CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

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Title: Factory energy efficiency improvement in compressed air demand and supply in Malaysia
Version: -01
Date: 22nd January 2007

A.2. Description of the small-scale project activity:

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DENSO (Malaysia) SDN. BHD. (DNMY) is a subsidiary company of DENSO Co., Ltd. (DNJP), the Japanese top manufacturing company of automotive parts. The company was established in Malaysia in 1980, and now produces mainly the parts of car air conditioner, radiator, heater, engine control unit.

The manufacturing process needs significant amount of electricity, which is the primary environmental aspect of this kind of factory. DNJP has been promoting the campaign for energy efficiency improvement in factories in Japan for many years, and has been developing state-of-the-art technologies. The campaign has been successful and resulted in 38% reductions of GHG emissions per unit of productions though variety of energy efficient measures since 1990.

The main methods of improvement measures to be adopted in this proposed project has also been developed by DNJP most recently. This could imply these measures are less attractive than the other ones that had previously developed and adopted for the company with high energy efficiency such as DNJP. In order to examine and implement the energy efficiency improvement measures, energy saving diagnosis was carried out by the experts of DNJP at the factories of DNMY.

The purpose of the project activity:
The objective of the proposed project is to reduce GHG emissions through reduction of electricity consumption by introducing energy efficiency improvement program at DNMY. The energy efficient measures are to reduce demand of compressed air, and then resulting in reduction of electricity consumed by installed air compressors.

Energy efficiency program for the project activity has been designed by DNJP, which includes energy efficiency diagnosis, replacement or installation of air related equipments, and air leakage controls. Air leakage control is not included as part of the project activity. Energy efficient equipments for the project activity are such as high energy-efficient air nozzles, blower installation technically developed by DNJP and SMC Corporation (demand side), and also upgrade of existing air compressors to high energy-efficient ones (supply side). To replace or install those equipments and make them work properly to achieve energy efficiency improvement, not only knowledge about those equipments but skill for rearrangement of air piping is required.

Contribution to sustainable development:
According to the Malaysian national CDM criteria approved by the National committee on CDM (NCCDM), CDM projects must bring direct and indirect sustainable development (social, economic and environmental) benefits to the sector concerned and the economy as a whole.

Social sustainability:

Reduction of energy use for manufacturing process will strengthen DNMY in terms of cost competitiveness and green aspect of its products. That will strengthen their competitiveness against other manufacturers such as foreign competitors, which will bring more income and its business stability. As long as the company is competitive, it will maintain current employment level or even create more opportunity for local people to be employed. As a result, taxes to be paid to the local government will be increased, and also social well being in the local area will be increased with secured employment.

Under the circumstances of recent remarkable rise in crude oil price and insufficient supply of natural gasses, energy security is always a major concern for a country like Malaysia whose economy is growing very fast. And now, the energy security also has to be concerned along with environmental issues.
As stated in 9th Malaysia Plan 2006-2010 chapter 19, energy efficiency initiatives are emphasized particularly industrial, transport and commercial sectors to ensure efficient utilization of energy resources. As described above, this project aims at reducing electricity consumption, which will reduce pressures on Malaysia's energy security, and also contributes to conservation of natural resources such as oils and natural gasses.

Economic sustainability:

The local employees will be trained by DNJP to practice this type of technology properly. Furthermore, the proprietary manuals developed by DNJP will be provided to carry out this project properly. These would increase skilled labours for energy efficiency improvement in manufacturing factories. As the number of those skilled labours increases, Malaysian industry will strengthen itself and contribute to its economic growth.
Success of the project will encourage companies in Malaysia to approach energy efficiency improvement in air system that is not common for them to practice at present. The adoption of these energy efficient measures will strengthen a cost competitiveness of manufacturers in Malaysia, and also will increase profits for them (including DNMY).

Environmental sustainability:

As an objective of all CDM project activity, the project leads to reduction of GHG emissions through reduction of electricity consumption by manufacturing processes. The reduction of electricity consumption will reduce pressures on power generation in Malaysia, which eventually leads to less GHG emissions and results in mitigation of global warming. None of the measures included in the CDM project activity leads to depletion of natural resource or environmental degradation in terms of local air quality, local water quality, local biodiversity, and so on. The implementation process also shall not cause any additional environmental effects to local community since only modification/replacement of existing equipments is required. Thus the project leads to overall improvement of the environment.

A.3. Project participants:

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Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Malaysia (host)	DENSO (MALAYSIA) SDN. BHD.	No
Japan	DENSO Co., Ltd.	No

The contact information on all project participants has been provided in Annex I.

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

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A.4.1.1. Host Party(ies):

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Malaysia

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

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Selangor Darul Ehsan

A.4.1.3. City/Town/Community etc:

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Bandar Baru Bangi

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

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The project is located at the address given below:

Lot 2, Jalan P/1, Section 13, 43650
Bandar Baru Bangi,
Selangor Darul Ehsan,
Malaysia

DENSO (MALAYSIA) SDN. BHD.

To Kuala Lumpur International Airport (KLIA) *KLIA to DNMY 35KM

A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

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Type and category of the proposed project activity:

Type II - Energy Efficiency Improvement Projects
Project Category - II.C. "Demand-side energy efficiency programmes for specific technologies" – applicable to the project activity adopting energy efficiency measures at many sites;

The proposed project has features as described below:
1. The proposed project activity adopts energy-efficient measures such as high-efficient air nozzles, blowers to replace existing equipments (air nozzles, aeration, vacuums, etc.) and upgrade of existing air compressors to reduce air consumption. Reduction of air consumption at demand side leads to less pressure on compressors, which eventually leads to energy savings.
2. The project activity is to be carried out at three factories located on one project site.
3. The annual energy savings of the project activity is estimated to be 322.5-337.5MWh_e/year, as detailed in section B, which is clearly less than 60GWh/year. As per Appendix B and the Decision -/CMP.2, the aggregate energy savings by a single project may not exceed the equivalent of 60GWh/year for small-scale CDM project activity.
4. All the proposed improvement measures will be adopted within the existing air distribution system and one that has already been planned to add as DNMY will expand its production capacity at one of the plants.

All the features listed above shows conformity to the criteria set under project category II.C. of "*the Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities*" (referred to as Appendix B). Hence the selected project category of small-scale CDM methodology is applicable to the proposed CDM project.

Technology description:
DNMY has planned to adopt technologies which have been developed by DNPJ. The energy efficiency improvement measures are:
- Replacement of air nozzles and air guns
- Installation of electric facilities (blowers, vacuums, drivers) to replace compressed air
- Removal of boosters
- Replacement of air compressors

Replacement of air nozzles and air guns:
By replacing existing air nozzles to be used for general blow and cooling at manufacturing lines with high-efficient nozzles, air demand decreases so as electricity to generate compressed air. For implementing this technology, not only high-efficient nozzles but special skill and know how is required to achieve the same air pressure as with the existing ones. The skill and know how developed by DNJP will be transferred thorough training and work manuals.
Air guns will also be adopted to replace existing ones with energy saving types, which will result in the same effect as high-efficient air nozzles.

Installation of electric facilities (blowers, vacuums, drivers) to replace compressed air:
By installing new electric facilities to replace air compressed by existing compressors with air compressed and supplied locally nearby manufacturing facilities, energy efficiency to achieve the same

work will be reduced. Those electric facilities include blowers for aeration to mix detergent, blowers for washing blow and air vacuums for dust and have part.
Compressed air is currently used for air drivers, too. Those air drivers will be replaced with electric drivers, which means compressed air will not be needed for drivers any more. To achieve the same work, the energy amount consumed to compress air for air drivers is more than that directly powers the electric drivers. Therefore, total amount of energy will be reduced over all.

Removal of boosters
By introducing technologies such as increasing piping size, shortening hose length, and so on, some boosters can be removed, then adequate air pressure can still be derived and pressure loss can be minimized and stabilized. This measure leads to utilization of air demand and therefore to energy savings.

Replacement of air compressors:
This measure is simply to replace the existing air compressors with high-efficient ones, which will reduce energy consumption for the same output of compressed air.

The table A.4.2 shows the list of energy efficiency improvement measures adopted for this project and the plants and compressor rooms where they are to be applied.

Table A.4.2. List of energy efficiency improvement measures

measures	usage	101 plant	102 plant	103 Plant	comp 1*
Nozzles and guns	Blow gun	●	●	●	
	Washing blow	●			
	Cooling	●			
Electric facilities	General blow (blower)	●	●	●	
	Aeration (blower)	●			
	Dust vacuum		●	●	
	Vacuum			●	
	Driver	●	●		
Booster		●	●		
Compressors					●

Note: "●" shows the applicability of energy improvement measures.
* comp 1 : compressor room 1

Technology transfer:
Technology transfer takes place through the following actions:
1. Training of local staff conducted by the energy efficiency experts from DNJP.
2. Introducing state-of-the-art technologies for energy efficiency improvement in the field of air demand and supply at manufacturing process.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

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The renewable crediting period of 7 years has been chosen for this proposed project.

Years	Estimation of annual emission reductions in tones of CO_2e
2007.6 – 2008.5	203.5
2008.6 – 2009.5	213.0
2009.6 – 2010.5	213.0
2010.6 – 2011.5	213.0
2011.6 – 2012.5	213.0
2012.6 – 2013.5	213.0
2013.6 – 2014.5	213.0
Total estimated reductions (tones of CO_2e)	1481.5
Total number of crediting years	7 years
Annual average of the estimated reductions over the crediting period (tones of CO_2e)	211.6

Note: In year of 2008, expansion of manufacturing line will be scheduled at 103 plant, and the same facilities as present manufacturing line will be installed. As a result, 103 plant will increase in production about 20%.

A.4.4. Public funding of the small-scale project activity:

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No public funding from parties included Annex-I has been sought for the project activity.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

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As mentioned under Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM project Activities, the following results into debundling of large CDM project:

"A proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

- With the same project participants;
- In the same project category and technology/measure; and
- Registered within the previous 2 years; and whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point."

The project proponent confirms that it has not registered any small scale CDM activity or applied for registration another small scale CDM project activity within 1 km of the project boundary of this proposed project, in the same project category and technology/measure. Hence the above criteria of debundling cases are not applicable for these CDM projects.

SECTION B. Application of a baseline and monitoring methodology

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

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TYPE II – ENERGY-EFFICIANCY IMPROVEMENT PROJECTS
AMS-II.C : Demand-side energy efficiency programmes for specific technologies
Version 08

B.2 Justification of the choice of the project category:

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As per the provisions of paragraph 12 of Annex II: Simplified modalities and procedures for small scale clean development mechanism project activities [FCCC/KP/CMP/2005/8/Add.1], "To use simplified modalities and procedures for small-scale CDM project activities, a proposed project activity shall:

(a) Meet the eligibility criteria for small-scale CDM project activities set out in paragraph 6 (c) of decision 17/CP.7;
(b) Conform to one of the project categories in appendix B to this annex;
(c) Not be a debundled component of a larger project activity, as determined through appendix C to this annex."

The definitions for small-scale clean development mechanism project activities referred to in paragraph 6 (c) of decision 17/CP.7, was revised at CMP.2 as follows:

(a) Type I project activities shall remain the same, such that renewable energy project activities shall have a maximum output capacity of 15 MW (or an appropriate equivalent);
(b) Type II project activities or those relating to improvements in energy efficiency which reduce energy consumption, on the supply and/or demand side, shall be limited to those with a maximum output of 60 GWh per year (or an appropriate equivalent);
(c) Type III project activities, otherwise known as other project activities, shall be limited to those that result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually;

(a) Meet the eligibility criteria for small-scale CDM project activities set out in paragraph 6 (c) of decision 17/CP.7;

The proposed project activity includes replacement and installation of a set of equipments and facilities to improve energy efficiency in the factories of DNMY and reduces electrical energy consumption on demand side. This indicates that the project falls into the category of Type II as described above. In addition, the annual average electrical energy reduction is to be of the order of 322.5-337.5MWh$_e$/year, which is within the limit of small scale CDM project activity requirement. Therefore, the project activity meets the eligibility criteria for small-scale CDM project activities set out in paragraph 6 (c) of decision 17/CP.7

(b) Conform to one of the project categories in appendix B to this annex;
The project activity conforms to "Project Category - II.C. Demand-side energy efficiency programmes for specific technologies" in appendix B. Justification of this conformity has been provided in Section A.4.2.
Further comparison between the features of proposed project activity and project category - II.C. in appendix B described in table B.2.-1 and table B.2.-2 also shows the conformity in terms of baseline methodology and monitoring methodology.

Table B.2.-1. Relationship between the proposed project activity and the "Technology/measure" of project category - II.C

Technology/measure	This project activity
1. This category comprises programmes that encourage the adoption of energy-efficient equipment, lamps, ballasts, refrigerators, motors, fans, air conditioners, appliances, etc. at many sites. These technologies may replace existing equipment or be installed at new sites.	This proposed project activity adopts energy efficiency measures in three manufacturing factories and a compressor room of DNMY. Those measures planned to be introduced are: □Replacement of the existing air nozzles and air guns with high-efficient ones □Installation of electric facilities (blowers, vacuums, drivers) to replace compressed air □Removal of boosters □Replacement of air compressors with high-efficient ones
The aggregate energy savings by a single project may not exceed the equivalent of 60 GWh per year.	The annual average electrical energy reduction is expected to be the order of 322.5-337.5MWh$_e$/year, which is clearly below 60 GWh per year.

Table B.2.-2. Relationship between the proposed project activity and the "Monitoring" of project category - II.C

Monitoring	This project activity
7. If the devices installed replace existing devices, the number and "power" of the replaced devices shall be recorded and monitored.[1] [1] This shall be monitored while replacement is underway to avoid, e.g.. that 40W lamps are recorded as 100W lamps, greatly inflating the baseline.	(a) Installation of high-efficiency air nozzles and sir guns: Number of air nozzles and air guns to be replaced is recorded, and the air flow volume of existing nozzles is monitored and recorded by sampling tests. (b) Installation of high-efficiency air compressors: Number of existing compressors to be replaced and their nameplate data are monitored and recorded.

