JCM Project Design Document Form

A. Project description

A.1. Title of the JCM project

Energy Saving for Air conditioning in Tire Manufacturing Factory with High Efficiency Centrifugal Chiller

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

The proposed JCM project aims to improve energy saving for air conditioning and process cooling by introducing high efficiency centrifugal chillers in a tire factory. The factory needs considerable electricity, and chillers consume significant amount of energy compared with the other machines in the factory. The proposed project locates in Bridgestone Tire Manufacturing (THAILAND) Co., Ltd. in Chonburi province in Thailand. Before the project was implemented, there were three (3) chillers, one absorption chiller and two centrifugal chillers. These chillers were replaced with three (3) high efficiency centrifugal chillers of 600 USRt by the project.

A.3. Location of project, including coordinates

Country	The Kingdom of Thailand
Region/State/Province etc.:	Chonburi province
City/Town/Community etc:	Amata Nakorn Industrial Estate Tambol Bankao Amphur Panthong
Latitude, longitude	N 13° 26' 52.4" and E 101° 03' 11.4"

A.4. Name of project participants

The Kingdom of Thailand	Bridgestone Tire Manufacturing (THAILAND) Co., Ltd. (hereinafter “Bridgestone”)
Japan	INABATA & CO., LTD.

A.5. Duration

Starting date of project operation	01/02/2018
Expected operational lifetime of project	9 years

A.6. Contribution from Japan

The proposed project was partially supported by the Ministry of the Environment, Japan (MOEJ) through the Financing Programme for JCM Model projects, which provided financial support of less than half of the initial investment for the projects in order to acquire JCM credits. As for technology transfer, capacity building on operation and monitoring activities has been conducted by Ebara (Thailand) Limited below:

1) Direct instruction on proper operation, and
2) The opportunity for local operators to visit buildings in Japan where district heating and cooling system are being operated and to learn actual status of chiller utilization.

B. Application of an approved methodology(ies)

B.1. Selection of methodology(ies)

Selected approved methodology No.	TH_AM005
Version number	Version 02.0

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	Project chiller is a non-inverter type centrifugal chiller with a capacity which is less than or equals to 1,500 USRt. *Note : 1 USRt = 3.52 kW*	Project chiller (Ebara high efficiency centrifugal chiller: RTBF 060S) is a centrifugal chiller with non-inverter type which is a capacity of 600 USRt. [Calculation] 2,110 [kW] / 3.52 = 599.43 ≒ 600 [USRt]
Criterion 2	COP for project chiller *i* calculated under the standardizing temperature conditions[*1] ($COP_{PJ,tc,i}$) is more than the threshold COP values set in the table below. ("x" in the table represents cooling capacity per unit.)	The COPs for project chillers ($COP_{PJ,tc,i}$) which are introduced to the proposed project are described below. COP of No.1 chiller is 6.31 COP of No.2 chiller is 6.36 COP of No.3 chiller is 6.36

Cooling capacity per unit [USRt]	**300≤x<500**	**500≤x<800**	**800≤x≤1500**
Threshold COP	5.67	5.81	6.05

	value			

$COP_{PJ,tc,i}$ is calculated by altering the temperature conditions of COP of project chiller *i* ($COP_{PJ,i}$) from the project specific conditions to the standardizing conditions. $COP_{PJ,i}$ is derived from specifications prepared for the quotation or factory acceptance test data by manufacturer.

