JCM Project Design Document Form

A. Project description

A.1. Title of the JCM project

Installation of Co-Generation Plant for On-Site Energy Supply and High Efficiency Non-Inverter Type Centrifugal Chiller in Motorcycle Factory

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

A co-generation system (hereinafter referred to as CGS), which mainly consists of a 7,800 kW gas engine and heat recovery steam generator, and a high efficiency centrifugal chiller (1,425USRt) are newly installed in a motorcycle factory located in a suburb of Bangkok by the local company, NS-OG Energy Solutions (Thailand) Ltd. (hereinafter referred to as NSET). The Japanese company, NIPPON STEEL ENGINEERING CO., LTD. (the company name has been changed from Nippon Steel & Sumikin Engineering Co., Ltd. from 01/04/2019) helps project implementation. The CGS and the centrifugal chiller are installed in a motorcycle factory owned by Thai Honda Manufacturing Co., Ltd. and owned and operated by NSET. Electricity generated by the CGS is consumed by the project centrifugal chiller and supplied to the motorcycle factory to substitute the grid electricity. The project centrifugal chiller consumes grid electricity when the CGS is not running. Steam and hot water generated by the CGS and chilled water generated by the centrifugal chiller are also supplied to the factory, which leads to reduction of fossil fuel consumption.

A.3. Location of project, including coordinates

Country	The Kingdom of Thailand
Region/State/Province etc.:	Bangkok
City/Town/Community etc:	410 Ladkrabang Industrial Estate, Chalongkrung Rd., Lamplatue, Ladkrabang, Bangkok, 10520 Thailand
Latitude, longitude	13°46'28.0"N 100°47'58.0"E

A.4. Name of project participants

The Kingdom of Thailand	NS-OG Energy Solutions (Thailand) Ltd.
Japan	NIPPON STEEL ENGINEERING CO., LTD.

A.5. Duration

Starting date of project operation	01/04/2018
Expected operational lifetime of project	15 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.

B. Application of an approved methodology(ies)

B.1. Selection of methodology(ies)

Selected approved methodology No.	TH_AM005
Version number	Ver2.0
Selected approved methodology No.	TH_AM009
Version number	Ver1.0

B.2. Explanation of how the project meets eligibility criteria of the approved methodology [TH_AM005]

<table>
<tr><th>Eligibility criteria</th><th>Descriptions specified in the methodology</th><th>Project information</th></tr>
<tr><td>Criterion 1</td><td>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</td><td>A non-inverter type centrifugal chiller manufactured by EBARA (product model type is “RTBF150”), whose capacity is 1,425 USRt, is installed for this project.</td></tr>
<tr><td>Criterion 2</td><td>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.)
<table>
<tr><td>Cooling capacity per unit [USRt]</td><td>300≤x<500</td><td>500≤x<800</td><td>800≤x≤1500</td></tr>
<tr><td>Threshold COP Value</td><td>5.67</td><td>5.81</td><td>6.05</td></tr>
</table></td><td>COP for the project chiller (RTBF150) calculated under the standardizing temperature conditions is 6.13 with a cooling capacity of 1425 USRt, which is more than the threshold COP value set in this criterion.</td></tr>
</table>

	$COP_{PJ,tc,i}$ 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 $COP_{PJ,tc,i}$] $\mathbf{COP_{PJ,tc,i} = COP_{PJ,i} \times [(T_{cooling-out,i} - T_{chilled-out,i} + TD_{chilled} + TD_{cooling}) \div (37 - 7 + TD_{chilled} + TD_{cooling})]}$ $COP_{PJ,tc,i}$: 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.	Periodical check is annually planned by the manufacturer.
Criterion 4	Ozone Depletion Potential (ODP) of the refrigerant used for project chiller is zero.	The refrigerant used for 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	The project chiller has been newly installed at the project site. Measures to prevent releasing refrigerant used in the project chiller to the air will

	for the existing one replaced by the project is prevented from being released to the air.	be taken when it is replaced.

