MOEJ/GEC JCM Methodology Demonstration Study (DS) 2013
Final Report

「Dissemination of high-efficiency inverter air conditioners」

（implemented by Shimizu Corporation）

Study partners		✓ Shikoku Electric Power CO., Inc. ✓ DAIKIN INDUSTRIES, ltd. ✓ POLYTECH ADD, INC. ✓ EGAT ✓ SUAN DUSIT RAJABHAT UNIVERSITY
Project site		Thailand, Vietnam, and Indonesia
Category of project		Energy Efficiency Improvement
Description of project		This is a program-type project intended to disseminate high-efficiency inverter air conditioners, which are an outstanding Japanese technology, to Southeast Asia starting from Thailand, Vietnam and Indonesia. Instead of monitoring power consumption, the methodology is applied whereby degree day theory is used and the outside temperature, etc. needed for calculations is monitored and reduction in emissions is calculated based on the sold quantity of air conditioners and their performance data. The demonstration study mainly focuses on Thailand, which implements an air conditioner energy saving labeling system, while the feasibility of applying the methodology developed for Thailand to Vietnam and Indonesia will also be examined.
JCM methodology	**Eligibility criteria**	Criterion 1: This is a program to disseminate high-efficiency air conditioners fitted with inverters in Thailand. Criterion 2: The high-efficiency air conditioner targeted by the program fulfill the following conditions: ✓ It is a new air-cooled air conditioner introduced either as a new installation or as an equipment upgrade. ✓ Rated capacity is in the 9,000~24,000 BTU/h class. ✓ It doesn't have a heating function. ✓ It is a separate type air conditioner, i.e. not a multi type air conditioner. ✓ It is ranked as Label 5.
	Default values	There are many default values such as climate zones, representative cities & their Latitude / longitude, Indoor temperature setting of air conditioners, and specifications of model buildings. They are set conservatively based on common knowledge and opinions of experts.
	Calculation of reference emissions	Reference is continuation of low-efficiency air conditioners and emissions from power consumption by using them. The reason for it is that it is impossible to pay back the price difference between a high-efficiency air conditioner and a low-efficiency air conditioner by cost saving from energy saving.
	Monitoring	It is necessary to monitor climate data, grid emission

	method	factor, natural dissemination rate of high-efficiency air conditioners, and sales performance of air conditioners annually in principle.
Result of monitoring		Emission reductions were monitored and calculated for the three-month period from August 1 to October 31, 2013 based on the number of high-efficiency air conditioners that were sold in the year of 2012.
GHG emission reductions		✓ Emission reduction = Reference emission – Project emission ✓ Reference emission = Standard reference emission * Degree day / Standard degree day ✓ Project emission = Standard project emission * Degree day / Standard degree day ✓ Standard reference emission, standard project emission, degree day, and standard degree day shall be calculated by using supplement sheet based on specifications of model buildings, performance curves of air conditioners, climate data, etc. ✓ The result of actual monitoring and calculation found that emission reduction was 24 tonCO2.
Environmental impacts		Environmental impact by this project is marginal.
Promotion of Japanese technologies		Japanese technologies can be hired by the way that project participants deal with air conditioners of Japanese manufacturers only.
Sustainable development in host country		The following points can be considered as contributions to the sustainable development of host countries as a result of implementing projects similar to this one. ✓ Prevention of global warming through reduction of emissions ✓ Prevention of energy resources depletion thanks to energy saving ✓ Prevention of air pollution thanks to energy saving ✓ Avoidance of power shortages and energy shortages thanks to energy saving ✓ Energy saving educational effect (spread of energy saving awareness to other electrical appliances in addition to air conditioners) ✓ Improvement in air conditioner design, manufacturing and maintenance technology
Development and deployment of similar projects		Projects that is focused in this study can be implemented not only in Thailand, Vietnam, and Indonesia, but also other South East Asian countries, South Asia, Middle East, Africa, and Latin America where there are cooling load.

