Is Japan's INDC "underwhelming"?

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1. Introduction: Some critical views on Japan's INDC

Since its announcement in July 2015, Japan's INDC has been subject to criticism from some environmental think-tanks and NGOs[1]. Below are some examples.

- Japan's target uses 2013 as its base year, in contrast to most other developed countries, which have selected 1990 or 2005. Japan's reduction target is equivalent to 18% below 1990 levels, in contrast to the EU's 40% pledge; or 25.4% below 2005 levels, the least aggressive target to date.
- With the policies it (Japan) already has in place, Japan can almost reach its proposed INDC target without taking any further action.
- Research shows that the country could go much further, reducing its emissions 31% below 2013 levels through additional investments in renewable energy and energy efficiency even without nuclear power.
- The strategy foresees a relatively large share of base load power plants (i.e., nuclear and coal fired power plants) of 46-48% in 2030 of total electricity generation. Increasing the role of base load technologies in an energy system is the diametric opposite of what can be observed in most countries on a path to a low carbon society.
- The strategy is paralleled by a recent surge in planning and construction of coal fired power plants that, according to an independent Japanese NGO, could lead to an increase of Japan's total GHG emissions of 10% of 1990 emissions or 127 MtCO2.
- The average rate of reductions implied by the INDC, however, are not

[1] http://climateactiontracker.org/countries/japan.html
http://www.wri.org/blog/2015/07/japan-releases-underwhelming-climate-action-commitment
http://www.e3g.org/news/media-room/japans-self-marginalisation-from-global-climate-change-politics

fully consistent with those needed to meet the 2050 target – a linear path to the 2050 target would imply at least 30% below 2013 levels by 2030.

- Japan also plans to purchase some of its reductions from developing countries through its Joint Crediting Mechanism…. Without robust accounting measures at the international level, those reductions may be "double counted" by the developing countries which sell those emission reductions to other countries, weakening global ambition.
- These credits are to be obtained from Japan's own bilateral offset program that includes the installation of efficient coal power stations in developing countries. This could degrade global efforts to decarbonize the energy system.

It should be noted that INDCs have been formulated based on specific national circumstances of respective countries. Finger-pointing at a particular country's INDC without a proper understanding of its background and specific national circumstances is an unproductive exercise. This is, unfortunately, the case for the above criticisms. This paper explains why.

2. Why was 2013 chosen as the base year?

The Great East Japan Earthquake and Tsunami in 2011 had a significant impact on Japan's energy supply structure and its GHG emissions. Due to this catastrophe, which could be regarded as "force majeure", there is a clear discontinuity in GHG emissions structure before and after March 2011.

The earthquake and tsunami caused the accident at the Fukushima-Daiichi nuclear power station and damaged other nuclear plants, such as Fukushima-Daini, located on the east coast of the northern island of Honshu. Furthermore, all the other nuclear power plants in Japan had to halt their operations, based on a political decision not to allow restarts after regular, pre-scheduled shutdowns. As a result, Japan lost a huge source of zero-emission power. Japan had to operate fossil-fuel power stations to compensate for the power shortage. This unavoidably caused a sudden increase in CO2 emissions. Consequently, contrary to Japan's will, GHG emissions marked a near-record high in 2013FY.

The domestic debate about energy policy that followed, including the role of nuclear in the total energy mix, was contentious. However, this situation was finally fixed by the formulation of the Strategic Energy Plan in April 2014, which defined the basic direction of energy policies, simultaneously aiming to achieve the "3E+S" goals; Energy Security, Economic Efficiency, Environment and Safety. Japan's energy mix underpinning its INDC was worked out based on this Plan.

The 26% reduction target included in Japan's INDC signifies its strong will towards bottom-up efforts to overcome these challenges and contribute to achieving the ultimate objective of the Convention.

Therefore, it is economically, technically and politically justifiable to choose a base-year after 2011, the year in which there was a clear break from past trends. Accordingly, 2013 was chosen as the base year since this was the year for which the most recent data was available and the immediate turbulence caused by the earthquake had somewhat subsided.

As shown in Table 1, the EU and the U.S. have chosen 1990 and 2005, respectively, as their base years, which also makes their INDCs look most ambitious. Many developing countries' INDCs do not have a "base year" in the first place. The UNFCCC Secretariat focused on the level of future GHG emissions in its recent synthesis report, rather than the level of reductions or increases as compared to any particular base year. Given all of this, it is surely a futile exercise to criticize a country's INDC by focusing on its choice of base year.

Table 1 INDCs expressed with different base years

	Emissions reduction rate from base year		
	From 1990	From 2005	From 2013
Japan: in 2030, -26% from 2013 levels	-18.0%	-25.4%	**-26.0%**
US: in 2025, about -26 to -28% from 2005 levels	-14 to -16%	**-26 to -28%**	-18 to -21%
EU28: in 2030, -40% from 1990 levels	**-40%**	-35%	-24%

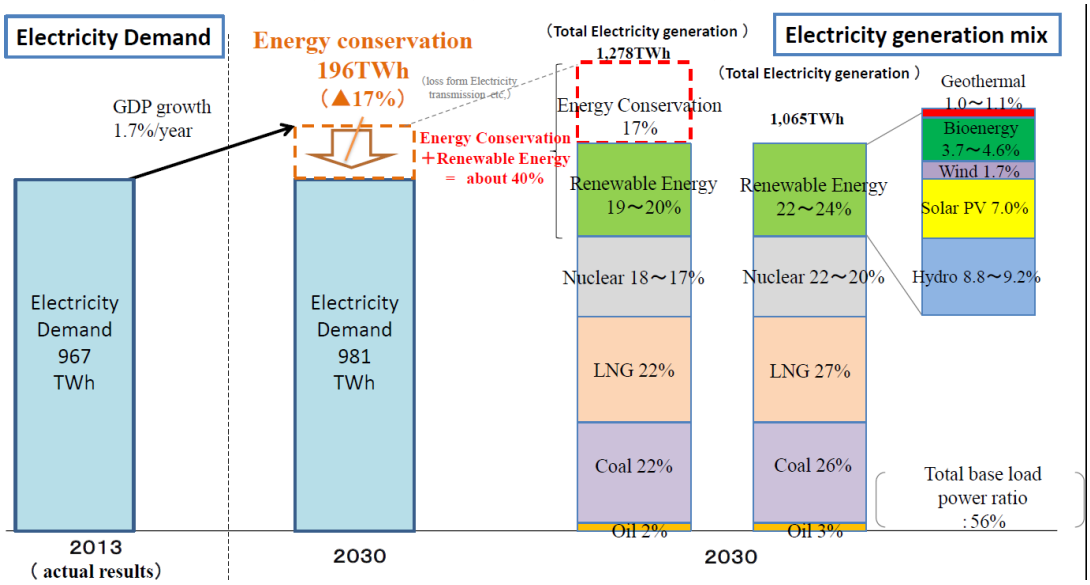
3. Can Japan easily achieve its INDC?

Japan's INDC is premised on the following three pillars:

- Significant energy conservation efforts, namely, 13% and 9.7% reduction of final energy consumption from business-as-usual (BAU) and 2013 levels, respectively, 17% reduction of electricity demand from BAU and a mere 1.4% increase from 2013 levels, while simultaneously achieving 1.7% real GDP growth per annum;
- 22-20% share of nuclear power in total power generation;
- 22-24% share of renewable energy in total power generation.

Given the current energy, economic and political situation, all of the above pose significant challenges for Japan.

