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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

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Using off gas cogeneration project in PT KPP
Version of document: version 05
Date: 05/11/2012

A.2. Description of the project activity:

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The Project Participant, PT. Krakatau Poscopower (hereinafter referred to as "PT. KPP" or "PP"), developed the project activity which is "Using off gas cogeneration project in PT. KPP" (hereinafter referred to as "the project activity" or "the proposed project activity"). The project activity is located in the Krakatau complex and near the site of the Integrated Steel Mill (hereinafter referred to as "ISM") owned by PT. Krakatau Posco (hereinafter referred to as "PT. KP") for supplying the steam and power.

Actually, PT. KPP is a joint venture which is between PT. Krakatau Daya Listrik (hereinafter referred to as "PT. KDL") and POSCO POWER Co., Ltd.
PT. KDL is a subsidiary of PT. Krakatau Steel which is national steel manufacturer in Indonesia. So PT. KDL has supplied PK. Krakatau steel with electricity and steam. Additionally, PT. KDL has authority for electricity business in the Krakatau complex.
POSCO POWER Co., Ltd operates some power plants in Korea. Especially, POSCO POWER Co., Ltd has been in possession of key technology related to the off gas which is by-product gas from ISM for power generation.

PT. KDL, that has authority for electricity business in the Krakatau complex, gives PT. KPP the authority for the electricity business only for the ISM site. Thus, PT. KPP supplies electricity to PT. KP.

In this project activity, the Project Participant will recover the surplus waste off gas from the ISM which is now under construction by PT. KP to generate the electricity and steam. The generated electricity and steam will be solely supplied to PT. KP site by PT.KPP according to Joint Venture Agreement between PT. KDL and POSCO POWER Co., Ltd.
Actually, for operating the ISM, 1,795,800 MWh/yr of electricity and 65 ton/hr of steam will be needed[1]. However, the PT. KP could not get equivalent of electricity and steam from their own facility.

[1] Based on the Feasibility Study published the PT. KP owned the Integrated steel mill in 2009

Therefore, PP took part in installing the cogeneration plant using the surplus waste off gas from ISM. As a result of project activity, 1,185,279 [2] MWh/yr of electricity could be generated and the rest of demanding electricity in ISM will be imported from regional Jawa-Madura-Bali grid [3] (hereafter referred to as "the JAMALI grid") owned by PLN which is the National Power Company. And 255,008[4] ton of steam would be generated and the rest of demanding steam in ISM will be generated by PT. KP.

The project activity will start to operate in Jan, 2014 which is same with the date of operating ISM.

Baseline Scenario

In the absence of the project activity, the off gas from the newly built ISM would have been used in the process of integrated steel partially and the surplus waste off gas would have been flared to the atmosphere after incineration because of low heat value and no other uses. Thus, the heat would be supplied by newly built fossil fuel based steam boiler system and the power requirement of the steel work will be totally met from the JAMALI grid.

Project Scenario

In the project scenario, the project activity will utilize a mix of the surplus waste off gas from ISM consisting of BFG (Blast Furnace Gas), COG (Coke Oven Gas) and LDG (Linze Donawitz Gas) (hereinafter referred to as "off gas") for generating electricity and steam. Inter alia, it will be designed to fire BFG as main fuel and the COG will be used as ignition fuel and auxiliary fuel for flame stabilizer. Therefore, PP does not need to use heavy-oil for ignition.

Thus, 292,837Nm^3/h [5] of the surplus waste off gas came from the integrated steel works will be recovered and utilized as a fuel of the gas-fired boilers. Therefore, the 1,185,279 MWh/yr of electricity and 32ton/hr[6]of steam which is at 260°C, 12.75bar[7] will be generated. Thus, the estimated amount of emission reductions is ***1,076,320*** tCO_2e per year by replacing the fossil fuel for generating the electricity and steam.

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[2] According to the 'Planning of operation', the available hour is 7,969 hr/y and available capacity for electricity is 158.23MW. Thus, 158.23MW x 7,969 hr x 0.94 = 1,185,279 MWh/y(considering 6% of internal consumption)

[3] The Indonesian power system is divided into seven interconnected regional grids, namely Sumatra, Java-Madura-Bali (JAMALI), Kalimantan (3grids) and Sulawesi (2grids), plus more than 600 isolated systems. And the *JAMALI* interconnected system is the largest (77% of power consumption) in the country.

[4] 32ton/hr x 7,969 hr/y = 255,008 ton/y

[5] Based on gas balance which is published by PT KP, the annual amount of steel slab and plate are 3 million tonne, and the designed available blast furnace gas amount is 237,012 Nm^3/h, Linze Donawitz Gas is 25,404 Nm^3/h and Coke oven Gas is 30,421Nm^3/h which are available to use in project activity.

[6] According to the document of steam energy balance which is provided by PT KP, the additional needed steam amount for ISM is 32 ton/hr.

[7] Based on the technical specification

Contribution of the project activity to sustainable development

The project activity complies with the national industrial policy and promotes sustainable development of the energy industry. In particular, the project activity will bring positive environmental and social benefits, and contribute to the local sustainable development.

• Social contribution

- The project activity will generate skilled and unskilled employment during both the construction and operation phases of the project activity. Additionally, the project activity will have a direct bearing on improving their professional skills.
- Furthermore, the benefit of business will be used for the social activities like as helping the orphan, planting mangrove for mitigating the air pollution, supplying the emergency kits for residents and so on.[8]

• Environmental contribution

- The project activity utilizes the surplus waste off gas to replace the electricity and steam from the facility using fossil fuel. Therefore, the project activity will contribute to reducing the emission of GHGs and mitigating other environmental pollution, such as nitrogen oxides, sulphur oxides, carbon monoxide and particulates at the power plant by replacing the equivalent electricity from the JAMALI grid.
- The project activity will improve the local air quality by eliminating the environmental hazards associated with disposal of fly ash generated during fossil fuel combustion.
- The project activity will reduce dependence on fossil fuels and reduce the pollution on atmosphere caused by using the waste off gas.

• Economic contribution

- The economic well being of the local people will be improved by the direct and indirect employment opportunities created by the project activity. Furthermore, the project activity encourages investment for environment friendly technologies in the nearby locality.
- The project activity will create extra job opportunities for unemployed local residents.

• Technology contribution

- The advanced the waste off gas recovery system will be transferred to the locals. And skilled workforce will be created through sharing of knowledge.
- Education and training will be conducted by experts and the managers to improve the knowledge on the technology and to ensure proper operation of the unit.
- Moreover, the project activity is the first of its kind project in steel manufacturing industries of host country. Hence possibility of replication for this technology in other steel manufacturing industries of host country is high.

[8] Relevant documents are sent to DNA in Indonesia.

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 wish to be considered as project participants (Yes/No)
Indonesia (Host)	PT. Krakatau Poscopower (Private Entity)	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

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Indonesia

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

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Banten Province

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

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Cilegon City

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

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The detailed address of the site is Afrika Street No.2, Krakatau Industrial complex, Cilegon, Banten, Indonesia. And the geo-coordinate is East 105.971889°, South 6.007139°. Precisely, this industrial area located between PT. Karakatau Power and PT Krakatau Bandar Smudra in the industrial zone is very strategic as viewed in terms of geography. This industrial area is about 110 km westward from the direction of Jakarta, located on the western coast of Banten Province.

As the residential area is apart from more than 10 km, the negative impacts which are like a noise and pollution of the construction are not affected residents. The location map of project activity is presented in the Figure as below;

< Figure. A-1 > location map of the project activity

< Figure. A-2 > Bird's eye view of the project activity

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

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The project activity utilizes the surplus waste off gas at ISM to generate the electricity and steam. Therefore, the project activity falls under the methodology, ACM0012 and the sectoral scope of the methodology is falls under 1(Energy industry) and 4(Manufacturing industry). Thus, the project activity also falls under the category. The category is described as follows:

•Sectoral Scope Number 1: Energy industry and
4: Manufacturing industry

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

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In the absence of the project activity, the surplus waste off gas will be vented to the atmosphere after incineration. But the electricity and steam which are needed in the ISM would have been supplied from the JAMALI grid and coal based steam boiler respectively. Therefore, through the project activity, the surplus waste off gas from ISM will be recovered to generate the electricity and steam.

The technology of using the surplus waste off gas for energy generation which is adopted in this project is an advanced and environment-friendly energy recovery technology. Especially, it is the first adoption related to using the waste off gas for generating energy in Indonesia. Accordingly, the introduction of such power and steam generation scheme is a positive step towards reducing the dependence on fossil fuels and fostering sustainable development in host country.

The project activity mainly consists of distribution system, combustion system, ignition system, main boiler system, water supply system, water condensation system, power transmission system etc. And, for generating electricity and steam, the project activity mainly is composed of two sets of off-gas fired boilers, two sets of steam turbine and generators.

The specification for each of facilities described as below:

<Table. A.1> Main parameters of gas-fired boiler

Type	Radiation, Convection and horizontal or vertical bare tube
Number of sets	2 units
Evaporation capacity	360,000 kg/hr
Overheating steam pressure	125.53 bar (at main stop valve inlet)
Overheating steam temperature	538°C (at main stop valve inlet)
Feed water temperature	245.3°C
Life time	15year

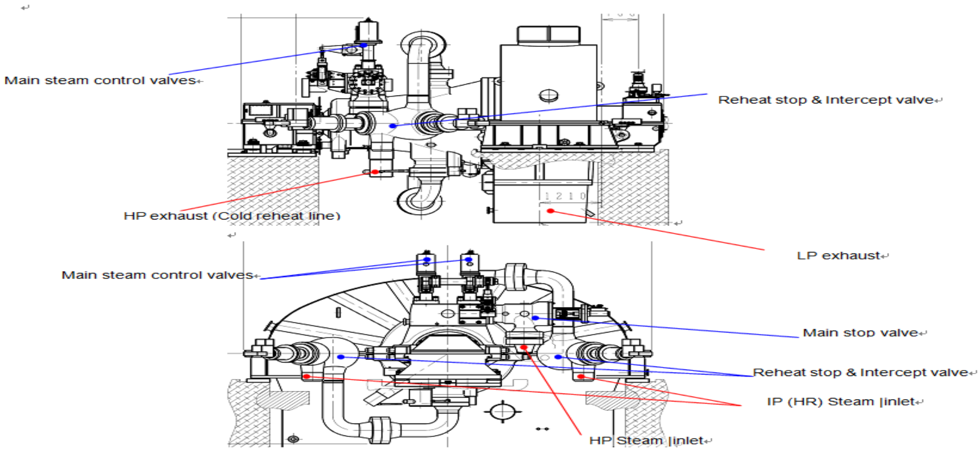
<Table. A.2> Main parameters of steam turbine

Type	Reheat type condensing turbine indoor use
Number of sets	2 units
Rated output	100,000 kW
Maximum output	104,650 kW
Maximum steam output	45Ton/hr
Rotating speed	3,000 rpm
steam pressure and temperature	12.75bar, 260 °C (extracting)

<Table. A.3> Main parameters of generator

Type	Horizontally mounted, rotating field, Air cooled, three phase synchronous generator
Number of sets	2 units
Rated capacity	117,700 kVA
Frequency	50Hz
Number of phase	Three(3)
Rotating speed	3,000rpm
Rated power factor	85%

The steam boiler will be designed to insure continuous operation. Safe and economical operation without undue heating, vibration or noise is very important for reliability. The boilers and their auxiliaries will be in general a slide along arrangement.



< Figure. A-3 > the structure of boiler

A proven furnace design will be chosen in order that flow stability can be assured during start up and under constant pressure operation. The surplus waste off gas which is by-product from ISM flows into the off gas fired steam boilers (2 units) which are composed of superheater, reheater, economizer and auxiliary parts for heating 32ton/hr of feed water in the boiler.

Especially, the surplus waste off gas which is used as fuel is composed of BFG, LDG and COG. But off gas fired boiler will be fired by 90 % of BFG as the main fuel and LDG and COG are used as the auxiliary fuel. When BFG is firing, COG for the stabilized fuel will be fired by 10% of heat capacity. And COG will be also used as the ignition fuel and auxiliary fuel for flame stabilizer. Thus, the performance will be based on the BFG.

And then, the generated steam at high temperature and high pressure will move into steam turbine for generation of the electricity. By-pass spill over system in steam turbine should be installed so that system can quickly respond to the changes in the electricity load and emergency situations and to minimize the effects by the changes in the load. Furthermore, it will be chosen in order that flow stability can be assured during start up and for constant pressure operation.

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

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The selected crediting period of the project activity is 10 years. The starting date of the crediting period for the project is in 2014.

<Table. A-4> The estimated amount of emission reductions

Years	Annual estimation of emission reductions in tonnes of CO_2e
Year 2014	1,076,320
Year 2015	1,076,320
Year 2016	1,076,320
Year 2017	1,076,320
Year 2018	1,076,320
Year 2019	1,076,320
Year 2020	1,076,320
Year 2021	1,076,320
Year 2022	1,076,320
Year 2023	1,076,320
Total estimated reductions (tonnes of CO_2e)	10,763,200
Total number of crediting years	10
Annual average over the crediting period of Estimated reductions (Tonnes of CO_2e)	1,076,320

A.4.5. Public funding of the project activity:

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No public funding is involved in the project activity.

SECTION B. Application of a baseline and monitoring methodology

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

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Following methodology is used:

Title of Baseline and monitoring methodology

Approved consolidated baseline and monitoring methodology, ACM0012: "Consolidated baseline methodology for GHG emission reductions from waste energy recovery projects (version 04)".

Additionality Tool

The "Tool for the Demonstration and Assessment of Additionality (version 7)" is used to demonstrate the additionality of the project activity.

The "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (version 02) will be used to calculate the project emission from fossil fuel combustion in emergency situation.

The "Tool to calculate the emission factor for an electricity system (version 02.2.1)" is used to calculate the baseline emission factor.

The "Tool to determine the remaining lifetime of equipment (version 01)" is used to determine the remaining lifetime of main equipment.

It has been referred from the list of approved methodologies for CDM project activities in the UNFCCC CDM website (http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html).

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

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Applicability

The project activity meets the applicability criteria of the selected methodology, as tabulated below;

Methodology applicability criteria	Project activity Scenario
•The consolidated methodology is applicable to project activities implemented in an existing or Greenfield facility converting waste energy carried in identified WECM stream(s) into useful energy. The WECM stream may be an energy source for : · Generation of electricity; · Cogeneration; · Direct use as process heat source; · Generation of heat in element process; · Generation of mechanical energy; or · Supply of heat of reaction with or without process heating	The project activity is implemented in a Greenfield facility and converting WECM stream into useful energy. The WECM stream is energy source for cogeneration.
•In the absence of the project activity, the WECM stream: (a) Would not be recovered and therefore would be flared, released to atmosphere, or remain unutilized in the absence of the project activity at the existing or Greenfield project facility; or (b) Would be partially recovered, and the unrecovered portion of WECM stream would be flared, vented or remained unutilized at the existing or Greenfield project facility.	In the absence of the project activity, the WECM stream would be partially recovered, and the unrecovered portion of WECM stream would be flared at the Greenfield project facility.

Project activities improving the WECM recovery may (i) capture and utilize a larger quantity of WECM stream as compared to the historical situation in existing facility, or capture and utilize a larger quantity of WECM stream as compared to a "reference waste energy generating facility"; and/or (ii) apply more energy efficient equipment to replace/ modify/ expand waste energy recovery equipment, or implement a more energy efficient equipment than the "reference waste energy generating facility".	The project activity improving the WECM recovery captures and utilizes a larger quantity of WECM stream as compared to a "reference waste energy generating facility" The reference waste energy generating facility is identified by Annex 1 of the methodology. As per the Annex 1 analyzed in Annex 4 of the PDD, PP chooses Option2 and WECM would be vented after flaring in alternative design. Hence, the project activity improving the WECM recovery captures and utilizes a larger quantity of WECM stream as compared to a "reference waste energy generating facility".
• For project activities which *recover waste pressure*, the methodology is applicable where pressure is used to generate electricity only the electricity generated from waste pressure is measurable;	The project activity does not recover the waste pressure of the waste off gas.
• Regulation do not require the project facility to recover and/or utilize the waste energy prior to the implementation of the project activity;	There is no regulation that mandates recovery of the waste off gas prior to the implementation of the project activity in host country.
• The methodology is applicable to both Greenfield and existing waste energy generation facilities. If production capacity of the project facility is expanded as a result of the project activity, the added production capacity must be treated as a Greenfield facility;	The project activity is a Greenfield facility which will commercially operate at the same time with the project facility. Thus, there is no added production capacity treated at the project facility.

• Waste energy that is released under abnormal operation of the project facility shall not be included in the emission reduction calculations.	In case where waste energy is released under abnormal operations like emergencies or shut downs, it will be monitored and recorded. And the emission reductions will not be claimed during abnormal operation.
• If multiple waste gas streams are available in the project facility and can be used interchangeably for various applications as part of the energy sources in the facility the recovery of any waste gas stream, which would be totally or partially recovered in the absence of the project activity, shall not be reduced due to the implementation of CDM project activity. For such situations, the guidance provided in Annex 3 shall be followed.	In the project activity, surplus waste off gas streams which consists of BFG, LDG and COG will be used interchangeably for various applications as part the energy sources in the ISM. Thus, According to the Annex-3 of ACM0012 (*version04*), PP will ensure that the recovery of any surplus waste gas stream shall not be reduced due to the implementation of CDM project activity. *(see the Annex-5 of the PDD)*
• The methodology is **<u>not</u>** applicable to the cases where a WECM stream is partially recovered in the absence of the CDM project activity to supply the heat of reaction, and the recovery of this WECM stream is increased under the project activity to replace fossil fuels used for the purpose of supplying heat of reaction.	Operations associated with the steel mill consume the off gas. The remained waste off gas is consumed by the project activity to produce electricity and steam. Thus all these surplus waste off gas from the ISM plants which would be released to atmosphere in the absence of the project activity at the Greenfield facility, will be wholly utilized for the project activity. Thus, WECM stream would not be partially recovered in the absence of the CDM project activity to supply the heat of reaction.
• This methodology is also **<u>not</u>** applicable to project activities where the waste gas/heat recovery project implemented in a single-cycle power plant (e.g. gas turbine or diesel generation) to generate power. However, the projects recovering waste energy from single cycle and/or combined cycle power plants for the purpose of generation of heat only can apply this methodology.	The project activity is not implemented in a single cycle gas turbine but combined cycle power plant to generate the heat and electricity.

• The emission reduction credits can be claimed up to the end of the lifetime of the waste energy generation equipment. The remaining lifetime of the equipment should be determined using the latest version of the " tool to determine the remaining lifetime of equipment"	Based on the "tool to determine the remaining lifetime of equipment (*version01)*" and the confirmation letter from the equipment supplier, the technical lifetime of cogeneration equipments are estimated as 25 years. However, according to PPA between PT. KPP andPT.KP, the period of supplying of electricity and steam generated by the proposed project is 15 years. Thus, PP decides that the lifetime of the proposed project is 15 years as conservative approach but for the investment analysis, the maximum lifetime as 20 years in accordance with "Guidelines on the assessment of investment analysis" is applied as conservative approach. Additionally, the fixed credits period (10 years) is applied to the project activity.
• The extent of use of waste energy from the waste energy generation facilities in the absence of the CDM project activity will be determined in accordance with the procedures provided in Annex 1(for Greenfield project facilities) and in Annex 2 (for existing project facilities) to this methodology.	As the project activity is a Greenfield project activity, Based on the Annex 1 in the methodology ACM0012 (*version 04*), PP shall demonstrate the extent of use of waste gas in the absence of the project activity.[9] *(See the Annex-4 of the PDD)*
• The applicability conditions included in the tools referred to above apply. (1) Tool for the Demonstration and Assessment of Additionality (Version 07.0.0)	As per the tool, once the additionally tool is included in an approved methodology, its application by project participants using this methodology is mandatory. Therefore, the tool is applicable to the proposed project activity since the tool is included in approved methodology ACM0012 (version 04).
• The applicability conditions included in the tools referred to above apply. (2) Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (version 02)	As per the tool, it can be used in cases where CO_2 emissions from fossil fuel combustion are calculated based on the quantity of fuel combusted and its properties. In case of the proposed project, the tool is applicable since the project emission from fossil fuel combustion is calculated in emergency situation.

