FY 2014 Feasibility Studies on Joint Crediting Mechanism Projects towards Environmentally Sustainable Cities in Asia

Feasibility study on a programme-type finance scheme for the JCM in Mongolia

Final Report

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FY 2014 Feasibility Studies on Joint Crediting Mechanism Projects towards Environmentally Sustainable Cities in Asia

"Feasibility study on a programme-type finance scheme for the JCM in Mongolia"

Contents

I. Summary

1. Background

In Mongolia, power demand has been increasing due to the increase in population and the overconcentration of population in urban areas in association with the economic growth, and the central power system around Ulaanbaatar, the country's capital, is burdened by the chronic rise in power demand. The aggravation of air pollution, resulting from the power system dependent solely on coal-generated energy, is also posing a serious problem.

According to the Mongolia: Assessment Report on Climate Change 2014 (MARCC-2014) issued by the Ministry of Environment, Green Development and Tourism (MEDGT), emission sources of the energy sector, which accounts for the bulk of greenhouse gas (GHG) emissions, are the consumption of solid fuels and fuels for coal-fired power plants. Mongolia, one of the world's largest producers of coal resources, relies almost entirely on coal for the country's energy supply sources, with a considerable amount of coal being used during midwinter. Because of this, Mongolia is experiencing serious air pollution, currently described as "worse than in China," which stems from the predominance of coal heating in the supply of heating.

Furthermore, the basin structure of Ulaanbaatar has the topographical characteristics prone to sedimentation of smoke exhaust, which makes the supply of coal-fired heating unsuitable from an environmental standpoint. The prevalent use of inefficient coal-fired thermal power-generation equipment comes against the backdrop of dependence on the single fuel, and a major challenge for the country is the review of this electric power policy.

One of actions needed concerning power supply and demand and air pollution is an improvement on the energy supply side, and this is under consideration in equipment subsidization projects and Study projects, etc., of the Joint Crediting Mechanism (JCM). Another important point is an improvement in the supply and demand of energy. More specifically, the promotion of energy-saving efforts at industrial plants is important. Currently, however, not many concrete policies or measures are being taken in Mongolia.

In order to support changes in such a situation, this Study project looked into the feasibility of the programme-type JCM scheme making use of finance enabling "leapfrog" development. With the participation of local entities and organizations as well as donors and supporting countries, the scheme can promote not only large-scale countermeasures on the energy supply side but also projects for multiple energy demands, albeit small in scale, and renewable energy projects, and can also cover projects for actions that were difficult to take despite their needs.

2. Details of the Study

In order to develop an idea for the programme-type JCM scheme that can support multiple projects through the financing and organizational management with the participation of local entities, this Study project conducted the following field surveys and preparation of relevant documents and held consultations with organizations involved.

- Consideration of the programme-type financing scheme and organizational formation in view of the JCM
- Identification of Japanese energy-saving and renewable energy technologies covered and consideration of the measurement, reporting and verification (MRV) methodology (draft) for greenhouse gas emissions

3. Survey Findings and Consideration for Commercialization

Consideration of the programme-type financing scheme and organizational formation in view of the JCM

We conducted the feasibility study on the programme-type JCM scheme and devised the following scheme:

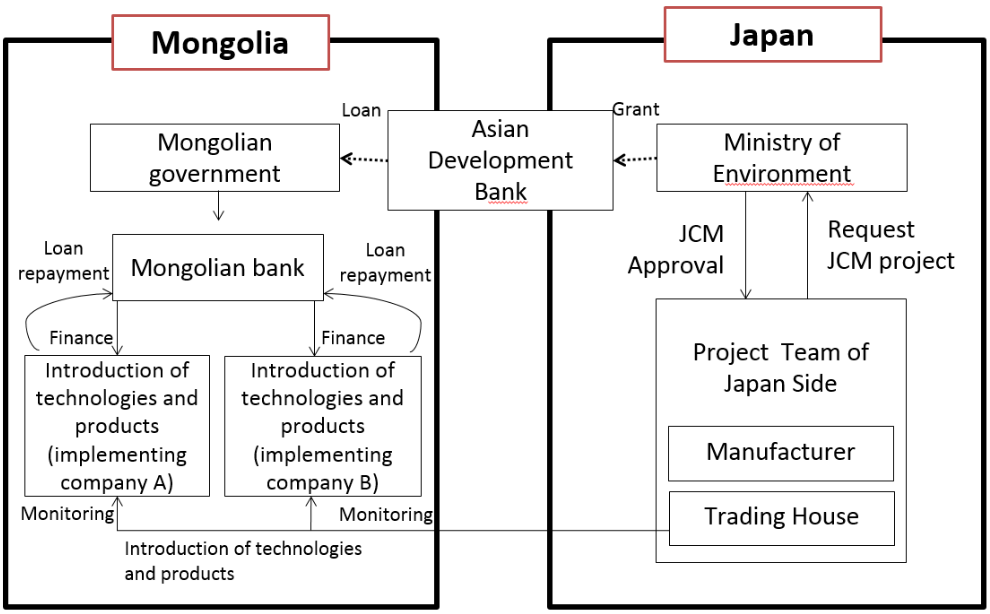


Figure1　Commercialization Structure Scheme Plan

Under this scheme plan, we considered the structure where donors, following loan negotiations between the Ministry of Finance of Mongolia and donors, provide a certain amount of financing (including grants under the JCM) to Mongolia and a local bank manages the financing under the supervision of the government, etc. By going through loan negotiations between the Ministry of Finance of Mongolia and donors, project participants are able to receive long-term financing at interest rates lower than regular commercial rates.

There are two key points in administering the scheme plan above: "management of funds" and "the management of the project, including greenhouse gas (GHG) MRV." We proposed the following scheme for the appropriate management of these two points:

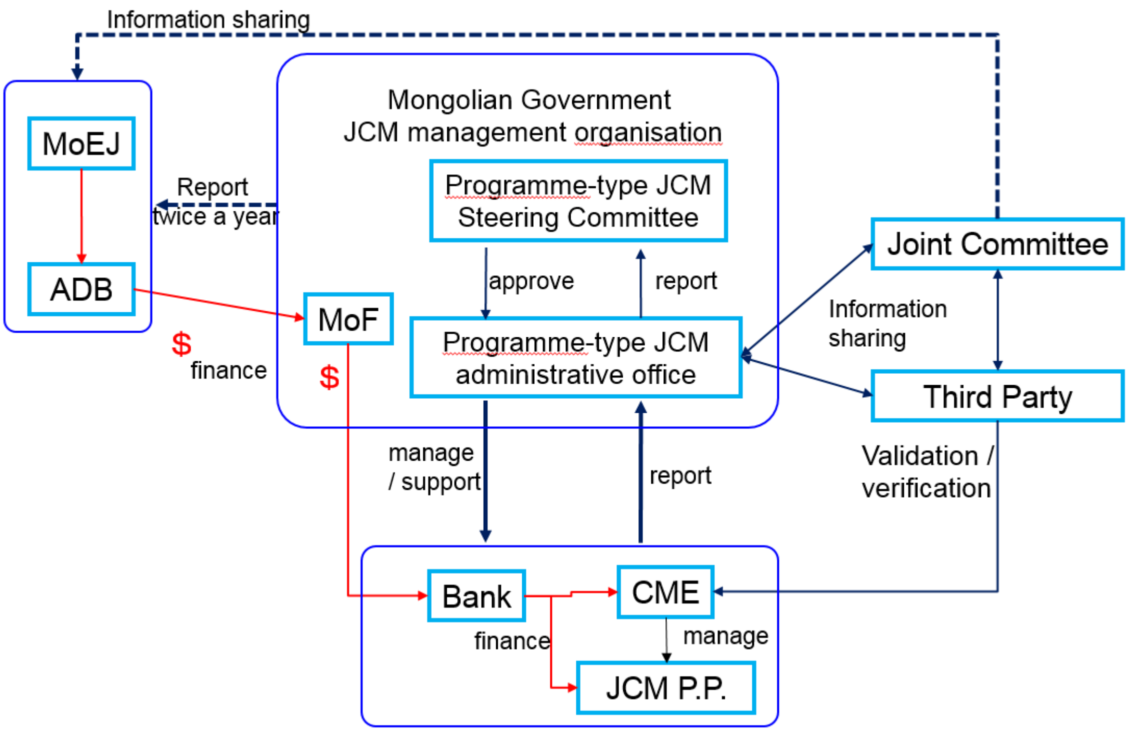


Figure2　Funds/Project Management Scheme Plan

Entities that implement the project under this scheme are basically private-sector as a project participant. However, it will be difficult for each project participant to conduct MRV for GHG emission. To deal with this issue, the figure above suggest the structure where the Coordinating Management Entity (CME) is able to manage the project. While the private sector-led implementation of these schemes is desirable, it is also necessary to take measures to avoid the conflict of interest, for example, whether local banks provide financing in an appropriate manner, or whether special favors are not being doled out to some private-sector companies. Thus, after investigations and consultations with the Ministry of Environment, Green Development and Tourism and the Ministry of Energy of Mongolia, we proposed the establishment of the "Programme-Type JCM Administrative Office" under the local government. Furthermore, since it may be difficult to operate the systems for the management of funds and GHG MRV by the private sector along in the initial phase of the project, we envisage that the Administrative Office also provides administrative and management support for them. In addition, as a result of consultations with the Mongolian government, we also envisage that in order to prevent the Administrative Office's arbitrary action, the Steering Committee consisting of ministries and agencies of the local government will be established and the Steering Committee will approve any final decisions.

4. Identification of Japanese Energy-Saving and Renewable Energy Technologies Covered and Consideration of the MRV Methodology (Draft)

In consideration of the state of affairs of Mongolia, we made a list of candidate technologies for the programme-type JCM by conducting hearings with the government, domestic and foreign banks and potential project participants, etc., surveys, on-site visits and training in Japan, and for the technologies listed, we identified the potential for the introduction of Japanese technologies in accordance with the assumed programme-type JCM scheme and narrowed down Japanese low-carbon technologies with high feasibility. Following discussions with the Ministry of Environment, Green Development and Tourism and the Ministry of Energy of Mongolia, we then narrowed down the technologies to be covered by this scheme to the greater efficiency of transformers owned in the private sector, the introduction of photovoltaic power generation equipment and the introduction of inverters to plants and other facilities, and considered the MRV methodology (draft).

5. Future Development Policy and Specific Schedule

Through the surveys and consultations conducted thus far, we have obtained responses from the Ministry of Environment, Green Development and Tourism and the Ministry of Energy of Mongolia that the programme-type JCM scheme (draft) is basically fine with the country. As for the schedule going forward, the

Ministry of Environment, Green Development and Tourism, the Ministry of Energy and other government ministries complete adjustments and the project can then be launched after loan negotiations with donor entities.

Private-sector companies that are potential project participants are positive about the implementation of the project leveraging JCM programme financing. In the private sector, while this scheme requiring little initial cost is very attractive given the financial conditions of small- and medium-sized enterprises, there are cases where financially-weak industries and businesses may find it difficult to make use of the scheme. As the Mongolian economy is almost entirely based on the mining and manufacturing industries, it is desirable to implement the scheme that benefits other industry sectors. To that end, the scheme would require further improvements.

As one of specific ideas, we have focused on the development of a sustainable scheme of the JCM programme-type scheme during FY2014. The leasing function is the one of the option of the JCM scheme to be easily access to the potential project participants. Through reduced initial investment and unified management of multiple projects by carrying out lease projects making use of local operators, which are already being surveyed, we will continue to consider a framework that allows a greater number of operators to participate in this scheme.

II. Text

1. Institutions and the business environment of the Target Country/Target City

(1) Social and Economic Conditions of the Target Country/Target City

Mongolia, the target country of this project, is a landlocked country in Northeast Asia, surrounded by Russia to the north and China to the south. Mongolia's population reached three million (roughly equivalent to the population of Ibaraki Prefecture) as of January 24, 2015, the population density is low (below 2 people per square kilometer) as its land area is approximately four times as large as Japan. On the other hand, the distribution of population shows that approximately 45% (some 1.32 million) of the total population live in Ulaanbaatar, the capital city and target city of this project. According to the Mongolian Economy, the pace of expansion of urban space in Mongolia stood at an annual rate of 2.6% over the period from 2000 to 2010, one of the fastest in the Asian region. In Ulaanbaatar, the population has been increasing rapidly with the growth rate coming to 4%. The density of population has been announced to be 411 people per square kilometer, showing the overconcentration of population in cities compared with the density of population for the whole country. The overconcentration of population has given rise to a variety of problems in Ulaanbaatar. In particular, the tight power supply-demand is the pressing issue.

Mongolia is rich in mineral resources, with abundant reserves of copper, gold, coal and uranium. As one of the world's largest coal resource producers, Mongolia covers the bulk of domestic energy demand with domestically-produced coal. The country's economy has been growing at annual rate of around 10%, accompanied with the ever-increasing demand for power.

Consequently, Mongolia cannot meet increasing power demand with existing domestic generation facilities, and has to rely on neighboring Russia to fill the shortage of power supply and for power conditioning. From the standpoint of energy security, it is being pointed out, dependence on Russia for power imports increases risk for Mongolia.

The country's geographical characteristics make it difficult to have access to natural gas or petroleum for energy conversion, and as such, Mongolia still depends on thermal power generation fired by domestically-produced coal. As if going against the degree of economic growth in recent years, the decrepit domestic power supply infrastructure has been blamed as the principal cause of the deterioration of air pollution during winter when power demand rises.

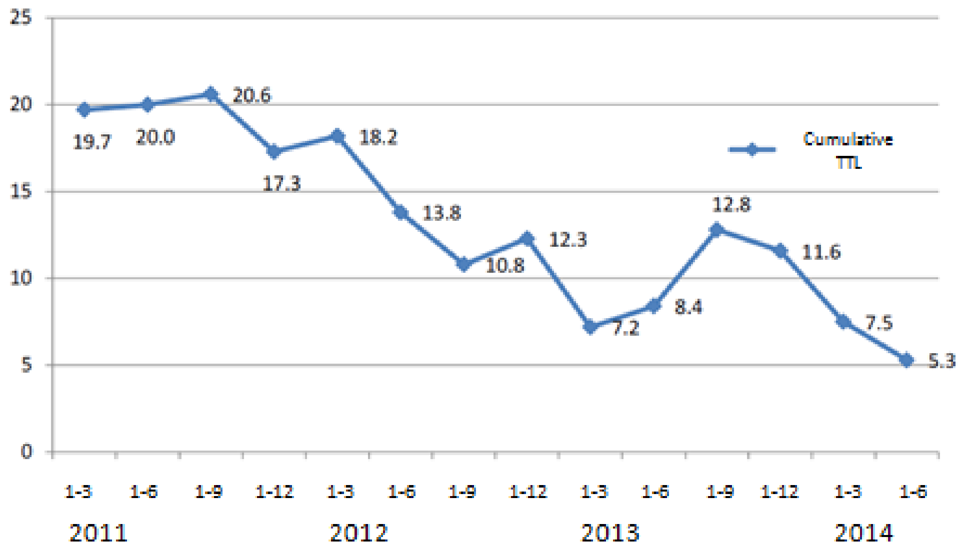
In order to deal with this problem, the Mongolian government is considering construction of the new fifth thermal power plant (hereinafter referred to as "CHP-5"), the introduction of highly-efficient energy-saving equipment and the choice of renewable energy.

Japan has been building support and cooperative structures for the electric power problem of Ulaanbaatar. Since the collapse of the former Soviet Union in 1989, Mongolia has witnessed frequent occurrences of power plant shutdowns due to accidents and other problems because of the withdrawal of Russian engineers and the shortage of necessary equipment due to the suspension of assistance from Russia. At the request of the Mongolian government, Japan then provided repayable and grant aid more than once, greatly contributing to the rescue of power plants and stable supply of energy.

In recent years, the power problem has been showing some improvements following the revamping of power plants and repletion of equipment, but the problem of power shortage has not been fundamentally solved, as mentioned above. Japan is expected to provide continuous assistance. In July 2014, President Tsakhia Elbegdorj visited Japan and he and Prime Minister Shinzo Abe reached broad agreement in economic partnership agreement (EPA) negotiations (JETRO, Economic Overview of Mongolia, and August 2014).

Table 1　Real GDP Growth Rate Trends

(%)



Source: National Statistical Office of Mongolia, Monthly Bulletin of Statistics

The International Monetary Fund (IMF, World Economic Outlook October 2013) forecast Mongolia's GDP growth at 11.7% for 2014. However, according to a survey by the Asian Development Bank (ADB), Mongolia's economic growth rate in the first half of 2014 slowed down to 5.3% over a year before.

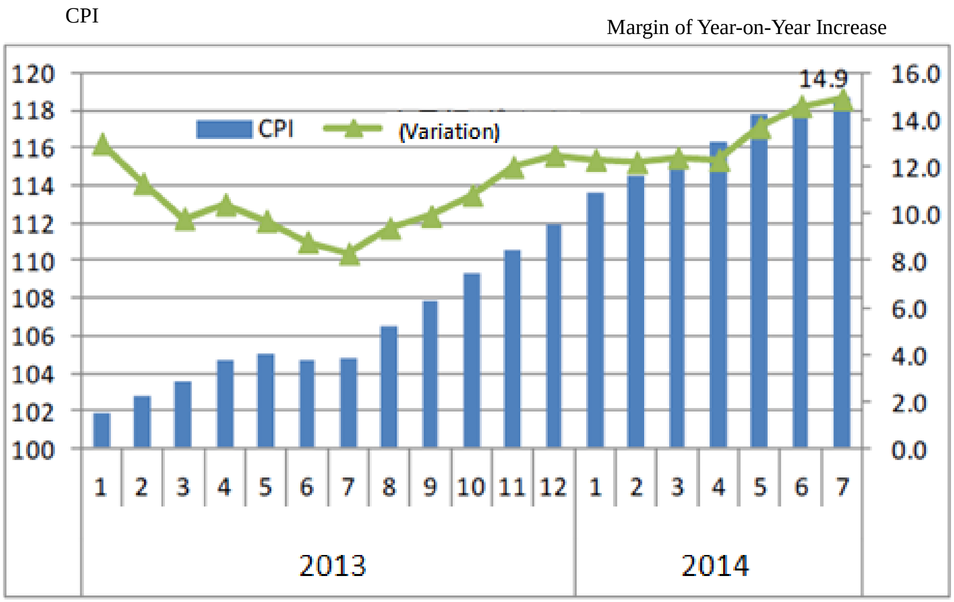
This follows the slowdown from 8.4% in the first half of 2013 to 7.5% in the first quarter of 2014, as seen in Table 1 above. The slowdown of economic growth was caused remarkably by external factors, such as restrained investment activities due to a sharp drop in foreign direct investment. On the other hand, exports grew significantly, led by copper and oil. In particular, in the five years following the Lehman Shock, as much as 81% of foreign direct investment concentrated on the mining industry, thanks to animated operations at the Tavan Tolgoi and Oyo Tolgoi mines. In anticipation of growth of exports of mineral resources, the GDP growth rate of 17% was estimated by 2015.

And as shown in Table 2 below, domestic consumption has been on the uptrend, with the consumer price index in July 2014 rising 14.9 points.

By item, points increased for all items except for mail/communication that dipped by 0.1 point from the same month of 2013 (Table 3).

When these factors are taken into account, it is expected that economic growth will be sustained going forward.

Table 2 Consumer Price Index Trends



Source: National Statistical Office of Mongolia, Monthly Bulletin of Statistics

Table 3 Margin of Increase in Consumer Price Index (CPI) by Item

(Points)

Item	Previous Year Comparison		Previous Month Comparizon	
	June	July	June	July
Foods	13.7	13.1	0.7	-1.0
Alcohol ･Tobacco	16.3	17.0	0.1	0.8
Clothing ･Shooes	20.9	20.8	1.0	0.5
Household ･Water	12.5	13.3	-1.2	2.5
Furniture ･Daily Commodity	19.0	19.1	0.7	1.1
Health	13.7	13.4	2.8	0.9
Transportation	6.8	9.3	0.6	2.0
Postal ･Correspondence	0.0	-0.1	0.1	-0.1
Leisure	3.1	3.0	0.4	0.1
Education	27.2	27.2	0.0	0.0
Restaurant ･Hotel	15.9	16.4	0.2	0.5
Other Products & Services	23.3	23.7	1.2	0.9

Source: National Statistical Office of Mongolia, Monthly Bulletin of Statistics

Looking at the real GDP growth rate by industry, the agricultural and pasturage sector expanded 16.3% year on year and the industrial and construction sector rose 10.1% year on year. The strong growth stems largely from the sharp rise in production at the Oyu Tolgoi copper mine and the construction boom backed by housing loan support measures by the central bank.

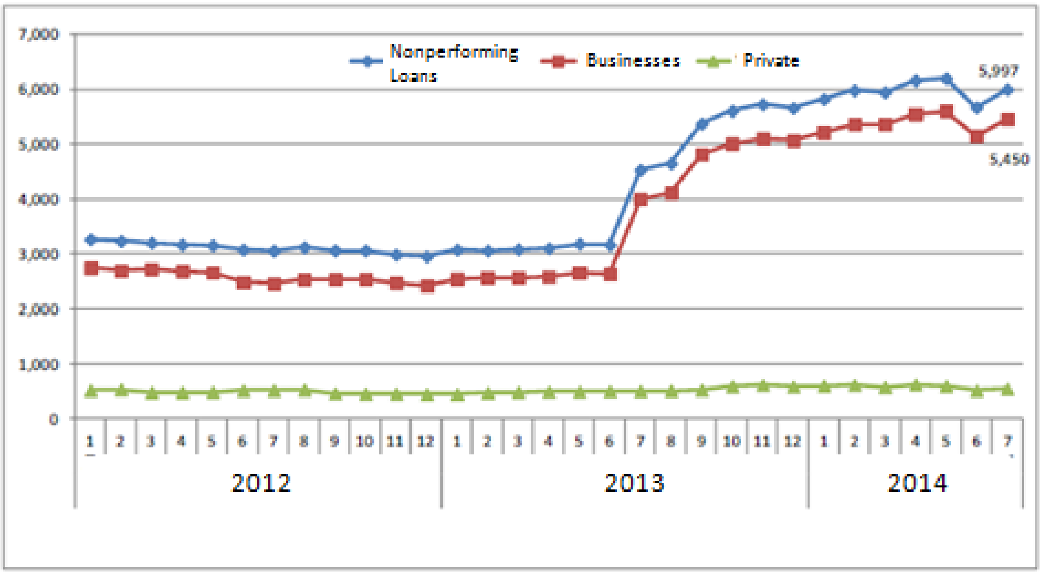
At the end of July 2014, the M2 money supply stood at 10,018 billion tugriks (Tg), up 24.6% over a year earlier.

