Evaluation Method of Co-Benefits Project for Updating HOB in Mongolia By Using JCM Methodology

25th January 2016
SUURI-KEIKAKU CO., LTD
Fumihiko KUWAHARA
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• 2. What is the “JCM”?  
• 3. What do we do (measure, estimate, calculate, verify, and etc.) in this Feasibility Study on the Co-Benefits Project?  
• 4. Measurement and Estimation (Calculation) Results  
• 5. Demonstration of Validation and Verification
1. What is the “Co-Benefit”? 

• Doing Co-benefit measures achieves the environmental pollution control measures and emission reduction measures of GHG (mitigation action) effectively at the same time.
• Co-benefit approach is very important policy tool.
• The environmental pollution control measures are issues of great urgency in Asia countries because of the rapid economic growth.
• At the same time, all country requires the voluntary mitigation action on GHG emission reduction.
2. What is the “JCM”? 

- Japan establishes and implements the JCM in order both to appropriately evaluate contributions from Japan to GHG emission reductions or removals in a quantitative manner achieved through the diffusion of low carbon technologies, products, systems, services, and infrastructure as well as implementation of mitigation actions in developing countries, and to use them to achieve Japan's emission reduction target.

3. What do we do?

- **OLYMPIA INDUSTRIAL CO., LTD.:**
  - Technical Support and Transfer (Low carbon technology & air pollutant control measures technology)

- **SUURI-KEIKAKU CO., LTD.:**
  - Estimation of GHG emission reductions based on JCM methodology which made by SUURI-KEIKAKU
  - Estimation of Air pollutant emission reductions based on JICA Capacity Development Project in Ulaanbaatar City (technical transfer of measurement survey method of air pollutant)

- **JAPAN QUALITY ASSURANCE ORGANIZATION:**
  - Identification and solution of issues regarding MRV activity of JCM project, and Technical Support regarding the assessment of NREC (TPE of JCM)
3. Main Activity on this FS

• 3.1 Outline of FS on Co-Benefits Project
• 3.2 Issues of Co-Benefits Manual
• 3.3 Co-Benefits Estimation Method of this Feasibility Study
• 3.4 Estimated Item of Co-Benefits
• 3.5 Estimation Points
• 3.6 JCM Methodology
• 3.7 Proposed Co-Benefits Methodology
3.1 Outline of FS on Co-Benefits Project

• Feasible Study on Co-Benefits Project for Updating HOB (Improved MUHT (MUHT1, MUHT2); MUHT + Japanese Technology) in 65th School in Ulaanbaatar.

• Reference HOB is set as vertical HOB.
  – Same as Approval Methodology of “JCM” (NM_AM002)

• Evaluation of Co-Benefits of Reference HOB and Improved MUHT(MUHT1 and MUHT2)

• Case Study of Application of NM_AM002
3.2 Issues of Co-Benefits Manual

• In the Co-Benefits Manual, the amounts of dry exhaust gas and the concentration of air pollutants are measured and quantified.

• Furthermore, monitoring frequency of the amounts of exhaust gas and the concentration of exhaust gas becomes once a month.

• These are not the sustainable monitoring activities in Mongolia. Particularly, it is difficult for Project Participants (PPs) to implement them.

• In the JCM project, the sustainable monitoring activity of PPs will be implemented. Based on this monitoring activity, the estimation of Co-Benefits are also evaluated.
3.3 Co-Benefits Estimation Method of this Feasibility Study

• In consideration of the diverseness and sustainable development of the developing countries, the evaluation method of co-benefits should reflect the independence of the country concerned.

• The Evaluation methods have the high Transparency and high Fairness.

• The Results of the Evaluation have Reproducibility.

• The Simple and Quick Evaluation is Possible.
3.4 Estimated Item of Co-Benefits

<table>
<thead>
<tr>
<th></th>
<th>The Amounts of Emission Reductions</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO2</td>
<td>“Emissions” = “Activity Data” x “Emission Factor”</td>
</tr>
<tr>
<td>NOx</td>
<td>Activity Data = “Net heat quantity which is supplied to the building” / “Boiler Efficiency”</td>
</tr>
<tr>
<td>DUST</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Heat quantities</th>
<th>Monitoring Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emission Factors</td>
<td>Default Values (set this FS)</td>
</tr>
<tr>
<td>Boiler Efficiency</td>
<td>Default Values (set this FS)</td>
</tr>
<tr>
<td>Net Calorific Value</td>
<td>Default Values (Coal Analysis)</td>
</tr>
<tr>
<td>Concentration of Air Pollutant</td>
<td>Measuring Item of this FS</td>
</tr>
</tbody>
</table>
3.5 Estimation Points

CO2, PM, SO2, NOx, etc.
3.6.1 JCM Project in Mongolia

- Two JCM Projects have already been registered in Mongolia.
- Project: MN001; Installation of high-efficiency Heat Only Boilers in 118th School of Ulaanbaatar City Project (30 Jun. 2015)
- Project: MN002; Centralization of heat supply system by installation of high-efficiency Heat Only Boilers in Bornuur soum Project (30 Jun. 2015)
- PP of both projects is “ANU-SERVICE CO., LTD” and “SUURI-KEIKAKU CO., LTD”.

