Solar and Wind Power Generation with a Lowered Cost Compared to Thermal Power Generation: The Impacts of 46% Decarbonization—Why Has Japan Missed the Mark?

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The Skyrocketing Greenhouse Gas Reduction Target


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The global wave of "decarbonization" has already descended upon Japan, and this has led to a great change in that direction. On April 22–23, the Leaders Summit on Climate hosted by the United States was held online after President Biden called for the summit, and there, Prime Minister Suga declared that Japan aims to reduce its greenhouse gas emissions by 46% in fiscal year 2030 from its fiscal year 2013 levels. The original goal was for a 26% reduction, so this number was close to double the original goal. FY 2013 levels are used as reference for these reduction goals, and Japan is already progressing well with energy conservation compared to the rest of the world. I get the sense that energy conservation is quite strict among the population, and industry may be even more involved. In establishing what could be called thoughtless numbers, there were considerable twists and turns even within the government. In this paper I want to look back and investigate this against the backdrop of a reduction in greenhouse gas emissions by 46%.

I worked at the Ministry of Foreign Affairs (MOFA) for nineteen years starting in 2007, and was involved in policy making related to the "Paris Agreement," a multilateral agreement on climate change measures. Reducing greenhouse gas emissions has been a global issue since before this agreement, and deliberations have taken place within the government led by the Ministry of Environment (MOE), the Ministry of Economy, Trade and Industry (METI) in control of energy policies, and MOFA, which negotiates with other countries. Past target values realistically collected by METI are thought to have been around the high 30% range, as reported by each company. However, Europeans have been promoting decarbonization for a while, and in September 2020, China declared that it would be carbon neutral by 2060, balancing CO_2 emissions with removal and absorption to reach zero. The Trump administration, which was negative towards decarbonization, was replaced by the positive Biden administration, and the global movement towards decarbonization has been quickly set towards advancement in one year. Japan was pressed to switch courses quickly, but where was the move towards decarbonization delayed?

Countries' Climate Change Policies Leading to the Paris Agreement

While climate change is an urgent issue for the world, deliberations have been a series of ups and downs as policies against climate change restrict manufacturing. Deliberations have also taken place in connection with local development from the start as the effects of climate change strongly affect developing countries with fragile social and physical infrastructure.

In 1992, the United Nations Framework Convention on Climate Change (UNFCCC) was adopted and, since 1995, the Conference of the Parties (COP) has become the stage for negotiations as deliberations on climate change take place here. Japan took the lead on climate change negotiations, being a leading country in energy saving at the time, and this was realized in 1997 with the adoption of the Kyoto Protocol to the United Nations Framework Convention on Climate Change (Kyoto Protocol), a framework for greenhouse gas reduction. However, the Kyoto Protocol itself also came to clearly reflect the difficulty of this issue.

The conflict here was the question of who should take responsibility for climate change. Developing countries assert that the responsibility lies with developed countries, as they produced large amounts of greenhouse gases in the past when achieving economic development. Developed countries, however, assert that it is an issue that should be dealt with by the entire world in one way or another. Without reaching a mutual agreement, negotiations were put on hold.

China and India were and still are countries with large greenhouse gas emissions, and both countries took sides with developing countries and laid out a case for demanding CO_2 reductions from developed countries. Former President Trump criticized the Paris Agreement system. The logic behind his China-specific criticism was a sense that is was unfair that China, with the highest emissions of greenhouse gases in the world, had lenient reduction goals and that the United States should be able to pursue economic activity without worrying about CO_2 emissions. The COP was the place where the recent interests of developed countries, developing countries, and industry were in conflict below the surface.

The shift in China's policies is one of the reasons that the situation has changed greatly in recent years. China achieved rapid economic growth, but they did so without any regard to the environment. The price of this growth became evident as environmental issues. Air pollution in particular is severe and has widely been seen as a hazard to the health of the Chinese population. China is a one-party dictatorship of the Communist Party and strengthening the support base is an absolute necessity at any rate. The health hazards of the people became strong enough to shake people's trust in the Communist Party and China has been working on the air pollution problem across the country since the 2010s. Miraculously, air pollution measures line up with measures against climate change, and China has come to showcase these initiatives globally. While China's CO_2 emissions are actually still on the rise, the fact that the country has taken on a stance of serious consideration for climate change measures has had an impact globally.

