JCM Project Design Document Form

A. Project description

A.1. Title of the JCM project

Installation of Energy-efficient Refrigerators Using Natural Refrigerant at Distribution Centre of Better Foods Co., Ltd.

A.2. General description of project and applied technologies and/or measures

The proposed JCM project aims to save energy by installing a refrigeration system with natural refrigerants (NH_3 and CO_2) in new cold distribution centers of Better Foods Co., Ltd. in Lopburi Province, Thailand. The project refrigeration system employs an "indirect cooling method," which uses ammonia to cool CO_2 and then CO_2 is transported to a cooler in a cold storage. Also, by this method, ammonia is contained in the machine room alone and only CO_2 is circulated in the cooler, ensuring the occupational safety.

The following refrigerators produced by MAYEKAWA MFG. CO., LTD. are installed in this project.

- NewTon R-8000 (HSC-120L-NN4I-03) (3 units)
- NewTon R-3000 (HSC-45L-NN4I-01) (2units)
- NewTon C (HSC-65H-PR4I-02) (1 unit)

The project refrigeration system has been improved in technology aspects of compressor, heat exchanger and system control, which leads to improvement of COPs hence energy savings.
COPs of the project refrigerators (COP_{PJ}) are 2.25 for Newton R-8000, 2.10 for Newton R-3000, and 3.37 for Newton C. Those values are calculated by dividing cooling capacity of the refrigerator by its electricity consumption based on the manufacturer's catalogue.

The estimated project CO_2 emissions are 1,613 tCO_2e/year, and the estimated reference CO_2 emissions are 2,040 tCO_2e/year resulting in an estimated annual GHG emission reduction of 427 tCO_2e.

A.3. Location of project, including coordinates

Country	Kingdom of Thailand
Region/State/Province etc.:	Lopburi Province
City/Town/Community etc:	Chong Sarika, Phatthana Nikhom District
Latitude, longitude	14°47'07.6"N 100°55'02.3"E

A.4. Name of project participants

The Kingdom of Thailand	Better Foods Co., Ltd.
Japan	KANEMATSU CORPORATON

A.5. Duration

Starting date of project operation	01/06/2017
Expected operational lifetime of project	10years

A.6. Contribution from Japan

The proposed project was partially supported by the Ministry of the Environment, Japan through the financing programme for JCM model projects which provided financial supports up to 50% of initial investment for the projects in order to acquire JCM credits.
As for technology transfer, MAYEKAWA MFG. CO., LTD has conducted OJT training and provided a manual on operation, maintenance and safety measures of the facilities introduced to the project of Better Foods Co., Ltd. Maintenance services after project implementation are provided by MAYEKAWA (THAILAND) CO., LTD., which also contribute to technical transfer through maintenance experiences of the staff of Better Foods Co., Ltd.

B. Application of an approved methodology(ies)

B.1. Selection of methodology(ies)

Selected approved methodology No.	TH_AM011
Version number	Version 01.0

B.2. Explanation of how the project meets eligibility criteria of the approved methodology

Eligibility criteria	Descriptions specified in the methodology	Project information
Criterion 1	Refrigerator(s) with a secondary loop cooling system using CO_2 as a refrigerant and equipped with inverter is installed at cold storage.	The following refrigerators with a secondary loop cooling system using CO_2 as a refrigerant and equipped with inverter are installed at a food industry cold storage of Better Foods Co., Ltd in Thailand. ・NewTon R-8000 (HSC-120L-NN4I-03)