The balance of loans outstanding expanded 34.1% over a year earlier to 12,225.4 billion Tg, comprising, by borrower, 6,612.5 billion Tg, or a little over 50%, to private-sector companies, 5,4993.5 billion Tg to individuals, or a little over 40%, and 98.8 billion Tg, a little less than 10%, to public-sector entities.

Total assets of commercial banks came to 18,586.3 billion Tg, up 28.4% over a year earlier, while government debt expanded 61.5% to 2,273.3 billion Tg.

The balance of nonperforming loans grew substantially over the same month of 2013 to 599.7 billion Tg (Table 4).

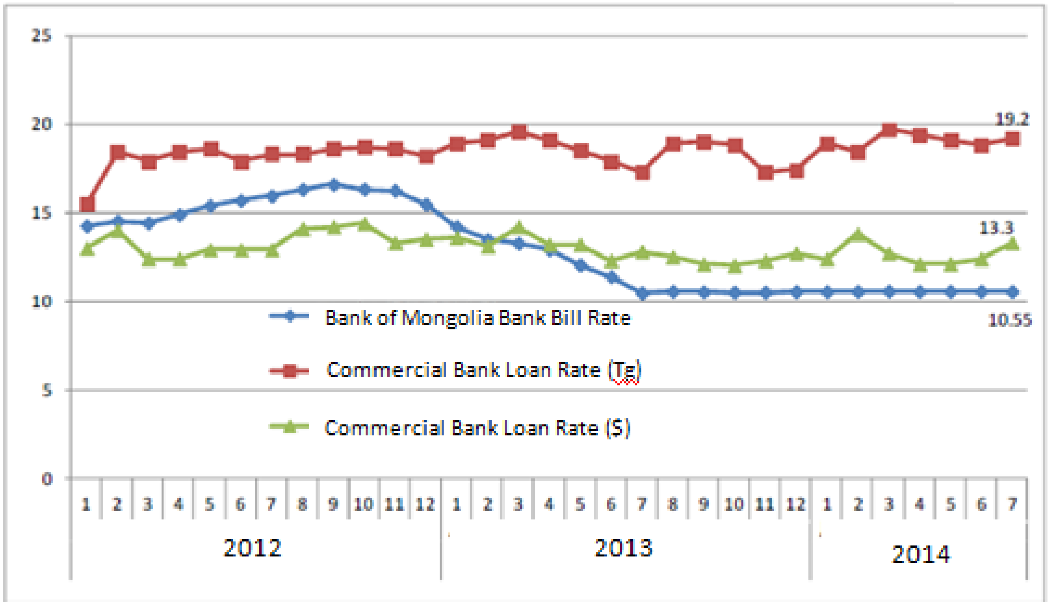
Table 4　Nonperforming Loans Trends　(%)



Source: National Statistical Office of Mongolia, Monthly Bulletin of Statistics

Looking at bank loan interest rates per annum by Table 5 below, tugrik-denominated loans carried 19.2%, up 1.9 points over a year before, and dollar-denominated loans 13.3%, up 0.5 point.

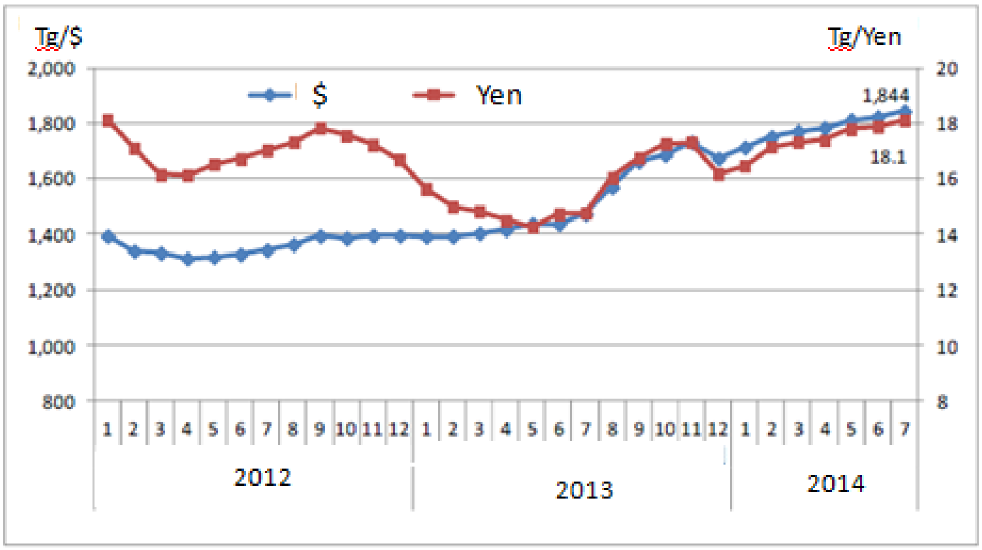
Table 5　Bank Loan Interest Rates Trends (Annual)　(%)



Source: Bank of Mongolia

By Table 6 below, the mean average exchange rate of tugrik in July 2014 stood at 1,844 Tg to the U.S. dollar and at 18.1 Tg to the yen, showing the continued strength of the Japanese currency.

Table 6 Foreign Exchange Rates Trends



Source: Bank of Mongolia

(2) Energy Consumption and Status of Greenhouse Gas Emissions in the Target Country/Target City

In Mongolia's central power system centering on Ulaanbaatar, power demand has been increasing chronically due to the population increase and the overconcentration of population. The present government considers the changeover of coal-fired thermal power plants for combined heat and power (CHP), or cogeneration, and coal-fired heat only boilers (HOBs), regarded as the main culprits for air pollution, to those with energy-saving specifications as one of its national priorities, placing high expectations on progress in JCM projects.

According to the U.N. Framework Convention on Climate Change (UNFCCC), the energy sector accounted for 60% of GHG emissions in Mongolia in 2006, with 30% coming from farm animal-derived methane gas.

MARCC-2014 of the Ministry of Environment, Green Development and Tourism points out that the emission source of the energy sector, which accounts for the bulk of GHG emissions, is consumption of solid fuels and coal. Solid fuel-derived missions, the main cause of carbon dioxide (CO_2) emissions, increased steadily from 8,135.04 gigagrams (Gg) in 1990 to 8,771.49 Gg in 2012.

Looking at the breakdown of CO_2 emissions by industry, as shown in Table 7 below, the share of the manufacturing industry is conspicuously high, rising from 63.22% in 1990 to 76.97% in 2012. The remainder comes from the manufacturing, transport, commercial, residential and agricultural sectors, etc., showing that CO_2 emissions by the energy sector are remarkably huge.

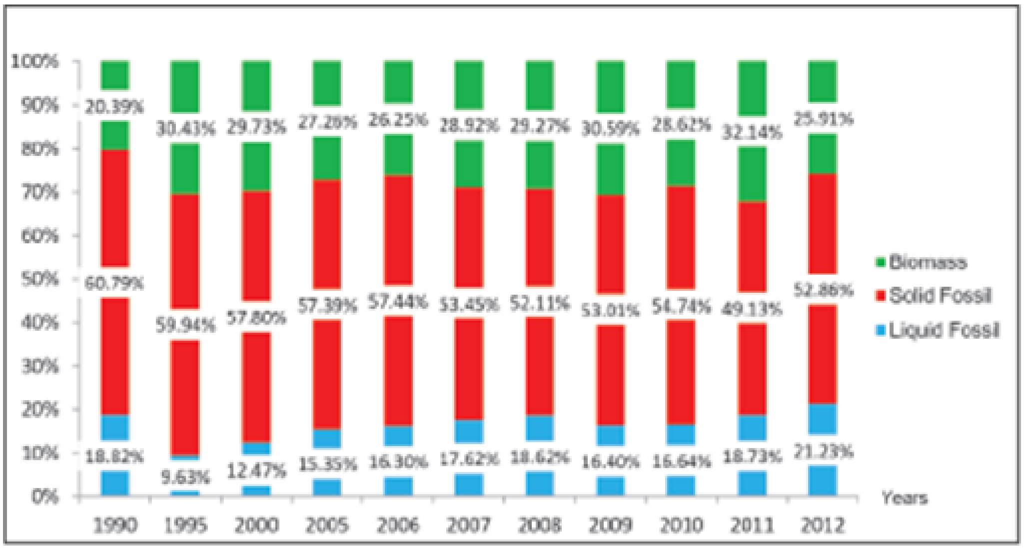
Table 7 CO_2 Emissions from Combustion of Solid Fuels Trends by Sector (Gg, %)

Years	Sectorial Approach							
	Energy Industries	Manufacturing Industries	Transport	Commercial	Residential	Agriculture	Other	TOTAL
1990	5,143.28 63.22%	1,387.31 17.02%	127.87 1.57%	338.75 4.16%	746.36 9.17%	178.35 2.19%	213.12 2.62%	8,135.04 100.00%
1995	4,599.77 73.12%	850.56 13.52%	108.8 1.73%	265.79 4.23%	176.5 2.81%	31.41 0.50%	257.99 4.10%	6,290.82 100.00%
2000	5,079.94 83.78%	267.04 4.40%	81.88 1.35%	262.09 4.32%	256.78 4.24%	3.37 0.06%	112.17 1.85%	6,063.27 100.00%
2005	5,254.11 83.24%	132.56 2.10%	112.5 1.78%	216.74 3.43%	443.15 7.02%	20.53 0.33%	132.12 2.09%	6,311.71 100.00%
2006	5,252.07 78.94%	253.88 3.82%	135.61 2.04%	179.54 2.70%	611.07 9.18%	9.2 0.14%	211.63 3.18%	6,652.99 100.00%
2007	5,849.64 81.55%	460.48 6.42%	136.85 1.91%	89.73 1.25%	420.63 5.86%	3.37 0.05%	212 2.96%	7,172.7 100.00%
2008	5,756.34 81.00%	448.25 6.31%	45.99 0.65%	195.17 2.75%	456.53 6.42%	7.85 0.11%	196.29 2.76%	7,106.43 100.00%
2009	5,891.73 78.04%	399.62 5.29%	46.21 0.61%	2.24 0.03%	669.64 8.87%	15.7 0.21%	524.95 6.95%	7,550.1 100.00%
2010	6,457.17 78.91%	387.66 4.74%	56.08 0.69%	3.37 0.04%	686.47 8.39%	11.22 0.14%	581.03 7.10%	8,183 100.00%
2011	6,302.89 78.26%	423.01 5.25%	59.45 0.74%	2.24 0.03%	717.88 8.91%	10.1 0.13%	538.41 6.69%	8,053.97 100.00%
2012	6,751.67 76.97%	624.9 7.12%	47.11 0.54%	12.34 0.14%	702.17 8.01%	4.15 0.05%	629.15 7.17%	8,771.49 100.00%

Source: MARCC-2014

In addition, in CO_2 emissions by fuel type, as shown in Table 1.8 below, solid fossil fuels accounted for 49-61%, far ahead of the shares of liquid fossil fuels and biomass.

Table 8　CO_2 Emissions from Fossil Fuel Combustion by Fuel Type (1990-2012)



Source: MARCC-2014

As shown in the composition ratio, solid fossil fuels account for the greater part of CO_2 emissions from the consumption of fossil fuels, becoming the main case of air pollution.

(3) Status of Environmental Loads Related to the Project (Air Pollution, etc.)

It is assumed that CHP and HOBs, referred to above, as well as yurt stoves constitute the main sources of CO_2 emissions in Mongolia. In the severe natural environment where temperatures in winter go below minus 30 degrees Celsius, the stable supply of heating is an important lifeline. However, as coal heating is the principal supply system of heating, Mongolia is experiencing serious air pollution often described as "worse than in China."

According to the National Agency for Meteorology and Environment Monitoring of Mongolia, Particulate matter less than 10 micrometers in diameter (PM10) exceeded 2,000 micrograms per cubic meter of air more than once in January 2014, over 100 times more than the environmental health standards set by the World Health Organization (WHO). PM2.5, sulfur dioxide and nitrogen dioxide also significantly exceed the WHO's standards. In addition, the basin structure of Ulaanbaatar has the topographical characteristics prone to sedimentation of smoke exhaust, which makes the supply of coal-fired heating unsuitable from an environmental standpoint. The problematic point is that there is no alternative to relying on equipment that is seen the principal cause of environmental pollution to ward off the cold.

In response to the current situation, the Ministry of Environment, Green Development and Tourism is promoting the introduction of coke in a bid to reduce pollutants, and is also considering a policy to "ban the use of unprocessed coal by 2016."

According to MARCC-2014 of the Ministry of Environment, Green Development and Tourism, GHG emissions by the domestic energy sector are conspicuously high compared with other sectors (see Table 1.7), which is attributed to fossil fuels. In a policy related to reductions in GHG emissions, the Mongolian government is seeking to reduce the use of coal by exploring the possibility of the use of alternative energy. In this context, as an option for GHG reductions, the revamping of CHP plants and improvements to heat only boilers are given importance as part of the future policy to reduce GHG emissions. In the current absence of a clear-cut energy-saving law, however, energy-saving equipment has yet to spread extensively. As future challenges, the government should produce a proper balance of power supply and demand through development of a proper legal system, including an enactment of an energy-saving law, and establish policies and principles conductive to reductions in GHG emissions.

(4) Status of Development of Infrastructure/Facilities, etc., Related to the Project

Mongolia has in place laws that provide for items such as power generation, power transmission and distribution and construction of facilities for effective utilization of domestic energy resources, but there is no adequate legal framework that would contribute to energy-saving. At present, with the assistance of the German Agency for International Cooperation (Deutsche Gesellschaft für Internationale. Zusammenarbeit GmbH, GIZ), the Ministry of Energy is in the process of developing an energy-saving law. In Mongolia, where the supply of power is chronically tight during winter, securing of energy in a stable manner is a matter of life or death. If energy security cannot be ensured, foreign investment would not be forthcoming and a negative impact on economic growth would be large.

In the process of development an adequate legal system, energy-saving and promotion of energy efficiency will be the two important matters that could influence of the future of the country. Mongolia's draft law on energy efficiency and energy-saving, whose preparation was supported by GIZ, stipulate the respective roles of major sectors in the revamping of decrepit equipment in the power and energy sectors, and the importance of utilization of new funds and existing funds for energy-saving and enhanced energy efficiency.

In the power sector, the draft law positions the revamping of power plants for greater efficiency as an important policy and also calls for investment in the introduction of advanced technologies and in the implementation of energy audit. From the energy-saving standpoint, the pressing issue is the promotion of an energy preservation program to avoid midwinter power outages and energy-saving efforts throughout the entire society, across households to commercial and industrial sectors. Specifically, the implementation of planned outages to improve peak-hour power loads and power capacity shortages and the new construction and revamping of power facilities should be considered.

As seen above, infrastructure for reductions of GHG that is following an uptrend in association with economic growth has yet to be adequately developed, and this is an area with much room for improvement.

(5) Status of Institutions Related to the Project

① Policies in the energy sector

As one of policies in the energy sector in Mongolia, an electric power source development program was formulated in 2013.

As described in the program, one of various factors for the power shortage Mongolia is faced with is the existing power supply system that depends on inefficient coal-fired thermal power generation. This makes power loss inevitable, and the dependence on the single fuel leaves no buffer when the coal-derived power source supply system fails. Therefore, in order to secure the state's supply of power sources, it is presumably effective to create wide-ranging options to use multiple fossil fuels, including natural gas and oil, with the diversification of energy sources in sight, let alone the promotion of the improved supply of power through new construction and revamping of power facilities. However, given the country's economic conditions, this is not a realistic approach as these fossil fuels are costlier than domestically-produced coal.

Furthermore, as described earlier, since the energy-saving law is still being formulated, policies for energy reductions are yet in the stage of development. On the other hand, as a policy related to this project, there is the law on renewable energy put together by the Ministry of Energy. The City of Ulaanbaatar, a basin geographically, is deemed suitable for photovoltaic power generation, given the high rate of sunshine and the extremely low density of population.

The law on renewable energy, part of Mongolia's energy-related legal framework, is applicable to corporations engaged in power generation and power distribution in the country, and in areas designated by the renewable energy fund, the fund is to provide subsidies to make up for differences in regional prices.

The law also provides for power selling prices between power transmission and distribution. It prescribes the power capacity of power generation and transmission and installation locations of measuring instruments as well as rates. In addition, there is the feed-in tariff (FIT) system for renewable energy, which sets margins of price settings as shown in Table 9 below (the figure in red shows fixed purchase prices for photovoltaic system power).

Table 9 Prices of Alternative Energy by Type under the Feed-in Tariff System

(USD/kWh)

	Hydro			Wind	Solar
	up to 0.5 MW	from 0.5 to 2 MW	from 2 to 5 MW		
Grid-connected	0.045 - 0.06	0.045 - 0.06	0.045 - 0.06	0.08 - 0.095	**0.15 - 0.18**
Stand alone	0.08 - 0.10	0.05 - 0.06	0.045 - 0.05	0.10 - 0.15	0.2 - 0.3
Prices are given in USD per kWh					

Source: Law of Mongolia on Renewable Energy

Purchase prices for photovoltaic system power generation is set at 0.15-0.18 USD/kWh, but this price band is not operative for now, as the government's fiscal resources have yet to be specified. The situation calls for the redevelopment of funds specializing in energy-saving and clean energy and subsidies.

(6) Government Organizations Related to the Project and Their Roles

Government organizations directly related to this project are the Ministry of Finance, the Ministry of Energy and the Ministry of Environment, Green Development and Tourism. The implementation of financing schemes involving the government requires approval by the Ministry of Finance. As this financing scheme is designed to diffuse and promote technologies that can reduce GHG emissions, including energy-saving and renewable energy, etc., the Ministry of Energy is also involved as a relevant ministry. In addition, since the Ministry of Environment, Green Development and Tourism serves as the Administrative Office of the Joint Committee for the JCM, the ministry is the principal ministry in the institutional and operational aspects of the JCM. The Ministry of Economic Development could be a relevant ministry, but it was decided that the ministry would be absorbed into the Ministry of Finance in the October 2014 reorganization of ministries and agencies. Thus, the aforementioned three ministries may be described as the government organizations related to this project.

In addition, there is the Clean Air Foundation (CAF), dedicated to measures against air pollution. The foundation was established with the support of the government-controlled National Committee for Reducing Air Pollution and the European Bank for Reconstruction and Development (EBRD). The Advisory Committee has been established for operating the foundation. Members of the Advisory Committee include the Ministry of Finance, the Ministry of Energy, the Ministry of Mining, the deputy mayor of Ulaanbaatar (Bat-Erdene in charge of ecology and green development), the chairman of the Ulaanbaatar citizens' committee, the Ministry of Population Development and Social Protection and nongovernment organizations (NGOs) (The Advisory Committee is chaired by the Minister of Environment, Green Development and Tourism).

The foundation is funded mainly by revenues of the tax on coal exports imposed at the rate of 1,000 Tg per ton of coal. The foundation finances the renewal of equipment listed below.

- Renewal of yurt stoves (to Turkish-made stoves)
- Renewal of low-pressure HOBs
- Introduction of LPG (liquefied petroleum gas)-diesel hybrid buses as a measure to reduce exhaust gas from vehicles.

The foundation has secure fiscal resources, and as it can be used directly for measures to combat air pollution, high expectations are placed on the foundation as part of economic support.

2. Study Target Project

(1) Project Target

Mongolia, one of the world's largest producers of coal resources, depends almost entirely on coal for domestic energy supply sources. As winter temperatures drop below minus 30 degrees Celsius, a considerable amount of coal is being consumed.

According to GHG emission forecasts of MARCC-2014, domestic GHG emissions in 2030 are likely to more than triple the amount of emissions in 2003. According to sector-by-sector GHG emissions shown in Table 2.1, of the five sectors, emissions by the energy sector are by far the largest, accounting for more than 80% of the total emissions forecast for 2030, for example. The overwhelming share, which is apparently associated with the rise in the average annual growth rate of emissions, is presumed to be the result of increased power demand stemming from the population expansion associated with economic growth.

Table 10 GHG Emissions by Sector

Sectors	GHG emissions in Gg CO_2-eq						Average annual growth rate,%			
	2006	2010	2015	2020	2025	2030	2006-2015	2015-2020	2020-2030	2006-2030
Energy	10,220	14,033	20,233	25,930	32,796	41,815	10.89	5.63	6.13	12.88
Industry	891	1,354	1,602	1,836	2,065	2,318	8.87	2.92	2.63	6.67
Agriculture	6,462	6,405	6,573	6,657	6,762	6,867	0.19	0.26	0.32	0.26
LUCF	-2,083	-1,932	-1,785	-1,420	-1,000	-680	-1.59	-4.09	-5.21	-2.81
Waste	138	158	183	209	254	294	3.62	2.84	4.07	4.71
Total	15,628	20,018	26,806	33,212	40,877	50,614	7.95	4.78	5.24	9.33

Sources: MNET, UNEP: Mongolia Second National Communication, Under the United Nations Framework Convention on Climate Change, 2010

On January 8, 2013, a bilateral document on the Joint Crediting Mechanism (hereinafter referred to as the "JCM") was signed in Ulaanbaatar, Mongolia, for the first time in the world, formally launching the JCM. The first meeting of the Joint Committee was held on April 11, 2013, followed by the second meeting on February 20, 2014. The first meeting addressed the determination of guidelines, etc., while at the second meeting, the decision was taken for the registration of the JCM proposed methodology for the first time in the world, showing the Mongolian government's positive stance on the implementation of the JCM. The Mongolian government made clear its stance on the JCM, with Vice Minister of Environment, Green Development and Tourism Mr. Tulga expressing high expectations on the implementation of the JCM at a ministerial meeting of the 19th session of the Conference of the Parties (COP19) to UNFCC.

Furthermore, the Mongolian government plans to further push ahead with measures to combat global warming in accordance with its National Action Program on Climate Change (NAPCC) revised in 2011, and has submitted its nationally appropriate mitigation actions (NAMAs) to UNFCCC. Mongolia's NAMAs list 11 items, of which six are related to actions in the energy sector, including power generation and power transmission and distribution, raising high hopes about countermeasures in the energy sector.

At the 38th session of the Subsidiary Body (SB38) of UNFCCC held in Bonn, Germany, in June 2013, Dagvadorj Damdin, Special Envoy on Climate Change Issues of Mongolia's Ministry of Environment, Green Development and Tourism, also announced that Mongolia will promote its NAMAs by making use of the JCM and push ahead with mitigation actions so that the country can simultaneously promote countermeasures against air pollution and energy security.

The equipment subsidization projects utilizing the JCM and feasibility studies have been under way since 2013, and the Mongolian government has provided the following comments.

