Climate change mitigation Policy Progression Indicator (CPPI)--a tool for measuring progression of climate change mitigation at national levels

Introduction and initial examination

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1. Objective

As an outcome of four years of multilateral negotiation under the United Nations Framework Convention on Climate Change (UNFCCC), it is expected that an agreement on the post-2020 framework would be reached at the 21st Conference of the Parties to the UNFCCC (COP21) to be held in Paris, in December 2015. Although the final outcome is yet to be materialized, it is likely that countries' commitment or contributions would not be to limit their greenhouse gas (GHG) emissions below the levels announced as Nationally Determined Contributions (NDCs) but rather to implement necessary policies and measures to achieve the NDCs and to periodically report and assess the progress made to reach them. Thus, procedure to examine the efforts made by each country is likely to become increasingly important in the post-2020 climate regime.

As the NDCs are expected to be non-legally binding by nature under the new institution, the reporting and assessment procedure should be considered as a means to promote countries' willingness to take additional actions to make further progress in climate change mitigation policies. The procedure should also be utilized to compare the level of achievement across countries. The procedure should be simple enough so that all countries can follow the process without much technical difficulty or financial capacity.

The aim of this project is, therefore, to develop a set of indicators that would contribute to making effective evaluation of the reporting and assessment procedures in the post-2020 period. The indicators aim at fulfilling two objectives. One is to measure actual efforts taken by countries to reduce GHG emissions. Countries' GHG emissions are affected by various factors irrelevant of policies. On one hand, countries could be praised when their GHG emissions were reduced, no matter what were the reasons of the reduction. On the other hand, countries should be praised or encouraged also by how much effort they put into reducing their GHG emissions, even if the effort did not lead to much reduction in actual emissions. The second objective is to compare the relative status of actual emissions across countries. Countries need to make further effort in climate change mitigation policies even if they were already judged as making significant effort.

The indicators should be simple and concise to allow their universal application to all countries. The measurement should also take into account the equity dimensions because the level of effort expected to be taken by developed countries should be significantly different from that to be taken by developing countries.

2. Research plan for three years

This is a three-year project that started in April 2015.

April 2015–March 2016: Design of tentative indicators and testing the applicability of the developed indicators by using data of four major countries/regions—the United States, EU, Japan, and China. The main focus will be on the energy, industry, and building sectors.

April 2016–March 2017: Continue developing the indicators. Transportation and forestry sectors will be added and GHGs other than CO_2 will also be considered. Data from other countries will be used to examine the utility of indicators. Equity dimension will also be taken into account.

April 2017–March 2018: Development of indicators is completed. Procedural matters will be considered so that the process could be incorporated in the official UNFCCC process.

3. Basics of the Climate change mitigation Policy Progression Indicator (CPPI)

3.1 Structure of the CPPI

The Climate change mitigation Policy Progression Indicator (CPPI) consists of two pillars.

Action Indicator: The purpose is to measure the countries' effort in reducing GHG emissions by introducing climate change mitigation policies. Countries' GHG emissions are relatively easy to measure, but they are affected by various factors such as economic recessions and warm winters, which are independent of implementation of climate change mitigation policies. This indicator will measure the level of climate mitigation policies by selecting key policy instruments that could be commonly introduced in all countries.

Outcome Indicator: The purpose is to assess the status of countries in respect to their achievement of actual GHG emission reduction by comparing with other countries as well as by comparing with each country's own past. This indicator shows the actual status of energy use and emissions independent of policy efforts taken by the countries.

The CPPI is to be updated and re-calculated every 5years; consequently, three timeframes, P(=past), S(=status), and F(=future), will be shifted 5years for each occasion.

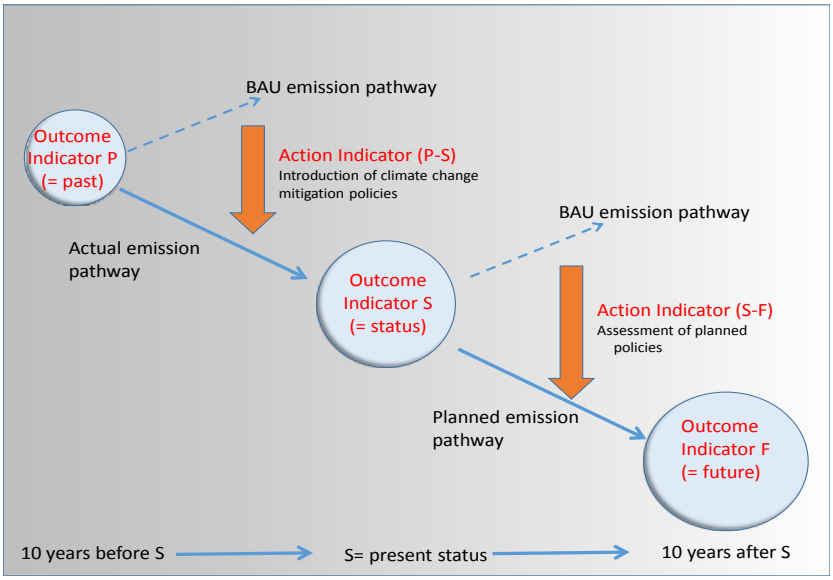

Figure 1: Structure of the CPPI

3.2 Common framework for Indicators

Although GHG emissions include gases that are not related to fossil fuel combustion, it goes without saying that fossil fuel combustion is the central target that needs to be tackled in order to mitigate climate change in the long run. Therefore, the indicators in this study mainly focus on energy use.

The use of energy differs from one country to another, depending on each country's level of economic development, geopolitical circumstances, availability of resources, climate, type of industries in the country, etc. Meanwhile, all countries should aim for three goals if they were to reduce GHG emissions

from fossil fuel combustion.

Goal 1:Decarbonization of energy

Decarbonization of energy: In order to reduce CO_2 emissions from fossil fuel combustion, all countries, in one way or another, should reduce consumption of fossil fuel. Reduction of oil extraction is also effective in reducing methane emissions. As an alternative, countries can increase the use of renewable energy, the use of nuclear power, or the use of carbon capture and storage (CCS) technology. While these options are effective in substituting fossil fuel combustion, the latter two face other issues. Nuclear power is a controversial energy for the risks other than climate change, whereas storage of CO_2 by CCS might not be an ultimate solution because of fear of gas leakages. These options could be considered as intermediary solutions until renewable energy is widely diffused.

The use of renewable energy is far more supported by the people than nuclear power. However, some voices emphasize concerns that renewable energies are more expensive than fossil fuels and their rapid expansion is therefore hindered economically. Some also argue that electricity generated by solar and wind technologies is too unstable and other types of power generation plants are needed anyway. These are the challenges that need to be overcome for a wide diffusion of renewable energy technologies.

Goal 2: Improvement of energy efficiency

Improvement of energy efficiency: Energy should be used in the most efficient way to achieve the greatest output. Energy efficiency has been improving worldwide, but the speed of improvement should be even faster if we were to minimize the impact of climate change. In some sectors, energy efficiency at the product level is satisfactory, but not at the system or community levels. Hence, various levels of energy efficiency need to be assessed.

Some policies to promote energy-efficient products do not always lead to overall emission reduction because they may stimulate increased consumption of products and energy at community level. However, this goal only intends to assess the efficiency aspect of products and systems.

Goal 3: Minimizing demand for energy service

Minimizing demand for energy service: While energy efficiency needs to be further improved, the best approach is to eliminate any need for energy. For instance, improvement of energy efficiency in automobiles is important, but people can use other means of transportation such as bicycles and public transportation while enjoying the same level of mobility. Energy demand management is another approach to reduce the pressure on insufficient electricity supply, rather than increasing the supply by burning more fossil fuels to meet the requirements. It is becoming more important to reduce unnecessary demand for energy and products to reach the climate mitigation goal.

plus...

Restoration of forests, & reducing emissions from deforestation and degradation

Both the Action and Outcome indicators are constructed in a way to measure countries' progress mainly in areas of the three goals. Several indicators are added to reflect other aspects of climate mitigation policies that cannot be covered by the three goals, such as non-CO_2 GHG and land use, land-use change and forestry (LULUCF).

3.3 Action Indicators

The Action Indicators aim at grasping the policy efforts taken by each country to reduce GHG. The actual effort cannot be measured by the amount of GHG emissions because emission can be increased or reduced due to various reasons. Rather, this set of indicators selects the key policies that are effective in reducing GHG emissions and tries to assess ambitiousness of these policies by checking these policies' coverage and level of stringency. Effective or agreeable climate policies can be different from one country to another, but there is no option for countries not to implement any of these policies.