[9] See the annex -4

• The applicability conditions included in the tools referred to above apply. (3) Tool to calculate the emission factor for an electricity system (version 02.2.1)	As per the tool, the tool may be applied to estimate the OM, BM and CM when calculating baseline emissions for a project activity that substitutes grid electricity. Also the tool is not applicable if the project electricity system is located partially or totally in an Annex I country. In case of the project activity, the tool is applicable to the project activity since the baseline scenario includes electricity import from the grid and relevant electricity system is only located in Indonesia, which is not Annex I country.
• The applicability conditions included in the tools referred to above apply. (4) Tool to determine the remaining lifetime of equipment (version 01)	As per the tool, the remaining lifetime of relevant equipment shall be determined prior to the implementation of the project activity and PP using the tool shall document transparently in the PDD how the remaining lifetime of applicable equipment has been determined, including all documentation used. Thus, PP uses the tool to determine the remaining lifetime for the equipment and all the relevant documents have been provided.

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

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As per the methodology of ACM0012 (*version04*), the geographical extent project boundary shall include the relevant WECM stream(s), equipment and energy distribution system in the following facilities:

The “project facility”
The “recipient facility (ies)”, which may be the same as the “project facility”

The relevant equipment and energy distribution system cover:

In a project facility, the WECM stream(s), waste energy recovery and useful energy generation equipment, and distribution system(s) for useful project energy;

In a recipient facility, the equipment which receives useful energy supplied by doing the project activity, and distribution system(s) for useful project energy;

Thus, as per above definition, the project facility includes the cogeneration facilities which are off gas fired boiler, steam turbine, electricity generator, combustion system, ignition system, main steam system, water supply system, condensation water system, power transmission system etc.

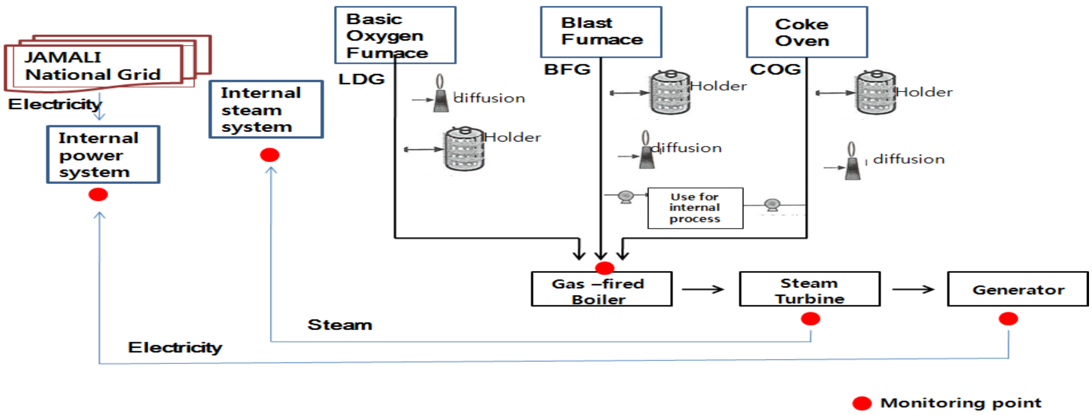
And the recipient facility is composed of ISM and distribution system which is connected with cogeneration system. The emission of the following greenhouse gases and their sources will be considered within the project boundary of the project activity.

<Table. B-1> Description of How the Sources and Gases Included in the Project Boundary

	Source	Gas	Included or Excluded	Justification/Explanation
Base line	The electricity generation supplied from the grid	CO_2	***Included***	Main emission source
		CH_4	Excluded	Not applicable
		N_2O	Excluded	Not applicable
	Fossil Fuel consumption in element process for thermal energy	CO_2	***Included***	Main emission source
		CH_4	Excluded	Not applicable
		N_2O	Excluded	Not applicable
	Fossil fuel consumption in cogeneration plant	CO_2	Excluded	Not applicable
		CH_4	Excluded	Not applicable
		N_2O	Excluded	Not applicable
	Generation of steam used in the flaring process, if any	CO_2	Excluded	Not applicable
		CH_4	Excluded	Not applicable
		N_2O	Excluded	Not applicable
Project Activity	Fossil fuel consumption for supply of process heat and/or reaction heat	CO_2	Excluded	Only WECM will be used for fuel.
		CH_4	Excluded	According to methodology ACM0012, CH_4 is excluded for simplification.
		N_2O	Excluded	According to methodology ACM0012, N_2O is excluded for simplification.
	Auxiliary fossil fuel consumption on-site in the project activity	CO_2	***Included***	Main source
		CH_4	Excluded	Not applicable
		N_2O	Excluded	Not applicable
	Supplemental electricity consumption	CO_2	Excluded	Internal electricity use will be deducted from total electricity generated by the project activity.
		CH_4	Excluded	Not applicable

		N_2O	Excluded	Not applicable
	Electricity import to replace captive electricity, which was generated using waste energy in absence of project activity	CO_2	Excluded	No captive electricity in the baseline is replaced by imported electricity.
		CH_4	Excluded	
		N_2O	Excluded	
	Project emission from cleaning of gas	CO_2	Excluded	Gas cleaning is not required.
		CH_4	Excluded	
		N_2O	Excluded	

Thus, the boundary of project activity is as below;



<Figure. B.1> **The project boundary of the project activity**

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

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Based in methodology ACM0012 (*version 04),* the baseline scenario is identified as the most plausible baseline scenario among all realistic and credible alternative(s).

For the project activity, the most realistic and credible alternatives of the project activity are determined for:

- ***Waste gas*** use in the absence of the project activity;
- ***Power generation*** in the absence of the project activity for each recipient facility if the project activity involves electricity generation for that recipient facility;
- ***Steam generation*** in the absence of the project activity, for each recipient facility if the project activity involves generation of useful heat for that recipient facility;

The PP shall exclude baseline options that:

- Do not comply with legal and regulatory requirements; or
- Depend on key resources such as fuels, materials or technology that are not available at the project site

In determining the baseline scenario, PP shall identify the realistic and credible alternatives to the project activity that would provide an output equivalent to the combined output of all the components of the project activity. These alternatives shall be determined as realistic combinations of the following options.

And following baseline scenario of an existing facility should be tailored for Greenfield facilities. Therefore, for the Greenfield project facilities, the following baseline scenarios should be analysed based upon the guidelines included in Annex I in the methodology of ACM0012(*version 04*) (see "Assessment of the utilization of waste energy in absence of CDM project activity in B.2)

For the use of waste energy the realistic and credible alternative(s) may include, inter alia:

Alternatives		Applicable	Justification/Explanation
W1	Waste off gas is directly vented to the atmosphere without incineration	Excluded	- There is a regulation[10] related to the emission standards. According to the regulation, it is stated that the factory shall equip with supporting facility and safety equipment for incineration. Thus surplus waste off gas cannot be vented to the atmosphere directly. - Hence, it is not a credible alternative.
W2	Waste off gas is released to the atmosphere(for example after incineration) or waste heat is released (or vented) to the atmosphere or waste pressure energy is not utilized	***Included***	- As explained in W1, This scenario is in line with national law and regulation. - Hence, it is a credible alternative.

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[10] Decree of the state minister for environment/KEP.13/MENLH/3/1995, Indonesia

W3	Waste gas is sold as an energy source	Excluded	- Even if this scenario is in line with national law and regulation, selling off gas has many barriers as follows: ・ Off gas is low in calories compared to fossil fuel. Thus size of the boiler should be bigger than other fossil fuel based boiler. ・ Off gas has a lot of dust. Thus cleaning facility is needed. ・ Stable supply of off gas is difficult because off gas is just generated at blowing time. Thus buffer facility is needed. - As a result, purchase of off gas is not attractive to a recipient facility. - Additionally, There are no customers that need the waste off gas around the complex[11]. - Hence, it is not a credible alternative.
W4	Waste gas is used for meeting energy demand at the recipient facility(ies)	***<u>Included</u>***	- This scenario is in compliance with the national law and regulation. And through the project activity, generated electricity and steam could be used at the recipient facility, ISM. - Hence, it is a plausible alternative.
W5	A portion of the quantity or energy of waste off gas is recovered for generation of heat and/or electricity and/or mechanical energy, while the rest of the waste energy produced at the project facility is flared/released to atmosphere/unutilised	Excluded	- This scenario is in compliance with the national law and regulation. However, the energy (electricity and steam) required by ISM is larger than the energy (electricity and steam) generated by the project activity (refer to Section A.2). Thus, all of surplus waste off gas could be used. - Hence, it is not a credible alternative.

[11] http://www.kiec.co.id/index.php?page=content&cid=20

W6	All the waste energy produced at the facility is captured and used for export electricity generation or steam	***Included***	- According to the contract with PT. KP, all steam and electricity generated by the surplus waste off gas will be supplied to PT. KP, not PLN. - Additionally, According to the law [12] in Indonesia, only state enterprises have authority for the electricity business. But, PT. KPP is the joint venture which is between PT. KDL that has authority for electricity business in the Krakatau complex which includes the project site and POSCO POWER Co., Ltd. And according to the Joint Venture Agreement, PT. KDL gives PT. KPP the authority for the electricity business only for the ISM site. Thus, PT. KPP can supply electricity to only PT. KP. - As result, the electricity and steam generated by the surplus waste off gas will be supplied to PT. KP according to the contracts. In that case, the scenario is same as the proposed project. - Hence, it is a credible alternative.

For power generation, the realistic and credible alternative(s) may include, inter alia:

Alternatives		**Applicabl e**	**Justification/Explanation**
P1	Project activity not undertaken as a CDM project activity	***Included***	-This alternative is in compliance with all applicable legal and regulatory requirements. - Hence, it is a part of possible scenario

[12] UNDANG-UNDANG REPUBLIK INDONESIANOMOR 30 TAHUN 2009

P2	On-site or off-site existing fossil fuel fired cogeneration plant	Excluded	-There is no on-site existing fossil fuel fired cogeneration plant as the location is a newly developed and the project activity is the first tenant. - And, although there is the off-site existing fossil fuel fired cogeneration plant, according to the law related to electricity in Indonesia[13], the electricity which is generated in fossil fuel fired cogeneration plant could not export other entity. Just it should be transmitted to PLN who is the national electricity company. - Hence, it is not a realistic alternative.
P3	On-site or off-site Greenfield fossil fuel fired cogeneration plant	***<u>Included</u>***	- Installing the off-site Greenfield fossil fuel fired cogeneration plant is possible but supplying electricity to PT. KP is impossible according to the law and the Joint Venture Agreement. (PT. KPP has the authority for the electricity business only for the ISM site, refer to W6 scenario) - Installing the on-site Greenfield fossil fuel fired cogeneration plant for captive power and steam supply is in line with national regulation. - Regarding fossil fuel, coal, natural gas and heavy-oil are available in host country. Therefore, more detailed discussion will be analyzed below step 2. - Hence, it is a plausible alternative
P4	On-site or off-site existing renewable energy based cogeneration plant	Excluded	-There is no on-site or off-site existing renewable energy based cogeneration plant. As the location is a newly developed and the project activity is the first tenant. - Although there is the off-site existing renewable energy based cogeneration plant, according to the law (which is same law specified in P2) related to electricity in Indonesia, the electricity which is generated in renewable energy based cogeneration plant could not export other entity. Just it should be transmitted to PLN who is the national electricity company. - Hence, it is not a credible alternative.

[13] UNDANG-UNDANG REPUBLIK INDONESIANOMOR 30 TAHUN 2009

P5	On-site or off-site Greenfield renewable energy based cogeneration plant	Excluded	- First of all, Although PP can install the off-site Greenfield renewable energy based cogeneration plant for generation of electricity, the electricity could not be directly transmitted to ISM (PT. KPP has the authority for the electricity business only for the ISM site, refer to W6 scenario). - And, regarding the on-site Greenfield renewable energy based cogeneration plant, first of all, there is no spare area for construction renewable energy based cogeneration plant. - Furthermore, installing the wind[14], hydro[15], ocean energy[16], solar[17] and biomass[18] based cogeneration plant is not possible. - Additionally, as the renewable energy is mostly affected by the Climate and surround situation, stable power supply is different, but ISM needs stable power provision. - Hence, it is not a credible alternative.

[14] http://ita.doc.gov/td/energy/Indonesia%20Renewable%20Energy%20Assessment%20(FINAL).pdf _Renewable energy market assessment report: Indonesia (5page)_ Indonesia's potential for wind energy is limited.

[15] http://energy-indonesia.com/03dge/Mochamad%20Sofyan.pdf _ Private participation on Hydropower Development(3page)_ As the project is located at seafront, it is lack of hydropower

[16] http://wreeec2011bali.com/uploads/files/Presentation%20Prof%20Mukhtasor.pdf _ ocean energy in Indonesia (14~15page) _ around the project site, ocean energy is limited.

[17] https://circle.ubc.ca/bitstream/id/160590/Wirasaputra_Vincent_2012_EECE492_Final_Report.pdf _ the Development of Photovoltaic System in Indonesia (9page) _ In the project area, the solar irradiation is not suitable.

[18] http://cilegonkota.bps.go.id/publikasi/CDA%202010.pdf _Cilegon in figure 2010(page11) _ Not only in the project site but also in Cilegon, there is no plantation. thus biomass is hard to get.

P6	On-site or off-site existing fossil fuel based existing identified captive power plant	Excluded	-There is no on-site or off-site existing fossil fuel based existing identified captive power plant as the project activity is Greenfield project. Also, although there is the off-site existing power plant, according to the law related to electricity in Indonesia, the electricity which is generated in captive power plant could not be exported to other entity. Just it could be transmitted to PLN who is the national electricity company. (same as P2) - Hence, it is not a credible alternative.
P7	On-site or off-site existing identified renewable energy or other waste energy based captive power plant	Excluded	-There is no on-site or off- site existing renewable energy based captive power plant. - Also, although there is the off-site existing renewable energy or other waste energy power plant, according to the law related to electricity in Indonesia, the electricity which is generated in captive power plant could not export other entity. Just it could be transmitted to PLN who is the national electricity company. (same as P2) - Hence, it is not a credible alternative.
P8	On-site or off-site Greenfield fossil fuel based captive plant	***Included***	- Installing the off-site Greenfield fossil fuel based captive plant is possible but supplying electricity to PT. KP is impossible according to the law and the Joint Venture Agreement.(PT. KPP has the authority for the electricity business only for the ISM site, refer to W6 scenario) - Installing the on-site Greenfield fossil fuel based captive plant is in line with national regulation. - Regarding fossil fuel, coal, natural gas and heavy-oil are available in host country. Therefore, more detailed discussion will be analyzed below step 2. - Thus, it is a plausible alternative.

P9	On-site or off-site Greenfield renewable energy or other waste energy based captive plant	Excluded	- Installing the on-site or off-site Greenfield renewable energy power plant has some barriers which are explained in P5. - And regarding using other waste energy, there is no other waste energy from and around the plant except the surplus waste off gas from PT.KP. - Hence, it is not a credible alternative.
P10	Sourced from grid-connected power plants	***<u>Included</u>***	- This scenario is compliance with national law and regulation in host country. - Hence, it is a realistic alternative.
P11	Existing captive electricity generation using waste energy.	Excluded	-There is no existing captive electricity generation using waste energy as the project activity is Greenfield project. - Hence, it is not a credible alternative.
P12	Existing cogeneration using waste energy. But at a lower efficiency or lower recovery	Excluded	- There is no existing power cogeneration using waste energy as the project activity is Greenfield project. - Hence, it is not a credible alternative.

For heat generation, the realistic and credible alternative(s) may include, inter alia:

Alternatives		Applicabl e	Justification/Explanation
H1	The project activity is not undertaken as a CDM project activity	***<u>Included</u>***	-This alternative is in compliance with all applicable legal and regulatory requirements. - Hence, it is a part of possible scenario

H2	On-site or off-site existing fossil fuel based cogeneration plant	Excluded	- As the same with above alternative P2, There is no on-site existing fossil fuel fired cogeneration plant as the location is a newly developed and the project activity is the first tenant. - And, although there is the off-site existing fossil fuel fired cogeneration plant, according to the law related to electricity in Indonesia, the electricity which is generated in captive power plant could not be exported to other entity. Just it could be transmitted to PLN who is the national electricity company. Thus, off-site existing fossil fuel based cogeneration supply the power and heat for their recipient facility. - Hence, it is not a realistic alternative.
H3	On-site or off-site Greenfield fossil fuel based cogeneration plant	***Included***	- The scenario is the same as the above alternative P3 - Hence, it is a plausible alternative
H4	On-site or off-site existing renewable energy based cogeneration plant	Excluded	- The scenario is the same as the above P4 - Hence, it is not a credible alternative.
H5	On-site or off-site Greenfield renewable energy based cogeneration plant	Excluded	- The scenario is same as the above alternative P5 - Hence, it is not a credible alternative.
H6	An existing fossil fuel based element process	Excluded	- There is no existing fossil fuel based element process. - Hence, it is not credible alternative.

H7	A new fossil fuel based element process	***Included***	- This scenario is in compliance with the national law and regulation in host country. The scenario will be analyzed below step 2. - Hence, it is a credible alternative.
H8	An existing renewable energy or other waste energy based element process to supply heat	Excluded	-There is no existing renewable energy or other waste energy based element process to supply heat. - Therefore, it is not credible alternative.
H9	A new renewable energy or other waste energy based element process to supply heat	Excluded	- Installing the on-site or off-site Greenfield renewable energy power plant has some barriers which are explained in P5. - And regarding using other waste energy, There is no other waste energy from and around the plant except the surplus waste off gas from PT.KP. - Hence, it is not a credible alternative.
H10	Any other source such as district heat	Excluded	- There is no district heat facility which is available in the project location[19]. -Hence, it is not credible alternative.
H11	Other heat generation technologies (e.g. heat pumps or solar energy)	Excluded	- Other heat generation technologies are not in the PP's business field. Furthermore, using other generation technologies is not efficient as much as project activity. Therefore, these technologies could not supply stable heat. - Hence, it is not credible alternative.

[19] http://www.kiec.co.id/index.php?page=content&cid=20

H12	Steam/process heat generation from waste energy, but with lower efficiency or lower recovery	Excluded	- According to Law of Indonesia[20], equipments with high efficiency are recommended to be applied. And the action plan[21] to reduce Green House Gas was established by the government in Indonesia. Thus, the lower efficiency of energy generation is deemed to be not complying with the regulation and policy. - Furthermore, lower efficiency means much less economical attraction. So, it will encounter more serious difficulties. - Hence, it is not a credible alternative.
H13	Cogeneration with waste energy, but at a lower efficiency or lower recovery	Excluded	- As explained in the above alternative, H12, it is not a credible alternative.
H14	On-site fossil fuel consumption to supply heat	***Included***	- Installing the on-site fossil consumption to supply heat is line with national regulation. - Regarding fossil fuel, coal, natural gas and heavy-oil are available in host country. Therefore, more detailed discussion will be analyzed in the below step 2. - Hence, it is a credible alternative.

To sum up, the most plausible scenarios obtained from the combination of the alternatives are presented in the following table B.2.

[20] Peraturan Menteri Energi Dan Sumbre Daya Mineral Republik Indonesia Nomor : 13 Tahun 2012_Penghematan Pemakaian Tenaga Listrik

[21] Guideline for implementing green house gas emission reduction action plan

< Table. B-2> Combination of baseline options and scenario

Scenario	Baseline scenario			Description of Situation
1	**W2**	**P3**	**H3**	The surplus waste off gas is released to the atmosphere after incineration and a new Greenfield fossil fuel based cogeneration plant is constructed to provide ISM electricity and steam.
2	**W2**	**P8**	**H14**	The surplus waste off gas is released to the atmosphere after incineration and Greenfield fossil fuel based captive plant is constructed to provide electricity, On-site fossil fuel is consumed to supply heat
3	**W2**	**P10**	**H7**	The surplus waste off gas is released to the atmosphere after incineration and the electricity is imported from the JAMALI grid and the heat is supplied from *fossil fuel* based steam boiler.
4	**W4/W6**	**P1**	**H1**	The surplus waste off gas is used for generating the electricity and steam to satisfy the demand at the recipient facility (not undertaken as a CDM project activity)

Step 2: Step 2 and/or Step 3 of the latest approved version of the "Tool for the demonstration and assessment of additionality" shall be used to identify the most plausible baseline scenario by eliminating non-feasible option <u>(e.g. alternatives where barriers are prohibitive or which are clearly economically unattractive).</u>

Thus, PP is required to use economic or barrier analysis for the identified baseline scenario. As the project activity is implemented in a Greenfield project facility, the investment analysis for the Greenfield projects include the cost of the fuel that would have been used by the recipient. In Indonesia, the available fossil fuels are the coal, LNG and heavy oil. Therefore, first of all, the price of fuels is presented as below;

< Table. B-3> Fuel price comparison per unit of energy

Item	Fuel price		Energy in joule		Price of fuel
					USD/GJ
LNG[22]	7.79	USD/MMBTU	1.055[23]	GJ/MMBTU	7.38
Heavy Oil[24]	0.68	USD/L	0.03586[25]	GJ/L	18.96
Coal[26]	62.39	USD/tone	24.03[27]	GJ/tone	2.60

[22]2011 Handbook of energy and economic statistics of Indonesia which is published by Ministry of Energy and Mineral Resource

[23] Unit conversion factor

[24]PT. MITRA OIL PERTAMINA's catalogue_7,068Rp/L_1USD=10339Rp(average of 2009)

(http://ptmitraoilpertamina.indonetwork.co.id/2846356/harga-jual-kami-mulai-tanggal-01-s-d-15-september-2011.htm)

[25] Volumetric energy density of Diesel oil (35.86 MJ/L)

[26]2011 Handbook of energy and economic statistics of Indonesia which is published by Ministry of Energy and Mineral Resource

[27] Indonesia Mineral, Coal and Geothermal Statistics 2006, p.28(applied NCV for Suralaya Coal)

First of all, LNG[28] is not available at site in accordance with Indonesia's gas balance. PT PGN limits the quantity of gas supplying for new customer[29]. And the infrastructure also did not equip with. As the result, using LNG cogeneration, power and steam project is impossible. [30]

Second, the price of heavy-oil is far expensive than other fuels. Actually, for the large quantity of power plant for generating electricity and steam, the heavy-oil fuel is not a credible scenario due to the cost of the fuel. Thus, it could be used for emergency purpose. Especially, the government got rid of the subsidy of oil. Therefore, the price of oil is expected to be expensive more than before. [31]

And, coal is most probable fossil fuel for alternative of project activity. However, PP shall eliminate non-feasible option to select the most plausible alternative. Because to install a coal based power plant, huge land is essential prerequisite to save coal[32]. The coal based power plant is needed almost same land requirement as the proposed project. However, the project activity is just a part of the ISM for supplying the electricity and steam. And, PT.KP already set up the layout of ISM by FSR. Thus, it is impossible to change the design considering coal based cogeneration plant and there is no empty land that is equivalent to the proposed project.
Below picture is the bird's eye view of the project activity.

