



**CLEAN DEVELOPMENT MECHANISM  
SMALL-SCALE PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM  
(CDM-SSC-PoA-DD) Version 01**

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**NOTE:**

- (i) This form is for the submission of a CDM PoA whose CPAs apply a small scale approved methodology.
- (ii) At the time of requesting registration this form must be accompanied by a CDM-SSC-CPA-DD form that has been specified for the proposed PoA, as well as by one completed CDM-SSC-CPA-DD (using a real case).



**SECTION A. General description of small-scale programme of activities (PoA)**

**A.1. Title of the small-scale programme of activities (PoA):**

Installing Solar Water Heating Systems in the South of Viet Nam

Version 04  
4 June 2012

**A.2. Description of the small-scale programme of activities (PoA):**

**Purpose of this programme of activities (PoA)**

The purpose of this PoA is to install new residential solar water heating (SWH) systems in households in the south of Viet Nam. The SWH systems will be systematically installed through a subsidy programme coordinated by the Energy Conservation Center (ECC) of Ho Chi Minh City. The cost of the SWH systems will be subsidised as an incentive to encourage people to install SWH systems.

The goal of this PoA is to promote energy saving in the southern region of Viet Nam. Each CPA included in the PoA will install a group of SWH systems in a certain year with the available budget for the subsidy in the year. Using solar energy for water heating reduces demand for electricity and reduces the greenhouse gases (GHGs) associated with producing electricity from the national grid.

This project is a voluntary initiative coordinated by the Energy Conservation Center (ECC) of Ho Chi Minh City. The ECC was established in 2002 through a decision by the People's Committee of HCMC, aiming to improve energy efficiency, promote renewable energy, fund research and development and develop human resources. The ECC aims to reduce electricity consumption in the south of Viet Nam through the use of SWH systems supplying heated water. The ECC will coordinate this PoA and all CPAs under this PoA.

The ECC will promote the use of SWH systems by providing information regarding the economic and environmental benefits of SWH systems and explain the support structure of the subsidy programme and SWH system distributors. Under the programme, the ECC will receive applications from prospective users and select applicants who are eligible for the subsidy. Consumers will receive the subsidy from the ECC only after the ECC have confirmed installation of the SWH system. The programme involves i) new construction projects under which SWH systems in newly-built residences, ii) existing residences that prior to the project implementation, do not have installed electric water heating systems, and iii) retrofit projects under which SWH systems replace existing electric water heating systems in the existing residences.

**Background of this PoA**

With the rapid growth of the economy in Viet Nam, electricity demand is increasing. The Vietnamese Government estimated the annual growth in electricity demand to be about 11% from 2005 to 2010. However, actual electricity consumption has been increasing at an average annual growth rate of 14%<sup>1</sup> which is higher than the Government's estimation. The Vietnamese Government is promoting energy

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<sup>1</sup> Viet Nam electricity survey 2011, June 2011, JETRO Hanoi



saving and the use of renewable energy in order to ensure a stable electricity supply. In the south of Viet Nam population growth and electricity demand are expected to increase, especially in Ho Chi Minh City, the biggest commercial city in Viet Nam, and industrial zones developed around Ho Chi Minh City.

About 40% of the electricity distributed by Electricity of Viet Nam (EVN) is sold to households<sup>2</sup>. Along with the rapid economic growth, home electronics, such as televisions, air-conditioners and electric water heaters have become widely used among Vietnamese people. Especially in urban areas, electric water heaters are commonly used for providing hot water for showers and the electricity consumed for water heating accounts for 13% and 7% of the total electricity consumption of one family in the urban and the rural area respectively<sup>3</sup>. Therefore, implementing energy saving measures for electricity consumption from water heating is an important task in Viet Nam.

### **Contribution to the sustainable development of the host country**

This PoA will contribute to sustainable development of Viet Nam in the following ways:

**Economic dimension** - Current electricity supply is not enough to meet projected demand especially in the southern region of Viet Nam. The Vietnamese Government is promoting energy conservation as well as expanding the electricity supply capacity in order to support the rapid development of the economy. The proposed PoA will reduce energy consumption for water heating for household use in the south of Viet Nam and help secure the electricity supply required for the country's continued economic growth.

**Environmental dimension** - The PoA reduces electricity consumption and thereby reduces the amount of GHGs produced by fossil fuel combustion at the national electricity grid. Through promotional activities in the mass media such as television and newspaper advertisements to enhance the use of SWH systems, the ECC will communicate the economic and environmental benefits of SWH systems. This publicity will raise awareness of renewable energy and energy conservation among the Vietnamese people.

**Social dimension** - The use of electric water heaters in the bathroom sometimes causes electric shock, which is a common concern for people who have small children. The introduction of SWH systems will provide a safe and steady supply of hot water and hence increase the quality of life of people in Viet Nam.

Through the programme, jobs will be created in the solar sector, with training provided for technicians to install and maintain the SWH systems.

### **A.3. Coordinating/managing entity and participants of SSC-POA:**

The coordinating entity for this PoA is the Energy Conservation Center of Ho Chi Minh City

The project participants being registered in relation to the PoA are as follows:

<b>Name of Party involved (*) (host) indicates a host Party)</b>	<b>Private and/or public entity(ies) project participants (*) (as applicable)</b>	<b>Kindly indicate if the Party involved wishes to be considered as</b>
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<sup>2</sup> Viet Nam electricity survey 2011, June 2011, JETRO Hanoi

<sup>3</sup> Figure is referred to the data from Jyukankyo Reserch Institute Inc. Original data is based on the survey conducted by EVN. <http://premium.nikkeibp.co.jp/em/column/nakagami/16/04.shtml>



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**CDM – Executive Board**

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		<b>project participant (Yes/No)</b>
Viet Nam (host)	The Energy Conservation Center of Ho Chi Minh City	No
Japan	Mitsubishi UFJ Morgan Stanley Securities Co., Ltd.	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		



**A.4. Technical description of the small-scale programme of activities:**

**A.4.1. Location of the programme of activities:**

**A.4.1.1. Host Party(ies):**

Socialist Republic of Viet Nam

**A.4.1.2. Physical/ Geographical boundary:**

The geographical boundary of the project is the south of Viet Nam. It is composed of Ho Chi Minh City (HCMC) and 21 provinces (Ninh Thuan, Binh Thuan, Lam Dong, Binh Duong, Binh Phuoc, Ba Ria Vung Tau, Dong Nai, Long An, Tien Giang, Ben Tre, Tay Ninh, Hau Giang, Bac Lieu, Can Tho, Ca Mau, Dong Thap, An Giang, Kien Giang, Vinh Long, Tra Vinh, Soc Trang).

The project boundary is located in between latitude of 8° 33'N and 12° 26'N and longitude of 103° 49'E and 109° 40'E.

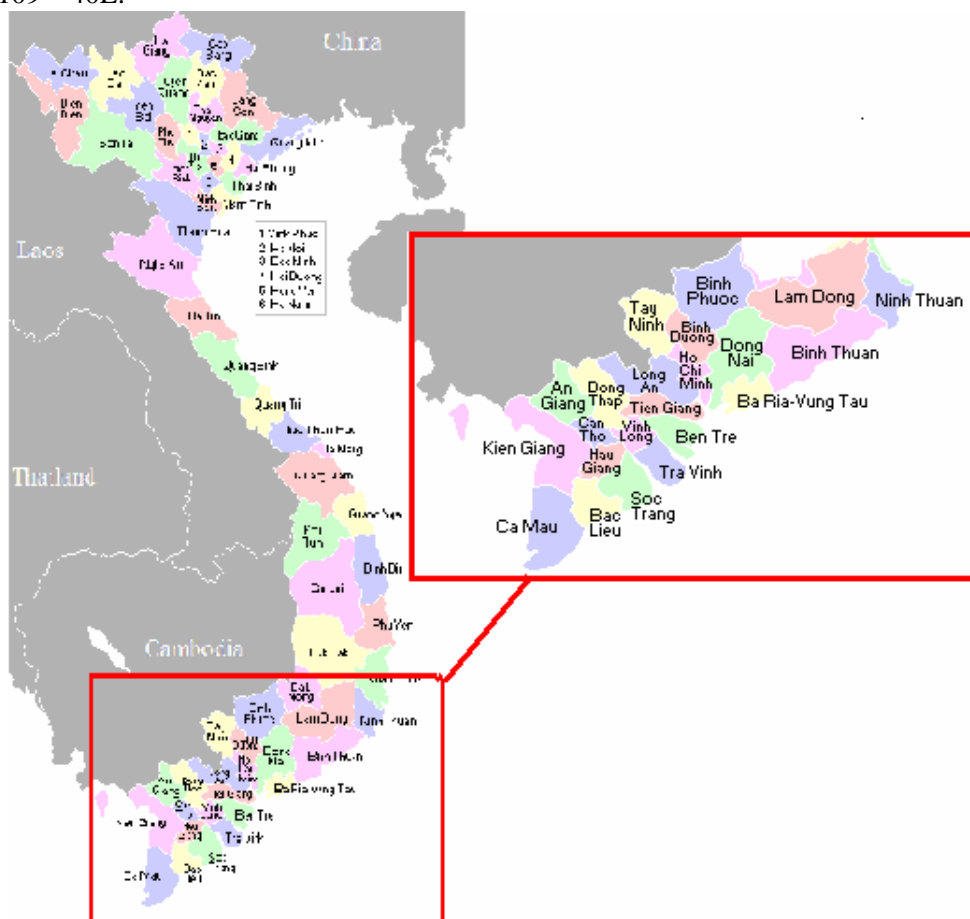


Figure 1. Map of Viet Nam and regions of Viet Nam<sup>4</sup>

<sup>4</sup> Image courtesy of Wikipedia([http://en.wikipedia.org/wiki/Provinces\\_of\\_Vietnam#Regions](http://en.wikipedia.org/wiki/Provinces_of_Vietnam#Regions))



**A.4.2. Description of a typical small-scale CDM programme activity (CPA):**

**A.4.2.1. Technology or measures to be employed by the SSC-CPA:**

In a typical CPA, SWH systems will be installed in the south of Viet Nam. SWH systems employ water heating technology using solar energy. The ECC, as the coordinating entity of a typical CPA, will enhance installation of SWH systems into households in the south of Viet Nam by providing subsidies to consumers. Through a typical CPA, the energy source for providing heated water will come from solar energy and displace electricity which would have been consumed from the Vietnamese national grid by electric water heaters. Electric water heaters are currently the only available technology in the market other than SWH systems. In order to participate in the programme, consumers must purchase SWH systems from distributors who are officially registered in the programme. The SWH distributors whose products comply with technical requirements for SWH systems TCVN8251: 2009 announced by the Ministry of Science and Technology, Viet Nam are qualified to register in ECC's programme. The SWH system distributors will determine optimum placement and install the systems at each building to collect enough solar radiation.