① JCM equipment subsidization projects

i. It is difficult to manage projects where energy-saving and renewable energy equipment is introduced at multiple sites or is sold to multiple local operators. They are hard to administer as equipment subsidization projects.

ii. Many equipment subsidization projects can cost around 10 million yen to more than 100 million yen per project. When target projects are above or below those values, some other support systems, if any, may be able to help reduce GHG emissions more.

② The situation of Mongolia

i. There have been many cases where transactions cannot be conducted due to the difficulty Mongolian partner companies face in obtaining credit, even for projects involving no technical problems.

ii. Financing is difficult. Commercial interest rates offered by local banks are around 20%. Even assuming long-term loans, it is felt that this is not a useful method of financing.

iii. Since corporate creditworthiness is an issue, Japanese banks find it possible to lend funds only to large corporations. Promotion of the JCM using these funds may be limited in its usage.

iv. In addition to the funding source mentioned above, the fund from the United Nations and the Japan Bank for International Cooperation (JBIC) will be one of the option. They may make it possible to introduce Japanese technologies suited to Mongolia's needs, if two-step loans, etc., are to be managed by local entities, not much restricted by international tenders.

v. Utilization of local entities should make it easier to manage programme-type projects, to be implemented in smaller sizes and in large numbers.

Projects cited in ① i. and ② v. above are rather small in the size of equipment (project scale), but are believed to have the potential for total amounts of GHG emissions to be reduced. If the programme-type JCM can be realized to support multiple smaller projects, substantial reductions of GHG emissions are attainable without carrying out large-scale projects difficult to be implemented by developing countries.

However, under the current financing scheme of the JCM, it is difficult to support multiple smaller projects like these due to such bottlenecks as the measurement, reporting and verification (MRV) of GHG emissions and a lot of sites to be managed. Development of a new JCM financing scheme is desired to support these smaller-scale multiple projects.

Against these backgrounds, in order to explore the building of a new JCM financing scheme, this Study looked into the feasibility of the programme-type JCM scheme that can support multiple smaller projects by leveraging financial support for the realization of leapfrog-type development (leapfrog financing) and through fund management via local banks, and conducted a survey on the identification of equipment that can introduce specific Japanese technologies by setting up organizations under this framework and the building of the local Mongolian structure for MRV implementation.

(2) Applicable Technologies/Institutions

① Technologies, Advantages and Costs

This Study covers wide-ranging energy-saving, renewable energy and other potentially applicable technologies that lead to reductions in GHG emissions.

In the energy-saving sector, Mongolia, unlike Japan, has only a limited scope of developed mining and industrial industries. More specifically, factories and plants operating in Mongolia are those for mining, cement, textiles, four milling, and food and beverages. Most factories and plants use out-of-date equipment, and in many cases, energy-saving measures are insufficient or there is the lack of sufficient knowledge about such measures. Thus, the potential for introducing Japanese technologies is high, but, on the other hand, the extent of advantages of reducing the consumption of electric power or coal through energy-saving measures is rather limited because call prices are extremely cheap in Mongolia. Another major difference from Japan is that prices of water are very high in Mongolia. As water prices in Mongolia is higher than prices of tap water in Japan, reductions in the use of water can have a major impact on the cost-benefit performance. As such, instead of adopting the same cost calculation method as in Japan, it is necessary to explore the potential for energy-saving at factories and plants by taking Mongolia's unique circumstances into consideration.

Mongolia also has its unique characteristics regarding renewable energy. In the photovoltaic power generation sector, for example, the power generating capacity is larger as Mongolia is a cold weather region relative to Japan and has longer hours of sunshine. On the other hand, as coal-derived power generation is the mainstream and power costs are extremely low, particular attention is required in scrutinizing profitability. The situation is similar for power generation by wind. As there are a lot of areas containing vast plains with strong winds, there are few problems with the efficiency of power generation or location space. But there are many matters to consider in terms of costs, as wind power generation requires the development of associated infrastructure, including connections to the power grid.

It is necessary to select appropriate technologies only after looking into these advantages and disadvantages.

② Comparison between Japanese Institutions and Overseas Institutions

This Study assumes the use of financing enabling leapfrog development.

There are two types of schemes. One is the fund to support projects seeking to reduce GHG emissions in collaboration with projects supported by Japanese entities, such as the Japan International Cooperation Agency (JICA). The other is designed to promote the adoption of advanced technologies that are not being readily adopted in projects of the Asian Development Bank (ADB) for higher costs of introduction by helping lower the additional costs with funds contributed to the ADB's trust fund. The financing scheme of either type combines loans and grants in aid.

When assuming support for Mongolia, foreign financial available includes loans from Germany's Kreditanstalt für Wiederaufbau (KfW) and the Millennium Challenge Account (MCA) of the United States. KfW has provided loans for the installation of additional turbines at the Darkhan power plant and also extended two-step loans in the past. The MCA has provided grant aid for the diffusion of yurt stoves in Mongolia. As for assistance from countries other than industrial nations, neighboring China is providing financial assistance by extending loans mainly in the mining and energy sectors.

On the other hand, these forms of financial assistance are neither funds for measures to combat global warming nor financial schemes for the promotion of energy-saving efforts and the use of renewable energy.

The only Japanese financing currently implemented in Mongolia are two-step loans provided by JICA, most of which are being used for helping nurture small- and medium-sized enterprises in that country. But 10-20% of the loans are directed at the environment sector. These projects financed by the loans are for the monitoring of air pollution, etc., by establishing indicators, but the loans are not primarily aimed at measures to combat against global warming. Therefore, the financial scheme being assumed in this Study represents a new attempt in Mongolia.

3. Study Method

(1) Challenges

As described above, in order to explore the building of a new JCM financing scheme, this Study looked into the feasibility of the programme-type JCM scheme that can support multiple smaller projects by leveraging financial support for the realization of leapfrog-type development (leapfrog financing) and through fund and organization management with the participation of local entities.

The first subject is “whether there is the likelihood of Japanese technologies being introduced.” As many of the equipment operating in Mongolia is based on coal-derived energy, there is a great potential for GHG emission reductions. However, there are many cases where Japanese technologies cannot be introduced so easily for such reasons as that Mongolia is located in a cold weather region and that the country is located high above sea level. In addition, with the Mongolian population standing at only some three million with the prospect of limited domestic demand, only a small number of Japanese businesses are currently operating in the country, requiring the digging up of a new market by leveraging the JCM.

Another subject is the development of an attractive financing scheme. The Mongolia economy has been robust with an annual economic growth rate of over 10% in the past three years, but it is not easy to conduct transactions directly between Mongolian business operators and Japanese businesses.

There are only a limited number of banks that can open letters of credit (L/C). Under these circumstances, there are a lot of hindrances to the building of the financing scheme making use of local banks.

On the other hand, loans carrying guarantees of the host country government enjoy lower risks of loan losses and can also reduce lending rates to relatively low levels of several percent. One of the conceivable concrete methods is to win government guarantees by obtaining the Mongolian Ministry of Finance’s guarantees. This scheme needs to be devised by taking these points into account.

(2) Implementation Structure

We implemented the project with the following implementation structure.

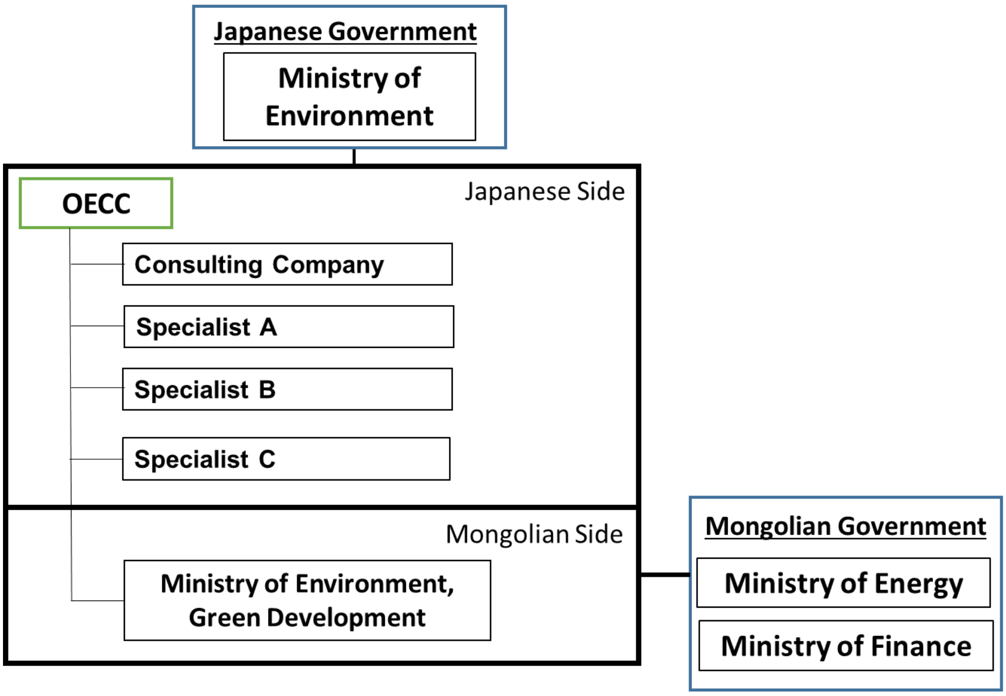


Figure 3 Implementation Structure

(3) Study Details

In this Study, in order to develop the programme-type JCM scheme plan that can support multiple projects through fund and organization management with the participation of local entities, we conducted the following on-site surveys, prepared relevant documents and materials, and held consultations with relevant entities at the request of the relevant Mongolian organizations (the Ministry of Environment, Green Development and Tourism, the Ministry of Energy and the Ministry of Finance).

① Consideration of the programme-type financing scheme and organizational formation in view of the JCM

This financial scheme assumes the use of JCM leapfrog financing, and thus we considered the scheme where a certain amount of loans is provided to the Mongolian side and local banks manage these funds under the government's supervision. As the JCM is required to appropriately implement MRV of GHG emissions as decided by the Joint Committee, we considered the organizational formation by taking this into account. The results of these considerations are described in "5. Considerations toward Commercialization."

i. Consideration of the programme-type financing scheme plan in view of the JCM

We looked into the programme-type JCM financing scheme plan in consideration of the JCM guidelines and discussions at the Joint Committee, while conducting hearings with local banks and relevant government entities and examining the status of lending to individual corporations, local government guarantees, lending terms and conditions, fund management by local banks and local environment-related funds (CAF, etc.). In carrying out this Study, we first considered the financing scheme plan based on the implementation structure that takes into account the structure on the Japanese side and procedures on the JCM side.

ii. Consideration of organization formation on the Mongolian side in view of the financing scheme and examination of the scheme implementation structure plan.

After looking into the assumable financing scheme above,
we Mil < Ulennium Challenge Account (MCA)

② Identification of target Japanese energy-saving and renewable energy technologies

When the financing scheme assumed in this Study becomes operable, the scheme can also cover potential projects for which measures have been difficult to implement thus far. Specifically, while a project to introduce a single technology to multiple sites, it is difficult for the Japanese side to control it remotely, but if the programme-type JCM support scheme that can be operated by local entities independently, the scope of target technologies and projects will widen.

Thus, this Study considered the potential for the introduction of Japanese technologies, focusing on enhanced efficiency of both the energy supply and demand sites while taking the situation of Mongolia into account.

i. Consideration of the potential for the introduction of Japanese technologies in line with the programme-type JCM scheme

We selected Japanese technologies and products suited to the current of Mongolia. After conducting the corporate matching in the selected target sectors, on-site guidance and surveys, we considered the possibility of applying to projects, etc., that leverage leapfrog financing, etc.

ii. Narrowing down of highly feasible Japanese low-carbon technologies and selection of projects

We narrowed down technologies examined above, and then selected covered by this scheme.

iii. Collection of data related to GHG MRV, formulation of the MRV methodology (draft) and preparations for the confirmation of the adequacy by the third-party entity

Concerning the technologies selected above, we collected information necessary for the identification of qualification requirements need for the implementation of the JCM as well as for the MRV methodology (draft).

Based on these, we also formulated the MRV methodology (draft) on the basis of the confirmation of the adequacy by the third-party entity (TPE). Assuming design, implementation and monitoring based on this methodology (draft), in the collection of data, we examined and coordinated items of data necessary for the identification of reference emissions and reductions of emissions required for submission as matters re-requested for the confirmation and verification of the adequacy as well as of materials and data such as specifications of target technologies and standards.

iv. Consideration of the building of the MRV implementation structure

In the implementation of the programme-type JCM support scheme, it is necessary to put in place the structure that can appropriately implement MRV of GHG emissions determined by the Joint Committee of the JCM. In Mongolia, the CAF, which involves the Ministry of Environment, Green Development and Tourism, has the track record of introducing improved yurt stoves, LPG buses and coal-fired heat only boilers, and projects are being managed based on preset indicators and assessment methods. However, since they are different from MRV required under the JCM, it is necessary to create a framework that can satisfy required items under the JCM and consider a new method.

Thus, in order to build the MRV implementation structure in accordance with the JCM framework and mechanism, we considered the selection of appropriate implementing entities and participating organizations as well as the method and scope of MRV to be locally implemented.

Based on the results of considerations of the appropriate implementing entities, participating organizations and the method and scope of MRV, we prepared the project design document (PDD) (draft) for the JCM.

4. Study Results

(1) Performance of Activities and Results

In order to proceed with the considerations discussed in 3., we conducted a total of six on-site surveys and sponsored one training session in Japan.

The first on-site survey: Conducted in August 2014
The second on-site survey: Conducted in September 2014
The third on-site survey: Conducted in October 2014
The fourth on-site survey: Conducted in November 2014
The fifth on-site survey: Conducted in December 2014
The sixth on-site survey: Conducted in January 2015

Training session in Japan: Conducted in October 2014

In the first on-site survey, we looked into the feasibility of the programme-type JCM financing scheme in consideration of the JCM guidelines and discussions at the Joint Committee, while conducting hearings with local banks and relevant government entities and examining the status of lending to individual corporations, local government guarantees, lending terms and conditions, fund management by local banks and local environment-related funds (CAF, etc.). For this Study, we conducted hearings in Japan about the latest discussions at the Joint Committee of the JCM and Japanese technologies with the potential for introduction in order to consider, before and after the Study, whether the financing scheme is based on the implementation structure that takes procedures on the Japanese side and the JCM site into account.

In the second on-site survey, based on the previous survey and surveys conducted in Japan, we made Study related to the building of the scheme and the possibility of the introduction of Japanese technologies centering on the Ministry of Energy and Ulaanbaatar Electricity Distribution Network Company, with the focus on greater efficiency of transformers held by the private sector in Ulaanbaatar.

In addition, we conducted hearings with three local private-sector banks, which were supposed to be able to become entities to operate the programme-type JCM scheme, examining the financing framework for operating the scheme and the response potential of the respective banks. We asked the banks to reply on a questionnaire on details that are difficult to grasp in the hearings, and we obtained their replies after the completion of the on-site survey.

In the third on-site survey, we prepared the scheme plan based on the results of the previous on-site survey and provided a briefing on the Ministry of Environment, Green Development and Tourism of Mongolia and discussed the scheme plan with the ministry.

On top of the on-site survey, we conducted a technological/information exchange between parties concerned of both countries. Specifically, we sponsored a training session in Japan. We invited to the training session officials of the Ministry of Environment, Green Development and Tourism and the Ministry of Energy, who will be the key players in the preparation of the scheme plan and its operation going forward, as well as officials of Ulaanbaatar Electricity Distribution Network Company relevant to the target technologies for greater efficiency of private-sector transformers, in a bid to help boost the motivation of the Mongolian side by having them directly witness the target technologies, including Japan's maintenance and operation control technologies. In addition, we arranged a tour for inspecting equipment related to Japanese technologies in line with the programme-type financing scheme and the programme-type JCM scheme and held training sessions in a didactic manner to share information on actions necessary for the future preparation of the scheme plan and actual operation, and the concrete roadmap, thereby pushing ahead with capacity-building efforts conducive to the building of the structure on the Mongolian side.

In the fourth on-site survey, we explained the scheme plan developed on the basis of the previous on-site surveys and the training session in Japan to the Mongolian government, local banks and relevant business operators at seminars and by visiting them separately, and obtained their comments on the scheme plan as well as their advice in consideration of the state of affairs on the part of Mongolia. Furthermore, as a result of scrutinizing target technologies most suitable to the scheme, we selected the three themes: the greater efficiency of transformers owned by the private sector, the introduction of photovoltaic power generation equipment and the introduction of inverters to plants and other facilities.

In the fifth on-site survey, we planned and coordinated seminars for clients of local Mongolian banks as part of ways to advertise and diffuse target technologies suited to the scheme in the Mongolian market. We also visited various companies to find candidate stakeholders in the programme-type JCM scheme. During the seminars and visits, we obtained advice useful for the next step.

In the sixth on-site survey, we held a seminar on the JCM financing scheme for clients of local banks and were able to discover a lot of new business partners. By obtaining advice from these companies, we collected opinions and views useful in building the scheme, such as problems with as well as expectations placed on the financing scheme in the process of formation. As moves toward the development of projects, we were consulted on specific projects by several private-sector companies. We were also able to proceed with concrete consultations with Ulaanbaatar Electricity Distribution Network Company on private-sector projects.

In order to implement the above processes in a simple and efficient manner wherever possible, we will conduct training and knowledge sharing with organizations that are to serve as operating organizations.

Specific details of the Study related to the selection of technologies for projects are described below:

① Selection of technologies covered by this scheme

Concerning the technologies listed above, we identified the potential for the introduction of Japanese technologies in accordance with the assumed programme-type JCM scheme and narrowed down Japanese low-carbon technologies with high feasibility, and based on discussions with the Ministry of Environment, Green Development and Tourism and the Ministry of Energy, we selected the following three technologies to be covered by this scheme.

i. Greater efficiency of transformers owned by the private sector

The ratio between state-owned transformers of Ulaanbaatar Electricity Distribution Network Company located around Ulaanbaatar and transformers owned by the private sector stood roughly at four to six, with the share of private-sector transformers gradually increasing as the government's policies failed to catch up with remarkable economic growth in cities.

The “Study for the development of JCM projects for comprehensive improvements in the power generation, transmission and distribution systems in Ulaanbaatar City and on the possibility of nationwide horizontal application of the same improvement model in Mongolia” being conducted separately covers the renewal of state-owned transformers. As mentioned above, however, since measures only for state-owned transformers that account for 40% of the total number of transformers cannot contribute to the efficiency and stabilization of power supply and it is important to improve the remaining 60% of transformers owned by the private sector, the Ministry of Energy of Mongolia is forthcoming about the implementation of this project not only for reductions in GHG emissions but also for the stabilization of energy supply and demand. In addition, unlike transformers owned by Ulaanbaatar Electricity Distribution Network Company, transformers in the private sector have different users, making it difficult to manage the project. Given the strong needs for the programme-type JCM with the potential for the unified operation of a large number of equipment, we decided to select the greater efficiency of transformers owned by the private sector as the technology covered by this scheme.

Furthermore, as Japan has excellent technology of amorphous transformers, whose introduction has been promoted under the Act on Temporary Measures to Promote Business Activities for the Rational use of Energy and the Utilization of Recycled Resources (the Energy Saving Act) and the Top Runner Approach, this can greatly contribute to the diffusion of low-carbon technologies.

ii. Introduction of photovoltaic power generation equipment

Mongolia has longer hours of sunshine than Japan. Mongolia also has better conditions for the conversion efficiency of solar panels due to cold weather. The World Bank has already implemented the grant project to provide small solar panels to non-electrification areas. But this project has been completed, and the Mongolian government intends to further spread the use of renewable energy. The country’s National Renewable Energy Program has the target of raising the share of renewable energy to 20-25% by 2020.

As the Mongolian government considers it desirable to manage the impact of increased use of renewable energy on the power system and the diffusion of the use of renewable energy by implementing the programme-type JCM capable of the unified operation of a large number of projects, instead of business operators individually managing each unit of solar panels, we decided to select the introduction of photovoltaic power generation equipment as the technology covered by this scheme.

As a result of our Study, we also found that although Mongolia purchases products manufactured by other countries, there are domestic manufacturers of photovoltaic power generation equipment and the country has the supply system for good-quality equipment in place. In addition, we have confirmed that we can provide product warranty and output guarantee for a period of 20 years by the manufacturing method and quality control that leverages Japan's excellent manufacturing technology for high-precision processed products. If we can make regular maintenance as the condition for the project, we can substantially reduce the probability of flaws and defects occurring in equipment. This program's capability to reduce technical risks should lead to the participation by wide-ranging business operators and local banks, etc.

iii. Introduction of inverters to plants and other facilities

Mongolia's average GDP growth rate over the past three years exceeds 10%. One factor behind this robust growth is increased exports of mineral resources. On top of coal, gold, copper, molybdenum, zinc and crude oil currently being exported, it is forecast that the manufacturing and exports of primary processed products will increase going forward, including rare metals and other mineral resources as well as refined petroleum and coal. Thus, GHG emissions from the energy demand side, including mining and manufacturing industries, are likely to grow significantly, and the introduction of energy-saving measures at these facilities is gaining in importance each year.

On the other hand, Mongolia does not have in place a legal framework conducive to reductions in GHG emissions, including an energy-saving law. The text of the proposed law, now in the process of formulation by the Mongolian government to promote energy-saving efforts, describes the revamping of decrepit equipment in the power and energy sectors as responses to a host of serious problems confronting Mongolia. It also refers to the importance of utilization of funds for energy-saving and enhanced energy efficiency as well as existing funds, with Mongolia considering the use of this scheme as the driving force to promote energy-saving in plants and other facilities.

The introduction of inverter equipment for fans and pumps, etc., can be cited as one of technologies applicable to plants and other facilities. As a concrete example, water pumps in Mongolia usually do not use inverters, as described below, they cannot control the number of rotations of motors and adjust the quantity of water by existing valves alone, causing a significant loss of power consumed.

