CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

Installation of Amorphous Transformers in the Ho Chi Minh City Power Distribution Grid (hereafter referred to as the "Project Activity").

Version 1.0
Date: 12/02/2009

A.2. Description of the project activity:

The purpose of the Project Activity is to install amorphous transformers in the Ho Chi Minh City (HCMC) power distribution grid. At present, silicon steel plate transformers are installed in HCMC, Viet Nam. Amorphous transformers are more efficient than traditional silicon steel transformers due to reduced no-load core loss.

The Project Activity will distribute and install 4956 amorphous transformers (from 100 to 2000 kVA types) over a seven year period (708 per year) throughout the HCMC (560,000kVA) grid as an alternative to silicon steel plate transformers reducing electricity loss and thereby contributing to reduced greenhouse gas emissions.

The city's electricity is supplied from the Ho Chi Minh City Power Company (HCMPC). As a result of the Project Activity the electricity savings from the installation of the new amorphous transformers will contribute to displacing 1,543 MWh per year from the grid, resulting in an average yearly emission reduction of 3,213 tonnes CO_2 equivalent (tCO_2e). During the project crediting period (7 years) a total of 10,801 MWh will be displaced from the national grid, giving a total emission reduction of 22,491 tCO_2e.

The Project Activity shall contribute to the reduction of greenhouse gas emissions by reducing the amount of atmospheric emissions from thermal fossil fuel-fired power stations and optimise the use of energy resources thereby boosting the regional economy and contributing to sustainable economic growth in Viet Nam. The Project Activity will also provide additional local employment in both the construction and operation phases of the project.

A.3. Project participants:

Table A-1. Project Participants.

Name of Party Involved	Private and/or public entity(ies) project participants	Kindly indicate if the Party involved wishes to be considered as a project participant (Yes/No)
Socialist Republic of Viet Nam (Host)	Ho Chi Minh Power Company	No
Japan	Mitsubishi UFJ Securities Co., Ltd.	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Socialist Republic of Viet Nam

A.4.1.2. Region/State/Province etc.:

Dong Nam Bo Province

A.4.1.3. City/Town/Community etc.:

Ho Chi Minh City

A.4.1.4. Details of physical location, including information allowing the unique identification of this project activity (maximum one page):

The project activity is the power distribution grid of the Ho Chi Minh City Power Company, Ho Chi Minh City, Dong Nam Bo Province, Viet Nam.

HCMC Reference Coordinates: 10° 46′ 10.56″ N, 106° 41′ 7.8″ E

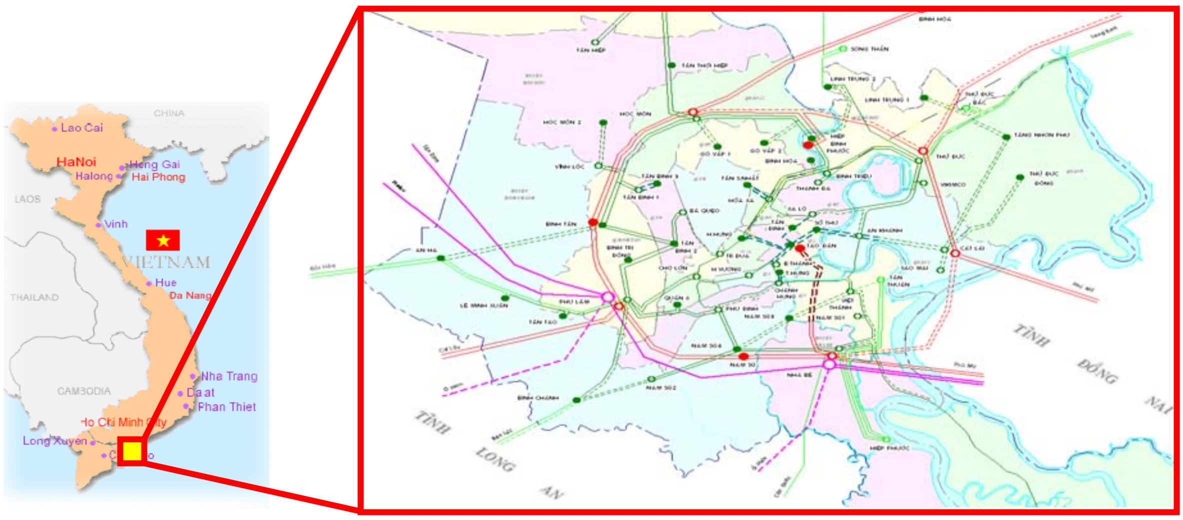

Figure A-1. Project Location.

A.4.2. Category(ies) of project activity:

The Project Activity falls under the following sectoral scope and category:

Sectoral Scope 02: Energy Distribution

A.4.3. Technology to be employed by the project activity:

Transformers are an essential part of the electricity transmission grid as they enable electricity to be converted to higher or lower voltage levels thereby minimising loss due to resistance as electricity is transmitted over large distances. An electrical distribution grid requires a large number of transformers with differing ranges of operating voltages. Electricity is dissipated in transformers and the energy loss is divided into two main categories: load loss and no-load loss.

Load loss arises from resistance in the transformer winding with eddy current losses in the primary and secondary conductors of the transformer and is proportional to the load current. No-load loss arises from hysteresis and the transformer core magnetising or energising independent of the transformer load and represents a significant, constant energy loss.

The Project Activity involves the installation of amorphous metal transformers in place of silicon steel plate transformers. Silicon steel plate transformers consist of a rigid crystal structured silicon steel core. The rigid structure of the core leads to hysteresis and eddy current losses as the core magnetises independent of the transformer load.