SWH systems installed in a typical CPA under the proposed PoA will be composed of solar collectors and tanks for the heated water. A number of different manufacturers provide SWH systems. Distributors, who are registered in this programme, will report the technical specification of their products to the ECC. SWH systems to be installed by a typical CPA under the proposed PoA have following specifications:

- The SWH systems under a CPA have either flat plate or evacuated tube collectors.
- The typical sizes of storage tank of SWH systems under a CPA range from 120 to 300liters.
- The typical sizes of collector area of SWH systems under a CPA range from 1.0 to 3.0m<sup>2</sup>.
- All SWH systems will be passive systems without a forced circulation system or auxiliary heat source, so that all systems installed under a typical CPA do not consume energy sources other than solar energy.



Figure 2.  
SWH system with evacuated tube solar collectors



Figure 3.  
SWH system with flat plate solar collectors



The typical size of a collector area per SWH system installed under a CPA will not exceed 3.0 m<sup>2</sup> which is less than 8.0 m<sup>2</sup> of a threshold of very small residential SWH systems determined in the methodology AMS-I.J version 01.

**A.4.2.2. Eligibility criteria for inclusion of a SSC-CPA in the PoA:**

According to “Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities” (Version 01.0), the eligibility criteria for inclusion of a CPA to be included in the PoA are listed as below:

The eligibility criteria required in “Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities”	The eligibility criteria of a CPA to be included in the PoA
(a) The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA;	Criterion 1. A CPA is located in the south of Viet Nam composed of Ho Chi Minh City and 21 provinces described in the Section A.4.1.2 of CDM-SSC-PoA-DD.
(b) Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo);	A CPA is uniquely identified and the SWH systems installed under each CPA are to be uniquely identified with a sequential registration number. Criterion 2. The database is set for a CPA and a sequential registration number will be assigned for the SWH systems under a CPA.
(c) The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications;	Criterion 3. The SWH systems under a CPA are purchased from and installed by distributors who are registered under the installation program of the ECC. Criterion 4. The size of collector surface area of the SWH system installed under a CPA do not exceed 8 m <sup>2</sup> of a threshold of very small residential SWH systems determined in the methodology AMS-I.J. Criterion 5. The SWH systems under a CPA are systems with either flat plate or evacuated tube collectors. Criterion 6. The SWH systems under a CPA are passive systems without a forced circulation system or auxiliary heat source. Criterion 7. The SWH systems under a CPA comply with technical requirements for SWH systems TCVN8251: 2009 announced by the Ministry of Science and Technology, Viet Nam and the requirements given below: -Unglazed collector must be stabilized against UV degradation; -Glazed collector must have at least one glass cover and be insulated on the sides and back to achieve a loss coefficient not more than 5 W/m <sup>2</sup> C;



	<p>-Evacuated tube collector must maintain vacuum insulation between absorber and ambient.</p> <p>Criterion 8. The volume of storage tanks of the SWH systems under a CPA is at least 50 litres per square meter of collector area.</p> <p>Criterion 9. The tilt and orientation of the solar collectors shall be +/-45 of due equator and a tilt +15 to -25 degrees of latitude. This requirement shall be ensured by the acceptance testing.</p> <p>Criterion 10. There must be no shading of the solar collectors between 10am to 2pm on the shortest day of the year at the time of installation. This requirement shall be ensured by the acceptance testing.</p>
(d) Conditions to check the start date of the CPA through documentary evidence;	<p>Criterion 11. The start date of a CPA is presented through the contract between the ECC and the SWH system distributors who participate in a CPA .</p>
(e) Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs;	<p>A CPA to be included in the PoA shall meet the conditions that ensure compliance with applicability and other requirements of the methodology AMS-I.J. The compliance with the following conditions:</p> <p>(1) The SWH systems installed under a CPA included in the PoA are residential SWH systems which (a) heated water to be used for domestic purposes only, (b) are installed to serve one or more residences, and (c) have a maximum stand alone (independent) collector area of 100m<sup>2</sup>.</p> <p>(2) A CPA included in the PoA involves a) retrofit projects under which SWH systems replace existing electric water heating systems in the existing residences, and (b) new construction projects under which SWH systems installed in (i) newly-built residences, and (ii) existing residences that prior to the project implementation, do not have installed water heating systems.</p> <p>(3) The aggregated installed collector area under a CPA in the PoA is less than 64,000 m<sup>2</sup>.</p> <p>(4) The energy savings are based on the hot water consumption. For CPAs of the PoA, the stipulated energy saving method is applied to calculate energy savings and it is demonstrated that the average annual daily amount of water heated by the SWH systems is less than or equal to the average annual, daily hot water demand.</p> <p>(5) A single value of 450 KWh/year per square meter</p>





	<p>of collector area is stipulated for energy savings by the SWH system installed under a CPA included in the PoA, and is based on 5kWh/m<sup>2</sup>/day solar resources, 25% solar water heater efficiency, and 365days/year of hot water use for applicants that can be reasonably demonstrated to have substantial hot water consumption demand year round.</p> <p>The eligibility criteria to ensure (1) ,(2) and (5)are;</p> <p>Criterion 12. The SWH systems installed under a CPA are residential SWH systems.</p> <p>Criterion 13. The SWH systems under a CPA will be installed to the residential buildings which are not temporary or seasonal housings.</p> <p>(3) is to be ensured in (k) by the Criterion 14 below. (4) is ensured by the item (iv) in Section E.6.1 of CDM-SSC-PoA-DD for the PoA.</p>
(f) The conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality as specified in Section A of “Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities”;	<p>A CPA to be included in the PoA shall meet the requirements pertaining to the demonstration of additionality in accordance with “Guidelines for demonstrating additionality of microscale project activities”. A CPA shall meet the additionality-related eligibility criteria;</p> <ul style="list-style-type: none"> <li>-Each of the independent subsystems/measures in the project activity is smaller than or equal to 1500kW electrical installed capacity, which is equivalent to 6,428m<sup>2</sup> of the collector size.</li> <li>-The end users of the subsystems or measures are households.</li> </ul> <p>The above requirements are ensured by the Criterion 4 and the Criterion 12 respectively.</p>
(g) The PoA-specific requirements stipulated by the CMEs including any conditions related to undertaking local stakeholder consultations and environmental impact analysis;	<p>N/A</p> <p>The information of local stakeholders’ consultation and the environmental analysis is provided at the PoA level. Justification of the choice of level at which the environmental analysis and local stakeholders’ consultation is undertaken is described in the Section C.1, and D.1 of CDM-SSC-PoA-DD.</p>
(h) Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance.	<p>Criterion 14.</p> <p>A CPA under the PoA will not receive any public funds resulting from official development assistance from Parties included in Annex I to the Convention</p>
(i) Where applicable, target group (e.g. domestic/commercial/industrial, rural/urban, grid-connected/off-grid) and distribution	<p>A CPA will install residential SWH systems in households.</p>



mechanisms (e.g. direct installation);	
(j) Where applicable, the conditions related to sampling requirements for a PoA in accordance with the approved guidelines/standard from the Board pertaining to sampling and surveys;	N/A Each CPA will be verified individually.
(k) Where applicable, the conditions that ensure that CPA in aggregate meets the small-scale or micro-scale threshold criteria and remain within those thresholds throughout the crediting period of the CPA;	Criterion 15. Total size of collector surface area of the SWH systems installed under a CPA does not exceed 21,428 m <sup>2</sup> of a threshold of microscale project activities throughout the crediting period of a CPA.
(l) Where applicable, the requirements for the debundling check, in case CPAs belong to small-scale (SSC) or microscale project categories.	N/A According to the “Guidelines on assessment of de-bundling for SSC project activities”, version 03, Section II, “Guidance for determining the occurrence of de-bundling under a programme of activities (PoA)”, Paragraph 10, as each independent subsystems/measures included in a CPA of the PoA is no greater than 1% of the small scale threshold defined by the methodology applied, then the CPA is exempted from performing a de-bundling check and is not considered a de-bundled component of a large scale activity.

The ECC as a coordinating/managing entity will check the features of potential CPAs and ensure that each CPA meets all eligibility criteria 1 to 15 listed above before inclusion in the registered PoA.

**A.4.3. Description of how the anthropogenic emissions of GHG by sources are reduced by a SSC-CPA below those that would have occurred in the absence of the registered PoA (assessment and demonstration of additionality):**

The proposed PoA is a voluntary coordinated action with the goal to promote energy saving in the south of Viet Nam by installing a large number of SWH systems.

According to the “Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities”, version 01.0, paragraph 7, additionality shall be demonstrated by establishing that in the absence of CDM, none of the implemented CPAs would occur. The additionality for CPAs should be conducted by means of the eligibility criteria according to paragraph 4 of the “Clarifications regarding the “procedures for registration of a programme of activities as a single CDM project activity and issuance of certified emission reductions for a programme of activities”, version 01.

Paragraph 8 of the standard denotes that PoAs that consist of one or more microscale projects as CPAs shall include eligibility criteria derived from all the relevant requirements of the “Guidelines for demonstrating additionality of microscale project activities”.

“Guidelines for demonstrating additionality of microscale project activities”, version 03, paragraph 2, defines that project activities up to 5 megawatts that employ renewable energy technology and the project



activity designed for distributed energy generation (not connected to a national or regional grid) which satisfy both conditions (i) each of the independent subsystems/measures in the project activity is smaller than or equal to 1500kW electrical installed capacity and (ii) end users of subsystems or measures are households/communities/small and medium enterprises are additional.