Figure 1　Japan's New Energy Mix



Source: Ministry of Economy, Trade and Industry (METI)

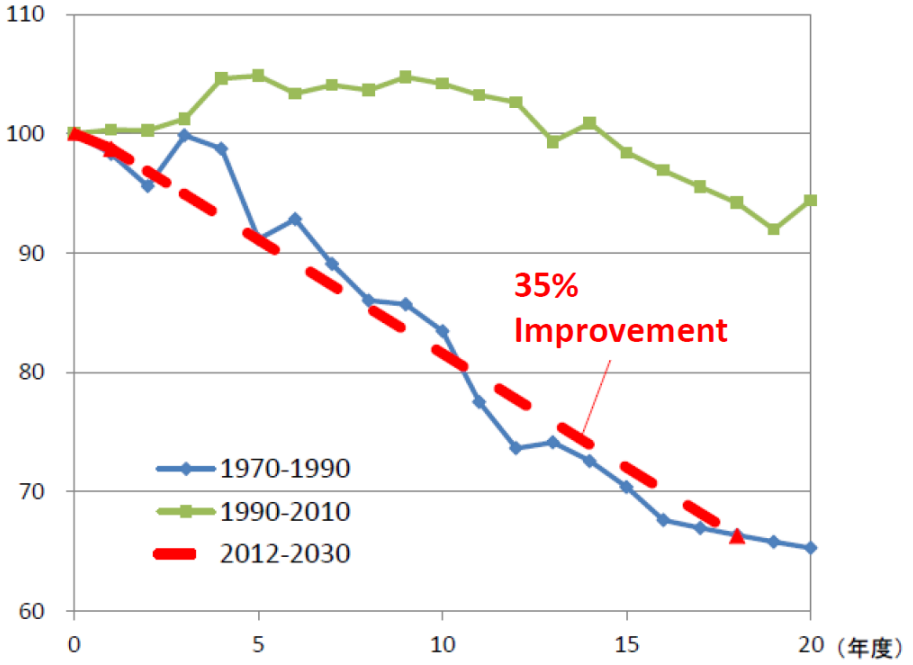
Japan's final energy consumption had been stable since the 1990s with a peak in 2008. With a view to reducing it by almost 10% from the 2013 level, energy demand must be reduced back to the level of the late 1980s. This requires a 35% cumulative, 2.3% annual improvement of energy intensity over the next 15 years. This level of energy efficiency improvement occurred only in the aftermath of the oil crises in the 1970s (Figure 2).

Since Japan has to date already achieved one of the best performances with regard to utilizing energy efficiently (Figure 3), such a rapid and drastic energy efficiency improvement cannot be achieved "without taking any further action".

There has always been a very strong correlation between Japan's real

GDP growth and electricity demand. Japan's GDP elasticity with respect to electricity demand has been higher than 1.0 since 1990s. Other OECD countries' GDP elasticities are lower than 1.0, but still positive. In the last 10 years, there were only limited cases where GDP elasticities were zero or negative (Figure 4, Figure 5). Keeping the GDP elasticity with respect to electricity demand at zero or negative for the next 15 years will be an unprecedented challenge globally.

Figure 2　Japan's Energy Efficiency Improvement in the Last 40 years



Energy Efficiency = Final Energy Consumption/Real GDP

Source: METI

Figure 3 Primary Energy Supply per Unit of GDP of Major Countries (2011)

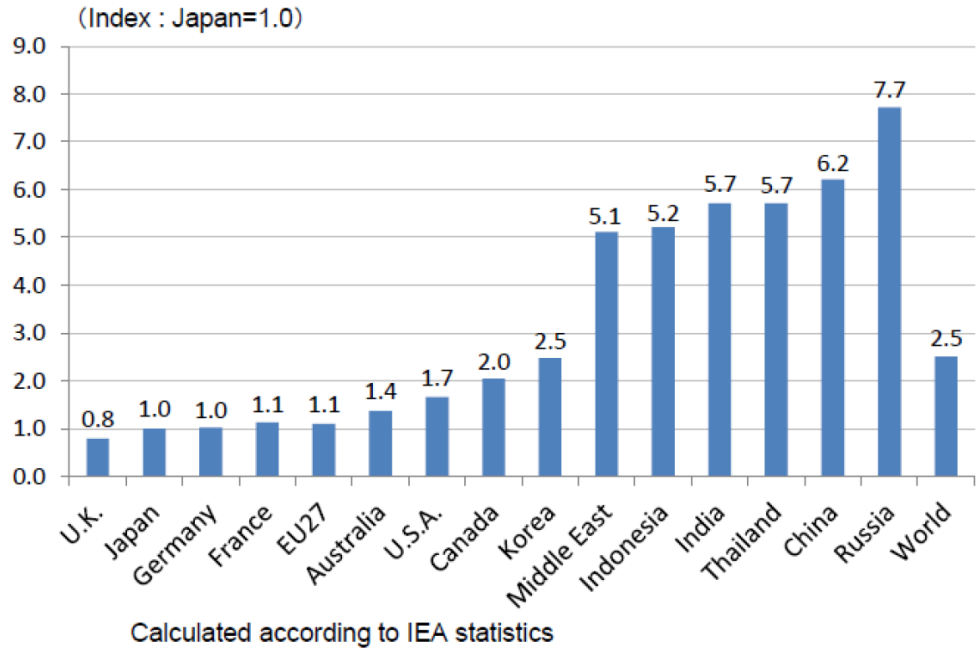
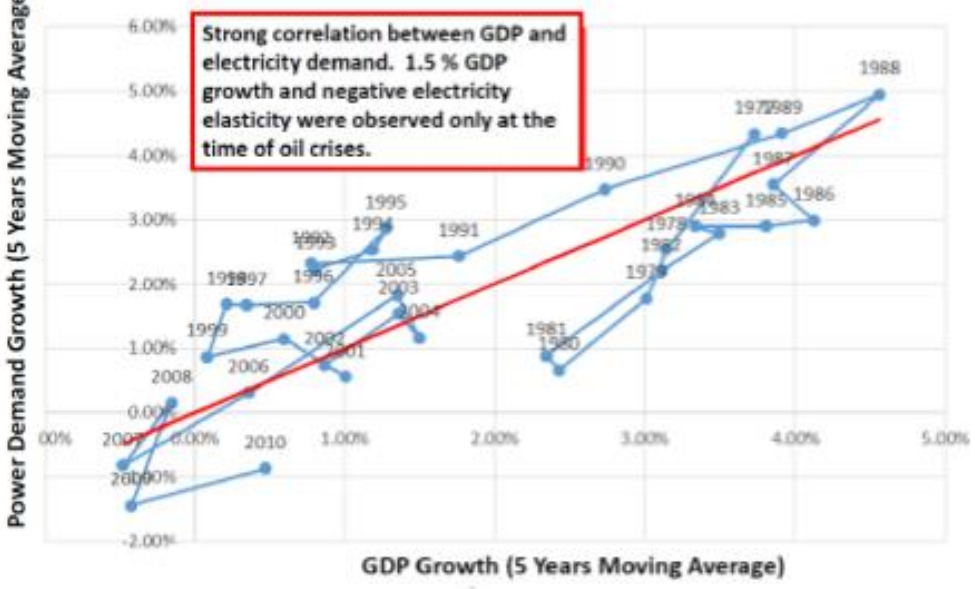
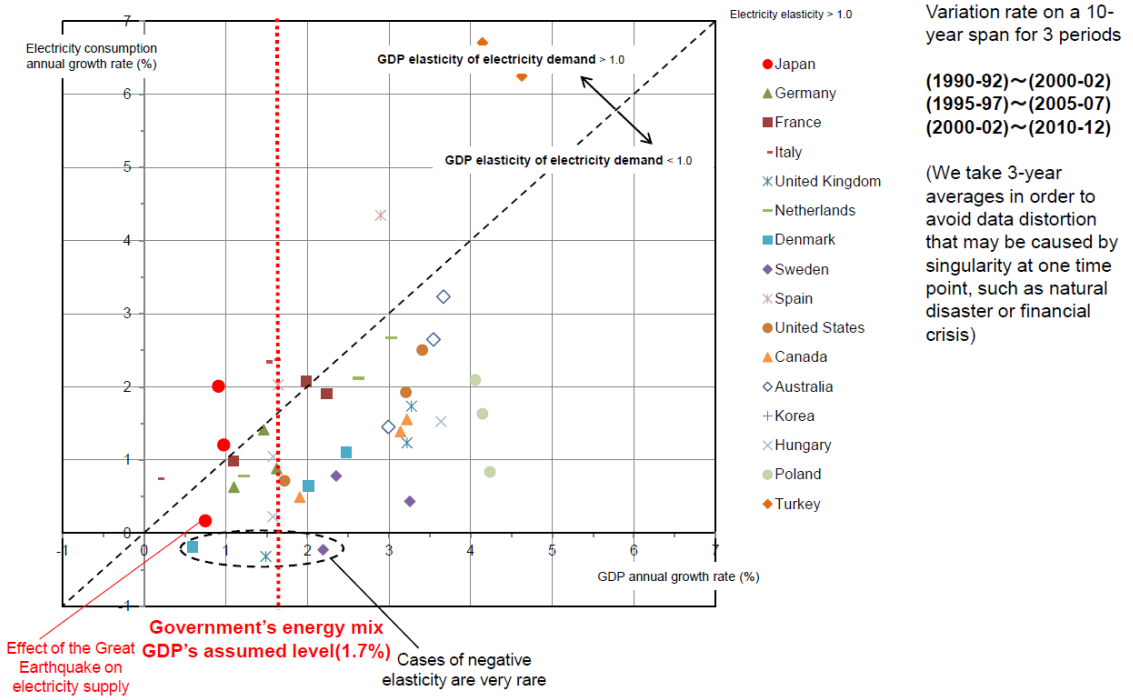


