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

CONTENTS

A. General description of the small scale project activity

B. Application of a baseline and monitoring methodology

C. Duration of the project activity / crediting period

D. Environmental impacts

E. Stakeholders' comments

Annexes

Annex 1: Contact information on participants in the proposed small scale project activity

Annex 2: Information regarding public funding

Annex 3: Baseline information

Annex 4: Monitoring Information

Revision history of this document

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

SECTION A. General description of small-scale project activity

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

Utilization of waste steam from Sulphur Recovery Unit to generate electricity

Version number 10
Date of completion : 19/09/2012

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

Background

PT Indo Raya Kimia (Hereinafter is called "IRK") is a leading producer of carbon disulfide in Asia Pacific which located in West Java, Indonesia. CS2 plant is operated since 1999 by Akzo Nobel and it was taken over by IRK in 2003.The earlier design of the production capacity was 132 t/d Carbon Disulphide (CS_2) which is supported by the state of the art and environment friendly technology from Akzo Nobel.

In the CS2 process, methane reacts with sulphur to produce CS2 and Hydrogen Sulphide (H_2S). CS2 is purified and taken out as product, while H_2S as by-product is taken for catalytic oxidation/reduction in a Sulphur Recovery Unit (SRU) to recover sulphur back to the process. The exothermal process in the SRU and furnace generates waste heat in the form of steam..

From the start of CS2 plant in 1999, 2 types of blower have been installed: steam (K-503)and electrical blower (k-504). The electrical blower was used for start-up, and then once CS2 plant in operation, the SRU and CS2 plant generate saturated steam, steam blower will take over and electrical ones was stop. The power demand for 132TPD CS2 production was 658.2kW and the quantity of steam generated from SRU and CS2 plant is 11.32TPH in which 1.59TPH for CS2 separation, 7.93TPH for steam blower and the rest was released to the atmosphere.

Baseline scenario

In May 2006, IRK expands its CS2 production capacity to 145 – 150 t/d by up grading power for SRU blower (K-504) from 315 kW to 420 kW because the steam blower (K-503) can't support the expansion demand. Based on historical data prior to the project activity, the average of electricity consumption per unit production of CS2 is approximately 168.57 kWh/t CS2. If CS2 production capacity is in the range of 145-150 t/d, then the power demand for the CS2 production would be 1.079-1.220 MW which is supplied from PLN (State-Owned Electricity Company) Jamali grid. The quantity of the saturated steam of 11.95TPH is generated from the SRU and CS2 plant. After used for CS2 separation of 1.59TPH, 10.10TPH of waste steam is being condensed and the heat is released to the atmosphere.

Purpose of project activity

The amount of 10.10TPH of 24 barg and 244^{o}C of waste steam from the SRU and CS2 plant which was unutilized is proposed to generate electricity. This will be done by using this waste steam to run a new 1.2 MW install capacity of steam turbine generator. The power required for the CS2 production is about 1.05 MW whereas 0.15 MW is required for power generation. The temperature and pressure of the waste

steam remains stable prior and after capacity expansion. By this project activity, IRK will reduce the electricity consumption from PLN about 6,446 MWh in a year.

The proposed project activity will consist of the following new equipment:

- Installation of steam turbine
- Installation of steam surface condenser
- Installation of generator
- Allied utilities for power plant (e.g., cooling tower, cooling water pump, Condensate Extraction Pump)

This new set-up is expected to reduce greenhouse gas emissions of about 5,557 tCO_2 e/y. The turbine was started in May 2007. Power generation from turbine is dependent on CS2 production. In case of any drop in CS2 production, steam generation is reduced thereby, affecting power generation from turbine.

The contributions of the project activity to sustainable development are listed as follows:

Environment:

- Conservation of energy resources: This energy efficiency project will reduce the dependence of electricity from PLN grid and project will reduce the consumption of energy resources, i.e. coal, in Indonesia. This project will help Indonesia to conserve its own resources.

- Mitigation of climate change : The project activity will reduce the green house gasses that would have led higher emission in the absence of the project activity. The mitigation of emission will further contribute positively to the global climate change

- Supporting the government of Indonesia program on diversification of energy sources.

Social:

- Encourages other large facilities in the local community, irrespective sector to reduce GHG emissions

Economy:

- Not lowering local community's income, for instance no termination of employee of IRK caused by the project activity.

Technology:

- The presence of the project activity will have a positive impact to the local employees due to the operation and maintenance of the new system by increasing local capacity on usage of new turbine and generator application through training and coaching.

A.3. Project participants:

Name of Party involved ((host) indicates a host Party)	Private and/or public entity (ies) Project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as Project participant (Yes/No)
Republic of Indonesia	• Private entity PT. Indo Raya Kimia	No

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

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

A.4.1.1. Host Party(ies):

Indonesia

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

South East Asia/Indonesia/West Java

A.4.1.3. City/Town/Community etc:

Karawang

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

Indo Raya Kimia is located in Kujang Industrial Park, at Jenderal Ahmad Yani street No. 39, Kalihurip, Cikampek, Karawang – 41373 Indonesia with coordinate location, from the Google Earth printed on 22 August 2008 at 02.15 pm, 6° 24'51" South latitude and 107° 26' 28" East longitudes. The located can be reached in 2 hours by car from Jakarta. The map of the location of IRK is presented in Figure 1.

Figure 1. Location of IRK, Karawang, Indonesia

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

The project falls into
Sectoral scope number : 04
Sectoral Scope : Manufacturing industries
Type III – Other project activities
Category Q : Waste Energy Recovery (gas/heat/pressure) Projects
Project Activity : Utilization of waste heat from Sulphur Recovery Unit to generate electricity

Technology to be employed in the project activity

As mentioned in section A.2., the proposed project activity is to generate the electricity from the amount of 10.10 t/h of steam from waste heat produced in SRU and from the furnace. The steam is generated by using heat exchanger which transfers energy from waste heat to water. The steam is then used to run a turbine generator with installed capacity of 1.2 MW of which 146 kW would be consumed for internal power plant.

The technology implemented in the project activity is environmentally safe and sound technology since it complies with international standard. The operation of the turbine also subjected to periodical monitoring and assessment based on the law No. 1/1970 and Ministry decree No. 04/Ministry/1988. Report of the inspection by the third party mentioned that installation of electricity at IRK facility meets the requirement of work safety stipulated by the Government of Indonesia. Moreover, IRK has Certificate for Zero Accident Award from The Labor and Transmigration Department of Republic Indonesia for six consecutive years since 2002 and Certificate of Verification from Indonesia National Responsible Care Committee which demonstrates that IRK complies with the requirements of responsible care management practices such as community awareness, employee health and safety, pollution prevention and process safety.

In sulphur recovery unit, the acid gas from CS_2 plant (rich in H_2S) is burned in firebox (furnace) using excess air so as to ensure conversion of H_2S to SO_2 in the ratio 2:1, at the temperature of 1300 ^{0}C. The gas mixture is further subjected to catalytic oxidation / reduction in a converter so as to produce sulphur. The sulphur in vapor phase (343 ^{0}C) is then cooled to 170 ^{0}C in shell and tube heat exchanger, to recover molten sulphur. In this overall process, high pressure steam 24 barg is produced.

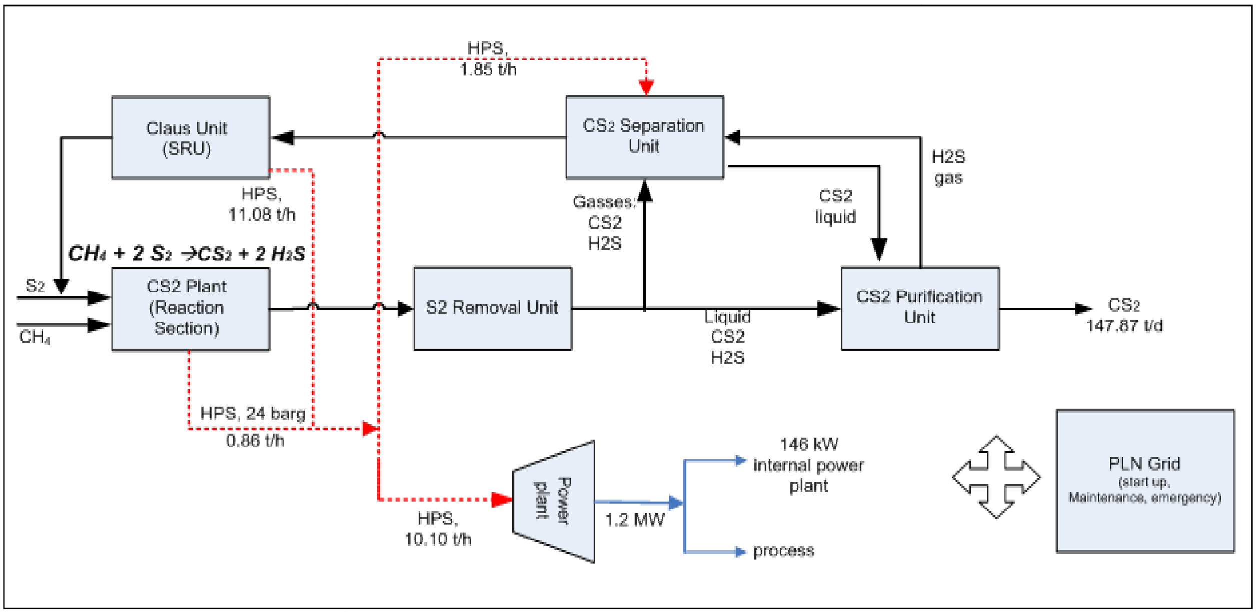

Figure 2. Project Activity

The technical specification of the additional electrical equipments at IRK are shown in the Table below:

Table 1. Specifications of Steam Turbine

Manufacturer	Dresser Rand
Type	Murray T-5742
Rated kW	1215
Lifetime	30 years
Inlet Temperature	244 °C
Inlet Pressure	24 barg

Table 2. Specifications of Generator

Manufacturer	Newage Stamford
Type	X05J390837
Installed Capacity	1200kW
Voltage	380 Volt
Frequency	50 Hz
RPM	1500
Power factor	0.8
Lifetime	30 years

Table 3. Specifications of Steam Surface Condenser

Manufacturer	New Field Industrial Equipment
Type	Shell & Tube
Heat Duty	5,544,000 kcal
Total steam to ejector	136 kg/hr
Lifetime	30 years

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

The chosen crediting period is 10-year fixed crediting period and the estimated annual emission reduction of about 5,557 ton of CO_2 e/y. This is less than the limits for small-scale project activities for type III of 60,000 tons of CO_2 e/y. The annual emission reductions through this project activity over the crediting period are estimated as shown below.