A CPA of the PoA is a project activity designed for distributed energy generation (not connected to a national or regional grid). The installed capacity of each of the independent subsystems in the project activity is smaller than or equal to 1500kW which is equivalent to 6,428m<sup>2</sup> of the collector size calculated using a conversion factor of 700Wth/m<sup>2</sup> following the “General guidelines to SSC CDM methodologies”, and the end users of subsystems are households. The aggregated thermal energy supplied to households in a CPA will remain under the amount of thermal energy equivalent to 5 megawatts, and the end users of SWH systems installed under a CPA will be households. Therefore, a CPA of the PoA is additional

The eligibility of project activities as microscale CDM project activities will be determined in accordance with the principles laid out in paragraph 3 and 4 of the “General Guidelines to SSC CDM methodologies”, i.e. listed as below;

The eligibility of project activities as microscale CDM project activities.	Project Activity
Paragraph 8. (a) Project activities remain under the thresholds defined in paragraph 2 “Guidelines for demonstrating additionality of microscale project activities” during each year of the crediting period and in cases where ex ante projected emissions reductions show an increase during the crediting period; project activities that go beyond the microscale limits in any year of the crediting period are not eligible	CPAs under the PoA remain under the thresholds of microscale project activities during each year of the crediting period which will be ensured by assessment of the eligibility criteria for inclusion of a CPA in the PoA in Section B.2 of a CDM-SSC-CPA-DD.
Paragraph 8. (b) Renewable energy projects that produce electrical, thermal and mechanical energy, and cogeneration projects are covered. Definitions provided for output capacity and guidelines provided for conversion from electrical to thermal units in the most recent version of “General Guidelines to SSC CDM methodologies” shall be used. Where applicable, additional guidelines provided in relevant methodologies shall be followed, e.g. eligibility of cogeneration projects as currently defined in AMS-I C.	In accordance with the “General Guidelines to SSC CDM methodologies”, 5 MW of the microscale limit is equivalent to 15 MW thermal. For thermal application projects, the threshold of microscale project activities is less than 15 MW thermal which is equivalent to the 21,428 m <sup>2</sup> of the collector area using a conversion factor of 700Wth/m <sup>2</sup> following the “General guidelines to SSC CDM methodologies”.
Paragraph 8. (c) A project activity with more than one component, where each component meets the microscale threshold, is eligible. The sum of the size of components of a project activity belonging to the same type (capacity for Type I, energy savings for Type II and emission reductions for Type III) shall not exceed the limits for microscale project activities (e.g. the limit for the methane recovery component is 20 ktCO <sub>2e</sub> /yr and the limit for the electricity production component is 5 MW	N/A CPAs under the PoA does not include more than one component.



output capacity).	
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“Guidelines for demonstrating additonality of microscale project activities” also provides two requirements for microscale CDM project activities as below;

Requirements	Project Activity
Microscale CDM project activities shall apply the “Guidelines on the demonstration and assessment of prior condition of the CDM”.	N/A According to the “Clarifications regarding the “Procedures for registration of a programme of activities as a single CDM project activity and issuance of certified emission reductions for a programme of activities””, “Guidelines for the demonstration and assessment of prior condition of the CDM” do not apply to PoAs,
Paragraph 10. Microscale CDM project activities shall demonstrate that they are not a debundled component of a small-scale CDM project activity by applying the criteria in the “Guidelines on assessment of debundling for SSC project activities”, for example by suitably considering microscale thresholds in the place of SSC thresholds.	According to the “Guidelines on assessment of de-bundling for SSC project activities”, version 03, each independent subsystems/measures included in a CPA of the PoA is no greater than 1% of the small scale threshold defined by the methodology applied, then the CPA is exempted from performing a de-bundling check and is not considered a de-bundled component of a large scale activity.  The typical SWH system installed under a CPA of the PoA will not exceed 8 m <sup>2</sup> of a threshold of very small residential SWH systems determined in the methodology AMS-I.J version 01, which is less than 0.0125% of the small scale threshold. Therefore, a CPA of the PoA is exempt from performing a de-bundling check and is not considered a de-bundled component of a large scale activity.

The table below indicates that the continuing and real actions were taken to secure CDM status for the PoA in parallel with its implementation.

CDM Actions	Date
MOU signed between the ECC and Mitsubishi UFJ Morgan Stanley Securities Co.,Ltd. as a CDM consultant	23/07/2008
Launch pilot project	15/08/2008
Start of CDM Feasibility Study	29/08/2008
Contract signed with Mitsubishi UFJ Morgan Stanley Securities Co., Ltd. as a CDM consultant	30/03/2009
Contract with DOE	01/04/2009
Submission of PDDs for public comments	04/06/2009
Approval from People’s committee of Ho Chi Minh City	09/11/2009
Approval from Vietnamese DNA	30/07/2010
Submission of PDDs version 2 for public comments	15/10/2011



The ECC will assess and demonstrate that a CPA under the PoA satisfies the eligibility criteria derived from all the relevant requirements of the “Guidelines for demonstrating additonality of microscale project activities” in Section B.2 of a CDM-SSC-CPA-DD.

**A.4.4. Operational, management and monitoring plan for the programme of activities (PoA):**

**A.4.4.1. Operational and management plan:**

The operational and management arrangements established by the coordinating/managing entity for the implementation of the PoA, the ECC, include:

*(i) A record keeping system for each CPA under the PoA*

The operational and management arrangements for the implementation of the PoA will be established by the coordinating / managing entity, the ECC. The ECC is the sole coordinating entity of this PoA and implementer of all CPAs under the PoA. The ECC will cooperate with registered SWH system distributors to ensure the proper installation and operation of SWH systems and collection of monitoring data. The ECC will provide subsidies to people who purchased SWH systems only after a SWH system distributor has confirmed proper installation and operation of the SWH system within a CPA. SWH system users will report any problem with a SWH system to a responsible SWH system distributor. The SWH system distributor will report to the ECC about the problem with the SWH system and its treatment to ensure the number of systems in operation in any CPA. Under the contract with the ECC, SWH system distributors have to give receipts and instruct their customers how to receive the subsidy from the ECC. In addition, SWH system distributors have to support the ECC to identify the sites where SWH systems are installed and they have to maintain the systems.

A database will be set up by the ECC for each CPA and for the PoA. Information included in the database is described in Section A.4.4.2.

*(ii) A system to avoid double accounting*

A database will be set up by the ECC for the PoA as well as each CPA under the PoA. The PoA database will include the following information for each CPA under the PoA:

- Location of SWH system registered under a CPA;
- Name of the SWH system owner;
- Installation date of the SWH system;
- SWH system distributor and technical specifications of the SWH system;
- SWH system sequential registration number;
- Results of acceptance testing;
- Results of annual inspection for the sample group;
- Crediting period of a CPA
- Status of verification of a CPA.

All SWH systems registered in one CPA will be uniquely defined and recorded, thus each CPA is uniquely identified. Each SWH system registered in a CPA will be uniquely identified through the cross check of several documents, invoice, receipt for the purchase of a SWH system, and voucher for the



subsidy, and will be recorded with the SWH system owner's information as listed above in the database. One voucher for the subsidy will be provided for one SWH system. The invoice number, the information of the purchased SWH system, and customer's information should be described in the voucher. The ECC will cross check the information of the voucher with the original invoice. Thus, the ECC will ensure that any SWH systems in a new CPA have neither already been registered as a CDM project activity nor as a CPA of another PoA.

(iii) The SSC-CPA included in the PoA is not a de-bundled component of another CDM programme activity (CPA) or CDM project activity

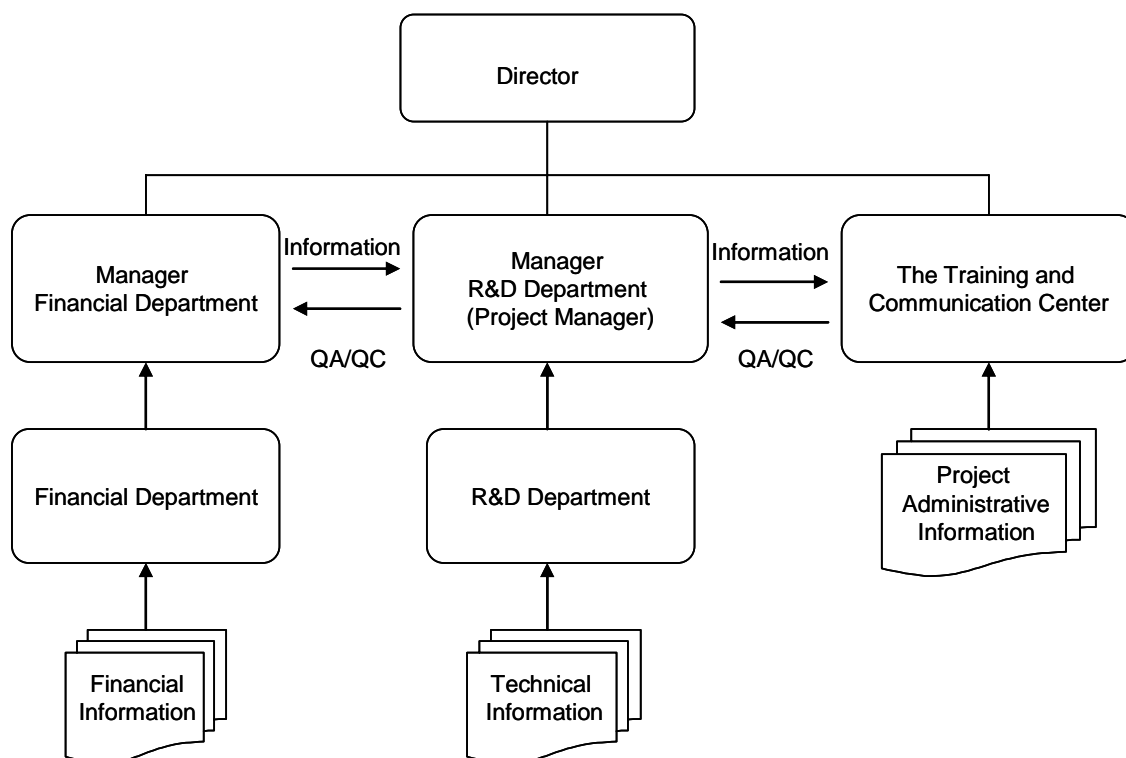
According to the "Guidelines on assessment of de-bundling for SSC project activities", version 03, Section II, "Guidance for determining the occurrence of de-bundling under a programme of activities (PoA)", Paragraph 10, as each independent subsystems/measures included in a CPA of the PoA is no greater than 1% of the small scale threshold defined by the methodology applied, then the CPA is exempted from performing a de-bundling check and is not considered a de-bundled component of a large scale activity.

According to "general guidelines to SSC CDM methodologies", version 17, Paragraph 4 (d), the maximum output capacity for thermal application of solar energy projects shall be 64,000m<sup>2</sup> of the collector area. The typical SWH system installed under a CPA of the PoA will have size of collector area ranging from 1.0 to 3.0 m<sup>2</sup> and no systems will exceed 8 m<sup>2</sup> of a threshold of very small residential SWH systems determined in the methodology AMS-IJ version 01, which is less than 0.0125% of the small scale threshold. Therefore, a CPA of the PoA is exempt from performing a de-bundling check and is not considered a de-bundled component of a large scale activity.

(iv) Provisions to ensure that those operating the CPA are aware of and have agreed that their activity is being subscribed to the PoA

The ECC is the sole coordinating entity of this PoA and also implementer of all CPAs under the PoA, hence the ECC is aware that all CPAs are subscribed to the PoA.

The below chart describes the responsibility of personnel involved in the operation and management of the PoA.



