Climate change mitigation Policy Progression Indicator (C-PPI)

--a tool for measuring progression of climate change mitigation at the national level

ver.3: 37 Action indicators and 6 Outcome indicators to measure climate mitigation policies

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Research project members:
Yasuko Kameyama, Tatsuya Hanaoka, Izumi Kubota, Shuichi Ashina
National Institute for Environmental Studies (NIES)
Yukari Takamura Nagoya University
Kentaro Tamura, Akihisa Kuriyama Institute for Global Environmental Strategies (IGES)
Toshi H. Arimura, Tatsuya Abe Waseda University

Partners:
Akinori Kawamoto, Tadashi Yamaguchi, Genki Shimazu Deloitte Touche Tohmatsu LLC.
Joshua Busby The University of Texas at Austin
Angel Hsu Yale – National University of Singapore
Takeshi Kuramochi New Climate Institute
Luan Dong Natural Resources Defense Council

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See our website *http://www-iam.nies.go.jp/climatepolicy/cppi/index.html*

Summary

The Paris Agreement calls for all countries to prepare, communicate, and maintain successive nationally determined contributions (NDCs) and pursue domestic mitigation measures with the aim of achieving the objectives of such contributions (Article 4.2). Emission targets are not legally binding by nature. Rather, countries are expected to follow a circular process of preparing NDCs, implementing policies and measures to fulfill the NDCs, and periodically reviewing and evaluating whether they are making enough progress to achieve their NDCs, with the ultimate long-term goal of balancing anthropogenic emissions and sequestrations of greenhouse gases (GHGs). Thus, methodologies to assess policy implementation have become increasingly important, especially for the post-2020 period.

The aim of this paper is to revise an earlier report (interim report ver. 2) and finalize a set of indicators that will contribute to the effective evaluation of the reporting and assessment procedures in the post-2020 period. The indicators are intended to fulfill two objectives. One is to measure actual efforts taken by countries to reduce GHG emissions. The other is to compare the relative status of actual emissions across countries. Countries need to make further efforts in climate change mitigation policies even if they have already been judged as making a significant effort.

Total of 37 Actions and 6 Outcome Indicators were finalized, and five countries—the United States, Germany, the United Kingdom, China, and Japan—were evaluated using the indicators. Through the final evaluation, we were able to recognize areas where countries are doing relatively well and areas where more efforts are required. The developed indicators are comprehensive and useful in evaluating the overall structure of countries' climate change policies.

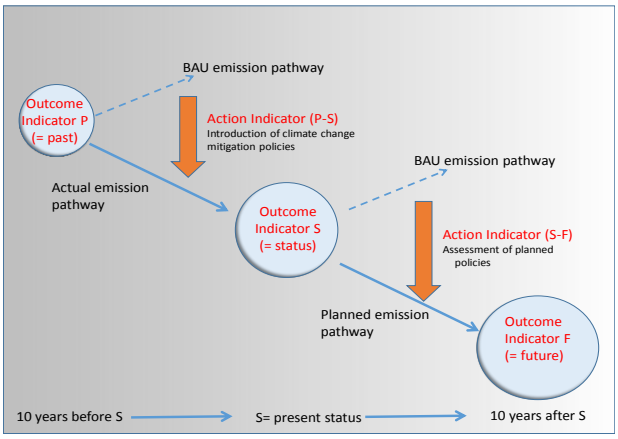


Figure i Structure of C-CPI

Table i. Six Outcome Indicators and the corresponding equity considerations

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. Final 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. Final energy consumption / capita	Developing countries could increase the rate up to a certain level, and then start declining it.
Goal 4: Non-CO_2 gases and sequestration by forests	5. Non-CO_2 GHGs / capita	Geographic and climatic circumstances shall be taken into account.
	6. Rate of change of forest coverage	Geographic circumstances shall be taken into account.

Table ii. Thirty-seven Action Indicators

Goal	Category	Action Indicators
Goal 1: Decarbonzation of energy	Promotion of renewable energy	1. The country sets concrete targets for renewable energy that are sufficient to reach its long-term goal. 2. The country has regulatory and financial supports, such as RPS and FIT, for the enhancement of renewable energy at a sufficiently high level to allow for the rapid diffusion of renewable energy. 3. The country has policies to remove barriers against the enhancement of renewable energy, particularly in the area of electricity grids, including the use of smart grids and demand responses.
	Decarboniz-ation of other energy sources	4. The country sets an emission intensity target on power plants satisfying at least one of these criteria: (i) 0.612 kCO_2/kWh for coal-fired power plants, (ii) 0.303 $kgCO_2$/kWh for gas-fired power plants, and (iii) 0.256 $kgCO_2$/kWh for the entire electricity sector. The country could implement an ETS that is as stringent as the intensity target. 5. The total number of a country's demonstration and commercialized CCS projects during a given assessment period is larger than it was during the former assessment period. 6. The country has a carbon tax or other effective tax rates for the power sector at a rate of at least US\$5/tCO_2.
	(optional) Nuclear power	7. The county fulfills safety standards SSR-2/1&2 of the IAEA for nuclear power plants. 8. The country has a compensation scheme and other necessary procedures in case of accidents.
	Decarboniz-ation in transportation sector	9. The country has financial supports, such as subsidies and tax incentives that are effective enough to provide incentives for consumers to purchase non-fossil fuel vehicles. 10. The country supports R&D on technologies related to next-generation vehicles, such as fuel-cell cars and light-weight batteries, with the aim of having 90% of all vehicles on the road be low-carbon by 2050. 11. The country has transportation rules such as priority lanes and parking spaces that give preferential treatment to carbon-free cars.
Goal 2: Improvements in energy efficiency	Industry sector	12. The country sets quantitative GHG emission targets or energy-efficiency targets for industries that are ambitious enough to reach its long-term emission reduction goal. 13. The country has mandatory reporting requirements and an auditing system for industries to monitor the use of energy and GHG emissions. 14. The country has an effective tax covering the industrial sector, with a rate of at least US\$5/tCO_2.
	Building sector	15. The country has energy performance standards for buildings that are ambitious enough to achieve its long-term emission reduction goal. 16. The country has subsidies and other supports to promote the sales of ZEBs and ZEHs so that the cost of building these types of structures will be almost equal to that of building traditional structures if the economic returns gained through energy savings in future years are accounted for. 17. The country has energy performance standards and labeling for electricity and other energy-related utilities for household and offices that are ambitious enough to follow an emission trajectory towards the country's long-term goal.
	Transportation sector	18. The country has tax credits or other kinds of financial supports for purchases of fuel-efficient vehicles, so that all gasoline-fueled vehicles (except heavy-duty trucks) currently in use have an efficiency of more than 30 km/L of gasoline by 2020. 19. The country has regulations against use of inefficient vehicles. 20. The country implements policies to improve fuel efficiency of aircraft and newly built ships at an annual rate of 2% through 2050.
Goal 3: Decreasing demand for energy service	Industry sector	21. The country sets an absolute national target for reducing/ limiting energy consumption to achieve its long-term goal. 22. The country promotes the effective use of waste heat, including combined heat and power (CHP) and partnerships in industrial parks. 23. The country utilizes life cycle assessment of products so as to minimize energy consumption during a product's life cycle.
	Building sector	24. The country has campaigns to raise awareness and educational programs so that at least 80% of the public recognize the risks of climate change, as measured by public opinion polls. 25. The country promotes introduction of visualization technologies (e.g., smart meters and other measures) so consumers can see the level of energy consumption in the building sector. 26. The country has effective tax rates for the building sector, which are greater than US\$5/tCO_2.
	Transportation sector and urban planning	27. The country has policies to reduce overall demand for mobility. 28. The country has effective tax rates on fuels for vehicles, which are greater than US\$50 /tCO_2. 29. The country promotes urban development planning towards low-carbon cities.
Goal 4: non-CO2 and LULUCF	(optional) Methane	30. The country has regulations to prohibit emissions from waste landfill sites. 31. The country has policies to reduce emissions from the agriculture sector. 32. The country has policies to reduce emissions from fossil fuel extraction plants.
	(optional) HFCs and other F-gases	33. The country has regulations related to the production and use of HFCs with the aim of meeting the country's long-term goal. 34. The country has regulations related to collection and destruction of HFCs and other F-GHGs contained in discarded products.
	(optional) LULUCF	35. The country sets absolute targets for increasing forest area. 36. The country promotes forest management so that the area of managed forests increases by at least 1% annually. 37. The country regulates illegal logging and promotes the wise use of labeled sustainable wood products.

1. Objective

The Paris Agreement, adopted on the final day of the 21st Conference of the Parties to the UNFCCC (COP21) held in Paris in December 2015, calls for all countries to prepare, communicate, and maintain successive nationally determined contributions (NDCs) and pursue domestic mitigation measures with the aim of achieving the objectives of such contributions (Article 4.2). Emission targets are not legally binding by nature. Rather, countries are expected to follow a circular process of preparing NDCs, implementing policies and measures to fulfill the NDCs, and periodically reviewing and evaluating whether they are making enough progress to achieve their NDCs, with the ultimate long-term goal of balancing anthropogenic emissions and sequestrations of greenhouse gases (GHGs). Thus, methodologies to assess policy implementation have become increasingly important, especially for the post-2020 period.

In an earlier version of this report, "interim report ver. 2" (C-CPI project team, http://www-iam.nies.go.jp/climatepolicy/cppi/index.html) published in August 2016, a long list of mitigation policies were introduced to evaluate the actions of the United States, the European Union (EU), China, and Japan. However, the evaluation method had two problems. First, the evaluation criteria were unclear. They were too dependent on expert judgement. Evaluation criteria need to be as clear and quantitative as possible so that everyone doing the evaluation will come to the same result or rating. A baseline setting is needed to make these types of objective evaluations. Second, there were too many different types of policies to evaluate. To develop successful indicators, we needed to narrow down the number of policies evaluated and keep only those that are indispensable in evaluating countries' actions.

The aim of this paper is to revise the earlier version and finalize the set of indicators that will contribute in making effective evaluation of the reporting and assessment procedures in the post-2020 period. As was explained in the previous paper, the indicators aim to fulfill two objectives. The first is to measure the actual efforts taken by countries to reduce GHG emissions. Countries' GHG emissions are affected by various factors unrelated to their policies. Countries should be praised or encouraged by the amount of effort they put into reducing their GHG emission targets, even if their efforts do not lead to enough reduction in actual emissions. The second objective is to compare the relative status of actual emissions across countries. Countries need to make additional efforts in climate change mitigation policies even if they have already been judged as making significant efforts. This paper focuses particularly on the latter objective with an emphasis on Action Indicators.

In this paper, six Outcome Indicators and 37 Action Indicators are finalized, and five countries—the United States, Germany, the United Kingdom, China and Japan—are evaluated accordingly. Through the final evaluation, we were able to recognize areas where countries are doing relatively well and areas where more efforts are required. The developed indicators are comprehensive and useful in evaluating the overall structure of countries' climate change policies.

2. Basics of the Climate change mitigation Policy Progression Indicator (C-PPI)

2.1 Structure of the C-PPI

The Climate change mitigation Policy Progression Indicator (C-PPI) consists of two pillars (Figure 1).

Action Indicators: The purpose of these indicators is to measure countries' efforts in reducing GHG emissions by introducing climate change mitigation policies. Countries have already been asked to report their GHG emissions data to the UNFCCC, but emissions are affected by various factors such as economic conditions and the weather, which are independent of any implementation of climate change mitigation policies. This indicator measures the level of effort of climate mitigation policies by selecting key policy instruments that could be commonly introduced in all countries.

Outcome Indicators: The purpose of these indicators is to assess the status of countries with respect to their achievement of actual GHG emissions reductions by comparing emissions data with those of other countries as well as by comparing each country's current data with its own past data. These indicators show the actual status of energy use and emissions independent of any policy efforts taken by the countries.

Both types of indicators measure two timeframes. The first timeframe, PS, represents a time between the past (P, such as a decade ago) and the current status (C, today). The second timeframe, SF, represents a time between the current status (today) and the future (F, such as a decade into the future). This study originally intended to select 2005 for P, 2015 for S, and 2025 for F, but because of data availability issues, 2012 had to be used for S. The C-PPI is to be updated and recalculated every 5 years; consequently, the three time reference points (P, S, and F) will shift by 5 years at each assessment.

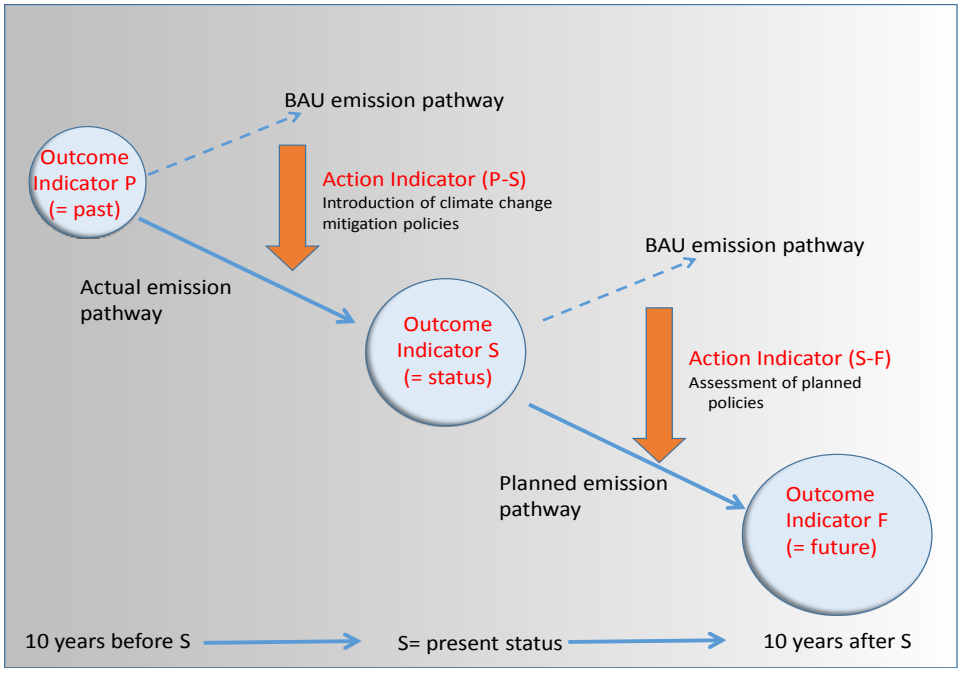


Figure 1. Structure of the C-PPI

2.2 Common framework for Indicators

Although GHG emission sources vary from one country to another and factors behind emission growth and reduction differ tremendously among countries, several common goals need to be shared by all countries if the world is going to achieve the long-term temperature increase goal of 2 °C or 1.5 °C. We selected four Goals, which are applied to both the Action and Outcome Indicators. Because fossil fuel combustion is the central target that needs to be tackled to mitigate climate change in the long run, the first three are related to energy use.

Goal 1: Decarbonization of energy

To reduce CO_2 emissions from fossil fuel combustion, countries can increase their use of renewable energy, nuclear power, or carbon capture and storage (CCS) technology. Although these options are all effective in substituting for the use of fossil fuels, the latter two options pose risks other than climate change. The use of renewable energy has greater support by more people than that of nuclear power. However, some people have emphasized concerns about the relatively high cost and instability of renewable energy. These challenges will need to be overcome to achieve a wide diffusion of renewable energy technologies.

Goal 2: 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 needs to be even faster if we are going to minimize the impact of climate change. In some sectors, energy efficiency at the product level is currently satisfactory, but it is not satisfactory at the system or community level. Hence, various levels of energy efficiency need to be assessed. In addition, promotion of energy-efficient products does not always lead to an overall emission reduction because these new products may stimulate increased consumption of products and energy at the community level. That said, this goal only addresses the efficiency aspect of products and systems.

Goal 3: Minimizing demand for energy service

Although energy efficiency needs to be further improved, the best approach is to eliminate the need for energy use altogether. For example, improving the energy efficiency in automobiles is important, but even more energy savings can be achieved if people use other means of transportation such as bicycles and public transportation while enjoying the same level of mobility. Similarly, improvements in the energy efficiency of heating and cooling systems can easily be cancelled out if consumers set temperatures too high during cold months or too low during hot ones. It is becoming increasingly important to eliminate unnecessary demand for energy and products to reach climate change mitigation goals.

Goal 4: Land use and non-CO_2 gases

In addition to CO_2 emissions related to energy use, several indicators have been added to reflect other aspects of climate mitigation policies that cannot be covered by the first three goals; examples include land use, land-use change and forestry (LULUCF), and non-CO_2 GHG emissions. In some countries, deforestation is responsible for a large share of CO_2 emissions. In such cases, Goal 4 will be the most important goal to reduce overall GHG emissions.

3. Selection of Indicators

3.1 Selection of Outcome Indicators

The purpose of the Outcome Indicators is to present the overall situation of a country by comparing its GHG emissions and other fundamental macro data with those of other countries, and to assess the progress within any given country by comparing its data across a specified time period. The outcomes of each country are affected by the actions or efforts taken by the country, as well as by many other factors that are not related to the country's efforts. Simple indicators need to be used so that the necessary data can be obtained. Six indicators were chosen for this study (Table 1). Data from five countries were collected and applied to these indicators in Section 4.