JCM Methodology Demonstration Study (PS) 2013
"Dissemination of high-efficiency inverter air conditioners"

(Host country: Thailand, Vietnam, and Indonesia)

Study Entity: Shimizu Corporation

1. Study Implementation Scheme

Table-1: Study Implementation Scheme

Country	Entity Involved in Study Implementation	Role
Japan	Shikoku Electric Power 【Subcontractor】	Detailed checking of site information, coordination with EGAT, examination of methods for disseminating and extending high-efficiency air conditioner technology, examination of the Dissemination program of high-efficiency inverter air conditioners utilizing JCM
Japan	Daikin Industries, Ltd. 【Subcontractor】	Provision of technical information and retail information concerning air conditioners
Japan	POLYTECH ADD INC. 【Subcontractor】	Assistance in PDD preparation
Host country (Thailand)	EGAT 【Study partner】	Collection of site information (collection of climate data, provision of information concerning the air conditioner labelling system, compilation of questionnaire survey on methods of air conditioner use, etc.)
Host country (Thailand)	SUAN DUSIT RAJABHAT UNIVERSITY 【Subcontractor】	Collection of site information (questionnaire survey on methods of air conditioner use, etc.)

2. Overview of Proposed JCM Project

(1) Description of Project Contents:

Table-2: Description of Project Contents

Outline of the Project targeted for Methodology Demonstration Study	
Outline of Project	This is a program-type project intended to disseminate high-efficiency inverter air conditioners, which are an outstanding Japanese technology, to Southeast Asia starting from Thailand, Vietnam and Indonesia. Instead of monitoring power consumption, the methodology is applied whereby degree day theory is used and the outside temperature, etc. needed for calculations is monitored and reduction in emissions is calculated based on the sold quantity of air conditioners and their performance data. The demonstration study mainly focuses on Thailand, which implements an air conditioner energy saving labeling system, while the feasibility of applying the methodology developed for Thailand to Vietnam and

	Indonesia will also be examined.
Project implementing entity	At the time of the main study, monitoring data was obtained from EGAT and the air conditioner maker, however, it is scheduled for a consortium to be newly formed on the Japanese side to be the project implementing entity at the time of implementation.
Start of monitoring	August 1, 2013
Monitoring period	3 months
GHG reduction	24tCO_2/year (according to the monitoring report)

(2) Situations of Host Country:

Table-3: Situations of Host Country

Country	JCM status	Policy on air conditioners (Labeling system)
Thailand	A Bilateral document has not yet signed by both governments.	There is a labeling system on air conditioners, but the system does not reflect annual energy consumption of air conditioners but only reflects rated performances of air conditioners.
Vietnam	A Bilateral document has already signed by both governments. 1st joint committee has already conducted.	There is a labeling system on air conditioners, but the system for non-inverter air conditioners does not reflect annual energy consumption of air conditioners but only reflects rated performances of air conditioners.
Indonesia	A Bilateral document has already signed by both governments. 1st joint committee has already conducted.	There is no labeling system on air conditioners so far.

3. Study Contents

(1) JCM methodology development

a. Eligibility criteria

Table-4: Eligibility criteria

Eligibility criteria	Reasons for deeming the criteria to be appropriate
This is a program to disseminate high-efficiency air conditioners fitted with inverters in Thailand.	In Southeast Asia, high-efficiency air conditioners fitted with inverters have hardly become disseminated at all. For example, according to the Thailand Ministry of Energy, the figure in 2011 was just 6.65%. The air conditioner maker Daikin Industries estimates the figure is 7% in 2013 (both figures are based on new unit sales). As this is the level even in such a relatively developed country (emerging nation) as Thailand, it is guessed that dissemination ratios are similarly low in other Southeast Asian countries (no specific statistical data can be found). Reasons for the low dissemination rates are the high price of high-efficiency air conditioners, lack of understanding about the effectiveness of

