WORLD RESOURCES INSTITUTE

IGES Institute for Global Environmental Strategies

Working Paper

GHG MITIGATION IN JAPAN: AN OVERVIEW OF THE CURRENT POLICY LANDSCAPE

TAKESHI KURAMOCHI

EXECUTIVE SUMMARY

Since the Fukushima nuclear disaster in March 2011, Japan has embarked on a major revision of its energy policies. It has shifted away from a planned scale-up of nuclear power, although with the policy still in development, it is not yet fully clear what will replace nuclear in Japan's national energy plans. What is clear, however, is that Japan's ability to meet its greenhouse gas (GHG) emissions mitigation target under the United Nations Framework Convention on Climate Change (UNFCCC) will depend in large part on the energy path it pursues in the wake of the Fukushima disaster.

In November 2013 at the 19th Conference of the Parties (COP19) to the UNFCCC in Warsaw, Japan announced a revised 2020 GHG emissions reduction target of 3.8 percent from 2005 levels. This "Warsaw Target" replaced an earlier 25 percent reduction from 1990 levels pledged in 2009 at COP15 in Copenhagen. The Warsaw Target is still tentative and will be revised following further review of the energy policy and energy mix, which is likely to take place within a year. The government recently announced a new Basic Energy Plan that clearly calls for the restart of nuclear power plants; whether this proves politically feasible—and if so, on what scale—remains to be seen.

CONTENTS

Suggested Citation: Kuramochi, Takeshi. 2014. "GHG Mitigation in Japan: An Overview of the Current Policy Landscape." Working Paper. Washington, DC: World Resources Institute. Available online at wri.org/publication/ghg-mitigation-policy-japan.

About the Series

This working paper is part of a series that provides an overview of the current policy landscape that key countries have pursued in the interest of GHG mitigation. For each country, the series:

- Describes the country's international mitigation pledge (e.g., GHG reduction commitment, Nationally Appropriate Mitigation Actions), including assumptions and conditions associated with the pledge, and in what respect – if any – it is codified domestically
- Outlines the country's key government institutions and legal authorities for mitigating climate change
- Outlines major policy instruments related to GHG mitigation, current, and under development
- Explains what is known about the country's GHG trajectory
- Identifies issues to watch in the coming years

This working paper surveys Japan's mitigation policy landscape and sets out to answer three questions:

- How does the ambition level of Japan's Warsaw Target compare with its Copenhagen Pledge and earlier 2020 mitigation targets?
- How can recent policy developments in Japan help it to meet its emissions reduction targets?
- Can Japan achieve its Warsaw Target within its existing policy landscape?

Even when factoring out GHG emissions avoidance by nuclear power, the ambition level of Japan's Warsaw Target has taken a step back from the Copenhagen Pledge.

Japan's Copenhagen Pledge relied on the expansion of nuclear power to help curb emissions. When the GHG emissions avoidance expected through nuclear power is factored out, Japan's domestic mitigation efforts under the Warsaw Target are only marginally more ambitious than the target that preceded the Copenhagen Pledge (so-called Mid-Term Target of 2009, pledging -9 percent domestically by 2020 from 1990 levels).

The Warsaw Target arguably takes a step backward from the Copenhagen Pledge by lowering the ambition level similar to the pre-Copenhagen Mid-Term Target and factoring out the CO_2 emissions avoidance that would have been achieved by nuclear power. Moreover, the Japanese government has not yet explained how its Warsaw Target is consistent with a planned 80 percent reduction by 2050 from 1990 levels stipulated in the fourth Basic Environment Plan, a long-term comprehensive national plan for environmental conservation.

Japan's evolving policy landscape includes sector-specific mitigation-related measures, but the lack of information on expected emissions makes it difficult to quantify their impact.

In the aftermath of the Fukushima disaster, Japan has implemented several policy measures that help position it to meet its mitigation targets, including a full-fledged feed-in tariff scheme for renewable electricity, a global-warming tax, and a number of measures to improve the thermal insulation level of households. These policies apply to sectors where few aggressive policy measures were taken before the Fukushima disaster (i.e., renewable energy, residential, and commercial). However, the Japanese government has not reported the expected CO_2 emissions reductions for most policy measures. This omission is at least partially attributable to the lack of a policy implementation plan to achieve the 2020 target.

The Japanese government is more explicit about promoting high-efficiency coal-fired power plants both domestically and overseas. While these plants are perhaps less CO_2-intensive than those currently operating, they are still highly CO_2-intensive compared to other fossil-fired power generation technologies in absolute terms. As with the Warsaw Target, the government has not clearly explained how its promotion of high-efficiency coal-fired power plants is consistent with its 2050 mitigation goal and the global 2°C target.

Japan can achieve its Warsaw Target if enhanced electricity-saving efforts launched following the Fukushima nuclear disaster are continued.

Another objective was to assess the achievability of the Warsaw Target by comparing it with three emissions projections under continued mitigation efforts available in the literature. Limited availability of information on how the target was developed made it difficult to draw

definite conclusions. Nonetheless, the results indicate that the continuation of enhanced electricity-saving efforts begun after the Fukushima nuclear disaster is crucial to achieving the Warsaw Target. When such enhanced electricity-saving efforts are combined with the continuation of other mitigation efforts and the modest economic growth rates estimated by the International Monetary Fund (IMF) and the International Energy Agency (IEA), Japan will likely achieve the Warsaw Target.

I. INTRODUCTION

In 2009, at the 15th Conference of the Parties to the UNFCCC (COP15) in Copenhagen, the Government of Japan, led by the Democratic Party of Japan (DPJ), pledged to reduce its national GHG emissions by 25 percent from 1990 levels by 2020. Premised on the establishment of "a fair and effective international framework in which all major economies participate" and "on agreement on ambitious targets by all the major economies" (GoJ, 2009a), Japan's pledge (hereinafter, "Copenhagen Pledge") was one of the most ambitious among developed countries' pledges at COP15 (Climate Action Tracker, 2013). Its reductions would be driven in large part by an expansion of nuclear power. Japan's 2010 Basic Energy Plan (2010 BEP) called for the construction of nine new nuclear power plants between 2010 and 2020—this in addition to the 54 reactors already existing (METI, 2010).

In March 2011, the Great East Japan Earthquake and resulting tsunami severely damaged the Fukushima Daiichi nuclear power plant. In the wake of the disaster, Japan is revising its energy policy to reduce its dependence on nuclear power. Not only has the planned expansion of nuclear power as stipulated in the 2010 BEP become politically unrealistic, but all existing nuclear power plants have stopped operating as of February 2014, and will not restart until they meet a new set of safety standards developed after the Fukushima nuclear disaster. While some commentators considered Japan's Copenhagen Pledge unreasonably ambitious from the outset (Murakoshi et al., 2010; Ogimoto and Yamaguchi, 2012), the Fukushima nuclear disaster has made it effectively unachievable (Ogimoto and Yamaguchi, 2012). In March 2012, the DPJ government reported to the UNFCCC that it would revise its mitigation target for 2020 following the establishment of a new energy and environment strategy (GoJ, 2012a).

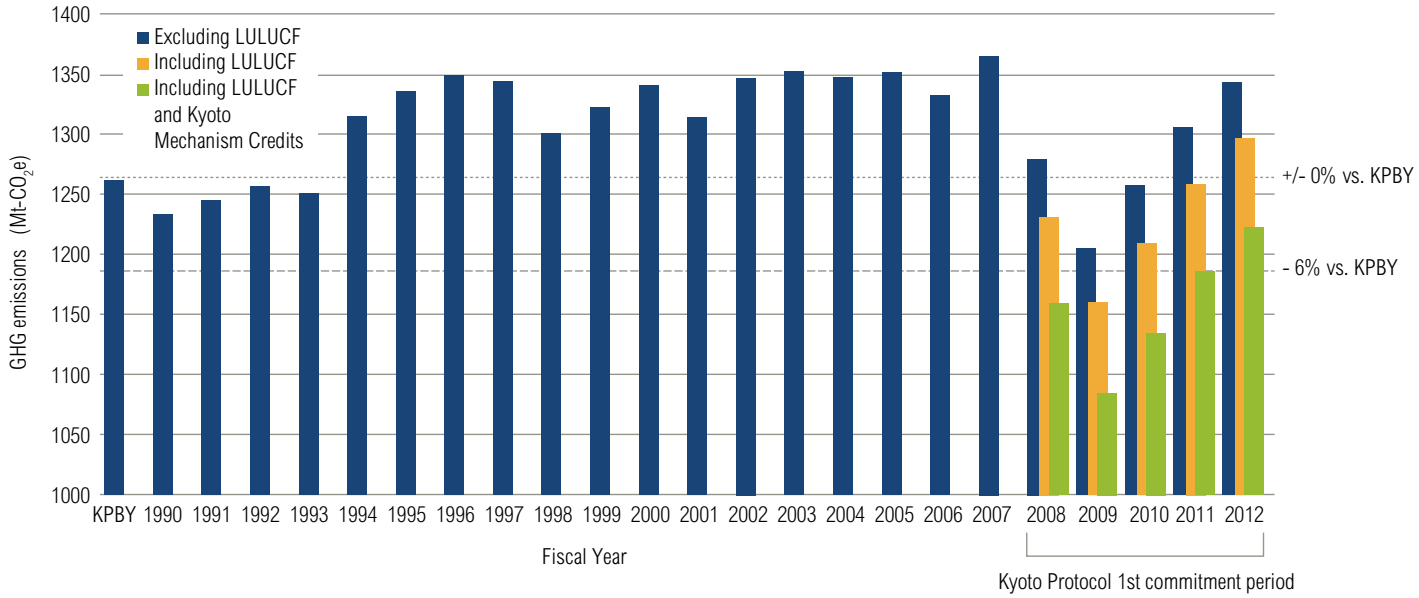
Japan's revised national energy policy will likely have major consequences for its future greenhouse gas (GHG) emissions reduction efforts. The uncertainty surrounding Japan's future nuclear power use, combined with political instability, makes the revision of the 2020 mitigation target all the more challenging. In September 2012, the DPJ government published the Innovative Strategy on Energy and Environment ("the Innovative Strategy"). Laying out the goal to phase out nuclear power by the end of the 2030s, the Innovative Strategy set the GHG reduction target at around 20 percent below 1990 levels for 2030, with indicative reduction figures of 5–9 percent below 1990 levels for 2020. However, following its landslide election in December 2012, the new Liberal Democratic Party (LDP) administration announced a complete revision of national energy and climate policies. National leaders have been unable to reach consensus on revised GHG reduction targets because of uncertainty about Japan's future nuclear policy and delayed safety examinations of existing plants by the Nuclear Regulation Authority.

It was only in November 2013, at the COP19 in Warsaw, that Japan finally announced the revised 2020 target (hereinafter, "Warsaw Target"): a reduction of 3.8 percent from 2005 levels, including forest sequestration and overseas credits, and assuming zero nuclear power (MOE, 2013a). The Warsaw Target is tentative, and Japan will likely revise it based on further review of its energy policy and mix (MOE, 2013a). Nonetheless, the size of the Warsaw Target's rollback from the Copenhagen Pledge, which is far larger than the volume of GHG emissions that nuclear power generation was expected to displace, surprised many observers (Climate Action Tracker, 2013).

This paper comprehensively reviews and assesses Japan's climate change mitigation policies. Its objectives are threefold. First, it assesses the ambition level of the Warsaw Target in comparison with the Copenhagen Pledge and earlier 2020 mitigation targets. Second, it reviews the development of mitigation-related policies since 2009, when national discussions on post-2020 climate mitigation efforts intensified. Third, it assesses whether Japan can meet the Warsaw Target through existing policies by comparing the Warsaw Target with "business-as-usual" GHG emissions projections.

This paper is structured in eight parts. Following this introduction (section I), section II provides the key metrics for GHG emissions and energy consumption. Section III describes the current status of Japan's GHG

Figure 1 | **Annual Total GHG Emissions Excluding and Including LULUCF in Japan Between FY1990 and 2012**



Notes: The annual Kyoto Units are assumed to be a 5-year average of total units acquired between 2008 and 2012. KPBY = Kyoto Protocol Base Year.
Source: GIO, 2014a.

mitigation commitments, and compares the Warsaw Target with previous mitigation targets for 2020. Section IV briefly describes policymaking processes and relevant governmental bodies for energy and climate policy implementation. Section V provides an overview of existing major policy measures expected to contribute to GHG emissions reductions toward 2020. Section VI describes some of the key mitigation policies currently under development. Section VII compares the Warsaw Target with "business-as-usual" GHG emissions scenarios reported in the literature. Section VIII summarizes the paper's findings and describes the outlook for future policy developments.

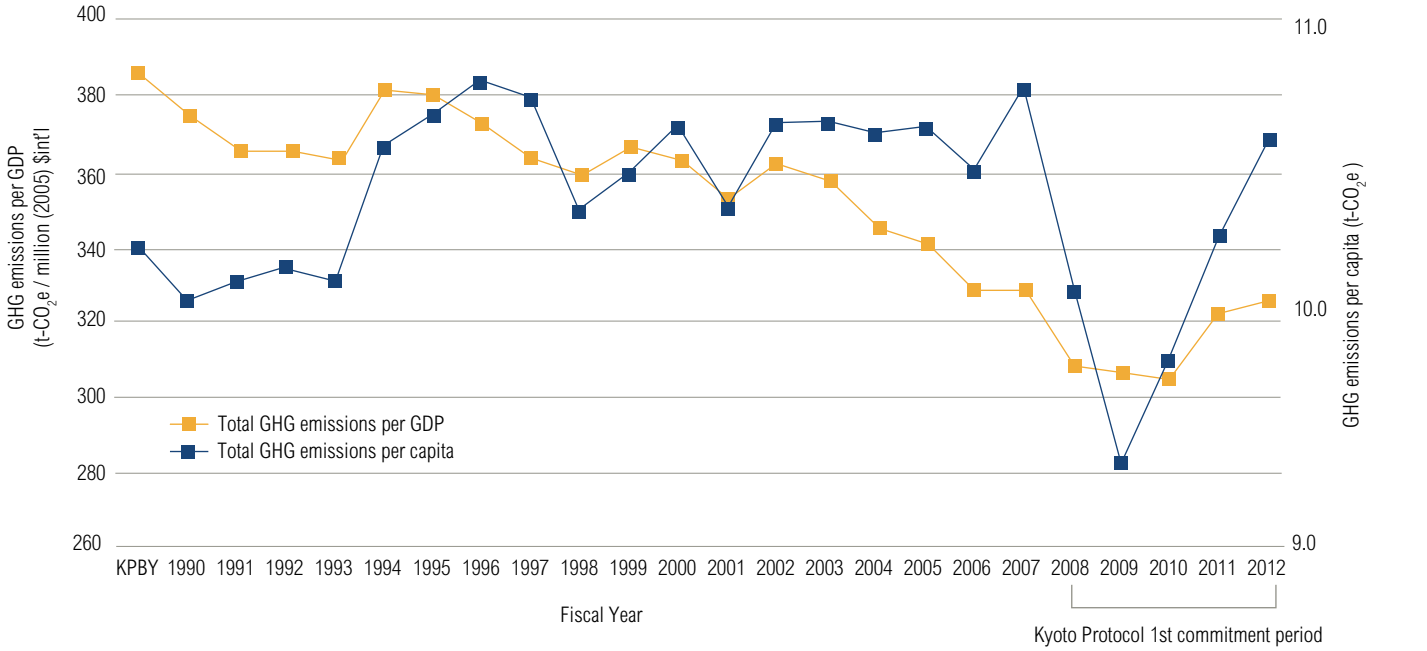
II. KEY METRICS

This section presents key GHG emissions metrics for Japan using data from the Greenhouse Gas Inventory Office of Japan (GIO, 2014a), which compiles the official GHG emissions data reported to the UNFCCC.

Japan is committed to reduce its GHG emissions by 6 percent from 1990 levels in the first commitment period of the Kyoto Protocol (KP-CP1: 2008–12). Figure 1 presents Japan's historical GHG emissions between FY1990 and FY2012. The Ministry of the Environment (MOE) recently announced that Japan achieved the KP-CP1 target, despite the increased emissions following the Fukushima nuclear disaster (MOE, 2014a). When the net sequestration through land use, land-use change, and forestry (LULUCF) and the purchases of Kyoto Units[1] are taken into account, preliminary results indicate that Japan has reduced on average 8.4 percent compared to 1990 levels for the KP-CP1 (MOE, 2013b). However, the average annual domestic GHG emissions excluding LULUCF between 2008 and 2012 were 1.4 percent above 1990 levels. Figure 1 also indicates that the emissions reductions between FY2008 and FY2010 mainly result from the global economic crisis (MOE, 2011a) and have contributed significantly to Japan's achieving its KP-CP1 target.

Despite nuclear power's share in total power generation decreasing to less than 2 percent, the FY2012 emissions (excluding LULUCF) are comparable to the emissions observed between FY1995 and FY2007, when the share of nuclear power in total centralized power generation (from General Electric Utilities) was constantly above 25 percent (METI, 2013a). This is mainly because of reduced emissions in the industrial and transport sectors. Compared with FY2005, when the emissions levels were nearly identical to the FY2012 level, while nuclear power generation was

Figure 2 | **Total GHG Emissions Per Capita and Per GDP (PPP) Between FY1990 and 2012**



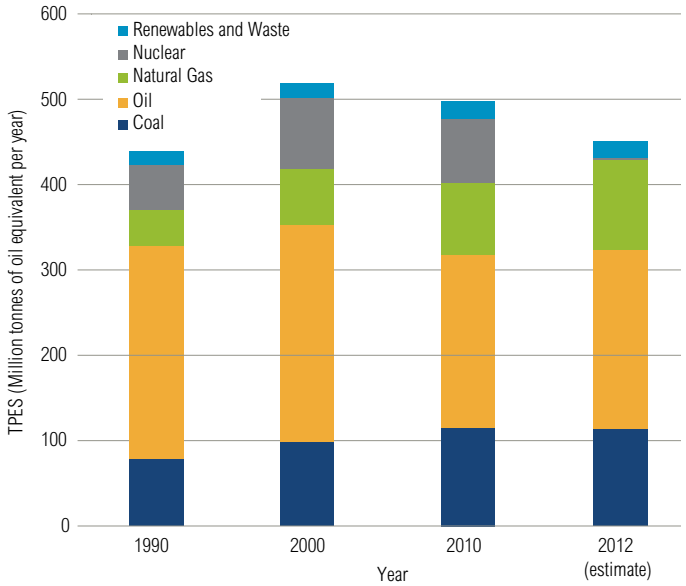
Notes: GDP data are adjusted for purchasing power parity (PPP) and reported in constant 2005 international dollars. KPBY = Kyoto Protocol Base Year.
Source: Author's calculation based on GHG emissions data from GIO, 2014a, and population and GDP (PPP) data from World Bank, 2013.

305 TWh/yr (IEEJ, 2013), energy-related CO_2 emissions (including indirect emissions from electricity generation) dropped from 459 Mt to 418 Mt for the industrial sector, and from 254 Mt to 226 Mt for the transport sector.

Figure 2 presents the historical total CO_2 emissions per capita and per GDP (in constant 2005 international dollars) between FY1990 and FY2011. While the trend for per GDP emissions has declined by 13 percent between 1990 and 2012, per capita emissions have been more or less unchanged, as have total GHG emissions (excluding LULUCF), except during the global economic crisis, particularly in 2009, when emissions decreased sharply.