Amorphous metal alloys have been cooled rapidly not allowing time for the crystalline structure to form. This ill-defined, non-crystalline, amorphous structure significantly reduces the core loss of conventional silicon transformers due to its ease in magnetising and demagnetising. Due to the amorphous nature of the metal alloy the amorphous transformers demonstrate the following properties:

- Low core loss;
- High magnetic permeability;
- Magnetostriction controlled over a wide range;
- High electrical resistance;
- A thermal expansion coefficient with a small temperature coefficient and
- High mechanical strength

No-load loss accounts for a significant portion of the energy generation loss. Compared to silicon steel plate transformers, amorphous transformers exhibit just under three times the electrical resistance and are about a twelfth of the thickness. The improved ability of amorphous transformers to magnetise and demagnetise, the low core loss, reduced magnetostriction and mechanical losses lead to improved conversion of electricity within the transformer.

This reduction in the no-load loss of the transformer as compared to silicon steel plate transformers thereby reduces the amount of electricity needed to be generated at the source for the same amount of electricity delivered. Therefore the emission of greenhouse gases from thermal fossil-fuel fired power plants or other plants in the Vietnamese national grid will be significantly reduced.

A.4.4. Estimated amount of emission reductions over the chosen crediting period:

Table A-2. Ex-ante Estimation of Emission Reductions.

Length of crediting period	**7 years**
Year	**Estimate of annual emission reductions in tonnes of CO2 equivalent**
2010	803
2011	1,606
2012	2,410
2013	3,213
2014	4,016
2015	4,819
2016	5,623
Total estimated emission reductions over the crediting period (tonnes of CO2 equivalent)	**22,491**
Annual average of estimated emission reductions over the crediting period (tonnes of CO2 equivalent)	**3,213**

A.4.5. Public funding of the project activity:

The Project will not receive any public funding from Parties included in Annex I of the UNFCCC.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

The most applicable of the CDM approved baseline and monitoring methodologies is AM0067 “Installation of Energy Efficient Transformers in a Power Distribution Grid”, Version 02, Sectoral Scope 02 (EB41).

The baseline and monitoring methodology refers to the following tools:

“Combined tool to identify baseline scenario and demonstrate additionality”, Version 02.2 (EB28);

“Tool to calculate emission factor for an electrical system”, Version 01.1 (EB35).

B.2. Justification of the choice of the methodology and why it is applicable to the project activity:

The Project Activity comprises measures increasing the efficiency of electricity transmission and distribution in a power grid and minimising energy loss thereby reducing the amount of greenhouse gas emissions associated with power generation. The methodology is applicable because the proposed Project Activity satisfies all the applicability conditions of the methodology as outlined below:

Applicability Condition	Comment
Applicability Condition (a): *Emission reductions due to the reduction in no-load losses alone are claimed.*	Emission reductions are claimed for the no-load loss of the transformers as per the manufacturer's specifications. No reductions are claimed for savings in load losses.
Applicability Condition (b): *Installation of transformers within the distribution grid is governed by performance levels established by local or national regulations, which define maximum permissible load losses and no-load losses.*	The installation of the transformers follows all national and company specific guidelines.
Applicability Condition (c): *Load losses, at rated load, of the transformers implemented under the project activity are demonstrated to be equal or lower than the load losses in transformers that would have been installed in the absence of the project activity.*	The load-losses of the amorphous transformers are lower than the silicon steel plate transformers that would have been installed in the absence of the project activity,.
Applicability Condition (d): *The transformers installed in the project activity comply with national/international QA/QC standards. This shall be demonstrated through certification based on tests conducted using relevant national/international testing standards from an accredited entity/government recognised entity. The certification report shall include information on the measured performance levels for load losses and no-load losses in various operational conditions and in addition, the associated uncertainty.*	All transformers installed in the project activity conform to the strictest national and international standards for quality. This shall be demonstrated through certification conducted using International Standard Organization (ISO) 9001. This is shown in the attached certification report for the amorphous transformers. The measured load and no-load losses in various operational conditions including the uncertainty will be included in the report.
Applicability Condition (e): *Project proponent implements a system to ensure that the replaced transformers are not used in other parts of the distribution grid or in another distribution grid.*	Any replaced transformers will be identified and destroyed so as to ensure that they are not used in other parts of the grid or other grids. The number of transformers destroyed will be matched with the number of transformers installed. This monitoring will be undertaken by the installation entity at the time of installation.
Applicability Condition (f): *A complete list of co-ordinates uniquely identifying each transformer installed under the project activity is provided.*	All transformers installed in the Project activity will be uniquely identified by a serial number and coordinates to ensure they are only used in the distribution grid specified in the PDD.
Applicability Condition (g): *Data on total number and type of transformers*	Data from the previous five years on the number and type of transformers installed is available from

installed over the last three years previous to the project implementation is available.	the power company.

B.3. Description of the sources and gases included in the project boundary:

As per AM0067, Version 2, the project boundary is the Ho Chi Minh Power Company power distribution grid where amorphous transformers are installed in the Project Activity. The boundary also includes fossil fuel power plants which supply electricity to the grid as this is the source of the anthropomorphic greenhouse gas emissions necessary to calculate the baseline emissions. The physical boundary of the Project is presented schematically below:

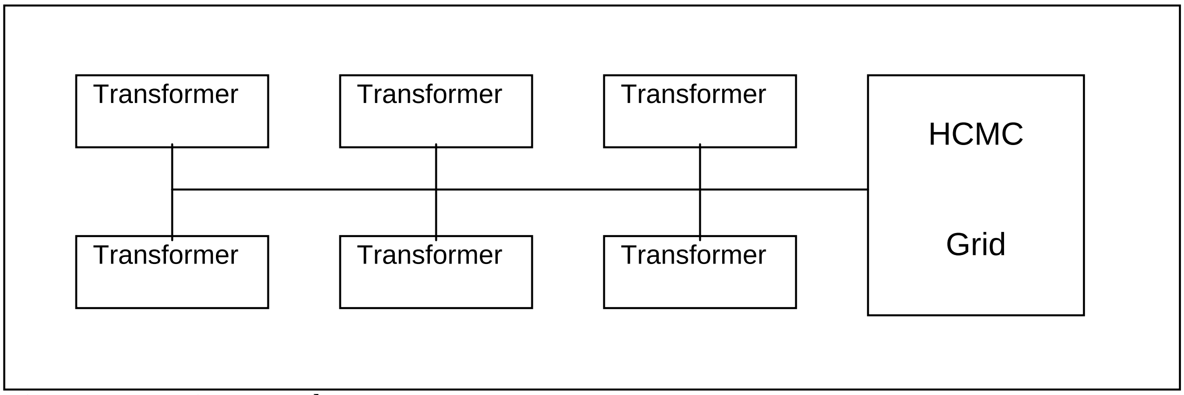

Figure B-1. Project Boundary

Table B-1. Emission Sources Included in the Project Boundary.

