Capacity building cooperation for development of NAMAs in a MRV manner

Overseas Environmental Cooperation Center (OECC), Japan

Masayoshi Futami
Outline

1. Introduction

2. Cooperation Activities

3. JCM scheme *

* The Joint Crediting Mechanism (JCM)
1. Introduction

2. Cooperation Activities

3. JCM scheme
1. Introduction

Partner countries and Selected sector

- Lao PDR: Transport Sector
- Mongolia: Energy Sector
- Vietnam: Waste Sector
- Cambodia: Energy Sector
1. Introduction

Institutional Arrangement of the cooperation

MONRE (Lao PDR)
MEGD (Mongolia)
MONRE (Vietnam)
MOE (Cambodia)

Working Group/Advisory Committee
(Relevant organizations)

Base study /secretariat function

Expert Team of Partner countries
- MONRE(Lao PDR)
- MEGD(Mongolia)
- IMHEM (Vietnam)
- CCD(Cambodia)

Consultant

Ministry of the Environment
Government of Japan

Japan NAMA Support Team

Designation/Finance

Recommendation

Technical Advices / Finance

Experts
Outline

1. Introduction

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3. JCM scheme
2. Cooperation Activities

Proposed Steps for NAMA Development

(1) Collection of Info on relevant policies and strategies
Collect and analyze relevant policy document

(2) Collection data for BAU in the sector
Collect data for calculating BAU emission with bottom-up approach

(3) Quantification GHG emissions of BAU
Quantify GHG emissions based on (2) data,
a) Identify the formulas
b) Calculate emission in BAU

(4) Examination and selection of NAMAs options
Select possible NAMAs options and technologies based on (1) policies and additional consideration.

(5) Quantification GHG emission reduction by NAMAs
Quantify GHG emissions with (4)NAMAs assumptions
a) Set the calculation formulas
b) Calculation
c) Aggregate potential with reduction by NAMAs

Low-carbon technology survey
Examination MRV methods
Capacity-buildings for NAMAs implication
MRV of policy based NAMAs

Review of KPTAP

“Kyoto Protocol Target Achievement Plan (KPTAP)” was formulated which carries on the Outline in order to stipulate the measures necessary to reliably achieve the target of a 6% reduction promised by Japan under the Kyoto Protocol.

Global Warming Prevention Headquarters
(National Committee on Climate Change)

- Chair: Prime Minister
- Co-chairs: Chief Cabinet Secretary, MOE, and METI
- Members: All Ministers

Periodical Report

Ministry
Ministry of the Environment
Ministry

NAMA ≠ KPTAP

Tracking KPTAP
Every year the Global Warming Prevention Headquarters under the cabinet of Japan comprehensively evaluates the progress of countermeasures and strengthens the policies as necessary with reference to the evaluation indicators
1. Identification of NAMA options
   Based on the NAMAs submitted by Mongolia to the UNFCCC, mitigation actions are elaborated, focusing on multiple application of energy efficiency improvement measures at the third and forth Combined Heat and Power plant (CHP3 and CHP4) in Ulaanbaatar, Heat Only Boilers and Renewable Energy.

2. Quantification of GHG emission reduction by identified NAMA options.
   Quantified emission reductions to be achieved by implementing specific measures at CHPs such as introducing high technologies.
Project level quantification for improvement of efficiency in CHP

\[ ER_y = EG_{grid,y} \times (SFC(E)_{BaU} - SFC(E)_y) \times NCV_{fuel} \times EF_{CO2,fuel} \]
\[ + QH_y \times (SFC(H)_{BaU} - SFC(H)_y) \times NCV_{fuel} \times EF_{CO2,fuel} \]

The amount of electricity supplied to the grid in a year \( y \) [MWh/y]

Specific fuel consumption per electricity supplied to the grid in BaU scenario (without NAMAs) [t-coal/MWh]

Specific fuel consumption per electricity supplied to the grid in a year \( y \) (with NAMAs) [t-coal/MWh]

Net calorific value of fuel [GJ/t-coal] = 7*4.184 \( \approx \) Coal for 7,000kcal/kg equivalent

\( SFC(E)_{BaU}, SFC(H)_{BaU} \) : May be fixed ex ante by yearly average value during latest 3 years before NAMAs implementation in case of domestic NAMAs.