There has been a policy shift in the United States, the world's largest economy and the country with the second highest greenhouse gas emissions. For the US, CO_2 reductions also mean making sacrifices for its economy. This is why the George W. Bush administration distanced itself from the Kyoto Protocol, hindering global momentum on climate change measures. President Obama, succeeding Bush, took on an active stance of making climate change his legacy. The result of this increase in momentum was the adoption of the Paris Agreement at COP21 in 2015.

Europe was originally aggressive with climate change measures, and with the United States and China catching up, most countries in the world signed this Agreement, something that made the stagnation in negotiations in the past seem like a lie. Under this framework, we saw historical progress with each country working to reduce greenhouse gas emissions.

However, President Trump took office in 2017 in the US, and trends in climate change measures shifted, as described later.

Renewable Energy and Its Shift towards Being Affordable

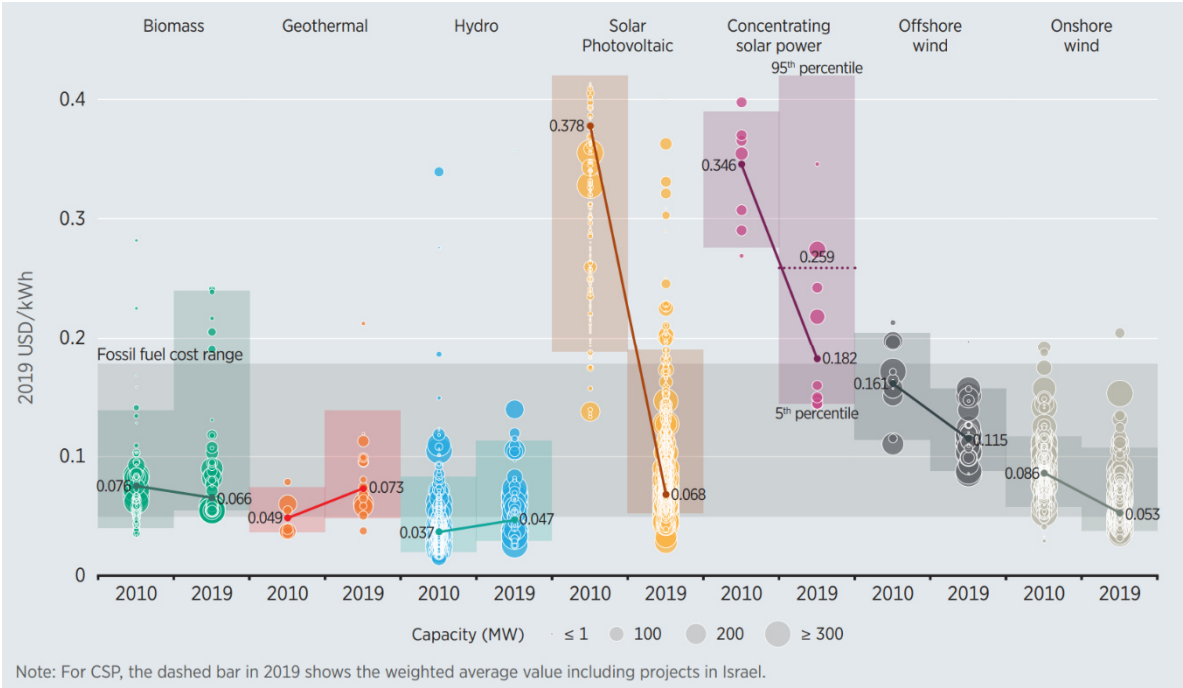
We've looked at the course of decarbonization in several countries from a diplomatic angle, but the nature of this seismic shift is found in the fact that renewable energy has become economical and has become a part of the capitalist economy.

Since the industrial revolution, the world economy has revolved around the production of energy. Not a day goes by where we don't use electricity in our everyday lives, and now, the issue of digital transformation in Japanese society naturally assumes that electricity will be available. If we look back, the history of the modern era could be said to be the history of diplomacy and even war over oil in figuring out how to ensure fossil fuel for power generation.