8. Monitoring shall consist of monitoring either the "power" and "operating hours" or the "energy use" of the devices installed using an appropriate methodology. Possible methodologies include: (a) Recording the "power" of the device installed (e.g., lamp or refrigerator) using nameplate data or bench tests of a sample of the units installed and metering a sample of the units installed for their operating hours using run time meters. OR (b) Metering the "energy use" of an appropriate sample of the devices installed. For technologies that represent fixed loads while operating, such as lamps, the sample can be small while for technologies that involve variable loads, such as air conditioners, the sample may need to be relatively large.	(a) High-efficiency air nozzles and air guns: Air flow volume as "power" using bench tests of a sample and production time as "operating hours" will be recorded for the proposed project activity, once the project is started. (b) High-efficiency air compressors and blowers: The amount of electricity consumption by all air compressors and electric facilities (blowers, vacuums drivers) installed will be metered and recorded.
9. In either case, monitoring shall include annual checks of a sample of non-metered systems to ensure that they are still operating (other evidence of continuing operation, such as on-going rental/lease payments could be a substitute).	About non-sampled facilities, including those which are not intended to improve, the number of operating facilities connected to the air distribution system is monitored annually.

(c) Not be a debundled component of a larger project activity, as determined through appendix C to this annex.
The project activity is not a debundled component of a larger project activity as determined through appendix C of Simplified Modalities and Procedures for Small Scale CDM Project Activities [FCCC/KP/CMP/2005/8/Add.1]. The justification of this conformity has been provided in Section A.4.5.

Therefore, applicability of the project activity to the project category - II.C. in appendix B has been determined.

B.3. Description of the project boundary:

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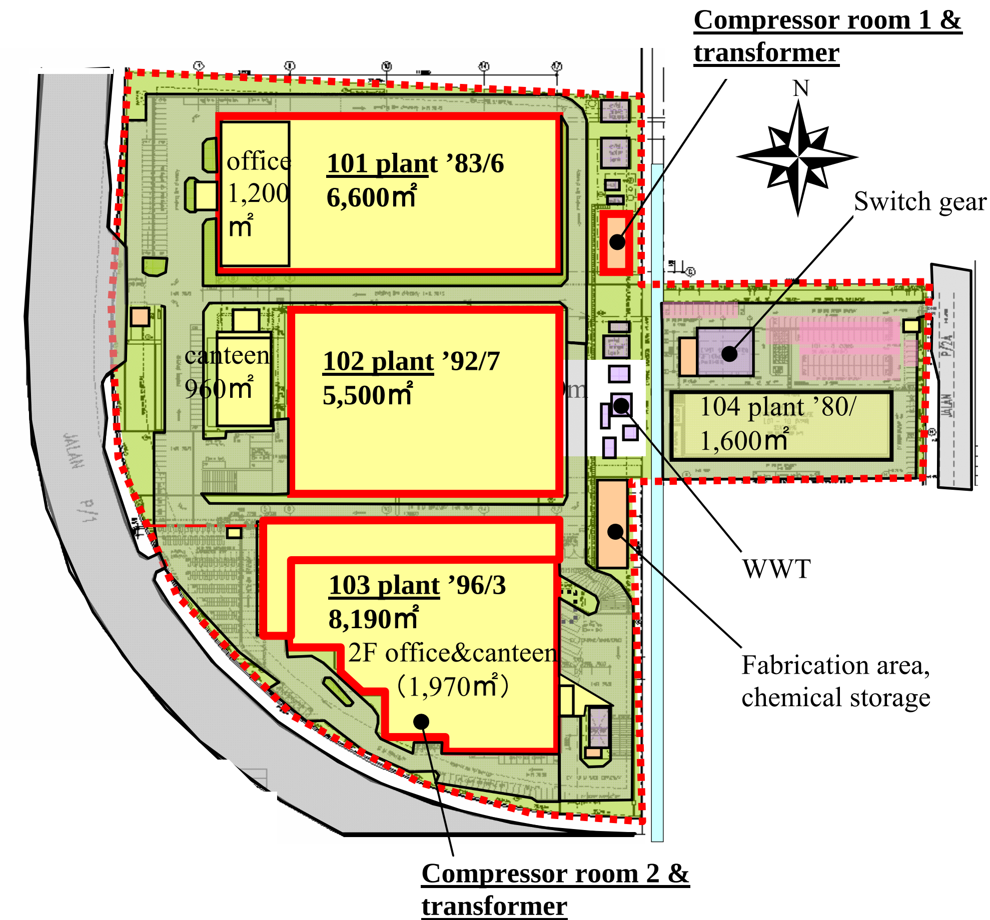
In accordance with the project category - II.C. in appendix B, "the project boundary is the physical, geographical location of each measure (each piece of equipment) installed."
The project activity involves a set of measures to improve energy efficiency in air demand and supply in manufacturing factories. Those measures are installed in three factories (101, 102 and 103 plants) in one geographical site.
There are four plants at the project site, but the project boundary involves only three of them. The project boundary is defined as two air distribution systems. One consists of air piping in 101 plant and 102 plant connected to compressors located outside 101 plant (compressor room 1). Another consists of air piping in 103 plant connected to compressors located inside 103 plant (compressor room 2).

GHG emission sources taken into account in the project activity are shown in the table B.3.

Table B.3. GHG emission sources related to the project activity

		Inside project boundary	Outside project boundary
Baseline Scenario	Calculated (to be monitored)	CO_2 emissions from electricity consumption of existing facilities	
	Not calculated (not to be monitored)	CH_4 and N_2O emissions from electricity consumption of existing facilities	
Project Scenario	Calculated (to be monitored)	CO_2 emissions from electricity consumption of facilities after applying energy-efficiency improvement measures	
	Not calculated (not to be monitored)	CH_4 and N_2O emissions from electricity consumption of facilities after applying energy-efficiency improvement measures	



B.4. Description of baseline and its development:

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According to the selected project category - II.C. in appendix B, baseline for the project of electricity displacement is described in paragraph 4 and 5:

4. If the energy displaced is electricity, the energy baseline is calculated as follows:
$E_B = \Sigma_i(n_i \cdot p_i \cdot o_i)$
Where:
E_B: annual energy baseline in kWh per year.
Σ_i: the sum over the group of "i" devices replaced (e.g. 40W incandescent bulb, 5hp motor), for which the replacement is operating during the year, implemented as part of the project.
n_i: the number of devices of the group of "i" devices replaced (e.g. 40W incandescent bulb, 5hp motor) for which the replacement is operating during the year.
p_i: the power of the devices of the group of "i" devices replaced (e.g. 40W, 5hp). In the case of a retrofit programme, "power" is the weighted average of the devices replaced. In the case of new installations, "power" is the weighted average of devices on the market.
o_i: the average annual operating hours of the devices of the group of "i" devices replaced.

5. The energy baseline is multiplied by an emission coefficient (measured in kg CO_2e/kWh) for the electricity displaced calculated in accordance with provisions under category I.D.

The project activity displaces the electricity in the baseline scenario and the quantum of displacement would be the difference in the energy consumption that occurred in the baseline scenario (i.e. pre-project activity) and project scenario (i.e. post project activity). The baseline scenario of proposed project is assumed to be a continuation of current practice, which does not include any energy efficiency improvement measures in existing air distribution systems but does only include compressed air leakage control regularly. Logical explanation for this assumption is detailed in section B.5. Since the expansion of manufacturing line in the year 2008 has already been planned, installation of sir related devices is included in the baseline scenario.

As stated above, the applied methodology corresponds to approved methodology AMS II.C., Version 8, and is developed along the following steps:

1. The amount of annual electricity consumption in baseline scenario (E_B) is equal to that of electricity consumed annually by air compressors ($E_{B\ comp}$).
2. The amount of electricity consumed annually by air compressors ($E_{B\ comp}$) is determined by the following three variables:
   (a) The number of compressor units in baseline scenario ($n_{B\ comp}$)
   (b) Electricity consumption per hour of a compressor unit in baseline scenario ($p_{B\ comp}$)
   (c) Annual Operation hours ($o_{B\ comp}$)
3. Electricity consumption per hour of a compressor unit in baseline scenario ($p_{B\ comp}$) is determined by the following two variables:
   (a) Average air flow volume per hour of a compressor unit in baseline scenario ($F_{B\ air.comp}$)
   (b) Air flow volume per electricity consumption of a compressor unit in baseline scenario ($AF_{B\ comp}$)
4. Average air flow volume per hour of a compressor unit in baseline scenario ($F_{B\ air.comp}$) is determined by the following three variables:
   (a) Total air flow volume per hour consumed by improved-devices in baseline scenario ($F_{B\ air.improve}$)

(b) Total air flow volume per hour consumed by NOT-improved-devices ($F_{air.NOT\ improve}$)
(c) The amount of air leakage per hour (***AL***)

5. Total air flow volume per hour consumed by improved-devices in baseline scenario ($F_{B\ air.improve}$) is determined by the following three variables:
(a) The number of group "j" air-consuming devices under the same condition in air supply system "i" ($n_{improve.i,j}$)
(b) Air flow volume consumed by one in group "j" air-consuming devices under the same condition in air supply system "i" in baseline scenario ($F_{B\ air.\ improve.\ i,j}$)
(c) On/Off time ratio in production time ($OF_{on/off\ i,j}$)
6. Total air flow volume per hour consumed by NOT-improved-devices ($F_{air.NOT\ improve}$) is determined by the following two variables:
(a) Average air flow volume per hour of a compressor unit in project scenario
(b) Total air flow volume per hour consumed by improved air-consuming devices in project scenario
7. Emission coefficient of the connected grid is determined by the following three steps:
(a) Calculation of the Operating Margin emission factor ($EF_{OM,y}$)
(b) Calculation of the Building Margin emission factor ($EF_{BM,y}$)
(c) Calculation of the Combined Margin emission factor and derive the baseline emission factor (EF_{grid})
8. The energy baseline ($E_{B\ comp}$) is multiplied by an emission coefficient (EF_{grid}) for the electricity displaced calculated in accordance with provisions under category I.D.

Table below shows the key variables and parameters to be used in this baseline calculation for the proposed project activity.

Variables/ Parameters	Description	Data source
E_B	Annual electricity consumption in baseline scenario	Calculated by DNMY
$E_{B\ comp}$	Annual electricity consumption of compressor units in baseline scenario	Calculated by DNMY
$n_{B\ comp}$	The number of compressor units in baseline scenario	Monitored by DNMY
$p_{B\ comp}$	Electricity consumption per hour of a compressor unit in baseline scenario.	Calculated by DNMY
$o_{B\ comp}$	Annual Operation hours	Calculated by DNMY
$F_{B\ air.comp}$	Average air flow volume per hour of a compressor unit in baseline scenario	Calculated by DNMY
$AF_{B\ comp}$	Air flow volume per electricity consumption of a compressor unit in baseline scenario	Specified by compressor manufacturers
$F_{B\ air.\ improve}$	Total air flow volume per hour consumed by improved-devices in baseline scenario	Calculated by DNMY
$F_{air.\ NOT\ improve}$	Total air flow volume per hour consumed by NOT-improved-devices	Calculated by DNMY
AL	The amount of air leakage per hour	Monitored by DNMY
$OF_{on/off\ i,j}$	On/Off time ratio in production time	Sample monitored by DNMY
$n_{improve\ \ i,j}$	The number of group "j" air-consuming devices under the same condition in air supply system" i"	Monitored by DNMY

Variables/ Parameters	Description	Data source
$F_{B\ air.improve\ i,j}$	Air flow volume consumed by one in group "j" air-consuming devices under the same condition in air supply system " i" in baseline scenario	Sample monitored by DNMY
$F_{P\ air.comp}$	Average air flow volume per hour of a compressor unit in project scenario	Monitored by DNMY
$F_{P\ air.\ improve}$	Total air flow volume per hour consumed by improved air-consuming devices in project scenario	Calculated by DNMY
$EF_{OM,y}$	Emission Factor of Operating margin	Official data from Pusat Tenaga Malaysia, and calculated by DNMY
$EF_{BM,y}$	Emission Factor of Build Margin	Official data from Pusat Tenaga Malaysia, and calculated by DNMY
EF_{grid}	Emission Factor of the connected grid	Official data from Pusat Tenaga Malaysia, and calculated by DNMY

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 small-scale CDM project activity:

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In order to establish the project activity is additional, the project proponents identified plausible project alternatives, which include all possible courses of action that could be adopted. These plausible options were further analyzed as per the guidance in Attachment A to Appendix B of the small scale modalities and procedures to establish project additionality and determine an appropriate and conservative baseline scenario.

In accordance with paragraph 28 of the simplified modalities and procedures for small-scale CDM project activities, a simplified baseline and monitoring methodology listed in Appendix B may be used if project participants can demonstrate that the project activity would otherwise not be implemented due to the existence of one or more barrier(s) listed in attachment A of Appendix B; (a) investment barrier, (b) Technological barrier, (c) Barrier due to prevailing practice, (d) Other barriers.

To identify the baseline scenario and demonstrate additionality, the following four steps have been applied;

STEP 1. Identification of alternative scenarios including consistency with mandatory applicable laws and regulations
STEP 2. Investment analysis
STEP 3. Barrier analysis (technology, prevailing practice, other barriers)

STEP 1. Identification of alternative scenarios:

There are three plausible alternatives considered by the project proponents:

Alternative 1- Continuation of current situation; No energy efficiency measure will be implemented
Alternative 2- Alternative energy efficiency improvement measures will be implemented

Alternative 3- The planned energy efficiency improvement measures will be implemented without CDM

In the alternative 1, DNMY would continue its manufacturing operation with the existing equipments and facilities which consume compressed air. This alternative is in compliance with all mandatory applicable laws and regulations.
In the alternative 2, there are some options to achieve energy efficiency in air distribution system, and DMNY may adopt one of the options.
In the alternative 3, DNMY would willingly implement the energy efficiency measures planned in this proposed project activity as business as usual practice.
As stated in 9th Malaysia Plan 2006-2010 chapter 19, energy efficiency initiatives are emphasized particularly industrial, transport and commercial sectors to ensure efficient utilization of energy resources. In compliance with the Plan, Malaysian Industrial Energy Efficiency Improvement Project (MIEEP) has been launched, and a set of programmes have been carried out. However energy efficiency in industrial sector is very much encouraged, it is not required for manufacturers to reduce their energy consumption to a prescribed standard. Therefore, the alternative-2 and -3 are also in compliance with all mandatory applicable laws and regulations.