Director of the ECC will:

- Oversee the implementation of the PoA

Manager of R&D Department of the ECC will:

- Be responsible to oversee the collection of data and information relevant to project administration conducted by the training and communication center
- Be responsible to double check the technical and financial information collected by the R&D department and the financial department, respectively
- Have overall responsibility of the database management
- Have overall responsibility to ensure that a CPA meets eligibility criteria for inclusion of a CPA in the PoA
- Have overall responsibility to ensure that a CPA has not already been registered either as a CDM project activity or as a CPA of another PoA

The staff of R&D department of the ECC will:

- Be responsible of collection of technical data and information
- Conduct acceptance testing
- Conduct annual inspection
- Ensure that SWH systems included in a CPA meet the all required technical specifications

Financial manger of the ECC will:

- Be responsible of financial plan of a CPA



- Be responsible to oversee the collection of financial data and information
- Have overall responsibility to ensure no duplicate payment of the subsidy to the SWH system at the time of inclusion the SWH system to a CPA in order to avoid double counting

The staff of financial department of the ECC will:

- Be responsible of collecting of financial data and information
- Ensure that no duplicate payment of the subsidy to the SWH system at the time of inclusion the SWH system to a CPA

The training and Communication Center will:

- Become windows to people who receive subsidy
- Be responsible of collecting information from households who receive subsidy
- Input and manage database

#### **A.4.4.2. Monitoring plan:**

The coordinating/ managing entity, the ECC, will verify each CPA individually and will implement a system that will allow the DOE to verify the emission reductions for each individual CPA. A database will be set up by the ECC for each CPA and the PoA. The database includes information on geographic location and the CDM status for each CPA under the PoA, to ensure no double accounting. The monitoring plan for each CPA under the PoA is discussed in Section E.7.

A database will be set up by the ECC for each CPA under the PoA. The database will include the following information for each SWH system:

- Location of SWH system registered under a CPA;
- Name of the SWH system owner;
- Installation date of the SWH system;
- SWH system distributor and technical specifications of the SWH system;
- SWH system sequential registration number;
- Results of acceptance testing;
- Results of annual inspection for the sample group;
- Crediting period of a CPA
- Status of verification of a CPA.

The ECC will keep a record of all monitoring data for a period of at least two years after the crediting period of the CPA. The figure in E.7.2 shows the monitoring structure for a typical CPA.

#### **A.4.5. Public funding of the programme of activities (PoA):**

The proposed PoA will not receive any public funds resulting from official development assistance from Parties included in Annex I to the Convention.

### **SECTION B. Duration of the programme of activities (PoA)**

#### **B.1. Starting date of the programme of activities (PoA):**





09/11/2009 (the date of approval of the PoA by the People's Committee of HCMC)

The approval from the People's Committee confirmed the implementation of the project as the PoA. No implementation or construction or real action of the project has been started before issuance of this approval.

**B.2. Length of the programme of activities (PoA):**

28 Years

**SECTION C. Environmental Analysis**

**C.1. Please indicate the level at which environmental analysis as per requirements of the CDM modalities and procedures is undertaken. Justify the choice of level at which the environmental analysis is undertaken:**

1. Environmental Analysis is done at PoA level ☒
2. Environmental Analysis is done at SSC-CPA level ☐

Environmental analysis is undertaken at the PoA level since the impact of all CPAs will be similar. In addition, the relevant impacts are the ones from all the SWH systems installed under the PoA together rather than the impacts of a certain group of SWH systems of an individual CPA.

Vietnamese law does not require an environmental impact assessment (EIA) to be completed for solar water heating (SWH) system installation according to Decree No.21/2008/ND-CP.

**C.2. Documentation on the analysis of the environmental impacts, including transboundary impacts:**

There are not expected to be any environmental impacts due to the implementation of the project.

**C.3. Please state whether in accordance with the host Party laws/regulations, an environmental impact assessment is required for a typical CPA, included in the programme of activities (PoA):**

According to Decree No.21/2008/ND-CP, Vietnamese law does not require an environmental impact assessment to be conducted for a typical CPA included in the PoA as per Section C.1 above.

**SECTION D. Stakeholders' comments**

**D.1. Please indicate the level at which local stakeholder comments are invited. Justify the choice:**

1. Local stakeholder consultation is done at PoA level ☒
2. Local stakeholder consultation is done at SSC-CPA level ☐

The geographical boundary of the PoA is the south of Viet Nam. Each CPA consists of a group of SWH systems installed in a same year across the south of Viet Nam. The ECC determined that there would be no significant difference in the comments toward this project depending on the year of installation. Therefore, it is considered appropriate to carry out the local stakeholder consultation at PoA level.



Comments were collected from the respondents who came from different provinces in the south of Viet Nam. The respondents were randomly selected and interviewed by the ECC. Detail process how the comments have been invited is described in D.2.

**D.2. Brief description how comments by local stakeholders have been invited and compiled:**

There are no laws/requirements for a stakeholders' consultation process in Viet Nam. The comments of stakeholders were collected thorough following process during a pilot project.

A pilot project to install SWH systems for the purpose of a feasibility study was implemented from August to December in 2008. The pilot project was promoted in print and broadcast media throughout the south of Viet Nam. Information including the purpose and description of the project, and the application process to join the project were promoted during the pilot project. Respondents who registered under the pilot project were interviewed after the installation of SWH. The ECC staff randomly interviewed 55 people out of 865 who came to the ECC office to receive subsidies from the ECC. Each respondent spent enough time to answer each question in a questionnaire provided and also ask question to the ECC staff if they have any.

**D.3. Summary of the comments received:**

Respondents were satisfied with the installation of SWH systems in their houses. 97% of respondents commented that their electricity cost was reduced after installing SWH systems and they were happy about this saving, while the remaining 3% had no comments. Comments indicating the safety and convenience of the SWH systems were also received. A summary of the comments received is shown below:

Why did you decide to purchase the SWH system?

Save electricity	95%
SWH is not dangerous	23%
Would like to reduce CO <sub>2</sub> emissions	5%

How did you notice this campaign (from which media)?

Newspaper and TV	63%
Friends	27%
SWH distributor	13%
Internet	3%

Do you remember any information provided through this campaign?

Save energy	37%
Subsidy	30%
SWH distributors' information	25%
Don't remember	30%

What do you expect by using a SWH system?

Economic benefit	90%
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Environmental benefit	45%
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What are the benefits provided to your family by this project?

Electricity cost saving	78%
Safety	2%
Convenience	32%

**D.4. Report on how due account was taken of any comments received:**

No negative comments were received, thus no further action was deemed necessary.

**SECTION E. Application of a baseline and monitoring methodology**

**E.1. Title and reference of the approved SSC baseline and monitoring methodology applied to a SSC-CPA included in the PoA:**

All CPAs in this PoA use baseline and monitoring methodology AMS-I.J. “Solar water heating systems”, version 01. Versions of the baseline and monitoring methodology may change according to the most recent guidance provided by the CDM Executive Board. The approved baseline and monitoring methodology AMS-I.J. version 01 was approved at EB60, and thus this is applied to a SSC-CPA included in the PoA.

**E.2. Justification of the choice of the methodology and why it is applicable to a SSC-CPA:**

AMS-I.J version 01 is applicable to a SSC-CPA under the PoA because a SSC-CPA satisfies the requirements in the methodology as below:

AMS-I.J requirements	Project Activity
1. This category comprises the installation of residential solar water heating (SWH) systems and commercial SWH systems for hot water production. The SWH systems displace electricity or fossil fuel that would otherwise have been used to produce hot water.	<p>The CPAs included in the PoA comprise the installation of residential SWH systems for hot water production. The SWH systems displace electricity that would otherwise have been used to produce hot water.</p> <p>The SWH systems installed under the CPAs included in the PoA are residential SWH systems which (a) heated water to be used for domestic purposes only, (b) are installed to serve one or more residences, and (c) have a maximum stand alone (independent) collector area of 100m<sup>2</sup>.</p> <p>The ECC will ensure above-mentioned criteria (a) and (b) through the piping structure of the SWH systems at the acceptance testing. For the criterion (c), the ECC will only include the SWH systems with the maximum collector area of 8m<sup>2</sup>. This will be checked through the technical specification of the SWH systems,</p>



	and confirmed at the acceptance testing.
<p>2. There are two types of projects included in this category: retrofits and new construction. For the purposes of defining baselines and other requirements the following definitions apply:</p> <p>(a) Retrofit projects are SWH project(s) that replace existing electric or fossil fuel based water heating system(s) in existing facility(ies);</p> <p>(b) New construction projects are: (i) SWH project(s) installed in new facility(ies); (ii) SWH project(s) installed in existing facility(ies) that, prior to the project implementation, do not have installed water heating systems; (iii) SWH project(s) installed in existing facility(ies) which require water heating capacity expansions; or (iv) Replacement of failed solar water heating system(s). This methodology is applicable if it is shown (as per paragraph 8) that for new construction projects, conventional electric or fossil fuel based water heating system(s) would have been installed in the absence of the project activity.</p>	<p>The CPAs included in the PoA involve a) retrofit projects under which SWH systems replace existing electric water heating systems in the existing residences, and (b) new construction projects under which SWH systems installed in (i) newly-built residences, and (ii) existing residences that prior to the project implementation, do not have installed water heating systems.</p>
<p>3. Commercial SWH systems shall include operational indicators that may be easily interpreted by the intended users of the systems and that indicate that water is being heated by solar energy. The minimum requirement for such an indicator is a visible temperature display (thermometer) on the solar preheat storage tank. The thermometer does not require calibration.</p>	<p>The CPAs included in the PoA do not involve installation of commercial SWH systems as described in 1 above. .</p> <p>This requirement is not relevant for the CPAs included in the PoA.</p>
<p>4. To qualify as a small-scale project, the definitions in paragraph 4(d) in the “General Guidelines to SSC CDM methodologies” or the related paragraphs in the latest version of the guidelines are applicable.</p>	<p>The aggregated installed thermal energy generation capacity of one CPA of the PoA is less than 45 MW thermal which is equivalent to the 64,000 m<sup>2</sup> of the collector area using a conversion factor of 700Wth/m<sup>2</sup> following the paragraph 4(d) in the “General guidelines to SSC CDM methodologies”.</p>
<p>5. For residential and commercial SWH projects the hot water consumption rate and temperature at which the hot water is supplied to the load (for example, 40 litres per day at 40° C), that occur during the crediting period are used to determine emissions savings. The consumption rate (and temperature) is the rate (and temperature) of water actually utilized (for example for personal washing or for an industrial process) and is not the rate (and temperature) at which hot water is produced, which may be greater than the rate (and</p>	<p>The energy savings are based on the hot water consumption. For CPAs of the PoA, the stipulated energy saving method is applied to calculate energy savings and it is demonstrated that the average annual daily amount of water heated by the SWH systems is less than or equal to the average annual, daily hot water demand in the item (iv) of the table in the section E.6.1.</p>



temperature) of consumption.	
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### **E.3. Description of the sources and gases included in the SSC-CPA boundary**

The gas reduced through this CPA is CO<sub>2</sub>. The CPA will reduce electricity consumption by providing energy via SWH systems. According to AMS-I.J., the physical, geographical site of the SWH system delineates the project boundary. The boundary also extends to the facility or facilities consuming the heated water generated by the SWH system.