Table 1. Outcome Indicators and the corresponding equity considerations

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. Final 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. Final energy consumption / capita	Developing countries could increase the rate up to a certain level, and then start declining it.
Goal 4: Non-CO_2 gases and sequestration by forests	5. non-CO_2 GHGs / capita	Geographic and climatic circumstances shall be taken into account.
	6. Rate of change of forest coverage	Geographic circumstances shall be taken into account.

3.2 Selection of Action Indicators

The aim of Action Indicators is to grasp policy efforts taken by each country to reduce GHG emissions. The actual effort cannot be measured by the amount of GHG emissions alone because emissions can increase or decrease for various reasons. Rather, this set of indicators selects key policies that are indispensable for most countries to effectively reduce GHG emissions. These indicators are used to assess the ambitiousness of these policies by checking the policies' coverage and level of stringency. Although effective or agreeable climate policies can vary from one country to another, these policies are indispensable in all countries.

Interim report ver. 2 addressed 13 categories of policies for Goal 1, 12 for Goal 2, 7 for Goal 3, and 3 for Goal 4. Within each category, there were usually about five to ten different types of policy instruments found in various countries; consequently there were several hundred policies. This number was too great to be useful as a set of indicators. We needed to select only those policies that were considered to be indispensable in guiding each country's long-term strategy of reaching its long-term goal.

Two issues arose during the selection process. First, some policy categories were crucial in some countries, whereas they were negligible in others. For example, nuclear power policies were important only in countries that relied on nuclear power plants to achieve decarbonization of energy. Similarly, afforestation and forest management were important only in those countries in which geographical and climatic conditions allowed for forest coverage. These categories were included in the list as "optional," meaning that the category can be included or not according to each country's national circumstances.

The second issue was related to setting baseline values for Action Indicators. The baselines need to be

set to define the level of stringency of various actions. Stringent baselines are required if the world wants to meet the 2 °C or 1.5 °C goals, but if the baselines are too strict, all countries will receive poor evaluations. The challenge, therefore, was to find an adequate level that would allow countries' actions to be differentiated. When a "long-term goal" is denoted in Table 1, it means that developed countries should aim for an approximate 80% GHG reduction by 2050 relative to 1990 or more current years (L'Aquila G8 Summit, 2009) and that developing countries should significantly deviate from their BAU emission trajectories by 2050.

Below, we describe the 37 Action Indicators, categorized by Goal, that were ultimately chosen from the long list of possible climate policies.

3.2.1 Goal 1: Decarbonization of energy

Action Indicators for Goal 1 are categorized into three groups: promotion of renewable energy, decarbonizaton of other energy sources, and decarbonization in the transportation sector. In addition, the optional fourth category of nuclear power is included.

- Promotion of renewable energy

Enhancement of renewable energy is one of the most important measures that should be taken in all countries, both developed and developing. The type of renewable energy can vary across countries according to each country's geographic and climatic circumstances. The relatively high cost of renewable energy used to be the most crucial barrier against its smooth diffusion, but this is no longer the case. The costs of solar and wind power have decreased greatly in the past decade. Although the initial start-up costs may still be relatively high, once introduced, the energy supply and relatively low operating costs are ensured for many years.

Indicator 1: The country sets concrete targets for renewable energy that are sufficient to reach its long-term goal.

It is possible to view target setting as merely a sort of signal to the public and not an action in itself. By setting concrete targets, however, governments can encourage stakeholders opposing the implementation of various policies to achieve the target. In addition, governments will be better able to secure budget allocations for these policies if they have quantitative targets. This study, therefore, included target setting as an action. If the world is to achieve the 2 °C target, most of the energy supply from all industrialized countries and most developing countries will need to be from renewable energy by 2050. Any renewable energy targets for the years between now and 2050 or beyond should be on a trajectory to meet this ambitious long-term goal.

Indicator 2: The country has regulatory and financial supports, such as RPS and FIT, for the enhancement of renewable energy at a sufficiently high level to allow for the rapid diffusion of renewable energy.

In many cases, renewable energy is still more expensive than fossil fuel energy. Thus, regulations for electricity suppliers and financial support for electricity consumers are both needed for the rapid diffusion of renewable energy. Examples of support include the Renewable Portfolio Standard (RPS), which sets a target on the share of renewable energy within the total electricity supply, and feed-in-tariffs (FITs), which promote investment in renewable energy by assuring the future return of any initial investment.

Indicator 3: The country has policies to remove barriers against the enhancement of renewable energy, particularly in the area of electricity grids, including the use of smart grids and demand responses.

Supply instability is an important issue related to renewable energy. A wide network of electricity grids is advantageous for countries to be able to utilize electricity generated by solar or wind power. Demand response and megawatt trading are methods that can be used to reduce grid investment and minimize

curtailment of low-carbon resources. Using these types of methods, aggregators are responsible for controlling the demand and matching the supply and demand in real time.

- Reducing carbon emissions from fossil fuel power plants

Countries that aim to phase out coal-fired power plants will not put much importance on improving the energy efficiency of coal-fired power plants or invest in CCS technology. As long as renewable energy prevails, there is no need to take into account policies related to fossil fuel power plants in this indicator. In reality, however, coal is still being used in many countries as a central source of energy. As long as countries continue to rely on coal for part of their energy supply, it is important that the coal be used in the most efficient manner. In addition, CCS can be used to greatly reduce or eliminate CO_2 emissions into the atmosphere from coal-fired power plants. The technology already exists, but CCS requires additional energy to capture, transfer, and store the CO_2, and it is still costly. Countries therefore need to determine whether they will continue to use coal with CCS or switch to renewable energy.

Indicator 4: The country sets an emission intensity target on power plants satisfying at least one of these criteria: (i) 0.612 kCO_2/kWh for coal-fired power plants, (ii) 0.303 $kgCO_2$/kWh for gas-fired power plants, and (iii) 0.256 $kgCO_2$/kWh for the entire electricity sector. The country could implement an ETS that is as stringent as the intensity target.

These baseline values were chosen because they are currently those of the best available technologies. The baseline for coal-fired power plants is based on the current best Integrated coal Gasification Combined Cycle (IGCC) technology. The baseline for the gas-fired power plants is based on the best gas turbine combined cycle (GTCC) technology available today. There is no baseline for oil-fired power plants because the 3rd IEA ministerial communique in 1979 recommended against building any new oil-fired power plants. The figure for the entire electricity sector was calculated from the 450 scenario of the World Energy Outlook 2015 (IEA 2015), where global electricity generation reaches 29,682 TWh and CO_2 emissions from the electricity sector reach 7,601 $MtCO_2$ by 2030. When a country implements an emission trading scheme (ETS), it usually covers the power sector. The total amount of emissions allowed under a nationwide ETS must be consistent with the country's emission reduction target. Therefore, the amount of the emission allowance is a key indicator that can be used to assess whether or not a policy for the power sector will be effective in helping countries achieve their emission reduction targets.

Indicator 5: The total number of a country's demonstration and commercialized CCS projects during a given assessment period is larger than it was during the former assessment period.

There have been a number of CCS sites throughout the world. Storing CO_2 through enhanced oil recovery (EOR) has commonly been used as a CCS method because the method was relatively less expensive and technically less difficult than other methods. Countries without oil reservoirs, however, have to find appropriate strata to store CO_2. CCS projects will generally not be voluntarily implemented without government support.

Indicator 6: The country has a carbon tax or other effective tax rates for the power sector at a rate of at least US$5/$tCO_2$.

In theory, various market mechanisms (including emissions trading and carbon taxes) have the potential to drive an economy towards reaching all four Goals. In reality, however, these mechanisms have not been introduced in a theoretically perfect way such that people's consumption patterns are changed and investment is shifted into less carbon-intensive technologies. One way to classify economic instruments into the four Goals is to categorize the policies according to their respective coverages. If an ETS places emission caps on electricity power generation plants or on power companies, the instrument is likely to be effective in terms of Goal 1. Similarly, pricing mechanisms that differentiate carbon-intensive forms of energy from carbon-neutral forms can also be classified into Goal 1. From such a perspective, carbon

taxes should be regarded as a Goal 1 policy, whereas energy taxes should be placed into Goals 2 and 3. Thus, carbon pricing instruments and ETS's covering energy sectors are included in Goal 1.

- Nuclear power plants

The two indicators under this item are optional and should only be used by countries that depend on nuclear power plants to reduce CO_2 emissions. For countries that are expecting a total phase-out or that have no nuclear power plants, these indicators should be omitted. For example, in our evaluation of Germany, we did not use these two indicators because Germany has decided to phase out nuclear power plants by 2022, so these policies will not be relevant.

Indicator 7: The country fulfills safety standards SSR-2/1&2 of the IAEA for nuclear power plants.

Once a government has decided to use nuclear power plants to partially achieve decarbonization of energy, it will have to ensure that the plants are safe. The IAEA's SSR-2/1&2 are international safety standards that have to be followed in all member countries. Although the standards do not have strictly quantified baselines, governments do have to follow a predetermined process to determine the countries' safety levels.

Indicator 8: The country has a compensation scheme and other necessary procedures in case of accidents.

Although the goal is to completely avoid all serious accidents at nuclear power plants, a clear and concrete compensation scheme should be established to clarify who is responsible for any accidents. Without this type of clarification, no one will want to take responsibility or appropriately invest in all necessary safety measures.

- Transportation

The transportation sector is an area where a decarbonization shift is not directly related to the decarbonization of electricity. Currently, most modes of transportation use oil as source of energy. To decarbonize transportation, oil needs to be replaced by energy sources that do not contain carbon. Biofuels are one option. Electricity is another, but the effectiveness of electric vehicles is undermined if the electricity is supplied by burning fossil fuels. Fuel cells have similar characteristics, in terms of the carbon intensity of the hydrogen production process.

Indicator 9: The country has financial supports, such as subsidies and tax incentives, that are effective enough to provide incentives for consumers to purchase non-fossil fuel vehicles.

Policies include subsidies and tax incentives at the time of purchase of less carbon-intensive vehicles, regulations against the sale and use of carbon-intensive fuels and vehicles that use such fuels, and promotion of the creation of infrastructure suitable for less carbon-intensive vehicles. Quotas for the use of biofuels are commonly observed in many countries.

Indicator 10: The country supports R&D on technologies related to next-generation vehicles, such as fuel-cell cars and light-weight batteries, with the aim of having 90% of all vehicles on the road be low-carbon by 2050.

Private companies make huge investments in research and development (R&D) for the development of carbon-free vehicles, but the development and diffusion need to speed up to achieve countries' emission targets in time. In addition to prioritizing decarbonization in the transportation sector, it is also important to raise awareness of consumers in general that decarbonization in transportation sector is indispensable in climate mitigation policies.

Indicator 11: The country has transportation rules such as priority lanes and parking spaces that give

preferential treatment to carbon-free cars.

Currently, there are not enough changing stations for electric cars, especially as compared to the number of gas stations. People will not choose electric cars if this situation remains unchanged. Governments need to supply various incentives and other types of preferential treatment for the owners of these new types of vehicles to encourage the use of low-carbon vehicles.

3.2.2 Goal 2: Improvements in energy efficiency

Action Indicators for Goal 2 are classified into the industrial, building (energy use in residential and commercial buildings), and transportation sectors.

- Industrial sector

Industries are major emitters of CO_2. Manufacturers cannot merely stop their manufacturing processes for the sake of climate change mitigation. Rather, they must try to make their activities as energy efficient as possible. Products that are produced by manufacturers also affect the level of energy consumption by consumers. Thus, industries are key for the world to transition to a decarbonized future. Many have already made tremendous efforts to improve the energy efficiency of their own activities and that of their products, but they are still required to do more.

Indicator 12: The country sets quantitative GHG emission targets or energy-efficiency targets for industries that are ambitious enough to reach its long-term emission reduction goal.

Setting targets for CO_2 emissions or energy efficiency for the industrial sector as a whole is a way to clearly define the maximum amount of carbon that should be emitted into the atmosphere. Some stakeholders do not consider "target setting" to be a policy, but rather to be an expected outcome in the future. In this study, target setting is considered to be a policy tool that justifies budget allocations to other policy instruments that are aimed at reaching the respective targets. Merely setting a target, however, is not sufficient. The level of the target should be stringent enough so each country can reach its long-term emission target.

Indicator 13: The country has mandatory reporting requirements and an auditing system for industries to monitor the use of energy and GHG emissions.

Monitoring and reporting by industries are important mechanisms that allow industries themselves to realize the absolute amounts as well as the sources of their GHG emissions. Such recognition helps companies to identify areas in which further emission reductions could be feasible. Reporting is also important so that governments can grasp the overall trends of the emission trajectory. In addition, companies may reveal their emission data to the public as a part of their Corporate Social Responsibility.

Indicator 14: The country has an effective tax covering the industrial sector, with a rate of at least US$5/$tCO_2$.

Putting a price on carbon emissions in the industrial sector has an impact on the industries' level of effort to improve energy efficiency; that is, it gives them an incentive to do so. Trading of emissions is another way to reflect the carbon price in energy, but this study categorizes trading of emissions as a Goal 1 indicator rather than a Goal 2 indicator. Subsidies on energy are included under this indicator. The tax rate of US$5/$tCO_2$ is most likely not high enough to achieve the 2 °C goal, but in reality, very few countries have implemented a higher carbon price. Therefore, we chose this rate as the baseline at this stage, but the rate should be altered in future assessments.

- Building sector

Carbon emissions from the building sector can be divided into two subcategories: one related to the

buildings themselves and the other to the electric and other energy-related utilities that are used in them. Indicators 15 and 16 are related to the former, and indicator 17 is related to the latter.

Indicator 15: The country has energy performance standards for buildings that are ambitious enough to achieve its long-term emission reduction goal.

There are binding standards related to the energy efficiency of buildings in most countries. In many cases, buildings that have met the standards are labeled such that this information is available to people who want to purchase the buildings. However, it is difficult to define the level that can be designated as ambitious enough to achieve a country's long-term target. In this study, we checked whether the levels of energy performance standards were on a trajectory towards realizing a society where almost all existing buildings and houses would be either Zero-Emission Buildings (ZEBs) or Zero-Emission-Houses (ZEHs) by 2050.

Indicator 16: The country has subsidies and other supports to promote the sales of ZEBs and ZEHs so that the cost of building these types of structures will be almost equal to that of building traditional structures if the economic returns gained through energy savings in future years are accounted for.

Financial supports are indispensable for countries to diffuse technologies that are more expensive than traditional ones. However, it was again difficult to set a common baseline across countries according to the amount of funding that would be available for building ZEBs and ZEHs. Therefore, we checked whether the amount of subsidies would be large enough that all new buildings and houses could be nearly ZEB or nearly ZEH by 2030.

Indicator 17: The country has energy performance standards and labeling for electricity and other energy-related utilities for household and offices that are ambitious enough to follow an emission trajectory towards the country's long-term goal.

Daily energy use in commercial and residential sectors can be divided into three categories: heating and cooling, lighting, and power. Many facilities and products are used in each of the three categories, including heating facilities, air conditioners, refrigerators, light bulbs, TV sets, washing machines, and other similar devices. Improvements in energy efficiency of each of these products will contribute to reducing energy use in the building sector, even without changing people's underlying behavior. However, in many cases, these products are more expensive than traditional ones; thus, consumers may avoid choosing these products, without understanding why they are more expensive. Appropriate labeling is one way to visualize the benefits of energy saving with energy-efficient products.

- Transportation sector

All transportation modes should aim at the near total replacement of fossil fuels by renewable energy by 2050. At the same time, it would be extremely difficult to make this type of replacement in the near future. Improvements in fuel efficiency are considered as a bridging technology until a non-carbon source of energy becomes available at a sufficiently low cost. Hybrid cars are included here as a means to improve fuel efficiency rather than as a decarbonization technology.

Indicator 18: The country has tax credits or other kinds of financial supports for purchases of fuel-efficient vehicles, so that all gasoline-fueled vehicles (except heavy-duty trucks) currently in use have an efficiency of more than 30 km/L of gasoline by 2020.

Until non-fossil fuels become widely available at low costs, gasoline-fueled cars will continue to be the primary means of transportation. Fuel efficiency in gasoline-fueled cars is improving rapidly, especially when hybrid cars are included. It is expected that efficiency will be further improved if the weight of vehicles decreases.

Indicator 19: The country has regulations against use of inefficient vehicles.

While supporting energy-efficient vehicles, governments can also impose regulations on inefficient vehicles that are already in use to discourage consumers from using old, inefficient vehicles. This is another way of encouraging consumers to replace old products with new ones.

Indicator 20: The country implements policies to improve fuel efficiency of aircraft and newly built ships at an annual rate of 2% through 2050.

The International Cargo Aviation Organization (ICAO) has agreed to Assembly Resolution A37-19, which states the aim of achieving a global annual average fuel efficiency improvement of 2% through 2020 and an aspirational global fuel efficiency improvement rate of 2% per annum from 2021 to 2050, calculated on the basis of volume of fuel used per revenue tonne-kilometer. Similarly, mandatory energy-efficiency standards for new ships and mandatory operational measures to reduce emissions from existing ships entered into force under an existing international convention (MARPOL Annex VI under the International Maritime Organization [IMO]) in 2013. By 2025, all new ships will be 30% more energy efficient than those built in 2015. Even though these agreements were only reached recently, the levels adopted in these agreements were used as baselines in this study.