STEP 2. Investment analysis:
DNMY adopts “payback time” as an indicator to evaluate whether the investment plan for energy efficiency improvement is attractive or not. The standard of minimum payback time for this kind project has been set as 3 years at DNMY.
In order to examine and implement the energy efficiency improvement measures, energy saving diagnosis was carried out by the experts of DNJP at the factories of DNMY. The table B.5. shows the study of payback time for each type of energy efficient measures based on the diagnosis. Costs for each measure to be implemented were estimated with variation between minimum and maximum based on the experiences of the experts who had actually practiced diagnosis in DNMY. Among those estimations the minimum estimated costs were selected for the proposed project as a conservative manner.

To estimate payback time, equipments costs are simply used for items of “nozzles and guns”, “electric facilities” and “boosters” since they are newly installed or replaced only when this project activity takes place.

Table B.5.-1. Payback time of each type of energy efficient measures

EE measures	items	total costs*	07-08 savings	08-14 savings	payback time
		RM	RM	RM	year
nozzles and guns	Blow gun	15,818	2,782	2,844	5.69
	General blow	56,364	6,866	7,007	8.21
	Cooling	11,818	338	338	34.97
	sub total	84,000	9,986	10,189	8.41
electric facilities	Washing blow	101,818	2,385	2,385	42.70
	Aeration	56,364	17,989	17,989	3.13
	Mist	126,061	13,649	16,206	9.24
	Vacuum	47,273	1,391	1,669	33.99
	air driver	68,485	992	992	69.05
	sub total	400,000	36,405	39,240	10.99
boosters		24,545	253	253	96.83
air compressors		227,273	8,970	8,970	26.55

* total costs : include “costs of each equipments adopted”, “diagnosis costs equally allocated to each item**” and “training costs equally allocated to each item***”
** diagnosis costs: Energy efficiency diagnosis is a part of the project activity and has been carried out in order to decide what measures to be adopted for the project. Numbers of this column are equal allocation of the total diagnosis costs (39,400 RM) to each item.
*** training costs: Energy efficiency training is to be carried out by DNJP to implement these energy efficiency measures properly once project has begun. Numbers of this column are equal allocation of the total training costs (69,700 RM) to each item

As shown in the table B.5-1., even the measure with the best cost effectiveness such as “Aeration” exceeds the standard payback periods of 3 years which has been set by DNMY. This fact indicates that the energy efficient measures proposed in this project activity are not attractive investment options for DNMY.

STEP 3. Barrier analysis (technology, prevailing practice, other barriers):

1. Technological barrier:
Since there are a set of technologies to be adopted in the project activity, technological barrier should be considered for each type of improvement measures.

(a) Air nozzles and air guns
The energy-efficiency improvement measures that DNJP owns such as high-efficiency air nozzles and air guns are considered to be state-of-the-art technologies even in Japan with such an advanced level of energy-efficiency improvement. Those technologies of Denso were also selected as “The Excellent Practice of Energy Efficiency Award” by the METI (the Ministry of Economy, Trade and Industry). DNMY has few Malaysian engineers with enough knowledge and experience to properly operate and manage the energy-efficiency improvement technologies to be introduced as CDM project. To overcome this barrier, additional local staff training and education programs for them will be implemented in the project activity.

(b) Electric facilities
Facilities which currently use compressed air as power supply are replaced with ones powered by electricity. Not only energy efficiency diagnosis skills but appropriate selection of nozzles and rearrangement of piping are required to install electric facilities properly which perform at required work levels.

(c) Boosters
Removal of boosters requires very high skill to re-design air system for optimization. That kind of skill has been experienced and developed by DNJP, and additional local staff training and education programs for them will also be implemented in the project activity.

(d) Air compressors
When one air compressor out of a unit is replaced, coordination and utilization of those compressors is normally needed for optimal operation. Since a control system of air compressors has already been adopted in DNMY a few years ago, there will be less technological barrier for update in this aspect. However, this can not be achieved only with simple coordination and utilization of compressors. Reduction of air volume will lead to reduction of air supply pressure, which will result in reduction of electricity consumption, then appropriate rearrangement of piping and experienced skills are required to implement.

In any cases, relatively high level of technologies and skills is required to implement these energy efficiency items to be operated and achieve required work level. There are few engineers in Malaysia who have these technologies and skills as detailed below in "2. Barrier due to prevailing practice". Therefore, the proposed project can not be done without transferring the-state-of-art technologies of DNJP.

2. Barrier due to prevailing practice:
As stated above, MIEEP has been launched in Malaysia, and several programmes to encourage energy efficiency at industrial sector have been carried out. One of the programmes is to introduce the-state-of-art technologies as case studies conducted by Pusat Tenaga Malaysia, a national energy research centre for Malaysia. However the case studies include some cases of energy efficiency, they are such as "utilization of compressed air system", "compressed air leakage control" and "compressed air control system", which are very common to be practiced by the companies like DNJP. This indicates that the measures proposed in the project activity are not well-known and not commonly practiced in Malaysia.

The analysis demonstrates the existence of several issues which make the DENSO technology appear most unattractive to manufacturers of automotive parts. Given these high barriers, in the absence of the project activity it is expected that manufacturers will continue to use the current and existing technologies. The project activity would therefore result in lower CO_2 emissions compared to the level of CO_2 emissions that would occur if an equivalent amount of automotive parts were to be manufactured with using the current and existing technologies already adopted. The project activity should therefore be considered additional.

The analysis of additionality is summarised in table B.5.-2.

Table B.5.-2. The summary of Additionality analysis

Energy efficiency measures	Investment analysis/barrier	Technological barrier	Barrier due to Prevailing practice	Identified alternative
Blow gun	Yes	High	High	Alternative 1
General blow	Yes	High	High	Alternative 1
Cooling	Yes	High	High	Alternative 1
Washing blow	Yes	High	High	Alternative 1
Aeration	Yes	High	High	Alternative 1
Mist	Yes	High	High	Alternative 1
Vacuum	Yes	High	High	Alternative 1
Air driver	Yes	High	High	Alternative 1
Booster	Yes	High	High	Alternative 1
Air compressor	Yes	Middle	Middle	Alternative 1

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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Project category-II.C in Appendix B is applied for the proposed project activity as explained in B.1. and B.2. of this PDD.

II.C in Appendix B offers the equation below in order to calculate annual electricity consumption in baseline scenario.

4. If the energy displaced is electricity, the energy baseline is calculated as follows:

$$E_B = S_i(n_i \cdot p_i \cdot o_i)$$

E_B annual energy baseline in kWh per year

S_i the sum over the group of "i" devices replaced (e.g. 40W incandescent bulb, 5hp motor), for which the replacement is operating during the year, implemented as part of the project.

n_i the number of devices of the group of "i" devices replaced (e.g. 40W incandescent bulb, 5hp motor) for which the replacement is operating during the year.

p_i the power of the devices of the group of "i" devices replaced (e.g. 40W, 5hp). In the case of a retrofit programme, "power" is the weighted average of the devices replaced. In the case of new installations, "power" is the weighted average of devices on the market.

o_i the average annual operating hours of the devices of the group of "i" devices replaced.

The amount of reduced GHG emissions for the project activity is calculated as follows.

$$ER_y = BE_y - PE_y$$
$$= (E_B - E_P) * EF_{grid} - L$$

Where	Description	unit	Monitor no.
ER_y	Annual reduction of GHG emissions	tCO_2e/y	1
BE_y	Annual GHG emissions in baseline scenario	tCO_2e/y	2
PE_y	Annual GHG emissions in project scenario	tCO_2e/y	3
E_B	Annual electricity consumption in baseline scenario	MWh/y	4
E_P	Annual electricity consumption of compressor units in project scenario	MWh/y	24
EF_{grid}	Emission Factor of the connected grid	kg CO_2e/kWh	23
L	Annual GHG emission from outside of the boundary in project scenario (leakage)	tCO_2e/y	—

1) Annual electricity consumption in baseline scenario (E_B)

1)-1Calculation of Annual Electricity Consumption

The project employs the baseline scenario assuming that the existing air-related devices (e.g. nozzles, air-driver and compressors) will not be improved in the project period. Therefore, the amount of electricity consumption in the baseline scenario is equal to that of the exiting compressors.
In the year 2008, there is the plan to build on new manufacturing line in 103 plant, air-related devices will install existing model in the baseline scenario.

$$E_B = E_{B\ comp}$$

Where	Description	unit	Monitor no.
E_B	Annual electricity consumption in baseline scenario	MWh/y	4
$E_{B\ comp}$	Annual electricity consumption of compressor units in baseline scenario	MWh/y	5

$$E_{B\ comp} = S\ (n_{B\ comp} * p_{B\ comp} * o_{B\ comp})$$

$$p_{B\ comp} = F_{B\ air.comp} / AF_{B\ comp} / 1000$$

Where	Description	unit	Monitor no.
$E_{B\ comp}$	Annual electricity consumption of compressor units in baseline scenario	MWh/y	5
$n_{B\ comp}$	The number of compressor units in baseline scenario	-	6
$p_{B\ comp}$	Electricity consumption per hour of a compressor unit in baseline scenario.	MWh/h	7
$o_{B\ comp}$	Annual Operation hours	h/year	8
$F_{B\ air.comp}$	Average air flow volume per hour of a compressor unit in baseline scenario	m^3/h	10
$AF_{B\ comp}$	Air flow volume per electricity consumption of a compressor unit in baseline scenario	m^3/kWh	11

1)-2 Average air flow volume per hour generated by compressor units

Electricity consumption per hour of compressors is correlated to flow volume of compressed air they supply. The air flow volume per hour is the total of air flow volume of the improved-devices and the not-improved-devices, and the amount of air leakage identified.

$$F_{B\ air.comp} = F_{B\ air.improve} + F_{air.NOT\ improve} + AL$$

$$F_{B\ air.\ improve} = S_i\ (S_j\ (n_{improve.i,j} * F_{B\ air.\ improve.\ i,j} * OF_{on/off\ i,j})\ *60\ /\ 1000$$

$$F_{air.\ NOT\ improve} = F_{P\ air.comp} - F_{P\ air.\ Improve} - AL$$

Where	Description	unit	Monitor no.
$F_{B\ air.comp}$	Average air flow volume per hour of a compressor unit in baseline scenario	m^3/h	10
$F_{B\ air.\ improve}$	Total air flow volume per hour consumed by improved-devices in baseline scenario	m^3/h	12
$F_{air.\ NOT\ improve}$	Total air flow volume per hour consumed by NOT-improved-devices	m^3/h	13
AL	The amount of air leakage per hour	m^3/h	14
$OF_{on/off\ i,j}$	On/Off time ratio in production time	%	15
$n_{improve.\ i,j}$	The number of group “j” air-consuming devices under the same condition in air supply system” i”	-	16
$F_{B\ air.\ improve\ i,j}$	Air flow volume consumed by one in group “j” air-consuming devices under the same condition in air supply system “ i” in baseline scenario	m^3/h	17
$F_{P\ air.comp}$	Average air flow volume per hour of a compressor unit in project scenario	m^3/h	18
$F_{P\ air.\ improve}$	Total air flow volume per hour consumed by improved air-consuming devices in project scenario	m^3/h	19

*1; The same condition means the same facilities’ specifications and the same use condition (continuous operation/intermittent operation)

*2; $F_{air.\ NOT\ improve}$ include air flow where used for monitoring air-leakage (annually).

2) Annual electricity consumption of compressor units in project scenario (E_P)

Assuming that the project is carried out, the annual electricity consumption is the total sum of that of compressors and electrical devices that are newly installed. This equation is considered to be the most accurate to calculate the value of project emission, since the parameter $E_{P\ comp}$ is actually measured after the project takes place and the parameter $E_{P\ electricity}$ is calculated based on spec of devices (provided by manufacturers), operating factor (on/off ratio, calculated in energy efficiency diagnosis) and operation time (actual operation time in each factories).

$$E_P = \quad (E_{P\ comp} + E_{P\ electricity})$$

Where	Description	unit	Monitor no.
E_P	Annual electricity consumption in project scenario	MWh/y	23
$E_{P\ comp}$	Annual electricity consumption of compressor units in project scenario	MWh/y	24
$E_{P\ electricity}$	Annual electricity consumption of installed electrical devices	MWh/y	25

3) Emission Factor of the connected grid (EF_{grid})

The project applies Combined Margin for Emission Factor of the connected electricity grid on the basis of AMS-I.D. version 10 and ACM0002 version 6.

STEP 1. Calculate the Operating Margin emission factor(s) ($EF_{OM,y}$)

In order to calculate OM, the project adopts (a)Simple OM amongst 4 options given in ACM0002, due to the reasons below.

- ”Study on Grid Connected Electricity Baseline in Malaysia : April 2006”, published by Puset Tenaba Malaysia , shows that no data needed for dispatch data analysis are available. Therefore, (c) Dispatch Data Analysis OM, the first option, is rejected.

- According to ACM0002, low-cost/must run resources shall constitute more than 50% of total grid generation so that a project adopts (d) Average OM. However in the case of the grid serving Peninsula Malaysia, the energy from hydraulic power plant which corresponds to the “low-cost/must run resources” from 2001 to 2004 is less than 10% of total electricity generated. Thus, (d) Average OM is rejected.