Therefore, the project boundary for a CPA under the PoA includes the physical site of each SWH system as well as the houses which consume the heated water generated by the SWH systems. The project boundary for a CPA under the PoA also includes the national electricity grid from which electricity is sourced in the baseline scenario. Each CPA and SWH system can be uniquely identified based on sequential registration number with the location.

Below table summarizes the sources and gases included in the SSC-CPA boundary.

	Source	Gas	Included?	Justification/Explanation
<b>Baseline</b>	Electricity consumption	CO <sub>2</sub>	Included	Heating water consumes electricity, which had been sourced from the national electricity grid.
		CH <sub>4</sub>	Excluded	Excluded for simplification. This is conservative.
		N <sub>2</sub> O	Excluded	Excluded for simplification. This is conservative.
<b>Project</b>	Heat generation	CO <sub>2</sub>	Excluded	There is no CO <sub>2</sub> emission.
		CH <sub>4</sub>	Excluded	There is no CH <sub>4</sub> emission.
		N <sub>2</sub> O	Excluded	There is no N <sub>2</sub> O emission.

### **E.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:**

The average annual growth in electricity consumption was about 14% from 1990 to 2010 in Viet Nam. The Vietnamese government is planning the development of new power sources on the basis of the average annual growth rates of 13% by 2030 in the Power Development Plan No7 (PDP7)<sup>5</sup>.

As well as the increase in the supply of electricity, the Vietnamese government has been promoting energy saving. Below table shows the major national and/or sectoral policies in Energy Efficiency and Conservation (EE&C). There are no policies and circumstances to oblige households to install SWH systems.

Policies	Date of Issuance/ Enforcement	Contents
Decree on EE&C	03/09/2003	Assigning Ministry of Industry (currently

<sup>5</sup> Viet Nam electricity survey 2011, June 2011, JETRO Hanoi



(No.102/2003/ND-CP)		Ministry of Industry and Trade) to play a role of coordination of EE&C in Viet Nam.
Circular on EE&C (No.01/2004/TT/BCN)	02/07/2004	Providing guidelines for EE&C measures in industry
Electricity Law No.28/2004/QH11	Issued on 03/12/2004 Enforced on 01/07/2005	Specifying major electricity efficiency options/measures in generation, transmission, distribution and utilization of electricity.
Energy Commercial Building Code (No.40/2005/QD-BXD)	17/11/2005	Applicable to commercial buildings to reduce energy losses and improve working/ living conditions in buildings.
Decision on Vietnam National Energy Efficiency Program (No.79/2006/QD/TTg)	14/04/2006	Consisting of 6 pillars, 11 projects to promote EE&C activities
Law on Energy saving and Efficiency (No.50/2010/QH12)	Issued on 17/06/2010 Enforced on 01/01/2011	Consisting of 12 chapters and 48 Articles to institutionalize the Party's and State's policies in developing national energy resources, ensuring energy security, using and exploiting domestic energy resources rationally to protect the environment and to meet the demand of socio-economic development.

Although several national policies and programs have been implemented, the electricity consumption has been increasing and is expected to continue to grow. The electricity consumption in the consumer sector accounts for about 40% in 2010. With the growth of economy and increasing penetration rate of home electric appliances, such as air conditioners and electric water heaters, the electricity consumption in the consumer sector is expected to continue to increase in future<sup>6</sup>.

Other than SWH systems, electric water heaters are the only available technology in the market of Viet Nam to heat water for household showering which is the predominant usage of the heated water generated by the SWH systems at household. In fact, the electricity consumed for water heating accounts for 13% and 7% of the total electricity consumption of one family in the urban and the rural area respectively<sup>7</sup>. Due to its reasonable price range (USD100-160<sup>8</sup>) compared to the price of solar water heaters (USD400-700<sup>9</sup>), and easy installation, the electric water heater is the most commonly used technology in Viet Nam. Therefore, the electric water heater is identified as the baseline system. The baseline scenario is identified in accordance with Paragraph 7 and Paragraph 8 of the approved small-scale baseline and monitoring methodology, AMS-I.J, "Solar water heating systems (SWH)", version 01. Paragraph 9 indicates that baseline emissions for displacement of electricity from a grid shall be calculated as per the procedures detailed in AMS-I.D., "Grid connected renewable electricity generation", version 17 (see Section E.6.2 for calculations).

<sup>6</sup> Viet Nam electricity survey 2011, June 2011, JETRO Hanoi

<sup>7</sup> Figure is referred to the data from Jyukankyo Research Institute Inc. Original data is based on the survey conducted by EVN. <http://premium.nikkeibp.co.jp/em/column/nakagami/16/04.shtml>

<sup>8</sup> Feasibility Study Report of ECC (2008)

<sup>9</sup> Exchange Rate: VND 1 = USD 0.00006 (24 December 2008: <http://www.gocurrency.com/v2/historic-exchange-rates.php?ccode2=VND&ccode=USD&frMonth=11&frDay=24&frYear=2008>)



**E.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the SSC-CPA being included as registered PoA (assessment and demonstration of additionality of SSC-CPA):**

**E.5.1. Assessment and demonstration of additionality for a typical SSC-CPA:**

According to the “Guidelines for demonstrating additionality of microscale project activities”, version 03, paragraph 2, project activities up to 5 megawatts that employ renewable energy technology and the project activity designed for distributed energy generation (not connected to a national or regional grid) which satisfy both conditions (i) each of the independent subsystems/measures in the project activity is smaller than or equal to 1500kW electrical installed capacity and (ii) end users of subsystems or measures are households/communities/small and medium enterprises are additional.

For thermal application projects, the threshold of microscale project activities is less than 15 MW thermal which is equivalent to the 21,428 m<sup>2</sup> of the collector area using a conversion factor of 700Wth/m<sup>2</sup> following the “General guidelines to SSC CDM methodologies”. The typical SWH systems installed under a CPA of the PoA have 1.0 to 3.0 m<sup>2</sup> of the collector area. The average size of the collector area of SWH systems sold in Viet Nam is 2.07 m<sup>2</sup>. The target number of systems planned to be installed under a CPA is about 10,000 units depending on the budget availability. The expected total collector area is around 20,700 m<sup>2</sup> with this project plan which is below the threshold of microscale project activities.

A CPA of the PoA is a project activity designed for distributed energy generation (not connected to a national or regional grid). The installed capacity of each of the independent subsystems in a CPA under the PoA is smaller than or equal to 1500kW which is equivalent to 6,428m<sup>2</sup> of the collector size calculated using a conversion factor of 700Wth/m<sup>2</sup>, and the end users of subsystems are households.

Therefore a typical CPA under a PoA is considered as the microscale CDM project activities and hence additional.

The aggregate collector area of a CPA is assessed for each CPA not to exceed 21,428 m<sup>2</sup> of the threshold of microscale project activities.

**E.5.2. Key criteria and data for assessing additionality of a SSC-CPA:**

Following Section E.5.1, a CPA of the PoA is additional if the total collector area installed under a CPA is less than 21,428 m<sup>2</sup>. The ex-ante estimation of total collector area size of each CPA is examined in the CPA-DD.

**E.6. Estimation of Emission reductions of a CPA:**

**E.6.1. Explanation of methodological choices, provided in the approved baseline and monitoring methodology applied, selected for a typical SSC-CPA:**

A typical CPA is eligible as a small scale project category AMS-I.J., “Solar water heating systems (SWH)”, version 01 as described in E.2. According to AMS-I.J., Paragraph 9, AMS-I.D., “Grid connected renewable electricity generation”, version 17 is applied to calculate baseline emissions for supply of electricity to and/or displacement of electricity from a grid. AMS-I.D further describes that the emission factor for an electricity system is calculated as per the “Tool to calculate the Emission Factor for an electricity system”, version 02.2.1. Accordingly, the baseline and monitoring methodologies AMS-I.J.,



version 01, AMS-I.D., version 17 and the “Tool to calculate the Emission Factor for an electricity system”, version 02.2.1 are applied for a typical SSC-CPA. Versions of the baseline and monitoring methodologies and the tool may change according to the most recent guidance provided by the CDM Executive Board.

### ***Emission Reductions***

Emission reductions for a typical CPA under the PoA shall be calculated in accordance with paragraph 9 to 11 of AMS-I.J. version 01. According to Paragraph 9 of AMS-I.J. version 01, emission reductions are calculated as the energy saving that result from the project implementation multiplied by an emission factor for the electricity and/or fossil fuel displaced. The baseline scenario for a CPA is that electricity is imported from the grid for water heating by consumers. For calculating the emission factor for displaced electricity, an annual emission factor shall be calculated in accordance with the provisions in AMS-I.D., “Grid connected renewable electricity generation”.

Paragraph 10 of AMS-I.J. version 01 provides three methods to determine energy saving that result from the project implementation. The stipulated energy saving method which is applicable to residential SWH system projects that displace electricity for water heating is applied to a CPA under the proposed PoA.

The stipulated energy saving method is applicable only when all the following conditions are satisfied. Justification of the choice of the method is summarized in below table.

	<i>AMS-I.J. requirements</i>	<i>Project Activity</i>
(i)	Individual solar collector area per system is less than or equal to eight square meters per residential unit (e.g. eight square meters for a single family residence or 32 square meters for a four unit apartment building)	The solar collector area of systems installed under a CPA of the PoA is less than 8 m <sup>2</sup> .
(ii)	The tilt and orientation of the solar collectors shall be +/- 45 of due-equator and a tilt +15 to -25 degrees of latitude	The proper installation of SWH systems is checked by the ECC and the SWH system distributors through the acceptance testing.
(iii)	Thermal storage volume (preheat tank volume) is either: (a) At least 50 litres per square meter of collector area; or (b) Adequate to bridge time gap between solar supply and load demand during an average winter day for a typical installation, as demonstrated by calculation or model	Preheat tank volume of systems installed under a CPA of the PoA is at least 50 liters/m <sup>2</sup> .
(iv)	The sizing calculations of the SWH systems are documented to be such that the average annual, daily amount of water heated by the SWH systems is less than or equal to the average annual, daily hot	The average household water consumption is approximately 740L/house/day and 34% of it was used for showers <sup>10</sup> . According to the calculation based on the daily solar radiation record for South of Viet Nam <sup>11</sup> ,

<sup>10</sup> Comparing household water end-use data from Vietnam and Australia: Implications for water and wastewater planning, Monique R, et al.