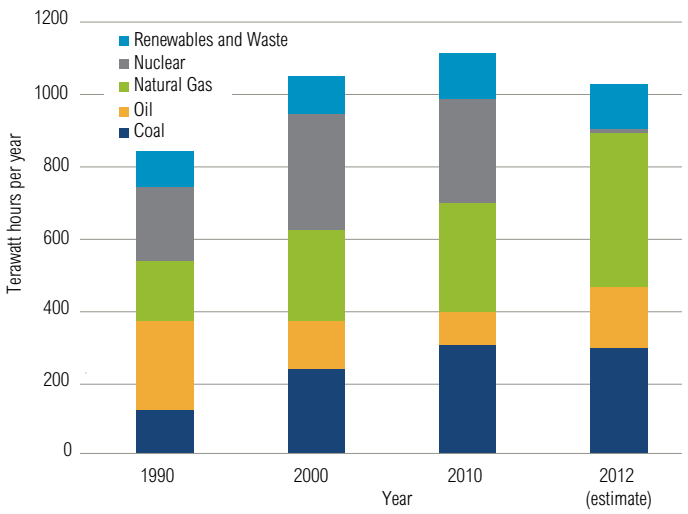
Figures 3 and 4 present the historical total primary energy supply (TPES)[2] and total gross electricity generation for 1990, 2000, 2010, and 2012. TPES for 2012 is comparable to that for 1990, and is 13 percent below 2010 levels. Figure 3 shows that natural gas supply has been constantly increasing since 1990, and the increase following the Fukushima nuclear disaster is noticeable. Oil consumption decreased 16 percent by 2012 from 1990 levels, but it continues to account for more than 40 percent of TPES; in the aftermath of the Fukushima nuclear disaster, oil's contribution to gross power

Figure 3 | **Historical Total Primary Energy Supply (TPES) for 1990, 2000, 2010, and Estimated Values for 2012**



Source: IEA, 2013a.

Figure 4 | **Historical Total Gross Power Generation (excluding Pumped Storage Hydropower) for 1990, 2000, 2010, and Estimated Values for 2012**



Source: IEA, 2013a.

generation increased as it was used as an emergency fuel source for electricity generation (Figure 4). Coal consumption has stabilized; coal-fired power generation did not increase after the Fukushima nuclear disaster. Nuclear power once accounted for over 330 TWh, or 33 percent, of total electricity generation (in 1998, excluding pumped storage hydropower), but it had decreased to nearly zero in 2012 (Figure 4). The share of renewable energy (including large hydropower) in TPES has been very small and has only increased slightly, from 3.5 percent in 1990 to 4.6 percent in 2012.

III. INTERNATIONAL STATEMENTS OF FUTURE GHG MITIGATION

This section describes the status of Japan's climate change mitigation commitments and the relevant framework policies that support them. The subsection entitled Current Legal Status of Japan's Climate Change Mitigation Commitments describes the status of Japan's commitments to GHG emissions reductions as of April 2014. The subsection entitled Comparison of the Warsaw Target with Previous 2020 Targets seeks to better understand the Warsaw Target by comparing it with the previously announced 2020 targets.

Current Legal Status of Japan's Climate Change Mitigation Commitments

International Mitigation Commitment Under the UNFCCC

For the first commitment period of the Kyoto Protocol (KP-CP1), Japan pledged to reduce its GHG emissions by 6 percent compared to 1990 levels. During this period, Japan achieved an 8.4 percent reduction, including LULUCF and Kyoto Units acquisitions (see section II, Key Metrics). For the post-2012 period, Japan announced in the Warsaw Target that it would reduce its GHG emissions by 3.8 percent by 2020 from 2005 levels (1,351 Mt/yr), including the use of forest sinks and overseas credits.[3] The Warsaw Target is equivalent to 1,300 Mt-CO_2e/yr and 3.1 percent increase from 1990 levels, and replaces the Copenhagen Pledge of a 25 percent reduction from 1990 levels. The future GDP growth projection underlying the target is on average 1.8 percent/yr in real terms between 2010 and 2020, assuming that the current government's economic stimulus policies are successful (Cabinet Office, 2013a; GoJ, 2013a). The Warsaw Target is tentative; it assumes no nuclear power generation and will be revised following further review of the energy policy and energy mix.

The Warsaw Target is a domestic target—not a commitment under the Kyoto Protocol second commitment period (KP-CP2). Japan declared at the COP16 in Cancun, Mexico, and communicated to the UNFCCC in December 2010, that "it does not have any intention to be under obligation of the second commitment period of the Kyoto Protocol after 2012" (UNFCCC, 2012). Accordingly, Japan is unable to make secondary acquisitions of Kyoto Units. Japan cites the nonparticipation of the United States and China as a factor in its decision: it argues that the current Kyoto Protocol framework covers little more than a quarter of total CO_2 emissions from the Parties, and given that the United States and China are "very unlikely" to participate in the legally binding framework in the near future, the KP-CP2 will only solidify the "unfair and ineffective" framework for the post-2012 period (GoJ, 2010a).

Domestic Codification of the International Pledge and Framework Policies

The Warsaw Target is not yet enshrined in domestic legislation; consequently, no specific framework policy is in place to support it. For the KP-CP1, the *Law Concerning the Promotion of the Measures to Address Global Warming* ([Act No. 117, 1998], the "*GW Countermeasures Promotion Act*") provided a

legal framework for Japanese policies and measures to tackle climate change (Takamura, 2011). The *GW Countermeasures Promotion Act* also called for plans and measures to achieve the KP-CP1 target, such as the Kyoto Protocol Target Achievement Plan, the National and Local Government Action Plan, and the mandatory GHG Accounting and Reporting System (2002 revision). Following the end of the KP-CP1, the 2013 revision of the *GW Countermeasures Promotion Act* requires the development of a "Plan for Global Warming Countermeasures," which succeeds the Kyoto Protocol Target Achievement Plan. The Plan for Global Warming Countermeasures will stipulate the necessary measures for achieving the revised 2020 target once it is legally enshrined. As of May 2014, Japan had not yet started to draft the Plan for Global Warming Countermeasures.

Japan's long-term mitigation target is enshrined under broader environmental legislation. The fourth revision of the Basic Environment Plan (MOE, 2012a), a long-term comprehensive national plan for environmental conservation, states that Japan aspires to reduce GHG emissions by 80 percent by 2050 from 1990 levels,[4] although the steps to achieve that target are undefined. The Basic Environment Plan is codified in the 1993 *Basic Environment Act*, which revised the *Basic Law for Environmental Pollution Control* and established a broad national policy on the environment. Although the Basic Environment Plan is not law, new legislation must comport with it (as well as with the Basic Energy Plan) because the Cabinet has adopted it (see Annex 1 for details on Cabinet decisions and adoptions). Research groups led by the National Institute of Environmental Studies have modeled and assessed several pathways to achieve 80 percent reduction by 2050 that have then been discussed in the MOE Central Environment Council ("2050 Japan Low-Carbon Society" Scenario Team, 2009; MOE, 2012b). However, no public documents clarify the degree to which the Warsaw Target aligns with the long-term mitigation target stipulated in the fourth Basic Environment Plan.

Comparison of the Warsaw Target with Previous 2020 Targets

Japan has not fully disclosed the calculation approach or principles on which its Warsaw Target is based. This section examines the Warsaw Target and its ambition level based on the limited information that is publicly available.

Japan's First Biennial Report to the UNFCCC (GoJ, 2013a) provides some details on the Warsaw Target. The underlying final energy consumption figures are consistent with the high economic growth scenarios proposed as options for the Innovative Strategy (EEC, 2012a), indicating that at

Table 1 | **Energy-Related CO_2 Emissions by Sector; Historical Data for 1990 (Kyoto Protocol Base Year), FY2005, FY2012, and Projections Under the Warsaw Target**

YEAR / SECTOR	HISTORICAL EMISSIONS			FUTURE EMISSIONS PROJECTIONS		
	1990 (KPBY)	FY2005	FY2012	FY2020: WARSAW TARGET		
	Mt-CO_2/YR	Mt-CO_2/YR	Mt-CO_2/YR	Mt-CO_2/YR	VS. 1990	VS. 2005
Industry	482	459	418	484	+0.4%	+5.4%
Commercial and other	164	235	272	263	+60%	+11%
Residential	127	174	203	176	+38%	+1.1%
Transport	217	254	226	190	-13%	-25%
Energy conversion	68	79	88	95	+40%	+20%
Total energy-related CO_2 emissions	1,059	1,202	1,208	1,208	+14.1%	+0.4%

Note: The emissions from the steam and electricity generation in the energy conversion sector are allocated to end-use sectors based on consumption.
Sources: Based on data from GIO, 2014a; and GoJ, 2013a.

least some of the discussions that informed the Innovative Strategy were considered. The domestic GHG emissions projection for 2020 excluding LULUCF is 1,364 Mt-CO_2e/yr, or 8.2 percent above the 1990 levels (1,261 Mt/yr). Energy-related CO_2 emissions are projected at 1,208 Mt/yr, or 14 percent above the 1990 levels (1,059 Mt/yr). As seen in Table 1, the CO_2 emissions projections under the Warsaw Target are higher than the historical values in both 1990 and 2005 for all sectors except transport. The projected increase of emissions in the industrial, commercial, and residential sectors, despite projected reductions in final energy consumption (1.1 percent, 6.5 percent, and 17.9 percent from 2005 levels, respectively), mainly result from the high estimates of CO_2 emissions intensity for electricity.

The amount of carbon removed by forest sinks between 2013 and 2020 is estimated to be on average 44 Mt-CO_2/yr, or 3.5 percent of 1990 total GHG emissions. These figures indicate that Japan would need to reduce an additional 20 Mt-CO_2e/yr to achieve the Warsaw Target, either by implementing policy measures that are not yet planned or by purchasing credits from overseas. If the full amount was to be reduced through credit purchase, the amount of purchase would be similar to Japan's average annual acquisition of Kyoto Units during the KP-CP1 (about 20 Mt-CO_2e/yr) (MOE, 2013b). It is worth noting that during the KP-CP1, the power sector acquired Kyoto Units amounting to an annual average of 55 Mt-CO_2e/yr in addition to those acquired by the government (MOE, 2013b).

Table 2 | **Comparison of Japan's Revised 2020 Mitigation Target ("Warsaw Target") in Comparison with the Previously Announced Mitigation Targets**

TARGET YEAR		1990 (HISTORICAL)	2005 (HISTORICAL)	2008-2012	2020			
				KP-CP1	"MID-TERM TARGET"		COPENHAGEN PLEDGE (NOV. 2009)	WARSAW TARGET (2013)
					ORIGINAL (JUNE 2009)	NO NUCLEAR VARIANT (2013)		
GHG emissions target	Relative terms	NA	NA	-6% vs. 1990 levels	-15% vs. 2005 levels	+2.1% vs. 2005 levels	-25% vs. 1990 levels	-3.8% vs. 2005 levels
	Absolute terms (Mt-CO_2e/yr)	1,261	1,351	1,185	1,149	1,380	946	1,300
Include forest sinks?		no	no	yes	no		yes	yes (on average 44 Mt-CO_2/yr for 2013–20)
Include overseas credits?		no	no	yes	no		yes	yes (about 20 Mt-CO_2e/yr)
GHG emissions excl. LULUCF and credits		1,261	1,351	1,185	1,149	1,380	NA	1,364
Nuclear share in centralized power generation		27%	31%	36%	42%	0%	NA	0%
Compared to 1990		—	+7.1%	-6%	-8.9%	+9.4% (+6.4% incl. forest sinks)*	-25%	+3.1%
Compared to 2005		-6.7%	—	-12%	-15%	+2.1% (-0.7% incl. forest sinks)*	-30%	-3.8%

Note: *GHG reductions due to forest sinks are assumed to be 38 Mt-CO_2e/yr in 2020, as targeted by the government (GoJ, 2013a).
Sources: GoJ, 2013a, 2010b; MOE, 2013a.

How does the Warsaw Target's ambition compare with the previous 2020 targets when the share of GHG emissions reductions slated to be achieved by nuclear power in 2020 is excluded? In explaining the ambition level of the Warsaw Target (MOE, 2013a), the current government refers not to the Copenhagen Pledge but to the "2009 Mid-Term Target," which preceded the Copenhagen Pledge and aimed for a 9 percent reduction from 1990 levels domestically (excluding LULUCF). The target level is roughly consistent with the 25 percent reduction scenario for developed countries as a whole with an effort-sharing based on equal additional cost per GDP according to government estimates. Table 2 shows that when factoring out the GHG emissions that would have been avoided by nuclear power, the Mid-Term Target would translate into 1,380 Mt-CO_2e/yr.[5] Therefore, the Mid-Term Target differs from the Warsaw Target's projected domestic GHG emissions (1,364 Mt-CO_2e/yr) by only 16 Mt-CO_2e/yr (1.3 percent of 1990 emissions).

Arguably, the Warsaw Target took a step back from the Copenhagen Pledge by lowering the ambition to a level similar to the pre-Copenhagen "Mid-Term Target," and by factoring out the avoided CO_2 emissions that would have been achieved by nuclear power. At the same time, the expected emissions reductions through overseas credits are challenging considering that Japan cannot make secondary acquisitions of Kyoto Units. Instead, the government aims to maximize use of the Joint Crediting Mechanism (see section VI, subsection on Joint Crediting Mechanism).

When Japan first announced its 25 percent target at the UN Climate Summit in September 2009 (GoJ, 2009b), it did not detail the steps it would take to achieve that target. Whether the Copenhagen Pledge was achievable at all is open to debate. The literature suggests that a 25 percent domestic reduction would have been difficult to achieve if the structure of the economy and consumption trends continued. A social and economic shift toward a low-carbon society would have been required. The National Institute of Environmental Studies (NIES, 2009) examined whether a 25 percent reduction was achievable using a bottom-up energy system model analysis. The analysis drew on the same set of fixed macroeconomic activity projections (i.e., independent of mitigation effort levels) used for the Mid-Term Target, which represented an extension of the current economic structure. The analysis demonstrated that a reduction of only about 20 percent was achievable domestically, even with the maximum deployment of available mitigation technologies (regardless of their economic feasibility).[6] The report emphasized that when setting future mitigation targets, one must consider a long-term economic growth strategy that is not only realistically achievable but also consistent with long-term national mitigation goals.

In the end, Japan's Copenhagen Pledge was undermined by the DPJ government's failure to implement the key policy measures needed to realize major emissions reductions. Among the three key policy measures outlined in the bill of the *Basic Act on Global Warming Countermeasures* (Annex 2), only the feed-in tariff scheme was realized; Prime Minister Naoto Kan agreed to resign after the Fukushima nuclear disaster in exchange for the opposition's support of the feed-in tariff.

IV. RELEVANT GOVERNMENT INSTITUTIONS AND LEGAL AUTHORITIES

Several government bodies play important roles in planning and implementing domestic climate change mitigation policies in Japan. This section notes the most important bodies and describes their role.

Under the direct command of the Prime Minister as the chief, the Global Warming Prevention Headquarters (GWPH) was established within the Cabinet in 1997 to steadily implement the Kyoto Protocol and to "comprehensively advance concrete and effective measures for the prevention of global warming" (Cabinet, 2013). The ministers responsible for the Ministries of the Environment (MOE) and of Economy, Trade, and Industry (METI) serve as deputy chiefs.

The MOE and METI are the most prominent ministries in Japan's GHG mitigation policies. The Ministry of Environment leads the formulation of climate change-related legislation and administers the use of revenues from carbon taxes (the Global Warming Countermeasures Tax) together with METI. The MOE is also responsible for designing Japan's Voluntary Emissions Trading Scheme (JVETS) and Japan's Verified Emissions Reduction (J-VER) scheme. Moreover, the MOE is responsible for environmental impact assessments, including those for wind farms and fossil fuel–fired power plants. In addition, the Nuclear Regulation Authority—formed from the former Nuclear Safety Commission under the Cabinet and the Nuclear and Industrial Safety Agency under METI—is now affiliated with the MOE.

The Ministry of Economy, Trade, and Industry is responsible for most of Japan's energy policies. As stipulated in the *Basic Act on Energy Policy*, METI formulates the Basic Energy Plan every three years to outline the mid- to long-term national energy policy for the next two decades. METI's policy portfolio includes various energy efficiency standards; energy and carbon taxes; schemes for renewable energy promotion; and research, development, and deployment of advanced low-carbon energy technologies.

The Ministry of Land, Infrastructure, Transport, and Tourism (MLIT) is responsible for energy efficiency standards for buildings, houses, and vehicles (together with METI), as well as CO_2 emissions reductions from aviation and marine transport. The MLIT also manages water resources, floods, and extreme weather impacts from climate change. The Ministry of Agriculture, Forestry, and Fisheries (MAFF) is responsible for forest-related policies, including carbon sequestration through afforestation and improved forest management, as well as emissions mitigation from agriculture. The Ministry of Education, Culture, Sports, Science, and Technology (MEXT) is responsible for various research programs on climate change mitigation and adaptation, as well as climate change observation, prediction, and impact assessment. The Japan Meteorological Agency (JMA) is responsible for observing and monitoring GHG concentrations, ocean climate, and climate change and their trends in Japan and all over the world. The Ministry of Foreign Affairs (MOFA) leads climate change negotiations and is mainly responsible for various multilateral engagements with governments on climate change and bilateral support through official development assistance of developing countries' climate change measures.

In addition to the national government bodies, the *GW Countermeasures Promotion Act* stipulates that local governments are required to develop their own GHG emissions mitigation plans in accordance with the national mitigation plan (see section V, subsection on Major Subnational Policies). The national mitigation target is not divided among prefectures (Sugiyama and Takeuchi, 2008); instead, local governments decide their mitigation target levels on their own.

V. OVERVIEW OF MAJOR EXISTING POLICIES

This section reviews recent policy developments aimed at limiting or reducing GHG emissions. It focuses on energy-related and sector-specific policies enacted after 2008, when government discussions of post-2012 mitigation targets intensified around the development of the 2009 Mid-Term Target. Nearly all of Japan's significant mitigation-related policies do not set quantitative reduction targets, or estimate mitigation impacts (MOE, 2012c). Table 3 shows the major national policies that support GHG emissions reduction in Japan as of April 2014.

Framework policies

Global Warming Countermeasures Promotion Act

As described in section III, the *GW Countermeasures Promotion Act* is currently the framework legislation for achieving the Warsaw Target. The Plan for Global Warming Countermeasures, expected to be formulated after the Warsaw Target is revised, will provide a package of mitigation policy measures and their expected mitigation impacts, as with the Kyoto Protocol Target Achievement Plan.

While the *GW Countermeasures Promotion Act* provides a policy framework for achieving the nearest-term mitigation target, no high-level comprehensive law systematically sets out consistent short- and long-term policy directions on climate policy. The fourth Basic Environment Plan (described in section III, subsection on Domestic Codification of the International Pledge and Framework Policies) stipulates an aspirational target of 80 percent reduction by 2050, but its lack of detail on how that target will be achieved limits the document's influence on short- to midterm mitigation policymaking.

The DPJ government developed the bill of the *Basic Act on Global Warming Countermeasures* ("*GW Basic Act*"; see Annex 2) to establish climate policy as a pillar of Japan's policymaking on par with energy policy and general environmental policy, but the bill never passed the Diet (see Annex 1). The *GW Basic Act* could have legally bound other legislation to be consistent with short- and long-term climate goals. As of January 2014, there was no sign that the LDP government was considering high-level comprehensive legislation on climate change.