This is fine for oil producing countries, but most countries, like Japan, do not have oil. The world then searches for other energy sources. Nuclear power attracted attention in the past. It was expected to be the future of energy, but it did not spread widely across the globe as developed countries strictly managed nuclear energy, which has the energy to destroy the world, under the guise of peaceful use of nuclear power and nuclear non-proliferation. The occurrence of major nuclear accidents at Chernobyl and Fukushima also brought about opposition to the proliferation of global nuclear power generation.

What then came to the forefront in the 2000s were renewable energies, such as solar and wind power generation. These technologies had existed since the 1980s, but they weren't viable when seen from the perspective of cost performance. Their costs dropped, however, due to technological innovations, and there was an increase globally in the amount of renewable energy that was introduced. And in 2013, the amount of renewable energy being introduced finally overtook that of non-renewable energy.

Fig. 1: Global LCOEs from newly commissioned utility-scale renewable power generation technologies, 2010-2019

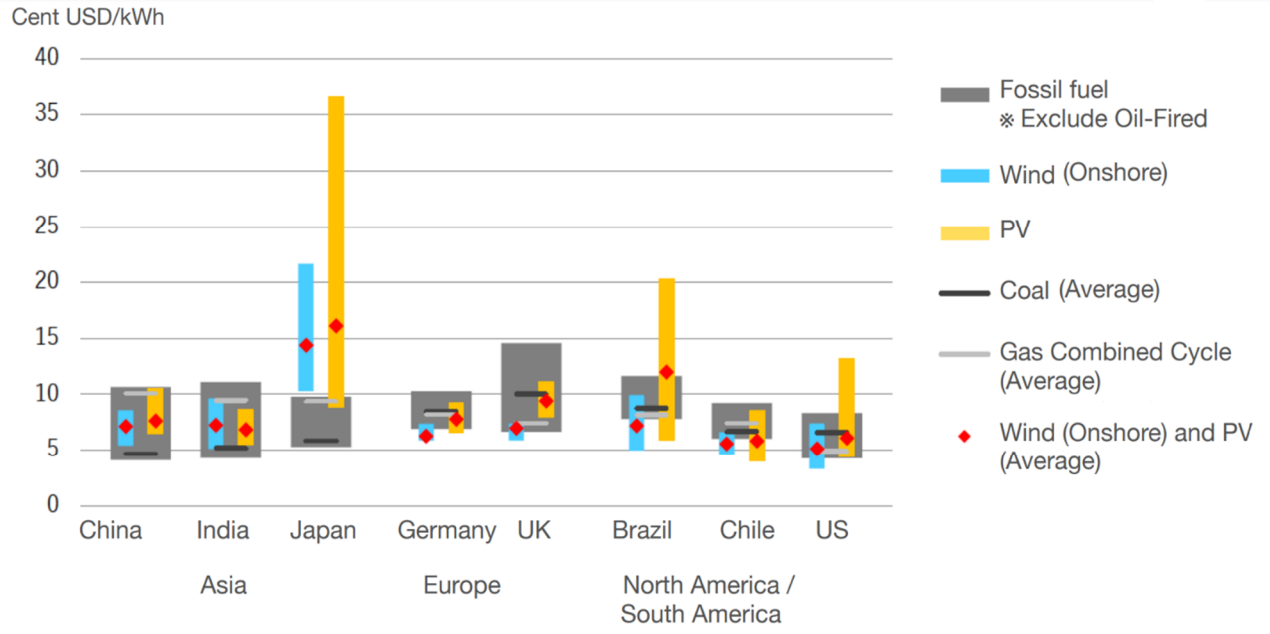


***Note*:** This data is for the year of commissioning. The diameter of the circle represents the size of the project, with its centre the value for the cost of each project on the Y axis. The thick lines are the global weighted-average LCOE value for plants commissioned in each year. Real weighted average cost of capital (WACC) is 7.5% for OECD countries and China and 10% for the rest of the world. The single band represents the fossil fuel-fired power generation cost range, while the bands for each technology and year represent the 5th and 95th percentile bands for renewable projects.
***Source*:** IRENA Renewable Cost Database/Renewable Power Generation Costs in 2019

