# Joint Credit Mechanism (JCM):
# Official development assistance in the era of decarbonization competition

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Summary

Considering the current situation in which Japanese power source composition is centered on thermal power generation and Japan cannot rely on nuclear power plants, the realization of carbon neutrality before 2050 will be extremely challenging.

This paper proposes that the geographical boundary of carbon neutrality should not be limited in Japan by utilizing Joint Credit Mecanism (JCM). The Japanese government has traditionally admitted the importance of overseas “carbon offset” activities to prevent global warming.

JCM meets Japan’s conventional principles of Official Development Assistance (ODA) and the purpose of the new International Cooperation Charter of Japan. Mitigation of climate change is one of the most urgent issues facing the international community, and Japan now has the goal of achieving carbon neutrality before 2050, as promised by the Prime Minister of Japan. Such visible support to developing countries as JCM may increase trust toward Japan among developing countries, and it will gain the diplomatic benefits of achieving the international commitments of the Paris Agreement.

it is also important to introduce cooperative systems, such as shared CO2 emission responsibility between goods exporting and importing countries and/or an international carbon tax for importing goods. However, these systems are complicated to realize without the shared agreement of all major countries in the international community. t is appropriate to promote the current support for developing countries through ODA, including JCM, to solve the urgent issue of climate change prevention.

Key Words.

Joint Credit Mecanism (JCM), Carbon neutrality, Paris Agreement, Official Development Assistance (ODA)

## 1. Introduction: the era of decarbonization competition

Global warming is steadily progressing and could have a devastating impact on our lives and ecosystems. The United Nations Framework Convention on Climate Change (UNFCCC) was established during the 1992 United Nations Conference on Environment and Development; also known as the “Earth Summit” in Rio de Janeiro. Since that time, the international community has been making efforts to prevent global warming. The Kyoto Protocol was signed as the first international numerical target for preventing global warming at the 3rd UNFCCC meeting (COP3) in 1997, and the Paris Agreement was adopted as the target for 2030 at COP21 in 2015.

The Paris Agreement is institutionally different from the Kyoto Protocol in terms of two points. First, under the Paris Agreement, all the participants have national greenhouse gas (GHG) reduction targets.[1] Although the significance of full participation is highly evaluated, the GHG reduction targets of each country were voluntary, not compulsory. The GHG reduction target of each country is its Nationally Determined Contribution (NDC).[2] This agreement was unavoidable to allow for GHG reduction targets in developing countries. The second difference is that the Paris Agreement clarified the importance of technology development (innovation) and technology transfer, not explicitly addressed in the Kyoto Protocol. The Paris Agreement emphasized the development of fossil energy-saving and renewable energy technologies and the transfer of those technologies from developed countries to developing countries.[3] NDC for developing countries may be only a slogan without technology transfer since the technological capabilities of developing countries are often not high enough to achieve the DNC.

Incidentally, the international circumstances on anti-global warming policies changed significantly after 2020. The year 2020 can be considered the beginning of a decarbonization competition era. Ms. Ursula Gertrud Von der Leyen, President of the European Commission, has been advocating for a

1 Under the Kyoto Protocol, only developed, including former socialist, countries (called Annex I countries) had GHG reduction targets.

2 NDC is often referred to as “the voluntary target of the Paris Agreement”. Japan’s NDC was to reduce GHG emissions by 24% by 2030, compared to 2013.

3 Article 10, paragraph 6 states: “Support, including financial support, shall be provided to developing country Parties for the implementation of this Article, including for strengthening cooperative action on technology development and transfer at different stages of the technology cycle, with a view to achieving a balance between support for mitigation and adaptation.”

“European Green Deal” for some time, aiming at carbon neutrality by investing in technological innovation. Carbon neutrality means that the amount of carbon dioxide emitted by human economic activities and the amount of carbon dioxide absorbed by plants (forests, etc.) are in equilibrium. On September 16, 2020, President Von der Leyen proposed to renew the GHG reduction target from 40% to 55% reduction by 2030 compared to 1990 levels to achieve carbon neutrality by 2050. President Xi Jinping of China, the world’s largest GHG emitting country, declared at the 2020 United Nations General Assembly (September 22) that China’s $CO_2$ emissions will peak before 2030 and realize carbon neutrality by 2060. The first half of this declaration is the same as China’s NDC in the Paris Agreement, but the second half took the international community by surprise.

Prime Minister Suga Yoshihide of Japan announced a climate change policy to aim for carbon neutrality by 2050 at the 203rd Extraordinary Diet Session on October 26, 2020. This announcement surprised the world *and* the Japanese people since the Japanese government was previously hostile regarding the measures needed to prevent global warming.

According to the policies announced by US President Joe Biden thus far, the USA will reduce $CO_2$ emissions from power generation to zero by 2035 and achieve carbon neutrality by 2050. President Biden also announced a plan to invest US$ 2 trillion in environmental protection over four years to introduce renewable energy and expand electric and fuel cell vehicles.

Furthermore, on December 3, the Japanese government announced that it would ban the sales of new gasoline-powered vehicles by the mid-2030s as a part of its measures to prevent global warming. This initiative is consistent with movements in Europe, the United States, and China, which also announced a ban on the sale of new gasoline-powered vehicles by the mid-2030s. This announcement demonstrates the seriousness of the Japanese government to achieve carbon neutrality.

