

Review and Prospects of Taiwan's Response to Climate Change and Post-Disaster Recovery

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Strategy adjustment of Taiwan's response to the conclusions of IPCC 2007

Different scientific hypotheses affect our view of the environmental damage caused by climate change. For instance, there are two different views on climate change: (1) greenhouse gases constitute a variety of gases, not all of which are environmental pollutants. Because some of the gases capture infra-red radiation in the atmosphere, the Earth is changed from a black-body radiator of -18°C to a habitable environment with an average temperature of 15°C . (2) Earth is currently in an interglacier period; global warming is a natural phenomenon, and global cooling will follow at some point in the future. Therefore, the global climate change being discussed at present is simply a small fluctuation in the long-term evolution of Earth, and there is nothing surprising about it.

Both of the aforementioned viewpoints might be true. However, we are the population living on Earth at this point in time, and it is we who will face difficulties, in the current generation. Global climate change may even cause a major disaster in this century, and it will be our problem when it happens. Taiwan is at a relative disadvantage in facing global warming in comparison with other countries, as Taiwan is an island country. Therefore, we need to deal with the issues caused by sea-level rises and relevant land-use problems as a priority.

The IPCC 4th Assessment Report, *Climate Change 2007*, identified that global warming is taking place and cannot be ignored. The CO_2 level in the atmosphere was at a stable level of 280 ppm in the pre-industrial period; however, it has been increasing ever since the industrial revolution, and currently stands at 380 ppm. This is an anomalous value when considering the past half a million years, and our dangerous over-reliance on fossil fuels needs to be corrected. IPCC 2007 made two major predictions: (1) In the 20th century, the average temperature increase was 0.6°C , but the potential average temperature increase by the end of the 21st century is $2\text{--}4.5^{\circ}\text{C}$, the best estimate being 3°C , but not less than 1.5°C ; (2) The mean rise in sea level was 17 cm (1.7 mm/year) in the 20th century, but increased to 3.4 mm/year during 1993-2003; therefore, the estimated sea-level rise is 18-59 cm by the end of the 21st century.

In terms of strategies for adaptation to global warming, most countries (especially those in the EU) consider that a temperature increase of 2°C over that of the pre-industrial revolution period is the tolerable limit. However, based on business-as-usual scenarios, the global temperature increase will easily reach this limit by 2100; it is therefore likely that more aggressive international action will need to be taken in order to control the temperature increase, action that may include regulation of

the global carbon-trading market, carbon taxation, and measures for the control of CO₂ emissions. These actions will directly affect the cost of electricity and the amount of power generated in Taiwan. Although Taiwan is not a full member of UNFCCC, in order to be a responsible country, Taiwan needs to take a symbolic and substantive response to the threat of global warming.

The 1997 Kyoto Protocol deemed that, by 2012, industrialized nations will have cut their greenhouse-gas emissions by 5% initially on average to below the level of 1990; however, this target is currently impossible, because the international treaty does not have as powerful a normative force behind it as for example the Montreal Protocol, which is being used to ban CFCs in order to reduce ozone depletion. Taiwan aims to reduce its CO₂ emission level to the level of 2000 by 2025, although this goal is an almost impossible one as the demand for electricity is still rapidly increasing. The power installation capacity of Taiwan was 16,880 MW in 1990, 29,460 MW in 2000 (from the Taiwan Power Company, TPC), and 46,400 MW in 2009 (from the TPC plus private companies), and it is estimated that it will reach 53,780 MW by 2021. This shows that the power consumption has been growing over years. Power supply reflects the needs of residential, business and industrial consumers. The CO₂ emissions resulting from power generation account for 1/3 of the total CO₂ emission in Taiwan, and also indirectly affect the other 2/3 of the total CO₂ emission; this is because nearly 60% of the electricity is used by industry in Taiwan, and the CO₂ produced by industry, particularly the petrochemical and steel industries, accounts for the majority of the total CO₂ emission in Taiwan. Although the use of nuclear power has reduced the generation of CO₂, this reduction represents less than 5% of the total CO₂ emission generated by all electricity facilities in Taiwan. In addition, green technology and renewable energy sources are still in the initial stages of development. As Taiwan cannot currently reduce the power supply, it will not be possible to reach the goal set for CO₂ reduction, and a forced reduction would have a direct impact upon industry. Therefore, a completely different approach to making the adjustments needed to the economic and industrial structure should be taken, although no effective adjustments are being made at present.

