

## **CDM Feasibility Study on Energy Efficiency Project through Installing High Efficiency Air Conditioners in Viet Nam, with New CDM Methodology Development**

**By Mitsubishi UFJ Morgan Stanley Co., Ltd.**

### **1. Study Implementation Structure:**

<Vietnamese side>

- Ministry of Industry and Trade (MOIT): Project implementing entity. Support on the policy front.
- Energy Conservation Center (ECC): Project implementing entity. Assistance relating to performance criterion development and certification, project consultation.
- Institute of Energy (IE): Support on the policy front.

<Japanese side>

- Japan Refrigeration and Air Conditioning Industry Association: Sharing of domestic data.

<DOE>

- Japan Quality Assurance Organization (JQA): Performs duties for UN submission of the new methodology.

### **2. Project Summary:**

#### **(1) Outline of the Project:**

The purpose of the Project is for the participating organizations, led by the Vietnamese Ministry of Industry and Trade (MOIT), to popularize and promote the use nationwide in Viet Nam of household inverter air conditioners featuring high-efficiency heat pump technology by taking advantage of subsidies, in an attempt to achieve greenhouse gas emission reductions.

As shown in Table 1, an annual average of 121,853 tCO<sub>2</sub> greenhouse gas emissions can be expected to be reduced nationwide in Viet Nam through the phased-in introduction of Japanese energy efficient air conditioners, which are on a top level globally, to replace conventional non-inverter air conditioners in Viet Nam, a country with a low inverter air conditioner introduction rate.

**Table 1: Number of Inverter Air Conditioners to be Introduced**

Year since introduction	Inverter air conditioners (Number of units)	
	Number of units introduced	Cumulative total
Year 1	13,000	13,000
Year 2	20,000	33,000
Year 3	50,000	83,000
Year 4	100,000	183,000
Year 5	200,000	383,000
Year 6	300,000	683,000
Year 7	500,000	1,183,000

In addition to reducing greenhouse gas emissions, the Project will also contribute as an anti-pollution measure to reducing emissions of NO<sub>x</sub>, SO<sub>x</sub>, and soot and dust from grid-connected power plants. It is intended that, through this study, a CDM methodology applicable to the Project will be developed so that the Project will be launched from April 2013.

## **(2) Methodology to be Applied:**

Methodology for introduction of energy efficient air conditioners to households (a new methodology)

## **3. Details of the Study**

### **(1) Study Themes**

The study is designed so that the basic study conducted last year will be reexamined and updated, mainly with respect to the following details, in order to submit it to the Methodology Panel of the UN CDM Executive Board for approval as a new methodology.

#### ① Study on the baseline monitoring methodology

Confirm the appropriateness of the method to identify baseline scenario, conduct a review of the entire methodology, including the emissions calculation procedures and the monitoring method, so that the accuracy of the methodology is increased, and submit an application to the UN CDM Executive Board.

#### ② Study on the baseline scenario

Scrutinize and rectify the baseline identification method applied in the draft methodology in terms of how its conservativeness is ensured and also in terms of its feasibility. At the same time, update the household air conditioner market information used in the PDD with up-to-date information.

#### ③ Study on the demonstration of additionality

Examine the appropriateness of the benchmark methodology through an investment analysis. Try to gather information that substantiates the appropriateness of the benchmark assumed in the PDD, which is the number of investment payback years.

#### ④ Study on the monitoring method and plan

Examine the appropriateness of the project sampling survey method and procedures from the viewpoint of feasibility and ensuring its conservativeness, etc. At the same time, reexamine the monitoring items, method, and plan and update them as needed.

#### ⑤ Study on calculations of greenhouse gas emissions (or sink)

When calculating an estimate of greenhouse gas emission reductions, apply the air conditioner market information and the latest grid emission factor figures on the basis of the baseline scenario study. Also examine the appropriateness of the method of calculating ex-post greenhouse gas emissions, together with the examination results from the project sampling survey.

#### ⑥ Stakeholder comment survey

A questionnaire-based survey will be conducted in February 2012 to invite a broad range of comments from the general public.

#### ⑦ Study on the contribution to sustainable development of the host country

Perform a validation on the basis of the latest policy measures by the Vietnamese government, stakeholder comments, etc.

