



JOINT IMPLEMENTATION PROJECT DESIGN DOCUMENT FORM  
Version 01 - in effect as of: 15 June 2006

CONTENTS

- A. General description of the project
- B. Baseline
- C. Duration of the project / crediting period
- D. Monitoring plan
- E. Estimation of greenhouse gas emission reductions
- F. Environmental impacts
- G. Stakeholders' comments

Annexes

- Annex 1: Contact information on project participants
- Annex 2: Baseline information
- Annex 3: Monitoring plan

**SECTION A. General description of the project****A.1 Title of the Project:****Title of the Project : Minoil Flare Gas Reduction Project****Version number of the Document: 20061118****Date: 2006-11-18****A.2 Description of the Project**

It is a project of methane recovery which is suitable for a Joint Implementation (JI) project. The Minoil project covers flare gas utilization which otherwise would be flared.

The gas separation option seems the most appropriate - along with energy generation. First liquefying the heavier portions of the gas (butane/Propane) and then burning the remainder (methane) to produce electricity will reduce greenhouse gas emissions. The electrical generation will be done using natural gas and/or flare gas electrical generator of 120 KW electrical power. After gas processing the light fractions of gas will be effectively used for electric power generation - methane.

The extraction of oil generates consequent amount of Flare Gas (a high-BTU gas mainly composed of methane, ethane, butane and propane) that is flared. The amount of gas flared is estimated via a conservative statistical forecast and can rise dependent on new oil fields. The flare gas has a calorific value over 40MJ/Kg and is suitable for separation and/or direct burning in gas engines or gas turbines.

Electricity generation by Minijos Nafta facilities would result in direct and indirect reduction of CH<sub>4</sub> and CO<sub>2</sub> emission from fuel combustion on a statewide scale. Particularly after 2005 when the decommissioning of the only Nuclear Power Station of the Region, Ignalina NPP, will start.

The LPG recovered during the gas separation process will be sold locally in the area and will provide an affordable and less-polluting fuel for local cars. The electricity generated by the recovery of methane can in turn provide electricity to the national grid and/or provide electricity to nearby villages. It is important to note that the electricity grid is weak in the countryside area where the wells are situated. Hence the electricity produced by the methane recovery can reinforce the local electricity grid that is decaying. It can save the national electricity provider(s) from renewal of main electricity lines to the villages. It will allow local municipalities to support their sustainable development programs by having access to high quality electricity. Finally, it will also allow the development of carbon reduction project in this region and an efficient use of the resources of Lithuania, as the Flare gas will not be burnt for nothing but to generate energy.

**A.3 Project Participants:**

<b>A.3. Project Participants:</b>		
<b>Party Involved</b>	<b>Legal entity project participant</b>	<b>Please indicate of the party involved wishes to be considered as a project participant (Yes/No)</b>
Lithuania (Host Party)	Minijos Nafta UAB (Minoil)	No
Denmark	Ministry of Environment - Danish Environmental Protection Agency (DEPA)	Yes

JSC Minijos Nafta UAB, referred to as “Minoil”, is the largest of four oil producing companies in Lithuania extracting oil in the western part of the country. Minijos Nafta is the leading oil producing company in the Baltic States. Production is from 17 wells located in 8 different well sites. Minijos Nafta flares the associated gas at the well sites. <http://www.minijosnafta.lt/>

Danish Carbon – DEPA, as supporting financing of the project with an ERPA. The Ministry of Environment of the Kingdom of Denmark. <http://www.mst.dk/transportuk/01070000.htm>

LitPronergija – is engineering consultant and PDD developer. - [www.lit-energy.com](http://www.lit-energy.com)

Further information about the parties in Annex 1.

**A.4 Technical Description of the Project:**

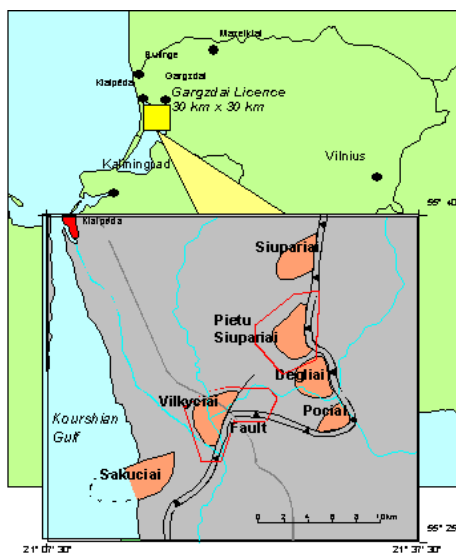
The project involves utilization of flare gas for two purposes: production of LPG as car fuel and power production from separated light hydrocarbon mixture(methane/ethane) or dried flare gas as the case may be . Gas condensation plants will be established at each selected well site and will separate heavy hydrocarbons (propane, butane) from the light ones (methane, ethane). Separated light fraction will be used in power generators on-site while the liquidized heavy hydrocarbons, where possible, will be transported by trucks to Vilkyčiai gas separation plant for LPG production.

**A.4.1 Location of the project:****A.4.1.1 Host Party:**

**Lithuania** is Member of the European Union. Situated North of Poland and South of Latvia.

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

The Project is situated in the Licensed **Region of Gargzdai** in Western Lithuania near the Baltic sea.



**A.4.1.3 City/Town/Community selected:**

Well sites selected for the project: Vilkyčiai, Pietu Siupariai, Degliai, Siupariai, Sakučiai, Uoksai, Agluonieniai and Pociai and other well sites -currently under drilling at Kintai and Pangiriai. The selected well sites include over 20 oil wells.