Table 3 | **List of Key Policies in Force as of April 2014 Expected to Contribute to Significant GHG Emissions Reductions**

SECTOR	NAME OF POLICY/LEGISLATION	PROMULGATED	MINISTRY/AGENCY IN CHARGE
Framework policies	*Global Warming Countermeasures Promotion Act*	1997 (last revision 2013)	MOE
	Energy Conservation Act and the Top Runner Program	1979 (Top Runner Program from 1998, last revision 2013)	METI with relevant ministries
	Basic Energy Plan (2014 revision under development)	2014 (planned)	METI
Cross-sectoral policies	Global Warming Countermeasures Tax	2012	MOF (revenues allocated to MOE and METI)
	Voluntary Emissions Trading Scheme/Trial Integrated Market	2005	MOE/METI
Power sector	CO_2 emissions performance guidelines for centralized power plants as part of the Environmental Impact Assessment procedure	2013	MOE/METI
	Renewable Energy Act (feed-in tariff)	2012	METI
Industrial sector	*Energy Conservation Act*: Energy efficiency benchmarking	2010	METI
	Support for combined heat and power system installations	2013	METI
	New Voluntary Action Plan toward 2020	2009	METI Keidanren
Transport sector	Top Runner Program: Fuel efficiency standards for passenger and heavy duty vehicles	1998 (last revision 2013)	METI/MLIT
	Eco-car tax breaks and subsidies	2009	METI/MLIT
Residential and commercial sectors	*Low-Carbon City Promotion Act*	2012	MLIT
	Energy Conservation Act: Top Runner standards for building materials	2013	METI/MLIT
Agriculture, forestry, and other land use (AFOLU)	2011 revision of Forests and Forestry Basic Plan	2011	MAFF
Subnational policies	Prefectural mitigation action plans	2007 and later	Prefectural governments
	Tokyo Emissions Trading Scheme (ETS)	2010	Tokyo Metropolitan Government

Energy Conservation Act and the Top Runner Program

The *Act Concerning the Rational Use of Energy* ("*Energy Conservation Act*," Act No. 49 of 1979) was enacted between the two oil crises and is Japan's most comprehensive legislation on energy conservation. The *Energy Conservation Act* is significant from a climate mitigation perspective for two reasons (Takamura, 2011). First, it tackles energy-related CO_2 emissions, which constitute approximately 90 percent of national GHG emissions. Second, it includes mandatory measures, whereas most other energy and climate measures are not mandatory. The *Energy Conservation Act* therefore became a core measure for tackling climate change, even though it does not specifically refer to climate change (Takamura, 2011).[7]

The *Energy Conservation Act* requires energy management in industrial and commercial sectors[8] and sets out energy efficiency standards for machinery and equipment (including "Top Runner Standards" for electric appliances and vehicles), as well as for residential and commercial buildings. The *Energy Conservation Act* has been amended seven times on an ad hoc basis and has been strengthened by widening its sectoral coverage, detailing the monitoring from office- and factory-level to appliance-level, and

increasing ambition levels by benchmarking industrial leaders. The *Energy Conservation Act* governs around 90 percent of final energy consumption in the industrial sector, 70 percent in the residential sector, and 50 percent in the commercial sector (METI, 2011a).

Following the adoption of the Kyoto Protocol, the 1998 revision of the *Energy Conservation Act* introduced the Top Runner Program. The program was the first attempt in the world, according to the government, to establish the highest energy efficiency in a given industry as the standard for the entire industry (MOE, 1998). The program started with nine products, including passenger and freight vehicles and air conditioners, and today covers 28 energy-consuming products and building materials (METI, 2013b). The 2013 inclusion of building materials, including window and insulation materials, was the first time that the Top Runner Program included products that do not themselves use energy (METI, 2013c). According to a 2009 survey, products included in the Top Runner Program cover approximately 70 percent of final energy use in the household sector (METI, 2011b), while the coverage is lower in the commercial sector (around 20 percent as of 2007, before printers and multifunction devices were listed in 2012) (METI, 2007). Further coverage of products in the commercial sector is anticipated in the coming years.

2014 Basic Energy Plan

The *Basic Act on Energy Policy* (Act No. 71, 2002) requires METI to formulate the Basic Energy Plan (BEP). This Cabinet-adopted document (see Annex 1 for details on Cabinet decisions and adoptions) sets the basic direction of national energy policy for the next two decades in line with three fundamental principles—the "3Es": energy security, environmental protection, and efficient supply (METI, 2010).

The first BEP was formulated in 2003 and revised in 2007 and 2010. The 2010 revision ("2010 BEP") planned to reduce domestic energy-related CO_2 emissions by around 30 percent below 1990 levels by 2030, mainly by building 14 new nuclear power plants by 2030 (9 plants by 2020) in addition to the 54 plants existing in 2010. This nuclear power expansion plan would have increased the installed capacity from 49 GWe in 2010 to 60 GWe in 2020, and the electricity generation from 288 TWh in 2010 to around 430 TWh, or nearly 40 percent of total centralized power generation (from General Electric Utilities) in 2020 (METI, 2009).

The 2014 BEP (METI, 2014a)—the first BEP formulated after the Fukushima nuclear disaster—adds "safety" to the 3Es as a pillar of national energy policy. The most important point in the new BEP in relation to domestic mitigation efforts is that it overturns the previous (DPJ) government's direction to phase out nuclear power during the 2030s. While the document states that dependence on nuclear power will be reduced as much as possible, it calls for a swift restart of existing nuclear power plants following safety approval from the Nuclear Regulation Authority (NRA), and it does not rule out building new plants in the future.

The policy decision to restart existing nuclear power plants means that the Warsaw Target will need to be revised. However, the new BEP does not indicate the energy mix for the next 20 years; the future energy mix will be proposed only when there is greater clarity on the issue of nuclear power safety examinations, international climate policy discussions, and the progress of feed-in tariffs. Perhaps for this reason, the 2014 BEP does not include midterm quantitative targets for technology deployment on nuclear power and combined heat and power. The target for renewable electricity (13.5 percent and 20 percent of total electricity generation excluding automobile production for 2020 and 2030, respectively) is unchanged from the 2010 BEP and only suggested in a footnote of the new BEP document as the reference level beyond which the country should aim. According to the Japan Renewable Energy Foundation (JREF, 2014), this target can almost be achieved with the current renewable power capacity (see section V, subsection on Feed-in-Tariff (FIT) Scheme).

In addition to its provisions on nuclear power, the 2014 BEP promotes "unabated"[9] coal-fired power plants domestically and overseas, and sets out to shorten the environmental impact assessment period not only for brownfields (from the current three years to about one year), but also for greenfields. It should also be noted that the carbon capture and storage commercialization timeline set out in the 2010 BEP was omitted from the 2014 BEP.

Cross-Cutting Policies

Global Warming Countermeasures Tax

The Tax for Measures to Cope with Global Warming ("GW Tax") is an upstream environment tax enacted in October 2012 (MOE, 2012d). It is levied on all fossil fuels based on specific CO_2 emissions. The GW Tax is legally positioned as a surtax on the existing upstream

Petroleum and Coal Tax, which is one of many fossil fuel taxes. The Petroleum and Coal Tax has been imposed on various fossil fuels at the point of import or extraction since 1978, when it was first introduced as the Petroleum Tax. The tax rate will be gradually increased in three steps over a 3.5-year period from JPY95/t-CO_2 (USD0.95/t-CO_2)[10] in October 2012, to JPY289/t-CO_2 (USD2.89/t-CO_2) by April 2016 (MOE, 2012d).[11]

All fossil fuels that were exempted from the Petroleum and Coal Tax before October 2012 are also exempt from the GW Tax, including imported coal used for the production of iron and steel, coke and cement (referred to as "specific coal"), and volatile oil feedstock for the production of petrochemical products.[12] These exemptions were designed in part to maintain the international economic competitiveness of Japan's energy-intensive industries (MOF, 2012). Moreover, exemption and return measures also apply to a number of other specific fossil fuel uses (only for the GW Tax portion) until March 31, 2016.[13] Despite these exemptions, calculations based on the tax rate and the expected revenue after FY2016 indicate that the GW Tax should cover domestic fossil fuel consumption equivalent to about 910 Mt-CO_2 per year, or 80 percent of energy-related CO_2 emissions in FY2010 (1,123 Mt [GIO, 2014a]). Electric utilities are not exempt from the GW Tax, but they are allowed to pass on the cost to consumers through the fully distributed cost method, which allows electric utilities in the regulated market to secure a certain level of income and recover expenses incurred (JFTC, 2012).

The GW Tax is not revenue neutral, and the revenue it generates will be used to promote energy conservation, renewable energy, distributed generation, and innovative technologies (including new generation batteries and carbon capture and storage) through various measures, including facility installation subsidies and R&D support (GoJ, 2012b). In addition, the government will also provide support for cost reduction in fuel production and distribution, stabilization of fuel supply and energy savings in logistics and transport sectors, and depopulated or cold climate areas (MOE, 2012d). The expected annual revenues from the GW Tax are JPY39 billion (USD390 million) in FY2012 and JPY262 billion (USD2.6 billion) after FY2016 (MOE, 2012d). According to MOE estimates (MOE, 2012d), an average household will experience an increased tax burden of approximately JPY1,200 (USD12) per year after the full tax rate is imposed. This will be approximately JPY100 (USD1) per month.

The impact of the GW Tax on CO_2 emissions reduction in 2020 is estimated to be around 6–24 Mt/yr (0.5–2.2 percent of CO_2 emissions in 1990), of which 1.8 Mt/yr results from a "price effect" (reduction in energy use through taxation) and 3.9–22 Mt/yr results from a "budget effect" (reduction through the use of tax revenue for emissions reduction measures). The wide range for the "budget effect" signifies that the overall impact of the GW Tax largely depends on the effective use of tax revenue. The use of GW Tax revenue includes the promotion of the Joint Crediting Mechanism (see section VI, subsection on Joint Crediting Mechanism). However, the revenue from the GW Tax is lumped together with the revenue from the Petroleum and Carbon Tax, and it is not possible to track in detail how the GW Tax portion was spent during FY2012 and FY2013.

Emissions Trading Schemes

Although Japan has considered introducing a nationwide mandatory emissions trading scheme (ETS), it has yet to do so.[14] Beginning in 2005, the MOE oversaw the Japan Voluntary Emissions Trading Scheme (JVETS), a voluntary trial scheme that ended in March 2014 after seven terms, in order to gain experience and knowledge in establishing a nationwide cap-and-trade ETS. JVETS was subsidy-assisted: participants could receive subsidies up to a third of total project cost for the installation of emission-saving facilities (MOE, 2011b). The invitation to join JVETS was extended at the business facility level (e.g., factories and offices), and participants could join and leave on a term basis. The number of participants ranged between 21 and 89 per term, and the aggregate number of participants over the seven terms totaled 389. Because JVETS was developed mainly for businesses not part of the Voluntary Action under Keidanren (the most influential business association in Japan; see subsection on The Keidanren's Voluntary Action Plan (VAP) toward 2020, below), the coverage of CO_2 emissions was limited throughout the seven terms. The largest coverage of CO_2 emissions was 3.4 Mt/yr (0.3 percent of national total CO_2 emissions in 1990) observed for the fourth term. The author's analysis, based on a report from the Ministry of Environment (MOE, 2014b), indicates that cumulative total CO_2 emissions reductions during the seven terms between FY2005 and FY2012 amounted up to 2.2 Mt-CO_2, or a 24.1 percent reduction compared to the cumulative total base year emissions. The annual average prices ranged between JPY216/t-CO_2 (USD2.2/t-CO_2, FY2012) and JPY1,250/t-CO_2 (USD13/t-CO_2, FY2007) (MOE, 2014b).

The Trial Implementation of an Integrated Domestic Market for Emissions Trading ("Trial Integrated Market") began in 2008 with the aim of linking the MOE-led JVETS and METI-led Keidanren's Voluntary Action Plan (VAP; see subsection on The Keidanren's Voluntary Action Plan (VAP) toward 2020, below) for the KP-CP1 (GWPH, 2008). The participants of the Trial Integrated Market are also able to meet their targets flexibly by banking and borrowing their emissions allowances, and by using credits obtained through a so-called Domestic Clean Development Mechanism baseline-and-credit scheme run by METI (GWPH, 2008).[15] The Trial Integrated Market attracted greater participation than JVETS, covering about half of national total CO_2 emissions at the start (Mochizuki, 2011). There is, however, a limited amount of up-to-date information available on the coverage of CO_2 emissions and the amount of emissions reductions achieved under the Trial Integrated Market.

Without an ambitious mitigation target for 2020, and given the strong opposition from businesses and industries (Keidanren, 2012), it is unlikely that the Trial Integrated Market will develop into a full-fledged national ETS scheme in the near future.

Power Sector

In FY2012, Japan's power sector accounted for 478 Mt-CO_2/yr, or 37 percent of national total GHG emissions (excluding LULUCF). CO_2 emissions from power generation have increased by about 65 percent since FY1990 (290 Mt-CO_2/yr), mainly because of increased electricity demand (880 TWh in FY2012 compared to 748 TWh in FY1990) and the increased use of fossil fuel-fired power plants following the Fukushima nuclear disaster (0.53 kg/kWh in FY2012 compared to 0.39 kg/kWh in FY1990). The increase in electricity use was observed mainly in the residential and commercial sectors, which together are responsible for more than 60 percent of power sector emissions. The power sector is subject to the GW Tax, but it can pass on the additional costs to final consumers.

Some of the recent important developments with regard to GHG emissions reductions include the CO_2 emissions guidelines for thermal power plants and the feed-in tariff scheme.

Thermal Power Plant Emissions Guidelines

There are no legally enshrined CO_2 emissions standards available to date. However, there has been movement within the government toward restricting the uncontrolled expansion of coal-fired power plants to minimize the increase of CO_2 emissions in the power sector. In April 2013, when Tokyo Electric Power Company (TEPCO) was preparing for a call for bids on new thermal power plants of total 2.6 GWe to start operating between 2019 and 2021, METI and the MOE developed guidelines for CO_2 emissions from new fossil fuel-fired power plants as part of a legally mandatory environment impact assessment procedure (METI and MOE, 2013). The guidelines accept coal-fired power plants provided that they use at least Best Available Technology and are consistent with the mid- and long-term national mitigation goals (TEPCO, 2013). Assuming a CO_2 emissions factor of 780g/kWh representative for ultrasupercritical plants, and the capacity factor of 90 percent, the TEPCO plan may lock in additional CO_2 emissions of about 16 Mt/yr for the next decades.

With regard to Best Available Technologies, the guidelines provide a list of technologies and their efficiencies, which will in principle be updated every year. Table 4 presents the benchmark efficiencies of Best Available Technologies for new coal power plants indicated in the guidelines. It should be noted that when it submitted a bid, TEPCO set a requirement for electricity generation cost that can be achieved only by coal-fired power plants.

Table 4 | **Best Available Technologies as Benchmarks for New Coal Power Plants (Commercialized Technologies Only)**

PLANT SCALE	TECHNOLOGY (WITHOUT CCS)	NET EFFICIENCY (LHV)
900–1,100 MW	USC	42%
700 MW	USC/SC	42%
600 MW	USC	41%
200 MW	Subcritical	40%
	IGCC	42%

Notes: USC: ultrasupercritical, SC: supercritical, IGCC: integrated gasification combined cycle, CCS: carbon capture and storage, LHV: lower heating value.
Source: METI, 2014b.

With regard to the consistency of new coal-fired power plants with mid- and long-term national mitigation goals, the guidelines stipulate that excess CO_2 emissions in comparison with gas-fired power plants must be offset with international credits through, for example, the Clean Development Mechanism (CDM) under the UNFCCC and Japan's Joint Crediting Mechanism (see section VI, subsection on Joint Crediting Mechanism), in the absence of a mitigation framework for the power sector (for midterm). The guidelines also state that the deployment of innovative mitigation technologies such as carbon capture and storage (CCS) should be continually considered for plants that are likely to be operating in 2050. However, the guidelines do not clarify whether newly built plants should be "CCS ready" or give development timelines for CCS technology.

Without stringent CCS requirements, the current guidelines on coal-fired power plants are likely to have implications for future GHG emissions trends and costs. The construction of new coal-fired power plants locks in a considerable amount of CO_2 emissions. To meet its 2020 target, Japan would need to rely on unproved technologies such as CCS, the installation schedule of which is uncertain. Moreover, for "non-CCS ready" plants, the cost of retrofitting CCS can be very costly.

The abovementioned power plant emissions guidelines impeded the government's promotion of high efficiency coal-fired power plants within and outside Japan, as reflected in the 2014 BEP and in the government's Action for Cool Earth (MOFA, METI, and MOE, 2013). The government considers high-efficiency coal-fired power plants to be a key technology for reducing Japan's energy import costs and decreasing CO_2 emissions in developing countries, as well as important export products. The Japanese climate finance portfolio includes construction of coal-fired power plants through the Japan International Cooperation Agency and Japan Bank for International Cooperation (Kuramochi et al., 2012; Nakhooda et al., 2013).

Renewable Energy Promotion

The share of renewable energy (including large hydropower) in Japan's total primary energy supply has been very small, increasing from 3.5 percent in 1990 to 4.6 percent in 2012 (IEA, 2013a). The main policy measure to promote renewable energy deployment in Japan is the feed-in tariff (FIT) scheme.

FEED-IN TARIFF (FIT) SCHEME

The *Act on Special Measures concerning the Procurement of Renewable Electric Energy by Operators of Electric Utilities* ("*Renewable Energy Act*" [Act No. 108, 2011]) is one of the more successful pieces of legislation on renewable energy promotion in Japan to date. Other legislation was introduced before the *Renewable Energy Act*, such as the 2003 Renewable Portfolio Standard (RPS) and a FIT for residential solar PV, but they were unsuccessful in boosting renewable energy deployment. Propelled partly by the increased interest in renewable energy following the Fukushima disaster, the *Renewable Energy Act* passed the Diet in August 2011 and was enacted in July 2012. It requires electric utility operators to purchase all the renewable electricity generated[16] from most of the renewable energy sources (solar, onshore wind, geothermal, biomass, and hydro smaller than 30 MW) (METI, 2013d).[17] As of FY2014, offshore wind power is included in the FIT scheme (METI, 2014c).

Under the FIT scheme, electric power utilities collect surcharges from electricity users to cover the costs of purchasing renewable electricity.[18] The introduction of the revised FIT scheme boosted renewable energy installations, in particular solar PV due to the high FIT level (JPY42/kWh = USD0.42/kWh for 20 years at the start of the scheme), which was among the highest in the world (WWF Japan, 2012). Between July 2012 and December 2013, 7 GW of new renewable power capacity became operational, 97 percent of which was solar PV (METI, 2013e). Moreover, the new installation applications approved by METI during the same period was as high as 30 GW, with solar PV accounting for 94 percent. These numbers are particularly notable when compared with the total national renewable power capacity of around 20 GW (excluding large hydropower) before the FIT scheme started. When assuming capacity factors reported in a government report (NPU, 2011), the renewable capacity approved under the FIT scheme as of December 2013 could generate about 38 TWh, which is over 3 percent of national total electricity generation today. The Japan Renewable Energy Foundation estimates that the current renewable power capacity can provide 12.7 percent of total electricity generation (JREF, 2014)—close to the deployment target of 13.5 percent indicated in the 2014 BEP.

Solar PV's higher profitability compared to other renewables due to initial high tariff rates may have hindered the deployment of other renewables. In April 2013, the FIT for solar PV was reduced by 10 percent while FITs for other

renewables were kept unchanged (METI, 2013e) to adjust for the declining PV module price and achieve a more balanced deployment of various renewable energy sources.

To reduce the burden on large electricity users, targeted businesses receive an 80 percent discount on the surcharge. Manufacturing companies with specific electricity consumption per sales more than eight times higher than the sector average and nonmanufacturing companies with specific electricity consumption per sales more than 14 times higher than the sector average benefit from this discount.[19]

The current FIT scheme design faces a number of challenges. First, there is a large discrepancy between the actual installed capacity (5.3 GW) and the approved installation capacity (30.3 GW), which is particularly large for nonhousehold facilities (Table 5).

One explanation for this discrepancy is the absence of a time limit for the start of operation after a renewable energy facility is approved for FIT. The FIT rate of a renewable energy facility is determined at the time the application for facility installation is approved by the government. However, there was no requirement for when the facility must start operating following government approval.[20]

This approach may have provided perverse incentives to operators who could maximize profits by first securing a high tariff rate at an early stage of the FIT scheme, then postpone actual installation until the installation cost fell (Mainichi, 2013). METI recently investigated the status of installations at nonhousehold facilities approved during FY2012 (METI, 2014d). It found that 672 approved facilities with total capacity of 3 GW had either not secured land (purchased or leased) or ordered the purchase of a solar PV system,[21] or did not respond to the inquiry from METI. To resolve this problem, revised regulations require that from FY2014 onward, approved facilities must prove to METI that they have secured land and PV systems within 180 days of the approval (METI, 2014c).