Why did this occur? As mentioned before, if access to nuclear power was difficult, then thermal power generation would become a realistic option. But for developing countries, thermal power required a large investment making its introduction difficult. Power generation with renewable energy, such as solar and wind power, however, did not require as large an investment as thermal power. It also allowed for the supply of energy on its own without the need for the procurement of fossil fuels. Energy could be procured from deserts with previously little use value simply by installing solar panels or wind power generators. The increase in the amount of energy introduced leads to the creation of demand, and the cost is lowered through economies of scale. This cycle of positive growth quickly developed in the 2010s. The cost of solar power generation in 2019 in particular dropped to 1/5 the cost compared to 2010, dropping to 7 cents per kWh (Fig. 1). Even when looking at the action of various countries, analysis shows that 2016 to 2017 was the turning point since the adoption of the Paris Agreement, with the cost per kWh for solar and wind power at less than 10 cents in major countries in the first half of 2017, and we can see that this has a cost-competitiveness with gas-fired power generation and coal fired power generation (Fig. 2). Renewable energy with its increased cost performance has truly become a game changer.

Currently, solar power aims for global popularization at 2 cents per kWh, and a cost of 1.47 cents per kWh was achieved in August 2019 in a Portuguese project. Technological innovation continues to progress every day, and we are now in an age where renewable energy has become the top choice from the perspectives of both future prospects and cost performance. In the Net Zero by 2050 Roadmap announced by the International Energy Agency (IEA) in May 2021, it was even shockingly reported that the fossil fuel sector is no longer profitable.

Fig. 2: Comparison Power Generation Cost among Major Countries (LCOE, 2017 First Half)



Source: BNEF (2017), Levelized Cost of Electricity

Source: Data from "Advisory Panel on Climate Change," Ministry of Foreign Affairs

Japan, Where the Experiences of the Kyoto Protocol Backfired

Japan has completely missed the global trend. One of the reasons given is that a cost reversal did not occur here. As can be seen in Fig. 2, the costs of solar and onshore wind power are approximately two to three times as much as thermal power. The world shifted to cheaper renewable energy based on a capitalist economy, but as the situation was different in Japan, there was naturally no interest in renewable energy. The government offered subsidies as a pro-renewable energy policy, named the "Feed-in Tariff (FIT) system," but the private sector rested on their laurels with high pricing and no competitive private company entered to form a market.

The effects of this also brought about a reduction in competitiveness for Japanese manufacturers producing solar panels. Until the mid 2000s, Japan held a top share of global solar panel production, but China overtook Japan all at once, and out of the top ten solar panel companies in the world, nine of them have bases in China. Japan's share of the market has currently dropped to 1%. With wind power, all Japanese manufacturers withdrew from the market as they were unable to compete with the world. Japan is in a situation where it cannot compete with the world on the two major future energies, solar and wind.

It seems that the experience of leading the Kyoto Protocol led to a misjudgment on Japan's part, which may be behind the fact that Japanese missed the global momentum. The Kyoto Protocol was unable to gain the cooperation of the United States, and without Japan even setting a reduction goal in the second term, the country experienced the difficulty of negotiations on climate change measures. It isn't strange then that Japan assumed that the Paris Agreement wouldn't soon be enacted, as it took more than seven years for the Kyoto Protocol to be enacted in 2005 after adoption in 1997. The Paris Agreement was actually enacted less than a year after adoption, but unfortunately, Japan misjudged the situation and hadn't ratified the Agreement by the time it was enacted, leading to a blunder where the country was not included as one of the contracting parties when enacted.

However, the Trump administration was inaugurated in 2017, as if a lifeboat for Japan. The Trump administration negated the Obama administration's legacy, the most extreme of which was in the climate change field. The Trump administration radically offered up anti-climate change measures as policy, including the declaration of the withdrawal from the Paris Agreement, and gave favorable treatment to fossil fuels and the coal sector in particular. This was a convenient policy for Japan, as it had not progressed with decarbonization.

But a reversal naturally came when President Biden took office in 2021. In addition to the shift in policy of the United States, an ally of Japan, China announced their plans for becoming carbon neutral before Japan, despite a negative view on Chinese environmental measures by Japan, and because of this, Japan has finally realized that decarbonization is the only way forward.