Years	Estimation of annual emissions reduction in tonnes of CO_2 e
Year 2012	1,389
Year 2013	5,557
Year 2014	5,557
Year 2015	5,557
Year 2016	5,557
Year 2017	5,557
Year 2018	5,557
Year 2019	5,557
Year 2020	5,557
Year 2021	5,557
Year 2022	4,168
Total estimated reductions (tonnes of CO_2 e)	**55,572**
Total number of crediting years	10
Annual average of estimated reductions over the crediting period (tCO_2e)	5,557

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

No public funding will be involved in the proposed project activity.

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

The project proponent confirms that the proposed project activity is not a debundled component of a larger project activity.
The project is not a debundled component of a larger project activity because:

- There is no similar small scale project activity proposed by the same project participant, under the same project category.
- There is only one location of the project activity.
- There is more than 1 km of the project boundary distance to the other proposed small-scale CDM project activity

Above conditions do not comply to the requirements as provided by appendix C of the Simplified Modalities and Procedures for Small Scale CDM project activities in determining the occurrence of debundling. Therefore, it can be inferred that the project is not debundled component of a larger 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 small-scale project activity:

The baseline and monitoring methodologies applied to the project activity are the approved baseline and monitoring methodology:

1. AMS III Q , version 04, EB 60 "Waste Energy Recovery (gas/heat/pressure) Projects",
2. ACM 0012, version 04.0.0, EB 60 "Consolidated baseline methodology for GHG emission reduction from waste energy recovery projects" ,
3. AMS I.D, version 17, EB 50 "Grid connected renewable electricity generation".

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

The justification of the choice of the project category is described in detail in Table 4.

Table 4. Justification of the choice of project type and category

Criteria of technology/measure under type III Q: Other project activities: waste gas based energy systems	project activity
Paragraph 1 The category is for project activities that utilize waste gas and/or waste heat at existing facilities as an energy source for: • Cogeneration; or • Generation of electricity; or • Direct use as process heat; or • Generation of heat in elemental process1 (e.g. steam, hot water, hot oil, hot air). • Generation of mechanical energy	This project activity uses waste heat at CS_2 manufacturing facility to generate electricity. The existing facilities (plant expansion) is started in May 2006. Therefore for this purpose, a new steam turbine generator is installed.
Paragraph 2 The category is also applicable to the project activities that use waste pressure to generate electricity at existing facilities.	This project activity utilizes the waste heat at CS_2 manufacturing facility to generate electricity instead of waste pressure.
Paragraph 3 The recovery of waste gas/heat/pressure should be a new initiative (no waste gas/heat/pressure was recovered from the project activity source prior to the implementation of the project activity).	The project activity is a new initiative. In the absence of the project activity, IRK imported electricity from the grid to meet the power demand
Paragraph 4 Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually.	The estimated emission reduction is about 5,557 tCO_2 e/y, which is less than 60 kt CO_2 e/y.
Paragraph 5 The category is applicable under the following conditions: - The energy produced with the recovered	- The energy produced with the recovered waste

waste gas/heat pressure should be measurable. - Energy generated in the project activity may be used within the industrial facility or exported to other industrial facilities (included in the project boundary). - Electricity generated in the project activity may be exported to the grid or used for captive purposes. However, the methodology is not applicable to projects where the waste gas/heat recovery project is implemented in a single cycle power plant (e.g gas turbine or diesel generator) where heat generated on site is not utilizable for any other purposes on site except to generate power. - For a project activity which recovers waste gas/heat/pressure for power generation from multiple sources, this methodology can be used in combination with AMS-III.AL provided that: (i) Within the project activity it is possible to distinguish two distinct waste energy sources such that: • Waste energy source I belongs to such waste heat sources which are eligible under AMS-III.Q; • Waste energy source II belongs to such waste heat sources which are eligible under AMS III.AL; (ii) It is possible, for each waste energy source, to determine the baseline according to the specific methodology referred to; (iii) It is possible to objectively allocate the electricity produced in the project activity to each waste energy source, by means of one of the following methods: • Through separate measurements of the electricity produced by utilizing waste energy from each waste energy source; or • Through separate measurements of the energy content of the waste energy carrying medium (WECM) streams used for electricity production; or	heat is measurable by kWh meter - The energy generated in the project activity will be used within IRK. - Electricity generated in the project activity is used for captive purposes. The waste heat recovery project is implemented in a single cycle power plant but the heat generated on site is utilized for CS2 separator and Waste Water Stripper at the IRK facility beside is utilized for power generation. - Project activity is to generate the electricity from waste heat produced in SRU and the furnace. As the project activity is new initiative, it will not use AMS III.AL.

• Through separate measurements of the energy content of the waste energy streams that are associated with each energy source and used for electricity production or for the WECM generation in a common waste heat recovery system.	
- The emission reduction are claimed by the generator of energy using waste energy	- The emission reductions are claimed by the 1.2 MW generator of energy using waste energy which would be sourced from PLN grid in the absence of the project activity.
- In cases where the energy is exported to other facilities (included in the project boundary), the following are required : (i) all historical information from the recipients plants (ii) an official agreement exists between the owners of the project energy generation plant (henceforth referred to as generator, unless specified otherwise) with the recipient plant(s) that the emission reduction would not be claimed by the recipineht plant (s) for using a zero emission energy source	- No energy exported to other facility. The energy produced will be used within IRK
- For those facilities and recipients included in the project boundary, that prior to implementation of the project activity (current situation) generated energy on site (sources of energy in the baseline), the credits can be claimed for minimum of the following time periods : (i) the remaining lifetime of equipments currently being used (ii) crediting period	- Prior to the project activity, the energy generated is sourced from the PLN grid.
- The waste gas/heat pressure utilized in the project activity would have been flared or released into the atmosphere in the absence of the project activity.	- The waste energy utilized in the proposed project activity was vented into the atmosphere in the absence of the proposed project activity at the existing facility. Electricity energy bills are available as the evidences to demonstrate that all the energy required for the CS_2 production process was procured commercially in absence of proposed project activity. The average electricity consumption per ton of CS2 production prior to the project activity was 163.58 kWh/tCS_2.
Paragraph 6	

For the purpose of this category waste energy is defined as: by-product gas/heat/pressure from machines and industrial processes having potential to provide usable energy, for which it can be demonstrated that it was wasted. For example gas flared or released into the atmosphere, the heat or pressure not recovered (therefore wasted). Gases that have intrinsic value in a spot market as energy carrier or chemical (eg. Natural gas, hydrogen, liquefied petroleum gas, or their substitutes) are not eligible under this category,	In the absence of the project activity the waste steam as defined as by product of the CS_2 production, directly released to the atmosphere. The proven data of unuseful waste steam is shown in the table of ER calculation spreadsheet for the 6 months data.

B.3. Description of the project boundary:

The project boundary is delineated as the CS_2 manufacturing facility of IRK where the waste heat is produced, described in Figure 2, section A.4.2. The GHG emission sources related to the project activity is given in Table 4.

Table5. GHG emission sources related to the project activity

	Source	Gas	Included?	Justification/Explanation
Baseline	Electricity import from PLN JAMALI Grid	CO_2	Included	Main emission source
		CH_4	Excluded	Excluded for simplification and conservativeness
		N_2O	Excluded	Excluded for simplification and conservativeness
Project Activity	Electricity consumption by the project activity due to power requirement for the power plant taken from PLN	CO_2	Included	Main emission source.
		CH_4	Excluded	Excluded for simplification
		N_2O	Excluded	Excluded for simplification

B.4. Description of baseline and its development:

Step 1. Identification of possible baseline scenarios for electricity generation

In the absence of this CDM project, IRK has the following alternatives to provide electricity:
Scenario 1) Continuous operation by purchasing electricity from PLN JAMALI Grid
Scenario 2) Installation of waste heat based-power plant not as CDM project activity

Step 2. Evaluation of each baseline scenario alternative

Scenario 1) Continuous operation by purchasing electricity from PLN JAMALI Grid

IRK purchases electricity from PLN Grid to run the process. This scenario is the current practice, and continuing this practice will not create any investment by IRK. IRK has utilized electricity from PLN JAMALI Grid since the starting date of the company and the technology is well known and is a common practice in industries. Therefore, this scenario can be the baseline scenario.