While Japan also declared participation in the “decarbonization competition,” Japan’s current power source composition is centered on thermal power generation with a high degree of carbon intensity. Although regulating new car sales to plug-in hybrid vehicles and electric vehicles may reduce gasoline consumption, GHG emission reduction would be offset if the power supply is fossil energy-based. Considering the current situation in which Japan cannot rely on nuclear power plants, the realization of carbon neutrality before 2050 will be extremely challenging.

This paper proposes that the geographical boundary of carbon neutrality should not be limited in Japan to avoid “2050 carbon neutrality” ending up as merely an unobtainable slogan. The Japanese government has traditionally admitted the importance of overseas “carbon offset” activities to prevent global warming. Carbon offset activities have economic rationality and meet the Japanese policy stance on Official Development Assistance (ODA) that ODA should be non-military and should support the sustainable development of developing countries.

This paper is composed of the following six sections. Section 2 describes the economic rationality of carbon offset activities. Section 3 examines shared international responsibility on $CO_2$ emissions. Section 4 outlines the international solidarity tax. Section 5 describes the Joint Credit Mechanism (JCM) of the carbon offset program that the Japanese government has initiated as part of its ODA, and section 6 presents the conclusion

## 2. Greenhouse gas and carbon offset

### 2.1 Greenhouse gas

GHG absorbs part of the infrared from the ground to create a greenhouse effect on the Earth. Thanks to GHGs, the temperature changes on the Earth are currently rather gentle; however, if GHGs increase too much, it causes a global warming phenomenon. The 1997 Kyoto Protocol of the UNFCCC set the reduction target on six controllable GHGs, including carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6).[4] Among them, $CO_2$ has the highest contribution to global warming, explaining approximately 60% of the GHG effect on the Earth. Japan’s $CO_2$ share is particularly high, reaching 90%; therefore, it is imperative to reduce $CO_2$ emissions by saving fossil energy to prevent global warming.

### 2.2 Differences in $CO_2$ abatement costs by country

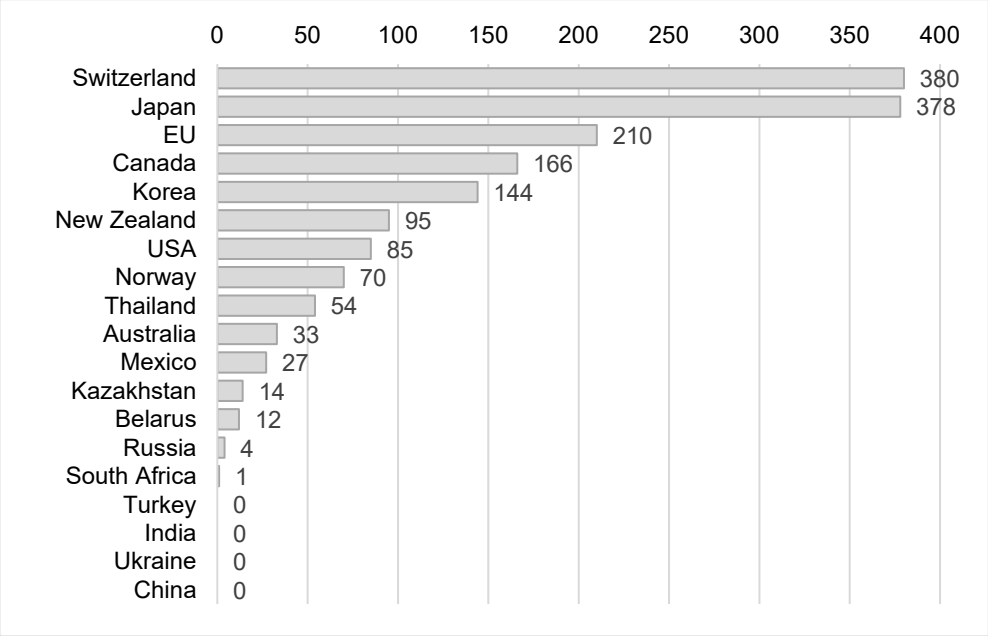
Figure 1 presents the marginal abatement costs of $CO_2$ estimated by the Research Institute of Innovative Technology for the Earth. According to this estimation, the reduction cost for Japan is extremely high compared to other countries, including other developed countries. In other words, $CO_2$ emission

4 Although water vapor has the strongest GHG effect, it is not controllable since it is generated by the evaporation of water from the ocean.

reduction activities in other countries are more economically advantageous than those in Japan.

*Figure 1 Marginal abatement cost of $CO_2$ by country*

(USD/t-$CO_2$, in 2030)




Source: Created by the author based on Akimoto (2017).

The effect of preventing global warming through reducing $CO_2$ emissions is common no matter where $CO_2$ emissions decrease in the world. Thus, it would be advantageous to reduce $CO_2$ abatement costs for economic efficiency without including national responsibility. The concept of carbon offset is one of the measures to prevent global warming. Carbon offset refers to reducing $CO_2$ emissions in one region to compensate for $CO_2$ emissions made elsewhere. It represents an attempt to absorb $CO_2$ emitted in one place in other places through $CO_2$ reduction activities, including afforestation, clean energy projects, or purchasing emission credits. One example of carbon offset is a Kyoto mechanism introduced in the Kyoto Protocol. The regional international differences in marginal $CO_2$ abatement cost form the basis of the economic rationality of carbon offset.

## 2.3 Kyoto mechanisms

The Kyoto Protocol imposed GHG reduction targets on developed countries, including a 6% reduction for Japan, a 7% reduction for the United States, and an 8% reduction for the EU, with 1990 set as the base year. Conversely, the Kyoto

Protocol did not provide any numerical targets for GHG reduction to developing countries due to insufficient financial capacity and technical force. The developed countries were tasked with assisting developing countries to reduce GHGs.