	high-efficiency air conditioners, low awareness of energy saving and so on. Therefore, introduction of high-efficiency air conditioner is required as a condition for eligibility.
The high-efficiency air conditioner targeted by the program fulfill the following conditions: ✓ It is a new air-cooled air conditioner introduced either as a new installation or as an equipment upgrade. ✓ Rated capacity is in the 9,000~24,000 BTU/h class. ✓ It doesn't have a heating function. ✓ It is a separate type air conditioner, i.e. not a multi type air conditioner. ✓ It is ranked as Label 5.	✓ Second hand air conditioners are not targeted. This is to prevent double counting of units that are counted when sold new. Moreover, there is little likelihood of air conditioners that are removed to make way for new units being used again. ✓ The scope of capacity of small air conditioners retailed in Thailand is within the scope indicated on the left. Large-size air conditioners are not targeted in the methodology. If they were, building modeling would become too diverse and troublesome. ✓ This methodology only targets cooling but does not include heating. Since there is hardly any heating load in Southeast Asia, there is little need to make the methodology include this. For example, in Thailand, there is no heating load but cooling load is incurred all year round. ✓ Since air-cooled air conditioners are the most widespread in Southeast Asia, they are targeted by the methodology. Other types of air conditioners (water-cooled air conditioners, air-cooled chillers, water-cooled chillers, geothermal utilizing heat pumps, etc.) are not handled because they have technical differences with air-cooled air conditioners when it comes to evaluating performance, etc. ✓ In multi-type air conditioners, the amount of power consumption varies according to the operating situation of multiple indoor units. Since the methodology would become too complicated if multi-types were targeted, this is deemed unfeasible. ✓ The goal of this methodology is to introduce higher efficiency air conditioners. Consideration should also be given to the fact that almost all the air conditioners sold in Thailand are the highest rank Label 5. In other words, air conditioners having a lower rank than 5 are deemed to be inferior products. Therefore, the criteria on the left are required.

b. Data and parameters fixed *ex ante*

Table-5: Data and parameters fixed ex ante

Name of setting	Set value	Basis for setting	Classification of methodology default value or preliminary setting (project unique value)
Climate zone in Thailand	4 types, i.e. Northern, Northeastern, Central, and Southern	Information from EGAT	Methodology default value
Representative city in Northern	Chiang Mai	Information from EGAT	Methodology default value
Representative city in Northeastern	Ubon Ratchathani	Information from EGAT	Methodology default value
Representative city in Central	Bangkok	Information from EGAT	Methodology default value

Representative city in Southern	Songkhla	Information from EGAT	Methodology default value
Latitude and longitude of Chiangmai	Latitude 19.27 degrees N. Longitude 98.94 degrees E.	Google map	Methodology default value
Latitude and longitude of Ubon Ratchathani	Latitude 16.21 degrees N. Longitude 104.77 degrees E.	Google map	Methodology default value
Latitude and longitude of Bangkok	Latitude 13.92 degrees N. Longitude 100.60 degrees E.	Google map	Methodology default value
Latitude and longitude of Songkhla	Latitude 8.36 degrees N. Longitude 100.46 degrees E.	Google map	Methodology default value
Water vapor partial pressure in saturated air	As there are multiple values, indication is omitted here. See the methodology.	Chronological Scientific Tables (National Astronomical Survey of Japan)	Methodology default value
Solar constant	1,367W/m^2	New Solar Energy Utilization Handbook (Japan Solar Energy Society)	Methodology default value
Day declination	As there are multiple values, indication is omitted here. See the methodology.	Basics of Building Equipment (Kenichi Kimura)	Methodology default value
Average year outside dry bulb temperature	As there are multiple values, indication is omitted here.	Thai Meteorological Department	Preliminary setting
Either ① or ② or ③ ① Average year outside relative humidity ② Average year outside absolute humidity ③ Average year outside water vapor partial pressure	As there are multiple values, indication is omitted here.	Thai Meteorological Department	Preliminary setting
Either ① or ② ① Average year direct normal solar radiation and diffuse horizontal solar radiation	As there are multiple values, indication is omitted here.	Thai Meteorological Department	Preliminary setting