\( EG_{grid,y}, SFC(E)_y, OH_y, SFC(H)_y \) : Values by “Energy statistics” in a year \( y \) are applied.
## Result of quantification

<table>
<thead>
<tr>
<th>Potential NAMA options and projected emissions reductions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Potential NAMA menu</strong></td>
</tr>
<tr>
<td>-------------------------</td>
</tr>
<tr>
<td><strong>CHP3</strong></td>
</tr>
<tr>
<td>Combustion Improvement (Low O₂ operation)</td>
</tr>
<tr>
<td>Adoption of speed control for Boiler Feedwater Pump</td>
</tr>
<tr>
<td>Replacement by Top runner Transformer</td>
</tr>
<tr>
<td>Adoption of Light Emitting Diode (LED) Resin coating of blades surface of Condenser Pump</td>
</tr>
<tr>
<td>Reinforcement of insulator</td>
</tr>
<tr>
<td><strong>CHP4</strong></td>
</tr>
<tr>
<td>Installation of Soot Blowers</td>
</tr>
<tr>
<td>Replacement to high efficiency turbine</td>
</tr>
<tr>
<td>Replacement by top runner LED</td>
</tr>
<tr>
<td>Adoption of LED</td>
</tr>
<tr>
<td>Resin coating on blades surface of Cooling Water Pump</td>
</tr>
<tr>
<td>Resin coating on blades surface of Condenser Pump</td>
</tr>
<tr>
<td>Reinforcement of insulator</td>
</tr>
</tbody>
</table>

The above mentioned NAMAs are basically expected various opportunities for financing these actions such as unilateral, bilateral and multilateral financial resources including ODA and soft loan. Also, in order to scale up the level of finance and facilitate transfer of technologies, finances through mechanisms such as the Joint Crediting Mechanism (JCM) and other innovative means of finance are also expected.
Outline

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3. JCM Scheme

- Facilitating diffusion of leading low carbon technologies, products, systems, services, and infrastructure as well as implementation of mitigation actions, and contributing to sustainable development of developing countries.

- Appropriately evaluating contributions to GHG emission reductions or removals from Japan in a quantitative manner, by applying measurement, reporting and verification (MRV) methodologies, and use them to achieve Japan’s emission reduction target.

- Contributing to the ultimate objective of the UNFCCC by facilitating global actions for GHG emission reductions or removals, complementing the CDM.
JCM studies and model projects for JFY 2013

Mongolia:
- Upgrading and Installation of Centralized Control System of High-Efficiency Heat Only Boiler (HOB)
- 10MW-scale solar power plant and rooftop solar power system
- Centralization of heat supply system by installation of high efficiency heat only boiler (HOB)
- 10MW-scale solar power generation for stable power supply
- Energy conservation at cement plant
- Improvement of thermal installation and water cleaning/air purge at power plants

Lao PDR:
- Promotion of use of electric vehicles (EVs)

Cambodia:
- Small-scale Biomass Power Generation by Using Stirling Engines

Vietnam:
- Integrated Energy Efficiency Improvement at Beer Factories
- Anaerobic digestion of organic waste for cogeneration at market
- Energy Efficiency improvement of glass furnace
- Promotion of public transport use by park-&-ride system
- Energy saving glass windows for buildings
- REDD+ with livelihood development

Source: http://gec.jp/
Fin
Countries with which Japan has signed on bilateral documents

- Japan has held consultations for the JCM with developing countries since 2011 and signed the bilateral document for the JCM with Mongolia, Bangladesh, Ethiopia, Kenya, Maldives, Viet Nam, Lao PDR, Indonesia, Costa Rica and Palau.

  **Mongolia**  
  On January 8, 2013 (Ulaanbaatar)

  **Bangladesh**  
  On March 19, 2013 (Dhaka)

  **Ethiopia**  
  On May 27, 2013 (Addis Ababa)

  **Kenya**  
  On June 12, 2013 (Nairobi)

  **Maldives**  
  On June 29, 2013 (Okinawa)

  **Viet Nam**  
  On July 2, 2013 (Hanoi)

  **Lao PDR**  
  On August 7, 2013 (Vientiane)

  **Indonesia**  
  On August 26, 2013 (Jakarta)

  **Costa Rica**  
  On December 9, 2013 (Tokyo)

  **Palau**  
  On January 13, 2014 (Ngerulmud)

- Japan held the 1st Joint Committee with Mongolia, Bangladesh, Ethiopia, Kenya, Viet Nam and Indonesia respectively.

  Government of Japan

  + Cambodia
JCM Model Projects in 2013 by MOEJ

Mongolia:
- Upgrading and Installation of Centralized Control System of High-Efficiency Heat Only Boiler (HOB)
  The high-efficiency Heat Only Boilers (HOBs) will replace outdated low-efficiency HOBs, to supply heated water for winter indoor heating. The project will also introduce centralized control system for the integrated heat supply in collective buildings.

Cambodia:
- Small-scale Biomass Power Generation by Using Stirling Engines
  The introduction of small-scale biomass power generation systems with stirling engines will replace diesel-based power generation at rice mills. The stirling engine, external-combustion engine, is suitable for the utilisation of biomass such as rice husk.