[28]http://prokum.esdm.go.id/Publikasi/Handbook%20of%20Energy%20&%20Economic%20Statistics%20of%20Indonesia%20/Handbook%20of%20Energy%20&%20Economic%20Statistics%20ind%202011.pdf _Handbook of Energy & Economic Statistics of Indonesia (17page) _all produced LNG is consumed in LNG plant.

[29] It could be demonstrated by the estimation letter of LNG form PT PGN.

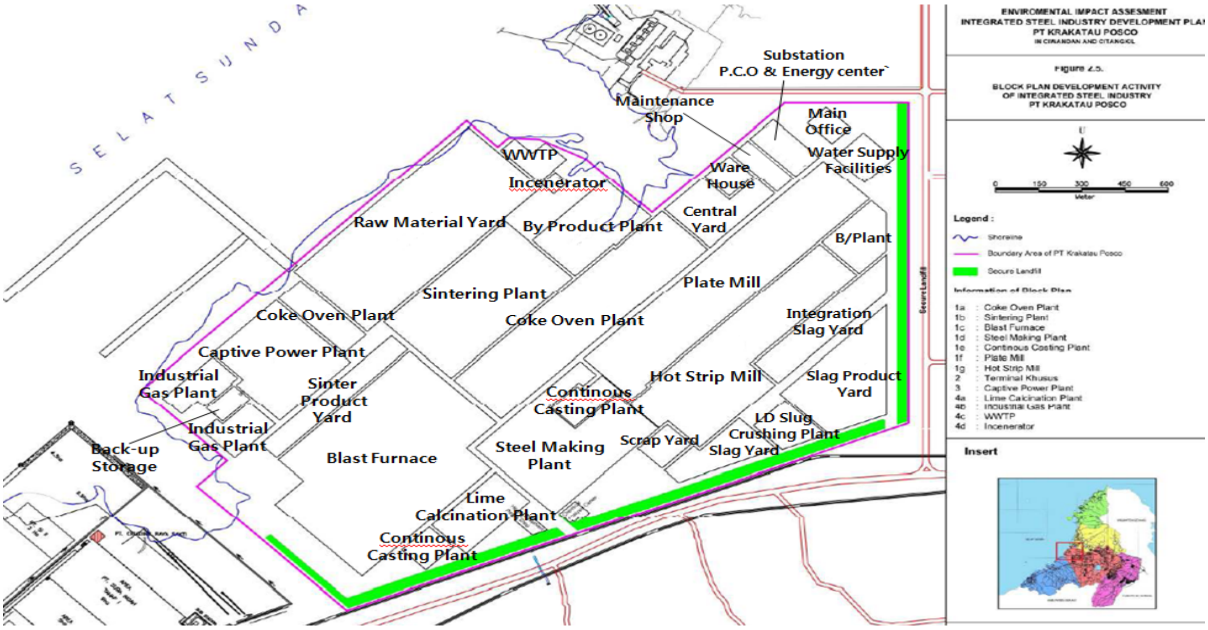
[30] Long term infrastructure development plan to meet domestic gas demand/ ministry of energy and mineral resources, directorate general of oil and gas/ the 5th International Indonesian Gas Conference & Exhibition

[31] http://www.iisd.org/gsi/sites/default/files/ffs_actionplan_indonesia.pdf _ Indonesia's Fuel subsidies(1page)

http://www.businessweek.com/news/2012-03-26/indonesia-fuel-price-rise-needed-to-protect-growth-basri-says

[32] http://globalenergyobservatory.org/geoid/41522 , 200MW coal power plant is needed about 0.16km^2

http://globalenergyobservatory.org/geoid/43057, 260MW coal power plant is needed about 0.38km^2 (0.29 km^2 for 200 MW)



< Figure. B-2 > the layout of the project activity and ISM

Therefore, the scenario 1 and 2 is not a plausible scenario. Furthermore, the scenario 4 has the investment barrier as the IRR is far less than benchmark rated, which will be analyzed below section B.5. Thus, the scenario 1, 2 and 4 will be eliminated due to the credible barriers.

As the result, the surplus waste off gas would be released to the atmosphere after incineration. The electricity would be imported from the JAMALI grid and the heat would be supplied fossil fuel based steam boiler. It could be the most plausible alternative. Especially, in scenario 3, the steam boiler would use coal as the fuel. As explained above, it is impossible that PP could get LNG as much as they want for generation steam and heavy oil is too expensive to get the equivalent amount of steam. However, in the absence of the project activity, PP may have empty land to store the coal as the steam boiler supplying the 32t/h steam would need the just about 6% of the enthalpy of the project activity. Therefore, using coal steam boiler could be the most plausible alternative.

Step 3: If more than one credible and plausible alternative scenario remain, the alternative with the lowest baseline emissions shall be considered as the baseline scenario

There is no more credible and plausible alternative scenario.

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

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Firstly, PT KP implemented the Feasibility Search Report (FSR) which was finished on 31 Dec 2009. Through the FSR, the project activity as CDM is identified. And then PP studied the possibility of the project activity and held the Executed Board Meeting on 21 Dec, 2012. As the result of the meeting, although the project activity is not financially attractive project compared to other type power plant, PP decided to implement the project activity as a CDM project due to the benefit of the CERs.

Thus the PP subsequently signed a CDM development contract with RCC Co. Ltd., who is a CDM consultancy company on 01 Nov 2011. And the Project activity smoothly started the EIA approval, the construction approval and power business approval from City hall. While, PP also held the stakeholder's meeting for informing the project activity and hear their opinions on 6th Feb, 2012.

Finally, submitted the application for approval of DNA and got the approval of the DNA on 27th August, 2012. Subsequently, PP contracted with PT KP for supplying the electricity and steam. Below PP summarize implementation schedule of the project activity, illustrating the main events leading up to the start of operation. An overview of key events is given as follows;

< Table. B-4> Time line of the project activity

Date	Key event
2010.10.15	Finished the Feasibility study Report surveyed by POSCO POWER Co., Ltd
2010.12.21	Held Executed Board Meeting by POSCO POWER Co., Ltd
2011.07.14	Joint Venture Agreement with PT KDL
2011.08.05	Board decision for the investment cost
2011.08.15	Registered entrepreneur
2011.10.05	Started the project activity : contract the installing the power plant
2011.11.01	Contract with RCC Co., Ltd for implementation of CDM project
2011.11.08	Submitted the prior consideration to UNFCCC & DNA
2012.01.05	Got the approval of the Environmental Impact Assessment
2012.02.16	Held the stakeholder's meeting
2012.08.27	Got the approval of DNA
2012.09.25(estimate)	Contract with PT KP and PT KPP for Power Purchase Agreement

These key events can prove that CDM has been seriously taken into account before construction of the proposed project activity and the relevant proof document was submitted to the DOE at the time of the on-site validation.

According to ACM0012 (*version04*), the "Tool for the demonstration and assessment of additionality (*version 07*)" is applied to demonstrate the additionality of the project activity.

Step 0: Demonstration whether the proposed project activity is the first-of-its-kind

This step is optional. If it is not applied it shall be considered that the proposed project activity is not the first-of-its-kind.

Outcome of Step 0:

If the proposed project is the first-of-its-kind, its additionality is demonstrated; otherwise, proceed to Step 1.

Step1. Identification of alternatives to project activity consistent with current laws and regulations

Define realistic and credible alternatives6 to the project activity(s) through the following Sub-steps:

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

PP Identified realistic and credible alternative(s) available to the project participants or similar project developers that provide outputs or services comparable with the proposed CDM project activity. As stated in B.4, there is a realistic alternative remaining:

Outcome of step 1a:

Scenario	Baseline scenario			Description of Situation
3	W2	P10	H7	The surplus waste off gas is released to the atmosphere after incineration, the electricity is imported from the JAMALI grid and the heat is supplied from coal based steam boiler.

Sub-step1b: Consistency with mandatory laws and regulations:

The section B.4 contains the confrontation of the alternatives with Indonesia's applicable law and regulations, and practical and feasible alternatives to cogeneration and the use of the surplus waste off gas have been selected. A further argument is that the project activity is consistent with the national policies for environmental protection, energy conservation and sustainable development. However, there exists no binding legal and regulatory requirement for this type of project yet.

Outcome of Step 1b:

The section B.4 contains the confrontation of the alternatives with Indonesia's applicable laws and regulations, and practical and feasible alternatives to cogeneration which uses the surplus waste off gas. Therefore, the selected alternatives are all in line with the existing Indonesia's laws and regulations.

Step2. Investment analysis

The purpose of this step is to determine whether the project is financially attractive than other alternatives without additional revenue/funding which is possibly from the sale of emission reductions (CERs). The investment analysis was conducted in the following steps;

Sub-step 2a: Determine appropriate analysis method:

Three methods suggested by 'Tool for the demonstration and assessment of additionality (*version 07*)' are simple cost analysis (option I), investment comparison analysis (option II) and benchmark analysis (Option III). First of all, as the project activity will earn revenues not only from the CER but also from the electricity and steam output, the Option I is not appropriate. And according to "Guidelines on the assessment of investment analysis (*version 05*)", If the alternative to the project activity is the supply of electricity from the JAMALI grid this is not to be considered an investment and a benchmark approach is considered appropriated. Therefore, the project activity applied the benchmark investment analysis (option III) for demonstrate the additionality.

Sub-step 2b: Option III. Apply benchmark analysis:

According to the Guidelines on the assessment of investment analysis (version 05), required return on equity are appropriate benchmark for a Project IRR. Therefore, the Project IRR is used for compare to the benchmark rate. Regarding the benchmark rate, PP did not have any abroad project experience for CDM project in Indonesia. Therefore, based on the "Demonstration and assessment of additionality (version 06.1.0)", Indonesia bank investment lending rate[33] which is 13.58 %[34] could be applied as the benchmark rate. Thus, it is sufficiently considered the risk of host country for equity of investors.

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

To be applied financial parameters are as below;

[33] http://www.bi.go.id/web/id/Statistik/Statistik+Ekonomi+dan+Keuangan+Indonesia/Versi+HTML/Sektor+Moneter/, in this web page, 1.26 Suku Bunga Pinjaman Rupiah yang diberikan Menurut Kelompok Bank dan Jenis

[34] As conservative approach, average of investment lending rate (2006~2010) for State, regional government, private national, foreign and joint and commercial bank during is used to decide the benchmark.

< Table. B-5> the Financial indicator

Item		Value	Source
Total Capacity of Turbine		100MW * 2 Unites	Based on the technical specification
Electricity generation		1,185,279 MWh/y	Based on the Feasibility Document for Executive Board (6% of total generation is captive use)
Steam generation		53,950 MWh/y	Calculated[35]
Annual net output		1,239,229 MWh/y	Based on the Feasibility Document for Executive Board
Total Investment		277,000,000 USD	Board decision for the investment cost
O&M Cost		4,500,000 USD/y	Based on the Feasibility Document for Executive Board
Combined Tariff		3.24 cent/kWh	= Weighted average tariff[36] – Waste off gas tariff
Weighted average tariff		9.32 cent/kWh	Electricity output : steam output = 94 : 6
	Electricity tariff	8.89 cent/kWh	Based on the Power Purchase Agreement between PP and PT KP
	Steam tariff	16.17 cent/kWh	Based on the Power Purchase Agreement between PP and PT KP
Waste off gas tariff		6.08 cent/kWh	Based on the Power Purchase Agreement between PP and PT KP
Lifetime		20 years	Based on the PPA (Power Purchase Agreement), the lifetime is 15 year but as conservative approach in investment analysis, PP decides the lifetime as 20 year which is maximum value in accordance with "Guidelines on the assessment of investment analysis".
Income tax		25%[37]	Based on the National Regulation

The price of the waste off gas is calculated compared to the Natural gas price. Thus, the price of 0.0254 USD/Mcal was calculated at the time of determining the project activity and then PP could estimate the enthalpy of the waste off gases which are supplied to project activity. As the result, 6.08 cent/kWh is calculated and the supported documents are submitted to DOE. Therefore, PP is interested in the difference between the weighted average tariff (electricity tariff and steam tariff) and waste off gas price per kWh.

Thus, the result of the IRR is as below;

[35] 32 ton= 6.77 MW, thus, 1ton =211.56 kW

[36] electricity output: steam output = 94 : 6

[37] http://www.taxrates.cc/html/indonesia-tax-rates.html

Item	IRR
Without CERs	10.2 %
With CERs (10 Euro)	15.0 %

The financial Indicators with and without CER revenues are listed in the table above. Without CER revenues, the project IRR of the project activity is only 10.2%, lower than the benchmark 13.58 % and the project activity is financially unacceptable. Therefore, the project activity is only financially viable if the project activity generated additional revenue from the CDM through the sale of the emission reductions. During 2008.8~2012.12, the average price of CERs is 10[38] Euro/tCO_2, Therefore, PP considered the CDM revenues and the Project IRR is came out 15.0%. The spread sheet will be available to the DOE during validation.

Sub-step 2d: Sensitivity analysis

The purpose of the sensitivity analysis is to examine whether the conclusion regarding the financial viability of the project activity is sound and tenable with those reasonable variations in the assumptions.

√ *Total investment*
√ *combined Tariff*
√ *O&M cost*
√ *Annual net output*

As the average inflation rate[39] during 2007~2011 is just 6.43 %, their fluctuations are normally within the range of ±10%.
In order to further demonstrate, the sensitivity analysis on the above indicators is analyzed as follows:

Total investment

When the total investment cost is decreased by 10%, the IRR is 11.8%. However, the project participant already made the contract and the contract cost is higher than FSR. Thus, it is impossible to reach the benchmark by decreasing the total investment cost.

[38] http://www.bluenext.eu/statistics/downloads.php
[39] http://www.bi.go.id/biweb/Templates/Moneter/Default_Inflasi_EN.aspx?NRMODE=Published&NRNODEGUID=%7bC6BDA4D3-9471-4D99-A3B73A2ADE59E98C%7d&NRORIGINALURL=%2fweb%2fen%2fMoneter%2fInflasi%2fData%2bInflasi%2f&NRCACHEHINT=Guest

Combined Tariff

When the combined tariff is increased by 10%, the IRR is 11.5%. The combined tariff is different between Weighted average tariff (weighted average for electricity price and steam price) and waste gas tariff.
According to the PPA contracted between project participant and PT. KP, the electricity price (cent/kwh) is the purchasing price of electricity from PLN. And the waste off gas tariff and the steam price are calculated as per the price of PLN. Thus, the indicators could be changed by electricity purchasing price from PLN. Even if electricity purchasing price from PLN is increased, the waste gas tariff is also increased. Therefore, PP can get fixed profit (energy charge which consists of O&M price and margin) regardless of the price of PLN.

In other words, if the purchasing price of electricity from PLN is increased, the energy charge for electricity will be increased because the capacity charge is fixed with O&M cost and the margin. Additionally, energy charge for steam is also increased (refer to the below table). As the result waste off gas tariff is increased by the amount corresponding to energy charge for electricity and steam.
Thus, the combined tariff (= sales price – waste off gas tariff) could not be changed. In conclusion, it is impossible to reach the benchmark by increasing the tariff.

The Steam price	Capacity charge for steam
	Energy charge for steam (energy charge for electricity * proportion of steam among total calories consumed)
The Electricity price (purchasing price from PLN x electricity generated)	Capacity charge for electricity
	Energy charge for electricity
The waste off gas tariff	Energy charge for steam
	Energy charge for electricity

O&M Cost

As mentioned the above, average inflation rate[40] during 2007~2011 is just 6.43 %. Additionally, if the operation & maintenance cost is not considered, the IRR is just 11.7%. Thus, it is obviously unlike to happen.

[40]http://www.bi.go.id/biweb/Templates/Moneter/Default_Inflasi_EN.aspx?NRMODE=Published&NRNODEGUID=%7bC6BDA4D3-9471-4D99-A3B7 3A2ADE59E98C%7d&NRORIGINALURL=%2fweb%2fen%2fMoneter%2fInflasi%2fData%2bInflasi%2f&NRCACHEHINT=Guest

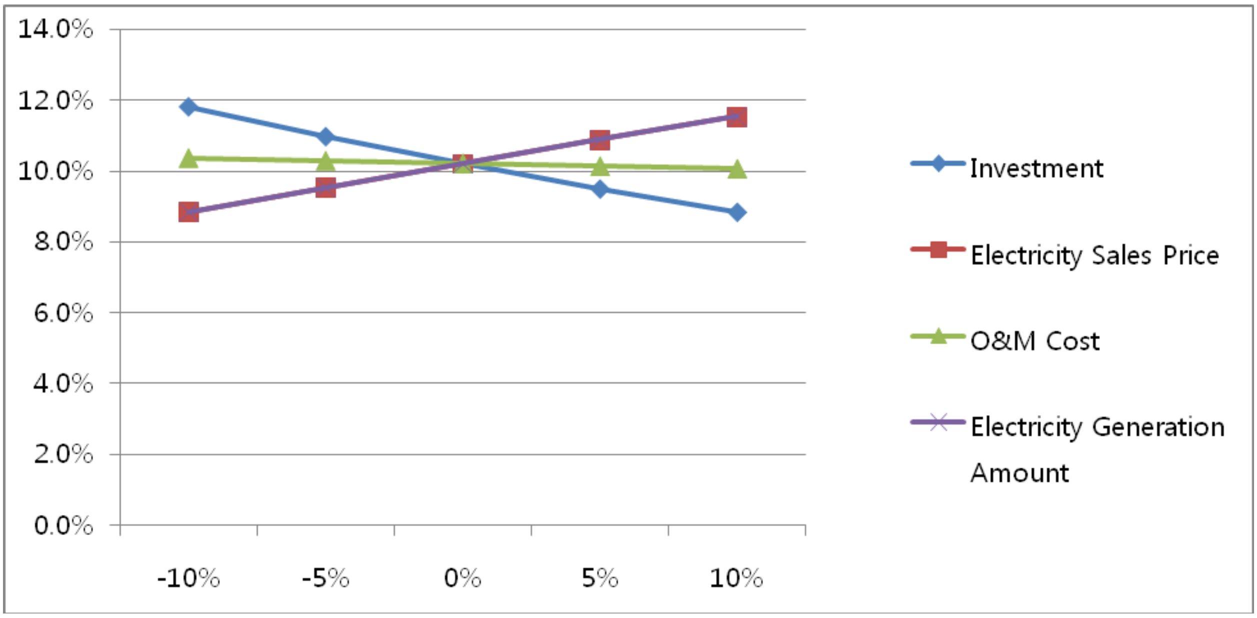
Annual net output

When the annual net output is increased by 10%, the IRR is 11.5%.
However, the outputs generated by the project rely on the amount of fuel (off gas) and it is limited by capacity of Coke oven, BF and BOF. Thus, PP calculates maximum quantity[41] of the waste off gas based on data from other ISM in Korea and then sets up maximum output[42].
Hence, it is impossible to reach the benchmark by increasing the annual net output.