Figure 4 Strong Correlation between GDP and Electricity Demand



Source: Central Research Institute of Electric Power Industry (CRIEPI)

Figure 5 GDP Elasticity of Electricity Demand of OECD Countries (10 Years Average)



Source: The Research Institute of Innovative Technology for the Earth (RITE), July 2015

Restoring the share of nuclear power from the current 1% to 22-20% is premised on a steady reoperation of existing nuclear power plants. After the earthquake and the tsunami, Japan introduced the most stringent safety regulations in the world, which require more than 1 trillion yen (approx. U.S.$8.2 billion at current exchange rates) of additional safety-related investments for reoperation. The new regulations have also defined the plant-life as 40 years in principle, exceptionally allowing for a single 20year extension at maximum. While the above target requires plant-life extension of some nuclear power plants, the Nuclear Regulatory Authority has not yet defined clear guidelines for such approvals. Furthermore, given the still widespread antinuclear sentiment (as pointed out by Climate Action Tracker), this target demands immense political capital. In fact, Climate Action Tracker itself projects a 7% share of nuclear in 2030 in “Current Policy Projections”. The 22-20% nuclear share target certainly cannot be regarded as “almost reached”.

Japan also aims to expand the generation from non-hydro renewables by 7-8 times from 31 TWh to 237-252 TWh, equivalent to a 12.5% increase per annum, between 2013 and 2030. Such a rapid pace of expansion is comparable with notable previous rapid expansions such as

those of Germany, the UK and Italy from 2000 to 2013 (indeed, in terms of absolute increase in generation, it is more impressive). Additionally, it should be noted that Japan has to achieve this target without any grid connections with other countries, which makes the target even tougher.

Some argue for even more aggressive penetration of renewable energy. In fact, in the midst of the debate on the future energy mix, MRI (Mitsubishi Research Institute) presented scenarios raising the share of renewables to as high as 35%[2]. However, this scenario analysis was not regarded as an useful basis for consideration, due to its unrealistic assumptions (e.g., unlimited power control of solar and wind, double-counting of benefits of reducing fossil fuel imports, almost unlimited integrated operation of power grids).

The energy mix underpinning Japan's INDC was worked out in response to a "quadlemma", namely, a sudden drop in energy self-sufficiency, an outflow of national wealth, an energy cost hike and an urgent need to tackle increasing GHG emissions, a combination which had never been experienced by any other country. It was formulated based on thorough discussions at relevant expert meetings as well as a national debate, striking an extremely delicate balance of the 3"Es", energy security (restoring some energy self-sufficiency), economic efficiency (reducing energy cost) and environment protection (reducing GHG emissions). Further "enhancing" the INDC by focusing solely on GHG mitigation will jeopardize this delicate balance and make Japan's energy policy unsustainable.

At the same time, it is particularly challenging to achieve this energy mix in parallel with electricity market liberalization. The government and power industry should collaborate to promptly plan, establish and implement effective framework and measures to achieve CO2 intensity, which is compatible with Japan's INDC.

4. Is Japan's INDC insufficiently "aggressive"?

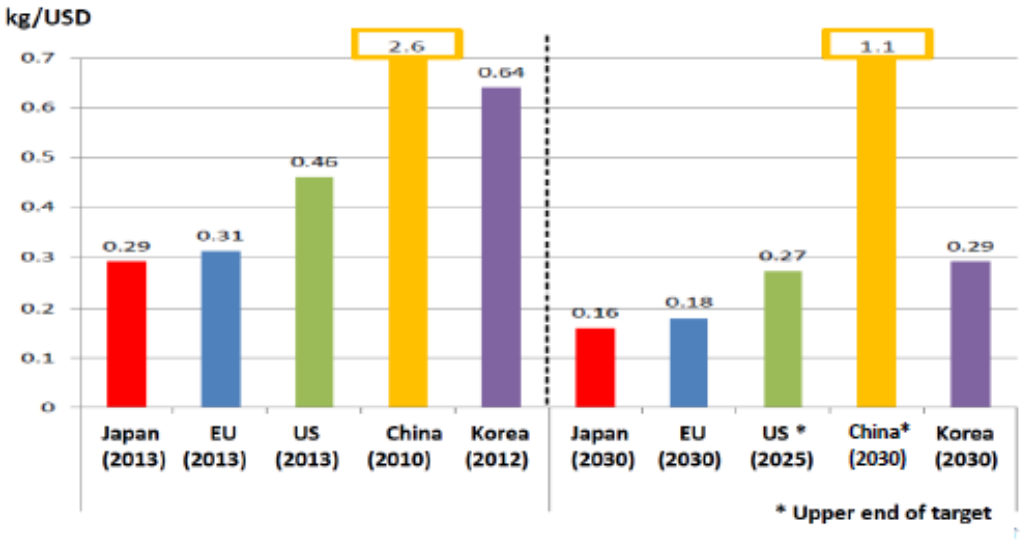
It seems an anachronistic, Kyoto Protocol-type mind-set to recalculate Japan's INDC using 1990 or 2005 as the base year, compare it with numbers from the EU or U.S., and criticize the "lack of ambition".