Due to current drilling of new wells, the host company reserves the right to change the configuration for LPG production (sites of production) and Electricity generation on site (quantities and location). The sites of Siuparai, Sakučiai, Pociai and Kintai and Pangiriai have undergone a program of drilling that will produce oil and associated gas for the period of consideration. Figures are not yet available for Kintai. Depending on production level at these sites, it will be reported under the monitoring and reporting and the baseline will be adapted accordingly.

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

The “**Minoil Flare Gas Reduction Project**” will take place in the physical location of:

**Country:** Lithuania

**Region:** Gargzdai

**Villages' Names** (with Geographical Location coordinates in LKS94 or Unical System (Lithuanian):

Pietu Siuparai – (LKS94) X = 6162542 ; Y = 341021

Vilkiciai -(LKS94) X= 6155618 ; Y = 332911

Degliai -(LKS94) X = 6158914 ; Y = 341308

Sakučiai – (LKS94) X = 6151530 ; Y = 326743

Pociai – (LKS94) X= 6155537 ; Y = 343532

Siuparai – (LKS94) X = 6169525 ; Y = 346729

Kintai – (Unical-Nr.) 4400-0116-7559

Pangiriai – (Apmin-Ref.) - Nr.9.14.2 – V4-4348

Uoksai – (related to Siuparai Ref. - see above)

Agluonieniai – (related to Siuparai Ref. - see above)

The technologies and sizes of systems used for each site is dependent on the production at each site and might vary depending on production and time.

**A.4.2 Technologies to be employed, or measures, operations or actions to be implemented by the project:**

At the moment associated gas is flared in open flares at the company's well sites.

There has been two 120 KW power generators installed for testing purposes -only- at two well sites: Vilkyčiai and Pietu Siupariai, on a temporary basis. The generators used associated gas directly without separation for power production.



The project involves utilization of flare gas for two purposes: production of LPG as car fuel and power production from separated light hydrocarbon mixture and as the case may be from dried Flare gas.

**Gas condensation & separation plants** will be established at selected well sites and will separate heavy hydrocarbons (propane, butane) from the light ones (methane, ethane) when possible. Then the separated light fraction (methane) will be used in **power generators on-site** while the liquidized heavy hydrocarbons will be transported by trucks to Vilkyciai gas separation plant for LPG production. If there is not enough Flare Gas to be separated then Flare Gas will be directly burnt into generator to produce electricity.

#### **Main Technologies:**

Technology 1: Gas Condensation & Separation – to produce LPG and Methane separately

Technology 2: Electricity Generator power by Gas engine

Supplementary technologies could increase the emission reduction project further by increasing the efficiency of energy production versus the fuel. But that cannot be taken in account due to local conditions at the time of writing the Project Design Document – such as non existent heat water piping system for district heating or industrial local farmers to absorb heat or connection to national electricity grid.

#### **Supplementary Technologies:**

Technology 3: Co-generation System powered by Gas engine/turbine

Technology 4: Heat-Pumping from wells to produce hot water for District Heating

Technology 5: Heat to Electricity Binary Plant

These supplementaries technologies will be taken into account by the Participant according to local development from local farmers and local authorities. But the project will start with the Implementation of systems based on the Main technologies.

#### **A.4.3 Brief explanation of how the anthropogenic emissions of greenhouse gases by sources are to be reduced by the proposed JI project, including why the emission reduction would not occur in the absence of the proposed project, taking in to account national and/or sectoral policies and circumstances:**

Emissions are reduced below the level that would occur in the absence of this project by using previously flared gas for electricity and LPG generation.

#### **Assessment of other alternative baseline scenarios**

Heat production was also considered during the project screening phase, but the idea was abandoned due to economic considerations. The neighboring areas do not have enough potential users of district heating, and the cost of DH network development would be too high for the project. Another drawback would be security of heat supply – it would be impossible to guaranty the continuous heat supply at the stable temperature to the DH network, due to fluctuations in amounts of associated gas. In case of gas network, there also would be not enough users in the surrounding areas to make a development of gas network economically viable. Hence, the power generators without heat utilization (co-generation) will be installed at the selected well sites.

In conclusion, the only plausible scenarios are the baseline scenario i.e the flaring of all associated gas, and the project scenario i.e. the use of parts of the gas for the production of electricity and LPG.

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**Financial Barrier**

The problem is to sell produced excess power to the grid. Power suppliers at the moment, according the Lithuanian law are not obliged to buy in power produced from associated gas as it is not considered renewable energy source<sup>1</sup> nor as energy produced from waste gas. Hence, Minoil would have to negotiate with local power supplier JSC “Vakaru Skirtomieji Tinklai” (VST) about the possibility to sell power to the national grid.

The negotiations between Minoil and VST have been ongoing for more than a year but have not yet given any results. There is no economic interest from the VST side to purchase power produced from associated gas as the supply reliability of such power would be rather low.

A different situation is with LPG production. There is an increasing demand on the market for LGP as a car fuel due to growing prices for gasoline and diesel oil. This trend makes a situation that LPG can be easily sold on the market. Considering this, the maximum Propane-butane extraction is assumed for the project.

