JCM Proposed Methodology Form

Cover sheet of the Proposed Methodology Form

Form for submitting the proposed methodology

Host Country	Socialist Republic of Vietnam
Name of the methodology proponents submitting this form	Nihon Crant Co. Ltd.
Sectoral scope(s) to which the Proposed Methodology applies	7. Transport
Title of the proposed methodology, and version number	Modal Shift from Truck to Cargo Ship with Freshness Preservation Reefer Container, Version 01.0
List of documents to be attached to this form (please check):	☐The attached draft JCM-PDD: ☐Additional information
Date of completion	27/03/2022

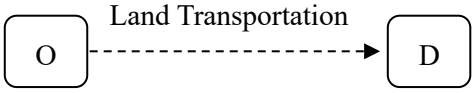
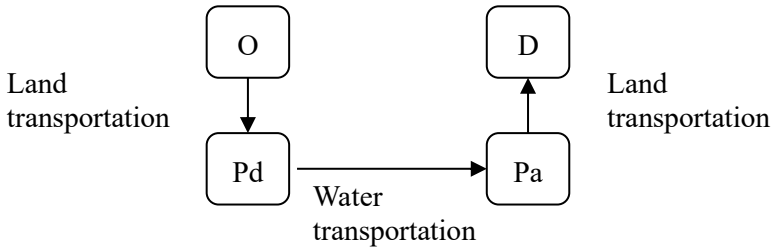
History of the proposed methodology

Version	Date	Contents revised
01.0	27/03/2022	First edition

A. Title of the methodology

Modal shift from truck to cargo ship with freshness preservation reefer container, Version 01.0

B. Terms and definitions

Terms	Definitions
Freshness Preservation Reefer Container	A reefer container which forms static electric field to maintain freshness of foods and so on.
Reference route	A reference route is a route of land transportation from an origin (O) where the freight is picked up to a destination (D) where the freight is delivered. 
Project route	A project route is a route of the following transportations: ● Land transportation from an origin (O) to a departure port (Pd) where the freight is loaded on a cargo ship. ● Water transportation from a departure port (Pd) to an arrival port (Pa) where the freight is unloaded. ● Land transportation from an arrival port (Pa) to a destination (D). 

C. Summary of the methodology

Items	Summary
GHG emission reduction measures	Modal shift from truck (reference route) to cargo ship (project route) leads to reduction of fossil fuel consumption per

	transportation of a unit of freight.
Calculation of reference emissions	Reference emissions are calculated from total mass of project freight transported through the project land route, one-way land transportation distance of the reference route, a CO_2 emission factor.
Calculation of project emissions	Project emissions include the emissions resulting from land transportation by trucks, and water transportation by cargo ships. (1) Land transportation Project emissions from land transportation are calculated from total mass of project freight transported through the project land route, one-way land transportation distance of the project route and a CO_2 emission factor. (2) Water transportation Project emissions from water transportation consist of fossil fuel consumption by cargo ships and electricity consumption by reefer containers. (a) Fossil fuel consumption by cargo ships Project emissions from fossil fuel consumption by cargo ships are calculated by using one of the following options, in order of preference: ● Option.1 Energy-based approach Project emissions from fossil fuel consumption by cargo ships are calculated from fossil fuel consumption by cargo ships through the project water transportation activity, total mass of project freight transported through the project water transportation activity, total mass of all freight transported through the project water transportation activity, net calorific value and a CO_2 emission factor. ● Option. 2 Activity-based approach Project emissions from fossil fuel consumption by cargo ships are calculated from total mass of project freight transported through the project water transportation activity, one-way water transportation distance of the project activity, and a CO_2 emission factor.

	(b) Electricity consumption by reefer containers Project emissions from electricity consumption by reefer containers are calculated from total electricity consumption by project reefer containers transported through the project water transportation activity and a CO_2 emission factor, if applicable. Project emissions from fuel/electricity consumption by gantry cranes to load the freight on a cargo ship and unload the freight from a cargo ship are excluded from project emissions since the ratio of project emissions from gantry cranes to the total project emissions are considered to be very small.
Monitoring parameters	● One-way land transportation distance of the reference route ● One-way land transportation distance of the project route ● One-way water transportation distance of the project activity ● Total mass of project freight transported through the project land route ● Fossil fuel consumption by cargo ships through the project water transportation activity ● Total mass of project freight transported through the project water transportation activity ● Total mass of all freight transported through the project water transportation activity ● Total electricity consumption by project reefer containers transported through the project water transportation activity

D. Eligibility criteria

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

Criterion 1	Freshness preservation reefer containers are introduced.
Criterion 2	The freshness preservation reefer containers are transported by water.
Criterion 3	A plan for prevention of releasing refrigerant used for project reefer containers is prepared. In the case of replacing the existing reefer containers with the project reefer containers, a plan for prevention of releasing refrigerant used in

	the existing reefer containers to the air (e.g. re-use the pure refrigerants and/or recover and destroy blend refrigerants) is prepared. Execution of this plan is checked at the time of verification, in order to confirm that refrigerant used for the existing one replaced by the project is prevented from being released to the air.