② Average year global horizontal solar radiation			
Time difference with Japan	－2 hours	Common knowledge	Methodology default value
Method of air conditioner use (Outdoor temperature above which air conditioner is operated)	26.04℃	Questionnaire survey	Methodology default value
Method of air conditioner use (Indoor temperature setting of air conditioners)	24.82℃	Questionnaire survey	Methodology default value
Method of air conditioner use (Possibility (probability) that air conditioners are operating at each hour on weekdays)	As there are multiple values, indication is omitted here. See the methodology.	Questionnaire survey	Methodology default value
Method of air conditioner use (Possibility (probability) that air conditioners are operating at each hour on Saturdays)	As there are multiple values, indication is omitted here. See the methodology.	Questionnaire survey	Methodology default value
Method of air conditioner use (Possibility (probability) that air conditioners are operating at each hour on holidays)	As there are multiple values, indication is omitted here. See the methodology.	Questionnaire survey	Methodology default value
Model building M1 – size, window size and applicable air conditioners capacity class	4m×3m 1.71m^2 9,000BTU/h	Building expert, air conditioner expert	Methodology default value
Model building M2 – size, window size and applicable air conditioners capacity class	4m×4m 2.29m^2 12,000BTU/h	Building expert, air conditioner expert	Methodology default value
Model building M3 – size, window size and applicable air conditioners capacity class	4m×5m 2.86m^2 15,000BTU/h	Building expert, air conditioner expert	Methodology default value

Model building M4 – size, window size and applicable air conditioners capacity class	4m×6m 3.43m^2 18,000BTU/h	Building expert, air conditioner expert	Methodology default value
Model building M5 – size, window size and applicable air conditioners capacity class	4m×8m 4.57m^2 24,000BTU/h	Building expert, air conditioner expert	Methodology default value
Model building roof area	0 m^2	Because adopting the value on the left is conservative	Methodology default value
Model building window orientation	North	Because adopting the value on the left is conservative	Methodology default value
Model building floors	2.5m	Building expert	Methodology default value
Structure and thickness of model building exterior walls	Concrete 100 ㎜	Building expert	Methodology default value
Model building window thickness	6 ㎜	Building expert	Methodology default value
Thermal conductivity of concrete	1.64W/m℃	Practical Knowledge on Air Conditioning Equipment (Society of Heating, Air-Conditioning and Sanitary Engineers of Japan)	Methodology default value
Thermal conductivity of glass	0.779W/m℃	Practical Knowledge on Air Conditioning Equipment (Society of Heating, Air-Conditioning and Sanitary Engineers of Japan)	Methodology default value
Solar transmittance of glass	0.65	Because adopting the value on the left is conservative	Methodology default value
Heat-transfer coefficient on inner side of external walls	22.7W/m^2℃	Practical Knowledge on Air Conditioning Equipment (Society of Heating, Air-Conditioning and Sanitary Engineers of Japan)	Methodology default value
Heat-transfer coefficient on outer side of external walls	8.37W/m^2℃	Practical Knowledge on Air Conditioning Equipment (Society of Heating,	Methodology default value

		Air-Conditioning and Sanitary Engineers of Japan)	
Calorific value of indoor devices	5W/m^2	Building expert	Methodology default value
Human density per room	1 person	Because adopting the value on the left is conservative	Methodology default value
Ventilation per person	0m^3/h	Because adopting the value on the left is conservative	Methodology default value
Sensible heat load per person	58.1W/person	Practical Knowledge on Air Conditioning Equipment (Society of Heating, Air-Conditioning and Sanitary Engineers of Japan)	Methodology default value
Latent heat load per person	64.0W/person	Practical Knowledge on Air Conditioning Equipment (Society of Heating, Air-Conditioning and Sanitary Engineers of Japan)	Methodology default value
Air conditioner performance curve (relationship of cooling capacity, outside dry bulb temperature, indoor wet bulb temperature and power consumption)	As there are multiple values, indication is omitted here.	Air conditioner maker	Preliminary setting
Air conditioners sales record	As there are multiple values, indication is omitted here.	Air conditioner maker or agent or retailer, etc.	Preliminary setting
Annual power consumption of high-efficiency air conditioner in each climate zone and building model	As there are multiple values, indication is omitted here.	See the methodology for the calculation method	Preliminary setting
Annual power consumption of low-efficiency air conditioner in each climate zone and building model	As there are multiple values, indication is omitted here.	See the methodology for the calculation method	Preliminary setting
Standard (extended) degree day in each climate zone and	As there are multiple values, indication is omitted here.	See the methodology for the calculation method	Preliminary setting