[equation to calculate $COP_{PJ,tc,i}$]

$$\mathbf{COP_{PJ,tc,i}} = \mathbf{COP_{PJ,i}} \times [(\mathbf{T_{cooling-out,i}} - \mathbf{T_{chilled-out,i}} + \mathbf{TD_{chilled}} + \mathbf{TD_{cooling}}) \div (\mathbf{37 - 7} + \mathbf{TD_{chilled}} + \mathbf{TD_{cooling}})]$$

$COP_{PJ,tc,i}$: COP of project chiller *i* calculated under the standardizing temperature conditions* [-]

$COP_{PJ,i}$: COP of project chiller *i* under the project specific conditions [-]

$T_{cooling-out,i}$: Output cooling water temperature of project chiller *i* set under the project specific conditions [degree Celsius]

$T_{chilled-out,i}$: Output chilled water temperature of project chiller *i* set under the project specific conditions [degree Celsius]

$TD_{cooling}$: Temperature difference between condensing temperature of refrigerant and output cooling water temperature 1.5 degree Celsius set as a default value [degree Celsius]

$TD_{chilled}$: Temperature difference between evaporating temperature of refrigerant and output chilled water temperature, 1.5 degree Celsius set as a default value [degree Celsius]

*1 : The standardizing temperature conditions to calculate $COP_{PJ,tc,i}$

Chilled water:	output	7 degrees Celsius
	input	12 degrees Celsius
Cooling water:	output	37 degrees Celsius
	input	32 degrees Celsius

Criterion 3	Periodical check is planned at least one (1) time annually.	Bridgestone agreed to conduct periodical checks more than one (1) time annually, in order to check the troubles occurred from the last check.

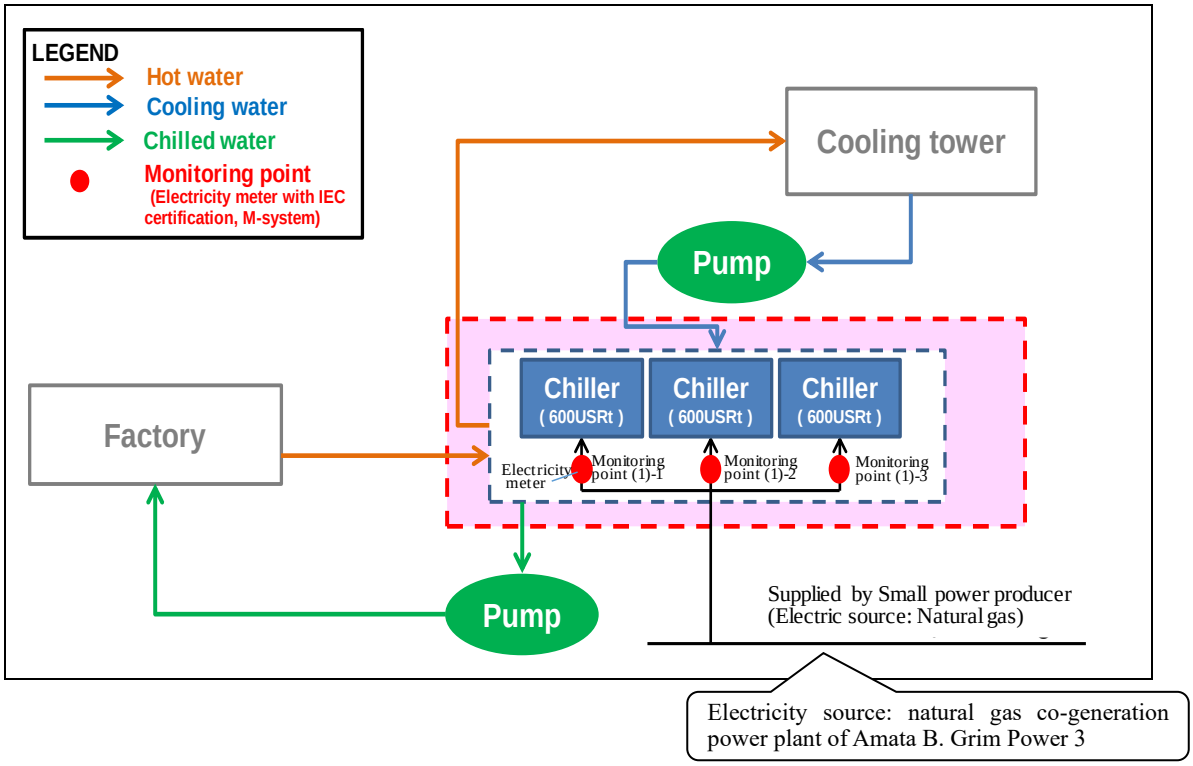
Criterion 4	Ozone Depletion Potential (ODP) of the refrigerant used for project chiller is zero.	Refrigerant for the project chiller is HFC 245fa, whose ODP is zero.
Criterion 5	A plan for prevention of releasing refrigerant used for project chiller is prepared. In the case of replacing the existing chiller with the project chiller, a plan for prevention of releasing refrigerant used in the existing chiller 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.	"Refrigerant recovery and charging procedure plan" was prepared by the chiller manufacturer and signed by the project participants properly. Also, the existing chiller was replaced by the project chiller and its refrigerant was removed and re-used properly by the chiller manufacturer (Ebara Thailand).

