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

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SECTION A. General description of project activity

A.1 Title of the project activity:

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- Tambun LPG Associated Gas Recovery and Utilization Project
- Version 3.12
- Updated on 13th December 2007

A.2. Description of the project activity:

>>The purpose of the project activity is the recovery and utilization of gases produced as a by-product of oil production activities at the Tambun and Pondok Tengah Oil Fields. Tambun Oil Field is located about 40 km west of Jakarta in West Java Province.. The field started production in 2003 at 4000 BBL per day. Associated gas was flared, initially at 6 to 7 mmscfd increasing to 12 to 15 mmscfd as oil production increased to 8,000 barrels per day in 2006. Pondok Tengah Oil Field, located about 10 km North of Tambun, has recently come on stream at a faster rate than planned. The field is currently producing around 3000 - 4000 BBL per day with associated gas flow at around 5 mmscdf and is projected to increase to 25 mmscfd by the end of 2007.

The project activity is the construction of the processing and transport infrastructure to take gas that would otherwise have been flared to the Cirebon to Cilegon pipeline. The scope of the project activity includes all of the gas from Tambun and Pondok Tengah Oil Fields.

The Tambun LPG processing facility was originally built to process the gas from Tambun Oil Field. As will be described later, the decision to invest was based, amongst other things, on the CDM. The presence of the treatment plant and the pipeline have made it technically possible to process and transport the increased quantities of gas from Pondok Tengah which were not anticipated at the time of the original investment. As will be described later, without the presence of the Tambun facility, all of the Pondok Tengah gas would have been flared until such time as Pertamina install facilities for its capture and utilization.

Contracts were signed for the purchase of the Tambun gas on 11th November 2004; gas started flowing on 5th November 2005 and the LPG plant started operation on 27th December 2006.

The potential of Indonesia's oil and gas sector was highlighted in July 2004 version of CDM Monitor available at http://www.mgminter.com/pdfs/english_version/CDM_Monitor_14_July_2004.pdf.

The project contributes to the sustainable development of Indonesia in a number of ways. The project provides an additional source of natural gas to support the development needs of Indonesia. It reduces the reliance on imported energy, and contributes to improved local and global air quality by improving the efficiency of combustion of methane and related gases when compared to open flaring. In addition, the project activity contributes to social and economical sustainable developments such as constructing public water facility; participating in Global Environment day and social football tournament; donating for flood victim, orphan and social celebration; creating local employment (60 employees hired from local area) and improving public education in project's surrounding area. The project also provides revenue for the local government of Bekasi, which is strapped for cash like local governments everywhere in the developing world, from the capture of value from gas used to generate power rather than being flared

A.3. Project participants:

>>

Name of Party Involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Republic of Indonesia (host)	PT Odira Energy Persada	No
United Kingdom of Great Britain and Northern Ireland	Sindicatum Carbon Capital Ltd.	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

>> Indonesia

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

>> West Java Province, Bekasi District

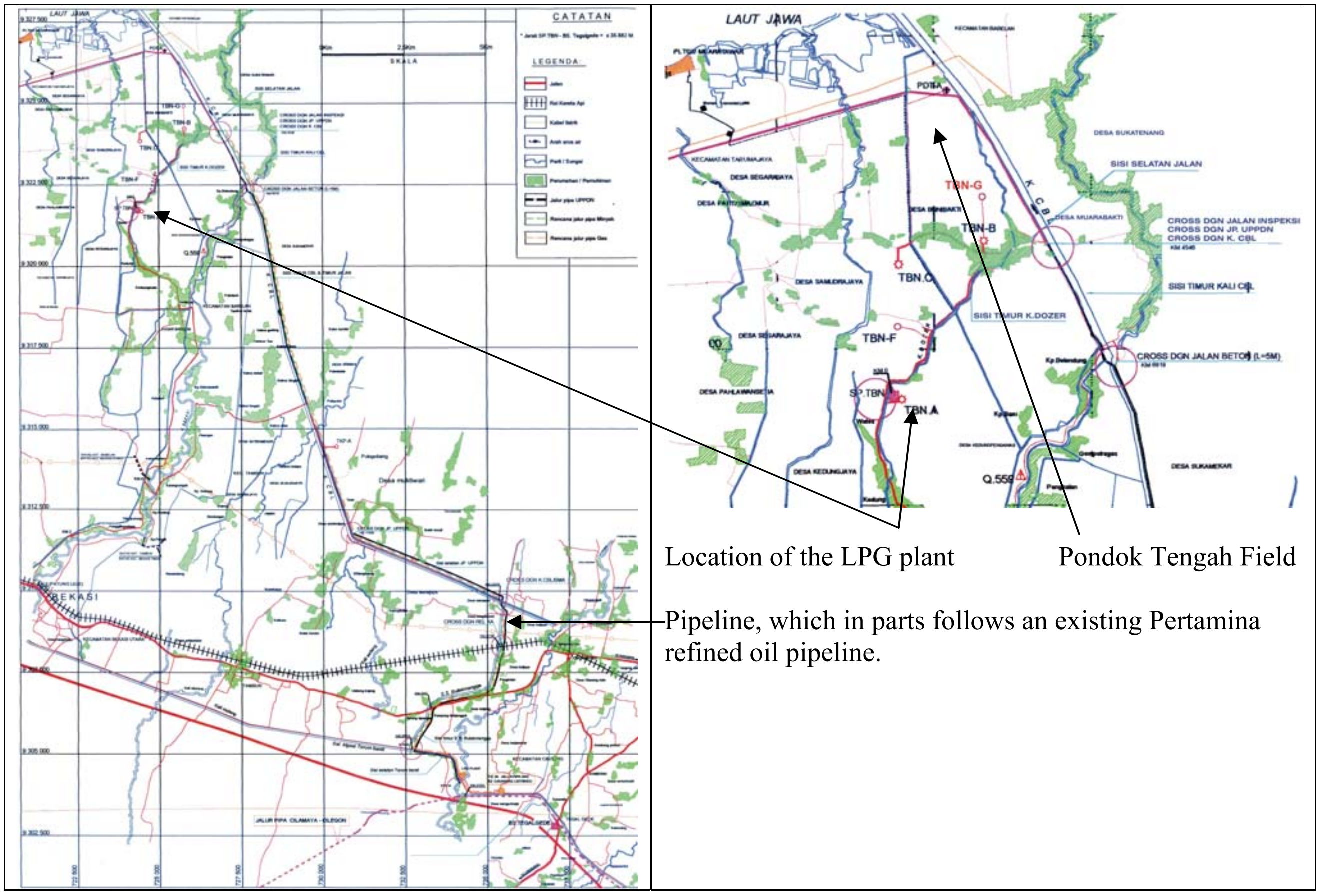
A.4.1.3. City/Town/Community etc:

>> Babelan sub-district, Kedung jaya village

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

>> The LPG plant is located at 107 01’ 40” E, 0 07’ 55” S. Tambun Oil Field comprises several wells, located within a few km of the LPG plant. Pondok Tengah Oil Field is located at adjacent to, and to the north of Tambun Oil Field. See the maps below:

The figures below show the location of pipeline and the LPG plant:



Location of the LPG plant

Pondok Tengah Field

Pipeline, which in parts follows an existing Pertamina refined oil pipeline.

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

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Sectoral scope 10: Fugitive emissions from fuels

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

>>The technology consists of a mini LPG plant with a design input capacity of 12 mmscf per day; condensate removal facilities and a 35 km 8” diameter steel pipeline, with associated compressors, metering stations and safety valves. The processing plant and pipeline were constructed in full compliance with environmental regulations and was subject to environmental appraisals as per Indonesian environmental regulations (see section D for more details).

The processing plant is powered by the gas supply, with back-up diesel for generators and fire pumps.

The supply pipeline runs 35 km to the main east -west supply line. The pipeline is constructed from carbon steel, with a mid-wall diameter of 8 inches. Emergency shut down valves are located at the start and finish of the pipeline and two Line break control valves (LBCV) installed at approximately 12km and 24km from the start.

Metering points are present for the import of wet gas and the export of dry gas. LPG is sold by weight, via a weighbridge. Condensates are sold by volume via calibrated tankers. An additional metering point is located at Tegal Gede where the pipeline joins the main transmission line, but this is under the control of Pertamina.

Figure 1: Photographs of the LPG facility

a) Tambun LPG Tank and distillation columns

b) Tambun oil terminal operated by Pertamina

c) gas flaring continues on the Pertamina Tambun oil terminal

d) LPG loading bay and weighbridge at Odira

 e) Chillers for production of LP power by gas fired generator with diesel back-up	 f) Odira LPG facility
 g) first and second grade condensate	 h) Main compressor, gas fired, with barrels of lubricating oil – this is sent for recycling rather than consumed by the compressor
 i) Workers accommodation on site – air	 j) Stakeholder consultation in process

conditioned	

Figure 2: Schematic of Tambun project showing compression, LPG Plant and pipeline.

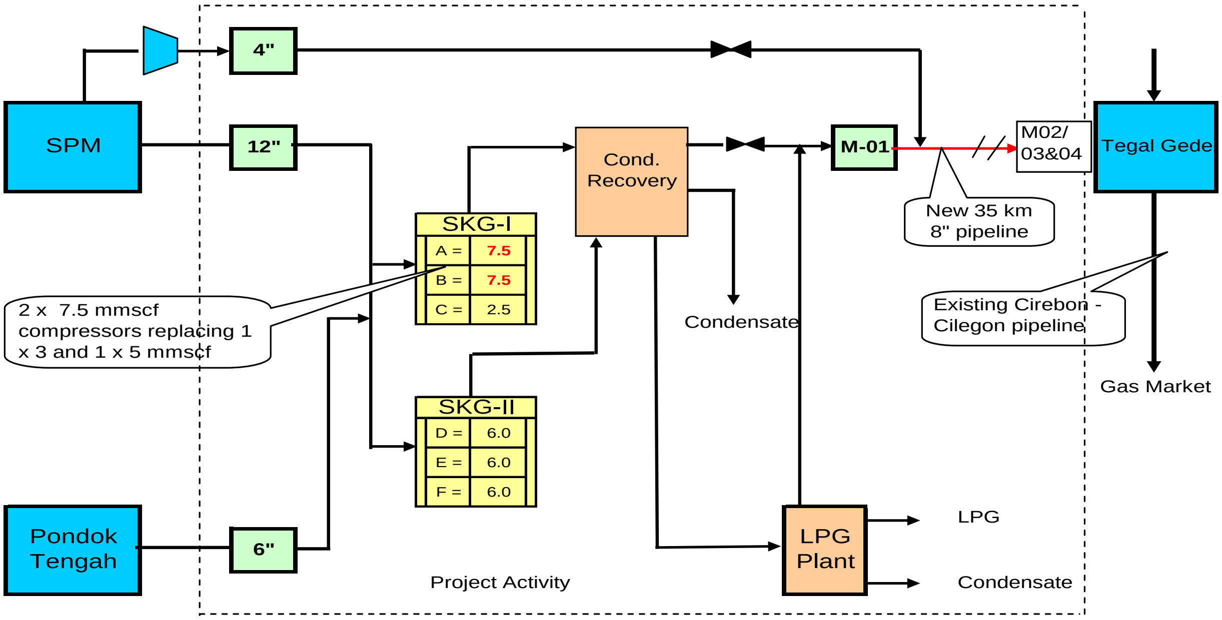
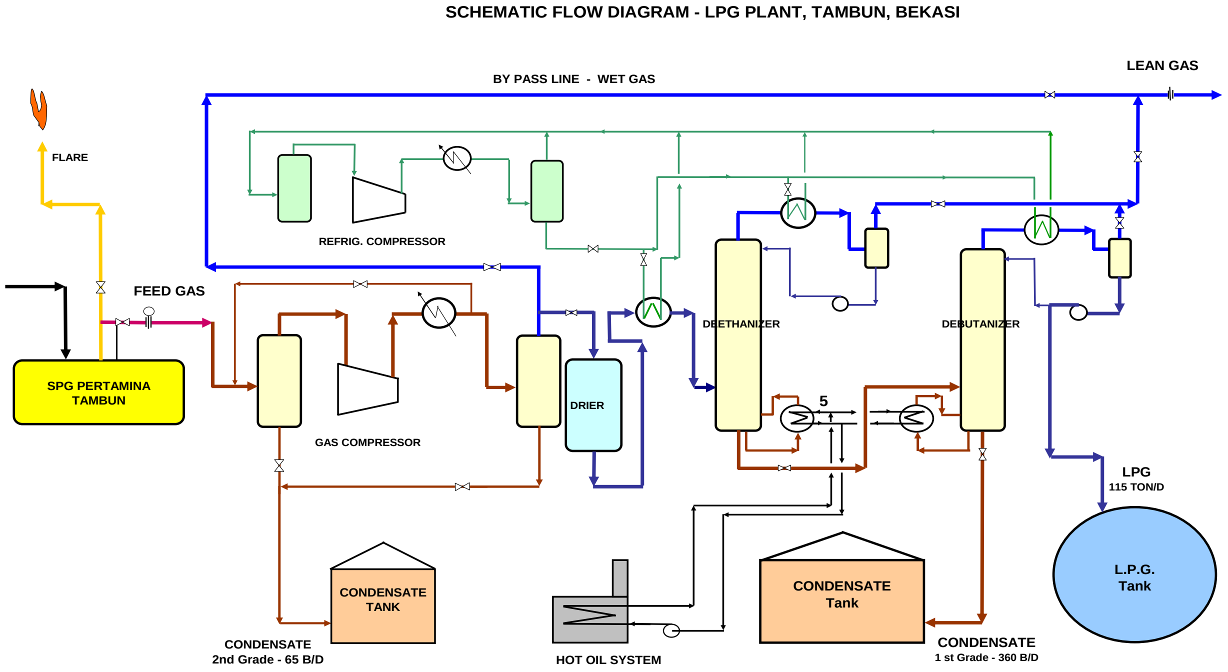


Figure 3: Schematic of Tambun LPG plant



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

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Years	**Annual estimation of emission reductions in tones of CO_2 e**
1	355,095
2	682,202
3	682,202
4	355,095
5	355,095
6	295,849
7	295,849
8	295,849
9	295,849
10	295,849
Total estimated reductions (tonnes of CO_2e)	3,908,934
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	390,893

A.4.5. Public funding of the project activity:

>>None

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:

>> AM0009 Ver 2: Recovery and utilization of gas from oil wells that would otherwise be flared.

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

>>The project activity satisfies all of the applicability criteria defined in AM0009 as follows:

- Gas at oil wells is recovered and transported in pipelines to a process plant where dry gas, LPG and condensate are produced.
- Energy required for transport and processing of the recovered gas is generated by using the recovered gas
- The products (dry gas, LPG and condensate) are likely to substitute in the market the same type of fuels or fuels with a higher carbon content per unit of energy
- The substitution of fuels due to the project activity is unlikely to lead to an increase of fuel consumption in the respective market
- In the absence of the project activity, the gas is mainly flared
- Data (quantity and fraction of carbon) is accessible on the products of the gas processing plant and on the gas recovered from other oil exploration facilities in cases where these facilities supply recovered gas to the same gas processing plant.