The analysis can be made though the spread sheet which will be submitted to DOE for validation, the conclusion for the sensitivity analysis is stated as below;

<Table.B-6> Sensitivity analysis of the project activity

Parameter / Range	-10%	-5%	0	+5%	+10%
Investment	11.8%	11.0%	10.2%	9.5%	8.8%
Electricity Sales Price	8.8%	9.5%	10.2%	10.9%	11.5%
O&M Cost	10.3%	10.3%	10.2%	10.1%	10.0%
Electricity Generation Amount	8.8%	9.5%	10.2%	10.9%	11.5%



< Figure. B-3 > sensitivity result of project activity

Based on the above sensitivity analysis, PP confirmed that the project activity is still financially unattractive project as the IRR is less than the Benchmark rate, 13.58%. Thus, the project activity has an investment barrier without the revenue of the CERs and the project activity is additional.

[41] BFG:237,012Nm^3/h, COG:30,421Nm^3/h, LDG:25,404Nm^3/h

Step3. Barrier analysis

This step is skipped.

Step4. Common practice analysis

The above generic additionality tests shall be complemented with an analysis of the extent to which the proposed project type (e.g. technology or practice) has already diffused in the relevant sector and region. This test is a credibility check to complement the investment analysis (Step 2) or barrier analysis (Step 3). Identify and discuss the existing common practice through the following sub-steps. If the proposed CDM project activity (ies) applies measure(s) that are listed in the definitions section above proceed to Sub-step 4a; otherwise, proceed to Sub-step 4b.

In case of the project activity, the measure of the project activity is '*(ii) Switch of technology with or without change of energy source (including energy efficiency improvement as well as use of renewable energies)*' which is specified in the "Tool for the demonstration and assessment of additionality(Ver. 7)".
The measure of the project activity is involved in 'Industrial energy efficiency' according to the CDM Methodology booklet and changes energy source from grid and fossil fuel to the surplus waste off gas in the ISM.
Thus, Sub-step 4a is analyzed.

Sub-step 4a: The proposed CDM project activity(ies) applies measure(s) that are listed in the definitions section above

The Guidelines on common practice (*version 02.0*) is used to analyze this step. The below stepwise approach demonstrates that there are similar activities in the relevant region.

Step 1: Calculate applicable output range as +/-50% of the design output or capacity of the proposed project activity.

As the design capacity of the proposed project activity is 200MW, the applicable capacity range as +/-50% of the design capacity of the proposed project activity is 100 MW to 300 MW.

Step 2 : identify similar project (both CDM and non-CDM) which fulfill all of the following conditions:

(a) The projects are located in the applicable geographical area;
(b) The projects apply the same measure as the proposed project activity;
(c) The projects use the same energy source/fuel and feedstock as the proposed project activity, if a technology switch measure is implemented by the proposed project activity;

[42] 158.23MW of electricity and 32ton/hr of steam

(d) The plants in which the projects are implemented produce goods or services with comparable quality, properties and applications areas (e.g. clinker) as the proposed project plant;
(e) The capacity or output of the projects is within the applicable capacity or output range calculated in Step 1;
(f) The projects started commercial operation before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of proposed project activity, whichever is earlier for the proposed project activity.

To begin with, PP could define the some basic preconditions like as applicable geographical area, measure, output and distinguished technology.

First of all, the geographical area is entire host country as default in accordance with the "Tool for the demonstration and assessment of additionality(Ver. 7). However, for the conservative analysis, PP extended to ASEAN countries as applicable geographical area considering the Indonesia level. 10 countries[43] included in ASEAN (Association of South-East nations) are adjacent geographically and the economic level also similar to promote Economy Integration next year[44]. Additionally, projects in ASEAN would be implemented in a comparable environment that is investment, financing, technology and natural conditions. Thus, PP identified the applicable geographical area is entire host country and ASEN countries.

Second, Measure of the project activity is *(ii) Switch of technology with or without change of energy source (including energy efficiency improvement as well as use of renewable energies)*' which is specified in the "Tool for the demonstration and assessment of additionality(Ver. 7)".
The measure of the project activity is involved in 'Industrial energy efficiency' according to the CDM Methodology booklet and changes energy source from grid and fossil fuel to the surplus waste off gas in the ISM. Thus, for generating the power and steam, in the absence of the project activity, the conventional fossil fuel is used. But through the project activity, the surplus waste off gas from integrated steel mill could be used as fuel. Further, the project activity is not involved in industrial gases, transport and afforestation/reforestation projects.
Especially, regarding industrial gases, HFC-23, other HFCs, N_2O adipic acid, N_2O nitric acid, PFC and SF_6 project are involved in industrial gases.

Third, regarding energy source, the surplus waste off gas is used for energy generation. The surplus waste off gas consists of the BFG (Blast Furnace Gas), COG (Coke Oven Gas) and LDG (Linze Donawitz Gas) which are by-product from integrated steel mill.

Fourth, outputs are electricity and steam generated by the surplus waste off gas from the ISM.

Actually, many fossil fuel based power plants exist in Indonesia[45]. However, the fuels of the project activity are the surplus waste off gas from the ISM. Thus, in view of the applied technology

[43] Bruni Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, Viet Nam / http://www.aseansec.org/18619.htm

[44] http://www.aseansec.org/10372.htm

[45] PLN statistics 2011, http://www.pln.co.id/eng/?p=2773

characteristic, firstly PP searched the integrated steel mill in host country.

But [46]there is no integrated steel mill and all of the factories are used the technology of Electric Arc Furnace process which is different with the Integrated steel process as below table.

< Table. B-7> Steel Industry in Indonesia[47]

No	Factories	Technology	Established year	Capacity
1	PT Krakatau Steel[48]	Electric arc furnace	1970	2.45 million tons/year
2	PT Krakatau Wajatama[49]	Electric arc furnace	1992	332,000 tons/year
3	PT KHI Pipe industries[50]	Electric arc furnace	1973	120,000 tons/year
4	PT Cigading Habeam[51]	Electric arc furnace	1885	60,000 tons/year
5	PT Ispatindo[52]	Electric arc furnace	1976	700,000 tons/year
6	PT Gunung Garuda[53]	Electric arc furnace	1986	14 million tons/year
7	PT Essar[54]	Electric arc furnace	1997	550,000 tons/year
8	PT Jakarta Cakra Tunggal[55]	Electric arc furnace	1989	360,000 tons/year
9	PT Budi Dharma steel[56]	Electric arc furnace	2000	160,000 tons/year

< Table. B-8> Comparison of ISM and Electric arc furnace

Technology	Integrated steel mill	Electric arc furnace
Output	Crude Steel	Steel
Source of Output	iron ore, coal, coke	scarp
Energy source	Coal	Electricity

[46] http://www.worldsteel.org/statistics/BFI-production.html, Kondisi Industri Baja Hadapi Pasar Bebas AC-FTA, 2010

[47] Conditions facing the steel industry of the free market AC-FTA, 2010

[48] http://www.krakatausteel.com/?page=content&cid=94

[49] http://www.bumn.go.id/krakatausteel/tentang-kami/tentang-perusahaan-afiliasi/ ,www.krakatauwajatama.co.id

[50] http://www.bumn.go.id/krakatausteel/tentang-kami/tentang-perusahaan-afiliasi/ , www.khi.co.id

[51]http://regionalinvestment.bkpm.go.id/newsipid/komoditipelakuusaha.php?ia=36&is=122&rowPerPage=10&hlm=2

[52] http://www.ispatindo.com/

[53] http://halamanadiirawan.blogspot.com/2008/09/baja.html

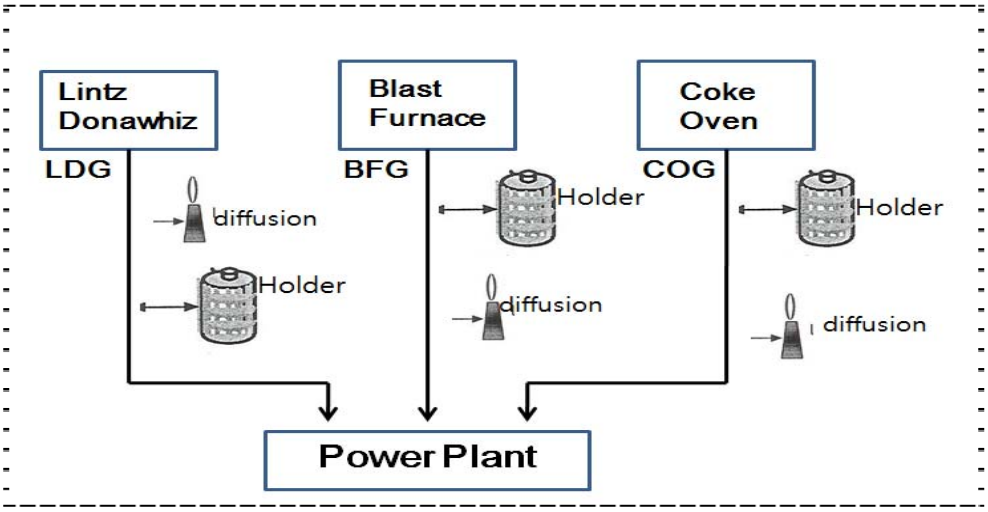
[54] http://essarindonesia.indonetwork.co.id/

[55] http://www.dataon.com/id/article/article1222.htm

[56] Based on personal interview

The process for generate output	Coke Oven →Blast furnace →Basic oxygen converter	Electric arc furnace

Thus, the waste off gas is emitted only in the integrated steel mill process as below figure. Likewise, although, there are many power plants that generate same output with the project activity in Indonesia, the energy source used for the proposed project is different from others. The waste off gas should be cleaned before using it as a fuel gas and it has many dust and low calorific value compared to oil and natural gas.



< Figure. B-4 > sensitivity result of project activity

Additionally, it is very difficult to enumerate the list of all cogeneration plant in ASEN members. But, in ASEAN, there is no integrated steel mill.[57]

As the result, no similar project is indentified. It means that the project is first project in Indonesia and the additionality can be demonstrated. But PP also demonstrates the additionality by investment analysis to make sure that the project is additional.

Step 3: within the projects identified in Step 2, identify those that are neither registered CDM project activities, project activities submitted for registration, nor project activities undergoing validation. Note their number N_{all}.

As no similar project is indentified in Step2, N_{all} is 0

Step 4 : Step 4: within similar projects identified in Step 3, identify those that apply technologies that are different to the technology applied in the proposed project activity. Note their number N_{diff}.

As no similar project is indentified in Step2, N_{all} is 0

[57] http://www.worldsteel.org/statistics/BFI-production.html

Step 6: Calculate factor $F=1-N_{diff}/N_{all}$ representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity.

Parameter	Criteria value	Project Value	Status
Factor F ($F=1-N_{diff}/N_{all}$)	> 0.2	0	The project activity is not common practice
N_{all} - N_{diff}	> 3	0	The project activity is not common practice

As the result, Factor F could be 0. Thus, the project activity is not a "common practice" within a sector in the applicable geographical area if both the following conditions are fulfilled.

<u>Sub-step 4b. Discuss any similar options that are occurring</u>

As above explained, there is no similar project comparing the proposed project activity in relevant region and host country prior to the implementation of the proposed project. Therefore, the discussion of this step can be skipped.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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As per methodology ACM0012 (version 04), the baseline emissions and project emission together with emission reduction should be calculated with formulas below;

<u>Baseline Emission</u>

Baseline emissions are given as:

$$BE_{y} = BE_{En,y} + BE_{flast,y}$$

Where,

BE_{y} = Total baseline emissions during the year *y* in tCO_2

$BE_{En,y}$ = Baseline emissions from energy generated by the project activity during the year *y* in tCO_2

$BE_{flast,y}$ = Baseline emissions from fossil fuel combustion, if any, using fossil fuel, that would have been used for flaring the waste gas in absence of the project activity (tCO_2e per year), calculated as per equation. This is relevant for those project activities where in the baseline steam is used to flare the waste gas.

The calculation of baseline emissions (BE_y) depends on the identified baselines scenario. In the project activity, the surplus waste off gas used in the projects is released to atmosphere after incineration and the electricity is obtained from the JAMALI grid, steam is obtained by new fossil fuel based element process.

$$BE_{En,y} = BE_{Elec,y} + BE_{Ther,y}$$

Where:

$BE_{Elec,y}$	=	Baseline emissions from electricity during the year *y* in tCO_2
$BE_{Ther,y}$	=	Baseline emissions from thermal energy (due to heat generation by elemental processes) during the year *y* (tCO_2)

Baseline emissions from electricity ($BE_{Elec,y}$) generation

$$BE_{Elec,y} = f_{cap} * f_{wcm} * \sum_j \sum_i (EG_{i,j,y} * EF_{Elec,i,j,y})$$

Where:

$BE_{elec,y}$	=	Baseline emissions due to displacement of electricity during the year *y* (tCO_2)
$EG_{i,j,y}$	=	The quantity of electricity supplied to the recipient *j* by generator, which in the absence of the project activity would have been sourced from source *i* (the grid or an identified source) during the year *y* in MWh
$EF_{elec,i,j,y}$	=	The CO_2 emission factor for the electricity source *i* (gr for the grid, and is for an identified source), displaced due to the project activity, during the year *y* (tCO_2/MWh)
f_{wcm}	=	Fraction of total electricity generated by the project activity using waste energy. This fraction is 1 if the electricity generation is purely from use of waste energy according to the methodology. In the project activity, electricity generation is purely from use of the surplus waste off gas thus, the fraction is 1.
f_{cap}	=	Factor that determines the energy that would have been produced in project year *y* using waste energy generated at a historical level, expressed as a fraction of the total energy produced using waste source in year *y*. For Greenfield facilities, f_{cap} is 1. If the procedure in Annex 1 concludes that the waste energy would have been partially utilised in the "reference waste energy generating facilities" this fact will be captured in the factor $f_{practice}$

Baseline emissions from thermal ($BE_{Ther,y}$) generation

$$BE_{Ther,y} = f_{cap} * \sum_j \left\{ \left(\sum_n f_{wcm,n,y} * HG_{n,j,y} \right) * EF_{heat,j,y} \right\}$$

Where:

$BE_{Ther,y}$	=	Baseline emissions from thermal energy (as steam) during the year *y* in tCO_2.
$HG_{n,j,y}$	=	Net quantity of heat supplied to the unit process/element process/reactor *n* in recipient facility *j* by the project activity during the year *y* (TJ).
$f_{wcm,n,y}$	=	Fraction of total heat generated in the unit process/element process/reactor *n* by the project activity using waste energy. This fraction is 1 if the heat generation in process *n* is purely from use of waste energy. In the project activity, electricity generation is purely from use of the surplus waste off gas thus, the fraction is 1.
f_{cap}	=	Factor that determines the energy that would have been produced in project year *y* using waste energy generated at a historical level expressed as a fraction of total energy produced using waste source in year *y*. For Greenfield facilities f_{cap} is 1. If the procedure in Annex 1 concludes that the waste energy would have been partially utilised in the "reference waste energy generating facilities" this fact in the factor $f_{practice}$
$EF_{heat,j,y}$	=	The CO_2 emission factor of the element process that would have supplied the heat to recipient facility *j* in absence of the project activity (tCO_2/TJ). This is calculated as per in equation (16)

Determination of $EF_{heat,j,y}$

$$EF_{heat,j,y} = \sum_i ws_{i,j} \frac{EF_{CO2,i,j}}{\eta_{EP,i,j}}$$

Where:

$EF_{heat,j,y}$	=	The CO_2 emission factor of the element process supplying heat that has or would have supplied the recipient facility *j* in absence of the project activity, expressed in tCO_2 e/TJ
$EF_{CO2,i,j}$	=	The CO_2 emission factor per unit of energy of the baseline fuel used in i^{th} element process used by recipient *j*, in tCO_2 e/TJ, in absence of the project activity (IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in (Energy) of the 2006 IPCC Guidelines on National GHG Inventories is used)
$\eta_{EP,i,j}$	=	Efficiency of the i^{th} element process that has or would have supplied heat to j^{th} recipient in the absence of the project activity
$ws_{i,j}$	=	Fraction of total heat that is used by the recipient *j* in the project that in absence of the project activity would have been supplied by the i^{th} element process

If the recipient facility is a Greenfield facility and its baseline source of heat is an element process, refer to the definition of "reference energy generation facility" for the identification of the reference element process. The efficiency of "reference element process" ($\eta_{EP,i,j}$) shall be determined as follows according to the methodology:

(a) Highest of the efficiency values provided by two or more manufacturers for "reference" element process; or
(b) Assume an efficiency of 100% based on the net calorific value as a conservative approach;

In case of the proposed project, the recipient facility is a Greenfield facility. Therefore, the project participant should choose (a) or (b) to determine the efficiency of "reference element process" ***($\eta_{EP,i,j}$)***. Thus, PP chooses option (b) and the efficiency is assumed as 100% based on the net calorific value as a conservative approach.

Capping factors

The methodology requires the baseline emissions to be capped irrespective of planned/unplanned or actual increase in output of plant, change in operational parameters and practices, change in fuel type and quantity resulting in an increase in generation of waste energy. The cap can be estimated using the three methods[58] described below, following this hierarchy: (i) Method-1 can be used to estimate the capping factor if required data is available; (ii) if the project activities implemented in a Greenfield facility, or in existing facilities where the required data is unavailable Method-2 shall be used; (iii) If the project proponents demonstrate technical infeasibility in direct monitoring of waste heat / pressure of waste energy carrying medium (WECM), then Method-3 is used. The project activity is implemented in a Greenfield facility. Thus, Method-2 was used for capping the baseline emission.

Method-2

If three-year historical data is not available, the manufacturer's data for the facility shall be used to estimate the amount of waste energy the facility generates per unit of "product". The "product" is produced by the process that generates waste energy (departmental process or process of entire project facility, whichever is more justifiable and accurate). If any modification is carried out by the project proponent or if the manufacturer's data is not available for an assessment, this should be carried out by independent qualified/certified external process experts such as a chartered engineer on a conservative quantity of waste energy generated by the project facility per unit of product manufactured by the process generating waste energy. The value arrived at based on above sources of data, shall be used to estimate the baseline cap (f_{cap}). Under this method, the following equations should be used to estimate f_{cap}.

$$f_{cap} = \frac{Q_{WCM,BL}}{Q_{WCM,y}}$$

$$Q_{WCM,BL} = Q_{BL,product} \times q_{wcm,product}$$

Where:

$Q_{WCM,BL}$	=	Quantity of waste energy generated prior to the start of the project activity (kg or m^3 at NTP or TJ or MWh of WECM or other relevant unit)
$Q_{WCM,y}$	=	Quantity of WECM used for energy generation during year *y* (kg or m^3 at NTP or TJ or MWh of WECM or other relevant unit)

[58] In case the methods for determination of capping factor described in this section do not apply to the situation of project of the project participants, they may consider submitting new approaches to determine this factor.

$Q_{BL, product}$	=	Production associated with the relevant waste energy generation as it occurs in the baseline scenario. The minimum of the following two figures should be used: (1) average annual historical production data from start-up of the facility, if the facility's operational history is less than three years, or (2) the most relevant manufacture's data for normal operating conditions. In the case of Greenfield facilities or where data is not available, the manufacture's data for normal operating conditions shall be used (Units for product can be in no. of pieces, tons, m^3 or other appropriate unit)
$q_{wcm, product}$	=	Amount of waste energy per unit of product generated by the process (that generates waste energy) in the facility (Units in kg or m^3at NTP/unit product, MWh/unit product or TJ/unit product or other appropriate unit)

The value of f_{cap} is assumed to be 1 for ex-ante calculation in the PDD, and will be determined by actual measurement data for each crediting year.
During the crediting period, the value of f_{cap} will be updated ex-post when the $Q_{WCM,y}$ is monitored and calculated and its value is available for calculating f_{cap} as per ACM0012(version 4.0).

Calculation of the CO_2 emission factor for the electricity

Calculate of the grid emission factor

In order to quantify emissions reductions achieved by the project activity, procedures to calculate project emissions, baseline emissions, leakage and emissions reductions set put in methodology are applied as follows.

1. Calculation of $EF_{grid\ CM,\ y}$ of JAMALI grid

The baseline emissions are calculated as the product of the kWh produced by renewable generation times an emission coefficient (baseline emission factor) calculated as a combine margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the "Tool to calculate the emission factor for an electricity system", Version 02.2.1, EB 63, Annex 19, 29 September 2011 in the following steps:

STEP 1: Identify the relevant electric power system.
STEP 2: Choose whether to include off-grid power plants in the project electricity system (optional)
STEP 3: Select a method to determine the operating margin (OM)
STEP 4: Calculate the operating margin emission factor according to the selected method.
STEP 5: Calculate the build margin emission factor.
STEP 6: Calculate the combined margin (CM) emission factor.