The Action Indicators are not intended to rank countries by their GHG emission levels. Rather, they are useful to verify those policies that are already effective in many countries and those that could be strengthened or should be implemented in other countries. By comparing different time periods in a country, we will be able to assess whether the country is making progress in tackling the climate change.

The Action Indicators specify the levels of implementation of policies; thus, they do not highlight the equity dimension of climate change problem. Generally speaking, developed countries are expected to implement more ambitious policies aiming at more ambitious goals than the developing countries.

Table 1 lists the policy instruments that are considered candidates for Action Indicators. We are now examining these policies to identify which of these policies could be selected as Action Indicators. Countries are not expected to implement all of the policies listed in this table but rather to select policies and construct their respective policy packages to achieve significant emission reduction. Even if implemented, some policies will not lead to actual emission reduction if they are not sufficiently ambitious. For example, carbon or environmental taxes are already in place in many countries, but they are not effective if the tax rates are not high enough or if large emitting industries are exempted from the tax. This research project plans to develop measurement of ambitiousness of these policies.

Table 1: Candidates of policy instruments as Action Indicators (tentative)

Goal	Category	Candidates for Action Indicators
Goal 1: Decarbonization of energy	Promotion of renewable energy	Target setting; feed-in tariff; subsidy; policies related to power grids and transmission; policies to increase social acceptance; policies to mobilize investment into renewables
	Promotion of decarbonization of fossil fuel power plants	CO_2 emission standards for coal power plants at power plant level; CO_2 emission standards for coal power plants at power sector level; phase out of subsidies for fossil fuels; Carbon Capture and Storage (CCS); Policies to mobilize investments into less carbon intensive energy
	Nuclear power	Safety standards; preparation for emergency
	Incentive to shift to less carbon intensive energy	Emissions trading
	Transportation sector	Subsidies for less carbon intensive means of transportation

Goal 2: Improvements in energy efficiency	Industry sector	Target setting for emissions; Target setting for efficiency; Subsidies to promote efficiency; Agreement between government and industry; Policies to mobilize investments into energy; efficient products and production processes; Emissions trading at national levels; Emissions trading at regional levels; Carbon- and energy-related taxes; Other market mechanisms
	Building sector	Standards and regulations concerning new buildings and existing buildings; Subsidies to promote energy efficient buildings; Standards and regulations concerning electric home utilities; Subsidies for development and sales of electric home utilities
	Transportation sector	Regulations related to energy efficiency of automobiles; Subsidies to promote energy efficient cars; Policies to promote energy efficiency in other means of transportation
Goal 3: Minimizing the demand for energy service	Demand-responses in area of energy and industry sectors	Target setting; Standards and regulations concerning demand-responses; Subsidies to promote demand-responses; Agreements between governments and industries; Energy management system in industry parks; Policies to mobilize investments in the area of demand-side management; Emissions trading; Carbon tax and energy tax
	Demand-side management in building sector	BEMS and HEMS, other energy management systems; Standards and regulations to reduce energy demands; Visualization and other means to change consumer behavior; Policies to mobilize investments to reduce energy demand; Carbon tax and energy tax
	Transportation sector	Transportation system to reduce demands for mobility; Promotion to shift to means of transportation from private cars; Carbon tax and energy tax
	Regional development	Construction of low carbon cities
Others	LULUCF	Standards, regulations, and subsidies for conservation of forests; Promotion of wise-use of wood products; Promotion of minimizing land-use change from forests
	HFCs and other fluorinated gases	Regulatory measures to prohibit or reduce consumption of HFCs; Regulatory measures to collect and destroy or recycle CFCs and HCFCs in products
	Methane	Measures to reduce methane emissions

3.4 Outcome Indicators

This indicator aims to present the overall situation of a country by comparing it to other countries, and to assess the progress within one country by comparing it across a time period. The outcome of each country is affected by actions or efforts taken by each country, as well as by many other factors that are not related to the efforts. Simple indicators should be chosen so that necessary data can be obtained. Five indicators are chosen in this study (Table 2).

Table 2: Outcome Indicators and the corresponding equity consideration (tentative)

Goals	Outcome indicators	Equity consideration
Goal 1. Decarbonization of energy	1. CO_2 emission/Total Primary Energy Supply(TPES)	Developed countries should aim at lower levels than developing countries.
	2. Renewable energy supply/TPES	Developed countries should aim at higher levels than developing countries.
Goal 2. Improvement of energy efficiency	3. Total energy consumption/Gross Domestic Products (GDP)	Developed countries should aim at lower levels than developing countries
Goal 3. Minimizing the demand for energy service	4. Total energy consumption/population	Developing countries could increase the rate up to a certain level, and then start declining it.
Others	5. Land covered by forests	Geographic and climatic circumstances shall be taken into account.

4. Initial examination: application to major economies

4.1 Examination of Action Indicators

Because of tight time constraint, we focused on GOAL 1 and collected data on policies implemented in four key countries/regions (United States, EU, Japan, China) in years between 2005 and 2012, and those that are planned to be implemented in these countries and regions in years between 2012-2025. After collecting data, we developed a criteria for the assessment (Table 3)

Table 3: Criteria for assessment of mitigation policies (tentative)

Level	Criteria for the assessment
A+	Action sufficient to lead the country's emission in line with 2°C target.
A	Action with more progress than in previous terms in the country, and more ambitious than most of other countries.
A-	Action with more progress than in previous terms in the country, or more ambitious than many of other countries.
B+	Action with little more progress than in previous terms in the country, or a little more ambitious than many of other countries.
B	Action with little more progress than in previous terms in the country, and level of about an average of all countries.
B-	Action with almost no progress than in previous terms in the country, or less ambitious than most of other countries.
C+	Action with almost no progress than in previous terms in the country, and less ambitious than most of other countries.
C	Action with no progress, or retreat from previous terms in the country, and less ambitious than most of other countries.
C-	A clear retreat from previous terms in the country.

This criteria was a difficult decision, because the Action Indicator is intended to measure progress in each country above all, but, at the same time, is expected to be able to compare level of ambitiousness between countries. Another difficulty we faced was consideration on equity among countries in different levels of economic prosperity. A question was raised whether policy implemented in an industrialized country should be compared equally with policy implemented in a least developing country. An option to overcome this issue is to develop different sets of criteria according to level of economic development. However, subdivision of criteria for assessment will complicate the whole scheme. We are aiming at a simple and concise scheme as possible, and decided to use this simple criteria. Developing countries might not be able to obtain more "A"s than developed countries, but that is not an issue we are willing to take up. It will be an issue if some of the most developed countries did not obtain more "A"s than many developing countries.

The summary of the assessment is shown in Table 4. More detailed explanation on which the assessment is based is attached as an Annex at the end of this report. We can draw out from this summary some remarks regarding policy implemented for decarbonization of energy. First, most countries are making progress in almost all area of policies categorized in this table, when compared between the last decade (years between 2005 and 2012) and the upcoming decade (years between 2012 and 2025). Even today, deepening of policies are planned for the near future in many areas in all four countries and regions covered by this study. This is a good sign. Second, countries are doing relatively well in the area of policies to mobilize investment into renewables, CCS, safety standards and plans in case of emergency for nuclear energy plants, and emissions trading. On the other hand, there are potentials for further progress in the area of CO_2 emission standards for fossil fuel power plants at the plant level, CO_2 emission targets at the sector level, and phase out of subsidies for energy and fossil fuels.

Table 4: Summary of policy assessment for GOAL 1: Decarbonization of energy

Category	Candidates for Action Indicators	US		EU		CHN		JPN	
		2005 -2012	2013 -2025	2005 -2012	2013 -2025	2005 -2012	2013 -2025	2005 -2012	2013 -2025
1. Promotion of renewable energy	(1) Target setting								
	(2) Feed-in Tariff								
	(3) Subsidy								
	(4) Renewable Portfolio Standards (RPS)								
	(5) Policies related to power grids and transmission								
	(6) Policies to increase social acceptance								
	(7) Policies to mobilize investment into renewables	B	B-	B	B+	B-	A-	B	B-
2. Promotion of decarbonization of fossil fuel power plants	(1) CO_2 emission standards for fossil fuel power plants at power plant level	B+	A	C+	B+	C+	A	C+	B
	(2) CO_2 emission targets for coal power plants at the sector level	C+	A	A-	A-	C+	B-	B-	B-
	(3) Phase out of subsidies for energy and fossil fuels	C+	C+	B+	B-	B	C+	B-	C+
	(4) Policies to promote less carbon intensive energy (other than EPS and subsidies/tax)	A	B-	B	C+	B+	B+	B+	B
	(5) Carbon Capture and Storage (CCS)	A-	B	B	B	B-	B-	B	A-
3. Nuclear power	Safety standards, Plans in case of emergency	B+-	B	B+-	B+	B	B	B+	B-
4. Incentive to shift to less carbon intensive energy	Emissions trading (also effective for goals 2 & 3)	B	A-	A	A	B	A-	B+	B-
5. Transportation sector	Subsidies for less carbon intensive means of transportation								

Note: Cells with B+ and Bs are in dark gray. Cells with B- and/or below are colored in yellow.