**LPG & Electrical Production On-Site:**

<i>Net Benefits of Scenario 2 (No ERUs)</i>	<i>6.2</i>	<i>million USD</i>	<i>IRR Scenario 2 (No ERUs)</i>	<i>8%</i>
<i>Net Benefits of Scenario 2 (w ERUs)</i>	<i>8.6</i>	<i>million USD</i>	<i>IRR Scenario 2 (w ERUs)</i>	<i>13%</i>

In the Scenario with electricity and LPG production, the project goes just over 10% with ERUs and without ERUs is less than 10% which would not make the project receivable for investment by the Board of Minijos Nafta.

**Technological Barrier**

The production of LPG from flared gas is the first of its kind in Lithuania. All major equipment had to be imported from Russia and the EU. The equipment was bought in 2004 but only installed in 2006 due to delays during the approval of design documentation and pending permission. Also, the electricity generators are specifically designed to burn a mixture of associated gas.

**Regulatory Barrier**

The energy strategy of Lithuania (Energy Strategy 2002) highlights the importance of reduction of national dependence on one fuel supplier (Russia). For this purpose power producers are given incentives to use several kinds of fuel and especially to use indigenous and renewable energy sources. Since the oil extracted in Lithuania is considered as indigenous energy source – it is supported by the government. As a result, oil extracting companies are not imposed with any additional financial burdens related to use of the natural resources i.e. they are not charged for carbon release. This situation is not likely to change in the near future. Another argument for additionality is that the oil extracting companies are not included into the Phase 1 of the EU emission trading scheme (EU ETS), so they do not have an incentive for reducing their carbon emissions.

**Current Practice Barrier**

There is no incentive from the government to reduce gas flaring – and CO<sub>2</sub> emissions from gas flaring. The licenses of Minijos Nafta (Minoil) allow flaring without any restriction. Hence without the JI project the CO<sub>2</sub> emission would not be reduced.

Due to these barriers, Minijos Naphta contacted carbon consultants already in 2003, in order to provide much

<sup>1</sup> Power suppliers are obliged to buy in power produced from the renewable sources, according to given quotas for each supplier (Decision no 1474, 5 December 2001, Lithuanian government)



needed support to the project.

*Therefore given the above descriptions of barriers the project is additional.*

**A.4.3.1 Estimated Amount of Emission Reduction over the crediting period :**

**147 529 tCO<sub>2</sub> over the Crediting Period**

	Years
Length of the crediting Period	5
Year	Estimate of annual emission reduction in tonnes of CO <sub>2</sub> equivalent
2008	36,293
2009	31,905
2010	28,586
2011	26,350
2012	24,395
Total estimated emission reduction over the crediting period (tonnes of CO <sub>2</sub> equivalent)	147,529
Annual average of estimated emission reduction over the crediting period (tonnes of CO <sub>2</sub> equivalent)	29,506

**A.5 Project Approval by the Parties involved:**

**Host Country:** Ministry of Environment of Lithuania - Letter of Approval

**Danish Carbon :** Ministry of Environment of Denmark - Letter of Approval .

*Scanned Copies of the referred Above Documents:*

**Lithuanian Ministry of Environment -Letter of Approval:**

Fax

22 Jun 2006 9:50 P001/002

**LIETUVOS RESPUBLIKOS APLINKOS MINISTERIJA  
THE MINISTRY OF ENVIRONMENT OF THE REPUBLIC OF LITHUANIA**

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DK- 1401 Copenhagen K  
Denmark

19 -06-2006

No. (10-5)-D8- 5164

Cc: JSC „Minijos Nafta“  
JSC „LitPronergija Engineering“  
Lithuanian Environmental Investment Fund

**LETTER OF APPROVAL**

The undersigned, as legal and authorized representative of Lithuania (the Host Country), referring to the project Minijos Nafta JSC Joint Implementation project - „Minijos Flare Gas reduction Project“ (the JI Project), submitted by Minijos Nafta JSC (the Project Host) to Danish Carbon, herewith declares that:

1. The Host Country has ratified the Kyoto Protocol.
2. In order to participate in activities under Article 6 of the Kyoto Protocol the Host Country is aware that it should comply with the eligibility requirements as stated in the Marrakesh Declaration no later than September 2006.
3. The Host Country recognises the JI Project to be a Joint Implementation project in accordance with Article 6 of the Kyoto Protocol and its underlying decisions.
4. The Host Country authorises the Project Host and any future owner of the JI project to generate Claims on ERUs, by operation of the JI project, in accordance with Article 6 of the Kyoto Protocol.
5. The Host Country accepts the transfer amount, percentage of verified ERUs, generated through the JI Project to the Government of Denmark during the period 2008-2012 of the JI Project, through the transfer of ERUs by the Host Country. The transfer of ERUs is irrespective of any legal or other transfer of the JI project to third parties.
6. The transfer of ERUs from the Host Country to Denmark will be free of any taxes or levies.
7. The transfer of ERUs from the Host Country to Denmark is irrespective of any legal or other transfer of the JI Project to third parties.
8. In case the Host Country and Denmark fully comply to the participation requirements of the

Dokumentas pateiktas rašomai.



page 2- LoA

Marrakesh accords, the transfer of ERUs will be based on Article 23 of these accords (JI track one).

9. The Host Country acknowledges the fact that the JI Project will already be operational prior to 2008 and will reduce GHG emissions in the period. According to national laws of the Host country ERUs generated by the JI Project could be transferred to Denmark only after 2008. Prior to 2008 there is a possibility to accumulate a reserve of ERUs on purpose to transfer them to Denmark during the first commitment period and during the second commitment period, i. e. after 2012.

