JCM Proposed Methodology Form

Cover sheet of the Proposed Methodology Form

Form for submitting the proposed methodology

Host Country	Kingdom of Thailand
Name of the methodology proponents submitting this form	Toray Industries Inc.
Sectoral scope(s) to which the Proposed Methodology applies	3. Energy demand
Title of the proposed methodology, and version number	Installation of energy saving air jet loom at textile factory, Version 1.0
List of documents to be attached to this form (please check):	☐The attached draft JCM-PDD: ☒Additional information Appendix 1: Additional information to the proposed JCM methodology “Installation of energy saving air jet loom at textile factory”
Date of completion	01/08/2017

History of the proposed methodology

Version	Date	Contents revised
1.0	01/08/2017	First edition

A. Title of the methodology

Installation of energy saving air jet loom at textile factory, Version 1.0

B. Terms and definitions

Terms	Definitions
Air jet loom	A loom which uses a jet of air to propel the weft yarn through the shed
Specific electricity consumption of the air compressors	Amount of electricity to generate one unit of compressed air
Specific air consumption of the air jet loom	Amount of compressed air to weave one unit of fabric

C. Summary of the methodology

Items	Summary
GHG emission reduction measures	Replacement of existing air jet looms at textile factory with the ones equipped with energy saving technology reduces compressed air consumption and leads to reducing electricity consumption by the compressor, and consequently GHG emission reductions.
Calculation of reference emissions	Reference emissions are calculated with amount of fabric produced in the project, the specific air consumption of the project air jet loom, reduction rate of air consumption, the specific electricity consumption of the air compressors and CO_2 emission factor for electricity consumed.
Calculation of project emissions	Project emissions are calculated with amount of fabric produced in the project, the specific air consumption of the project air jet loom, the specific electricity consumption of the air compressors and CO_2 emission factor for electricity consumed.
Monitoring parameters	● Amount of fabric woven in the project

D. Eligibility criteria

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

Criterion 1	The project replaces existing air jet looms at a weaving factory with air jet looms equipped with energy saving technologies such as an optimized shape reed's tunnel of nozzles and a pressure sensor to measure air pressure of nozzles for optimization of compressed air consumption of welt insertion.
Criterion 2	The air jet looms which are installed by the project reduce the specific air consumption by at least 15% compared with the reference air jet looms in line with the description in Section I of this methodology.

E. Emission Sources and GHG types

Reference emissions	
Emission sources	GHG types
Electricity consumption by air compressors to generate compressed air for the reference air jet looms	CO_2
Project emissions	
Emission sources	GHG types
Electricity consumption by air compressors to generate compressed air for the project air jet looms	CO_2

F. Establishment and calculation of reference emissions

F.1. Establishment of reference emissions

Reference emissions are calculated with the following parameters:

- Amount of fabric produced in the project at each project factory [m/p], which is expressed as the amount of fabric produced as per the project air jet loom type which is determined by, for example, a model of the project air jet loom by the manufacturer during the monitoring period;
- Specific air consumption as per the project air jet loom type at each project factory [Nm^3/m], which is expressed as amount of compressed air to weave one unit of fabric;
- Reduction rate of specific air consumption at each project factory [%], which is expressed as the average of reduction rates of specific air consumptions by the project air jet loom

to specific air consumptions by the reference air jet loom as per fabric type;

- Specific electricity consumption of the air compressors at each project factory [kWh/Nm^3], which is expressed as amount of electricity to generate one unit of compressed air; and
- CO_2 emission factor for electricity consumed [tCO_2/kWh].

Net emission reductions are achieved by setting specific air consumption as per the project air jet loom type at each project factory at a minimum value in line with the description in Section I of this methodology.

Specific electricity consumption of the compressor(s) is recalculated in line with Section I below if any of the existing compressors is replaced with a new one, or the configuration of compressors connected to supply compressed air to the project air jet looms is changed at the time of or after registration of the project.