[2] http://www.japanfs.org/en/news/archives/news_id035296.html

What matters is not a comparison between percentage points, but the comparability of effort.

For example, levels of GHG emissions per GDP or GHG emissions per capita for the present and for 2030 clearly show that Japan's INDC is sufficiently ambitious compared with the EU and the U.S. (Figure 6 and 7).

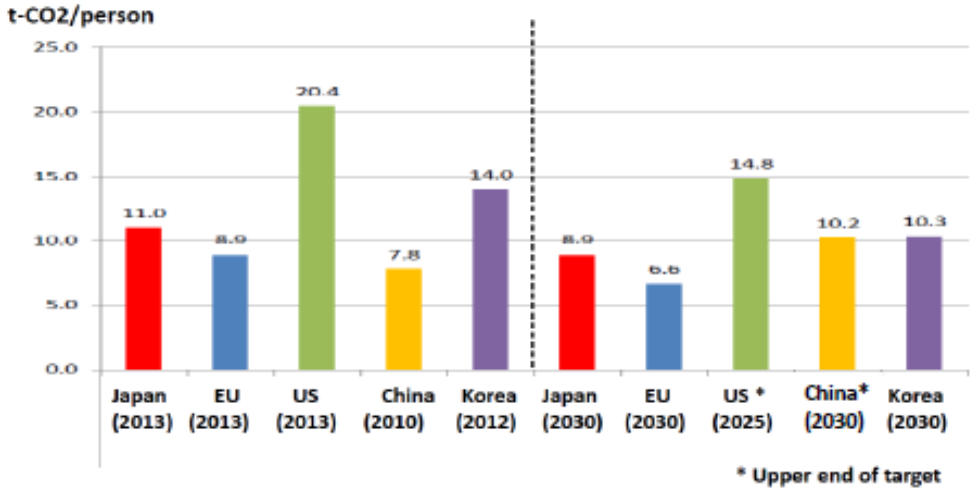
Figure 6　GHG Intensity of Major Countries (Present and 2030)



Note: The above data is a rough estimate based on different underlying assumptions (e.g. for GDP growth) across countries and lack of published data (especially for China)

Source: METI based on IEA and UN statistics

Figure 7　GHG per Capita of Major Countries (Present and 2030)

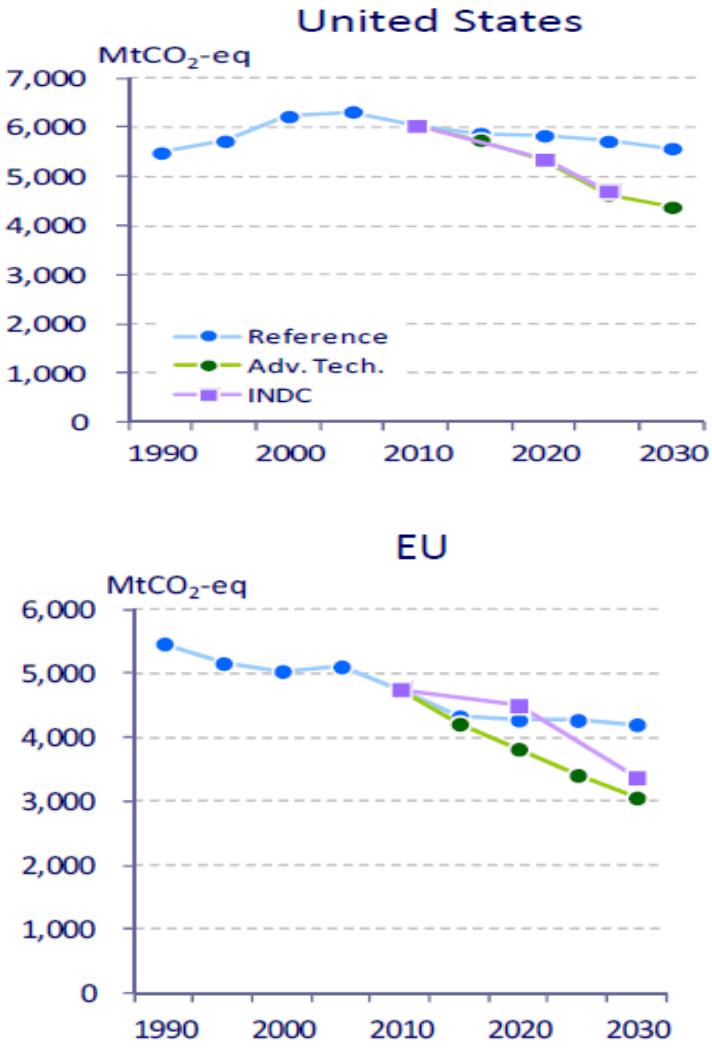


Note: The above data is a rough estimate based on different underlying assumptions (e.g. for GDP growth) across countries and lack of published data (especially for China)

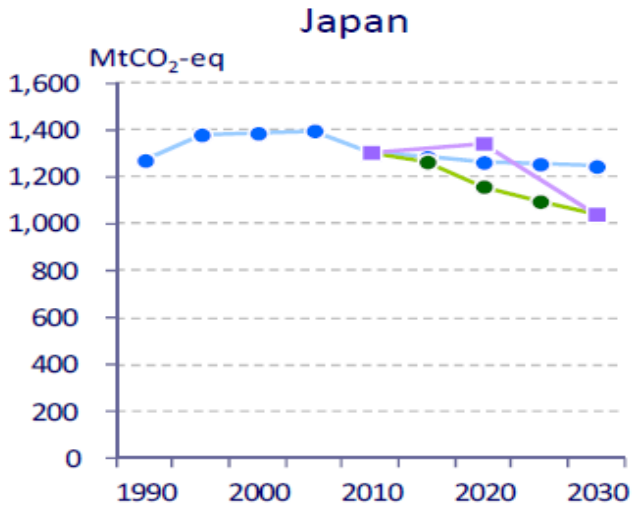
Source:METI based on IEA and UN statistics

The Asia/World Energy Outlook 2015 by the Institute of Energy Economics of Japan (Figure 8) shows that Japan's INDC is as ambitious as the ATS (Advanced Technology Scenario), which assumes maximum introduction of energy efficiency and low carbon technologies. [3]

Figure 8 Comparison of INDC, Reference Case and Advanced Technology Scenario



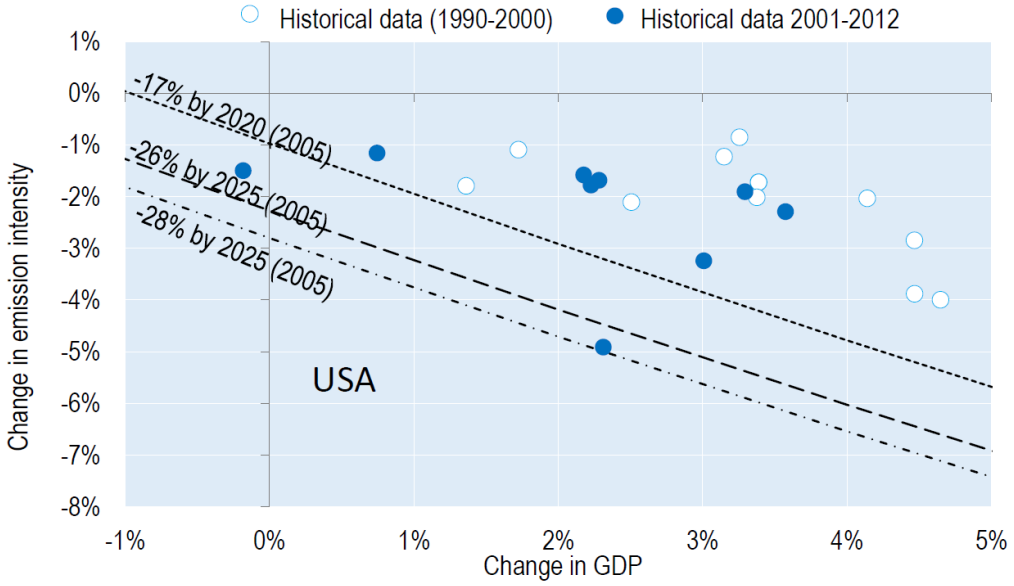
[3] Japan's 2020 target does not count nuclear.