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3.6.2 Approval JCM Methodology in Mongolia

• MN_AM002: “Replacement and Installation of High Efficiency Heat Only Boiler (HOB) for Hot Water Supply Systems”

• URL:

• Date of approval : 28 Jan 15

• Methodology Proponent: SUURI-KEIKAKU CO., LTD., Climate Experts LTD.
3.6.3 Basic Estimation Equation

- **Reference Emissions**
  
  \[ RE_p = \frac{PT_p}{\eta_{RE,HOB}} \times EF_{CO2, coal} \]

- **Project Emissions**
  
  \[ PE_p = \frac{PT_p}{\eta_{PJ,HOB}} \times EF_{CO2, coal} + EC_p \times EF_{CO2, grid} \]

- **Where**
  
  - \( \eta_{RE,HOB} \): Boiler Efficiency of the Reference HOB
  - \( \eta_{PJ,HOB} \): Boiler Efficiency of the Project HOB
  - \( PT_p \): Net heat quantities supplied by the project HOB during the monitoring period \( p \) [GJ/p]
  - \( EF_{CO2, coal} \): \( CO_2 \) Emission Factor of the consumed coal [t\( CO_2 /GJ \)]
  - \( EF_{CO2, grid} \): \( CO_2 \) Emission Factor of the grid consumed by the project HOB [t\( CO_2 /MWh \)]
### 3.6.4 Boiler Efficiency of Reference

<table>
<thead>
<tr>
<th>Boiler No.</th>
<th>Type of Boiler</th>
<th>Site</th>
<th>Measurement Day</th>
<th>Measurement equipment</th>
<th>Boiler efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>CLSG</td>
<td>TAVAN GAN TRADE LLC</td>
<td>Dec. 11, 2012</td>
<td>Heatmeter</td>
<td>53.4</td>
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<tr>
<td>R2</td>
<td>CLSG</td>
<td></td>
<td>Dec. 19, 2012</td>
<td></td>
<td>42.8</td>
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<tr>
<td>R3</td>
<td>CLSG</td>
<td></td>
<td>Nov. 1, 2012</td>
<td>“Thermocouple-type thermometer” +</td>
<td>40.1</td>
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<tr>
<td>R4</td>
<td>CLSG</td>
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<td>Nov. 2, 2012</td>
<td>“Ultrasonic flowmeter” (TUF)</td>
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<tr>
<td>R5</td>
<td>HP</td>
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<td>Dec. 7, 2012</td>
<td></td>
<td>49.6</td>
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<tr>
<td>R6</td>
<td>HP</td>
<td>SEN-1 residence</td>
<td>Dec. 4, 2012</td>
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<td>40.7</td>
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<tr>
<td>R7</td>
<td>HP</td>
<td></td>
<td>Dec. 10, 2012</td>
<td></td>
<td>43.6</td>
</tr>
<tr>
<td>R8</td>
<td>HP</td>
<td>79th school</td>
<td>Nov. 20, 2013</td>
<td>Heatmeter</td>
<td>60.0</td>
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<tr>
<td>R9</td>
<td>HP</td>
<td>79th school</td>
<td>Nov. 26, 2013</td>
<td></td>
<td>63.8</td>
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<td>R10</td>
<td>HP</td>
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<td>Nov. 27, 2013</td>
<td></td>
<td>37.1</td>
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<td>R11</td>
<td>HP</td>
<td>79th school</td>
<td>Nov. 28, 2013</td>
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<td>43.2</td>
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<tr>
<td>R12</td>
<td>HP</td>
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<td>Dec. 16, 2013</td>
<td></td>
<td>51.4</td>
</tr>
<tr>
<td>R13</td>
<td>HP</td>
<td>79th school</td>
<td>Dec. 19, 2013</td>
<td></td>
<td>53.2</td>
</tr>
<tr>
<td>R14</td>
<td>HP</td>
<td>79th school</td>
<td>Dec. 20, 2013</td>
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<td>45.0</td>
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<td>R15</td>
<td>CLSG</td>
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<td>54.0</td>
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<td>R16</td>
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<td>Dec. 18, 2013</td>
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<td>R17</td>
<td>CLSG</td>
<td>TAVAN GAN TRADE LLC</td>
<td>Dec. 23, 2013</td>
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<td>50.9</td>
</tr>
</tbody>
</table>