<sup>11</sup> NASA surface meteorology and solar energy data set, <http://eosweb.larc.nasa.gov/sse/RETScreen/>





	water demand for a typical installation;	the average annual daily amount of water can be heated by the SWH systems with the average solar collectors of 2.07m <sup>2</sup> is less than 251L/house/day of average annual daily hot water demand for a typical installation. The solar collector size of 2.07m <sup>2</sup> is the average collector size of the SWH systems sold in Viet Nam. The calculation is shown in Annex 3 (Table A3.1).
(v)	There must be no shading of the solar collectors between 10 am to 2 pm on the shortest day of the year at the time of installation;	The proper installation of systems is checked by ECC and SWH system distributors. There is no shading of the solar collectors between 10am and 2pm on the shortest day of the year at the time of installation.
(vi)	<p>The quality and performance of the solar collectors and SWH systems shall meet the criteria in the OG100 standard at &lt;<a href="http://www.solar-rating.org">www.solar-rating.org</a>&gt;, or equivalent national or international standard, or the requirements given below:</p> <p>-Unglazed collector must be stabilized against UV degradation;</p> <p>-Glazed collector must have at least one glass cover and be insulated on the sides and back to achieve a loss coefficient not more than 5 W/m<sup>2</sup>C;</p> <p>-Evacuated tube collector must maintain vacuum insulation between absorber and ambient.</p>	<p>The SWH systems installed under a CPA of the PoA comply with Vietnamese technical requirements of solar water heaters, TCVN 8251:2009 announced by Ministry of Science and Technology. In addition, the SWH systems installed under a CPA shall meet the following requirements:</p> <p>-Unglazed collector must be stabilized against UV degradation;</p> <p>-Glazed collector must have at least one glass cover and be insulated on the sides and back to achieve a loss coefficient not more than 5 W/m<sup>2</sup>C;</p> <p>-Evacuated tube collector must maintain vacuum insulation between absorber and ambient.</p>

The stipulated energy saving method provides two allowable stipulated energy saving values:

- (i) For applications that can be reasonably demonstrated to have substantial hot water consumption demand year round: a single value of 450 kWh/year per square meter of collector area is stipulated for energy savings and is based on 5 kWh/m<sup>2</sup>/day solar resource, 25% solar water heater efficiency, and 365 days/year of hot water use;
- (ii) For applications that cannot be reasonably demonstrated to have substantial hot water consumption demand year round: a single value of 300 kWh/year per square meter of collector area is stipulated for energy savings.



A CPA under the PoA installs SWH systems to houses located in South of Viet Nam which are not temporary or seasonal housing. In South of Viet Nam under its tropical climate, temperatures undergo few changes throughout the year with averages ranging between 24°C and 28°C, and hence the hot water consumption demand undergoes very little change throughout the year. Therefore, 450kWh/year per square meter of collector area is applied for estimation of energy savings which is multiplied by the aggregate collector area verified to have been installed by the project activity.

According to paragraph 11 of AMS-I.J. version 01, displaced electricity can include technical grid losses (transmission and distribution) for the grid serving the locations where the project SWH system(s) are installed. A default value of 10% provided in AMS-I.J. version 01 is used for average annual technical grid losses for a CPA under the PoA.

### ***Grid emission factor***

Emission factor of the connected grid is calculated using AMS-I.D., version 17. In line with AMS-I.D., Paragraph 12, the emission factor is calculated in a transparent and conservative manner as a) a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the “Tool to calculate the emission factor for an electricity system”, version 02.2.1. The detail procedures, equations, and parametric values to calculate grid emission factor are described in E.6.2.

### **Leakage**

The SWH systems to be installed under a CPA of the PoA will not be transferred from another activity and baseline equipments will not be transferred to another activity. Therefore, the leakage is not considered under a CPA of the PoA.

**E.6.2. Equations, including fixed parametric values, to be used for calculation of emission reductions of a SSC-CPA:**

According to paragraph 9 to 11 of AMS-I.J. version 01, emission reductions are calculated by a flowing equation.

$$ER_y = ES_y \times \sum_{x=1}^N (A_{x,y} \times D_{x,y}) \times R_y \times 10^{-3} \times EF_{EL,y} \times 1/(1-l_y) \quad (1)$$

Where:

<b>Parameter</b>	<b>Value</b>	<b>Unit</b>	<b>Description</b>
$ER_y$		(tCO <sub>2</sub> e /yr)	Emission reduction in year y
$ES_y$	450	(kWh /m <sup>2</sup> /year)	The stipulated energy saving values
$A_{x,y}$		(m <sup>2</sup> /year)	The collector area of SWH system x verified to have been installed by the project activity in year y
$D_{x,y}$		-	The proportion of days in which SWH system x is being installed in year y
$R_y$		-	The proportion of SWH systems that are operational and



			in compliance with manufacture-required maintenance procedures in year y
$EF_{EL,y}$	0.5764	(tCO <sub>2</sub> e /MWh)	Emission factor for electricity grid
$l_y$	-		Average annual technical grid losses during year y
$x$	-		The SWH system unit x
$N$		(units)	The number of SWH systems installed

### ***Grid emission factor***

Emission factor of the connected grid is calculated using AMS-I.D., version 17. In line with AMS-I.D., Paragraph 12, the emission factor is calculated in a transparent and conservative manner as a) a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the “Tool to calculate the emission factor for an electricity system”, version 02.2.1, as follows:

The DNA of Viet Nam published the emission factor of the national electricity grid in the Official Letter No.151/KTTVBKDH dated 26 March 2010<sup>12</sup>.

#### ***Step 1. Identify the relevant electric systems***

The electricity displaced by the CPA will be delivered from the Vietnamese national grid, the only grid that exists in the country.

#### ***Step 2. Select a method to determine the operating margin (OM)***

As no dispatch data is available and low-cost/must-run resources constitute less than 50% of total grid generation over the past five (5) years, the simple OM method is used (See Table A3.2 in Annex 3). For the simple OM, the ex-ante option is selected.

#### ***Step 3. Calculate the operating margin emission factor according to the selected method***

The simple OM emission factor is calculated based on total fuel consumption and electricity generation of the system (Option B). The following formula is used to calculate Simple OM:

$$EF_{grid,OMsimple,y} = \frac{\sum_i (FC_{i,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y})}{EG_y} \quad (2)$$

Where:

<b>Parameter</b>	<b>Unit</b>	<b>Description</b>
$EF_{grid,OMsimple,y}$	(tCO <sub>2</sub> e /MWh)	Simple operating margin CO <sub>2</sub> emission factor in year y
$FC_{i,y}$	(mass or volume unit)	Amount of fuel type <i>i</i> consumed in the project electricity system in year y
$NCV_{i,y}$	(GJ/mass or volume unit)	Net calorific value (energy content) of fossil fuel type <i>i</i> in year y

<sup>12</sup> [http://www.noccop.org.vn/Data/vbpq/Airvariable\\_ldoc\\_vnHe%20so%20phat%20thai.pdf](http://www.noccop.org.vn/Data/vbpq/Airvariable_ldoc_vnHe%20so%20phat%20thai.pdf)



$EF_{CO_2,i,y}$	(tCO <sub>2</sub> /GJ)	CO <sub>2</sub> emission factor of fossil fuel type $i$ in year $y$ (tCO <sub>2</sub> /GJ)
$EG_y$	(MWh)	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year $y$
$i$		All fossil fuel types combusted in power plant/unit $m$ in year $y$
$y$		The three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex-ante option )

The operating margin emission factor calculations are performed ex-ante using official data available on fuel consumption and electricity generation for each plant connected to the Vietnamese national grid in 2006-2008. All data is summarized in Table A3.3 in Annex3.

The “Operating Margin” emission factor is calculated as:

$$EF_{OM} = 0.6465 \text{ tCO}_2/\text{MWh}$$

*Step 4. Calculate the build margin (BM) emission factor*

In terms of vintage of data, Option 1 (ex-ante) was selected for this CPA.

The sample group of power units  $m$  used to calculate the build margin should be determined as per the following procedure, consistent with the data vintage selected above:

(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently (SET<sub>5-units</sub>) and determine their annual electricity generation (AEG<sub>SET-5-units</sub>, in MWh);

The set of five power units that started to supply electricity to the grid most recently (SET<sub>5-units</sub>) and their annual electricity generation (AEG<sub>SET-5-units</sub>) are listed in Table A.3.4 in Annex 3.

$$AEG_{SET-5-units} = 7,829,812 \text{ MWh}$$

(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG<sub>total</sub>, in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEG<sub>total</sub> (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) (SET<sub>≥ 20%</sub>) and determine their annual electricity generation (AEG<sub>SET-≥ 20%</sub>, in MWh);

$$AEG_{total} = 74,689,636 \text{ MWh}$$

The set of power units that started to supply electricity to the grid most recently and that comprise 20% of (SET<sub>≥ 20%</sub>) and their annual electricity generation (AEG<sub>SET-≥ 20%</sub>, in MWh) are listed in Table A.3.4 in Annex 3.

$$AEG_{SET-≥ 20\%} = 16,514,761 \text{ MWh}$$

(c) From SET<sub>5-units</sub> and SET<sub>≥ 20%</sub> select the set of power units that comprises the larger annual electricity generation (SET<sub>sample</sub>); Identify the date when the power units in SET<sub>sample</sub> started to supply electricity to



the grid. If none of the power units in  $SET_{sample}$  started to supply electricity to the grid more than 10 years ago, then use  $SET_{sample}$  to calculate the BM.

$AEG_{SET \geq 20\%}$  is larger than  $AEG_{SET-5-units}$ .

Therefore, the set of power units that started to supply electricity to the grid most recently and that comprise 20% of ( $SET_{\geq 20\%}$ ) is identified as  $SET_{sample}$ . The oldest power units started supply electricity to the grid in 2004 and which is less than 10 years ago.

The BM emissions factor is the generation-weighted average emission factor ( $tCO_2/MWh$ ) of all power units  $m$  during the most recent year  $y$  for which electricity generation data is available, calculated as follows:

For the CPA, the sample group of power units  $m$  used to calculate the build margin consists of the set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. In terms of vintage of data, Option 1 (ex-ante) was selected for this CPA.

The build margin is calculated as the generation-weighted average emission factor ( $tCO_2/MWh$ ) for a sample of power plants as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad (3)$$

Where:

Parameter	Unit	Description
$EF_{grid,BM,y}$	( $tCO_2e / MWh$ )	Build margin $CO_2$ emission factor in year, $y$
$EG_{m,y}$	(MWh)	Net quantity of electricity generated and delivered to the grid by power unit $m$ in year, $y$
$EF_{EL,m,y}$	( $tCO_2/MWh$ )	$CO_2$ emission factor of power unit $m$ in year, $y$
$m$		Power units included in the build margin
$y$		Most recent historical year for which power generation data is available

For the proposed CPA, Option A1 shall be chosen: Calculate the Build Margin emission factor  $EF_{grid,BM,y}$  ex-ante based on the most recent information available on plants already built for sample group  $m$  at the time of PDD submission. The sample group of power unit  $m$  used to calculate the build margin consists of the set of power capacity additions in the electricity system that comprise 20% of the system generation (in GWh) and that have been built most recently. Data for the build margin calculation is shown in the table A3.4 in Annex 3.