Source		Gas	Included?	Justification/Explanation
Baseline	Fossil fuel power plants in the grid	CO_2	Included	Emissions that would have occurred at the fossil fuel power plants if the baseline transformers would have been installed.
		CH_4	Excluded	Excluded for simplification. Conservative.
		N_2O	Excluded	Excluded for simplification. Conservative.
Project Activity	Fossil fuel power plants in the grid	CO_2	Included	Emissions at the fossil fuel power plants when the energy-efficient transformers introduced by the project activity are used.
		CH_4	Excluded	Excluded for simplification. Conservative.
		N_2O	Excluded	Excluded for simplification. Conservative.

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

The Methodological "Combined tool to identify baseline scenario and demonstrate additionality", Version 02.2 (EB28), is used for selection of the baseline scenario.

Step 1: Identification of alternative scenarios
Step 1a: Define alternative scenarios to the proposed CDM project activity

The following plausible alternative scenarios are considered for selection of the baseline scenario:

(1) Replacement or installation of transformers adopting a more efficient technology other than the technology of the project activity;

(2) Continuation of current practice. Replacement or installation of transformers with the most commonly used transformers in the geographical region where the project activity is implemented;

(3) Replacement or installation of transformers as per new performance levels enforced by regulation;

(4) Replacement or installation of transformers adopting the project activity technology without CDM benefits.

Step 1b: Consistency with mandatory applicable laws and regulations

All alternative scenarios are in compliance with all applicable laws and regulations in Viet Nam.

Step 2: Barrier Analysis
Step 2a: Identify barriers that would prevent the implementation of alternative scenarios (See also Section B.5 below for more information on selection of the baseline scenario and demonstration of additionality)

Technological Barriers

- Manufacture of the amorphous material is a state-of-the-art technology with limited production capability in Viet Nam. The technology required to manufacture energy efficient amorphous transformers is not widely disseminated in Viet Nam and requires specialist know-how in manufacture, installation and maintenance.

- The Project is the first-of-its-kind and there is a lack of ability and technical know-how which hinders implementation.

Investment Barriers

- The financing capacity of the project is much less than other investment opportunities in Viet Nam.

Government funding is limited due to the nature of the project and the risk associated with first-of-a-kind projects.

Prevailing Practice Barriers

- Commonly used silicon steel plate transformers are the preferred practice as they are readily available from a range of suppliers, the installation and maintenance methods are well-established and the initial purchase price is less than amorphous transformers.

Step 2b: Eliminate alternative scenarios which are prevented by the identified barriers

Details of each scenario are given below:

Scenario 1: Replacement or installation of transformers adopting a more efficient technology other than the technology of the project activity.

This scenario involves the utilization of energy efficient transformers other than amorphous transformers. Transformers which are currently available or are likely to be developed in the near future include:

a) Energy-efficient silicon steel plate transformers
b) Amorphous transformers

The top-runner silicon steel plate transformers are up to three times less efficient than amorphous transformers and less efficient on a cost basis however additional investment will be needed to finance the cost of the new amorphous transformer technology and it is not considered a realistic alternative due to the investment barriers outlined above.

Scenario 2: Continuation of current practice. Replacement or installation of transformers with the most commonly used transformers in the geographical region where the project activity is implemented.

This scenario involves no changes in existing equipment or the replacement and installation of new transformers with the current standard in Ho Chi Minh City. No additional investment is needed for the implementation of this scenario. This scenario faces no barriers.

Scenario 3: Replacement or installation of transformers as per new performance levels enforced by regulation.

This scenario involves upgrading existing equipment via the replacement and installation of new transformers according to new standards and regulations in Ho Chi Minh City. There are currently no new performance levels enforced by regulation and none are expected within the timeframe of the Project Activity so this scenario will not be considered.

Scenario 4: Replacement or installation of transformers adopting the project activity technology without CDM benefits.

The installation of amorphous transformers involves significant cost and additional investment and is not considered feasible on a business as usual basis. The scenario faces significant technological and investment barriers. The project is the first-of-its-kind and the manufacturing technology is not available in Viet Nam. These barriers prevent the scenario from being considered as a project alternative.

Accordingly, Scenario 2: Continuation of current practice is considered to be the most feasible baseline scenario and applicable as per the approved CDM methodology, AM0067 "Methodology for installation of energy efficient transformers in a power distribution grid", Version 2.

The baseline of the Project Activity is the replacement and installation of transformers with the most commonly used transformers in the region (Ho Chi Minh City).

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

The Project Activity involves the installation of energy efficient amorphous metal transformers. There are no legally binding or mandatory requirements for the installation of energy efficient transformers, nor is the implementation of the Project Activity required under Vietnamese regulations. The Project Activity faces a number of barriers, as described below, which prevent its implementation on a BAU basis:

Technological Barriers

The Project is the first-of-its-kind and there is a lack of ability and technical know-how which hinders implementation. The manufacture of amorphous ribbon is state-of-the-art technology requiring significant research and development in order to manufacture and the lack of raw materials is an obstacle for manufacturing the high-performance transformers.

As outlined in Section A.4.3 amorphous transformers are comprised of an amorphous core. This amorphous metal alloy has been formed by a rapid cooling process which doesn't allow for the formation of a crystalline structure. The lose, ill-defined structure of the material is the key to reducing the no-load loss of the transformer and thereby reducing the power generation requirement for the same electricity output. The required manufacturing technology for this advanced material is not widespread in Viet Nam and there is a lack of knowledge and infrastructure in Viet Nam limiting the development of the technology. Installation, operation and maintenance of the transformers also requires training in the technology and additional investment is required for this training, the establishment of technical support services and the preparation of special operation manuals which would not be required if traditional technology were implemented. These technological risks make implementation of the Project Activity much less attractive without the support of additional financing in the form of CER's to overcome these hurdles.

