Experience and lesson learned in developing standardized baseline (Rice mill sector)

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Cambodia DNA
This Standardized Baseline (SB) is made available for Cambodia through cooperation and assistance of the Market Mechanism Group, Institute for Global Environmental Strategies of Japan.
Cambodia is abundant with small and medium scale of rice mill that are unable to apply for CDM due to technical and financial barriers.

With SB, it can:
- Reducing transaction cost
- Enhancing transparency, objectivity and predictability
- Facilitating access to CDM
- Scaling up the abatement of GHG emissions
2. SB Submission

- DNA submitting this form: **Cambodia (MoE)**
- Developer of SB: **IGES**
- Party or Parties to which SB applies: **Cambodia**
- Sector to which the proposed SB applies: **Rice mill sector**

- The final report was submitted to EB by MoE on 25 Sept. 2012.
- The second Submission (after comment from CDM team) was on 7-Jun. 2013
- SB was approved during CoP19 (Nov. 2013)
3. SB Development

- SB development activity was started in late 2011
- Cambodia, according to the statistic, has about 27,000 rice millers entire the country ranging from the small moving unit to large installment.
  - Not available data for SBs => Sampling survey
3. SB Development

Data needs:

- Status of use of fuel (energy source) and technology for operating a rice mill factory
- Parameter for the rice mill sector’s emission factor; Qt. of fuel consumption, Qt. of rice production, type of fuel (energy source), CO$_2$ emission factor/Net calorific value by fuel (IPCC)

The required specific data was collected base on a set of questionnaire from selected rice millers.
3. SB Development
Field survey activities
3. SB Development

Technology 1: Power Driven by diesel engine

4 technologies were identified in rice milling sector

\[ EF_{t1,y} = 0.0483 \text{t-CO}_2/\text{t-rice} \]

Where:
- \( EF_{t1,y} \): Emission Factor of Technology 1 in year \( y \) (t-CO\(_2\)/t-rice)
- \( EF_{t1,m,y} \): Emission Factor of rice mill \( m \) adopting Technology 1 in year \( y \) (t-CO\(_2\)/t-rice)
- \( DC_{m,y} \): Quantity of diesel consumption in rice mill \( m \) in year \( y \) (l)
- \( DD \): Density of diesel (0.8439 kg/l (International Energy Agency et al, 2004))
- \( EF_{CO2,diesel} \): CO\(_2\) emission factor of diesel (3.2 kg-CO\(_2\) per kg of diesel, AMS-LB.)
- \( MR_{m,y} \): Quantity of milled rice production in rice mill \( m \) in year \( y \) (t)
- \( M \): Rice mill adopting Technology 1
- \( Y \): The relevant year
- \( N \): Number of rice mills adopting Technology 1

\[ EF_{t1,m,y} = \frac{DC_{m,y} \times DD \times EF_{CO2,diesel} \times 10^{-3}}{MR_{m,y}} \]

\[ EF_{t1,y} = \frac{\sum (EF_{t1,m,y} \times MR_{m,y})}{\sum MR_{m,y}} \]
Technology 2: Electricity Supplied from Rural Electricity Entrepreneur

\[ EF_{t2,m,y} = \frac{EC_{m,y} \times EF_{REE}}{MR_{m,y}} \]

Where:
- \( EF_{t2,y} \): CO₂ emission Factor of Technology 2 in year \( y \) (t-CO₂/t-rice)
- \( EC_{m,y} \): Quantity of electricity consumption, supplied by a grid to a rice mill \( m \) in year \( y \) (MWh)
- \( EF_{REE} \): Emission Factor of REE (Rural Electricity Entrepreneur) (0.8t-CO₂/MWh)
- \( MR_{m,y} \): Quantity of milled rice production in rice mill \( m \) in year \( y \) (t)
- \( M \): Rice mill adopting Technology 2
- \( Y \): The relevant year
- \( N \): Number of rice mills adopting Technology 2

\[ EF_{t2,y} = 0.036 \text{ t-CO}_2/\text{t-rice} \]
Technology 3: Power Driven by a dual mode engine and rice husk gasification

\[ EF_{t3, m, y} = \frac{DC_{m, y} \times DD \times EF_{CO2, diesel} \times 10^{-3}}{MR_{m, y}} \]

\[ EF_{t3, y} = \sum_{m} (EF_{t3, m, y} \times MR_{m, y}) \sum_{m} MR_{m, y} \]

\[ EF_{t3, y} = 0.0162 \text{ t-CO}_2/\text{t-rice} \]