The Kyoto Protocol presents a special international framework that incorporates the emission reduction abroad with domestic emission reduction called “Kyoto mechanisms.” Kyoto mechanisms are the first internationally recognized carbon offset and include three types.

1) Clean Development Mechanism (CDM)

When a developed country implements a project as a global warming countermeasure in a developing country, some of the $CO_2$ reduction can be considered domestic $CO_2$ reduction.

2) Joint Implementation (JI)

When a developed country implements a project as a global warming countermeasure in another developed country, some of the $CO_2$ reduction of this project can be considered domestic $CO_2$ reduction, the same principle as CDM.

3) Emissions Trading (ET)

The EU emission trading system (EU-ETS) is the first attempt to develop an international $CO_2$ emission trading system in which developed countries can buy and sell $CO_2$ emission allowance. EU-ETS was introduced since the EU has a GHG emission quota, although individual EU member countries also have individual emission quotas.

This study focuses on CDM, which targets developing countries. This system is a so-called “two birds with one stone” system, wherein a developing country (host country) accepts an energy-saving project based on new technology and additional funding, and the developed country (investment country) obtains certification of $CO_2$ emission reduction. In practice, CDM leads to the sustainable development of host countries.

Table 1 presents the Kyoto Protocol Target Achievement Plan in Japan, formulated in 2005. Although, at the time, the Japanese government was conducting a campaign called “Team Minus 6%,” the reality was not minus 6%. $CO_2$ absorption due to forest management (minus 3.9%) was determined in the course of negotiations in the Kyoto Protocol, assuming that the Japanese forest absorbed such an amount. Since this minus 3.9% is achieved automatically, Japan needs to reduce no more than 2.1%, achieving 1.6% through the Kyoto

mechanisms in Japan's plan. The Japanese government planned on applying Kyoto mechanisms from the beginning. They used the CDM Kyoto mechanism in large quantities when the first commitment period was closed.[5]

*Table 1 Kyoto Protocol Achievement Plan (the original proposal)*

| Reduction measures | Share against the total reduction target |
|---|---|
| Domestic measures total | −0.5% |
| $CO_2$ from energy consumption | +0.6% |
| $CO_2$ of non-energy origin | −0.3% |
| methane | −0.4% |
| Nitrous oxide | −0.5% |
| CFC substitutes, etc. | +0.1% |
| Sinks (automatically achieved) | −3.9% |
| Kyoto Mechanism (International Cooperation) | −1.6% |
| Total | −6.0% |

Source: Author's compilation based on Japan's Kyoto Protocol Achievement Plan (Cabinet office, 2005).

## 3. $CO_2$ emissions base and international solidarity tax

### 3.1 Recent interpretation of the carbon leakage

In recent years, the meaning of "carbon leakage" has expanded. The traditional meaning refers to production sites' tendency to relocate from a country with strict $CO_2$ emission regulations to a country with relaxed regulations through direct investment when the degree of regulation varies from country to country. $CO_2$ reduction cost is generally higher for industries in countries with strict regulations. As a result, $CO_2$ emissions decrease in more regulated developed countries and increase in less regulated developing countries. The Kyoto Protocol could have facilitated this trend, as only developed countries had carbon emission restrictions imposed, whereas developing countries had no restrictions on carbon emissions under the Kyoto Protocol.

$CO_2$ emission sites can be relocated from developed countries to developing countries for other reasons. Production costs, including labor, are generally higher in developed countries than in developing countries. As a result, developed countries import more final goods for consumption and investment in developing countries, resulting in decreased $CO_2$ emissions in developed countries and increased $CO_2$ emissions in developing countries. As a result,

5 The commitment period of the Kyoto Protocol was five years, from 2008 to 2012. Total Japanese GHG emissions in this period were 1.4%, an increase compared to base year 1990, regardless of Japan's Kyoto target being a 6% reduction. However, the Kyoto target was achieved since forests were recognized as 3.9% and Japan purchased overseas credit through the Kyoto mechanism for 5.9%.

developing countries practically assume the $CO_2$ emissions for the final demands in developed countries. In recent years, this phenomenon is also called “carbon leakage.”

Table 2 presents the $CO_2$ emissions trends of major countries with production base and final demand base, as issued by the OECD. Block A in Table 2 presents the $CO_2$ emissions in production base countries. Those in OECD member countries, such as the United States and Germany, show a decreasing trend (except Japan), whereas non-OECD countries increased substantially, rising 1.7 times in China, 1.9 times in India, and 1.5 times in ASEAN countries from 2005 to 2015. The main reason for this phenomenon is that developed countries no longer supply enough goods to meet domestic demand, thus importing goods from developing countries at higher rates.

Next, block B in Table 2 presents the $CO_2$ emissions induced by countries’ domestic final demands. $CO_2$ emissions with a final demand base are larger than those with a production base, without exception, although final demand-based $CO_2$ emissions also exhibit decreasing trends. In contrast, in non-OECD countries, $CO_2$ emissions in countries with a production base are larger than those with a final demand base.

Block C in Table 2 presents the difference between production and final demand-based $CO_2$ emissions. Figures for OECD countries are all negative, while those for non-OECD countries are all positive. In the recently expanded definition of carbon leakage, developed countries transfer $CO_2$ emissions that would otherwise be domestically discharged to developing countries. In other words, developing countries assume developed countries’ $CO_2$ burden to produce the final demands for developed countries.