3.2.3 Goal 3: Decreasing demand for energy services

In all five countries studied, the number of policies implemented towards Goal 3 was considerably smaller than those for Goals 1 and 2. Some policies, such as carbon pricing, had effects on both Goals 2 and 3. These overlapping policies were classified in one of the two goals, depending on the major policy targets. Policies categorized in Goal 3 were further grouped into three types: those targeting demand-side management in the industrial and energy sectors, those targeting the building sector and final consumers, and those targeting the transportation sector and urban planning.

- Decreasing demand for energy services in the industrial sector

Most industries would prefer to meet CO_2 reduction by shifting to less carbon-intensive sources of energy (Goal 1) and by improving energy efficiency (Goal 2). Meanwhile, in some cases, industries may be able to reduce their overall use of energy while continuing to increase revenues. A big push from the government may be necessary to get industries to invest in reducing energy use.

Indicator 21: The country sets an absolute national target for reducing/ limiting energy consumption to achieve its long-term goal.

Setting targets for energy consumption is not as easy as one may think because it requires wide support from the public. Targets on energy consumption may be perceived by industries or by the public as a limitation to economic growth. As a result, very few countries have actually set reduction targets for the absolute level of energy consumption.

Indicator 22: The country promotes the effective use of waste heat, including combined heat and power (CHP) and partnerships in industrial parks.

Heat is a type of energy that is wasted locally. Unlike electricity, heat cannot be transmitted over great distances. Therefore, systems need to be established in each region to share heat among industries and residences. Usually, the industrial sector requires high temperature heat, whereas residential uses require relatively low temperature heat. Although few countries have introduced legislation for heat sharing at the national level, some municipalities and cities have shown local initiatives in sharing heat within the region.

Indicator 23: The country utilizes life cycle assessment of products so as to minimize energy consumption during a product's life cycle.

In the free-trade world, manufacturers are dependent on the international product chain. In addition, food

products are also shipped around the world. There are a number of well-known indicators such as the carbon footprint and food mileage that attempt to indicate the environmental load various products place on the environment. Some countries have carbon footprint labeling, which shows the amount of CO_2 emitted during the production and transportation stages of certain products. Other countries recommend that the public purchase items that are produced locally. However, in most countries, these policies are implemented on a voluntary basis.

- Decreasing demand for energy service in the building sector

The building sector consists of commercial buildings and households. For both building types, behavioral changes by the users are indispensable to reduce overall energy consumption because merely improving energy efficiency at the product level will not necessarily lead to an absolute reduction in the amount of energy consumed. People could end up using products (e.g., heating and cooling facilities, lighting, etc.) more than they did before once they realize that the energy-efficient products use less electricity and thus incur lower additional payments for additional use.

Indicator 24: The country has campaigns to raise awareness and educational programs so that at least 80% of the public recognize the risks of climate change, as measured by public opinion polls.

People's consumption patterns and lifestyles affect each country's GHG emissions at the grass-root level. Even though changes are necessary in all countries in this area, it is still hard for individuals to recognize the link between their own individual behaviors and global climate change. Environmental education, public campaigns, and other outreach activities are already in place in all five study countries, but the threat of climate change has not yet been fully acknowledged by the majority of the population. The goal of 80% was set to identify whether the perceptions of climate change risks are fully recognized by most people in a given country.

Indicator 25. The country promotes introduction of visualization technologies (e.g., smart meters and other measures) so consumers can see the level of energy consumption in the building sector.

A variety of energy management services (EMSs), including Building EMS (BEMS) and Home EMS (HEMS), are available in all countries, but their use remains voluntary. For ordinary citizens, it is important to be able to actually see how much energy they use and how much energy is being consumed by different types of facilities such as air conditioners and refrigerators. Smart metering is one way to easily visualize the level of energy consumption by users. In addition, some smart meters not only aid in consumer visualization, but also allow companies to obtain consumer data and make recommendations on measures to reduce unnecessary consumption.

Indicator 26: The country has effective tax rates for the building sector, which are greater than US\$5/tCO_2.

In theory, demand for energy should decrease as the price of energy rises. Taxes on energy could therefore be effective in reducing the demand if the rate was high enough. In most countries that have already introduced energy or carbon taxes, however, the tax rates are not high enough to induce such changes. Economic incentives can influence consumers' decision-making in purchasing or using their dwellings, household utilities, and other products that use energy. Again, US\$5/tCO_2 is not sufficiently large to change consumption patterns enough to reach the 2 °C target, but it is a starting point. The level should be revisited in the next round of evaluations.

- Decreasing demand for transportation

Indicator 27: The country has policies to reduce overall demand for mobility.

Attempts to reduce the heavy dependency on private cars are being observed in all countries, but mainly

at local levels rather than at the national level, most likely because the reasons for traffic congestion differ from place to place. However, demand for mobility can also be reduced by changing people's lifestyles. For example, conducting business meetings via telecommunications is one way to reduce the need for business travel. Reducing the number of cars on the road at any given time by restricting operating hours to cars according to license plate number is another practice that has been implemented in some areas. A modal shift is a policy that is utilized in many places, for example, when incentives are offered for people to shift from the use of private cars to public transportation or bicycles.

Indicator 28: The country has effective tax rates on fuels for vehicles, which are greater than US$50 /$tCO_2$.

The price of fuel can influence people's behavior in their use of private cars. When the price of gas increases, more people will shift from cars to other means of transportation, such as public transportation and bicycles. Taxes on fuels can be found in almost all countries, but the tax rates are not high enough in many countries to change people's behavior. From a study by the OECD (2016), much higher rates for fuel tax has been set in most countries, and the rate \$50/tCO_2 was chosen from the study.

Indicator 29: The country promotes urban development planning towards low-carbon cities.

Urban design affects citizens' needs for transportation. People will not have to rely on private cars if schools, working places, and shops are within walking distance or are accessible by public transportation. Many cities have already begun taking initiatives towards low-carbon development, but such movements will be further promoted with support from the national government.

3.2.4 Goal 4: Non-CO_2 gases and sequestration by forests

Action indicators for Goal 4 were categorized into three groups: reducing methane emissions, reducing emissions of fluorinated greenhouse gases (F-gases), and enhancing sequestration by forests. The conditions regarding these three categories vary greatly from one country to another. Therefore, all of the indicators under this Goal are optional. They should be utilized only when the emissions or activities are relevant to the country's specific circumstances.

- Methane

Methane is emitted from various sources. Countries can determine by themselves which of the three indicators they want to use to measure the progress stemming from actions taken to reduce methane emissions. We decided that methane indicators do not apply to Japan because the amount of methane emission from Japan is considerably smaller than it is in the other countries covered in this study.

Indicator 30: The country has regulations to prohibit emissions from waste landfill sites.

Most countries use landfill sites for waste disposal, but they do not have strict regulations against methane emissions from disposal sites. Methane can be collected and utilized as a renewable energy source.

Indicator 31: The country has policies to reduce emissions from the agriculture sector.

Similar to the situation with landfill sites, the agriculture sector emits methane but mostly without any effective policies to reduce emissions. Methane fermentation is useful as a source of renewable energy, but it has thus far only been considered as an expensive treatment technology.

Indicator 32: The country has policies to reduce emissions from fossil fuel extraction plants.

Natural gas and coal extraction sites emit methane as a fugitive gas into the atmosphere. Technologies exist to reduce such emissions, but they are considered to be costly. Therefore, few countries have made

sufficient efforts to reduce emissions of these gases. We decided that this indicator does not apply to Germany, because there is little methane emission from this sector in Germany.

- F-gases

F-gases are GHGs with high global warming potential. Among these gases, production of HFCs has increased globally because of regulations in the Montreal Protocol that limit the production of CFCs and HCFCs for the protection of the ozone layer. Discussions are currently ongoing about the use of HFCs under the ozone regime, but it is also necessary to start reducing HFC emissions at the national level.

Indicator 33: The country has regulations related to the production and use of HFCs with the aim of meeting the country's long-term goal.

Annex I countries that were parties to the Kyoto Protocol had legally binding emission reduction targets that covered HFCs. However, emissions of HFCs were not effectively reduced in large part because of policies taken in line with the Montreal Protocol to replace ozone-depleting substances with HFCs. China has not directly introduced policies to regulate these gases, but it has hosted Clean Development Mechanism (CDM) projects to reduce the use of HFCs in collaboration with Annex I countries.

Indicator 34: The country has regulations related to collection and destruction of HFCs and other F-GHGs contained in discarded products.

Prohibiting production and consumption of F-gases is the priority, but large numbers of products that contain F-gases were produced before their production was prohibited. These are known as banked gases, and they should be collected at the time of product disposal and properly disposed of. Collection and destruction of these gases are time consuming and costly, but they are crucial to eliminating emission of these gases into the atmosphere.

- Enhancement of forests

Forest conservation, afforestation, and reforestation are indispensable if the world is serious about reaching its long-term goals by the end of this century, because besides CCS, they are the only means of uptaking carbon from the atmosphere anthropogenically. However, few countries have implemented forestry-related polices for the purpose of climate change mitigation. Internationally, Reducing Emissions from Deforestation and Degradation (REDD+) is a policy that has been shown to be effective in increasing carbon sequestration in developing countries. This study, however, focused only on policies that affect domestic emissions.

Indicator 35: The country sets absolute targets for increasing forest area.

Few countries have set absolute targets for increasing forest area. Setting such targets is difficult for many countries because decisions on land-use changes cannot be made solely by people in charge of climate change mitigation policies. Meanwhile, countries that have been successful in setting targets have seen increases in forest area.

Indicator 36: The country promotes forest management so that the area of managed forests increases by at least 1% annually.

For countries that have difficulty in setting afforestation targets, forest management is the second best solution to maintain the capacity of their forests to sequester carbon from the atmosphere.

Indicator 37: The country regulates illegal logging and promotes the wise use of labeled sustainable wood products.

Regulating Illegal logging and promoting sustainable forestry is important, particularly in many developing countries. In addition, the wise use of wood products is important, even in developed countries, to promote forestry as a sustainable industry.

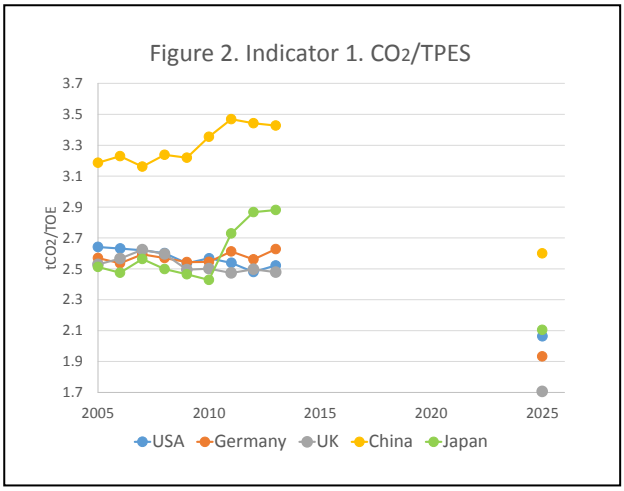
4. Country assessments

This section examines five countries: the United States, Germany, the United Kingdom, China, and Japan. In our previous two reports, we included the EU as a region, but we have determined that to be inappropriate because different types of climate change policies have been introduced in each EU member country. Thus, we decided to replace the EU with its two largest GHG emitters, Germany and the United Kingdom.

4.1 Outcome indicators

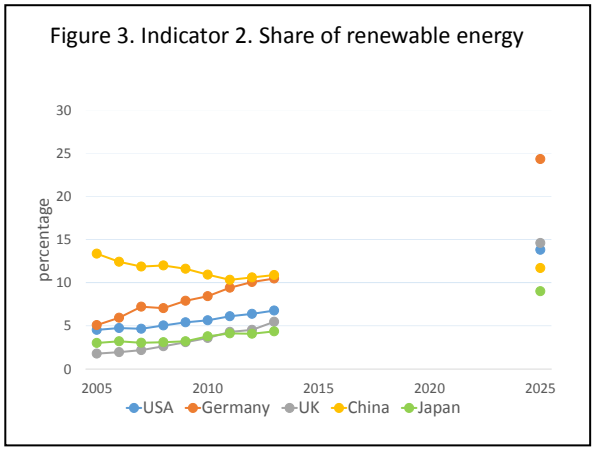
Indicator 1: CO_2 emission/Total Primary Energy Supply (TPES)　（Figure 2）

All developed countries are heading towards energy decarbonization, although the speed of the shift needs to increase in all countries to reach each country's respective 2025 targets. Japan's rate worsened after the nuclear power accident in 2011 and the subsequent closing of all nuclear power plants. The trend started to improve in 2013 because of its efforts to increase the supply of renewable energy. The rate for China worsened through 2011 but has been improving since then. China's target for 2025 is higher than those of the developed countries, but the gap is expected to decrease by 2025. The United States had the best performance in terms of the rate of improvement from 2005 to 2012.



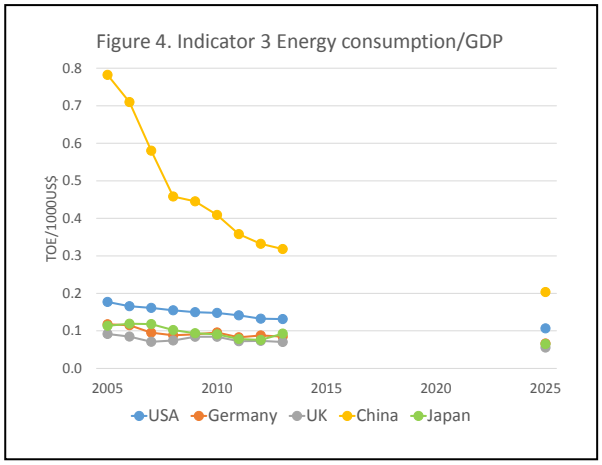
Indicator 2: Renewable energy supply/TPES　(Figure 3)

All of the developed countries are heading towards increasing the rate of renewable energy within TPES. Germany is the leading country in this indicator. It has succeeded in increasing the share of renewable energy through 2012 and is aiming at an even higher rate of growth through 2025. The rate of the United Kingdom was relatively low in 2005, mainly because of the very low amount of hydropower potential in the country. However, it then experienced a rapid increase in renewable energy through 2012. China's rate declined throughout the PS period, mainly because it had previously relied on traditional biomass energy and shifted to fossil fuel. It is now shifting to new types of renewable energy and is expected to make modest growth in terms of this indicator through 2025.



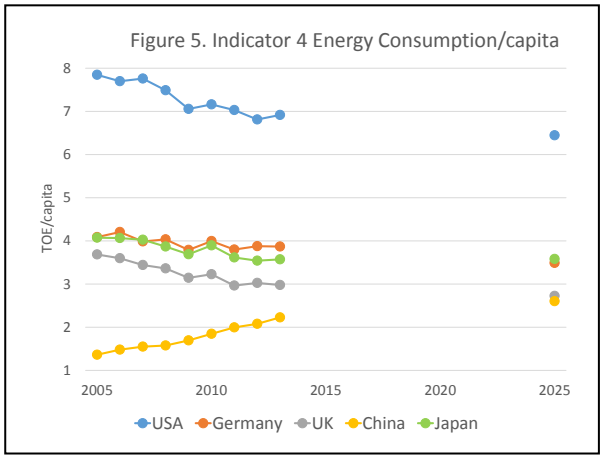
Indicator 3: Final energy consumption/Gross Domestic Product (GDP) (Figure 4)

The rates in Germany, the United Kingdom, and Japan are converging. The United States has consistently been higher. All of the developed countries are heading in the right direction to improve energy efficiency, but the rate of improvement has been relatively small in recent years, and it is likely to decrease in the future without additional efforts for further improvements. China has rapidly improved its rating mainly because of its rapidly increasing GDP. This trend is likely to continue in the future, but again, the rate of improvement is likely to decrease in the future.



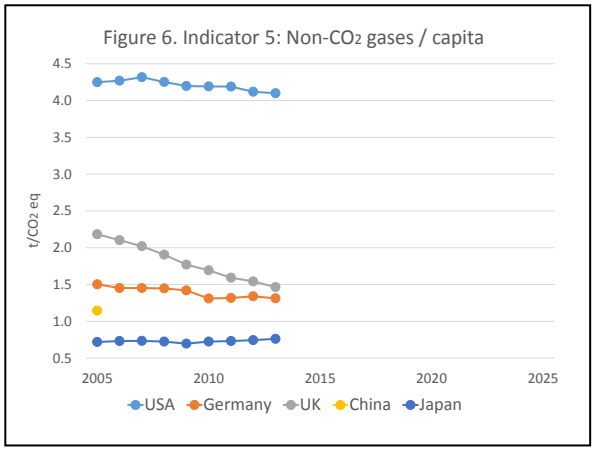
Indicator 4: Final energy consumption/population (Figure 5)

All of the developed countries are trending in the right direction to decrease the demand for energy services, although the rate of improvement has been almost negligible in recent years. Germany, the United Kingdom, and Japan had very similar rates in 2005, but the United Kingdom has been more ambitious than the other two in improving its expected future rate to achieve the 2025 target. The United States has the highest rate, but the rate of improvement throughout both the past and future periods is expected to be better than the other developed countries. China's rate actually increased throughout the PS period, but it is still in the midst of economic development, which should not be discouraged. China is likely to catch up with the United Kingdom by 2025, which means that China should reach a peak in per-capita energy use by 2025.