## **(2) Study Descriptions:**

### ① Study on the baseline monitoring methodology

While the methodology originally contemplated contained a baseline scenario identification method consisting of two options, one being a sampling approach and the other being an investment analysis based on market information, it was judged, as a result of scrutinizing the CDM Executive Board rules and similar methodologies, that it is desirable to select a single option that best suits the project activity in question. As a result of consultation with related local organizations, the latter option (an investment analysis based on market information) was chosen to be reflected in the methodology.

There are also other changes that were made, for instance: the calculation process for estimating GHG emission reductions was reviewed and a load factor approach was introduced in the calculation of electricity consumption from the use of inverter air conditioners.

Furthermore, the methodology was submitted to the UN and response was subsequently provided as per the following schedule.

- A. October 2011: A request was issued to the Japan Quality Assurance Organization (JQA) to perform a completeness check.
- B. November 2011: The new methodology was submitted to the Secretariat of the CDM Executive Board; notice was received that the completeness check had been finished.
- C. January 2012: The UN Secretariat provided the result of the initial assessment and comments.

### ② Study on the baseline scenario

In the new methodology, a baseline scenario is identified by means of an investment analysis based on market information. On the basis of the latest household air conditioner sales information obtained from a market survey of mass retailers during the first local survey, a non-inverter air conditioner with energy efficiency of 10.43 (BTU/h/w), the most financially/economically attractive model, was selected as the baseline model for the Project. The functions and features of this model were reflected in the PDD to calculate greenhouse gas emission reductions.

### ③ Study on the demonstration of additionality

On the basis of the tool for the demonstration of additionality, the demonstration of additionality was performed by a benchmark-based investment analysis approach. Since it was discovered that there was no official benchmark for the number of investment payback years following air conditioner purchases, the figure of 3.5 years was used, which is the ideal number of investment payback years at the time of decision-making on the purchase of an energy efficient household appliance, as learned from our questionnaire-based survey.

### ④ Study on the monitoring method and plan

As a result of the review of the baseline monitoring methodology, monitoring items have been set as follows:

- A. Baseline scenario identification method: an investment analysis approach has been selected.
- B. Project sampling survey method and procedures: they have been assessed on the basis of methods applied in similar methodologies, to formulate a monitoring methodology.

### ⑤ Study on calculations of greenhouse gas emissions (or absorptions)

GHG emission estimates have been updated on the basis of the energy efficiency of non-inverter air conditioners derived from the baseline scenario study and on the latest grid emission factor figures in Viet Nam obtained from the first field study.

#### ⑥ Stakeholder comment survey

A broad range of comments from general stakeholders were collected at a seminar on energy saving held in February 2012. The second field survey was conducted in January 2012 to make advance preparations for a questionnaire-based survey.

#### ⑦ Study on the contribution to sustainable development of the host country

As a result of consultation with related local organizations, it was confirmed that there are great expectations for the Project in terms of its contribution to sustainable development of the country of Viet Nam.

## 4. Findings from Studies for Implementation of the CDM Project

### (1) Baseline Monitoring Methodology

#### ① Applicability conditions

As there was no existing methodology applicable to the Project, a new methodology has been developed through this study. The title of the new methodology is "Methodology for introduction of energy efficient air conditioners to households," and it will be applied to the replacement of existing air conditioners with new energy efficient air conditioners and the new installation of energy efficient air conditioners. If the Project is not implemented, either the continued use of conventional air conditioners or the new installation of conventional air conditioners would be expected to occur. Other applicability conditions and the fulfillment status of the Project are summarized in Table 2.