building model			

c. Result of actual monitoring

In this study, climate data for the period from August 1 to October 31, 2013 was used. Moreover, concerning the sold number of air conditioners, data for one year from 2012 was used. In other words, emission reductions were calculated for the three-month period from August 1 to October 31, 2013 based on the number of high-efficiency air conditioners that were sold in the year of 2012. The stud targeted only the Central climate zone, four models of air conditioners by a certain maker (A-09, B-12, C-18, D-24) and building models compatible with these air conditioners (M1, M2, M4, M5). The results are shown below. Moreover, the emission factor of grid is 0.5113tonCO_2/MWh, and the natural dissemination rate of high-efficiency air conditioners is 0.06827.

Table-6: Results of Monitoring Implementation

Air conditioner model	Compatible building model	Sold units N (units)	Reference power consumption WR (kWh)	Project power consumption WP (kWh)	Standard extended degree day SDD (℃ day)	Extended degree day during the monitoring period DD (℃day)
A-09	M1	270	179	120	446	398
B-12	M2	310	208	168	466	417
C-18	M4	480	263	224	493	442
D-24	M5	156	314	258	511	459

d. Calculation of GHG emissions (including reference and project emissions)

Method for calculating reference emissions and project emissions

Reference emissions are calculated using the following formula.

$$RE_y = \sum_i \sum_j \sum_k (WR_{i,j,k} \times EF_{PJ,y} \times \frac{DD_{i,j,y}}{SDD_{i,j}} \times \sum_{m=y-7}^{y-1} (N_{i,j,k,m} \times (1 - c_m))) \quad (1)$$

Where,

RE_y Reference emissions (tCO_2/y)

$WR_{i,j,k}$ Annual power consumption (MWh/unit/y) under standard climate data of low efficiency air conditioners corresponding to high-efficiency inverter air conditioners *k* for model building *j* in climate zone *i*.

$EF_{PJ,y}$ Emission factor of grid (tCO_2/MWh) that can be acquired in *y* year

$DD_{i,j,y}$ Extended degree day (or degree day) (°Cday) during the monitoring period for model building *j* in climate zone *i* in *y* year

$SDD_{i,j}$ Standard extended degree day (or standard degree day) (°Cday) for model building *j* in climate zone *i*.

$N_{i,j,k,m}$ Number of units sold in *m* year of high-efficiency inverter air conditioners *k* for model building *j* in climate zone *i*.

c_m Natural dissemination rate of high-efficiency air conditioners in year *m* (-)

y Monitoring year (Western calendar)

i Climate zone category

j Building model category

k Model of high-efficiency inverter air conditioners

m Integer from Western calendar year *y-6* to year *y*. In other words, credits are available for a maximum of seven years from the point of air conditioner sale. However, the minimum value of *m* shall be the year when monitoring is started + 1.

Moreover, in the case where formula (1) is applied at the project registration stage, $DD_{i,j,y} = SDD_{i,j}$ shall be assumed.

Project emissions are calculated using the following formula.

$$PE_y = \sum_i \sum_j \sum_k (WP_{i,j,k} \times EF_{PJ,y} \times \frac{DD_{i,j,y}}{SDD_{i,j}} \times \sum_{m=y-7}^{y-1} (N_{i,j,k,m} \times (1 - c_m))) \quad (2)$$

Where,

PE_y Project emissions (tCO_2/y)

$WP_{i,j,k}$ Annual power consumption (MWh/unit/y) under standard climate data of high-efficiency air conditioners *k* for model building *j* in climate zone *i*.