Investment Barriers

The installation of new transformers requires significant investment. The HCMPC is owned by the Vietnamese Government and funding from the government budget is limited. The main priority of the government is the continued steady supply of electricity to the power grid rather than focusing on expensive, state-of-the-art energy efficiency measures. The cost of the amorphous metal transformers is about 15% higher than that of silicon steel plate transformers and this extra cost is not considered economically feasible.

A benchmark analysis comparing the IRR of the project both with and without the additional revenue stream provided by the sale of CER's is deemed a suitable financial indicator to determine if the project is financially attractive. The table below represents the main parameters used in the IRR calculation for the project. The calculation was conducted in a conservative manner and all assumptions are listed below in order to maintain transparency. The normal bank interest rate in Viet Nam of 8.5% per annum (Dec. 2009) is taken as the benchmark for the Project[1].

Table B-5. IRR Calculation Data

Item	Value	
Electricity Savings	1,543	MWh
Initial Cost	824,517	USD/yr（7 years）
Funding Source: Loan/Financing	100%	
Electricity Tariff	53.4	USD/MWh
Tax Rate	28%	
Interest	8.5%	
CER Estimated Cost (US$)	10, 15, 20	USD
Grid Emission Factor	0.52	tCO2e/MWh
O&M Costs	N/A	

Data Assumptions

1. Depreciation of 4%
2. O&M costs are negligible
3. Electricity tariff is 0.0534USD/kWh

The Project's IRR is estimated to be 6.84%, which is below the benchmark value of 8.5% and prevents the project being implemented on a BAU basis. The additional revenue from the sale of CER's increases the IRR to 7.73% (USD10), 8.16% (USD15) or 8.59% (USD20) respectively depending on the market price and makes the project more financially attractive.

To determine the financial attractiveness of the project under different conditions a sensitivity analysis was performed on key parameters:

1. Electricity Tariff increases by 10% (IRR 7.75%)
2. Initial investment costs are reduced by 10% (IRR 8.01%)
3. O&M costs are increased to 5% (IRR 1.58%)

These values are still below the benchmark of 8.5% and confirm that the project is unlikely to be implemented on a BAU basis. With the added incentive of the revenue generated from the sale of CERs the project becomes more viable to potential investors.

[1] http://www.sbv.gov.vn/en/CdeCSTT-TD/laisuat1.jsp

Barriers due to Prevailing Practice

Currently there are no amorphous metal transformers in operation in Viet Nam and the Project Activity represents the first-of-its-kind in the field.

The current transformers in the Ho Chi Minh City power grid are outdated and ageing resulting in transmission losses of up to 7.07% across the entire grid while increased economic growth in HCMC has seen the demand for electricity increase at a rate of approximately 10% per annum.

The following environmental policies have been successively enacted by the Ministry of Natural Resources and Environment (MONROE):

- 1991 "National Plan for the Environment and Sustainable Development (1991-2000)"
- 1994 "Fundamental Framework for the Protection of the Environment"
- 1995 "Vietnamese Standards Determining Environmental Standards for Atmospheric and Water Condition Levels and Exhaust Standards"
- 2003 "National Strategy for Environmental Protection Showing the Strategy to 2010 and the Vision to 2020"
- 2005 "Revision to the Environmental Protection Law"

The government has also enacted a program to save electricity from 2006 to 2010 (The Decision of the Prime Minister; No. 80/2006/QD-TTg). It sets the target of saving electricity and additionally sets the electricity loss target at 9% for 2010.

As part of its vision to combat pollution and increase environmental protection the Vietnamese Government has identified the need to install new transformers. The Government also recognises the operational cost-saving benefits of the energy efficient amorphous transformers, however, due to the increased installation cost the government plans to continue installation of the current silicon steel plate transformers.

A large number of transformers of different classes and sizes are needed in the transmission and distribution network, with a wide range of operating voltages. There are two manufacturers of transformers in Viet Nam: Thibidi and EMC. Transformers are also imported from abroad by firms such as: GE, Wagner, Standard, ABB, SCCD, Takaoka, Osaka, Mitsui, Letrans, MG, TSC, Tatung, Westinghouse, Hitachi and Spokane. All transformers used meet the requirements of TCVN 1984 – 1994 and other local standards.

The ready availability of silicon steel plate transformers and the lack of available material and know-how for local companies to manufacture amorphous transformers have precluded the installation of the transformers.

Due to the barriers described above, the development of the Project Activity is highly unlikely without the additional cash flow provided from the sale of CER's and thus the Project Activity is considered to be additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Baseline Emissions

According to the baseline methodology the no-load loss of the transformers that would have been installed in the baseline scenario will be estimated based on historical installation data provided by HCMPC and Power Company Three (PC3) for the past five years of the ratio of each type of transformer and its associated no-load loss installed in the Ho Chi Minh City power distribution grid and the PC3 power distribution grid. Baseline emissions will be reassessed before starting a new crediting period. The data provided for PC3 is considered to conform to national regulations and act as a standard for the region whereas the no-load loss for transformers in the HCMPC is much less and therefore a more conservative figure.

The baseline emissions will be calculated using the following equation:

$$BE_y = \sum_{k=1}^{n} \left(NLL_{BL,k} \times n_{k,y}\right) \times MP \times \left(1 - Br\right) \times EF_{CO_2,grid,y} \times 10^{-6} \qquad (1)$$

Where,

BE_y Baseline emissions in year, *y* (tCO2e/yr)

k Index 'k' represents the type of transformers installed in the Project Activity

$NLL_{BL,k}$ No-load loss rate of the transformer type 'k' that would have been installed by the end of the year 'y-1' in the baseline scenario (see equation 2 below)

MP Duration of each monitoring period (hours)

Br Black out rate of each monitoring period (%)

$EF_{CO_2,grid,y}$ CO2 emission factor of the grid for the year 'y' when the project activity is implemented (tCO2/MWh). EF is calculated using the combined margin as outlined in the methodological "Tool to calculate the emission factor of an electricity system".