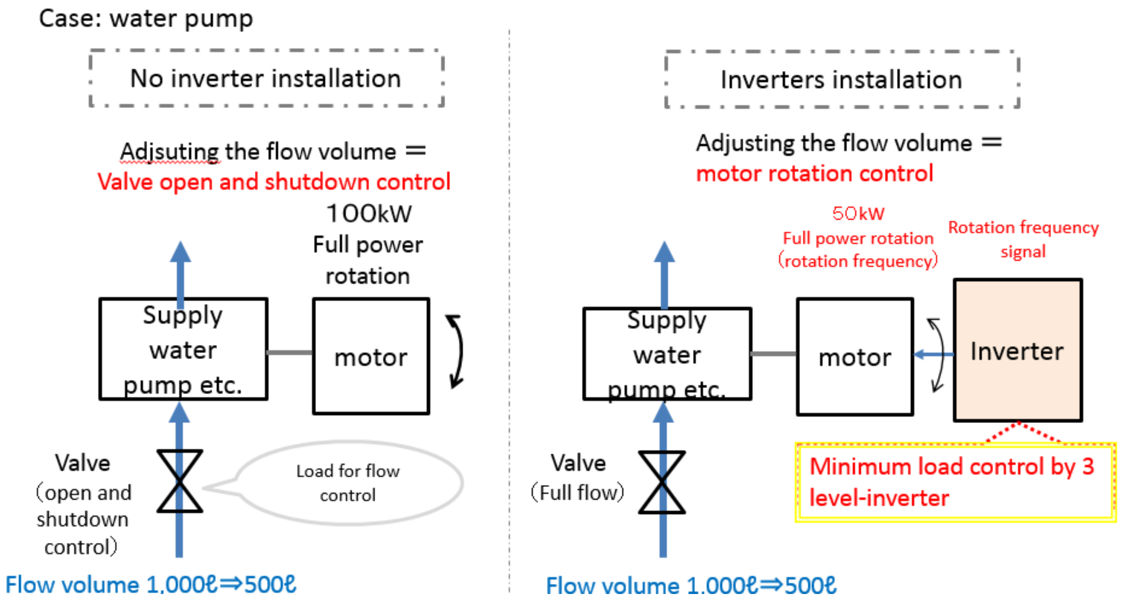


Figure 4 Introduction of Inverters

As refining plants at mines use a large quantity of water, industrial water is supplied by pumps from rivers and underground water veins tens of kilometers away. In addition, fans that pump air into processes at industrial plants do not use inverters either. Thus, the potential for energy-saving is huge, and as the number of subject facilities is expected to increase in the wake of future economic growth, we decided to select the introduction of inverters to plants and other facilities as the technology covered by this scheme.

Furthermore, the “three-level control” can be cited as Japan’s technological contribution to inverters in fans and pumps, etc. Compared with the conventional two-level inverter formula, the three-level control enables more precise control, and can rein in surge voltage harmful to motors, lower noises and keep shaft voltage and current leakages at lower levels. The adoption of this excellent technology instead of the conventional inverter formula can contribute to enhanced control of plants and other facilities, let alone reductions in GHG emissions.

(2) Effect of Reducing GHG Emissions

We identified the effects of GHG emission reductions of the three selected technologies of the greater efficiency of transformers owned by the private sector, the introduction of photovoltaic power generation equipment and the introduction of inverters to plants and other facilities. As this is the JCM, we calculated the reductions of energy-derived GHG emissions. Specific calculation formulas were described in 5. (2) “MRV Methodology and Monitoring Structure”. This calculation may be altered in association with the progress going forward in the development of the project and the JCM methodology.

① Greater efficiency of transformers owned by the private sector

Project emissions: 2,214 tCO_2/y

Reference emissions: 8,741 tCO_2/y

Reduction in emissions: 6,527 tCO_2/y

Premises:

・When 1,389 units of 11kV amorphous transformers (801,365kVA) are renewed and bolstered

② Introduction of photovoltaic power generation equipment

Project emissions: 0 tCO_2/y

Reference emissions: 10,091 tCO_2/y

Reduction in emissions: 10,091 tCO_2/y

Premises:

・When a total of 1,500 sets of 4.8kW solar panels (Max generation capacity: 7.2MW) are introduced and used as the power source of five motors (1.36MW per unit) (Max load 1.36MW * 5 = 6.8 MW) at the pump station of Mine A

・Annual hours of sunshine = 3,000h, but the reference figure of 1,752h (58.4%) is applied

(Source: the 2012 Study report of the National Renewable Energy Center of Mongolia)

・The Grid emission factor of 0.8 (t-CO_2/MWh) is used.

③ Introduction of inverters to plants and other facilities

Project emissions: 78,248tCO_2/y

Reference emissions: 120,381tCO_2/y

Reduction in emissions: 42,133 tCO_2/y

Premises:

・Introduction of inverters for 21 existing units of induction motors at Mine B (total load 24.18MW)

・Assumed combined total annual consumption of power: 109,140MWh

・Reference consumption of power is calculated on the basis of the correlation between the past consumption of power by motors and the discharge flow rate

・Power is supplied from the Grid, the Grid emission factor of 1.1298 (t-CO_2/MWh) is used (the value published by the National Statistical Office, 2009-2011).

(3) Co-Benefits Effects Other Than Reductions in GHG Emissions

Mongolia's central power system centering on Ulaanbaatar is witnessing an ever-increasing shortage of power, and the impact of air pollution and increased GHG emissions on the environment is getting increasingly serious, calling for urgent actions to cope with them. While actions on the supply side, such as the enhancement of power generation equipment and improvement in the efficiency of existing power plants, are important, actions on the power demand side (the diffusion of energy-saving equipment and the use of renewable energy, etc.) are similarly necessary. Thus, one of the co-benefits effects is the contribution to the stabilization of power supply and demand in Mongolia through the introduction of the programme-type JCM scheme. As mentioned earlier, Mongolia is proceeding with the revision of the law on renewable energy, and regarding energy-saving, the country is currently working on the formulation of the energy-saving law. It will be possible to contribute to the Mongolian government's promotion of policies by creating the synergy between this scheme and these policies.

In addition, the individual co-benefits effects of the three selected technologies of the greater efficiency of transformers owned by the private sector, the introduction of photovoltaic power generation equipment and the introduction of inverters to plants and other facilities are as follows.

① Greater efficiency of transformers owned by the private sector

- Increase in the surplus supply capacity of power plants (equivalent to the reduction in power losses)
- Increase in the transient stability of power systems
- Reductions in NOx and SOx, etc., associated with reduced consumption of power
- Power system stabilization through enhanced specifications of power transmission and distribution equipment (reduction in the number of power outages, etc.)

② Introduction of photovoltaic power generation equipment

- Reductions in NOx, SOx and soot dust through reduced coal consumption by replacing coal-fired thermal power generation with photovoltaic power generation
- Promotion of the awareness about renewable energy and the effect of facilitating the diffusion of renewable energy

③ Introduction of inverters to plants and other facilities

- Control of surge voltage harmful to motors
- Reductions in noise, shaft voltage and current leakages

(4) Overall Cost of Project

Shown below are the results of the overall cost surveys conducted in line with (2) above. We calculated the overall project cost for each of ① Greater efficiency of transformers owned by the private sector, ② Introduction of photovoltaic power generation equipment, and ③ Introduction of inverters to plants and other facilities. The calculation is provisional, and may be altered with the future progress in this project.

① Greater efficiency of transformers owned by the private sector

Project cost: million JPY

Premises:

- When 1,389 units of 11kV amorphous transformers (801,365kVA) are renewed and bolstered

② Introduction of photovoltaic power generation equipment

Project cost: million JPY

Premises:

- When a total of 1,500 sets of 4.8kW solar panels (Max generation capacity: 7.2MW) are introduced and used as the power source of five motors (1.36MW per unit) (Max load 1.36MW * 5 = 6.8 MW) at the pump station of Mine A
- Annual hours of sunshine = 3,000h, but the reference figure of 1,752h (58.4%) is applied

  (Source: the 2012 Study report of the National Renewable Energy Center of Mongolia)
- The Grid emission factor of 0.8 (t-CO_2/MWh) is used (the value published by the National Statistical Office, 2009-2011)

③ Introduction of inverters to plants and other facilities

Project cost: million JPY

Premises:

- Introduction of inverters for 21 existing units of induction motors at Mine B (total load 24.18MW)
- Assumed combined total annual consumption of power: 109,140MWh

5. Considerations toward Commercialization

(1) Commercialization/JCM Scenario

① D iscussion of the possibility of commercialization

This project targets the energy supply sector and the project cost in the power generation and power transmission and distribution sectors, etc., will amount at least to several billions JPY. As the financing scheme toward the materialization of the project, we are considering the application of finance enabling leapfrog development. The projects we have selected, like the greater efficiency of transformers owned by the private sector and the introduction of photovoltaic power generation equipment, are believed to have the great potential for reducing large amounts of GHG emissions despite the small size (project scale) of individual equipment. If the programme-type JCM can be realized to support multiple smaller projects, substantial reductions of GHG emissions are attainable without carrying out large-scale projects difficult to be implemented by developing countries.

In Tokyo on June 25, 2014, Minister of the Environment Nobuteru Ishihara conferred with visiting Asian Development Bank (ADB) President Takehiko Nakao and they signed the "Letter of Intent for Cooperation on Environmental Issues." They also announced the establishment of the new Japan Fund for the Joint Crediting Mechanism (JFJCM), with Japan providing a grant of ¥1.8 billion to the ADB to support the adoption of advanced low-carbon technologies in developing countries in Asia.

The new fund is designed to promote the adoption of advanced low-carbon technologies that are not being readily adopted in ADB projects for higher introduction costs by helping lower the additional costs with funds contributed to the ADB's trust fund.

We held consultations with the Ministry of Energy and the Ministry of Environment, Green Development and Tourism, in which the Mongolian government agreed to cooperate in the implementation of the above projects utilizing the new fund. The Mongolian government is in discussions with the ADB, and the Ministry of Economic Development and the ADB have already concluded a memorandum on the outline of the two-step loan project for lump-sum loans to local banks so that this financing can be utilized for private-sector projects. Going forward, we will prepare necessary data and materials in the course of this Study.

② Commercialization Structure

The Study team, together with the Mongolian government, looked into the commercialization structure when the JCM leapfrog fund (contributions to the ADB) is utilized. Specifically, we proposed the following scheme plan to the Ministry of Environment, Green Development and Tourism and the Ministry of Energy, and the Mongolian government told us that it will make intra-government adjustments and adjustments with the ABD on the basis of this scheme plan.

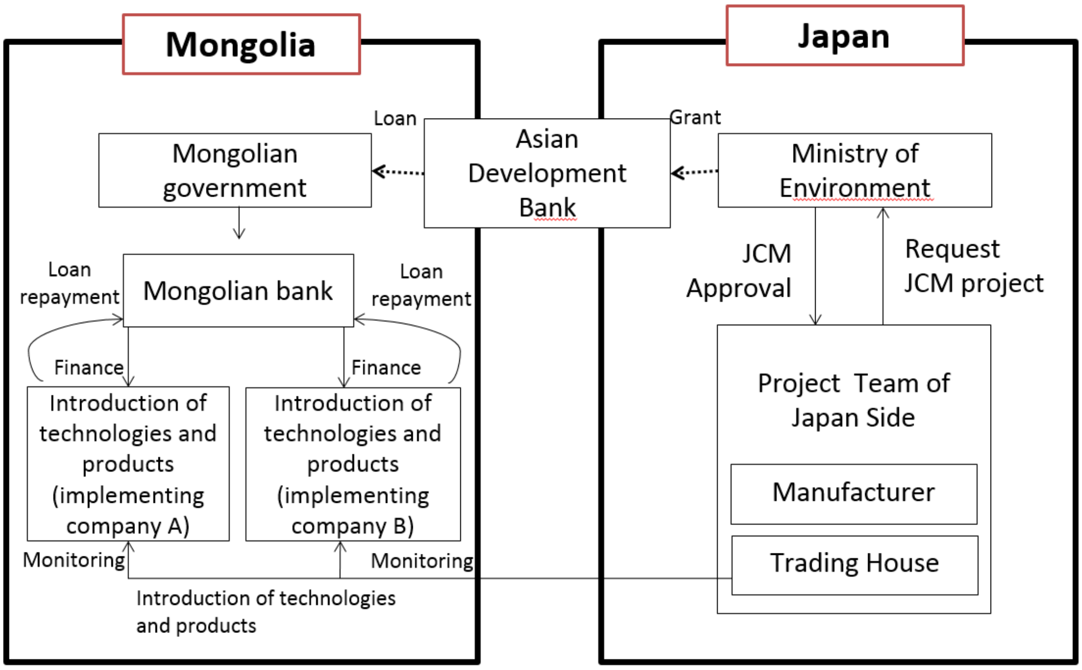


Figure 5 Commercialization Structure Scheme Plan

Under the scheme plan, we considered the structure where donors, following loan negotiations between the Ministry of Finance of Mongolia and donors, provide a certain amount of financing (including grants under the JCM) to Mongolia and a local bank manages the financing under the supervision of the government, etc. As an advantage of this approach, if the structure for the independent management of funds and projects by local management organizations can be adopted, it will become possible to easily carry out smaller-scale projects that have been difficult to implement thus far despite the large sum of the energy-saving potential as well as programs for implementation at many sites, and it will also lead to efficient reductions of GHG emissions. In addition, as it allows the implementation of a large number of projects, with each equipment or unit capable of only reducing small amounts of emissions, substantial reductions can be achieved depending on subject technologies. Furthermore, by going through loan negotiations between the Ministry of Finance of Mongolia and donors, project participants are able to receive long-term financing at interest rates lower than regular commercial rates. There are two key points in administering the scheme plan above: "management of funds" and "management of the project, including GHG MRV." We are proposing the following scheme for the appropriate management of these two points:

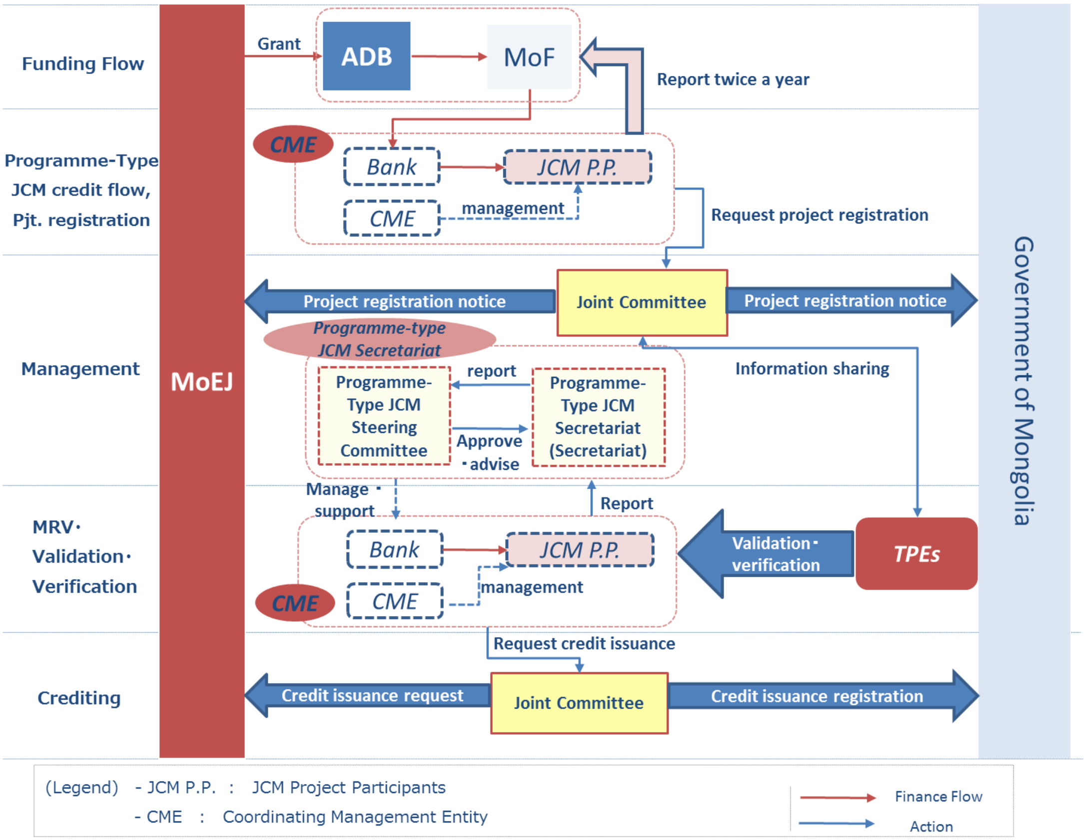


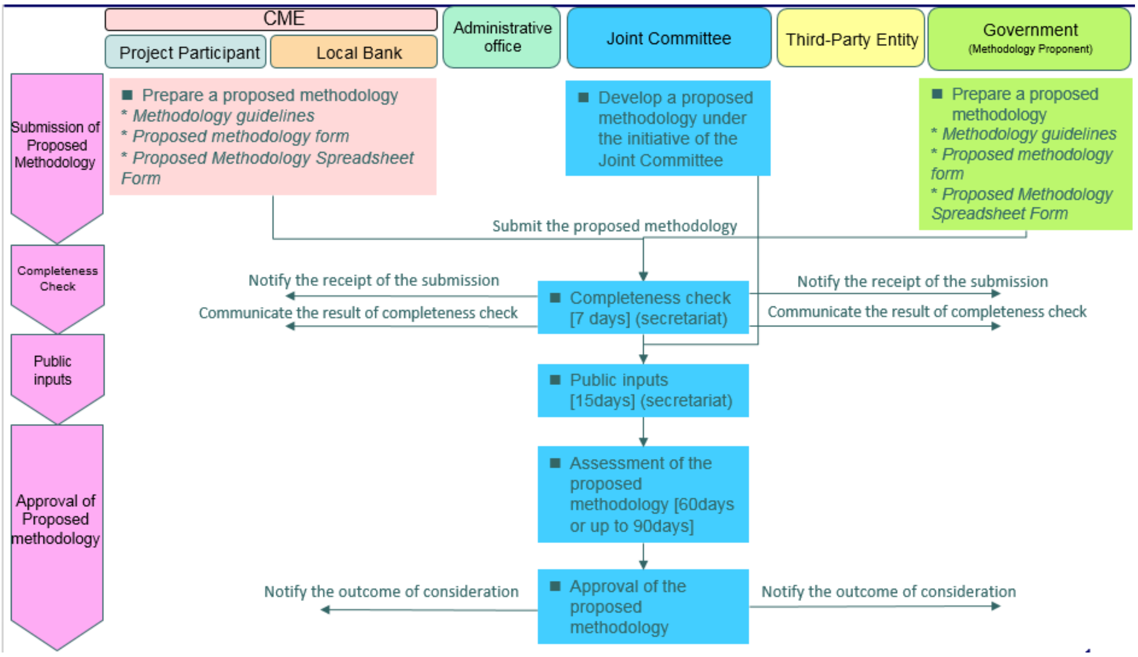
Figure 6 Fund/Project Management Scheme Plan

Entities that implement the project under this scheme are basically private-sector entities. On the other hand, it is difficult for each project participant to conduct GHG MRV. To deal with this difficulty, we proposed a system where the Coordinating Management Entity (CME) manages the project. This refers to the knowledge of the Clean Development Mechanism (CDM), and there is the CDM rule that a programme that gathers up many small-scale activities is implemented as a CDM project (Programme of Activities: PoA). If we can create a manager that takes up the role of the CME in the CDM-PoA under the JCM, it can simplify the process of MRV of GHG emissions than that to be implemented by each project participant. Depending on projects, it may also be possible to appropriately manage them by making the CME responsible for fund management as well. As management structures other than that described above, we consider it also effective for a local Mongolian bank to serve as the CME to manage and control the project. Since banks are the beneficiaries of this scheme in terms of interest rates and the acquisition of new clients and have clear incentives, this can be the useful management structure depending on project details. In the CDM-PoA, there are already multiple projects for which banks are serving as the CME, including "PoA 5979: Methane recovery and combustion with renewable energy generation from anaerobic animal manure management systems under the Land Bank of the Philippines' (LBP) Carbon Finance Support Facility," "PoA 7398: Standard Bank Energy Efficient Commercial Lighting Programme of Activities" and "PoA 6573: Caixa Economica Federal Solid Waste Management and Carbon Finance Project."

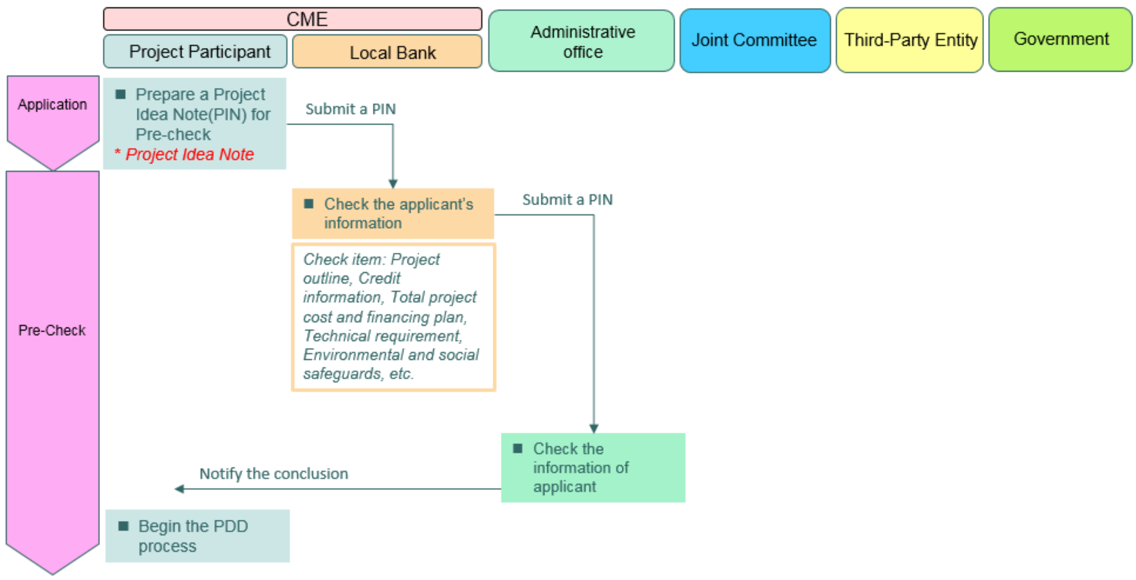
While the private sector-led implementation of these schemes is desirable, it is also necessary to take measures to avoid the conflict of interest, for example, whether local banks provide financing in an appropriate manner, or whether special favors are not being doled out to some private-sector companies. Thus, after investigations and consultations with the Ministry of Environment, Green Development and Tourism and the Ministry of Energy of Mongolia, we have proposed the establishment of the "Programme-Type JCM Administrative Office" under the local government. Furthermore, since it may be difficult to operate the systems for the management of funds and GHG MRV by the private sector along in the initial stage of the project, we envisage that the Administrative Office also provides administrative and management support for them. In addition, we are in agreement with the Ministry of Environment, Green Development and Tourism and the Ministry of Energy of Mongolia that in order to prevent the Administrative Office's arbitrary action, the Steering Committee consisting of ministries and agencies of the local government will be established and the Steering Committee will approve any final decisions.