A second challenge facing Japan's FIT scheme is that although the *Renewable Energy Act* mandates that renewable electricity be given priority access to the grid, this requirement is undermined by exceptions. Electric utilities are permitted to refuse to buy and/or grant grid access to renewable electricity if needed to secure stable electricity supply. No institution reviews such refusals, and there is a risk of electric utilities abusing the right. Since the start of the FIT scheme in July 2012, there have been several cases of renewable electricity refusal (Jones Day, 2013).

Table 5 | **Current Status of Renewable Electricity Deployment Under the Feed-in Tariff Scheme**

PERIOD/GENERATION CAPACITY / TECHNOLOGY	BEFORE JULY 2012	JULY 2012–DECEMBER 2013		
	CUMULATIVE INSTALLED CAPACITY (MW)	FACILITIES THAT BEGAN OPERATING (MW)	FACILITIES APPROVED FOR FIT (MW)	PERCENTAGE OF FIT-APPROVED FACILITIES IN OPERATION
Solar PV (households)	4,700	2,016	2,257	89.3%
Solar PV (nonhousehold)	900	4,829	26,124	18.5%
Wind	2,600	74	956	7.7%
Small–medium hydro (< 30 MW)	9,600	5	244	2.0%
Biomass	2,300	119	716	16.6%
Geothermal	500	1	13	7.7%
Total	20,600	5,275	30,311	17.4%

Source: METI, 2013e.

SUBSIDIES AND TAX BENEFITS

For residential applications, solar PV systems with a capacity below 10 kW (the scale range in which FIT is only applicable to excess electricity generated) were eligible for a subsidy. Installations with system prices of JPY410,000–500,000/kW (USD4,100–5,000/kW) will receive JPY15,000/kW (USD150/kW). Those with prices of JPY20,000–410,000/kW (USD200–4,100/kW) would receive JPY20,000/kW (METI, 2014e). This subsidy scheme terminated at the end of FY2013.

For commercial applications, the currently available subsidy schemes cover renewable installations not approved or eligible for the FIT scheme. For renewable electricity, subsidies of up to 50 percent of the installation cost for public entities and one-third for private entities are provided for those not approved for the FIT. The subsidy scheme covers electricity from solar PV, wind, biomass, hydro, and geothermal to be self-consumed within the area (METI, 2014e). For renewable heat, both public and private entities can receive subsidies up to 50 percent of the installation cost for public entities and one-third for private entities.[22] The subsidy scheme covers facilities that utilize various renewable thermal energy sources ranging from solar heat to snow and ice (METI, 2014e). The mitigation impacts of these subsidies are not indicated in the public literature.

A number of tax benefits are also available for renewable energy installations. For residential applications, there is no tax break scheme specific to renewable energy. However, solar PV installations can be part of the income tax deduction scheme for household energy efficiency improvement constructions. This home renovation tax deduction scheme applies to the costs for retrofit of all residential windows plus additional measures such as floor insulation, ceiling insulation, wall insulation, and solar PV installation. Income tax equivalent to 10 percent of the total renovation cost will be deducted if the total cost exceeds JPY300,000 (USD3,000) and the residential space renovation accounts for more than half of the total cost (METI, 2014e). The deduction is not applicable to the portion of the renovation cost that is subsidized.

For commercial facilities, either deduction of renewable facility purchase tax or preferential depreciation is applicable for approved facilities that started operating within a year after the acquisition of the facility (METI, 2014e). In particular, solar PV and wind power facilities that are approved for FIT are eligible for a tax deduction. These tax breaks are part of the Green Investment Tax Break scheme, which also applies to other low-carbon energy installations until the end of FY2015.[23] In addition, facilities approved for a FIT are eligible for a one-third reduction of the fixed asset tax for the first three years. The mitigation impacts of these taxation measures are not reported in the public literature.

Support for Cogeneration System Installation

A decentralized energy system is one of the key components of Japan's post-Fukushima energy policy. Accordingly, METI launched a number of new schemes in FY2013 to promote distributed energy generation (METI, 2013f).[24] First, in FY2013 it introduced a new subsidy scheme to promote installation of cogeneration systems (with a budget of JPY25 billion, or USD250 million, for the establishment of a fund) (METI, 2013g). METI states that its priority is to support installations of relatively large-scale facilities able to supply electricity to the grid. Second, the government reduced fixed asset taxes for cogeneration systems approved by the end of FY2014 (tax exemption for one-sixth of the asset values) for three years from their installation (METI, 2013h). Third, until the end of FY2014, the installation of cogeneration systems will be eligible for a tax deduction (METI, 2013h). No quantitative targets regarding these cogeneration support schemes are provided.

Industry

In FY2012, the total GHG emissions from the industrial sector, including direct emissions and indirect emissions from electricity use, amounted to 487 Mt-CO_2e/yr (author's calculation based on data from GIO 2014b), equivalent to 36 percent of national total GHG emissions (excluding LULUCF). Compared to 1990, industrial emissions have decreased by 16 percent from 582 Mt-CO_2/yr.

Energy Conservation Act: Sectoral Benchmarks

The 2008 revision to the *Energy Conservation Act* introduced sectoral energy efficiency benchmarking. Since 2010, operators in energy-intensive sectors (such as iron from blast furnaces; steel from electric furnaces; power generation; cement, paper and paperboard; petroleum refining; basic petrochemicals; and soda) are encouraged to meet the benchmark set for each sector. Operators are required to annually report their progress toward the achievement of the benchmarks. Sectoral benchmarks are set by METI to levels that only 10 to 20 percent of the operators in the relevant sectors can easily meet. This

forward-looking approach contrasts with the existing *Energy Conservation Act*, which encourages businesses to improve their energy efficiency in comparison with past results. The annual sectoral report discloses information such as the name and number of companies that achieved the target and the average value and standard deviation of energy intensity results. There are neither penalties for falling short of the target nor incentives for achieving the target, and it is not clear how often the benchmarks will be updated. Consequently, benchmarking primarily helps business operators identify where they stand and encourages them to improve their energy efficiency. For FY2012, 176 business operators reported their achievement status, with 32 operators surpassing the benchmarks (METI, 2013i).

The Keidanren's Voluntary Action Plan (VAP) toward 2020

In 1997, just before the Kyoto Protocol was adopted, the Keidanren, the most influential business association in Japan, launched the Voluntary Action Plan (VAP) on the Environment (Keidanren, 1997). As an organization whose members account for the large majority of emissions from energy conversion and industrial sectors,[25] the Keidanren aimed to reduce average CO_2 emissions from these sectors for FY2010 to below FY1990 levels through the VAP (Keidanren, 1997). VAP participants were given flexibility in setting their voluntary targets (between energy and emissions, and between total quantity and intensity). This voluntary commitment by a major industrial organization was seen as a preemptive measure, designed to avoid government imposition of carbon pricing, against the expected outcomes of the Kyoto negotiations (van Asselt, Kanie, and Iguchi, 2009). In fact, the progress of the VAP was later monitored under the Kyoto Protocol Target Achievement Plan enforced in 2005, despite the plan's "voluntary" nature (Wakabayashi and Sugiyama, 2007). After 2008, a total of 61 sectors participated in the VAP (Keidanren, 2013a).

For the KP-CP1, the Keidanren reports that it has surpassed the target pledged under the VAP; the CO_2 emissions from its members in FY2010 decreased by 9.5 percent from FY1990 levels excluding credits, and 12.1 percent including credits (Keidanren, 2013a), through sectoral actions under the VAP as well as government policies on energy efficiency. Between different target types, Sugino and Arimura (2011) show that sectoral actions with absolute targets were effective in increasing energy efficiency improvements but not for those with relative targets. It is worth noting that some members of the Keidanren purchased large amounts of credits to meet their own sectoral emissions targets even though the Keidanren as a whole could achieve the target without credits. In particular, the power sector purchased 273 Mt-CO_2e of credits during the KP-CP1 (MOE, 2013b) in order to reduce the CO_2 emissions intensity for power generation by 20 percent, down to 0.34 kg-CO_2/kWh from FY1990 levels (GoJ, 2010b).

The Keidanren plans to continue this approach for the period up to 2020; in December 2009, it announced the development of a new voluntary mitigation plan, *The Commitment to a Low Carbon Society* (hereinafter, *Commitment*), which covers the period up to 2020 (Keidanren, 2009). Launched in January 2013 (Keidanren, 2013b), the *Commitment* features four approaches to reducing emissions: (i) emissions reduction targets for domestic business operations up to 2020, (ii) reductions in product life cycle CO_2 emissions, (iii) CO_2 emissions reductions outside Japan through technology transfer, and (iv) development of innovative technologies (Keidanren, 2013b). Forty-three sectors have submitted their targets to date; seven additional sectors have expressed their intention to participate in the *Commitment* (Keidanren, 2013b).

Unlike the VAP for the KP-CP1, there is currently no mitigation target for the Keidanren as a whole under the *Commitment* for the period up to 2020, in part because there is no national mitigation target and there is considerable uncertainty concerning the power sector. Each industrial organization developed its own emissions reduction targets with the same flexibility on target setting as under the VAP. The progress under the *Commitment* will be monitored and reported by each industrial organization and verified by a third-party committee from target setting to emissions results. However, it is not entirely clear from the literature how business-as-usual (BAU) emissions are defined and emissions reductions targets for each sector are estimated. Moreover, it is unclear how emissions reductions from product life cycles and technology deployment overseas would be monitored and verified. In addition, the Keidanren does not define "innovative technologies" and how the BAU technology development scenario would compare to the targets of each sector.

The assumptions for future economic growth, including future industrial production growth, have been contentious in the formulation of future mitigation targets (e.g., MOE, 2012b; NIES, 2009). In an important step

Table 6 | **Overview of 2020 Emissions Reduction Targets for Carbon-Intensive Sectors Described in Keidanren's *Commitment* to a Low-Carbon Society**

SECTOR (UNIT OF ACTIVITY: BASE YEAR)	INDICATOR	ANNUAL PRODUCTION	ANNUAL CO_2 EMISSIONS (MT/YR)	SPECIFIC CO_2 EMISSIONS (T/UNIT PRODUCT)
Iron and steel (Mt crude steel: FY2005)	Base year data	108	187	1.73
	BAU projections for 2020	115	195	1.70
	2020 target under the *Commitment*		190	1.66
	2020 target vs. BAU (in percentage)	—	-5 (-2.6%)**	-0.04 (-2.6%)**
	2020 target vs. BY (in percentage)**	—	3.4 (1.8%)	-0.1 (-4.1%)
Chemicals (in million kLCOE: FY2005)	Base year data	29.1	67.4	2.32
	BAU projections for 2020	29.0	67.3	2.32
	2020 target under the *Commitment*		65.8	2.27
	2020 target vs. BAU (in percentage)	—	-1.5 (-2.2%)**	-0.05 (-2.2%)**
	2020 target vs. BY (in percentage)**	—	-1.6 (-2.4%)	-0.1 (-2.2%)
Cement (Mt cement: FY2010)	Base year data	56.1	4.95 million kLCOE (21.8 Mt-CO_2, excl. process emissions)	3.43 GJ/t cement
	BAU projections for 2020	56.2	NA	NA
	2020 target under the *Commitment*		4.89 million kLCOE	3.37 GJ/t cement
	2020 target vs. BAU (in percentage)	—	0.056 million kLCOE (-1.1%)**	NA (-1.7%)**
	2020 target vs. BY (in percentage)	— —	NC	
Pulp and paper (Mt paper and paperboard: FY2005)	Base year data	27.3	24.8	0.91
	BAU projections for 2020	24.7	22.4	0.91
	2020 target under the *Commitment*		21.0	0.85
	2020 target vs. BAU (in percentage)	—	-1.4 (-6.2%)**	-0.06 (-6.2%)**
	2020 target vs. BY (in percentage)	—	-3.7 (-15%)**	-0.06 (-6.2%)**
Refineries (energy consumption in million kLCOE: FY2009)*	Base year data	16.3 million kLCOE	39.2	2.4 t/kLCOE*
	BAU projections for 2020	NA	NA	NA
	2020 target under the *Commitment*		Energy efficiency measures equivalent to 1.4 Mt-CO_2/yr reduction (530 thousand kLCOE)	NC
	2020 target vs. BAU (in percentage)	—	NC	
	2020 target vs. BY (in percentage)	—		

Notes: NA: not available; NC: not calculable. *Excludes reductions due to the improvement of electricity CO_2 emissions factor, unless otherwise noted. **Author's calculation.
Sources: Based on Keidanren, 2014, 2013a, 2013b, and author's own calculations.

forward, under the *Commitment*, certain key sectors (such as the iron and steel industry) provide emissions or energy targets for different future production activity levels to account for the impact of assumptions for future production levels on baseline emissions.

Table 6 presents the voluntary action plans under the *Commitment* submitted by the major emitting sectors as of November 2013 (Keidanren, 2013b). The Keidanren's emphasis on various indirect CO_2 emissions reductions and its aims for limited direct emissions reductions are reflected in the data.

Carbon Capture and Storage

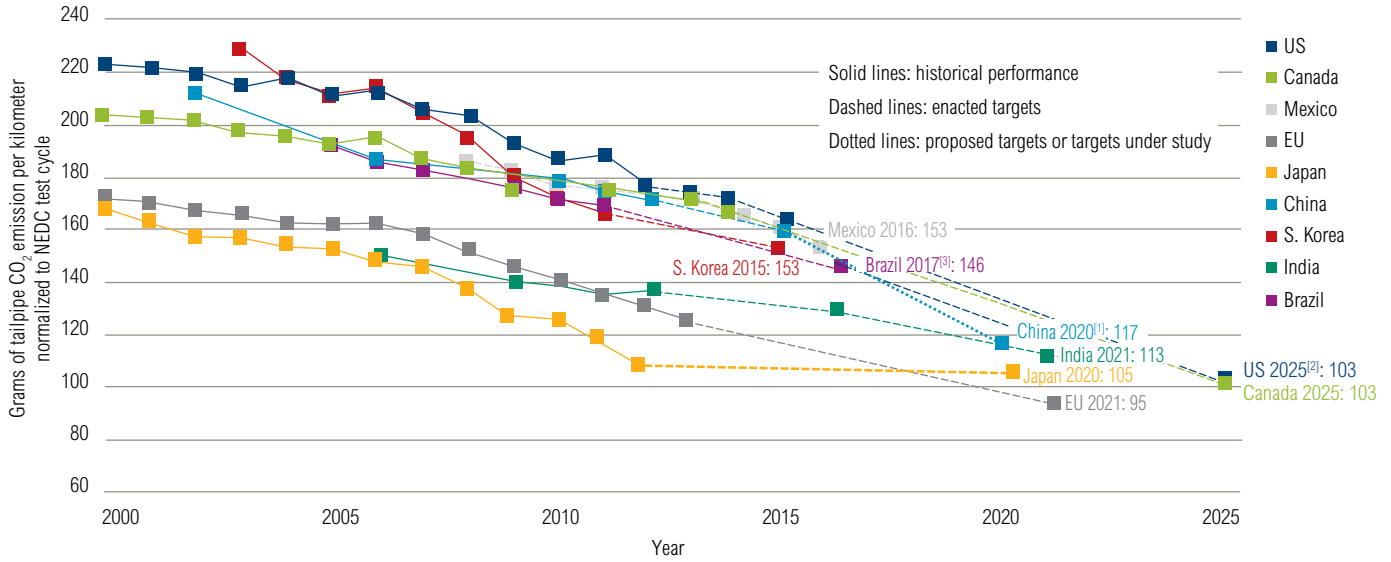
Carbon capture and storage (CCS) will be a crucial technology for Japan if it is to achieve its long-term mitigation target. CCS deployment is often referred to as a tool for harmonizing the long-term mitigation goals and current energy policy, particularly on the construction of coal-fired power plants. With regard to policy targets for future CCS deployment, however, the 2014 BEP took a step backward from the 2010 BEP by failing to indicate the timeline for CCS deployment or require that newly built coal-fired power plants be "CCS-ready."[26]

On the ground, the first full-scale domestic CCS demonstration project was launched in Tomakomai using CO_2 from an oil refinery (Japan CCS, 2012). The Japan Iron and Steel Federation has also been testing hydrogen-reduction blast furnace technology with CCS ("COURSE50"), which will likely be deployed around 2030 provided that CO_2 storage infrastructure and economic conditions exist (Keidanren, 2013b).

Transport

The transportation sector accounted for 226 Mt-CO_2/yr, or 18 percent, of the total energy-related CO_2 emissions in FY2012, with the vast majority being direct emissions from fuel consumption. Policies to reduce emissions from the transportation sector include energy efficiency standards, tax breaks, and subsidies to promote the purchase of vehicles with lower emissions and higher fuel efficiency. Recent policies target passenger vehicles, with the fuel efficiency standards updated in 2011 (described below). In contrast, the standards for heavy duty vehicles have not been updated since 2006 (Transportpolicy.net, 2014).

Figure 5 | **Comparison of Historical and Future Specific CO_2 Emissions Per Distance Driven Across Selected Major Economies**



Notes: NEDC = New European Driving Cycle. Supporting data can be found at http://www.theicct.org/info-tools/global-passenger-vehicle-standards. [1] China's target reflects gasoline vehicles only. The target may be higher after new energy vehicles are considered. [2] US fuel economy standards set by National Highway Traffic Safety Administration reflecting tailpipe GHG emission (i.e. exclude low-GWP refrigerant credits). [3] Gasoline in Brazil contains 22% of ethanol (E22), all data in the chart have been converted to gasoline (E00) equivalent.
Source: ICCT, 2014.

Energy Efficiency Standards for Vehicles (Top Runner Standards)

METI and the MLIT jointly regulate vehicle fuel efficiency standards, which have been in place for more than three decades. The *Energy Conservation Act* of 1979 introduced fuel efficiency standards for passenger and heavy duty vehicles. Passenger and freight vehicles were included in the Top Runner Program products in 1998 (MLIT, 2013a). The current targeted fuel efficiency standard for FY2020 set in 2011 is 20.3 km/litre. By achieving this standard, the average fuel efficiency of passenger vehicles will increase by 24.1 percent compared to that in 2009 (METI, 2011c). Government policies and the innovative work of domestic car manufacturers have helped Japan maintain one of the world's most efficient passenger vehicle fleets (ICCT, 2011).

The literature indicates, however, that Japan's current energy efficiency standard for FY2020 is not the most ambitious when compared with that of other countries. The International Council on Clean Transportation (ICCT, 2013) estimates that Japan may soon fall behind the European Union in vehicle fuel efficiency and specific CO_2 emissions per distance driven; by 2020, the United States and China are expected to catch up to Japan (see Figure 5). Moreover, Lipscy and Schipper (2013) demonstrate that, when traffic congestion is taken into account, the actual fuel economy observed for Japan does not differ significantly from that observed in the United States. The ICCT (2011) points out that the current regulations divided by vehicle weight classes discourage efficiency improvement through vehicle weight reduction.

Eco-Car Tax Break and Subsidy

The 2014 BEP aims for 50 to 70 percent of new cars to be "next-generation" vehicles (electric vehicles, fuel cell vehicles, and plug-in hybrids, as well as clean diesel vehicles and natural gas vehicles)[27] (METI, 2014a). In 2009, the government started promoting next generation vehicles through tax breaks and subsidies (House of Representatives, 2009). Tax breaks for more environmentally friendly vehicles are available for three automobile taxes: tonnage, acquisition, and ownership. Next-generation vehicles and internal combustion engine vehicles, including hybrids,[28] receive tax breaks. The tax break period for tonnage and acquisition taxes was extended for three years until 2015 (MLIT, 2012a).