$n_{k,y}$ Cumulative number of type 'k' transformers installed by the Project Activity at the end of year 'y-1'.

Table B-2. Baseline Data Source.

Data Variable	Data Source
k	HCMPC
$NLL_{BL,k}$	Calculated (see below) from data supplied by manufacturer
MP	HCMPC
Br	HCMPC
$EF_{CO_2,grid,y}$	HCMPC
$n_{k,y}$	Installation entity HCMPC

The no-load loss is calculated as follows:

$$NLL_{BL,k} = \min\{NLL_{reg,k}, NLL_{AVG,k}\} \qquad (2)$$

Where,

$NLL_{reg,k}$ No-load loss rate defined by national regulations for *k* type transformers (W) (PC3 data) as shown in Table B-3 below:

$NLL_{AVG,k}$ Average of no-load loss rates provided by the manufacturer of all *k* type transformers whose performance is among the top 20% (W) (HCMPC data) as shown in Table B-3 below:

Table B-3. Regulated and Average No-load Loss for k-type Transformers.

Transformer Capacity (kVA)	Regulated no-load loss (NLL_{reg}) PC3 silicon steel plate transformers (W)	Average no-load loss (NLL_{AVG}) HCMPC silicon steel plate transformers (W)
100	330	230
160	510	280
250	550	340
320	700	390
400	900	450
560	1,000	580
630	1,300	787
750	1,400	855
800	1,460	880
1,000	1,700	980
1,250	1,800	1,020
1,500	2,200	1,305
2,000	2,800	1,500
2,500	2,870	3,500

Such that,

$$NLL_{BL,k} = \min\{NLL_{reg,k}, NLL_{AVG,k}\}$$

$$NLL_{BL,k} = NLL_{AVG,k}$$

Project Emissions

The Project emissions will be calculated using:

$$PE_y = \sum_{k=1}^{n} \left((1+UNC) \times NLL_{PR,k} \times n_{k,y} \times MP \times (1-Br) \times EF_{CO_2,grid,y} \times 10^{-6} \right) \qquad (3)$$

Where,

PE_y	Project emissions in year 'y' (tCO2e/yr)
k	Index 'k' represents the type of transformers installed in the Project Activity
$NLL_{PR,k}$	No-load loss rate of the transformer type 'k' that would have been installed by the end of the year 'y-1' in the Project Activity (W)
MP	Duration of each monitoring period (hours)
Br	Black out rate of each monitoring period (%)
$EF_{CO_2,grid,y}$	CO_2 emission factor of the grid for the year 'y' when the project activity is implemented (tCO_2/MWh). EF is calculated using the combined margin as outlined in the methodological "Tool to calculate the emission factor of an electricity system"
$n_{k,y}$	Cumulative number of type 'k' transformers installed by the Project Activity at the end of year 'y-1'
UNC	Maximum allowable uncertainty for the no-load losses stated in the certification report provided by an accredited entity

Table B-4. Project No-load Loss for k-type (Amorphous) Transformers.

Transformer Capacity (kVA)	**Project no-load loss (NLL_{PR}) Amorphous transformers (W)**
100	60
160	80
250	120
320	140
400	170
560	215
630	240
750	270
800	300
1,000	340
1,250	410
1,500	470
2,000	490
2,500	630

Leakage

No leakage is expected from the Project Activity as the replaced transformers will not be used elsewhere and will be scrapped.

Emission Reductions

The Emissions Reductions are then calculated as:

$$ER_y = BE_y - PE_y \qquad (4)$$

Where,

ER_y Emissions reductions during the year, *y* (tCO_2e)
BE_y Baseline emissions during the year, *y* (tCO_2e)
PE_y Project emissions during the year, *y* (tCO_2e)

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	**$LL_{BL,k}$**
Data unit:	W
Description:	Load loss rate of the transformer type ‘k’ that would have been installed in the baseline scenario.
Source of data used:	1.Vietnamese legislation for transformer performance levels 2.Manufacturer’s specifications
Value applied:	Various. See Table below:
Justification of the choice of data or description of measurement methods and procedures actually applied :	Minimum of load losses as defined by Vietnamese regulations and manufacturers specifications
Any comment:	-

Transformer Capacity (kVA)	**Load-loss (W)**
100	1,320
160	1,940
250	2,600
320	3,330
400	4,200
560	4,810
630	5,570
750	6,725
800	6,920
1000	8,550
1250	10,690
1500	13,680
2000	17,100
2500	21,740

Data / Parameter:	**$NLL_{reg,k}$**
Data unit:	W
Description:	No-load losses defined by Vietnamese regulations for k type transformers.
Source of data used:	Vietnamese legislation for transformer performance levels.
Value applied:	Various: See Table B-3
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Latest regulations

Data / Parameter:	**$NLL_{AVG,k}$**
Data unit:	W
Description:	Average of no-load loss rate provided by the manufacturer of all k type of transformers installed in the geographical region whose performance is among the top 20% of their type in the last five years prior to the implementation of the project activity.
Source of data used:	Manufacturer's specifications at time of installation
Value applied:	Various: See Table B-3
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	-

B.6.3. Ex-ante calculation of emission reductions:

Baseline Emissions

The baseline emissions, BE_y (tCO_2e), in year, *y* is given by:

$$BE_y = \sum_{k=1}^{n} \left(NLL_{BL,k} \times n_{k,y} \right) \times MP \times \left(1 - Br \right) \times EF_{CO_2,grid,y} \times 10^{-6} \quad (1)$$

Table B-5. Baseline Parameters.