- According to ACM0002, low-cost/must run resources shall constitute more than 50% of total grid generation so that a project adopts (a) simple OM. Since the grid serving Peninsula Malaysia matches the criterion, the project rejects (b) Simple adjusted OM, and adopts (a) Simple OM.

The OM emission factor for the project activity is calculated ex-ante as a 3-year average based on the most recent 3-year data of electricity generation.

For calculation of Simple OM, the project employs the following equation based on ACM0002.

$$EF_{OM,y} = S_{i,j}(F_{i,j,y} * COEF_{i,j}) \ / \ S_j(GEN_{j,y})$$

Where	Description	unit	Monitor no.
$EF_{OM,y}$	Emission Factor of Operating margin	kg CO_2e/kWh	20
$F_{i,j,y}$	the amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources *j* in year(s) *y*,	-	-
j	*j* refers to the power sources delivering electricity to the grid, not including low-operating cost and mustrun power plants, and including imports[6] to the grid	-	-

$COEF_{i,j\,y}$	the CO_2 emission coefficient of fuel *i* (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources *j* and the percent oxidation of the fuel in year(s) *y*, and	-	-
$GEN_{j,y}$	the electricity (MWh) delivered to the grid by source *j*.	MWh	-

$$COEF_i = NCV_i * EF_{CO_2,i} * OXID_i$$

Where	Description	unit	Monitor no.
NCV_i	net calorific value (energy content) per mass or volume unit of a fuel *i*,	-	-
$OXID_i$	oxidation factor of the fuel (see page 1.29 in the 1996 Revised IPCC Guidelines for default values),	-	-
$EF_{CO_2,i}$	CO_2 emission factor per unit of energy of the fuel *i*. Where available, local values of ***NCV_i*** and ***$EF_{CO_2,i}$*** should be used. If no such values are available, country-specific values (see e.g. IPCC Good Practice Guidance) are preferable to IPCC world-wide default values.	-	-

STEP 2. Calculate the Build Margin emission factor ($EF_{BM,y}$)

The Build Margin emission factor for the project activity is calculated ex-ante as the data from 5 most recently constructed power plants

For calculation of BM, the project employs the following equation based on ACM0002.

$$EF_{BM,y} = S_{i,m}(F_{i,m,y} * COEF_{i,m}) / S_m (GEN_{m,y})$$

Where	Description	unit	Monitor no.
$EF_{BM,y}$	Emission Factor of Build Margin	Kg CO_2e/kWh	21
$F_{i,m,y}$	the amount of fuel i (in a mass or volume unit) consumed by relevant power sources m in year(s) y,	-	-
m	The sample group m consists of either the five power plants that have been built most recently	-	-
$COEF_{i,m,y}$	the CO_2 emission coefficient of fuel i (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources m and the percent oxidation of the fuel in year(s) y, and	-	-
$GEN_{m,y}$	the electricity (MWh) delivered to the grid by source m.	MWh	-

STEP 3. Calculate the baseline emission factor EF_y

For calculation of Combined Margin, the project employs the following equation based on ACM0002.

$$EF_{grid} = w_{OM} * EF_{OM,y} + w_{BM} EF_{BM,y}$$

Where	Description	unit	Monitor no.
EF_{grid}	Emission Factor of the connected grid	kg CO_2e/kWh	22
w_{OM} w_{BM}	the weights w_{OM} and w_{BM}, by default, are 50% (i.e., $w_{OM} = w_{BM} = 0.5$)	%	-

4) Annual GHG emission from outside of the boundary in project scenario (leakage)

4)-1 Determined leakage

II.C in Appendix B mentions leakage to be considered as follows.

Leakage

6. If the energy efficiency technology is equipment transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered.

There is no leakage in the project on either installation side or disposal side, due to the following reasons. The project intends to install high-efficiency nozzles and air compressors, and blower. These facilities are not relocated from other factories, but newly purchased. Thus, the leakage on the installation side does not occur.
In addition, existing air nozzles and compressors are to be disposed of. Also, HFC, refrigerant of compressors, is safely extract or decomposed by the designated disposal services. Therefore, the leakage on the disposal side does not occur.
Moreover, the project files necessary evidences to verify these facts.

4)-2 Other leakage

No change in GHG emissions associated with the project occurs outside the boundary.

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

(Copy this table for each data and parameter)

1) Emission Factor of the connected Grid

Data / Parameter:	***EF_{grid}***
Data unit:	*kg CO_2/kWh*
Description:	*Emission Factor of the connected grid*
Source of data used:	*Calculation / Official data*
Value applied:	0.631
Justification of the choice of data or description of measurement methods and procedures actually applied :	*Data from "Study on Grid Connected Electricity Baselines in Malaysia" Pusat Tenaga Malaysia/Danida April 2006*
Any comment:	*Pusat Tenaga Malaysia : a national energy research centre for Malaysia.* *See B.6.3 1)-3*

Data / Parameter:	***$EF_{OM,y}$***
Data unit:	*kg CO_2/kWh*
Description:	*Emission Factor of Operation Margin*
Source of data used:	*Calculation / Official data*
Value applied:	0.580
Justification of the choice of data or description of measurement methods and procedures actually applied :	*Data from "Study on Grid Connected Electricity Baselines in Malaysia" Pusat Tenaga Malaysia/Danida April 2006*
Any comment:	*Pusat Tenaga Malaysia : a national energy research centre for Malaysia.* *See B.6.3 1)-3*

Data / Parameter:	***$EF_{BM,y}$***
Data unit:	*kg CO_2/kWh*
Description:	*Emission Factor of Build Margin*
Source of data used:	*Calculation / Official data*
Value applied:	0.681
Justification of the choice of data or description of measurement methods and procedures actually applied :	*Data from "Study on Grid Connected Electricity Baselines in Malaysia" Pusat Tenaga Malaysia/Danida April 2006*
Any comment:	*Pusat Tenaga Malaysia : a national energy research centre for Malaysia.* *See B.6.3 1)-3*

2) Monitoring at initial diagnosis

Data / Parameter:	***$OF_{on/off\ i,j}$***
Data unit:	*%*
Description:	*On/Off time ratio in production time*
Source of data used:	*Monitor (Initial Diagnosis Data)*
Value applied:	*See Annex 3-1*
Justification of the choice of data or description of measurement methods and procedures actually applied :	*At initial diagnosis, adviser of DNJP measured operation time of all improvement devices.*
Any comment:	

Data / Parameter:	***$F_{B\ air.\ improve\ i,j}$***
Data unit:	*m3/h*
Description:	*Air flow volume consumed by one in group "j" air-consuming devices under the same condition in air supply system " i" in baseline scenario*
Source of data used:	*Monitor (Initial Diagnosis Data)*
Value applied:	*See Annex 3-1*
Justification of the choice of data or description of measurement methods and procedures actually applied :	*At initial diagnosis, adviser of DNJP measured flow volume of all improvement devices by using flow meter.*
Any comment:	*These monitoring activities are aimed to keep quality of products.*

Data / Parameter:	***$F_{P\ air.\ improve\ i,j}$***
Data unit:	*m3/h*
Description:	*Air flow volume consumed by one in group "j" air-consuming devices under the same condition in air supply system " i" in project scenario*
Source of data used:	*Monitor (Initial Diagnosis Data)*
Value applied:	*See Annex 3-1*
Justification of the choice of data or description of measurement methods and procedures actually applied :	*At initial diagnosis, adviser of DNJP measured flow volume of all improvement devices by using flow meter.*
Any comment:	*These monitoring activities are aimed to keep quality of products.*

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

In the year 2008, there is the plan to build on new manufacturing line in 103 plant, air-related devices will install existing model in the baseline scenario.

1) Project Emission (PE_y)

Anthropogenic GHG emissions due to the project within the boundary are calculated ex-ante as follows.

$$PE_y = E_P * EF_{grid}$$
$$E_P = (E_{P\ comp} + E_{P\ electricity})$$

Where	Description	unit
PE_y	Annual GHG emissions in project scenario	tCO_2e/y
E_P	Annual electricity consumption in project scenario	MWh/y
EF_{grid}	Emission Factor of the connected grid	kg CO_2e/kWh
$E_{P\ comp}$	Annual electricity consumption of compressor units	MWh/y
$E_{P\ electricity}$	Annual electricity consumption of the installed electric facilities	MWh/y

1)-1 $E_{P\ comp}$

Annual electricity consumption of compressor units is calculated ex-ante as follows.

$$E_{P\ comp} = S\ (n_{P\ comp} * p_{P\ comp} * o_{P\ comp})$$
$$p_{P\ comp} = F_{P\ air.comp} / AF_{P\ comp} / 1000$$

Where	Description	unit
$E_{P\ comp}$	Annual electricity consumption of compressor units	MWh/y
$n_{P\ comp}$	The number of compressor units in project scenario	-
$p_{P\ comp}$	Electricity consumption per hour of a compressor unit in project scenario	MWh/h
$o_{P\ comp}$	Annual operating hours	h/year
$F_{P\ air.comp}$	Average air flow volume per hour of a compressor unit in project scenario	m^3/h
$AF_{P\ comp}$	Air flow volume per electricity consumption of a compressor unit in project scenario	m^3/kWh

$$F_{P\ air.comp} = F_{P\ air.improve} + F_{air.NOT\ improve} + AL$$

$$F_{P\ air.\ improve} = S_i\ (S_j\ (n_{improve.i,j} * F_{P\ air.\ improve.\ i,j} * OF_{on/off\ i,j})*60\ /\ 1000$$

$$F_{air.\ NOT\ improve} = F_{B\ air.comp} - F_{B\ air.\ Improve} - AL$$

Where	Description	unit
$F_{P\ air.comp}$	Average air flow volume per hour of compressor units in project scenario	m^3/h
$F_{P\ air.improve}$	Total air flow volume per hour consumed by improved-devices in project scenario	m^3/h
$F_{air.NOT\ improve}$	Total air flow volume per hour consumed by NOT-improved-devices	m^3/h
AL	Air leakage per hour in project scenario	m^3/h
$n_{improve.\ i,j}$	The number of group “j” air-consuming devices under the same condition in air supply system” i”	-
$F_{P\ air.\ improve\ i,j}$	Air flow volume consumed by one in group “ j” air-consuming devices under the same condition in air supply system “ i” in project scenario	l/min
$OF_{on/off\ i,j}$	On/Off time ratio in production time	%
$F_{B\ air.comp}$	Average air flow volume per hour of a compressor unit in baseline scenario	m^3/h
$F_{B\ air.\ improve}$	Total air flow volume per hour consumed by air-consuming devices in baseline scenario	m^3/h

*1; The same condition means the same facilities’ specifications and the same use condition (continuous operation/intermittent operation)

*2; $F_{air.\ NOT\ improve}$ include air flow where used for monitoring air-leakage (annually).

Estimation $E_{P\ comp}$ （2007.6 - 2008.5 : before increasing manufacturing line at 103 plant）

Table B6.3-1 Estimation $F_{P\ air.improve}$

System	Item	$n_{improve.i,j}$	$F_{P\ air.\ improve.\ i,j}$	$OF_{on/off\ i,j}$	$F_{P\ air.\ improve}$
101&102	Blow gun	48	122 l/min	5 %	17.6 m^3/h
	General blow	31	210 l/min	25 %	97.7 m^3/h
	Cooling	1	140 l/min	100 %	8.4 m^3/h
	Booster	9	50 l/min	10 %	2.7 m^3/h
103	Blow gun	5	122 l/min	5 %	1.8 m^3/h
	General blow	16	210 l/min	5 %	10.1 m^3/h

Table B6.3-2 Estimation $F_{air.\ NOT\ improve}$

System	$F_{B\ air.comp}$	$F_{B\ air.\ improve}$	AL	$F_{air.NOT\ improve}$
101&102	1937.8 m^3/h	531.0 m^3/h	31.9 m^3/h	1374.9 m^3/h
103	3600.1 m^3/h	306.4 m^3/h	1.6 m^3/h	3292.1 m^3/h

Table B6.3-3 Estimation $E_{P\ comp}$

System	$n_{P\ comp}$	$p_{P\ comp}$		$o_{P\ comp}$*1	$E_{P\ comp}$
		$F_{P\ air.comp}$	$AF_{P\ comp}$		
101&102	1 unit	1533.1	12.06	4080 hours	518.85 MWh/y
103	1 unit	3305.6	10.4	5760 hours	1830.81 MWh/y
				$E_{P\ comp}$	2349.66 MWh/y

*1 Operating hour = 17h/day(101&102 plant)、24h/day(103 plant)
Annual operating time = 240day/year (all plants)

Estimation $E_{P\ comp}$ (2008.6 - 2014.5 : after increasing manufacturing line at 103 plant)

Table B6.3-4 Estimation $F_{P\ air.improve}$

System	Item	$n_{improve.i,j}$	$F_{P\ air.improve.i,j}$	$OF_{on/off\ i,j}$	$F_{P\ air.improve}$
101&102	Blow gun	48	122 l/min	5 %	17.6 m^3/h
	General blow	31	210 l/min	25 %	97.7 m^3/h
	Cooling	1	140 l/min	100 %	8.4 m^3/h
	Booster	9	50 l/min	10 %	2.7 m^3/h
103	Blow gun	6	122 l/min	5 %	2.2 m^3/h
	General blow	19	210 l/min	5 %	12.0 m^3/h

Table B6.3-5 Estimation $F_{air.\ NOT\ improve}$

System	$F_{B\ air.comp}$	$F_{B\ air.\ improve}$	AL	$F_{air.NOT\ improve}$
101&102	1937.8 m^3/h	531.0 m^3/h	31.9 m^3/h	1374.9 m^3/h
103	4320.1 m^3/h	367.4 m^3/h	1.9 m^3/h	3950.8 m^3/h

Table B6.3-6 Estimation $E_{P\ comp}$

System	$n_{P\ comp}$	$p_{P\ comp}$		$o_{P\ comp}$*1	$E_{P\ comp}$
		$F_{P\ air.comp}$	$AF_{P\ comp}$		
101&102	1 unit	1533.1	12.06	4080 hours	518.85 MWh/y
103	1 unit	3966.8	10.4	5760 hours	2197.02 MWh/y
				$E_{P\ comp}$	2715.87 MWh/y