**Table 2: Applicability conditions for the methodology and fulfillment status of the Project**

<i>Applicability conditions</i>	The Project
1) <i>This methodology applies to the project activities in the category of energy demand.</i>	The project activity involves reduction of energy demand by introducing energy-efficient air conditioners.
2) <i>This methodology applies to project activities that involve installation and operation of energy efficient air conditioners in individual households within the project area. This methodology is applicable to the replacement of the existing air conditioners by new inverter energy efficient air conditioners, and/or new installation of energy efficient air conditioner. In the absence of project activity, continuing use of existing conventional less efficient air conditioners and/ or installation of new but less efficient air conditioners of similar rated cooling/heating capacity would occur.</i>	The project activity involves both new installation of inverter air conditioners and replacement of existing non-inverter air conditioners with inverter air conditioners. Only cases where conventional (non-inverter) air conditioners of similar rated cooling capacity would be used in absence of the project activity are selected for subsidy program under the project activity.
3) <i>Electricity delivered from the grid is the only energy used by air conditioners under project and baseline scenario.</i>	In accordance with the baseline survey, the baseline air conditioners only use grid electricity as energy source in the baseline scenario.
4) <i>All households participating in the project activity are connected to a national or regional electricity grid.</i>	Only households connected to a national or regional grid will be allowed to participate in the project activity as a condition of subsidy provision.
5) <i>Energy efficient air conditioners installed under the project activity are new and not transferred from another activity.</i>	The government only provides subsidy for new air conditioners and will require sales receipts of such air conditioners for receiving the subsidy.
6) <i>The rated cooling capacity of the inverter air conditioners installed under the project activity at each household is not significantly smaller (maximum -10%) or significantly larger (maximum +50%) than the baseline air conditioner.</i>	Only cases where the rated cooling capacity of the inverter air conditioners installed under the project activity at each household is not significantly smaller or larger than the baseline air conditioner as stipulated by the methodology are be selected for subsidy under the project activity. Cooling capacity of the existing air conditioners are inspected through baseline survey

	and will be cross checked with cooling capacities and sales receipt of new air conditioners purchased for the Project.
7) <i>Refrigerants that are contained in the inverter air conditioners installed under the project activity shall be CFC free.</i>	Only air conditioners using CFC free refrigerants will be selected for subsidy under the project activity. "CFC free" statement is required on sales receipt.
8) <i>If the project activity involves replacement of existing air conditioners, the refrigerant contained in the existing air conditioner will be recovered and destroyed, or stored in suitable containers within suitable premises to ensure that the recovered, stored refrigerant gases can be monitored and tracked. Stored refrigerant gases may be withdrawn from storage for re-use, or for destruction by a method approved under regulations by the host country and/or pursuant to international treaties signed by the host country under Montreal, Kyoto or other Protocol that may in the future apply.</i>	Subsidy will only be provided under the condition that the refrigerant contained in the existing air conditioners replaced under the project activity will be recovered and destroyed or stored in suitable containers within suitable premises. In cases where existing air conditioners are replaced, households are required to submit record of refrigerant being recovered and destroyed or stored properly.
9) <i>Location of all energy efficient air conditioner installed under the project activity is traceable throughout the crediting period. In case any household stops the use of air conditioners installed under the project activity, this should be noted in the database and removed from the emissions reduction calculation.</i>	Location of all inverter air conditioners installed under the project activity are recorded on the project database when applications for subsidy are filed and will be monitored throughout the crediting period by regular survey and monitoring checks. Households are also required to report termination of the use of inverter air conditioners.
10) <i>A measure is established within the project area which ensures all households participating in the project activity receive CDM benefit in a form other than CERs.</i>	CER income will be returned to households in a form of increased fund to subsidize more inverter air conditioners when households wish to purchase additional air conditioners.
11) <i>Individual households participating in the project activity agree not to claim CER from the project activity</i>	Individual households will only be able to receive subsidy under the condition that they will not claim CERs from the project activity.
12) <i>A project activity implementation plan that specifies the procedures for establishing the project activity is available and fully documented in the CDM-PDD. The information in the project activity implementation plan includes, but not limited to, the project area, project coordinator details, the total number of energy efficient air conditioners that are planned to be installed under the project activity in the project area over the duration of the crediting period, installation schedule, and data-base management plan.</i>	A project activity implementation plan is documented in Appendix A of the PDD.
13) <i>Lastly, this methodology is not applicable if the identification of baseline scenario conducted prior to the project implementation concludes that the use of energy efficient air conditioner is the most plausible scenario in the project area.</i>	Section B.5 discusses in detail how the use of energy efficient air conditioner is not the most plausible scenario in the project area.

② Method of confirming the fulfillment status

With respect to the status of fulfillment of the applicability conditions, it is expected that from among the 13 items, 6) and 8) in particular would be difficult to confirm. What is being contemplated is to arrange a written declaration at the time of soliciting participation in the Project to check, under item 6), the power output of the conventional air conditioner being replaced, and to make it obligatory to have the refrigerant recovered by a designated collection business, etc. to track the refrigerant as set out in item 8).