$EF_{PJ,y}$ Emission factor of grid (tCO_2/MWh) that can be acquired in *y* year

$DD_{i,j,y}$ Extended degree day (or degree day) (°Cday) during the monitoring period for model building *j* in climate zone *i* in *y* year

$SDD_{i,j}$ Standard extended degree day (or standard degree day) (°Cday) for model building *j* in climate zone *i*.

$N_{i,j,k,m}$ Number of units sold in *m* year of high-efficiency inverter air conditioners *k* for model building *j* in climate zone *i*.

c_m Natural dissemination rate of high-efficiency air conditioners in year *m* (-)

y Monitoring year (Western calendar)

i Climate zone category

j Building model category

k High-efficiency inverter air conditioners

m Integer from Western calendar year *y-7* to year *y*. In other words, credits are available for a maximum of seven years from the point of air conditioner sale. However, the minimum value of *m* shall be the year when monitoring is started + 1.

Moreover, in the case where formula (2) is applied at the project registration stage, $DD_{i,j,y} = SDD_{i,j}$ shall be assumed.

Emissions reductions are calculated using the following formula.

$$ER_y = (RE_y - PE_y) \quad (3)$$

Where,

ER_y Emissions reductions (tCO_2/y)

RE_y Reference emissions (tCO_2/y)

PE_y Project emissions (tCO_2/y)

The following describes the procedure for calculating emissions reduction in this methodology. For calculating the extended degree day, data on solar radiation, ventilation and indoor heating, etc., which are not required for calculating the degree day, are needed. However, in the case of cities other than Bangkok where solar radiation data is not available, the degree day method is used under certain conditions.

Table-7: Procedure for Calculating Emissions (Reference Emissions, Project Emissions, Emissions Reduction) before Project Registration (at PDD Preparation) (ex-ante calculation procedure)

No.	Case utilizing the Degree Day Method	Case utilizing the Extended Degree Day Method	Reference Methodology Appendix
1	Obtain, process and organize standard climate data	Obtain, process and organize standard climate data	Appendix-2
2	Calculate vertical solar radiation in standard climate data	Calculate vertical solar radiation in standard climate data	Appendix-3
3	Setting of the air conditioner use method (questionnaire survey)	Setting of the air conditioner use method (questionnaire survey)	Appendix-4
4	Obtain, process and organize performance curve of air conditioner on the market	Obtain, process and organize performance curve of air conditioner on the market	Appendix-5
5	Obtain, process and organize past sales figures for air conditioners on the market.	Obtain, process and organize past sales figures for air conditioners on the market.	Appendix-6
6	Compile combinations of high-efficiency air conditioners and corresponding low-efficiency air conditioners.	Compile combinations of high-efficiency air conditioners and corresponding low-efficiency air conditioners.	Appendix-6
7	Modeling of buildings	Modeling of buildings	Appendix-7
8	Compile combinations of high-efficiency air conditioners and corresponding modeled building.	Compile combinations of high-efficiency air conditioners and corresponding modeled building.	Appendix-6 Appendix-7
9	Calculate the cooling load and degree day ($SDD_{i,j}$) of model buildings under standard climate data.	Calculate the cooling load and degree day ($SDD_{i,j}$) of model buildings under standard climate data.	Appendix-8 Appendix-9 Appendix-10
10	Calculate air conditioner power consumption ($WR_{i,j,k}$, $WP_{i,j,k}$) under standard climate data of high-efficiency air conditioners and	Calculate air conditioner power consumption ($WR_{i,j,k}$, $WP_{i,j,k}$) under standard climate data of high-efficiency air conditioners and	Appendix-11

	low-efficiency air conditioners.	low-efficiency air conditioners.	
11	Calculate the natural dissemination rate of high-efficiency air conditioners	Calculate the natural dissemination rate of high-efficiency air conditioners	Appendix-12
12	Calculate the reference emissions (RE_y), project emissions (PE_y) and emissions reduction (ER_y) under standard climate data (use expressions (1)~ (3) assuming $DD_{i,j,y} = SDD_{i,j}$)	Calculate the reference emissions (RE_y), project emissions (PE_y) and emissions reduction (ER_y) under standard climate data (use expressions (1)~ (3) assuming $DD_{i,j,y} = SDD_{i,j}$)	-