The project implementation processes are as follows:

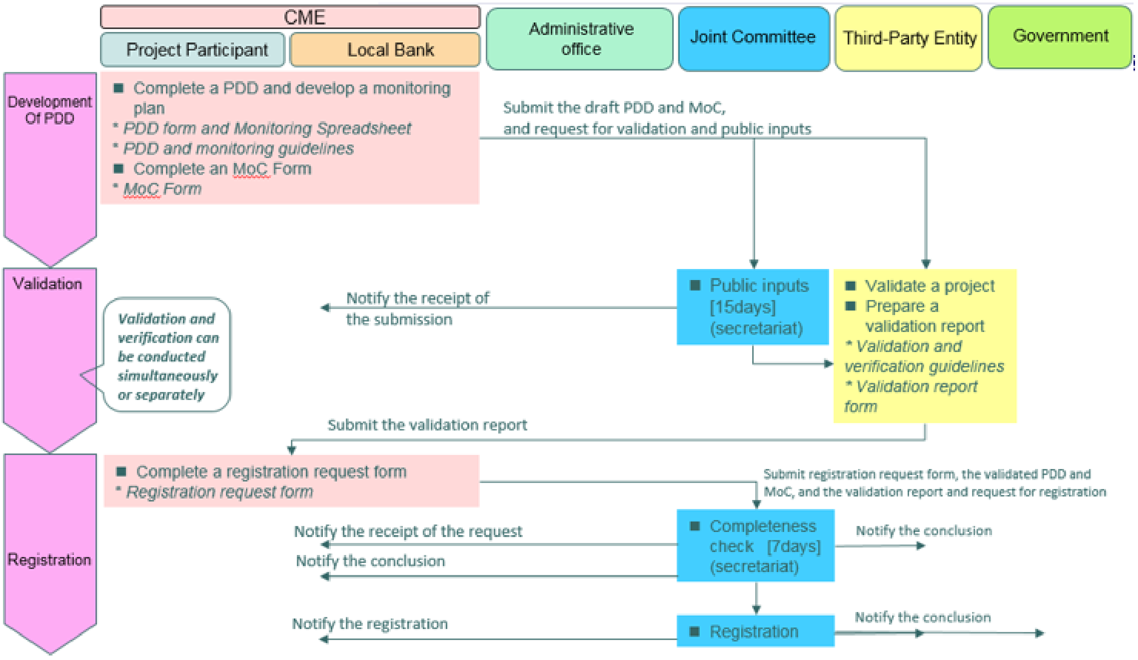
< 1 >Process for Development and Approval of the Methodology



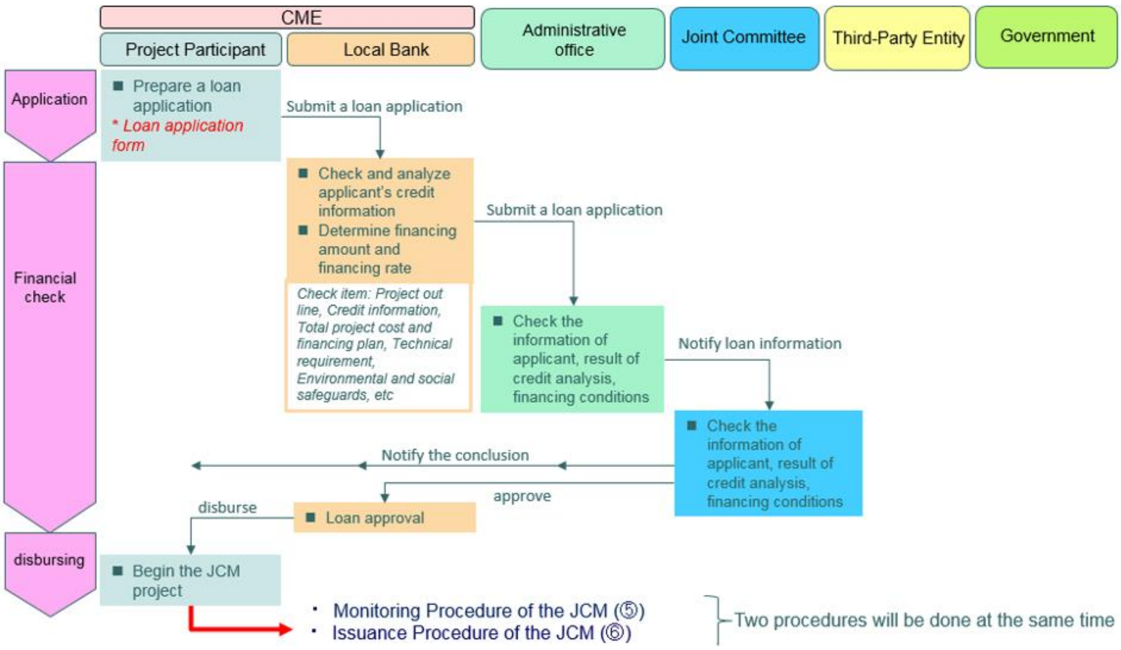
< 2 >Pre-Check of the JCM Procedure



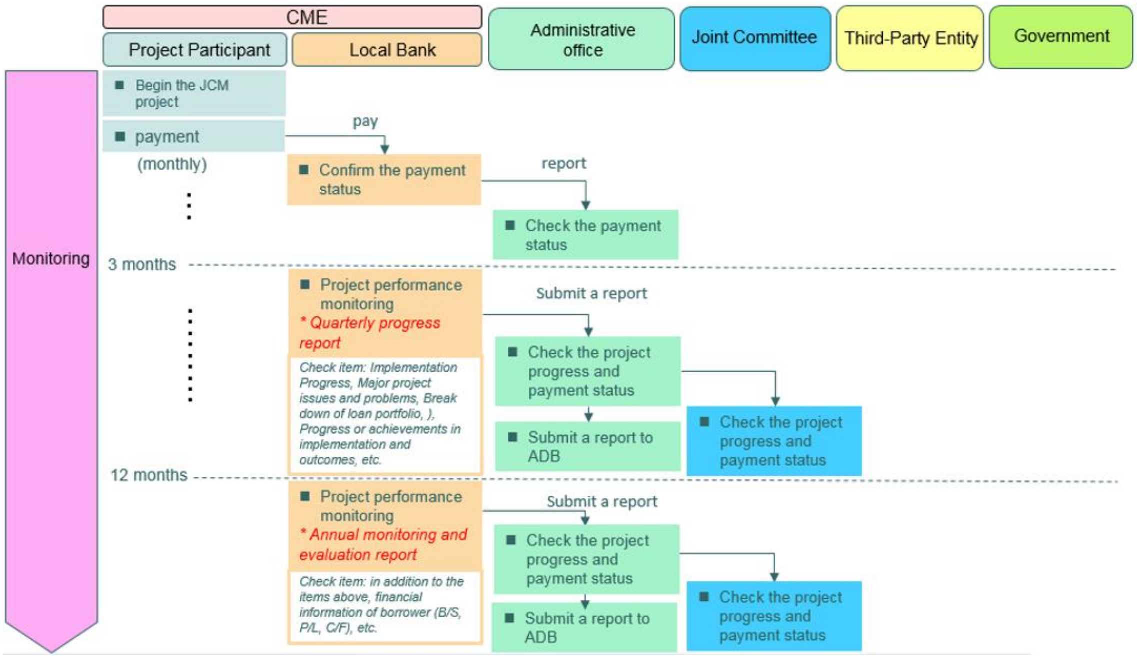
＜ 3 ＞Registration Procedure of the JCM



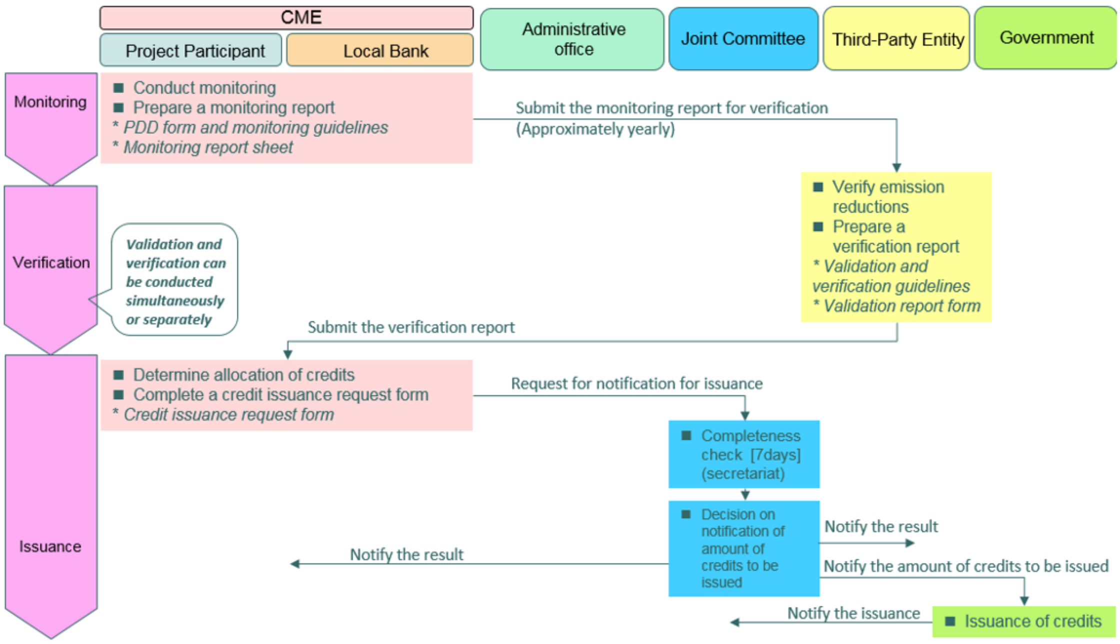
＜ 4 ＞ Credit Check for the Participation in JCM Projects



＜ 5 ＞Monitoring Procedure of the JCM



＜ 6 ＞Credit Issuance Procedure of the JCM



Next, the structure plans for MRV of GHG emissions and fund management are described below as specific examples for (a) Greater efficiency of transformers owned by the private sector and (b) Introduction of photovoltaic power generation equipment, two of the subject technologies selected in this Study.

(a) Greater efficiency of transformers owned by the private sector

The ratio between state-owned transformers of Ulaanbaatar Electricity Distribution Network Company and transformers owned by the private sector located around Ulaanbaatar stands roughly at four to six. The "Feasibility Study on Project Formation for Power Generation and Power Transmission and Distribution in Ulaanbaatar, Mongolia, and Horizontal Development to Other Urban Power Systems" being conducted separately covers the renewal of state-owned transformers. As the implementation of two projects makes it possible to improve both state-owned and private-sector power distribution equipment across Ulaanbaatar, the Ministry of Environment, Green Development and Tourism and the Ministry of Energy of Mongolia are displaying their willingness to proactively carry out the projects.

Unlike transformers owned by Ulaanbaatar Electricity Distribution Network Company, transformers in the private sector have different users, making it difficult to manage them, and there are strong needs for the programme-type JCM with the potential for the unified operation of a large number of projects. More specifically, we are proposing the management under the following scheme.

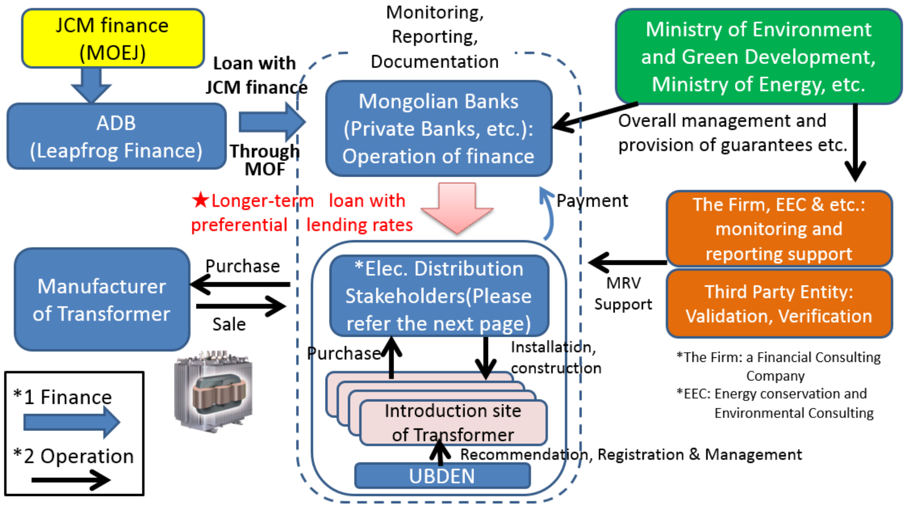


Figure 7　Implementation Structure Plan for Introduction of Transformers

In Mongolia, when building owners and developers introduce transformers to buildings they own, installation and construction work is usually left entirely up to constructors under EPC contracts (construction work service contracts for construction projects, including engineering, procurement and construction). In these cases, constructors undertake most of necessary services, from the procedure to apply for installation of transformers to the government to the selection and delivery of relevant equipment (depending on types of equipment to be introduced, companies that design equipment for power transmission and distribution may also participate). Therefore, we assume that not only building owners and developers but also constructors function as an organization of project participants in the programme-type JCM. Even private-sector power distribution equipment needs to be registered with and controlled by the government. The state-owned power distribution network company under the aegis of the Ministry of Energy desires to manage transformers owned by the private sector, which account for 60% of the total number of transformers installed, for the stability of electric power supply. Specifically, the distribution network company's control measures include the recommendation to the private sector of high-quality specifications of power distribution equipment, such as highly-efficient transformers, management of the number of registered transformers, and management of the distribution network information management system (DNIMS) under consideration for future introduction. The participation of the distribution network company in the project should help it become the programme-type JCM and also makes MRV of GHG emissions easier in terms of data collection. Who should serve as the CME is to be ultimately decided by project participants. Optimally, if either a local bank, an ESCO-implementing business operator, a power distributor or the state-owned distribution network company takes up the CME role, we believe, the project can be facilitated more easily than cases where individual participants manage the project and implement MRV of GHG emissions.

(b) Introduction of photovoltaic power generation equipment

Mongolia has longer hours of sunshine than Japan. Mongolia also has better conditions for the conversion efficiency of solar panels due to cold weather. The World Bank has already implemented the grant project to provide small solar panels to non-electrification areas. But this project has been completed, and the Mongolian government intends to further spread the use of renewable energy. The country's National Renewable Energy Program, which was formulated in 2005, has the target of raising the share of renewable energy to 20-25% by 2020.

As the Mongolian government considers it desirable to manage the impact of increased use of renewable energy on the power system and the diffusion of the use of renewable energy by implementing the programme-type JCM capable of the unified operation of a large number of projects, instead of business operators individually managing each unit of solar panels. Specifically, we are proposing the operation of solar panels under the following schemes.

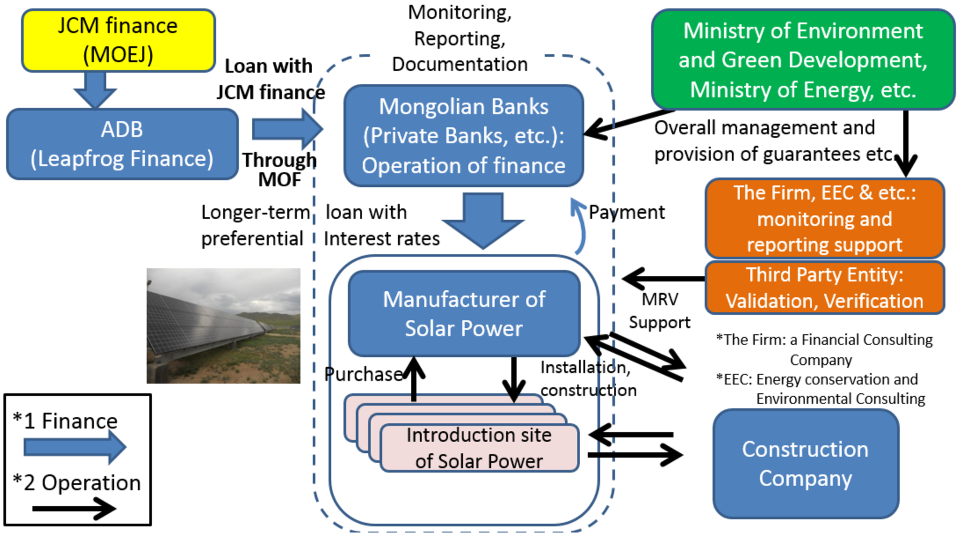


Figure 8 Implementation Structure Plan for Introduction of Solar Panels (1)

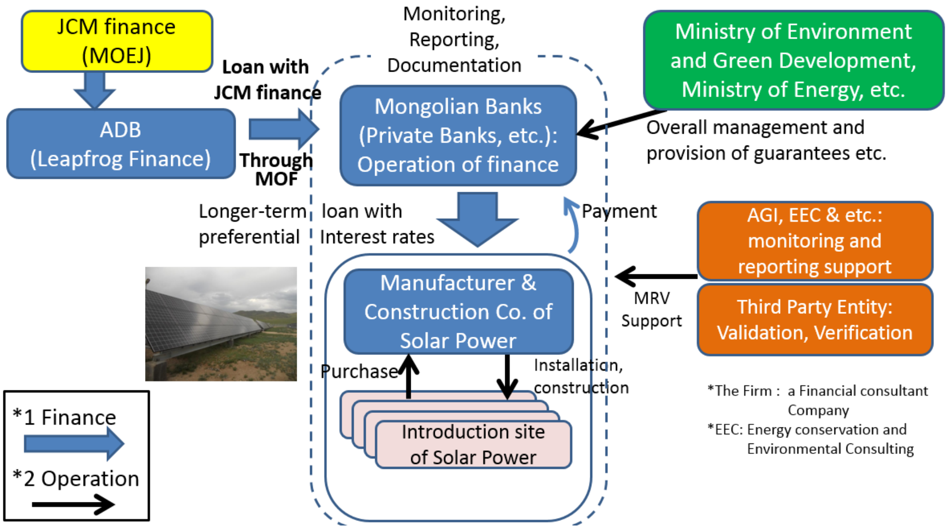


Figure 9 Implementation Structure Plan for Introduction of Solar Panels (2)

As a result of our Study, we found that although Mongolia purchases products manufactured by other countries, there are domestic manufacturers of photovoltaic power generation equipment and the country has the supply system for good-quality equipment in place. It is also important to thoroughly manage maintenance services, etc., in order to avoid occurrences of flaws and defects in equipment to be introduced under the program. As Mongolian manufacturers are capable of satisfying these requirements, we are proposing the programme-type JCM with the participation of manufacturers in order to reduce technical risks in the program.

If we can make regular maintenance as the condition for the project, we can substantially reduce the probability of flaws and defects occurring in equipment. This program's capability to reduce technical risks should lead to the participation by wide-ranging business operators and local banks, etc. Who should serve as the CME is to be ultimately decided by project participants. Optimally, if either of a local bank, an ESCO-implementing business operator, a power distributor or the state-owned distribution network company takes up the CME role, we believe, the project can be facilitated more easily than cases where individual participants manage the project and implement MRV of GHG emissions. As for projects involving the possibility of power selling, one of project participants is required to obtain a license for the power selling business.

Following is the proposed methodology and PDD of three listed technologies, including transformer, solar panel and inverter.

(2) MRV methodology and the monitoring structure

・**Joint Crediting Mechanism Proposed Methodology For Transformer**

Cover sheet of the Proposed Methodology Form

Form for submitting the proposed methodology

Host Country	Mongolia
Name of the methodology proponents submitting this form	Overseas Environmental Cooperation Center, Japan
Sectoral scope(s) to which the Proposed Methodology applies	Sectoral Scope : 2, Energy distribution
Title of the proposed methodology, and version number	Installation of Energy Efficient Transformers (IEET) Ver.1
List of documents to be attached to this form (please check):	☐The attached draft JCM-PDD: ☐Additional information
Date of completion	19, Feb. 2015

History of the proposed methodology

Version	Date	Contents revised
1.0	19, Feb. 2015	First edition

A. Title of the methodology

Installation of Energy Efficient Transformers (IEET) Ver.1.0

B. Terms and definitions

Terms	Definitions
Grid	A distribution grid is the portion of the electric system that is dedicated to delivering electric energy to the end-users. It delivers power at medium voltage levels (less than 35 kV).
Applicable boundary	If the Grid consists of several service areas of Power

	Companies (PCs) which is connected each other's as one Grid, the applicable boundary is the same of service areas of PC, and each boundary is treated as a different project.
No-load loss	No-load loss is a loss due to transformer core magnetizing or energizing. The loss occurs whenever a transformer is energized and remain constant regardless of the amount of electricity flowing through it.
Load loss	Load loss is a loss due to resistance in the electrical winding of the transformer.
Reference Transformer	It is a transformer with Reference Loss which is the values specified as mandatory requirement of the latest Tender Specification specified by PC. If no mandatory requirement, it is calculated as per the procedure defined that the transformers currently connected and used in an applicable boundary of the Grid during the most recent three years and which has factory test data of both No-load losses and Load losses, and selected with No-load losses within Top 20%.
Project Transformer	It is a transformer specified as the high efficient transformer for replacement of existing lower-efficiency transformers in an applicable boundary of the Grid; or for new installation of high efficiency transformers in the new areas covered by expansion of an applicable boundary of the Grid.
Performance level	It is certified maximum level of load and no-load losses for transformers installed in the Grid, which is provided in accordance with IEC 60076 as International Standard.
Type of transformer	The type of transformer for the purpose of this methodology is defined by its capacity (kVA) and transformation ratio.

C. Summary of the methodology

Items	Summary
GHG emission	Reduction of No-load loss by ;

reduction measures	(1) installation new Project Transformers in the new areas covered by expansion of the Grid, or (2) adoption of Project Transformers in the replacement of Reference Transformers on such as a faulty case within the Grid
Calculation of reference emissions	Calculation of GHG emission due to No-load loss of Reference Transformer.
Calculation of project emissions	Calculation of GHG emission due to No-load loss of Project Transformer.
Monitoring parameters	This monitoring methodology requires the monitoring of the following items to complete project emission calculations: 1. When the Project Transformers installed; • Load and No-load loss rate (W) of Project Transformers; • Specifications of each Project Transformers installed (date of installation, technical data); 2. At the time of end of fiscal year; • Latest CO_2 emission factor (tCO_2/MWh) of the Grid published by Authority; • Blackout rate of the Grid during the year '*y*' (%); • The number of transformers which are installed and in operation. (i.e. consider the number of Project Transformers removed since installed). All data collected as part of monitoring are archived electronically and kept until the end of monitoring period.