Aleksandras Spruogis  
Undersecretary of the Ministry

J. Rabauskaite, (+370 5) 2663508, e-mail: j.rabauskaite@am.lt

Dokumento pakeičios nuoroda



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**DANISH MINISTRY  
OF THE ENVIRONMENT**

Environmental  
Protection Agency

J.nr. 3212-00004  
December 8 2006

**Letter of Approval for project under Article 6 of  
the Kyoto Protocol – Joint Implementation**

Undersigned, as a legal and authorised representative of the Designated Focal Point for the Kingdom of Denmark under the Kyoto Protocol to the United Nations Framework Convention on Climate Change,

Noting that the Danish Environmental Protection Agency has confirmed that they are a project participant in the proposed Joint Implementation project "Minoil Flare Gas Reduction Project" ("the Project") in Lithuania;

Considering that the Project by implementing technologies to utilize associated gas from oil production to produce electricity is expected to provide a reduction in greenhouse gas emissions by sources that is additional to any that would otherwise occur;

declares that:

1. The Kingdom of Denmark has ratified the Kyoto Protocol to the United Nations Framework Convention on Climate Change on May 31, 2002;
2. Denmark recognises "Minoil Flare Gas Reduction Project" to be a Joint Implementation project under article 6 of the Kyoto Protocol and underlying decisions;
3. Denmark authorises the legal entity "Danish Environmental Protection Agency" as a project participant in the Joint Implementation project activity of "Minoil Flare Gas Reduction Project" in Lithuania.

This letter of approval is issued in pursuance of § 21 a in the Danish Law on CO<sub>2</sub> allowances and amendments hereto.

Signed on behalf of the Environmental Protection Agency in its capacity as the Danish Designated Focal Point for the Joint Implementation:

Karsten Skov

Deputy Director-General

**SECTION B. Baseline****B.1 Description and Justification of the baseline chosen:**

The methodology is based on measuring the amount of gas which would have been sent to the flare in the absence of the project, as well as all useful products from the use of this gas. The methodology uses the logic of the approved CDM methodology AM0009 version 2.

The justification is that this allows for measurable emission reductions. The following outlines the equations and the assumptions used:

**Baseline emissions**

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. 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 assumption, as accounting of methane emissions from flaring would increase baseline emissions. Baseline emissions are calculated as follows:

$$BL_y = BL_{A,y} + BLDE_y \quad (11)$$

where:

$BL_{A,y}$  Are the baseline emissions during the period  $y$  in tons of CO<sub>2</sub> equivalents.

$BLDE_y$  is the baseline for displaced electricity from the grid

$BL_{A,y}$  Is the Base Line calculated based on the gas recovered  $V_A$  from the oil fields at point A in Figure 1 during the period  $y$  – calculation is done according to the AM0009 as described in Chapter B and in the Annex 2.



### *Flared gas*

The project intends to measure the gas flow and the carbon content of the gas previously flared. The project uses the approach from the previously approved CDM methodology AM0009 version 2 and assumes full oxidization.

$$BL_{A,y} = V_{A,y} * w_{carbon,A,y} * 44/12 * 1/1000 \quad (11.1)$$

where:

$BL_{A,y}$  Are the baseline emissions during the period y in tons of CO<sub>2</sub> 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<sup>3</sup>.

$w_{carbon,A,y}$  Is the average content of carbon in the gas recovered at point A in Figure 1 during the period y in kg-C/m<sup>3</sup>.

The average methane content in the gas  $w_{carbon,A,y}$  is determined from regular measurements of the composition of the gas, taking into account the molecular weight of all fractions of the gas. A weighted average is determined for the project sites based on the 2005 production level for each well sites.

Updated Production figures :2005 – used to calculate the weight of production for the GOR Factor and for the average carbon content  $w_{Carbon,A,y}$ .



Minijos Nafta Year 2005 Sources: Letter 15 Nov.2006-Minoil

Oil Fields	Oil Production (M3)	GOR m3/m3	Flare Gas Production (M3)	Weight (%)	Weigthed GOR
Vilkyčiai	49,848	34.17	1,703,306	29.68%	10.14
Pietų Šiūpariai	25,859	51.69	1,336,653	23.29%	12.04
Diegliai	14,204	51.28	728,365	12.69%	6.51
Šiūpariai	8,402	55.30	464,653	8.10%	4.48
Sakučiai	18,139	48.70	883,374	15.39%	7.50
Pociai	15,750	27.78	437,588	7.62%	2.12
Agluonėnai	1,687	86.03	145,124	2.53%	2.18
Uoksai	772	52.33	40,413	0.70%	0.37
<b>TOTAL</b>	<b>134,662</b>		<b>5,739,476</b>	<b>100%</b>	<b>45.32</b>

**Average GOR (m3/m3) 45.32**

Sources: Letter 17 Nov.2006-Minoil (Pangiriai Oil Field)

Minijos Nafta Forecast And Letter 15 Nov.2006-Minoil (General Oil Fields)

Year(y)	Oil Production (M3)	GOR m3/m3	Flare Gas Production $V_A$ (M3)
2008	281,448	45.32	12,755,399
2009	247,415	45.32	11,212,995
2010	221,675	45.32	10,046,429
2011	201,427	45.32	9,128,797
2012	185,272	45.32	8,396,643
<b>TOTAL</b>	<b>1,137,238</b>		<b>51,540,262</b>

Forecast Based on averaged Production on existing Oil Sites,  
Based on the Minoil 2007 Development Programme for existing oil sites,  
Including the pangiriai Oil Site.