Bangladesh:
- Brick Production based on Non-Firing Solidification Technology
  In place of the existing brick production with the firing process with the combustion of coal, the new brick production with the non-firing solidification technology will be introduced.

Indonesia:
- Energy Saving for Air-Conditioning and Process Cooling at Textile Factory (in Batang city)
  The high performance refrigerating machine with efficient compressor and economizer cycle will be introduced for factory air-conditioning.
- Energy Savings at Convenience Stores
  The latest high-efficiency chillers with natural refrigerant (CO2 refrigerant), inverter controlled air-conditioners, and LED lighting will be introduced in convenience stores. Rooftop photovoltaic power generation systems will also be introduced.
- Energy Efficient Refrigerants to Cold Chain Industry
  The advanced energy efficient non-fluorocarbon cooling system using NH3 and CO2 will be introduced in the food industry and logistics industry. A screw compressor and an IPM (Interior permanent magnet synchronous) motor are adopted and operated integrally, to achieve high efficient operation of the cooling facility.
- Energy Saving by Double Bundle-Type Heat Pump at Beverage Plant
  A double bundle-type heat pump, generating both heating and cooling energy, will be installed to reduce energy consumption.
- Energy Saving for Air-Conditioning and Process Cooling at Textile Factory (in West Java province & Banteng province)
  The high performance refrigerating machine with efficient compressor and economizer cycle will be introduced for factory air-conditioning.

Viet Nam:
- Integrated Energy Efficiency Improvement at Beer Factory
  A set of high performance equipment for energy efficiency improvement and renewable energy generation will be introduced in beer factories. Before the installation, the potential of energy saving and possible high potential points in the beer production process will be identified by using the energy structure analysis simulation technology.
- Energy Efficient NH3 Heat Pumps to Marine Products Processing Industry
  The high efficient heat pump using ammonia (NH3) as a refrigerant will be introduced to save their energy consumptions.
Overview of JCM Planning/Demonstration/Feasibility Studies in 2013 by MOEJ

Mongolia:
- 10MW-Scale Solar Power Plant and Rooftop Solar Power System
- Centralization of Heat Supply System by Installation of High Efficiency Heat only Boiler (HOB)
- 10MW-Scale Solar Power Generation for Stable Power Supply
- Energy Conservation at Cement Plant
- Improvement of Thermal Installation and Water Cleaning/Air Purge at Power Plants

Bangladesh:
- High-Efficiency Rice Husk Based Cogeneration
- Solar Power Generation with Long-Life Storage Battery in Non-Electrified Regions

Lao PDR:
- Promotion of Use of Electric Vehicles (EVs)

Thailand:
- Dissemination of High-Efficiency Inverter Air Conditioners
- Heat Recovery to Generate Both Cooling and Heating Energy

Viet Nam:
- Anaerobic Digestion of Organic Waste for Cogeneration at Market
- Integrated Energy Efficiency Improvement at Beer Factories
- Energy Efficiency Improvement of Glass Furnace
- Promotion of Public Transport Use by Park-&-Ride System
- Energy Saving Glass Windows for Buildings
- REDD+ with Livelihood Development and Biomass-based Power Generation

Kenya:
- Expansion of Geothermal Project

Myanmar:
- Geothermal Binary Power Generation
- Solar–Diesel Hybrid Power Generation

Indonesia:
- Energy Saving by High-Efficiency Centrifugal Chiller
- Power Generation by Waste Heat Recovery in Cement Industry
- Regenerative Burners for Aluminum Melting Furnaces
- Anaerobic Treatment for Wastewater from Rubber Plants
- Solar Power System at Off-Grid Cell Towers
- Improvement of REDD+ Implementation Using IC Technology

Sri Lanka:
- Sustainable Biomass-Based Power Generation

Note: "△" indicates a feasible or demonstration project, while "◆" indicates a project under planning.
Cost benefit comparisons of the energy industry subsector technologies for climate change mitigation (TNA 2013)
Components of KPTAP

KPTAP provides mitigation measures information in a tabular format by responsible ministries.

- Individual countermeasures
  = Planed RE project (capacities)

- Their evaluation indicators
  = Total introduced capacity in target year

- Expected GHG emissions reduction
  = Electricity generation × EF

- Policies of the government
  = Renewable Energy low, National Action Program on Climate Change, National Renewable Energy Program, Mongolia’s Strategy Low of Mongolia on Energy etc
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Case study
- Individual countermeasures = Planed RE project (capacities)