D. Eligibility criteria

This methodology is applicable to projects that satisfy all of the following criteria.

Criterion 1	Replacement of Reference Transformer with Project Transformer in the Grid, or Installation of new Project transformer in the new areas covered by expansion of the Grid where in the absence of the Reference Transformer installed.
Criterion 2	No-load loss of Project Transformers is lower than that of Reference Transformers, and; Load loss of Project Transformers is not higher than that of Reference Transformers.
Criterion 3	Project Transformers installed comply with in accordance with IEC 60076 as a national / international QA/QC standards. The certification report includes

	information on the measured performance levels for load loss and no-load loss as per Standard and in addition, the associated uncertainty.
Criterion 4	A complete list of co-ordinates uniquely identifying each Project Transformers.
Criterion 5	No-load loss and Load-loss are specified as mandatory requirement of the latest Tender Specification specified by PC. If no mandatory requirement, these losses are calculated as per the procedure defined by the transformers currently connected and used in an applicable boundary of the Grid during the most recent three years and which has factory test data of both No-load loss and Load loss.

E. Emission Sources and GHG types

Reference emissions	
Emission sources	GHG types
Fossil fuel power plants in the grid	CO_2
Project emissions	
Emission sources	GHG types
Fossil fuel power plants in the grid	CO_2

F. Establishment and calculation of reference emissions

F.1. Establishment of reference emissions

The IEET JCM project aims to install high energy efficient transformers across the Grid. This also involves an adoption of the energy efficient transformers in the replacement of the inefficient and faulty existing transformers within the applicable boundary of the Grid.

The major source of GHG emissions arise from the power plants for the generation of electricity. A JCM project intends to reduce GHG emissions by implementing energy efficient transformers.

Transformer losses

Losses in distribution transformers are classified as follows:

- Load loss: It is also called coil loss. It is a loss due to resistance in the electrical winding of the transformer. Load loss is generated by the square of the load current and therefore increase with an increase in transformer loading. They represent the greatest portion of the total losses when a transformer is heavily loaded.

・No-load loss: It is also called core loss. It is a loss due to transformer core magnetizing or energizing. No-load loss is generated whenever a transformer is energized and remain constant regardless of the amount of electricity flowing through it. It represents the greatest portion of the total losses when the transformer is lightly loaded.

For the purposes of claiming certified emission reductions as "Reference Emission" is considered by the following manners for satisfying the requirement of below the "BaU" and "Conservativeness".

1. Reference No-load loss is selected and specified as mandatory requirement (values) of the latest Tender Specification specified by PC which reflected the requirement of applying the latest technology. If no mandatory requirement, it is calculated as per the procedure defined by the transformers currently connected and used in an applicable boundary of the Grid during the most recent three years and which has factory test data of No-load loss and selected with the values within Top 20%.

A. Project No-load loss is selected as parameter fixed ex ante at the start of JCM project and keep through the monitoring period of project activity.

B. *"UNC"* (Maximum allowable uncertainty for the no-load losses stated in the certification report in accordance with IEC 60076 as International QA/QC standards) is applied to only the calculation of project emission for satisfying the requirement of "Conservativeness".

F.2. Calculation of reference emissions

The reference emissions, (RE_y), in a year '*y*' are given by:

$$RE_y = \sum_{k=1}^{n} \left(NLL_{RL,k} \times n_{k,y} \right) \times MP \times (1 - Br) \times EF_{CO2,grid,y} \times 10^{-6} \quad (1)$$

Where:

RE_y	=	Reference emissions in year '*y*' (tCO_2/year)
k	=	Index 'k' represents type of Project Transformers installed
$NLL_{RL,k}$	=	No-load loss rate of the transformer type 'k' that would have been installed by the end of the year '*y-1*'. No-load loss rate for each Reference Transformer type 'k' is determined individually,

as given in F.2. equation 2 (W)

MP	=	Duration of each year (hours)
Br	=	Black out rate of each year (%)
$EF_{CO2,grid,y}$	=	CO_2 emission factor of the grid for year 'y' published by Authority (tCO_2/MWh) .
$n_{k,y}$	=	Cumulative number of type 'k' transformers installed at the end of year 'y-1'

Procedure to estimate Reference no-Load Loss ($NLL_{RL,k}$)

Reference Loss: $NLL_{RL,k}$ is the values specified as mandatory requirement of Tender Specification specified by PC. If no mandatory requirement, it is calculated as per the procedure defined as follows:

$$NLL_{RL,k} = \{NLL_{AVG,k}\} \qquad (2)$$

Where:

$NLL_{AVG,k}$ = Average of no-load loss of Reference Transformers measured at the time of pre-delivery inspection by the manufacturers of all k type of transformers whose performance is among the top 20 % during the most recent three years (W)

Procedure to calculate $NLL_{AVG,k}$:

(i) List all transformer type k installed in the Grid during the most recent three years (N);

(ii) Order the transformers from least to highest No-Load Losses, the No-Load Losses as defined by the manufacturer's performance level specification;

(iii) Take the first 20% (0.2N) of all Reference Transformers from the order arrived at in (ii) and average them.*Note

*Note:

UNFCCC's CDM "SB Guidelines (EB 66 Report Annex 49)" specifies that in the case of a lack of accuracy, the average values of the top 20% of data can be used as a conservative approach.

Therefore, the same calculation is applied as a conservative calculation.

G. Calculation of project emissions

Project Emissions

The project emissions PE_y in a year *y* is given by:

$$PE_y = \sum_{k=1}^{n} \left[(1+UNC) \times NLL_{PR,k,y} \times n_{k,y} \times MP \times (1-Br) \times EF_{CO2,grid,y} \times 10^{-6} \right] \quad (3)$$

Where:

PE_y	=	Project emissions in year '*y*' (tCO_2/year)
k	=	Index 'k', type of Project Transformer, installed at the end of year 'y-1'
$NLL_{PR,k,y}$	=	No-load loss rate of Project Transformers which will have been installed by the end of the year '*y-1*' (Watts)
MP	=	Duration of each year (hours)
Br	=	Black out rate of each year (%)
$EF_{CO_2,grid,y}$		CO_2 emission factor of the grid for year 'y' published by Authority (tCO_2/MWh).
UNC	=	Maximum allowable uncertainty for the no-load losses stated in the certification report in accordance with IEC 60076 as a national / international QA/QC standards. Since *UNC* is applied to only the calculation of project emission, a conservativeness can be kept by the value of *UNC*.
$n_{k,y}$	=	Total cumulative number of type 'k' Project Transformers installed at the end of year 'y-1'

H. Calculation of emissions reductions

Emission reductions

Emission reductions are calculated as follows:

$$ER_y = RE_y - PE_y \quad (4)$$

Where:

ER_y	=	Emission reductions during the year *y* (tCO_2/year)

RE_y	= Reference emissions during the year y (tCO_2/year)
PE_y	= Project emissions during the year y (tCO_2/year)

I. Data and parameters fixed *ex ante*

The source of each data and parameter fixed *ex ante* is listed as below.

Parameter	Description of data	Source
$NLL_{RL,k}$ or $NLL_{AVG,k}$	$NLL_{RL,k}$ is the values specified as mandatory requirement of Tender Specification specified by PC. (W) If no mandatory requirement, $NLL_{AVG,k}$ is calculated as per the procedure defined as follows: Average of no-load loss provided by the manufacturers of all k type of transformers installed in the Grid whose performance is among the top 20 % of their type during the most recent three years. It is selected as parameter fixed *ex ante* at the start of JCM project and fixed through the monitoring period of project activity. (W)	• No-load-loss specified as mandatory requirement of the latest Tender Specification specified by PC. • Specifications or Test certificate supplied by manufacturers at the time of pre-delivery inspection. • Parameter fixed *ex ante* at the start of JCM project.
$NLL_{PR,k,y}$	No-load loss of Project Transformer is selected as parameter fixed ex ante at the start of JCM project. (W)	• Manufacturer's performance test report which measured at the time of pre-delivery inspection. • Parameter fixed *ex ante* at the start of JCM project.
$LL_{RL,k}$	Load loss of Reference Transformer type 'k' that would have been installed in the Grid is selected as parameter	There are two sources of information: 1. Local, national legislation

	fixed ex ante at the start of JCM project and fixed through the monitoring period of project activity. (W)	for transformer performance levels; 2. Information provided by the manufacturer as Test certificate.
UNC	Maximum allowable uncertainty for the no-load losses stated in the certification report provided by an accredited entity.	The value of 15% is applied in accordance with IEC 60076 as a national / international QA/QC standards.

- **Joint Crediting Mechanism Project Design Document for Tansformer**

A. Project description

A.1. Title of the JCM project

Installation of Energy Efficient Transformers (IEET) in Private Sector 11kV of Grid of UBEDN(Ulaanbaatar Electricity Distribution Network Company)

A.2. General description of project and applied technologies and/or measures

The IEET JCM project aims to install high energy efficient transformers across national electricity distribution grids. This may also involve adoption of the energy efficient transformers in the replacement of the inefficient and faulty existing transformers within the geographical boundary of Ulaanbaatar capital city of Mongolia.

The energy efficient transformer that will be implemented on JCM project will reduce the primary voltage of the electric distribution system down to the utilization voltage serving the customer. A transformer is a static device constructed with two or more windings used to transfer alternating current electric power by electromagnetic induction from one circuit to another at the same frequency but with different values of voltage and current. The following diagram depicts the general electricity generation, generation and distribution processes.

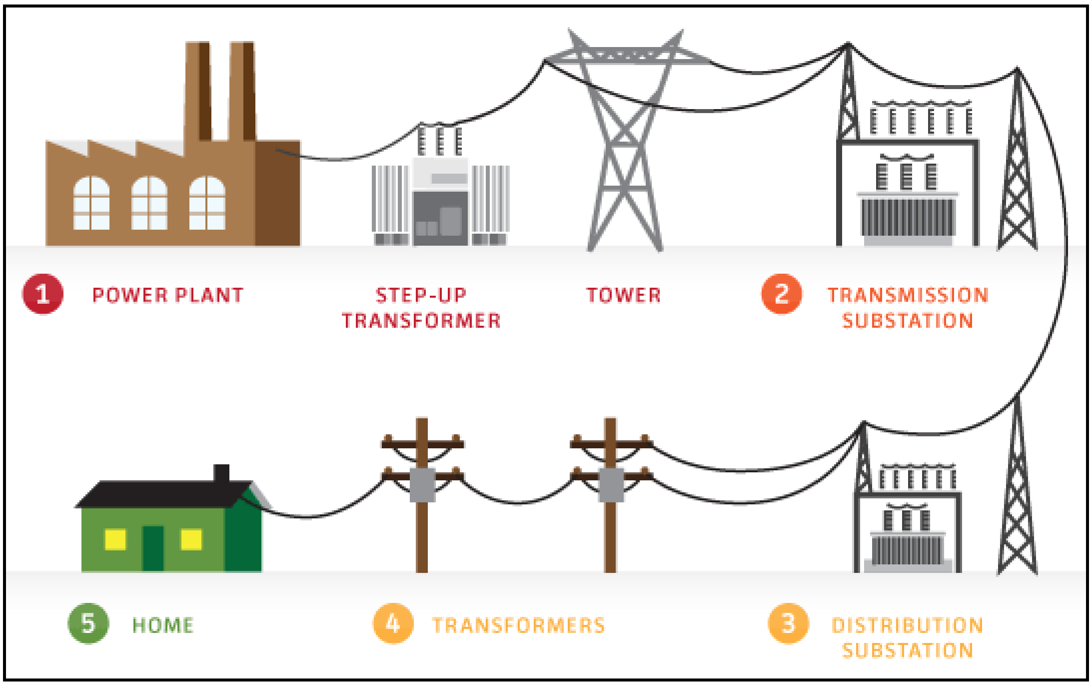


Figure A.2.1: The electricity generation, transmission and distribution process.

The major source of GHG emissions arise from the power plants (number 1 as shown in the above figure) for the generation of electricity. A JCM project would intend to reduce GHG emissions by implementing energy efficient tranformers. The transformers that the JCM project will implement or replace are those located between the distribution substation and the home (number 4 as shown in the above figure).

Transformer losses

Transformers aren't perfect devices; they don't convert 100% of the energy input to useable energy output. The difference between the energy input and that which is available on their output is quantified in losses. Losses in distribution transformers are classified as follows:

- **Load losses:** Also called coil losses. These are losses due to resistance in the electrical winding of the transformer. These losses include eddy current losses in the primary and secondary conductors of the transformer. Load losses are widely a function of the square of the load current and therefore increase with an increase in transformer loading. They represent the greatest portion of the total losses when a transformer is heavily loaded.
- **No-load losses:** Also called core losses. These are losses due to transformer core magnetizing or energizing. These losses occur whenever a transformer is

energized and remain constant regardless of the amount of electricity flowing through it. They represent the greatest portion of the total losses when the transformer is lightly loaded.

For the purposes of claiming certified emission reductions only no-load losses will be considered.

Facilities, systems and equipment in operation prior to the implementation of the JCM project.

Facilities, systems and equipment in operation prior to the implementation of the JCM project such as substations, electricity poles will remain the same after implementation of the JCM project. The JCM project introduces equipment (i.e. transformers) that is more energy efficient than the transformers in operation prior to the implementation of the JCM project.

Technology/standards and specifications/identification

Transformers installed by the JCM project may be supplied to the JCM project implementers via a number of manufacturers/suppliers and will be subject to the following conditions:

- Be distribution transformers only/ transformers be installed on distribution grid only;
- Load losses, at rated load, will be demonstrated to be equal or lower than the load losses in transformers that would have been installed in absence of the JCM project;
- The transformers installed in the JCM project will comply with and demonstrated using national / international QA/QC standards;
- Project transformers will be identifiable within the JCM project's management information system.

A.3. Location of project, including coordinates

Country	Mongolia
Region/State/Province etc.:	Ulaanbaatar capital
City/Town/Community etc:	Ulaanbaatar
Latitude, longitude	

A.4. Name of project participants

Mongolia	UBEDN(Ulaanbaatar Electricity Distribution Network Company)
Japan	Industrial Electrical Equipment Company

A.5. Duration

Starting date of project operation	April. 1, 2016
Expected operational lifetime of project	March. 31, 2021(7years as 1st period), and 3 times of period and max.28 years

A.6. Contribution from developed countries

To be informed later.

B. Application of an approved methodology(ies)

B.1. Selection of methodology(ies)

Selected approved methodology No.	TBD
Version number	TBD

B.2. Explanation of how the project meets eligibility criteria of the approved methodology

Eligibility criteria	Descriptions specified in the methodology	Project information
Criterion 1	Replacement of Reference Transformers with Project Transformer in the Grid, or Installation of new Project transformers in the new areas covered by expansion of the Grid where in the absence of the project, Reference Transformers would have been installed.	OK, Confirmed
Criterion 2	No-load loss of Project Transformers is lower than that of Reference Transformers, and; Load loss of Project Transformers is not higher than that of Reference Transformers.	OK, Confirmed
Criterion 3	Project Transformers installed comply with in accordance with IEC 60076 as a national / international QA/QC standards. The certification report includes information on the measured performance levels for load losses and no-load losses as per Standard and in addition, the associated uncertainty.	OK, Confirmed
Criterion 4	A complete list of co-ordinates uniquely identifying each Project Transformers.	OK, Confirmed

Criterion 5	No-load loss and Load-loss loss are specified as mandatory requirement of the latest Tender Specification specified by PC. If no mandatory requirement, these losses are calculated as per the procedure defined that the transformers currently connected and used in an applicable boundary of the Grid during the most recent three years and which has factory test data of both No-load losses and Load losses.	OK, Confirmed in accordance with IEC 60076-

C. Calculation of emission reductions

C.1. All emission sources and their associated greenhouse gases relevant to the JCM project

Reference emissions	
Emission sources	GHG type
Fossil fuel power plants in the grid	CO2
Project emissions	
Emission sources	GHG type
Fossil fuel power plants in the grid	CO2

C.2. Figure of all emission sources and monitoring points relevant to the JCM project

This monitoring methodology requires the monitoring of the following items to complete project emission calculations:

- Load and No-load loss rate (W) of energy efficiency transformers installed by the project activity;
- Specifications of each high-efficiency transformer installed by the project activity (date of installation, localization, technical data);
- CO_2 emission factor (tCO_2/MWh) of the grid;
- Yearly blackout rate of the grid during the year '*y*' (%);
- The number of transformers which are installed in the project activity and are in operation. (i.e. consider the number of high-efficiency transformers removed since installed).

All data collected as part of monitoring should be archived electronically and be kept at least for 2 years after the end of the last crediting period. 100% of the data should be monitored if not indicated otherwise in the tables below. All measurements should be conducted with calibrated measurement equipment according to relevant industry standards.

C.3. Estimated emissions reductions in each year (4years)

11kV replacement and addition to Grid

Year	Estimated Reference emissions (tCO_{2e})	Estimated Project Emissions (tCO_{2e})	Estimated Emission Reductions (tCO_{2e})
2017	8,741	2,214	6,527
2018	8,741	2,214	6,527
2019	8,741	2,214	6,527
2020	8,741	2,214	6,527
Total (tCO2e)	34,964	8,858	26,106

D. Environmental impact assessment

D. Legal requirement of environmental impact assessment for the proposed project

SECTION D. Environmental impacts

D.1. Level at which environmental analysis is undertaken

Environmental analysis of IEET JCM Project has been done.

Justification:

The design document of the JCM Project describes virtually every procedure regarding governance of all the JCM Projects and includes:

- Installation
- Replacements
- Identification
- Scrapping
- Role of entities, etc.

In addition, JCM Projects may be implemented in almost identical environments targeting identical baselines. In this regard, it is reasonable that the environmental analysis of IEET JCM Project be undertaken.

D.2. Analysis of the environmental impacts

The IEET JCM Project involves the installation of energy efficient distribution transformers across electricity distribution grids and scrapping of all of the replaced existing transformers. This documentation takes into account that in the absence of this JCM Project, replaced worn out transformers will be taken for refurbishment and returned back to operation in the same sites or elsewhere.

Air pollution

There is no problem of electric insulation oil leakage for both exsiting and the project transformers. The electric insulation oil obtained from the process of scrapping the existing transformers does not contain polychlorobiphenyl and is non-volatile and can be recycled after disposal. The implementation of the IEET JCM Project saves electricity, consequently reducing green-house gases released during generation of the same amount of electricity by fossil fuel based grid-connected power plants. The tools used during the exchange of distribution transformers produce negligible emissions.

Waste water

Installation of energy efficient transformers will not involve the discharge of wastewater. Distribution transformers are scrapped into four kinds of waste: electric insulation oil, waste aluminum coil, waste iron core and oil tanks. The process of scrapping will be undertaken by accompany that satisfies the requirements laid down by the CME, and is to involve no wastewater discharge.

Noise

There is no obvious, excessive noise generated during the process of the installation of distribution transformers.

Solid waste

The solid waste from the project activity is the replaced faulty transformers. No other solid waste will be generated during the process of installing the energy efficient transformers as well as during scrapping of the replaced transformers.

Solution

JCM Project implementers will put in place an Environmental Management Plan which will be in line with regulations stipulated under relevant local environment management authority guidelines.

Ecological environment

Implementation of the activities under IEET JCM Porject - i.e. installation and scrapping - will not affect the ecological environment by way of, among others, deforestation or new road reserves, around transformer locations.

Conclusion

Generally, the proposed project activity does not have an obvious negative effect on the environment on the whole. There are many beneficial effects such as reduced dependence on fossil fuels for electricity generation, increased access to grid electricity etc. Therefore the project will have positive impact on the environment.

D.3. Environmental impact assessment

As stated on E.2 above, an EIA is not required for JCM Projects in the country of Mongolia, as activities under the IEET JCM Project are not in the second schedule of the Environmental Management that require an Environmental

Impact Assessment (EIA)

E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

SECTION E. Local stakeholder comments

E.1. Solicitation of comments from local stakeholders

Local stakeholder consultation of IEET JCM Project has been done.

Justification

All JCM Projects are implemented in almost similar environments targeting similar baseline features. It is therefore anticipated that there will be no significant social impact variations within the individual CPAs and hence it is reasonable to invite local stakeholder comments on IEET JCM Project.

On 21March, xxx, and yyy 2014 a JCM Project stakeholder consultation meeting was held in Ullanbataar, Mongolia to receive further comments and inputs from various groups of stakeholders

E.2. Summary of comments received

Table E.2.1 Stakeholder comments received.

	Stakeholders	Comments Received
1.	TBD	
2.	TBD	

E.3. Report on consideration of comments received

Table E.3.1: Responses to stakeholder comments.

No.	Question	Response
1.	TBD	
2.	TBD	
3.	TBD	

SECTION E. Approval and authorization

IEET JCM Project has received a Approval from the National Environment Management Authority (NEMA), the Mongolian Designated National Authority (DNA) and UBEDN(Ulaanbaatar Electricity Distribution Network Company) is the authorized Coordinating/Managing Entity (CME) of the JCM Project.

E.2. Summary of comments received and their consideration

Stakeholders	Comments received	Consideration of comments received
TBD		
TBD		

F. References

Appendix 4. Further background information on ex ante calculation of emission reductions

Reference lists to support descriptions in the PDD, if any.

Annex

Appendix 4-1. Number of Replaced/Addition Transformers

11kV Distribution transformers for replacement and addition.(1,389sets/year, 462,099kVA)

kV	kVA	No. of Transformers	Sub-total of Capacity (kVA)
11	63	0	0
	100	0	0
	160	0	0
	250	623	155,788
	400	766	306,311
	630	0	0
	800	0	0
		1,389	462,099

Appendix 4-2. Emission Reductions Spreadsheet

Appendix 4-3. Reference No-load Loss as Top20% and Project loss

Type of Transformers (kVA)	NLLRL (W)	NLLPR (W)
63	194	50
100	276	75
160	359	97
250	529	123
400	751	160

	630	1118	320	
	800	980	412	

Revision history of PDD		
Version	Date	Contents revised
Ver.1	Nov. 14, 2014	

- **Joint Crediting Mechanism Proposed Methodology for Solar PV**

Cover sheet of the Proposed Methodology Form

Form for submitting the proposed methodology

Host Country	Mongolia
Name of the methodology proponents submitting this form	Overseas Environmental Cooperation Center, Japan (OECC)
Sectoral scope(s) to which the Proposed Methodology applies	Sectoral scope(s): 01 Energy industries (renewable-/non-renewable sources)
Title of the proposed methodology, and version number	Solar PV Project in Mongolia, ver. 01.0
List of documents to be attached to this form (please check):	☐The attached draft JCM-PDD: ☐Additional information
Date of completion	14/02/2015

History of the proposed methodology

Version	Date	Contents revised
01.0	14/02/2015	First edition

C. Title of the methodology

Solar PV Project in Mongolia ver. 01.0

D. Terms and definitions

Terms	Definitions
Solar PV project	The project generates renewable energy by converting the solar energy into electricity energy using PV modules, which is made by silicon semiconductor, through photovoltaic effect.