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

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Project emissions

- CO2 emissions due to fuel combustion for recovery, transport and processing of the gas
- CO2 emission due to consumption of other fuels in place of the recovered gas, and
- CH4 and CO2 emissions from leaks, venting and flaring during the recovery, transport and processing of recovered gas.

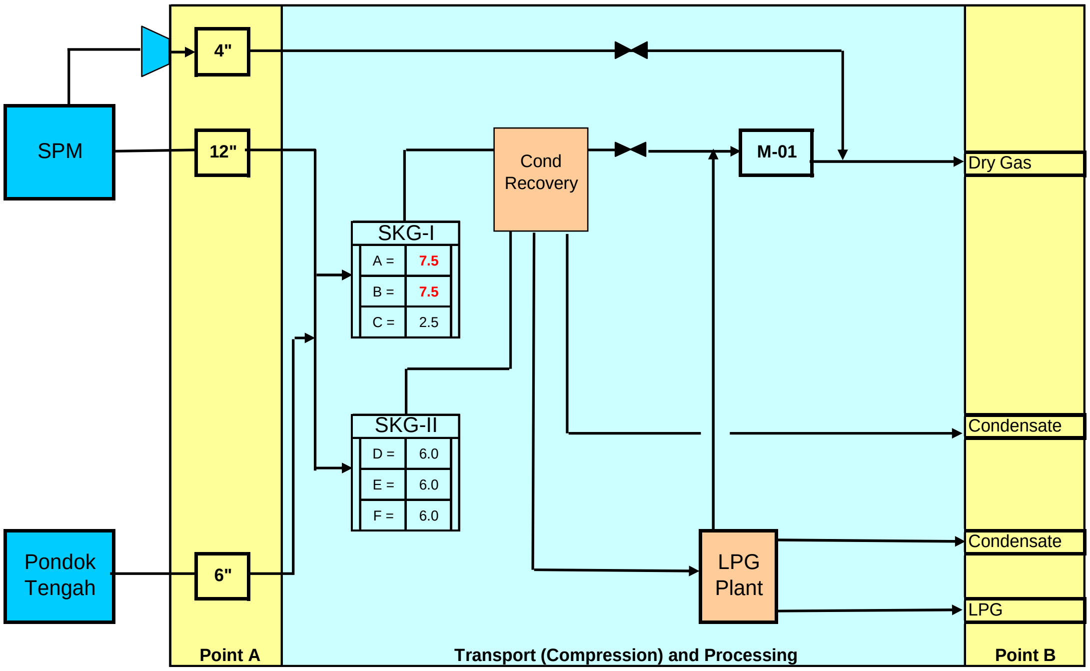
As per AM0009, the project emissions due to fuel combustion are determined from the carbon mass balance calculation using the known carbon content of the associated gas input and the known carbon content of product outputs. The carbon that is not accounted for in products is assumed to have been released as CO2, either through combustion for compression, power generation for on-site use or venting or flaring. For the purposes of this project, this quantity is determined by the difference between the sum of feed gas inputs (12” and 6” pipeline carbon) and the sum of outputs (M01 dry gas, LPG and Condensate carbon). This is entirely consistent with the actual process flows to the fuel and flare gas headers within the LPG and Condensate plants. The methodology assumes that all hydrocarbons, including methane, are oxidised to CO2 during combustion. In comparison to the baseline, this is conservative.

The only other fuel use on site is small amounts of diesel for back-up power supplies for compressors and fire pumps. These engines are tested weekly. Emissions from these sources are ascribed to the project activity.

Emissions of CH4 from leaks from flanges and valves etc. and due to accident and emergency situations are included as project emissions.

Baseline emissions
All of the carbon in the associated gas from the sources within the project boundary is assumed to be oxidized to CO2 during the flaring or venting in the baseline. N2O emissions are ignored. This is conservative.

Figure 4 below shows the project boundary and AM0009 Measurement Points:



Note 1: - Fuel gas used for compression upstream of the 4" input measurement is from the condensate plant fuel gas header and is therefore accounted for within the PECO2 Point A-Point B balance.
Note 2: - PECO2 balance calculation uses measurement of Dry Gas from orifice meter M01, rather that total pipeline flow. As per Note 1, there are no PECO2 emissions associated with the 4" bypass

Project oil wells include Tambun Oil Field and Pondok Tengah Oil Field, both operated by Pertamina E&P. Gas that would have been flared by Pertamina is transported to Tambun via Measurement Point A, which comprises orifice meters on three separate lines measuring volume of recovered wet gas. The quantities of products are measured at Measurement Point B, which comprises mass of LPG, volume of dry gas and volume of condensate. As there are no other wells or pipeline partners outside of the project boundary, measurement points C and Xi as shown in AM0009 are not required. Measurement Points A and B measure the carbon entering the project boundary and the carbon leaving the project boundary in usable products. Project emissions from combustion of gas for compression, processing and flare are determined by from this balance.

The gases and sources included the baseline and project boundary are shown below:

	Source	Gas	Included?	Justification
Baseline	Pertamina Tambun and Pondok Tengah flaring and reinjection	CO_2	Included	Emissions from flaring of associated gas from Tambun and Pondak Tengah oil fields. Main emissions source for baseline.
		CH_4	Excluded	Assumed destruction efficiency of flaring system as 100%. This is conservative.
		N2O	Excluded	Negligible.
	Leakage of methane from pipelines during recovery	CH_4	Excluded	This is conservative
Project	Tambun LPG plant – emissions from processing, consumption of other fuels and flaring (project emissions)	CO_2	Included	Emissions from fuel combustion, leaks, flaring and venting during transport and processing of recovered gas (counted by carbon mass balance). Emissions from consumption of other fuels than recovered gas.
		CH_4	Included	Fugitive emission from feed gas supply pipeline and gas processing plant.
		N2O	Excluded	Emissions from consumption of other fuels than recovered gas are negligible and small.
	Transportation of products (project emissions) LPG and Condensate	CO_2	Excluded	These emissions are beyond the control of the project owner and transport of displaced fuel would cause similar emissions in the baseline.
		CH_4	Excluded	As above
		N2O	Excluded	As above

	Transportation of products (Project emissions) Dry gas. Fugitive emissions of CH4 from the 35 km pipeline and venting during emergency situations	CH4	Included	Fugitive emission from 35 km lean gas pipeline from gas processing plant to main pipeline connection at Tegal Gede.

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

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AM0009 is only applicable to situations where the associated gas is mainly flared in the absence of the project activity. The baseline scenario is determined in two ways:
1) by observing common practice in the oil and gas industry in Indonesia; and
2) by the elimination of possible scenarios in the additionality test.

The World Banks GGFR Indonesia Associated Gas Survey dated 25th October 2006 (http://siteresources.worldbank.org/INTGGFR/Resources/indonesiaassociatedgassurvey.pdf) concluded that “Indonesia flares a significant amount of associated gas in the course of oil production. Based on 2003 data, Indonesia ranks fourth among all countries in terms of total annual gas flaring and is third highest in terms of quantities of gas flared per barrel of oil produced. While there was significant improvement in 2004, Indonesia still has significant potential for flaring reduction.”

At present, around 400 mmscfd are flared daily (pers comm. Triyatno Atmodiharjo, Technical Director at Odira) mainly from small fields that do not have ready access to a pipeline (like Tambun and Pondok Tengah). The World Bank GGFR (op. cit.) reported a figure of 358 mmscfd in 2004. Both the Tambun and Pondok Tengah Oil Fields are owned and operated by Pertamina E&P. Pertamina E&P do not operate any LPG plants of their own and in the absence of an off-taker or third party willing to build an LPG plant, commonly flare their associated gas.

Section B5 describes the barriers that prevent other potential baselines from being implemented.

The identified baseline is flaring of associated gas. The quantity of CO2 that would be released due to flaring in the baseline is determined as the total amount of carbon contained in the processed condensate, LPG and gas delivered to market, under the assumption that all of the carbon is oxidised to CO2.

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

The Tambun LPG facility was designed to use the gas from Tambun Oil Field and the LPG component has capacity for 12 mmscfd, but the gas cleaning facilities to remove condensate have excess capacity (up to 20 mmscfd) and this has allowed the facility to take extra gas from the Pongdok Tengah field which was not anticipated at the time of the initial investment. Pongdok Tengah has come on stream ahead of schedule and the necessary infrastructure for the recovery and treatment of the gas has not been installed. In mid 2006 Pertamina E&P was instructed by the President to increase oil production and Pondok Tengah was targeted as the highest priority to develop. The projected yields of oil increased, as did the projected yield of associated gas. The initial projection was for around 10 mmscfd by the end of 2007 but the revised projections increased this to 25 mmscfd by December 2007. If the excess processing capacity at Tambun and the pipeline were not available, the associated gas would be flared. Associated gas from the Pondok Tengah facility is therefore included in the project until such time as Pertamina or a third party develop the capacity to treat the gas. The Tambun Oil Field is presented as a case study in The World Banks GGFR Indonesia Associated Gas Survey dated 25th October 2006 (http://siteresources.worldbank.org/INTGGFR/Resources/indonesiaassociatedgassurvey.pdf) section 5.2. The case study accurately describes Pertamina's decision to sell the gas to Berkasi Regency (BR) but does not address the economic barriers which are described in section B.5 below.

The additionality is assessed by following AM0009 ver 2. The methodology requires that at least five different options are identified as potential baseline scenarios and the most likely baseline scenario is determined by assessing the legal, technical and economic barriers:

The options for associated gas from both fields are as follows:
Option 1: Release to the atmosphere at the oil production site (venting).
Option 2: Flaring at the oil production site.
Option 3: On-site consumption.
Option 4: Injection into the oil reservoir.
Option 5: Recovery, transportation, processing and distribution to end-users.
Option 6: Recovery and transportation to end-users without processing
No further options were identified.

Step 1: Evaluation of legal aspects for both Tambun and Pondok Tengah
Option 1 is restricted, but not prohibited by Indonesian law. Venting gas presents an explosive hazard risk assessed by Odira as unacceptable. The remaining four options are legally permitted.

Step 2: Evaluation of technical feasibility and economic attractiveness for Tambun
Option 2: Flaring at the oil production site. This was the current practice at Tambun before the implementation of the project activity. This is technically the simplest way of dealing with the associated gas and it faces no barriers. Even now, after the implementation of the project and the construction of the pipeline, Pertamina E&P still continue to flare in the region of 3.5 mmscfd at Tambun (see photograph c in Fig 1).

Option 3: On-site consumption: Only a fraction of the associated gas is and can be consumed on the Pertamina E&P production sites, where there is very limited demand for electrical power. The use of this gas is not relevant to the project because in both gases, the gas is purchased net of any consumption on site. Additional gas will be utilized to run the compressors and at Tambun LPG plant to power the treatment processes for the gas. This consumption is included under project emissions, but it does not consume a significant quantity of the gas (see photographs Fig 1 e) and h) showing the gas power compressors and generator chillers (more photographs available to DOE).

Option 4: Re-injection of associated gas. A small amount of gas is re-injected by Pertamina at the Tambun oil field, but it is not technically feasible to re-inject any more. Pertamina already re-inject water at Tambun.

Option 5: Recovery, transport, processing and distribution to end-users.
This is the project activity. Financial analysis shows that at the time that the decision to invest in the project, and during its initial stage of operation, the IRR for the recovery and treatment of the Tambun Associated gas was too low to be attractive. With the inclusion of CDM revenues, the IRR is increased, as shown in table 1 below:

Table 1: Economic analysis of the Tambun LPG plant

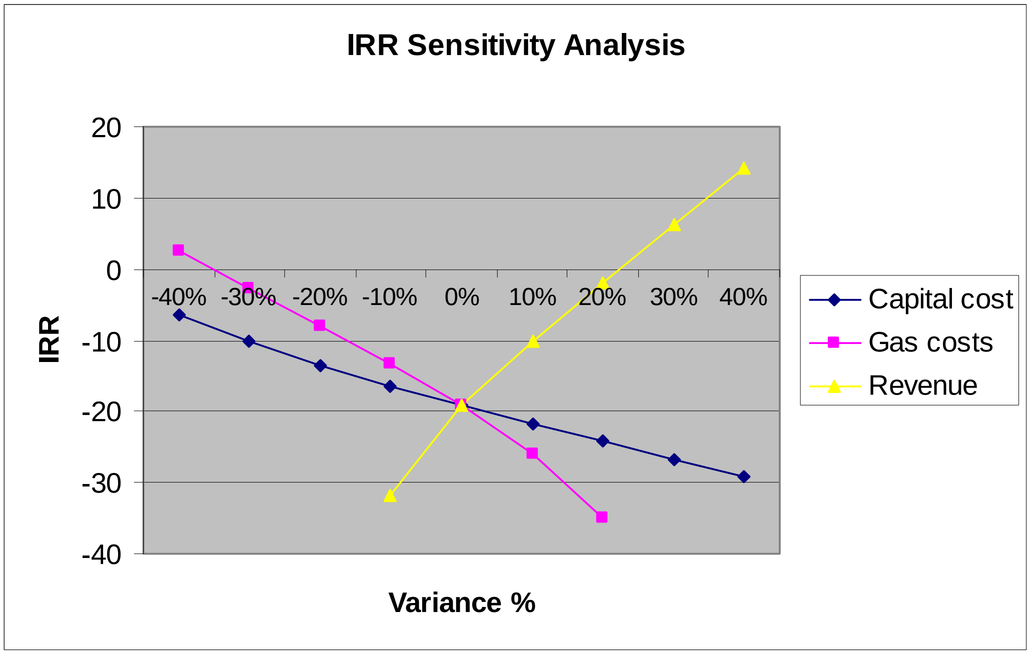
Please note that additional data supporting the financial analysis has been provided to and reviewed by the validating DOE.

The Project Developer has evidence to support the fact that revenues from the CDM were a significant factor in their decision to proceed – in the form of official minutes from Board Meetings where individuals were instructed to pursue the development of the project under the CDM. The delay in the preparation and registration of the PDD has been brought about by limited management resources, the need to concentrate on the development of the processing plant and difficulty in finding and contracting with a suitable CDM Project Developer.