Sources: Letter 17Nov 2006, Letter 15Nov2006 and Letter 24Nov2006 from Minijos Nafta to DNV.



Calculation of the average Carbon factor for Minijos Nafta flare gas, in the Annex 2.

<b>Carbon Content – Minoil Typical Gas</b>	
Typical Minoil Gas (Weighted Average) $w_{carbon,A}$ KgC/m <sup>3</sup>	<b>1.090</b>
$K_{CO_2,A}$ KgCO <sub>2</sub> /M <sup>3</sup>	<b>3.997</b>

Flare Gas Base Line:

**Flared Gas – Baseline (Formula 11.1)**

Years (y)	$w_{carbon,A}$	$V_{A,y}$	$BL_{A,y}$
2008	1.09	12,755,399	50,977
2009	1.09	11,212,995	44,813
2010	1.09	10,046,429	40,151
2011	1.09	9,128,797	36,484
2012	1.09	8,396,643	33,558
<b>TOTAL</b>		<b>51,540,262</b>	<b>205,983</b>

*Electricity displaced from the grid*

**Emissions related to power consumed for the on-site oil extraction**

At the present power consumed for oil extraction is supplied from the national grid. After the project implementation the power produced by the generators will substitute power from the power grid. Hence the same baseline that was estimated for the national power grid will be used to estimate emission reductions related to power consumed for on-site oil extraction. Power produced by on-site generators using methane-ethane will result in different amount of CO<sub>2</sub> compared to the flaring of associated gas, due to the different composition of gases flared. The emission factors for the on-site power production will be calculated.

*The baseline emissions from displacing electricity from the grid are calculated as follows:*

$$BLDE_y = (\sum Kwh_{,displaced,y}) \cdot KCO2_{,grid,y} \quad (11.2)$$

$Kwh_{,displaced,y} = (\sum Kwh_{,generators}) - Kwh_{,gas\ plant, project,y}$  is the electricity displaced from the grid in KWH

$Kwh_{,generators}$  is the total Kwh generation by electrical generator for the year y on the oil fields,

$Kwh_{,gas\ plant, project,y}$  is the KWH generation use for all equipments related to the project ( ie gas processing plant, pumps, pipeline pumps, security equipment etc..)

$KCO2_{,grid,y}$  is for the year y, the CO<sub>2</sub> Lithuanian grid factor equivalent in Ton of Co<sub>2</sub> for per Kilowatt of electrical power displaced from the Lithuanian grid. Either in force in Lithuania and/or in the EU and/or calculated as proposed in the PDD while doing the monitoring. (is determined in the table 4 for the period 2008-2012).

**Baseline from Electricity Displaced (Formula 11.2)**

Years(y)	$\sum Kwh_{,generators}^*$	$Kwh_{,gas\ plant}^{***}$	$Kwh_{,displaced,y}$	$K_{CO2,grid,y}^{**}$	$BLDE_y$
2008	22,298,378	8,865,002	13,433,375	0.457	6,139
2009	19,602,020	7,793,031	11,808,989	0.457	5,397
2010	17,562,687	6,982,268	10,580,419	0.457	4,835
2011	15,958,525	6,344,514	9,614,012	0.496	4,769
2012	14,678,609	5,835,667	8,842,942	0.514	4,545
<b>TOTAL</b>	<b>90,100,219</b>	<b>35,820,482</b>	<b>90,100,219</b>		<b>25,685</b>

* Generator 20M3 per Hours (Methane/Ethane) – source: Schmitt-Enertec Doc.FMB190GMK	
Power Ratio	3.33 KWH/NM3
**From KCO2grid from Table 4 – calculated	
***PeterburgNiimach- Technical Documentation	
Gas Processing Recovery Efficiency	0.7 KWH/M3flareGas



### Emissions related to substituted power on the national power grid

The Power on the national Grid would be produced in the absence of the JI Project.

Minoil project will substitute power from the national power grid in Lithuania. This means that power production in other power plants on the grid will be reduced by a certain amount. Decline in power production will also result in CO<sub>2</sub> emission reductions. In order to calculate these reductions, one has to know the present average CO<sub>2</sub> emissions of power production in the country. Most often emissions baseline for power production is expressed in t CO<sub>2</sub> / MWh generated. CO<sub>2</sub> emissions baseline for power grid in Lithuania is estimated in this chapter.

Since the electricity grid in Lithuania is fully integrated, the entire grid is selected as emission boundary for this project. First step for developing emissions baseline is to choose the right baseline approach. BASREC JI guidelines suggest three types of baseline approach:

- Baseline based on actual or historical data
- Baseline based on economically attractive technology
- Baseline based on average emissions of similar activities

Baseline based on actual or historical data is not appropriate for Lithuania's case because of planned significant changes in the energy sector: decommissioning of Ignalina Nuclear power plant (INPP), planned reconstruction of Lithuanian Power Plant (LPP), and planned erection of new CHPs. These changes will significantly influence emission levels resulting from power production, which will not be consistent with the historical data.

Baseline based on economically attractive technology looks not to be exactly appropriate for the Minoil project. Lithuania's total installed power generation capacity exceeds demand of the country several times. So it is not likely that new power plants will comprise significant share in power generation by 2012. There are also power plants under construction in neighboring Kaliningrad and Riga that reduces potential for new installed capacity in Lithuania. Therefore emissions from new power plants in Lithuania are not likely to comprise a significant share in the total CO<sub>2</sub> emissions of the country.