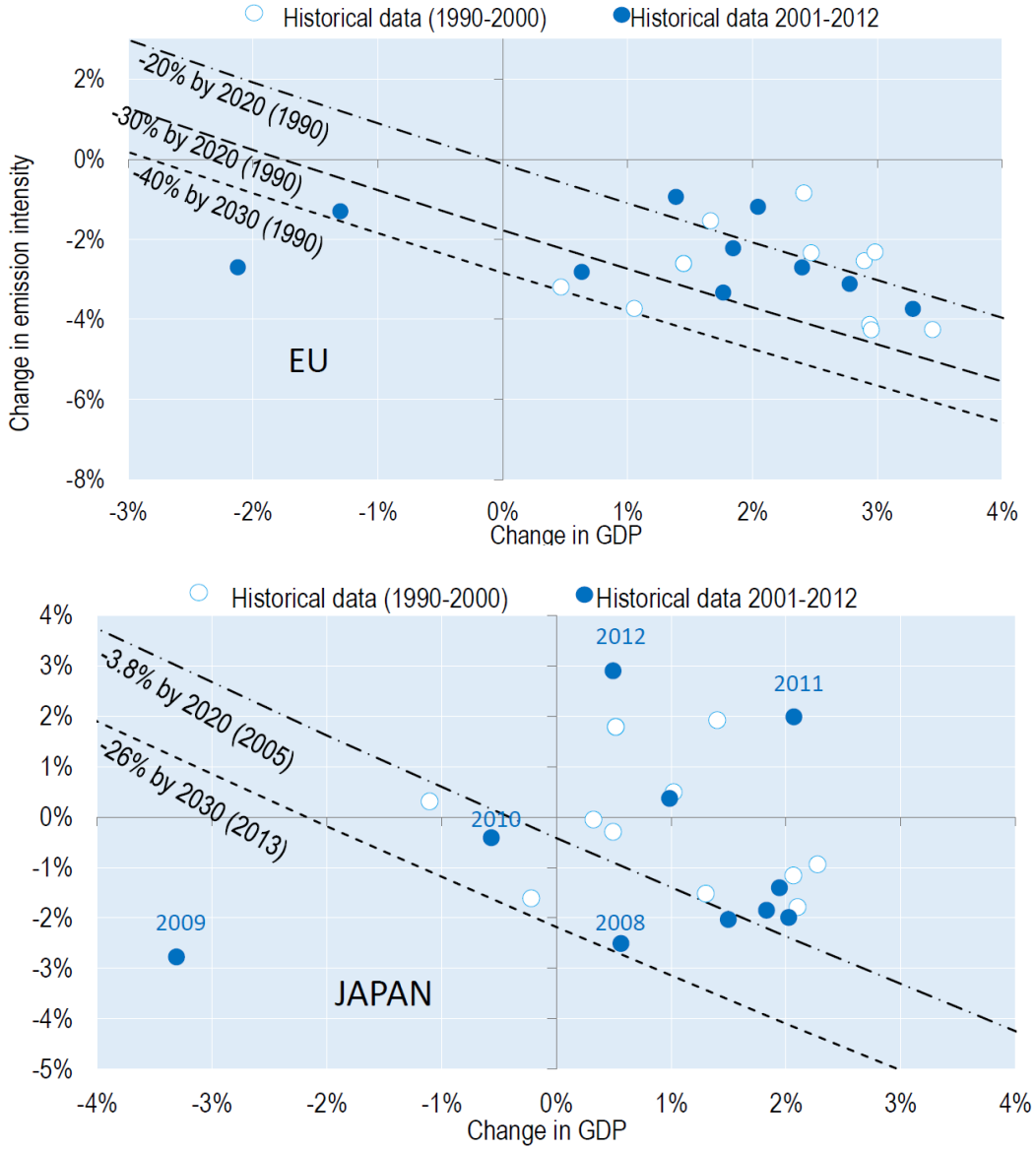
Source: Institute of Energy Economics of Japan

Recent OECD analysis[4] shows that the targets of the U.S., EU and Japan all require large deviations from their historical trends of correlation between GDP growth and emissions intensity improvement. Among them, it is clear that Japan needs to achieve a particularly large shift from its 2011 and 2012 performance to put itself on track for the 26% target.

Figure 9 Emission Intensity and GDP Scatter Plots of U.S., EU and Japan



[4] https://www1.oecd.org/publications/climate-change-mitigation-9789264238787-en.htm

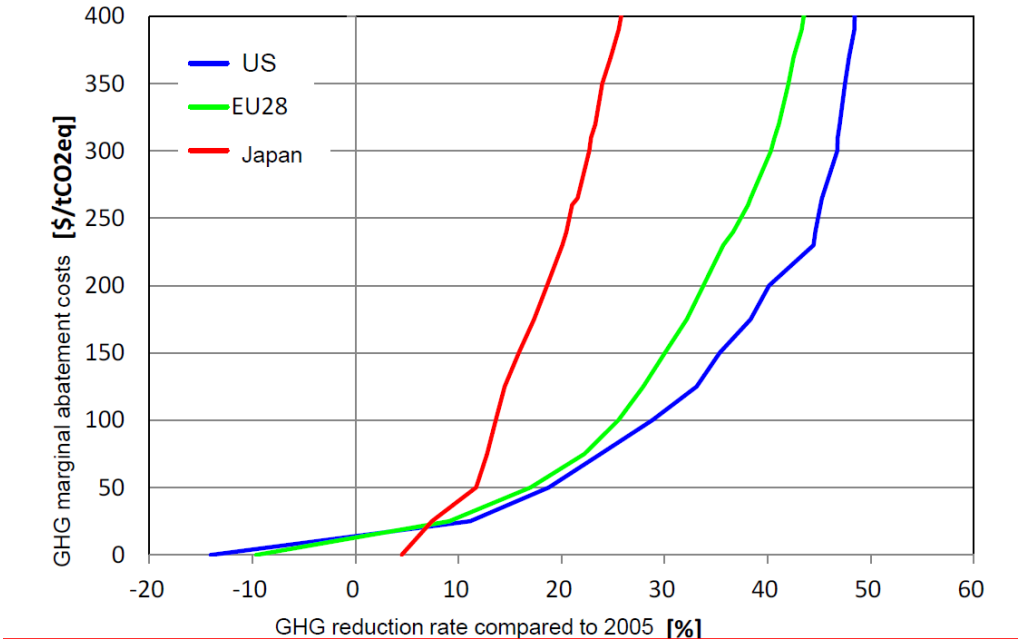


Source: OECD "Climate Change Mitigation – Policies and Progress" (October 2015)

Furthermore, according to the model analysis by the Research Institute of Innovative Technology for Earth (RITE)[5], Japan's marginal abatement cost (MAC) is higher than those of the U.S. and the EU (Figure 9). Therefore, Japan's INDC is far more ambitious than the U.S. and the EU in terms of MAC (Table 2) and, at the least, of comparable magnitude in terms of average cost per GDP (Table 3).