Step 1. Identify the relevant electricity systems

The project electricity system is determined from transmission lines indicated in the Single Line

Diagram of the JAMALI (Ministerial Decree of the Minister of Energy and Mineral Resources Number: 55 K/30/MEM/2003, regarding National Transmission Line)[59]. The JAMALI grid, to which electricity generated by the project activity is exported, has transmission lines that are connected to the power generations of the project activity located in Central Java Province, West Java Province, East Java Province and Bali Province. The grid is not connected to other grid systems so that there is no import and export of electricity from or to the grid.

Step 2. Choose whether to include off-grid power plants in the project electricity system (optional)

There are two options prescribed in "Tool to calculate the emission factor for an electricity system" (Version 02.2.1, EB 63, Annex 19, 29 September 2011) as below,

Option I : Only grid power plants are include in the calculation

Option II: Both grid power plant and off grid power plant are included in the calculation

The project activity involves in the electricity generation for exporting to the JAMALI grid. Since there will be no specified consumers to be supplied by the project activity, **Option I** is selected to calculate the operating margin and building margin emission factor.

Step 3. Select a method to determine the operating margin (OM)

According to the "Tool to calculate the emission factor for an electricity system" Version 02.2.1, EB 63, Annex 19, 29 September 2011, the calculation of the operating margin emission factor $EF_{grid, OM,,y}$ can be based on one of the four available methods:

(a) Simple OM,
(b) Simple adjusted OM, or
(c) Dispatch Data Analysis OM, or
(d) Average OM

Simple OM is selected from the methods because low-cost/must run resources are less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term average hydroelectric production. The proportion of low-cost/must-run resources[60] in the JAMALI grid from 2005 to 2009 is less than 50% of the total grid generation[61] (The low-cost/must-run resources in the JAMALI Grid were respectively 13.8% in 2005, 11.7% in 2006, 11.7% in 2007, 12.2% in 2008, and 12.8% in 2009.

As the low-cost/must run resources of the grid constitute less than 50% of the total grid generation in

[59]Keputusan Menteri Energi dan Sumberdaya Mineral Nomor: 55 K/30/MEM/2003, tentang Jaringan Transmisi Nasional (JTN)

[60] Low-cost/must run resources are defined as only nuclear and renewable energy power generation. ("Tool to calculate the emission factor for an electricity system", Version 02.2.1, EB 63, Annex 19, 29 September 2011)

average of the five most recent years, then the simple OM method is selected for calculating emission factor.

The data required to calculate the operating margin emission factor using method Dispatch data analysis OM or Simple adjusted OM are not publicly available. Therefore, the calculation of $EF_{grid, OM,,y}$ is based on the Simple OM method.
According to the "Tool to calculate the emission factor for an electricity system" (Version 02.2.1, EB 63, Annex 19, 29 September 2011, the emission factor can be calculated using either of the two following data vintages:

- ***Ex ante* option:** If the *ex ante* option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation. For off-grid power plants, use a single calendar year within the 5 most recent calendar years prior to the time of submission of the CDM-PDD for validation, or

- ***Ex post* option:** If the *ex post* option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required to calculate the emission factor for year *y* is usually only available later than six months after the end of year *y*, alternatively the emission factor of the previous year *y-1* may be used. If the data is usually only available 18 months after the end of year *y*, the emission factor of the year preceding the previous year *y-2* may be used. The same data vintage (*y*, *y-1* or *y-2*) should be used throughout all crediting periods.

"Ex ante option: A 3-year generation - weighted average" is selected for the calculation of the emission reductions of this project. Ex-ante calculation of the average OM, $EF_{grid, OM,,y}$ refers to the three-year generation-weighted average (2007, 2008 and 2009) of the most recent statistics available at the time of PDD submission.

Step 4. Calculate the operating margin emission factor according to the selected method

The simple OM emission factor ($EF_{grid,OM,,y}$ or $EF_{grid,OMsimple,,y}$) is calculated as the generation-weighted average CO_2 emission per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system not including low-cost/must-run power plants/units. It may be calculated:

- **Option A:** Based on the net electricity generation and a CO_2 emission factor of each power plant/unit,

or

- **Option B:** Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

The data on electricity generation and the fuel types for all power plants supplying electricity to the JAMALI grid is available. **Option A** is selected for the simple OM calculation.

Option A-Calculation based on average efficiency and electricity generation of each plant.
Under this opinion, the simple OM emission factor is calculated based on the net electricity generation of each power unit and an emission factor for each power unit, as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Where:

$EF_{grid,OMsimple,y}$	=	Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL, m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/ MWh)
m	=	All power unit serving the grid in year *y* except low-cost/must-run power units
y	=	The relevant year as per the data vintage chosen in step 3.

The emission factor of each power unit m should be determined as follows:

Option A1, if for a power unit *m* data on fuel consumption and electricity is available, the emission factor ($EF_{EL,m,y}$) should be determined as follows :

$$EF_{EL,m,y} = \frac{\sum_i (FC_{i,m,y} \times NCV_{i,y} \times EF_{CO2,i,y})}{EG_{m,y}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

Where:

$FE_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$FC_{i,m,y}$	=	Amount of fossil fuel type i consumed by power unit *m* in year *y* (mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ / mass or volume unit)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fossil fuel type *i* in year y (tCO_2/GJ)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m*, in year *y* (MWh)
i	=	All fossil fuel types combusted in power unit *m*, in year *y*
y	=	The relevant year as per the data vintage chosen in step 3.

Option A2, if for a power unit *m* only data on electricity generation and the fuel types used is available, the emission factor should be determined based on the CO_2 emission factor of the type fuel type used and the efficiency of the power unit, as follows:

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} \times 3.6}{\eta_{m,y}} \qquad (3)$$

Where:

$FE_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$EF_{CO2,m,i,y}$	=	Average CO_2 emission factor of fossil fuel type *i* used in power unit *m* in year *y* (tCO_2/GJ)
$\eta_{m,y}$	=	Average net energy conversion efficiency of power unit *m* in year (ratio)
m	=	All power units serving the grid in year *y* except low-cost/must-run power units
y	=	The relevant year as per the data vintage chosen in step 3.

Where several fuel types are used in the power unit, use the fuel type with the lowest CO_2 emission factor for $EF_{CO2,m,i,y}$

The data on net electricity generation are obtained from the statistics Report of PT IP year 2005, 2006, 2007, 2008, 2009, Statistic Report of PT PLN Pembangkitan Jawa Bali (PJB) 2005-2009, Statistics report of PT PLN year 2005 and 2006 and Evaluation of Operation System of Jawa-Bali 2007, 2008 and 2009 (published annually). Some coal consumption from IPPs in 2005 and 2006 are taken from Indonesia Mineral and Coal Statistics year of 2006 issued by Ministry of Energy and Mineral Resources, and the data 2007, 2008 and 2009 are obtained from 'Dissemination and Promotion Technology for Tackling Global issued by The Energy and Economics Japan'

The net caloric value of the heavy oil is obtained from the *Bahan Bakar Minyak, LPG* Warming by the Institute of Energy Economics Japan in 2011. *dan BBG untuk Kendaraan, Rumah Tangga, Industri dan Perkapalan* (published by Pertamina, May 2003). The net caloric value of the gas is obtained from *Table 1.4* of the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, Volume 2, Chap 1, p. 1.23-1.24. The emission factors adopted are obtained from *Table 1.3* and *Table 1.4* of the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, Volume 2, Chap 1, p. 1.23-1.24.

The data taken from above reference is not all available for fuel consumption used of power unit. Therefore the emission factor is determined by two options, **Option A1** and **Option A2**.

Step 5. Calculate the build margin emission factor.

In term of vintage of data, project participants can choose between one of the following two options:

Option 1. For the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring emission factor during the crediting period.

Option 2. For the first crediting period, the build margin emission factor shall be updated annually, ex-post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emission factor shall be calculated ex-ante, as described in option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

Option 1 is chosen in the build margin (BM) emission factor calculation in the project activity.

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

(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5\text{-units}}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-units}}$, in MWh);

(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total}, in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEG_{total} (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\%}$) and determine their annual electricity generation ($AEG_{SET\text{-}\geq 20\%}$, in MWh);

(c) From $SET_{5\text{-units}}$ and $SET_{\geq 20\%}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample});

Identify the date when the power units in SET_{sample} started to supply electricity to the grid. If none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, then use SET_{sample} to calculate the build margin. In this case ignore steps (d), (e) and (f).

Otherwise:

(d) Exclude from SET_{sample} the power units which started to supply electricity to the grid more than 10 years ago. Include in that set the power units registered as CDM project activities, starting with power units that started to supply electricity to the grid most recently, until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) to the extent is possible. Determine for the resulting set ($SET_{sample\text{-}CDM}$) the annual electricity generation ($AEG_{SET\text{-}sample\text{-}CDM}$, in MWh);

If the annual electricity generation of that set is comprises at least 20% of the annual electricity generation of the project electricity system (i.e. $AEG_{SET\text{-}sample\text{-}CDM} \geq 0.2 \times AEG_{total}$), then use the sample group $SET_{sample\text{-}CDM}$ to calculate the build margin. Ignore

steps (e) and (f).

Otherwise:

(e) Include in the sample group SETsample-CDM the power units that started to supply electricity to the grid more than 10 years ago until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation);

(f) The sample group of power units m used to calculate the build margin is the resulting set ($SET_{sample\text{-}CDM\geq10yrs}$).

The total set of power units ($AEG_{SET\geq20\%}$), excluding power units registered as CDM project activities that started supply electricity to the grid most recently and comprises 20% of AEG_{total} (total annual electricity generation) determined by steps (a), (b) and (c) in steps 5 is selected for calculation of build margin emission factor in this project activity.

Geothermal Power plants of Wayang Windu II and Drajad III are registered as CDM project activities, these projects is excluded in the set of power unit ($AEG_{SET\geq20\%}$)..

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

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad \text{……………………………...……………………………..(4)}$$

Where:

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

Step 6. Calculate the combined margin (CM) emission factor

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:

(a) Weighted average CM; or
(b) Simplified CM.

The weighted average CM method (option A) should be used as the preferred option. The simplified CM method (option b) can only be used if:

- The project activity is located in a Least Developed Country (LDC) or in a country with less than 10 registered CDM projects at the starting date of validation; and
- The data requirements for the application of step 5 above cannot be met.

Weighted average CM is selected for the calculation of the combined margin emission factor. The calculation is as follows,

$EF_{grid,CM,y} = EF_{grid,OM,y}\ x\ \ w_{OM} + EF_{grid,BM,y}\ x\ w_{BM}$ …………………….(5)

Where:

$EF_{grid,\ BM,\ y}$	=	Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,\ OM,\ y}$	=	Operating margin CO_2 emission factor in year y (tCO_2/MWh)
W_{OM}	=	Weighting of operation margin emissions factor (%)
W_{BM}	=	Weighting of build margin emissions factor (%)

The following default values for w_{OM} and w_{BM} is 0.5, respectively. The emission reductions values and calculations are as follows:

Parameter	Formula	Value	Unit
$EF_{grid,\ OM,\ y}$	Provided in section B.6.1	0.9280	tCO_2e/MWh
$EF_{grid,\ BM,\ y}$	Provided in section B.6.1	0.8199	tCO_2e/MWh
$EF_{grid,\ CM,\ y}$	Provided in section B.6.1	0.87393	tCO_2e/MWh

Project Emission

Project Emissions include emissions due to (1) combustion of auxiliary fuel to supplement waste gas/heat and (2) electricity emissions due to consumption of electricity for cleaning of gas before being used for generation of energy or other supplementary electricity consumption.

$$PE_y = PE_{AF,y} + PE_{EL,y}$$

Where:

PE_y	=	Project emissions due to the project activity (tCO_2)
$PE_{AF,y}$	=	Project activity emissions from on-site consumption of fossil fuels by the unit process(es) and/or co-generation plant(s) if they are used as supplementary fuels due to non-availability of waste energy to the project activity or due to any other reason (tCO_2)
$PE_{EL,y}$	=	Project activity emissions from on-site consumption of electricity for gas cleaning

equipment or other supplementary electricity consumption (tCO_2) (as per Table 1: Summary of gases and sources included in the project boundary)

(i) Project emission due to auxiliary fossil fuels *($PE_{AF,y}$)*

There emission are calculate by multiplying the quantity of fossil fuels ($FC_{i,j,y}$) used by the recipient plant(s) with the CO_2 emission factor of the fuel type i ($EF_{CO2,i,y}$), as follows:

$$PE_{AF,y} = \sum FC_{i,j,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}$$

Where:

$PE_{AF,y}$	=	The emissions from the project activity in year y due to combustion of auxiliary fuel in tons of CO_2
$FC_{i,j,y}$	=	The quantity of fossil fuel type i combusted in the project activity during the year y, in energy or mass units
$NCV_{i,y}$	=	The net calorific value of the fossil fuel type i combusted as supplementary fuel, in TJ per unit of energy or mass units, obtained from reliable local or national data, if available, otherwise taken from the country specific IPCC default factors
$EF_{CO2,i,y}$	=	The CO_2 emission factor per unit of energy or mass of the fuel type i in tons CO_2 obtained from reliable local or national data, if available, otherwise taken from the country specific IPCC default factors

For the emergency case, the fossil fuel will be used for auxiliary fuel and the quantity of fossil fuel will be monitored

(ii) Project emissions due to electricity consumption of gas cleaning equipment or other supplementary electricity consumption *($PE_{EL,y}$)*

$$PE_{EL,y} = \sum EC_{PJ,y} \cdot EF_{CO_2,EL,y}$$

$EC_{PJ,y}$	=	Additional electricity consumed in year y as a result of the implementation of the project activity (MWh).
$EF_{CO2,EL,y}$	=	The CO_2 emission factor for electricity consumed by the project activity in year y(tCO_2/MWh)

The electricity for gas cleaning equipment would be consumed in baseline and project emissions. Thus electricity consumption for gas cleaning is ignored according to the methodology. Additionally, all electricity consumed for the project activity will be supplied from electricity generated by the project activity. The electricity consumed for the project activity will be deducted from total electricity generated by the project activity. Thus, the electricity consumed for the project activity is also ignored and the ex-ante project emission is zero. However, in case of the emergency situation or the start-up project activity, the electricity will be supplied from the JAMALI grid. Thus it will be monitored and considered as the project emission.

Calculation of Leakage

In accordance with ACM0012 (version04), no leakage is considered.

Calculation of Emission Reduction

Emission reductions due to the project activity during the year *y* are calculated as follows:

$$ER_y = BE_y - PE_y$$

BE_y = the baseline emissions due to displacement of electricity during the year y (tCO_2e)
PE_y = the project emissions during the year y (tCO_2e)

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

Data / Parameter:	**Net Calorific Value (NCV)**
Data unit:	TJ/kt fuel (Terra Joule/kilo tonne fuel)
Description:	Net calorific value (energy content) per mass or volume unit of a fuel
Source of data used:	"Bahan Bakar Minyak, Elpiji dan BBG untuk kendaraan, rumah tangga, industri dan perkapalan", published by PERTAMINA 2003 Ministry of energy and Mineral Resources Directorate General of Mineral, Coal and Geothermal, 2007, published by Ministry of energy and Mineral Resources Directorate General of Mineral, Coal and Geothermal, 2007 2006 IPCC Guidelines on National GHG Inventories
Value applied:	NCV for IDO is 41.96, MFO is 41.02, HSD is 42.73, Coal is 24.03 and Natural Gas is 46.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	The NCV data of coal, IDO, HSD and MFO are available. Therefore, IPCC's data is not used. However, IPCC default values at the lower limit of the uncertainty at a 95% confidence interval is used for the NCV data of Natural gas
Any comment:	Data provided in Annex 3

Data / Parameter:	**Density**
Data unit:	kt/kl (kilo tonne / kilo Litre)
Description:	Liquid density of HSD and MFO
Source of data used:	"Bahan Bakar Minyak, Elpiji dan BBG untuk kendaraan, rumah tangga, industri dan perkapalan", published by PERTAMINA 2003
Value applied:	Density value for MFO is 0.000990 (kt/kl) and HSD is 0.000845 (kt/kl),
Justification of the choice of data or description of measurement methods	The density data of coal and gas is not used in calculation.

and procedures actually applied :	
Any comment:	Data provided in Annex 3

Data / Parameter:	**Carbon Content**
Data unit:	t C/TJ (tonne of Carbon/Terra Joule)
Description:	Carbon content in the fuel per unit of energy
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories: Chapter 1: Introduction, Table 1-3, p.21.
Value applied:	Residual Fuel Oil is 20.60, Natural Gas is 14.80, Sub-Bituminous Coal is 25.30, Gas/Diesel Oil is 19.80
Justification of the choice of data or description of measurement methods and procedures actually applied :	Use default data
Any comment:	Data provided in Annex 3

Data / Parameter:	**$OXID_i$**
Data unit:	---
Description:	The carbon oxidation factor for fuel i
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	1
Justification of the choice of data or description of measurement methods and procedures actually applied :	Use default data
Any comment:	Data provided in Annex 3

Data / Parameter:	$EG_{facility,y}$
Data unit:	MWh (Mega Watt hours)
Description:	Electricity generated
Source of data used:	a) Statistics PLN 2005 issued by PT PLN in 2006 b) Statistics PLN 2006 issued by PT PLN in 2007 c) Statistics report 2005 issued by PT Indonesia Power in 2006 d) Statistics report 2006 issued by PT Indonesia Power in 2007 e) Statistics report 2007 issued by PT Indonesia Power in 2008 f) Statistics report 2008 issued by PT Indonesia Power in 2009 g) Statistics report 2009 issued by PT Indonesia Power in 2010 h) Company Statistics Report 2005-2009 issued by PT Pembangkitan Jawa-Bali in 2010 i) Evaluation of Operation System of Jawa-Bali 2007 issued by P3B in 2008 j) Evaluation of Operation System of Jawa-Bali 2008 issued by P3B in 2009 k) Evaluation of Operation System of Jawa-Bali 2009 issued by P3B in 2010
Value applied:	Available in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	All data of generated electricity for the most recent five years (2005-2009) in the JAMALI grid is used to calculate the ratio of Low Cost and Must Run Power Plants in the JAMALI grid. Data for the most recent three year data (2007, 2008 and 2009) in the JAMALI grid is used to calculate the Operating Margin emission factor(s) ($EF_{OM,y}$).
Any comment:	Data provided in Annex 3

Data / Parameter:	$FC_{i,m,y}$
Data unit:	kl (kilo litre) , kt (kilo tonne), MMBTU (Million Metric British Thermal Unit)
Description:	Amount of fuel combusted per type of technology
Source of data used:	a) Statistics report 2005 issued by PT Indonesia Power in 2006 b) Statistics report 2006 issued by PT Indonesia Power in 2007 c) Statistics report 2007 issued by PT Indonesia Power in 2008 d) Statistics report 2008 issued by PT Indonesia Power in 2009 e) Statistics report 2009 issued by PT Indonesia Power in 2010 f) Company Statistics Report 2005-2009 issued by PT Pembangkitan Jawa-Bali in 2010 g) “Dissemination and Promoting Technology for tackling global warming” issued by The Institute of Energy Economics Japan in 2011 [62]
Value applied:	Available in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The most recent three years data (2007, 2008 and 2009) is used for calculating CO_2 emission.
Any comment:	Data provided in Annex 3

[62] http://www.meti.go.jp/meti_lib/report/2011fy/E001696.pdf

Data / Parameter:	Average Electricity Losses
Data unit:	%
Description:	The average electricity losses refers to parasitic power and electricity losses
Source of data used:	a) Statistics PLN 2005 issued by PT PLN in 2006 e) Statistics PLN 2006 issued by PT PLN in 2007
Value applied:	Available in Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data for the average electricity losses is used to calculate net electricity generated (electricity exported to the JAMALI grid) in year 2005 and 2006. In case of 2007 ~ 2009, net electricity generated is specified in the Evaluasi Operasi Sistem Jawa Bali. Thus, Average electricity losses is not needed in 2007~2009.
Any comment:	Data provided in Annex 3

Data / Parameter:	$HG_{n, process, j, y}$(= $HG_{n,j,y}$)
Data unit:	TJ
Description:	Net quantity of heat (enthalpy) supplied to the element process *n* in recipient facility *j* in year *x* from the identified WECM stream(s). In the case of steam this is expressed as the difference of energy content between the steam supplied to the recipient facility and the feed water to the boiler. (TJ)
Source of data used:	Project participants information
Value applied:	452.23 TJ
Justification of the choice of data or description of measurement methods and procedures actually applied:	Measured by project participants through an appropriate metering device(calibrated flow meters) for three years prior to implementation of project activity
Any comment:	-