The list will be updated by future study. After completion, we are expecting to have other experts to assess our expert judgement to see if any revisions are necessary.

4.2 Examination of Outcome Indicators

As an example, we calculated the Outcome Indicators for the years 2005, 2012, and 2025. We planned to choose the year 2015 rather than 2012 as the "status" year, but the year 2012 was eventually chosen because of data availability. The following major countries were selected: Australia, Canada, China, the EU, Japan, Russia, and the United States.

We utilized the scenarios in the World Energy Outlook 2014 (WEO 2014) (OECD/IEA2014) to determine the level of CO_2 emission that should be achieved by 2025 in order to reach the long-term goal of limiting temperature rise to 2°C. Three scenarios are set in the document (OECD/IEA 2014, p. 38).

- Current Policies Scenario: Describes a business-as-usual future that takes into consideration only those policies and implementing measures that had been formally adopted as of mid-2014.

- New Policies scenario: Includes a number of proposals that have been announced by governments over the past years but are not yet formally adopted. Examples are regulations in the United States to cut GHG emissions from power plants and the EU's 2030 policy framework for climate and energy policies.

- The 450 Scenario: Adopts a specified outcome—the international long-term average goal to limit temperature rise to 2°C—and illustrates how that might be achieved. The scenario assumes a set of policies that generate a trajectory of GHG emissions from the energy sector that is consistent with the goal.

Data from the following sources were used for the calculations:

- Population: (United Nations 2015) for all years
- Gross Domestic Production (GDP): (World Bank 2015) for years 2005 and 2012. Annual growth rate for GDP in WEO 2015 was used to estimate GDP in 2025.
- Energy-related and CO_2 emission data: WEO 2015 was used for years 2005 and 2012.
- For energy-related data and CO_2 emission data for the year 2025, the Intended NDCs (INDCs) submitted by countries were taken into account. The INDCs were compared with emissions in "new policy" scenario and "450" scenario.

Since the INDCs of Australia, Canada, the EU, and the United States were the closest to the 450 scenario of WEO 2014, the projection in the 450 scenario was used to calculate the Outcome Indicator for the year 2025 of these countries. The INDCs of China, Japan, and Russia were the closest to the New policies scenarios of WEO 2014, and the projection in the New policies scenario was used to calculate the Outcome Indicator for the year 2025 of these countries.

Outcome Indicator 1: CO_2 emission/Total Primary Energy Supply (TPES) (Figure 2)

- Decarbonization in almost all countries except Russia and China are expected to improve at around the same rate since 2012 into the near future. The rate of decarbonization in these countries is almost sufficient to reach the long-term goal, as long as this rate is maintained beyond the year 2025. China and Russia could improve faster than they have planned in their INDCs between 2012 and 2025, when compared with other countries.
- Decarbonization level in Japan worsened after the March 2011 earthquake, followed by closing of nuclear power plants. The level is expected to make a rapid improvement by diffusion of renewable energy but is not likely to converge to the levels that are expected to be reached in many other countries.

- The leadership of the EU is clearly observed.
- In order to follow a path set by the WEO (2015) 450 scenario, further decarbonization is needed by the year 2025, jointly with the Annex I countries.

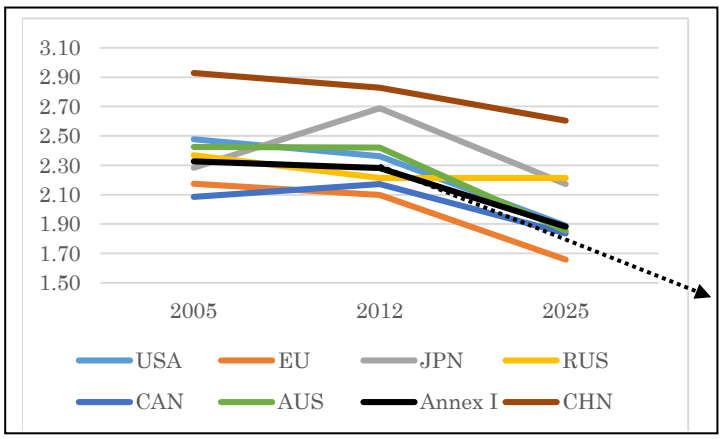

Figure 2: Outcome indicator 1 for major economies (MtC/million tons of oil equivalent [TOE])

⋯⋯→ ＝path of Annex I countries total in WEO 450 scenario

Outcome Indicator 2: Renewable energy supply/TPES (Figure 3)

- The rate of renewable energy was high, particularly in Canada, throughout the three periods due to high rate of hydropower. China's rate of renewable energy used to be relatively high as a result of use of traditional biomass and hydropower, but the rate has declined since then.
- The EU will reach Canada by the year 2025, mostly by diffusion of renewables other than hydro power, whereas Russia is behind other Annex I countries.
- Although Japan pledges to invest in renewables in the future, the set target is not high enough to reach most of other Annex I countries.
- In order for the Annex I countries to follow the path of WEO 450 scenario, all Annex I countries need to reach Canada and the EU and further increase the rate by the year 2025.

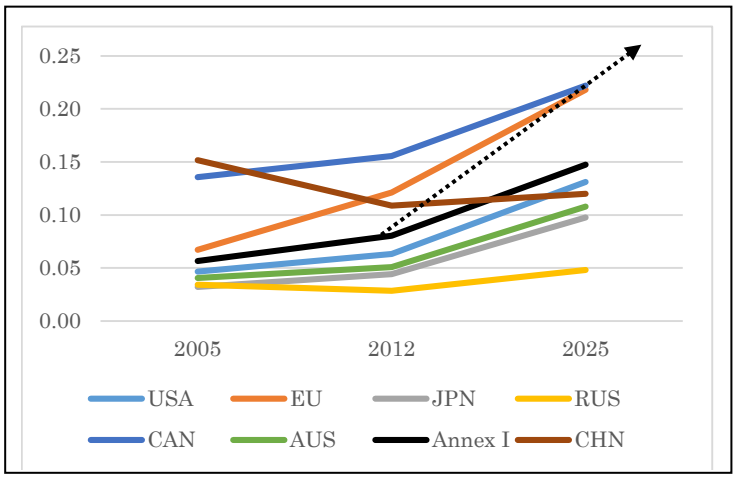

Figure 3: Outcome Indicator 2 for Annex I countries (%)

⋯⋯→ ＝path of Annex I countries total in WEO 450 scenario

Outcome Indicator 3: Final energy consumption/GDP (Figure 4)

- Japan keeps the front runner's position, but the EU is likely to reach it by 2025. China and Russia have rapidly improved the efficiency rate, but further improvement is required in coming years.
- The United States and Australia need to increase their efforts to improve the final energy consumption/GDP rate.
- If countries were to follow the path of WEO 450 scenario, all of the Annex I countries should be at the same level with Japan and further improve by 2025 and beyond.

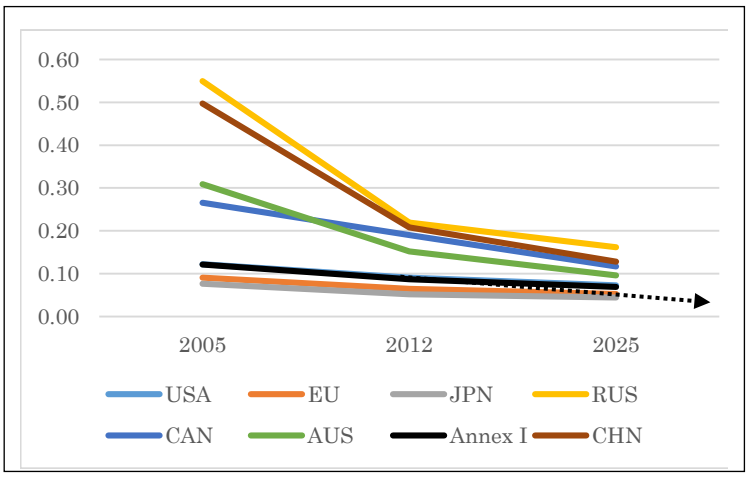

Figure 4: Outcome Indicator 3: Final energy consumption/GDP (mil. tons of oil eq. [TOE]/billion USD)