Table-8: Procedure for Calculating Emissions (Reference Emissions, Project Emissions, Emissions Reduction) after Project Registration (at Preparation of the Monitoring Report) (ex-post calculation)

No.	Case utilizing the Degree Day Method	Case utilizing the Extended Degree Day Method	Reference Methodology Appendix
13	Obtain, process and organize climate data during project implementation	Obtain, process and organize climate data during project implementation	Appendix-2
14	-	Calculate vertical solar radiation in climate data during project implementation	Appendix-3
15	Obtain, process and organize performance curves of air conditioners on the market.	Obtain, process and organize performance curves of air conditioners on the market.	Appendix-5
16	Obtain, process and organize sales figures for air conditioners during project implementation.	Obtain, process and organize sales figures for air conditioners during project implementation.	Appendix-6
17	Compile combinations of high-efficiency air conditioners and corresponding low-efficiency air conditioners.	Compile combinations of high-efficiency air conditioners and corresponding low-efficiency air conditioners.	Appendix-6
18	Compile combinations of high-efficiency air conditioners and corresponding modeled buildings.	Compile combinations of high-efficiency air conditioners and corresponding modeled buildings.	Appendix-6 Appendix-7
19	Calculate the degree day ($DD_{i,j,y}$) under climate data during project implementation.	Calculate the extended degree day of the modeled building ($DD_{i,j,y}$) under climate data during project implementation.	Appendix-8 Appendix-9 Appendix-10
20	Calculate the natural dissemination rate of high-efficiency air conditioners	Calculate the natural dissemination rate of high-efficiency air conditioners	Appendix-12
21	Calculate the reference emissions (RE_y), project emissions (PE_y) and emissions reduction (ER_y) under climate data during project implementation.	Calculate the reference emissions (RE_y), project emissions (PE_y) and emissions reduction (ER_y) under climate data during project implementation.	-

Emissions and reductions based on the results of monitoring

During the monitoring period (3 months), reference emissions were 123 tonCO_2, project emissions were 99 tonCO_2 and emission reductions were 24 tonCO_2. At the same time, it was demonstrated that the methodology can be applicable.

Table-9: Emissions and Reduction based on the Results of ③

Air conditioner model	WR	WP	N	c	EF	SDD	DD	RE	PE	ER
-	MWh	MWh	unit	-	tonCO_2/MWh	℃day	℃day	tonCO_2	tonCO_2	tonCO_2
A-09	0.179	0.120	270	0.06827	0.5113	446	398	21	14	7
B-12	0.208	0.168	310	0.06827	0.5113	466	417	27	22	5
C-18	0.263	0.224	480	0.06827	0.5113	493	442	54	46	8
D-24	0.314	0.258	156	0.06827	0.5113	511	459	21	17	4
Total	-	-	-	-	-	-	-	123	99	24

(2) Development of JCM Project Design Document (PDD)

Need or not for environmental impact assessment

Because the project targets introduction of small-scale air conditioners, environmental impact assessment is not needed.

Method for identifying local stakeholders and implementing consultations with them

Because the Project targets introduction of small-scale air conditioners, there will be no consultations with stakeholders. However, in the case where the Project is implemented as a JCM program, it cannot be denied that a separate approach may arise. TGO, which is the JCM window agency of the host country government, has expressed no views on this point.

(3) Project development and implementation

a. Japan's contribution

Japan's contribution through implementation of similar projects

Through implementing similar projects to the one here, Japanese high-efficiency air conditioners

can be disseminated and contribution made to energy saving in the host countries.