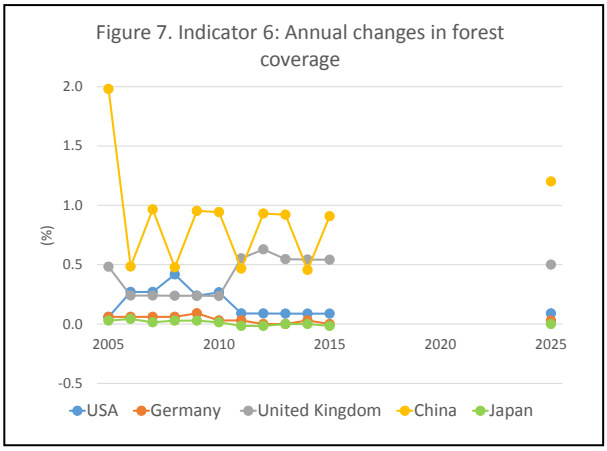
Indicator 5: Non-CO_2 GHGs/population (Figure 6)

Countries differ widely in terms of the amount of non-CO_2 gases emitted into the atmosphere. Japan's emissions remain quite small, as compared with the other study countries, but the other countries' emissions were in no way negligible. Emissions of non-CO_2 GHG gases in most countries remained stable throughout the PS period, possibly because it is technically difficult to reduce emissions relevant to this indicator without reducing overall activity in the target sector. United Kingdom was the only country that made a significant progress, mainly by reducing methane emission from landfill sites.



Indicator 6: Rate of change of forest coverage (Figure 7)

Forest coverage varies widely from one country to another, mainly for reasons unrelated to climate change mitigation policies. That said, the annual rate of change of forest coverage may be influenced by climate change policies. China's unstable pattern could be related to data reporting. Nevertheless, China has been increasing forest coverage 1-2% annually each year, which is the largest annual increase in forest area of the studied countries. The United Kingdom began to make considerable progress in 2011. Germany and Japan have not been successful in increasing forest areas.



4.2 Action indicators

The ratings reflect an aggregation of the responses to the indicators within each category. For example, in the case with three indicators in a category, an "A" rating indicates that all three indicators were deemed to be positive. A "B" indicates two of the three indicators were positive, and a "C" shows that only one of the three indicators was positive. More details are provided in Tables 2a and 2b for other cases.

There were instances where local governments implemented policies in the absence of any national action. In such cases, the ratings were upgraded one rank if the local governments' initiatives were considered to affect at least several percent of national emissions within the boundary of the given category. Similarly, if part of an industry or sector was rated positively for an indicator, then the rank was upgraded if it affected a large enough amount of emissions.

This rating system was designed to be used by all countries, independent of the country's level of economic development. From an equity perspective, developed countries should have higher ratings than developing countries. Most of the 37 indicators have baselines that were chosen such that the long-term target of a 2 °C temperature increase will be met; that is, they are relatively strict.

Table 3 shows the rating results for the five countries. More detailed results are available in the Annex.

Table 2a. Criteria for rating mitigation policies (three indicators in one category)

Rating	Criteria
A+	"Yes" for all three indicators, plus additional effort in SF compared to PS
A	"Yes" for all three indicators
AB	B at the national level, plus additional effort at the local level
B	One "No" and two "Yes" responses
BC	C at the national level, plus additional effort at the local level
C	Two "No" and one "Yes" responses
C-	"No" responses for all indicators in the category

Table 2b. Criteria for rating categories of mitigation policies (two indicators under one category)

Rating	Criteria
A+	"Yes" for both indicators, plus additional effort in SF compared to PS
A	"Yes" for both indicators
AB	BC at the national level, plus wide-spread additional effort at the local level
B	BC at the national level, plus some additional effort at the local level
BC	One "No" and one "Yes" response
C	C- at the national level, plus some additional effort at the local level
C-	"No" for both indicators

Table 3a. Summary of the Action Indicator assessment for Goal 1

Category	Action Indicators	USA		Germany		UK		China		Japan	
		PS	SF	PS	SF	PS	SF	PS	SF	PS	SF
Renewables	(1) Target setting	N	N(Y)	Y	Y	Y	Y	N(Y)	N	N	N(Y)
	(2) RPS, FIT	N(Y)	N(Y)	Y	Y	Y	N(Y)	N	N(Y)	N(Y)	N(Y)
	(3) Power grid	N(Y)	N(Y)	N	N	N	N(Y)	N	N	N	N
	Rating	BC	B	B	B	B	B	C	C	C	BC
Fossil fuels	(4) Emission regulations	N	Y	N	Y	N	Y	N	N	N	N
	(5) CCS	Y	Y	Y	N	Y	N	Y	Y	Y	Y
	(6) Carbon tax	N	N	N(Y)	N(Y)	N(Y)	N(Y)	N	N	N	N
	Rating	C	B	BC	BC	BC	BC	C	C	C	C
Nuclear (optional)	(7) Safety standards	Y	Y	-	-	Y	Y	N	Y	Y	Y
	(8) Compensation	Y	Y	-	-	N	Y	N	N	N	Y
	Rating	A	A	-	-	BC	A	C-	BC	BC	A
Transport-ation	(9) Support for purchase	N(Y)	N(Y)	N(Y)	N(Y)	N(Y)	Y	N(Y)	N(Y)	N(Y)	N(Y)
	(10) R & D on technology	Y	Y	Y	Y	N	Y	N(Y)	N(Y)	N(Y)	Y
	(11) Preferencial treatments	N(Y)	N(Y)	N	N	N	N(Y)	N	N(Y)	N	N
	Rating	B	B	BC	BC	C	AB	BC	B	BC	BC

Note: PS=2005–2012; SF= 2013–2025.

(Y) represents policy implementations at the local level or in a part of a sector, leading to an upgraded ranking.

Table 3b. Summary of the Action Indicator assessment for Goal 2

Category	Action Indicators	USA		Germany		UK		China		Japan	
		PS	SF	PS	SF	PS	SF	PS	SF	PS	SF
Industry	(12) Target setting	N	N(Y)	Y	Y	Y	Y	N(Y)	N(Y)	Y	Y
	(13) Monitoring & reporting	Y	Y	Y	Y	Y	Y	N	N(Y)	Y	Y
	(14) Carbon pricing	N	N	Y	Y	Y	Y	N	N	N	N
	Rating	C	BC	A	A	A	A	C	BC	B	B
Building	(15) Performance standards	N	N	Y	Y	Y	Y	Y	Y	N	Y
	(16) Financial support	N	N	Y	Y	N	Y	N	N	N(Y)	N(Y)
	(17) Efficient home appliances	N	N	N	Y	N	Y	N	N	Y	Y
	Rating	C-	C-	B	A	C	A	C	C	BC	AB
Transport-ation	(18) Financial support	N	N	Y	Y	N	N	N(Y)	N(Y)	Y	Y
	(19) Regulations	N	N	Y	Y	Y	Y	N(Y)	N(Y)	Y	Y
	(20) Aviation and vessels	N	N(Y)	Y	Y	Y	Y	N	N	Y	Y
	Rating	C-	C	A	A	B	B	BC	BC	A	A

Note: PS=2005–2012; SF= 2013–2025.

(Y) represents policy implementations at the local level or in a part of a sector, leading to an upgraded ranking.

Table 3c. Summary of the Action Indicator assessment for Goal 3

Category	Action Indicators	USA		Germany		UK		China		Japan	
		PS	SF	PS	SF	PS	SF	PS	SF	PS	SF
1. Energy and Industry	(21) Target setting	N	N	Y	Y	Y	Y	N	N	N	N(Y)
	(22) Waste heat utilization	N(Y)	N(Y)	N(Y)	N(Y)	N	N	N(Y)	N(Y)	N	N
	(23) Minimizing carbon footprint	N	N	N	N	Y	Y	N	N	N(Y)	N(Y)
	Rating	C	C	BC	BC	B	B	C	C	C	BC
2. Building	(24) Increasing awareness	N	N	Y	Y	Y	Y	N	Y	N	Y
	(25) Visualization of energy use	N(Y)	N(Y)	N	N(Y)	Y	Y	N	N	N	N(Y)
	(26) Energy tax	N	N	Y	Y	Y	Y	N	N	N(Y)	Y
	Rating	C	C	B	AB	A	A	C-	C	C	AB
3. Transpor-tation	(27) Reducing mobility demand	N	N	N(Y)	N(Y)	N	N(Y)	N	N	N(Y)	N(Y)
	(28) Tax on fuels	N	N	Y	Y	Y	Y	N	N	Y	Y
	(29) Urban development	N(Y)	N(Y)	N(Y)	N(Y)	N(Y)	N(Y)	N(Y)	N(Y)	N(Y)	N(Y)
	Rating	C	C	B	B	BC	B	C	C	B	B

Note: PS=2005–2012; SF= 2013–2025.

(Y) represents policy implementations at the local level or in a part of a sector, leading to an upgraded ranking.

Table 3d. Summary of the Action Indicator assessment for Goal 4

Sector	Action Indicators	USA		Germany		UK		China		Japan	
		PS	SF	PS	SF	PS	SF	PS	SF	PS	SF
1. Methane	(30) Waste land-fill sites	N	N	Y	Y	N	N	N	N	-	-
	(31) Agriculture sector	N	N	N	N	Y	Y	N	N	-	-
	(32) Fossil fuel extraction sites	N	Y	-	-	N	N	N	N	-	-
	Rating	C-	C	BC	BC	C	C	C-	C-	-	-
2. F-gases	(33) Production and use	N	N(Y)	N(Y)	N(Y)	N	N	N	N	N	N
	(34) Collections and destruction	N	N	N	N(Y)	N	N(Y)	N	N	N(Y)	N(Y)
	Rating	C-	C	C	BC	C-	C	C-	C-	C	C
3. Forests	(35) Target setting	N	N	N	N	Y	Y	Y	Y	N	N
	(36) Forest management	N	N	Y	Y	Y	Y	N	N	Y	Y
	(37) Sustainable wood products	N	N	N	N	N	Y	N	N	N	N
	Rating	C-	C-	C	C	B	A	C	C	C	C

Note: PS=2005–2012; SF= 2013–2025.

(Y) represents policy implementations at the local level or in a part of a sector, leading to an upgraded ranking.

In the following sub-sections, we present the ratings graphically to visually represent the overall effect of policies in each country. In the figures, vertical height represents the share of emissions in the given country. For example, in the figure for the United States, 83 represents the percent of CO_2 emissions from fossil fuel combustion as part of total GHG emissions, 17 represents the share of emissions of non-CO_2 gases in terms of a CO_2 equivalent, and 13 represents the share of net emissions or sequestration by LULUCF sectors. The share of CO_2 emissions from fossil fuel combustion (83 in the case of the United States) is divided into the first three goals. Goal 1 is then further divided, depending on the relevant number of categories in Goal 1. The height of the bars within the goals represents the share of energy supplied by each energy source. The figures do not always add up to 100 because only major sources of emissions are evaluated by the indicators and not all sources of emissions are included.

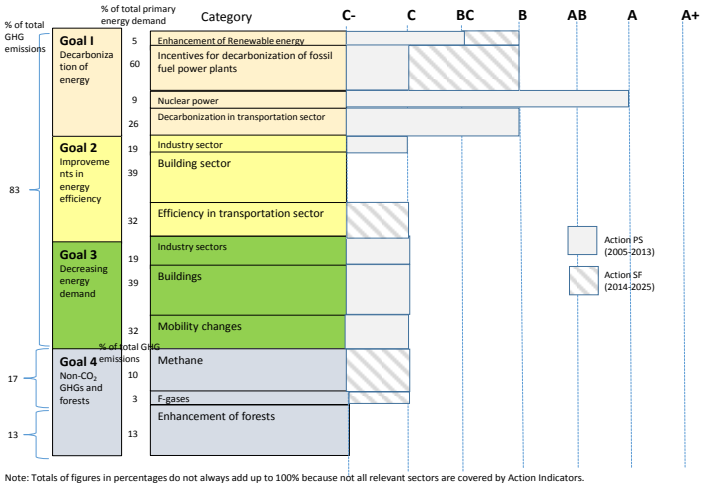
The length of each bar (on the right) denotes the category rating. Gray bars represent the rating for the PS period (2005–2012), and striped bars represent policies in the SF period (2013–2025).

4.3. United States

4.3.1 Action Indicators (Figure 8)

With a balanced package of enhancement of renewable energy, decarbonization of fossil fuel power plants, and nuclear power, relatively good efforts have been put forth to date towards meeting Goal 1. The expected future implementation of the Clean Power Plan to extensively reduce CO_2 from coal-fired power plants should contribute to continued improvements in future years. Decarbonization in the transportation sector has also occurred with the introduction of electric cars and the blending of biofuels with gasoline.

Figure 8. Rating by Action Indicators: USA



Actions to meet the other three goals remain as unfinished tasks. Although some actions have taken place at the state level, more policies need to be implemented at the national level in the areas of improving energy efficiency in all sectors, reducing overall demand for energy services, reducing emissions of non-CO_2 gases, and enhancing forest development and management. In 2016, the Obama Administration announced an initiative to address some of the above-mentioned elements, including reducing emissions of methane from fossil fuel extraction plants and of HFCs, both of which are related to Goal 4. More policies may be implemented after the upcoming presidential election. Under the legally binding Paris Agreement, the United States needs to consider ways to reduce energy use.

4.3.2 Overall remarks

The United States is generally heading in the right direction in all six Outcome Indicators.

Goal 1: The United States had its best performance under Outcome Indicator 1 in making improvements in the PS period, largely because of a comprehensive implementation of policies related to the decarbonization of energy. Decarbonization in the United States is being achieved through a mix of renewable energy, regulations on fossil fuel power plants, the use of nuclear power, and decarbonization in the transportation sector.

Goal 2: The United States has been making some progress in the PS period, but needs to do more to narrow the gap between it and other developed countries. More ambitious actions need to be taken in setting energy-efficiency regulations for industries, building codes, and vehicles.

Goal 3: The United States has been making good progress on this goal in the PS period, and more is expected in the SF period. Actions in the areas of making better use of heat during the winter, encouraging people's general awareness of energy use, and designing urban areas so that people are better able to use public transportation and bicycles could be effective in improving progress towards meeting this goal.

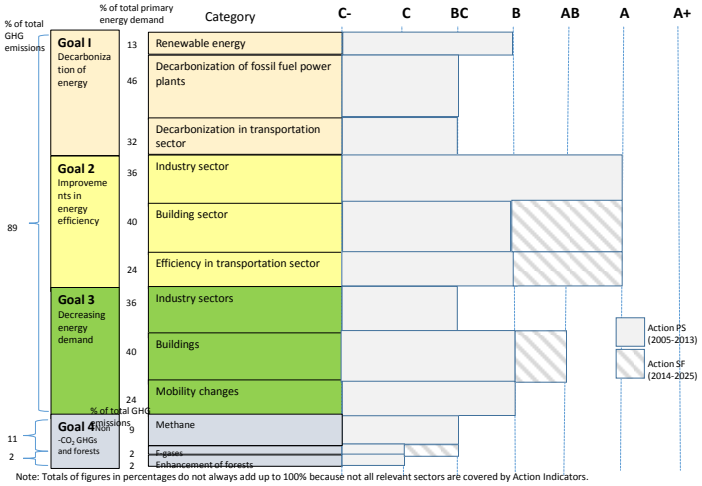
Goal 4: The share of emissions related to Goal 4 is considerably larger in the United States than it is in the other countries covered by this study. Policy implementation in this area therefore has the potential to be more effective in the United States than in the other countries. Ambitious target setting is a first step towards reducing emissions of non-CO_2 gases and enhancing forests and forest management to sequester CO_2.

4.4. Germany

4.4.1 Action Indicators (Figure 9)

Germany's actions received some of the highest rankings of the five countries studied. Action indicators related to nuclear power were excluded because the country plans to phase out nuclear power plants by 2022. Germany has many policies related to the introduction of renewable energy, improvements in energy efficiency in industry sector, and also in reducing demand for energy services. Even faster reduction of GHG gases is expected in the future, but there are not many new policies under Goal 1 that would help the country achieve Goal 1.

Figure 9. Rating by Action Indicators: Germany



Renewable energy would be better supported if policies related to grid control (e.g., demand response) were introduced.

In the future, Germany expects to introduce more policies under Goals 2 and 3 than the other four countries covered in the study. One possible reason is that Germany, unlike the other four countries, does not plan on using nuclear power plants. Therefore, it must invest more in renewable energy, energy efficiency improvements, and reducing overall demand for energy.

4.4.2 Overall remarks

Germany is generally heading in the right direction in all six Outcome Indicators.

Goal 1: Germany has been more or less stable in Outcome Indicator 1 and has performed its best in Outcome Indicator 2. To improve its performance in Outcome Indicator 1, Germany should further improve regulating emissions from fossil fuel power plants, make better use of smart grids to control demand for electricity, and work on the decarbonization of vehicles.

Goal 2: Germany is one of the best performers under this goal, and even more improvements are expected in the future. The rate of improvement has lagged since 2008, and more effort is needed in the building and transportation sectors.

Goal 3: Germany is slowly improving in this area. The action indicators for Goal 3 show that Germany is taking efforts to address this goal, but the Outcome indicator only show little progress, so there is an inconsistency between actions being taken and the outcomes observed. The inconsistency could be caused by the decline in population. Germany should consider long-term urban planning to develop low carbon cities.