## **(2) Determination of the Baseline Scenario and Project Boundary**

### **① Baseline Scenario**

The new methodology developed during the study provides that a baseline scenario should be determined by using an investment analysis of the air conditioner market to be conducted in the project area. This relates to an approach whereby, prior to the start of the Project, appliances that are prevalent in the market are studied and the model that is found by an investment analysis to be the most financially/economically attractive is identified as a baseline model.

The methodology also stipulates that models that are prevalent in the market should be identified either by reference to a public or third-party market report or, when there is no report of such kind, by an independent study conducted by a project implementing entity. As neither any public market report nor any market report by a third party, such as a trade organization, has been found to exist in the host country thus far, air conditioners that have the same level of power output as the inverter air conditioner to be installed under the Project (12,000 BTU) and are currently sold in mass retailers were studied in the PDD developed in this study to seek out the most financially/economically attractive air conditioner.

As we move with the intention of having the Project realized, validated, etc. in the future, it will remain necessary, in view of uncertainty, to carefully examine the appropriateness of taking the lowness of the price relative to power output to evaluate how financially/economically attractive an air conditioner is, but the initial cost of inverter air conditioners is obviously a significant obstacle to the implementation of the Project. In addition, care is taken to maintain the conservativeness in the methodology as a whole by, for instance, only considering air conditioners of global brands that are sold in large, mass home appliance retailers as potential baseline models and by adding discount factors to the baseline emissions calculation formulas. Thus, in an effort to address issues expected to be raised by the validation entity with respect to uncertainty that comes with the approach applied in the baseline establishment, which is to evaluate the financial/economic attractiveness of an air conditioner by reference to its price relative to power output, an understanding will be promoted by taking steps to maintain the conservativeness of calculation results, taking into account such uncertainty, when developing a methodology and a PDD.

The new methodology, developed based on the aforementioned concepts was deemed “unqualified” by the UN Secretariat with the main factor being the method of identification of the baseline scenario. According to its comments, the Secretariat takes the method of judging the decision to purchase an air-conditioner solely on the account of economic attractiveness is not appropriate and instead, recommends the application of the benchmark approach used in AM0070. In order to achieve methodology approval, the best option is to revise the methodology in line with the “benchmark approach” in accordance with the Secretariat’s comments. However, application of the baseline scenario identification method of AM0070 will entail issues in applicability to the Project, versatility of the methodology as well as data availability. Therefore, further discussion will be held with local partners with regards to the future of the methodology with view towards seeking the possibility of using bilateral offset credit mechanism.

### **② Project Boundary**

Based on the new methodology to be developed in this study, the project boundary covers all inverter air conditioners introduced under the Project in question and the electricity grids to which houses where an inverter air conditioner will be installed are connected.

### (3) Monitoring Plan:

The new methodology sets the following items that are needed to calculate greenhouse gas emission reductions and are therefore deemed necessary to be subject to regular monitoring. Monitoring is performed once a year through a project sampling group (PSG) survey. Energy efficiency of the air conditioners used in the baseline and project scenarios will be monitored for each crediting period.

**Table 3: Monitoring Items**

	Symbol	Item	Monitoring frequency	Unit
1	$n_{ac,PJ,y}$	Number of energy efficient air conditioners installed within the project area under the project activity that are operating in year $y$	Every year	Number of units
2	$n_{ac,PSG,y}$	Total number of energy efficient air conditioners installed in the households covered by the project sampling group that are operating in year $y$	Every year	Number of units
3	$N_{PJ,y}$	Population in year $y$ within the project area. Limited to the number of households participating in the project activity in year $y$ .	Every year	Number of persons
4	$n_{ac,rss,stopped,y}$	Number of energy efficient air conditioners for which operation is suspended that are covered by the sampling survey for determining the discount rate for year $y$	Every year	Number of units
5	$EC_{PSG,i,j,y}$	Annual electricity consumption (kWh) in year $y$ by energy efficient air conditioner $i$ in household $j$ in the project sampling group (refer to the monitoring plan)	Every year	kWh
6	$P_{PSG,i,j,y}$	Power output of energy efficient air conditioner $i$ in household $j$ in the project sampling group in year $y$	Every year	kW
7	$\eta_{ac,BL}$	Energy efficiency of the air conditioner found by an investment analysis to be the most financially/economically attractive from among air conditioners on the market	Each crediting period	-
8	$\eta_{ac,PJ}$	Energy efficiency of the air conditioner installed under the Project	Each crediting period	-