*1 Operating hour = 17h/day(101&102 plant)、24h/day(103 plant)
Annual operating time = 240day/year (all plants)

1)-2 $E_{P\ electricity}$

Annual electricity consumption of the installed electric facilities is calculated ex-ante as follows.

$$E_{P\ electricity} = S_i\,(n_{P\ electricity} * p_{P\ electricity} * o_{P\ electricity})$$

$$p_{P\ electricity\ r} = SP_{electricity} * OF_{on/off\ i,j} / 1000$$

Where	Description	unit
$E_{P\ electricity}$	Annual electricity consumption of the installed electric facilities in project scenario	MWh/y
$n_{P\ electricity}$	The number of group "j" installed electrical facility units in air supply system "i" in project scenario	-
$p_{P\ electricity}$	Electricity consumption per hour of the installed electric facilities in project scenario	MWh/h
$o_{P\ electricity}$	Annual operating hours	h/year
$SP_{electricity}$	Electricity consumption per hour of electric facilities (from nameplate data)	kWh
$OF_{on/off\ i,j}$	On/Off time ratio in production time	%

Estimation $E_{P\ electricit}$ （2007.6 - 2008.5 : before increasing manufacturing line at 103 plant）

Table B6.3-7 Estimation $E_{P\ electricit}$

System	*Item*	$n_{P\ electricity}$	$p_{P\ electricity}$		$o_{P\ electricity}$	$E_{P\ electricity}$
			$SP_{electricity}$	$OF_{on/off\ i,j}$		
101&102	Washing blow	2	5.50 kWh	12.5 %	4080	5.61 MWh/y
	Aeration	1	5.50 kWh	100 %	4080	22.44 MWh/y
	Mist	1	1.00 kWh	100 %	4080	4.08 MWh/y
	Air driver	38	0.05 kWh	5 %	4080	0.39 MWh/y
103	Mist	15	1.00 kWh	100 %	5760	86.40 MWh/y
	Vacuum	5	1.00 kWh	5 %	5760	1.44 MWh/y
					$E_{P\ electricity}$	120.36 MWh/y

*1 Operating hour = 17h/day(101&102 plant)、24h/day(103 plant)
Annual operating time = 240day/year (all plants)

Estimation $E_{P\ electricit}$ （2008.6 - 2014.5 : after increasing manufacturing line at 103 plant）

Table B6.3-8 Estimation $E_{P\ electricit}$

System	*Item*	$n_{P\ electricity}$	$p_{P\ electricity}$		$o_{P\ electricity}$	$E_{P\ electricity}$
			$SP_{electricity}$	$OF_{on/off\ i,j}$		
101&102	Washing blow	2	5.50 kWh	12.5 %	4080	5.61 MWh/y
	Aeration	1	5.50 kWh	100 %	4080	22.44 MWh/y
	Mist	1	1.00 kWh	100 %	4080	4.08 MWh/y
	Air driver	38	0.05 kWh	5 %	4080	0.39 MWh/y
103	Mist	18	1.00 kWh	100 %	5760	103.68 MWh/y
	Vacuum	6	1.00 kWh	5 %	5760	1.73 MWh/y
					$E_{P\ electricity}$	137.93 MWh/y

*1 Operating hour = 17h/day(101&102 plant)、24h/day(103 plant)
Annual operating time = 240day/year (all plants)

1)-3 EF_{grid}

The emission factor of the connected grid is calculated ex-ante as follows.

STEP 1. Calculate the Operating Margin emission factor(s) ($EF_{OM,y}$)

$$EF_{OM,y} = S_{i,j}(F_{i,j,y} * COEF_{i,j}) / S_j(GEN_{j,y})$$

Where	Description
$F_{i,j,y}$	the amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources *j* in year(s) *y*,
j	*j* refers to the power sources delivering electricity to the grid, not including low-operating cost and mustrun power plants, and including imports[6] to the grid
$COEF_{i,j\,y}$	the CO_2 emission coefficient of fuel *i* (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources *j* and the percent oxidation of the fuel in year(s) *y*, and
$GEN_{j,y}$	the electricity (MWh) delivered to the grid by source *j*.

$$COEF_i = NCV_i * EF_{CO_2,i} * OXID_i$$

Where	Description
NCV_i	net calorific value (energy content) per mass or volume unit of a fuel *i*,
$OXID_i$	oxidation factor of the fuel (see page 1.29 in the 1996 Revised IPCC Guidelines for default values),
$EF_{CO_2,i}$	CO_2 emission factor per unit of energy of the fuel *i*. Where available, local values of NCV_i and $EF_{CO_2,i}$ should be used. If no such values are available, country-specific values (see e.g. IPCC Good Practice Guidance) are preferable to IPCC world-wide default values.

The calculation of "Operation Margin" is based on the generation-weighted emissions per electricity unit of all power plants generating units serving the grid system in Peninsular Malaysia. This excludes the generation from "Hydro" as a must-run/ low-costs fuel source. The data available for the most recent 3 years are the years 2002, 2003 and 2004. These 3 years of historical data are illustrated below:

Table B6.3-9:Simple Operation Margin for Peninsular Malaysia

Years	Generation (GWh)	CO_2 Emission (t)	Baselines (kg CO_2e/kWh)
2004	77,566	48,808,151	0.629
2003	67,511	37,833,007	0.560
2002	62,854	34,604,511	0.551
Average Operation Margin for 3 years			0.580

Sources : Energy Commission (2004)

STEP 2. Calculate the Build Margin emission factor ($EF_{BM,y}$)

The Build Margin emission factor for the project activity is calculated ex-ante as the data from 5 most recently constructed power plants

Build Margin is calculated as follows, based on the ACM0002 version 6.

$$EF_{BM,y} = S_{i,m}(F_{i,m,y} * COEF_{i,m}) / S_m (GEN_{m,y})$$

Where	Description
$F_{i,m,y}$	the amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources *m* in year(s) *y*,
m	The sample group *m* consists of either the five power plants that have been built most recently
$COEF_{i,m,y}$	the CO_2 emission coefficient of fuel *i* (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources *m* and the percent oxidation of the fuel in year(s) *y*, and
$GEN_{m,y}$	the electricity (MWh) delivered to the grid by source *m*.

The calculations of "Build Margin" are based on the weighted average emissions of the 5 most recently installed power plants in Peninsular Malaysia.
The total output generated by these 5 plants in 2003 is more than 20% of the total system generation in Peninsular Malaysia (20,055,350 MWh out of the total 82,550,893 MWh or 24%). The Build Margin for Peninsular Malaysia is calculated as follows

Table B6.3-10: Build Margin for Peninsular Malaysia

Name of Projects /Fuel Types	Year Operation	Capacity, MW	Total Generation, MWh	CO_2 Emission, ton
1. Janamanjung Power Plant/Coal	September-03	2070	12,289,662	11,299,338
2. GB3 Power Station/Gas	March-03	640	4,246,276	1,957,087
3. Panglima Power station/Gas	April-03	720	5,577,858	2,758,729
4. Perlis Power Station/Gas	April-03	650	5,328,046	3,229,780
5. SKS Prai Power Station	June-03	350	2,113,703	872,175
TOTAL			29,555,545	20,117,109

Source: Energy Commission (2004)

CO_2 Emissions divided by the total generation = 20,117,109 ton CO_2 /29,555,545 MWh or 0.681 kg CO_2/kWh.

STEP 3. Calculate the baseline emission factor EF_y

Combined Margin is calculated as follows, based on the ACM0002.

$$EF_y = w_{OM} * EF_{OM,y} + w_{BM} EF_{BM,y}$$

Where	Description
w_{OM} w_{BM}	the weights w_{OM} and w_{BM}, by default, are 50% (i.e., $w_{OM} = w_{BM} = 0.5$)

Finally the "Combined Margin" is calculated by averaging the "Simple Operation Margin" with the "Build Margin". Therefore the "Combined Margin" is (0.580 + 0.681)/2 or 0.631 kg CO_2/kWh.

Estimation of EF_{grid}

TableB6.3-11 Estimation of EF_{grid}

	Approximate Operation Margin (kg CO_2/kWh)	Build Margin (kg CO_2/kWh)	Average of Approximate Operation Margin and Build Margin (kg CO_2/kWh)
Peninsular Malaysia Grid	0.580	0.681	0.631

1)-4 Estimation of project emission (PE_y)

$$PE_y = E_P * EF_{grid}$$

$$E_P = (E_{P\,comp} + E_{P\,electricity})$$

Where	Description	unit
PE_y	Annual GHG emissions in project scenario	tCO_2e/y
E_P	Annual electricity consumption in project scenario	MWh/y
EF_{grid}	Emission Factor of the connected grid	kg CO_2e/kWh
$E_{P\,comp}$	Annual electricity consumption of compressor units	MWh/y
$E_{P\,electricity}$	Annual electricity consumption of the installed electric facilities	MWh/y

*1 Data Source: Tenaga Nasional Berhad

Estimation of *PE_y*（2007.6 - 2008.5 : before increasing manufacturing line at 103 plant）

Table B6.3-12 Estimation of PE_y

EP_{comp}	$EP_{electricity}$	EF_{grid}	PE_y
2349.7 MWh/y	120.4 MWh/y	0.631 kg CO_2e/kWh	1558.6 tCO_2e/y

Estimation of PE_y（2008.6 - 2014.5 : after increasing manufacturing line at 103 plant）

Table B6.3-12 Estimation of PE_y

EP_{comp}	$EP_{electricity}$	EF_{grid}	PE_y
2715.9 MWh/y	137.9 MWh/y	0.631 kg CO_2e/kWh	1800.7 tCO_2e/y

1)-5 Leakeage

No change in GHG emissions associated with the project occurs outside the boundary.

1)-6 The sum of the small-scale project activity emissions

1558.6 tCO_2e/y　(2007.6 - 2008.5 : before increasing manufacturing line at 103 plant)
1800.7 tCO_2e/y　(2008.6 - 2014.5 : after increasing manufacturing line at 103 plant)

2) Baseline emission (BE_y)

The anthropogenic GHG emission in baseline scenario is calculated ex-ante as follows.

$$BE_y = E_B * EF_{grid}$$
$$E_B = E_{B\ comp}$$

Where	Description	unit
BE_y	Annual GHG emissions in baseline scenario	tCO_2e/y
E_B	Annual electricity consumption in baseline scenario	MWh/y
EF_{grid}	Emission Factor of the connected grid	kg CO_2e/kWh
$E_{B\ comp}$	Annual electricity consumption of compressor units in baseline scenario	MWh/y

2)-1 $E_{B\ comp}$

Annual electricity consumption of compressor units is calculated ex-ante as follows.

$$E_{B\ comp} = S\ (n_{B\ comp} * p_{B\ comp} * o_{B\ comp})$$
$$p_{B\ comp} = F_{B\ air.comp} / AF_{B\ comp} / 1000$$

Where	Description	unit
$E_{B\ comp}$	Annual electricity consumption of compressor units in baseline scenario	MWh/y
$n_{B\ comp}$	The number o compressor units in baseline scenario	-
$p_{B\ comp}$	Electricity consumption per hour of a compressor unit in baseline scenario	MWh/h
$o_{B\ comp}$	Annual operating hours	h/year
$F_{B\ air.comp}$	Average air flow volume per hour of a compressor unit in baseline scenario	m^3/h
$AF_{B\ comp}$	Air flow volume per electricity consumption of a compressor unit in baseline scenario	m^3/kWh

$F_{B\ air.comp} = F_{air.present\ state}$

Where	Description	unit
$F_{B\ air.comp}$	Average air flow volume per hour of a compressor unit in baseline scenario	m^3/h
$F_{air.present\ state}$	Average air flow volume per hour of a compressor unit in present status	m^3/h

Estimation $E_{B\ comp}$ (2007.6 - 2008.5 : before increasing manufacturing line at 103 plant)

Table B6.3-13 Estimation $E_{B\ comp}$

System	$n_{B\ comp}$	$p_{B\ comp}$		$o_{B\ comp}$*1	$E_{B\ comp}$
		$F_{B\ air.comp}$	$AF_{B\ comp}$		
101&102	1 unit	1937.8 m^3/h	9.9	4080 hours	798.61 MWh/y
103	1 unit	3600.1 m^3/h	10.4	5760 hours	1993.90 MWh/y
				$E_{P\ comp}$	2792.51 MWh/y

*1 Operating hour = 17h/day(101&102 plant)、24h/day(103 plant)
Annual operating time = 240day/year (all plants)

Estimation $E_{B\ comp}$ (2008.6 - 2014.5 : after increasing manufacturing line at 103 plant)

Table B6.3-14 Estimation $E_{B\ comp}$

System	$n_{B\ comp}$	$p_{B\ comp}$		$o_{B\ comp}$*1	$E_{B\ comp}$
		$F_{B\ air.comp}$	$AF_{B\ comp}$		
101&102	1 unit	1937.8 m^3/h	9.9	4080 hours	798.61 MWh/y
103	1 unit	4320.1 m^3/h	10.4	5760 hours	2392.68 MWh/y
				$E_{P\ comp}$	3191.29 MWh/y

*1 Operating hour = 17h/day(101&102 plant)、24h/day(103 plant)
Annual operating time = 240day/year (all plants)

2)-2 EF_{grid}

See B.6.3 1)-3.for the further information on calculation of Emission Factor of the connected grid.