Scenario 2) Installation of waste heat based-power plant not as CDM project activity

IRK plant basic design technology is supplied by Akzo Nobel which does not have provision for power generation. Installation of power plant would involve not only investment but also modification in the basic process design. Considering unfamiliarity with the technology and the additional investment, the waste heat based power plant would not have been installed if there was no motivation for CDM.

Therefore, in the absence of the project, the baseline scenario selected is the continuous operation by purchasing electricity from PLN JAMALI Grid.

Baseline scenario:

In the absence of the project activity, all electricity requirement of CS_2 plant of IRK, is supplied by PLN Jamali grid. Justification value of baseline scenario is based on the historical data of CS_2 plant operation for the 6 months (May up to June 2006 and January up to April 2007) during the operational of electric blower K-504, 400 kW in normal condition, where the steam produced was unutilized and emitted to the atmosphere. Data for July up to December 2006 is not taken into consideration for baseline scenario since during this period the plant was not running in normal condition such as plant load down, getting alarm active at K-504 (electric blower of 400 kW) and the utilization of K-503 (steam blower) as back-up blower. The SRU and CS2 plant generated 11.95 t/h of steam and 24 barg steam (High Pressure Steam). This steam, in the total amount of 1.85 t/h, was used for CS_2 separation and Waste Water Stripper, while the excess steam, 10.10 t/h, was being condensed in a fan condenser and the water generated was used as demineralised water.

Data used for baseline calculation is taken from data recorded through Distributed Control System (DCS) such as steam generated in the Claus Unit/SRU (FI-5091) and steam produced from CS_2 plant/furnace (FI-2007). Then the rationale steam used to CS_2 separation and Waste Water Stripper is 0.3 ton of steam/unit CS_2 production based on Basic Engineering Package from the technology provider and electricity consumption taken from PLN invoice. Figure 3 described the baseline condition.

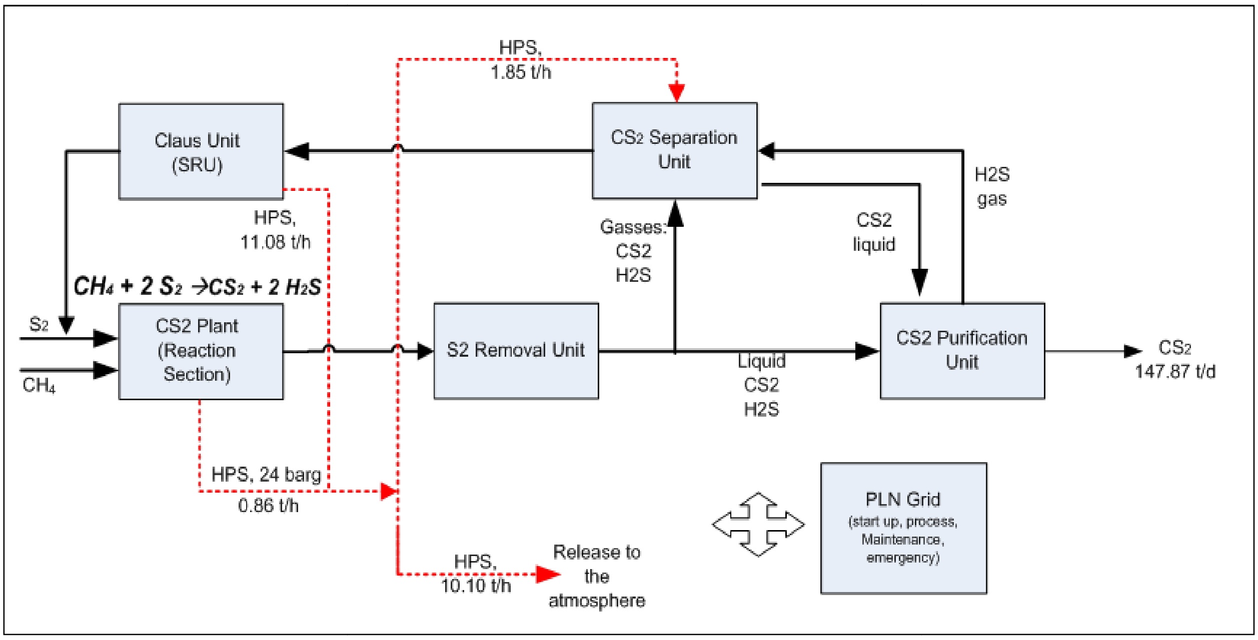

Figure 3. Baseline activity

Baseline emission

In accordance with paragraph 9 of the methodology, in the situation where the electricity is obtained from the grid, the calculation of the baseline emissions follows the procedure of paragraph 9 (a) of Approved baseline methodology which the baseline emissions is calculated from electricity ($BE_{elec,y}$) generated by waste energy. Moreover, it is mentioned if the displaced electricity for recipient is supplied by a connected grid system, the CO_2 emission factor of the electricity $EF_{elec,gr,j,y}$ shall be determined following the guidance provided in the “Tool to calculate the emission factor for an electricity system”.

Refer to Tool to calculate the emission factor for an electricity system, if the DNA of host country has published a delineation of the project electricity system and connected electricity system, these delineations should be used. Indonesian DNA has stipulated the figure of emission factor for JAMALI grid which connected to the project activity. The emission coefficient stipulated by the Indonesian DNA [1] is calculated according to ”Tool to calculate the emission factor for an electricity system version 01.1” and calculated based on the historical data year 2004-2006[2]. The value of the emission coefficient is 0.891 tCO_2 e/MWh.

In addition, the Executive Board has stipulated the latest version of Tool to calculate the emission factor for an electricity system version 02, EB 50 Annex 14, October 2009. The differences between the previous version 01.1 and the latest version 02 is step 2 “choose whether to include off-grid power plants in the project electricity system (optional). To accommodate the latest version, the emission coefficient is update using the existing data (data year 2004-2006). In Indonesia, the publicly available data of Statistic PLN (data of grid power generation) for year y usually available latter than 6 months after the end of year y. Data of PLN statistic 2007 has just been released by the State own electricity company (PLN) in July 2008. Therefore, data year 2004-2006 to calculate the emission factor is the most recent data at the time of PDD submission. In the update emission factor calculation, only grid power plants are included in the calculation and the IPCC default values of $EF_{CO2i,y}$ taken at the lower limit of the uncertainty at a 95% confidence interval as provided in the table 1.4 of Chapter 1 of Vol 2 (energy) of the 2006 IPCC Guidelines on National GHG inventories. Therefore, the new emission coefficient of JAMALI grid refer to tool to calculate the emission factor version 02 is 0.862 tCO_2/MWh and it will be fixing applied in the project activity over the crediting period.

Parameter used to determine the baseline emissions :

Table 6. Parameter used to determine the baseline emission

No	Parameter	Symbol	Unit	Source
1	Electricity which would have been imported from the PLN grid in the absence of the project activity	$EG_{,i,j,y}$	MWh/y	Calculation using the historical data in May-June 2006 and January – April 2007 during the period when only single operational electric blower of 400 kW in normal condition.

[1] Indonesian DNA letter No. B-227/Dep.III/LH/01/2009 dated 19 January 2009

[2] Indonesian DNA letter No.494/21/650.1/2009 dated 13 February 2009

2	Emission coefficient of PLN Jamali grid	$EF_{ELec, grid,j y}$	t CO_2 e/MWh	Indonesian DNA letter no,: a. B-227/Dep.III/LH/01/2009 dated 19 January 2009 b. B-494/21/650.1/2009 dated 13 February 2009
3	Fraction of total electricity generated by the project activity using waste energy	f_{wcm}		According to AMS III.Q v04, this fraction is 1 if the electricity generation is purely form use of waste energy.
4	Capping factor	f cap		calculated as per section ACM0012 ver 04

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

According to the Attachment A, Appendix B of the simplified modalities and procedures for small scale project activities, Project participants shall provide an explanation to show that the project activity would not have occurred anyway through explanation of certain barriers.

The implementation of the project activity is a voluntary step undertaken by IRK and this project activity is not mandated by law. There are few barriers to implement this project and the carbon credits expected from CDM would overcome the following barriers :

Institutional Barrier

The project faces instutional barrier due to a lack of relevant experiences. PT. Akzo Nobel Satindo, a well-known chemical product manufacturer, was taken over by PT. Indo Bharat Rayon in the year 2003 under the name of PT. Indo Raya Kimia. Akzo Nobel has so far developed 3 CS_2 plants globally, one in Cologne, Germany, one near Mobile, Alabama, USA and the other is IRK. During the period of CS2 plant operated by Akzo Nobel (1999-2002), there was no initiative taken to utilize the waste steam to produce electricity. The electricity required by IRK plant is fully supplied from PLN Jamali grid. Before the take over period, PT. Indo Bharat Rayon did not have any experience of operating gas based CS2 plant. After Akzo Nobel CS2 plant was acquired by Aditya Birla Group under IRK, some ideas and initiatives were developed to make use of the waste steam and finally, utilization of waste steam to generate electricity was proposed. The evidence that among all Akzo Nobel designed for CS2 plants, only IRK uses waste steam to generate electricity is available for validation purpose.

Under Aditya Birla Group, there is another natural gas based CS_2 plant which is being commissioned in Thailand, where the technology is taken from Chinese manufacturer. The CS_2 plant supplier from China has given the offer to Thai Rayon Public Company Limited under Aditya Birla Group. In the offer, there is no provision of power generation in the plant design. This also demonstrates that utilization of waste steam to produce electricity is not a common practice in CS_2 industry in China. Therefore, the utilising waste steam from CS_2 process as source of electricity is not commonly adopted by CS2 manufacturers.