⋯⋯→ = path of Annex I countries total in WEO 450 scenario

Outcome Indicator 4: Final energy consumption/population (Figure 5)

- Australia and Canada show by far the largest figures, but the rates of improvement in these countries between 2012 and 2025 are likely to be faster than in other countries.
- In Japan, the rate worsens between 2012 and 2025 due to population decrease.
- The rate is relatively flat during the two decades in the EU, while China is approaching the levels of Japan and the EU.
- If Annex I countries were to follow the 450 scenario, they have to increase their efforts to improve this

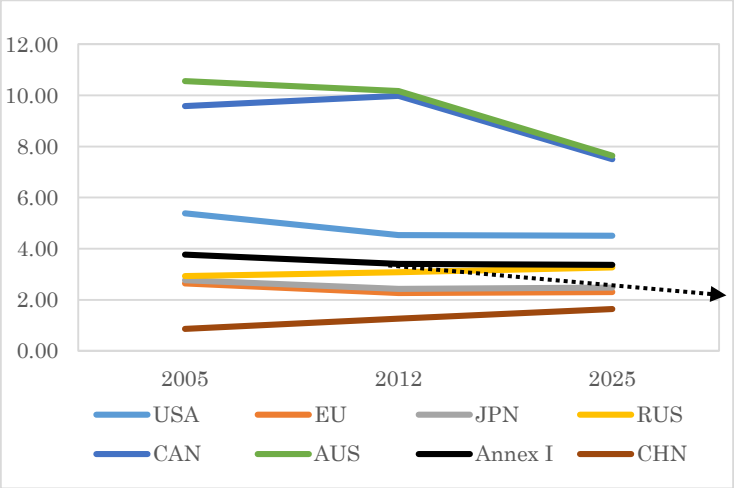

Figure 5: Outcome Indicator 4. Final energy consumption/capita (mil. tons of oil eq. [TOE]/million)

⋯⋯→ =path of Annex I countries total in WEO 450 scenario

Outcome Indicator 5: Forest coverage rate (Figure 6)

- Not may INDC reports have clearly indicated goals for forest coverage, but some of them have given important messages into the future.
- Particularly, China has inscribed in its INDC that it would aim at increasing forested area by 40 million hectares and the forest stock volume by 1.3 billion cubic meters compared to the 2005 level. China seems to be the front runner in this respect, even when compared with the developed countries.
- Forest coverage of Japan has been high throughout the two decades. It may be relatively difficult to further enhance forest coverage in Japan, but it can make greater contribution in tackling deforestation in developing countries by means of REDD+. Contributions in other countries will not be directly reflected in this outcome indicator, but it is likely to be shown in an indirect manner, if all countries, including developing countries, introduced this indicator.

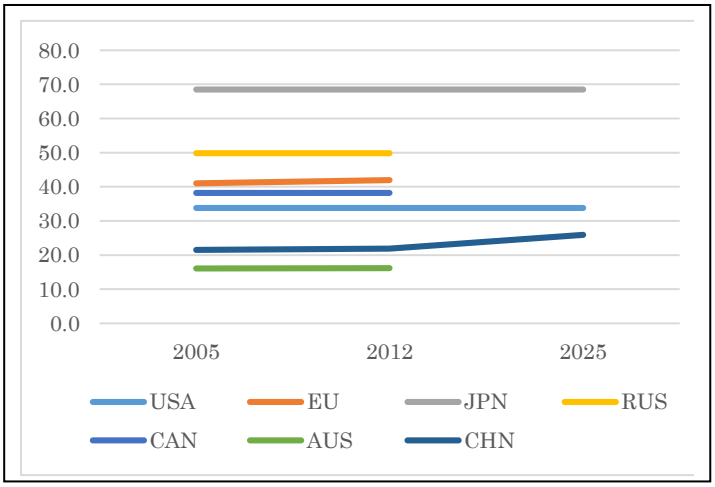

Figure 6: Outcome Indicator 5. Forest coverage rate (%)

5. Future work

We have commenced collecting data for both Action and Outcome Indicators to identify the policies that should be chosen as indicators, i.e., tools that show the countries' overall level of effort to mitigate climate change. We will start from four major countries/regions: the EU, the United States, Japan, and China, and will extend the study to test whether the indicators can be applied to all countries.

The final set of indicators should also include non-GHGs and sequestration by land use, land-use change and forestry. It is our goal to propose the use of indicators as a way to conduct assessment of countries' climate change mitigation policies.

Relevant studies are being conducted around the world, and it is also our intention to exchange views with those other research projects and try to find common ground for actual implementation of reporting and measurement of policies.

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Annex: Descriptive analysis on Action Indicator

GOAL 1: Decarbonization of energy

1. Promotion of renewable energy (we are still working on sections (1)-(6))

(1) Target setting
(2) Feed-in-Tariff
(3) Subsidies to renewables
(4) Renewable Portfolio Standards (RPS)
(5) Policies related to power grids and transmission
(6) Policies to increase social acceptance

(7) Policies to mobilize investment into renewables

country	Term	Assess -ment	Supplemental information for the Assessment
US	2005 -2012	B	**Tax credit schemes are established to promote renewable energy.** The federal renewable electricity production tax credit (PTC) has been implemented since 1992 to provide an inflation-adjusted per-kilowatt-hour (kWh) tax credit for electricity generated by qualified energy resources and sold by the taxpayer to an unrelated person during the taxable year. The amount of credit for each technology is as follows; $0.023/kWh for wind, $0.023/kWh for closed-Loop Biomass, $0.011/kWh for open-loop biomass, $0.023/kWh for geothermal energy, $0.011/kW for landfill gas, $0.011/kWh for municipal solid waste, $0.011/kWh for qualified hydroelectric and $0.011/kWh for marine and hydrokinetic. Residential Renewable Energy Tax Credit was established by the Energy Policy Act of 2005. A taxpayer may claim a credit of 30% of qualified expenditures for a system that serves a dwelling unit located in the United States that is owned and used as a residence by the taxpayer. The scope of technologies includes solar-electric property, solar water-heating property, fuel cell property, small wind-energy property, and geothermal heat pump.
	2013 -2025	B-	**Tax credit schemes will continue to exist to promote renewable energy.**
EU	2005 -2012	B	**Loans, repayment bonuses, funds, and tax credit schemes are observed in limited number of member countries.** Germany: Since 2009, Germany has implemented KfW Renewable Energies Programme that consists of three parts - "standard", "premium" and “storage”. The "standard" programme comprises of loans for electricity from solar energy (photovoltaics), biomass, biogas, wind energy, hydropower, geothermal energy as well as electricity and heat from renewable energies, generated in combined heat and power (CHP) stations. The "premium" programme offers loans and repayment bonuses for heat from renewable energies generated in large plants. The “storage” programme offers funds for new installation of stationary battery storage system combined with photovoltaic systems. In 2013, KfW provided a total credit volume of EUR 298 million for Premium and around EUR 4.4 billion for Standard, Funding for Storage amounted ERU 45 million. France: Since 2003, France has implemented the tax credit for acquiring energy production equipment which uses a renewable source of energy, and which is installed in new housing. The credit is equal to 15% of the amount of the purchase price.
	2013 -2025	B+	**Loans cover additional types of renewables.** In 2015, KfW announced EUR 430 million for Offshore Wind Energy Programme that was established in 2011. The amount of budget is the fourth and the largest financing support under this programme.
CHN	2005 -2012	B-	**Tax refund was introduced for wind power generation only.** Since July 1, 2008, the 50% of VAT for wind power generation have been refunded.
	2013 -2025	A-	**Tax refund will continue. In addition, portion of tax paid in excess will be invested into renewable energy.**

			During October 1st 2013 to December 31st 2015, PV manufacturers are refunded 50% of the value-added tax (VAT). From 1 January 2013 to 31 December 2015, the portion of VAT paid in excess of 8 percent shall be refunded on the sale of self-produced electricity by hydro power station. From 1 January 2016 to 31 December, the portion of VAT paid in excess on the sale of self-produced electricity by hydroelectric power station with 1 million kW installed capacity. 100 % refund of VAT is paid on the sale of biodiesel oil generated by the utilization of abandoned-animal fat and vegetable oil.
JPN	2005 -2012	B	**Partial depreciation against standard purchase prices, tax credits, and low interest loans have been established.** In 2011, Agency for Natural Resources and Energy (ANRE) implemented Green Investment Tax Incentive that a tax payer can choose one incentive from the following; 30% special depreciation against standard purchase prices, 100 percent depreciation (i.e. total acquisition costs can be expensed upfront), tax (7% of acquisition costs) credit, only available for small and medium sized enterprise (SME). In 2012, ANRE implemented a tax relief that can reduce property tax for three years. Japan Finance Corporation (JFC) provides low interest loan for solar heating, wind, biomass energy, heat pumping system, geothermal and hydropower.
	2013 -2025	B-	**No additional plan has been provided for a foreseeable future.**