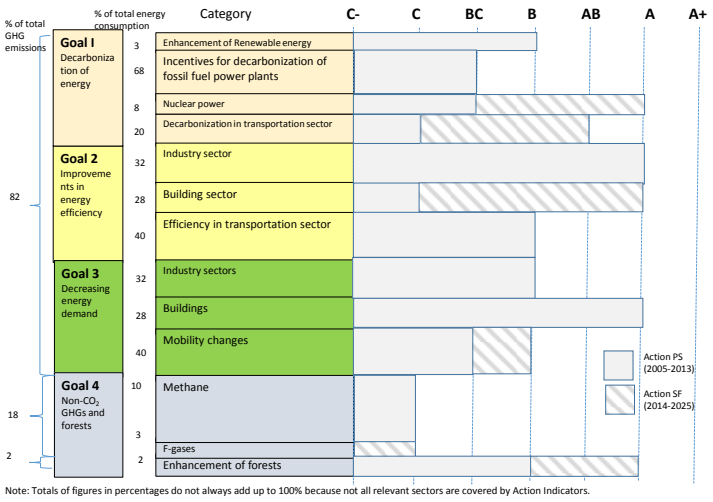
Goal 4: Germany has not shown notable progress in this goal in either the Outcome or the Action Indicators. More actions could be taken to reduce methane emissions from the agriculture sector, reduce HFC emissions from industries, and increase forest area.

4.5. United Kingdom

4.5.1 Action Indicators (Figure 10)

The United Kingdom also received very high rankings for the Action Indicators. The United Kingdom has been able to aim at decarbonization of energy by increasing the energy efficiency of fossil fuel power plants and by introducing nuclear power plants, which could be a reason for the country's relatively late entry into the field of renewable energy. Energy efficiency improvements and energy demand reductions in the industrial sector have been achieved to some extent through its participation in the EU-ETS.

Figure 10. Rating by Action Indicators: United Kingdom



Note: Totals of figures in percentages do not always add up to 100% because not all relevant sectors are covered by Action Indicators.

With the introduction of the Climate Change Act in 2008, the United Kingdom became the world's leading country in setting its own carbon budget. With the support of this and other energy-related legislation, the United Kingdom is positioned to meet its goals set for 2030 and beyond.

4.5.2 Overall remarks

The United Kingdom is successfully heading in the right direction in all six Outcome Indicators.

Goal 1: The United Kingdom is gradually improving its Goal 1 rating, which is helped by adequate policy implementation. The United Kingdom has lagged behind in supporting renewable energy, but it started to make greater efforts to increase the share of renewables in the PS period. More could be done by introducing smart grids and other measures to control the demand for electricity and on the decarbonization (or electrification) of vehicles.

Goal 2: The United Kingdom is the best performer in the field of energy efficiency of the five study countries. It has been successful in reducing energy consumption while at the same time increasing GDP. Its target for energy efficiency in 2025 is relatively modest compared to its current actual performance. The country could aim for higher efficiency in the future by improving efficiency in the building sector.

Goal 3: The United Kingdom is also the best performer among the developed countries studied in terms of per capita energy consumption. Policies in the industrial sector (e.g., making use of heat generated in this sector) and in the area of urban planning (so that people are less reliant on personal vehicles for transportation) could yield potential further reductions in the demand for energy.

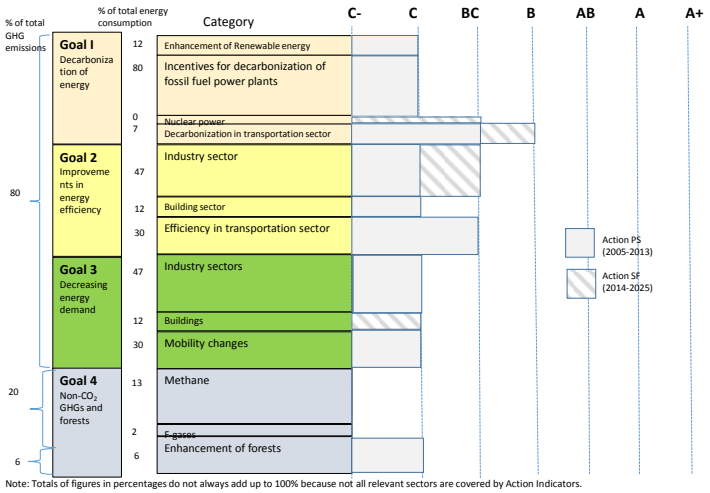
Goal 4: The United Kingdom also has an increasing forest area, largely because effective policies have been put in place to support forest-related activities. Methane emissions could be reduced further, particularly because its share of methane emissions is relatively large compared to some of the other developed countries covered in this study.

4.6. China

4.6.1 Action Indicators (Figure 11)

China has started to implement effective policies in recent years. It has a nearly comprehensive list of policies that tackle all categories under all four Goals, but the rankings are low, primarily because the baseline levels of each policy were not sufficiently high to reach the long-term goal set by the Paris Agreement. Although China's ratings for the past decade may not be satisfactory, China has more recently become much more aggressive in implementing more stringent and effective policies to improve its ratings in all four goals.

Figure 11. Rating by Action Indicators: China



Note: Totals of figures in percentages do not always add up to 100% because not all relevant sectors are covered by Action Indicators.

The ratings are relatively balanced, a reflection of the comprehensive nature of climate change mitigation policies in China. Decarbonization in transportation is one of the few areas where policies are lacking. There are also relatively few policies in the area of non-CO_2 GHGs, but data collection was problematic in this field, because we were only able to obtain data for 2005 for non-CO_2 GHGs in China. International cooperation will aid in data collection in the future. In addition, international technological cooperation will also be effective in reducing methane emissions in China.

4.6.2 Overall remarks

China's last decade was a period of rapid economic growth as China "caught up" with the developed countries. The upcoming decade will be a crucial one for the country to change its course towards low carbon development.

Goal 1: China has set a clear goal to increase the rate of its non-fossil fuel energy supply, which should help it achieve its 2030 emissions target. By 2025, China should be able to reach a similar level as the other countries covered in this study. It could aim at a higher share of renewable energy to improve its ranking on Outcome Indicator 2.

Goal 2: China has a comprehensive list of policies to improve energy efficiency in all sectors, but the Action Indicator ranking was relatively low because of the relatively stringent standards set by the developed countries. Outcome Indicator 3 showed great improvement, meaning that China achieved rapid economic development without a correspondingly large expansion in energy demand. More efficiency gains could be gained in the building sector.

Goal 3: Reducing energy demand was not a priority in China in the last decade because it was still in the development stage. Without additional policy implementation, Outcome Indicator 4 (per capita energy use) will reach the level of the United Kingdom by 2025. More could be done to reduce demand for energy, for example, by reducing the demand for heating in the northern region by CHP and by imposing a carbon tax on energy.

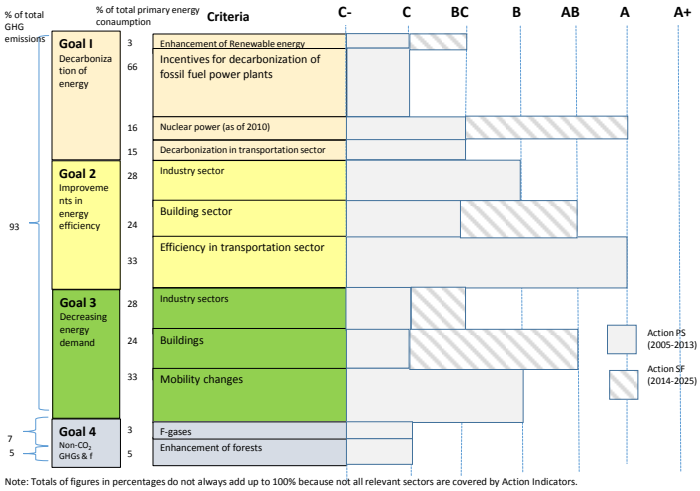
Goal 4: China is one of a few countries that have set a concrete target to increase biomass, and it continued to increase its forest area over the last decade. China's share of F-gases is still relatively small, and it has hosted CDM projects to reduce these gases. Further reduction of methane emissions is possible.

4.7. Japan

4.7.1 Action indicators (Figure 12)

Japan's climate change mitigation policies were relatively highly ranked for Goal 2 (especially in the industrial and transportation sectors) and for the transportation sector and urban development for Goal 3. Some of the progress has stemmed from various measures to save energy, which were sometimes implemented independent of climate change mitigation.
From a climate change perspective, Japan needs to take additional measures, particularly with regard to Goal 1 (decarbonization) to reach its 2030 NDC.

Figure 12. Rating by Action Indicators: Japan



Note: Totals of figures in percentages do not always add up to 100% because not all relevant sectors are covered by Action Indicators.

Japan's share of renewable energy currently is considerably smaller than that of the other countries covered in this study. More policies are expected to be implemented in the building sector to improve Japan's ranking for Goals 2 and 3. Japan's share of GHG emissions is concentrated in CO_2 from fossil fuel combustion, so it is reasonable that most of its policies are concentrated in Goals 1, 2, and 3. On the other hand, emissions of F-gases should not be neglected.

4.7.2 Overall remarks

Goal 1: In the past, Japan relied heavily on nuclear power to decarbonize energy. Since 2011, policies have been implemented to rapidly increase the share of renewable energy. Electricity generation by renewable energy reached a limit because of grid constraints, and it is now crucial for Japan to increase grid capacity to make greater use of renewables. Japan has put a great deal of effort into improving the energy efficiency of coal-fired power plants. This has contributed largely towards meeting its 2030 goal, but it may also become a burden if Japan wants to reach net-zero emissions in the long run. Decarbonization in the area of transportation is also relatively lagging, in part because more emphasis has been placed on improving the energy efficiency of vehicles.

Goal 2: Japan is a frontrunner in the field of energy efficiency in industrial production processes and in products. There has been much support for increasing the share of energy-efficient vehicles, including hybrid cars. However, relatively little progress was made in the last decade; thus, additional efforts are needed to make further improvements under this goal. The building sector could improve in many areas, for example, by improving insulation in buildings.

Goal 3: Japan's rating on Outcome Indicator 4 was not bad for the past decade, but its target for 2030 shows no improvement from the current level. The population in Japan is expected to continue to decrease, which makes it more difficult to improve per capita indicators, but the implementation of some policies could help. Japan could further utilize industrial heat by sharing heat within regions, and improve urban planning so that public transportation is more convenient to use.

Goal 4: Japan's performance in Indicator 5 (non-CO_2 gases) is good in terms of the amount of emissions, but emissions have been increasing in the last decade, whereas all of the other countries covered in this study have seen a downward trend. Similarly, although Japan has put a great deal of effort into forest management, forest area actually decreased in the PS period.

5. Conclusion

This paper finalized Outcome and Action Indicators of climate mitigation policies and used the indicators to assess climate policies in five countries. By combining the output of the two types of indicators, we could more clearly identify the areas where more efforts are needed in the various countries. The indicators could also be useful in developing a package of policies that will comprehensively cover all areas of activities.

The set of indicators is applicable to all countries. Action indicators are useful because individual countries can check whether they have at least one policy related to each of the 37 indicators. A remaining challenge with the Outcome Indicators is the collection of data not only for GHGs, but also for energy supply and consumption, the amount of energy generated from renewables, GDP, and population for the past, present, and expected future. This type of data collection could be burdensome for many developing countries, but with international technical support, it would be worth beginning to collect statistics on these parameters at the national level in all countries.

The C-CPI project plans to apply these indicators to other countries in the coming year, for example, the G20 countries. Its application to more countries may reveal new issues not observed in the present study.

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Annex: List of policies and ranking of Action Indicator by countries

Indicator 1. Target setting for renewable energy

Country	Term	Assess-ment	Supplemental information for the Assessment
US	2005-2012	N	Texas set a target in 2005 to introduce renewable energy in State of Texas 5000MW by 2015, 10000MW by 2025. California set its target in 2008, that all electricity companies shall have more than 33% of electricity supplied by renewable energy by 2020.
	2013-2025	N(Y)	A target was set at the federal level in 2013, to double the share of renewable energy within electricity supply by 2020 from current year.
Germany	2005-2012	Y	Share of renewables within final energy consumption reach 18% by 2020.
	2013-2025	Y	2014 EU target: Share of renewables within final energy consumption reach 27% by 2030.The rate is currently 15% in 2013.
UK	2005-2012	Y	Share of renewables within final energy consumption reach 15% by 2020.
	2013-2025	Y	2014 EU target: Share of renewables within final energy consumption reach 27% by 2030.The rate is currently 15% in 2013.
CHN	2005-2012	N(Y)	Target set by NDRC (2012): Renewables should supply 20% of total electricity supply.
	2013-2025	N	INDC (2015) Share of non-fossil fuel within final energy consumption reach 20% by 2030.
JPN	2005-2012	N	No target
	2013-2025	N(Y)	Energy prospects (2015): Share of renewables within electricity power generation reach 22-24% by 2030.

Indicator 2. RPS, or FIT and other economic incentives for the enhancement of renewable energy

Country	Term	Assess-ment	Supplemental information for the Assessment
US	2005-2012	N (Y)	RPS: California: Net-Metering has been in place. Texas: Competitive RE Zone has been implemented since 2008 by §1603 American Recovery and Reinvestment Tax Act (ARRTA) program FIT：California (2008) tariff at market price, Vermont (2009) tariff $125-240/MWh
	2013-2025	N (Y)	Average rate of tariff (2013): $122.2/MWh More planned to be implemented at state level.
Germany	2005-2012	Y	FIT implemented since 1990.
	2013-2025	Y	Continuation
UK	2005-2012	Y	The UK has implemented Renewable Obligation (RO) from 2002, a regulation requiring utility companies to supply a certain share by renewable energy. Aims at supplying 30% of electricity by renewables by 2020.
	2013-2025	N(Y)	Level of tarrif for FIT has been reduced, due to decrease in cost of renewable energy.
CHN	2005-2012	N	The government purchases renewable energy at a fixed rate. Large scale solar 0.9-1RMB/kWh, small-scale solar 0.42RMB/kWh, biomass from woods 0.75RMB/kWh、biomass from waste 0.65RMB/kWh, biogas 0.25RMB/kWh, wind on shore 0.49-0.61RMB/kWh, wind off shore 0.75, 0.85RMB/kWh
	2013-2025	N (Y)	Increases the scope of buying up renewables (2012) Shanghai 0.617RMB/kWh (=$0.51/kWh) small house hold, 0.977RMB/kWh for large house hold. Beijing 0.488RMB/kWh for small house hold, 0.788RMB/kWh for large household RPS has been under discussion.
JPN	2005-2012	N(Y)	RPS: Was implemented in 2002 but was replaced by FIT in 2012. FIT: Implemented in 2012 but without setting targets for renewable energy.
	2013-2025	N(Y)	With target setting related to INDC, FIT and other subsidies are likely to expand.

Indicator 3. Removing barriers, particularly related to grid capacity

Country	Term	Assess-ment	Supplemental information for the Assessment
US	2005-2012	N(Y)	2009 the American Recovery and Reinvestment Act urged the DOE's Smart Grid Program to match funding from individual utilities for activities related to automatic demand response
	2013-2025	N(Y)	
Germany	2005-2012	N	Demand reponse under consultation
	2013-2025	N	
UK	2005-2012	N	2007 Short Term Operating Reserve (STOR), managed by the UK National Grid system operator has comprised the main market method for demand response (DR)
	2013-2025	N(Y)	More expansion of DR markets.
CHN	2005-2012	N	
	2013-2025	N	Some pilot projects are undergoing.
JPN	2005-2012	N	Energy efficiency law obliges industries to select personnel in charge of energy use. The selected person should monitor energy use.
	2013-2025	N	Demand response in electricity sector is under consultation.

Indicator 4. CO_2 emission intensity targets or emission trading schems for fossil-fuel power plants

Country	Term	Assess-ment	Supplemental information for the Assessment
US	2005-2013	N	Some states introduced emissions performance standards (EPS), but not at federal level. 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). Northeast States introduced the Regional Greenhouse Gas Initiative (RGGI), a mandatory emissions trading scheme for the power sector.
	2014-2025	Y	The Clean Power Plan (CPP) announced in 2015 launched Carbon Pollution Standards for new, modified and reconstructed power plants. The emission standards for existing power plants are 0.56 kgCO_2/kWh for coal-fired power plants and 0.34 kgCO_2/kWh for gas-fired power plants. The emission standards for new power plants are 0.596 kgCO_2/kWh for coal-fired power plants and 0.45 kgCO_2/kWh for gas-fired power plants. The CPP is expected to reduce 32% of CO_2 emission in the electricity sector compared to 2005 levels by 2025.
Germany	2005-2013	N	The EU, as well as its member countries, including Germany, rely on EU-ETS to control CO_2 emissions from fossil fuel power plants. 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. Phase II: 2008-2012. The proportion of free allocation of allowances decreased slightly to at least 90%. The emission cap was tightened by 6.5% compared with the 2005 level. This report concludes that the level of emission allowance by EU-ETS during these periods was not in line with two degree emission pathways.
	2014-2025	Y	EU will continue to make the best use of EUETS into the future. Phase III: 2013-2020 The ETS 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. Phase IV: 2021-2030 The overall number of emission allowances under EU-ETS will decline at an annual rate of 2.2% from 2021 onwards, compared to the current 1.74%.
UK	2005-2013	N	During EU-ETS Phase I, emission allowance for electricity power sector was allocated by grandfathering method. In the UK, the allowance was allocated based on the CO_2 emission during 1998-2003. This report concludes that the level of emission allowance by EU-ETS during these periods was not in line with two degree emission pathways.
	2014-2025	Y	Given the low carbon price under the EU-ETS, the Energy Act 2013 established an EPS at the level of 0.45kg CO_2/kWh, to limit CO_2 emissions from new fossil fuel power stations. The level of 0.450kg/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	N	No emission standards at plant levels. There were no emission targets for CO_2 emissions from

	-2013		power sector. Regulations for other pollutants indirectly contributed in reducing CO_2 emissions.
	2014 -2025	N	The Energy Development Strategy Action Plan (2014-2020) which put the cap on the annual coal consumption at 4.2billion tCO_2 until 2020. The provision that the coal consumption rate for new coal-fired power plants should be less than 300g/kWh (equivalent to around 0.7kgCO_2/kWh). In 2015 China announced that it will launch a national 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 -2013	N	There were no CO_2 emission standards for fossil-fuel power plants at the plant level. A voluntary target 0.305 kgCO_2/kWh during 2008-2012 for the electricity sector.
	2014 -2025	N	The Federation of Electric Power Companies in Japan (FEPC) announced the voluntary emission intensity target of 0.322 kgCO_2/kWh for the whole electricity sector. In 2016, the Ministry of Economy, Trade and Industry revised Energy Conservatoin Act which regulate CO2 emission intensity to 0.825 tCO_2/MWh for newly built coal-fired power plant and 0.359 tCO_2/MWh for newly built gas-fired power plant, respectively. However, this regulation is not compulsory law but effort obligation.

