Issues Concerning the Paris Agreement on Global Warming: Limitations of Negative Emissions Dependence — Make Zero Emissions the Guiding Principle

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Key points:

- It is apparent that the Nationally Determined Contributions (NDCs) submitted by member countries will not be enough to reach the 2 degree target
- Technologies and feasibility for massive negative emissions are unproven
- It is effective to accumulate technologies for zero emissions in each sector


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The Paris Agreement, a new framework of global warming prevention, was adopted at the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC), which was held in Paris in December 2015. The Parties agreed to keep the average global temperature rise well below 2˚C above pre-industrial levels (the Two-Degree Goal), keeping it in mind to do our best to keep the rise less than 1.5˚C, and realize zero net emissions by balancing anthropogenic greenhouse gas emissions with negative emissions in the second half of this century.

All countries and regions were required to draw up their voluntary NDCs (pledges) for reducing greenhouse gas emissions and review these goals every five years. In addition, it was decided that the whole world would examine the progress of the goals every five years. Individual countries and regions submitted their pledges, mainly for 2030, to the UNFCCC Secretariat in accordance with this decision.

The details of these pledges varied, however. Most pledges made by emerging economies and developing countries in particular referred to the reduction goals per GDP (China and India,

etc.) and reduction rates compared with business as usual (BAU) emissions (Mexico and South Korea, etc.). In addition, many pledges were based on the condition of various types of assistance from advanced countries. The final global absolute emissions based on compliance with the pledges are unclear.

Many experts point out that it will be impossible to reach the orbit of achieving the Two-Degree Goal with these pledges and that the possibility of implementing the pledges themselves is questionable, including the US withdrawal from the Paris Agreement. In this situation, the Parties to the Agreement will confirm their commitments to each other at the Talanoa Dialogue, and they will discuss strengthening the pledges of individual countries and regions through the first global stocktake, which will be conducted in 2023. Negative reactions for strengthening of NDCs are expected to be raised, however, and it will not be easy to realize it.

A long-term drastic reduction scenario may face serious problems as well. Because CO_2 remains as it is in the air for an ultra-long time, if additional CO_2 is emitted, the temperature will rise accordingly. In this sense, unless zero CO_2 emissions are realized, the temperature will not be stabilized. The question is how to realize zero CO_2 emissions.

The Two-Degree Goal was agreed on in the Paris Agreement, but the Intergovernmental Panel on Climate Change (IPCC) had drawn up scenarios on reducing CO_2 emissions to achieve the goal prior to the adoption of the agreement. Most of these scenarios specify less than net zero CO_2 emissions by 2100. Examined in detail, these scenarios show that although about 20 billion tons of positive-emissions remain unabated, these emissions will be offset by negative emissions that are larger than this, thus leading to net negative emissions by 2100.

As a result, negative emissions will total up to 600 billion to 800 billion tons within the twenty-first century, more than twenty years' worth of the current global CO_2 emissions. That is, the Two-Degree Goal is a scenario that depends on a huge amount of negative emissions. This was hardly known to policy makers.

The main technology of negative emissions is the BECCS (Bio-Energy with Carbon Capture and Storage), which uses bioenergy, captures emitted CO_2 and stores it underground. At present, however, this technology is not put into practical use at all and entails serious issues.

The first issue is the limitations of land. Land as large as the area of India or up to twice its size is required to grow plants for BECCS on this scale. This is the equivalent of 25% to 46% of farmable land all over the world. The second issue is the negative impact on the diversity of species and water supplies. The third issue is where to store such a huge amount of CO_2. If a method depending on large-scale BECCS becomes deadlocked, the Two-Degree Goal will fail, which will cause the temperature to continue rising in the long term. This situation must be avoided.

A new goal we are proposing is zero CO_2 emissions that do not depend on a large amount of negative emissions.

Fundamentally speaking, the 2°C goal has unclear instructions as to how individual actors, including the government, companies and individuals, should act. Zero CO_2 emissions show clear goals for all actors, and if this goal is achieved, the temperature will become stable. But unlike the Paris Agreement, you should set neither an upper limit on the rise in temperature nor the deadlines for achieving goals. To steadily push forward with the long-term goal of zero emissions instead of failing while attempting to achieve an attractive-looking goal is an effective measure against global warming, although it is a slow and steady effort. A strong weak goal is better than a weak strong goal that may collapse.