2. Promotion of decarbonization of fossil fuel power plants

(1) CO_2 emission standards for fossil-fuel power plants at the plant level

country	Term	Assess-ment	Supplemental information for the Assessment
US	2005 -2012	B+	**Some states introduced emissions performance standards (EPS), but not at federal level.** There had been no CO_2 emission standard on coal-fired power plants by 2012at the federal level, although regulations for SO_2, NO_2 and mercury were implemented under the Clean Air Act. However, several States have implemented EPS. EPS at the level of 1,100lbsCO_2/MWh (500g/kWh) to coal-fired power stations were introduced in California (SB1368) in 2006, which prevented the construction of unabated coal-fired power plants. In 2007, the same level of EPS was also introduced in Washington (SB6001), Oregon (HB3283, SB101), and New Mexico (SB0994).In 2008, Montana (HB25) and Illionois (SB1987) adopted different approaches of EPS which more explicitly aimed at CCS (requesting coal-fired power plants to capture 50% of emissions). (The share of electricity supply by the coal-fired plants has been decreased since 2009 owing to increase of gas production. The shares of electricity supply in each year are as follows; 49% in 2007, 49% in 2008, 45% in 2009, 46% in 2010, 43% in 2011, 38% in 2012.)
	2013 -2025	A	**The Clean Power Plan (CPP) is expected to reduce 32% of CO_2 emission in the electricity sector compared to 2005 levels by 2025, and a standard will be set for each power plant.** On August 3, 2015, President Obama and Environmental Protection Agency (EPA) announced the CPP towards 32% of CO_2 emission reductions in the electricity sector compared to 2005 levels. Under the CPP, 0.59 kgCO_2/kWh of performance rate for fossil fuel-fired electric steam generating units and 0.35 kgCO_2/kWh for stationary combustion turbines would be applied for existing generation units if a state plans is designed to impose an intensity target on each power plants. In addition to CPP, it also launched Carbon Pollution Standards for new, modified and reconstructed power plants. The emission standards are 0.64 kgCO_2/kWh for new coal-fired plants, 0.816kgCO_2/kWh for reconstructed coal-fired plants less than 586MW, 0.907 kgCO_2/kWh for reconstructed coal-fired plants more than 596MW and 0.454 kgCO_2/kWh for all gas-fired plants.
EU	2005 -2012	C+	**No EPS at the EU level and the member state level.** In the EU, the electricity supply by coal-fired has been decreased by 10% from 1,000 TWh in 2005 to 900 TWh in 2013. In Germany, once electricity supply coal-fired plant had decreased from 298TWh in 2005 to 260 TWh in 2009 but it increased to 293 TWh again in 2013. Similarly in the UK, electricity supply coal-fired plant had decreased from 136TWh in 2005 to 104 TWh in 2009 but it increased to 144 TWh again in 2012 and 132 TWh in 2013. In France, the share of coal-fired plant have accounted for less than 5% due to the large amount of electricity supply by nuclear power plants.
	2013 -2025	B+	**No EPS at the EU level, but some progress at member state level.** In the UK, the Energy Act 2013 established an EPS that establishes an emission standard as 0.45kg/kWh to limit carbon dioxide emissions from new fossil fuel power stations.
CHN	2005	C+	**No emission standards at plant levels.**

	-2012		The electricity supply from coal fired power sector in China has been rapidly increased. It supplied electricity around 2,000 TWh in 2005 and 4,100TWh in 2013.
	2013 -2025	A	**Caps will be set on coal-fired power plants.** The Energy Development Strategy Action Plan (2014-2020) which put the cap on the annual coal consumption at 4.2billion tCO_2 until 2020.includes the provision that the coal consumption rate for new coal-fired power plants should be less than 300g/kWh (this is equivalent to around 0.7kgCO_2/kWh).
JPN	2005 -2012	C+	**No emission standards at plant levels.** There were no CO_2 emission standards for fossil-fuel power plants at the plant level. (Electricity supply by coal-fired plants in Japan has been around 300TWh since 2005.)
	2013 -2025	B	**No emission standards at plant levels, but best available technologies (BAT) is recommended.** There are no CO_2 emission standards. However, in April 2013, the Ministry of the Environment has published the list of best available technologies for coal-fired and gas-fired power plants by generation capacity. During environments impact assessment MOEJ requests a power producers to adopt BATs that are already commercialized or under demonstration testing. As of April 2014, USC is listed in commercialized coal-fired power plant and A-USC (around 0.75kgCO_2/kWh) and IGCC (0.75kgCO_2/kWh) are listed in demonstrated coal-fired power plants. This listed will be updated in every year.

(2) CO_2 emission target for coal power plants at the sector level

country	Term	Assess -ment	Supplemental information for the Assessment
US	2005 -2012	C+	**No emission target at federal level.**
	2013 -2025	A	**The CPP is expected to reduce 32% of CO_2 emission in the electricity sector compared to 2005 levels by 2025.** If each state designing mass-based plan and rate-based plan to fulfill emission goals for each states under the CPP, CO_2 emission standard at power sector level is applied.
EU	2005 -2012	A-	**The EU Emissions Trading Scheme (EU-ETS) was utilized as a means to reduce CO_2 emissions from coal power plants.** During EU-ETS Phase I, emission allowance for electricity power sector was allocated by grandfathering method. In Germany, 97.55% of average CO_2 emission during 2000-2002 was allocated for fuel combustion facilities, including coal-fired plant. In the UK, the allowance was allocated based on the CO_2 emission during 1998-2003. During EU-ETS Phase II, the emission allowance for electricity power sector was allocated by benchmark method. For example in the UK, the benchmark for coal-fired power plant was calculated as follows. Benchmark = capacity of power plants * load factor (2001-2003) * average emission intensity of all coal-fired power plant in the UK.
	2013 -2025	A-	**The EU Emissions Trading Scheme (EU-ETS) will continue to be utilized as a means to reduce CO_2 emissions from power sector, but the effectiveness will depend on allocations of allowances.** During EU-ETS Phase III, auction method is applied for electricity power sector except for eight of the Member States Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Lithuania, Poland and Romania. Those countries have made use of a derogation under Article 10c of the EU ETS Directive which allows them to give a decreasing number of free allowances to existing power plants for a transitional period until 2019.All the emission allowance under the EU-ETS is subject to EU's 2020 emission reduction target, i.e. 20% cut in GHG emissions from 1990 levels. UK: Given the low carbon price under the EU-ETS, the Energy Act 2013 established an EPS at the level of 450g CO2/kWh, to limit carbon dioxide emissions from new fossil fuel power stations. The level of 450g/kWh is fixed until the end of 2044, and the secondary legislation will be required to raise the level of the performance standard. For the implementation of the EPS, the Emissions Performance Standard Regulations 2015 (SI 2015/933) came into force on 25 March 2015.
CHN	2005 -2012	C+	**There was no emission targets for CO_2 emissions from power sector. Regulations for other pollutants existed.**

	2013 -2025	A-	**ETS will be utilized to reduce CO_2 emissions from power sector** On 25 September 2015, China released a joint statement on climate change with U.S. China's President Xi Jinping announced that the country will launch a national emissions trading system (ETS) in 2017. The mandatory system will cover key sectors including power generations. This ETS is expected to be in line with China's INDC and would expand on the seven existing ETS pilots that are already operating in Chinese cities and provinces."
JPN	2005 -2012	B+	**Voluntary agreement is utilized to reduce CO_2 emissions from power sector** The Federation of Electric Power Companies (FEPC) has published an intensity target of 0.34 $kgCO_2$/kWh under its voluntary actions plans to fulfil the electricity sector target under Kyoto achievement plan.
	2013 -2025	C	**Emission from power sector is likely to continue to depend on voluntary actions of companies.** On 17th July, 2015, the 35 electricity companies that cover 99% of electricity sales in Japan jointly announced 0.37$kgCO_2$/kWh of the intensity target for whole electricity sector at 2030, as its voluntary action plan. However, no concrete framework to fulfil this target has been announced. Power companies are planning to build new coal power plants, criticized by Ministry of the Environment.