The BASREC JI guidelines (BASREC 2003) suggest a baseline approach appropriate for countries in Central and Eastern Europe, where the economy as well as energy sector has undergone significant changes. The guidelines suggest to project production and emissions data into the future. The guidelines mention that such data should be derived from analysis of expansion plans, economic models and extrapolation of current trends for the future. It is also recommended to exclude nuclear power plants and large hydro from calculation. This approach was chosen for the Minoil project as most suitable one.

In order to project future emissions from power generation, two variables must be forecasted: the contribution of each power plant to the power generation expressed in percentage and the aggregated average fuel mix used by each type of power plant. To evaluate the first variable the results from "Economic analyses in the electricity sector in Lithuania" (Elkraft System, COWI et al. 2002) were used. The report is part of EU Phare Twinning Project "Restructuring of Lietuvos Energija". Balmorel model was used in the project make projections of power sector in Lithuania. A number of variables were used in the model: heat and electricity demand, technical and financial characteristics for each kind of production unit, environmental taxes and quotas, possibilities for transmission of electricity between regions and countries. Model results in the baseline scenario (common Baltic power market with the phased closure of INPP) are presented in Appendix III. These results were used for Minoil PDD to find out the contribution of each power plant to the total power production expressed in percentages (see Table 1). The percentage of Condensing TPP, old CHPs and new CHPs are expressed by comparing to all thermal PP. All thermal, Nuclear and Hydro PP production shares are compared to the total production for the certain year. Contribution of condensing, old and new CHPs is expressed as a fraction of All thermal PP.

The results of the Elkraft - COWI study were adjusted to the present conditions in the energy sector. It was assumed the shares of power generating plants will be stable during the period of 2005-2010.

**Table 1 forecast of power generation shares in %**

Year	2004	2005	2011	2012
<b>All Thermal PP</b>	<b>14,0%</b>	<b>48,0%</b>	<b>96,5%</b>	<b>96,7%</b>
Condensing TPP	9,2%	54,4%	49,8%	53,9%
CHPs	90,8%	34,7%	27,5%	24,7%
New CHPs	0,0%	10,8%	22,8%	21,4%
<b>Nuclear PP</b>	<b>84,0%</b>	<b>49,7%</b>	<b>0,0%</b>	<b>0,0%</b>
<b>Hydro PP</b>	<b>2,0%</b>	<b>2,3%</b>	<b>3,5%</b>	<b>3,3%</b>

The next step is to forecast the fuel mix that will be used in each power plant. The data about present fuel consumption was taken from the annual report of the Association of Heat Producers in Lithuania and directly from Lietuvos elektrine power plant (LPP). To forecast fuel mix changes the National Allocation Plan for Lithuania under EU ETS (NAP 2004) was used. The forecasts for fuel mix in NAP are available only for 2005-2007 hence the assumption was made that the forecasted fuel mix for 2007 will remain constant until the end of the crediting period (i.e. 2012). Calculation results are presented in Annex 2.

While forecasting future fuel mix, the main consideration is fuel prices. The assumption made in NAP is that Lithuanian PP will use up to 80% of Orimulsion in its fuel mix for power production by 2007 and the fuel mix ratio in Vilnius and Kaunas CHPs is predicted to be 60% natural gas and 40% heavy fuel oil. The predictions for the high consumption of Orimulsion can be justified by the fact that the cost of produced MWh using Orimulsion is almost twice less than the MWh produced using natural gas (LEI 2004).

Orimulsion as well as Heavy fuel oil is more carbon intensive fuel than the natural gas. This means that Orimulsion and HFO would require more CO<sub>2</sub> allowances compared to natural gas. However, the price of an allowance should be around 200 LTL for Orimulsion to become more expensive type of fuel than the natural gas. The price of an EU allowance at the beginning of July 2005 was about 90 LTL. Hence, the marginal price of CO<sub>2</sub> allowance at its present price is twice lower compared to the marginal savings on fuel (orimulsion against natural gas). Hence, an assumption can be made that Orimulsion will be an attractive fuel type for Lithuanian TPP during the crediting period.

At the present fuel prices, Orimulsion is cheaper type of fuel than the natural gas. However, the price of heavy fuel oil (HFO) at the moment is very high and is expected to decrease. The price for natural gas is predicted to increase due to growing global demand for it. Due to these conditions fuel mix forecast in NAP can be justified. For the marginal fuel price and CO<sub>2</sub> allowance price calculation results see Annex 2.

Power plant contribution to the total power generation and the average fuel mix then was translated into the emission factors for three types of thermal power plants: condensing TPP, old CHPs and new CHPs. CO<sub>2</sub> emission factors for fuel combustion were used from the BASREC JI guidelines, and the country specific fuel calorific values were taken from the Lithuanian Energy Institute report (LEI 2004). The following fuel conversion efficiency factors were used for calculation: new CHPs - 0,88, old CHPs - 0,70 and condensing TPPs - 0,38. The results are presented below:

**Table 2 Emissions from electricity production, tCO<sub>2</sub>/MWh**

Fuel	New CHP	Old CHP	Condensing TPP
Natural gas	0,178	0,289	0,531
Heavy fuel oil	0,245	0,398	0,733
Orimulsion	0,256	0,415	0,765

Emission factors then were adjusted to average fuel mix forecasts. Results are presented in Table 3.