[For TH_AM009]

Eligibility criteria	Descriptions specified in the methodology	Project information
Criterion 1	A CGS, whose electricity is generated by a gas engine(s), is newly installed and supplies electricity and heat to recipient facility(ies).	A CGS manufactured by, Wärtsilä Corporation (model number is "W 16V34SG"), whose power generation is driven by a gas engine, is newly installed and supplies electricity and heat to the recipient facilities.
Criterion 2	Electricity and heat, each of which is generated in separate systems, is supplied to and consumed by recipient facility(ies) before the installation of a project CGS.	Before the installation of the project CGS, electricity was supplied by the grid and heat was generated by a gas boiler, and they were consumed at the recipient facilities.

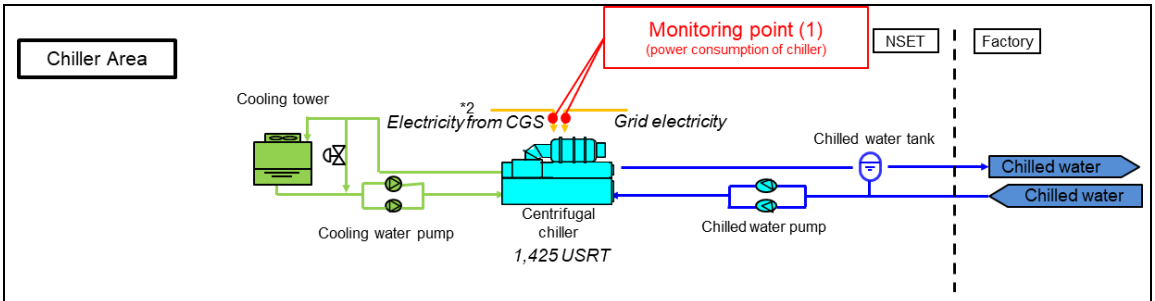
C. Calculation of emission reductions

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

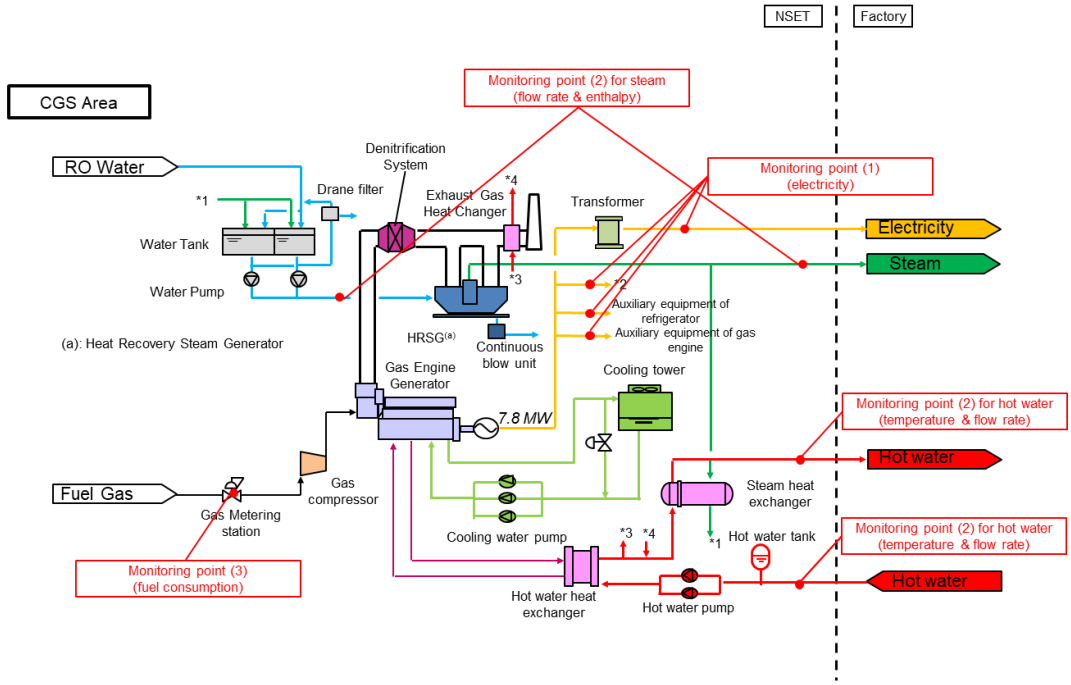
Reference emissions	
Emission sources	GHG type
Power consumption by reference chiller	CO_2
Electricity consumption in recipient facility(ies)	CO_2
Fossil fuel consumption for production of heat consumed in recipient facility(ies)	CO_2
Project emissions	
Emission sources	GHG type
Power consumption by project chiller	CO_2
Gas fuel consumption by CGS	CO_2