\Moreover, initiative of putting up turbine to utilize the waste process steam in the IRK CS_2 plant to generate the electricity is the first kind of the project activity under Aditya Birla Group. The group has put an effort to prepare the resources and their personel to opearte gas based CS2 plant as well as to initiate the power generation from waste steam of CS2 plant. In this case the group faces institutional barrier

which would be overcome by the incentive from CDM through training and also to familiarize the operation and maintenace under Aditya Birla group.

Technological barrier

The project faces technological barrier due to a lack of relevant engineering capacities. During the period of CS2 plant operated by Akzo Nobel (1999-2002), there was no initiative taken to utilize the waste steam to produce electricity. Prior to the implementation of the project activity, the electricity required by IRK plant is fully supplied from PLN Jamali grid. In addition, there is natural gas based CS2 plant under Aditya Birla Group which is commissioning in Thailand. The CS_2 plant supplier from China has given the offer to Thai Rayon Public Company Limited under Aditya Birla Group. In the offer, there is no provision of power generation in the plant design. Therefore, the utilization of waste steam to generate the electricity based CS2 plant is the first initiative taken in IRK also under Aditya Birla Group.

Furthermore, the power generation in the project activity is dependent on the steam generation from the CS2 production process. Any disturbance in the CS_2 manufacturing process adversely affects the waste steam generation consequently affecting the steam and power generation. The plant is designed for minimum methane fraction of 91% and CO2 content < 1%. Any deterioration in gas quality i.e drop in methane fraction and increase in CO2 content will directly impact the productivity of CS2 process.

The variation of methane content and CO2 content for the CS2 production process is described in the table as below :

Month	CS2 production (TPD)	Steam generation (TPH)			Natural Gas quality	
		From Claus	From CS2 plant	Total	CH4 (%)	CO2 (%)
May 2006	148.57	10.71	0.92	11.63	95.63	1.15
June 2007	142.72	10.95	0.91	11.86	91.71	3.92
April 2008	133.20	10.00	0.87	10.87	89.05	4.28
July 2008	117.51	8.84	0.76	9.59	87.43	5.07
April 2009	105.36	5.82	0.54	6.36	85.38	6.79
Dec 2009	125.75	8.64	0.87	9.51	85.52	6.44

The design of CS2 plant involves the application of complex chemical and thermodynamics. Practical knowledge and experience of the operating regimes and failure modes of associated equipment is necessary to minimise the risk of equipment failure and plant downtime. Therefore, the operational aspects and maintenance of power generation are the main technological barrier for IRK facility since they are new to engineers and supervisors of IRK. Thus, the management of IRK has considered about the operation and maintenance of this new system and conducted a local staff training for introducing new system and trouble shooting of waste steam based-power generator. Since IRK is new to gas based power plant technology in CS2 manufacturing, any addition to the process faces the risk which would not exist if IRK continue the current practice. The revenue from CERs provided IRK with the incentive to assume these risks.

Barriers to prevailing practice

The prevailing practice taken in industrial facility in Indonesia for electricity consumption to fulfil the power demand is supplied from fossil fuel based power plant or imported from PLN grid.

It is to be noted that in the Cikampek Kujang Industrial Park/Kawasan Industri Kujang Cikampek (KIKC), the area where IRK facility is located, most of industrial facilities depend on electricity supply from PLN Jamali grid to fulfill the electricity requirements for their plant.

There is no existing regulatory or policy requirement which regulates how industries have to fulfil their electricity demand. Therefore, there are several options for industries to meet their electricity demands such as development captive power plant or purchase the electricity from PLN grid.

In Java Island, based on PLN statistics 2006 which is published by PT. Perusahaan Listrik Negara/PLN (State owned electricity company), a large amount of 93.69% of electricity exported from PLN Jamali grid is consumed by industrial facilities compared to others consumers such as households, business, social, government office and public facilities. The practice to import the electricity from PLN grid is well known and is a common practice in industries.

In Indonesia, we have *Bureau Central Statistic (BPS/Badan Pusat Statistik) of Indonesia, a Non-Departmental Government Institution that has the principal function of providing basic statistical data, both for government and for the general public, national and regional levels. Based on BPS document year 2007"Manufacturing Industry Directory, catalogue BPS : 6102 page 661, it is stated under the head of basic organic chemical of vegetables or animal origin, that* IRK is the only CS2 plant in Indonesia. Therefore, to put up the power plant to utilize the waste steam in CS2 plant would be the first kind of its project activity and IRK is the first initiative taken to generate the electricity from waste steam in CS2 facility in Indonesia.

Alternatives in the absence of the project activity would have led higher emissions of green house gases. Therefore, the utilization of waste steam to generate the electricity is additional.

Consideration of CDM prior to the Project Implementation and CDM milestone

No	Scenario	Date
1	Board resolution of IRK In the minutes of meeting, board decided to implement the project activity under the CDM program and the credits may be used to minimize the risk associated with the project activity.	21/02/2005
2	PO for turbine – generator (Starting date of project activity)	22/09/2005
3	Filled Project Inquiry Note (PIN) submitted by IRK	07/12/2005
4	Proposal submission to IRK for CDM consultancy services	09/01/2006
5	Authorization to Proceed the CDM consultancy services	15/03/2006
6	Technical Feasibility Study report for increasing CS2 product from 132 TPD to 145 TPD	April 2006
7	Process Engineering Report subjected to calculation of minimum flow new blower K-504 to prevent surging	05/05/2006
8	Work order for civil work of turbine package	02/06/2006
9	Contract for various pipe work for turbine genset	12/07/2006
10	Contract for fabrication and erection of turbine genset structure	14/07/2006
11	Process Engineering Report subjected to commissioning of electrical blower K-504	August 2006
12	Payment for the purchase main equipment	30/08/2006

13	Announcement of new EF 0.754 by Indonesian DNA to the CDM developer participants	12/09/2006
14	Synchronization system of turbine with PLN which is located at IRK	06/12/2006
15	Commissioning of IRK vacuum system–surface condenser & ejector	January 25-26, 2007
16	Notification letter of the changing name of the CDM consultant company to IRK	15/03/2007
17	Alignment gearbox with steam turbine and generator	28/04/2007
18	The date of commissioning for the operational of the project activity	May 2007
19	Stakeholder Consultation Meeting	05/02/2008
20	Approached with DOEs for validation services	25 February 2008
21	Contract with the DOE for validation services	14 May 2008
22	PDD to be hosted for GSP	07 June - 06 July 2008

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Emission reductions by this project activity are calculated as shown below:

$ER_y = BE_y – PE_y$

Where :

ER_y = Emission reductions of the project activity in year y (tCO_2 e/y).
BE_y = Baseline emission in year y (tCO_2 e/y).
PE_y = Project emission in year y (tCO_2 e/y).

1. Baseline emission (BE $_y$)

According to approved methodology of AMS III.Q version 04, where the electricity is obtained from the grid, baseline emission is calculated from electricity ($BE_{elec,y}$) generated by waste energy. Therefore, in this project activity, the baseline emission is calculated based on the electricity generated by the waste steam during the project activity which would have been imported from the PLN grid in the absence of the project activity.

Baseline emission calculation is determined by the following formula:

$$BE_{Elec,y} = f_{cap} * f_{wcm} * \sum_j \sum_i (EG_{i,j,y} * EF_{Elec,i,j,y}) \quad \text{.................} (1)$$

Where:

$BE_{Elec,y}$ = Baseline emissions due to displacement of electricity during the year y in tons of CO2 (tCO_2 e/y).

$EG_{j,j,y}$ = The quantity of electricity supplied to the recipient j by generator, that in the absence of the project activity would have been sourced from i^{th} source during the year y in MWh (MWh/y).

$EF_{Elec,i,j,y}$ = The CO2 emission factor for the electricity source i, displaced due to the project activity, during the year y in tons of CO2/MWh (0.862 tCO_2e/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 form use of waste energy.

f_{cap} = Capping factor to exclude increase waste energy utilization in the project year y due to increased level of activity of the plant, relative to the level of activity in the base years before project start. The ratio is 1 if the waste energy generated in the project year y is same or less than that generated in base years. F cap shall be estimated according to the corresponding section of ACM0012.

The proportion of electricity that would have been sourced from the i^{th} source to the j^{th} recipient plant should be estimated based on historical data of the proportion received during the three most recent years. Since the historical data of three most recent years are not available, the $EG_{i,j,y}$ in the baseline is calculated based on the historical data of CS_2 plant operation for the 6 months (May to June 2006, January to April 2007) during the operational of electric blower K-504, 400 kW in normal condition, which the steam produced was un utilized and emitted to the atmosphere.

Capping of baseline emissions

As per requirement of AMS III Q ver 04 paragraph 9, the parameter f_{cap} shall be determined according to the corresponding section of ACM0012 (version 04). As an introduction to the element of conservativeness, this methodology requires that the baseline emissions should 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 one of three methods. Project proponent shall use method-1 to estimate the cap if data is available. In case of project activities implemented in new facility, or in facility where three years data on production is unavailable, Method-2 shall be used. In case the project proponents demonstrate technical limitations in direct monitoring of waste heat/pressure of waste energy carrying medium (WECM), then Method-3 is used. .

Since there are no available data for the last 3 years priors to the start date of the project activity, the capping of baseline emissions for the project activity is determined by adopting Method-2.

Under this method, 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 steam generated prior to the start of the project activity (t/y).