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} = \frac{8,362,386.09}{16,514,761.12}$$



The build margin emission factor is calculated as:

$$EF_{BM} = 0.5064 \text{ tCO}_2/\text{MWh}$$

*Step 5. Calculate the combined margin baseline emission factor*

The combined margin emission factor is calculated based on weighted average CM method as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \quad (4)$$

Where:

Parameter	Unit	Description
$w_{OM}$	(%)	Weighting of the operating margin emission factor
$w_{BM}$	(%)	Weighting of the build margin emission factor

$w_{OM}$  and  $w_{BM}$ , by default, are both valued at 50%

The baseline emission factor is calculated as:

$$EF_{EL,y} = EF_{grid,CM,y} = 0.5764 \text{ tCO}_2/\text{MWh}$$

**E.6.3. Data and parameters that are to be reported in CDM-SSC-CPA-DD form:**

<b>Data / Parameter:</b>	<b>EF<sub>EL,y</sub></b>
Data unit:	(tCO <sub>2</sub> /MWh)
Description:	Emission factor for electricity grid in year y
Source of data used:	Data published by DNA Viet Nam
Value applied:	0.5764
Justification of the choice of data or description of measurement methods and procedures actually applied :	The grid emission factor is calculated using the “Tool to calculate the emission factor for an electricity system,” according to AMS.I.D., version 17.
Any comment:	---

<b>Data / Parameter:</b>	<b>ES<sub>y</sub></b>
Data unit:	(kWh/m <sup>2</sup> /year)
Description:	The stipulated energy saving values
Source of data used:	AMS-I.J version 01
Value applied:	450
Justification of the choice of data or description of	The value is used following the stipulated energy saving method which is applicable to residential SWH system projects that displace electricity for water heating. Since the households which install SWH systems under a typical CPA



measurement methods and procedures actually applied :	have substantial hot water demand year round, a value of 450 kWh/year per square meter of collector area is stipulated for energy savings.
Any comment:	---

**E.7. Application of the monitoring methodology and description of the monitoring plan:**

**E.7.1. Data and parameters to be monitored by each SSC-CPA:**

<b>Data / Parameter:</b>	<i>N</i>
Data unit:	units
Description:	The number of SWH systems installed
Source of data to be used:	Data base developed by the ECC
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be determined in each CPA-DD.
Description of measurement methods and procedures to be applied:	Directly determined in the course of installing SWH systems included in a CPA. The ECC will collect and record the number of systems installed under a CPA. The value will be monitored continuously.
QA/QC procedures to be applied:	The ECC will cross-check against its internal records of the number of applicants who received the subsidy and the number of SWH systems installed by each applicant.
Any comment:	---

<b>Data / Parameter:</b>	$A_{x,y}$
Data unit:	$m^2$
Description:	The collector area of the SWH system <i>x</i> verified to have been installed by the project activity in year <i>y</i>
Source of data to be used:	Data base developed by the ECC
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be determined in each CPA-DD
Description of measurement methods and procedures to be applied:	The ECC will record the collector area of each SWH system installed under a CPA based on the specification of each system. The value will be monitored continuously.
QA/QC procedures to be applied:	The ECC will cross-check against its internal records of specification of each SWH system under a CPA and the result of acceptance testing in which the ECC will check the specifications of a SWH system.
Any comment:	---



<b>Data / Parameter:</b>	<b><i>Result of acceptance test</i></b>
Data unit:	-
Description:	Result of acceptance test
Source of data to be used:	Database developed by the ECC
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Only the SWH systems which passed the acceptance are to be considered for the calculation of emission reductions. Therefore, the value is not used for the calculation of emission reductions.
Description of measurement methods and procedures to be applied:	The ECC and the SWH system distributors will inspect and undergo acceptance testing (commissioning) for proper operation in compliance with manufacturer specifications within three months of installation of each SWH system. The ECC will record the result of acceptance testing. The SWH systems do not pass the acceptance test are not included in a CPA.
QA/QC procedures to be applied:	-
Any comment:	-

<b>Data / Parameter:</b>	<b><math>D_{x,y}</math></b>
Data unit:	-
Description:	The proportion of days in which SWH system $x$ is being installed in year $y$
Source of data to be used:	Database developed by the ECC
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	The ECC will collect and record the date of installation of each SWH system installed under a CPA. The proportion of days in year $y$ is calculated based on the record of the date of installation of each SWH system and recorded in the database.
QA/QC procedures to be applied:	-
Any comment:	-

<b>Data / Parameter:</b>	<b><math>R_y</math></b>
Data unit:	-
Description:	The proportion of SWH systems that are operational and in compliance with manufacture-required maintenance procedures in year $y$
Source of data to be used:	Database developed by the ECC
Value of data applied for the purpose of calculating expected	-





emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	The ECC will conduct an annual inspection to check the proper operation and in compliance with manufacturer-required maintenance procedures for the sampled SWH systems. The sample of the residences where the systems are installed will be selected by simple random sample method to meet 90/10 confidence/ precision following “Standard for sampling and surveys for CDM project activities and programme of activities”, version 02.0.
QA/QC procedures to be applied:	-
Any comment:	-

<b>Data / Parameter:</b>	$I_v$
Data unit:	-
Description:	Average annual technical grid losses during year y
Source of data to be used:	Electricity of Viet Nam (EVN)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	The value shall be determined from recent data published by EVN. The ECC will collect the data from EVN.
QA/QC procedures to be applied:	-
Any comment:	-

#### **E.7.2. Description of the monitoring plan for a SSC-CPA:**

The monitoring methodology AMS-I.J. “Solar water heating systems (SWH)”, version 01 is applied for a CPA. The methodology consists of the following:

According to AMS-I.J., paragraph 13, 14, and 15, the monitoring procedure for a typical CPA consists of :

- 1) The ECC will keep a record of the number, location, type, the installation date, and owner of each SWH system under a CPA.
- 2) The SWH system distributors will inspect and undergo acceptance testing (commissioning) for proper operation in compliance with manufacturer specifications within three months of installation of each SWH system. The result of acceptance testing shall be sent to the ECC. The ECC will record the result of acceptance testing for each SWH system in the database.



3) The ECC will conduct an annual inspection to check the proper operation and in compliance with manufacturer-required maintenance procedures for sampled SWH systems. The sample of the residences where the systems are installed will be selected by simple random sample method to meet 90/10 confidence/ precision following “Standard for sampling and surveys for CDM project activities and programme of activities”, version 02.0. The sampling plan is as below:

The objective of the sampling is determining the rate of SWH systems “ $R_y$ ” that are demonstrated to be operational and in compliance with manufacture-required maintenance procedures during the crediting period, and with a 90/10 confidence/precision.

The target population is all SWH systems included in a CPA. Simple random sampling is to be used for the project. The sample size ( $n$ ) is calculated using the following equation based on the “Best practice examples focusing on sample size and reliability calculations”, version 01.0 for each CPA:

$$n \geq \frac{1.645^2 NV}{(N-1) \times 0.1^2 + 1.645^2 V}$$

Where:

$$V = \frac{p(1-p)}{p^2}$$

$n$	Sample size
$N$	Total number of SWH systems
$p$	The expected proportion ( $R_y$ )
1.645	Represents the 90% confidence required
0.1	Represents the 10% relative precision

The sample size is calculated before conducting the annual inspection of a CPA for every monitoring period based on the number of SWH systems ( $N$ ), and the expected proportion of SWH systems which are operational and in compliance with manufacture-required maintenance procedures ( $p$ ).

The ECC will select samples randomly using random number tables from the database every 12 months for each CPA. The assigned staff of the ECC will visit the households that have sample SWH systems to confirm 1) that SWH is operational, and 2) in compliance with manufacture-required maintenance procedures. When the SWH system satisfies both requirements, it is identified as “Success”. The result “Success/Fail” will be recorded in the database. In case the responses cannot be obtained from some sampled households, the additional samples should be selected using random number tables to collect the result from  $n$  SWH systems. The proportion “ $R_y$ ” will be calculated after the all  $n$  results are recorded in the database.

The sampling frame which is the database including the information of all SWH systems under a CPA will be kept for a period of at least two years after the crediting period of the CPA.

The ECC will prepare the manual include the procedure for identification of sample households, data collection, and analysis. The training is provided to the personnel of the ECC before conducting the annual inspection of a CPA every year.

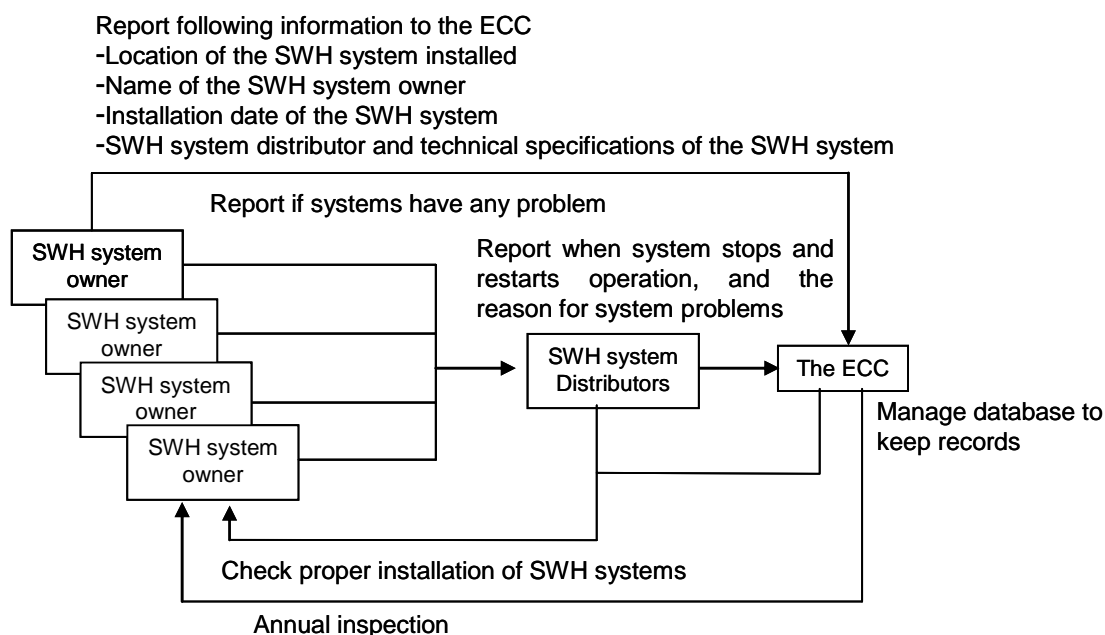


A database will be set up by the ECC for each CPA under the PoA. The database will include the following information for each SWH system:

- Location of SWH system registered under a CPA;
- Name of the SWH system owner;
- Installation date of the SWH system;
- SWH system distributor and technical specifications of the SWH system;
- SWH system sequential registration number;
- Results of acceptance testing;
- Results of annual inspection for the sample group;
- Crediting period of a CPA
- Status of verification of a CPA.

