Case Study for Replacement of Inefficient Boilers: HOB Standardized Baseline in Mongolia

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Yuriko KOYANAGI
Assistant Researcher, Market Mechanism Group, IGES

Step 1: Define Aggregation Level

Host country: Mongolia
- Cold winter
- Coal is the most important energy source

Sector: Supply side energy efficiency improvement (district heating for larger sized building)

Measure: Replace old inefficient polluting coal-fire and heat-only-boilers (HOBs) with environment friendly highly energy-efficient boilers

Defined output level: 0.3MW-5MW thermal
Step 2: Define Additionality Criteria

Exemption from demonstrating additionality:

✓ The remaining lifetime* of boilers is over **10 years**

Refer to “Tool to determine the remaining lifetime of equipment (ver. 1)” [EB50, Anx15]

✓ The thermal efficiency of the boilers to be replaced is **lower than 55%**

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Current efficiency of most boilers in Ulaanbaatar (UB) city is 50...60%

(according to the research under the World Bank projects in cooperation with Ministry of Nature Environment and Tourism, Mongolia (MNET))

Source: “Market Study of heat-only Boilers and Coal-fired Water Heaters” 2009, p.43

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Step 2: Define Additionality Criteria (cont.)

How to define the benchmark of additional level?

- The **average efficiency** of boilers manufactured and supplied in Mongolian market is **75%**.

<table>
<thead>
<tr>
<th>Efficient rate</th>
<th>X &lt; 65%</th>
<th>75% 75%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total # (2008)</td>
<td>28 boilers</td>
<td>81 boilers</td>
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</table>

Estimation by IGES (raw data from “Market Study of heat-only Boilers and Coal-fired Water Heaters” 2009, p. 35)

- The current **most efficient boiler** supplied in Mongolia is **80%** efficiency.

Thus, **80% efficiency seems to be the most possible project scenario.**
Step 3: Identify Baseline Scenario

Baseline scenario:
Continuation of heat supply by the current HOBs

✓ The energy baseline
  The monitored performance of the existing generating unit

✓ Threshold
  Due to the highly share of coal as fuel (almost 100%), the threshold is defined as energy efficient rate, not energy rate.

Step 3: Identify Baseline Scenario (cont.)

Issue to be developed

How to calculate the average efficiency?

✓ average or median?
✓ Boiler efficiency test?
✓ Boiler registration system?

The types and share of HOBs in UB city (2008-2009)

- W 55%
- 55% < X < 70%
- 70% < Y < 75%
- 75% < Z

23% 24% 37% 16%

66 boilers might be the target of CDM (PoA)

Estimation by IGES (raw data from “Market Study of heat-only Boilers and Coal-fired Water Heaters” 2009, pp. 6-7)
Step 4: Baseline Emission Factor

\[
BE = E_{BL} \times \text{CO}_2\text{-EF}
\]

Baseline emissions \hspace{1cm} Primary Energy consumed in the baseline

Emission factor of the coal \(=\) NCV coal (lignite) by the IPCC default value 0.101t-CO\(_2\)/GJ

In case of 1MW boiler replacement

\[
E_{BL} = E_{ou} / \eta_{BL} = 14.40 \text{TJ} / 0.55 = 26.18 \text{TJ}
\]

\(E_{ou}\): useful energy output in year
\(\eta_{BL}\): measured efficiency of the baseline boilers 55%

\(E_{BL}\): measured energy output of the baseline boiler

\(E_{ou}\): useful energy output in year

\[
BE = 26.18 \text{TJ} \times 101\text{t-CO}_2/\text{TJ} = 2,644\text{t-CO}_2
\]

Summary

- Positive list for boiler replacement CDM:
  - Mongolia (and other regions characterized by cold winter and importance of coal as fuel)
  - the remaining lifetime of replaced boiler is over 10 yrs
  - the benchmark of additional level is 80% efficiency

- More possibility as PoA than normal CDM

- Setting the baseline scenario, how to define the average efficient rate? 55% efficiency or…?

- As for baseline \(\text{CO}_2\)-EF, IPCC default value