**Table 4: Actual measurement of boiler efficiency for the reference HOBs**

- **Source:** JCM_MN_AM002
  - JCM_MN_PM002_ver
  - 01.0_Add_Info1

**Note:**
- The average value of all data: 47.8
- The average value of data excluding one value (R9) which is not within the range of two times of standard deviation ($\mu \pm 2\sigma$): 46.9
- The average value of data excluding one value (R9) which is not within the range of two times of standard deviation ($\mu \pm 2\sigma$), and excluding nine value (R2, R3, R4, R6, R7, R10, R11, R14, R16) which is less than the abovementioned average value (46.9): **53.3%**
3.7.1 Proposed Co-Benefits Methodology of SOx Estimation

- **Reference Emissions**
  \[ RE_{SO2,p} = \frac{PT_p}{\eta_{RE,HOB}} \times \frac{1}{NCV_{coal}} \times EF_{SO2,coal} \]

- **Project Emissions**
  \[ PE_{SO2,p} = \frac{PT_p}{\eta_{PJ,HOB}} \times \frac{1}{NCV_{coal}} \times EF_{SO2,coal} \]

- **Where:**
  - \( \eta_{RE,HOB} \): Boiler Efficiency of the Reference HOB
  - \( \eta_{PJ,HOB} \): Boiler Efficiency of the Project HOB
  - \( PT_p \): Net heat quantities supplied by the project HOB during the monitoring period \( p \) [GJ/p]
  - \( EF_{SO2,coal} \): SO\(_2\) Emission Factor of the consumed coal [kgSO\(_2\)/t]
3.7.2 Proposed Co-Benefits Methodology of NOx Estimation

- Reference Emissions
  
  \[ RE_{NOx,p} = \frac{PT_p}{\eta_{RE,HOB}} \times \frac{1}{NCV_{coal}} \times EF_{NOx,coal} \]

- Project Emissions;
  
  \[ PE_{NOx,p} = \frac{PT_p}{\eta_{PJ,HOB}} \times \frac{1}{NCV_{coal}} \times EF_{NOx,coal} \]

- Where;
  
  - \( \eta_{RE,HOB} \): Boiler Efficiency of the Reference HOB
  - \( \eta_{PJ,HOB} \): Boiler Efficiency of the Project HOB
  - \( PT_p \): Net heat quantities supplied by the project HOB during the monitoring period p [GJ/p] or [kgCoal/p]
  - \( EF_{NO2,coal} \): NO2 Emission Factor of the consumed coal [kgNOx/t]
  - \( NCV_{coal} \): Net Calorific Value of the consumed coal [GJ/t]
3.7.3 Proposed Co-Benefits Methodology of CO Estimation

• Reference Emissions
  \[ RE_{CO,p} = PT_p / \eta_{RE,HOB} \times 1 / NCV_{coal} \times EF_{CO,coal} \]

• Project Emissions;
  \[ PE_{CO,p} = PT_p / \eta_{PJ,HOB} \times 1 / NCV_{coal} \times EF_{CO,coal} \]

• Where;
  – \( \eta_{RE,HOB} \): Boiler Efficiency of the Reference HOB
  – \( \eta_{PJ,HOB} \): Boiler Efficiency of the Project HOB
  – \( PT_p \): Net heat quantities supplied by the Project HOB during the monitoring period p [GJ/p] or [kgCoal/p]
  – \( EF_{CO,coal} \): CO Emission Factor of the consumed coal [kgCO/t]
  – \( NCV_{coal} \): Net Calorific Value of the consumed coal [GJ/t]
3.7.4 Proposed Co-Benefits Methodology of DUST Estimation

• Reference Emissions
  \[ RE_{DUST,p} = PT_p / \eta_{RE,HOB} \times 1 / NCV_{coal} \times EF_{DUST,coal} \]

• Project Emissions;
  \[ PE_{DUST,p} = PT_p / \eta_{PJ,HOB} \times 1 / NCV_{coal} \times EF_{DUST,coal} \]

• Where;
  \( \eta_{RE,HOB} \): Boiler Efficiency of the Reference HOB
  \( \eta_{PJ,HOB} \): Boiler Efficiency of the Project HOB
  \( PT_p \): Net heat quantities supplied by the Project HOB during the monitoring period p [GJ/p] or [kgCoal/p]
  \( EF_{DUST,coal} \): DUST Emission Factor of the consumed coal [kgDUST/t]
  \( NCV_{coal} \): Net Calorific Value of the consumed coal [GJ/t]
4. Measurement and Estimation (Calculation) Results

• 4.1 Emission Factor (Measurement results)
• 4.2 Estimated Amounts of Activities
• 4.3 Draft Estimated Amounts of Emission
# 4.1 Draft Emission Factors