The level of tax deduction depends on the level of fuel efficiency and type of vehicle. Next-generation vehicles and internal combustion engine vehicles (including hybrids) with fuel efficiency more than 20 percent higher than the FY2015 standard will receive the maximum tax reduction: exemption from the tonnage tax at the first safety inspection and 50 percent reduction at the second inspection, exemption from the acquisition tax, and approximately 50 percent reduction of the property tax. At the same time, an approximately 10 percent increase in the automobile property tax will be enforced for diesel vehicles over 11 years old and gasoline vehicles over 13 years old.

The eco-car subsidy was also available for two periods: between April 2009 and September 2010, and between December 2011 and September 2012 (Cabinet Office, 2012). In the latest eco-car subsidy scheme, regular and light vehicles registered between December 2011 and January 2013 were given subsidies of JPY100,000 (USD1,000) and JPY70,000 (USD700), respectively, if they met the FY2015 fuel efficiency standard or exceeded the FY2010 fuel efficiency standard by 25 percent (Next Generation Vehicle Promotion Center, 2014a). The scheme was so popular that the application period for the subsidy closed in September 2012 because the budget limit had been reached (Next Generation Vehicle Promotion Center, 2014b).

The CO_2 mitigation impacts of these financial support schemes for new vehicles are debatable (JCER, 2010; Suganuma, 2011). The Japan Center for Economic Research (JCER, 2010) indicates that the eco-car subsidy and tax break schemes for FY2009 would contribute to CO_2 reductions equivalent to only 0.1 percent of total national emissions in 2020 at a specific mitigation cost of JPY56,000 (USD560) per t-CO_2.

Residential and Commercial Sectors

The residential and commercial sectors directly and indirectly accounted for 475 Mt-CO_2/yr, or 35 percent of national total GHG emissions in FY2012 (excluding LULUCF) and have increased by nearly 60 percent since 1990 (292 Mt-CO_2/yr). In other words, the importance of these two sectors in Japan's domestic GHG emissions reductions is growing rapidly.

Energy Conservation Act: Building standards

As with business entities, builders (of new buildings) and owners (of existing buildings) are required to submit energy-saving plans for new construction or extensive renovations. The 2008 revision of the *Energy Conservation Act* (which entered into force in 2010) expanded its regulatory coverage of buildings by lowering the minimum floor space from 2,000 m^2 to 300 m^2. At the same time, the regulations were strengthened by allowing governing agencies to issue orders in case of "significantly insufficient" energy-saving measures and to penalize builders and owners for refusing orders (METI/ECCJ, 2011).

Thermal insulation performance standards are also applied to new noncommercial buildings under the *Energy Conservation Act,* but this measure has not been effective for two main reasons. First, the government has not updated the standards since the last revision in 1999. Japan's 1999 standards for residential buildings are lax compared to those in other developed countries such as France, Germany, Sweden, the United Kingdom, and the United States (MLIT, 2013b). Second, thermal insulation performance standards are not mandatory. For FY2011, the rates of compliance with the 1999 standards for newly built nonresidential and residential buildings were 85 percent and 49 percent, respectively (MLIT, 2013c). The Japanese government announced a roadmap to gradually mandate compliance with thermal insulation performance standards by 2020 (MLIT, 2013b), but it has not yet announced a full revision of the current standards.

In addition, the latest amendment of the *Energy Conservation Act*, in 2013 (METI, 2013j), adds building materials (e.g., windows and insulation materials) to the Top Runner Program. This is the first time that the Top Runner Program has been applied to products other than machinery and equipment that consume energy.

Promotion of Zero Energy and Energy-Saving Buildings

"Zero Energy Buildings and Houses" achieve a net annual primary energy consumption of zero or almost zero through various energy-saving measures, and by using renewable energy onsite (METI, 2011a). MLIT, in collaboration with METI and the MOE, has prepared a timeline to start deploying Zero Energy Buildings and Houses by FY2020 and have required the average net energy consumption of newly constructed buildings and houses to be zero by 2030. The target is to increase the total floor space of environmentally friendly real estate to 10 million m^2 by 2020 (MLIT, 2013d). Information from the Zero Energy Promotion Office (2014) indicates that for FY2013, the total subsidy to builders amounted to JPY5.7 billion (USD57 million), with the aggregated energy-saving effects of over 18,000 kLCOE per year.

Agriculture, Forestry, and Other Land Use

The agriculture sector accounted for a relatively small share of national GHG emissions (29 Mt-CO_2e/yr in 2012, including direct emissions and indirect emissions from electricity use). Agriculture, forestry, and other land use (AFOLU) has been particularly important for Japan with regard to domestic GHG emissions reduction because Japan accounted for carbon removal by forest sinks equivalent to 3.8 percent of 1990 emissions to achieve the Kyoto target.

For the post-2012 period, Japan aims to take full advantage of carbon removal by forest sinks allowed under the UNFCCC regime—3.5 percent of total GHG emissions in 1990 (UNFCCC, 2011). The government has adopted a forest sequestration target of 3.5 percent on average between 2013 and 2020, and about 3 percent in 2020 through enhanced forest management (GoJ, 2013a).

The Ministry of Agriculture, Forestry, and Fisheries (MAFF) aims to reduce GHG emissions from the agricultural sector by 0.6 Mt-CO_2e/yr by 2020 compared to 2005 levels. To achieve this target, funds from the national budget are allocated to promote energy and resource saving technologies in the agricultural sector, and to develop an accounting methodology for carbon sequestration in agricultural soil (MAFF, 2013).

Major Subnational Policies

Japan comprises 47 prefectures, including the Tokyo Metropolitan Government (TMG). All local government bodies were instructed to develop their own mitigation action plans under the *GW Countermeasures Promotion Act* (2002 revision). For the KP-CP2, 29 prefectures have set GHG mitigation targets for 2020 and/or 2030 as of October 2012. These prefecture targets cover about 750 Mt-CO_2/yr on the base year basis (FY2008–10), with an average mitigation target of 19 percent (MOE, 2013c). It is uncertain whether these prefecture-level midterm

mitigation targets will remain in place after the announcement of the Warsaw Target, as they were formulated to be consistent with the Copenhagen Pledge.

Local governments have limited authority to independently formulate climate policies because the *GW Countermeasures Promotion Act* provides them neither the legal competence nor the support necessary to reduce their GHG emissions (Sugiyama and Takeuchi, 2008). Therefore, the local government actions have been limited to the formulation of action plans and awareness-building activities, and it is only in recent years that some local governments started using local ordinances to commit to more concrete climate actions (Sugiyama and Takeuchi, 2008).

Tokyo Cap-and-Trade System

This subsection describes the Tokyo cap-and-trade system as an example of prefectural efforts to achieve midterm mitigation targets, and the *Low-Carbon City Promotion Act* as an example of recent national legislation to stimulate local government actions.

The city of Tokyo emitted 57 Mt-CO_2e of GHG in FY2010 (including indirect emissions from the use of electricity generated outside Tokyo), accounting for around 4.5 percent of national total GHG emissions (TMG, 2013a). Tokyo aims to reduce its GHG emissions by 25 percent from 2000 levels by 2020 (TMG, 2007).

The Tokyo Metropolitan Government introduced Japan's first mandatory cap-and-trade emissions trading scheme (ETS) in April 2010 (TMG, 2010a). The Tokyo ETS covers 1,100 office buildings and 300 factories, which in total account for about 13 Mt-CO_2e/yr, or more than 20 percent of Tokyo's total GHG emissions (TMG, 2010b). Businesses with annual fuel, heat, and electricity usage of more than 1,500 kLCOE are covered by the Tokyo ETS. ETS participants are also required to report their nonenergy emissions of CO_2, CH_4, N_2O, PFC, HFC, and SF_6. In addition to trading excess emissions reductions, various offset credits (e.g., renewable energy credits and emissions reductions from smaller business facilities within and outside Tokyo) can also be used under the Tokyo ETS. Businesses that fail to meet their reduction obligations are ordered to reduce their emissions by 1.3 times the reduction shortage. Businesses that violate this order will have to pay the monetary value of the reduction shortage and an additional penalty up to JPY500,000 (USD5,000). In addition, they face public disclosure.

The first compliance period for the Tokyo ETS runs from FY 2010 through FY 2014, and the emissions reduction target is set at 6 to 8 percent (period average, depending on business facility types) below the baseline levels. The baseline emissions are defined as the average emissions of any consecutive three-year period between FY2002 and FY2007 selected by the emitters themselves. The CO_2 emissions factor for grid electricity is fixed at the average of the three-year period between FY2005 and FY2007 throughout the first compliance period (382 g-CO_2/kWh).

The preliminary results for 934 out of a total 1,392 facilities covered by the ETS indicate that the emissions in FY2011 were 23 percent lower than the baseline levels (TMG, 2013b). The reduction target for the second compliance period (FY2015–FY2019) is currently planned at 17 percent below the baseline levels. The CO_2 emissions factor for the second compliance period will be revised upward to reflect the increased fossil fuel–fired power generation following the Fukushima nuclear disaster (TMG, 2013c). A survey commissioned by the Tokyo Metropolitan Government estimated trading prices of JPY8,000–10,000 (USD80–100) per t-CO_2 for excess emissions reductions and JPY9,000–11,000 (USD90–110) per t-CO_2 for renewable energy credits as of November 2013 (TMG, 2013d).

In FY2011, neighboring Saitama Prefecture introduced a regional ETS similar to the Tokyo ETS, with baseline CO_2 emissions of 7.6 Mt. The emissions credits from the Tokyo ETS and the Saitama ETS are mutually tradable.

Low-Carbon City Promotion Act (2012)

Approximately 50 percent of Japan's total CO_2 emissions come from the residential, commercial, and transport sectors, which together represent urban economic activities. In the future, local governments are likely to face challenges to growth, including an aging and decreasing population and the consequent decline of revenues (MLIT, 2012b).

The 2012 *Low-Carbon City Promotion Act* (Act No. 84, 2012, hereinafter "*City Act*") aims to promote cross-sectoral emissions reductions through the development of compact cities to achieve both low-carbon urban

development and more efficient city administration. The *City Act* provides tax breaks for certified energy efficient buildings that reduce primary energy consumption by more than 10 percent compared to the reference level (based on the thermal insulation performance standard under the *Energy Conservation Act*), combined with low-carbon measures such as home energy management systems, water saving measures, the use of timber as building materials, and "heat-island" prevention measures. The *City Act* also requires that municipalities (including towns and villages) formulate Low-Carbon City Development Plans (hereinafter, "City Plans") (MLIT, 2013e). As of March 2014, the MLIT reports at least seven cities and towns have formulated Low-Carbon City (Town) Plans (MLIT, 2014).

VI. OVERVIEW OF MAJOR POLICIES IN DEVELOPMENT

This section describes three major energy- and climate-related policies currently under development: nuclear policy, the Joint Crediting Mechanism (JCM), and power market reform.

Nuclear Policy: Future Policy Directions and Restart Examinations

There are strong indications that Japan's future energy policy direction will remain undecided for the next year or two. Under the 2014 BEP, the new energy mix for the next 20 years will be proposed only when the circumstances regarding nuclear power, international climate policy discussions, and the progress of the FIT become foreseeable (METI, 2014a). The Minister of Economy, Trade, and Industry, Toshimitsu Motegi, has indicated that the government will decide on a new future energy supply mix within one year (METI, 2014f).

The future direction of nuclear power policy will have major implications for the development of Japan's new energy and climate policy. Two main issues may affect the future of nuclear power in Japan: the restart of existing reactors and the construction of new reactors. The former is the issue most relevant to domestic mitigation toward 2020 and 2030. The Nuclear Regulation Authority (NRA) set out the examination criteria for the restart of nuclear power plants and began the examination process for nuclear power restart in July 2013. As of February 2014, 17 reactors from 11 plants have submitted applications for restart (NRA, 2014). The examination period was initially expected to last about six months, but the process was delayed and the first restart is expected to take place only after the summer of 2014 (Financial Times, 2014). The examination results may also determine which nuclear power plants will be decommissioned. After safety approval from the NRA, the restart applications will in practice also require approval from the respective local governments and communities, although this is not legally required. The delays in restart examinations will also affect the revision of the Warsaw Target, which was planned to take place by the fall of 2014.

Joint Crediting Mechanism (JCM)

Japan was a large purchaser of Kyoto Units during the KP-CP1, when it reduced its GHG emissions equivalent to 1.6 percent of 1990 emissions annually (around 100 Mt-CO_2e for five years) through the Kyoto mechanism (GoJ, 2010b). In practice Japan has obtained many more Kyoto Units; as of March 2012, the government has secured around 98 Mt-CO_2e, and domestic businesses have transferred their acquired Kyoto Units of about 200 Mt-CO_2e to the government account (GWPH, 2013).

To further facilitate global actions for GHG emissions reductions and thereby complement the existing Clean Development Mechanism, the government has proposed the Joint Crediting Mechanism (JCM, also referred to as the Bilateral Offset and Crediting Mechanism) as a new mechanism for the post-2012 period. Under the JCM, the Japanese government will subsidize up to 50 percent of the installation costs of energy- and CO_2-saving technologies in return for half of the total emissions credits generated from the project (Kuriyama, 2013). The finance source of the subsidy is the revenue from the GW Tax (see section V, subsection on Global Warming Countermeasures Tax).

As of January 2014, 10 countries have signed bilateral documents for the JCM (GoJ, 2014). The governments of Japan and each host country form a joint operation committee that oversees the operation of the JCM, develops guidelines and methodologies, designates third-party entities for project validation, and registers projects (GoJ, 2014). The design and implementation of the JCM reflects a set of key principles:

- "Ensuring robust methodologies, transparency and environmental integrity;
- "Maintaining simplicity and practicality based on the rules and guidelines;
- "Promoting concrete actions for global GHG emissions reductions or removals;
- "Preventing uses of any mitigation projects registered under the JCM for the purpose of any other international climate mitigation mechanisms to avoid double counting of GHG emissions reductions or removals." (UNFCCC, 2013)

There are some key differences between the JCM and the CDM. First, the JCM has broader coverage of sectors and projects; it does not exclude nuclear power plants and explicitly promotes high efficiency coal-fired power plants (Prime Minister of Japan and His Cabinet, 2014). Second, the JCM aims for more flexible and speedier implementation than does the CDM by (i) developing a standardized approach for drawing baseline emissions and (ii) by allowing validation and verification processes to be conducted simultaneously and by the same third-party entities. Japan has been promoting the JCM as one of the various approaches under the UNFCCC framework (GoJ, 2013b). Besides playing a role complementary to the CDM, the JCM may become an important alternative to the CDM for Japan to obtain emissions credits abroad toward 2020 and beyond.

The budget for the JCM comes from the GW Tax revenues. The annual budget for the JCM project subsidy from the MOE was JPY1.2 billion (USD12 million) for FY2013; it will increase to JPY7.2 billion (USD72 million) for FY2014 (GoJ, 2014). Some of these funds will be channeled through the Asian Development Bank. METI has a budget of JPY6 billion (USD60 million) for FY2014 to finance infrastructure and capacity development as well as demonstration plants related to JCM (GoJ, 2014).

With regard to the expected mitigation impact delivered by the JCM, no study to date has quantified the potential amount of emissions credits that can be obtained toward 2020. However, the projects financed to date indicate that the mitigation impacts delivered by the JCM so far are modest. During FY2013, 11 projects were subsidized by MOE under the budget of JPY1.2 billion (USD12 million; excluding spends for feasibility studies and other preparatory activities) with the acquisition of emission credits. Total annual CO_2 emissions reductions expected from these projects are 33.9 kt/yr, with project-level CO_2 emissions reductions ranging between 390 t/yr and 15,000 t/yr. The future scale-up of the mitigation impacts from the JCM may depend on large-scale projects such as high-efficiency coal-fired power plants, which METI and New Energy and Industrial Technology Development Organization (NEDO) are currently studying (GoJ, 2014).

For JCM to become an internationally recognized scheme under the UNFCCC framework, a number of issues need to be addressed. These include compliance with World Trade Organization rules, the additionality of emissions reductions, and the methodologies for avoiding double-counting emissions reductions between Japan and the JCM signatory countries (Le and Delbosc, 2012; Michaelowa, 2012). The government of Japan will likely promote the JCM regardless of its status under the UNFCCC.

Electricity market reform

The restructuring of Japan's electricity system has attracted significant attention since the Fukushima disaster. The Japanese power sector has been practically monopolized by 10 vertically connected regional utilities, hindering the development of a competitive electricity market. Japan began to reform the electricity market in 1995, but the impact of those efforts has been limited; electricity prices remain high, undermining the competitiveness of Japanese firms in global markets (Jones and Kim, 2013).

Following the Fukushima disaster and the decline of nuclear power, the need for serious market reform became more urgent. The shift away from nuclear power creates a greater need for renewable energy to limit GHG emissions and energy imports, which would further increase already high electricity prices. To minimize electricity price increases while promoting renewable electricity, it is essential that Japan liberalize its electricity market (Jones and Kim, 2013).

In April 2013, the government approved the Policy on Electricity System Reform, which has three major objectives: (i) to secure the stable electricity supply, including enhanced use of renewable power and nonutility power generation; (ii) to suppress electricity rates to the maximum extent possible, and (iii) to expand choices for consumers and businesses (METI, 2013k). Table 7 sets out the measures and timelines the government has developed to achieve these three objectives.

The bill for the *Act for Partial Revision of the Electricity Business Act*, which passed the Diet in November 2013, executes the first phase and stipulates provisions for the execution of the second and third phases.[29]

Through enhanced use of renewable energy and distributed cogeneration, it is expected that the electricity market reform will contribute to future CO_2 emissions reduction, although the scale of this reduction is not reported in the existing literature.

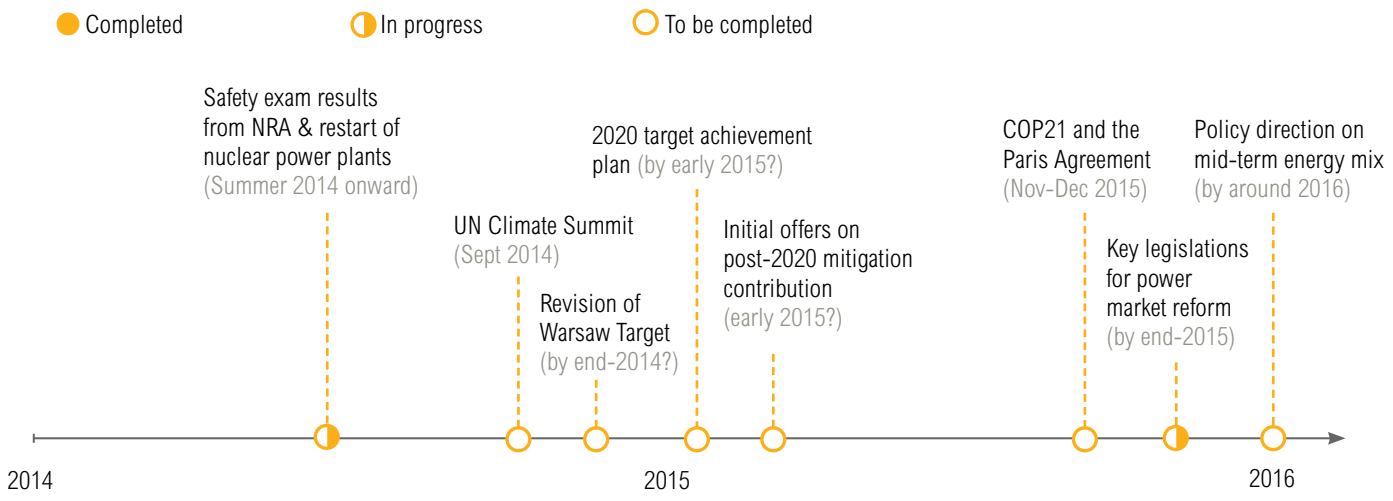
Figure 6 summarizes the timeline of the development of key policies.