In a PSG survey, households to be included in the sample group will be selected randomly, questionnaires will then be distributed to the selected households, information necessary for monitoring, such as the list of households covered by the PSG survey, will be collected. The information collected will be recorded in the PSG database.

As for a monitoring implementation structure, a project committee will be established in the MOIT; this committee will develop and implement a monitoring plan in coordination with area coordinators of the respective regions. Also, for this committee, the actual data collection will be performed by survey staff under the direction of area coordinators.

### (4) Greenhouse Gas Emission Reductions:

As, in accordance with the applicability conditions of the methodology, the Project only covers air conditioners that are newly installed and are not transferred from another activity, it is not necessary to take leakages into account. Therefore, GHG emissions are arrived at as a difference between the baseline emissions and project emissions. The calculation formulas and calculation results are shown below. The figures used in the calculation formulas are those from the first year of project implementation.

**<Baseline Emissions>**

$$\begin{aligned}
 BE_y = BE_{EC,y} &= EC_{BL,y} \times EF_{CO_2,ELEC,y} \\
 &= 51,414 (MWh) \times 0.5764 (tCO_2 / MWh) \\
 &= 29,635 (tCO_2)
 \end{aligned}$$

**<Project Emissions>**

$$\begin{aligned}
 PE_y = PE_{EC,y} &= n_{ac,PJ,y} \times \left( \mu_{EC,PGS,y} - \frac{\sigma_{EC,PGS,y}}{\sqrt{n_{ac,PGS,y}}} \right) \times EF_{CO_2,ELEC,y} \\
 &= 13,000 \times \left( 3.4 - \frac{0}{\sqrt{336}} \right) (MWh) \times 0.5764 (tCO_2 / MWh) \\
 &= 25,305
 \end{aligned}$$

**Table 4: Greenhouse Gas Emission Reductions (Estimates) (Unit: t CO<sub>2</sub>)**

	$BE_{EC,y}$	$PE_{EC,y}$	$ER_y$
01/04/2013 – 31/03/2014	29,635	25,305	4,329
01/04/2014 – 31/03/2015	75,227	64,236	10,991
01/04/2015 – 31/03/2016	189,207	161,563	27,644
01/04/2016 – 31/03/2017	417,167	356,217	60,950
01/04/2017 – 31/03/2018	873,088	745,525	127,562
01/04/2018 – 31/03/2019	1,556,968	1,329,487	227,481
01/04/2019 – 31/03/2020	2,696,769	2,302,757	394,012
Total	<b>5,838,061</b>	<b>4,985,090</b>	<b>852,971</b>
Annual average			121,853

**(5) Operational Lifetime of the Project – Credit Acquisition Period:**

At the time of the proposal, the Project, as well as its credit acquisition period, was scheduled to begin in April 2012, but as a result of consultation with related local organizations during the local survey, a consensus has been reached that the Project, as well as its credit acquisition period, should begin after the project implementation structure is rebuilt following the development of the new methodology and approval from the CDM Executive Board.

It is envisaged that the Project will start in April 2013 with the project lifetime of 14 years until 2027. However, consideration of revision and resubmission of the methodology has become necessary as a result of the initial assessment of the new methodology submitted in November 2011. At the same time, it is difficult to develop a clear time table towards project start date as the Meth Panel meeting schedule for 2012 is yet to be fully published. Nevertheless, the aim of starting the Project as early as possible will remain. Also, project participants do not find implementing the Project during the second commitment period of Kyoto Protocol an issue. MUMSS is currently the only Japanese project participant and MUMSS is capable of making flexible arrangements while watching how international negotiation will develop with regards to the possibility of Japan to make use of CDM during the second commitment



period.