*Table 2 $CO_2$ emissions and international trade (unit: million tons)*

A. $CO_2$ emissions (production-based)

| | 2005 | 2007 | 2009 | 2011 | 2013 | 2015 |
|---|---|---|---|---|---|---|
| OECD | 13,425 | 13,572 | 12,409 | 12,679 | 12,520 | 12,204 |
| Germany | 814 | 799 | 745 | 770 | 799 | 766 |
| Japan | 1,221 | 1,250 | 1,106 | 1,205 | 1,271 | 1,202 |
| USA | 5,834 | 5,823 | 5,217 | 5,249 | 5,147 | 5,020 |
| Non-OECD | 13,645 | 15,407 | 16,406 | 18,659 | 19,768 | 20,072 |
| China | 5,478 | 6,556 | 7,236 | 8,687 | 9,319 | 9,281 |
| India | 1,081 | 1,269 | 1,511 | 1,681 | 1,867 | 2,043 |
| ASEAN | 968 | 1,064 | 1,099 | 1,204 | 1,293 | 1,408 |

B. $CO_2$ emissions (final demand-based)

| | 2005 | 2007 | 2009 | 2011 | 2013 | 2015 |
|---|---|---|---|---|---|---|
| OECD | 15,563 | 15,776 | 14,014 | 14,540 | 14,166 | 13,781 |
| Germany | 940 | 928 | 869 | 911 | 899 | 853 |
| Japan | 1,502 | 1,463 | 1,308 | 1,472 | 1,497 | 1,361 |
| USA | 6,799 | 6,715 | 5,873 | 5,932 | 5,837 | 5,795 |
| Non-OECD | 11,507 | 13,204 | 14,801 | 16,798 | 18,122 | 18,495 |
| China | 4,261 | 4,885 | 6,020 | 7,151 | 7,782 | 7,978 |
| India | 1,022 | 1,235 | 1,419 | 1,632 | 1,697 | 1,919 |
| ASEAN | 843 | 935 | 982 | 1,139 | 1,258 | 1,307 |

C. Balance of $CO_2$ trade: Difference between production-based emissions and final demand-based emissions

| | 2005 | 2007 | 2009 | 2011 | 2013 | 2015 |
|---|---|---|---|---|---|---|
| OECD | −2,138 | −2,203 | −1,605 | −1,861 | −1,645 | −1,577 |
| Germany | −126 | −129 | −124 | −141 | −99 | −88 |
| Japan | −281 | −213 | −202 | −267 | −227 | −159 |
| USA | −965 | −892 | −657 | −684 | −690 | −775 |
| Non-OECD | 2,138 | 2,203 | 1,605 | 1,861 | 1,645 | 1,577 |
| China | 1,217 | 1,670 | 1,217 | 1,535 | 1,537 | 1,303 |
| India | 59 | 34 | 92 | 49 | 170 | 125 |
| ASEAN | 124 | 128 | 117 | 66 | 35 | 101 |

Source: created by the author based on OECD statistics “Carbon dioxide emissions embodied in international trade”.
Note: OECD refers to OECD total and Non-OECD to Non-OECD total, not the total of the countries in Table 2.

With this background, there is a proposal to consider final demand-based $CO_2$ emissions in addition to the production-based $CO_2$ emissions as a base of responsibility-sharing of $CO_2$ emissions (WWF, 2017). However, it will be politically difficult for developed countries to agree with the idea of sharing responsibility for $CO_2$ emissions with import partners in developing countries in terms of the expansion of international trade. Moreover, even if developed countries agree, it will be difficult to develop an international consensus on a method for calculating the amount of carbon represented by trade goods. For

those reasons, the consideration of final demand-based responsibility-sharing regarding $CO_2$ emissions has not been realized.

3.2 International solidarity tax and international carbon tax

The international solidarity tax was officially discussed at the United Nations International Conference on Development Funds held in Monterrey, Mexico, in March 2002 as one of the innovative funding mechanisms for achieving the United Nations Millennium Development Goals. However, the Nobel laureate in economics, Dr. James Tobin, proposed an international tax for the first time for international capital movement. For this reason, this type of tax is sometimes called a Tobin tax. The original purpose of the Tobin tax was to curb fluctuations in the exchange rate. However, there is now a need for funding sources to solve global issues, such as global environmental problems, and support developing countries. The Tobin tax is now being reassessed as one of several proposed international solidarity taxes.

At the 2005 World Economic Forum (Davos Conference), French President Jacques Chirac announced the idea of introducing a wide range of international solidarity taxes, including an international carbon tax. Among them, the one that has already been realized is a Solidarity Levy on Air Tickets. Currently, European countries and South Korea are participating, and passengers traveling overseas by air are taxed through an addition to the airport tax when purchasing a ticket. This tax income is contributed to UNITAID hosted by the WHO to purchase medical products to support developing countries.

Conventional carbon tax imposes a fixed amount per ton of carbon content by country. When taxing carbon globally, it is necessary to consider the tax rate because the carbon tax rate is income-regressive if the rate is fixed per ton of carbon content, as proposed by Uzawa (2009). It is difficult for developing countries to introduce high-performance technology with low $CO_2$ emissions when $CO_2$ emissions per unit GDP are generally high in developing countries. Therefore, in consideration of international fairness, the carbon tax rate should differ depending on each country’s income level. No matter what the tax rate may be, the tax revenue of the international carbon tax is collected by an

internationally managed organization and used for global warming prevention and adaptation measures for developing countries.[6]

When introducing an international carbon tax, it would be realistic to add carbon tax on tariffs for international trade that are commonly accepted. However, an international carbon tax is meaningless unless all the major countries in the world agree to its introduction. Even if the major countries in the world agree with its introduction, it is difficult for the world to agree on calculating the amount of carbon represented in trade goods. The same applies to the use of tax revenue. Even more institutionally, differing tariff rates will be applied to the same product from country to country, which can be a WTO violation. For this reason, the implementation of an international carbon tax has not been realized at present.