2)-3 Estimation of project emission (BE_y)

$BE_y = E_B * EF_{grid}$

Where	Description	Unit
BE_y	Annual GHG emissions in baseline scenario	tCO_2e/y
E_B	Annual electricity consumption in baseline scenario	MWh/y
EF_{grid}	Emission Factor of the connected grid	kg CO_2e/kWh

Estimation of BE_y（2007.6 - 2008.5 : before increasing manufacturing line at 103 plant）

Table B6.3-16 Estimation of BE_y

E_B	EF_{grid}	BE_y
2792.5 MWh/y	0.631 kg CO_2e/kWh	1762.1 tCO_2e/y

Estimation of BE_y（2008.6 - 2014.5 : after increasing manufacturing line at 103 plant）

Table B6.3-17 Estimation of BE_y

E_B	EF_{grid}	BE_y
3191.3 MWh/y	0.631 kg CO_2e/kWh	2013.7 tCO_2e/y

3) The emission reductions (ER_y)

$ER_y = BE_y – PE_y$
  = 1762.1 – 1558.6
  = 203.5 tCO_2e/y （2007.6 - 2008.5 : before increasing manufacturing line at 103 plant）

$ER_y = BE_y – PE_y$
  = 2013.7 – 1800.7
  = 213.0 tCO_2e/y （2008.6 - 2014.5 : after increasing manufacturing line at 103 plant）

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

>>

Year	Baseline emission tCO_2e/y	Project emission tCO_2e/y	Emission Reduction tCO_2e/y
2007.6 – 2008.5	1762.1	1558.6	203.5
2008.6 – 2009.5	2013.7	1800.7	213.0
2009.6 – 2010.5	2013.7	1800.7	213.0
2010.6 – 2011.5	2013.7	1800.7	213.0
2011.6 – 2012.5	2013.7	1800.7	213.0
2012.6 – 2013.5	2013.7	1800.7	213.0
2013.6 – 2014.5	2013.7	1800.7	213.0
total	13844.3	12362.8	1481.5

* In year of 2008, increasing manufacturing line will be scheduled at 103 plant.
But, in this increasing line plan, same facilities as present line will be installed.
As a result, 103 plant will increase in production about 20%.

* Project will be started in 01/06/2007.

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

B.7.1 Data and parameters monitored:

1) Calculating reduction of GHG emissions

Data / Parameter:	***ER_y***
Data unit:	*tCO_2e/y*
Description:	*Annual reduction of GHG emissions*
Source of data to be used:	*Calculation (=BE_y -PE_y)*
Value of data:	
Description of measurement methods and procedures to be applied:	*Annually 100% electronic*
QA/QC procedures to be applied:	*Energy saving expert(s) are appointed from the project participants. The person(s) are engaged in data collection and calculation.* *Denso Malaysia acquired ISO14001 Certification in 2000, all activities of this project controlled by Environmental Management System. ISO 14001 certification from SIRIM.*
Any comment:	

Data / Parameter:	***BE_y***
Data unit:	*tCO_2e/y*
Description:	*Annual GHG emissions in baseline scenario*
Source of data to be used:	*Calculation (=E_B * EF_{grid} – L)*
Value of data:	
Description of measurement methods and procedures to be applied:	*Annually 100% electronic*
QA/QC procedures to be applied:	*Energy saving expert(s) are appointed from the project participants. The person(s) are engaged in data collection and calculation.* *Denso Malaysia acquired ISO14001 Certification in 2000, all activities of this project controlled by Environmental Management System. ISO 14001 certification from SIRIM.*
Any comment:	***L** means GHG emission from out of boundary , but this project have no leakage.*

Data / Parameter:	***PE_y***
Data unit:	*tCO_2e/y*
Description:	*Annual GHG emissions in project scenario*
Source of data to be used:	*Calculation (=E_P * EF_{grid} – L)*
Value of data:	
Description of measurement methods and procedures to be applied:	*Annually 100% electronic*
QA/QC procedures to be applied:	*Energy saving expert(s) are appointed from the project participants. The person(s) are engaged in data collection and calculation.* *Denso Malaysia acquired ISO14001 Certification in 2000, all activities of this project controlled by Environmental Management System. ISO 14001 certification from SIRIM.*
Any comment:	***L** means GHG emission from out of boundary , but this project have no leakage.*

2) Monitoring the GHG emissions in baseline scenario (annual electricity consumption)

Data / Parameter:	***E_B***
Data unit:	*MWh/y*
Description:	*Annual electricity consumption in baseline scenario*
Source of data to be used:	*Calculation (= $E_{B\ comp}$)*
Value of data:	
Description of measurement methods and procedures to be applied:	*Annually 100% electronic*
QA/QC procedures to be applied:	*Energy saving expert(s) are appointed from the project participants. The person(s) are engaged in data collection and calculation.* *Denso Malaysia acquired ISO14001 Certification in 2000, all activities of this project controlled by Environmental Management System. ISO 14001 certification from SIRIM.*
Any comment:	

Data / Parameter:	$E_{B\ comp}$
Data unit:	*MWh/y*
Description:	*Annual electricity consumption of compressor units in baseline scenario*
Source of data to be used:	*Calculation* ($=S\ (n_{B\ comp} * p_{B\ comp} * o_{B\ comp})$)
Value of data:	
Description of measurement methods and procedures to be applied:	*Monthly 100% electronic*
QA/QC procedures to be applied:	*Energy saving expert(s) are appointed from the project participants. The person(s) are engaged in data collection and calculation.* *Denso Malaysia acquired ISO14001 Certification in 2000, all activities of this project controlled by Environmental Management System. ISO 14001 certification from SIRIM.*
Any comment:	

Data / Parameter:	$n_{B\ comp}$
Data unit:	*number of unit*
Description:	*The number of compressor units in baseline scenario*
Source of data to be used:	*Monitor*
Value of data:	
Description of measurement methods and procedures to be applied:	*Annually 100% electronic* *Energy saving expert(s) count and record number of compressor unit annually.* *If the number of compressor unit will increase, Energy saving expert(s) are record at once.*
QA/QC procedures to be applied:	*Energy saving expert(s) are appointed from the project participants. The person(s) are engaged in data collection and calculation.* *Denso Malaysia acquired ISO14001 Certification in 2000, all activities of this project controlled by Environmental Management System. ISO 14001 certification from SIRIM.*
Any comment:	*In the project activity, number of compressor unit will not change.* *(101&102 plant: 1 unit)* *(103 plant : 1 unit)*

Data / Parameter:	$p_{B\ comp}$
Data unit:	*MWh/h*
Description:	*Electricity consumption per hour of a compressor unit in baseline scenario*
Source of data to be used:	*Calculation* ($= F_{B\ air.comp} / AF_{B\ comp} / 1000$)
Value of data:	
Description of measurement methods and procedures to be applied:	*Monthly 100% electronic*
QA/QC procedures to be applied:	*Energy saving expert(s) are appointed from the project participants. The person(s) are engaged in data collection and calculation.* *Denso Malaysia acquired ISO14001 Certification in 2000, all activities of this project controlled by Environmental Management System. ISO 14001 certification from SIRIM.*
Any comment:	

Data / Parameter:	***OB comp***
Data unit:	*h/year*
Description:	*Annual Operation hours*
Source of data to be used:	*Monitor (**Factory Operation Data**)*
Value of data:	
Description of measurement methods and procedures to be applied:	*Monthly 100% electronic* *Energy saving expert(s) are record Operating Time Data daily, and integrate these data monthly.*
QA/QC procedures to be applied:	*Energy saving expert(s) are appointed from the project participants. The person(s) are engaged in data collection and calculation.* *Denso Malaysia acquired ISO14001 Certification in 2000, all activities of this project controlled by Environmental Management System. ISO 14001 certification from SIRIM.*
Any comment:	

Data / Parameter:	***FB air.comp***
Data unit:	*m3/h*
Description:	*Average air flow volume per hour of a compressor unit in baseline scenario*
Source of data to be used:	*Calculation （**= FB air.improve + F air.NOT improve + AL**）*
Value of data:	
Description of measurement methods and procedures to be applied:	*Monthly 100% electronic*
QA/QC procedures to be applied:	*Energy saving expert(s) are appointed from the project participants. The person(s) are engaged in data collection and calculation.* *Denso Malaysia acquired ISO14001 Certification in 2000, all activities of this project controlled by Environmental Management System. ISO 14001 certification from SIRIM.*
Any comment:	

Data / Parameter:	***AFB comp***
Data unit:	*m3/kWh*
Description:	*Air flow volume per electricity consumption of a compressor unit in baseline scenario*
Source of data to be used:	*Calculation (= **FP air. Comp / EP comp)***
Value of data:	
Description of measurement methods and procedures to be applied:	*Monthly 100% electronic* *Energy saving expert(s) calculates using data of **FP air. Comp** and **EP comp.*** *After installation of High-efficiency compressor, using specification data of compressor installed in baseline scenario.*
QA/QC procedures to be applied:	*Energy saving expert(s) are appointed from the project participants. The person(s) are engaged in data collection and calculation.* *Denso Malaysia acquired ISO14001 Certification in 2000, all activities of this project controlled by Environmental Management System. ISO 14001 certification from SIRIM.*
Any comment:	

3) Monitoring the GHG emissions in baseline scenario （Average air flow volume per hour generated by compressors）

Data / Parameter:	***$F_{B\ air.\ improve}$***
Data unit:	*m3/h*
Description:	*Total air flow volume per hour consumed by improved-devices in baseline scenario*
Source of data to be used:	*Calculation* （= S_i (S_j ($n_{improve.i,j}$ * $F_{B\ air.\ improve.\ i,j}$ * $OF_{on/off\ i,j}$) *60 / 1000）
Value of data:	
Description of measurement methods and procedures to be applied:	*Monthly 100% electronic*
QA/QC procedures to be applied:	*Energy saving expert(s) are appointed from the project participants. The person(s) are engaged in data collection and calculation.* *Denso Malaysia acquired ISO14001 Certification in 2000, all activities of this project controlled by Environmental Management System. ISO 14001 certification from SIRIM.*
Any comment:	

Data / Parameter:	***$F_{air.\ NOT\ improve}$***
Data unit:	*m3/h*
Description:	*Total air flow volume per hour consumed by NOT-improved-devices*
Source of data to be used:	*Calculation* （＝ $F_{P\ air.comp}$ - $F_{P\ air.\ Improve}$ - AL）
Value of data:	
Description of measurement methods and procedures to be applied:	*Monthly 100% electronic*
QA/QC procedures to be applied:	*Energy saving expert(s) are appointed from the project participants. The person(s) are engaged in data collection and calculation.* *Denso Malaysia acquired ISO14001 Certification in 2000, all activities of this project controlled by Environmental Management System. ISO 14001 certification from SIRIM.*
Any comment:	

Data / Parameter:	***AL***
Data unit:	*m3/h*
Description:	*The amount of air leakage per hour*
Source of data to be used:	*Monitor （**Factory air record**）*
Value of data:	
Description of measurement methods and procedures to be applied:	*Monthly 100% electronic* *Energy saving expert(s) record air flow volume when factory is not operated, using flow meter of compressor.* *This flow volume means air leak volume at all time.*
QA/QC procedures to be applied:	*The monitoring device will calibrate annually, and maintain according to factory standards.* *Energy saving expert(s) are appointed from the project participants. The person(s) are engaged in data collection and calculation.* *Denso Malaysia acquired ISO14001 Certification in 2000, all activities of this project controlled by Environmental Management System. ISO 14001 certification from SIRIM.*
Any comment:	

Data / Parameter:	$n_{improve.\ i,j}$
Data unit:	*number*
Description:	*The number of group "j" air-consuming devices under the same condition in air supply system" i"*
Source of data to be used:	*Monitor (**Factory Improvement Record**)*
Value of data:	
Description of measurement methods and procedures to be applied:	*monthly 100% electronic* *Energy saving expert(s) are record the case of improvement air-consuming devices, and integrate these data monthly.*
QA/QC procedures to be applied:	*Energy saving expert(s) are appointed from the project participants. The person(s) are engaged in data collection and calculation.* *Denso Malaysia acquired ISO14001 Certification in 2000, all activities of this project controlled by Environmental Management System. ISO 14001 certification from SIRIM.*
Any comment:	

Data / Parameter:	***$F_{P\ air.\ comp}$***
Data unit:	*m3/h*
Description:	*Average air flow volume per hour of a compressor unit in project scenario*
Source of data to be used:	*Monitor (**Factory Air Record**)*
Value of data:	
Description of measurement methods and procedures to be applied:	*Monthly 100% electronic* *Energy saving expert(s) record air flow volume when factory is operated, using flow meter of compressor.* *And calculate using Operating Time Data.*
QA/QC procedures to be applied:	*The monitoring device will calibrate annually, and maintain according to factory standards.* *Energy saving expert(s) are appointed from the project participants. The person(s) are engaged in data collection and calculation.* *Denso Malaysia acquired ISO14001 Certification in 2000, all activities of this project controlled by Environmental Management System. ISO 14001 certification from SIRIM.*
Any comment:	

Data / Parameter:	***$F_{P\ air\ .improve}$***
Data unit:	*m3/h*
Description:	*Total air flow volume per hour consumed by improved air-consuming devices in project scenario*
Source of data to be used:	*Calculation (= **Si (Sj (n** $_{improve.i,j}$ *** F** $_{P\ air.\ improve.\ i,j}$ *** OF** $_{on/off\ i,j}$**) *60 / 1000**)*
Value of data:	
Description of measurement methods and procedures to be applied:	*Monthly 100% electronic*
QA/QC procedures to be applied:	*Energy saving expert(s) are appointed from the project participants. The person(s) are engaged in data collection and calculation.* *Denso Malaysia acquired ISO14001 Certification in 2000, all activities of this project controlled by Environmental Management System. ISO 14001 certification from SIRIM.*
Any comment:	

4) Monitoring GHG emissions in project scenario

Data / Parameter:	E_P
Data unit:	*MWh/y*
Description:	*Annual electricity consumption in project scenario*
Source of data to be used:	*Monitor (=$E_{P\ comp}$ + $E_{P\ electricity}$)*
Value of data:	
Description of measurement methods and procedures to be applied:	*Monthly 100% electronic* *Energy saving expert(s) record electricity consumption data of compressor unit monthly.*
QA/QC procedures to be applied:	*Energy saving expert(s) are appointed from the project participants. The person(s) are engaged in data collection and calculation.* *Denso Malaysia acquired ISO14001 Certification in 2000, all activities of this project controlled by Environmental Management System. ISO 14001 certification from SIRIM.*
Any comment:	

