conducted based on available data are preliminary, in order for Bhutan to develop while maintaining carbon neutrality, the introduction of low-carbon measures is thought to be essential.

Future plans

Although the above outcomes were achieved in 2016, at the present time future projections based on ExSS remain preliminary and further progress via cooperation with local people is essential. From here on, projected figures considering adaptation to climate change impacts on hydroelectric power and carbon absorption will be incorporated and applied to Bhutan.

Further, for future changes in the energy service demand of developing countries made up mainly of mountainous regions and valley cities, projections that take not only economic growth into consideration, but also use of forest resources and land use conversion, must be made possible. For this purpose, cooperation with experts that possess this knowledge is indispensable. Accordingly, more precise projection of both the country's future greenhouse gas emissions and the effectiveness of low-carbon measures would be made possible.

Additionally, although Bhutan has developed GNH (Gross National Happiness) as an indicator for national development goals, internationally there are also indicators such as the SDGs. Future research will examine the impacts of various scenarios and measures on a variety of development goals, such as GNH and SDGs.



Via this research, an examination of the potential in Bhutan for development policy up to 2050 geared toward not passing through a state of high energy consumption technological dependence will be examined and additionally suggestions for low-carbon development potential in other developing countries inferred.