**Table 3 Emission factors according to fuel mix forecasts, t CO<sub>2</sub>/MWh**

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Condensing TPP</b>	0,574	0,588	0,635	0,728	0,728	0,728	0,728	0,728	0,728
<b>CHPs</b>	0,319	0,339	0,339	0,339	0,339	0,339	0,339	0,339	0,339
<b>New CHPs</b>	0,000	0,178	0,178	0,178	0,18	0,178	0,178	0,178	0,178

Then the factor of table 2 are applied weighted using the LEI fuel mix as described above.

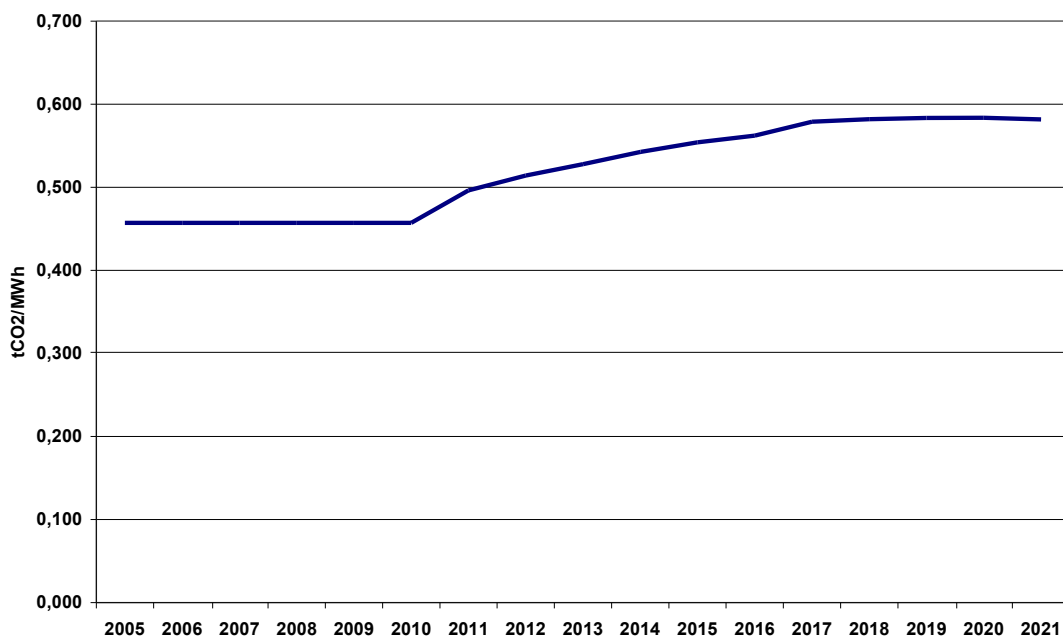
As the table shows, an increase in average emission factor will be mainly related to increase in emission factor of condensing TPP. This is resulted by the fact that the reconstruction of Lietuvos elektrine TPP, mainly means that it is adjusted to combust Orimulsion, by installing fume gas filtering equipment and special combustors. So the share of Orimulsion will gradually increase in the total country's fuel mix and that will result in increase of an average emission factor for condensing TPP.

Then the emission fuel factors were aggregated according to power production forecasts in every type of power plants. The results are presented in the table below

**Table 4 Aggregated emission factors, tCO<sub>2</sub> MWh**

	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Without INPP</b>	0,343	0,457	0,457	0,457	0,457	0,457	0,457	0,496	0,514
<b>INPP and HPP included</b>	0,048	0,219	0,219	0,219	0,219	0,219	0,219	0,479	0,497

OECD – Practical Baseline Recommendations for Greenhouse gas mitigation projects in the electric power sector – 2002. [www.oecd.org/env/cc](http://www.oecd.org/env/cc) and BASREC JI guidelines .



**Figure 4-1 Baseline CO<sub>2</sub> emission factor for substituted power**

## Project emissions

### *Emissions from flaring*

According to AM0009, baseline emissions minus emissions contained in useful products lead to emissions due to flaring during the project activity:

A carbon mass balance is conducted between points A, B. In doing so, it is assumed that all carbon in the recovery gas released, flared, vented or combusted will be oxidized completely to CO<sub>2</sub>. 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. The quantity of CO<sub>2</sub> 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). CO<sub>2</sub> emissions are attributed to the project activity according to the relative share of gas recovery of the project activity:

$$PE_{CO_2, gas, y} = [m_{carbon, A, y} - V_{B, dry\ gas, y} * W_{carbon, dry\ gas, B, y} - m_{LPG, B, y} * W_{carbon, LPG, B, y} - m_{condensate, B, y} * W_{carbon, condensate, B, y}] \cdot \frac{44}{12} \cdot \frac{1}{1000} \quad (1)$$

with

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

$PE_{CO_2, gas, y}$  Are the CO<sub>2</sub> emissions from the project activity due to combustion, flaring or venting of recovered gas during the period y in tons of CO<sub>2</sub>.

$m_{carbon, A, y}$  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.

$m_{carbon, dry\ gas, B, y}$  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.

$V_{B, dry\ gas, y}$  Is the quantity of dry gas that is produced in the gas processing plant (point B Figure 1) during the period y in m<sup>3</sup>.

$m_{LPG, B, y}$  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 m<sup>3</sup>.

$W_{carbon, A, y}$  Is the average content of carbon in the gas recovered at point A in Figure 1 during the period y in kg-C/m<sup>3</sup>.

$W_{carbon, dry\ gas, B, y}$  Is the average content of carbon in dry gas at point B in Figure 1 during the period y in kg-C/m<sup>3</sup>.

