JCM Project Design Document Form

A. Project description

A.1. Title of the JCM project

Introduction of 1MW Solar Power System and High Efficiency Centrifugal Chiller in Large Shopping Mall

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

The proposed JCM project involves introduction of "1MW Solar Power System" and "High Efficiency Centrifugal Chiller" in a large shopping mall, AEON MALL Sen Sok City in Phnom Penh. "1MW Solar Power System" consists of the solar photovoltaic (PV) system (Capacity of approximately 1MW). The PV system in the proposed project activity is connected to internal grids of the shopping mall which is connected to the national grid. The PV systems replace grid electricity and contribute to greenhouse gas emissions reduction in Cambodia. "High Efficiency Centrifugal Chiller" which consists of 5 units (1,300USRt:2 units, 1,200USRt:2 units and 500USRt:1 unit) is newly installed. The COP of each unit is higher than that of conventional centrifugal chillers, and contributes to degrease grid electricity consumption and greenhouse gas emissions.

A.3. Location of project, including coordinates

Country	The Kingdom of Cambodia
Region/State/Province etc.:	Phnom Penh
City/Town/Community etc:	Sangkat Kmounh and Sangkat Phnom Penh Thmey, Khan Sen Sok, Phnom Penh, the Kingdom of Cambodia
Latitude, longitude	N 11°36'02" and E, 104°53'06"

A.4. Name of project participants

The Kingdom of Cambodia	AEON MALL(CAMBODIA)CO.,LTD
Japan	AEON Mall co., Ltd.

A.5. Duration

Starting date of project operation	01/07/2018
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 program 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. Further, implementation of the proposed project promotes diffusion of low carbon technology within Cambodia as well as technology transfer.

B. Application of an approved methodology(ies)

B.1. Selection of methodology(ies)

Selected approved methodology No.	KH_AM002
Version number	Ver1.0
Selected approved methodology No.	KH_AM003
Version number	Ver1.0

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

[KH_AM002]

Eligibility criteria	Descriptions specified in the methodology	Project information
Criterion 1	The project installs solar PV system(s).	The solar PV systems are installed on to a large shopping mall.
Criterion 2	The PV modules have obtained a certification of design qualifications (IEC 61215, IEC61646 or IEC 62108) and safety qualification (IEC 61730-1 and IEC 61730-2).	The PV modules installed in the project have been certified for IEC 61215, IEC 61730-1 and IEC 61730-2.
Criterion 3	The equipment to monitor output power of the solar PV system(s) and irradiance is installed at the project site.	Electricity meters and pyranometers have been installed at the project sites to monitor output power and irradiance, respectively.

[KH_AM003]

Eligibility criteria	Descriptions specified in the methodology	Project information
Criterion 1	Project chiller is a centrifugal chiller with a capacity of less than or equal to 1,300 USRt. * 1 USRt = 3.52 kW	The capacities of the chillers introduced in the project are 1,300USRt, 1,200USRt and 500USRt.
Criterion 2	COP for project chiller i calculated under the standardizing temperature conditions* ($COP_{PJ,tc,i}$) is more than the threshold COP	The COP for project chiller ($COP_{PJ,tc,i}$) which are introduced to the proposed

	values set in the tables below. ("x" in the table represents cooling capacity per unit.) [Threshold COP values for project chiller] Cooling capacity per unit (USRt) | 300≤x≤350 | 350<x≤550 | 550<x≤750 | 750<x≤1,300 Threshold COP value | 5.46 | 5.76 | 5.90 | 6.03 $COP_{PJ,tc,i}$ is a recalculation of COP of project chiller *i* ($COP_{PJ,i}$) djusting temperature conditions 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 at the time of shipment by manufacturer. [equation to calculate COPPJ,tc,i] $COP_{PJ,tc,i}=COP_{PJ,i} \times [(T_{cooling-out,i} - T_{chilled-out,i} + TD_{chilled} + TD_{cooling}) \div (37 - 7 + TD_{chilled} + TD_{cooling})]$ *$COP_{PJ,tc,i}$: 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 condition [degree Celsius]* *$T_{chilled-out,i}$: Output chilled water temperature of project chiller i set under the project specific condition [degree Celsius]* *$TD_{cooling}$: Temperature difference between condensing temperature of refrigerant and output cooling water temperature 1.5 degrees Celsius set as a default value [degree Celsius]* *$TD_{chilled}$: Temperature difference between evaporating temperature of refrigerant and output chilled water temperature, 1.5 degrees Celsius set as a default value [degree Celsius]* **The standardizing temperature conditions to calculate COPPJ,tc,i* *Chilled water: output 7 degrees Celsius* *input12 degrees Celsius* *Cooling water: output 37 degrees Celsius* *input32 degrees Celsius*	project are 1,300USRt : 6.64, 1,200USRt : 6.45 and 500USRt : 6.35. [Calculation result] <1,300USRt> 6.64=6.64 × [(37-7+1.5+1.5)] ÷(37-7+1.5+1.5) <1,200USRt> 6.45=6.45 × [(37-7+1.5+1.5)] ÷(37-7+1.5+1.5) <500USRt> 6.35=6.35 × [(37-7+1.5+1.5)] ÷(37-7+1.5+1.5)
Criterion 3	Periodical check is planned more than one (1) time annually.	Periodical check is planned one times annually.