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

[TH_AM005]



[TH_AM009]



The data monitored and required for verification and issuance are kept and archived for two years after the final issuance of credits.

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	-	-	-
2018	N/A	N/A	5,447

2019	N/A	N/A	7,262
2020	N/A	N/A	7,262
2021	N/A	N/A	7,262
2022	N/A	N/A	7,262
2023	N/A	N/A	7,262
2024	N/A	N/A	7,262
2025	N/A	N/A	7,262
2026	N/A	N/A	7,262
2027	N/A	N/A	7,262
2028	N/A	N/A	7,262
2029	N/A	N/A	7,262
2030	N/A	N/A	7,262
Total (tCO_2e)			92,591

D. Environmental impact assessment	
Legal requirement of environmental impact assessment for the proposed project	YES IEE (Initial Environmental Examination, 28/9/2016)

E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

In order to collect comments from stakeholders, a local stakeholder consultation has been conducted on 22 August 2018 at the plant of Thai Honda Manufacturing Co., Ltd. where the project was implemented in Bangkok, Thailand. The schedule and participants of the meetings are provided below.

*The company name has been changed to NIPPON STEEL ENGINEERING CO., LTD. from Nippon Steel & Sumikin Engineering Co., Ltd. from 01/04/2019.

Date:22 August 2018

Venue: Office of NS-OG Energy Solutions (Thailand) Ltd. located in the factory of Thai Honda Manufacturing Co., Ltd.
No.410, Ladkrabang Industrial Estate, Chalongkrung Road, Ladkrabang, Bangkok, 10520, Thailand

Agenda:

1. Opening remarks by Nippon Steel & Sumikin Engineering Co., Ltd.
2. Introductions about company involved;

   Nippon Steel & Sumikin Engineering Co., Ltd.

   NS-OG Energy Solutions (Thailand) Ltd.

   Thai Honda Manufacturing Co., Ltd.
3. Project Overview and Introduced Technology and Facility

   by Nippon Steel & Sumikin Engineering Co., Ltd.
4. Questions and answers
5. Plant tour
6. Closing

[Local stakeholders]

No	Organization	Position
1	Thailand Greenhouse Gas Management Organization	Manager, Review and Monitoring Office
2	Thailand Greenhouse Gas Management Organization	Technical Officer, Review and Monitoring Office
3	The Joint Graduate School of Energy and Environment, King Mongkut's University of Technology Thonburi	Student
4	The Joint Graduate School of Energy and Environment, King Mongkut's University of Technology Thonburi	Student
5	The Joint Graduate School of Energy and Environment, King Mongkut's University of Technology Thonburi	Student
6	Thai Honda Manufacturing Co., Ltd.	General Manager Production Engineering Division
7	Thai Honda Manufacturing Co., Ltd.	Department Manager Environment & Facility Engineering Dept.
8	Thai Honda Manufacturing Co., Ltd.	Staff
9	NS-OG Energy Solution (Thailand) Ltd.	Manager, Operation Manager
10	NS-OG Energy Solution (Thailand) Ltd.	Plant Manager
11	Nippon Steel & Sumikin Engineering Co., Ltd.	Senior Manager, Project Manager
12	Nippon Steel & Sumikin Engineering Co., Ltd.	Manager, Engineering Manager
13	Nippon Steel & Sumikin Engineering Co., Ltd.	Construction Manager

14	Nippon Steel & Sumikin Engineering Co., Ltd.	Staff

[Project participants]
Project participants:
Nippon Steel & Sumikin Engineering Co., Ltd.
NS-OG Energy Solution (Thailand) Ltd.