Data / Parameter:	$EF_{CO2,i,y}$
Data unit:	tCO_2/GJ
Description:	The CO_2 emission factor per unit of energy of the fuel type i
Source of data used:	The data obtained from 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	See B.6.3
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.
Any comment:	-

Data / Parameter:	**$EF_{grid, OM, y}$**
Data unit:	tCO_2/MWh
Description:	Average operating margin CO_2 emission factor in year y
Source of data used:	Calculation result using equation (1)
Value applied:	0.9280
Justification of the choice of data or description of measurement methods and procedures actually applied :	The most recent three years data (2007, 2008 and 2009) of emission production in t-CO_2, and power generation in MWh are used to calculate average operating margin CO_2 emission factor using equation (1).
Any comment:	-

Data / Parameter:	**$EF_{grid, BM, y}$**
Data unit:	tCO_2/MWh
Description:	Build margin CO_2 emission factor in year *y*
Source of data used:	Calculation result using equation (2)
Value applied:	0.8199
Justification of the choice of data or description of measurement methods and procedures actually applied :	Emission production in t-CO_2, and power generation in MWh generated by the set of power units additions in the electricity system that comprise 20% of the system generation, excluding power units registered as CDM project activities that started to supply electricity to the grid most recently and comprises 20% of AEG_{total} determined by steps (a), (b) and (c) in Steps 5 is used to calculate Build Margin using equation (4).
Any comment:	-

Data / Parameter:	**$EF_{grid, CM, y}$**
Data unit:	tCO_2/MWh
Description:	Combined margin CO_2 emissions factor in year *y*
Source of data used:	Calculation result using equation (3)
Value applied:	0.87393
Justification of the choice of data or description of measurement methods and procedures actually applied :	Using average operating margin CO_2 emission factor in year 2007, 2008, and 2009 and Build Margin CO_2 emission factor in year 2009, Combined margin CO_2 emissions factor is calculated using equation (5).
Any comment:	-

Data / Parameter:	$EF_{heat,j,y}$
Data unit:	Tons CO_2/TJ
Description:	CO_2 emission factor per unit of energy of coal used in boiler used by recipient j during year y in absence of the project activity.
Source of data used:	The data obtained from 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	89.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	The IPCC default value is applied since there are no country or project specific data available. In the proposed project, project specific data or country specific data is difficult to obtain. Thus IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in (Energy) of the 2006 IPCC Guidelines on National GHG Inventories is used.
Any comment:	-

Data / Parameter:	$\eta_{EP,i,j}$
Data unit:	%
Description:	Baseline efficiency of the element process *i* in recipient plant *j*
Source of data used:	Section 1.1.1 of the methodology ACM0012 (version 4.0)
Value applied:	100%
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the methodology ACM0012 (Version 04.0.0), if the recipient facility is a Greenfield facility and its baseline source of heat is an element process, the efficient of the element process shall be determined as follows: (a) Highest of the efficiency values provided by two or more manufacturers for “reference” element process; or (b) Assume an efficiency of 100% based on the net calorific value as a conservative approach. In case of project activity, the option (b) is applied.
Any comment:	

Data / Parameter:	f_{cap}
Data unit:	
Description:	Factor that determines the energy that would have been produced in project year *y* using waste energy generated at a historical level, expressed as a fraction of the total energy produced using waste source in year *y*
Source of data used:	Calculated
Value applied:	1 (ex-ante)
Justification of the choice of data or description of measurement methods and procedures actually applied :	-
Any comment:	- The value is estimated using the following equations: $f_{cap} = \frac{Q_{WCM,BL}}{Q_{WCM,y}}$ $Q_{WCM,BL}$: A average quantity of WECM released in atmosphere in baseline $Q_{WCM,y}$: The quantity of WECM used for energy generation during year *y*

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

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Application of the formulae presented in Section B.6.1 to yields the following results:

Estimate the Baseline Emission

BE $_{y}$ = BE $_{En, y}$ + BE $_{Ther, y}$

$$BE_{Elec,y} = f_{cap} * f_{wcm} * \sum_{j} \sum_{i} (EG_{i,j,y} * EF_{Elec,i,j,y})$$

f $_{WCM}$ = The fuel used in the project activity is purely the surplus waste off gas and there is no fossil
fuels. Therefore, the value is 1.

f $_{cap}$ = The project activity is Greenfield project. Furthermore, through the Option2 in Annex-1 of ACM0012 (vesrion04), the project activity is not the financially attractive project compared to other technical alternatives which would have been the baseline scenarios (see the Annex-4 in the PDD). Thus, the value is 1.

EG $_{i, j, y}$ = 1,185,279 MWh/yr which is included the captive power consumption 6%.

EF $_{E lec, i ,j ,y}$ = 0.87393 tCO_2/ MWh

Therefore, BE $_{Elec, y}$ = 1*1* (1,185,279) *0.87393= *1,035,846 tCO_2/y*

$$BE_{Ther,y} = f_{cap} * \sum_{j} \left\{ \left(\sum_{n} f_{wcm,n,y} * HG_{n,j,y} \right) * EF_{heat,j,y} \right\}$$

f $_{WCM,n,y}$ = The fuel used in the project activity is purely the surplus waste off gas and there is no fossil
fuels. Therefore, the value is 1.

f $_{cap}$ = The project activity is Greenfield project. Furthermore, through the Option2 in Annex-1 of ACM0012 (vesrion04), the project activity is not the financially attractive project compared to other technical alternatives which would have been the baseline scenarios (see the Annex-4 in the PDD). Thus, the value is 1.

HG $_{n,j,y}$ = 452.23 TJ which is difference between net enthalpy of steam outlet and feed water inlet (=723.48TJ – 271.25TJ)

$$EF_{heat,j,y} = \sum_{i} ws_{i,j} \frac{EF_{CO2,i,j}}{\eta_{EP,i,j}}$$

EF $_{CO2,i,j}$ = 89.5 tCO_2/TJ(PCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in (Energy) of the 2006 IPCC Guidelines on National GHG Inventories is applied as conservative approach)

$\eta_{EP,i,j}$ = 1 (efficiency is assumed as 100% based on the net calorific value as a conservative approach according to the methodology.)

$ws_{i,j}$ = 1 (Fraction of total heat that is used by the recipient *j* in the project that in absence of the project activity would have been supplied by the i^{th} element process boiler would be supplied totally by the coal-fired boiler.)

Therefore, BE $_{\text{Ther, y}}$ = *40,474 tCO_2/MWh*

BE $_y$ = BE $_{\text{En, y}}$ + BE $_{\text{Ther, y}}$ = *1,035,846 + 40,474 = 1,076,320 tCO_2/y*

Project Emission

$$PE_y = PE_{AF,y} + PE_{EL,y}$$

$PE_{AF,y}$ = There is no supplement fossil will be consumed in the project activity. Hence, 0 tCO_2.

$PE_{EL,y}$ = There is no electricity consumption or supplement of gas cleaning system. Hence, 0 tCO_2.

Leakage

According to ACM0012 (version04), there is no leakage for the proposed project activity.

Emission Reduction

In a given year, the emission reductions realized by the project activity(ER_y) is equal to baseline GHG emission (BE_y) minus

ER_y = BE_y – PE_y = *1,078,320 tCO_2/year - 0tCO_2/year = 1,076,320 tCO_2/year*

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

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Year	Estimation of project activity emissions (tones of CO_2e)	Estimation of baseline emissions (tones of CO_2e)	Estimation of leakage (tones of CO_2e)	Estimation of overall emission reductions (tones of CO_2e)
2014	0	1,076,320	0	1,076,320
2015	0	1,076,320	0	1,076,320
2016	0	1,076,320	0	1,076,320
2017	0	1,076,320	0	1,076,320
2018	0	1,076,320	0	1,076,320
2019	0	1,076,320	0	1,076,320
2020	0	1,076,320	0	1,076,320
2021	0	1,076,320	0	1,076,320
2022	0	1,076,320	0	1,076,320
2023	0	1,076,320	0	1,076,320
Total (tones of CO_2e)	0	10,763,200	0	10,763,200

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

B.7.1 Data and parameters monitored:

Data / Parameter:	***$ws_{i,j}$***
Data unit:	
Description:	Fraction of total heat that is used by the recipient *j* in the project that in absence of the project activity would have been supplied by the i^{th} element process
Source of data to be used:	Estimated from data on heat consumption by recipient j
Value of data applied:	1
Description of measurement methods and procedures to be applied:	- In the absence of the proposed project, the heat only produced by coal-based boiler would be supplied to the ISM. - The fraction will be monitored yearly.
QA/QC procedures to be applied:	- Proper advice and information of any change will be given and maintained by the person in charge during monitoring period.
Any comment:	- All data achieved in the project activity shall be kept for 2 years from the end of the crediting period.

Data / Parameter:	$Q_{WCM, BFG, y}$ $Q_{WCM, LDG, y}$ $Q_{WCM, COG, y}$
Data unit:	Nm^3
Description:	The quantity of waste off gas used for energy generation during year *y*
Source of data to be used:	Measured by flow meter
Value of data applied:	Directly measured during the crediting period
Description of measurement methods and procedures to be applied:	- The quantity of waste off gas will be continuously measured by flow meter and recorded monthly. - The accuracy of the meter is ±1.0% of F.S. - The measurement and management of the meter will be undertaken by experienced staffs in charge of monitoring of the proposed project.
QA/QC procedures to be applied:	- The flow meter will be calibrated in accordance with the national regulation or manufacturer's specification. - The quantity of waste off gas will be cross-checked with balance bill.
Any comment:	- All data achieved in the project activity shall be kept for 2 years from the end of the crediting period.

Data / Parameter:	$HG_{n,j,y}$
Data unit:	TJ
Description:	Net quantity of heat supplied to the recipient facility *j* by the project activity during the year *y*
Source of data to be used:	Calculated by $Q_{steam,return,y}$, $T_{steam, return, y}$, $P_{steam, return,y}$, $Q_{feed\text{-}water,y}$, $T_{feed\text{-}water,y}$ and $P_{feed\text{-}water,y}$
Value of data applied:	Calculated by above parameters during the crediting period
Description of measurement methods and procedures to be applied:	- The data are aggregated at least once a year and managed by experienced staffs in charge of monitoring of the proposed project. - The value is the difference between the enthalpy of steam supplied to recipient facility j and the enthalpy of feed water.
QA/QC procedures to be applied:	Refer to the QA/QC procedures of $Q_{steam,return,y}$, $T_{steam, return, y}$, $P_{steam, return,y}$, $Q_{feed\text{-}water,y}$, $T_{feed\text{-}water,y}$ and $P_{feed\text{-}water,y}$
Any comment:	- The enthalpy of steam supplied to recipient facility j should be determined by the monitored parameter of $Q_{steam,return,y}$, $T_{steam, return, y}$ and $P_{steam, return,y}$. - The enthalpy of feed water should be determined by the monitored parameter of $Q_{feed\text{-}water,y}$, $T_{feed\text{-}water,y}$ and $P_{feed\text{-}water,y}$. - All data achieved in the project activity shall be kept for 2 years from the end of the crediting period.

Data / Parameter:	$Q_{feed\text{-}water,\ y}$
Data unit:	*Ton*
Description:	The quantity of feed water provided to the boiler during year *y*
Source of data to be used:	Measured by flow meter
Value of data applied:	Directly measured during the crediting period
Description of measurement methods and procedures to be applied:	- The quantity of steam returned will be continuously measured by flow meter and recorded monthly. - The accuracy of the meter is ±1.0% of F.S. - The measurement and management of the meter will be undertaken by experienced staffs in charge of monitoring of the proposed project.
QA/QC procedures to be applied:	- The flow meter will be calibrated in accordance with the national regulation or manufacturer's specification.
Any comment:	- All data achieved in the project activity shall be kept for 2 years from the end of the crediting period.

Data / Parameter:	$T_{feed\ water,\ y}$
Data unit:	*°C*
Description:	The temperature of feed water provided to the boiler during year *y*
Source of data to be used:	Measured by thermometer
Value of data applied:	Directly measured during the crediting period
Description of measurement methods and procedures to be applied:	- The temperature of feed water will be continuously measured by thermometer and recorded monthly. - The accuracy of the meter is ±1.5% of dial range. - The measurement and management of the meter will be undertaken by experienced staffs in charge of monitoring of the proposed project.
QA/QC procedures to be applied:	- The thermometer will be calibrated in accordance with the national regulation or manufacturer's specification.
Any comment:	- All data achieved in the project activity shall be kept for 2 years from the end of the crediting period.

Data / Parameter:	$P_{feed\ water,\ y}$
Data unit:	kg/m^2
Description:	The pressure of feed water provided to the boiler during year *y*
Source of data to be used:	Measured by manometer
Value of data applied:	Directly measured during the crediting period
Description of measurement methods and procedures to be applied:	- The pressure of feed water will be continuously measured by manometer and recorded monthly. - The accuracy of the meter is ±1.0% of scale range. - The measurement and management of the meter will be undertaken by experienced staffs in charge of monitoring of the proposed project.
QA/QC procedures to be applied:	- The manometer will be calibrated in accordance with the national regulation or manufacturer's specification.
Any comment:	- All data achieved in the project activity shall be kept for 2 years from the end of the crediting period.

Data / Parameter:	***$Q_{steam, return, y}$***
Data unit:	*Ton*
Description:	The quantity of steam returned to the recipient facility, ISM during year *y*
Source of data to be used:	Measured by flow meter
Value of data applied:	Directly measured during the crediting period
Description of measurement methods and procedures to be applied:	- The quantity of steam returned will be continuously measured by flow meter and recorded monthly. - The accuracy of the meter is ±1.0% of F.S. - The measurement and management of the meter will be undertaken by experienced staffs in charge of monitoring of the proposed project.
QA/QC procedures to be applied:	- The flow meter will be calibrated in accordance with the national regulation or manufacturer's specification.
Any comment:	- All data achieved in the project activity shall be kept for 2 years from the end of the crediting period.

Data / Parameter:	***$T_{steam, return, y}$***
Data unit:	*°C*
Description:	The temperature of steam returned to the recipient facility, ISM during year *y*
Source of data to be used:	Measured by thermometer
Value of data applied:	Directly measured during the crediting period
Description of measurement methods and procedures to be applied:	- The temperature of steam returned will be continuously measured by thermometer and recorded monthly. - The accuracy of the meter is ±1.5% of dial range. - The measurement and management of the meter will be undertaken by experienced staffs in charge of monitoring of the proposed project.
QA/QC procedures to be applied:	- The thermometer will be calibrated in accordance with the national regulation or manufacturer's specification.
Any comment:	- All data achieved in the project activity shall be kept for 2 years from the end of the crediting period.

Data / Parameter:	***$P_{steam, return, y}$***
Data unit:	*bar*
Description:	The pressure of steam returned to the recipient facility, ISM during year *y*
Source of data to be used:	Measured by manometer
Value of data applied:	Directly measured during the crediting period
Description of measurement methods and procedures to be applied:	- The pressure of steam returned will be continuously measured by manometer and recorded monthly. - The accuracy of the meter is ±1.0% of scale range. - The measurement and management of the meter will be undertaken by experienced staffs in charge of monitoring of the proposed project.
QA/QC procedures to be applied:	- The manometer will be calibrated in accordance with the national regulation or manufacturer's specification.
Any comment:	- All data achieved in the project activity shall be kept for 2 years from the end of the crediting period.

Data / Parameter:	***$EG_{j,y}$***

Data unit:	*MWh*
Description:	The net quantity of electricity supplied to the recipient facility by the project activity during the year *y*
Source of data to be used:	Measured by watt-hour meter
Value of data applied:	Directly measured during the crediting period
Description of measurement methods and procedures to be applied:	- The net quantity of electricity supplied to the recipient facility will be continuously measured by watt-hour meter and recorded monthly. The net quantity of electricity supplied to the recipient facility is the difference between total electricity generated by the project activity and electricity consumed for the project activity. - The accuracy of the meter is ±0.2%. - The measurement and management of the meter will be undertaken by experienced staffs in charge of monitoring of the proposed project.
QA/QC procedures to be applied:	- The watt-hour meter will be calibrated in accordance with the national regulation or manufacturer's specification. - The quantity of electricity supplied to the recipient facility will be cross-checked with balance bill.
Any comment:	- All data achieved in the project activity shall be kept for 2 years from the end of the crediting period.

Data / Parameter:	$EC_{PJ,y}$
Data unit:	*MWh*
Description:	The electricity consumed for the project activity in emergency and start-up case during the year *y*
Source of data to be used:	Measured by watt-hour meter
Value of data applied:	Directly measured during the crediting period
Description of measurement methods and procedures to be applied:	- The quantity of electricity consumed for project activity in emergency and start-up case will be continuously measured by watt-hour meter and recorded monthly. - The accuracy of the meter is ±1.0%. - The measurement and management of the meter will be undertaken by experienced staffs in charge of monitoring of the proposed project.
QA/QC procedures to be applied:	- The watt-hour meter will be calibrated in accordance with the national regulation or manufacturer's specification. - The quantity of electricity consumed will be cross-checked with balance bill.
Any comment:	- All data achieved in the project activity shall be kept for 2 years from the end of the crediting period.

Data / Parameter:	***$FC_{i,j,y}$***
Data unit:	*Mass or volume unit per year*
Description:	The quantity of fossil fuel combusted in the project activity during year *y*
Source of data to be used:	Measured by flow meter
Value of data applied:	Directly measured during the crediting period
Description of measurement methods and procedures to be applied:	- The quantity of fossil fuel (heavy oil) combusted will be continuously measured by flow meter and recorded monthly. - The accuracy of the meter is ±1.0% of F.S. - The measurement and management of the meter will be undertaken by experienced staffs in charge of monitoring of the proposed project.
QA/QC procedures to be applied:	- The flow meter will be calibrated in accordance with the national regulation or manufacturer's specification. - The quantity will be cross-checked with bill.
Any comment:	- All data achieved in the project activity shall be kept for 2 years from the end of the crediting period.

Data / Parameter:	**$EF_{CO2,i,y}$**
Data unit:	Tons CO_2/GJ
Description:	Weighted average CO_2 emission factor of fossil fuel i combusted in the project activity
Source of data used:	IPCC 2006 default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol.2(Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value of data applied:	
Description of measurement methods and procedures to be applied:	-Value provided by the fuel supplier in invoices is not available. Thus, IPCC 2006 default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol.2(Energy) of the 2006 IPCC Guidelines on National GHG Inventories is used in accordance with the "tool to calculate project or leakage CO_2 emissions from fossil fuel combustion".
QA/QC procedures to be applied:	-Any future revision of the IPCC Guidelines should be taken into account.
Any comment:	

Data / Parameter:	**$NCV_{,i,y}$**
Data unit:	GJ per mass or volume unit
Description:	Weighted average net calorific value of fossil fuel i combusted in the project activity
Source of data used:	IPCC 2006 default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol.2(Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value of data applied:	
Description of measurement methods and procedures to be applied:	-Value provided by the fuel supplier in invoices is not available. Thus, IPCC 2006 default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol.2(Energy) of the 2006 IPCC Guidelines on National GHG Inventories is used in accordance with the “tool to calculate project or leakage CO_2 emissions from fossil fuel combustion”.
QA/QC procedures to be applied:	-Any future revision of the IPCC Guidelines should be taken into account.
Any comment:	

Data / Parameter:	*Abnormal operation*
Data unit:	*hours*
Description:	The hours of abnormal operation of parts of project facility that can have an impact on waste energy generation and recovery
Source of data to be used:	Operation of project facility
Value of data applied:	N/A
Description of measurement methods and procedures to be applied:	- The abnormal operation will be daily recorded and annually aggregated. - The recording and aggregating will be undertaken by experienced staffs in charge of monitoring of the proposed project.
QA/QC procedures to be applied:	N/A
Any comment:	- All data achieved in the project activity shall be kept for 2 years from the end of the crediting period.

Data / Parameter:	***COG*** $_{process\ j,\ y}$
Data unit:	Nm^3
Description:	The quantity of COG used in each process j (Coke oven, Sinter plant, Blast furnace, Basic oxygen furnace, Casting and Rolling) during year *y*
Source of data to be used:	Measured by flow meter
Value of data applied:	Directly measured during the crediting period
Description of measurement methods and procedures to be applied:	- The quantity of waste off gas will be continuously measured by flow meter and recorded monthly. - The accuracy of the meter is ±1.0% of F.S. - The measurement and management of the meter will be undertaken by experienced staffs in charge of monitoring of the proposed project.
QA/QC procedures to be applied:	- The flow meter will be calibrated in accordance with the national regulation or manufacturer's specification. -It is monitored by the verifying DOE every year
Any comment:	- All data achieved in the project activity shall be kept for 2 years from the end of the crediting period.