Criterion 4	Ozone Depletion Potential (ODP) of the refrigerant used for project chiller is zero.	The refrigerant type of the project chiller is HFC-134 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.	The project newly installs 5 chillers and doesn't replace existing chillers.

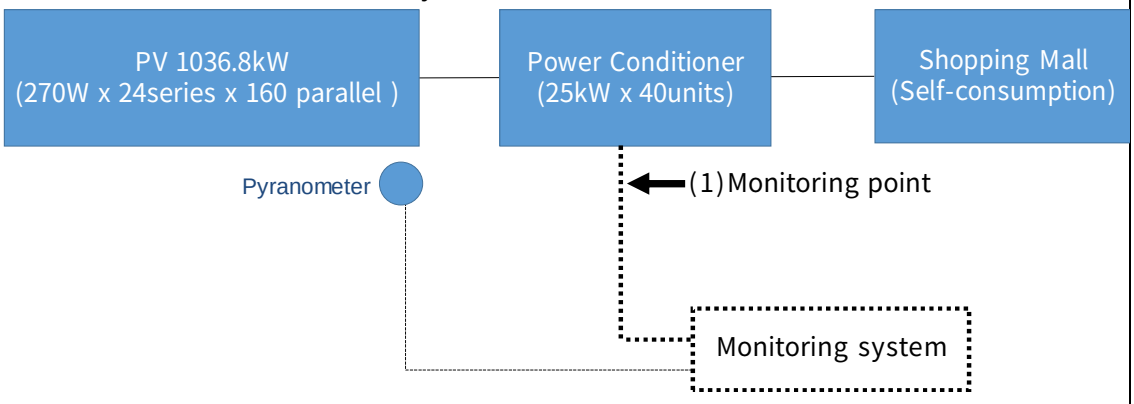
C. Calculation of emission reductions

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

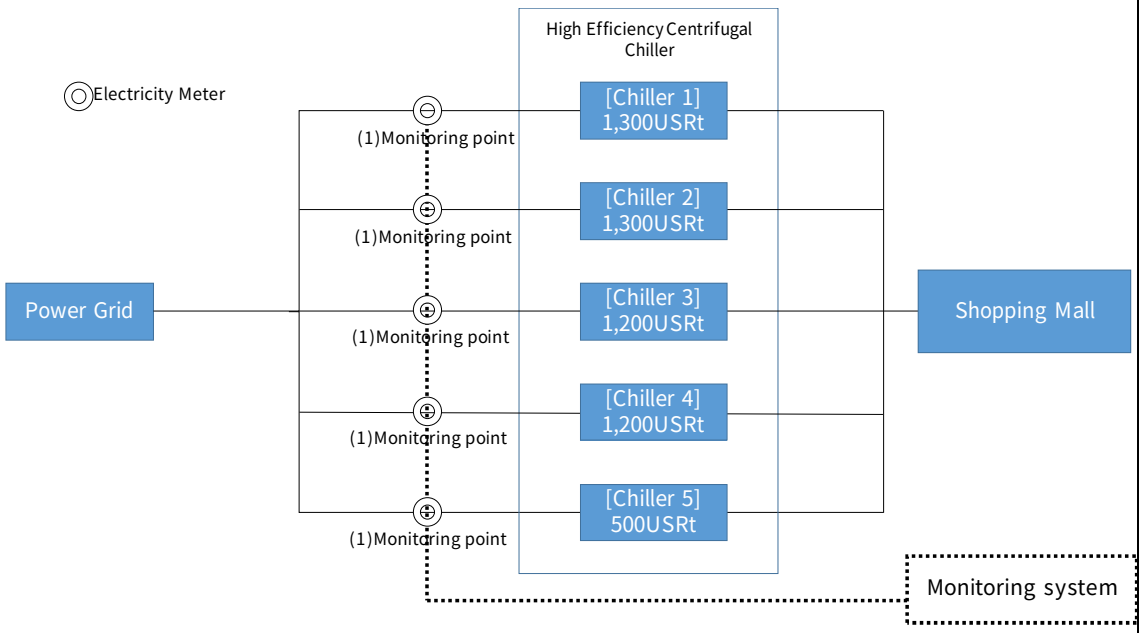
Reference emissions	
Emission sources	GHG type
Consumption of grid electricity and/or captive electricity	CO_2
Power consumption by reference chiller	CO_2
Project emissions	
Emission sources	GHG type
Generation of electricity from solar PV system(s)	N/A
Power consumption by project chiller	CO_2