<table>
<tr><td></td><td></td><td>・NewTon R-3000
(HSC-45L-NN4I-01)
・NewTon C
(HSC-65H-PR4I-02)</td></tr>
<tr><td>Criterion 2</td><td>COP of project refrigerator(s) installed in the project cooling system is more than the threshold COP values set in the tables below. (“x” in the table represents cooling capacity per unit.)
<table><tr><th>Room temperature condition</th><th>Cooling capacity (kW)</th><th>Threshold COP value</th></tr><tr><td>- 25 deg. C</td><td>42.4 ≤ x ≤ 340.0</td><td>1.71</td></tr><tr><td>0 deg. C</td><td>73.6 ≤ x ≤ 516.4</td><td>2.79</td></tr><tr><td>5 deg. C</td><td>86.2 ≤ x ≤ 612.6</td><td>3.20</td></tr></table>COP for the project refrigerator(s) are calculated with the following conditions:
・ Room temperature condition: - 25 deg. C or 0 deg. C or 5 deg. C
・ Cooling water fed to condenser: inlet 32 deg. C</td><td>The following types of Refrigerators are installed according to room temperature conditions.
・NewTon R-8000
(HSC-120L-NN4I-03)
<table><tr><th>Room temperature condition</th><th>Cooling capacity (kW)</th><th>COP value</th></tr><tr><td>- 25 deg. C</td><td>270.0</td><td>2.25</td></tr></table>・NewTon R-3000
(HSC-45L-NN4I-01)
<table><tr><th>Room temperature condition</th><th>Cooling capacity (kW)</th><th>COP value</th></tr><tr><td>- 25 deg. C</td><td>94.7</td><td>2.10</td></tr></table>・NewTon C
(HSC-65H-PR4I-02)
<table><tr><th>Room temperature condition</th><th>Cooling capacity (kW)</th><th>COP value</th></tr><tr><td>0 deg. C</td><td>237.0</td><td>3.37</td></tr></table></td></tr>
<tr><td>Criterion 3</td><td>Periodical check is planned at least one (1) time annually.</td><td>Periodical check is planned in an “Operation Manual” at least once a year to be conducted by MAYEKAWA MFG. CO., LTD, the manufacturer of project refrigerators.</td></tr>
<tr><td>Criterion 4</td><td>In the case of replacing the existing refrigerator with the project refrigerator, a plan for prevention of releasing</td><td>The project refrigerators are newly installed at the project site.</td></tr>
</table>

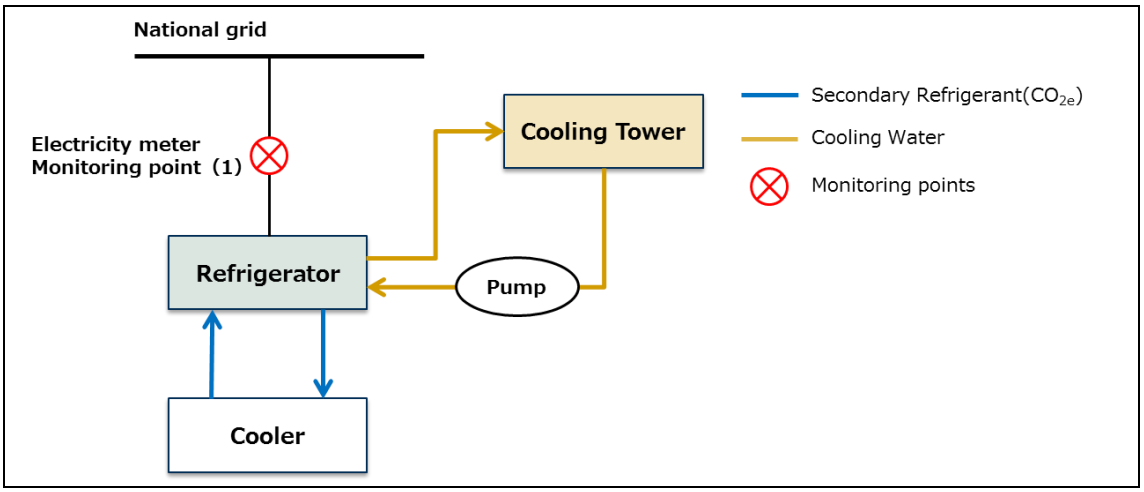
	refrigerant used in the existing refrigerator to the air (e.g. re-use of the equipment) is prepared. Execution of this plan is checked at the time of verification, in order to confirm that refrigerant used for the existing one replaced by the project is prevented from being released to the air.	

