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' 54.0" and E 101° 03' 10.5"

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	Chiller 1 : 01/09/2016 Chiller 2 : 01/06/2017 Chiller 3 : 01/02/2018
Expected operational lifetime of project	9 years for each chiller

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 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 value	5.67	5.81	6.05

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

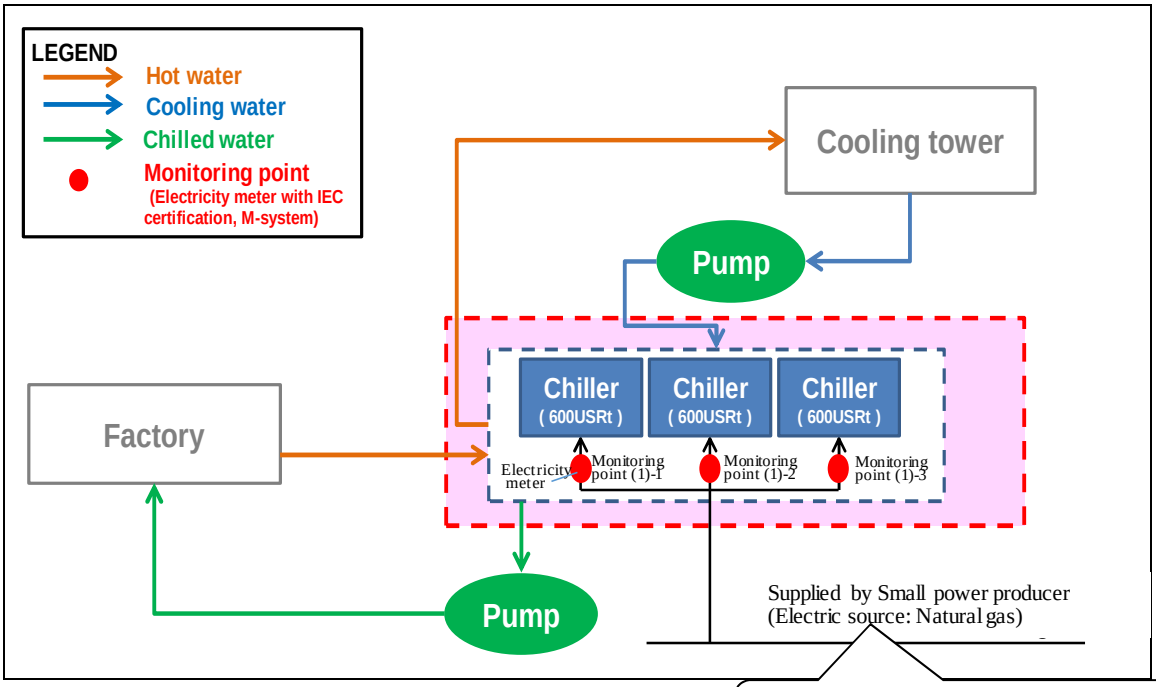
	used for project chiller is zero.	chiller is HFC 245fa, whose ODP is zero.
Criterion 5	A plan for prevention of releasing refrigerant used for project chiller is prepared. In the case of replacing the existing chiller with the project chiller, a plan for prevention of releasing refrigerant used in the 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.	Letter of consent on not releasing refrigerant used for project and existing chillers was prepared by Bridgestone. CFC-123 (refrigerant for the existing chiller) had been properly removed and kept by 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)
2016	895.9	820.3	75
2017	4,255.7	3,896.6	359
2018	7,839.5	7,178.0	661
2019	8,063.5	7,383.1	680
2020	8,063.5	7,383.1	680
2021	8,063.5	7,383.1	680
2022	8,063.5	7,383.1	680
2023	8,063.5	7,383.1	680
2024	8,063.5	7,383.1	680
2025	7,167.5	6,562.7	604
2026	3,807.7	3,486.4	321
2027	223.9	205.0	18
2028	–	–	–
2029	–	–	–
2030	–	–	–
Total (tCO_2e)			6,118

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

The main stakeholders of the project are people working at the project sites. In order to collect comments from these stakeholders, the project participants held a stakeholder meeting.

Date and time	Venue	Participants
November 28, 2017	Meeting room of Bridgestone	Manager and engineer of Bridgestone, Engineer of Ebara Thailand etc.

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 Greenhouse Gas Management Organization (TGO)	How does it calculate/estimate the coefficient of performance (COP) of the project chiller?	At the factory inspection, COP was 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	Positive opinion was received. No action is needed.

	reduced. And, confirmation of the energy saving can be identified easily with the monitoring system installed.	

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