(3) Phase out of subsidies for energy and fossil fuels

country	Term	Assess -ment	Supplemental information for the Assessment
US	2005 -2012	C+	**No tax and subsidies have been imposed on fossil fuels for electricity generation, but subsidies do exist at the upstream of fossil fuel supply chain.** [subsidies for the supply/production of fossil fuel] Average annual national subsidies for upstream oil and gas; multiple fossil fuels or unspecified, coal mining, oil and gas pipelines, power plants and refining; coal-fired power during 2013-2014 was 20,491 million USD. Average annual public finance for fossil fuel production 2013-2014 was 3,735 million USD.
	2013 -2025	C+	
EU	2005 -2012	B+	**There are no subsidies for fossil fuels for electricity generation, while some member countries impose taxes on CO_2 from energy. Subsidies exist on upstream of fossil fuel supply chain.** [energy CO_2 tax] UK: In the UK, 10EUR/tCO_2 of taxes is imposed on electricity for whole sectors. Germany: In Germany, 30-40 ERU/tCO_2 of taxes is imposed on electricity sector but certain energy intensive sector has a tax exemption. In France, around 50 EUR/tCO_2 of tax is imposed on electricity for industrial sector. But the tax for the power plants that capacity is more than 250kW is same level as household sector, i.e. 10ERU/tCO_2. [subsidies for the supply/production of fossil fuel] Average annual national subsidies for Upstream oil and gas; Multiple fossil fuels or unspecified, coal mining in UK during 2013-2014 was 9,047 million USD. Average annual public finance for fossil fuel production 2013-2014 was 1,382 million USD in France, 2,595 million USD in Germany, 5,515 million USD in UK. .
	2013 -2025	B-	
CHN	2005 -2012	B	**Subsidy for fossil fuel consumption as well as production existed. Amount of the former is on the decrease.** [subsidies for fossil-fuel consumption] According to IEA fossil-fuel subsidies database, fossil fuel subsidy in China is 7.2 billion USD (2.2 % of average subsidization rate) in 2012. This number has been decreased from11.9 billion USD in 2011 and 11.8 billion USD. [subsidies for the supply/production of fossil fuel] Average annual national subsidies for coal mining, upstream oil and gas during 2013-2014 were 3,375 million USD. Average annual public finance for fossil fuel production 2013-2014 was 16,623 million USD.

	2013 -2025	C+	
JPN	2005 -2012	B-	**There are no subsidies for fossil fuel consumption, while tax on CO_2 from energy is imposed. Subsidies exist on upstream of fossil fuel supply chain.** [energy-related CO_2 tax] For the coal-fired plant, 8 yen/tCO_2 is imposed. (9 yen/tCO_2 for gas-fired power plant and 10yen/tCO_2 for gas-fired power plants) [subsidies for the supply of fossil fuel] Average annual national subsidies for upstream oil and gas; oil and gas pipelines; power plants and refining during 2013-2014was 736 million USD. Average annual public finance for fossil fuel production 2013-2014 was 19,029 million USD.
	2013 -2025	C+	**Tax for Climate Change Mitigation is introduced in 2012, but the rate is low.** The price of tax is JPY289 per ton per CO_2.

(4) Policies to promote less carbon intensive energy (other than EPS and subsidies/tax)

country	Term	Assess -ment	Supplemental information for the Assessment
US	2005 -2012	A	**DOE has allocated a large amount of budget for R&D on shale gas, for example.** Natural Gas R&D by DOE (Annual natural gas budget of $12 – 117 MM) and Incentive pricing that delegate the well head sales price for shale gas
	2013 -2025	B-	**Budget for R&D on less carbon intensive energy is likely to decrease in a near future.** Governmental interest has shifted to safe development of the energy resource using techniques like hydraulic fracturing, or fracking
EU	2005 -2012	B	**Large Combustion Plant Directive (Directive 2001/80/EC)of 2001 was effective in shutting down old coal-fired power plants.** Large Combustion Plant Directive(Directive 2001/80/EC)of 2001 set emission limits for pollutants (SO_2, NOx, and dust) from large combustion plants including fossil-fuel power plants, which effectively led to the shutdown of old coal-fired power plants.
	2013 -2025	C+	
CHN	2005 -2012	B+	**Regulatory policy to shut down inefficient old power plants, and target setting by the government** In 2007, National Development and Reform Commission (NDRC) announced “Notification to facilitate the closure of small thermal power plants” that orders to decommission the following power plants; power plants that have less than 50,000 kW of capacity, power plants that have less than 100,000 kW of capacity and operates more than 20 years, power plants less than 200,000 kW and operates more than its service life. The 12th Five Year Plan for its coal industry aimed to curb China’s national coal production and consumption at around 3.9 billion tons by 2015.
	2013 -2025	B+	**China, in cooperation with the U.S., is likely to offer more opportunity for renewable energy suppliers.** In the U.S.-China joint statement on climate change in 2015, President Xi Jinping announced “green power dispatch, giving priority…to renewable power generation”, which will change the current market design that guarantees each power plant a certain amount of operating hours and effectively favored coal-fired power plants.
JPN	2005 -2012	B+	**Budget for R&D on renewable energy has been quite abundant.** NEDO invested on R&D for IGCC .A-USCC, IGCC, IGFC technology. The budget was 573 million yen for 2010 and 478 million yen for 2011
	2013 -2025	B	**Budget for R&D will be maintained.** Japan continuously invested on the pilot project for A-USCC, IGCC, IGFC technology. Budget is 7 billion yen for 2013, 6.270 billion yen for 2014, 5.95 billion yen for 2015, 1.18 billion yen for 2016 and 3.54 billion yen for 2017

(5) Carbon Capture and Storage (CCS)

country	Term	Assess -ment	Supplemental information for the Assessment
US	2005 -2012	A-	**Strong financial support for CCS was established.** Since 2008, the federal government has enforcedCO_2 Capture and Sequestration Tax Credit that subsidize In 1997, Department of Energy (DOE) launched CCS Demonstration and Large-Scale Geologic Storage Cooperative Agreements to help develop the technology, infrastructure, and regulations to implement large-scale CO2 storage (also called carbon sequestration) in different region. The amount of budget in FY 2012 was 368.4 Million USD. USD10 credit per ton for the first 75 million metric tons of CO_2 captured and transported from an industrial source for use in enhanced oil recovery (EOR), and a USD 20 credit per ton for CO_2 captured and transported from an industrial source for permanent storage in a geologic formation. Facilities are required to capture at least 500,000 metric tons of CO_2 per year to qualify. During 2008-2010, the DOE launched Innovations for Existing Plants (IEP) Program that supports: USD 36 million for 15 CCS projects.
	2013 -2025	B	**Strong support for CCS is likely to continue.** As of December 2015, 7 large-scale projects are operating. There are further three due to become operational in 2016 and two in 2019/2020.
EU	2005 -2012	B	**No policy at EU level, but some member states financially supported CCS projects.** UK: In 2009, the Department of Energy and Climate Change (DECC)introduced the CCS Directive requirement that all new combustion power plants over 300MW must be constructed as CO_2 Capture Ready (CCR). On 14 June 2005, the Carbon Abatement Technology Strategy under DECC received GBP 25 million of the total funds. The CCS grant funded the development of demonstration plants to either capture carbon after combustion or to decarbonize fuels before they are fed into electricity generators. The Strategy also studies methods to improve the general energy efficiency of fossil fuel-burning power plants. France: The Ministry of research launched New Energy Technology R&D Program that include the construction of a demonstrator project for separation and storage of carbon dioxide. This program support €80 million annually and amount of fund for CCS was 10 M€ in 2005.
	2013 -2025	B	The Engineering and Physical Sciences Research Council (EPSRC) invested £10 million over a five-year period from 2012, with funding of £3 million from DECC to establish new capital facilities that supported innovative research. DECC also launched its CCS Commercialization Programme and Roadmap which set out the Government's vision for achieving commercial deployment of CCS in the UK in the 2020s, including investing £125 million in CCS research and development between 2011-2015.
CHN	2005 -2012	B-	N.A
	2013 -2025	B-	**Government started to take action on CCS projects, which is likely to make a gradual development in the next coming decade.** One large-scale project in Yanchang (chemical plants) is expected to take a final investment decision by the middle of 2016 (as a China-US cooperative project). There are further 3 projects in advance planning.
JPN	2005 -2012	B	METI has invested in the Tomakomai pilot plant. The budget was 5.9 billion yen for 2010, 4.9 billion yen for 2011 and 10.2 billion yen for 2012
	2013 -2025	A-	MOEJ and METI jointly announced to accelerate the technology development of CCS towards commercialization of its technology by 2020 and an implementation of CCS to coal-fired power plant by 2030. The Ministry of Economy, Trade and Industry (METI) has supported the CCS technology and potential investigation, allocating the following budgets. 6.3 billion yen (51 million USD) for 2011, 11.7 billion yen for 2012 (95 million USD), 12.6 billion yen (102 million USD) for 2013, 11.3 billion yen for 2014 (92 million USD), 11.7 billion (95 million USD) yen for 2015 and 11.2 billion yen (91 million USD) for 2016 The MOEJ has supported the CCS technology by 1.2 billion yen for 2014, 2.5 billion yen for 2015 and 9.1 billion yen for 2016.