The ECC will prepare the monitoring report which covers the monitoring after the project is registered. The report covers number of SWH system units operating, operating days per year of SWH units, and calculation of the emission reductions, etc.

The monitoring structure including the role of each party involved is shown as below.



**E.8. Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)**

The baseline and monitoring study was completed on 04/06/2012 by:

Clean Energy Finance Division  
Mitsubishi UFJ Morgan Stanley Securities Co., Ltd. (MUMSS)  
5th Floor, Toyosu Front,  
3-2-20 Toyosu, Koto-ku,



Tokyo, 135-0061, Japan  
kurokawa-ayato@sc.mufg.jp

MUMSS is a project participant listed in Annex 1.



**Annex 1**

**CONTACT INFORMATION ON COORDINATING/MANAGING ENTITY and PARTICIPANTS  
IN THE PROGRAMME of ACTIVITIES**

Organization:	The Energy Conservation Center of Ho Chi Minh City
Street/P.O. Box:	244 Dien Bien Phu St., District 3
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City:	Ho Chi Minh City
State/Region:	
Postfix/ZIP:	
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URL:	www.ecc-hcm.gov.vn
Represented by:	
Title:	Director
Salutation:	Mr.
Last Name:	Huynh
Middle Name:	Kim
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Organization:	Mitsubishi UFJ Morgan Stanley Securities Co., Ltd.
Street/P.O.Box:	3-2-20 Toyosu
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E-Mail:	kurokawa-ayato@sc.mufg.jp
URL:	<a href="http://www.sc.mufg.jp/english/e_cafc/index.html">http://www.sc.mufg.jp/english/e_cafc/index.html</a>
Represented by:	
Title:	Consultant
Salutation:	Mr.
Last Name:	Kurokawa
Middle Name:	
First Name:	Ayato
Department:	Clean Energy Finance Division
Mobile:	



Direct FAX:	
Direct tel:	
Personal E-Mail:	

**Annex 2**

**INFORMATION REGARDING PUBLIC FUNDING**

The PoA will not receive any public funds resulting from official development assistance from Parties included in Annex I to the Convention.



**Annex 3**

**BASELINE INFORMATION**

Daily amount of water heated by the SWH systems is calculated as follows.

*Table A3.1. Calculation of average annual daily amount of water heated by SWH systems*

	Provinces	Daily solar radiation*1 (kWh/m2/day)	Collector size (m2)	Heat Absorption (kWh/day) (kJ/day)		Water Temperature	Hot Water Temperature	Gap	Amount of water heated (L)
						$T_1$ (°C)	$T_2$ (°C)	$T_2-T_1$ (°C)	
1	HoChiMinh	5.09	2.07	6.32	22,745	26	60	34	162
2	Binh Duong	5.27	2.07	6.54	23,549	26	60	34	168
3	Dong Nai	5.10	2.07	6.33	22,790	26	60	34	162
4	Baria-Vungtau	5.10	2.07	6.33	22,790	26	60	34	162
5	Lam Dong	5.10	2.07	6.33	22,790	25	60	35	156
6	Ninh Thuan	5.10	2.07	6.33	22,790	25	60	35	156
7	Binh Thuan	5.10	2.07	6.33	22,790	25	60	35	156
8	Binh Phuoc	5.27	2.07	6.54	23,549	26	60	34	168
9	Long An	5.27	2.07	6.54	23,549	26	60	34	168
10	Tien Giang	5.09	2.07	6.32	22,745	26	60	34	162
11	Ben Tre	5.01	2.07	6.22	22,376	27	60	33	160
12	Tay Ninh	5.27	2.07	6.54	23,549	26	60	34	168
13	Hau Giang	4.83	2.07	5.99	21,561	26	60	34	153
14	Bac Lieu	4.83	2.07	5.99	21,561	26	60	34	153
15	Can Tho	4.83	2.07	5.99	21,561	26	60	34	153
16	Ca Mau	4.83	2.07	5.99	21,561	26	60	34	153
17	Dong Thap	5.05	2.07	6.26	22,544	26	60	34	161
18	An Giang	5.05	2.07	6.26	22,544	26	60	34	161
19	Kien Giang	4.83	2.07	5.99	21,561	26	60	34	153
20	Vinh Long	5.05	2.07	6.26	22,544	26	60	34	161
21	Tra Vinh	5.01	2.07	6.22	22,376	27	60	33	160
22	Soc Trang	5.01	2.07	6.22	22,376	27	60	33	160

\*1: Data source: NASA surface meteorology and solar energy data set  
<http://eosweb.larc.nasa.gov/sse/RETScreen/>

\*2: Average air temperature is used for calculation for the conservative approach.



The data used for the Project's grid emission factor calculation conducted by Vietnamese DNA<sup>13</sup> are as follows.

*Table A3.2. Contribution of low-cost/must-run resource to overall power generation in Viet Nam*

<b>Year</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>Average</b>
Hydro power generation (MWh)	17,858,651	16,365,438	19,508,244	22,385,232	25,933,762	102,051,327
Total generation (MWh)	44,974,169	50,330,468	57,160,493	66,348,589	74,689,636	293,503,355
Rate of low-cost/must-run resources (%)	39.71%	32.52%	34.13%	33.74%	34.72%	34.77%

*Table A3.3. Electricity outputs and fuel consumptions of thermal power sources in 2006– 2008<sup>14</sup>*

<b>Power plant types</b>	<b>Fuel consumption (Coal:Kton, Oil:Kton, Gas:mm<sup>3</sup>)</b>	<b>Net electricity generated and delivered to the grid (MWh)</b>	<b>Emission (t CO<sub>2</sub>)</b>
<b>2006</b>			
Coal thermal	5,645.86	8,989,230	11,823,610
Turbine		26,542,978	12,479,578
Gas Turbine	5,743,235.28	18,838,764	12,244,651
Oil turbine	70.14	233,582	234,927
Recycled heat	0	7,470,632	0
Oil thermal	397.65	1,043,991	1,327,593
FO Diesel	16.60	80,000	51,642
DO Diesel	6.39	25,000	20,495
Imported electricity		937,000	0
<b>Total</b>		<b>37,618,119</b>	<b>25,702,918</b>
<b>2007</b>			
Coal thermal	6,386.09	9,836,548	13,272,897
Turbine		29,474,918	13,116,063
Gas Turbine	5,910,941.84	20,023,591	12,570,669
Oil turbine	163.27	557,880	545,394
Recycled heat	0	8,893,447	0
Oil thermal	614.06	1,834,409	2,046,368
FO Diesel	25.15	104,626	79,867
DO Diesel	9.16	42,000	29,088
Imported electricity		2,629,000	0
<b>Total</b>		<b>43,921,501</b>	<b>28,544,283</b>
<b>2008</b>			
Coal thermal	6,483.99	10,055,394	13,378,811
Turbine		33,857,135	14,716,799
Gas Turbine	6,839,114.84	22,396,231	14,535,266
Oil turbine	54.35	183,088	181,533

<sup>13</sup> [http://www.noccop.org.vn/Data/vbpq/Airvariable\\_idoc\\_vnHe%20so%20phat%20thai.pdf](http://www.noccop.org.vn/Data/vbpq/Airvariable_idoc_vnHe%20so%20phat%20thai.pdf)





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Recycled heat	0	11,277,816	0
Oil thermal	534.59	1,481,880	1,784,825
FO Diesel	22.48	90,465	71,385
DO Diesel	3.73	15,000	11,879
Imported electricity		3,220,000	0
<b>Total</b>		<b>48,719,874</b>	<b>29,963,699</b>
<b>Total 2006-2008</b>		<b>130,259,494</b>	<b>84,210,900</b>
<b>OM</b>			<b>0.6465</b>



*Table A3.4. Calculation of BM emission factor in 2008*

Power plant names	Year of operation	Fuel consumption (Coal:Kton, Oil:Kton, Gas:mm <sup>3</sup> )	Net electricity generated and delivered to the grid (MWh)	Emission (t CO <sub>2</sub> )
<b>Set of 5 power units that started to supply electricity to the grid most recently</b>				
A Vuong	2008	Hydro power	0	168,103.50
Tuyen Quang	2008	Hydro power	0	1,136,112.18
Dai Ninh	2008	Hydro power	0	1,145,108.50
Nhon Trach	2008	Gas	166.38	544,808.60
Ca Mau 1&2	2007	Gas	647.24	2,106,807.27
		Recycled heat		2,728,827.00
<b>Total</b>			<b>7,829,812.02</b>	
<b>Set of power units that started to supply electricity to the grid most recently and that comprise 20% of the system generation</b>				
A Vuong	2008	Hydro power	0	168,103.50
SROC Phu Mieng IDICO	2006	Hydro power	0	241,556.00
Se San 3A	2006	Hydro power	0	394,895.70
Tuyen Quang	2008	Hydro power	0	1,136,112.18
Dai Ninh	2008	Hydro power	0	1,145,108.50
Se San 3	2006	Hydro power	0	1,131,614.00
Quang Tri	2007	Hydro power	0	250,804.40
Uong Bi 2	2007	Coal	281,759	532,000.00
Na Duong	2005	Coal	532	627,930.00
Cao Ngan	2007	Coal	526	708,693.00
Formosa	2004	Coal	495	560,295.00
Nhon Trach	2008	Gas	166.38	544,808.60
Ca Mau 1&2	2007	Gas	647.24	2,106,807.24
		Recycled heat		2,728,872.00
Phu My 2,2	2004	Gas	1,159.75	4,141,980.00
Dam Phu My	2006	Gas	56.15	7,716.00
Cai Lan - Vinashin	2007	FO	22.48	90,465.01
<b>Total</b>			<b>16,514,761.12</b>	<b>8,362,386.09</b>
<b>BM EF Calculation result</b>				
Total Emission			8,362,386.09 (t CO <sub>2</sub> )	
Total Electricity generation to grid			16,514,761.12 (MWh)	
<b>BM (2008)</b>			<b>0.5064 (t CO<sub>2</sub> /MWh)</b>	



**Annex 4**

**MONITORING INFORMATION**

The monitoring information is described in the relevant sections of the PoA-DD.