E. Summary of the methodology

Items	Summary
GHG emission reduction measures	Due to the zero emission renewable energy solar PV project, emission reduction is equivalent to the electricity generated by the project.
Calculation of reference emissions	Reference emissions are calculated on the basis of the AC output of the solar PV system(s) multiplied by the conservative emission factor of the captive electricity.
Calculation of project emissions	Project emissions are zero due to the renewable energy project.
Monitoring parameters	Amount of electricity generated by the project

F. Eligibility criteria

This methodology is applicable to projects that satisfy all of the following criteria.

Criterion 1	The solar PV system is connected to the internal power grid of the project site and/or to the grid for displacing grid electricity and/or captive electricity at the project site.
Criterion 2	This methodology is applicable to project activities that install a new solar PV power plant.
Criterion 3	Solar PV Project applies solar PV panels to prevent from unexpected failure or aging degradation of output power in the long term basis from perspective of quality design, factory test before shipment, maintenance program during the operation period. Followings are included in terms of quality capability of applied solar PV panel: ■ Certified by IEC authorized certification entity for design qualifications using the latest version of IEC 61215 and for safety

	qualification using the latest version of IEC 61730-1 and IEC 61730-2 ■Component used for solar PV panel are selected after 5,000 hours aging test for seeking robustness in durability ■At least once a year regular maintenance such as surface cleaning, visual inspection by maintenance engineer available under maintenance contract ■Deterioration rate is guaranteed in a contract as less than 1% a year during 20 service years

G. Emission Sources and GHG types

Reference emissions	
Emission sources	GHG types
Consumption of grid electricity and/or captive electricity	CO_2
Project emissions	
Emission sources	GHG types
None due to renewable energy based system	N/A

H. Establishment and calculation of reference emissions

F.1. Establishment of reference emissions

The reference emissions are the product of electrical energy reference $EG_{RE,y}$ expressed in MWh of electricity produced by the solar PV power generating unit multiplied by the emission factor.

In Mongolia, it is commonly practiced that the fossil-fuel used captive power is also equipped in the case where even the grid electricity service is available. Thus, in the consideration of which emission factor is to use, the CO2 emission factor of the fossil-fuel used for the captive electricity is to select rather than that of the grid because it is smaller. Furthermore, when the solar power becomes in service, the transportation for the fossil-fuel of captive power displace by the solar PV power is inevitably cut down.

In conclusion, the reference emissions are conservatively calculated.

F.2. Calculation of reference emissions

■Calculation of reference emissions

Reference emissions due to electricity consumed during the period of year y, assuming the solar PV plant is not implemented are calculated by the following equation.

$$RE_y = EG_{RE,y} * EF_{RE} \quad (1)$$

Where

RE_y	=	Emission reductions in year y [tCO_2/y]
EF_{RE}	=	The reference CO_2 emission factor of captive electricity [tCO_2/MWh]
$EG_{RE,y,}$	=	Quantity of the electricity generated by the solar PV project as a result of the implementation of the JCM project activity in year *y* [MWh]

I. Calculation of project emissions

Project emissions are zero because the project is renewable energy project activity.

$$PE_y = 0 \quad (2)$$

Where

PE_y	=	Project emissions in year y [tCO_2/y]

J. Calculation of emissions reductions

Emission reductions are calculated by the following equation.

$$ER_y = RE_y - PE_y \quad (3)$$

Where

ER_y	=	Emission reductions in year y [tCO_2/y]
RE_y	=	Reference emissions in year y [tCO_2/y]
PE_y	=	Project emissions in year y [tCO_2/y]

K. Data and parameters fixed *ex ante*

The source of each data and parameter fixed *ex ante* is listed as below.

Parameter	Description of data	Source
EF_{RE}	The reference CO_2 emission factor of captive electricity [tCO_2/MWh]	The most recent value available from CDM approved small scale methodology AMS-I.A. at the time of validation is applied.

- **Joint Crediting Mechanism Project Design Document for Solar PV**

A. Project description

A.1. Title of the JCM project

Solar PV Project in Mongolia, ver.01.0

A.2. General description of project and applied technologies and/or measures

The proposed project is schemed as one of projects under a Program-JCM aiming zero emission renewable energy production by converting the solar energy into electricity energy using PV modules, which is made by silicon semiconductor, through photovoltaic effect in Mongolia.

The project requires introduction of solar panels to maintain high power output level by preventing aging degradation of conversion performance of solar to electricity on the long term basis.

Solar PV panel is to satisfy following conditions to keep high efficiency for contribution of more CO2 emission reduction in its lifetime duration;

■Certified by certification authority

■Capable to provide guarantee for keeping specified efficiency performance on long term basis

■Designed, manufactured and factory tested under the established QMS based on the scheme of ISO9001

■Component selection with own criteria stricter than standard requirement in industry

■Long term field exposure test data available

It is another advantageous aspect to apply solar panels manufactured by Mongolia-based company in terms of frequent effective maintenance for keeping higher performance of panels.

A.3. Location of project, including coordinates

Country	Mongolia
Region/State/Province etc.:	Orhon ayma
City/Town/Community etc:	Erdenet City
Latitude, longitude	N-49°01'40" E-104°02'40"

A.4. Name of project participants

Mongolia	Erdenet Mining Corporation LLC
Mongolia	Solar Power Company

A.5. Duration

Starting date of project operation	dd/mm/yy
Expected operational lifetime of project	20 years

A.6. Contribution from developed countries

The proposed project is financially supported by the ministry of the Environment, Japan through the financing programme for JCM model projects which seeks to acquire JCM credits

Applying high quality solar panels is the key factor for the proposed solar panel project.

There are many solar panel manufacturers these days, especially low cost ones are available manufactured in developing countries. However those supplied by manufacturer in developing countries is, in general, inferior in quality. That is, less availability, less reliability, less serviceability and it results in more maintenance cost and less electricity output.

Solar power company is Mongolian manufacturer with capability of supplying high quality products with strong technical support from Japanese parent company.

Also, it is expected that Japanese government provide its grant for the proposed project because of applying advanced technology based high quality solar system, which can be deemed as another contribution from developed country (Japan).

B. Application of an approved methodology(ies)

B.1. Selection of methodology(ies)

Selected approved methodology No.	TBD
Version number	TBD
Selected approved methodology No.	TBD
Version number	TBD
Selected approved methodology No.	TBD
Version number	TBD

B.2. Explanation of how the project meets eligibility criteria of the approved methodology

Eligibility criteria	Descriptions specified in the methodology	Project information
Criterion 1	The solar PV system is	Erdenet mining corporation need to

	connected to the internal power grid of the project site and/or to the grid for displacing grid electricity and/or captive electricity at the project site.	reduce daily electricity cost due to huge consumption in its production line. The proposed project focus on solar PV power generation to reduce running cost for electricity use from grid or captive electricity line for long distance water supply facilities, such as water supply pumps, lighting and air conditioning in one of four remote small offices.
Criterion 2	This methodology is applicable to project activities that install a new solar PV power plant.	There are 3 remote relay point offices and the target is No.3 relay point office in which five 1.36MW motors are installed and total capacity required is 7MW. Currently required electricity is sourced from the central grid. Solar PV power plant is newly installed for supplying electricity needed for the motors above.
Criterion 3	Solar PV Project applies solar PV panels to prevent from unexpected failure or aging degradation of output power in the long term basis from perspective of quality design, factory test before shipment, maintenance program during the operation period. Followings are included in terms of quality capability of applied solar PV panel: ■ Certified by IEC authorized certification entity for design qualifications using the	The applied solar PV is manufactured in Ulaanbaatar by Solar power company of which parent company of Japanese manufacturer of solar PV panel. Followings are available to submit as evidenced quality capability; ■ Accredited TUV Reinland Certification for design qualifications using the latest version of IEC 61215 and for safety qualification using the latest version of IEC 61730-1 and IEC 61730-2 ■Component selection is done through 5,000hours aging test by “Chemitox” ■The project proponent, company in Mongolia being in easy situation to

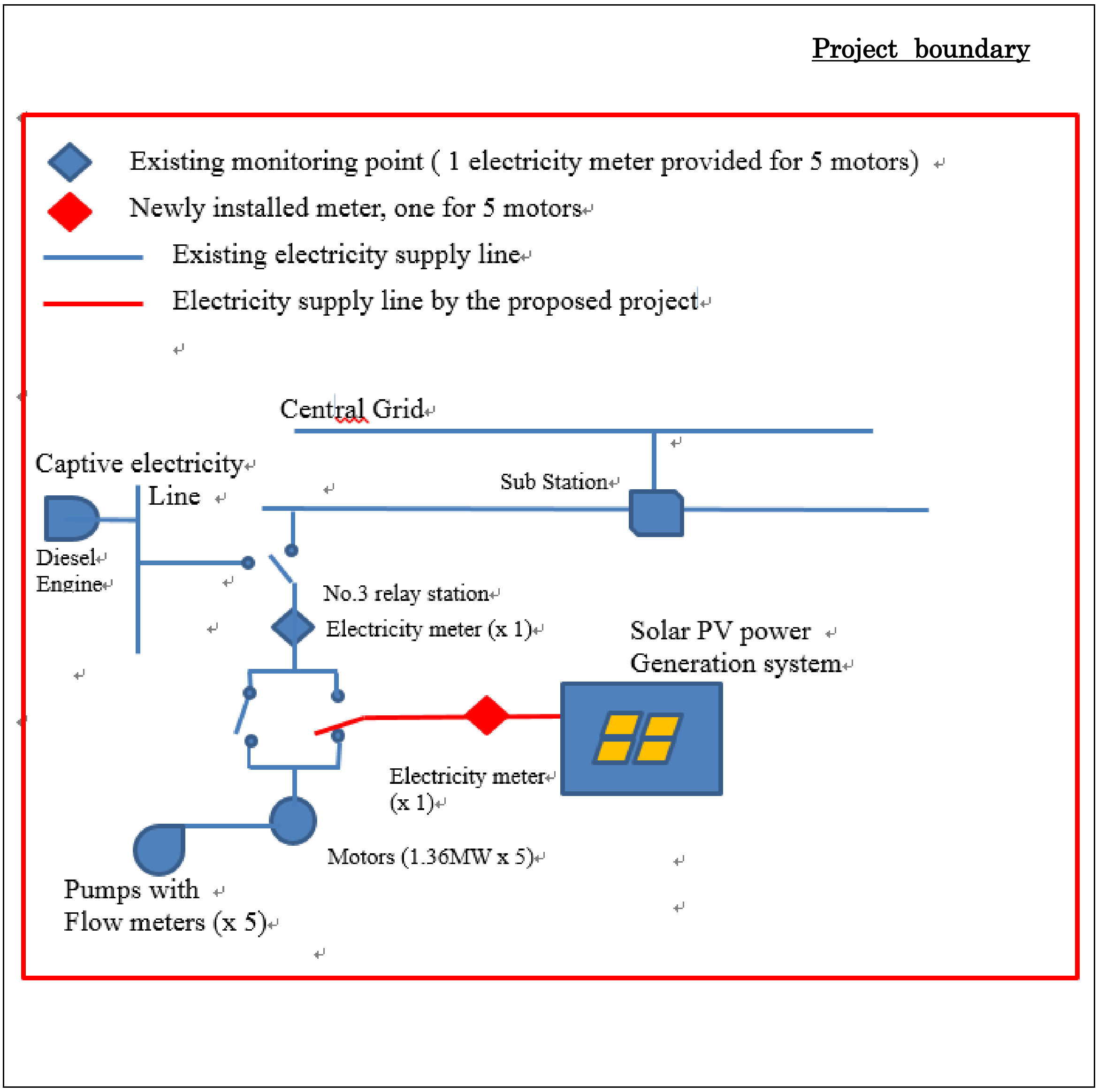
	latest version of IEC 61215 and for safety qualification using the latest version of IEC 61730-1 and IEC 61730-2 ■Component used for solar PV panel are selected after 5,000 hours aging test for seeking robustness in durability ■At least once a year regular maintenance such as surface cleaning, electric circuit testing by maintenance engineer available under maintenance contract ■ Deterioration rate is guaranteed in a contract as less than 1% a year during 20 service years	provide at least once a year regular maintenance ■Once a year regular maintenance for surface cleaning and electric circuit testing by maintenance engineer is accepted under maintenance contract ■ The project proponent's claim for giving guarantee of less than 1% deterioration rate in 20 service years confirmed

C. Calculation of emission reductions

C.1. All emission sources and their associated greenhouse gases relevant to the JCM project

Reference emissions	
Emission sources	GHG type
Consumption of grid electricity and/or captive electricity	CO2
Project emissions	
Emission sources	GHG type
None due to renewable energy based system	CO2

C.2. Figure of all emission sources and monitoring points relevant to the JCM project



■Reference emissions (RE_y)

Total rated power of motors; 6.8MW

Average load factor; 80%

Average yearly electricity consumption from grid; 47,654MWh/y (= 6.8 x 0.8 x 8,760h)

Total Solar Power capacity; 7.2MW

Average yearly insolation hours; 3,000hours

Average yearly actual operation hours (Availability); 1,752hours (20%)

Average yearly power generation; 12,614MWh/y

Average grid electricity saving; 12,614MWh/y

Emission Factor (EF_{RE} = 0.8 tCO_2/MWh)

Therefore,

RE_y = 12,614MWh x 0.8tCO_2/MWh = 10,091tCO_2/y

In Mongolia, it is commonly practiced that the captive power is also equipped in the case where even the grid electricity service is available. Thus, in the consideration of which emission factor is to use, the captive electricity is to select rather than that of the grid because it is smaller. (Emission factor; EF_{Grid} = 1.128 tCO_2/MWh, EF_{RE} = 0.8 tCO_2/MWh)

Accordingly, the reference emissions is conservative.

■Project emissions (PEy)

PEy = 0

■Emission Reduction

REy – PEy = 10,091tCO2

C.3. Estimated emissions reductions in each year

Year	Estimated Reference emissions (tCO_{2e})	Estimated Project Emissions (tCO_{2e})	Estimated Emission Reductions (tCO_{2e})
2013	0	0	0
2014	0	0	0
2015	0	0	0
2016	0	0	0
2017	10,091	0	10,091
2018	9,990	0	9,990
2019	9,890	0	9,890
2020	9,791	0	9,791
Total (tCO_{2e})	39,761	0	39,761

Performance deterioration is assumed 1% per year.

D. Environmental impact assessment	
Legal requirement of environmental impact assessment for the proposed project	No

E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

TBD

E.2. Summary of comments received and their consideration

Stakeholders	Comments received	Consideration of comments received
TBD		

F. References

TBD

Reference lists to support descriptions in the PDD, if any.

Annex

TBD

Revision history of PDD

Version	Date	Contents revised
Ver. 01.0	2015.02.z007A17	First issue

- **Joint Crediting Mechanism Proposed Methodology For Inverter**

Cover sheet of the Proposed Methodology Form

Form for submitting the proposed methodology

Host Country	Mongolia
Name of the methodology proponents submitting this form	Overseas Environmental Cooperation Center, Japan (OECC)

Sectoral scope(s) to which the Proposed Methodology applies	Sectoral scope(s): 03 Energy Demand
Title of the proposed methodology, and version number	**Efficiency improvement of Pumps/Fans by Inverter in Mongolia, ver. 01.0]**
List of documents to be attached to this form (please check):	☐The attached draft JCM-PDD: ☐Additional information
Date of completion	17/02/2015

History of the proposed methodology

Version	Date	Contents revised
01.0	17/02/2015	First edition

・**Joint Crediting Mechanism Proposed Methodology for inverter**

Cover sheet of the Proposed Methodology Form

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List of documents to be attached to this form (please check):	☐The attached draft JCM-PDD: ☐Additional information
Date of completion	17/02/2015

History of the proposed methodology

Version	Date	Contents revised
01.0	17/02/2015	First edition

A. Title of the methodology

Efficiency improvement of Pumps/Fans by Inverter in Mongolia, ver. 01.0

B. Terms and definitions

Terms	Definitions
Inverter	An inverter is an electronic device that changes direct current (DC) to alternating current (AC) and it enables to control process flow like water or air/gas by adjusting motor rotating speed to eventually reduce throttle loss instead of changing opening of flow control valve or damper.
High voltage motor	High voltage motor means motor of which capacity is more than 100kW and voltage is more than 3,000V
Motor facility	Motor facility means pump or fan which is equipment driven by motor.
Motor system	Motor system is a motor facility integrated with motor

C. Summary of the methodology

Items	Summary
GHG emission reduction measures	Reduction of electricity consumption by introduction of inverter for motor speed control instead of valve/damper opening control when reducing output (flow of water or air/gas) of motor facility.
Calculation of reference emissions	Calculation of reference emissions is performed based on the quantity of electricity consumption by motors for driving motor facility (pump or fan) assumed before the introduction of inverter.
Calculation of project emissions	Calculation of project emissions is performed based on the quantity of electricity consumption by motors facilities after introduction of inverters.

Monitoring parameters	1. Output of motor facility such as water, air, gas and so forth 2. Electricity consumed by motor

D. Eligibility criteria

This methodology is applicable to projects that satisfy all of the following criteria.

Criterion 1	Project inverter is either having "Matrix Converter" capability or "3 Level Cascade Multiplexing" capability. The matrix converter (MC) is featured by "Regeneration", "AC-AC Direct Conversion" instead of AC-DC-AC, "Input current THD (Total Harmonic Distortion) less than 7 %" and "Input Power Factor more than 98%". MC is effectively applied to fan motor of which response to speed down demand is made faster overcoming its large inertia as well as enabling energy saving with less throttle losses. MC has also an outstanding feature of 97% efficiency which is exceptionally high performance realized by introducing AC-AC conversion whereas mostly AC-DC-AC. The 3 Level Cascade Multiplexing Inverter (3-level inverter) is featured by 97 % efficiency and 95 % power factor concurrently enabling minimum input harmonic (IEEE519 guideline) and surgeless voltage for AC output. As output wave shape is more close to sine wave, 3-level inverter has advantage for miniaturization or reduction of noise.
Criterion 2	Project inverter is provided with engineering/maintenance support tool for easy parameter tuning and easy access for maintenance with remote terminal unit.
Criterion 3	Targeted motor for the project is an existing and/or newly introduced high voltage motor system so as to enable to control its output (flow of water or air/gas) by adjusting motor rotating speed to eventually reduce throttle loss instead of changing opening of flow control valve or damper.
Criterion 4	Measurement of electricity consumption for inverter controlled motors is recorded at least 1 month interval for past 12 months before project implementation.
Criterion 5	Measurement of output of motor facility is recorded at least 1 month

	interval for past 12 months before project implementation.
Criterion 6	Measurement of electricity consumption of motors by one meter as a group is applicable as far as motor system is same type.
Criterion 7	Measurement of output of motor facility by one meter as a group is applicable as far as driven pumps/fans are same type.

E. Emission Sources and GHG types

Reference emissions	
Emission sources	**GHG types**
Electricity consumption by reference motor	CO_2
Project emissions	
Emission sources	**GHG types**
Electricity consumption by project inverter-coupled motors	CO_2

F. Establishment and calculation of reference emissions

F.1. Establishment of reference emissions

Reference emissions are established under the assumption that the current motor would continue to be used and introduced technology/measures would improve the efficiency.

The reference electricity consumption is calculated using the specific energy consumption (e.g. MWh / m3 or MWh / ton) in the reference multiplied by the output in project year y.

Specific energy consumption (SEC) is defined as “Electricity consumption per unit output of pump or fan expressed in MWh/ton or MWh/m3.”

Then the emission reduction is calculated multiplying the reference electricity consumption in the project year by the emission factor.

In order to make certain of conservativeness for keeping derived emission reductions less than BaU, SEC is calculated as average based on the bottom half of monthly SECs obtained under the condition of normal operation in the year just before the project start.

Also in Mongolia, it is commonly practiced that the fossil-fuel used captive power is also equipped in the case where even the grid electricity service is available. Thus, in the consideration of which emission factor is to use, the CO2 emission factor of the fossil-fuel used for the captive electricity is to select rather than that of the grid when both are available, however at the site where no captive power is available, the CO2 emission factor of the grid is used.

F.2. Calculation of reference emissions

The reference emissions is calculated in the following procedure:

■Calculation of specific energy consumption

The yearly average specific energy consumption in year z before the project start is calculated as follows:

(a) Calculate monthly specific energy consumption for each motor group (i) in each month (k) in year z:

$$SEC_{BP,z,k,i} = EC_{BP,z,k,i}/Q_{BP,z,k,i} \quad (1)$$

(b) Select bottom half (max 6) of $SEC_{BP,z,k,i}$ in each group (i) and calculate its average (= $SEC_{BP,z,i,ABM}$)

Where

$SEC_{BP,z,k,i}$		The specific energy consumption of motor system of group i in month k, in year z (MWh/ton or MWh/m^3) A group is a collection of motor system sharing, functions, schedules, outputs (MWh/ton or MWh/m^3)
$EC_{BP,z,k,i}$	=	Average monthly electricity consumption of motor system group i, in month k, in the most recent year (z) before project start (MWh)
$Q_{BP,z,k,i}$	=	Average monthly quantity of output of the motor system group i in month k, in the most recent year (z) before project start in units of weight or volume (ton or m3)
$SEC_{BP,z,i,ABM}$	=	The yearly average of bottom half of specific energy consumption of motor system of group i (MWh/ton or MWh/m^3) in year z (MWh/ton or MWh/m^3)

■Calculation of reference electricity consumption

The reference electricity consumed for each group (i) is conservatively calculated using yearly average of bottom half of specific electricity consumption per unit of output (MWh/ton or MWh/m3) as given in the above step (b) multiplied by the output in project year y, which is described in the clause F.1.;

$$EC_{RE,y,i} = SEC_{BP,z,i,ABM} * Q_{PJ,y,i} \qquad (2)$$

Total reference electricity consumed for all motor groups are conservatively calculated by the following equation.

$$EC_{RE,y} = \sum_i SEC_{RE,z,i,ABN} * \ Q_{PJ,y,i} \qquad (3)$$

Where

$EC_{RE,y,i}$	=	Reference electricity consumed by motor system of group i in year y (MWh)
$EC_{RE,y}$	=	Reference electricity consumed by all motor system groups in year y (MWh)
$Q_{PJ,y,i}$	=	Annual quantity of output of the motor system group i in year (y) after project start in units of weight or volume (ton or m3)

■Reference emissions calculation

According to the result of calculation (1), (2) and (3) above, reference emissions are given as follows;

$$RE_y = EC_{RE,y} * EF_{elec} \qquad (4)$$

Where

RE_y	=	Total reference emissions in year y(t CO_2)
EF_{elec}	=	CO_2 emission factor for consumed electricity [tCO_2/MWh]

G. Calculation of project emissions

Project emissions for each motor group i is calculated by multiplying the electricity consumption in the project ($EC_{PJ,y,i}$) by the emission factor.
For the calculation of the project emissions, emission factor (EF_{elec}) is used according to the existing electricity provision (both of grid and captive or only grid).
Thus, the project emissions is calculated as below;

$$EC_{PJ,y} = \sum_i EC_{PJ,y,i} \tag{5}$$

Therefore, total project emission is given as follows;

$$PE_y = EC_{PJ,y} * EF_{elec} \tag{6}$$

Where

$EC_{PJ,y,i}$	=	Electricity consumed during the project year y for motor system group i Project emissions during the period of year y for motor group i [MWh/y]
$EC_{PJ,y}$	=	Total electricity consumed during the project year y for all motor system groups Project emissions during the period of year y for motor group i [MWh/y]
PE_y	=	Total project emissions in year y [tCO_2/y]
EF_{elec}	=	CO_2 emission factor for consumed electricity [tCO_2/MWh]

H. Calculation of emissions reductions

Emission reductions are calculated by the following equation.

$$ER_y = RE_y - PE_y \tag{7}$$

Where

ER_y	=	Emission reduction in year y [tCO_2/y]
RE_y	=	Reference emission in year y [tCO_2/y]
PE_y	=	Project emission in year y [tCO_2/y]

I. Data and parameters fixed *ex ante*

The source of each data and parameter fixed *ex ante* is listed as below.