Indicator 5. Use of carbon capture and storage (CCS)

Country	Term	Assess -ment	Supplemental information for the Assessment
US	2005 -2013	Y	Since 2008, the federal government has enforced CCS Tax Credit that subsidize investing into CCS infrastructure. USD10 credit per ton for the first 75Mt/CO_2 captured and transported from an industrial source for use in 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 0.5Mt/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.
	2014 -2025	Y	Major support on R&D on CCS, FutureGen 2.0 terminated in 2015. As of December 2015, 7 large-scale projects are still operating. There are further three projects become operational in 2016 and two in 2019/2020.
Germany	2005 -2013	Y	2009 Directive 2009/31/EC provides that all member states must transpose CCS regulations in accordance with the Directive into their national laws by 25 June 2011. The Act on the Demonstration and Use of the Technology for the Capture, Transport and Permanent Storage of CO_2 (KSpG) entered into force in 2012. The KSpG shall ensure a permanent storage of CO_2 in underground rock layers in a way that protects mankind and the environment and takes the responsibility for future generations into consideration. The law regulates the exploration, testing and demonstration of the permanent CO_2 storage technology.
	2014 -2025	N	There is no plan to expand the current projects on CCS.
UK	2005 -2013	Y	UK (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). In 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.
	2014 -2025	N	In 2015, government support for CCS commercial programme terminated due to budgetary constraint.
CHN	2005 -2013	Y	The 10th Five-Year Plan (2001-2005) started support for R&D on CCS, supporting 9 pilot projects.
	2014 -2025	Y	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 -2013	Y	METI has invested in the Tomakomai pilot plant for CCS. The budget was 5.9 billion yen for 2010, 4.9 billion yen for 2011 and 10.2 billion yen for 2012
	2014 -2025	Y	MOE 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. 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.

Indicator 6. Imposition of carbon tax / phase out of subsidies on fossil fuels

Country	Term	Assess-ment	Supplemental information for the Assessment
US	2005-2012	N	No tax and subsidies have been imposed on fossil fuels for electricity generation at federal level. City of Boulder was the first in the United States to introduce carbon tax on electricity generated by fossil fuel fire power plants. Tax income is used for the city's Climate Action Plan.
	2013-2025	N	City of Boulder decided to extend its carbon tax up to 2018.
Germany	2005-2012	N(Y)	30-40 Euro/tCO_2 of taxes is imposed on electricity sector but certain energy intensive sector has a tax exemption.
	2013-2025	N(Y)	Continuation
UK	2005-2012	N(Y)	10Euro/tCO_2 of taxes is imposed on electricity for whole sectors.
	2013-2025	N(Y)	Continuation
CHN	2005-2012	N	Subsidy for fossil fuel consumption as well as production existed. Amount of the former is on the decrease.
	2013-2025	N	
JPN	2005-2012	N	For the coal-fired plant, 8 yen/tCO_2 (about \$0.1/tCO_2) is imposed. (9 yen/tCO_2 for gas-fired power plant and 10yen/tCO_2 for gas-fired power plants)
	2013-2025	N	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.

Indicator 7&8. Nuclear power: regulations concerning safety, and preparations for accidents

Country	Term	Indicator 10	Indicator 11	Supplemental information for the Assessment
US	2005-2012	Y	Y	The 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.
	2013-2025	Y	Y	The discussion over final disposal site is yet to be solved.
Germany	2005-2012	-	-	Council Directive 2009/71/Euratom (2009) on nuclear safety Obligations
	2013-2025	-	-	2014the EU amended its Nuclear Safety Directive from 2009, which sets up common safety rules for nuclear installation. 2011 Germany 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.
UK	2005-2012	Y	N	Council Directive 2009/71/Euratom (2009) on nuclear safety Obligations
	2013-2025	Y	Y	2014, the EU amended its Nuclear Safety Directive from 2009, which sets up common safety rules for nuclear installation. 2014 Office for Nuclear Regulation (ONR) was established as a statutory Public Corporation under the Energy Act 2013. It provides the framework of responsibilities and the powers of the organization.
CHN	2005-2012	N	N	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.
	2013-2025	Y	N	A new safety plan for nuclear power was approved in 2012 to respond to the Fukushima accident.
JPN	2005-2012	Y	N	Nuclear Safety Commission (NSC) checked the compliance of the facilities, equipment and materials in accordance with these safety regulations, but the regulatory system did not work as the organization was not independent from a nuclear-promoting agency and electric power companies.
	2013-2025	Y	Y	Nuclear Regulation Authority was established in 2012 to respond to the Fukushima accident. 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.

Indicator 9. Financial support for the purchase of non-fossil fueled vehicles

Country	Term	Assess-ment	Supplemental information for the Assessment
US	2005-2012	N(Y)	2008 The Plug-in Electric Drive Motor Vehicle Tax Credit is for the purchase of a new qualified plug-in electric drive motor vehicle that draws propulsion using a traction battery that has at least 4kWh of capacity, uses an external source of energy to recharge the battery, has a gross vehicle weight rating of up to 14,000 pounds, and meets specified emission standards. The minimum credit amount is USD 2,500, and the credit may be up to USD 7,500, based on each vehicles traction battery capacity and the gross vehicle weight rating.
	2013-2025	N(Y)	Continuation
Germany	2005-2012	N(Y)	2008 EV car taxes are exempted 50~100%.
	2013-2025	N(Y)	2016 Financial support total of 1 billion Euro for the purchase of EV (Euro 4000) and PHV(Euro 3000)
UK	2005-2012	N(Y)	2009 The Green Bus Fund is a fund which is supporting bus companies and local authorities in England to help them buy new low carbon buses. Its main purpose is to support and hasten the introduction of hundreds of low carbon buses across England 2011 Plug-in car grant 2012 Plug-in van grant
	2013-2025	Y	2014 Ultra low emission vehicles (ULEVs) are vehicles that produce less than 75g CO2/km. Both private and business users of ULEVs receive a number of tax benefits. 1. Fuel Duty:EVs and including hydrogen fuel cell vehicles are exempt from fuel duty. 2.Vehicle Excise Duty (VED) :vehicles emitting up to 100g CO2/km currently pay no VED. The government has announced reforms to VED for vehicles registered on or after 1 April 2017. 3.Value Added Tax (VAT) :electricity used to recharge a plug-in vehicle at home attracts only a 5% level of VAT, much lower than road fuels (20%). 2016 Fuel Cell Electric Vehicle Fleet Support Scheme. £2 million funding competition for fleets to buy or lease hydrogen fuel cell cars and vans. Public sector, support up to 75% of initial cost. Private Enterprise: maximum 200,000€, 75% of initial cost.
CHN	2005-2012	N(Y)	
	2013-2025	N(Y)	2013 subsidy is given for the purchase of EV and PHV, 35 -60 thousand RMB (about $5000-$10000).
JPN	2005-2012	N(Y)	2009 Eco-car tax exemption reduces car tax for EVs, PHVs, etc.
	2013-2025	N(Y)	

Indicator 10. Support on R & D for next generation vehicles

Country	Term	Assess-ment	Supplemental information for the Assessment
US	2005-2012	Y	2008 The Automotive X Prize (AXP) is an open competition with the goal of inspiring a new generation of super-efficient vehicles that dramatically reduce oil dependence and GHG emissions. The Department of Energy (DOE) has partnered with AXP to develop an educational outreach programme aimed at engaging students and the public in learning about advanced, energy-efficient vehicles. The Mainstream class has a prize of USD 5 million awarded to the fastest vehicle in its class. The Alternate class has 2 separate prizes of USD 2.5 million, one for the fastest vehicle with side-by-side seating and one for the fastest vehicle with tandem seating. DOE only funds the educational component of the X Prize. 2009 The Electric Drive Vehicle Battery and Component Manufacturing Initiative supports grants for US-based manufacturers to produce batteries and electric drive components. The battery manufacturing area is focused on battery manufacturing plants, material and component supplier manufacturing plants, and recycling plants, including facilities and manufacturing equipment, for Lithium-ion and other advanced batteries for advanced vehicles such as electric drive vehicles (EDVs) and micro-hybrids.
	2013-2025	Y	Continuation
Germany	2005-2012	Y	2002 The Clean Energy Partnership (CEP) was established as a joint initiative of government and industry lead-managed by the German Ministry of Transport and Industry. Its aim is to test the suitability of hydrogen as a fuel. 2008 NIP is intended to speed up the process of market preparation of products based on this future-oriented technology. The total budget of NIP invested over a period of ten years until 2016 amounts to € 1.4 billion. The Federal Ministry of Transport and Digital Infrastructure (BMVI) and the Federal Ministry for Economic Affairs and Energy (BMWi)

			provide half of this sum, while the balance is funded by participating industry
	2013 -2025	Y	Continuation
UK	2005 -2012	N	
	2013 -2025	Y	2015 Three companies have been awarded a share of a £25 million fund to help develop greener fuel technology and boost local industry, Transport Minister Andrew Jones announced today (7 September 2015).All the successful projects will use waste products which would otherwise be disposed of and turn them into biofuels, fuelling cars and lorries.
CHN	2005 -2012	N (Y)	2008, the government of Guangxi Province launched the 1 Million Mu Bio-Fuel Forest Project. The plan calls for Guangxi to develop a 1 million Mu (approximately 165 00 acres) jatropha tree forest (also known as small tung oil tree). The forest is to yield over 160 000 MT of biodiesel, worth CNY 640 million. The Guangxi Zhilian Renewable Energy Co. Ltd. And the Guangxi Forestry Science and Technology Institute entered into an agreement, with CNY 500 million to be invested in the development of the jatropha forest, and CNY 200 million in the construction of a biodiesel refinery and production lines for related products. The trees will be planted on lands not suitable for crop cultivation, yielding fruit every 30 years. Every 10 Mu of jatropha trees will yield approximately 3 MTU of seeds with 60% or more oil content, yielding 1 MT of crude oil, or 0.98 MT of biodiesel after refining. Besides Guangxi Province, Sichuan, Yunnan, Guizhou and Fujian Provinces have begun developing jatropha forests.
	2013 -2025	N(Y)	Continuation
JPN	2005 -2012	N(Y)	2012 Financial support for R&Ds related to car batteries and on fuel cell cars
	2013 -2025	Y	Continuation with additional funding

Indicator 11. Preferencial treatment for non-fossil fueld vehicles

Country	Term	Assess -ment	Supplemental information for the Assessment
US	2005 -2012	N(Y)	2008 Financial support is given to install EV charging station, amount up to $50,000 for commercial facilities and $2,000 for residents.California law allows single-occupant use of High Occupancy Vehicle (HOVs) lanes by certain qualifying clean alternative fuel vehicles. Many other states have similar policies.
	2013 -2025	N(Y)	Continuation
Germany	2005 -2012	N	In August 2006, Germany implemented a tax on coal, coke and lignite and rescinded tax breaks for biofuels. Under the law, biodiesel is now taxed at euro0.09 per litre, slightly lower than the government first planned. Taxation of biofuels will be extended and raised, reaching euro 0.45 per litre for rapeseed biodiesel and ethanol by 2012. To replace biofuel tax exemptions, the German government introduced an obligation on suppliers to ensure a 5.75% of motor fuels by 2010.
	2013 -2025	N	
UK	2005 -2012	N	
	2013 -2025	N (Y)	2016 Electric vehicle homecharge scheme: guidance for customers. The grant is a 75% contribution towards the cost of one chargepoint and its installation up to a maximum of £500 (including VAT) per household/eligible vehicle. EVs and PHVs are exempted from London Congestion Charge
CHN	2005 -2012	N	
	2013 -2025	N (Y)	2014 Number plates with EVs and PHVs are given preferencial treatment to enter city zone.
JPN	2005 -2012	N	
	2013 -2025	N	2016 Subsidies to install energy stations for fuel cell cars.

Indicator 12. Target setting for GHG emission or on energy efficiency

Country	Term	Assess -ment	Supplemental information for the Assessment
US	2005 -2012	N	Energy Efficiency Resource Standard (EERS) is a standard introduced at state level that establishes specific, long-term targets for energy savings that utilities or non-utility program administrators must meet through customer energy efficiency programs. Meanwhile, the level of targets are not suggicient to reach the US's long-term goal of 83% reduction by 2050.
	2013 -2025	N(Y)	As of 2015, 25 states have EERS. Some states set emission targets for industries as a part of emissions trading scheme.
Germany	2005 -2012	Y	Germany sets emission caps on industries as a part of EU-ETS.The first NEEAP was issued in 2007 in line with the 2006 EU Directive. The second NEEAP was released in 2011. The action plan's report confirms that Germany will meet the indicative energy savings target of 9% by 2016. The 2010 Energy Concept sets energy efficiency target, which is to improve productivity of energy by 2.1 annually.
	2013 -2025	Y	Continues to be part of the EU-ETS. The third NEEAP is a requirement of the EU Energy Efficiency Directive (EED, 2012/27/EU). Targets: average annual increase of 2.1% in macroeconomic energy productivity from 2008 to 2020, reduce primary energy consumption from 2008 levels by 20% by 2020 and by 50% by 2050.
UK	2005 -2012	Y	The UK sets emission caps on industries as a part of EU-ETS.The UK's NEEAP was published in 2007. To fulfil the UKs obligations under the Energy End-Use Efficiency and Energy Services Directive (ESD), in which member states adopted an overall national indicative energy savings target of 9% by 2016.
	2013 -2025	Y	Continues to be part of the EU-ETS. The UK's 2nd NEEAP brought together in one document all the then current and planned policies and measures the government and the Devolved Administrations have in place to improve energy efficiency.
CHN	2005 -2012	N (Y for some industries)	11th Five-Year Plan (2006 - 2010) includes energy efficiency of coal-burning boilers and kilns should be improved by five and two percentage points. The 12th Five-year Plan (2011 - 2015) on National Economic and Social Development includes binding energy targets, with non-fossil fuel resources reaching 11.4% of primary energy consumption by 2015, energy consumption per unit of GDP decrease by 16% and CO_2 emissions per unit of GDP decrease by 17% by 2015.
	2013 -2025	N (Y for some)	The 12th Five-Year Plan aims to promote the industrialization and local manufacturing of energy efficient and clean energy technologies.
JPN	2005 -2012	Y	2008 The Japan Business Federation (Keidanren)'s "Keidanren Voluntary Action Plan on the Environment" was one of pillars of Japan's energy efficiency and conservation and CO_2 emission reduction policy targeting the private sector. The Act on the Rational Use of Energy (Energy Conservation Act) passed in 1979, revised in 1993 and 1998, 2002, 2005, 2009, and 2013 sets the foundation for industrial energy efficiency and energy management regulations.
	2013 -2025	Y	The INDC has set assumptions that Japan will be improving energy efficiency by 20 to 40% by 2030 from 2013.