But it is politically unrealistic to renounce the Two-Degree Goal that was agreed on. just three years ago. We propose that long-term zero CO_2 emissions should be set as the guiding principle for all actors, including the central government. Based on this guiding principle, individual actors should elaborate on the reduction technologies to be taken on. For example, we examined technologies for and issues concerning zero emissions with a focus on power generation, transportation and steel, the major CO_2-emitting sectors. (Please refer to the Chart.)

The technologies for and issues concerning the feasibility of zero CO_2 emissions in the main sectors

Sector	Technology for zero emissions	Issues to be resolved
Power generation	Renewable energy	・Supplying a large amount of batteries to achieve supply-demand balance for changeable outputs of solar and wind power generation ・Establishing high-speed control technology for frequency stabilization
	Nuclear power	The issue of the disposal of spent nuclear fuel, etc.
Transportation	Electrification and hydrogen (passenger cars and light trucks, etc.)	Cost reductions of batteries
	Biofuel (large trucks, ships and aircraft)	Mass-producing inexpensive cellulosic biofuels
Steel	Reduction of iron ore directly by hydrogen	Supplying no-carbon electricity for electrolysis, and realizing cost reductions
		Coordinated use with the blast furnace method equipped with CO_2 capture and storage devices (CCS)

In the power generation sector, it is necessary to realize almost zero fossil fuels and increase solar and wind power significantly. The issues are how to secure batteries and how to stabilize

frequency. In the transportation sector, measures for large trucks, ships and aircraft are issues. The required capacity of batteries is too large. The use of biofuel is almost the only answer. Attempts to mass-produce inexpensive cellulose fuel are made in many parts of the world, but it is not possible to be optimistic about whether they will be successful.

In the industrial sector, steel, which emits a huge amount of CO_2, is a key issue. Currently, iron is produced mainly by blast furnaces and revolving furnaces, but because coal is used to reduce iron ore, the emission of CO_2 is unavoidable. Direct reduction by hydrogen or electrolysis is necessary for non-carbonization. But both of these consume such a large amount of electricity that this electricity needs to be carbon-free, for example by introducing renewable energy.

The development of such technology was not examined comprehensively except by some organizations, including the International Energy Agency (IEA). If you repeat this approach, you will obtain a picture of when you can realize zero emissions by sector. This is in line with the concepts behind the Paris Agreement, which introduced the bottom-up method. After all these endeavors have been tried, we should try to offset the CO_2 emissions that unavoidably remain, both physically and economically, with technologies for negative emissions. This is a realizable and effective structure for coping with climate change.

Lastly, we would like to note uncertainty and the balance with other important issues in pursuing climate strategies.

The predominant issue of uncertainty is the relationship between the concentration of CO_2 in the air and the rise in temperature (climate sensitivity). According to the IPCC, the rise in temperature is within the range of 1.5°C to 4.5°C if the concentration of CO_2 doubles, surprising three-fold gaps. The IPCC drew up a scenario on achieving the Two-Degree Goal by using a moderate value of 3°C climate sensitivity, and they mainly focused on achieving the goal with a probability of more than 66%. That is, the probability of exceeding 2°C comes in at up to 34%. Considering the abovementioned gaps in climate sensitivity, the probability of achieving the goal swings significantly upward and downward. We should note that the scenarios on achieving the Two-Degree Goal involve this significant uncertainty.

In addition, as shown in the United Nations Sustainable Development Goals, there are goals to be tackled simultaneously around the world, including the eradication of poverty and hunger in addition to climate change. Additionally, advanced countries are saddled with a mountain of pressing issues, such as fiscal deficit, declining birthrates and population aging and their pension and medical systems. Politicians should make decisions on how to allocate limited resources efficiently to the climate change issue and a wide range of other issues. Our proposal of zero CO_2 emissions in the long term is compatible with both the issue of uncertainty and the issue of the effective use of resources.

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