The Paris Agreement: Climate Mission Sustainable?

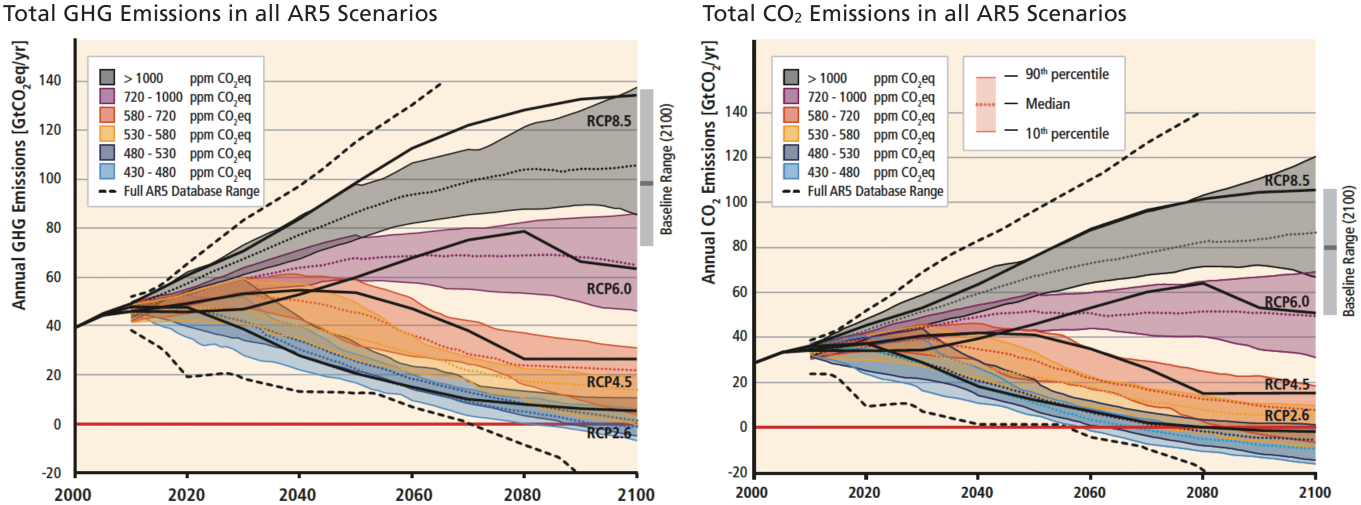
The parties to the United Nations Framework Convention on Climate Change last year embarked on a collective long-term commitment to achieve a net zero CO_2 emission society. **Yamaguchi Mitsutsune**, special advisor for the Research Institute of Innovative Technology for the Earth (RITE), examines some of the challenges ahead.

The 21st session of the Conference of the Parties (COP21) to the United Nations Framework Convention on Climate Change (UNFCCC) held in Paris last December ended in success thanks partly to meticulous consensus building by the French government and cooperation between the United States and China. The Paris Agreement represents the pledge of all parties to make effort towards cutting or limiting greenhouse gases. It represents a groundbreaking effort to act on climate change measures in a number of ways. First, all parties have agreed to pursue cuts or limits to greenhouse gases and toward that end have pledged to make specific contributions toward 2025–2030 and beyond. Every five years, they will report the progress they've made on their existing contributions while submitting enhanced ones, with their report then undergoing a technical expert review. Under the "global stocktake" provision, every five years the parties will assess the progress they've made collectively at the global level. Not only developed countries have agreed to provide financial resources to developing nations in order to support their efforts, but also developing nations themselves are encouraged to allocate funds on a voluntary basis.

In this way, the Paris Agreement represents a truly revolutionary step towards furthering climate change efforts. Moreover, parties will attempt to hold the increase in the global average temperature to well below 2°C above pre-industrial levels while pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels. They will seek to achieve a balance between anthropogenic emissions from sources and the removal by sinks of greenhouse gases (GHGs) in the second half of this century. The Paris Agreement that represents a combination of the bottom-up approach involving pledges made by each country and the top-down approach involving targeted limits on temperature increases will be the best possible modality at the present time. Clearly another relevant fact is that carbon emissions over the past two years have remained unchanged despite economic growth. That said, it is clear from UNFCCC and International Energy Agency (IEA) analysis that, extrapolating from existing pledges, achieving a 2°C target will be nearly impossible, so achieving that target will require that countries make all the more enhanced efforts when upgrading

Figure 1: 2°C Target Scenario vs. Negative Emissions (left panel GHGs; right panel CO_2)

Total GHG Emissions in all AR5 Scenarios | Total CO_2 Emissions in all AR5 Scenarios



Source: Extract from Figure 6.7 in IPCC/AR5/WG3/Ch.6

their contributions every five years.