E. Emission Sources and GHG types

Reference emissions	
Emission sources	GHG types
Fossil fuel combustion by truck	CO_2
Project emissions	
Emission sources	GHG types
Fossil fuel combustion by truck	CO_2
Fossil fuel combustion by cargo ships	CO_2
Electricity consumption by reefer containers	CO_2

F. Establishment and calculation of reference emissions

F.1. Establishment of reference emissions

Reference emissions are calculated from total mass of project freight transported through the project land route, one-way land transportation distance of the reference route, a CO_2 emission factor for land transportation per freight tonne kilometres. Total mass of project freight transported through the project land route and one-way land transportation distance of the reference route are monitored through the crediting period.

To ensure net emission reductions, a CO_2 emission factor for land transportation per freight tonne kilometres is set in a conservative manner, which is referred to the CDM methodology "AM0090 Modal shift in transportation of cargo from road transportation to water or rail transportation Version 1.1.0".

Type of cargo transported	Emission factor (tCO_2/tonne-km)
Perishable and semi-perishable foodstuff and canned food	0.000094

F.2. Calculation of reference emissions

$$RE_p = \sum_i \left(FR_{PJ,i,p} \times AD_{RE,land,i} \times EF_{FR,land} \right)$$

Where

RE_p	:	Reference emissions during the period p [tCO_2/p]
$FR_{PJ,i,p}$	:	Total mass of project freight transported through the project land route i during period p [tonne/p] * $FR_{PJ,i,p}$ does not include tare weight of containers.
$AD_{RE,land,i}$	:	One-way land transportation distance of the reference route i [km]
$EF_{FR,land}$	:	CO_2 emission factor for land transportation per freight tonne kilometres [tCO_2/tonne-km]
i	:	Indication number of the land transportation route as follows; - For project route: a combination of a route from the origin to departure port and from arrival port to the destination. - For reference route: a route from the origin to the destination, which are the same as the project route.

* Electricity consumption by reefer containers is also considered as an emission source during land transportation, however it is already included in the emission factor for land transportation per freight tonne kilometres.

G. Calculation of project emissions

$$PE_p = PE_{land,p} + PE_{water,p}$$

Where

PE_p	:	Project emissions during the period p [tCO_2/p]
$PE_{land,p}$	:	Project emissions from land transportation during the period p [tCO_2/p]
$PE_{water,p}$	:	Project emissions from water transportation during the period p [tCO_2/p]

(1) $PE_{land,p}$ are calculated as below.

$$\boldsymbol{PE_{land,p} = \sum_{i}\left(FR_{PJ,i,p} \times AD_{PJ,land,i} \times EF_{FR,land}\right)}$$

Where

$FR_{PJ,i,p}$: Total mass of project freight transported through the project land route i during period p [tonne/p]
* $FR_{PJ,i,p}$ does not include tare weight of containers.

$AD_{PJ,land,i}$: One-way land transportation distance of the project route i [km]

$EF_{FR,land}$: CO_2 emission factor for land transportation per freight tonne kilometres [tCO_2/tonne-km]

i : Indication number of the land transportation route as follows;
- For project route: a combination of a route from the origin to departure port and from arrival port to the destination.
- For reference route: a route from the origin to the destination, which are the same as the project route.

* Electricity consumption by reefer containers is also considered as an emission source during land transportation, however it is already included in the emission factor for land transportation per freight tonne kilometres.

(2) $PE_{water,p}$ are calculated as below.

$$\boldsymbol{PE_{water,p} = PE_{ship,p} + PE_{container,p}}$$

Where

$PE_{ship,p}$: Project emissions from fossil fuel consumption by cargo ships during the period p [tCO_2/p]

$PE_{container,p}$: Project emissions from electricity consumption by reefer containers transported through the project water transportation during the period p [tCO_2/p]

(a) $PE_{ship,p}$ are calculated by using one of the following options.