C. Calculation of emission reductions

C.1. All emission sources and their associated greenhouse gases relevant to the JCM project

Reference emissions	
Emission sources	GHG type
Power consumption by the reference refrigerator	CO_2
Project emissions	
Emission sources	GHG type
Power consumption by the project refrigerator	CO_2

C.2. Figure of all emission sources and monitoring points relevant to the JCM project



C.3. Estimated emissions reductions in each year

Year	Estimated Reference emissions (tCO_2e)	Estimated Project Emissions (tCO_2e)	Estimated Emission Reductions (tCO_2e)
2013	-	-	-
2014	-	-	-

2015	-	-	-
2016	-	-	-
2017	1,274.3	1,007.3	267
2018	2,177.7	1,721.3	456
2019	2,177.7	1,721.3	456
2020	2,177.7	1,721.3	456
2021	2,177.7	1,721.3	456
2022	2,177.7	1,721.3	456
2023	2,177.7	1,721.3	456
2024	2,177.7	1,721.3	456
2025	2,177.7	1,721.3	456
2026	2,177.7	1,721.3	456
2027	897.4	709.3	188
2028	-	-	-
2029	-	-	-
2030	-	-	-
Total (tCO_2e)			4,559

D. Environmental impact assessment	
Legal requirement of environmental impact assessment for the proposed project	No

E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

In order to cover a diverse group of stakeholders, on 12th December, a local stakeholder consultation has been conducted with participation of the local stakeholders listed in the table below.

The list of participants to the meeting has been consulted to the JC secretariat of Thai side (Thailand Greenhouse Gas Management Organization), and the local stakeholders to be invited have been fixed. The project participants sent invitation letters to those stakeholders except for those who work at the project site to notify of convening local stakeholder consultation meeting.

The schedule and participants of the meetings is provided below.

Date: 12th December 2017
Venue: Betagro Tower (North Park), 323 Vibhavadi Rangsit Rd., Lak Si, Bangkok,10210, Thailand
Time: 10:00-11:15

Agenda
1. Opening remarks
2. Introduction about Betagro Group
3. Introduction about Kanematsu Corporation and Project Overview
4. Introduction about JCM
5. Introduced Technology and Facility
6. Q&A and collection of comments
7. Closing

[Local stakeholders]

No.	Organization	Position
1	Thailand Greenhouse Gas Management Organization (TGO), Ministry of Natural Resources and Environment	Manager
2	Thailand Greenhouse Gas Management Organization (TGO), Ministry of Natural Resources and Environment	Technical officer
3	Kasetsart University	Lecturer
4	Better Foods Co., Ltd.	Engineer

[Project participants]
Project participants: [Thailand] Better Foods Co., Ltd., [Japan] Kanematsu Corporation
Manufacturer of the project refrigerator: MAYEKAWA MFG. CO., LTD., MAYEKAWA (THAILAND) CO., LTD.

At each agenda item, a brief presentation was made by the project participants and manufacturer of the project refrigerator, and opinions of the stakeholders were solicited. A summary of the comments received and consideration of those comments are provided in Section E.2. below.

E.2. Summary of comments received and their consideration

Stakeholders	Comments received	Consideration of comments received
Manager, Thailand Greenhouse Gas Management Organization (TGO), Ministry of Natural Resources and Environment	Since this project is to install energy-efficient equipment at a distribution centre, it seems no environmental impact on local stakeholders outside the distribution centre.	No further action is needed.
Manager, Thailand Greenhouse Gas Management Organization (TGO), Ministry of Natural Resources and Environment	Operational safety of equipment is to be considered since it utilises ammonia as refrigerant.	Volume of ammonia in the project refrigerators is very small compared to the conventional type. Furthermore, it is carefully designed to avoid leakage of ammonia. No further action is needed.
Lecturer, Kasetsart University	Load factor of refrigerators may need to be considered to calculate GHG emissions.	Equations are determined in the methodology to be able to calculate GHG emissions regardless of load factor. No further action is needed.
Lecturer, Kasetsart University	I am very happy to have such high-efficiency refrigerators in cold food storage system in Thailand.	No further action is needed.
Lecturer, Kasetsart University	As an expert of mechanical engineering, it seems safety of operators working in the cold storage is ensured in regard to ammonia refrigerant.	No further action is needed.

F. References

Reference lists to support descriptions in the PDD, if any.

Annex

Revision history of PDD		
Version	Date	Contents revised
1.0	01/12/2021	First draft