Where:
- \( EF_{t3, y} \) - Emission Factor of Technology 3 in year \( y \) (t-CO\(_2\)/t-rice)
- \( EF_{t3, m, y} \) - Emission Factor of rice mill \( m \) adopting Technology 3 in year \( y \) (t-CO\(_2\)/t-rice)
- \( DC_{m, y} \) - Quantity of diesel consumption in rice mill \( m \) in year \( y \) (l)
- \( DD \) - Density of diesel (0.8439 kg/l (International Energy Agency et al, 2004))
- \( EF_{CO2, diesel} \) - CO\(_2\) emission factor of diesel (3.2 kg-CO\(_2\) per kg of diesel, AMS-I.B.)
- \( MR_{m, y} \) - Quantity of milled rice production in rice mill \( m \) in year \( y \)
- \( M \) - Rice mill adopting Technology 3
- \( Y \) - The relevant year
- \( N \) - Number of rice mills adopting Technology 3

Rice mill factory

Gasifier system

Rice husk

Dual fuel mode engine

Dynamo

Generator

Power

Electricity

Rice mill machines

Appliances

Lighting
Technology 4: Electricity generated by steam turbine with rice husk combustion

This technology does not consume any fuel other than rice husk, a by-product of the milling process.

Emissions from this technology are zero t-CO$_2$
Energy generation technology of rice mill sector

Technology 1: Power-driven by a diesel engine
Technology 2: Electricity supplied from REE
Technology 3: Power-driven by a dual mode engine and rice husk gasification
Technology 4: Electricity generated by steam turbine with combustion of rice husk

Criteria for Additionality:
- 0% Additionality
- 20% Additionality
- 40% Additionality
- 60% Additionality
- 80% Additionality
- 100% Additionality

Carbon intensity:
- Low: Technology 4, 0% CO2/t-rice
- High: Technology 1, 90.9%, 0.0483t-CO2/t-rice

% of rice produced:
- 0%
- 20%
- 40%
- 60%
- 80%
- 90%
- 100%
3. SB Development

Additionality demonstration
Cost comparison analysis in the first proposal

<table>
<thead>
<tr>
<th>Initial cost</th>
<th>Annual operating cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology 1</td>
<td>Technology 2</td>
</tr>
<tr>
<td>47 USD/t-rice</td>
<td>24 USD/t-rice</td>
</tr>
<tr>
<td>Technology 2</td>
<td>Technology 3</td>
</tr>
<tr>
<td>249 USD/t-rice</td>
<td>36 USD/t-rice</td>
</tr>
<tr>
<td>Technology 3</td>
<td>Technology 4</td>
</tr>
<tr>
<td>74 USD/t-rice</td>
<td>22 USD/t-rice</td>
</tr>
<tr>
<td>Technology 4</td>
<td></td>
</tr>
<tr>
<td>771 USD/t-rice</td>
<td>28 USD/t-rice</td>
</tr>
</tbody>
</table>

Baseline technology
Technology 1 < Additional Technology
Technology 2,3,4

Cost comparison analysis was excluded finally, because Technology 3 and 4 in this case can meet the criteria for automatically additional.

- **Up to 5 MW that employ renewable energy as their primary technology**
- **The geographic location of the project activity is in one of the LDCs**

Guidelines for demonstrating additionality of microscale project activities
4. Benefit of SB is simplifying monitoring

- AMS-I.B. - Number of monitoring parameters is seven (7) at least. It is difficult to measure mechanical energy output, additional parameters maybe required.