<table>
<thead>
<tr>
<th></th>
<th>Reference HOB (HP10-60Ж)</th>
<th>Target HOB 1 (MUHT1)</th>
<th>Project HOB 2 (MUHT2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO2</td>
<td>6.071 (t-SO2/t)</td>
<td>6.071 (t-SO2/t)</td>
<td>6.071 (t-SO2/t)</td>
</tr>
<tr>
<td></td>
<td>This FS</td>
<td>This FS</td>
<td>This FS</td>
</tr>
<tr>
<td>NOx</td>
<td>2.21 (kg-NOx/t)</td>
<td>0.71 (kg-NOx/t)</td>
<td>0.73 (kg-NOx/t)</td>
</tr>
<tr>
<td></td>
<td>JICA Phase I</td>
<td>This FS</td>
<td>This FS</td>
</tr>
<tr>
<td>CO</td>
<td>82.82 (kg-CO/t)</td>
<td>8.80 (kg-CO/t)</td>
<td>12.27 (kg-NOx/t)</td>
</tr>
<tr>
<td></td>
<td>JICA Phase I</td>
<td>This FS</td>
<td>This FS</td>
</tr>
<tr>
<td>DUST</td>
<td>9.91 (kg-DUST/t)</td>
<td>3.20 (kg-DUST/t)</td>
<td>5.57 (kg-DUST/t)</td>
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<tr>
<td></td>
<td>JICA Phase I</td>
<td>This FS</td>
<td>This FS</td>
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<tr>
<td>CO2</td>
<td>0.074 (t-CO2/GJ)</td>
<td>0.074 (t-CO2/GJ)</td>
<td>0.074 (t-CO2/GJ)</td>
</tr>
<tr>
<td></td>
<td>This FS</td>
<td>This FS</td>
<td>This FS</td>
</tr>
</tbody>
</table>
### 4.2 Estimated Amounts of Activities

#### 65th School

<table>
<thead>
<tr>
<th>Period</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>9/17 ~ 12/31</td>
<td>2196.5 (GJ/p)</td>
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</tbody>
</table>

#### Measured Activity

<table>
<thead>
<tr>
<th>Type</th>
<th>Coal Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference HOB (53%)</td>
<td>557 (t-Coal/p)</td>
</tr>
<tr>
<td>MUHT1 (74.4%)</td>
<td>446 (t-Coal/p)</td>
</tr>
<tr>
<td>MUHT2 (72.0%)</td>
<td>461 (t-Coal/p)</td>
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</tbody>
</table>

#### Estimated Activity

<table>
<thead>
<tr>
<th>Period</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>9/15 ~ 5/15</td>
<td>5035 (GJ/p)</td>
</tr>
</tbody>
</table>

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### 4.3 Draft Estimated Amounts of Emission

<table>
<thead>
<tr>
<th></th>
<th>Reference HOB Emissions</th>
<th>MUHT2 Emissions</th>
<th>Evaluation of Co-Benefits (Emission Reductions)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CO₂</strong></td>
<td>699 (tCO₂/p)</td>
<td>517 (tCO₂/p)</td>
<td>182 (tCO₂/p)</td>
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<tr>
<td><strong>SO₂</strong></td>
<td>3382 (kgSO₂/p)</td>
<td>2798 (kgSO₂/p)</td>
<td>584 (kgSO₂/p)</td>
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<tr>
<td><strong>NOₓ</strong></td>
<td>2131 (kgNOₓ/p)</td>
<td>336 (kgNOₓ/p)</td>
<td>895 (kgNOₓ/p)</td>
</tr>
<tr>
<td><strong>CO</strong></td>
<td>46130 (kgCO/p)</td>
<td>5655 (kgCO/p)</td>
<td>40475 (kgCO/p)</td>
</tr>
<tr>
<td><strong>DUST</strong></td>
<td>5520 (kgDUST/p)</td>
<td>2567 (kgDUST/p)</td>
<td>2953 (kgDUST/p)</td>
</tr>
</tbody>
</table>
5. Demonstration of MRV Activity on the assumed JCM project

• MUHT2 is assumed as JCM Project, and the demonstration of MRV activity on JCM Project was carried out.

• NREC (Mongolian company, the first TPE of host country on JCM) made PDD and collected evidence. (main activity entity)

• We get the issues of developing this FS as JCM project.
  – Main support entity of Japanese side is JQA (Mr. Yamamoto).
5.1 Main Activity of Demonstration of MRV activity

• Confirm the importance of creating “Monitoring Plan” with considering “Verification”.
  – Arrangement of requirement on PDD and monitoring activity based on each Manuals of JCM in this FS.
  – Collection and Assessment of Evidence in this FS.
  – Confirmation of Issues of JCM MRV in this FS.
  – 22 Jan. 2016 (last Friday): Results briefing session
    • Participants : Ministry of Environment, Green Development and Tourism, Mongolian Agency for Standardization and Metrology, Regulatory Agency of the Government, etc.
Thank you!

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