Data Variable	Value	Units	Comments
k	-	-	Silicon steel plate type transformer
$NLL_{BL,silicon}$	See Table B-6	W	Depends on capacity of transformers
MP	8760	h	HCMPC (assumed continually operational)
Br	0.037	%	Data obtained from HCMPC
$EF_{CO2,grid,y}$	0.52	tCO_2e/MWh	Data obtained from HCMPC
$n_{k,y}$	708	-	Installation entity (to be monitored)

Table B-6. Total Baseline No-load Loss.

Capacity (kVA)	Number of Transformers[2]	Total Capacity (kVA)	Baseline No-load Loss, NLL_{BL} (W)	Total Baseline No-load Loss (W)
100	1	60	230	138
160	99	15,896	280	27,818
250	190	47,500	340	64,600
320	112	35,840	390	43,680
400	247	98,980	450	111,353
560	32	17,892	580	18,531
630	6	3,560	787	4,447
750	2	1,163	855	1,325
800	0	200	880	220
1,000	6	5,500	980	5,390
1,250	1	1,500	1,020	1,224
1,500	0	600	1,305	522
1,500	1	1,600	1,305	1,305
2,000	3	5,600	1,500	4,200
2,500	0	0	2,870	0
TOTAL	**708**	**238,038**	**-**	**284,752**

The baseline emissions for the year, *y* are:

BE_y = 284,752 x 8760 x (1 – 0.037) x 0.52 x 10^{-6}

= **1,249 tCO_2e/year**

Project Emissions

The baseline emissions, PE_y (tCO_2e), in year, *y* is given by:

$$PE_y = \sum_{k=1}^{n} \left((1 + UNC) \times NLL_{PR,k} \times n_{k,y} \times MP \times (1 - Br) \times EF_{CO_2,grid,y} \times 10^{-6} \right) \quad (3)$$

[2] For the sake of clarity the number of transformers in each size category have been rounded up to the nearest whole number however, the actual average figure is represented in the accompanying spreadsheet.

Table B-7. Project Parameters.

Data Variable	Value	Units	Comments
k	-	-	Amorphous type transformer
$NLL_{PR,amorphous}$	See Table B-8	W	Capacity of transformers
MP	8760	h	HCMPC (assumed continually operational)
Br	0.037	%	Data obtained from HCMPC
$EF_{CO2,grid,y}$	0.52	tCO_2e/MWh	Data obtained from HCMPC
$n_{k,y}$	708	-	Installation entity (to be monitored)
UNC	0	-	Uncertainty of NLL_{PR}

Table B-8. Project No-load Loss.

Capacity (kVA)	Number of Transformers[3]	Total Capacity (kVA)	Project No-load Loss, NLL_{PR} (W)	Total Project No-load Loss (W)
100	1	60	60	36
160	99	15,896	80	7,948
250	190	47,500	120	22,800
320	112	35,840	140	15,680
400	247	98,980	170	42,067
560	32	17,892	215	6,869
630	6	3,560	240	1,356
750	2	1,163	270	419
800	0	200	300	75
1,000	6	5,500	340	1,870
1,250	1	1,500	410	492
1,500	0	600	470	188
1,500	1	1,600	470	470
2,000	3	5,600	490	1,372
2,500	0	0	630	0
TOTAL	**708**	**238,038**	-	**101,641**

[3] For the sake of clarity the number of transformers in each size category have been rounded up to the nearest whole number however, the actual average figure is represented in the accompanying spreadsheet.

The project emissions for the year, *y* are:

$$PE_y = (1 + 0) \times 101{,}641 \times 8760 \times (1 - 0.037) \times 0.52 \times 10^{-6}$$

$$= \mathbf{446\ tCO_2e/year}$$

Emissions Reductions

$$ER_y = BE_y - PE_y \qquad (4)$$

$$= 1{,}250 - 445\ tCO_2e/year$$

$$= \mathbf{803\ tCO_2e/year}$$

B.6.4 Summary of the ex-ante estimation of emission reductions:

Table B-9. Emissions Reductions.

Year	Estimated baseline emissions (tonnes of CO_2 equivalent)	Estimated project emissions (tonnes of CO_2 equivalent)	Estimated leakage (tonnes of CO_2 equivalent)	Estimated emission reductions (tonnes of CO_2 equivalent)
2010	1,249	446	0	803
2011	2,498	892	0	1,606
2012	3,747	1,338	0	2,410
2013	4,996	1,783	0	3,213
2014	6,246	2,229	0	4,016
2015	7,495	2,675	0	4,819
2016	8,744	3,121	0	5,623
Total (tonnes of CO_2 equivalent)	**34,975**	**12,484**	**0**	**22,491**
Annual Average (tonnes of CO_2 equivalent)	**4,996**	**1,783**	**0**	**3,213**

B.7. Application of the monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

Data / Parameter:	$EF_{CO2,grid,y}$
Data unit:	tCO_2/MWh
Description:	v
Source of data to be used:	Data published by EVN
Value of data applied:	0.5255
Description of	Yearly Monitoring

measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	**MP**
Data unit:	Hours
Description:	Duration of monitoring period
Source of data to be used:	Data obtained from HCMPC
Value of data applied:	8760
Description of measurement methods and procedures to be applied:	Yearly
QA/QC procedures to be applied:	Blackout data will be collected as part of normal business operations. The data shall be cross-checked with other internal company reports.
Any comment:	-

Data / Parameter:	**Br**
Data unit:	%
Description:	Blackout rate in monitoring period
Source of data to be used:	Data obtained from HCMPC
Value of data applied:	0.037
Description of measurement methods and procedures to be applied:	Yearly
QA/QC procedures to be applied:	Blackout data will be collected as part of normal business operations. The data shall be cross-checked with other internal company reports.
Any comment:	-

Data / Parameter:	**k**
Data unit:	Type of transformer (type based on capacity and transformer ratio)
Description:	Index ‘k’ represents type of transformers installed by the Project Activity
Source of data to be used:	Record of high efficiency transformers provided by installation entities.
Value of data applied:	See Table B-4
Description of measurement methods and procedures to be applied:	Data reported at each transformer installation or replacement within the project boundary.
QA/QC procedures to be applied:	Data collected as part of normal business operations and cross-checked with other internal company reports.
Any comment:	-