- 1st proposal - Number of monitoring parameters is only one
  \[ E_{R_{CO2}} = B_{E_{CO2}} - P_{E_{CO2}} \]
  \[ B_{E_{CO2}} = \text{Milled rice} \times \text{Baseline emission factor} \times \text{Diesel replacement rate} \]

- Recommendation from the secretariat - Number of monitoring parameters is two
  \[ E_{R_{CO2}} = B_{E_{CO2}} - P_{E_{CO2}} \]
  \[ B_{E_{CO2}} = \text{Milled rice} \times \text{Baseline emission factor} \]
  \[ P_{E_{CO2}} = \text{Diesel consumptions} \times \text{Diesel density} \times \text{CO2 emission factor for diesel} \]

Monitoring parameter

Default value
5. Final Decision by EB - Number of monitoring parameters is one (basically)

\[ BE_y = \min(3000, \frac{Q_{rice,y}}{Q_{cap,daily} \times 200}) \times EF_{baseline} \]  

Equation (1)

- **Where:**
  - \( BE_y \) = Baseline emissions in year \( y \) (t CO\(_2\))
  - \( Q_{rice,y} \) = Quantity of rice produced in year \( y \) (t rice)
  - \( Q_{cap,daily} \) = Maximum quantity of rice produced per day, determined ex ante according to design specification of the rice mill machines (t rice/day)
  - 200 = Typical number of days for processing per year (days); with justification an alternative number may be used
  - \( EF_{baseline} \) = Baseline emission factor (t CO\(_2\)/t rice), 0.0506 t CO\(_2\)/t rice for small/medium mills (\( \leq 1,000 \) t rice /yr) and 0.033 t CO\(_2\)/t rice for semi-large mills (>1,000 t rice /yr and \( \leq 3,000 \) t rice /yr)

(c) The following parameter (if diesel is consumed by the project activity) shall be monitored according to the provisions in AMS-1.B, and the other parameters in the methodology do not apply:

(i) Quantity of diesel consumption in year \( y \);
6. Justification for the data was the issue

Careful reading to the QA/QC guideline and a QC report by DNA before the proposal submission were required for a smooth assessment.

Checking items: Consistency, Completeness, Traceability, Conservativeness, Calculation, Transparency

Conservativeness VS. Project development enhancement

Emission factor (CO₂ emissions per 1t of rice production)

- Actual 0.022 - 0.090 t-CO₂/t-rice
- Weighted average 0.048 t-CO₂/t-rice
- 90th percentile 0.027 t-CO₂/t-rice

Simple average (1st proposal) 0.054 t-CO₂/t-rice

Grouping by scale and 90th or 80th percentile 0.026 - 0.051 t-CO₂/t-rice

Emissions t-CO₂ in a mill

Small scale mill → Large scale mill
Key factors for the success to developing SB proposal

- To identify a target project type, check not only the potential of emission reductions but also data availability
- Well designed survey plan and quality check system
- Carefully review the related guidelines
- Work closer cooperation with DNA and the UNFCCC secretariat

Improvement for the SB related guidelines

Need to provide flexibility for the requirements
- Data vintage
- Threshold for baseline & additionality
- Options for demonstration of technology/fuel/feedstock penetration
- Options for additionality demonstration measure
- Allow to use for partly incomplete data and information with some treatment
- The role and responsibility of DNA for developing and maintaining data
7. Conclusion and recommendation

- The SB seems very appropriate with “Small-middle” and “Semi-large” categories of rice mill,
- The above rice mills may need to have special financial support in order to engage them with PoA and new technologies,
- SB is basically for CDM PoA, using it in other carbon credit mechanisms remains a question,
- Rice husk is a potential renewable energy that could help reducing production cost of milled rice, which is an important factor for improving competition of rice market of Cambodia.
THANK YOU!

Cambodia’s DNA

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