In order to cope with the rising sea level, some scholars in Taiwan have suggested that the example of the Netherlands be learned from, in which a one-meter increase was anticipated in the 21st century as a precautionary measure and practical preventive measures have been employed to combat this rise. However, the issue involves environmental control, disaster prevention, responsibility transfer, and the division and integration of the responsibilities of different government authorities. The complexity of this task is described below.

Disaster management of the issues of global climate change in Taiwan

Taiwan is a hazard-prone island country, and often needs to mobilize all the available manpower and resources of the country in response to natural disasters such as typhoons, floods, landslides, water shortages, and earthquakes. Therefore, the regulations and systems for disaster relief and reconstruction, and the funding mechanism behind those systems, are generally competent. However, land-use planning and land development have been proven ineffective. Therefore, in response to a short-term bursting regional natural disaster, Taiwan implements a comprehensive mechanism to cope with the disaster successfully; however, in response to the "slow" formation of a large-scale regional disaster, such as global climate change, Taiwan lacks a national mechanism by which to provide disaster relief. This is especially true in dealing with the issue of sea-level rise. Two examples are described below.

1. Taiwan's west coast has serious problems in terms of land subsidence, seawater intrusion, and over-exploitation of industrial buildings around residential areas. One important example is the land subsidence in Yun-lin County, which threatens the safety of the high-speed rail network. This problem will be highlighted when the sea level rises by 50-100 cm, which will have a great impact on the western coast of Taiwan. In the IPCC 2007 report, Taiwan is one of the high-risk countries, and the Taiwanese government must therefore invest a large amount of funding for coastal management and must implement a long-term strategy and yearly operational plans. The Dutch experience may be a good model to use as a reference, but Taiwan still needs its own practical and financial plans in order to complete the complex tasks required.
2. In the past, Taiwan has not been particularly successful in the construction of microzones to combat flooding and debris flows, and thus has faced many difficulties in this regard. However, using the experience accumulated over the past few decades, this situation has increasingly been improved. With regards to the impact of sea-level rise on the western coast, simulation results are already being used as a reference, and therefore the problem at present is not that of being unaware of the range and intensity of the impact, but rather how to manage it. In addition to a strategy of effective coastal management, the relocation of people is another option. However, it has never been possible to relocate people successfully post-disaster in Taiwan in the past. During the disasters of the 921 Chi-Chi Earthquake in 1999 and the Typhoon Toraji in 2001, the government made attempts to relocate hundreds of households without success, and after Typhoon Morakot in 2009, the relocation of the thousand households was attempted in hot debate.

Evacuation and relocation involve issues of land transfer and property ownership, as well as employment problems. Resistance to relocation may arise due to people having developed strong feelings towards the land or to other issues of socio-cultural barriers. These are serious problems in Taiwan, and a national mechanism therefore needs to be formulated and a common understanding of the population reached; otherwise, the results of the simulation will only lead to anxiety, with no concrete prevention strategies. With regards to the relocation of factories and industry, the important

issues are associated with national economic and industrial policy, and the impact is no less than that of residential relocation.

The problems discussed above reveal that global climate change really is a threat to Taiwan. Structural issues such as power supply, coastal management, and relocation and resettlement post-disaster are complex, and long-term, comprehensive and practical planning is required. Although there are still a few decades before the worst of the problems arise, if we do not formulate and implement an effective response now, it may be too late.