## 4. A new system to assist developing countries: JCM

### 4.1 Challenges with CDM

The previous section introduced two ways in which reduction of $CO_2$ emissions and support for sustainable development in developing countries can be achieved simultaneously, including the $CO_2$ embodied in imported goods to the $CO_2$ emissions of the importing country and taxing $CO_2$ emissions as an international solidarity tax. While certainly represent appropriate measures for $CO_2$ emission reduction, as mentioned above, even if these concepts are theoretically attractive, barriers for realization remain, as various problems to be solved remain, particularly reaching international consensus on the policy measures. In reality, bilateral assistance to developing countries is the most realistic in the contemporary international environment.

As previously noted, the CDM is an international cooperation scheme wherein developed countries (investing countries) implement $CO_2$ reduction projects in developing countries (host countries). Part of the $CO_2$ reduction in CDM is allocated to reducing the investing countries to its $CO_2$ reduction targets. In developed countries, such as Japan, the marginal cost of GHG reduction is relatively high compared to developing countries, and it is more efficient to reduce $CO_2$ emissions in developing countries. The CDM system considers such differences in $CO_2$ emission reduction costs between developed and developing

6 Introduction of a “carbon border adjustment mechanism” (border carbon tax) is scheduled in the plan of the EU Green Deal. This system imposes taxes on imports from countries outside the EU depending on carbon content. It should be noted that ultimate purpose of this tax is to reduce carbon emissions but it also protects industries in the EU in a sense, which differs from the basic idea of international carbon tax.

countries. According to the UNFCCC, 7,846 CDM projects have been registered, and the amount of $CO_2$ reduction by CDM exceeds 2 billion t-$CO_2$[7] as of January 2021. However, multiple problems are apparent in CDM (Asuka, 2008).

1) Complexity of approval process

The process from project application to approval of carbon credit (CER issuance) is extremely complex and time-consuming.

2) Skewed distribution of host countries

Host countries are limited to large developing countries, such as China, India, and Brazil, which are relatively developed among developing countries.

3) Difficulty of proof of additionality

CDM requires environmental, technological, financial additionality. Regarding the financial additionality, for an energy-saving project to be approved as a CDM project, it must be proven impossible without the CDM. In other words, a project that can be implemented without CDM is not considered a CDM project. Therefore, it was quite difficult for such energy-saving measures as policy-based measures and product-based measures to be admitted as a CDM project since project boundaries and cost-benefit relationships are sometimes unclear.

4.2 JCM

The government of Japan proposed a JCM following the end of the first commitment period of the Kyoto Protocol to alleviate the above-mentioned CDM problems and to avoid poor quality $CO_2$ reductions. The Japanese government estimates that the JCM project will reduce a cumulative 50 to 100 million t-$CO_2$ by 2030 (Agency for Natural Resources and Energy, 2018). The basic JCM concept comprises the following three points (Ministry of the Environment, 2015c).

1) Contribution to the sustainable development of developing countries by accelerating the dissemination of Japan's high-performance, low carbon technologies, products, systems, services, and infrastructure advancements and the implementation of $CO_2$ mitigation activities.

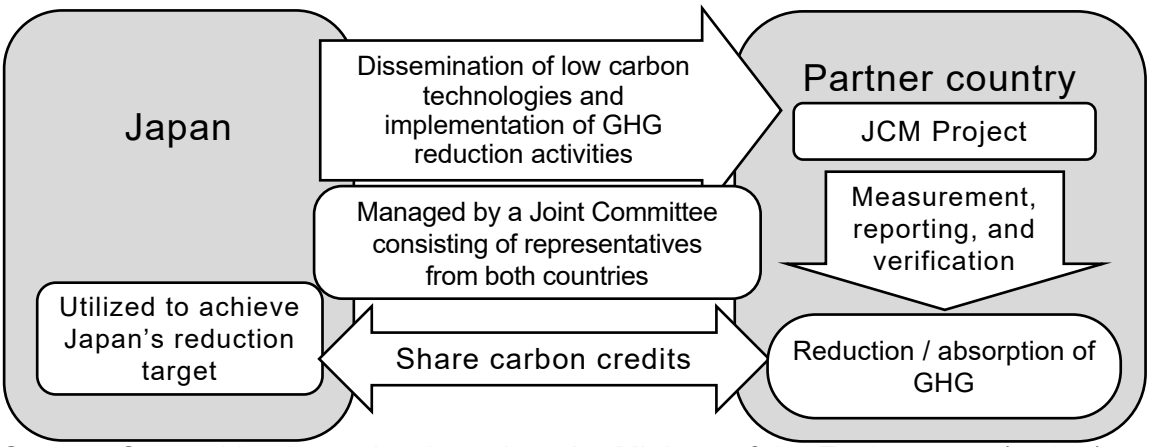
7 This figure is rather large considering annual Japanese GHG emissions were 1.2 billion t-CO2 in 2019.

2) Use of the carbon credit to achieve Japan's emission reduction targets by quantitative evaluation of Japan's contribution to GHG reduction and absorption.
3) Contribution to achieving the ultimate objectives of the United Nations Framework Convention on Climate Change by promoting global GHG emission reduction and absorption actions.