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
Capital	26,509,154	3,471,432									
Tambun Feed gas receive - usd	12,369,063	12,369,063	12,369,063	12,369,063	12,369,063	10,307,553	10,307,553	10,307,553	10,307,553	10,307,553	
Tambun Lean gas deliver – usd	7,614,600	7,614,600	7,614,600	7,614,600	7,614,600	6,345,500	6,345,500	6,345,500	6,345,500	6,345,500	
PT Feed gas receive –usd	-	19,525,275	19,525,275	-	-	-	-	-	-	-	
PT Lean gas deliver – usd	-	21,094,500	21,094,500	-	-	-	-	-	-	-	
Net cost Tambun feed gas - usd	4,754,463	4,754,463	4,754,463	4,754,463	4,754,463	3,962,053	3,962,053	3,962,053	3,962,053	3,962,053	43,582,578
Net cost of PT feed gas - usd	-	- 1,569,225	- 1,569,225	-	-	-	-	-	-	-	- 3,138,450
35k Pipeline Toll cost	1,428.00	3,108.00	3,108.00	1,428.00	1,428.00	1,120.00	1,120.00	1,120.00	-	-	13,860
Compressor rental – usd	2,127,516	1,575,794	1,575,794	356,400	356,400	356,400	356,400	356,400	356,400	356,400	-
SBLC loan cost – usd	401,159	791,664	791,664	401,159	401,159	334,299	334,299	334,299	334,299	334,299	4,458,300
Insurance – usd	79,527	89,942	89,942	89,942	89,942	89,942	89,942	89,942	89,942	89,942	889,003
O&M cost – usd	1,671,495	3,298,601	3,298,601	1,671,495	1,671,495	1,392,913	1,392,913	1,392,913	1,392,913	1,392,913	18,576,250
Local government contribution - usd	668,598	668,598	668,598	668,598	668,598	557,165	557,165	557,165	557,165	557,165	6,128,815
Total outflow	36,211,912	13,081,269	9,609,837	7,942,057	7,942,057	6,692,771	6,692,771	6,692,771	6,692,771	6,692,771	108,250,985
Revenue											
Total Revenue - usd	9,240,000	17,115,000	17,115,000	9,240,000	9,240,000	7,700,000	7,700,000	7,700,000	7,700,000	7,700,000	100,450,000
Cashflow pre CER											
Cashflow before tax	- 26,971,912	4,033,731	7,505,163	1,297,943	1,297,943	1,007,229	1,007,229	1,007,229	1,007,229	1,007,229	- 7,800,985
	- 26,971,912	- 22,938,181	- 15,433,018	- 14,135,075	- 12,837,132	- 11,829,902	- 10,822,673	- 9,815,444	- 8,808,215	- 7,800,985	
Cashflow after tax (30%)	- 26,971,912	2,823,612	5,253,614	908,560	908,560	705,060	705,060	705,060	705,060	705,060	- 13,552,263
	- 26,971,912	- 24,148,300	- 18,894,686	- 17,986,126	- 17,077,566	- 16,372,505	- 15,667,445	- 14,962,384	- 14,257,324	- 13,552,263	

NPV	-$15,718,193
IRR	-16.34%

Based on the analyses above, the projected yield without CDM is very marginal, offering a significantly negative NPV. Adding CDM (at USD 15 per CER) improves this substantially to around 30%. The sensitivity analysis below shows that only in the case of revenues from the sale of products increasing by approximately 30%, or gas costs decreasing by about 30% does the project gain a positive IRR. This does not take into consideration the possibility that the yield of gas will be lower than projected.



Increasing the expected yield of LPG has the potential to improve the project economics, but still not to the extent that the project surpasses the investment threshold:

LPG production rate tonnes LPG / mmscf	IRR %
100 tpd for 10 years	11.5%
8.33	7.43
8	5.64
7.5	2.84
7	-0.14
6.5	-3.37
6	-6.69
5.5	-11.13
5	-16.34

Operating at 100% production rate for the entire lifetime of the project still only yields a return of 11.5% and this is not feasible as the yield of wet gas is expected to decrease from 12 to 10 mmscfd. Assuming the yield does fall and the gas is still sufficiently wet to give 8.33 t LPG per mmscf (which is unlikely as the gas dries as the field matures) then the IRR is 7.43 and this is very sensitive to reductions below the maximum output level. A 19% drop in average production to 7.0 tonnes per mmscf reduces the IRR to below zero.

Option 6:Recovery and transport to end-users without processing
Technically this is not possible because the wet gas needs to be refined to remove the liquid components. This option is considered technically in-feasible.

The determination of the baseline for Tambun is summarised as follows:

	Legal issues	Technical	Economic	Conclusion
Venting	Restricted	-	-	Not likely
Flaring	Allowed	Feasible	Lowest cost	Most likely
Use on site	Allowed	Feasible, but only uses a small proportion of the gas; project baseline is net of any utilisation by Pertamina; Odira usage constitutes project emissions	-	Not likely
Re-injection	Allowed	Small amounts are already being injected; project baseline is net of any re-injection	-	Not likely
Recovery, processing and utilisation	Allowed	In 2004, when the contact was signed, this was financially unattractive	Higher cost	Not likely
Recovery and utilisation without processing	Allowed	Not feasible	-	Not likely

Step 2: Evaluation of technical feasibility and economic attractiveness for Pondok Tengah
Option 2: Flaring at the oil production site. Flaring is technically the simplest way of dealing with the associated gas and it faces no barriers. In the absence of any means of getting the gas to market, it will be flared.

Option 3: On-site consumption: Only a fraction of the associated gas is and can be consumed on the Pertamina E&P production sites, where there is very limited demand for electrical power. The use of this gas is not relevant to the project because in both gases, the gas is purchased net of any consumption on site. Additional gas will be utilized to run the compressors and at Tambun LPG plant to power the treatment processes for the gas. This consumption is included under project emissions, but it does not consume a significant quantity of the gas.

Option 4: Re-injection of associated gas. There is no re-injection of gas at Pondok Tengah yet – re-injection is not usually practiced until the pressure of the oil field reduces as it gets older.

Option 5: Recovery, transport, processing and distribution to end-users.
This is the project activity. In the absence of the project activity, this solution is technically infeasible because no facilities to process and transport the gas can be constructed in time. Pertamina E&P have plans to facilitate the construction of an LPG plant from 2010. In early 2007, Pertamina carried out a "pre-tender briefing" during which they explained their proposed terms for the transport and utilization of the gas from Pondok Tengah. The terms included a requirement that the gas would flow by 1 January 2008 and the contract would be let for 2 years. Under these terms, no-one other than Odira is able to meet the conditions because no-one can construct the pipeline in such a short time, and Odira is only in the position to process and transport the gas because of the CDM.
Furthermore, Odira is not licensed as a gas transporter; the license for the pipeline is only valid for the transport of their own gas, therefore Odira cannot even transport gas for another company under a toll arrangement.

Option 6:Recovery and transport to end-users without processing
Technically this is not possible because the wet gas needs to be refined to remove the liquid components. Also, without the Odira pipeline, there is no means of getting the gas to market. This option is considered technically in-feasible.

The determination of the baseline for Pondok Tengah is summarised as follows:

	Legal issues	Technical	Economic	Conclusion
Venting	Restricted	-	-	Not likely
Flaring	Allowed	Feasible	Lowest cost	Most likely
Use on site	Allowed	Feasible, but only uses a small proportion of the gas	-	Not likely
Re-injection	Allowed	Not yet feasible. Small amounts may be re-injected in future	-	Not likely
Recovery, processing and utilisation	Allowed	Not feasible until Pertamina facilitate the construction of necessary infrastructure	-	Not likely
Recovery and utilisation without processing	Allowed	Not feasible	-	Not likely

Conclusion: Option 2, flaring of associated gas on both the Tambun and Pondok Tengah oil fields is considered to be the most likely baseline scenario.

Relevant legislation:

Law of the Republic of Indonesia Number 22 year 2001 Concerning oil and natural gas

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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CO2 emissions

CO2 emissions from fuel combustion, leaks, flaring and venting' during transport and processing of recovered gas are not calculated from single emission sources, but a carbon mass balance is conducted between points A and B in Figure 4. The quantity of CO2 emissions corresponds to the difference of carbon in the products of the gas processing plant (point B) and the carbon supplied by the project activity (point A). In doing so. it is assumed that all carbon in the recovery gas released, flared, vented or combusted will be oxidized completely to CO2. This approach is appropriate, as the methodology is only applicable to projects where the energy required to transport and process the recovered gas is generated with the gas and not with other fuel sources.

$$PE_{CO2,gas,y} = \frac{m_{carbon,A,y}}{m_{carbon,A,y} + m_{carbon,X,y}} \cdot \left(m_{carbon,A,y} + m_{carbon,X,y} - m_{carbon,B,y}\right) \cdot \frac{44}{12} \cdot \frac{1}{1000} \qquad (1)$$

with

$$m_{carbon,A,y} = V_{A,y} \cdot w_{Carbon,A,y} \qquad (2)$$

$$m_{carbon,B,y} = V_{B,dry\ gas,y} \cdot w_{carbon,dry\ gas,B,y} + m_{LPG,B,y} \cdot w_{carbon,LPG,B,y} + m_{condensate,B,y} \cdot w_{carbon,condensate,B,y} \qquad (3)$$

$$m_{carbon,X,y} = \sum_i V_{Xi,y} \cdot w_{Carbon,Xi,y} \qquad (4)$$

where:

$PE_{CO2,gas,y}$ Are the CO2 emissions from the project activity due to combustion, flaring or venting of recovered gas during the period y in tons of CO2.

$M_{carbon,A,y}$ Is the quantity of carbon in the recovered gas from the project area at point A in Figure 1 during the period y in kg.

$M_{carbon,B,y}$ Is the quantity of carbon in the products (dry gas, LPG, condensate) leaving the gas processing plant at point B in Figure 1 during the period y in kg.

$M_{carbon,Xi,}$y Is the quantity of carbon in recovered gas from other oil wells at all points Xi in Figure 1 during the period y in kg = 0

$V_{B,drygas,y}$ Is the quantity of dry gas that is produced in the gas processing plant (point B Figure 1) during the period y in m3.

$M_{LPG,B,y}$ Is the quantity of LPG that is produced in the gas processing plant (point B Figure 1) during the period y in kg.

$M_{condensate,B,y}$ Is the quantity of condensate that is produced in the gas processing plant (point B Figure 1) during the period y in kg.

$V_{A,y}$ Is the volume of gas recovered at point A in Figure 1 during the period y in m3.

$V_{Xi,y}$ Is the volume of gas recovered from oil well i at point X in Figure 1 during the period y in m3 = 0

$W_{carbon,A,y}$ Is the average content of carbon in the gas recovered at point A in Figure 1 during the period y in kg-C/m3.

$W_{carbon,drygas,B,y}$ Is the average content of carbon in dry gas at point B in Figure 1 during the period y in kg-C/m3.

$W_{carbonLPG,B,y}$ Is the average content of carbon in LPG at point B in Figure 1 during the period y in kg-C/kg.

$W_{carboncondensate,B,y}$ Is the average content of carbon in condensate at point B in Figure 1 during the period in kg-C/kg.

$W_{carbon,Xi,y}$ Is the average content of carbon in the gas recovered from oil well i at point X in Figure 1 during the period in kg-C/m3.

Since there is no gas flow from sources Xi in figure 1, equation 1 is simplified to:

$$PE_{CO2,gas,y} = (M_{carbonA,y} – M_{carbonB,y}) * 44/12 * 1/1000 \qquad (1a)$$

The carbon content of the products ($W_{carbon,dry\ gas,B,y}$, $W_{carbon,LPG,B,y}$, $W_{carbon,condenate,B,y}$) may be taken from project specifications, if products are homogeneous in their composition, or should be monitored if the carbon content of the products varies.

Other fuel consumption

If other fossil fuels than the recovered gas are consumed at the oil well and if this consumption is a result of the project activity (e.g. substitution of gas for on-site generation or use in the compressor station), CO2 emissions from combustion of these fuels should also be accounted:

$$PE_{CO2,other\ fuels,y} = \frac{1}{1000} \cdot \sum_{Fuels} m_{fuel,y} \cdot NCV_{fuel} \cdot EF_{CO2,fuel} \qquad \textbf{(5)}$$

where:

$PE_{CO2other\ fuels,y}$ Are the CO2 emissions due to consumption of other fuels than the recovered gas due to the project activity during the period y in tons of CO2.

$M_{fuel,y}$ Is the quantity of a specific fuel type that is consumed due to the project activity during the period y in kg.

NCV_{fuel} Is the net calorific value of the respective fuel type in kJ/kg.

$EF_{CO2,fuel}$ Is the CO2 emission factor of the respective fuel type in kg C02/kJ.

CH4 emissions from recovery and processing the gas

Fugitive CH4 emissions occurring during the recovery and processing of gas may in some projects be small, but should be estimated as a conservative approach. Emission factors may be taken from the IPCC Good Practice Guidance and/or from the 1995 Protocol for Equipment Leak Emission Estimates, published by EPA2. Emissions should be determined for all relevant activities and all equipment (such as valves, pump seals, connectors, flanges, open-ended lines. etc.).

$$PE_{CH4,plants,y} = GWP_{CH4} \cdot \frac{1}{1000} \cdot \sum_{equipment} w_{CH4,stream} \cdot EF_{equipment} \cdot T_{equipment,plants} \qquad (6)$$

where:

$PE_{CH4,p1ants,y}$ Are the CH4 emissions from the project activity at the gas recovery facility and the gas processing plant during the period y in tons of CO2 equivalents.

GWP_{CH4} Is the approved Global Warming Potential for methane = 21

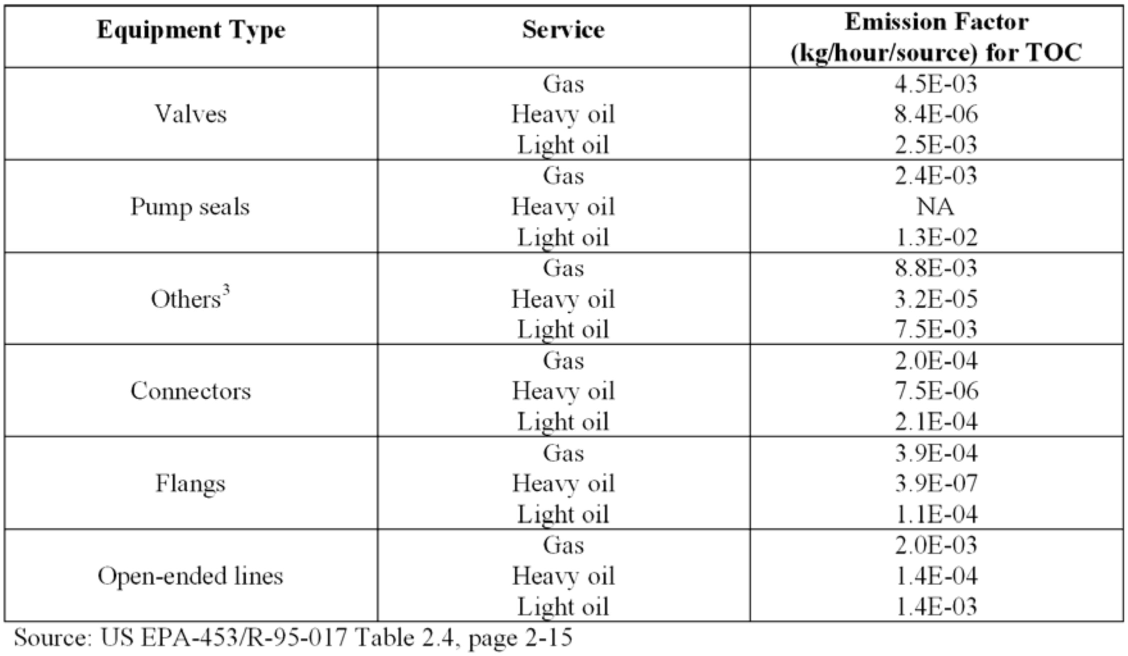
$T_{equipment}$ Is the operation time of the equipment in hours (in absence of further information, the monitoring period could be considered as a conservative approach).