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

[KH_AM002 *1MW Solar Power System]



[KH_AM003 *High Efficiency Centrifugal Chiller]



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	n/a	n/a	363
2019	n/a	n/a	663
2020	n/a	n/a	663
2021	n/a	n/a	663
2022	n/a	n/a	663
2023	n/a	n/a	663
2024	n/a	n/a	663
2025	n/a	n/a	663
2026	n/a	n/a	663
2027	n/a	n/a	663
2028	n/a	n/a	663
2029	n/a	n/a	663
2030	n/a	n/a	663
Total (tCO_{2e})			8,319

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 project participant identified the following stakeholders. Branch of Aeon delight (Vietnam) Company limited is in charge of operating facilities installed by JCM project.
The project participant conducted a face-to-face interview with local stakeholder consultation with identified stakeholders (see below). Comments received from the participants of the local stakeholder consultation are summarized in the following section E.2. below. The project received no negative comments from the participants of the local stakeholder consultation, and, also, it was confirmed that none of the received comments requires further mitigation action from the project side.

- Venue: Meeting Room, AEON MALL Sen Sok City, Phnom Penh, Cambodia
- Date/Time: 19th December 2019, 10:00-11:30
- Stakeholders:
  - AEON MALL Co., Ltd.
  - AEON MALL(CAMBODIA)CO.,LTD
  - Branch of Aeon delight (Vietnam) Company limited
  - NTT Data Institute of Management Consulting, Inc.

E.2. Summary of comments received and their consideration

Stakeholders	Comments received	Consideration of comments received
Branch of Aeon delight (Vietnam) Company limited	Is PDD a part of JCM Financing Program? How about LSC?	JCM Financing Program is completed when the subsidy is paid. PDD is a part of MVR which is separate process. LSC is a part of PDD process.
Branch of Aeon delight (Vietnam) Company	Batteries may be used to save day-time electricity usage by charging electricity at night and releasing it during day time. Can it be subsidy	No if electricity charged and released comes from the grid. If it comes from electricity generated by PV system, yes.

limited	target?	

F. References

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

Annex

< KH_AM002 *1MW Solar Power System >

Reference emissions	
Emission sources	GHG type
Consumption of grid electricity and/or captive electricity	CO_2
Project emissions	
Emission sources	GHG type
Generation of electricity from solar PV system(s)	N/A

Year	Estimated Reference emissions (tCO_{2e})	Estimated Project Emissions (tCO_{2e})	Estimated Emission Reductions (tCO_{2e})
2018	304.5	0	304
2019	522.2	0	522
2020	522.2	0	522
2021	522.2	0	522
2022	522.2	0	522
2023	522.2	0	522
2024	522.2	0	522
2025	522.2	0	522
2026	522.2	0	522
2027	522.2	0	522
2028	522.2	0	522
2029	522.2	0	522
2030	522.2	0	522
Total (tCO_{2e})			6,568

< KH_AM003 *High Efficiency Centrifugal Chiller >

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

Year	Estimated Reference emissions (tCO_{2e})	Estimated Project Emissions (tCO_{2e})	Estimated Emission Reductions (tCO_{2e})
2018	759.1	700.0	59
2019	1,822.0	1,680.1	141
2020	1,822.0	1,680.1	141
2021	1,822.0	1,680.1	141
2022	1,822.0	1,680.1	141
2023	1,822.0	1,680.1	141
2024	1,822.0	1,680.1	141
2025	1,822.0	1,680.1	141
2026	1,822.0	1,680.1	141
2027	1,822.0	1,680.1	141
2028	1,822.0	1,680.1	141
2029	1,822.0	1,680.1	141
2030	1,822.0	1,680.1	141
Total (tCO_{2e})			1,751

Revision history of PDD		
Version	Date	Contents revised
1.0	17/09/2020	First Edition