Data / Parameter:	$n_{k,y}$
Data unit:	Number
Description:	Cumulative number of transformers of type 'k' installed in the Project Activity by the end of year 'y-1'.
Source of data to be used:	Record of installation of high efficiency transformers provided by installation entities.
Value of data applied:	4956 (708 per year for seven year crediting period)
Description of measurement methods and procedures to be applied:	Reported yearly.
QA/QC procedures to be applied:	Data collected as part of normal business operations and cross-checked with other internal company reports.
Any comment:	-

Data / Parameter:	$NLL_{PR,k,y}$
Data unit:	W
Description:	No-load loss rate of the high energy efficiency transformers type 'k' installed by end of year 'y-1' by the Project Activity.
Source of data to be used:	Manufacturer's performance test report which is measured at the time of pre-delivery inspection.
Value of data applied:	See Table B-8
Description of measurement methods and procedures to be applied:	Reported every time a transformer is installed. Following the highest Vietnamese and international standards.
QA/QC procedures to be applied:	Manufacturer's performance test report submitted by the manufacturer and validated by certification entity.
Any comment:	A certification report shall be provided by an accredited entity.

Data / Parameter:	$LL_{PR,i}$
Data unit:	W
Description:	Load-loss rate of energy efficiency transformers installed by the Project Activity.
Source of data to be used:	Manufacturer's performance test report which is measured at the time of pre-delivery inspection.
Value of data applied:	Every time transformers are installed the load-loss value at a rated current is measured at the time of pre-delivery inspection.
Description of measurement methods and procedures to be applied:	Every time transformers are installed the load-loss value at a rated current is measured at the time of pre-delivery inspection.
QA/QC procedures to be applied:	Manufacturer's performance test report submitted by the manufacturer and validated by certification entity.
Any comment:	A certification report shall be provided by an accredited entity.

Data / Parameter:	Number of replaced transformers
Data unit:	-
Description:	Historical record of replaced transformers under the Project Activity including a record of how the transformers are not going to be used in other parts of the grid or in another grid.
Source of data to be used:	Record of removal/installation of transformers provided by installation entities and disposition of transformers by utility.
Value of data applied:	4956 (708 per year for seven year crediting period)
Description of measurement methods and procedures to be applied:	Yearly
QA/QC procedures to be applied:	-
Any comment:	-

B.7.2. Description of the monitoring plan:

The Project participant in Viet Nam will be in charge of collection and compilation of all the monitoring data. Amorphous transformers will be installed by trained professionals from HCMPC and regularly inspected. In addition to regular operation and maintenance the grid company (HCMPC) is responsible for periodic reporting for CDM purposes.

The applicable methodology (AM0067v.2) requires the monitoring of the following items to confirm applicability conditions:

- The actual installed type, capacity, transformation ratio and load loss rate (W) of each amorphous transformer installed by the project activity;

The methodology also requires the monitoring of the following items to complete project emission calculations:

- Load and No-load loss rate (W) of energy efficiency transformers installed by the project activity;

- Specifications of each high-efficiency transformer installed by the project activity (date of installation, localization, technical data);

- CO_2 emission factor (tCO_2/MWh) of the grid;

- Yearly blackout rate of the grid during the year, *y* (%);

- The number of transformers which are installed in the project activity and are in operation. (i.e. consider the number of high-efficiency transformers removed since installed).

All data collected as part of monitoring should be archived electronically and be kept at least for two years after the end of the last crediting period. 100% of the data should be monitored if not indicated otherwise in the tables below. All measurements should be conducted with calibrated measurement equipment according to relevant industry standards.

In addition, the monitoring provisions in the tools referred to in this methodology apply.

B.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 study and monitoring plan was completed on 12/02/2009 by:

Clean Energy Finance Committee
Mitsubishi UFJ Securities Co., Ltd.
Mitsubishi Building,
2-5-2 Marunouchi, Chiyoda-ku
Tokyo, 100-0005, Japan.

watanabe-hajime@sc.mufg.jp

SECTION C. Duration of the project activity / crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

1/1/2010

C.1.2. Expected operational lifetime of the project activity:

30 years

C.2. Choice of the crediting period and related information:

C.2.1. Renewable crediting period:

C.2.1.1. Starting date of the first crediting period:

1/1/2010

C.2.1.2. Length of the first crediting period:

7 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not Applicable

C.2.2.2. Length:

Not Applicable

SECTION D. Environmental impacts

D.1. Documentation on the analysis of the environmental impacts, including trans-boundary impacts:

According to the National Resources and Environment Research Programme (NRERP) (1984) an Environmental Impact Assessment is required for projects requiring a development licence. This project does not require a development licence and therefore an EIA is not required to be undertaken under Vietnamese regulations.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

The environmental impacts of the project are not considered to be significant and an EIA is not required under national regulations as outlined above.

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

A stakeholder's meeting was held for the HCMPC Amorphous Transformer Installation Project from 9am to 1pm on the 2nd October 2008. Fourteen people attended.

No.	Position	Company
1.	Vice Director	Dong Nai Electric Appliances Joint Stock Company
2.	Technical Manager	Electrical Equipment Joint Stock Company
3.	Technician	Electrical Equipment Joint Stock Company
4.	Vice General Director	Electrical Equipment Joint Stock Company
5.	Technician	Electrical Equipment Joint Stock Company
6.	Vice Director	Electrical Testing Center – Power Company of HCM City
7.	Technician	Power Company of HCM City
8.	Reporter	Dat Viet Newspaper
9.	Reporter	The Voice of HCM City People
10.	Technician	Power Company 2
11.	Technician	Energy Conservation Center of HCM City

12.	Technician	Energy Conservation Center of HCM City
13.	General Director	Electric Power Dep., Hitachi Metal, Ltd.
14.	CDM/JI Consultant	Mitsubishi UFJ Securities

The stakeholder's meeting followed the following agenda that was designed to inform the participants and invite them to share their views on the developments:

1. Opening Remarks from Energy Conservation Center of HCM City.
2. Introduction of Mitsubishi UFJ Securities
3. Introduction of Ho Chi Minh Power Company
4. Introduction on amorphous steel and amorphous transformers
5. Introduction of Electrical Equipment Joint Stock Company (Thibidi)
6. Q&A Session
7. Closing Remarks from Energy Conservation Center of HCM City

E.2. Summary of the comments received:

Questions and answers from the stakeholder meeting for the HCMPC Amorphous Transformer Installation Project:

- Q: Where is it possible to install amorphous transformers?
  A: Amorphous transformers can be used in many places, such as office buildings, schools, plants.