$W_{CH4,stream}$. Is the average methane weight fraction in the respective stream in kg-CH4/kg.

$EF_{equipment}$ Is the appropriate emission factor from Table 2 below in kg/hour/equipment.

For the purpose of this calculation the equipment will be grouped according to the different stream types.

Table 2: Oil and gas production operations average emission factors



Equipment Type	**Service**	**Emission Factor (kg/hour/source) for TOC**
Valves	Gas	4.5E-03
	Heavy oil	8.4E-06
	Light oil	2.5E-03
Pump seals	Gas	2.4E-03
	Heavy oil	NA
	Light oil	1.3E-02
Others[3]	Gas	8.8E-03
	Heavy oil	3.2E-05
	Light oil	7.5E-03
Connectors	Gas	2.0E-04
	Heavy oil	7.5E-06
	Light oil	2.1E-04
Flangs	Gas	3.9E-04
	Heavy oil	3.9E-07
	Light oil	1.1E-04
Open-ended lines	Gas	2.0E-03
	Heavy oil	1.4E-04
	Light oil	1.4E-03

Source: US EPA-453/R-95-017 Table 2.4, page 2-15

3 “Other” equipment type as derived from compressors, diaphragms, drains, dump anns, hatches, instruments, meters, pressure relief valves, polished rods, relief valves and vents. This “other” equipment type should be applied for any equipment type other than connectors, flanges, open-ended lines, pumps or valves.

CH4 emissions from transport of the gas in pipelines under the normal operation condition

Fugitive CH4 emissions occurring during the transport of the gas in pipelines may, in some projects, be small, but should be estimated as the same approach as CH4 emissions from recovery and processing the gas” explained above.

$$PE_{CH4,pipeline,y} = GWP_{CH4} \cdot \frac{1}{1000} \sum_{equipment} w_{CH4,pipeline} \cdot EF_{pipeline} \cdot T_{equipment,pipeline} \qquad (7)$$

Where:

$PE_{CH4,pipeline,y}$ Are the CH4 emissions from the project activity during the transport of the gas in pipelines under the normal operation during the period y in tons of CO2 equivalents.
GWP_{CH4} Is the approved Global Warming Potential for methane = 21
$W_{CH4,pipeline}$ Is the average methane weight fraction in the pipeline in kg-CH4/kg.
$EF_{pipeline}$ Is the appropriate emission factor from Table 3 in kg/hour/pipeline
$T_{equipment}$ Is the operation time of the equipment in hours (in absence of further information, the monitoring period could be considered as a conservative approach)

CH4 emissions from transport of the gas in pipelines when accidental event occurred
When an accident causes gas leakage from a pipeline, the gas leakage volume is less than the sum of (1) the total amount of gas that flowed during the time the accident occurred until the gas flow is shut and (2) the total amount of gas remaining in the pipeline. In the interest of conservativeness, the volume set out above should be estimated as the gas leakage from a pipeline caused by an accident.
CH4 emissions from the transport of the gas in pipelines when accidental event occurred can be calculated as:

$$PE_{CH4,pipeline,accident} = GWP_{CH4} \cdot \frac{1}{1000}(V_{A,accident} + V_{remain,accident}) \cdot W_{CH4,pipeline,accident} \quad \textbf{(8)}$$

with:

$$V_{A,accident} = t_{accicdent} \cdot F = (t_2 - t_1) \cdot F \quad \textbf{(9)}$$

$$V_{remain,accident} = d^2 \cdot \pi \cdot L \cdot \frac{P_p}{P_s} \cdot \frac{T_s}{T_p} \cdot \frac{V_{A,d,accident}}{\sum_i V_{Xi,d,accident}} \quad \textbf{(10)}$$

The final term in equation (10) should read

VA,d,accident / (ΣVXi,d,accident) + VA,d,accident

And since in this project, there is no flow of gas from other sources, Xi = zero and therefore the final term in this equation is 1 or 100%, confirming that all of the gas in the pipeline at the time of an accident is from the project.

where:
$PE_{CH4,\ pipeline,\ accident}$ Are the CH4 emissions from the project activity due to transport of the recovered gas in the pipeline when the accidental event happens in tons of C02 equivalent.
GWP_{CH4} Is the approved Global Warming Potential for methane.
$V_{A,accident}$ Is the volume of gas supplied to pipeline via both lean gas meter M01 and 4”HP bypass meter in Figure 1 from the time the gas leakage started until the shutdown valves closed the pipeline in m.
$V_{remain,accident}$ Is the volume of gas remaining in the pipeline after the shutdown valves close the pipeline in m3.
$W_{CH4,\ pipeline,accident}$ Is the average methane weight fraction in the gas recovered at point A in Figure 1 in kg-CH4/m3
$T_{accident}$ Is the time difference between t1 and t2 determined as “retention time” in seconds.

t1 Is the time the gas leakage caused by the accident occurred. “t1” is determined based on the continuous monitoring data such as pressure etc.
t2 Is the time that the shutdown valves closed both the upstream and downstream pipeline. “t2” is determined based on the operation data.
F Is the flow rate of gas supplied from the oil well at point A in Figure 1 in m3/second.
d Is the radius of the pipeline in meters. The data is derived from P & I (Piping and Instrument).
π Is the ratio of the circumference of a circle to its diameter.
L Is the length of the pipeline in meters. The data is derived from P & I (Piping and Instrument).
P_p Is the pressure in the pipeline when the shutdown valves close both the upstream and downstream of the pipeline in atmospheres (atm).
P_s Is the standard pressure in atm.
T_p Is the temperature in the pipeline when the shutdown valves close both the upstream and downstream of the pipeline in degrees Centigrade.
T_s Is the standard temperature in Centigrade.
$V_{A,d,accident}$ Is the volume of gas supplied to the pipeline from oil well at point A in Figure 1 before the accident occurs during the period day in m3.
$V_{xi,d,accident}$ Is the volume of gas supplied to the pipeline from oil well i at point X in Figure 1 before the accident occurs during the period day in m3.

In summary, CH4 emissions from pipeline caused by accidental events will be estimated based on the above formulae and data.

Baseline

In calculating baseline emissions, it is assumed that the recovered gas would mainly be flared in the absence of the project. A minor part may be combusted for on-site energy generation[1]. It is assumed that all carbon in the gas is completely oxidized to carbon dioxide.
In practice, flaring is often conducted under sub-optimal combustion conditions and part of the gas is not combusted, but released as methane and other volatile gases. However, measurement of the quantity of methane released from flaring is difficult. Hence, for the purpose of determining baseline emissions, it is assumed that all carbon in the gas is converted into carbon dioxide. This is a conservative assumptions, as accounting of methane emissions from flaring would increase baseline emissions.
Baseline emissions are calculated as follows:

$$BL_y = V_{A,y} \cdot W_{carbon,A,y} \cdot \frac{44}{12} \cdot \frac{1}{1000} \qquad \textbf{(11)}$$

where:
BL_y Are the baseline emissions during the period y in tons of CO2 equivalents.
$V_{A,y}$ Is the volume of gas recovered from the oil field at point A in Figure 1 during the period y in m
$W_{carbon,A,y}$ Is the average content of carbon in the gas recovered at point A in Figure 1 during the period y in kg-C/m3.

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[1] If the gas would be used for on-site energy generation in the absence of the project, other fossil fuels (e.g. diesel) may be used in place of the gas for on-site generation after implementation of the project activity. If this is the case, GHG emissions from combustion of such fuels are accounted as part of the project emissions in equation 5 above.

The average methane content in the gas $W_{CH4,A,y}$ is determined from regular measurements of the composition of the gas, taking into account the molecular weight of all fractions of the gas.

Leakage

Leakage emissions comprise:

- CO2 emissions due to fuel combustion for transport and processing of the gas, where the transport and processing of the gas is not under control of project participants
- CH4 and CO2 emissions from leaks, venting and flaring during transport and processing of recovered gas, where the transport and processing is not under control of project participants, and

- Changes in CO2 emissions due to the substitution of fuels or additional fuel consumption at end-users, where these effects occur.

1) The emissions from the transport of the dry gas are already accounted in the compressors on the Odira Tambun facility. Emissions from the transport of LPG and condensate are discounted because they would arise in the baseline scenario, where displaced fuel would also be transported.
2) CH4 and CO2 emissions from processing, flaring, fugitive emissions on site are captured within the project boundary. Fugitive emissions of CH4 from the 35 km pipeline and from emergency venting of the pipe counted as leakage.
3) The final point is not considered relevant because the products from the processing plant do not substitute more carbon efficient fuels (eg renewable energy) nor do they increase fuel consumption as the market is already short of supply. The LPG is used for domestic cooking purposes and the supply from this project only displaces other supplies of the same product. The first grade condensates from this field are in fact used for spray painting, not for combustion, because they are colourless and contain only C5 and C6 compounds. Under the methodology it is assumed that they are 100% oxidised in the atmosphere even without combustion. In practice, they displace lower quality solvents with higher carbon contents (C7 and above) and therefore have a marginally beneficial impact which is not included in this project. The lower grade condensates and dry LPG are used as fuel and displace fuels of the same or higher carbon content.

Changes in CO2 emissions due to the substitution of fuels at end-users

Project participants should assess

• Whether the supply of additional fuels by the project activity to the market will lead to additional fuel consumption, and

• Whether the fuels of the project activity substitute fuels with a lower carbon intensity (e.g. if electricity generation with the recovered gas substitutes renewable electricity generation).

There is no reason to expect that the supply of additional fuels will fuel additional consumption – Indonesia is growing rapidly and there is a high demand for power and fuel. This fuel will not lead to increased consumption.

The supply of these fuels into the Indonesian market will not substitute for renewable energy. Indonesia is short of power and plans to build further coal fired power plants. With Indonesia's abundance of coal it is a heavily fossil-fuel intensive power market. 127.2 GWh was produced in 2005, of which 114.4 GWh was from fossil-fuel and only 8.9 GWh from hydro (the other 3.1 GWh being geothermal).

The 2006 Presidential Decree No 71/2006 (the "Fast Track Program") was put in place to accelerate the construction of 40 new coal-fired plants in Indonesia to increase installed capacity from 26,500 MW by a massive 10,000 MW of new build coal. The Fast Track Program is also intended to retrofit oil fired plants to coal fired plants.

PLN has warned investors in its recent US$ 1 billion capital markets offering which secured its capital for the Fast Track Program that it runs the risk of being unable to secure natural gas for certain of its gas plants – making PLN even more dependent on coal.

Emission Reductions

Emission reductions are calculated as the difference between baseline and project emissions, taking into account any adjustments for leakage:

$EF_y = BL_y - PE_{CO2,gas,y} - PE_{CO2,otherfuels,y} - PE_{CH4,plants,y} - L_y$ ………(12)

And

$L_{y\,=}\, PE_{CH4,pipeline,y} + PE_{CH4,pipelineaccident,y}$ (13)

where:

EF_y Are the emissions reductions of the project activity, adjusted for leakage, during the period y in tons of CO2 equivalent.
BL_y Are the baseline emissions during the period y in tons of CO2 equivalent.
$PE_{CO2gas,y}$ Are the CO2 emissions from the project activity due to combustion, flaring or venting of recovered gas during the period y in tons of CO2.
$PE_{CO2otherfuel,y}$ Are the CO2 emissions due to consumption of other fuels than the recovered gas due to the project activity during the period y in tons of CO2.
$PE_{CH4,plants,y}$ Are the CH4 emissions from the project activity at the gas recovery facility and the gas processing plant during the period y in tons of CO2 equivalent.
$PE_{CH4pipeline,y}$ Are the CH4 emissions from the project activity due to transport of the recovered gas in the pipeline during the period y in tons of CO2 equivalent.
$PE_{CH4,\ pipeline,\ accident}$ Are the CH4 emissions from the project activity due to transport of the recovered gas in the pipeline when the accidental event occurs in tons of C02 equivalent.
L_y Are any leakage emissions during the period in tons of CO2 equivalent.

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

(Copy this table for each data and parameter)

Data / Parameter:	**McarbonXi,y**
Data unit:	Tonnes
Description:	Mass of carbon supplied in gas from sources outside the project boundary
Source of data used:	n/a
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	There are no external sources of gas. The pipeline is dedicated to the associated gas from the field that are included in the project boundary.

Any comment:	This simplifies some of the equations

Data / Parameter:	**$EF_{CO2,fuel,y}$**
Data unit:	Tonnes CO2 per tonne
Description:	Default factor for gas oil / diesel
Source of data used:	IPCC 2006
Value applied:	3.211 tCO2 per tonne
Justification of the choice of data or description of measurement methods and procedures actually applied :	Typical default value
Any comment:	tCO2/t EF negates the requirement for NCV and energy conversion

Data / Parameter:	**GWPCH4**
Data unit:	T CO2e
Description:	Global warming potential of methane
Source of data used:	IPCC
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	This is the default value applied under the Kyoto Protocol
Any comment:	No comment

Data / Parameter:	**$EF_{equipment,plant}$**
Data unit:	Tonnes
Description:	Emission rates from leakage of methane from processing plant
Source of data used:	Processing plant design drawings and source list. AM0009 default emission factors

<table>
<tr><td>Value applied:</td><td>
<table>
<tr><th>Equip</th><th>kgCH4/hr</th><th>Number</th></tr>
<tr><td>Valves</td><td>4.50E-03</td><td>215</td></tr>
<tr><td>Pump seals</td><td>2.40E-03</td><td>0</td></tr>
<tr><td>Other</td><td>8.80E-03</td><td>229</td></tr>
<tr><td>Connectors</td><td>2.00E-04</td><td>0</td></tr>
<tr><td>Flanges</td><td>3.90E-04</td><td>64</td></tr>
<tr><td>Open ended lines</td><td>2.00E-03</td><td>0</td></tr>
<tr><td>Valves (light oil)</td><td>2.50E-03</td><td>444</td></tr>
<tr><td>Pump seals (light oil)</td><td>1.30E-02</td><td>0</td></tr>
<tr><td>Other (light oil)</td><td>7.50E-03</td><td>0</td></tr>
<tr><td>Connectors (light oil)</td><td>2.10E-04</td><td>0</td></tr>
<tr><td>Flanges (light oil)</td><td>1.10E-04</td><td>481</td></tr>
<tr><td>Open ended lines</td><td>1.40E-03</td><td>0</td></tr>
</table>
</td></tr>
<tr><td>Justification of the choice of data or description of measurement methods and procedures actually applied :</td><td>Calculated as the sum of methane emissions from all of the flanges, valves etc in the processing plant.</td></tr>
<tr><td>Any comment:</td><td>No Comment</td></tr>
</table>