Prime Minister Suga then announced that Japan would be carbon neutral by 2050 at an extraordinary Diet session in October 2020, established a "Green Growth Strategy" in December 2020, and quickly announced decarbonization policies for a 46% reduction in greenhouse gas emissions at the Leaders Summit on Climate in April 2021.

Japan Made a Fool by Pressure from the US

I'd like to look back at the background of the Leaders Summit on Climate. The United States has deemed China its biggest threat and has formed an encirclement around China from the perspective of security

and the economy, and they have held the same awareness of the issues with decarbonization. The Leaders Summit was then held in April. The US encouraged participating countries to announce targets for 2030, sooner than the goal of becoming carbon neutral by 2060 as announced by China. As a result, the US announced they would reach a 50–52% reduction (from 2005 levels) in greenhouse gas emissions by 2030, the EU announced they would reach a 55% reduction (from 1990 levels) also by 2030, and the UK announced they would reach a 78% reduction (from 1990 levels) by 2035. China also participated in this summit, but they were unable to hammer out an effective reduction goal here. This US target was also reflected in consensus documents from the G7 summit meeting, and there was language that suggested that action for decarbonization would also be sought after from China.

According to the *New York Times* and a tweet by former Vice President Al Gore, the United States was pressing for a 50% reduction by 2030 in Japan under these conditions. But this 50% reduction line far exceed Japan's speculation. It was reported that US Special Presidential Envoy for Climate John Kerry had previously coordinated with each country, and naturally, there should've been coordination with Japan prior to the Japan-US Foreign Ministers' Meeting on March 16, 2021. At this meeting, however, an unusual statement from Secretary of State Antony Blinken was given before news cameras. He pressured Japan to "do more" with climate change measures. This type of honest opinion usually is conveyed behind closed doors after the media leave. It is thought that this unusual statement was given due to a decision that Japan needed to be strongly pressured, as the country was reluctant to offer up satisfactory figures prior to the Leaders Summit.

At the same time, Japan needed cooperation from the United States to host the Tokyo 2020 Olympic and Paralympic Games and to ensure a supply of COVID-19 vaccines. This meant it was necessary to respond to the US demands, even if it meant making sacrifices. It is assumed that the initial 26% was then raised by 20% and given as 46%, which when rounded up is 50%.

Is a 46% Reduction Really Possible for Japan?

It is normal to explain policies to companies in advance in Japan, which has a culture of building consensus. But surely many Japanese companies did not think that this rapid development would lead to a change in the government's direction on decarbonization. This isn't unreasonable, as the Japanese government had up until recently expressed a position of maintaining support for the export of coal-fired power plants.

A straightforward reaction was that of the President of Toyota Motor Corporation, Toyoda Akio in December 2020. At an industry group interview, in response to the government's gasoline-free vehicle policy, he discouraged the view of a total shift towards electric vehicles and stated that production of a wide range of vehicles, including hybrid cars, was the way for Japan to survive. At the same time, we have also come to see action calling for the promotion of carbon neutral not only in companies themselves like with the Mitsubishi UFJ Financial Group, but from investment recipients, as well. Even if there was some confusion, we are seeing that companies are gradually adopting decarbonization policies and making these policies clear.

The key to a 46% reduction in greenhouse gas emissions is in how far Japan can enhance offshore wind, solar, and other renewable energy. The roadmap for the "Green Growth Strategy" contains something truly faithful to the basics. Decarbonization of the power sector, digitalization of Japanese

industries and shipping as much as possible, and promotion of energy saving in each sector. There is no other option than to steadily implement these concepts.

It feels like a 46% reduction will be a monumental journey and it offers a sense of hopelessness, but true to the strategy, if decarbonization and technological innovation of renewable energy is promoted and efficiency and cost reductions progress, the need for decarbonized power will increase, leading to business opportunities and a new spontaneous influx of providers. Economies of scale will quickly work to enable rapid development and a cycle of positive growth. Cross-sectional reductions in CO_2 by the power sector will be a key factor in particular.

The shift in behaviors of individuals towards decarbonization will then become a powerful force in motivating companies and countries. I hope that Japan will move forward with decarbonization and improvements in the competitiveness of its economy.

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EnergyShift: https://energy-shift.com/ (in Japanese)