Table 7 | **Implementation Schedule of the Measures for Electricity Market Reform**

PHASE AND MEASURES TO BE IMPLEMENTED	SCHEDULE FOR IMPLEMENTATION	SCHEDULE FOR SUBMITTING THE BILL TO THE ORDINARY DIET SESSION
1st phase: Establishing the organization for operations of wide-area electrical grids	Around 2015	The bill, which also stipulated provisions for the reform of 2nd and 3rd phases, passed in November 2013.
2nd phase: Full liberalization of the electricity retail market into which retail entities are able to enter	Around 2016	2014.
3rd phase: Further securing neutrality of the power transmission/distribution sector through legal separation; full liberalization of electricity rates through unbundling	By 2018–20	Aim for 2015.

Source: METI, 2013k.

Figure 6 | **Timeline for the Development of Key Policies in Japan in the Next Several Years**



VII. GHG PROJECTIONS

This section assesses the achievability of the Warsaw Target by comparing it with "business-as-usual" GHG emissions for 2020 reported in the literature. This paper defines "business-as-usual" (BAU) as the scenario in which current effort levels continue to be in force until 2020. In addition, this analysis seeks to align with provisions of the Warsaw Target by providing a comparison here that is based on the assumption of zero nuclear power in 2020.

No governmental institution in Japan annually reports BAU or reference GHG emissions projections. The METI Long-Term Energy Demand and Supply Outlook ("METI Outlook") projects energy-related CO_2 emissions for different scenarios approximately every three years, with the last version published in 2009 (METI, 2009). However, the 2009 METI Outlook projections are not comparable with the Warsaw Target because they are based on different (or outdated) future macroeconomic activity assumptions. At the same time, the Japanese government did not clarify baseline/reference GHG emissions for 2020 when it announced the Warsaw Target.

This paper therefore presents three GHG emissions pathways reported in the literature as indicative of zero-nuclear BAU scenarios for 2020. Table 8 presents an overview of these pathways. The first is the New Policies ("IEA-NP") scenario of the IEA World Energy Outlook 2013 (IEA, 2013b), which reports energy-related CO_2 emissions only and takes account of policies already enacted as of mid-2013 as well as other relevant commitments that have been announced, even when the implementation measures have not been fully defined. The IEA-NP scenario assumes future economic growth rates based on estimates from international organizations such as the International Monetary Fund, the Organization for Economic Co-operation and Development, and the World Bank. An important characteristic of this scenario is that it projects about 6 percent higher electricity generation in 2020 compared to 2010 levels; nearly 20 percent of this increase is nuclear power. It is not entirely clear, however, whether this scenario takes into account the long-term impact of behavioral changes following the Fukushima nuclear disaster that enabled significant electricity savings.

The second and third scenarios are the "Continued Efforts —Zero Nuclear" scenarios from the report prepared by the MOE's Central Environment Council (CEC) for the development of the Innovative Strategy (MOE, 2012b). The CEC's Continued Efforts scenarios assume the continuation of existing and currently planned policy measures and use the same future GDP growth assumption as the Warsaw Target (Cabinet Office, 2013a). One of the important characteristics of the CEC scenarios is that it assumes significant electricity-saving efforts that took place after the Fukushima nuclear disaster will continue, with total electricity generation projected to become about 10 percent lower by 2030 compared to 2010 levels. Some observers criticize the Innovative Strategy for assuming overly optimistic energy savings without any solid evidence. Homma and Akimoto (2013) argue that the reference power generation would be 21 percent higher if the historical GDP elasticity of power generation between 2000 and 2010 was applied for future projections up to 2030, and that the sustainable electricity savings induced by the Fukushima nuclear disaster would be at most 5 percent of 2010 levels.

One of the Continued Efforts scenarios (CEC-H scenario) assumes high economic growth identical to that foreseen by the Warsaw Target and is consistent with the government's growth strategy (GoJ, 2013a). The other (CEC-M scenario) assumes medium economic growth.

To enable fair comparison of the aforementioned scenarios with the Warsaw Target projections, this study makes a number of assumptions and adjustments. For the IEA-NP scenario, it adjusts CO_2 emissions from the power sector, including autoproducers, for the difference in CO_2 emissions intensity using an average CO_2 intensity in FY2012 (0.515 kg/kWh, derived from METI, 2013l). This study does not consider the impact of the changes in end-user electricity price on electricity consumption levels resulting from the reduction of nuclear power. It assumes nonenergy-related CO_2 emissions and non-CO_2 GHG emissions in 2020 to be the same levels as those foreseen by the Warsaw Target (in total, 156 Mt-CO_2e/yr). For CEC scenarios, this study adjusts the emissions projections for the power sector, excluding autoproducers, for the difference in electricity CO_2 emissions intensity (0.47 kg-CO_2/kWh, compared to 0.53 kg-CO_2/kWh for FY2012 [METI, 2013l]).

Table 8 | **Underlying Data of Reference GHG Emissions Scenarios Compared with the Warsaw Target in this Study**

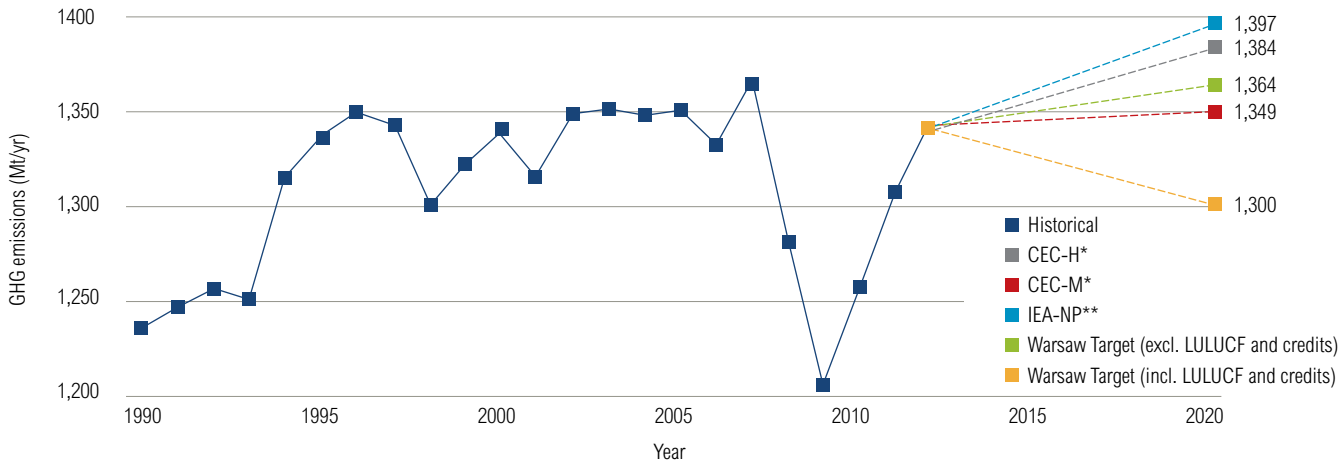
SCENARIOS / PARAMETER AND INDICATOR	2010 VALUE	IEA NEW POLICIES SCENARIO	CEC CONTINUED EFFORTS SCENARIOS (ZERO NUCLEAR IN 2020)		WARSAW TARGET
			HIGH-GROWTH CASE	MEDIUM-GROWTH CASE	
GDP growth rate (compound average between 2010 and 2020, in real terms)	—	1.4%/yr (2011–20)	1.8%/yr	1.1%/yr	1.8%/yr
Total electricity generation in 2020 (TWh)	1,110	1,169	1,080	1,052	Approx. 1,090**
Nuclear power generation in 2020 (TWh)	288	220	0	0	NA
Ratio between natural gas-fired and coal-fired power generation in 2020	1.18	1.36	1.94*	1.85*	NA
Total energy-related CO_2 emissions in 2020 (Mt/yr)	1,203	1,081	1,171	1,141	1,208
Total GHG emissions excluding LULUCF in 2020 (Mt-CO_2e/yr)	1,351	NA	1,324	1,291	1,364

Notes: *Excludes autoproducers. **Author's estimate based on the fact that the projections for final energy use for the Warsaw Target are identical to those for options proposed for the development of the Innovative Strategy (EEC, 2012b).
Sources: MOE 2012b; IEA 2013b.

Figure 7 presents Japan's Warsaw Target and the three reference emissions scenarios. The reference domestic GHG emissions projections for 2020 are calculated to be 1,397 Mt-CO_2e/yr for IEA-NP, and 1,384 Mt-CO_2e/yr and 1,349 Mt-CO_2e/yr for CEC-H and CEC-M, respectively. The domestic emissions under the Warsaw Target are found to be 20-25 Mt-CO_2e/yr (1.6–2.8 percent of 1990 emissions), lower than the IEA-NP and CEC-H scenarios and about 15 Mt-CO_2e/yr (1.2 percent of 1990 emissions) higher than the CEC-M scenario.

The three reference scenarios used here are not the official reference scenarios used by the Japanese government and include different sets of underlying assumptions. Although it is not possible to draw definite conclusions, the results provide three important indications. First, the comparison with the IEA-NP scenario indicates that additional mitigation equivalent to nearly 3 percent of 1990 emissions would be required to achieve the Warsaw Target. Given the limited time until 2020, this can be considered a major challenge. Second, in order to achieve this goal, the two CEC scenarios in comparison with the IEA-NP scenario show that the enhanced electricity-saving efforts made after the Fukushima nuclear disaster need to be continued to the greatest extent possible toward 2020. Although considerable uncertainty remains as to the extent to which GDP growth and the electricity consumption level will be decoupled in the post-Fukushima period, the reduction of electricity consumption by 5 percent of 2010 levels, as suggested by Homma and Akimoto (2013), would already reduce emissions by about 30 Mt-CO_2, or 2.4 percent, of 1990 levels. Such emissions reductions under the IEA-NP scenario would result in GHG emissions comparable to the Warsaw Target. Third, the two CEC scenarios show that the achievability of the Warsaw Target would be largely affected by the actual economic growth toward 2020. The GDP growth rates forecast by the IMF (compound annual average of 0.96 percent/yr; IMF, 2014), are lower than in any of the three reference scenarios presented here, suggesting that actual GDP growth toward 2020 may be favorable for achieving the Warsaw Target, which was developed using optimistic economic growth assumptions.

Figure 7 | **Comparison of Japan's Warsaw Target with the GHG Emissions Projections for 2020 Reported in and Estimated from the Literature**



Notes and Sources: *Adjusted for electricity emission intensity. **Adjusted for electricity emission intensity and non-energy GHG emissions. CEC-H: Current Policies—Zero Nuclear in 2020, High Economic Growth scenario in MOE, 2012b; CEC-M: Current Policies—Zero Nuclear in 2020, Medium Economic Growth scenario in MOE, 2012b; IEA-NP: New Policies scenario in IEA, 2013b.

VII. CONCLUSION AND LOOKING AHEAD

One objective of this paper has been to analyze the gap between Japan's Warsaw Target and its Copenhagen Pledge, a 25 percent reduction from 1990 levels. When the GHG emissions avoidance expected through nuclear power is factored out, government documents show the level of domestic mitigation efforts under the Warsaw Target to be only marginally more ambitious than the target that preceded the Copenhagen Pledge ("Mid-Term Target": -9 percent by 2020 from 1990 levels, excluding LULUCF). The domestic emissions target under the Warsaw Target (1364 Mt-CO_2e/yr) is more ambitious than the Mid-Term Target without nuclear power (estimated to be 1380 Mt-CO_2e/yr) by only 16 Mt-CO_2e/yr, or 1.3 percent of 1990 emissions. At the same time, the expected emissions reductions through overseas credits are challenging to evaluate considering that Japan cannot make secondary acquisitions of Kyoto Units. While a government-commissioned modeling study found the Copenhagen Pledge to be ambitious, it is unfortunate that the DPJ government failed to implement measures to at least try to achieve the target. The literature review conducted in this paper also showed that the Japanese government has not yet explained how its Warsaw Target is consistent with the planned 80 percent reduction by 2050 stipulated in the fourth Basic Environment Plan.

Another objective of this paper was to review recent developments of key energy- and climate-policy measures that help position Japan to meet its mitigation targets, including a full-fledged feed-in tariff scheme for renewable electricity, a global-warming tax, and a number of measures to improve thermal insulation for both commercial and residential buildings. These policies apply to sectors (renewable energy, residential, and commercial) where few aggressive policy measures were taken before the Fukushima disaster. The introduction of the GW Tax is an important step toward greener taxation, but its actual mitigation impacts depend largely on how effectively the tax revenue is used. This omission is at least partially attributable to the lack of a policy implementation plan to achieve the 2020 target.

Another observation is that the Japanese government is more explicit about promoting high-efficiency coal-fired power plants both domestically and overseas. While these plants are perhaps less CO_2-intensive than the ones currently operating, they are still highly CO_2-intensive compared to other fossil-fired power generation technologies in absolute terms. As with the Warsaw Target, the government has not clearly explained how its promotion

of high-efficiency coal-fired power plants within and outside Japan is consistent with its 2050 mitigation goal and the global 2°C target.

This paper's final objective was to assess the achievability of the Warsaw Target by comparing it with three emissions projections under continued mitigation efforts available in the literature. It was not possible to draw definite conclusions because of the limited information available on how the target was developed. Nonetheless, the results show that if the Warsaw Target is to be attained, it will be crucial to continue the enhanced electricity-saving efforts that followed the Fukushima nuclear disaster. If such enhanced electricity-saving efforts are combined with other continued mitigation efforts and the modest economic growth rates estimated by the IMF and IEA, Japan will likely achieve the Warsaw Target.

Looking ahead, this paper has identified the following points to be tracked in the future based on the above assessments.

- Unlike the Warsaw Target, which was decided behind closed doors, the revision of the Warsaw Target and the development of the upcoming post-2020 target need to be transparent, as was the development of the 2009 Mid-Term Target and the 2012 Innovative Strategy.

- The Warsaw Target will need to be revised sooner or later following the nuclear policy directions set out in the 2014 Basic Energy Plan. In revising the target, the government needs to consider not only the additional GHG emissions that can be avoided through use of nuclear power but also mitigation opportunities considered in the wake of Fukushima, as well as economic developments "on the ground," including actual GDP growth and renewable energy deployment in recent years.

- Revision of the Warsaw Target and development of the post-2020 mitigation target should be consistent with the long-term mitigation goal (80 percent reduction from 1990 levels by 2050) enshrined in the fourth Basic Environment Plan. The Japanese government can thus demonstrate to the international community that the country will catch up with climate mitigation efforts delayed by the Fukushima nuclear disaster. Moreover, the demonstration of the consistency with the long-term mitigation goal will lead to identification of technologies that are necessary to achieve the goal and their development roadmaps. At the same time, the new targets must be based on thorough ex-ante assessment of the target's achievability.

- Since the discussions in the past several years have shown that assumptions of future macroeconomic activity largely affect the achievable mitigation levels, the short- to mid-term mitigation target should be updated frequently based on the latest macroeconomic activity projections.

- The guidelines for the construction of new coal-fired power plants within and outside Japan must be clearer and stronger in their consistency with the long-term mitigation goal.

- A plan for Global Warming Countermeasures needs to be developed as soon as possible. Even if the future nuclear policy remains uncertain at the moment, mitigation actions and measures can be stipulated for end-use sectors.

Looking ahead, a number of important mitigation-related policy measures are being planned. Electricity market reform may impel further deployment of renewable energy and affect the future of nuclear power. Japan is also preparing the Joint Crediting Mechanism (JCM), which aims to further facilitate global actions for GHG emissions reductions and thereby complement the existing CDM. However, no study to date has quantified the potential amount of emissions credits that can be obtained toward 2020 through the JCM. The future introduction of an economy-wide ETS is unclear, since currently Japan has no midterm mitigation targets and little political will for domestic climate change mitigation. It remains to be seen whether the current LDP government will promote climate change as one of the pillars of national policymaking by developing a comprehensive higher law on climate change similar to the *Basic Act on Global Warming Countermeasures* proposed by the DPJ government.

ANNEX 1: LAW-MAKING PROCESS, LAWS, AND CABINET DECISIONS IN JAPAN

A detailed description of the Japanese lawmaking process at the national level can be found in the literature (e.g., Cabinet Legislation Bureau, 2013). In Japan, any new national laws to reduce GHG emissions must pass the National Diet, which comprises the House of Councillors ("Upper House") and the House of Representatives ("Lower House"). A bill is generally drafted by the ministry with jurisdiction. All legislative bills to be introduced by the Cabinet are first examined by the Cabinet Legislation Bureau, then approved by the Cabinet for submission to the Diet. The Lower House is the stronger of the two, since it is able to override rejections by the Upper House with a vote of two-thirds of members present (Article 59 of the Constitution of Japan). Bills are scrapped when a Diet session ends unless they have been voted for continued deliberation in the following session.

Among laws, Basic Acts (*kihonhou*) are higher and comprehensive laws that provide direction on key policy areas. They can overrule other laws in their respective policy areas. A Basic Act requires the government to develop a Basic Plan in the given policy areas. Examples include the Basic Energy Plan under the *Basic Act on Energy Policy* and the Basic Environment Plan under the *Basic Environment Act* (see section III for details). While the Basic Plans themselves are not laws, all new legislation must take the plans into serious consideration.

With regard to other forms of government decisions, Cabinet Decisions and Adoptions (*kakugi kettei*) are formal and have a certain degree of binding force even though they are not legislation. While the legal force of Cabinet Decisions and Adoptions is not clearly defined, Cabinet Decisions bind all ministers and all government bodies and their employees under the Cabinet's control (Cabinet, 2003). Cabinet Decisions and Adoptions are also in principle effective over succeeding Cabinets, unless a Cabinet overturns them by making a new Cabinet Decision or legislation.

ANNEX 2: THE BILL OF THE BASIC ACT ON GLOBAL WARMING COUNTERMEASURES

In order to realize the 25 percent mitigation target for 2020 pledged in the Copenhagen COP, the DPJ government prepared a set of midterm mitigation policy measures. In March 2010, under the DPJ government, the bill of the *Basic Act on Global Warming Countermeasures* ("*GW Basic Act*") was approved by the Cabinet for deliberation in the Diet. The *GW Basic Act* would have legally enshrined the 2050 target of an 80 percent GHG reduction and the 2020 target of a 25 percent reduction, both compared to 1990 levels. The major policy measures proposed in the bill included provisions for fiscal and market-based measures such as a carbon tax, a domestic Emissions Trading Scheme (ETS), and increased renewable energy production. The *GW Basic Act* could have made climate policy of the pillars of Japan's policymaking, on par with the energy policy underpinned by the *Basic Act on Energy Policy*.

The bill of the *GW Basic Act* passed the Lower House of the Diet but never passed the Upper House, largely as a result of the DPJ's unstable handling of the government. In June 2010, DPJ Prime Minister Yukio Hatoyama resigned. The bill was scrapped following the dissolution of the Lower House in November 2012 (Secretariat of the House of Councillors, 2013).