<table>
<tr><td>Data / Parameter:</td><td>$EF_{equipment,pipeline}$</td></tr>
<tr><td>Data unit:</td><td>KG CH4 per hour leaking from pipelines</td></tr>
<tr><td>Description:</td><td>Summation of emissions from leakage of methane from pipeline</td></tr>
<tr><td>Source of data used:</td><td>Pipeline design drawings and AM0009 default emission factors</td></tr>
<tr><td>Value applied:</td><td>
<table>
<tr><th>Equip</th><th>kgCH4/hr</th><th>Number</th></tr>
<tr><td>Valves</td><td>4.50E-03</td><td>4</td></tr>
<tr><td>Pump seals</td><td>2.40E-03</td><td>0</td></tr>
<tr><td>Other</td><td>8.80E-03</td><td>2</td></tr>
<tr><td>Connectors</td><td>2.00E-04</td><td>0</td></tr>
<tr><td>Flanges</td><td>3.90E-04</td><td>20</td></tr>
<tr><td>Open ended lines</td><td>2.00E-03</td><td>0</td></tr>
</table>
</td></tr>
<tr><td>Justification of the choice of data or description of measurement methods and procedures actually applied :</td><td>Calculated as the sum of methane emissions from all of the flanges, valves etc in the pipeline.
The design drawings show the following numbers of flanges, valves etc:</td></tr>
<tr><td>Any comment:</td><td>No comment</td></tr>
</table>

Data / Parameter:	**ID**
Data unit:	M
Description:	Internal Diameter of pipeline
Source of data used:	Design drawings

Value applied:	0.203
Justification of the choice of data or description of measurement methods and procedures actually applied :	Required for calculation of $V_{remain,accident}$
Any comment:	No comment

Data / Parameter:	**L**
Data unit:	M
Description:	Length between safety slam shut valves
Source of data used:	Design drawings
Value applied:	12000 m
Justification of the choice of data or description of measurement methods and procedures actually applied :	Maximum volume loss possible is within distance between safety valves which close when a drop in pressure is detected either behind or infront of the valve. Required for calculation of $V_{remain,accident}$
Any comment:	No comment

B.6.3 Ex-ante calculation of emission reductions:

Estimated mass of carbon in Wet Gas import, based on current analysis and predicted gas supply from Tambun and Pondok Tengah Oil Fields

$M_{carbon,A,y} = V_{A,y} * W_{carbon,A,,y}$

	Tambun Feed tCO2	PDT Feed tCO2	McarbonA tCO2
2007	380,067	0	380,067
2008	380,067	393,438	773,505
2009	380,067	393,438	773,505
2010	380,067	0	380,067
2011	380,067	0	380,067
2012	316,723	0	316,723
2013	316,723	0	316,723
2014	316,723	0	316,723
2015	316,723	0	316,723
2016	316,723	0	316,723
Total			4,270,824

Estimated mass of carbon leaving in product exports, based on current production and analysis data.

$\mathbf{M_{carbonB,y} = V_{dry\ gas,y} * W_{carbon,dry\ gas,y} + M_{LPG,y} * W_{carbon\ LPG,y} + M_{condensate,y} * W_{carbon,condensate,y}}$

	Dry gas	LPG	Condensate	McarbonB
	tCO2	tCO2	tCO2	tCO2
2007	261,933	63,084	30,464	355,482
2008	535,188	78,855	68,545	682,589
2009	535,188	78,855	68,545	682,589
2010	261,933	63,084	30,464	355,482
2011	261,933	63,084	30,464	355,482
2012	218,278	52,570	25,387	296,235
2013	218,278	52,570	25,387	296,235
2014	218,278	52,570	25,387	296,235
2015	218,278	52,570	25,387	296,235
2016	218,278	52,570	25,387	296,235
Total				3,912,795

Net Mass of CO2 from on-site use of gas for fuel and flare

$\mathbf{PE_{CO2,gas,y} = M_{carbonA,y} - M_{carbon,B,y}}$

Note; The conversion terms 44/12 * 1/1000 used to convert kgC to tCO2 are redundant as tCO2 emission factors are applied.

	McarbonA	McarbonB	PECO2gas
	tCO2	tCO2	tCO2
2007	380067	355482	24,585
2008	773505	682589	90,916
2009	773505	682589	90,916
2010	380067	355482	24,585
2011	380067	355482	24,585
2012	316723	296235	20,488
2013	316723	296235	20,488
2014	316723	296235	20,488
2015	316723	296235	20,488
2016	316723	296235	20,488
Total			358,029

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

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$EF_y = BL_y - PE_{CO2,gas,y} - PE_{CO2,otherfuels,y} - PE_{CH4,plants,y} - L_y$ ………(12)

$$L_{y} = PE_{CH4,pipeline,y} + PE_{CH4,pipelineaccident,y} \qquad (13)$$

	BL tCO2	PECO2 gas tCO2	PECO2 Other fuel tCO2	PECH4 Plant tCO2	PECH4 Pipeline tCO2	PECH4 Accident tCO2	EF (CER) tCO2
2007	380,067	24,585	86	297	3	0	355,095
2008	773,505	90,916	86	297	3	0	682,202
2009	773,505	90,916	86	297	3	0	682,202
2010	380,067	24,585	86	297	3	0	355,095
2011	380,067	24,585	86	297	3	0	355,095
2012	316,723	20,488	86	297	3	0	295,849
2013	316,723	20,488	86	297	3	0	295,849
2014	316,723	20,488	86	297	3	0	295,849
2015	316,723	20,488	86	297	3	0	295,849
2016	316,723	20,488	86	297	3	0	295,849
Total							3,908,934
						Average	390,893

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

B.7.1 Data and parameters monitored:

Data / Parameter:	V_{Ay}
Data unit:	Mmscf
Description:	LPG plant wet gas input
Source of data to be used:	Continuous measurements at metering points 12", 4" and 6" in Figures 2 and 4
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Tambun feed 12 mmscf/d forecast for years 1 to 5 and 10 mmscfd for years 6 to 10 And Pondok Tangah 15 mmscfd forecast for years 2 + 3
Description of measurement methods and procedures to be applied:	1. The 12" LP Tambun meter is a fiscal designed metering system on the 12" LP wet gas import line from Tambun. This meter is subject to government regulation and Metrology Department 'Directorat Metrologi' inspection and calibration. This is a pressure and temperature corrected orifice plate system utilising high quality transmitters and a dedicated flow computer. As such this system is capable of delivering measurement uncertainty less than 1%. 2. The 6" Pondok Tangah meter is a fiscally designed metering system on the 6" import line from Pondok Tangah,. Calibration evidence is not yet available. 3. The 4" HP Tambun meter is a fiscal designed metering system on the 4" HP wet gas import line from Tambun. Tambun gas flows through this meter as a bypass when compression capacity is

	limited at the Condensate/LPG plant and the flow is included in baseline. This meter is subject to government regulation and Metrology Department 'Directorat Metrologi' inspection and calibration. This is a pressure and temperature corrected orifice plate system utilising high quality transmitters and a dedicated flow computer. As such this system is capable of delivering measurement uncertainty less than 1%.
QA/QC procedures to be applied:	Ensure annual calibration is maintained throughout life of project Request calibration 'as-found' status to allow calibration errors to be assessed for materiality Ensure flow computer configured gas composition and or density values are updated monthly Data trend to be analysed in Monitoring Report Maintain calculation cell protection in Monitoring Report
Any comment:	No comment

Data / Parameter:	**$W_{carbon,A,y}$**
Data unit:	KgCO2/Sm3
Description:	Measurement with gas chromatography
Source of data to be used:	Weekly samples taken manually from 12", 4" and 6" sample points are measured by means of a gas chromatograph at an external laboratory analysis. Monthly average is used.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	12" LP Tambun feed - 3.1957 kgCO2/Sm3 from Q1 2007 analysis 4" HP Tambun bypass – not used in Ex Ante calculation as will be shut in. 6" Pondok Tangah feed – 2.6485 kgCO2/Sm3 from initial May 2007 analysis
Description of measurement methods and procedures to be applied:	Sample extraction and laboratory gas chromatograph analysis to international ASTM standards
QA/QC procedures to be applied:	Ensure sampling and analysis continue to be carried out in accordance with ASTM or equivalent standards Monthly data trend analysis in Monitoring Report Maintain calculation cell protection in Monitoring Report
Any comment:	No comment

Data / Parameter:	**$M_{carbon,Ay}$**
Data unit:	T CO2
Description:	Calculated from V_{Ay} * $W_{carbon,A,y}$
Source of data to be used:	Total metered volume from monthly sums of daily 00:00 – 00:00 metered volumes, manually transcribed from metering daily reports to Monthly Gas Report * Weighted average EF
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Tambun feed 380067 tCO2 in years 1 to 5, falling to 316723 tCO2 in years 6 to 10. Pondok Tengah feed – 393438 tCO2 in years 2 and 3 only.

Description of measurement methods and procedures to be applied:	CO2 calculated monthly and summed annually
QA/QC procedures to be applied:	Monthly data trend analysis in Monitoring Report Maintain calculation cell protection in Monitoring Report
Any comment:	No comment

Data / Parameter:	**$V_{B,drygas,y}$**
Data unit:	Mmscf
Description:	Dry gas output
Source of data to be used:	Continuous measurement of flow from M01 dry gas output. Note this will not include bypass flow from 4”, but that this is not required for PE calculations
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.75 mmscf/mmscf forecast. Actual 0.8 mmscf/mmscf used
Description of measurement methods and procedures to be applied:	M01 dry gas meter is a fiscal designed metering system at the exit from the LPG plant. This meter is subject to government regulation and Metrology Department ‘Directorat Metrologi’ inspection and calibration. This is a pressure and temperature corrected orifice plate system utilising high quality transmitters and a dedicated flow computer. As such this system is capable of delivering measurement uncertainty less than 1%.
QA/QC procedures to be applied:	Ensure annual calibration is maintained throughout life of project Request calibration ‘as-found’ status to allow calibration errors to be assessed for materiality Ensure flow computer configured gas composition and or density values are updated monthly Data trend to be analysed in Monitoring Report
Any comment:	No comment

Data / Parameter:	**$W_{carbon,drygas,B,y}$**
Data unit:	kgCO2/Sm3
Description:	Measurement with gas chromatography
Source of data to be used:	Samples taken manually from M01 sample point and external laboratory analysis on a weekly basis and averaged to give monthly emission factor.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	2.753 kgCO2/Sm3 from Q1 2007 analysis Dry gas EF is expected to change slightly when PDT 6” feed is flowing. For years 2 and 3 this is estimated as no analysis data is available at this time.
Description of measurement methods and procedures to be	Sample extraction and laboratory gas chromatograph analysis to international ASTM standards

applied:	
QA/QC procedures to be applied:	Ensure sampling and analysis continue to be carried out in accordance with ASTM or equivalent standards Monthly data trend analysis in Monitoring Report Maintain calculation cell protection in Monitoring Report
Any comment:	No comment

Data / Parameter:	**$M_{B,carbon,dry gas,y}$**
Data unit:	T CO2 per year
Description:	Calculated from $V_{B,drygas,y}$ * $W_{carbon,drygas,B,y}$
Source of data to be used:	Monthly sums of daily 00:00 – 00:00 metered volumes manually transcribed from metering daily reports to Monthly Gas Report * Weighted average EF
Value of data applied for the purpose of calculating expected emission reductions in section B.5h	Tambun flow 261,933 tCO2 in years 1 to 5 and 218,278 t CO2 in years 6 to 10, plus Pondok Tangah flow 273,255 tCO2 in years 2 and 3.
Description of measurement methods and procedures to be applied:	CO2 calculated monthly and summed annually
QA/QC procedures to be applied:	Monthly data trend analysis in Monitoring Report Maintain calculation cell protection in Monitoring Report
Any comment:	No comment

Data / Parameter:	**$M_{LPG,B,y}$**
Data unit:	Tonnes per year
Description:	LPG produced
Source of data to be used:	Daily readings of continuous flow meter recording mass of LPG production, summed over the reporting period.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	60 tonnes per day based on an average yield of 5 tonnes of LPG per mmscfd and 12 mmscfd, increasing / decreasing in line with the gas feed.
Description of measurement methods and procedures to be applied:	The quantity of LPG produced is measured continuously using an Venturi type flow meter calibrated by Indonesia's Department Metrologi on an annual basis. The meter measures flow through the differences in pressure from the upstream side to the downstream side of a partially obstructed pipe. This volume is converted to mass terms using monthly Standard Density value from compositional analysis. 0.667 kg/lit applied for forecast data
QA/QC procedures to be applied:	Ensure the flow meter is regularly maintained and calibrated in accordance with the manufacturer's instructions. A consistency check on LPG production to be performed by comparison of

	metered production against sales, which are based on the weighbridge data. The weighbridge under control of, and subject to calibration by the Department Metrologi.
Any comment:	No comment

Data / Parameter:	**$W_{carbon,LPG,B,y}$**
Data unit:	TCO2 per tonne
Description:	Measurement with e.g. gas chromatography
Source of data to be used:	Samples taken manually from LPG sample point and external laboratory analysis on a monthly basis. Emission factor calculated and applied monthly
Value of data applied for the purpose of calculating expected emission reductions in section B.5	3.004 tCO2/tonne from Q1 2007 analysis
Description of measurement methods and procedures to be applied:	Sample extraction and laboratory gas chromatograph analysis to international ASTM standards
QA/QC procedures to be applied:	Ensure sampling and analysis continue to be carried out in accordance with ASTM or equivelant standards Monthly data trend analysis in Monitoring Report Maintain calculation cell protection in Monitoring Report
Any comment:	No comment

Data / Parameter:	**$M_{B,carbon,LPG,y}$**
Data unit:	T CO2 per year
Description:	Calculated from $M_{B,LPG,y}$ * $W_{carbon,LPG,B,y}$
Source of data to be used:	Annual sum of monthly sum of LPG leaving plant, plus closing stock less opening stock * Monthly EF calculated from weekly compositional analysis
Value of data applied for the purpose of calculating expected emission reductions in section B.5	63084 tCO2 in years 1 to 5 and 52570 t CO2 in years 6 to 10 Increase to 78,855 tCO2 during PDT flow in years 2 and 3
Description of measurement methods and procedures to be applied:	CO2 calculated monthly and summed annually
QA/QC procedures to be applied:	Monthly data trend analysis in Monitoring Report Maintain calculation cell protection in Monitoring Report
Any comment:	No comment

Data / Parameter:	**$M_{Condensate,B,y}$**
Data unit:	Tonnes per year
Description:	Condensate produced
Source of data to be	The quantity of condensate produced is measured continuously by means of

used:	calibrated flow meters.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	22.5 bbl/mmscf feed. Converted to mass terms using monthly Standard Density value from compositional analysis. 0.667 kg/lit applied for forecast data. Actual achieved to date is close at 21.3 bbl/mmscf
Description of measurement methods and procedures to be applied:	1st Grade Condensate The quantity of condensate produced is measured continuously by a Venturi type flow meter annually calibrated by Indonesia's Department Metrologi a more realistic value than the plant capacity of 100 TPD, reflecting the lower LPG content of the gas from Tambun field. This reduction is address further in the sensitivity analysis The fluid flowing in the pipe is led through a contraction section to a throat, which has a smaller cross-sectional area than the pipe, so that the velocity of the fluid through the throat is higher than that in the pipe. This increase of velocity is accompanied by a fall in pressure, the magnitude of which depends on the rate of flow, so that by measuring the pressure drop, the discharge may be calculated. This volume is converted to mass terms using monthly Standard Density value from compositional analysis. 2nd Grade Condensate The quantity of condensate if measured continuously using a turbine flow meter calibrated (annually) by Indonesia's Department Metrologi . The flow meter is of volumetric type and measures the rate of flow via a rotor that spins as the liquid passes through its blades where the rotational speed is a direct function of flow rate. This is converted to mass terms using monthly Standard Density value from compositional analysis.
QA/QC procedures to be applied:	Ensure the flow meter is regularly maintained and calibrated in accordance with the manufacturer's instructions. A consistency check on condensate production may be performed by comparison of metered production against sales, which are based on the weighbridge data. The weighbridge under control of, and subject to calibration by the Department Metrologi.
Any comment:	No comment