The credit acquisition period will be 14 years, from 2014 to 2028, with 2014 being one year after the start of the Project, and a renewable credit period (to be renewed once for additional seven years) is scheduled. The Project will extend over effectively 15 years, from the project start in 2013 until the end of the credit acquisition in 2028. This credit period will be discussed, however, in view of things like a projection for the increased use of inverter air conditioners on the market in the future, also taking into consideration an option of 10 years with no renewal.

## **(6) Environmental Impacts and Other Indirect Effects:**

As the Vietnamese legal system does not require an environmental impact assessment to be performed for a project that does not involve any construction work or physical changes to the surroundings, no environmental impact assessment is scheduled to be performed in this project.

By introducing inverter air conditioners that consume less energy than conventionally popular models, the Project is designed to reduce electricity consumption in households in which those air conditioners are installed. This will contribute to reducing the amount of fuel used in power plants connected to the electricity grid and contribute to developing an environmentally sustainable society in which there are less greenhouse gases generated from fossil fuel combustion.

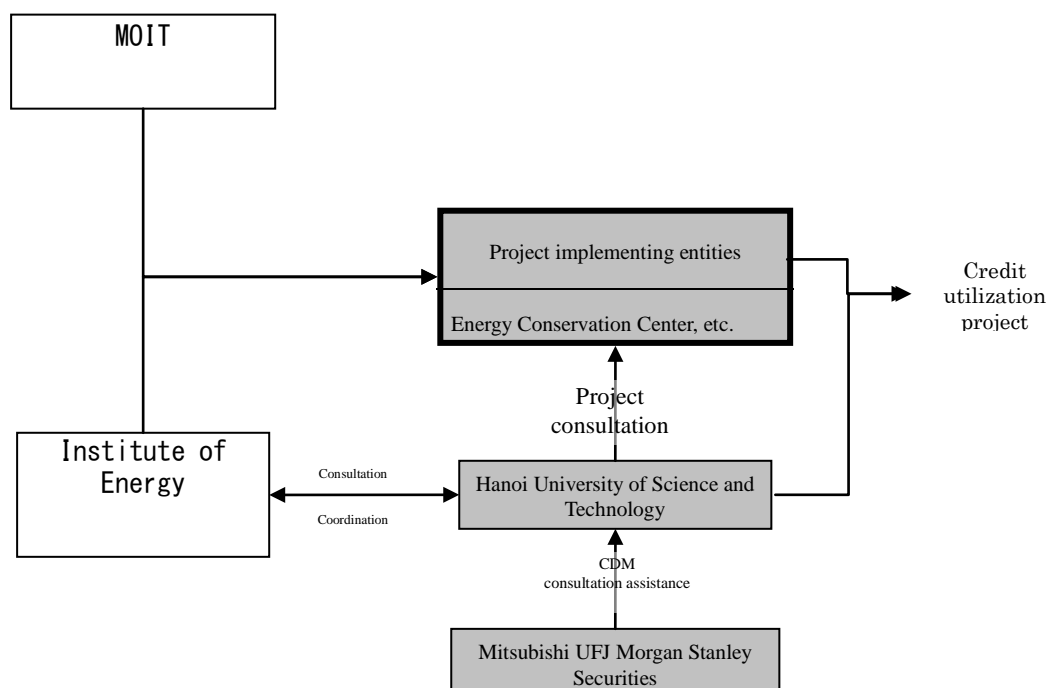
On the other hand, the introduction of inverter technology is said to cause noise (phase) in the electricity grid, and there are concerns about causing static in devices that involve audio, such as phones and radios. Referring to the past studies on household air-conditioning equipment, however, such issues can presumably be mitigated by taking countermeasures such as installing a noise filter.

## **(7) Comments from Stakeholders:**

A questionnaire-based survey was conducted at a workshop on energy efficient home appliances held by another Japanese company in February 2012 to gather comments from stakeholders, including residents, local government officials, and local public service companies. The analysis of the survey results shows that the majority of the respondents are aware of the inverter air conditioners as well as their merits in energy saving and GHG emission reduction. On the other hand, it is also evident that the high cost of inverter air conditioner continues to remain as a barrier to further diffusion. In addition, the amount of subsidy requested for purchasing inverter air conditioners is USD 250 on average, which far exceeds the USD 50 planned for the Project. This gap will need to be further discussed at the implementation stage of the Project.