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 reference chiller	CO_2
Project emissions	
Emission sources	GHG type
Power consumption by project chiller	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)
2018	2,264.3	2,073.2	191
2019	2,470.1	2,261.7	208
2020	2,470.1	2,261.7	208
2021	2,470.1	2,261.7	208
2022	2,470.1	2,261.7	208
2023	2,470.1	2,261.7	208
2024	2,470.1	2,261.7	208
2025	2,197.2	2,010.4	186
2026	1,169.8	1,068.0	101
2027	68.8	62.8	5
Total (tCO_2e)			1,731

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

Local Stakeholder Consultation (LSC) had been held in 28th November 2017, which had invited several stakeholders (see the list of participants below). As for the invitation to Thailand government organization, the invitation letter sent to TGO on 23th November 2017. Details of the LSC are presented below;

Date : Nov. 28, 2017 10:00 -

Venue : Meeting room of Bridgestone Tire Manufacturing (THAILAND) Co., Ltd.

Agenda :

#	Time	Program	Remarks
1	10:00 - 10:10	Opening remarks	TGO and BTMT or Inabata
2	10:10 – 10:20	Overview of the project	Inabata
3	10:20 – 10:30	Explanation of technology introduced at the BTMT factory	Ebara Thailand
4	10:30 – 10:50	Questions and answers	All
5	10:50 – 11:00	Closing remarks	TGO and BTMT or Inabata

List of the participants:

#	Organization
1	Bridgestone Tire Manufacturing (Thailand) Co., Ltd. (BTMT) (Managing Director, Administration Director, Plant Manager, Department Manager of Engineering Dept., Manager of Accounting & Finance Dept, Interpreter etc.)
2	Thailand Greenhouse Gas Management Organization (TGO)
3	Inabata & Co., Ltd.
4	Ebara (Thailand) Limited
5	Nippon Koei Co., Ltd.

E.2. Summary of comments received and their consideration

Stakeholders	Comments received	Consideration of comments received
Thailand Greenhouse Gas Management Organization (TGO)	Please let us know the installation place of chillers. Also, is there any possibility of releasing the refrigerant from the project chiller?	1) As for the installation place, the chillers were installed inside the factory building. [Bridgestone] 2) As for the refrigerant, it will not be released to the air. [Bridgestone] The comments were closed.
Thailand	How does it calculate/estimate the	At the factory inspection, COP was

Greenhouse Gas Management Organization (TGO)	coefficient of performance (COP) of the project chiller?	checked based on the Japanese Industrial Standards (JIS) code properly and reported in the inspection sheet. [Ebara Thailand Limited] The comment was closed.
Staff of Bridgestone	Through the JCM model project, electricity consumption has been reduced. And, confirmation of the energy saving can be identified easily with the monitoring system installed.	Positive opinion was received. No action is needed.

F. References

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

Annex

Revision history of PDD		
Version	Date	Contents revised
01.0	28/02/2019	First edition
02.0	10/07/2020 17/06/2022	Second edition Initial registration by the Joint Committee through electronic decision