5 http://www.rite.or.jp/Japanese/labo/sysken/about-global-warming/download-data/E-Energymix_INDCs_20150818.pdf

Figure 10 Comparison of Marginal Abatement Cost Curves of Major Countries (2030)



Source: RITE

Table 2 Marginal Abatement Costs of CO2 for Major Countries' INDCs

	Marginal abatement cost ($/tCO2eq)	
	Low case	High case
Japan: in 2030, -26% from 2013 levels	**About 380** (for the target of energy-related CO2 only, the estimate is about 260)	
US: in 2025, about -26 to -28% from 2005 levels	**60**	**69**
EU28: in 2030, -40% from 1990 levels	**166**	
Russia: in 2030, -25% to 30% from 1990 levels	**0**	**6**
China: in 2030, -60% to -65% of CO2 intensity from 2005 levels	**～0**	**～0**

Note : All the costs do not consider LULUCF measures.

Source: RITE

Table 3 CO2 Emissions Reduction Cost/GDP of Major Countries' INDCs

	Emissions reduction costs per GDP (%)	
	Low case	High case
Japan: in 2030, -26% from 2013 levels	About 0.7	
US: in 2025, about -26 to -28% from 2005 levels	**0.36**	**0.42**
EU28: in 2030, -40% from 1990 levels	**0.82**	
Russia: in 2030, -25% to 30% from 1990 levels	**~0**	**~0**
China: in 2030, -60% to -65% of CO_2 intensity from 2005 levels	**~0**	**~0**

Source: RITE

5. Can Japan present more ambitious INDC even without nuclear?

Referring to the Institute for Global Environmental Strategies (IGES) Working Paper "Comparative Assessment of GHG Mitigation Scenarios for Japan in 2030"[6], which indicates that Japan could go much further in its mitigation efforts (reducing its emissions 31% below 2013 levels through additional investments in renewable energy and efficiency even without nuclear power), the World Resources Institute notes that it is "underwhelmed" by Japan's INDC. However, as the IGES paper itself admits: "this study did not discuss the economic implications for different mitigation effort levels. While economic implications were out of our research scope, economic assessment results are often considered as one of the most important indicators for formulating national GHG emissions reduction targets."[7]

Given that the INDC will have significant economic implications for the Japanese economy, any study that simply disregards these elements is completely meaningless as a guide for policymaking.

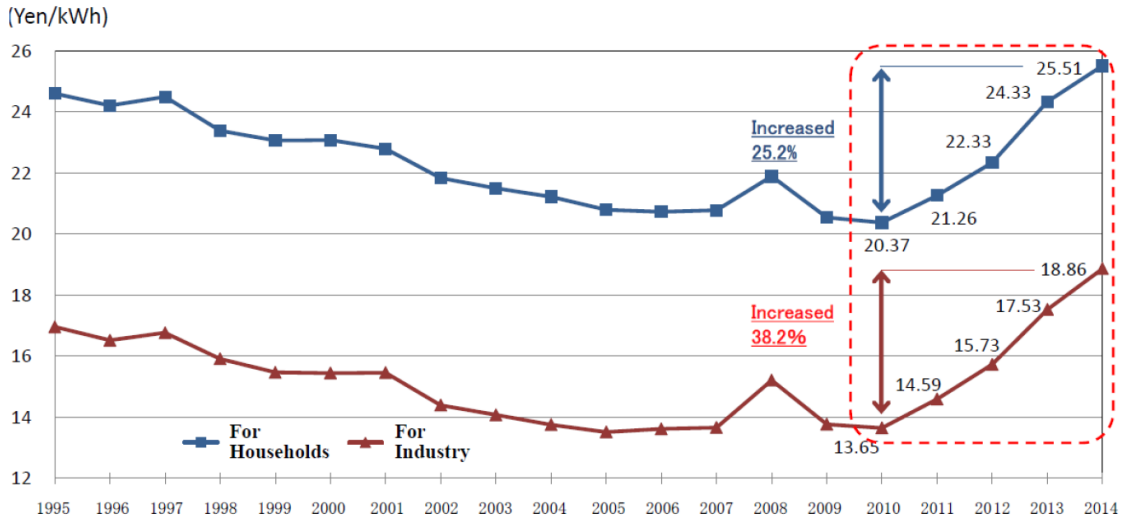
Due to surging fossil fuel imports, yen depreciation and FIT surcharges, electricity prices in Japan has risen by 25-40% since the earthquake (Figure 11) and are causing a heavy burden to people's daily lives, industrial

[6] http://pub.iges.or.jp/modules/envirolib/view.php?docid=5974

[7] Id., page 24.

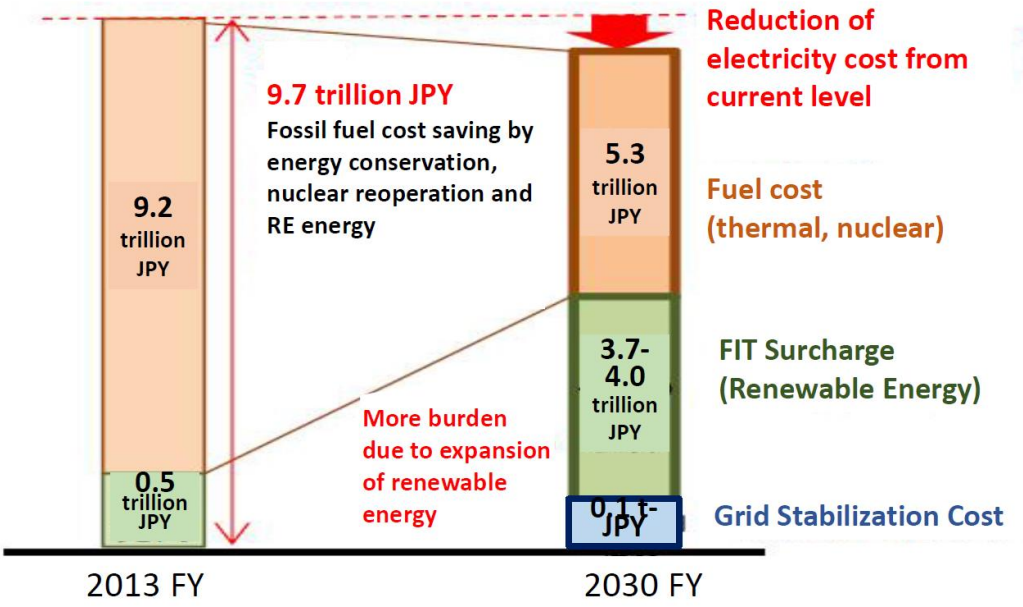
activity and the macro economy.