Data / Parameter:	***BFG*** $_{process\ j,\ y}$
Data unit:	Nm^3
Description:	The quantity of BFG used in each process j (Coke oven, Blast furnace) during year *y*
Source of data to be used:	Measured by flow meter
Value of data applied:	Directly measured during the crediting period
Description of measurement methods and procedures to be applied:	- The quantity of waste off gas will be continuously measured by flow meter and recorded monthly. - The accuracy of the meter is ±1.0% of F.S. - The measurement and management of the meter will be undertaken by experienced staffs in charge of monitoring of the proposed project.
QA/QC procedures to be applied:	- The flow meter will be calibrated in accordance with the national regulation or manufacturer's specification. -It is monitored by the verifying DOE every year
Any comment:	- All data achieved in the project activity shall be kept for 2 years from the end of the crediting period.

B.7.2. Description of the monitoring plan:

>>

This monitoring plan will set out a number of monitoring tasks in order to ensure that all aspects of project greenhouse gas (GHG) emission reductions for the project activity are controlled and reported.

This requires an ongoing monitoring of the project to ensure performance according to its design and that claimed certified emission reductions (CERs) are actually achieved. The monitoring plan of the project activity is a guidance document that provides the set of procedures for preparing key project indicators, tracking and monitoring the impacts of the project activity.

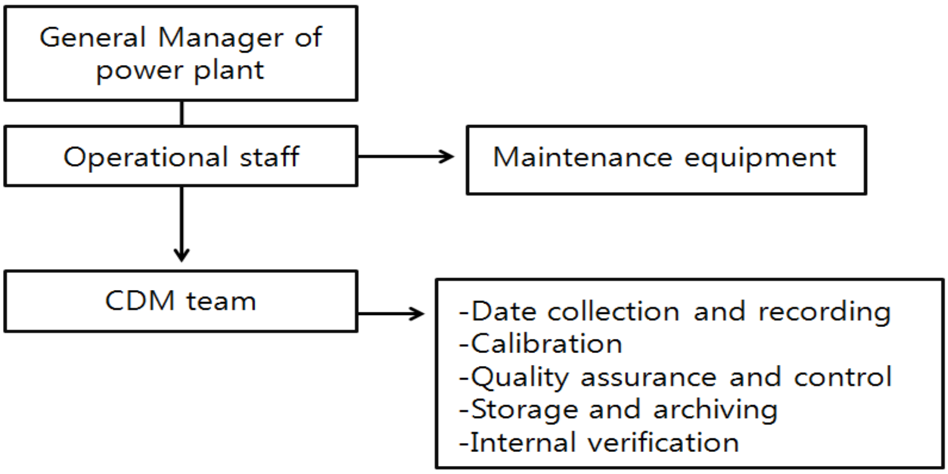
Also, especially the generated electricity and steam will be sold to PT KP who operates the recipient facility, ISM. Therefore, the seller is the project participant, PT KPP and the buyer is the PT KP and these two companies will be mentioned as 'parties' in this PDD.

Monitoring organization

- PP shall be in charge of and responsible for the routine upkeep and maintenance of the project facility in accordance with the relevant provision, the electricity and steam shall continue to be transmitted and delivered in accordance with the dispatch order, at the interconnection point to buyer uninterrupted and in a safe and efficient manner.

- Also, The PP will set up a special CDM group to take charge of data collection and recording, meter calibration, QA/QC procedures and verification.
- And members of staff who are involved in the project activity will be given training related to the CDM monitoring plan and reporting requirements, prior to registration of the project. Furthermore, new members of staff joining the CDM project team will also be given training in relation to their responsibilities.

- The organization of the monitoring group is as follows:



<Figure. B-5> The organization for monitoring of the project activity

Monitoring equipment

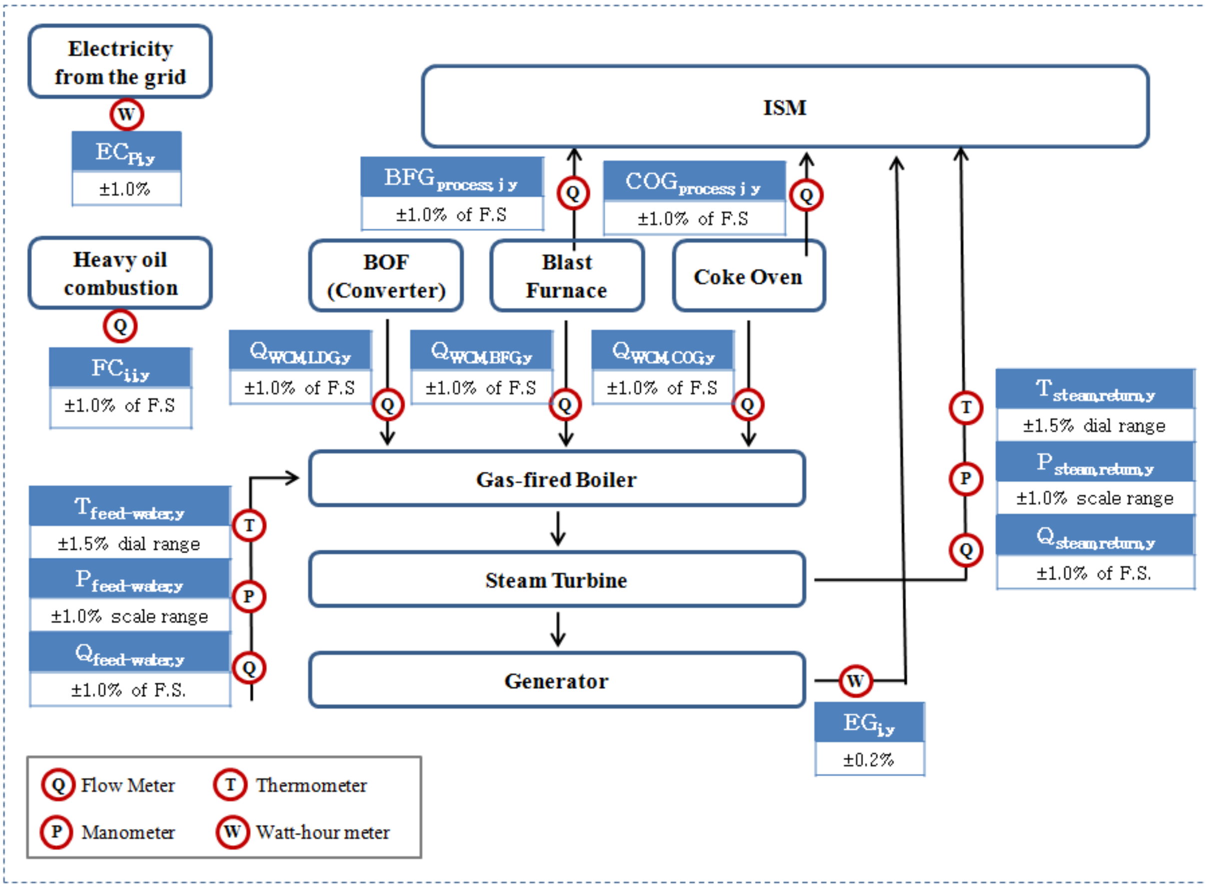
- PP shall install, operate and maintain the monitoring equipment that meets the national standards. And flow meters, manometers, thermometers and watt-hour meters installed in the proposed project activity are used to measure the monitoring data.

- The monitoring equipments shall be sealed by PP and if the seal is removed for the purpose of inspection, test, examination, maintenance, replacement or adjustment by PT KP, its representatives shall entitled to be present at any such inspection.

- The calibration of the monitoring equipments as flow meters, manometers, thermometers and watt-hour meters will be periodically performed in accordance with the national regulation or manufacturer's specification.

- The calibration of the meters will be certified by authorized organization.

- The monitoring points of the proposed project activity are as below.



<Figure. B-6> The monitoring point of the project activity

Measure & Archive

- The net electricity delivered to ISM shall be measured and recorded by the meter on an hourly, a daily and a monthly basis. The energy center shall also be able to obtain such measurement and record through the metering system.

- All electricity consumed for the project activity (except gas cleaning equipment[63]) will be supplied from electricity generated by the project activity. The electricity consumed for the project activity will be deducted from total electricity generated by the project activity. Thus, the electricity consumed for the project activity is ignored and the ex-ante project emission is zero. However, in case of the emergency situation or the start-up project activity, the electricity will be

supplied from the JAMALI grid. Thus it will be measured and recorded by the meter on a monthly basis.

- All of data will be automatically measured and archived by Data Acquisition System (DAS) and the reading of the meters shall be conducted at midnight of the last day of each applicable billing period by the representative of both parties. The monitoring system will check a summary of operations over the previous 24 hours, including total generation, fuel consumption, major equipment abnormal conditions, tagged out equipment, etc. In case where waste energy is released under abnormal operations like emergencies or shut downs, the hour is recorded and the emission reductions will not be claimed during the abnormal operation.
  In the event of the failure of normal operation of the Metering Facilities due to the malfunction or other causes, the Parties shall negotiate and determine the amount of the Net Electrical Capacity per each hour by taking into account the relevant materials presented by each Party.

- All data achieved in the project activity shall be kept for 2 years from the end of the crediting period.

QA & QC

- All of meters will be calibrated in accordance with the national regulation or manufacturer's specification by qualified institution or entity, calibration reports will be provided by qualified institution or entity.

- The process for calibration of meter should be reported. The electricity meters, flow meters, thermometer and manometer which have been calibrated will be prepared for replacement of each meter in case any of them doesn't work.

<Table. B-9> The monitoring equipment

Monitoring equipment	Allowance of equipment
Watt hour meter	±0.2%(electricity supplied) / ±1.0(electricity consumed)
Flow meter	±1.0% of F.S
Pressure device	±1.0% of scale range
Temperature device	±1.5% of dial range

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

>>

Date of completion of the application of the baseline study and monitoring methodology:

30/11/2011

Responsible person(s)/entity(ies):

[63] The electricity for gas cleaning equipment would be consumed in baseline and project emissions. Thus electricity consumption for gas cleaning is ignored according to the methodology.

• Sung-jae Moon, Ph/RCC Co.,Ltd
E-mail :sjmoon@rcc-posco.co.kr, telephone : 82-54-223-2300

• IrhanFebijanto, BPP Teknologi
E-mail : irhan.febijanto@gmail.com, telephone : 62-812-130-3020

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:

>>
05/10/2011. The date for contracting the equipments and construction

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

>>
15 years

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

The Fixed period is chose

C.2.1. Renewable crediting period:

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

>>
N.A

C.2.1.2. Length of the first crediting period:

>>
N.A

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
01/03/2014 or effective date to UNFCCC, whichever later.

C.2.2.2. Length:

>>
10 years.

SECTION D. Environmental impacts

>>

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>>

PP implemented an Environmental Impact Assessment (EIA) [64] which is compliance with the environmental regulations and got the license from Cilegon city hall in Jan 5th, 2012 at the same time of the integrated steel mill as the project activity is affiliated with the integrated steel mill. The PT KPP has compiled an Environmental Impact Assessment (EIA) report for the proposed project. The conclusions of the EIA are summarized as follows:

Impact on Air Quality

The main air pollutants from the proposed project will be NOx, SO_2, NH_3, H_2S, CO, CH_4 and dust. Based on the simulation of air quality emissions issued by each of the existing chimney PT Krakatau Steel (as hue early life environment) the results of measurements of the above gases are still below the threshold, standard of Indonesia Minister of State for the Environment No. 08 of 2008 Quality Standards Emission Sources and International Finance Corporation (IFC) for ISMs Sector. Therefore the integrated steel activities do not have significant impact on Air quality.

Impact on Noise

To find out the noise around the project site, noise measurements have been conducted at 4 points of sampling sites that are located equal to air quality. The results of noise measurements around the project site varied from 48.4 to 58.4 dBA. The noise level around the project site is still below the quality standard noise levels in industrial areas which is 70dBA based on the Decree of the Minister of Environment No. 48 of 1996 on the Quality Standard Noise Level because the location is still far from roads and industrial activities.

Impact on Water Quality

The quality of sea water is strongly influenced by the water in the drainage channels/river which empties into the sea. To determine the influence of river water to sea water quality, PP conducted an analysis of sea water which is represented by 8 locations. The analysis refers to the Minister of Environment Decree No. 51 of 2010 for the Port and Marine Waters. The results of the analysis on aspects of chemical physics in the waters around the area of Krakatau Steel showed several variables that have a tendency to show the natural conditions of sea water environment.

In summary the project is expected to have a net environmental benefit in addition to the greenhouse gas emissions reductions. There are no trans-boundary impacts.

[64] *Analisa Eengenai Dampak Lingkungan (AMDAL)*

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

>>

The environmental impacts of the proposed project are not considered to be significant.

SECTION E. Stakeholders' comments

>>

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

>>

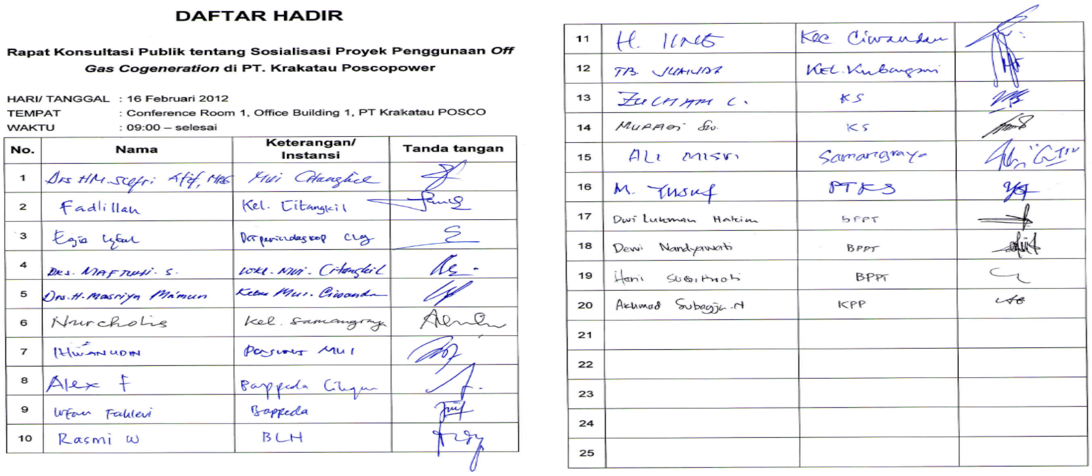
The project developer, PT.KPP has called for stakeholders' comments on the project activity through invitation letters that were sent on Jan 27, 2012. A meeting with people from local community and government representatives was held on Thursday, 16 Feb 2012 to discuss about the project activity. The meeting took place at a meeting room located beside the project location in Cilegon.

The stakeholder list includes the government and nongovernment parties, which are involved in the project activity at various stages. They have invited all identified stakeholder explaining clearly about the project and sought their view in the project. The meeting was attended by the representatives of the identified stakeholders.

In the meeting, a presentation was given as the following topics:

- Brief explanation about climate change mechanism and the effort to tackle it by participating in CDM
- Information about the project activity and how the project can reduce GHG

< Figure. E-1> the picture of stakeholder's place



DAFTAR HADIR

Rapat Konsultasi Publik tentang Sosialisasi Proyek Penggunaan *Off Gas Cogeneration* di PT. Krakatau Poscopower

HARI/ TANGGAL : 16 Februari 2012
TEMPAT : Conference Room 1, Office Building 1, PT Krakatau POSCO
WAKTU : 09:00 – selesai

No.	Nama	Keterangan/ Instansi	Tanda tangan
1	Drs HM. Sofri Afif, MBA	MUI Citangkil	
2	Fadlillah	Kel. Citangkil	
3	Egia Iqbal	Disperindagkop Clg	
4	Drs. Maftuhi. S.	Wkl. MUI. Citangkil	
5	Drs.H.Masriyn Ma'mun	Ketua MUI. Ciwandan	
6	Nurcholis	Kel. Samangraya	
7	Ikhwanudin	Pengurus MUI	
8	Alex F	Bappeda Cilegon	
9	Irfan Fahlevi	Bappeda	
10	Rasmi W	BLH	
11	H. Ilng	Kec Ciwandan	
12	TB. Juanda	Kel. Kubangsari	
13	Zulham C.	KS	
14	Muradi [illegible]	KS	
15	Ali Misri	Samangraya	
16	M. Yusuf	PTKS	
17	Dwi Lukman Hakim	BPPT	
18	Dewi Nandyawati	BPPT	
19	Hari Sugiharto	BPPT	
20	Akhmad Subagja. M	KPP	
21			
22			
23			
24			
25			

<Figure. E-2> List of Participants in meeting

E.2.	**Summary of the comments received:**

>>
Overall, there were no negative comments received from any of the stakeholders' participants for the project activity. In addition, the project activity will contribute to sustainable development of the region through conservation of fossil fuel and providing employment opportunities for the local community.
The project activity will provide electricity to PT KP and reduce the gap between electricity supply and demand. The project will also help to increase local employment opportunity. The project activity will utilize the surplus waste off gas, which is generated by blast furnace and waste coke oven, for power generation. Additionally, the project activity improves the available energy utilization ratio, reduces energy losses and protects the local environment in general. If developed, the project would help optimize the local energy mix, improve environment quality, create employment opportunities and prompt technology transfer, thereby bringing both social and environment benefit to the community. Project registration would achieve significant improvement in the project's financial position and help ensure successful implementation. All participants supported the development of the project activity and encouraged the project owner to take full advantage of the CDM opportunity.

<Table. E-1> Comments received from the stakeholders

NO	Comments	Questioner
1	- How to generate the electricity using the waste off gas form ISM?	**Mr.Ujang ling** Head of sub-district of Ciwandan
2	- What is the difference between this project activity and natural gas power plant? - Dose the generated steam use for steel work?	**Mr Edi** Agenacy of Trade and Industry
3	- How to calculate CO_2 emission factor?	**Mr. Rasmi** Agency of Environment
4	- Is the facilities safety? - Is it helpful to decrease our electric power shortage?	**Mr. Muradi** Krakatau Steel

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

>>

The impacts of construction and operation of the project are basically positive. All stakeholders support the development of the project activity and its application for CDM support. According to the result of questionaires and stekeholder consultation meeting, all stakeholders were pleased with the development

<Table. E-2> Responses on the comments

NO	Answers
1	- In PT KPP, steel will be burned in blast furnace that will produce off gas equal with 45,000 liter of diesel oil. In conventional steel factory, usually it would be just flared, but in this project, the off gas will be utilized as a fuel to generate electricity and fulfil the need of electricity in PT KP.
2	- The surplus waste off gas which is source to project activity is composed of the Blast Furnace gas, Coke gas and Linze Donawitz gas. The waste off gas will be generated from the process of ISM. Actually, in the absence of the project activity, these gases will be flared to atmosphere. However through the project activity the surplus waste off gas acts as natural gas fuel. As the result, we do not need to use the natural gas or coal for generating the electricity. By doing project activity, it is very helpful for the environment. - Right, the steam generated will be supplied to steel work.
3	- CO_2 reduction is calculated based on coal as a fuel because this kind of project usually using the coal.
4	- The partner POSCO POWER Company has their own using waste off gas power plant technology. Also they have experiences and knowhow for operating. And, our staff will be trained professionally and repair periodically. Therefore, it could be sustained safely. - The ISM which is under construction needs lots of electricity but that amount of electricity could not be imported from the JAMALI grid. Therefore, this project activity will supply the electricity to steel mill. Accordingly, the imported electricity will be decreased by doing the project activity. In conclusion, the project activity could not help directly decrease the electric shortage. However it will prevent from getting even worse.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	PT. Krakatau Poscopower
Street/P.O.Box:	Afrika Street No.2, Krakatau Industrial Complex, Cilegon, Banten, Indonesia
Building:	PT. Krakatau Poscopower
City:	Cilegon
State/Region:	Banten
Postcode/ZIP:	
Country:	Indonesia
Telephone:	+62-254- 2578-666
FAX:	+62-254- 2578-555
E-Mail:	lark@poscoenergy.com
URL:	
Represented by:	
Title:	President director
Salutation:	-
Last name:	Choi
Middle name:	-
First name:	Young lark
Department:	
Mobile:	
Direct FAX:	+62-254- 2578-555
Direct tel:	+62-254- 2578-666
Personal e-mail:	lark@poscoenergy.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding for project activity.