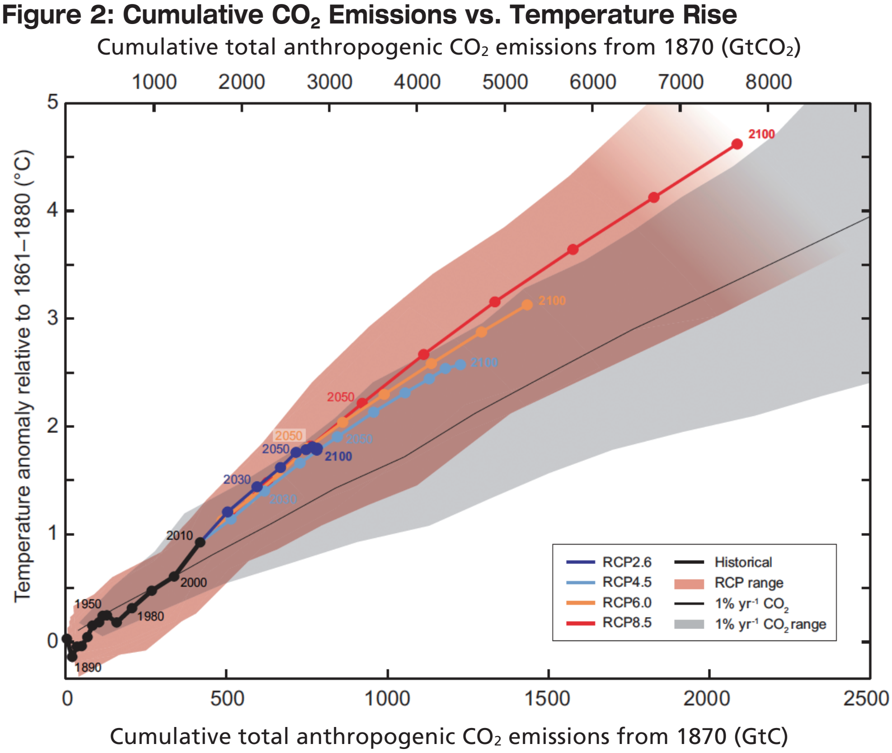
Sustainability of the Paris Agreement

However, there is some concern whether pledges made under the Paris Agreement can be substantially strengthened in the future. The biggest concern with the Paris Agreement is that, unless a huge volume of negative CO_2 emissions can be achieved, the emissions pathway which results from the enhanced pledges may not turn out to be one which can achieve the 2°C target. Another concern is that the Paris Agreement contains the phrase, "...on the basis of equity, and in the context of sustainable development and efforts to eradicate poverty" with a view to striking a balance between emissions and absorption. Giving consideration to equity means tailoring the margin of a country's burden according to the degree of its industrialization, or in other words, not making the marginal abatement cost equal. This means that the cost of efforts for the world as a whole will correspondingly rise. Also, seeking to achieve the goal together with sustainable economic development means attempting to achieve the 2°C target while also taking consideration of the adverse impact of climate change measures on sustainable economic growth. In short, there are constraints in these areas as well.

Are Negative Emissions Realistically Achievable?

The IPCC Fifth Assessment Report incorporates **Figure 1**, which includes emissions scenarios designed to achieve the 2°C target. The left panel shows all GHGs while the right panel shows CO_2 only. The light blue emissions pathway represents 430–480 parts per million CO_2 equivalent, which is generally believed to correspond to achieving the 2°C target. Looking at GHGs, though some scenarios show negative emissions, others anticipate positive emissions of about 5 to 10 Gt as of 2100, and if, as hoped under the Paris Agreement, zero net GHG emissions can be achieved by the end of this century, it would be possible to hold the temperature increase below 2°C. However, looking at CO_2 as indicated in the right panel shows that from around 2060 through 2080 negative net emissions should be required to achieve the 2°C target under nearly all scenarios, with negative emissions of around 10 Gt being reached in 2100. The reason is that the atmospheric lifetime of CO_2 is extremely long compared to other greenhouse gases, and the relationship between cumulative CO_2 emissions and the rise in temperature is basically proportional (**Figure 2**). Typical examples of ways to achieve negative net emissions include the technology known as Bio-Energy Carbon Capture and Storage (BECCS), which uses bio-energy, captures emitted CO_2 and stores it deep underground, and another known as Afforestation and Reforestation (AR), which involves planting and replanting of forests on a massive scale. Is this actually possible? A number of research findings on this issue have been published very recently in scientific journals. Most of these adopt a cautious stance with regard to factors such as the limitation of land area for biomass and afforestation, and the cost and the adverse impact on ecosystems.