Data / Parameter:	$W_{carbon,condensate,B,y}$
Data unit:	TCO2 per tonne
Description:	Measurement with e.g. gas chromatography
Source of data to be used:	Samples taken manually from LPG sample point and external laboratory analysis on a monthly basis. Emission factor calculated and applied monthly
Value of data applied for the purpose of calculating expected	3.044 tCO2/tonne from Feb 2007 analysis

emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Sample extraction and laboratory gas chromatograph analysis to international ASTM standards
QA/QC procedures to be applied:	Ensure sampling and analysis continue to be carried out in accordance with ASTM or equivalent standards Monthly data trend analysis in Monitoring Report Maintain calculation cell protection in Monitoring Report
Any comment:	No comment

Data / Parameter:	**$M_{B,carbon,condensate,y}$**
Data unit:	T CO2 per year
Description:	Calculated from $M_{condensate,B,y}$ * $W_{carbon,condensate,B,y}$
Source of data to be used:	Annual sum of monthly sum of condensate leaving plant, plus closing stock less opening stock * Monthly EF calculated from compositional analysis
Value of data applied for the purpose of calculating expected emission reductions in section B.5	30465 tCO2 in years 1 to 5 and 25387 in years 6 to 10 rising to 68545 tCO2 during PDT flow in years 2 and 3
Description of measurement methods and procedures to be applied:	CO2 calculated monthly and summed annually
QA/QC procedures to be applied:	Monthly data trend analysis in Monitoring Report Maintain calculation cell protection in Monitoring Report
Any comment:	No comment

Data / Parameter:	**$M_{fuel,,y}$**
Data unit:	Tonnes
Description:	LPG plant use of diesel fuel for firepumps, compressors and standby generation
Source of data to be used:	Monthly diesel (gas oil) deliveries plus opening stock less closing stock from tank dips * Standard density
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.842 tonnes
Description of measurement methods and procedures to be applied:	Typical methodology for determining total consumption of liquid fuels. No assessment of accuracy applied as highly deminimus source of project emissions.
QA/QC procedures to be applied:	Stock take carried out to recognised standard Monthly Diesel Report total transcribed correctly to Monitoring Report
Any comment:	No comment

Data / Parameter:	**$W_{CH4,stream}$**
Data unit:	Kg CH4 / Kg
Description:	CH4 content of plant gas
Source of data to be used:	Annual average methane content of dry and wet gas CH4 from compositional analysis
Value of data applied for the purpose of calculating expected emission reductions in section B.5	36.9%
Description of measurement methods and procedures to be applied:	CH4 content of dry gas from the previous 12 months, or if accident occurs within 12 months of start-up, best available average.
QA/QC procedures to be applied:	As per compositional analysis Monthly data trend analysis in Monitoring Report Maintain calculation cell protection in Monitoring Report
Any comment:	No comment

Data / Parameter:	**$T_{equipment,plants}$**
Data unit:	Hrs
Description:	Plant annual running hours
Source of data to be used:	Forecast operating hours
Value of data applied for the purpose of calculating expected emission reductions in section B.5	8592 hours
Description of measurement methods and procedures to be applied:	358 days * 24 hours allowing for 7 days planned annual shutdown
QA/QC procedures to be applied:	Running hrs to be updated in the event of any unplanned dshutdown
Any comment:	No comment

Data / Parameter:	**$W_{CH4,pipeline}$**
Data unit:	Kg CH4 / kg
Description:	CH4 content of pipeline gas
Source of data to be used:	Annual average methane content of dry gas CH4 from compositional analysis
Value of data applied for the purpose of calculating expected emission reductions in	43.53%

section B.5	
Description of measurement methods and procedures to be applied:	CH4 content of dry gas from the previous 12 months, or if accident occurs within 12 months of start-up, best available average.
QA/QC procedures to be applied:	As per compositional analysis Monthly data trend analysis in Monitoring Report Maintain calculation cell protection in Monitoring Report
Any comment:	No comment

Data / Parameter:	**$T_{equipment,pipeline}$**
Data unit:	Hours
Description:	Annual operating hours
Source of data to be used:	Forecast operating data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	8592 hours
Description of measurement methods and procedures to be applied:	As above 358 days allowing for an 7 day planned shutdown
QA/QC procedures to be applied:	Monitoring report to be updated following any unplanned shutdown
Any comment:	No comment

Data / Parameter:	**T1 and T2**
Data unit:	Time
Description:	Time between 1st evidence of leak and shutdown valves closing
Source of data to be used:	Pressure, temperature and flowrate trends
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Nil
Description of measurement methods and procedures to be applied:	AM0009 methodology Required for calculation of $V_{A,accident}$
QA/QC procedures to be applied:	Appropriate to incident
Any comment:	No comment

Data / Parameter:	**F**

Data unit:	Sm3 per hour
Description:	Pipeline entry flow rate
Source of data to be used:	Sum of M1 and 4” HP bypass metered data. (Please refer to figure 2)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Nil
Description of measurement methods and procedures to be applied:	Metering points as used for baseline flow data Required for calculation of $V_{A,accident}$
QA/QC procedures to be applied:	Meters used as per baseline determination. Metering QA/QC assured through calibration program.
Any comment:	No comment

Data / Parameter:	$\mathbf{P_{pipeline}}$
Data unit:	Bara
Description:	Pressure in pipeline at time of valve closure
Source of data to be used:	Pipeline section pressure transmitter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Nil
Description of measurement methods and procedures to be applied:	Required for calculation of $V_{remain,accident}$
QA/QC procedures to be applied:	Appropriate to incident
Any comment:	No comment

Data / Parameter:	$\mathbf{T_{pipeline}}$
Data unit:	Degrees Centigrade
Description:	Temperature in pipeline at time of valve closure
Source of data to be used:	Pipeline section temperature transmitter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Nil
Description of measurement methods	Required for calculation of $V_{remain,accident}$

and procedures to be applied:	
QA/QC procedures to be applied:	Appropriate to incident
Any comment:	No comment

B.7.2 Description of the monitoring plan:

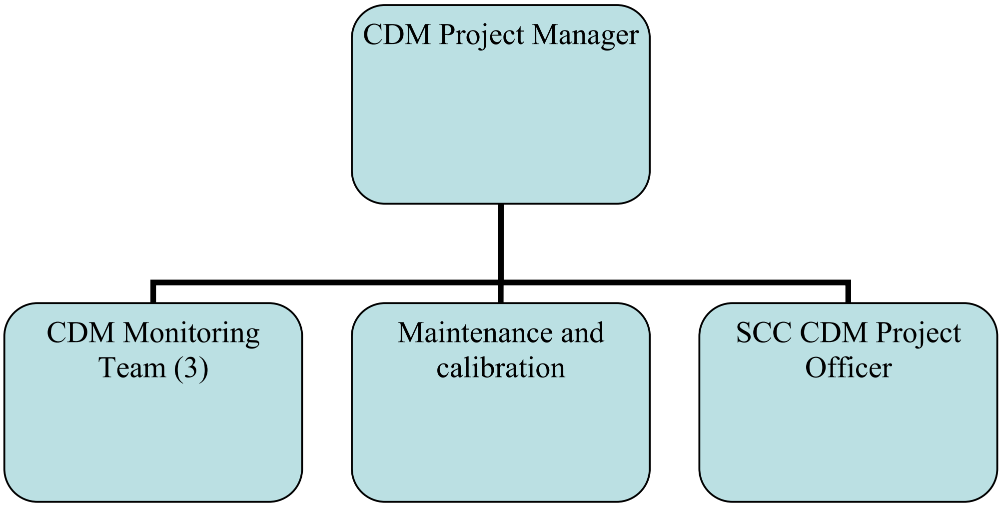
>>

Draft Procedure for implementation of Tambun LPG Associated Gas Recovery and Utilization Project Monitoring Plan

Purpose: To ensure that the approved monitoring methodology is correctly implemented in order to enable the accurate and transparent determination of avoided emissions.

Scope: This procedure covers the project activity described in the CDM project entitled Tambun LPG Associated Gas Recovery and Utilization Project.

Responsibility: The CDM Project Manager is responsible for overseeing the implementation of this procedure. Competency requirements for the position of Project Manager will be defined and applied to ensure that the Project Manager is able to implement this procedure. Additional competencies e.g. for the maintenance and calibration of the meters and online reporting system will be sourced externally where necessary. The organisational structure will be as follows:



Wet gas Import and Dry Gas Export Measurement - On-line live metering systems
All key meters required to determine GHG emissions and emission reductions will be monitored on a daily basis. For the gas import and export metering, flow rate is calculated using orifice plate differential pressure metering systems. Each system comprises of an industry standard dedicated flow computer, calculating standard (normalised) volume flow rate to AGA3 standard from live field instrument 4-20mA inputs and manually configured gas property values. The field instruments are dual range differential

pressure, line pressure and temperature transmitters. The flow computers calculate flow rate typically on a 5 second cycle and calculate hourly and daily totalised flow. Daily reports are printed automatically showing the 00:00- 00:00 total flow, pressure, temperature and density values. The flow calculation requires line (flowing) density at the meter and standard density values and these are calculated within the flow computer to AGA8 standard from the gas composition mole %. The composition is updated on a weekly basis from the analysis results for each stream.. These daily report totals are transcribed manually to the Monthly Gas Report, and from there to the CDM Monitoring Report.

The gas is sampled and analysed at each metering point on a weekly basis for molar composition using gas chromatographs, with the analytical services being provided by an approved third party. The results (examples of which are shown in Annex 3) provide the % molar composition of the different fractions of carbohydrates, from which the carbon content may be determined. The average CO2 content is calculated and applied to monthly total flow.

LPG and Condensate Production

The quantities of LPG and Condensate produced are being measured continuously by means of flow meters.

The 1st Grade Condensate is measured continuously via a Venturi meter installed upstream of the condensate tanks. This meter is set up to provide continuous measurements electronically to the plant control room and also has a local readout display

The 2nd Grade Condensate is continuously monitored by means of a turbine flow meter. This meter is of volumetric type is set up to provide continuous measurements electronically to the plant control room and also has a local readout display

The composition of the LPG is measured on a monthly basis by means of a gas chromatograph.

The composition of the condensate is sampled on a monthly basis and measured using gas a chromatograph, with the analytical services being provided by an approved third party.

Check of LPG and Condensate production - Batch measurement

A consistency check of the LPG production is performed by monitoring the weight of product leaving by tanker using the on-site weighbridge under control of Indonesia's Department Metrologi. The monthly production balance is adjusted to take into account the change in volume stock held at end of month. The stock is measured continuously by the LPG tank level instruments. Total monthly production is calculated as follows: -

M LPG (t) = Total product export – opening stock + closing stock

Delivery records are summed and the balance calculated on the Monthly LPG Report. The monthly total is transcribed to the CDM Monitoring Report.

A consistency check of the Condensate production is performed by monitoring the quantity of product leaving by road tanker using the on-site weighbridge under control of Indonesia's Department Metrologi . The monthly production balance is adjusted to take into account the change in volume of stock held at end of each month. Total monthly production is calculated as follows: -

Mcondensate (t) = Total product export – opening stock + closing stock * VCF * Standard Density

Delivery records are summed and the balance calculated on the Monthly Condensate Report. The monthly total is transcribed to the CDM Monitoring Report.

Both LPG and condensate are sampled and measured on a monthly basis using a gas chromatograph.

Additional data are required as follows:

- Consumption of diesel oil
- Losses of gas during emergency situations, via flow rate, temperature and pressure of the gas at the time of the incident.

Calculation of avoided emissions:
The data required to calculate baseline emissions and project emissions will be fed into a protected spreadsheet (see Annex 4) which will calculate the emission reductions according to the formulae described above, using the defined default values. Access to the spreadsheet will be controlled. The spreadsheet will be include various checks, such as a comparison of total methane consumed against total power generated and the spreadsheet will be regularly audited to ensure it is operating correctly.

Uncertainty Analysis Meeting Requirements of EB23

Year	2007,2010, 2011 tCO2	2008-2009 tCO2	2012-2016 tCO2	Flow Uncertainty	EF Uncertainty	Combined Uncertainty
12" LP Feed	380067.06	380067.06	316722.55	2.07%	1.00%	2.30%
4" HP Bypass	0.00	0.00	0.00	1.95%	1.00%	2.19%
6" PDT Feed	0.00	393437.85	0.00	1.50%	1.00%	1.80%
Dry Gas M01	261933.13	535188.47	218277.61	1.65%	1.00%	1.93%
LPG	63084.00	131372.43	52570.00	1.00%	1.00%	1.41%
Cond	30464.47	68545.06	25387.06	1.00%	1.00%	1.41%
Baseline (BL)	380067.06	773504.92	316722.55			
Project Emissions (PECO2)	24585.46	38398.96	20487.88			
PE Other	387.49	387.49	387.49			5%
CER	355094.11	734718.47	295847.18			
BL Uncertainty	2.30%	1.45%	2.30%			
PECO2 Uncertainty	28.71%	10.30%	28.71%			

CER Uncertainty	1.45%	1.43%	1.45%

Uncertainties for each flow metering point are calculated using ISO5167. Uncertainties in batch measurement and analysis are added subjectively and the overall uncertainties calculated in accordance with ISO 5168. A high uncertainty in PECO2gas is to be expected due to the by-difference calculation method. This is accepted within the AM0009 methodology. The overall uncertainty in CERs are calculated to be within typical verification materiality.

Quality control

Data will be compared from month to month using trend analysis to show where parameters have deviated significantly from preceding or following values. Any values identified as being unusual in this manner will be rechecked. Where preceding or following values are not available, references values may be taken from published data, other oil wells etc. as appropriate.

Commercial data (i.e. invoices and delivery notes) will be used to corroborate total volumes of:

- incoming gas
- products including dry gas, condensate and LPG
- incoming fuels – i.e. fuel oil for standby engines

Fugitive emissions of methane from the processing plant and pipelines and from accidental releases of methane from the transmission pipelines will be checked against the IPCC Good Practice Guidelines Table 2.16 (page 2.86) available at the following link: http://www.ipcc-nggip.iges.or.jp/public/gp/english/2_Energy.pdf

Any significant differences between these values will be reviewed, taking into consideration the overall magnitude of the emissions.