Data / Parameter:	$E_{P\ comp}$
Data unit:	*MWh/y*
Description:	*Annual electricity consumption of compressor units*
Source of data to be used:	*Monitor (**Factory Electricity Consumption Data**)*
Value of data:	
Description of measurement methods and procedures to be applied:	*Monthly 100% electronic*
QA/QC procedures to be applied:	*The monitoring device will calibrate annually, and maintain according to factory standards.* *Energy saving expert(s) are appointed from the project participants. The person(s) are engaged in data collection and calculation.* *Denso Malaysia acquired ISO14001 Certification in 2000, all activities of this project controlled by Environmental Management System. ISO 14001 certification from SIRIM.*
Any comment:	

Data / Parameter:	$E_{P\ electricity}$
Data unit:	*MWh/y*
Description:	*Annual electricity consumption of electric facilities newly installed*
Source of data to be used:	*Calculation (= $S_i\ (n_{P\ electricity} * p_{P\ electricity} * o_{P\ electricity})$)*
Value of data:	
Description of measurement methods and procedures to be applied:	*Monthly 100% electronic*
QA/QC procedures to be applied:	*Energy saving expert(s) are appointed from the project participants. The person(s) are engaged in data collection and calculation.* *Denso Malaysia acquired ISO14001 Certification in 2000, all activities of this project controlled by Environmental Management System. ISO 14001 certification from SIRIM.*
Any comment:	

Data / Parameter:	***nP electricity***
Data unit:	*MWh/y*
Description:	*Annual electricity consumption of electric facilities newly installed*
Source of data to be used:	*Calculation (**Factory Improvement Record**)*
Value of data:	
Description of measurement methods and procedures to be applied:	*Monthly 100% electronic* *Energy saving expert(s) are record the case of installation of electric facilities to replace compressed air, and integrate these data monthly.*
QA/QC procedures to be applied:	*Energy saving expert(s) are appointed from the project participants. The person(s) are engaged in data collection and calculation.* *Denso Malaysia acquired ISO14001 Certification in 2000, all activities of this project controlled by Environmental Management System. ISO 14001 certification from SIRIM.*
Any comment:	

Data / Parameter:	***pP electricity***
Data unit:	*MWh/y*
Description:	*Annual electricity consumption of electric facilities newly installed*
Source of data to be used:	*Calculation (**Specification of electric facilities**)*
Value of data:	
Description of measurement methods and procedures to be applied:	*Monthly 100% electronic* *Energy saving expert(s) are record the case of installation of electric facilities to replace compressed air, and integrate these data monthly.*
QA/QC procedures to be applied:	*Energy saving expert(s) are appointed from the project participants. The person(s) are engaged in data collection and calculation.* *Denso Malaysia acquired ISO14001 Certification in 2000, all activities of this project controlled by Environmental Management System. ISO 14001 certification from SIRIM.*
Any comment:	

Data / Parameter:	***oP electricity***
Data unit:	*MWh/y*
Description:	*Annual electricity consumption of electric facilities newly installed*
Source of data to be used:	*Calculation (**=Factory Operation Data * OF$_{on/off\ i,j}$**)*
Value of data:	
Description of measurement methods and procedures to be applied:	*Monthly 100% electronic*
QA/QC procedures to be applied:	*Energy saving expert(s) are appointed from the project participants. The person(s) are engaged in data collection and calculation.* *Denso Malaysia acquired ISO14001 Certification in 2000, all activities of this project controlled by Environmental Management System. ISO 14001 certification from SIRIM.*
Any comment:	

B.7.2 Description of the monitoring plan:

>>

The project organizes the executive committee so that it is ensured that operation and management are carried out, and emission reduction and leakage are monitored.

Position	Role
General Manager of Machinery & Facilities Department	**Management of the project**
Assistant Manager of Machinery & Facilities Department Facilities Section	**An enforcement person in charge of a project**

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

>>

Date: 22/01/2007

Contact information:

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Mitsubishi UFJ Research & Consulting Co., Ltd. is a consulting firm and not a project participant.

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:

>>
01/04/2007

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

>>
20 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:

>>
01/06/2007

C.2.1.2. Length of the first crediting period:

>>
7 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
NA

C.2.2.2. Length:

>>
NA

SECTION D. Environmental impacts

>>

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

>>

Under the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 1987, the activities specified in the Schedule section which EIA to be required, where this kind of industry is not required to conduct EIA.

There is no additional source of GHG emissions to be adopted in implementation of the proposed project activity. The environmental impacts derived through the project activity are such positive ones as energy savings and lowering noises in factories.

Therefore, EIA dose not need to be carried out. This has also been confirmed by the Department of Environment with an official letter which is attached with this PDD.

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:

>>

As stated in D.1., it has been confirmed by the Department of Environment that environment impact assessment is not required for the proposed project activity.

SECTION E. Stakeholders' comments

>>

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

>>

The project activity implementation involves replacement and installation a set of relatively small equipments such as air nozzles, blow guns, and blowers, which does not require major transportation or other energy inputs. It has no significant negative environmental impacts to noise, air or water pollution outside the project site. And also the surrounding area of the project site is mostly occupied by other manufacturing factories. Therefore, comments from the local population are not considered to be necessary.

However, some of the stakeholders listed below had been identified since the proposed project activity may affect them at various stages. Consultation meetings with them were conducted on 15/11/2006 and 16/11/2006 to explain and receive comments on this CDM project. The comments expressed by them were recorded.

- The department of environment, State of Selangor
- Employee of DNMY

E.2. Summary of the comments received:

>>

The comments received from those stakeholders were very positive in the way that the project complied with the Malaysian energy policy encouraging energy efficiency projects in industry sector. Improving the working environment and transferring energy efficiency skills were also welcomed.

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

>>

Taking those positive comments received into account, it has been concluded that this proposed project should be carried out.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	DENSO (MALAYSIA) SDN. BHD.
Street/P.O.Box:	Lot 2, Jalan P/1, Seksyen 13
Building:	
City:	43650 Bandar Baru Bangi
State/Region:	Selangor Dural Ehsan
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Country:	Malaysia
Telephone:	+60-3-87328888
FAX:	+60-3-87328866
E-Mail:	
URL:	http://www.denso.com.my
Represented by:	
Title:	General Manager
Salutation:	
Last Name:	MOHD MAHDZIM
Middle Name:	
First Name:	BIN MD. NOR
Department:	Machinery & Facilities Department
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Direct FAX:	
Direct tel:	+60-3-87328751
Personal E-Mail:	mbinmdno@denso.com.my

Organization:	DENSO Co., Ltd.
Street/P.O.Box:	1-1, Showamachi
Building:	
City:	Kariya
State/Region:	
Postfix/ZIP:	448-8661
Country:	Japan
Telephone:	+81-566-616154
FAX:	+81-566-254530
E-Mail:	
URL:	http://www.denso.co.jp
Represented by:	
Title:	
Salutation:	
Last Name:	Kudo
Middle Name:	
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Direct tel:	+81-566-255809
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No fund from public sources is used in any aspect of the proposed project.

Annex 3

BASELINE INFORMATION

Annex 3-1 Data of initial diagnosis

Mon. 2 ～ Tue. 3,Oct.2006 Check 101 plant
Tue. 3 ～ Wed. 4,Oct.2006 Check 102 plant
Wed. 4 ～ Thu. 5,Oct.2006 Check 103 plant and explain improvement items
Fri. 6,Oct.2006 Making report and wrap up meeting

101plant saving operating hours = 17H/D annual operating hours = 240D/Y
＊ operation fator is considered usage condition.

item	contents	flow rate L/ｍｉｎ	number	＊ operation factor	annual comsuption Nm3/Y	reduction ratio %	reduction volumn Nm3/Y
blow	blow gun	305	24	0.05	89,597	60	53,758
	general blow	350	18	0.25	385,560	40	154,224
	washing blow	2500	10	0.125	76,500	80	61,200
	aeration	4000	1	1	979,200	80	783,360
	cooling	200	1	1	48,960	30	14,688
air vaccum	mist						
	vacuum						
booster		100	7	0.1	17,136	50	8,568
air driver		100	21	0.05	36,288	80	29,030

102plant saving operating hours = 17H/D annual operating hours = 240D/Y
＊ operation fator is considered usage condition.

item	contents	flow rate L/ｍｉｎ	number	＊ operation factor	annual comsuption Nm3/Y	reduction ratio %	reduction volumn Nm3/Y
blow	blow gun	305	24	0.05	89,597	60	53,758
	general blow	350	13	0.25	278,460	40	111,384
	washing blow	2500	1	0.125	76,500	80	61,200
	aeration						
	cooling						
air vaccum	mist	300	1	1	73,440	80	58,752
	vacuum						
booster		100	2	0.1	4,896	50	2,448
air driver		100	17	0.05	20,808	80	16,646

103plant saving operating hours = 24H annual operating hours = 240D/Y
＊ operation fator is considered usage condition.

item	contents	flow rate L/ｍｉｎ	number	＊ operation factor	annual comsuption Nm3/Y	reduction ratio %	reduction volumn Nm3/Y
blow	blow gun	305	5	0.05	26,352	60	15,811
	general blow	300	16	0.05	82,944	40	33,178
	washing blow						
	aeration						
	cooling						
air vaccum	mist	300	15	1	1,555,200	80	1,244,160
	vacuum	1000	5	0.05	86,400	80	69,120
booster							
air driver							

Annex3-2 Details of Estimation

1) Air consumption of 101&102 plant (2007-2008)

101&102 Plant	
240	day/year
17	hour/day
4,080	hour/year

:need to input

air comsumption in bseline

Compressor	Title	number		flow rate	operation factor	air comsumption
	in PDD	*n nozzle.i.j*		*F P air. improve i,j*	*OF on/off i,j*	*F B air. improve*
	unit	–		l/min	%	CMH/H
Blow gun	improve air-consuming	48		305	5.0%	43.9
General blow		31		350	25.0%	162.8
Cooling		1		200	100.0%	12.0
booster		9		100	10.0%	5.4
Washing blow	install blower	2		2,500	12.5%	37.5
Aeration		1		4,000	100.0%	240.0
Mist	install vacuum pump	1		300	100.0%	18.0
Vacuum						0.0
Have part						0.0
air driver	install electrical driver	38		100	5.0%	11.4

air comsumption in project

Compressor	Title	number	(reduction rate)	flow rate	operation factor	air comsumption
	in PDD	*n nozzle.i.j*	-	*F P air. improve i,j*	*OF on/off i,j*	*F P air.improve*
	unit	–	%	l/min	%	CMH/H
Blow gun	improve air-consuming	48	60%	122	5.0%	17.6
General blow		31	40%	210	25.0%	97.7
Cooling		1	30%	140	100.0%	8.4
booster		9	50%	50	10.0%	2.7

electric consumption of installed electorical device in project

Electricity	Title	number	spec	operating factor	operation time	electrical consumption
	in PDD	*n P electricity*	*SP electricity*	*OF on/off i,j*	*o P comp*	*E P electricity*
	unit	–	kW/h	%	hour/year	MWh/y
Washing blow	install blower	2	5.5	12.5%	4,080	5.61
Aeration		1	5.5	100.0%	4,080	22.44
Mist	install vacuum pump	1	1.0	100.0%	4,080	4.08
Vacuum		0	1.0	0.0%	4,080	0.00
Have part		0	1.0	0.0%	4,080	0.00
air driver	install electrical driver	38	0.05	5.0%	4,080	0.39

2) Air consumption of 103 plant (2007-2008)

103 Plant	
240	day/year
24	hour/day
5,760	hour/year

:need to input

air comsumption in bseline

Compressor	Title	number		flow rate	operation factor	air comsumption
	in PDD	n nozzle.i.j		F P air. improve i,j	OF on/off i,j	F B air. improve
	unit	−		l/min	%	CMH/H
Blow gun	improve air-consuming	5		305	5.0%	4.6
General blow		16		350	5.0%	16.8
Cooling						0.0
booster						0.0
Washing blow	install blower					0.0
Aeration						0.0
Mist	install vacuum pump	15		300	100.0%	270.0
Vacuum		5		1,000	5.0%	15.0
Have part		0		150	100.0%	0.0
air driver	install electrical driver					0.0

air comsumption in project

Compressor	Title	number	(reduction rate)	flow rate	operation factor	air comsumption
	in PDD	n nozzle.i.j	-	F P air. improve i,j	OF on/off i,j	F P air.improve
	unit	−	%	l/min	%	CMH/H
Blow gun	improve air-consuming	5	60%	122	5.0%	1.8
General blow		16	40%	210	5.0%	10.1
Cooling		0	30%	0	0.0%	0.0
booster		0	50%	0	0.0%	0.0

electric consumption of installed electorical device in project

Electricity	Title	number	spec	operating factor	operation time	electrical consumption
	in PDD	n P electricity	SP electricity	OF on/off i,j	o P comp	E P electricity
	unit	−	kW/h	%	hour/year	MWh/y
Washing blow	install blower	0	5.5	0.0%	5,760	0.00
Aeration		0	5.5	0.0%	5,760	0.00
Mist	install vacuum pump	15	1.0	100.0%	5,760	86.40
Vacuum		5	1.0	5.0%	5,760	1.44
Have part		0	1.0	100.0%	5,760	0.00
air driver	install electrical driver	0	0.05	0.0%	5,760	0.00

3) Calculation of consuming electricity for compressor (2007-2008)