$Q_{BL,product}$ = Production associated with the relevant waste steam generation as it occurs in the baseline scenario. The minimum of the following two figures should be used : (1) average annual production data from start up, if the plant's operational history is

less than three years, of the plant or (2) the most relevant manufacture's data for normal operating conditions. In case of new facilities or where data is not available the manufacture's data for normal operating conditions shall be used (tonCS2/y).

q wcm, product = Amount of waste steam per unit of product generated by the process (that generates waste energy) in the industrial facility (t/ton CS2).

$Q_{WCM,y}$ = Quantity of waste steam used for energy generation during year y (t/y).

To determine the f cap, average annual production data associated with the relevant waste energy generation in the baseline scenario is used. The production process that most logically relates to the waste steam generated in the baseline is CS_2 production. Based on recorded data in the Bill of Material Report and YTD production summary, it obtained CS_2 production is 147.87 ton CS_2/day. Besides the CS_2 production data, in the historical data through Distributed Control System (DCS) recorded the steam generated by the SRU and Furnace. After internal consumption, the waste energy generated is 10.10 ton/hour or equal to ratio 1.64 ton of steam/ton of CS_2 production. Since the IRK plant has historical data less than three years of waste energy generated prior to the start of the project activity, then this figure will be applied in the calculation ($Q_{WCM,BL}$) to estimate f cap.

Moreover, this amount of waste energy per unit of product generated by the process is lower than estimated waste energy per unit of product generated, 1.74 ton steam/ton CS2 production, based on design manufacturer's data of 132 t/d. Refer to Feasibility conducted due to modification production capacity from 132 t/d to 145-150 t/d, the CS2 production unit (Reaction, Sulfur removal, CS2 Purification and Separation) has ability to operate up to 150 t/d without bottle neck point or no major modification for main equipment. Therefore, the amount of 10.10 ton/hour is used as a conservativeness quantity of waste steam generated prior to the start of the project activity to calculate the f cap.

Emission Factor of baseline emission

The emission coefficient stipulated by the Indonesian DNA[3] is calculated according to "Tool to calculate the emission factor for an electricity system version 01.1" and calculated based on the historical data year 2004-2006[4]. . In addition, the Executive Board has stipulated the latest version of Tool to calculate the emission factor for an electricity system version 02, EB 50 Annex 14, October 2009. The differences between the previous version 01.1 and the latest version 02 is step 2 "choose whether to include off-grid power plants in the project electricity system (optional).

To accommodate the latest version, the emission coefficient is update using the existing data.

Step 1. Identify the relevant electric power system
The project activity is connected to the Java Madura Bali (Jamali) grid electricity system.

Step 2. Choose whether to include off-grid
In the tool, project participants may choose between the two option to calculate the operating margin and build margin emission factors as follow :

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[3] Indonesian DNA letter No. B-227/Dep.III/LH/01/2009 dated 19 January 2009

[4] Indonesian DNA letter No.494/21/650.1/2009 dated 13 February 2009

Option I : only grid power plants are included in the calculation
Option II : Both grid power plants and off-grid power plants are included in the calculation

Based on the option offered in the tool to calculate the operating margin and build margin emission factor, the emission factor calculation stipulated by Indonesian DNA select the option I which only grid power plants are included in the calculation.

Step 3. Select an operating margin (OM) method
The "Tool to calculate the emission factor for an electricity system" (version 02, EB50 annex 14) offers four methods to calculate the OM and any of the four methods can be used :

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

The emission factor can be calculated using either of the two following data vintages:

- **Ex ante option:** 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, without requirement to monitor and recalculate the emissions factor during the crediting period, or
- **Ex post option:** 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 proceeding 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" has been selected for the purpose of emission reductions calculation for this project and remains the same during the 1st crediting period.

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

The average OM emission factor selected in this project is calculated as the average emission rate of all power plants serving the grid, weighted average CO_2 emissions per unit net electricity generation (tCO_{2e}/MWh) of all generating power plants serving the using the methodological guidance as described under the simple OM, but including in all equations also low-cost/must-run power plants. It may be calculated:

- Based on data on the net electricity generation and a CO2 emission factor of each power unit (Option A), or
- Based on data 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 (Option B).

Option B can only be used if the necessary data for Option A is not available.

Out of those options, option B is selected based on the following reasons :

The necessary data in Option A, data on the net electricity generation of type power plant unit serving the JAMALI grid is not publicly available.

Under this option, the OM emission factor is calculated based on net electricity supplied to the grid by all power plants serving the system and based on the fuel type (s) and total fuel consumption of the project electricity system, as follows :

$$EF_{grid,OMsimple,y} = \frac{\sum_i (FC_{i,y} \, x \, NCV_{i,y} \, x \, EF_{CO2,i,y})}{EG_y} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots..(1)$$

Where:

$EF_{\text{grid, OM simple, y}}$	=	Simple operating margin CO_2 emission factor in year (tCO_{2e}/MWh)
$FC_{i,y}$	=	Amount of fossil fuel type I consumed in the project electricity system 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_{2e}/MWh)
EG_{iy}	=	Net electricity generated and delivered to the grid by all power sources serving the system in year y (MWh)
i	=	All fossil fuel types combusted in power sources in the project electricity system in year y
y	=	The relevant year as per data vintage chosen in Step 3

In the update emission factor calculation, the IPCC default values of $EF_{CO2i,y}$ taken at the lower limit of the uncertainty at a 95% confidence interval as provided in the table 1.4 of Chapter 1 of Vol 2 (energy) of the 20006 IPCC Guidelines on National GHG inventories.

Step 5. Identify the cohort of power units to be included in the build margin (BM)
In the sample group used, the participants have selected the largest annual generation between the following choices:

1. The set of five power units that have been built most recently, or
2. The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

"The set of power capacity additions in the electricity system that comprise 20% of the system generation and have been built most recently" is selected for calculating Build Margin in this project activity

Step 6. Calculate the build margin emission factor
The build margin emissions factor is the generation-weighted average emission factor (tCO_{2e}/MWh) of all power unit *m* during the most recent year *y* for which power generation data is available, calculated as follows:

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

Where:

$EF_{\text{grid, BM, y}}$	=	Build margin CO_2 emission factor in year *y* (tCO_{2e}/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_{2e}/MWh)
m = Power units included in the build margin.
y = Most recent historical year for which power generation data is available

Step 7. Calculate the combined margin emission factor

The combined margin emission factor is calculated as follows:

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

Where:
$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year *y* (tCO_{2e}/MWh)
$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year *y* (tCO_{2e}/MWh)
w_{OM} = Weighting of operation margin emission factor (%)
W_{BM} = Weighting of build margin emission factor (%)

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

The new emission coefficient of JAMALI grid refer to tool to calculate the emission factor version 02 is 0.862 tCO_2/MWh and it will be fixing applied in the project activity over the crediting period.

2. Project emission (PE_y)

Referring to the approved methodology used for the project activity, project emissions include emissions due to combustion of auxiliary fuel to supplement waste gas and emissions due to consumption of electricity by the project activity.

In this project, no auxiliary fuels are combusted. *Therefore,* there is no project emission from fuel combustion. The project emission is accounted from the consumption of electricity in the project activity due to power requirement by the power plant and the consumption of electricity from PLN grid by the project activity during shut down, maintenance and start up period which would not occur in the absence of the project activity.

The project emission by the project activity will be calculated as follow :

$$PE_y = EC_{internal,y} \; x \; EF_{Elec,i,j,y}$$

Whereas :

PE_y = Project emission in year y (tCO_2e/y)
$EC_{internal,y}$ = Quantity of electricity consumed for internal power plant and the electricity consumed from PLN grid by the project during the shut down, maintenance and start up period in year y (kWh/y)
$EF_{Elec,I,j,y}$ = The CO2 emission factor for the electricity source I during the year y in tons of CO2/MWh (0.862 tCO_2 e/MWh).

The internal power plant encompasses condensate extraction pump, cooling water pump and cooling tower fan. The electricity consumption for internal power plant is calculated based on the quantity of electricity consumed associated by the internal power plant. To guard the conservativeness to estimate the emission reduction calculation in the PDD, project emission from internal power plant is determined based on its power name plate multiplied by the operational hours and operational days as provided in the formulae below:

$EC_{internal,y}$ (MWh/y) = Power nameplate (condensate extraction pump + cooling water pump + cooling tower fan) kW x operating hours/day x operating days/year /1000

In the PDD development, the amount of electricity consumed from PLN grid by the project during shut down, maintenance and start up is considered zero but it will be measured and monitored during the crediting period.

For the monitoring purposes, the project emission for the electricity consumption by power plant will be measured by installed kWh meter on site.