F.2. Calculation of reference emissions

$$RE_p = \sum_j \left(SEC_j \times \sum_i (SAC_{PJ,i,j} \times AP_{PJ,i,j,p}) \div \left(1 - \frac{RR_{i,j}}{100}\right) \times EF_{elec,j} \right)$$

Where:

RE_p : Reference emissions during the period *p* [tCO_2/p]

SEC_j : Specific electricity consumption of the air compressors at the project factory *j* [kWh/Nm^3]

$SAC_{PJ,i,j}$: Specific air consumption of the project air jet loom type *i* at the project factory *j* [Nm^3/m]

$RR_{i,j}$: Reduction rate of specific air consumption of the project air jet loom type *i* at the project factory *j* [%]

$AP_{PJ,i,j,p}$: Amount of fabric woven by the project air jet loom type *i* at the project factory *j* during the period *p* [m/p]

$EF_{elec,j}$: CO_2 emission factor for consumed electricity at the project factory *j* [tCO_2/kWh]

i : Identification number of the project air jet loom type, differentiated according to, for example, models

j : Identification number of the project factory

G. Calculation of project emissions

$$PE_p = \sum_j \left(SEC_j \times \sum_i (SAC_{PJ,i,j} \times AP_{PJ,i,j,p}) \times EF_{elec,j} \right)$$

Where:

PE_p : Project emissions during the period p [tCO_2/p]

SEC_j : Specific electricity consumption of the air compressors at the project factory j [kWh/Nm^3]

$SAC_{PJ,i,j}$: Specific air consumption of the project air jet loom type i at the project factory j [Nm^3/m]

$AP_{PJ,i,j,p}$: Amount of fabric woven at the project air jet loom type i at the project factory j during the period p [m/p]

$EF_{elec,j}$: CO_2 emission factor for consumed electricity at the project factory j [tCO_2/kWh]

i : Identification number of the project air jet loom type, differentiated according to, for example, models

j : Identification number of the project factory

H. Calculation of emissions reductions

$$ER_p = RE_p - PE_p$$

Where:

ER_p : Emission reductions during the period p [tCO_2/p]

RE_p : Reference emissions during the period p [tCO_2/p]

PE_p : Project emissions during the period p [tCO_2/p]

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
SEC_j	Specific electricity consumption of the air compressors at the project factory *j* [kWh/Nm^3] The default value is fixed *ex ante* for each project by the project participant. SEC_j is calculated from the linear function of shaft power [kW] and generated compressed air [Nm^3/h] of the compressors which are used to supply compressed air to the project air jet looms at the project factory *j*, assuming that the compressor is operating at the highest efficiency, determined from the performance curve of the compressors. In case that multiple air compressors are used at the project factory, the most conservative value (i.e. the highest efficiency) is selected as the default value regardless of the capacity or the model of the compressors. In case that any of the existing compressors is replaced with a new compressor, or the configuration of compressors connected to supply compressed air to the project air jet looms of the project is changed after registration, SEC_j for the corresponding factory is recalculated in the same manner described above.	Performance curve of the air compressors from their manufacturers
$SAC_{PJ,i,j}$	Specific air consumption of the project air jet loom type *i* at the project factory *j* [Nm^3/m] The default value is fixed as the minimum value of air consumption by the project air jet loom type, based on the data collected for the all fabric types	Experimental data from the manufacture of the project air jet looms

	woven at the project site as per the factory by experimental data from the manufacture of the project air jet looms (e.g.. consumption of compressed air and amount of fabric woven). In the case that only one fabric type is woven at the project factory, multiple data (at least two) of the corresponding fabric type are collected. In determining the default value, the fabric type woven at the project factory is categorized preceding the installation of the project air jet loom. Fabric type is defined by the value calculated by weft density multiplied by fabric width. The choice of fabric type is explained by, for example, the most recent fabric production inventory or production plan of the factory before the start date of project operation. The fabric is regarded as the same type if the variation of the value calculated as indicated above within one category of fabric type does not differ by more than plus or minus 5% in the value of fabric type. In case several fabric types are within the 5% range, choose the closest one to the fabric type woven by the project.	
$RR_{i,j}$	Reduction rate of specific air consumption of the project air jet loom type *i* at the project factory *j* [%] The value is fixed as an average of reduction rate of specific air consumption for each fabric type woven as per project air-jet loom type in the project factory. Reduction rate of specific air consumption is calculated for each project as per a project air jet loom type at the project factory in the following manner: - The reference air jet looms are defined as one of the	Based on project and reference specific air consumption collected as per the project

	following whichever is produced at a later date: 1) the previous model of air jet looms produced by the same manufacture of the project air jet loom by one generation (e.g. a substantial model change which leads to reduction of air consumption) 2) existing air jet looms in the project factory - Collect dataset of specific air consumption by reference air jet looms (SAC_{RE}) 1) for the previous model of air jet looms, in a same manner as to that of the project air jet looms in line with this Section 2) for the existing air jet looms, in a same manner as to that of the project air jet looms in line with this Section except data of consumption of compressed air and amount of fabric woven. These data are directly measured with measuring equipment at the existing air jet looms in a same manner as to that of the project air jet looms. - Compare the specific air consumption of reference air jet looms to that of project air jet looms as per the fabric type and calculate the reduction rate as following manner: Calculate reduction rates of specific air consumption comparing that of the project air jet loom and the reference air jet loom according to the categories of fabric type established above and average the derived values. Reduction rate of specific air consumption of the project air jet loom type *i* at the project factory *j* is expressed by the following formula, where *i*, *j* and *k* are suffixes denoting air jet loom type, factory and fabric type.	