3. Nuclear power

country	Term	Assess -ment	Supplemental information for the Assessment
US	2005 -2012	B+	**The Nuclease Regulatory Commission (NRC) was established in 1974.** The U.S. Nuclear Regulatory Commission (NRC) was set up as an independent agency by Congress in 1974 to ensure the safe use of radioactive materials for beneficial civilian purposes while protecting people and the environment. The NRC regulates commercial nuclear power plants and other uses of nuclear materials, such as in nuclear medicine, through licensing, inspection and enforcement of its requirements. The NRC is headed by five Commissioners appointed by the President and confirmed by the Senate for five-year terms. The Chairman is the principal executive officer of and the official spokesman for the NRC http://www.nrc.gov/about-nrc/governing-laws.html Yucca Mountain had been designated as the final disposal site of nuclear waste, but was turned down in 2009 by Obama administration. The Blue Ribbon Commission on America's Nuclear Future (BRC) did not come to a conclusion on specific siting area.
	2013 -2025	B	**Strong support from federal government will continue, but nuclear power plants are losing economic competitiveness.** With strong support from federal government, however, nuclear power plants are losing competitiveness over other sources of energy such as natural gas and coal, as maintenance of nuclear plants are far more expensive. The discussion over final disposal site is yet to be solved.
EU	2005 -2012	B+	**The European Nuclear Safety Regulators Group (ENSREG) was established in 2007 as an independent, authoritative expert body, consisting of experts in the field of the national nuclear safety, radioactive waste safety or radiation protection regulatory authorities from all member states.** Its role is to help to establish the conditions for continuous improvement and to reach a common understanding in the areas of nuclear safety and radioactive waste management. France: ASN (Nuclear Safety Authority), established in 2006, is an independent administrative authority concerning nuclear transparency and safety is tasked, on behalf of the State, with regulating nuclear safety and radiation protection in order to protect workers, patients, the public and the environment from the risks involved in nuclear activities. It also contributes to informing the citizens. Germany:**Federal Ministry for the Environment, Nature Conservation and Nuclear Safety is responsible for the nuclear safety.** **A coalition government** between the Social Democratic Party (SPD) and the Green Party, **formed after the 1998 federal elections had the phasing out of nuclear energy as a feature of its policy.** The new Christian Democrat (CDU) and Liberal Democrat (FDP) coalition government elected in September 2009 was committed to rescinding the phase-out policy, but the financial terms took a year to negotiate. In September 2010 a new agreement was reached, to give eight-year license extensions (from 2001-agreed dates) for reactors built before 1980, and 14-year extensions for later ones. However, again, this agreement was canceled out by the Fukushima Daiichi accident.
	2013 -2025	B+	**In July 2014, the EU amended its Nuclear Safety Directive from 2009, which sets up common safety rules for nuclear installation.** EU's Directive for the Management of Radioactive Waste and Spent Fuel sets out rules for safely disposing of used radioactive materials. The 'Waste Directive' also requires the creation of EU country plans for financing the safe disposal of radioactive waste during decommissioning. The EU also established nuclear decommissioning assistance programmes to help Bulgaria, Lithuania, and Slovakia finance the safe decommissioning of old reactors. Germany: On 30 May 2011 the government decided to revive the previous government's phase-out plan and close all reactors by 2022 but without abolishing the fuel tax, thus reneging on the new fuel tax trade-off. United Kingdom: Office for Nuclear Regulation (ONR) was established as a statutory Public Corporation on 1 April 2014 under the Energy Act 2013. It provides the framework of responsibilities and the powers of the organization.
CHN	2005 -2012	B	**The National Nuclear Safety Administration (NNSA), under the China Atomic Energy Authority (CAEA), is the licensing and regulatory body. Nuclear power companies are state-owned enterprises.** NNSA is responsible for licensing all nuclear reactors and other facilities, safety inspections and their reviews, operational regulations, licensing transport of nuclear materials, waste management, and radiation protection. The 2003 Law on Prevention and Control of Radioactive Pollution passed by Congress is supplemented by a number of Regulations issued over 1986 to 2011 with the authority of State Council. China has requested and hosted 12 Operational Safety Review Team (OSART)

			missions from IAEA teams in 2011, and each plant generally has one external safety review each year, either OSART, WANO peer review, or CNEA peer review (with the Research Institute for Nuclear Power Operations, RINPO). In December 2013 the NNSA with its Japanese and South Korean counterparts agreed to form a network to cooperate on nuclear safety and quickly exchange information in nuclear emergencies. NNSA is also part of the ASEAN+3 Forum on Nuclear Safety.
	2013 -2025	B	**A new safety plan for nuclear power was approved in 2012 to respond to the Fukushima accident.** The State Council responded to the Fukushima accident by announcing that it would suspend approvals for new nuclear power stations and conduct comprehensive safety checks of all nuclear projects, including those under construction. In May 2012 a new safety plan for nuclear power was approved. The State Council considered a report on civil nuclear facilities including changes made since the Fukushima accident, and affirmed that the fundamental principle of China's nuclear safety and radioactive pollution prevention is to put safety and quality first.
JPN	2005 -2012	B-	**Nuclear and Industrial Safety Agency (NISA) was established in 2001 under Agency for Natural Resources and Energy for regular checking of commercial nuclear power plants, but the regulation was not tight as this was not an independent organization from promoting agency.** NISA was set up in 2001 to regularly check commercial nuclear power plants. The Nuclear Safety Commission (NSC) also checked the compliance of the facilities, equipment and materials in accordance with these safety regulations. However, the regulatory system did not work as the organization was not independent from a nuclear-promoting agency and electric power companies.
	2013 -2025	B+	**Nuclear Regulation Authority was established in 2012 to respond to the Fukushima accident.** Future of Japan's nuclear power policy is still very uncertain. Related to discussions on Japan's emission reduction target for the year 2030 (INDC), the Japanese government decided to aim at supplying 20~22% of electricity in Japan by 2030. However, there is yet to see the public's acceptance of nuclear power plants after the earthquake, and the government has not developed any additional policies and measures to resolve people's distrust towards nuclear power.

4. Incentive to shift to less carbon intensive energy

country	Term	Assess -ment	Supplemental information for the Assessment
US	2005 -2012	B	T**he Congress discussed a few climate changes related bills including the American Clean Energy and Security Act (Waxman-Markey Bill) or McCain-Lieberman bill, but the Congress was not able to pass any of these bills. Meanwhile, Regional Greenhouse gas Initiative (RGGI) was implemented at state level, in north-eastern states and California by passing passed AB32.** <u>California Cap-and-Trade Program:</u> The California Air Resources Board (ARB) adopted the original Scoping Plan in 2008, which included a market-based mechanism which ultimately evolved into the cap-and-trade program in 2013. The aim was to reduce the state's GHG emissions to 1990 levels by 2020. The rule applied to large electric power plants and large industrial plants, and its target was approximately 17% below 2013 emissions by 2020. <u>Regional Greenhouse Gas Initiative (RGGI):</u> A group of states consisting of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont started the first market-based program to cap and reduce CO_2 emissions from the power sector by more than 50% from 2005 levels by 2020. It has achieved emission well below the cap set initially in 2005.
	2013 -2025	A-	**The federal government will utilize the Clean Air Act to regulate GHG emissions from power plants. The Clean Power Plan, announced by the EPA, includes emission trading schemes for compliance. California started ETS from 2013. RGGI continues as a state-level ETS with a CO_2 cap declining 2.5 percent each year from 2015 to 2020.** <u>Clean Power Plan</u> Clean Power Plan aims at reducing CO_2 emissions from power sector 32% of 2005 levels by 2030.Many commenters from states supported the use of mass-based and rate-based emission trading programs in state plans, including interstate ETS. The EPA also received a number of comment that EPA should develop and/or administrate tracking systems to support state administration of ETS. "(http://www2.epa.gov/sites/production/files/2015-08/documents/cpp-final-rule-ria.pdf)