Air flow of NOT improved devices

Title	total flow volume	sum of air comsumption	air leake	flow volume of NOT improved
in PDD	$F_{B\ air.comp}$	$F_{B\ air.improve}$	AL	$F_{air.NOT\ improve}$
unit	CMH/H	CMH/H		CMH/H
101&102	1937.8	531.0	31.9	1,374.9
103	3600.1	306.4	1.6	3,292.1

note: average of 2006.1-2006.10

Air generate of compressor in project

Title	air comsumption/hour	flow volume of NOT improved	air leake	air genereation volume
in PDD	$F_{P\ air.improve}$	$F_{air.NOT\ improve}$	AL	$F_{P\ air.comp}$
unit	CMH/H	CMH/H	CMH/H	CMH/H
101&102	126.3	1,374.9	31.9	1,533.1
103	11.9	3,292.1	1.6	3,305.6

consuming electricity for compressor in project

Title	number of comp unit	total flow volume	air / electric.	operation hours	air genereation volume
in PDD	$n_{P\ comp}$	$F_{P\ air.comp}$	$AF_{P\ comp}$	$o_{P\ comp}$	$E_{P\ comp}$
unit	-	CMH/H	m^3/kWh	hour/year	MWh/year
101&102	1	1,533.1	12.056	4,080	518.8490246
103	1	3,305.6	10.4	5,760	1830.813231
					2349.662255

consuming electricity for compressor in baseline

Title	number of comp unit	total flow volume	air / electric.	operation hours	air genereation volume
in PDD	$n_{B\ comp}$	$F_{B\ air.comp}$	$AF_{B\ comp}$	$o_{P\ comp}$	$E_{B\ comp}$
unit	-	CMH/H	m^3/kWh	hour/year	MWh/year
101&102	1	1,937.8	9.9	4,080	798.6084848
103	1	3,600.1	10.4	5,760	1993.901538
					2792.510023

4) Calculation of GHG emission (2007-2008)

Baseline Emission

	Title	comp
	in PDD	$E_{B\,comp}$
	unit	MWh/year
Compressor	**101&102**	798.6
	103	1993.9
		2792.5

total	emission factor	amount of emission
-	EF_{grid}	BE_y
MWh/year	tCO_2/MWh	$tCO_2/year$
2792.5	0.631	1762.1

Project Emission

	Title	comp	elect	total	emission factor	amount of emission
	in PDD	$E_{P\,comp}$	$E_{P\,electricity}$	-	EF_{grid}	PE_y
	unit	MWh/year	MWh/year	MWh/year	tCO_2/MWh	$tCO_2/year$
Compressor	**101&102**	518.8	32.52	2470.0	0.631	1558.6
	103	1830.8	87.84			
		2349.7	120.4			

def. elect
MWh/year
322.5

emission reduction
t-co2/year
203.5

5) Air consumption of 101&102 plant (2008-2014)

101&102 Plant	
240	day/year
17	hour/day
4,080	hour/year

:need to input

air comsumption in bseline

Compressor	Title	number		flow rate	operation factor	air comsumption
	in PDD	*n* nozzle.i.j		*F* P air. improve i,j	*OF* on/off i,j	*F* B air. improve
	unit	–		l/min	%	CMH/H
Blow gun	improve air-consuming	48		305	5.0%	43.9
General blow		31		350	25.0%	162.8
Cooling		1		200	100.0%	12.0
booster		9		100	10.0%	5.4
Washing blow	install blower	2		2,500	12.5%	37.5
Aeration		1		4,000	100.0%	240.0
Mist	install vacuum pump	1		300	100.0%	18.0
Vacuum						0.0
Have part						0.0
air driver	install electrical driver	38		100	5.0%	11.4

air comsumption in project

Compressor	Title	number	(reduction rate)	flow rate	operation factor	air comsumption
	in PDD	*n* nozzle.i.j	-	*F* P air. improve i,j	*OF* on/off i,j	*F* P air.improve
	unit	–	%	l/min	%	CMH/H
Blow gun	improve air-consuming	48	60%	122	5.0%	17.6
General blow		31	40%	210	25.0%	97.7
Cooling		1	30%	140	100.0%	8.4
booster		9	50%	50	10.0%	2.7

electric consumption of installed electorical device in project

Electricity	Title	number	spec	operating factor	operation time	electrical consumption
	in PDD	*n* P electricity	*SP* electricity	*OF* on/off i,j	*o* P comp	*E* P electricity
	unit	–	kW/h	%	hour/year	MWh/y
Washing blow	install blower	2	5.5	12.5%	4,080	5.61
Aeration		1	5.5	100.0%	4,080	22.44
Mist	install vacuum pump	1	1.0	100.0%	4,080	4.08
Vacuum		0	1.0	0.0%	4,080	0.00
Have part		0	1.0	0.0%	4,080	0.00
air driver	install electrical driver	38	0.05	5.0%	4,080	0.39

6) Air consumption of 103 plant (2008-2014)

103 Plant	
240	day/year
24	hour/day
5,760	hour/year

:need to input

air comsumption in bseline

Compressor	Title	number		flow rate	operation factor	air comsumption
	in PDD	n nozzle.i.j		F P air. improve i,j	OF on/off i,j	F B air. improve
	unit	–		l/min	%	CMH/H
Blow gun	improve air-consuming	6	5	305	5.0%	5.5
General blow		19	16	350	5.0%	20.0
Cooling						0.0
booster						0.0
Washing blow	install blower					0.0
Aeration						0.0
Mist	install vacuum pump	18	15	300	100.0%	324.0
Vacuum		6	5	1,000	5.0%	18.0
Have part		0	2	150	100.0%	0.0
air driver	install electrical driver					0.0

air comsumption in project

Compressor	Title	number	(reduction rate)	flow rate	operation factor	air comsumption
	in PDD	n nozzle.i.j	-	F P air. improve i,j	OF on/off i,j	F P air.improve
	unit	–	%	l/min	%	CMH/H
Blow gun	improve air-consuming	6	60%	122	5.0%	2.2
General blow		19	40%	210	5.0%	12.0
Cooling		0	30%	0	0.0%	0.0
booster		0	50%	0	0.0%	0.0

electric consumption of installed electorical device in project

Electricity	Title	number	spec	operating factor	operation time	electrical consumption
	in PDD	n P electricity	SP electricity	OF on/off i,j	o P comp	E P electricity
	unit	–	kW/h	%	hour/year	MWh/y
Washing blow	install blower	0	5.5	0.0%	5,760	0.00
Aeration		0	5.5	0.0%	5,760	0.00
Mist	install vacuum pump	18	1.0	100.0%	5,760	103.68
Vacuum		6	1.0	5.0%	5,760	1.73
Have part		0	1.0	100.0%	5,760	0.00
air driver	install electrical driver	0	0.05	0.0%	5,760	0.00

7) Calculation of consuming electricity for compressor (2008-2014)

Air flow of NOT improved devices

Title	total flow volume	sum of air comsumption	air leake	flow volume of NOT improved
in PDD	***F*** ***B air.comp***	***F*** ***B air.improve***	***AL***	***F*** ***air.NOT improve***
unit	CMH/H	CMH/H		CMH/H
101&102	1937.8	531.0	31.9	1,374.9
103	4320.1	367.4	1.9	3,950.8
	3600.1	note: average of 2006.1-2006.10	1.6	

Air generate of compressor in project

Title	air comsumption/hour	flow volume of NOT improved	air leake	air genereation volume
in PDD	***F*** ***P air.improve***	***F*** ***air.NOT improve***	***AL***	***F*** ***P air.comp***
unit	CMH/H	CMH/H	CMH/H	CMH/H
101&102	126.3	1,374.9	31.9	1,533.1
103	14.2	3,950.8	1.9	3,966.8

consuming electricity of compressor in project

Title	number of comp unit	total flow volume	air / electric.	operation hours	air genereation volume
in PDD	***n*** ***P comp***	***F*** ***P air.comp***	***AF*** ***P comp***	***o*** ***P comp***	***E*** ***P comp***
unit	-	CMH/H	m^3/kWh	hour/year	MWh/year
101&102	1	1,533.1	12.056	4,080	518.85
103	1	3,966.8	10.4	5,760	2197.02
					2715.87

consuming electricity of compressor in baseline

Title	number of comp unit	total flow volume	air / electric.	operation hours	air genereation volume
in PDD	***n*** ***B comp***	***F*** ***B air.comp***	***AF*** ***B comp***	***o*** ***P comp***	***E*** ***B comp***
unit	-	CMH/H	m^3/kWh	hour/year	MWh/year
101&102	1	1,937.8	9.9	4,080	798.61
103	1	4,320.1	10.4	5,760	2392.68
					3191.29

8) Calculation of GHG emission (2008-2014)

Baseline Emission

Title		comp	total	emission factor	amount of emission
in PDD		$E_{B\,comp}$	-	EF_{grid}	BE_y
unit		MWh/year	MWh/year	tCO_2/MWh	$tCO_2/year$
Compressor	101&102	798.6	3191.3	0.631	2013.7
	103	2392.7			
		3191.3			

Project Emission

Title		comp	elect	total	emission factor	amount of emission
in PDD		$E_{P\,comp}$	$E_{P\,electricity}$	-	EF_{grid}	PE_y
unit		MWh/year	MWh/year	MWh/year	tCO_2/MWh	$tCO_2/year$
Compressor	101&102	518.8	32.52	2853.8	0.631	1800.7
	103	2197.0	105.41			
		2715.9	137.9			

def. elect
MWh/year
337.5

emission reduction
t-co2/year
213.0

Annex 4

MONITORING INFORMATION

Monitoring Procedure for CDM DNMY

After project implementation, data listed below have to be monitored and recorded to calculate GHG emission reduction.
Use table below & calculate tool, we record Emission Reduction to sheet[RECORD] & print all sheet.

(red)	:need to input
(yellow)	:fixed (initial data)
(white)	:calculate automatically

	from	to
INPUT DATA:	/ /	/ /
	(dd/mm/yyyy)	(dd/mm/yyyy)

(to calculate PROJECT emission)

in PDD	Description	frequency	how / where	unit	who
E ***P comp***	electricity consumption of compressor units in project scenario	monthly	amount of electricity consumption of 101&102	MWh	facility manager of compressor
		monthly	amount of electricity consumption of 103	MWh	facility manager of compressor
E ***P electricity***	electricity consumption of installed electrical devices	monthly	number of electrical device installation 101&102	number	Facilities Department Facilities Section
		monthly	factory operation hours 101&102	hour	Facilities Department Facilities Section
		monthly	number of electrical device installation 103	number	Facilities Department Facilities Section
		monthly	factory operation hours 103	hour	Facilities Department Facilities Section

(to calculate BASELINE emission) *;overlapped

in PDD	Description	frequency	how / where	unit	who
$n_{improve. i,j}$	The number of group "j" air-consuming devices under the same condition in air supply system" i"	monthly	number of device which improve in 101&102	number	Facilities Department Facilities Section
		monthly	number of device which improve in 103	number	Facilities Department Facilities Section
$F_{P\ air.comp}$	Average air flow volume per hour of a compressor unit in project scenario	monthly	monthly air flow volume of compressor 101&102	m^3	facility manager of compressor
		monthly	factory operation hours 101&102*	hour	Facilities Department Facilities Section
		monthly	monthly air flow volume of compressor 103	m^3	facility manager of compressor
		monthly	factory operation hours 103*	hour	Facilities Department Facilities Section
AL	The amount of air leakage per hour	monthly	air flow volume of compressor when factory is not operate in 101&102	m^3/h	Facilities Department Facilities Section
		monthly	air flow volume of compressor when factory is not operate in 103	m^3/h	Facilities Department Facilities Section

Whenever any change is implement, we must record;

in PDD	Description	frequency	how / where	unit	who
$n_{B\ comp}$	The number of compressor units		whenever we change structure of air system, we must record number of compressor units (necessary to increase line of excel)	number	Facilities Department Facilities Section
$AF_{B\ comp}$	Air flow volume per electricity consumption of a compressor unit in baseline scenario		whenever we install High-efficiency compressor, we must record specification data of compressor which will install in absence of CDM	m3/kWh	Facilities Department Facilities Section

Record Emission Reduction for CDM / / ~ / /

Emission reduction (this month)

tCO_2/year

in PDD	Description	this month	
BE y	*GHG emissions in baseline scena*	0.0	** please copy these value to table blow*
PE y	*GHG emissions in project scenar*	0.0	** please copy these value to table blow*
ER y	*reduction of GHG emissions*	0.0	** please copy these value to table blow*

how to copy	how to paste
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	[Alt] key+v

Emission reduction record

year 2007 tCO_2/year

in PDD	Description	year total	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BE y	*GHG emissions in baseline scena*	0.0												
PE y	*GHG emissions in project scenar*	0.0												
ER y	*reduction of GHG emissions*	0.0												

year 2008 tCO_2/year

in PDD	Description	year total	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BE y	*GHG emissions in baseline scena*	0.0												
PE y	*GHG emissions in project scenar*	0.0												
ER y	*reduction of GHG emissions*	0.0												

year 2009 tCO_2/year

in PDD	Description	year total	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BE y	*GHG emissions in baseline scena*	0.0												
PE y	*GHG emissions in project scenar*	0.0												
ER y	*reduction of GHG emissions*	0.0												

year 2010 tCO_2/year

in PDD	Description	year total	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BE y	*GHG emissions in baseline scena*	0.0												
PE y	*GHG emissions in project scenar*	0.0												
ER y	*reduction of GHG emissions*	0.0												

year 2011 tCO_2/year

in PDD	Description	year total	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BE y	*GHG emissions in baseline scena*	0.0												
PE y	*GHG emissions in project scenar*	0.0												
ER y	*reduction of GHG emissions*	0.0												

year 2012 tCO_2/year

in PDD	Description	year total	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BE y	*GHG emissions in baseline scena*	0.0												
PE y	*GHG emissions in project scenar*	0.0												
ER y	*reduction of GHG emissions*	0.0												

year 2013 tCO_2/year

in PDD	Description	year total	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BE y	*GHG emissions in baseline scena*	0.0												
PE y	*GHG emissions in project scenar*	0.0												
ER y	*reduction of GHG emissions*	0.0												

Calculation tools shown in Annex 3 are also going to be used for monitoring.

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