Accuracy and calibration of instruments

All meters will be purchased and maintained to ensure a high level of accuracy. The exact specifications of each meter will be determined during the detailed design of the project. Thereafter the meter accuracies will be included in this procedure and steps taken to maintain those levels of accuracy.

All key meters will be subject to a quality control regime that will include regular maintenance and calibration. A record will be maintained showing the location and unique identification number of each meter, the calibration status of that meter (when last calibrated, when next due for calibration) and who performs the calibration service. Calibration certificates will be retained for all meters until two years after the end of the crediting period.

Determination of carbon consumed on-site will be by mass balance and therefore accuracy is very important as small errors in large number (incoming wet gas and outgoing dry gas) will have a big impact upon the relatively small consumption of gas. Metering of gas consumption is being considered.

Archiving of data

The monitoring team will periodically archive data to a secure and retrievable storage format on a periodic e.g. weekly basis. Calibration records may be archived by scanning and storage in an accessible electronic format.

These data will be stored until 2 years after the end of the crediting period.

Document Control

The Project Manager will implement a document control system that ensures that the current versions of necessary documents are available at the point of use. All documents must be maintained in English with local translations because English is the formal language of the CDM.

Preparation of monitoring report

The archived / live data will be used to prepare a periodic monitoring report to be submitted to the CDM EB for verification and issuance of CERs. A standard format for the monitoring report will be prepared and prior to the submission of the first monitoring report.

Manual data recording system

The CDM Project Manager will implement a manual data recording system to act as a back-up for the on-line system. This will involve completion of a daily log sheet that records flow meter readings at the start of the day (which is also the end of the previous day). Spot readings of other values (temperature, pressure of gas, flow rate) will also be recorded periodically and at the times when flow meter readings are taken. At least one set of manual readings will be taken directly from the meters each day, and used to check the read-outs in the control room.

These log sheets will act as a back-up for total volume combusted and a means of estimating other essential data in the event of a prolonged failure of the on-line system (prolonged failure will constitute more than 24 hours (uninterrupted) without on-line monitoring).

Treatment of missing or corrupted data

Where data in the on-line system are corrupted or missing whilst the plant is operating (as shown, for example, stock change records) the missing data can be estimated by taking the lower of the average value for the parameter in question in the hour before the error arose or the hour immediately after the system came on-line again. If there is evidence to suggest that both of these values are un-representative, the average from the previous 24 hours will be used.

The error will be recorded in the daily log sheet and the occurrence of the error will be investigated and rectified as soon as possible. If the on-line system is compromised for more than 24 hours, data will be manually recorded.

Audit function and management review

The Project Manager will arrange for an audit of the management system periodically and at least once per year. The auditor will not be involved in the daily operation of the mine and if necessary, may be sourced from a third party. The auditor will assess the implementation of the monitoring procedure and the preparation of the monitoring report. Audit findings, and steps taken to address findings will be recorded and reviewed in a Management Review meeting (convened at least annually) at which time the effectiveness of these procedures will be reviewed and necessary changes implemented.

Please refer to Annex 4 for full details of the monitoring plan (available to DOE)

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)

>> 2nd April 2007. The baseline study was prepared by Gareth Phillips, Chief Climate Change Officer, Sindicatum Carbon Capital Ltd. Gareth,Phillips@carbon-capital.com, assisted by SCC’s competent consultants.

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:

>> 11th November 2004

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

>> 25 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:

>>not selected

C.2.1.2. Length of the first crediting period:

>>not selected

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>15th December 2007

C.2.2.2. Length:

>> 10 years

SECTION D. Environmental impacts

>>

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

>> Under the Indonesian State Minister of Environment (or Menteri Negara Lingkungan Hidup) decree No. 17 year 2001, organization or individuals are required to submit an Environmental Impacts Assessment (EIA) or "Analisa Dampak Lingkungan (AMDAL) to the State management agency for appraisal and approval prior to construction or renovation in a Project. And referring to the Indonesian Government Decree no. 27 year 1999, for the small size project, it should not submit an EIA but only Environmental Management Program or Upaya Pengelolaan Lingkungan Hidup (UKL) and Environmental Monitoring Program or Upaya Pemantauan Lingkungan Hidup (UPL).

The Tambun LPG plant and associated 35 km pipeline is considered a small project.

To meet the requirements, PT. Odira Energy Persada has been preparing and proposing in February 2005 the UKL & UPL which covers the entire activities for constructing the Mini LPG Plant at Kedungjaya, Babelan, Bekasi, West Java, and constructing the 8 inch diameter pipe line, about 35 KM length, from Babelan to Cikarang. Finally PT. Odira Energy Persada has got the UKL and UPL approval from Technical Director of Oil and Gas, Indonesian Directorate General of Oil and Gas, on March 04, 2005.

UKL and UPL

In describing the Environmental Impacts, prior to having approval on UKL and UPL, an environmental assessment undertaken in accordance with the procedures as required by the host Party.

1. **Scope of the UKL.**

Scope of activities and impact examined in the UKL and UPL :

- Pre-installation
- Construction/installation and commissioning activities
- Operation
- Accidental events

In evaluating the potential and significant impacts of activities, the following items and factors were taken into account during the assessment :

- Magnitude of impact (combining severity, scale, duration impact, and recovery ability of the receiving environment)
- Frequency of impact (probability occurrence)
- Potential regulatory and legal exposure (legislation requirements)
- Cost management (including technical difficulty of changing the impact), and
- Community and stakeholder concerns, effects on the company's public image

The assessment of the above factors are described in quantitative terms wherever this has been possible. A scoring system was also developed to assist the impact assessment. In accordance with this scoring system, a value of impact frequency (probability occurrence) and value of items (legislation requirement – Vl, cost management Vcm and community impact – Vc) is scored from 1 to 4. Level of impact significant increase from scores 1 to 4,

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:

(1) >> Major impacts : Oil Spill Response
Some impacts are deemed as significant but the only impact deemed unacceptable is a large-scale oil spill, which would occur only as the result of an accident. To minimize the changes of such an occurrence, all Oil or Condensate Tanks are provided with their own bund wall to cover the 100% full capacity of the tanks volume.

(2) Pipe Line Gas Leak Impacts

Some other impacts are deemed as significant but the only impact deemed unacceptable is a large-scale gas leak as the result of accident of the broken pipe line. To minimize the impact, PT. Odira Energy Persada installed 2 (two) Line Brake Control Valves (LBCV) at the 35 KM pipe line, and 2 (two) Emergency Shut Down Valves at the LPG Plant and Tegal Gede Receiving Point, to automatic close the valve whenever the35 KM pipe line is broken.

(3) Oily Water Impacts
The oily water that comes from the drain points of the process drums, or tanks, it is flowed into the Oil Catchers to separate the oil and water. The oil that is caught from the Oil Catcher is pumped into the Condensate Tanks, and the water from the Oil Catcher is flowed into the next Oil Catcher to catch or separate any oil that may be carried in the water. Finally the Oil Free Water is flowed into the Water Lagoon inside the LPG Plant area to ensure there is no any oily water flow into the rice field or other places.

(4) Other Environmental Impacts,
For other environmental impacts, as described above, PT. Odira Energy Persada established appropriate mitigation measures as well as proposing an Environmental Monitoring Program or Upaya Pemantauan Lingkungan Hidup (UPL), which includes the Discharge Monitoring at Source and Environmental Monitoring Source Program, approved in the UKL for LPG Plant and 35 KM Pipe Line Projects by Technical Director of Oil and Gas, Indonesian Directorate General of Oil and Gas, on March 04, 2005. Furthermore, the Regulatory Compliance Register was developed and distributed to employees for the purpose of ensuring compliance with all relevant HSE, Law, Regulations and Standards, including environmental legislation, standards and guidelines.

SECTION E. Stakeholders’ comments

>> Stakeholder consultation was undertaken as part of the normal planning and approval procedures in line with Indonesian regulations. In addition to this, a further stakeholder consultation for the purposes of CDM registration, was undertaken on Thursday 8th March.

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

>>Stakeholders were identified by preparation of a list of known stakeholders which included local residents, local village representatives, workers on the plant and their union representatives, local and national government environmental bodies and representatives of the DNA. In addition, a public notice of the meeting was posted in the local newspaper.
Participants were invited to attend a meeting at Hotel Horison, Bekasi, Krakatau Room commencing at 09.30 am.
The meeting started with an introduction to the project by Odira staff, followed by questions from participants and ended at 12.30, when lunch was served.

E.2. Summary of the comments received:

>>
1) Is there any justification other than economic reasons for constructing this plant? Is the CDM project just an effort to justify the project to the Ministry of Environment?

Answer: Response Initially, Odira considered the project from an economic point of view but on learning more about CDM, we realized that CDM could help overcome a number of problems the project faced. Consequently Odira committed to establishing the project under CDM. The CDM project is voluntary and there is no need to justify it to the Minitry of Environment or the DNA.

2) What efforts have the Project Owners made so that Bekasi citizen can get social and cultural benefits from LPG Plant development?

Answer: Odira and BBWM have been focused on these benefits. The first step we undertook was to maximize the hire of local (Kedungjaya) persons. There are 39 local employees out of total of 60 LPG Plant employees. They work as operators, technicians and security staff.

3) Have CDM mechanism been started? How far the local citizen been involved? Are the LPG Plant equipments meet the standards to avoid explosion?

Answer: The CDM program has just started, and it is a voluntary project. The team from Sindicatum came recently to complete the all CDM requirements. This meeting is one of company's efforts to involve the local society in this program. All LPG Plant equipment were constructed under International Standards, and these were certified by Directorate General of MIGAS or Oil and Natural Gas. We are avoiding any explosion or disaster to date.

4) What is the benefit of LPG Plant for society ? How much local citizen have been employed in LPG Plant? Is there a risk of the pipeline exploding? What kind of company efforts to prevent pipe line exploding?

Answer: All of equipment used by Odira has been tested and meets the necessary safety standards. The equipment has been certified by Government. We have received The Certification of Equipment Utilizing Eligibility (SKPP) and also will get The Certification of Installation Utilizing Elegibility (SKPI). Concerning employment of local citizens, please refer to our previous response.

5) Does Odira try to minimize the global warming effect or just run the company business?

Global warming reduction is a good opportunity which could be done by Odira. CDM program is an ideal combination of business and environment. There is no funding from other party. Implementing a CDM project Is not easy because there are additional costs. KLH will also give the project their approval.

6) [Referring to the Kedungjaya Development Program]: We agree with this program. However, 287 million per year budget from Migas for local development is insufficient. Does the LPG Plant support the Kedungjaya development program? How does the project contribute to society? Can Odira improve the communication between the Parties and the local community?

Answer: Oil and Gas contribution for region development is part of Pertamina and Local government responsibility, not Odira's responsibility. However a Community Development Program has been started by Odira. It starts from small scope according to the small income, but will be improving from time to time. Both of company and local society have the same expectation about a better living for local society. Odira commits to improve the impact on community development. Odira will provide some scholarships to the best Operators to the University for getting Engineer degree. Hopefully we could do some other things for the Community Development program in future.

Communication between company and local community has been started and will be improved.

In addition to the CDM SHC described herein, stakeholders were also contacted as part of the normal environmental permitting process described in Section D above. The following questions / comments were noted:
Surrounding villages were very supportive of proposals to reduce the flaring
Bad experience to date:
Land purchase was to be undertaken in transparent manner (without a broker)
They hope that Odira will not flare in their project because the heat from the flare had damaged crops
Better channels of communication between project owner and communities. Their experience was that Pertamina officers had no authority to communicate any information.
Maximise work opportunities for local residents from the – 35 unskilled permanent staff now employed, during 200 temporary workers during 1 year of construction
Project owner to support economy of local people – Odira pays $0.1 per mmBTU to community fund.

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

None of the comments required any specific actions from Odira. The participants at the meeting were satisfied with the responses received and showed their support for the project. Signed minutes of the meeting are available to the DOE in Bahasa Indonesia, along with a list of attendees.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	PT. ODIRA ENERGY PERSADA
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FAX:	+44 20 3008 4752
E-Mail:	Gareth.phillips@carbon-capital.com
URL:	
Represented by:	Gareth Phillips
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Middle Name:	
First Name:	Gareth
Department:	
Mobile:	

Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

NO PUBLIC FUNDING WAS UTILIZED IN THISPROJECT

Annex 3

BASELINE INFORMATION

Reference 1 Gas yield from Tambun: 12 mmscfd until end 2011, falling to 10 mmscfd thereafter

Reference 2. Average carbon content of incoming gas from monthly measurements. 3 examples of historic analysis

Reference 3. Average carbon content of products: Analysis of LPG available; and one full analysis of condensate available

Reference 4. Gas yield from PT: average mmscfd for 7/07 to 6/08 26.55 mmscfd; from then on, 27 mmscfd until end 2009. (See Ref 4)

Reference 5. Metrology Department calibration certificate for M1 (LP dry gas input)

Reference 6. Metrology Department calibration certificate for M4 (Tengal Gebe)

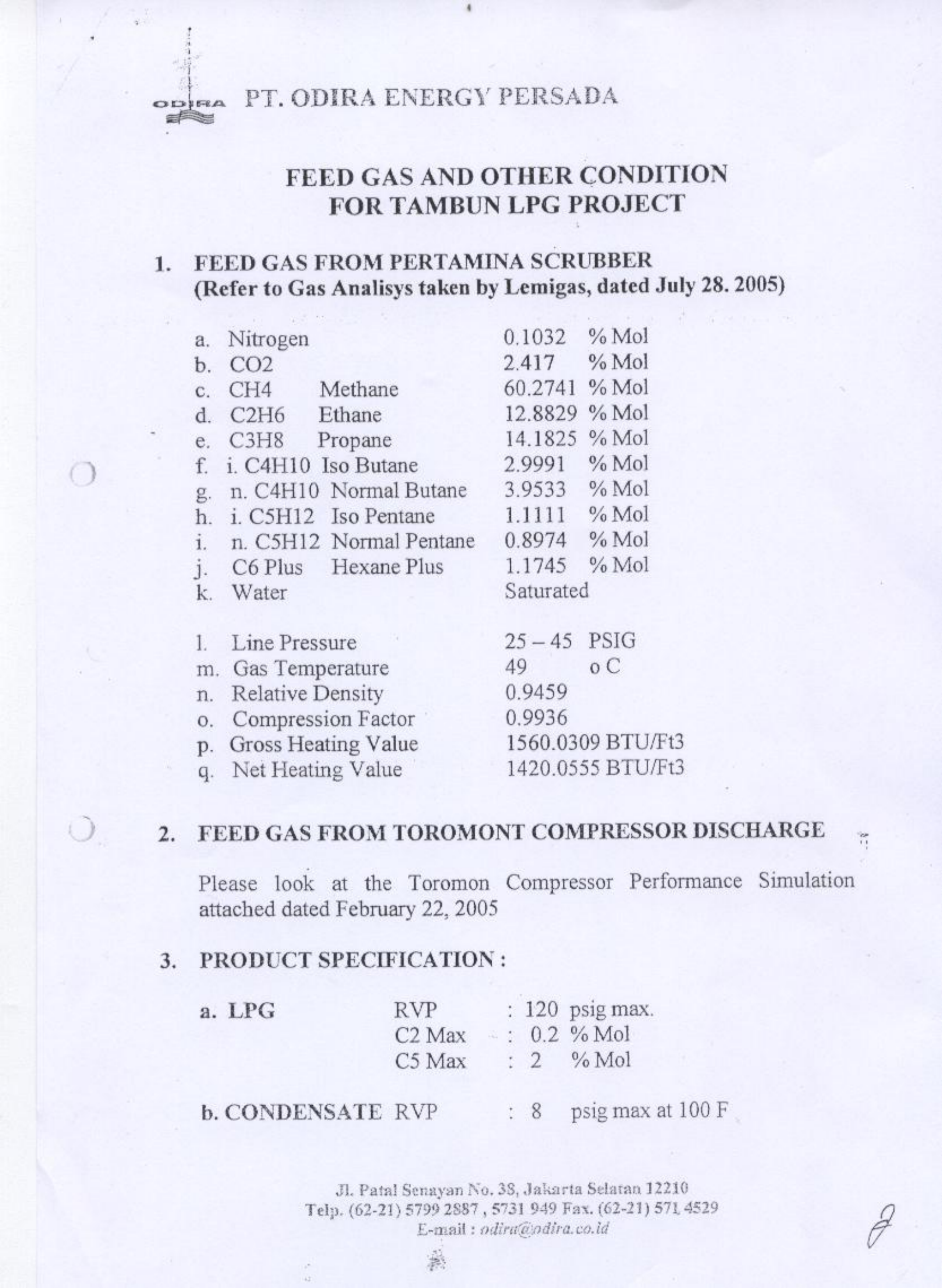
Reference 7 Fugitive Emissions Equipment list