	$$RR_{i,j} = \frac{1}{m}\sum_{k=1}^{m}\left[(1-\frac{SAC_{PJ,i,j,k}}{SAC_{RE,j,k}}) \times 100\right]$$	
$EF_{elec,j}$	CO_2 emission factor for consumed electricity in the project factory j [tCO_2/kWh] When only grid electricity or captive electricity is consumed in the project factory, the project participant applies the CO_2 emission factor respectively. When both grid electricity and captive electricity may be consumed in the project factory, the project participant applies the CO_2 emission factor with lower value. [CO_2 emission factor] For grid electricity: The most recent value available from the source stated in this table at the time of validation For captive electricity, it is determined based on the following options: a) Calculated from its power generation efficiency (η_{elec} [%]) obtained from manufacturer's specification The power generation efficiency based on lower heating value (LHV) of the captive power generation system from the manufacturer's specification is applied; $$EF_{elec} = 3.6 \times \frac{100}{\eta_{elec}} \times EF_{fuel}$$ b) Calculated from measured data The power generation efficiency calculated from monitored data of the amount of fuel input for power generation ($FC_{PJ,p}$) and the amount of electricity	[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 "Grid Emission Factor (GEF) of Thailand", endorsed by Thailand Greenhouse Gas Management Organization unless otherwise instructed by the Joint Committee. [Captive electricity] For the option a) Specification of the captive power generation system provided by the manufacturer (η_{elec} [%]). CO_2 emission factor of the fossil fuel type used in the captive power generation system (EF_{fuel} [tCO_2/GJ]) For the option b) Generated and supplied electricity by the captive power generation system

<table>
<tr>
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<td>generated ($EG_{PJ,p}$) during the monitoring period p is applied. The measurement is conducted with the monitoring equipment to which calibration certificate is issued by an entity accredited under national/international standards;
$$EF_{elec} = FC_{PJ,p} \times NCV_{fuel} \times EF_{fuel} \times \frac{1}{EG_{PJ,p}}$$
Where:
NCV_{fuel} : Net calorific value of consumed fuel [GJ/mass or weight]

Note:
In case the captive electricity generation system meets all of the following conditions, the value in the following table may be applied to EF_{elec} depending on the consumed fuel type.
・ The system is non-renewable generation system
・ Electricity generation capacity of the system is less than or equal to 15 MW
<table>
<tr><th>fuel type</th><th>Diesel fuel</th><th>Natural gas</th></tr>
<tr><td>EF_{elec}</td><td>0.8 *1</td><td>0.46 *2</td></tr>
</table>

*1 The most recent value at the time of validation is applied.
*2 The value is calculated with the equation in the option a) above. The lower value of default effective CO_2 emission factor for natural gas (0.0543tCO_2/GJ), and the most efficient value of default efficiency for off-grid gas turbine systems (42%) are applied.</td>
<td>($EG_{PJ,p}$ [MWh/p]).
Fuel amount consumed by the captive power generation system ($FC_{PJ,p}$ [mass or weight/p]).
Net calorific value (NCV_{fuel} [GJ/mass or weight]) and CO_2 emission factor of the fuel (EF_{fuel} [tCO_2/GJ]) in order of preference:
1) values provided by the fuel supplier;
2) measurement by the project participants;
3) regional or national default values;
4) IPCC default values provided in table 1.4 of Ch.1 Vol.2 of 2006 IPCC Guidelines on National GHG Inventories. Lower value is applied.

[Captive electricity with diesel fuel]
CDM approved small scale methodology: AMS-I.A.

[Captive electricity with natural gas]
2006 IPCC Guidelines on National GHG Inventories for the</td>
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		source of EF of natural gas. CDM Methodological tool "Determining the baseline efficiency of thermal or electric energy generation systems version02.0" for the default efficiency for off-grid power plants.