Annex 3
BASELINE INFORMATION

Table 1 : Fuel Specifications

Fuel Type	(A)			(B)	(C)	(D)	(E)	(F)	(G)
	Calorific value per mass			Default Carbon Content	Default Carbon Oxidation factor	Carbon (A)x(B)x(C)	CO_2 emissions (D) x 44/12	Density	CO_2 emissions (E) x (F)
	TJ/kt fuel			(tC/TJ)	-	tC/kt fuel	tCO_2/kt fuel	kt/k l	tCO_2/kl fuel
Data source	PERTAMINA	MEM	IPCC	IPCC	IPCC	-	-	-	
MFO	41.02			20.6	1	845.01	3,098.37	0.00099	3.067
HSD	42.73			19.8	1	846.05	3,102.18	0.000845	2.671
Coal		24.03		25.3	1	607.99	2,229.30		
IDO	41.96			19.8	1	830.80	3,046.30		
Natural GaS			46.50	14.8	1	688.20	2,523.40		

Note :*HSD : High Diesel Speed, MFO : Marine Fuel Oil,IPCC : Intergovernmental Panel on Climate Change; PERTAMINA: Perusahaan Pertambangan Minyak dan Gas Bumi Negara/State-Owned Oil Company of Indonesi; MEM: Ministerial Energy and Mineral Resources,*kt fuel: kilo tonne fuel; tC: tonne carbon, TJ: Terra Joule, kl fuel : kilo litre fuel

Table 2: Power Plants in the grid by source

source of plant	operation year	2005	2006	2007	2008	2,009
	fuel	GWh				
Hydro		7,023	5,309	5,930	6,251	6,635
Diesel	Oil	128	101	87	173	121
Gas Turbine	Gas	2,603	2,038	2,126	3,073	4,688
	Oil	2,547	2,087	1,958	2,191	3,275
Geothermal		6,185	6,183	6,672	7,337	8,188
Steam	Coal	45,477	51,826	57,206	54,140	56,965
	Gas	646	669	941	690	563
	Oil	6,673	7,171	7,685	8,274	7,301
Combined Cycle	Gas	16,559	16,193	17,929	18,953	20,301
	Oil	8,980	8,444	7,192	10,505	7,527
TOTAL NET PRODUCTION		96,821	100,021	107,726	111,586	115,564

Source : Statistics Report of PT IP in 2005,2006, 2007, 2008, 2009, Statistic Report of PT PLN Pembangkitan Jawa Bali (PJB) 2006-2009,Evaluation of Operation System of Jawa-Bali 2007,2008, 2009

Table 3: Ratio of Low Cost and Must Run Power Plants in the most recent five years (2005-2009)

	Units	2005	2006	2007	2008	2009
Total Generation Net	GWh (net)	83,436	88,351	95,124	97,999	100,741
Low Cost and Must-run generation	GWh (net)	13,385	11,670	12,603	13,588	14,823
Low Cost and Must-Run Generation/ Total Generation	%	**16%**	**13%**	**13%**	**14%**	**15%**

Source : Statistics Report of PT IP in 2005,2006, 2007, 2008, 2009, Statistic Report of PT PLN Pembangkitan Jawa Bali (PJB) 2006-2009,Evaluation of Operation System of Jawa-Bali 2007,2008, 2009

Table 4: Percentage of Average Losses

	Year				
				2005	**2006**
Average losses in Java-Bali system due to own consumption and losses at sub station				*3.94%*	*4.21%*

Source : Statistics report of PT PLN in 2005, 2006

Table 5: Fuel Consumption in the grid during 2002-2006

	year	2005	2006	2007	2008	2009
Fuel Type	**unit**					
HSD	kilo litre	4,406,883	3,623,332	3,498,197	4,031,017	2,781,649
MFO	kilo litre	1,944,142	2,054,365	2,225,317	2,374,577	2,150,386
IDO	kilo litre	4,074	2,343	2,306	4,401	-
Gas	MMBTU	136,744,924	141,147,996	145,991,700	167,844,288	219,008,065
Coal	ton	24,524,261	26,860,205	29,584,714	28,353,988	29,409,721

Source : Statistics Report of PT IP in 2005,2006, 2007, 2008, 2009, Statistic Report of PT PLN Pembangkitan Jawa Bali (PJB) 2005-2009, Indonesia Mineral and Coal Statistics year of 2006 issued by Ministry of Energy and Mineral Resources&"Dissemination and Promoting Technology for tackling global warming" issued by The Institute of Energy Economics Japan in 2011

Table 6: CO_2 Emissionsin the grid during 2005-2009

year	2005	2006	2007	2008	2009
fuel type	**t-CO2**				
HSD	11,785,015	9,689,620	9,354,980	10,779,863	7,438,768
MFO	6,108,049	6,454,344	6,991,436	7,460,377	6,756,020
IDO	11,142	6,408	6,307	12,037	-
Gas	8,093,881	8,354,497	8,641,195	9,934,641	12,963,006
Coal	56,615,701	62,008,365	68,298,053	65,456,849	67,524,209
TOTAL	82,613,788	86,513,234	93,291,971	93,643,767	94,682,002

Table 7: Three-year average (2007-2009) of Emission Factor Operating Margin

Item	Unit	2007	2008	2009	TOTAL
Total Emissions	tCO_2e	93,291,971	93,643,767	94,682,002	281,617,740
Total Generation	MWH (net)	95,123,861	97,998,684	100,741,000	293,863,545
EF_{OM}	tCO_2e/MWh				0.958

Source : Statistics Report of PT IP in 2005,2006, 2007, 2008, 2009, Statistic Report of PT PLN Pembangkitan Jawa Bali (PJB) 2005-2009 &"Dissemination and Promoting Technology for tackling global warming" issued by The Institute of Energy Economics Japan in 2011

Table 8: Sample plant group (M) for determining Build Margin Emission Factor

Sample group (m) Classification	"The five power plants that have been built recently" (GWh)	"The power plants capacity addition to the electricity system that comprises 20% of system generation (in GWh) and that have been built most recently"	Comments
Electricity quantity	12,578.0	25,660	Total generation is 115,564 (GWh) in JAMALI grid
Proportion (ratio to total generation in JAMALI grid)	10.88%	22.20%	
Selected group		**O**	

Source : Statistics Report of PT IP in 2005,2006, 2007, 2008, 2009, Statistic Report of PT PLN Pembangkitan Jawa Bali (PJB) 2006-2009,Evaluation of Operation System of Jawa-Bali 2007,2008, 2009

Table 9: Sample group plants used in the Build Margin calculation and CO_2 Emission Factor for Build Margin

No.	Power Plant		fuel type	operation year	Capacity	Capacity Factor	Generated Power		Thermal Efficiency	NCV		Fuel Consumption			unit	Effective CO2 emission factor	convert value	Emission Reduction	
							Actual Data	calculation data				Actual data	calculation data						
					MW		MWh		GJ/GWh	GJ/k t fuel	GJ/ k ltr fuel					(t- CO2/GJ)	GJ/MMBTU	t-CO2	
	Owner	Power Plant			A	B	C	C=AxBx8760/ 1000	D	E		F	G= CxD/E	G= 1000x CxD/E		H	I	G=(ExF)xH/1000	G=ExGxH
1	PT Java Power	Paiton II #6	Steam-Coal	Nov, 2000	1220		4541.7		0.00	24,031	-	-	-	-	--	-	-	-	-
2	PT Geo Dipa Energi	Dieng	Geothermal	2002	50		93.0		0.00	-	-	-	9,014,689	-	MMBTU	0	1.06	-	533,576
3	PT Cikarang Listrindo Power	Cikarang	GT-Gas	2003	150		1043.0		9119.04	-	-	-	-	769	ton	0	-	1,775	-
4	PT Krakatau Daya Listrik	Krakatau	Steam-Coal	2003	0		2.0		9235.95	24,031	-	-	30,726,000	-	MMBTU	0	1.06	-	1,818,661
5	Muara Tawar	Block 3 & 4	GT-Gas	2004	840		3555.0		9119.04	-	41	-	-	78,820	kltr	0	-	237	-
6			GT-Oil	2004	840		351.0	-	9119.04	-	-	1,899,271	-	-	ton	0	-	4,384,579	-
7	PT Sumberenergi Sakti Prima	Cilacap #1	Steam-Coal	2006	562		3496.0		9235.95	24,031	-	-	-	-	-	-	-	-	-
8		Cilacap #2		2006					0.00	-	-	3,620,231	-	-	ton	0	-	8,357,517	-
9	Tanjung Jati B	unit #1	Steam-Coal	2006	660		8226.0		9235.95	24,031	-	-	-	-	-	-	-	-	-
10		unit #2		2006	660				0.00	-	-	-	22,282,040	-	MMBTU	0	1	-	1,318,866
11	Cilegon	Cilegon	CCGT-Gas	2006	740		3916.0		6003.37	-	-	-	-	-	ton	0	-	-	-
12	Indorama	Indorama	Steam-Coal	2007	50		0.0		9235.95	24,031	-	-	-	-	ton	0	-	386,848	-
12	Indorama	Indorama	Steam-Coal	2007	50		0.0		9235.95	24,031	-	-	-	167,571	-	-	-	-	-
14	PLN	Labuhan	Steam-Coal	2009	300		436.0		9235.95	24,031	-	-	-	-	-	-	-	-	-
15	TOTAL	0	0	0	0		0.0		0.00	-	-	-	-	-	-	-	-	-	21,770,522
	TOTAL							**25,659.7**											**16,802,058**

Source : Statistics Report of PT IP in 2005,2006, 2007, 2008, 2009, Statistic Report of PT PLN Pembangkitan Jawa Bali (PJB) 2006-2009,Evaluation of Operation System of Jawa-Bali 2007,2008, 2009., “Dissemination and Promoting Technology for tackling global warming” issued by The Institute of Energy Economics Japan in 2011

Table 10: the parameters of the Emission Factor

Item	Unit	Value
$EF_{OM,simple,y}$	(tCO_2 e/MWh)	0.9280
$EF_{BM,y}$	(tCO_2 e /MWh)	0.8199
$EF_{CM},_y$	(tCO_2 e /MWh)	0.87393

Annex 4

Assessment of the utilization of waste energy in absence of project activity

According to the ACM0012 *(version 04.0.0),* it is requested that the project activity should demonstrate that the waste energy utilized in the project activity was flared or released into the atmosphere in the absence of the project activity at the existing facility by either one of the following ways;

Option 1: Assessment of other existing facilities

1. The Greenfield (or new) facility generating the WECM used in the CDM project activity should be categorized based on following criteria applicable to project facility: (i) industry sector; (ii) product manufactured, its specifications and applications; (iii) production capacity; (iv) quality of raw material used; (v) process flow or technology type; (vi) configuration of the facility; (vii) facilities implemented in the previous 10 years.
2. Based on the literature from the recognized sources, or from surveys in the relevant industry sector, these facilities which follow the criteria mentioned above should be listed. The selected facilities can vary by +/-10% in terms of capacity of the facility as compared to the proposed facility under CDM.
3. These facilities should not cover those which are already registered (or under validation) under CDM for waste energy recovery projects from the same source that is recovered under the proposed project under CDM.
4. The difference between the project facility and the selected facilities would be the use of waste energy from the source that is recovered under proposed project activity.
5. The facilities identified above should be studied for the use of waste energy. The following can be the possible uses of waste energy by these facilities: (i) the waste energy completely used, (ii) waste energy partially used, (iii) waste energy not used but incinerated, flared or released to atmosphere.
6. Analyse the practice of more than 75% facilities in the list. For example the following situations can apply: (i) if more than 50% of the facilities do not use waste energy, it can be decided that the proposed Greenfield facility also would have wasted the energy in the absence of waste energy recovery CDM project; (ii) if more than 50% of the facilities use the waste energy partially, the baseline emissions can be capped using the most conservative baseline practice factor ($f_{practice}$) based on the percentage of waste energy used in the baseline; for example a 50% usage of waste energy in these facilities results in to $f_{practice}$ of 0.5; (iii) if more than 50% of the facilities recover the waste energy fully, the methodology is not applicable as it cannot be demonstrated that waste energy would not have been recovered in the absence of CDM project. Use operational information or manufacturer's specification of the facilities.
7. In case none of the above practices are followed by more than 50% of facilities, the most conservative practice decides the baseline emissions practice factor ($f_{practice}$).

For the use of Option 1, it is necessary that at least five facilities are analysed to arrive at "reference facility" practice.

According to the World steel Association, there is no ISM in Indonesia[65]. Therefore, the waste off gas could not be generated in the absence of the project activity in Indonesia.
Additionally, according to Steel statistical yearbook, facilities implemented in the previous 10 years and +/-10% in terms of capacity of the facility as compared to the proposed facility(capacity of the BF is 3,800m^3) are just four facilities as the below table.

<Table 11> World Ironworks implemented in the previous 10 year(3,420m^3~4,180m^3)

Country	Ironworks	No. of B.F.	Diameter of Hearth(m)	Volume in B. F. (m3)	Year & Month of Firing
Austria	Voestalpine, Linz	No. 1	12	3,550	10. 2004
China	Sandong, Iljo	-	-	3,800	9. 2008
	Ansan, Younggu	No. 1	13.3	4,038	9. 2008
		No. 2	13.3	4,038	4. 2009

As a result, PP could not assess the extent of use of WECM and baseline practice factor through the method of option 1. Finally, PP shall review the Option 2.

Option 2: Assessment of alternative design of the project facility

This option 2 is to be used if the project participants are not able to arrive at five facilities of similar type as the Greenfield project facility. The manufacturer of the project facility will be invited to submit an alternative design including the usage of WECM that is recovered under project. The project participants have to demonstrate through investment analysis that the use (or no use) of WECM(s) of such alternative design would have been the baseline scenario for the waste energy generated in the Greenfield facility. The alternative design provides the value of factor “$f_{practice}$” that is referred in Option 1 above.

First of all, PP should identify an alternative design including the use of WECM that is recovered under project. In the project activity, WECM is waste off gas that is remained from the ISM. An alternative design using the off gas could be the project activity without CDM project. Additionally, all WECM may be used in each process in the ISM. It may be also an alternative design.
Except those alternative designs, the remained waste off gas will be incinerated to the atmosphere and the facility for the incineration could be installed by PT KP owned ISM.
Thus, in case of use of WECM, alternative design would the project activity without CDM project and all WECM may be used in each process in the ISM.

Secondly, PP should find another alternative design for generating the electricity regarding no use of waste off gas.
Actually the project activity is the co-generation power plant using waste off gas. However, the

[65] http://www.worldsteel.org/statistics/BFI-production.html

investment analysis is conducted for the power plant using waste off gas without considering steam because the project activity adopts the condensing extraction turbine to generate steam.
The condensing extraction turbine just needs pipe line to generate steam compared to the power plant which generates just electricity. The construction of pipe line for steam comprises a negligible cost compared to total investment cost. Additionally, the rated capacity (165MW[66]) is considered to calculate electricity generation per year.

Thus, the possible alternative designs are identified as below. And levelised cost analysis is conducted for the below cases to demonstrate that the use (or no use) of WECM of such alternative design would have been baseline scenario for the waste energy generated in the Greenfield facility.

<Table 12> Alternative design

WECM		Alternative design
Waste off gas	***Use*** of WECM	- An alternative design including the use of WECM would be the project activity without CDM project (Case 1) - And all WECM may be used in each process in the ISM (Case 2).
	No Use of WECM	- An alternative design is the fossil fuel based plant if supplying fossil fuel is available.(Case 3) - Otherwise, An alternative design is that the electricity could be supplied from the JAMALI grid (Case 4)

In case of the use of WECM, the alternative design is waste off gas based power plant (case 1).
The levelised cost for Case 1 is 80.27USD/MWh. However, the alternative design that may use all WECM for each process in the ISM (Case 2) is impossible since the ISM will supply the remained waste off gas to PT.KPP to generate electricity and steam after PT.KP uses the off gas as much as they can. Thus, the alternative design, all WECM is used in the ISM, is the impossible design and the alternative design is removed in the analysis.

<Table 13> Levelised cost for case 1

Item	Value	Unit
	Coal	
Investment	277,000,000	USD
O&M cost	4,500,000	USD/y

[66] If steam is generated, rated capacity for electricity is 158.23MW.

Fuel price	79,945,008	USD/y
Discount rate	8	%
Electricity Generation Cost	80.27	USD/MWh

In case of the no use of WECM, firstly, the alternative design is the fossil fuel based power plant if supplying fossil fuel is available (case 3).

First of all, based on the analysis of "Table.B-3", PP could figure out that the heavy oil is far expensive in comparison to other fossil fuel based power plant. Thus, Gas and Coal is most plausible fossil fuel for operating cogeneration project. Based the Indonesian National Report[67] which is using the mini G4Econs Model[68] from IAEA (International Atomic Energy Agency) year 2008, electricity generation cost for Natural gas and coal is seen as below table 14.

<Table 14> Levelised cost for case 3

Item	Value		Unit
	Natural Gas	Coal	
Capital expenditure	15.12	24.00	USD/MWh
O&M cost	3.37	6.47	USD/MWh
Fuel price	42.66	29.17	USD/MWh
Decommissioning cost	-	0.02	USD/MWh
Electricity Generation Cost	61.52	59.66	USD/MWh

As result of case 3, coal based power plant is cost-effective way.

And the alternative design is that the electricity could be supplied from the JAMALI grid using the fossil fuel (case 4). According to PPA, purchasing cost for electricity is 88.9 USD/MWh.

The result is the below table.

<Table 15> The result of levelised cost analysis

Item	Levelised cost	Unit
Case 1	80.27	USD/MWh
Case 3	**59.66**	**USD/MWh**
Case 4	88.9	USD/MWh

Therefore, the coal based cogeneration plant is the most financially attractive design.

[67] PERBANDINGAN BIAYA PEMBANGKITAN LISTRIK NUKLIR DAN FOSIL DENGAN MEMPERTIMBNGKAN ASPEK LINGKUNGAN, http://www.batan.go.id/ptrkn/file/tkpfn16/Makalah_peserta/Kel_E/47.M.Nasrullah,E348-352rev2.pdf

According to the result of the analysis through the option2, in the absence of the project activity, the most attractive design is coal based cogeneration plant and in that case, WECM would have been fully vented after incineration. Hence, $F_{practice}$= 1.

However, in the baseline scenario, coal based cogeneration plant (Case 3) and the project activity without CDM project (Case 1) is eliminated due to the barrier. Thus, case 4 is selected as baseline scenario. (Refer to Section B.4)

[68] http://www.iaea.org/INPRO/cooperation/4th_GIF_Meeting/14-Bill-Rasin-GIF-Economics.pdf

Annex 5

Conservative baseline emissions if multiple waste gas stream(s) with potential for interchangeable application exist in the project activity

According to the methodology ACM0012 (*version04*), If several waste off gas streams are available in the project facility, and can be used interchangeably for various applications or are commonly used as a part of energy sources in the facility, there is always a possibility that the potential for leakage exists due to the implementation of the CDM project.

Therefore, it has to be ensured that any decrease of waste off gas energy recovery of one source due to recovery of waste off gas energy of another source is properly adjusted to ensure conservativeness of emission reduction.

As the project activity is a Greenfield project, firstly, ***(1) Define an extended boundary of the project***.

If the waste gas energy recovered under the CDM project is usable in the other applications in the facility either independently, or by mixing with similar other waste gas energy source in the facility the project boundary should include the generation of all other waste gas streams and the potential applications.

For this CDM project, an extended boundary for the mixture of waste fuel gases can be defined as follows;

By-product gas	Extended System Boundary						
	Coke oven	Sinter Plant	Blast Furnace	Basic Oxygen Furnace	Casting and Rolling	Power Generation	Selling as a Energy Fuel
COG	Yes	Yes	Yes	Yes	Yes	Yes	No
BFG	Yes	No	Yes	No	No	Yes	No
LDG	No	No	No	No	No	Yes	No

Secondly, ***(2) Determination of conservative baseline emission for the CDM project in a existing facility***

An energy balance is to be established for the demand and supply of energy in all the applications covered in extended project boundary identified in Step 1 above and it is checked by the DOE.

As the ISM is Greenfield facility, it is established that there is no likelihood of decrease in energy recovery of other WECM stream(s) under the extended project boundary. Thus, the methodology is deemed application to the project.

Each off gas used in each process mentioned in the above table will be monitored by installed flow meter and recorded monthly. It is also monitored by the verifying DOE every year (Refer to the 'COG process j, y' and 'BFG process j, y' in the B.7.1).
If there is a decrease in the energy recovery of WECM(s) in the extended boundary excluding the project activity WECM, a technical justification along with energy balance should be demanded explaining why the reduction in recover is not due to the CDM project. If this explanation is not satisfactory and there are possibilities of increase in emission due to the project activity within the extended project boundary, the methodology cannot be applied to the project activity anymore and no CERs can be claimed for the rest of the monitoring period.