Reference 8 Monthly Gas Report

Reference 9. Monthly LPG Report

Reference 10 Monthly Condensate Report

Reference 11 Monthly Diesel Report



PT. ODIRA ENERGY PERSADA

FEED GAS AND OTHER CONDITION FOR TAMBUN LPG PROJECT

1. FEED GAS FROM PERTAMINA SCRUBBER

(Refer to Gas Analisys taken by Lemigas, dated July 28. 2005)

a.	Nitrogen		0.1032	% Mol
b.	CO2		2.417	% Mol
c.	CH4	Methane	60.2741	% Mol
d.	C2H6	Ethane	12.8829	% Mol
e.	C3H8	Propane	14.1825	% Mol
f.	i. C4H10	Iso Butane	2.9991	% Mol
g.	n. C4H10	Normal Butane	3.9533	% Mol
h.	i. C5H12	Iso Pentane	1.1111	% Mol
i.	n. C5H12	Normal Pentane	0.8974	% Mol
j.	C6 Plus	Hexane Plus	1.1745	% Mol
k.	Water		Saturated	

l.	Line Pressure	25 – 45	PSIG
m.	Gas Temperature	49	o C
n.	Relative Density	0.9459	
o.	Compression Factor	0.9936	
p.	Gross Heating Value	1560.0309	BTU/Ft3
q.	Net Heating Value	1420.0555	BTU/Ft3

2. FEED GAS FROM TOROMONT COMPRESSOR DISCHARGE

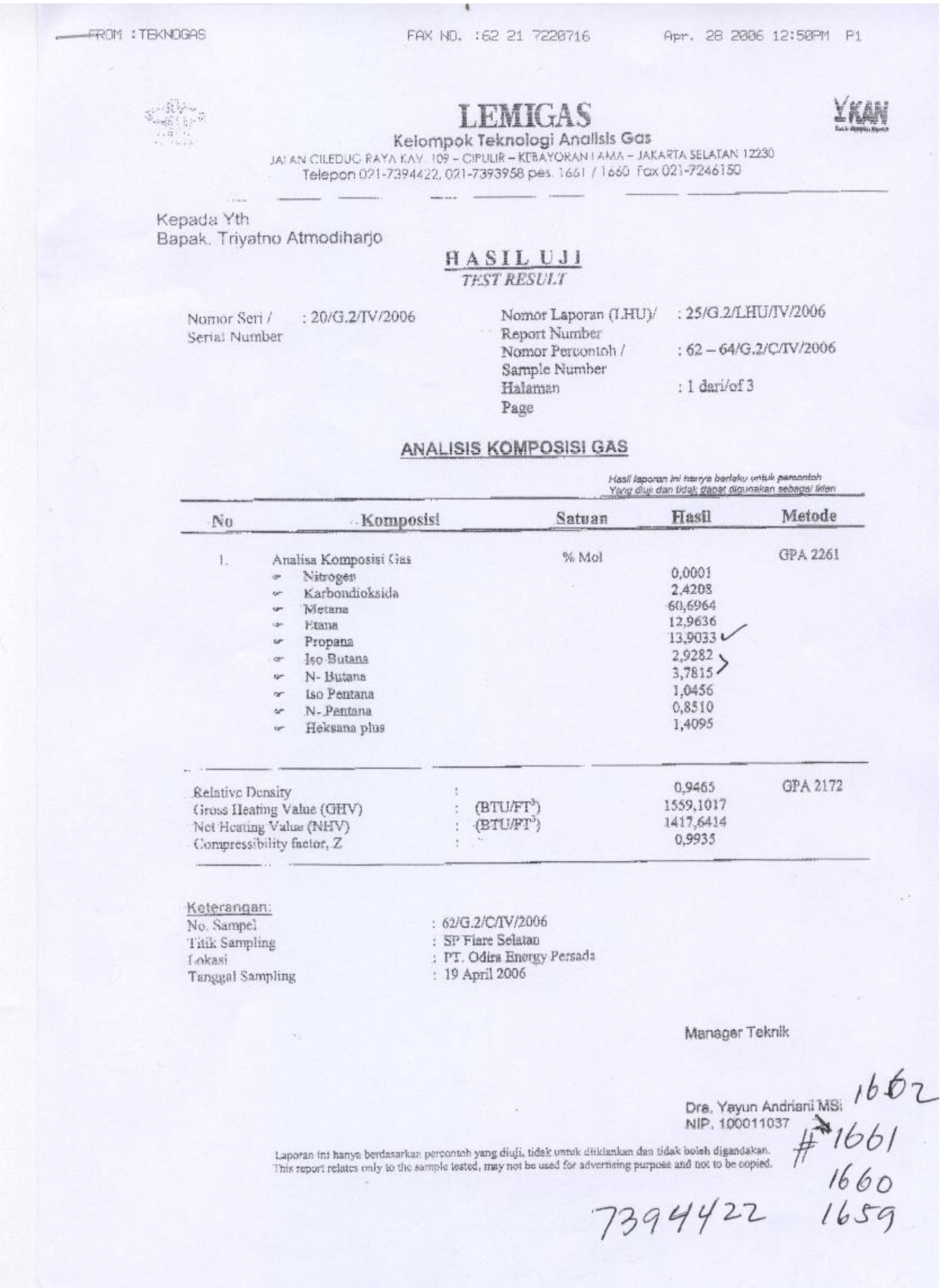
Please look at the Toromon Compressor Performance Simulation attached dated February 22, 2005

3. PRODUCT SPECIFICATION :

a. LPG
RVP : 120 psig max.
C2 Max : 0.2 % Mol
C5 Max : 2 % Mol

b. CONDENSATE RVP : 8 psig max at 100 F

Jl. Patal Senayan No. 38, Jakarta Selatan 12210
Telp. (62-21) 5799 2887 , 5731 949 Fax. (62-21) 571 4529
E-mail : odira@odira.co.id



FROM :TEKNOGAS FAX NO. :62 21 7220716 Apr. 28 2006 12:50PM P1

LEMIGAS
Kelompok Teknologi Analisis Gas
JALAN CILEDUG RAYA KAV. 109 – CIPULIR – KEBAYORAN LAMA – JAKARTA SELATAN 12230
Telepon 021-7394422, 021-7393958 pes. 1661 / 1660 Fax 021-7246150

KAN

Kepada Yth
Bapak. Triyatno Atmodiharjo

HASIL UJI
TEST RESULT

Nomor Seri / Serial Number : 20/G.2/IV/2006

Nomor Laporan (LHU)/ Report Number : 25/G.2/LHU/IV/2006
Nomor Percontoh / Sample Number : 62 – 64/G.2/C/IV/2006
Halaman Page : 1 dari/of 3

ANALISIS KOMPOSISI GAS

Hasil laporan ini hanya berlaku untuk percontoh Yang diuji dan tidak dapat digunakan sebagai iklan

No	Komposisi	Satuan	Hasil	Metode
1.	Analisa Komposisi Gas	% Mol		GPA 2261
	- Nitrogen		0,0001	
	- Karbondioksida		2,4208	
	- Metana		60,6964	
	- Etana		12,9636	
	- Propana		13,9033 ✓	
	- Iso Butana		2,9282	
	- N- Butana		3,7815	
	- Iso Pentana		1,0456	
	- N- Pentana		0,8510	
	- Heksana plus		1,4095	

Relative Density	:	0,9465	GPA 2172
Gross Heating Value (GHV)	: (BTU/FT^3)	1559,1017	
Net Heating Value (NHV)	: (BTU/FT^3)	1417,6414	
Compressibility factor, Z	:	0,9935	

Keterangan:
No. Sampel : 62/G.2/C/IV/2006
Titik Sampling : SP Flare Selatan
Lokasi : PT. Odira Energy Persada
Tanggal Sampling : 19 April 2006

Manager Teknik

Dra. Yayun Andriani MSi
NIP. 100011037

1662
1661
1660
1659
7394422

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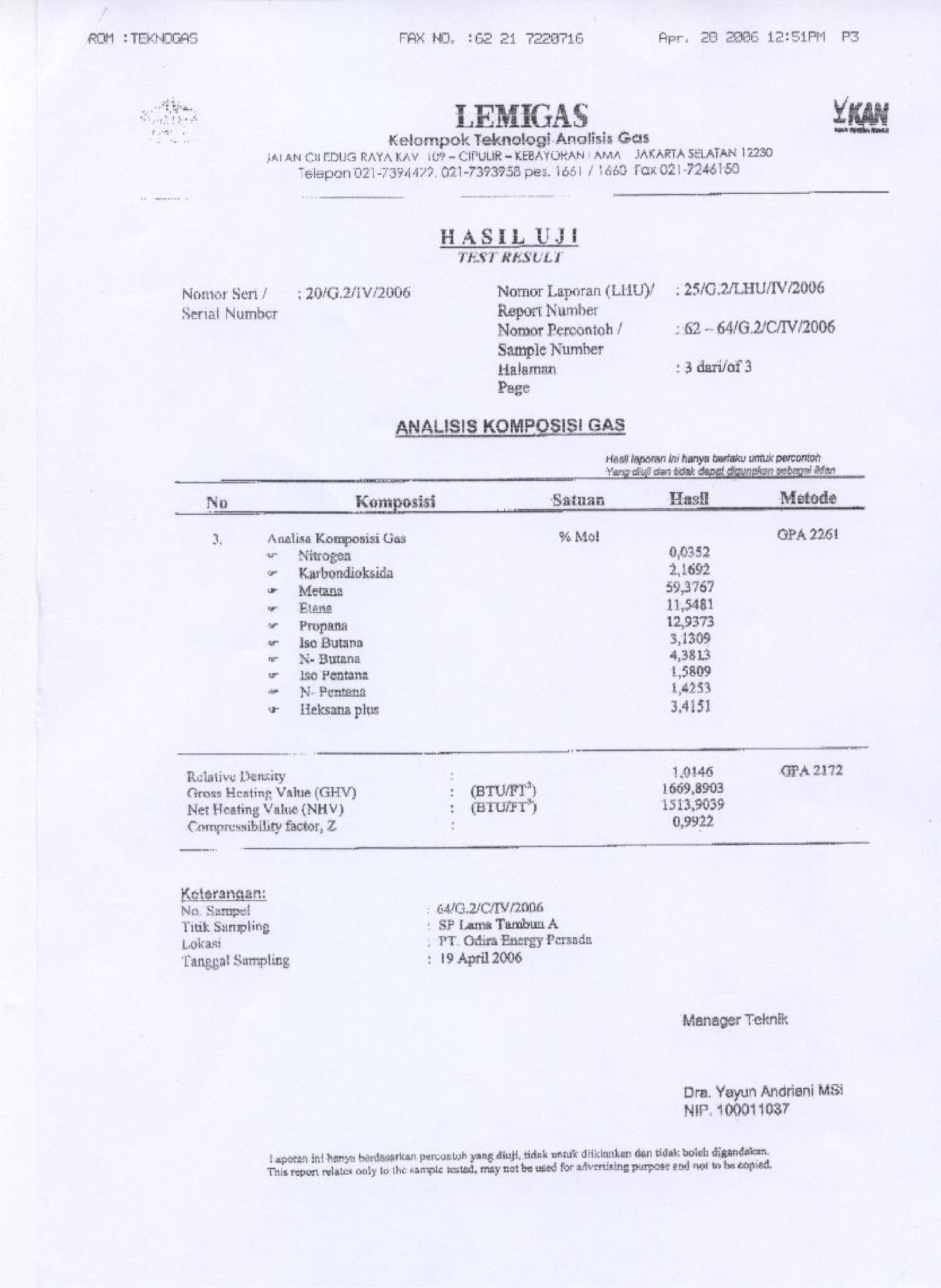

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LEMIGAS
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Telepon 021-7394422, 021-7393958 pes. 1661 / 1660 Fax 021-7246150

HASIL UJI
TEST RESULT

Nomor Seri / Serial Number : 20/G.2/IV/2006
Nomor Laporan (LHU)/ Report Number : 25/G.2/LHU/IV/2006
Nomor Percontoh / Sample Number : 62 – 64/G.2/C/IV/2006
Halaman Page : 3 dari/of 3

ANALISIS KOMPOSISI GAS

Hasil laporan ini hanya berlaku untuk percontoh
Yang diuji dan tidak dapat digunakan sebagai iklan

No	Komposisi	Satuan	Hasil	Metode
3.	Analisa Komposisi Gas	% Mol		GPA 2261
	☞ Nitrogen		0,0352	
	☞ Karbondioksida		2,1692	
	☞ Metana		59,3767	
	☞ Etana		11,5481	
	☞ Propana		12,9373	
	☞ Iso Butana		3,1309	
	☞ N- Butana		4,3813	
	☞ Iso Pentana		1,5809	
	☞ N- Pentana		1,4253	
	☞ Heksana plus		3,4151	

Relative Density	:		1,0146	GPA 2172
Gross Heating Value (GHV)	:	(BTU/FT^3)	1669,8903	
Net Heating Value (NHV)	:	(BTU/FT^3)	1513,9039	
Compressibility factor, Z	:		0,9922	

Keterangan:
No. Sampel : 64/G.2/C/IV/2006
Titik Sampling : SP Lama Tambun A
Lokasi : PT. Odira Energy Persada
Tanggal Sampling : 19 April 2006

Manager Teknik

Dra. Yayun Andriani MSi
NIP. 100011037

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Annex 4

MONITORING INFORMATION

Reference 4.1 Monitoring Plan and Report