ABBREVIATIONS AND ACRONYMS

AFOLU	agriculture, forestry, and land use
BAU	business as usual
BEP	Basic Energy Plan
BY	base year
CCS	carbon capture and storage
CDM	Clean Development Mechanism
CEC	Central Environment Council, Ministry of the Environment
CER	certified emissions reduction
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
COP	Conference of the Parties of the United Nations Framework Convention on Climate Change
DPJ	Democratic Party of Japan
EEC	Energy and Environment Council
ETS	emissions trading scheme
FIT	feed-in tariff
FY	Fiscal year. In Japan, the fiscal year begins on April 1 and ends on March 31.
GDP	gross domestic product
GHG	greenhouse gas
GIO	Greenhouse Gas Inventory Office
g-CO_2	grams of carbon dioxide
GWPH	Global Warming Prevention Headquarters
IEA	International Energy Agency
IGES	Institute for Global Environmental Strategies
IPCC	Intergovernmental Panel on Climate Change
JCM	Joint Crediting Mechanism
JMA	Japan Meteorological Agency
JPY	Japanese yen
JREF	Japan Renewable Energy Foundation
J-VER	Japan's offset credit scheme
JVETS	Japan's voluntary emissions trading scheme
kL	kilolitres
KP	Kyoto Protocol
KP-CP1	first commitment period of the Kyoto Protocol (2008–12)
KP-CP2	second commitment period of the Kyoto Protocol (2013–20)
kt	kilotonnes
LCER	long-term certified emissions reduction
LDP	Liberal Democratic Party
LNG	liquefied natural gas
LULUCF	land use, land-use change, and forestry
MAFF	Ministry of Agriculture, Forestry, and Fisheries
METI	Ministry of Economy, Trade and Industry
MEXT	Ministry of Education, Culture, Sports, Science, and Technology
MLIT	Ministry of Land, Infrastructure, Transport, and Tourism
MOE	Ministry of the Environment
MOF	Ministry of Finance
MOFA	Ministry of Foreign Affairs
Mt-CO_2	million tonnes of carbon dioxide
Mt-CO_2e	million tonnes of carbon dioxide equivalent
NPU	National Policy Unit, the Government of Japan
NRA	Nuclear Regulation Authority
PM	prime minister
PV	photovoltaic
R&D	research and development
RPS	Renewable Portfolio Standard
t-C	tonnes of carbon
t-CO_2	tonnes of carbon dioxide
TEPCO	Tokyo Electric Power Company
TMG	Tokyo Metropolitan Government
TPES	total primary energy supply
UNFCCC	United Nations Framework Convention on Climate Change
USD	US dollars
VAP	Voluntary Action Plan, Keidanren
yr	year

Energy Units

GJ/t	gigajoules per tonne = 109 joules per tonne
GW	gigawatt = 109 watt
HHV	higher heating value
kLCOE	kilolitre of crude oil equivalent = $38.8*10^9$ joules HHV
kW	kilowatt = 103 watt
kWh	kilowatt-hour = 3,600 joules
LHV	lower heating value
MW	megawatt = 106 watt
TWh	terawatt-hour = 1012 kWh

ENDNOTES

1. "Kyoto units" is a collective term for emission allowances that are generated, cancelled, acquired or transferred through LULUCF activities and through participation in the Kyoto mechanisms (UNFCCC, 2008).
2. TPES is made up of indigenous production plus imports minus exports minus international bunkers plus or minus stock changes (IEA, 2013a).
3. The future GDP growth projection underlying the Warsaw Target is a growth target (compound average annual growth rate of 1.8 percent per year in real terms between 2010 and 2020) rather than a reference growth scenario, assuming effective implementation of policy measures set out in the Japan Revitalization Strategy (Cabinet Office, 2013a, 2013b). With regard to the coverage of GHGs, the 2013 revision of the Global Warming Promotion Act, enacted in May 2013 (Act No. 18, 2013), stipulates that Japan's mitigation efforts covers "Kyoto gases," i.e., CO_2, CH_4, N_2O, HFCs (specified by Cabinet Order), PFCs (specified by Cabinet Order), SF_6, and NF_3.
4. The reference year is mentioned only in the English version, not in the Japanese original version (MOE, 2012a).
5. The CO_2 emissions factor used by the government is 0.53 kg/kWh, which is the average value for General Electric Utilities in FY2012 (METI, 2013l) as indicated in the Biennial Report to the UNFCCC (GoJ, 2013a).
6. A follow-up analysis (NIES, 2010) showed that the 25 percent reduction domestically is feasible. The analysis included revisiting the technology inventory, considering earlier commercial deployment of CCS, and revising the capacity factor of nuclear power plants upward.
7. Under the Kyoto Protocol Target Achievement Plan, expected mitigation impacts were reported for all mitigation-related policy measures. However, there is no such reporting because no target achievement plan is available for the 2020 target.
8. Under the Energy Conservation Act, factories, workplaces, and companies (including franchisees) with annual energy use of more than 1,500 kilolitre crude oil equivalent (kLCOE) are required to select energy managers, report their energy usage, and develop a mid- to long-term energy-saving plan. They are encouraged to reduce energy intensity by on average 1 percent per year. The names of business entities (factories, workplaces, and companies) will be publicly disclosed and ordered by the governing agency to take actions when their energy conservation measures are "significantly insufficient," and even penalized a maximum of JPY1,000,000 (USD10,000) if they refuse the order. The level of "significantly insufficient" is defined by governing agencies, i.e., local governments (METI/ECCJ, 2011).
9. "Unabated coal" is defined as "coal burning without carbon capture and storage (CCS)…all forms of 'high-efficiency coal technologies' are counted as unabated coal, unless equipped with CCS" (Davidson et al., 2013).
10. A currency exchange rate of 1 US Dollar = 100 Japanese Yen, which is a representative value for the period between May 2013 and April 2014, is used throughout the paper.
11. A carbon tax was first proposed to the Cabinet in 2004 by the MOE as one of the measures to achieve the KP-CP1 target (MOE, 2004). The proposed tax rates were JPY2,400/t-C (JPY655/t-CO_2 = USD6.55/t-CO_2), and the expected total emissions reduction was 52 Mt-CO_2, which is more than 4 percent of 1990 total GHG emissions. The idea of a carbon tax was controversial, however, given the industrial sector's fear of economic losses and weakened international competitiveness (e.g., Keidanren, 2003).
12. Other fossil fuels exempted from the global-warming tax include (i) specific coal for electricity generation in Okinawa, (ii) imported and domestic bunker A fuel oil for agriculture, forestry, and fishery, and (iii) domestic oil asphalt (MOE, 2012d).
13. These uses include (i) imported coal used for onsite electricity generation at caustic soda manufacturing industry, (ii) heavy and light oil for ships for domestic transport and regular passenger lines, (iii) light oil used for railway business, (iv) aviation fuel loaded onto planes for domestic periodical transport business, (v) imported coal used for onsite electricity generation at salt manufacturing industry using ion exchange membrane method, and (vi) light oil used for agriculture, forestry, and fishery (MOE, 2012d).
14. English sources include Institute for Industrial Productivity, 2014; and MOE, 2012e.
15. Another baseline-and-credit scheme, called J-VER, was initiated by the MOE in 2008. Domestic CDM and J-VER unified and became the J-Credit scheme in April 2013 (METI, 2013m).
16. Except for solar PV smaller than 10kW, of which only excess electricity will be purchased.
17. The RPS Act was superseded by the Renewable Energy Act, but existing renewable energy facilities can choose either to continue their operation under the original RPS Act or switch to the new FIT scheme (with an exception for those operating under the 2009 PV-FIT scheme).
18. Currently there are two kinds of surcharges because of the transition from the 2009 PV-FIT scheme to the revised FIT scheme; JPY0.35/kWh (US cents 0.35/kWh) for renewable electricity surcharge and JPY0.01–0.09/kWh (US cents 0.01-0.09/kWh) for solar PV promotion surcharge. These surcharges are billed to all households and businesses.
19. The areas affected by the Great East Japan Earthquake are also exempted from the surcharge.
20. The tariff is determined when the facility is approved by METI. The application for access to the electric power system also needs to be submitted to the electric utility.
21. The FIT application requires information on facility location and the PV system specifications, but the original regulations did not indicate by when the proofs of securement of land and PV systems had to be submitted to METI.
22. For both the renewable energy and renewable heat subsidies, businesses receiving subsidies must, at their own expense, contribute to renewable energy promotion activities, including receiving visitors to their renewable energy facilities, publicize their installed facilities through their website, brochures, seminars, etc.

23. Except for the option of a tax deduction, which can be applied only until the end of FY2014.
24. All three schemes described below are introduced in this reference, but since it is a Japanese document, sources in English are also provided.
25. The Keidanren reports that its members account for 83 percent of total CO_2 emissions from energy conversion and industrial sectors. However, CO_2 emissions attributable to the electricity sold to non-Keidanren companies are not counted (Kiko Network, 2012). An analysis by Kiko Network (Kiko Network, 2012) indicates that the Keidanren members collectively accounted for 62 percent of national total CO_2 emissions in 2010.
26. The 2010 BEP stated that the definition of "CCS-ready" will be discussed in the future by referring to other international examples, such as EU directives.
27. These are diesel vehicles that meet FY2009 exhaust gas regulations and natural gas vehicles that have NOX emissions levels more than 10 percent below the FY2009 exhaust gas regulation.
28. These are hybrids that meet the new fuel efficiency standards of FY2015.
29. www.meti.go.jp/english/policy/energy_environment/electricity_system_reform/index.html.

REFERENCES

"2050 Japan Low-Carbon Society" Scenario Team. 2009. "Japan Roadmaps towards Low-Carbon Societies (LCSs), Scenario. 2050 Japan Low-Carbon Society." National Institute for Environmental Studies (NIES), Kyoto University, and Mizuho Information and Research Institute.

Act No. 49. 1979. *Energy Conservation Act.*

Act No. 117. 1998. L*aw Concerning the Promotion of the Measures to Address Global Warming.*

Act No. 71. 2002. *Basic Act on Energy Policy.*

Act No. 108. 2011. *Act on Special Measures Concerning the Procurement of Renewable Energy by Electric Utilities.*

Act No. 84. 2012. *Low-Carbon City Promotion Act.*

Act No. 18. 2013. *Partial Revision of the Law Concerning the Promotion of the Measures to Address Global Warming.*

Article 59 of the Constitution of Japan. n.d. "Disagreement between the Two Houses."

Cabinet. 2003. "Cabinet Response to the Question No. 44 of the 155th Diet Session."

—. 2013. "Establishment of the Global Warming Prevention Headquarters." www.kantei.go.jp/foreign/policy/ondanka/konkyo_e.html.

Cabinet Legislation Bureau. 2013. "II. The Law-Making Process 1. Outline of the Chain of Events from the Drafting of a Legislative Bill to Be Introduced by the Cabinet, to Its Approval and Promulgation." www.clb.go.jp/english/process.html.

Cabinet Office. 2012. "Nihon keizai 2012–2013 [Japanese Economy, 2012–2013]." Chapter 1, section 3. In Japanese. Tokyo: Cabinet Office, Government of Japan.

Cabinet Office. 2012. "Nihon keizai 2012–2013 [Japanese Economy, 2012–2013]." Chapter 1, section 3. In Japanese. Tokyo: Cabinet Office, Government of Japan.

—. 2013a. *Economic and Fiscal Projections for Medium to Long Term Analysis* (Provisional translation). Tokyo: Cabinet Office, Government of Japan.

—. 2013b. "Japan Revitalization Strategy: Japan Is Back." www.kantei.go.jp/jp/singi/keizaisaisei/pdf/en_saikou_jpn_hon.pdf.

Climate Action Tracker. 2013. "Japan: From Frontrunner to Laggard." Ecofys, Climate Analytics, Potsdam Institute for Climate Impact Research, November 15.

Davidson, O., P. C. Frumhoff, N. Höhne, E. La Rovere, F. C. Matthes, et al. 2013. "New Unabated Coal Is Not Compatible with Keeping Global Warming below 2°C: Statement by Leading Climate and Energy Scientists." www.europeanclimate.org/documents/nocoal2c.pdf.

Energy and Environment Council (EEC). 2012a. *Shinario shousai deta (seichou kesu teiseichou kesu tsuika) [Detailed Scenario Data (High and Low Economic Growth Cases Added)]*." Tokyo: EEC, National Policy Unit, Cabinet Office.

—. 2012b. *Options for Energy and the Environment* (provisional translation). Tokyo: Energy and Environment Council, Government of Japan.

Financial Times. 2014. "Japan Effort to Restart Nuclear Plants Delayed until after Summer." May 2.

Global Warming Prevention Headquarters (GWPH). 2008. *Experimental Introduction of an Integrated Domestic Market for Emissions Trading (Global Warming Prevention Headquarters' Decision on October 21, 2008)*. Tokyo: GWPH.

—. 2013. *Progress Update on the Kyoto Protocol Target Achievement Plan.* Tokyo: GWPH.

Government of Japan (GoJ). 2009a. *Communications Received from Parties in Relation to the Listing in the Chapeau of the Copenhagen Accord, Bonn, Germany*. Tokyo: GoJ.

—. 2009b. "Statement by H. E. Dr. Yukio Hatoyama Prime Minister of Japan at the United Nations Summit on Climate Change." Tokyo: GoJ.

—. 2010a. "Japan's Position Regarding the Kyoto Protocol." www.mofa.go.jp/policy/environment/warm/cop/kp_pos_1012.html.

—. 2010b. *Japan's Fifth National Communication under the United Nations Framework Convention on Climate Change*. Tokyo: GoJ.

—. 2012a. *Submission by Japan: Clarification of Quantified Economy-wide Emission Reduction Targets*. Tokyo: GoJ.

—. 2012b. "CO_2 wo yokusei surutame chikyuuondanka taisaku no tameno zei ga hajimarimasu [Global Warming Countermeasures Tax for Reducing CO_2 Emissions Is Starting]." www.gov-online.go.jp/useful/article/201210/1.html.

—. 2013a. *Japan's First Biennial Report under the United Nations Framework Convention on Climate Change*. December. Tokyo: GoJ.

—. 2013b. *Submission by Japan on Various Approaches, Including Opportunities for Using Markets to Enhance the Cost-Effectiveness of, and to Promote, Mitigation Actions*. Tokyo: GoJ.

—. 2014. *Recent Development of the Joint Crediting Mechanism (JCM)*. Tokyo: GoJ, January.

Greenhouse Gas Inventory Office of Japan (GIO). 2014a. *The GHGs Emissions Data of Japan (1990–2012)*. Tsubaka, Ibaraki Prefecture: GIO, National Institute of Environmental Studies,

—. 2014b. *National Greenhouse Gas Inventory Report of JAPAN*. Tsukuba, Ibaraki Prefecture: GIO, National Institute of Environmental Studies.

Homma, T., and K. Akimoto. 2013. "Analysis of Japan's Energy and Environment Strategy after the Fukushima Nuclear Plant Accident." *Energy Policy*, 1–10.

House of Representatives. 2009. *Japan's Future Development Strategy and Growth Initiative towards Doubling the Size of Asia's Economy: Speeches and Statements by Prime Minister*. Tokyo: House of Representatives.

Institute of Energy Economics, Japan (IEEJ). 2013. *EDMC Handbook of Energy & Economic Statistics*. 2013 edition. Tokyo: Energy Conservation Center.

Institute for Industrial Productivity. 2014. "Industrial Efficiency Policy Database." http://iepd.iipnetwork.org/.

International Council on Clean Transportation (ICCT). 2011. "ICCT Comments on Japan's 2020 Fuel Consumption Standards." www.scribd.com/doc/66403485/Japan-PV-fuel-economy-standards.

—. 2014. *Global Comparison of Light-Duty Vehicle Fuel Economy/GHG Emissions Standards*. Update May 2014. Washington, DC: ICCT.

International Energy Agency (IEA). 2013a. *Electricity Information 2013*. Paris: IEA.

—. 2013b. *IEA World Energy Outlook 2013*. Paris: IEA.

International Monetary Fund (IMF). 2014. "World Economic Outlook Database, April 2014." www.imf.org/external/pubs/ft/weo/2014/01/weodata/index.aspx.

Japan CCS. 2012. "CCS Demonstration Project. Prospective Activities up to 2015." www.japanccs.com/wp/wp-content/uploads/2012/12/pamphlet_demonstration1.pdf.

Japan Center for Economic Research (JCER). 2010. *Ekoka seido CO_2 sakugen wa kokunai souhaishutsuryou no 0.1% [Eco-car Support Scheme: CO_2 Reduction Impact Is Only 0.1% of National Total*]. Tokyo: JCER.

Japan Fair Trade Commission (JFTC). 2012. *Proposals for the Electricity Market from Competition Policy*. Tokyo: JFTC.

Japan Renewable Energy Foundation (JREF). 2014. "Enerugii kihon keikaku ni tsuite no seimei [Statement on the New Basic Energy Plan]." jref.or.jp/activities/reports_20140411.php.

Jones Day. 2013. *Renewable Energy in Japan: One Year after the Implementation of the Feed-In-Tariff Law*. Jones Day Commentary, August.

Jones, R. S., and M. Kim. 2013. "Restructuring the Electricity Sector and Promoting Green Growth in Japan." OECD Economics Department Working paper no. 1069. Paris: OECD.

Keidanren. 1997. *Keidanren Voluntary Action on the Environment*. Tokyo: Keidanren.

—. 2003. "Kankyouzei no dounyuu ni hantai suru [Opposition to the Introduction of Environment Tax]." www.keidanren.or.jp/japanese/policy/2003/112.html.

—. 2009. "Nippon Keidanren's Commitment to a Low Carbon Society." www.keidanren.or.jp/english/policy/2009/107.html.

—. 2012. "Opinion Paper on Climate Change Policy." Tokyo: Keidanren,

—. 2013a. "Section on Global Warming Measures. Performance in Fiscal 2012." In Results of the Fiscal 2013 Follow-Up to the Voluntary Action Plan on the Environment (Summary). Tokyo: Keidanren. www.keidanren.or.jp/en/policy/2013/101.pdf

—. 2013b. *KEIDANREN's Commitment to a Low Carbon Society*. Tokyo: Keidanren.

—. 2014. "Keidanren's Commitment to a Low Carbon Society: Sector-Specific Documentation." www.keidanren.or.jp/policy/2013/003.html.

Kiko Network. 2012. *Nihon Keidanren Kankyou Jishukoudou Keikaku no hyouka* [*Evaluation of Keidanren's Voluntary Action Plan on the Environment*]. Tokyo and Kyoto: Kiko Network.

Kuramochi, T., N. Shimizu, S. Nakhooda, and T. Fransen. 2012. "The Japanese Fast-Start Finance Contribution." Working paper. Washington, DC, and London: World Resources Institute and Overseas Development Institute.

Kuriyama, A. 2013. "IGES Capacity Building Activities for the JCM." In *Carbon Forum Asia at Bangkok, Sep 2013*. Bangkok.

Le, H., and A. Delbosc. 2012. "Japan's Bilateral Offset Crediting Mechanism: A Bilateral Solution to a Global Issue?" Climate Brief no. 11. *CDC Clim. Res.*

Lipscy, P. Y., and L. Schipper. 2013. "Energy Efficiency in the Japanese Transport Sector." *Energy Policy* 56: 248–58.

Mainichi. 2013. "Editorial: Crack Down on Feed-In Tariff Beneficiaries Not Doing Their Part." August 27. www.mainichi.jp/english/english/perspectives/news/20130827p2a00m0na001000c.html.

Michaelowa, A., and Perspectives GmbH. 2012. "Linking the CDM with New and Emerging Carbon Markets." *CDM Policy Dialogue*.

Ministry of Agriculture, Forestry, and Fisheries (MAFF). 2013. *Budget Overview: Addressing Climate Change in the Agricultural Sector*. Tokyo: MAFF.

Ministry of Economy, Trade, and Industry (METI). 2007. "Gyoumuyou reizouko oyobi shoukeesu nado handankijun shouiinkai no kaisai ni tsuite [Annoucement on the Subcommittee on Standards for Commercial Refrigerators and Showcases]." Tokyo: Energy Conservation Standard Council, Advisory Committee for Natural Resources and Energy, METI.

—. 2009. "Choki enerugi jukyuu mitooshi (Saikeisan) [Long-Term Energy Supply and Demand Outlook (Recalculations)]." www.meti.go.jp/committee/materials2/downloadfiles/g80808a02j.pdf.

—. 2010. *The Strategic Energy Plan of Japan: Meeting Global Challenges and Securing Energy Futures*. Summary, revised June 2010. Tokyo: METI.

—. 2011a. *Energy Conservation Policies of Japan*. Tokyo: Agency of Natural Resources and Energy Energy Conservation and Renewable Energy Department.

—. 2011b. *Toppu rannaa kijun no genjounado ni tsuite* [*Latest Status of the Top Runner Standards*]. Tokyo: METI.

—. 2011c. *New Efficiency Standard for Passenger Vehicles*. Tokyo: METI.

—. 2013a. *Energy White Paper 2013*, chapter 2. Tokyo: METI.

—. 2013b. "Top Runner Program Current Status of Addition on the Product List." www.enecho.meti.go.jp/policy/saveenergy/data/111102tokuteikiki-tsuika.pdf.