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

(Copy this table for each data and parameter)

Data / Parameter:	$Q_{BL,\ product}$
Data unit:	t/d
Description:	Production of process that most logically relates to waste steam generation in baseline i.e CS2 production
Source of data used:	Historical data
Value applied:	147.87
Justification of the choice of data or description of measurement methods and procedures actually applied :	To calculate $Q_{BL,product,y}$ the minimum of the following two figures should be used according to ACM0012 v04: (1) average annual historical production data from start up, if the plant 's operational history is less than three years, of the plant or (2) the most relevant manufacture's data for normal operating conditions. In case of new facilities or where data is not available the manufacture's data for normal operating conditions shall be used. The average annual historical production data is chosen. This value applied is based on historical data of CS2 plant operation for the 6 months (May-June 2006 and January – April 2007) recorded from Bill of Material report & Year to Date (YTD) summary during the operational of electric blower K-504, 400 kW (normal operation).
Any comment:	

Data / Parameter:	$q_{WCM,product}$
Data unit:	T/Ton CS2
Description:	Amount of waste steam the industrial facility generates per unit of CS2 production
Source of data used:	Calculation
Value applied:	1.64
Justification of the choice of data or	The value is calculated based on data Engineering package from Akzo Nobel

description of measurement methods and procedures actually applied :	
Any comment:	-

Data / Parameter:	Operating days
Data unit:	d/y
Description:	Number of days in a year
Source of data used:	Calculation
Value applied:	330
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value is determined by sum of operating days prior to the implementation of the project activity. The total operating days were 339,04 . The value based on historical data of CS2 plant operation for the 6 months (May – June 2006 and January – April 2007) during the operational of electric blower of 400 kW in normal condition which the steam produced was un utilized and emitted to the atmosphere. For the conservative manner in the emission reduction calculation, 330 is taken.
Any comment:	

Data / Parameter:	Load factor
Data unit:	
Description:	The power it can generate from the turbine
Source of data used:	Information from the technology supplier
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	The figure taken is coming form the information from the technology supplier. This value is determined to estimate the baseline emission of emission reduction calculation in the PDD
Any comment:	

Data / Parameter:	f_{wcm}
Data unit:	
Description:	Fraction of total electricity generated by the project activity using waste energy.
Source of data used:	Approved methodology AMS III.Q version 04
Value applied:	1
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to AMS III.Q v04, this fraction is 1 if the electricity generation is purely from use of waste energy. Since the project activity is utilized the waste heat of CS_2 plant to generate the electricity, then the value of 1 is taken.
Any comment:	

Data / Parameter:	$EF_{Elec,i,j,y}$

Data unit:	tCO_2 e/MWh
Description:	Default value of emission factor from PLN Jamali grid which is calculated based on Tool to calculate the emission factor for an electricity system version 02.
Source of data used:	Emission coefficient that stipulated by Indonesian DNA which is calculated based on tool to calculate the emission factor version 01.1 - Indonesian DNA letter No. B-227/Dep.III/LH/01/2009 dated 19 January 2009 - Indonesian DNA letter No.494/21/650.1/2009 dated 13 February 2009 Using the existing data available, the emission factor is updated refer to tool to calculate the emission factor for an electricity system version 02.
Value applied:	0.862
Justification of the choice of data or description of measurement methods and procedures actually applied :	This emission coefficient is calculated in a transparent and conservative manner as a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the 'Tool to calculate the emission factor for an electricity system'. Since the electricity supplied by PLN Jamali grid, therefore the COEF value is based on default value of COEF from Jamali grid
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

Estimation of Emission Reduction by the project activity is calculated hereafter:

1. Baseline emission (BE_y)

$$BE_{Elec,y} = f_{cap} * f_{wcm} * \sum_j \sum_i (EG_{i,j,y} * EF_{Elec,i,j,y}) \quad \text{.................} (1)$$

$= 1 * 1 * 7,603.20$ MWh/y * 0.862 tCO_2e/MWh

$= 6,553.96$ tCO_2e/y

$EG_{i,j,y}$ = Installed capacity * operating hour/y * load factor

= 1.2 MW x 24 h/d x 330 d/y * 0.8

= 7,603.20 MWh/y

Emission factor

Operating margin emission factor

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

= 0.818 (tCO_{2e} /MWh)

Build margin emission factor

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \bullet EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

$= 0.906\ (tCO_{2e}\ /MWh)$

<u>Combine margin emission factor</u>

$EF_y = w_{OM}\ EF_{OM,y} + w_{BM}\ EF_{BM,y}$
$= 0.5 \text{ x } [0.818\ (tCO_{2e}\ /MWh) + 0.906\ (tCO_{2e}\ /MWh)]$
$= 0.862\ (tCO_{2e}\ /MWh)$

Considering the load factor, total power can be generated by the power plant is less than the electricity consumption for the CS2 production. Then this figure is estimated as quantity of electricity supplied to the recipient j by generator that in the absence of the project activity would have been source from grid during the year y.

Capping of baseline emissions

For f cap calculation in this project activity, figures on average annual historical production data of the plant is taken. The production process that most logically relates to the waste steam generated in the baseline is CS_2 production. Based on recorded data in the Bill of Material Report and YTD production summary, it obtained CS_2 production is 147.87 ton/day. Besides the CS_2 production data, in the historical data recorded through Distributed Control System (DCS) the steam generated by the SRU and Furnace. After internal consumption, the waste steam generated is 10.10 ton/hour or equal to ratio 1.64 ton steam/ton CS_2.

Under the method-2, f cap is estimated by the following formulae:

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

$$= \frac{Q_{BL,product}\ x\ q_{wcm,product}}{Q_{WCM,y}}$$

$$= \frac{147.87\, tCS2/d\ *330\, d/y * 1.64\, ton\ steam/tCS2}{10.10\, ton\, steam/h*24\, h/d\ *330\, d/y}$$

$$= \frac{79{,}957.59\, t/y}{79{,}957.59\, t/y} = 1$$

2. Project emission (PE_y)

The project emission is determined from the consumption of electricity in the project activity due to power requirement by the power plant and the consumption of electricity from PLN grid by the project activity during shut down, maintenance and start up which would not occur in the absence of the project activity.

If there is electricity used for the project activity from the grid (i.e. $EC_{gridtoPJ}$), the CO2 emission shall be considered as the project emission. However, in the PDD development, the amount of electricity consumed from PLN grid by the project activity during shut down, maintenance and start up is considered zero but it will be measured and monitored during the crediting period.

The project emission by the project activity is calculated as follow :

$$PE_y = EC_{internal,y} \ x \ EF_{Elec,i,j,y}$$

$$= 1,156.32 \text{ MWh/y x } 0.862 \text{ tCO}_2\text{e/MWh}$$

$$= 996.75 \text{ tCO}_2\text{e/y}$$

The internal power plant encompasses condensate extraction pump, cooling water pump and cooling tower fan. (MWh/y). To guard the conservativeness to estimate the emission reduction calculation in the PDD, power name plate for each items are taken to estimate the emission for internal power plant.

$$EC_{internal,,y} = \frac{146 \ kW \ x \ 24 \ h/d \ x \ 330 \ d/y}{1000}$$

$$= 1,156.32 \text{ MWh/y}$$

3. **Emission Reduction (ER)**

The emission reduction of the project activity is calculated from the quantity of electricity supplied to the recipient by generator that in the absence of the project activity would have been sourced by PLN grid deducted by the quantity of electricity required associated by the project activity. Or the other hand, the emission reduction is calculated based on the net electricity generated by the project activity which would have been sourced from PLN grid in the absence of the project activity.

$$ER_y = BE_y – PE_y$$

$$= 6,553.96 - 996.75$$

$$= 5,557.21 \text{ tCO}_2 \text{ e/y}$$

In case there is the total number of electricity imported from the grid for the CS_2 production, this scenario is assumed to correspond to the condition prior to the implementation of the project activity, and the electricity imported from the grid is assumed to equal the quantity of electricity required to meet the electricity demand in the absence of the project activity and no emission reductions are assumed to occur.

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

The projection of the crediting period will start on January 2011 in line with the expected schedule to operate the power plant with full capacity.

The emission reduction from small-scale project activities is shown below:

Year	Estimation of project activity emissions (tCO_2 e)	Estimation of Baseline Emission (tCO_2 e)	Estimation of leakage (tCO_2 e)	Estimation of overall Emission Reductions (tCO_2 e)
Year 2012	249	1,638	0.00	1,389
Year 2013	997	6,554	0.00	5,557
Year 2014	997	6,554	0.00	5,557
Year 2015	997	6,554	0.00	5,557
Year 2016	997	6,554	0.00	5,557
Year 2017	997	6,554	0.00	5,557
Year 2018	997	6,554	0.00	5,557
Year 2019	997	6,554	0.00	5,557
Year 2020	997	6,554	0.00	5,557
Year 2021	997	6,554	0.00	5,557
Year 2022	748	4,915	0.00	4.168
Total (tones of CO_2 e)	**9,967**	**65,540**	0.00	**55,572**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	$Q_{WCM, y}$
Data unit:	tons
Description:	Quantity of waste steam used for electricity generation in year y
Source of data to be used:	Flow meter
Value of data	79,975.59
Description of measurement methods and procedures to be applied:	Actual data during the crediting period will be recorded through Distributed Control System (DCS). All data will be monitored continuously and recorded in monthly reports by Field/DCS operator and it will be kept for the crediting period plus two years.
QA/QC procedures to be applied:	The flow meter of waste steam generated will undergo / maintenance / calibration annually based on the DP (Differential Pressure) Cell Transmitters calibration procedure. In case the meter fails in the measurement and or under go for maintenance then the calibrated back up transmitter would be used to continue the measurement.

Any comment:	Used to calculate f cap

Data / Parameter:	$t_{WCM, y}$
Data unit:	^{o}C
Description:	The temperature of steam used in year y
Source of data to be used:	Temperature measuring instrument
Value of data	-
Description of measurement methods and procedures to be applied:	Data taken from field and automatic record in TPSDDE (Total Plant Solution Dynamic Data Exchange) Measured continuously, averaged daily.
QA/QC procedures to be applied:	The flow meter will be calibrated based on national standard annually by accredited third party.
Any comment:	- Data will be archived and be kept at least for 2 years after the end of the last crediting period.