After explanation about the proposed JCM project, questions and comments were solicited from the stakeholders. A summary of the received comments 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
Thailand Greenhouse Gas Management Organization (TGO), Ministry of Natural Resources and Environment	How to calculate the emission reductions by the chiller?	It is calculated by multiplying electricity consumption with the ratio of the energy efficiency (COP) between the reference chiller and the project chiller. COP of the project chiller is approximately 5% higher than COP of the reference chiller. No action is needed.
	What are steams generated by the gas engine co-generation system used for?	They are used for drying process. No action is needed.
	How does the gas engine co-generation system work during the failure of the grid electricity supply?	In case of an electricity outage, Honda will cut off some lines according to the electricity generation capacity of the gas engine co-generation system. No action is needed.
The Joint Graduate School of	How are the emission reductions achieved by the gas engine co-	The emission reductions are achieved by the recover and reuse of

Energy and Environment, King Mongkut's University of Technology Thonburi	generation system? Also, how are the emission reductions calculated?	waste heats and the avoidance of electricity losses of the distribution. For the grid electricity, there are losses of heat and electricity at the time of the generation and the distribution of electricity. For the gas engine co-generation system, due to on-site generation, there are less losses of electricity and waste heats are recovered and reused. The emission reductions are calculated from the difference between the project emissions and the reference emissions. The project emissions are calculated by multiplying the fuel consumption for the CGS by the emission factor. The reference emissions are calculated by multiplying amount of energy (electricity, heat and steam), consumed by the recipient facility which is generated by the CGS, by the emission factors which are assumed if the project is not implemented. (e.g. the energy is supplied from the grid electricity and a gas boiler) No action is needed.

F. References

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

Annex

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

[TH_AM005]

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

[TH_AM009]

Reference emissions	
Emission sources	GHG type
Electricity consumption in recipient facility(ies)	CO_2
Fossil fuel consumption for production of heat consumed in recipient facility(ies)	CO_2
Project emissions	
Emission sources	GHG type
Gas fuel consumption by CGS	CO_2

C.3.

Estimated emissions reductions in each year

[TH_AM005]

Year	Estimated Reference emissions (tCO_2e)	Estimated Project Emissions (tCO_2e)	Estimated Emission Reductions (tCO_2e)
2013	-	-	-
2014	-	-	-
2015	-	-	-
2016	-	-	-
2017	-	-	-
2018	1,714.5	1,693.3	21
2019	2,286.0	2,257.7	28
2020	2,286.0	2,257.7	28
2021	2,286.0	2,257.7	28

2022	2,286.0	2,257.7	28
2023	2,286.0	2,257.7	28
2024	2,286.0	2,257.7	28
2025	2,286.0	2,257.7	28
2026	2,286.0	2,257.7	28
2027	2,286.0	2,257.7	28
2028	2,286.0	2,257.7	28
2029	2,286.0	2,257.7	28
2030	2,286.0	2,257.7	28
Total (tCO_2e)	N/A	N/A	357

[TH_AM009]

Year	Estimated Reference emissions (tCO_2e)	Estimated Project Emissions (tCO_2e)	Estimated Emission Reductions (tCO_2e)
2013	-	-	-
2014	-	-	-
2015	-	-	-
2016	-	-	-
2017	-	-	-
2018	17,872.2	12,446.1	5,426
2019	23,829.6	16,594.8	7,234
2020	23,829.6	16,594.8	7,234
2021	23,829.6	16,594.8	7,234
2022	23,829.6	16,594.8	7,234
2023	23,829.6	16,594.8	7,234
2024	23,829.6	16,594.8	7,234
2025	23,829.6	16,594.8	7,234
2026	23,829.6	16,594.8	7,234
2027	23,829.6	16,594.8	7,234
2028	23,829.6	16,594.8	7,234
2029	23,829.6	16,594.8	7,234
2030	23,829.6	16,594.8	7,234
Total (tCO_2e)	N/A	N/A	92,234

Revision history of PDD		
Version	Date	Contents revised
1.0	24/09/2019	First edition
2.0	14/10/2020 17/06/2022	Second edition Initial registration by the Joint Committee through electronic decision