Figure 11 Changes in Household and Industrial Electricity Prices



Therefore, reducing the cost of electricity has been a crucial requirement, together with energy security (=restoring some energy self-sufficiency) and environmental protection (=reducing CO2 emissions) in considering the energy mix underpinning the INDC. The energy mix aims to absorb the cost increase caused by the expansion of renewable energy (inevitable due to the feed-in tariff system) with the cost savings from reduced fossil fuel imports through the restart of nuclear power plants, as well as energy conservation and renewables themselves.(Figure 12)

Figure 12　Forecast of Electricity Cost



Source: METI

In addition, a sensitivity analysis was also conducted to calculate the impact on economic cost and CO2 emissions when 1% of the share allocated to nuclear is substituted by coal, LNG or renewables. If all of the 22-20% share is substituted by renewables, electricity costs will be 4.8-4.3 trillion JPY (U.S.$40-36 billion) higher per annum than the forecast for the INDC. Instead of fulfilling the strong requirement for reducing costs , this will result in even higher electricity costs.

Table 4 Sensitivity Analysis about the Change of Power Mix

	Coal ▲1%	LNG▲1%	Nuclear ▲1%	RE ▲1%
Coal +1%		+4.4 mt-CO2 ▲64 billion JPY	+8.4 mt-CO2 +34 billion JPY	+8.4 mt-CO2 ▲184 billion JPY
LNG +1%	▲4.4 mt-CO2 +64 billion JPY		+4.0 mt-CO2 +98 billion JPY	+4.0 mt-CO2 ▲120 billion JPY
Nuclear +1%	▲8.4 mt-CO2 +34 billion JPY	▲4.0 mt-CO2 ▲98 billion JPY		±0 ▲218 billion JPY
RE+1%	▲8.4 mt-CO2 +184 billion JPY	▲4.0 mt-CO2 +120 billion JPY	±0 +218 billion JPY	

※ All approximate figures

Source:METI

Moreover, the MAC analysis by the RITE noted previously assumes the restart of nuclear power plants, of which the marginal cost is very low due

to the depreciation to date. The higher level of MAC compared to those of the EU and the U.S. mainly derives from the extremely ambitious energy efficiency target. If the restart of nuclear plants does not proceed as expected and the efficiency and renewable energy targets are further "enhanced", the MAC will skyrocket and have a devastating impact on the Japanese economy.

In short, it is crystal clear that the steady reoperation of nuclear power plants is the prerequisite for simultaneously achieving GHG emissions reductions, energy security and cost reductions. In Japan, it is odd that those insisting on more ambitious GHG reduction targets are often opposed to reoperation of nuclear power plants. Rather than pointing their fingers at Japan's INDC as insufficient, international environmental think-tanks and NGOs should send a strong signal to Japan supporting the restart of nuclear power plants as the most cost-effective way of reducing GHG emissions.

6. Is Japan obsessed with base load power?

As stated above**,** Japan's energy mix was formulated to strike a delicate balance among the 3"E"s plus safety. In Japan, LNG is much more expensive compared with gas in the U.S. and the EU- according to the IEA, more than four times expensive compared to the former and nearly double the latter, with significant divergences remaining even in 2040 due to geographical constraints.[8] Therefore, cheap and stable power plants are necessary to reduce electricity costs. The 46-48% share of nuclear and coal is the result of a comprehensive analysis taking into account the pros and cons of various power sources in meeting the 3"E"s.

Climate Action Tracker argues that "increasing the role of baseload technologies (i.e. nuclear and coal fired power plants) is the diametric opposite of what observed in most countries on a path to low carbon society". However, according to the IEA's "Energy and Climate Change - World Energy Outlook Special Report" (June 2015)[9] , the total share of nuclear and coal in 2030 under the "Bridge Scenario" is projected to be 42% in the U.S., 45% in the EU and 43% in the OECD as a whole. Given that

[8] World Energy Outlook 2014, page 51.

[9] https://www.iea.org/publications/freepublications/publication/WEO2015SpecialReportonEnergyandClimateChange.pdf#search='energy+and+climate+change+weo+special+report+2015'

the “Bridge Scenario” is a more ambitious scenario than the “INDC Scenario”, the 46-48% share of nuclear and coal in Japan’s INDC is reasonably comparable.

7. Is Japan dashing for coal?

Currently, there are projects for new coal fired power plants totaling approximately 17 GW in Japan. This should be seen in a broad context.

After the Fukushima Dai-Ichi accident, Japan lost nearly 10GW of zero emission power sources. In addition, as previously mentioned, the 40 years’ life-time rule with maximum extension of 20 years was put into legislation. Some nuclear reactors are to be decommissioned. Even if the remaining nuclear power plants come steadily back to operation, nuclear power will supply only 20-22% of total power generation. Given that nuclear power supplied 30% of total power generation before the earthquake, this gap needs to be filled by other power sources, taking into account their operational characteristics, costs and GHG emissions. Due to intermittency, wind and solar cannot fully substitute nuclear power and requires thermal power as back-up. Geothermal, hydro and biomass do not have this problem, but there are physical limitations to expanding them greatly. Despite its lower CO2 intensity, we cannot solely rely on LNG from the view point of electricity cost and energy security- unlike in North America, where natural gas is both cheap and available locally. That is why Japan needs a certain amount of coal fired power plants.

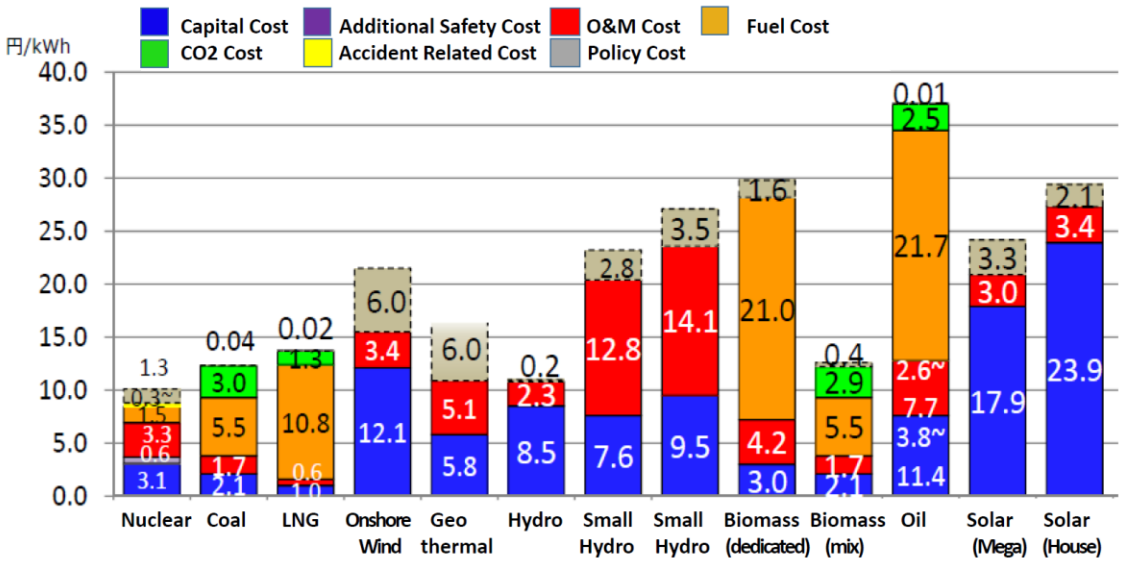
Furthermore, under the on-going process of electricity market liberalization, coal fired power will inevitably become more attractive due to its lower cost of generation. If nuclear power plants do not come back on line as expected, coal will likely serve as an alternative cheap and stable power source.