Figure 2 illustrates the JCM. This title is derived from the fact that Japan and each host country have signed bilateral documents to initiate JCM. The actual support target for the Japanese government is a joint venture entitled "international consortium," which is organized jointly by Japan and the partner country.

The international consortium needs to submit a $CO_2$ emission reduction plan as part of its business plan and must monitor and report on $CO_2$ reduction accordingly, appointing an independent third-party entity to verify the submitted report on $CO_2$ reduction. This monitoring, reporting, and verification process is referred to as MRV. The $CO_2$ reduction is then finally approved by the Joint Committee, as shown in the figure, after completing MRV. The Joint Committee is an organization with the secretariat function of the JCM project consisting of government officials from both Japan and the partner country.

*Figure 2 Conceptual diagram of the JCM*




Source: Created by the author based on the Ministry of the Environment (2015c).

Table 3 presents the countries participating in the JCM system. Seventeen countries are participating in the JCM system as of June 2019.[8]

8 Support for JCM is provided to Japan's ODA target countries. China is not a target country of JCM since Japan's ODA with China was completed prior to FY 2021.

*Table 3 JCM participating countries (as of June 2019)*

| Participating countries | Participation time | The number of JCM projects |
|---|---|---|
| Mongolia | Jan, 2013 | 9 |
| Bangladesh | Mar, 2013 | 5 |
| Ethiopia | May, 2013 | 1 |
| Kenya | Jun, 2013 | 2 |
| Maldives | Jun, 2013 | 3 |
| Vietnam | Kul, 2013 | 28 |
| Laos | Aug, 2013 | 5 |
| Indonesia | Aug, 2013 | 37 |
| Costa Rica | Dec, 2013 | 2 |
| Palau | Jan, 2014 | 5 |
| Cambodia | Apr, 2014 | 7 |
| Mexico | Jul, 2014 | 6 |
| Saudi Arabia | May, 2015 | 2 |
| Chile | May, 2015 | 5 |
| Myanmar | Sep,2015 | 9 |
| Thailand | Nov, 2015 | 37 |
| Philippines | Jan, 2017 | 14 |
| **Total** | **17** | **177** |

Source: Global Environment Center(GEC) web site.

JCM begins with a Japanese private company applying for a public offering at the Global Environment Center (JEC). In practice, an international consortium organized by a Japanese company, foreign local corporations, local Japanese subsidiaries, and local governments in the partner country implements a JCM project. The international consortium receives half of the initial investment cost from the Japanese government. It delivers more than half of the $CO_2$ reduction (carbon credits) to the Japanese government in return.[9]

*Table 4 Upper limit of subsidy rate*

| Number | Upper limit of subsidy rate |
|---|---|
| 0（First projects） | 50% |
| 1st to 3rd projects | 40% |
| After 4th projects | 30% |

Source: Created by the author based on the Global Environment Center (2019).

An upper limit to the subsidy rate on investment costs from the Japanese government is established, depending on the number of JCM projects using similar technologies in partner countries, as shown in Table 4.

JCM is similar to CDM, but the individual procedures differ. Table 5 summarizes the differences between JCM and CDM. Despite the system designed for development assistance, the host country of CDM was limited to

9 The Joint Committee determines allocation of the remaining credits.

the major developing countries that were relatively developed due to the complicated procedures of CDM. It was regrettable that developing countries that need assistance were not targeted for CDM projects.

*Table 5 Differences between CDM and JCM*

| | Clean Development Mechanism CDM | Joint Credit Mechanism JCM |
|---|---|---|
| Governance | Centralized structure (UNFCCC of the CDM Executive Board) | Decentralized structure (governments of each country, Joint Committee) |
| Target sector/ project scope | Quite limited. (Example: Improving the efficiency of power plants is not covered.) | Wider scope |
| Validate the project | ・Only designated operating organizations can conduct assessments.<br>・Evaluate the additivity of each project to the baseline | SO14065 authenticated institutions can implement.<br>・Check if the project meets the requirements that can be judged objectively |
| Calculation of emission reduction | ・Select from multiple formulas.<br>・Strict requirements on parameter estimation. | ・Spreadsheet is provided.<br>・Use conservative default values if the parameters have constraints. |
| Project validation | ・The institution that has confirmed the validity of the project cannot implement the verification.<br>・Validation and verification are performed separately. | ・The institution that has confirmed the validity of the project can implement the verification.<br>・Validation and verification can be performed simultaneously. |

Source: Partially revised by the author based on the Ministry of the Environment (2015a).

It was difficult to coordinate among stakeholders because the UN CDM board of directors managed the projects collectively in CDM, whereas it became easier to coordinate among stakeholders because each country manages projects individually in JCM. The scope of projects was very limited in CDM, whereas it can be broadly determined through bilateral agreements in JCM. Regarding the calculation of emission reduction amount of GHG, the operator had to select the most appropriate formulas from many options in CDM, whereas it can be calculated easily using a prepared spreadsheet in JCM. In addition, assessing the project's validity could only be conducted by a "designated operating entity" delegated by the United Nations in CDM. However, any organization certified by ISO14065 can perform the verification in JCM. In addition, the institution that confirmed the ex-ante validity cannot perform the ex-post verification in CDM. In contrast, the institution that confirmed the ex-ante

validity can also perform the ex-post verification in JCM. In this way, conducting JCM is a simpler, more efficient, and more flexible mechanism than CDM.