Parameter	Description of data	Source
$EC_{BP,z,k,i}$	Monthly electricity consumption of motor system group i, in month k, in the most recent year (z) before project start (MWh)	Monthly electricity consumption recorded by maintenance staff over the previous year of the project start.
$Q_{BP,z,k,,i}$	Monthly quantity of output of the motor system group i in month k, in the most recent year (z) before project start in units of weight or volume (ton or m3)	Monthly output for pump or fan recorded by maintenance staff over the previous year of the project start.
EF_{elec}	CO2 emission factor for Mongolian central grid or captive power, from which electricity is displaced due to the project	[Grid electricity] The most recent value available at the time of validation is applied and fixed for the monitoring period thereafter. The data is sourced from CDM Mongolia unless otherwise instructed by the Joint Committee. [Captive electricity] CDM approved small scale methodology: AMS-I.A.

- **Joint Crediting Mechanism Project Design Document For inverter**

A. Project description

A.1. Title of the JCM project

Efficiency improvement for the motor-driven equipment in the Erdenet Mining facility

A.2. General Description of project and applied technologies and/or measures

The proposed project is schemed as one of projects under a Program-JCM aiming to improve efficiency of the motor-driven equipment by introducing inverter control for various plant in Mongolia.

Currently so many Russian-made pumps driven motors which are also Russian-made.

Process flow quantity for most of those pumps are currently controlled by adjusting openings of flow control valves under almost rated output power of directly coupled motors.

Consequently it causes considerable mechanical energy losses at the passage of flow and excess electricity consumption due to constant high electric power loading of motor itself.

Erdenet Mining Corporation (hereinafter called EMC), one of biggest copper mining company all over the world, is pursuing energy saving in consideration of the above-mentioned situation, and agreed with OECC's proposal for the investigation and study of the effect of introducing inverters to their motor systems.

EMC introduces inverters to motor system which enables quantity of flow by adjusting motor speed with variation of electric power instead of changing openings of control valves which result in reduction of pressure losses for saving electricity consumption required.

In the proposed project, it is intended to apply inverters with which 3-level control function. It will be effectively applied to existing old Russian high voltage motors because of its following features;

■4 sets of IGBT circuit installed for AC-DC-AC conversion

■High precision of output AC waves

■Well-controlled AC output without surge in voltage

■Free from Noise/Leak current effect

Especially, due to its surge-free AC output, it is no need to replace or retrofit existing high voltage motors.

A.3. Location of project, including coordinates

Country	Mongolia
Region/State/Province etc.:	Orhon ayma
City/Town/Community etc:	Erdenet City
Latitude, longitude	N-49°01'40" E-104°02'40"

A.4. Name of project participants

Mongolia	Erdenet Mining Corporation LLC
Japan	Overseas Environmental Corporation Center, Japan

A.5. Duration

Starting date of project operation	dd/mm/yy
Expected operational lifetime of project	20 years

A.6. Contribution from developed countries

The proposed project is financially supported by the ministry of the Environment, Japan through the financing programme for JCM model projects which seeks to acquire JCM credits.

As for the technology transfer, Yaskawa Electric Corporation is to provide following

support to Erdenet mining Corporation;

- Provision of advanced technology applied inverters
- The opportunity for government officials and representatives/engineers of local companies to visit sites in Japan
- to learn actual status of advanced technology applied systems and products.

B. Application of an approved methodology(ies)

B.1. Selection of methodology(ies)

Selected approved methodology No.	TBD
Version number	TBD
Selected approved methodology No.	TBD
Version number	TBD
Selected approved methodology No.	TBD
Version number	TBD

B.2. Explanation of how the project meets eligibility criteria of the approved methodology

Eligibility criteria	Descriptions specified in the methodology	Project information
Criterion 1	Project inverter is either having “Matrix Converter” capability or “3 Level Cascade Multiplexing” capability. The matrix converter (MC) is featured by “Regeneration”, “AC-AC Direct Conversion” instead of AC-DC-AC, “Input current THD (Total Harmonic Distortion) less than 7 %” and “Input Power Factor more than 98%”. MC is effectively applied to fan motor of which response to speed down demand is made faster overcoming its large inertia as well as enabling energy saving with less throttle losses. MC has also an outstanding feature of 97% efficiency which is exceptionally high performance realized by introducing AC-AC conversion whereas mostly AC-DC-AC. The 3 Level Cascade Multiplexing Inverter (3-level inverter) is featured by 97 % efficiency and 95 % power factor concurrently enabling minimum input harmonic (IEEE519 guideline) and surgeless voltage for AC output. As output wave shape is more close to sine wave, 3-level inverter has advantage for miniaturization or reduction of noise.	Project inverter is 3 Level Cascade Multiplexing type featured with 97 % efficiency and 95 % power factor concurrently enabling minimum input harmonic (IEEE519 guideline) and surgeless voltage for AC output.
Criterion 2	Project inverter is provided with engineering/maintenance support tool for easy parameter tuning and easy	Engineering support tool is provided for remote parameter tuning and other

	access for maintenance with remote terminal unit.	maintenance work.
Criterion 3	Targeted motor for the project is an existing and/or newly introduced high voltage motor system so as to enable to control its output (flow of water or air/gas) by adjusting motor rotating speed to eventually reduce throttle loss instead of changing opening of flow control valve or damper.	Motor systems are all existing ones which comprise high voltage motor (6,000V) and water pump in the Erdenet Mining Factory. Output is quantity of water flow for the use at Mills and Relay Points.
Criterion 4	Measurement of electricity consumption for inverter controlled motors is recorded at least 1 month interval for past 12 months before project implementation.	N/A
Criterion 5	Measurement of output of motor facility is recorded at least 1 month interval for past 12 months before project implementation.	N/A
Criterion 6	Measurement of electricity consumption of motors by one meter as a group is applicable as far as motor system is same type.	Measurement of electricity consumption for each motor is not available, but measurement of total electricity consumed by motors belonging to same group is recorded at 1 month interval.
Criterion 7	Measurement of output of motor facility by one meter as a group is applicable as far as driven pumps/fans are same type.	Measurement of output of individual motor facility is not available, but measurement of total output by motor facilities belonging to same group is recorded at 1 month interval.

C. Calculation of emission reductions

C.1. All emission sources and their associated greenhouse gases relevant to the JCM project

Reference emissions	
Emission sources	GHG type
Electricity consumption by reference motor	CO_2
Project emissions	
Emission sources	GHG type
Electricity consumption by project inverter-coupled motors	CO_2

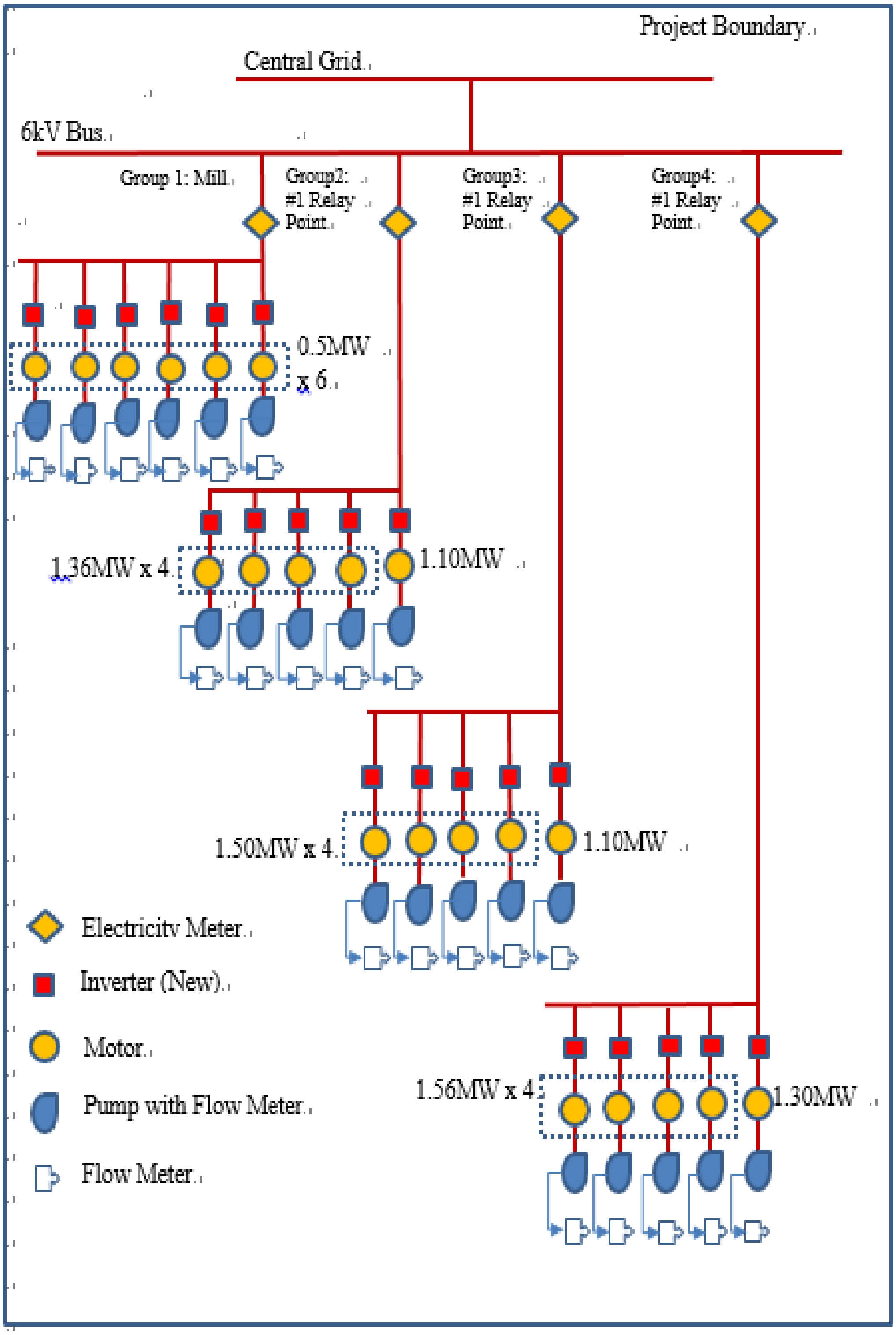
C.2. Figure of all emission sources and monitoring points relevant to the JCM project

Target pumps are separated to 4 groups as follows and electricity consumption and output load (water flow) are measured on each group basis :

Group 1: Motors and Water pumps for Mill
Group 2: Motors and Water pumps for #1 Relay station
Group 3: Motors and Water pumps for #2 Relay station
Group 4: Motors and Water pumps for #3 Relay station

Details for each group	Units	Capacity
- Group 1 for Mill:		
Motor for Carry pump for (0.5MW)	6	3MW
- Group 2 for #1 Relay Point 3		
Motor for #1 Relay Point (1.36MW)	4	5.44MW
Motor for #1 Relay Point (1.10MW)	1	1.10MW
- Group 3 for #2 Relay Point		
Motor for #2 Relay Point (1.50MW)	4	6.00MW
Motor for #2 Relay Point (1.10MW)	1	1.10MW
- Group 4 for #2 Relay Point		
Motor for #3 Relay Point (1.56MW)	4	6.24MW
Motor for #3 Relay Point (1.30MW)	1	1.30MW

Figure of all emission sources and monitoring points



■Historical data of operation for each pump/motor (No.1 – No.45)

Group (i)	Pump/motor No.	Capacity (MW)	Voltage (V)	Operation hour (H)	Electricity consumed (MWh)	Output (Mton)	SEC (MWh/ Mton)
1	1	0.5	6,000	7,500	****	26.l08	122.2
	2	0.5	6,000	7,500	****	26.08	122.2
	3	0.5	6,000	7,500	****	26.08	122.2
	4	0.5	6,000	7,500	****	26.08	122.2
	5	0.5	6,000	7,500	****	26.08	122.2
	6	0.5	6,000	7,500	****	26.08	122.2
	Total	3.0	-----	-----	19,125	156.5	122.2
2	7	1.36	6,000	5,000	****	52.5	65.7
	8	1.36	6,000	5,000	****	52.5	65.7
	9	1.36	6,000	5,000	****	52.5	65.7
	10	1.36	6,000	5,000	****	52.5	65.7
	11	1.10	6,000	5,000	****	42.5	110.0
	Total	6.54	-----	-----	27,795	252.5	110.1
3	12	1.50	Total	5,000	****	65.2	97.8
	13	1.50	Total	5,000	****	65.2	97.8
	14	1.50	Total	5,000	****	65.2	97.8
	15	1.50	Total	5,000	****	65.2	97.8
	16	1.10	Total	5,000	****	42.5	110.0
	Total	7.1	-----	-----	30,175	303.3	99.5
4	17	1.56	Total	5,000	****	82.87	80.0
	18	1.56	Total	5,000	****	82.87	80.0
	19	1.56	Total	5,000	****	82.87	80.0
	20	1.56	Total	5,000	****	82.87	80.0
	21	1.30	Total	5,000	****	52.7	104.8
	Total	7.54	-----	----	32,045	384.18	83.4
Total		24.18	-----	-----	-----	-----	-----

■Project emissions

Project emissions are estimated on the assumption that the 65% energy saving can be achieved by introducing inverters.

C.3. Estimated emission reductions in each year

Year	Estimated Reference emissions (tCO_{2e})	Estimated Project Emissions (tCO_{2e})	Estimated Emission Reductions (tCO_{2e})
2013	0	0	0
2014	0	0	0
2015	0	0	0
2016	0	0	0
2017	120,381	78,248	42,133
2018	120,381	78,248	42,133
2019	120,381	78,248	42,133
2020	120,381	78,248	42,133
Total (tCO_{2e})	481,524	312,992	168,532

D. Environmental impact assessment	
Legal requirement of environmental impact assessment for the proposed project	No

E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

TBD

E.2. Summary of comments received and their consideration

Stakeholders	Comments received	Consideration of comments received
TBD		

F. References
TBD

Reference lists to support descriptions in the PDD, if any.

Annex
TBD

Revision history of PDD		
Version	Date	Contents revised
TBD		

(3) Ideas for Facilitating the Introduction of Japanese Technologies

① Ways to establish a procurement structure conducive to the introduction of Japanese technologies in the host country

This scheme assumes the utilization of financing which enables leapfrog development (contributions to the ADB) in the JCM. Usually, projects sponsored by the JBIC involve international tenders. In the case of the proposed scheme, funds are lent out by the ADB to private-sector banks, and decisions on the introduction of technologies are made when private-sector banks lend funds to ordinary local business operators following the completion of ADB lending to private-sector banks. In other words, decisions on the introduction of technologies are made by the Mongolian government, private-sector banks or among business operators, and not under international tenders.

Therefore, it is possible to leave decisions on technologies up to the host country side, instead of international tenders usually prescribed by the International Development Association. In this case, there is a likelihood that the determination of technological specifications and terms for introduction of technologies under regulations set by the Administrative Office of this scheme may facilitate the introduction of superior Japanese technologies.

It is also possible to set up a scheme where the introduction of technologies is decided among local business operators participating in the project. In this case, it may be similarly possible to facilitate the introduction of superior Japanese technologies by clearly defining the quality and other matters in order to avoid any occurrence of defects or other such factors in the project. Business operators participating in the project naturally want to avoid the risk of any glitch in equipment introduced in the project, as do private-sector banks providing financing. We believe that the procurement structure satisfactory to participating business operators can be established by incorporating these ideas into the scheme.

② Inclusion in laws and regulations of the host country

An energy-saving law is one of legal systems related to this scheme. Unfortunately, Mongolia has yet to enact an energy-saving law. Mongolia is currently in the process of legislating such a law with the assistance of

Germany, and the energy-saving law is essential in order to promote reductions of GHG emissions in the energy-saving field. Under Japan's Energy Saving Act, we have exquisite regulations such as the Top Runner Approach, and we believe that the introduction of such regulatory systems is very useful. As the introduction of legal systems requires a lot of time, at the same time, it becomes necessary to provide sustained support for the Mongolian government and participating business operators.

③ Ways to utilize co-benefits other than GHG emission reductions as advantages at the time of commercialization

As described earlier, air pollution is the pressing issue Mongolia has to deal with. If the structure in 1 above can be established, in our opinion, incorporating these co-benefits effects in conditions for the adoption of technologies will prove effective. More specifically, we believe that the incorporation of indicators of NOx, SOx and soot dust, etc. in conditions for the adoption of technologies will help reduce air pollution and allow participating business operators to adopt superior technologies, thereby contributing to the host country.

(4) Ideas for Facilitating the Introduction of Japanese Technologies

① The necessity of capacity-building for stakeholders in the scheme

In this Study, we prepared the Programme-Type JCM Scheme (draft) after consultations with the Mongolian government and other stakeholders and detailed studies. Our Study found a conspicuous lack, on the part of the Mongolian government as well as private-sector banks and other business operators, of experience in the use of subsidies and loan schemes in the environment sector, as well as in and knowledge about and experiences in MRV for GHG emission reductions. When we explained the scheme (draft) to stakeholders, most of them comprehended the scheme's advantages. But there is still only a limited number of entities that can work out on their own how to actually use the scheme, how to form organizations among participating business operators to operate the scheme as the Programme-Type JCM Scheme, and how to establish the MRV structure for reducing GHG emissions.

We believe that the effective way to solve this problem is a capacity-building approach under which one or two specific cases are presented for a simulated operation of the scheme. Through this process, in our view, if some successful cases come up following the commencement of the scheme's operation, it should lead to the generation of similar ideas and ideas with a little more ingenuity, creating a situation where the scheme can be spontaneously operated without much difficulty.

② Financial support for MRV for GHG emission reductions

Currently, details of financial support for MRV have yet to be clearly expounded for projects that utilize the JCM's financing enabling leapfrog development. Once the project is launched, it will become subject to measurement and reporting as well as to periodical verification by the Third-Party Entity, imposing a significant burden of MRV costs on participating business operators for multiple years. Furthermore, participating business operators make decisions on commercialization after conducting studies on investment recovery, including IRR (internal rate of return), before the commencement of the project, and unless they know the size of costs and required period, etc. of MRV by the time they conduct these studies, they would have to push ahead with the project by taking significant risks. Stakeholders in Japan and the host country have made several inquiries about this matter, requiring prompt replies.

(5) Future Development Policy and Specific Schedule

Through the surveys and consultations conducted thus far, we have obtained responses from the Ministry of Environment, Green Development and Tourism and the Ministry of Energy of Mongolia that the Programme-Type JCM Scheme (draft) is basically fine with the country. As for the schedule going forward, the Ministry of Environment, Green Development and Tourism, the Ministry of Energy and other government ministries will complete adjustments, and the project can then be launched after loan negotiations with donor entities.

Private-sector companies that are potential project participants are positive about the implementation of the project leveraging JCM programme financing. While this scheme requiring little initial cost is very attractive given the financial conditions of small- and medium-sized enterprises in the private sector, there are cases where financially-weak industries and businesses may find it difficult to make use of the scheme. As the Mongolian economy is almost entirely based on the mining and manufacturing industries, it is desirable to implement a scheme that benefits other industry sectors. To that end, the scheme would require further improvement.

As one of specific ideas for improvement, we are considering the development of a sustainable development-type scheme that includes the leasing function in the Programme-Type JCM Scheme devised during FY2014. Through reduced initial investment and unified management of multiple projects by carrying out lease projects making use of local operators, which are already being surveyed, we will continue to consider a framework that allows a greater number of operators to participate in this scheme.

ABBREBIATION

ADB	Asian Development Bank
BaU	Business as Usual
CAF	Clean Air Foundation
CME	Coordinating Management Entity
CDM	Clean Development Mechanism
CDM-PoA	Programme of Activities
CHP	Combined Heat and Power Plant
CHP-5	Ulaanbaatar No.5 Combined Heat and Power Plant
COP	Conference of the Parties
tCO_2	ton-CO_2
DNIMS	Distribution Network Information Management System
EPC	Engineering, procurement, construction
GHG	Greenhouse effect gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
HOB	Heat on Boiler
IDF	Induced Draft Fan
IMF	International Monetary Fund
IRR	Internal rate of return
JCM	Joint Credit Mechanism
JICA	Japan International Cooperation Agency
KfW	Kreditanstalt fur Wiederaufbau
MARCC	Mongolia: Assessment Report on Climate Change
MCA	Millennium Challenge Account
MEGDT	Ministry of Environment, Green Development and Tourism
MOE	Ministry of Energy
MRV	Measurement, reporting and verification / measurable, reportable and verifiable
NAMA	Nationally Appropriate Mitigation Action
OCS	Optimized Control System
PDD	Project Design Document
SFC	Specific Fuel Consumption
STG	Steam Turbine and Generator
TPE	Third Party Entity

UBEDN	Ulaanbaatar Electricity Distribution Network Company
UNFCCC	United Nations Framework Convention on Climate Change
WHO	World Health Organization