—. 2013c. "Partial Revision of Energy Conservation Act Promulgated." News release. www.meti.go.jp/press/2013/07/20130708004/20130708004.pdf.

—. 2013d. "Renewable Energy FIT Programme Guidebook." www.enecho.meti.go.jp/saiene/data/kaitori/kaitori_jigyousha2013.pdf.

—. 2013e. "News Release: Saiseikanou enerugii hatsudensetsubi no dounyuujoukyou wo kouhyou shimasu (Heisei 25 nen 6 gatsu matsu jiten) [News Release: Renewable Energy Power implementation status (as of June 30, 2013)]." www.enecho.meti.go.jp/saiene/kaitori/dl/setsubi/201306setsubi.pdf.

—. 2013f. *Discussion Points for the Energy Consumption Phase*. Tokyo: Agency of Natural Resource and Energy, METI.

—. 2013g. "FY2013 Budget Request." www.meti.go.jp/english/aboutmeti/policy/fy2013/pdf/130129budget.pdf.

—. 2013h. "Major Points of the FY2013 METI Related Tax Reform." www.meti.go.jp/english/aboutmeti/policy/fy2013/pdf/130322tax.pdf.

—. 2013i. "Announcement of the Achievements of Business Operators for Reaching Benchmarks Pursuant to the Energy Conservation Act." www.meti.go.jp/english/press/2013/0930_02.html.

—. 2013j. "News Release: Act to Partially Amend the Act on the Rational Use of Energy (Energy Conservation Act) Was Passed by the Diet and Promulgated." www.meti.go.jp/english/press/2013/0708_03.html.

—. 2013k. "Cabinet Decision on the Bill for the Act for Partial Revision of the Electricity Business Act." www.meti.go.jp/english/press/2013/0412_01.html.

—. 2013l. "Comprehensive Energy Statistics. Fiscal Year 2012." www.enecho.meti.go.jp/info/statistics/jukyu/resource/xls/2012fy.xls.

—. 2013m. "Results of the 32nd Meeting of the Domestic Credit Certification Committee: 513 Applications for Domestic Credit Certification Approved (Nearly 280,000 t-CO_2): Record-High Approval!" News release, July 9. www.meti.go.jp/english/press/2013/0709_02.html.

—. 2014a. *2014 Basic Energy Plan*. Tokyo: Agency for Natural Resources and Energy, METI.

—. 2014b. "BAT no sankouhyou (zanteiban, heisei 25nen 4gatsu jiten) [Reference Table of BAT (Provisional, as of April 2014)]." Tokyo: METI.

—. 2014c. *Heisei 26 nendo no nintei unyou wo henkou shimasu [Revised Regulations on FIT Approval and Operation in FY2014]*. Tokyo: Agency for Natural Resources and Energy, METI.

—. 2014d. *Taiyoukou hatsudensetsubi ni kansuru houkoku choushuu no kekka ni tsuite* [*Reporting Results on Solar Power Plant Facilities*]. February 14. Tokyo: METI.

—. 2014e. "Kakushu shien seido [Various Measures for Renewable Energy Promotion]." www.enecho.meti.go.jp/category/saving_and_new/saiene/support/index.html.

—. 2014f. Press conference by Toshimitsu Motegi, Minister of Economy, Trade, and Industry, following the Cabinet meeting. April 11, 2014. In Japanese. www.meti.go.jp/speeches/data_ed/ed140411j.html.

—. 2014g. *Heisei 26 nendo Keizaisangyoushou kankeiyosan no gaiyou* [*Overview of METI Budget for FY2014*]. Tokyo: METI.

Ministry of Economy, Trade, and Industry (METI) and Ministry of the Environment (MOE). 2013. *Tokyo denryoku no karyokudengen nyuusatsu ni kansuru kankei kyokuchoukyuu kaigi torimatome* [*Summary Report of the Director-General-Level Conference Concerning the Bids on Thermal Power Generation Facilities of TEPCO*]. Tokyo: METI and MOE.

Ministry of Economy, Trade, and Industry (METI)/Energy Conservation Center, Japan (ECCJ). 2011. *Shouenehou no gaiyou 2010/2011* [*Overview of the Energy Conservation Act 2010/2011*]. Tokyo: METI/ECCJ.

Ministry of the Environment (MOE). 1998. "Promotion of Measures to Reduce CO_2 Emissions That Focus on Measures Related to Energy Supply and Demand." *Guidel. Meas. to Prev. Glob. Warm.*, part 2. Tokyo: MOE. www.env.go.jp/en/earth/cc/gw/part2.html.

—. 2004. "Kankyouzei no gutaian [Details of the Proposed Environment Tax]." www.env.go.jp/policy/tax/041105/01.pdf.

—. 2010. "Press Release: Cabinet Decision of Basic Act on Global Warming Countermeasures." Tokyo: MOE.

—. 2011a. "Japan's National Greenhouse Gas Emissions for Fiscal Year 2010 (Final Figures)." www.env.go.jp/en/headline/headline.php?serial=1580.

—. 2011b. "Jishusankagata kokunai haishutsuryou torihiki seido (JVETS) dai 7 ki mokuhyouhoyuusankasha no koubo ni tsuite [JVETS Seventh Term Application Open to Institutions with Emissions Reduction Targets]." www.env.go.jp/press/press.php?serial=13562.

—. 2012a. "The Fourth Basic Environment Plan." www.env.go.jp/en/focus/docs/files/20120427-01_01.pdf.

—. 2012b. "2013 nen ikou no taisaku sesaku ni kansuru houkokusho (Heisei 24 nen 6 gatsu). chikyuu ondankataisaku no sentakushi no gen-an ni tsuite [Report on the Global Warming Countermeasures beyond 2013. Proposed Options. June 2012]." www.env.go.jp/earth/report/h24-03/index.html.

—. 2012c. *2. Kokunai sesaku hyouka* [*2. Evaluation of Existing Policies*]. Tokyo: MOE.

—. 2012d. *Details on the Carbon Tax (Tax for Measures to Cope with Global Warming)*. Tokyo: MOE, October 1.

—. 2012e. *Current Status of Market Mechanisms in Japan.* Tokyo: MOE.

—. 2013a. "Warsaw Climate Change Conference, November 2013." www.env.go.jp/en/earth/cc/cop19_summary.html.

—. 2013b. "Japan's National Greenhouse Gas Emissions for Fiscal Year 2012 (Preliminary Figures)." News headline. Full document available only in Japanese. November 19. Tokyo: MOE.

—. 2013c. *Chihoukoukyoudantai ni okeru chikyuuondankataisaku no suishin ni kansuru houritsu sekoujoukyou chousakekka. Heisei 25 nen 3 gatsu* [*Survey Results on the Implementation Status of the Global Warming Countermeasures*]. Tokyo: MOE.

—. 2013d. *Heisei 26 nendo Kankyoushou juuten sesaku. Heisei 25 nen 12 gatsu* [*Important Policy Measures of the Ministry of the Environment in FY2014*]. Tokyo: MOE.

—. 2013e. *Hitoashitobi hatten no jitsugen ni muketa shikin shien* [*Financial Support for the Realization of Leap-Frog Development: Budget Request for FY2014*]. Tokyo: MOE.

—. 2014a. *Japan's National Greenhouse Gas Emissions in Fiscal Year 2012 (Final Figures)*. Tokyo and Kyoto: MOE.

—. 2014b. J*ishusankagata kokunai haishutsuryoutorihikiseido (JVETS) ni tsuite* [*On Japan's Voluntary Emission Trading Scheme (JVETS)*]. Tokyo: MOE.

Ministry of Finance (MOF). 2012. "Sozei tokubetsu sochihou (Sekiyusekitanzei [chikyuu ondanka taisaku no tameno kazei no tokurei] no kaisei" (Revision of Act on Special Measures Concerning Taxation (on the Global Warming Countermeasures Tax)). In Japanese. Tokyo: MOF.

Ministry of Foreign Affairs (MOFA), Ministry of Economy, Trade, and Industry (METI), and Ministry of the Environment (MOE). 2013. *ACE: Actions for Cool Earth. Proactive Diplomatic Strategy for Countering Global Warming.* Tokyo: MOFA, METI, and MOE.

Ministry of Land Infrastructure, Transport, and Tourism (MLIT). 2012a. *Overview of the New Eco-car Tax Break and Special Measures for Used Cars.* Tokyo: MLIT.

—. 2012b. *Low Carbon City Development Guidance* (digest). Tokyo: MLIT.

—. 2013a. "Jidousha no nenpi mokuhyou kijun ni tsuite [Fuel Efficiency Target Standards for Automobiles]." www.mlit.go.jp/jidosha/sesaku/environment/ondan/ondan.htm.

—. 2013b. "Policy and Programs for Energy Efficient Houses and Buildings." Presentation by Kimihiro Hashimoto, Deputy Director-General, Housing Bureau. February. Tokyo: MLIT.

—. 2013c. "Policy and Programs for Energy Efficient Houses and Buildings." Presentation by Akiko Ito, Director of Housing Production Division, Housing Bureau. December. Tokyo, MLIT.

—. 2013d. "Machi suimai koutsuu ga ittai to natta souene chikuene shoueneka no suishin [Integrated Promotion of Energy Generation, Storage, and Savings for Cities, Houses, and Transport]." www.mlit.go.jp/page/kanbo01_hy_002299.html.

—. 2013e. *Is Your City an Eco-town? Let's Start Developing a Compact City.* Tokyo: Urban Environment Planning Office, City Planning Division, City Bureau, MLIT.

—. 2014. "Teitanso machizukuri keikaku sakusei jirei [The Cases of Low-Carbon City Development Plan Formulation]." www.mlit.go.jp/toshi/city_plan/eco-machi-case.html.

Mochizuki, J. 2011. "Assessing the Designs and Effectiveness of Japan's Emissions Trading Scheme." *Clim. Policy* 11: 1337–49.

Murakoshi, C.,, H. Nakagami, T. Tsurusaki, and M. Nakamura. 2010. "Japanese Energy Efficiency Policy and the 25% Greenhouse Gas Reduction Target: Prime Minister Takes on Mission Impossible?" In *2010 ACEEE Summer Study on Energy Efficiency in Buildings*, 8: 270–86.

Nakhooda, S., T. Fransen, T. Kuramochi, A. Caravani, A. Prizzon, N. Shimizu, A. Halimanjaya, H. Tilley, and B. Welham. 2013. *Mobilising International Climate Finance: Lessons from the Fast-Start Finance Period*. Washington, DC: World Resources Institute, Overseas Development Institute, and Institute for Global Environmental Strategies.

National Institute of Environmental Studies (NIES). 2009. *Nihon onshitsukoukagasu haishutsuryou 2020 nen 25% sakugen mokuhyou tasseie muketa AIM model niyoru bunsekikekka (chuukan houkoku)* [*Preliminary Results of AIM Model Analysis for the Achievement of 25% Red.*]. Tsukuba, Ibaraki Prefecture: NIES.

—. 2010. *Chuuchouki roodomappu wo uketa onshitsukoukagasu haishutsuryou no shisan* [*Estimation of GHG Emissions Based on the Mid-Long Term Roadmap*]. Tsukuba, Ibaraki Prefecture: NIES.

National Policy Unit (NPU). 2011. Final Report of the Cost Verification Committee. Cost Review Committee, NPU, the Cabinet.

Next Generation Vehicle Promotion Center. 2014a. "Eco-car Subsidy." www.cev-pc.or.jp/ECO/eco-gaiyo/koufugaku.htm.

—. 2014b. "Next Generation Vehicle Promotion Center." www.cev-pc.or.jp/ECO/.

Nuclear Regulation Authority (NRA). 2014. "Shinkisei kijuntekigousei ni kakawaru shinsa (genshiryoku hatsudensho) [Examination of Compliance to the New Regulatory Requirements (Nuclear Reactors)]." www.nsr.go.jp/activity/regulation/tekigousei/power_plants.html.

Ogimoto, K., and M. Yamaguchi. 2012. "Nuclear Accident at the Fukushima Daiichi Nuclear Power Plant and Its Impact on Japanese Energy and Climate Policy." In *Climate Change Mitigation: A Balanced Approach to Climate Change. Lecture Notes in Energy,* vol. 4, ed. M. Yamaguchi, 223–44. London: Springer.

Prime Minister of Japan and His Cabinet. 2014. *"Abenomics" Is Progressing! The Latest Progress and Achievements in the First Year of the Abe Administration.* Tokyo.

Secretariat of the House of Councillors. 2013. "Kireme no nai chikyuu ondankataisaku no suishin - chikyuu ondankataisaku no suishin ni kansuru houritsu no ichibu wo kaiseisuru houritsuan" [Continuous promotion of global warming countermeasures - Bill of the partial revision of the Global Warming Count]. In: *Rippou to Chousa*. Secretariat of the House of Councillors: 42–57. Tokyo: Japan.

Suganuma, T. 2011. "Shashusenkou moderu wo mochiita jisedaijidousha fukyuu no tame no genzei hojokin sesaku no hyouka [Assessment of Subsidies and Tax Breaks for the Deployment of Next-Generation Vehicles Using a Vehicle Preference Model]." Master's thesis. In Japanese. Tokyo: University of Tokyo.

Sugino, M., and T. H. Arimura. 2011. "The Effects of Voluntary Action Plans on Energy-Saving Investment: An Empirical Study of the Japanese Manufacturing Sector." *Environ. Econ. Policy Stud.* 13: 237–57.

Sugiyama, N., and T. Takeuchi. 2008. "Local Policies for Climate Change in Japan." *J. Environ. Dev.* 17: 424–41.

Takamura, Y. 2011. "Japan." In *Climate Change Liability: Transnational Law and Practice*, ed. R. Lord, S. Goldberg, L. Rajamani, and J. Brunnée, 206–37. London: Oxfam.

Tokyo Electric Power Compay (TEPCO). 2013. "Comments on the *Summary Report of the Director-General-Level Conference Concerning the Bids on Thermal Power Generation Facilities of TEPCO*." www.tepco.co.jp/en/announcements/2013/1227310_5502.html

Tokyo Metropolitan Government (TMG). 2007. *Tokyo Climate Change Strategy: A Basic Policy for the 10-Year Project for a Carbon-Minus Tokyo.* Tokyo: TMG.

—. 2010a. *Tokyo Cap-and-Trade Program: Japan's First Mandatory Emissions Trading Scheme.* Tokyo: TMG.

—. 2010b. *Tokyo Cap and Trade: Japan's First Mandatory Emissions Erading Scheme.* Tokyo: TMG.

—. 2013a. "GHG Statistics FY2010." In Japanese. www.kankyo.metro.tokyo.jp/climate/other/attachement/2010gaiyo.pdf. Tokyo: TMG.

—. 2013b. *The Tokyo Cap-and-Trade Program Achieved 23% Reduction in the 2nd Year.* Tokyo: TMG.

—. 2013c. *Dai 2 keikaku kikan no omo na jokou nado. 1 (8) CO_2 haishutsu keisuu no minaoshi ① Zentai* [*Main Points for the 2nd Compliance Period. 1(8) Revision of the CO_2 Emissions Factors: Overall*]. Tokyo: TMG.

—. 2013d. *Souryou sakugen gimu to haishutsuryou torihiki seido torihiki kakaku no satei kekka ni tsuite* [*Cap-and-Trade Emissions Trading Scheme: Evaluation Results on Trading Prices*]. Tokyo: TMG.

Transportpolicy.net. 2014. "Japan: Heavy-Duty: Fuel Economy." transportpolicy.net/index.php?title=Japan:_Heavy-duty:_Fuel_Economy.

United Nations Framework Convention on Climate Change (UNFCCC). 2011. "Outcome of the Work of the Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol at Its Sixteenth Session." Draft decision. -/CMP.7 AWG-KP Outcome. Bonn: UNFCCC.

—. 2012. "Addendum Part Two: Action Taken by the Conference Parties." In *Report of the Conference of Parties Serving as the Meeting of the Parties to the Kyoto Protocol on Its Seventh Session, Held in Durban from 28 November to 11 December 2011*. FCCC/KP/CMP/2011/10/Add.1. Bonn: UNFCCC. unfccc.int/resource/docs/2011/cmp7/eng/10a01.pdf.

—. 2013. *Views on a Framework for Various Approaches*. FCCC/SBSTA/2013/MISC.11. Bonn: UNFCCC.

van Asselt, H., N. Kanie, and M. Iguchi. 2009. "Japan's Position in International Climate Policy: Navigating between Kyoto and the APP." *Int. Environ. Agreements Polit. Law Econ.* 9: 319–36.

Wakabayashi, M., and T. Sugiyama. 2007. "Japan's Keidanren Voluntary Action Plan on the Environment." In *Reality Check: The Nature and Performance of Voluntary Environmental Programs in the United States, Europe, and Japan*, ed. R. D. Morgenstern and W. A. Pizer. Washington, DC: Resources for the Future, 43-63.

World Bank. 2013. "World Development Indicators." data.worldbank.org/data-catalog/world-development-indicators.

WWF Japan. 2012. "Shin enerugiisenryaku kettei! Genpatsu zero mo ondankataisaku wa? [New Energy Strategy Announced! Zero Nuclear, but What about Mitigation?]." www.wwf.or.jp/activities/2012/09/1086314.html.

Zero Energy Promotion Office. 2014. "Zero Energy Promotion Office." In Japanese. www.zero-ene.jp/.

ACKNOWLEDGMENTS

This research was partly funded by the Korea Environment Institute (KEI). The author thanks Madoka Yoshino (IGES) for her substantive contributions to earlier drafts of the report. At WRI, Jenna Blumenthal, Thomas Damassa, and Taryn Fransen provided feedback and editing that helped shape this paper. The author also thanks Nate Aden, Pankaj Bhatia, Cynthia Elliott, Sarah Forbes, and Wee Kean Fong (WRI); Erwin Jackson and Olivia Kember (The Climate Institute, Australia); Jusen Asuka (Tohoku University, Japan); Yasuko Kameyama (National Institute of Environmental Studies, Japan); Mark Elder, Hironori Hamanaka, Hidefumi Imura, Shuzo Nishioka, and Kentaro Tamura (IGES); and Naoyuki Yamagishi (WWF Japan) for their valuable comments on the earlier drafts of the report. The author also would like to thank Heechan Kang and Hyejeong Lee of the KEI for their overall support of the research.

Thank you also to Hyacinth Billings, Bill Dugan, Alex Martin, Nick Price, Emily Schabacker, and Alston Taggart for their editing and publication design work.

ABOUT THE AUTHOR

Takeshi Kuramochi is a Policy Researcher in IGES's Climate and Energy Area. He joined IGES in 2011 and currently conducts a wide range of research on both domestic and international energy and climate policies, ranging from technoeconomic assessment of mid- to long-term CO_2 mitigation options to in-depth analysis of Japanese climate finance in developing countries. He holds a PhD in energy systems analysis from Utrecht University in the Netherlands.

Contact: kuramochi@iges.or.jp

ABOUT WRI

WRI is a global research organization that works closely with leaders to turn big ideas into action to sustain a healthy environment—the foundation of economic opportunity and human well-being.

ABOUT IGES

The Institute for Global Environmental Strategies (IGES), established under an initiative of the Government of Japan in 1998, is an international research institute conducting practical and innovative research for realising sustainable development in the Asia-Pacific region. IGES research focuses on three issues of critical importance: climate change, natural resource management, and sustainable consumption and production. IGES also serves as the secretariat for various international initiatives and research networks, actively contributing to policy formulation in the form of information sharing and policy proposals.

ABOUT THE OPEN CLIMATE NETWORK

The Open Climate Network brings together independent research institutes and stakeholder groups to monitor countries' progress on climate change. We seek to accelerate the transition to a low-emission, climate-resilient future by providing consistent, credible information that enhances accountability both between and within countries. http://www.openclimatenetwork.org.

PRODUCED IN PARTNERSHIP WITH

OPEN CLIMATE NETWORK