			California Cap-and-Trade Program The first compliance period (2013-2014) covered GHG emissions from facilities such as heavy industry and first deliverers and large-scale suppliers of electricity. The second compliance (2015-2017) extended its scope to include fossil transportation fuels and retail sales of natural gas. Almost 85% of Californian GHG emissions are now covered by the cap-and-trade program. "(https://ieta.memberclicks.net/assets/CaseStudy2015/california_case_study-may2015.pdf) Regional Greenhouse Gas Initiative (RGGI) The RGGI states have reduced more than 40% in power sector CO2 pollution between 2005 and 2012, while the regional economy has grown 8 %. The RGGI states conducted a comprehensive program review and further deepened level of ambition of the future target. (http://www.rggi.org/docs/ProceedsReport/Investment-RGGI-Proceeds-Through-2013.pdf)
EU	2005 -2012	A	**EU implemented the most comprehensive regional emission trading scheme in the world (EUETS), and expected it as the core of EU's climate mitigation policies.** PhaseI:2005-2007 This was a three-year pilot period of 'learning by doing' to prepare for Phase II. The scheme covered only CO_2emissions from power generators and energy-intensive industrial sectors. Almost all allowances were grandfathered, given free of charge. The total issued allowanced exceeded demand and resulted in the price of allowances falling to 1 euro / tCO_2 by 2007. (http://ec.europa.eu/clima/policies/ets/pre2013/index_en.htm) Phase II:2008-2012 This phase coincided with the first commitment period of the Kyoto Protocol, which required the EU and Member States to meet their emission targets. The three EEA-EFTA states – Iceland, Liechtenstein and Norway – joined the ETS at the start of Phase II. The proportion of free allocation of allowances decreased slightly to at least 90%. Several Member States held auctions. The emission cap was tightened by 6.5% compared with the 2005 level. For 2012 the cap on aviation was added in 2012, set at a level equivalent to 97% of aviation emissions in the 2004-2006. Between 2005 and 2014, emissions covered by the EU ETS (which represents about 45% of total EU emissions)decreased by 24%.Despite a number of factors such as economic crisis in 2008 that affected the economic activity as a whole leading to reduction of energy consumption, the ETS's overall effect is estimated as to be at least a 3.3% emissions reduction from base year in the EU-15states. (http://www.eea.europa.eu/publications/eea_report_2008_5 Commercial aviation was included in 2012 "(https://icapcarbonaction.com/ets-map)
	2013 -2025	A	**EU will continue to make the best use of EUETS into the future.** Phase III :2013-2020: The ETS in this phase aims at 21% cut from 1990 levels by 2020. Together with the member countries' national targets which will collectively deliver a reduction of around 10% in total EU emissions, it will accomplish the overall emission reduction goal of a 20% cut below 1990 levels by 2020. (http://ec.europa.eu/clima/policies/effort/index_en.htm) CCS installations, production of petrochemicals, ammonia, non-ferrous metals, gypsum and aluminum, nitric, adipic and glyoxylic acid were covered in 2015. PhaseⅣ:2021-2030 ・The European Commission presented in July 2015 a legislative proposal to revise the EU emissions trading system for the period after 2020.This is the first step in delivering on the EU's target to reduce GHG emissions by at least 40% domestically by 2030 in line with the 2030 climate and energy policy framework and as part of its contribution to the new global climate deal. ・To achieve the at least 40% EU target, the sectors covered by the ETS have to reduce their emissions by 43% compared to 2005.To this end, the overall number of emission allowances will decline at an annual rate of 2.2% from 2021 onwards, compared to 1.74% currently. "(http://ec.europa.eu/clima/policies/ets/revision/index_en.htm)
CHN	2005 -2012	B	**China started planning and preparation for starting pilot-phase of ETS at local levels.** In 2010, the State Council announced its 12th Five-year plan in which, a national carbon intensity reduction target was explicitly introduced for the first time, and called for the implementation of market-based mechanisms such as ETS as a tool to achieve the energy and carbon intensity goals of the FYP12. In 2011 the NDRC published a Notice that assigned the task of establishing ETS pilot programs to five cities(Beijing, Chongqing, Shanghai, Shenzhen and Tianjin) and two provinces (Guangdong and Hubei).

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Manufacturers and electricity providers were covered in Beijing, Shanghai, Guangdong, Tianjin, Hubei. Only manufacturerswere covered in Shenzhen and Chongqing.
“(https://ieta.memberclicks.net/assets/China-WG/china%20cheat%20sheet%20a3_web%20version%202015.pdf)
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<tr><td></td><td>Beijing</td><td>Shanghai</td><td>Guangdong</td><td>Shenzhen</td><td>Tianjin</td><td>Hubei</td><td>Chongqing</td></tr>
<tr><td>Emission Target reduction (intensity-based)</td><td>18% compared to 2010 levels</td><td>19% compared to 2010 levels</td><td>19% compared to 2010 levels</td><td>15% compared to 2010 levels</td><td>15% compared to 2010 levels</td><td>17% compared to 2010 levels</td><td>17% compared to 2010 levels</td></tr>
<tr><td>Trading period</td><td>2013-2015</td><td>2013-2015</td><td>2013-2020</td><td>2013-2015</td><td>2013-2015</td><td>2013-2015</td><td>2013-2015</td></tr>
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“(https://ieta.memberclicks.net/assets/China-WG/china%20cheat%20sheet%20a3_web%20version%202015.pdf)</td></tr>
<tr><td></td><td>2013 -2025</td><td>A-</td><td>China aims at implementation of ETS at national level to reduce CO_2 emissions from key industries in a cost-effective manner.

In Beijing, Guangdong, Shanghai, Shenzhen, and Tianjin, nearly all companies met their compliance obligations set in 2014, while 70%of the participants in Chongqing, and 80% of those in Hubei met the first compliance in June 2015. The amount of Chinese offsets has also been growing, bringing the total number of offsets issued to about 25 million CCER* by the end of July 2015. (Chinese Certified Emission Reduction (CCER): 1CCER=1tCO2eq.)
“(http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2015/09/21/090224b0830f0f31/2_0/Rendered/PDF/State0and0trends0of0carbon0pricing02015.pdf)
In 2015, the United States and China released a joint announcement: China will lower CO_2 emissions per unit of GDP by 60~65% from the 2005 level by 2030, and increase the forest stock volume by around 4.5 billion cubic meters on the 2005 level by 2030. China also pledged to start in 2017 its national ETS, covering key industry sectors such as iron and steel, power generation, chemicals, building materials, paper-making, and nonferrous metals.
“(http://en.ndrc.gov.cn/newsrelease/201509/t20150929_755626.html)

The National Development and Reform Commission (NDRC) released the Interim Management Plan for Emissions Trading Scheme in December 2014, setting out frameworks regarding the emission quota management and quota trading together with some other aspects like the national emission trading scheme (ETS). The Plan explicitly stated the quota reserve mechanism of the national ETS, for the purpose of auction, market adjustment and major new entrant projects. In addition, the allocation mechanism of emission quota will be made by NDRC. It also said local governments can only execute the standard introduced by NDRC or set more stringent regional provision, in terms of sector coverage and free quota allocation.</td></tr>
<tr><td>JPN</td><td>2005 -2012</td><td>B+</td><td>Japan discussed the introduction of a cap and trade scheme at the national level, but failed to introduce it. Voluntary schemes such as JVETS, JVER and domestic CDM were implemented partially as ETS. At the local government level, Tokyo metropolitan government introduced a cap and trade scheme.

The Tokyo Cap-and-Trade Program (TMG ETS)
The Tokyo Metropolitan Assembly passed the bill on cap-and-trade ETS, taking effect in fiscal 2010. In March 2009, TMG set the cap for the first compliance period (fiscal 2010 ~ 2014). This aims to reduce total emissions among the capped sectors (mainly business facilities such as office buildings, and industry facilities such as small-size factories), by 6% from the base-year emissions. Total emissions of the covered facilities for fiscal year 2012 were reduced by 22% from base-year emissions (base year emission= average of emissions of three consecutive fiscal years selected between FY2002-2007). The same level of reductions was again observed in fiscal year 2011, mainly due to significant energy savings required to respond to power crisis following the Great East Japan Earthquake.
“(https://www.kankyo.metro.tokyo.jp/en/climate/attachement/Tokyo%20C%26T%203rd%20Year%20Results.pdf)</td></tr>
<tr><td></td><td>2013-2025</td><td>B-</td><td>At national level, Japan still lacks in introducing a specific scheme to achieve the emission reduction target. Tokyo Metropolitan Government (TMG) remains the only region utilizing ETS in a foreseeable future.

The Tokyo Cap-and-Trade Program (TMG ETS)
During the 2nd period from fiscal year 2015 through 2019, the reduction obligations increase to 17% for businesses and 15% for industrial facilities. The Tokyo Cap-and-Trade Program has achieved a 23% reduction in emissions after the fiscal year 2013 of the program compared to base-year emissions.
“(https://www.kankyo.metro.tokyo.jp/en/climate/attachement/Tokyo_CAT_4th_Year_Results.pdf)</td></tr>
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