Joint Crediting Mechanism Approved Methodology VN_AM014
"Introduction of energy efficient wire stranding machines to automotive wire production factory"

A. Title of the methodology

Introduction of energy efficient wire stranding machines to automotive wire production factory, Version 01.0

B. Terms and definitions

Terms	Definitions
wire stranding machine	A machine which twists metal wires together with other ones for bundling using a bow by electric motor and winds wires to the bobbin.

C. Summary of the methodology

Items	Summary
GHG emission reduction measures	This methodology applies to the project that aims for saving energy by introducing energy efficient wire stranding machines in Vietnam.
Calculation of reference emissions	GHG emissions associated with electricity consumption of reference wire stranding machines are calculated based on the monitored electricity consumption of project wire stranding machines, electricity consumption ratio per production unit (hereinafter referred to as "ECR"), and the CO_2 emission factor for consumed electricity.
Calculation of project emissions	GHG emissions associated with electricity consumption of project wire stranding machines are calculated based on the monitored electricity consumption of project wire stranding machines and the CO_2 emission factor for consumed electricity.
Monitoring parameters	● Electricity consumption of project wire stranding machines

	● The amount of fuel consumption and the amount of electricity generated by captive power, where applicable

D. Eligibility criteria

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

Criterion 1	Wire stranding machine(s) with energy-saving measures such as reinforced frames, friction reduction mechanism, energy efficient bow, and lightweight parts is newly installed or installed to replace existing wire stranding machine(s).
Criterion 2	Flange diameter of bobbin of a wire stranding machine installed in the project is 560mm.
Criterion 3	Total motor capacity of a project wire stranding machine installed in the project is equal to or less than 11.0 [kW].

E. Emission Sources and GHG types

Reference emissions	
Emission sources	GHG types
Electricity consumption by reference wire stranding machines	CO_2
Project emissions	
Emission sources	GHG types
Electricity consumption by project wire stranding machines	CO_2

F. Establishment and calculation of reference emissions

F.1. Establishment of reference emissions

Reference emissions are calculated with electricity consumption of project wire stranding machines, electricity consumption ratio per production unit (ECR), and CO_2 emission factor for electricity consumed.

ECR is provided as a default value in this methodology and is conservatively set *ex ante* in the following manner to ensure the net emission reductions.

1. The wire stranding machine with higher energy efficiency currently available in the Vietnamese market is determined as a reference wire stranding machine.
2. Electricity consumption per production unit (EPU) of twisted wire by wire stranding machine, which is expressed in [kWh/km] varies depending on the twisting speed. Therefore, ECR is uniquely determined as the minimum ECR value in the range of the assumed operational twisting speed.

F.2. Calculation of reference emissions

$$RE_p = \sum_i \left(EC_{PJ,i,p} \times ECR\right) \times EF_{elec}$$

RE_p : Reference emissions during the period p [tCO_2/p]
$EC_{PJ,i,p}$: Electricity consumption of project wire stranding machine i during the period p [MWh/p]
ECR : Electricity consumption ratio per production unit [-]
EF_{elec} : CO_2 emission factor for consumed electricity [tCO_2/MWh]
i : Identification number of wire stranding machines [-]

G. Calculation of project emissions

$$PE_p = \sum_i EC_{PJ,i} \times EF_{elec}$$

PE_p : Project emissions during the period p [tCO_2/p]
$EC_{PJ,i,p}$: Electricity consumption of project wire stranding machine i during the period p [MWh/p]
EF_{elec} : CO_2 emission factor for consumed electricity [tCO_2/MWh]
i : Identification number of wire stranding machines [-]

H. Calculation of emissions reductions

$$ER_p = RE_p - PE_p$$

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
EF_{elec}	CO_2 emission factor of consumed electricity. When project wire stranding machines consume only grid electricity or captive electricity, the project participant applies the CO_2 emission factor respectively. When project wire stranding machines may consume both grid electricity and captive electricity, 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:	[Grid electricity] Ministry of Natural Resources and Environment of Vietnam (MONRE), Vietnamese DNA for CDM unless otherwise instructed by the Joint Committee. [Captive electricity] For the option a) Specification of the captive power generation system provided by the manufacturer ($\eta_{elec,CG}$ [%]). CO_2 emission factor of the fossil fuel type used in the captive power generation system ($EF_{fuel,CG}$ [tCO_2/GJ]) For the option b)

	a) Calculated from its power generation efficiency ($\eta_{elec,CG}$ [%]) 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; $$EF_{elec} = 3.6 \times \frac{100}{\eta_{elec,CG}} \times EF_{fuel,CG}$$ b) Calculated from measured data The power generation efficiency calculated from monitored data of the amount of fuel input for power generation ($FC_{PJ,CG,p}$) and the amount of electricity generated ($EG_{PJ,CG,p}$) 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; $$EF_{elec} = FC_{PJ,CG,p} \times NCV_{fuel,CG} \times EF_{fuel,CG} \times \frac{1}{EG_{PJ,CG,p}}$$ Where: $NCV_{fuel,CG}$: Net calorific value of fuel consumed by the captive power generation system [GJ/mass or volume] 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	Generated and supplied electricity by the captive power generation system ($EG_{PJ,CG,p}$ [MWh/p]). Fuel amount consumed by the captive power generation system ($FC_{PJ,CG,p}$ [mass or volume/p]). Net calorific value ($NCV_{fuel,CG}$ [GJ/mass or volume]) and CO_2 emission factor ($EF_{fuel,CG}$ [tCO_2/GJ]) of the fuel consumed by the captive power generation system 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 tables 1.2 and 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

<table>
<tr>
<td></td>
<td>
Electricity generation capacity of the system is less than or equal to 15 MW
<table>
<tr><td>fuel type</td><td>Diesel fuel</td><td>Natural gas</td></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 (0.0543 tCO_2/GJ), and the most efficient value of default efficiency for off-grid gas turbine systems (42%) are applied.
</td>
<td>the 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.</td>
</tr>
<tr>
<td>ECR</td>
<td>Electricity consumption ratio per production unit.

ECR is derived as a ratio of electricity consumption per production unit of reference wire stranding machine to that of project machine.
$$ECR = EPU_{RE}/EPU_{PJ}$$
Where;
EPU_{RE} : Electricity consumption per production unit of reference wire stranding machine [kWh/km]
EPU_{PJ} : Electricity consumption per production unit of project wire stranding machine [kWh/km]

The default value of ECR is set at the minimum value in a conservative manner, as follows;
$$\text{ECR} = \min\left(EPU_{RE}/EPU_{PJ}\right) = \mathbf{1.51}$$</td>
<td>Survey results on $\boldsymbol{EPU_{RE}}/\boldsymbol{EPU_{PJ}}$ of wire stranding machines that have high market share in Vietnam.

The default values should be revised if necessary.</td>
</tr>
</table>

History of the document

Version	Date	Contents revised
01.0	29 August 2018	Decision by the Joint Committee Initial approval.