Technologies and products required for similar projects

The technologies and products required to implement similar projects to this one are high-efficiency air conditioners (air-cooled air conditioners) equipped with inverters.

Comparison in terms of performance and price between technologies and products, etc. of Japan and other countries

On comparing the performance data of various companies' air conditioners according to catalogs acquired on site, there was found to be no clear indication that air conditioners made by Japanese makers have much higher performance (higher COP indicating efficiency at a rated point) than air conditioners by makers of other countries. However, this reflects the performance at a rated point. Since makers do not provide data concerning performance at partial load of high-efficiency air conditioners, it is not possible to make comparison. Moreover, there is no way of confirming whether or not the figures stated in catalogs are correct.
Looking at the price comparison of high-efficiency air conditioners in the same class (9,000~24,000BTU/h class), products by a certain Japanese maker sell at 2.90~3.41THB/(BTU/h) while those by a Korean maker sell at 1.83~2.25 THB/(BTU/h), indicating that Korean models are more competitive. In Thailand, since air conditioners are retailed upon displaying only performance at the rated point, the strength of Japanese products, i.e. good partial load characteristics and thus low annual power consumption, tend to be overlooked.

Conditions for introduction of Japanese technologies and products, etc.

As described above, because air conditioners made by Japanese makers do not have much higher performance than air conditioners by makers of other countries at a rated point, and data demonstrating the high partial load efficiency of Japanese air conditioners is not disclosed, it may not be possible to construct a methodology that can justify the preferred adoption of Japanese air conditioners only.
Therefore, the most effective and fastest way of promoting adoption of air conditioners made by Japanese makers is to seek it in the project implementation scheme. For example, limit the air conditioners handled by the consortium to those made by Japanese makers and seek the provision of performance data and sales data from Japanese makers only.
However, there is nothing to prevent Chinese or South Korean makers from organizing a counter consortium and implementing a similar program. Whether or not such a counter consortium is recognized under the JCM system is left to the discretion of the joint committee and governments of both countries and cannot be influenced by this company.
Moreover, although not related to JCM, useful methods for ensuring correct catalog displays of air

conditioner performance are to require makers to agree to a system whereby a third party certifies performance displays, or to establish a public agency for actually testing air conditioners and disclosing their performance. Furthermore, measures such as constructing a labeling system that also considers partial load characteristics are essential for disseminating high-efficiency air conditioners.

b. Environmental integrity

Guaranteeing favorable environmental impacts through implementation of similar projects

Favorable environmental impacts of the Project are energy saving, reduction of GHG emissions, reduction of fossil fuel consumption, reduction of air pollution and so on. In order to guarantee these favorable impacts, it is particularly necessary to education about the correct method of using high-efficiency air conditioners at the point of sale. A possible approach would be for the Japanese consortium that implements the Project to take the initiative in conducting an education campaign at retail agents.

Measures for averting negative environmental impacts resulting from implementation of similar projects

It is thought that the Project will impart no negative environmental impacts in particular. Certainly, air conditioners have some negative impacts such as vibration, noise and leakage of cooling medium, etc., however, these occur equally in low-efficiency air conditioners and are not unique to high-efficiency air conditioners. Rather, high-efficiency air conditioners that entail less intermittent operation are likely to have less negative impacts such as noise and vibration cause by stopping and starting of the compressor motor.

c. Sustainable development in host country

The following points can be considered as contributions to the sustainable development of host countries as a result of implementing projects similar to this one.

- ✓ Prevention of global warming through reduction of emissions
- ✓ Prevention of energy resources depletion thanks to energy saving
- ✓ Prevention of air pollution thanks to energy saving
- ✓ Avoidance of power shortages and energy shortages thanks to energy saving
- ✓ Energy saving educational effect (spread of energy saving awareness to other electrical appliances in addition to air conditioners)
- ✓ Improvement in air conditioner design, manufacturing and maintenance technology