Indicator 13. Reporting requirements for industries

Country	Term	Assess -ment	Supplemental information for the Assessment
US	2005 -2012	Y	2009 The US Department of Energy (DOEs) energy efficiency enforcement regulations provide for manufacturer submission of compliance statements and certification reports to DOE, maintenance of compliance records by manufacturers, and the availability of enforcement actions for improper certification or upon a determination of noncompliance. 2010 The US EPA Mandatory Reporting of Greenhouse Gases Rule requires large sources and suppliers in the United States to report GHG emissions annually.
	2013 -2025	Y	Continuation
Germany	2005 -2012	Y	Apart from EU-ETS, there is no mandatory GHG reporting regulations for private companies.
	2013 -2025	Y	Continuation.
UK	2005 -2012	Y	The Climate Change Act 2008 mandates companies to comply with the GHG reporting regulation.
	2013 -2025	Y	Continuation
CHN	2005 -2012	N	There are no requirements for companies to monitor and report their annual GHG emissions.
	2013 -2025	N(Y)	Continuation
JPN	2005 -2012	Y	2006 Under the Energy Conservation Act, companies in subsectors are subject to annual mandatory reporting on the status of their performance on the benchmarks. Nearly 8000

			Japanese firms must publicly report their annual CO_2 emissions.
	2013 -2025	Y	Continuation

Indicator 14. Energy tax or carbon tax on industry sector

Country	Term	Assess -ment	Supplemental information for the Assessment
US	2005 -2012	N	Some states introduce tax on electricity use.
	2013 -2025	N	No taxes at federal level.
Germany	2005 -2012	Y	Energy tax is introduced in 1999. The tax income is used for social welfare, not to invest in improve energy efficiency. EU-ETS introduced in 2005 also works as a way to introduce carbon price on energy.
	2013 -2025	Y	Continuation of energy tax.
UK	2005 -2012	Y	2001Climate change levy was introduced in 2001 respectively. The tax income is used for social welfare. EU-ETS introduced in 2005 also works as a way to introduce carbon price on energy.
	2013 -2025	Y	Climate change levy continues. The tax rate was \$15.75/ tCO_2e for year 2014.
CHN	2005 -2012	N	Introduction of excise taxes in 2009 covered almost all products related to oil, at a flat rate across all types of users.
	2013 -2025	N	China plans to introduce emissions trading, which might implicitly add carbon price on energy exceeding \$5.
JPN	2005 -2012	N	No introduction of carbon tax until 2012. Oil and coal tax had been introduced since 2003 mainly to use the tax revenue to subsidize construction and maintenance of roads.
	2013 -2025	N	Global warming tax was introduced in 2012. The initial tax rate was \$ 2.5/tonne CO_2 and was planned to increase over three years. Tax revenue is ear-marked, and invested into introduction of renewable energy and improvement of energy efficiency.

Indicator 15.Energy efficiency performance standards for buildings

Country	Term	Assess -ment	Supplemental information for the Assessment
US	2005 -2012	N	2008 The International Energy Conservation Code (IECC). Section 413 of the Energy Independence and Security Act of 2007 (EISA) required DOE to establish "standards for energy efficiency in manufactured housing" within 4 years (by December 2011).
	2013 -2025	N	Continuation
Germany	2005 -2012	Y	2010 EU Energy Performance of Buildings Directive (EPBD) (Directive 2010/31/EU) mandates all new buildings must be nearly zero energy buildings (nZEB) by 31 December 2020 (public buildings by 31 December 2018).
	2013 -2025	Y	Continuation
UK	2005 -2012	Y	2008 The CRC (carbon reduction commitment) Energy Efficiency Scheme (CRC Scheme) is designed to improve energy efficiency and cut emissions in large public and private sector organizations. The CRC affects large public and private sector organizations across the UK, together responsible for around 10% of UK GHG emissions. 2012 Under the Energy Efficiency Directive, EU countries make energy efficient renovations to at least 3% of buildings owned and occupied by central government.
	2013 -2025	Y	Continuation
CHN	2005 -2012	Y	2007 The central government adopted China's first national building energy standard as part of its 11th Five Year Plan. The standard requires a 50% reduction by 2020 of building's total operation load based on a building's energy consumption during the 1980s.
	2013 -2025	Y	2014 The standards are revised to meet the 2020 target.
JPN	2005 -2012	N	Standards for energy efficiency of buildings have been used since 2003. 2009 The Top Runner Program included houses to put a mandatory standard on energy efficiency.
	2013 -2025	Y	2014In the Basic Energy Plan published in 2014, the policy direction regarding the housing sector was stipulated that the government will facilitate energy efficiency in the sector through possible strengthening of energy efficiency standards, further dissemination of ZEH, and promotion of smart lifestyle, etc. Meeting energy efficiency standards, however, is not mandatory.

Indicator 16. Subsidies and other supports to promote energy efficient buildings

Country	Term	Assess-ment	Supplemental information for the Assessment
US	2005-2012	N	2008 The property-assessed clean energy (PACE) model is an innovative mechanism for financing energy efficiency and renewable energy improvements on private property. 2012 Industrial Assessment Centers (IACs) provide eligible SMCs with no-cost energy assessments. Over 15,000 IAC assessments have been conducted.
	2013-2025	N	
Germany	2005-2012	Y	2006 With Blue Angel ecolabelling scheme, the government's goal is to increase the energy efficiency of 5% of existing buildings built before 1978 every year. The Energy Saving Ordinance, enacted in 2002, was revised in 2009 to raise the level of energy performance of buildings. Funding is awarded for redevelopment to new construction level in conformity with KfW efficient building standards 100, 85, 70 and 55 as well as certain individual measures such as thermal insulation and heating or window replacement. 2012 Ecodesign Directive amended 2012/27/EU established an indicative national energy efficiency target.
	2013-2025	Y	From 1 January 2014, 3% of the total floor area of government-owned buildings should be in line with ZEBs.
UK	2005-2012	N	2012 Ecodesign Directive amended 2012/27/EU
	2013-2025	Y	2013 The Green Deal (GD) provides a framework of accredited market participants, through which people pay for some of the cost of improving their homes and businesses using a type of loan that is paid back with the savings they can expect to make on their fuel bills. The Energy Company Obligation (ECO)will work alongside the GD to provide additional support for viable packages of energy efficiency measures that are unlikely to be fully financed by the GD. By 2020 the GD and ECO could save UK homes and businesses 4.5 $MtCO_2$ per year.
CHN	2005-2012	N	2008 Energy Conservation Law aims at meeting residential demands for energy by promoting energy conservation with an emphasis on economic and social development as well as the economic benefits of energy efficiency. It includes a strategy to incorporate conservation and efficiency into economic and social planning nationwide, focusing on the rational use of energy and decreasing the environmental impact of energy use.
	2013-2025	N	Continuation
JPN	2005-2012	N(Y)	2006 The government adopted the "Basic Program for Housing", planning to improve housing standards over the next 10 years. Targets for housing by 2015:1) 40 percent of housing should adopt energy saving measures, for example double-paned windows (18% as of 2003); 2) increase the life span of housing to about 40 years (about 30 years as of 2003). 2010 Housing eco-point scheme is a scheme where consumers can earn points while shopping when buying scheme specified eco-friendly products.
	2013-2025	N(Y)	2011 ZEB and ZEH are recognized as the key energy and electricity saving concept in Government's national strategic documents such as 2011 Energy conservation technology strategy and the latest 2014 Basic Energy Plan.

Indicator 17. Energy efficiency standards, labeling and supports to promote energy efficient household electric and other energy-related products

Country	Term	Assess-ment	Supplemental information for the Assessment
US	2005-2012	N	2006 DOEs regulations under the National Appliance Energy Conservation Act (NAECA) established a new efficiency standard for certain heating and cooling systems. The Advanced Energy Design Guides (AEDG) are a series of publications designed to provide recommendations for achieving energy savings over the minimum code requirements of ANSI/ASHRAE/IESNA Standard 90.1-1999. The initial series of guides have an energy savings target of 30% which is the first step in the process toward achieving a net ZEB.
	2013-2025	N	
Germany	2005-2012	N	EU Eco-design Directive: 2009/125/EC established a framework for the setting of eco-design requirements for energy-related products. EU Eco-labeling Directive 2010/30/EU on the indication by labeling and standard product information of the consumption of energy and other resources by energy-related products. 2009 The aim of the "Buy Smart" in Germany is to promote the purchase of energy-efficient products. The project is targeted at public-sector and private buyers. 2012 Eco-design Directive amended 2012/27/EUEU Eco-labeling Directive Amended Directive 2012/27/EU establishes a common framework to promote energy efficiency.
	2013-2025	Y	Implementation of the EU Directive

UK	2005 -2012	N	EU Eco-design Directive: 2009/125/EC and EU Eco-labeling Directive: Directive 2010/30/EU. The British government began phasing out incandescent lightbulbs in early 2008 in favor of low energy varieties. The aim of this voluntary agreement with major lightbulb makers and retailers and energy utilities was to cut up to 5 mil.t CO_2 a year by 2012 by cutting electricity demand. 2012 Ecodesign Directive amended 2012/27/EUEU Eco-labeling Directive Amended Directive 2012/27/EU establishes a common framework to promote energy efficiency.
	2013 -2025	Y	Implementation of the EU Directive
CHN	2005 -2012	N	2008 As part of a plan to phase out incandescent lighting, the Ministry of Finance announced the first stage of the plan, to subsidize 50 million low-energy bulbs onto the market. 2009 The Chinese Government has begun a taxation and subsidy programme to encourage the public's use of energy efficient and low-carbon appliances.
	2013 -2025	N	2012 the State Council subsidizes the purchase of a variety of low-consumption household electrical appliances.
JPN	2005 -2012	Y	2008 The Energy-Efficient Household Appliance Promotion Forum was established with the aim of further promoting the widespread use of energy-efficient household appliances. The Energy Conservation Frontrunner Plan (or top-runner approach) sets a target to improve energy efficiency by 30% relative to 2006 by 2030. Eco-points were put on energy efficient household electrical appliances to subsidize the purchase of these products.
	2013 -2025	Y	2013-2015 The Energy Conservation Frontrunner Plan was revised to strengthen the standard for each product, as well as to widen the scope of the scheme.

Table 18. Financial incentives for energy efficient cars

Country	Term	Assess -ment	Supplemental information for the Assessment
US	2005 -2012	N	No policy found.
	2013 -2025	N	
Germany	2005 -2012	Y	2007～2009 220mil. Euro was subsidized for trucks meeting EURO5 requirements. 2009～2,500～6,050 per truck was subsidized for trucks meeting EURO6 requirements.EU directive in 2009 obligates car selling companies to sell vehicles of which the average fuel efficiency rate be above certain standards. Labeling is used to inform energy efficiency of vehicles. Also, vehicles more than 12tonne is taxed according to length of using toll roads. Oil tax rate has been elevated since 1999, and further elevated in 2000.
	2013 -2025	Y	Continuation
UK	2005 -2012	N	2001 Vehicle Excise Duty(VED) Vehicle tax rates are based on engine size, or fuel type and CO2 emissions, depending on when the vehicle was registered. Vehicle registration tax rate is in relation to carbon intensity. EU directive in 2009 obligates car selling companies to sell vehicles of which the average fuel efficiency rate be above certain standards. Labeling is used to inform energy efficiency of vehicles.
	2013 -2025	N	Continuation
CHN	2005 -2012	N (Y)	Tax rate in relation to engine size. efficiency Fuel efficiency standards are introduced in2005. China aims at improving energy efficiency by 10% by 2009, and by 20% by 2012 from levels of 2005.
	2013 -2025	N(Y)	Continuation. Aims at the same level of energy efficiency standards by 2020
JPN	2005 -2012	Y	Tax credits are introduced for energy efficient cars since 2009.
	2013 -2025	Y	Tax credits are offered to more energy efficient cars than before.

Table 19. Regulations against use of inefficient vehicles

Country	Term	Assess -ment	Supplemental information for the Assessment
US	2005 -2012	N	Gas Guzzler Tax has been introduced since 1978, cars less than 22.5miles/gallon will be taxed $1,000～7,700. 2006 Light Duty Vehicle Fuel Economy and Environment Label Every new car and light truck sold in the U.S. is required to have a fuel economy window sticker label, listing the city and highway miles-per-gallon estimates that are designed to help consumers compare and shop for vehicles. The city and highway miles per gallon (MPG) estimates help consumers

			compare the fuel economy of different vehicles when shopping for new cars.
	2013 -2025	N	Starting with model year 2013, the redesigned and improved fuel economy labels will be required to be affixed to all new passenger cars and trucks—both conventional gasoline powered and "next generation" cars, such as plug-in hybrids and electric vehicles. Automakers may voluntarily adopt the new labels earlier for model year 2012 vehicles.
Germany	2005 -2012	Y	2004 Mandatory fuel efficiency labelling to provide consumer information about fuel consumption and CO2 emissions with regard to the marketing of new passenger cars came into force in 2004. In practice this means that at locations where cars are sold a sign clearly indicating the fuel consumption and the relevant CO2 emission must be fixed on each new car type or in its vicinity. The Passenger Vehicle Energy Consumption Labelling Ordinance (Pkw-EnVKV) has been amended in 2011, introducing an improved energy label including energy efficiency classes. 2005 Mileage-based road toll for heavy commercial vehicles on federal motorways and some heavily used trunk roads. Spreading of the toll rate to account for pollutant class. Scrap incentive of 2500€ is offered when scrapping old cars and buying new energy efficient vehicle. Subsidies up to 6050€ is available when purchasing EUROV or EUROVI standard vehicles. Vehicle registration tax rate is in relation to carbon intensity.
	2013 -2025	Y	Scrap incentive is terminated.
UK	2005 -2012	N	2001 The UK's new car fuel economy label helps consumers to compare the carbon emissions, fuel costs and vehicle tax for different cars. Over 90% of new car dealerships in the UK now use this voluntary colour-coded label in their showrooms. Following the success of this scheme, the UK's used car fuel economy label was launched in 2009 with support from dealerships, manufacturers, the Low Carbon Vehicle Partnership and Government. To date over quarter of a million labels have been circulated into the used car market and nearly 2,000 used car dealers have signed up to this voluntary scheme Vehicle registration tax rate is in relation to carbon intensity.
	2013 -2025	N	Continuation
CHN	2005 -2012	N (Y)	Tax rate in relation to engine size.
	2013 -2025	N(Y)	Continuation
JPN	2005 -2012	Y	Tax credits of $1200-2500 are introduced for energy efficient cars since 2009, and scrap incentive is offered since 2012. Top-runner program prohibits sales of vehicles that do not satisfy standards. Labeling is used to inform energy efficiency of vehicles. Labeling is used for energy efficient vehicles.
	2013 -2025	Y	Tax credits are offered to more energy efficient cars than before. Scrap incentiveis terminated. From 2014, old cars (more than 11-13 years old) will be taxed at higher rate to motivate scrapping. Carbon tax on gasoline introduced in2012 is elevated in 2016 to be JPY760 per kilo litre.

Indicator 20. Aviation and vessels

Country	Term	Assess -ment	Supplemental information for the Assessment
US	2005 -2012	N	No policy found.
	2013 -2025	N(Y)	Supports ICAO target of stabilizing global emission at 2020 level.
Germany	2005 -2012	Y	Phase II: 2008-2012. The proportion of free allocation of allowances decreased slightly to at least 90%. 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.
	2013 -2025	Y	Continuation of implementation under EU-ETS.
UK	2005 -2012	Y	Phase II: 2008-2012. The proportion of free allocation of allowances decreased slightly to at least 90%. 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.
	2013 -2025	Y	Continuation of implementation under EU-ETS.
CHN	2005	N	No policy found.

	-2012		
	2013 -2025	N	No policy found.
JPN	2005 -2012	Y	2005 Under the Kyoto Protocol, Japan set a target to improve fuel efficiency of aviation by 15% from 1995 by 2010, and actually achieved 16% improvements.
	2013 -2025	Y	Supports debates under IMO

Indicator 21. Setting targets on amount of energy consumption

Country	Term	Assess -ment	Supplemental information for the Assessment
US	2005 -2012	N	There is no target for reducing energy consumption.
	2013 -2025	N	
Germany	2005 -2012	Y	2006 Communication from the European Commission: Action Plan for Energy Efficiency (2007-2012): COM(2006)545 final The Action Plan aimed at achieving a 20 % reduction in energy consumption by 2020.
	2013 -2025	Y	
UK	2005 -2012	Y	2006Communication from the Commission: Action Plan for Energy Efficiency (2007-2012): COM(2006)545 final 2011 The Carbon Emission Reduction Target (CERT) was a target imposed on the gas and electricity transporters and suppliers. The original Energy Efficiency Commitment 1 (2002–2005) program required that electricity and gas suppliers must achieve a combined energy saving of 62TWh by 2005. In Commitment 2 (2005–2008), energy saving targets were raised to 130TWh suppliers. The CERT (EEC3) was planned 2008-2011 and increased the previous targets to 154 MtC. In 2010 the Government increased the target to 293 MtC, to be achieved over an extended period running until the end of 2012.
	2013 -2025	Y	UK 2013 A target on final energy consumption of the year 2020 to be 18% less than the BAU case set at the time of 2007.
CHN	2005 -2012	N	2010 Final consumers of electricity were obliged to cut their demand for electricity by 0.3%, as well as to cut total peak of demand by 0.3%.
	2013 -2025	N	
JPN	2005 -2012	N	There is no target for absolute energy consumption.
	2013 -2025	N(Y)	The long-term energy demand-supply outlook of 2015 assumes about 10% decrease in energy demand between 2013 and 2030. Although this target is perceived as an ambitious target, the level is not sufficient to achieve Japan's GHG reduction goal for 2050.

Indicator 22. Effective use of waste by CHPs and by industrial parks

Country	Term	Asses s -ment	Supplemental information for the Assessment
US	2005 -2012	N (Y)	2008 The CHP Technical Assistance Partnerships (CHP TAPs) promote and assist in transforming the market for CHP, waste heat to power, and district energy technologies and concepts throughout the United States.
	2013 -2025	N(Y)	
Germany	2005 -2012	N(Y)	Germany 2008 The BMU started a funding programme, implemented by the BAFA, for small and highly efficient combined heat and power generation installations. The objective of the funding is to increase the use of mini-CHP plants in the heating market segment up to 50 kW by means of investment incentives. 2009 The purpose of the Heating Costs Ordinance, which is based on the Energy Savings Act (EnEG), is the creation of incentives to encourage economical use of energy by means of consumption-based metering and billing of heating and water heating usage. Germany 2012 CHP Agreements with Industry
	2013 -2025	N(Y)	
UK	2005 -2012	N	2010 target: attaining10000MWe of" Good-Quality" installed CHP set in 2000. One challenge has been the development of mechanisms to support and encourage the development of CHP in its various forms without adversely affecting the functioning of energy markets. While installed capacity of Good-Quality CHP has doubled since1990 and was responsible for 7% of all electricity generation in 2007, growth since after has slowed.