<table>
<thead>
<tr>
<th>Grid</th>
<th>Project location</th>
<th>Capacity</th>
<th>Annual electricity generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>HYDRO POWER PLANT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CES</td>
<td>Khutag-Undur soum, Bulgan province (Egiin HPP)</td>
<td>220 MW</td>
<td>500 mil kWh</td>
</tr>
<tr>
<td>CES</td>
<td>Tsagaannuur soum, Selenge province (Shuren HPP)</td>
<td>300 MW</td>
<td>1100 mil kWh</td>
</tr>
<tr>
<td>CES</td>
<td>Songinokhairkan district, Ulaanbaatar city</td>
<td>Pumped storage HPP, 100 MW</td>
<td>82 mil kWh</td>
</tr>
<tr>
<td>SOLAR POWER PLANT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CES</td>
<td>Sainshand city, Dornogovi province</td>
<td>30 MW</td>
<td>52 mil kWh</td>
</tr>
<tr>
<td>CES</td>
<td>Bayanteeg bag, Nariinteel soum, Uvurkhangai province</td>
<td>8 MW</td>
<td>13 mil kWh</td>
</tr>
<tr>
<td>WIND POWER PLANT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CES</td>
<td>Choir city, Govisumber province</td>
<td>50 MW</td>
<td>123 mil kWh</td>
</tr>
<tr>
<td>CES</td>
<td>Khanbogd soum, Umnugovi province</td>
<td>102 MW</td>
<td>300 mil kWh</td>
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Their evaluation indicators= Total introduced capacity in target year

National overall target for the share of Renewable Energy in 2020 is 20-25% according to the National Renewable Energy Program

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<tr>
<th>Target of electricity from renewable sources in total electricity production in 2020</th>
<th>20-25%</th>
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<tr>
<td>Expected total electricity consumption in 2020 (million kWh)</td>
<td>7800.0</td>
</tr>
<tr>
<td>Expected amount of electricity from renewable sources corresponding to 2020 target (million kWh)</td>
<td>1560.0</td>
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</table>

(TNA 2013)

Energy demand MW (Ministry of Energy)
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(TNA 2013)

Evaluation Indicator

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Planed RE project attain the target if it will be constrected and generated by 2020

\[2300 \text{ million kWh} > \text{Target (1560 million kWh)}\]

It should be reviewed by Mongolia government (in cross cutting manner) comparing with evaluation indicators in target year or break down of EI in planned initial year of the facilities
Components of KPTAP

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- Individual countermeasures
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- Their evaluation indicators
  = Total introduced capacity in target year

- Expected GHG emissions reduction
  = Electricity generation $\times$ EF

- Policies of the government
  = Renewable Energy low, National Action Program on Climate Change, National Renewable Energy Program, Mongolia’s Strategy Low of Mongolia on Energy etc
Case study

- Expected GHG emissions reduction = Electricity generation × EF

Emission Factor (EF)

<table>
<thead>
<tr>
<th>Regional Grid</th>
<th>2009-2010</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OM*</td>
</tr>
<tr>
<td>Central Energy System</td>
<td>1.1501</td>
</tr>
</tbody>
</table>

CDM National Bureau, Mongolia

Combined Margin (CM) is used by MEGD for the estimation of project

\[ EF = \frac{OM \text{ (Operating Margin)} + BM \text{ (Build Margin)}}{2} \]

\[ = \frac{1.1501 + 1.0559}{2} = 1.103 \text{ (tCO2/MWh)} \]

Expected GHG emissions reduction

\[ = 2300 \text{ million kWh/year} \times 1.103 \text{ tCO2/MWh} \]

\[ = 2,536,900 \text{ tCO2/year} \]
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Case study

- Policies of the government

**Renewable Energy low**
- Article 11.3 Feed in Tariff

<table>
<thead>
<tr>
<th>Type of renewable energy generation</th>
<th>Capacity</th>
<th>Connected to electricity grid</th>
<th>Independent power generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind power source</td>
<td>-</td>
<td>0.08-0.095</td>
<td>0.1-0.15</td>
</tr>
<tr>
<td>Hydropower station</td>
<td>Up to 5,000 kW</td>
<td>0.045-0.060</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Up to 500 kW</td>
<td>-</td>
<td>0.08—0.10</td>
</tr>
<tr>
<td></td>
<td>501-2,000 kW</td>
<td>-</td>
<td>0.05-0.06</td>
</tr>
<tr>
<td></td>
<td>2,001-5,000 kW</td>
<td>-</td>
<td>0.045-0.05</td>
</tr>
<tr>
<td>Solar power source</td>
<td>-</td>
<td>0.15-0.18</td>
<td>0.20-0.30</td>
</tr>
</tbody>
</table>

**Renewable Energy low**
- Article 13 Renewable Energy Fund

SNC 2010
Additional technology proposal

solves this future issue.

**RE output + Battery**
Battery mitigates the fluctuation caused by renewable energies.
The output of WF is smoothed by controlling a battery system.

The battery supports introduction of Wind and Solar facility to connect with CES.
It is possible to use night time generated electricity by RE supplying charged electricity during peak time to reduce the rate of electricity import from Russia or to reduce coal consumption.