For developing countries, JCM cash support is favorable to introducing expensive low carbon equipment, while it is also a great advantage that the CDM procedure can be simplified through JCM.

4.3 Benefits of JCM for the Japanese government and companies

From the Japanese government's perspective, JCM was presented as a tool for obtaining carbon credits at a low cost in the previous section. JCM has another benefit for the Japanese government.

Thirty years have passed since the first Japanese ODA Charter was established in 1992, which describes the basic idea and the principles of the Japanese government's implementation of aid policies. The basic intent of ODA was the demand principle and self-help efforts of developing countries. The principles of ODA include a balance of environment and development, peaceful use, diversion of weapons, and promotion of democratization in developing countries. However, the 2015 version of the charter was qualitatively different from the previous one, including its name change to "Development Cooperation Charter." One change is the specification of "national interest." Assistance is an aspect of diplomacy, partially based on national interest. However, the Japanese government had intentionally avoided specifying national interest in the previous ODA Charter. The major reason for this change in the new charter is likely the public opinion that Japan cannot afford to waste funds and human resources. There are various opinions about what constitutes national interest, but most agree it includes economic interests, strategic diplomatic interests, security interests, and other relevant concerns.

Another big change is that government and various actors, including private companies, can participate in development cooperation through the change from the term "aid" to "development cooperation." Japanese ODA has mainly been involved in infrastructure development such as roads/ports, telecommunications, and electricity/water supply in developing countries. Indeed, such infrastructure construction is essential to economic development, but the growth of the private sector in developing countries making use of infrastructure is supersedes this. It would be natural for the private sector in developed countries to support the private sector of developing countries since it is said that one should go to

specialists for the best results. In this way, JCM is in line with the Japanese government's policy of international cooperation.

In contrast, JCM also offers benefits for Japanese companies. There are three beneficial factors for Japanese companies in using JCM (Ministry of the Environment, 2015a).

(1) Expanding business opportunities in developing countries

Japanese ministries and agencies work together to promote the technology of private companies at the Joint Committee, wherein relevant ministries and agencies of Japan and partner countries meet. Therefore, the appeal of the Japanese side can easily reach partner countries, and it is easier to implement JCM projects.

(2) Business risk reduction in developing countries

Since the partner country's government is involved in the project from the planning stage, if a problem arises with the institutional aspect of the partner country, direct negotiations with the host government, with the support of the Japanese government, are possible. Business risk is lower than the business independently conducted by a private company.

(3) Reduction of the initial cost

The initial cost of Japan's energy-saving technology is rather expensive, but it is known to be superior to those of other countries in terms of operating costs. For this reason, it is not widely used in developing countries. Though China and other countries are trying to expand cheap technology to developing countries, Japanese private companies can supply high-quality products at a low initial cost using the JCM scheme.

## 5. An example of a JCM project in Cambodia

### 5.1 Minebea/Mitsumi's project in Cambodia

We will introduce the "High Efficiency Light Emitting Diode (LED) Lighting Utilizing Wireless Network" project in Cambodia as an example of a JCM project. Figure 3 presents the project overview. This project targets Phnom Penh and Siem Reap, where infrastructure is being developed and replaces 5,672 conventional streetlights with high efficiency LED streetlights to reduce energy consumption and $CO_2$ emissions. Streetlights are also dimmed according to the brightness of the surroundings and flow of people to improve energy-saving efficiency further. Since Cambodia primarily relies on imports for electricity, the project will also help reduce the consumption of imported electricity.

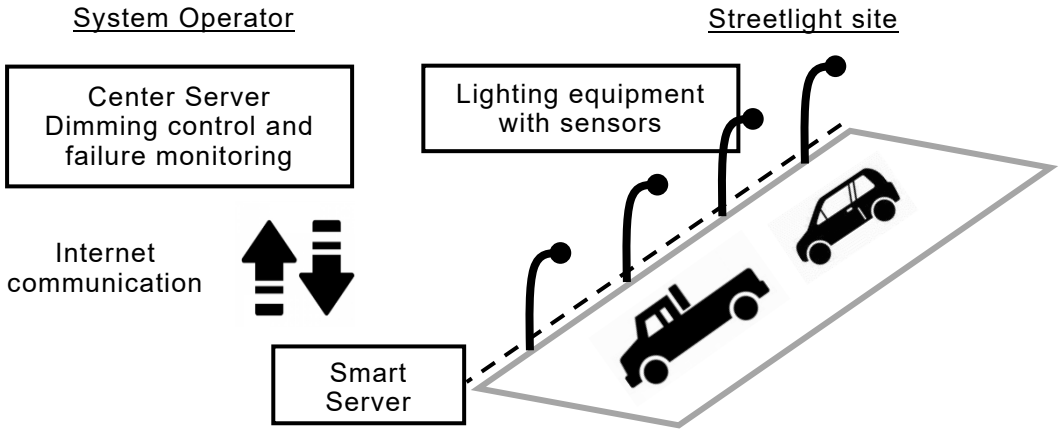



*Figure 3 Project overview*

Source: Created by the author based on the website of the Global Environment Center（GEC）

Table 6 presents the international consortium of this JCM project. Minebea/Mitsumi is a manufacturer of electrical parts, mainly bearings and motors, headquartered in Nagano Prefecture, Japan. It has the largest global share of small ball bearings, mostly produced in Southeast Asia. The Overseas Cambodian Investment Corporation (OCIC) is the largest developer in Cambodia, founded in 2002. It constructs condominiums, hotels, entertainment facilities, and public infrastructure for bridges and elevated roads. Siem Reap Provincial Hall and APSARA are the local governments in Siem Reap. The Authority for the protection of the site and the Management of the Region of Angkor (APSARA) is an organization that comprehensively handles archaeological site conservation, tourism development, and environmental conservation throughout Siem Reap Province.