Figure 2: Cumulative CO_2 Emissions vs. Temperature Rise



Source: IPCC 2014 (a) Figure SPM.10

Consideration of Costs

The 5th IPCC report sets the cost of achieving the 2°C target at 4.8% (3–11%) of consumption in the year 2100. As economies will grow faster however, the report estimates the cost would be just a dent in the consumption growth rate of 0.06 (0.04–0.14) percentage points each year. This estimate is based on three assumptions, namely that all countries begin reductions immediately, that they adopt a global uniform carbon tax and that all technologies are commercially available. However, if the timing at which the advanced, emerging and developing nations adopt these policies differs by twenty years in each case, the cost would increase by 50% to 100%, and if carbon capture and storage (CCS) technology is not commercialized, it would more than double. Moreover, a global uniform carbon tax is unlikely. When these facts are taken into consideration, it is possible that the actual cost will be, say, 15% of consumption in 2100. Given also the uncertain extent to which climate damage can be avoided through emissions cuts, it is questionable whether policymakers will be able to resolve to undertake these costs.

Trade-Offs and Co-Benefits

The fifth IPCC report stresses co-benefits in saying that mitigation policies will help in regard to air pollution and energy security, but it offers an incomplete analysis regarding the impact of BECCS and massive reforestation on agriculture, water and the diversity of species. One problem in particular is the potential impact on Sustainable Development Goals (SDG) being pursued at the United Nations level. These goals come under seventeen headings, including elimination of poverty and freedom from hunger, and the climate change problem is also one of them. Of course, climate change measures will be useful in achieving other SDG goals by, for example, contributing to the elimination of poverty, but if the goal is indeed elimination of poverty, it would be far more effective to work out measures specifically for that purpose.

Since global resources are limited, and while the author recognizes there exist co-benefits suggested by the IPCC report, any resources allocated for climate change cannot be used for other purposes. In other words, global leaders must weigh the problem of climate change against these urgent global issues as well as against equally important domestic problems in terms of both importance and urgency and only then decide what share of these scarce resources should be allocated to climate change. In view of the above and the fact that the Paris Agreement raises the 2°C target in the context of achieving sustainable development and eliminating poverty, one can only conclude that the Paris Agreement may be at risk of foundering in the end.

The case still remains, however, that the 2°C target will be achievable if equilibrium climate sensitivity (ESC) is low. (ECS measures the extent of increase in temperature when CO_2 concentration doubles.) Though IPCC figures shown here are calculated on the assumption that ECS is 3°C, our study shows that a difference of 0.5°C in climate sensitivity has a significant impact on emissions pathways and the cost of achieving the 2°C target (see the *Japan Journal*, March 2015). The margin of climate sensitivity (the uncertainty) is presently estimated at between 1.5°C and 4.5°C, and in this sense, it is vitally important to reduce this uncertainty.

Long-Term Net Zero CO_2 Emissions and Technological Innovation

The progress of warming must nevertheless be halted at some point. As mentioned above, cumulative CO_2 emissions are roughly proportional to the rise in temperature, so halting and at some point stabilizing the increase in temperature will require ensuring that long-term net CO_2 emissions are zero. This is the new goal that the world must aim for over the long term. In contrast with the Paris Agreement, this means not setting a 2°C temperature rise limit, not setting 2100 as a time limit to achieve it, and not assuming massive negative emissions.

However, even this goal will be quite challenging. In sectors such as steel and cement, which unavoidably emit CO_2 in the manufacturing process, fundamental changes in manufacturing methods or CCS will be essential. Further, even if the transportation sector of the world, including India and China, were run on electricity or hydrogen, the question would be whether all of this electricity or hydrogen could be obtained CO_2 free. Other difficult problems would then arise, such as how to build the infrastructure needed to replenish the hydrogen or recharge the electricity. It would also be necessary to supply the electricity through massive space-based solar power or nuclear fusion, for example, rather than intermittent renewable energy sources. The key to doing this will be the development and diffusion of revolutionary technologies, and toward that end, cooperative international research would definitely be necessary.

In that case, however, there is a risk that the temperature increase would still exceed 2°C, plunging humanity into a world unseen in the past 400,000 years. In that event, the climate may even change abruptly. To provide against that risk, it may be necessary to further research into solar radiation management, one of the ways of geoengineering that accompany another risk, aimed at limiting the increase in temperature, as by dispersion of aerosols in the stratosphere. We have to think about the risk/risk trade-off — the risk of climate change and the risk of response measures. The problem of climate change is truly one of risk management on a global scale.

WEBSITE OF THE PRIME MINISTER OF JAPAN AND HIS CABINET

Prime Minister of Japan Abe Shinzo speaks at COP21 in Paris, December 2015.

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