## **(8) Project Implementation Structure:**

Discussion is currently in progress about implementing entities for this project, in which national organizations associated with the MOIT, including the Energy Conservation Center (ECC), are mainly named.



**Figure 1: Project Implementation Structure**

### (9) Financial Plan:

The Project involves a plan to introduce inverter air conditioners in all parts of Viet Nam, gradually increasing the number of units from 13,000 in the first project year to as many as over 1 million in the seventh year. The government will provide subsidies in the amount of 50 US dollars per unit, and monitoring equipment and project management expenses are scheduled to be funded from the state budget. As, however, the state budget is tight, hopes are being placed on CER sales proceeds.

As a result of examining the financial plan, approximately 62 million dollars are deemed to be needed for operating the Project for the 15 years from the project start to the end of the credit acquisition. While operating revenues from the Project would be non-existent unless it is implemented as an CDM, a project feasibility assessment that was conducted on the assumption of CER revenues suggests that the Project would turn profitable in year 8 on a single-year basis and would generate a total of approximately 44.15 million dollars over the operational lifetime of the project, as shown in Table 5. Furthermore, if a scenario in which sales proceeds from CER are used to increase the number of units introduced is assumed, the first profitable year on a single-year basis would still be year 8 but the increased number of units introduced would add 1 million tons in total CER volume over 14 years, which leads to an expectation for improved revenues.

**Table 5: Comparison of Financial Flows in Case of 14-Year Project Operation**

	No CER revenues	CER revenues generated	CER revenues generated + increased number of units introduced, using 90% of CER revenues
CER (tCO <sub>2</sub> )	0	3,507,137	4,505,647
CER sales proceeds (US\$)	0	44,154,855	56,822,900
Number of units introduced (total)	1,183,000	1,183,000	2,073,386 (of which additional units introduced as a result of CER sales: 890,386)

Number of units introduced (as of 2028)	800,000	800,000	1,680,576
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\* Assumed CER price: 1tCO<sub>2</sub> = US\$ 12.59 (a 2013 vintage prediction by Barclays Capital)

## (10) Financial/Economic Attractiveness Analysis:

In this study, 3.5 years is set as a benchmark, which represents the average number of investment payback years (difference in initial purchase price / electricity tariff reduction realized by energy saving) in three cities that prompts decision-making at the time of purchasing an energy efficient home appliance, a figure obtained from a market survey that we independently conducted. As a result of calculating the number of investment payback years on the basis of 2011 data, the number of investment payback years in the absence of subsidies would be 12 years, which is higher than the benchmark figure, providing a clear indication that there is no incentive to purchase an inverter air conditioner, as shown below. A summary of the calculation of the number of investment payback years is shown in Tables 6 and 7, and the detailed calculation process is shown in an attachment of the full report.

**Table 6: Assumptions**

Item	Unit	Price <sup>1</sup>
Price of an inverter air conditioner to be introduced under the Project	USD/unit	690
Price of the monitoring equipment	USD/unit	5
Annual electricity consumption in the baseline scenario (per unit)	kWh/y	4,394
Annual electricity consumption under the project activity (per unit)	kWh/y	3,337
Electricity savings (per unit)	kWh/y	1,017
Electricity tariff	USD/kWh	0.0596
Income from electricity savings (per unit)	USD/y	61

**Table 7: Results of Calculation of Number of Investment Payback Years (Summary)**

	Without subsidy	With subsidy
Initial investment amount (USD)	690	640
Number of investment payback years	12	11

## (11) Demonstration of Additionality:

With respect to the demonstration of additionality, the new methodology developed in this study stipulates the application of Step 1 and Step 2 of the "Tool for the Demonstration and assessment of additionality." Additionality of the Project will be demonstrated by assessing, using designated procedures, whether the Project could be economically viable without CER sales proceeds, thus proving that there would be no economic attractiveness in the Project in the absence of CER sales proceeds.