This JCM project will exchange High-Intensity Discharged lights, which are conventional streetlights, for LEDs. The number of streetlights to change in each area is as shown in Table 7.

According to the Minebea/Mitsumi JCM Team (2017) data, changes in luminaires should increase efficiency by about 55%, and dimming should increase efficiency by about 15%, resulting in a total energy reduction of 70%. The project estimates $CO_2$ credits (5,599 t-$CO_2$) for 11 years, from 2018 to 2028. This project does not seem very effective, considering that the annual $CO_2$ emissions of Cambodia are about 10 million tons. Still, it is significant as a smart city pilot project by Minebea/Mitsumi in Cambodia.

*Table 6 international consortium*

| Role | Organization |
|---|---|
| Representative company on the Japanese side | Minebea/Mitsumi (Installation of streetlights; development of wireless communication system) |
| Cambodian Partners | Overseas Cambodian Investment Corporation (OCIC, a private enterprise in Phnom Penh),<br>Siem Reap Provincial Hall (Municipality),<br>The Authority for the protection of the site and the Management of the Region of Angkor (APSARA, Municipality) |
| Japanese providers | Iwasaki Electric (supplying LED streetlights), \<br>NTT Communications (providing network services) |

Source: JCM Web site, KH002 Introduction of High Efficiency LED Lighting Utilizing Wireless Network, JCM Project design document.

*Table 7 Project site*

| Project site | Number of installations |
|---|---|
| Diamond Island (Phnom Penh) | 766 |
| Chroy Chong Var (Phnom Penh) | 1,288 |
| APSARA area (Siem Reap) | 1,670 |
| Siem Reap Province Hall area (Siem Reap) | 1,948 |
| Total | 5,672 |

Source: JCM Web site, KH002 Introduction of High Efficiency LED Lighting Utilizing Wireless Network, JCM Project design document>

5.2 Toward the realization of smart cities

Minebea/Mitsumi's efforts in Cambodia can be evaluated as a demonstration experiment to realize a smart city. Residents of various life backgrounds live in the city, and companies and organizations of various industries are active. A smart city aims for the efficient use of energy, protection of vulnerable people (disabilities/elder people), elimination of traffic congestion, security maintenance, disaster countermeasures, and other measures, based on inhabitants', companies', and organizations' activities through the application of information and communications technology (ICT). The ICT system that supports a smart city is called a Cyber-Physical System (CPS). A CPS is a system that optimizes activities in real space by collecting data that reflects the circumstances and movement in real space, such as living places and street corners, and analyzing the data collected in virtual space. Data is collected through various information terminals and sent to the server via the network. Big data analysis is performed in virtual space, and the analysis results are then fed back to the real world.

Minebea/Mitsumi's pilot project in Cambodia is an example of CPS. This JCM project will install energy-saving, long-life LED streetlights, which also serve as information terminals. Then, by analyzing the information sent, the lighting/extinguishing/dimming status of LED streetlights will be managed, aiming for further energy-saving and operation cost reduction. This system is highly expandable and contributes to the realization of smart cities.

## 6. Challenges of JCM

JCM presents some challenges. The first issue is on the targeting technologies of JCM. Japanese companies have been taking pride in supplying high efficiency environmental technology to developing countries through ODA, but there is also a perspective that high-price environmental technology is not very welcomed by developing countries (Mori, 2009). Although JCM is a method for alleviating these problems, Japanese companies must share environmental technologies that meet the needs of developing countries considering the balance between the price and performance.

The second issue is that of the targeting countries. The selection of countries in which to implement JCM projects is also an important issue. Due to the complexity of CDM's procedure, recipient countries have been limited to relatively advanced developing countries, such as China, India, and Brazil. The Japanese government must determine JCM projects' investing countries considering the strategic diplomatic benefits of ODA, including poverty reduction or employment creation and the $CO_2$ reduction effect in the recipient countries (Arimura, 2015).

The third issue is the reliability of JCM. JCM might double count $CO_2$ reduction in the recipient countries. In other words, $CO_2$ reductions in projects under different systems or similar projects may be double registered since the range of defense covered by JCM is wide, and project boundaries can sometimes be vague. Japanese companies can avoid such risk by confirming there is no double registration through the third-party validation process (Endo et al., 2016).

## 7. Concluding remarks

First, JCM meets Japan's conventional principles of ODA and the purpose of the new International Cooperation Charter of Japan. Mitigation of climate change is one of the most urgent issues facing the international community, and Japan now has the goal of achieving carbon neutrality before 2050, as promised by the Prime Minister of Japan. Such visible support to developing countries as

JCM may increase trust toward Japan among developing countries, and it will gain the diplomatic benefits of achieving the international commitments of the Paris Agreement.

Second, it is also important to introduce cooperative systems, such as shared $CO_2$ emission responsibility between goods exporting and importing countries and/or an international carbon tax for importing goods. However, these systems are complicated to realize without the shared agreement of all major countries in the international community. And although they may agree on the principles of the system, it cannot be realized unless all major countries agree on a method for calculating the amount of carbon contained in imported goods. While such system building is a long-term challenge, it is appropriate to promote the current support for developing countries through ODA, including JCM, to solve the urgent issue of climate change prevention.

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