Option 1 : Energy-based approach

$$\boldsymbol{PE_{ship,p} = \sum_{j}\left(FC_{ship,j,p} \times NCV_{j} \times EF_{fuel,j} \times \frac{FR_{PJ,j,p}}{FR_{all,j,p}}\right)}$$

Where

$FC_{ship,j,p}$: Fossil fuel consumption by cargo ships through the project water transportation activity j during the period p [mass or volume/p]

NCV_j	:	Net calorific value for fossil fuel used by cargo ships through the project water transportation activity *j* [GJ/mass of volume]
$EF_{fuel,j}$	:	CO_2 emission factor for fossil fuel used by cargo ships through the project water transportation activity *j* [tCO_2/GJ]
$FR_{PJ,j,p}$	:	Total mass of project freight transported through the project water transportation activity *j* during the period *p* [tonne/p] * $FR_{PJ,j,p}$ includes tare weight of containers.
$FR_{all,j,p}$	:	Total mass of all freight transported through the project water transportation activity *j* during the period *p* [tonne/p] * $FR_{all,j,p}$ includes tare weight of containers.
j	:	Indication number of the project water transportation activity

Option 2 : Activity-based approach

$$\boldsymbol{PE_{ship,p} = \sum_{j} \left(FR_{PJ,j,p} \times AD_{PJ,water,j} \times EF_{FR,water,j} \right)}$$

Where

$FR_{PJ,j,p}$	:	Total mass of project freight transported through the project water transportation activity *j* during the period *p* [tonne/p] * $FR_{PJ,j,p}$ includes tare weight of containers.
$AD_{PJ,water,j}$	:	One-way water transportation distance of the project activity *j* [km]
$EF_{FR,water,j}$	:	CO_2 emission factor for the project water transportation activity *j* per freight tonne kilometres [tCO_2/tonne-km]
j	:	Indication number of the project water transportation activity.

(b) $PE_{container,p}$ are calculated as below.

$$\boldsymbol{PE_{conatiner,p} = \sum_{j} EC_{container,j,p} \times EF_{elec}}$$

Where

$EC_{container,j,p}$	:	Total electricity consumption by project reefer containers transported through the project water transportation activity *j* during the period *p* [MWh/p]
EF_{elec}	:	CO_2 emission factor for consumed electricity from captive power generation [tCO_2/MWh]

* In the case of Option1, Energy-based approach, if fuel consumption for captive power generation is included in $FC_{ship,j,p}$, then $PE_{container,p}$ is calculated as zero.

* Project emissions from fuel/electricity consumption by gantry cranes to load the freight on a cargo ship and unload the freight from a cargo ship are excluded from project emissions since the ratio of project emissions from gantry cranes to the total project emissions are considered to be very small.

H. Calculation of emissions reductions

$$\boldsymbol{ER_p} = \boldsymbol{RE_p - PE_p}$$

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
$EF_{FR,land}$	CO_2 emission factor for land transportation per freight tonne kilometres [tCO_2/tonne-km] Type of cargo transported: Perishable and semi-perishable foodstuff and canned food Emission factor (tCO_2/tonne-km): 0.000094	The default values provided in the CDM methodology "AM0090 Modal shift in transportation of cargo from road transportation to water or rail transportation Version 1.1.0".
NCV_j	Net calorific value for fossil fuel used by cargo ships through the project water transportation activity j [GJ/mass of volume]	In the order of preference: a) Values provided by the fuel supplier; b) Measurement by the project participants; c) Reginal or national default

<table>
<tr><td></td><td></td><td>values;
d) IPCC default values provided in 2006 IPCC Guidelines on National GHG Inventories. Upper value is applied.</td></tr>
<tr><td>$EF_{fuel,j}$</td><td>CO_2 emission factor for fossil fuel used by cargo ships through the project water transportation activity j [tCO_2/GJ]</td><td>In the order of preference:
a) Values provided by the fuel supplier;
b) Measurement by the project participants;
c) Reginal or national default values;
d) IPCC default values provided in 2006 IPCC Guidelines on National GHG Inventories. Upper value is applied.</td></tr>
<tr><td>EF_{elec}</td><td>CO_2 emission factor for consumed electricity from captive power generation [tCO_2/MWh]

The default emission factor of 1.3 is applied.</td><td>CDM methodological tool “TOOL 05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation, version 03.0”</td></tr>
<tr><td>$EF_{FR,water,j}$</td><td>CO_2 emission factor for water transportation activity j per freight tonne kilometres [tCO_2/tonne-km]

<table>
<tr><th>Type of ship</th><th>Size</th><th>Emission factor (tCO_2/tonne-km)</th></tr>
<tr><td rowspan="6">Container Ship</td><td>8,000 + TEU</td><td>0.0000125</td></tr>
<tr><td>5,000 – 7,999 TEU</td><td>0.0000166</td></tr>
<tr><td>3,000 – 4,999 TEU</td><td>0.0000166</td></tr>
<tr><td>2,000 – 2,999 TEU</td><td>0.0000200</td></tr>
<tr><td>1,000 – 999 TEU</td><td>0.0000321</td></tr>
<tr><td>0 – 999 TEU</td><td>0.0000363</td></tr>
</table>
</td><td>The default values provided in Table 9.1 in the “Second IMO Greenhouse Gas Study 2009” issued by IMO.</td></tr>
</table>

	* TEU stands for Twenty-Foot Equivalent Unit which can be used to measure a ship's cargo carrying capacity.	