- Q: How many amorphous transformers are in use in Japan?
  A: About 10% of all transformers in use are amorphous.

- Q: How can we produce and distribute amorphous transformers in Viet Nam?
  A: You can import the amorphous core and product amorphous transformers in Viet Nam. Hitachi Metal Ltd. will support Vietnamese company on technology.

E.3. Report on how due account was taken of any comments received:

A summary of the stakeholder's meetings was prepared, including the issues highlighted and the answers given. No follow up was necessary because all questions were answered satisfactorily during the meeting by the technical experts present, referring to the current project plans.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Energy Conservation Centre of Ho Chi Minh City (ECC)
Street/P.O.Box:	244 Dien Bien Phu St. Dist. 3
Building:	
City:	Ho Chi Minh City
State/Region:	
Postcode/ZIP:	
Country:	Viet Nam
Telephone:	84-8-9322372
FAX:	84-8-9322373
E-Mail:	Ecc-hcmc@hcm.vnn.vn
URL:	www.ecc-hcm.gov.vn
Represented by:	
Title:	Director
Salutation:	Mr.
Last name:	Tuoc
Middle name:	Kim
First name:	Huynh
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal e-mail:	

Organization:	Mitsubishi UFJ Securities Co., Ltd.
Street/P.O.Box:	2-5-2, Marunouchi
Building:	Mitsubishi Building
City:	Chiyoda-ku
State/Region:	Tokyo
Postfix/ZIP:	100-0005
Country:	Japan
Telephone:	+81-3-6213-6399
FAX:	+81-3-6213-6175
E-Mail:	watanabe-hajime@sc.mufg.jp
URL:	http://www.sc.mufg.jp/english/e_cefc/index.html
Represented by:	
Title:	Chairman of Clean Energy Finance Committee
Salutation:	Mr.
Last Name:	Watanabe
Middle Name:	
First Name:	Hajime
Department:	Clean Energy Finance Committee
Mobile:	
Direct FAX:	

Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

This Project involves no public funding.

Annex 3

BASELINE INFORMATION

Grid CEF calculations

The following tables provide information required to calculate emission factor:

Table A3.1. Rate of low cost/must-run sources based on generation

Year	2003	2004	2005	2006	2007	Average
Hydro power generation (GWh)	19,033	17,979	16,437	19,573	22,178	19,040
Total (GWh)	40,636	46,800	53,407	60,489	68,725	54,011
Rate of low cost/must-run sources generation (%)	46.84	38.42	30.78	32.36	32.27	35.25

Table A3.2. Electricity outputs and fuel consumptions of thermal power sources in 2004– 2006[4]

Fuel Type		2004	2005	2006
Coal	GWh	7,358	9,446	10,808
NCV = 22.19 *TJ/kt	kt	3,885	4,857	5,643
CO_2EF = 94.6 tCO_2/TJ –IPCC-2006	kt CO_2	8,134	10,083	11,581
Gas Turbine (Gas)	GWh	18,995	24,031	26,786
CO_2EF = 54.3 tCO_2/TJ –IPCC-2006	TJ	149,106	179,472	204,133
	kt CO_2	8,096	9,745	11,084
Diesel Oil	GWh	299	482	261
NCV = 42.7 TJ/kt – IPCC-2006	kt	84	136	73
CO_2EF = 72.6 tCO_2/TJ	kt CO_2e	261	422	228
Fuel Oil	GWh	2,131	2,638	2,095
NCV = 41.45 TJ/kt	kt	584	722	574
CO_2EF = 75.5tCO_2/TJ –IPCC-2006	kt CO_2e	1,826	2,259	1,797
Imported electricity	GWh	39	373	966

[4] Sources: Power Sector's Statistics of Electricity Generation from 2002-2007 of EVN and State's Annual Statistics 2003-2006.

Total CO2 emission from Viet Nam grid	kt CO_2e	18,317	22,509	24,691
Total thermal electricity output generated	GWh	28,820	36,970	40,916

*22.1.9 is used for all coal power plants except followings.
Na Duong: 14.65
Cao Ngan: 18.84
Formosa: 25.96

Table A3.3. The power plant capacity additions in the electricity system that comprise 20% of the system generation (in GWh) and that have been built most recently[5]

No	Plant name	Commissioning year	Capacity (MW)	Outputs (GWh)	Energy type	Emission (kt CO2)
1	Srok Phu Miêng	2006	51	252	Hydro	-
2	Cao Ngan*+(IPP) PC1	2006	100	445	Coal	442
3	Uong Bi 2	2006	300	520	Coal	458
4	Se San 3	2006	260	1,113	Hydro	-
5	Dam Phu My (IPP) PC2	2005	150	150	Gas	58
6	Na Duong*+(IPP) PC1	2004	110	744	Coal	763
7	Fosmosa	2004	150	1,113	Coal	864
8	Phu My 4	2004	450	3,142	Gas	1,411
9	Phu My 2-2	2004	720	5,004	Gas	1,937
10	Can Don	2003	259	361	Hydro	-
11	Phy My 3	2003	720	4,110	Gas	1,591
	Total			15,141		**6,615**

Annex 4

MONITORING INFORMATION

This section has been intentionally left blank.

- - - - -

[5] Sources: Recapitulative Report on the Operation of Vietnam National Electricity System in Year 2006, EVN/National Electricity System Dispatching Center - Department for Electricity System Operation, Hanoi, January 2007