### **Step 1: Identification of alternatives to the project activity consistent with mandatory laws and regulations**

#### ***Sub-step 1a: Define alternatives to the project activity***

Realistic and credible alternatives are identified as follows:

**Alternative scenario 1:** The project activity being proposed is implemented and either inverter air conditioners are newly installed or non-inverter air conditioners are installed as replacements, without receiving assistance from a CDM. (*A project activity without CDM*)

<sup>1</sup> As arrived at using the 2011 sales price of Panasonic Inverter E12LKR and the exchange rate as of September 11, 2011 (1,000VND = 0.048USD). <http://www.bloomberg.com>

**Alternative scenario 2:** Either existing non-inverter air conditioners are used or new non-inverter air conditioners are introduced for cooling and heating purposes in the respective households. (*Continuation of the current practice*)

***Sub-step 1b: Compliance with mandatory laws and regulations***

It was confirmed that both alternative scenarios are in compliance with mandatory laws and regulations in Viet Nam.

**Step 2: Investment analysis**

***Sub-step 2a: Determine an appropriate analysis method***

The methodology to be applied stipulates that either an investment comparison analysis or a benchmark analysis should be selected. A benchmark analysis is selected for the project activity.

***Sub-step 2b: Apply a benchmark analysis***

The number of investment payback years was chosen to be the indicator in a benchmark analysis, with 3.5 years set as the benchmark. The development leading up to this choice is as stated in section 3.10.

***Sub-step 2c: Calculation and comparison of financial indicators***

The result of calculating the number of investment payback years when the Project is not implemented as a CDM was 12 years, which is significantly higher than the benchmark and has thus revealed that the Project is not attractive as an investment option. The details of the calculation results are shown in Attachment of the full report.

***Sub-step 2d: Sensitivity analysis***

A sensitivity analysis was conducted on the assumption of cases that would give a positive effect on the financial/economic attractiveness of the Project, for example: inverter air conditioner prices dropping by 10% or the electricity tariff increasing by 10%. The results clearly showed that both cases would fall short of the benchmark, although the number of investment payback years would be shortened by one year to 11 years.

Thus, additionality of the Project has been demonstrated in accordance with the method of demonstrating additionally of a new methodology.

**(12) Prospect for Project Realization:**

As a result of consultation with related local organizations during the local survey, it has been found that there are great needs for the Project and budgetary steps are being discussed within the government for when the methodology is successfully approved. As, however, the government's budget is tight, it would be essential to secure revenues by means of CER, and for that reason, early approval of the methodology is hoped for. In order to be able to immediately bring the Project to an implementation stage taking into account further discussion required for the possibility of revision of the methodology, consultations with related local organizations have been started to discuss a project implementation plan.

**5. Findings from the Study on Co-Benefits**

The Project is designed to reduce electricity demand by introducing energy efficient appliances in private households and thus contribute indirectly to reducing air pollutants emitted from the use of fossil fuels at power plants that are connected to the electricity grid from which those households receive their electricity

supply. Referring to the "Manual for Quantitative Evaluation of the Co-Benefits Approach to Climate Change Projects: Version 1.0," a Tier 1 qualitative evaluation was performed, which led to the conclusion that the Project can be deemed to be a measure that could earn a score of 2, as it has a "High probability of reduction in air pollutant emissions," given that it will introduce equipment that contributes to reducing air pollutant emissions and the operation status of the equipment can be checked through monitoring after the activity implementation, as well as that it also falls under "Low interest financing and tax incentives relating to investments needed to promote implementation of air pollutant emission reduction measures" and "Subsidy programs for research and development."

## **6. Findings from the Study on the Contribution to Sustainable Development**

We believe that the Project will lead to economic growth based on a stable energy supply in Viet Nam, the reduction of air pollutants generated from fossil fuel combustion in power plants through proper adjustment to energy demand, and furthermore to the mitigation of climate change, thus contributing greatly to Viet Nam's sustainable development goal set out in its "Comprehensive Poverty Reduction and Growth Strategy," "National Strategy for Environmental Protection," etc.

In addition, the Project will introduce energy saving appliances to general households in all parts of Viet Nam and will therefore lead directly to improved living conditions for all Vietnamese people. As a result, it will also contribute to an objective set out in the Energy Saving Act: "establish an energy-saving lifestyle and daily habits in the use of home appliances." Further still, we believe that continuous technical assistance, such as the provision of inverter technology know-how achieved through this study and capacity-building regarding efficiency evaluation methods, plays a part in the creation of energy efficiency criteria and a labeling system that are set out in the Energy Saving Act.