Data / Parameter:	$P_{WCM, d}$
Data unit:	barg
Description:	Average Pressure of waste steam in year y
Source of data to be used:	Pressure measuring instrument (e.g. Pressure gauge, Manometer etc)
Value of data	-
Description of measurement methods and procedures to be applied:	Data taken from field and automatic record in TPSDDE (Total Plant Solution Dynamic Data Exchange) Measured daily, averaged daily.
QA/QC procedures to be applied:	The flow meter will be calibrated based on national standard annually by accredited third party.
Any comment:	- Data will be archived and be kept at least for 2 years after the end of the last crediting period.

Data / Parameter:	$\mathbf{EG_{i,j,y}}$
Data unit:	MWh
Description:	Quantity of Electricity supplied by the project activity, which would have been sourced from PLN grid in the absence of the project activity, during the year y
Source of data to be used:	kWh meter
Value of data	7,603.20
Description of measurement methods and procedures to be applied:	The actual energy generated from new turbine during the crediting period will be recorded automatically through Distributed Control System (DCS) with code KW8570. All data will be monitored continuously and registered in monthly reports by Field/DCS operator and it will be kept for the crediting period plus two years.
QA/QC procedures to be applied:	Currently, IRK shall calibrate the kWh meter by third party in accordance to Ministrial Decree of Trade and Industry of The Republic Indonesia No. 731/MPP/Kep/10/2002 regarding Management of Metrology and Management of Metrology Laboratory . The calibration should be done at least once in two years. The accuracy level of kWh meter is + 1%. In case the meter fails in the

	measurement then the value input would be based on the measurement of back up kWh meter
Any comment:	

Data / Parameter:	$EC_{internal,\ y}$
Data unit:	MWh
Description:	Electricity which is consumed for internal power plant and electricity consumed from PLN grid by the project during the shut down, maintenance and start up period in year y.
Source of data to be used:	kWh meter.
Value of data	1,156.32
Description of measurement methods and procedures to be applied:	For PDD development, The electricity consumed for internal power plant is based on power nameplate of allied utilities for power plant. The consumption of electricity by the project from PLN grid is considered zero. The actual energy consumption will be recorded through Distributed Control System (DCS). The parameter that would be measured by kWh meter to calculate the electricity consumption for internal power plant are : Equipments — Power name plate 1. Condensate pump — 11 kW 2. Cooling water pump — 90 kW 3. Cooling tower fan — 45 kW All data will be monitored continuously and registered in monthly reports by Field/DCS operator and it will be kept for the crediting period plus two years.
QA/QC procedures to be applied:	The calibration of kWh meter is done by the third party, once in two years. The accuracy level of kWh meter is +1%. In case the meter fails in the measurement, then the value input would be based on the measurement of back up kWh meter.
Any comment:	

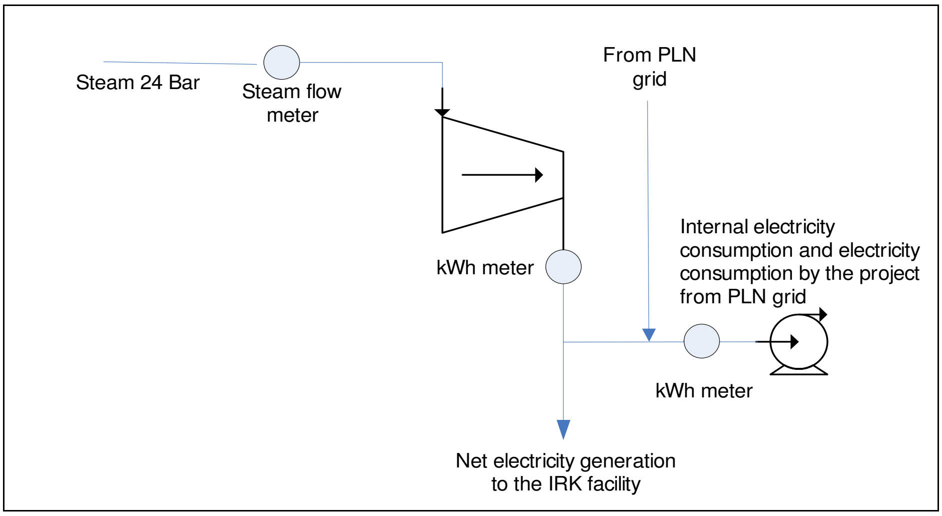
Equipments	Power name plate
1. Condensate pump	11 kW
2. Cooling water pump	90 kW
3. Cooling tower fan	45 kW

B.7.2 Description of the monitoring plan:

Monitoring for the CDM project activity includes the monitoring of the amount of waste steam used to generate the electricity, amount of electricity generated from the generator and turbine system, amount of electricity used for internal power plant and electricity consumption in the project activity due to power requirement for the power plant taken from PLN grid .

Meter installation

A kWh meter installed by IRK for monitoring the electricity generation and consumption in IRK manufacturing process. kWh meters are installed, one for monitoring the electricity generated from waste steam based-power plant and the other for monitoring the electricity consumption for internal power plant. Beside the kWh meter, flow meter also installed by IRK for monitoring the waste steam used to generate the electricity. All the parameters used to measure the emission reduction, will be monitored by plant operators in shift and put in the plant log sheets for CDM purposes.



The amount of emission reductions will be easily monitored through monitoring electricity generation from waste steam based power plant and electricity for internal consumption in the monitoring sheet. IRK provides spreadsheet /workbook contains of ER calculation which directly connected to electricity generation report. The amount of the electricity generation is monitored in control room and recorded by Distributed Control System (DCS) that periodical confirmed every month by the operational manager of IRK.

Parties involved in monitoring

The overall CDM project manager for the proposed project activity will be the Plant Unit Manager. The Plant Unit Manager will be supported by engineers in charge. The result of recorded log sheet will be compared to the DCS record. The Plant Unit Manager will assign an engineer in charge, who will be responsible to verify the readings of all measurement and collect all the data and compile them in a report format which is already linked with emission reduction spreadsheet. The engineer in charge will also be responsible for the schedule calibration of the meters and instruments required for monitoring of electricity. The daily and monthly reports prepared by the engineer in charge and will be reviewed by the Plant Unit Manager. The final monthly monitoring reports will be approved by Management.

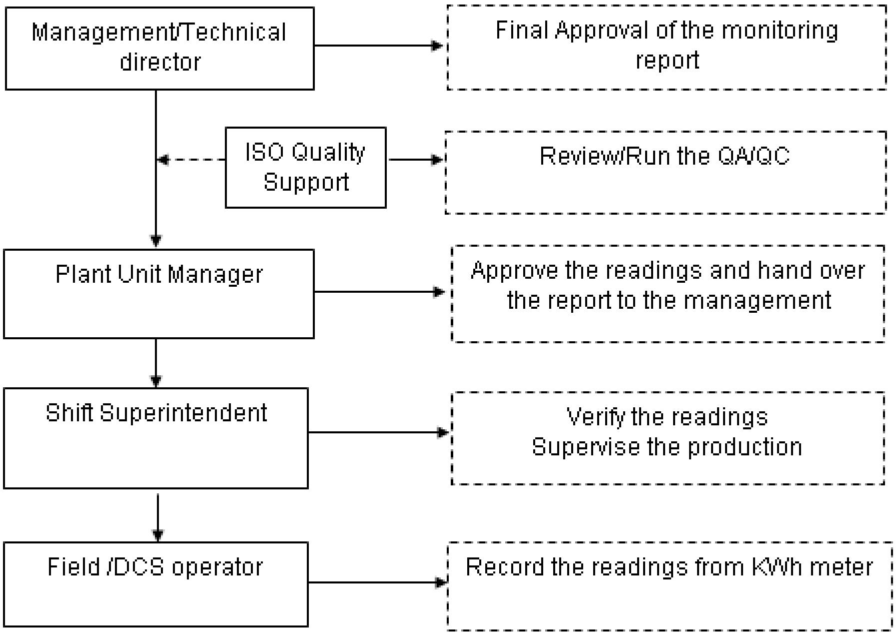


Figure.2. The Operational structure for monitoring CDM project in IRK.

QA/QC Procedure

In order to maintain appropriate data acquisition, recording and archiving data, calibration of kWh meters and flow meter shall be conducted. An engineer in charge, who will be responsible to verify the readings of all measurement and collect all the data and compile them in a report format which is already linked with emission reduction spreadsheet, will also be responsible for the schedule calibration of the meters and instruments required for monitoring of electricity. The kWh meters and flow meter would be calibrated by the third party. The calibration would be done at least once in two years.

Procedure for corrective action

In case that the main kWh meter fails to operate properly, then the electricity generated by the project activity and/or electricity consumption for internal power plant will be measured by the back-up kWh meter. Back up flow meter also prepared in case the flow meter fails in the measurement of quantity of waste energy used for electricity generation.

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

Date of completing the final draft of this baseline section (DD/MM/YYYY) : 19/09/2012

Organization	PT. Asia Carbon Indonesia
Street / Post Box	Palma One Building, 3rd fl. R.311. Jl. Rasuna Said, Kuningan
City	Jakarta
Postcode / Zip	12930
Country	Indonesia
Telephone	+62-21-5256619
Fax	-
E.mail	general.aci@asiacarbon.com
URL	www.asiacarbon.com

The person/entity mentioned in section B.8 of PDD is not a project participant. Therefore the person/entity is not listed in Annex I.

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:

22/09/2005

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

30 years

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

C.2.1. Renewable crediting period

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

C.2.1.2. Length of the first crediting period:

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/10/2012 or date of registration whichever later.