On the contrary, if nuclear power plants steadily come back to operation, there will be less need for coal fired power plants. As shown in the generation cost comparison based on new-build model plants in 2014 (Figure 12), even taking into account additional policy and accident related costs, nuclear power is still cheaper than coal. If existing nuclear power plants come back to operation, their generation cost will be even cheaper. This will significantly affect the competitiveness of new and existing coal fired power plants. It will, therefore, depend on the prospects of nuclear

reoperation whether all of the coal fired power projects currently on the drawing board will actually be built, as well as whether they will be operated at full capacity.

In Japan, those who are against new coal fired power projects often also oppose the restart of nuclear power plants. The best way to minimize the entry of new coal fired power plants is, however, to ensure the steady reoperation of nuclear power plants.

Figure 13 Generation Cost Comparison based on Model Plants (2014)



Source:METI

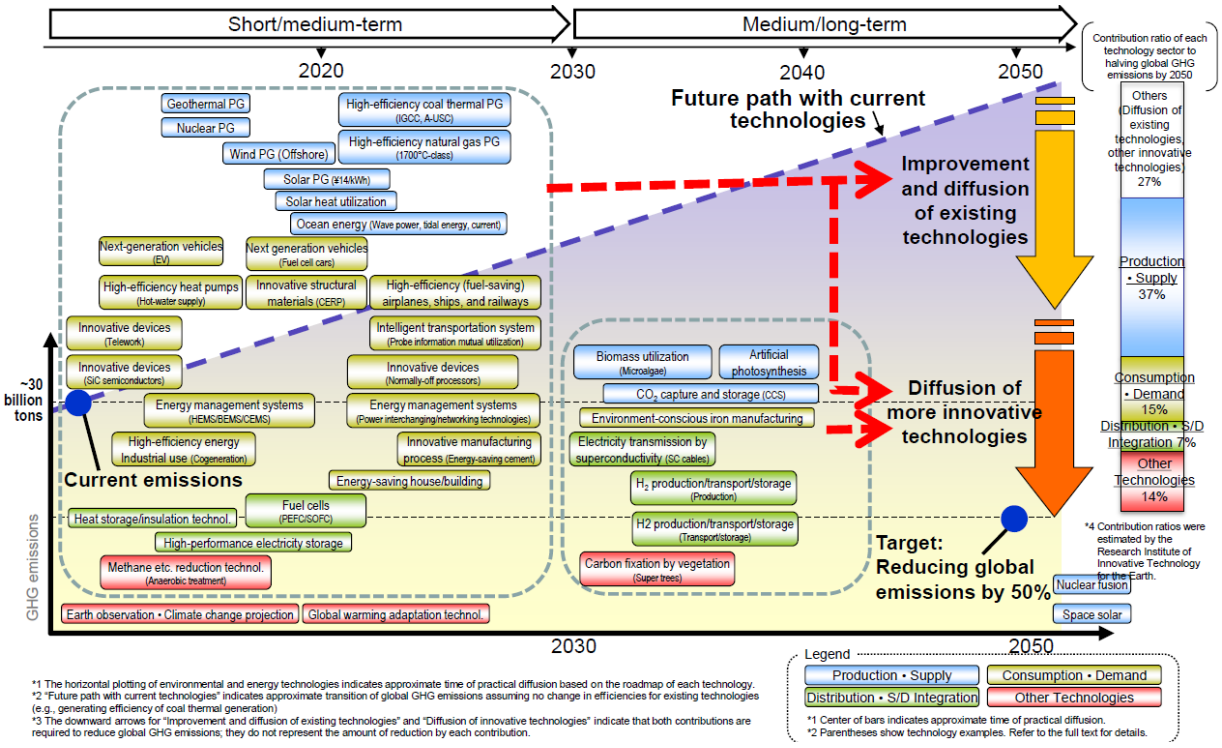
8. Is Japan's INDC inconsistent with its long-term target?

Criticism about inconsistency assumes a linear reduction pathway back-casted from an 80% reduction goal in 2050. 80% reduction might be technically possible, but its achievement would incur exorbitant cost with the current sets of technologies. That is why Japan will make utmost efforts for developing innovative energy and environment technologies, which would bend the emissions reduction pathway, as noted in the 2013 Environment and Energy Technology Innovation Plan (Figure 14). Taking into account the discontinuous nature of innovation, it is not valid to criticize Japan's INDC simply because it is not on the linear pathway towards an 80% reduction goal.

Development of innovative technologies requires strategic R&D investment by both the government and the private sector. To make this

happen, favorable macroeconomic conditions and industrial performance is prerequisite. Overly stringent GHG emission reduction targets in the nearer term and measures imposing unduly heavy burdens on the economy could hamper long-term R&D investment and be counterproductive from the viewpoint of long-term GHG emissions reduction.

Figure 14 Environment and Energy Technology Innovation Plan (Sept 2013)



9. Will Japan purchase Joint Crediting Mechanism (JCM) credits to achieve its INDC?

It is still undecided how market mechanisms, including the JCM, will be incorporated in the post-2020 framework. That is why Japan has not assumed crediting from JCM in formulating its INDC. It is not valid to criticize Japan's INDC by hastily presuming the use of JCM credits. Japan's priority is to realize the energy mix underpinning its INDC.

Separately, there is a criticism with regard to the JCM for including the possibility of credits from the installation of high efficiency coal fired power stations. However, this criticism does not reflect the realities surrounding energy. Given the existence of abundant and cheap coal

resources around the world, the demand for coal fired power plants will inevitably grow in developing countries. In the World Energy Outlook 2014, the IEA points out "where a decision to add coal fired capacity is being taken, investors do not always opt for the most efficient plant, even though more efficient plant technologies often have lower lifetime costs. This is especially the case where capital is constrained, because more efficient plants are generally more expensive to build. Despite the lower operating efficiency, it can be more attractive to build a less efficient plant"[10].

Japan is open to considering the transfer of high efficiency coal technologies through the JCM in response to the specific needs of developing countries. Several developing countries, most notably India[11], are aiming to improve the thermal efficiency of their coal fired power plants as part of their INDCs. Japan's high efficiency, low emissions coal combustion technologies could make a valuable contribution to avoid CO2 emissions which would otherwise be caused by maintaining or deploying less efficient technologies.

10. Conclusion: Encouragement, rather than finger pointing, is needed

It is very heartening that over 150 countries, covering roughly 90% of global emissions, have already submitted their INDCs at the this time of writing. While their content might merit further clarification, Japan has not criticized the adequacy of their levels.

As emphasized at the beginning, pointing fingers at a particular country's INDC without proper understanding of its background and specific national circumstances will simply cause unnecessary confrontation without any benefits.

Through the negotiation of the post-2012 framework, the lesson learned was that it was a fruitless exercise to compare Parties' targets based on specific "comparability criteria" or "equity criteria" and push them to change their targets. It is impossible to agree on a single set of criteria which all Parties could accept.

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[10] World Energy Outlook 2014 page 180 "The importance of efficiency in coal fired power plants"

[11] http://www4.unfccc.int/submissions/INDC/Published%20Documents/India/1/INDIA%20INDC%20TO%20UNFCCC.pdf#search='india+INDC'

INDCs have been formulated based on the specific national circumstances of respective countries. It is inconceivable that Parties will revise their targets in response to such simplistic criticisms as mentioned at the beginning of this paper.

It is far more productive to devote effort to the development of a facilitative framework where Parties can clarify, truly understand and mutually encourage the achievement of their respective INDCs.