	2013 -2025	N	The UK Government's recent decision in the Budget 2014 to exempt onsite CHP electricity production from the Carbon Price Floor is considered an important step forward, helping the stability of the existing CHP fleet and acting as an incentive to build new capacity. In addition, the new Contracts for Difference Feed-in Tariff will only support biomass when used in highly-efficient CHP mode. New CHP plants are also eligible to bid in the first Capacity Market auction in December 2014 for delivery in 2018/2019. Moreover, to ensure CHP's benefits are appropriately supported, the Department for Energy and Climate (DECC) has recently committed to developing a bespoke CHP policy.
CHN	2005 -2012	N (Y)	2006 The 11th Five Year Period included plans to enhance centralized heat supply in the areas whose heat demand is mainly for warming and is relatively small, combined supply of heat, electricity and gas, and distributed cogeneration and combined heat-power-cooling supply with clean fuels; - and the transformation of existent coal-burning small boilers for decentralized heat supply. Objectives: - expand coverage of urban centralized heat supply (27 percent in 2002,) to 40 percent in 2010; - add 40 million kilowatts of cogeneration units for heating; - save 35 million tons of standard coal. Through combined heat and power (CHP) systems, heat efficiency can be raised by 30 percent as compared to separated generation. Centralized heat supply is 50-percent more efficient than small boilers.
	2013 -2025	N(Y)	2014 China's Policies and Actions on Climate Change The Twelfth Five-Year Plan includes plans to adjusting industrial structure
JPN	2005 -2012	N	There have been pilot projects related to cogeneration, but has not been widely diffused.
	2013 -2025	N	

Indicator 23. Minimizing energy consumption during product life cycle

Country	Term	Assess -ment	Supplemental information for the Assessment
US	2005 -2012	N	
	2013 -2025	N	
Germany	2005 -2012	N	
	2013 -2025	N	
UK	2005 -2012	Y	2006 Carbon Trust
	2013 -2025	Y	.
CHN	2005 -2012	N	
	2013 -2025	N	
JPN	2005 -2012	N (Y)	2008 Carbon footprint labeling (voluntary)
	2013 -2025	N(Y)	

Indicator 24. Changing people's behavior by raising awareness

Country	Term	Assess -ment	Supplemental information for the Assessment
US	2005 -2012	N	2005 Energy Star National Campaign sponsors a variety of national campaigns which seek to encourage energy efficiency and energy savings by consumers. However, opinion by Pew Center in 2013 shows only about % of the respondents were aware of climate change risks.
	2013 -2025	N	2016 According to Gallup poll, 64% of Americans worried a "great deal" or "fair amount" about climate change.
Germany	2005 -2012	Y	Germany 2008 The municipal climate protection projects are intended to allow municipalities to identify and exploit potential savings in the public sector. As of 2009, total of 688 projects with a total volume of €101m and subsidies of about €52m have been approved, in some cases to be executed over several years.
	2013 -2025	Y	Germany 2012 The programme "Stromsparchecks" is funded by the Federal Ministry of Economics and Technology and implemented by a consumer association. 2015 According to the Euro Barometer, the vast majority (91%) believe that it is important that their governments set targets to increase the amount of renewable energy used.
UK	2005 -2012	Y	2005 The Climate Change Communications Initiative (CCCI) was launched, with a budget of GBP 12 million over three years (2005/6 - 2007/8).
	2013	Y	2015 An opinion poll showed that only 13% of the population take the opinion that climate

	-2025		change is not caused by human activity.
CHN	2005 -2012	N	
	2013 -2025	Y	The program aims to set up a long-term mechanism to incentivize energy-efficient “leaders”—i.e., manufacturers and brands that exceed specific energy-efficiency benchmarks set by the China Energy Label. It is expected that the government will regularly update the categories of most energy-efficient end-use appliances, most energy-efficient firms in high energy intensive industries, and most energy-efficient public institutions. 2014 According to a global survey, 91% of respondents from China agreed with statement, "We are heading for environmental disaster unless we change our habits quickly.
JPN	2005 -2012	N	2005 A “Cool Biz” campaign was introduced to wear light cloth during summer time at office. Citizens were requested to set air conditioners at 28°C. A similar campaign “Warm Biz” was also introduced during winter time. 2007 Eco driving promotion, The Carbon Footprint Labeling, introduction of smart metering
	2013 -2025	Y	2015 Cool-choice campaign is a new public awareness raising campaign to achieve 2030 emission reduction targets under the Paris Agreement. 2016 An opinion poll by the government showed around 90% of the populations interested in global environmental issues such as climate change.

Indicator 25. Visualization of energy use, such as by smart meters

Country	Term	Assess -ment	Supplemental information for the Assessment
US	2005 -2012	N(Y)	2008The U.S. Treasury Department's Accelerated Recovery Period for Depreciation of Smart Meters and Smart Grid Systems allows for accelerated depreciation for qualified smart electric meters and smart electric grid equipment.
	2013 -2025	N(Y)	
Germany	2005 -2012	N	
	2013 -2025	N(Y)	Germany 2015 Grants for consulting on as Energy Performance Contracts (EPC) are available for municipalities, municipal companies, recognized religious communities as well as SMEs.
UK	2005 -2012	Y	2007 The aim of the UK smart metering programme is for all homes and small businesses to have smart meters by 2020. Energy suppliers will be required to install smart meters and consumers with smart meters will be offered an in-home display (IHD) that lets them see how much energy they are using and what it will cost.
	2013 -2025	Y	
CHN	2005 -2012	N	
	2013 -2025	N	
JPN	2005 -2012	N	2005 Specifically for BEMS and HEMS, METI provided subsidies for introducing energy management systems in homes and buildings which help manage the energy consumption of appliances such as lighting, air-conditioning, and hot-water supply by using information technology systems.
	2013 -2025	N(Y)	2014 The government decided to set smart meters to all buildings by the end of 2020s.

Indicator 26. Energy tax or carbon tax for commercial and residential sectors

Country	Term	Assess -ment	Supplemental information for the Assessment
US	2005 -2012	N	City of Boulder was the first in the United States to introduce carbon tax on electricity generated by fossil fuel fire power plants. Tax income is used for the city’s Climate Action Plan.
	2013 -2025	N	No taxes at federal level. City of Boulder decided to extend its carbon tax up to 2018.
Germany	2005 -2012	Y	Germany introduced energy tax in 1999.The tax income is used for social welfare, not to invest in improve energy efficiency.
	2013 -2025	Y	Continuation
UK	2005 -2012	Y	UK introduced climate change levy in 2001. The tax income is used for social welfare, not to invest in improve energy efficiency.
	2013 -2025	Y	UK Climate change levy continues. The tax rate was \$15.75/ tCO_2e for year 2014.
CHN	2005	N	Introduction of excise taxes in 2009 covered almost all products related to oil, at a flat rate

	-2012		across all types of users.
	2013 -2025	N	
JPN	2005 -2012	N(Y)	No introduction of carbon tax until 2012. Oil and coal tax had been introduced since 2003 mainly to use the tax revenue to subsidize construction and maintenance of roads. 2012 Global warming tax was introduced to tax energy according to carbon intensity. The initial tax rate was $2.6/tonne CO_2 and was planned to increase over three years. Tax revenue is ear-marked, and invested into introduction of renewable energy and improvement of energy efficiency.
	2013 -2025	Y	

Indicator 27. Reducing overall demand for mobility

Country	Term	Assess -ment	Supplemental information for the Assessment
US	2005 -2012	N	2006 SmartWay Transport is a voluntary partnership between various freight industry sectors and the Environment Protection Agency (EPA). There are three primary components of the program: fleets, idling, and rail/intermodal. The fleets component invites companies that either use or provide freight shipping services (shippers and carriers, respectively) to become SmartWay Transport partners by applying innovative strategies and technologies to improve fuel efficiency and reduce emissions. USD 2.7 million in FY2013
	2013 -2025	N	Continuation
Germany	2005 -2012	N (Y)	Modal shift is being funded in various areas. Plans are laid out to make low carbon development in urban areas. 2002 To promote cycling the federal government adopted a National Cycling Plan, designed to initiate new strategies for and improvements to the promotion of cycling up to 2012. In addition the federal government has also made a financial commitment to cycling: in 2008 the government invested about €100m in the construction and maintenance of cycle paths on trunk roads, in the implementation of the National Cycling Plan, and in cycling safety work. Moreover, there are many packages of measures and individual projects initiated by cities and municipalities at local level which are designed to promote cycling further.
	2013 -2025	N (Y)	Continuation
UK	2005 -2012	N	No policy found
	2013 -2025	N (Y)	Sustainable Travel Transition Year, 2016 to 2017: successful bidders: List of the winning bids for funding as part of the Sustainable Travel Transition Year revenue competition for 2016 to 2017. Funding allocated is £20.6 million, shared between 23 projects across England. Funding will be to create projects will: ･make a range of initiatives to boost the local economy ･cut carbon by supporting cycling and walking 2015 £700,000 competition supports hire schemes across the country with hundreds of new electric bicycles to get more people cycling.
CHN	2005 -2012	N	Transportation infracstructure is not sufficient to shift passengers to means of transportation other than private cars. The World Bank and the Chinese government subsidize projects aiming at development of sustainable cities (total USD 414 million).
	2013 -2025	N	Continue to promote development of public transportation infrastructure and support modal shifts.
JPN	2005 -2012	N (Y)	2006 Subsidies are given to modal shift projects. Energy efficiency law obligates cargo owners to select energy efficienct means of transport. Tax credits are available on transportation using railroads.
	2013 -2025	N(Y)	In addition to above, subsidies are applied to urban development aiming at low carbon cities.

Indicator 28. Energy tax on fuels for transportation

Country	Term	Assess -ment	Supplemental information for the Assessment
US	2005 -2012	N	Fuels for automobile and for non-commercial boats are taxed at federal level. VAT is imposed on other energy products for transportation at state levels. Gasolines and diesels containing bio fuels are taxed at the same rate as normal gasolines and diesels. California, Texas and Pennsylvania impose other consumption taxes on transportation fuels in additin to federal taxes. Gas Guzzler Tax (USD1,000～7,700) is imposed to vehicles less than 22.5mile/gal. Labeling is used to inform energy efficiency of vehicles.
	2013	N	Continuation

	-2025		
Germany	2005 -2012	Y	Vehicles more than 12tonne is taxed according to length of using toll roads. Oil tax rate has been elevated since 1999, and further elevated in 2000.
	2013 -2025	Y	
UK	2005 -2012	Y	Fossile fule for road transporation is taxed with the effective tax rate of more than 300 euro per CO_2 ton.
	2013 -2025	Y	
CHN	2005 -2012	N	Energy efficiency standards are introduced in2005. China aims at improving energy efficiency by 10% by 2009, and by 20% by 2012 from levels of 2005.
	2013 -2025	N	Aims at same level of energy efficiency standards by 2020
JPN	2005 -2012	Y	Energy tax on oil as been introduced since the 1970s. Carbon tax was introduced in 2012, but the tax rate is not high enough to change people's consumption behavior.
	2013 -2025	Y	Carbon tax on gasoline introduced in2012 is elevated in 2016 to be JPY760 per kilo litre.

Indicator 29. Urban planning towards low-carbon cities

Country	Term	Assess -ment	Supplemental information for the Assessment
US	2005 -2012	N (Y)	Smart Growth promotes low carbon development of cities.
	2013 -2025	N (Y)	Continuation
Germany	2005 -2012	N (Y)	Action plans for Intelligent Transport System is developed.
	2013 -2025	N(Y)	A framework for the coordinated evolution of existing and the accelerated introduction of new Intelligent Transport Systems in Germany over the period to 2020
UK	2005 -2012	N(Y)	2003 London impose The Congestion Charge, which is an £11.50 daily charge for driving a vehicle within the charging zone between 07:00 and 18:00, Monday to Friday. The easiest way to pay the charge is by registering for Congestion Charge Auto Pay. There are a range of exemptions and discounts available to certain vehicles and individuals. 2003 A smart motorway uses technology to actively manage the flow of traffic. The technology is controlled from a regional traffic control centre. The control centres monitor traffic carefully and can activate and change signs and speed limits. This helps keep the traffic flowing freely.
	2013 -2025	N(Y)	Regional control centers manage highway roads to avert traffic congestion.
CHN	2005 -2012	N(Y)	Vehicles in urban areas are controled by number plates. 2012 The pilot phase of Beijing municipal public bicycle sharing service was inaugurated in Dongcheng and Chaoyang districts with 2,000 bicycles and 63 rental stations. Bicycle sharing is becoming more and more popular among Chinese cities.
	2013 -2025	N(Y)	Continuation
JPN	2005 -2012	N(Y)	Transportation Demand Management (TDM) and multi-modal policies are introduced to grasp overall demand for transportation and propose the most efficient means of transportation to minimize traffic congestion.
	2013 -2025	N(Y)	In addition to above, subsidies are given to cities aiming at low carbon development.

Indicators 30, 31 and 32. Reducing methane emissions

Country	Term	Indicator 30	Indicator 31	Indicator 32	Supplemental information for the Assessment
US	2005 -2012	N	N	N	Regulations to limit emissions from oil & gas sector (2012)
	2013 -2025	N	N	Y	Under the Clean Air Act, methane emissions from oil & gas sector is to be reduced 40-45% by 2025 from 2012.
Germany	2005 -2012	Y	N	-	Waste Framework Directive (2008/98/EC) Reducing and recycling methane emissions from wasteRegulations on organic waste
	2013 -2025	Y	N	-	2013 Reducing methane emission by airation of waste landfill sites.
UK	2005 -2012	N	Y	N	Urban Development Policy (2007-2013) Sustainable development with agriculture and forests Waste Framework Directive (2008/98/EC) Reducing and recycling methane emissions from waste
	2013	N	Y	N	Urban Development Policy (2014-2020)

	-2025				
CHN	2005 -2012	N	N	N	No policy found.
	2013 -2025	N	N	N	Reducing emissions from rice paddy and cultivated land Recycling waste into agricuture sector
JPN	2005 -2012	-	-	-	Improving organic material and water management (2007)
	2013 -2025	-	-	-	Reducing and recycling waste (2013) Regulations on direct diposal of organic materials into landfill sites (2013)

Indicators 33 and 34. Reducing fluorine-related GHG emissions

Country	Term	Indicator 33	Indicator 34	Supplemental information for the Assessment
US	2005 -2012	N	N	Responsible product disposal program (2006) Greenchill high performance freezer partnership (2007)
	2013 -2025	N(Y)	N	Clean Air Act introduces significant replacement program to reduce HFCs.
Germany	2005 -2012	N(Y)	N	F-gas regulation 2006/842/EC (2006). EU directive to reduce use of f-gases in air conditioners of automobiles (MAC) (2006) Germany: F-gas regulation by road transportation licence regulation (2012)
	2013 -2025	N(Y)	N(Y)	Revision of F-gas regulation in 2014 (EC 517/2014)
UK	2005 -2012	N	N	F-gas regulation 2006/842/EC (2006). EU directive to reduce use of f-gases in air conditioners of automobiles (MAC) (2006)
	2013 -2025	N	N(Y)	Revision of F-gas regulation in 2014 (EC 517/2014)
CHN	2005 -2012	N	N	No policy implementation. Host of CDM projects related to HFC reduction.
	2013 -2025	N	N	Strengthening regulations to reduce consumption and emission of HCFC-22. Reduce the production 35% from 2010 by 2020, 67.5 by 2025. HFC-23 will also be regulated by 2020.
JPN	2005 -2012	N	N(Y)	F-gas emission regulation law (2001) regulates emissions of f-gases within its lifecycle
	2013 -2025	N	N(Y)	Revised G-gas emission regulation law (2013)

Indicators 35, 36, and 37 Enhancement of carbon sinks by forest conservation and management

Country	Term	Indicator 35	Indicator 36	Indicator 37	Supplemental information for the Assessment
US	2005 -2012	N	N	N	Making use of woody biomass (2005) Conservation of private-owned forests (2008)
	2013 -2025	N	N	N	Assessment of ecosystem carbon sequestration(2015)
Germany	2005 -2012	N	Y	N	LULUCF accounting system as a party to the Kyoto Protocol.
	2013 -2025	N	Y	N	
UK	2005 -2012	Y	Y	N	LULUCF accounting system as a party to the Kyoto Protocol Enhancement of reforestation area by Forest Carbon Code (2011), revision of forest standards, sustainable forest management, wood fuel implementation plan, promotion of using heat from woods
	2013 -2025	Y	Y	Y	Britain growth action plan, aiming at increasing forest coverage and make use of wood products.
CHN	2005 -2012	Y	N	N	Announced in 2009 before COP15 that China aimed at increasing forest area 40million haby 2020 from 2005.
	2013 -2025	Y	N	N	Target to increase forest stock by 4.5billion m3 by 2030 from 2015 level. Promotion of afforestation, participation to tree planting activity by all citizens
JPN	2005 -2012	N	Y	N	Forest sequestration strategy (2007) Promotion of forest management including utilization of wood products. Tree planting in cities.
	2013 -2025	N	Y	N	Continuation