C.2.2.2. Length:

10 years

SECTION D. Environmental impacts

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

Referring to the Decree of the Minister of the Environment (MENLH No.11/2006 of the republic of Indonesia, an "Environmental Impact Assessment (hereinafter referred to as AMDAL)" is not required for the implementation of the project activity. Instead, a submission of UKL/UPL is required by the MENLH No.11/2006

Approval of UKL/UPL of IRK granted from the Head of Regional Agency of Environmental, Mining and Energy had been received, (Approval Carbon Disulphide industry, No.660.1/659/Dis LH Tamben, dated 27 September 2007).

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 project activity requires no AMDAL and will not result in significant impacts to the environment.

SECTION E. Stakeholders' comments

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

IRK has informed the Stakeholder Consultation Meeting to the participants by invitation letter dated 31 January 2008. The Stakeholder consultation Meeting was held on the 5 February 2008 at IRK office and was attended by the representative from the local environmental agency, the representative from neighbouring industries around IRK in Cikampek Industrial Park, the representative from local community located close to IRK, the representative from State-own electricity company (PLN), the representative from DNA, the representative from technology provider and the representative from residential area. These are the stakeholders which would indirectly or directly relate to the project activity.

During the opening of the stakeholder consultation, the objective of the stakeholder consultation was presented:

- To inform the stakeholders on the new project
- To explain the stakeholders about the benefits of the new project and the impact to their living environment and the sustainable development
- To receive comments from the stakeholders.

The presentation divided into two sections. The 1st presentation about Clean Development Mechanism (CDM) was represented by Asia Carbon Indonesia as a consultant and the 2nd presentation about the project activity under the CDM scheme was presented by IRK as the project developer. The objective of the project activity is to generate electricity from the waste steam of Sulphur Recovery Unit, replacing electricity supplied by PLN grid. In the presentation slide, it was described about the impact of project activity to sustainable development (in aspects of economy, environmental, social and technology).

The audiences were then given the opportunity to express their opinions and comments regarding the project activity through direct conversation in questions & answers session and distribution of questionnaires.

E.2. Summary of the comments received:

The comments taken from the audiences are listed hereafter:

- The representative of State-own electricity company (PLN) praised the initiative taken by IRK in using the waste steam to generate electricity for captive use. This would support diversification of energy sources and would inspire other industries at Cikampek Industrial park for alternative power sources. As of now, power requirement at this industrial park is quite significant and PLN needs to cater this demand. This participant asked about the synchronisation of the new power system with PLN standard.

- There was a remark from Mr. Theo van Hoek, the technical service manager from Akzo Nobel chemicals, who also attended the Stakeholder consultation meeting, that the initiative taken by IRK to use the waste steam to produce electricity is a novelty and a unique feature for natural gas-based CS2 plant. Akzo Nobel will also try to adopt this in their facility.

- The representative from neighbouring industries around IRK at Cikampek Industrial Park asked whether the steam produced by SRU still contains sulphur and asked about the method used in calculating the emission reduction in the project activity

- Other representative from neighbouring industries around IRK in Cikampek Industrial Park asked about the benefit which will be obtained with the emission reductions

- A remark was given from the representative from neighbouring industries around IRK in Cikampek Industrial Park who has developed the CDM activity. They recommended IRK to ensure continuous parameters recording in monitoring project to minimize discrepancies during verification.

- A question raised by the representative from residential area about the waste which might be produced in the project activity and whether there would by any training to the local community with regards to gas leakage

- Representative from Indonesian DNA The remarks by the representative from DNA for being transparent related to CDM project in terms of the emergency training and responds to the community.

Summary of the questionnaire

All of Participants agreed to the utilization of waste steam from Sulphur Recovery Unit (SRU) to generate electricity with the reasons mentioned below:

1. The project activity reduces the green house gases and global warming
2. The project activity reduces the dependency of electricity consumption from PLN grid
3. The project activity reduces the air pollution
5. The project activity contributes to the sustainable development

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

- Regarding the electricity synchronisation system, the new power set-up at IRK is based on the PLN frequency, voltage and phase standard.

- IRK responded to comments related to steam generation from SRU. It is stated that the steam generated from SRU will not contain sulphur because the steam is generated by using the waste heat in a heat exchanger. The heat exchanger is an indirect contact type, where there is no a direct contact between the heat transferred from the SRU and the heated water. Hence, no sulphur from SRU is carried over the steam.

- To determine the emission reduction calculation which reduces the electricity consumption from PLN grid, the amount of electricity consumption (MWh/y) is multiplied by the electricity emission coefficient (EF) default value (tCO_2/MWh). The EF value is 0.754 tCO_2 e/MWh.

- IRK mentioned that there might be a financial benefit due to the project activity. IRK also expressed their gratitude for the comments given by the other industry regarding data monitoring. IRK has manual recording system and Distributed Control System (DCS) which record hourly data electronically and all necessary parameters has been recorded since 2003. IRK still keeps this records.

- The wastes which might be produced during project activity is only waste oil. To date, the waste oil is delivered to a third party for further treatment. IRK declared to have emergency procedure which have been communicated among IRK personnel. IRK has 16 gas detectors indicates gas leakage over 5 ppm. This is more stringent than the industrial safety standard of 20 ppm.

- Other remarks to the project activity were received and responded.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	PT. Indo Raya Kimia
Street/P.O.Box:	Jenderal Ahmad Yani street No.39, Kalihurip
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URL:	-
Represented by:	-
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Salutation:	Mr
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Middle Name:	-
First Name:	Waris
Department:	-
Mobile:	-
Direct FAX:	+62-264 317915
Direct tel:	+62-264 317901
Personal E-Mail:	waris.jaiz@adityabirla.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding will be involved in the proposed project activity

Annex 3

BASELINE INFORMATION

A. Baseline information on projection of power generated at IRK

Month	CS2 Production		Steam Generation			Use for			Electricity consumption	
			from Claus Unit/SRU, by FI-5091	From CS2 Plant/Furnace, by FI-2007	Total Steam generated	CS2 Sep. and WWS	K-503	Excess		
	TPM	TPD.Average	TPH	TPH	TPH	TPH	TPH	TPH	kWh/month	kWh/t CS2
Source	**Bill of Material report & YTD Production summary**		**TPSDDE through DCS**		**Calculation**	**Basic Engineering Package from Akzo nobel**	**TPSDDE through DCS**	**Calculation**	**PLN invoice**	**Calculation**
Mei-06	3,197.22	148.57	10.71	0.92	11.63	1.86	0.00	9.78	709,480	221.91
Jun-06	4,456.89	149.93	10.95	0.89	11.84	1.87	0.01	9.95	696,000	156.16
Jul-06	4,549.07	146.94	10.75	0.92	11.66	1.84	1.96	7.86	645,200	141.83
Agust-06	3,843.06	132.11	9.52	0.79	10.31	1.65	8.12	0.54	436,160	113.49
Sep-06	2,650.22	143.58	10.50	0.93	11.43	1.79	1.26	8.37	519,000	195.83
Okt-06	4,592.57	148.31	10.83	0.94	11.77	1.85	0.00	9.92	747,840	162.84
Nop-06	4,462.30	148.93	11.05	0.92	11.97	1.86	1.28	8.83	738,760	165.56
Des-06	4,274.94	149.06	11.13	0.85	11.98	1.86	1.12	9.00	764,000	178.72
Jan-07	3,632.93	140.00	10.25	0.30	10.56	1.75	0.00	8.81	603,200	166.04
Feb-07	4,144.72	148.91	11.47	0.96	12.43	1.86	0.00	10.57	571,200	137.81
Mar-07	4,587.83	148.25	11.55	1.01	12.56	1.85	0.00	10.71	760,200	165.70
Apr-07	4,532.19	151.54	11.57	1.08	12.66	1.89	0.00	10.76	712,120	157.13
Average	**4,091.96**	**147.87**	**11.08**	**0.86**	**11.95**	**1.85**	**0.00**	**10.10**		**168.57**
Ratio per unit production (t/ton CS2)		**1.00**	**1.80**	**0.14**	**1.94**	**0.30**	**0.00**	**1.64**		

F cap calculation ((The figures from the average annual historical production data of the plant in baseline scanerio))

CS2 production	Production by process that most logically relates to waste steam generation in baseline which is the average of CS2 production	$Q_{BL, product}$	=	48,796	t/y
Steam generation	HP steam production from the Claus unit/SRU		=	1.80	t/ton CS2
	HP steam production from the CS2 plant/furnace		=	0.14	t/ton CS2
	Total steam production		=	1.94	t/ton CS2
Steam usage	HP steam usage for CS2 separation and Waste water Stripper		=	0.30	t/ton CS2
Waste steam generation	Amount of waste steam the industrial facility generates per unit of CS2 production	$q_{wg, product}$	=	1.64	t/ton CS2
	Quantity of waste steam generated prior to the start of the project activity	$Q_{WG, BL}$	=	79,975.59	t/y
The total amount of waste steam generated in the industrial facility will be used for electricity generation. 1.2 MW of power plant is utilized to generate the electricity and replace the electricity consumption from PLN grid.					
Electricity	Quantity of waste steam used for energy generation during year y	$Q_{WG, y}$	=	79,975.59	t/y
F cap	Capping factor	f cap	=	1.00	

B. Baseline information on projection of power consumed for IRK power plant

The estimated power consumed by:

- condensate extraction pump A (P-864) = 11 kW
- cooling water pump A (P-906) = 90 kW
- cooling tower fan (P-908) = 45 kW

Estimated total power required for IRK power plant = 146 kW * 24h/d * 330 d/y = 1,156,320 kWh/y

Annex 4

MONITORING INFORMATION

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This is according to the parameters to be monitored as demonstrated in Section B.7.1 and B.7.2