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

The carbon content of the products ( $W_{Carbon, dry\ gas, B, y}$ ,  $W_{Carbon, LPG, B, y}$ ,  $W_{Carbon, condensate, B, y}$ ) is homogeneous in their composition, and are monitored to check carbon content on a regular basis.

It will be assumed that 90% of the possible recovery from the hydrocarbon mass will be attained while using the gas separation plant. The rest of the hydrocarbon mass will be flared. Hydrocarbon mass of possible recovery from the flare gas is calculated in the Annex 2.

### Electricity generation

$$PE_{\text{electricity generation}} = [V_{B, \text{gas generator}, y} * W_{\text{carbon, gas generator, B, y}}] \cdot \frac{44}{12} \cdot \frac{1}{1000} \quad (1.1)$$

$V_{B, \text{gas generator}, y}$  Is the quantity of dry gas that is produced in the gas processing plant (point B Figure 1) during the period  $y$  in  $m^3$ . (Which is assumed for the calculation to be the dry gas volume from the gas separation plant).

$W_{\text{carbon, gas generator, B, y}}$  Is the quantity of carbon in the gas to go to generators during the period  $y$  in kg. - which is assumed to be the dry gas out of the gas processing plant.

At monitoring time the Volume and the carbon content will be based on exact measurement and chromatographic measurement.

### Fugitive methane emissions from recovery and processing the gas

#### CH<sub>4</sub> emissions from recovery and processing the gas

Fugitive CH<sub>4</sub> 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 EPA<sup>2</sup>. Emissions should be determined for all relevant activities and all equipment (such as valves, pump seals, connectors, flanges, open-ended lines, etc.).

Where the Average Emission Factor Approach by EPA is used to estimate emissions from the production of recovered gas and from the gas processing plant, emissions should be estimated separately for streams with different compositions. The following data needs to be obtained to follow this approach:

1. The number of each type of component in a unit (valve, connector, etc.).
2. The service each component is in (gas, light liquid or heavy liquid).
3. The total organic compound and methane concentration of the stream, and
4. The time period each component is in that service.

The EPA approach is based on average emission factors for total organic compounds (TOC) and has been revised to estimate CH<sub>4</sub> emissions. Methane emissions are calculated for each single equipment by multiplying the CH<sub>4</sub> concentration in the respective stream with the appropriate emission factor from Table 1.

$$PE_{CH_4, plants, y} = GWP_{CH_4} \cdot \frac{1}{1000} \cdot \sum_{\text{equipment}} w_{CH_4, stream} \cdot EF_{\text{equipment}} \cdot T_{\text{equipment}} \quad (6)$$

where:

$PE_{CH_4, plants, y}$  Are the CH<sub>4</sub> emissions from the project activity at the gas recovery facility and the gas processing plant during the period  $y$  in tons of CO<sub>2</sub> equivalents.

$GWP_{CH_4}$  Is the approved Global Warming Potential for methane.

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

$w_{CH_4, A, y}$  Is the average methane weight fraction in the respective stream in kg-CH<sub>4</sub>/kg.

$EF_{\text{equipment}}$  Is the appropriate emission factor from Table 1 in kg/hour/equipment.

For the purpose of this calculation it is recommended to group the equipment according to the different stream types.



Table 1: 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 <sup>3</sup>	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

**CH4 Leakage**

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

(1 year typical)

Equipment Type	Service	$EF_{equipment}$ Emission Factor (Kg/Hour/Source) for TOC	Qty of equipment in Project*	$T_{equipment}$	Total Kg per year
Valves	Gas	4.50E-003	26	8,300	971
Pump Seals	Gas	2.40E-003	0	8,300	0
Others *	Gas	8.80E-003	2	8,300	146
Connectors**	Gas	2.00E-004	13	8,300	22
Flanges	Gas	3.90E-004	64	8,300	207
Open-ended lines	Gas	2.00E-003	1	8,300	17
				<b>Total Gas</b>	<b>1,363</b>
* Source: Schematics of Flare gas loop in gas processing plant – Peterburgniimach					
CH4 in stream	19.41%	(mass ratio)			

Note for RFV Only: we assimilate flare gas and nat gas (LPG has no ch4 content) due to circulation in gas processing plant

Y(year)	Stream	$m_{stream(kg)}$	$W_{CH4,A}$ (KgC/Kg Stream)	$GWP_{CH4}$	$PE_{CH4,plants}$ (TCO2eq/year)
2008	Gas	1362.53	0.19	21	5.55
2009	Gas	1362.53	0.19	21	5.55
2010	Gas	1362.53	0.19	21	5.55
2011	Gas	1362.53	0.19	21	5.55
2012	Gas	1362.53	0.19	21	5.55
<b>Total Plant CH4 leakage, Gas</b>					<b>27.77</b>

<b>Total Project Emission</b>		
78800.49 tco2eq		
<b>CH4 Leakage</b>	<b>0.0352%</b>	<b>Of Project Emission(total)</b>

Hence the fugitive emission are considered to non-relevant to the Project Emissions as it represents less than 1% of the project emissions.

*Emissions from Truck*

The significance of CO<sub>2</sub> emissions from transportation of heavy hydrocarbon mix between well sites and Vilkyciai (where the gas separation plant will be situated) was evaluated by estimating:

- amount of heavy hydrocarbons transported
- distance between well sites and Vilkyciai
- emission factor CO<sub>2</sub>/ton LPG-km

Total distance between the well sites was increased by factor 3 (trucks will have to go both ways and not in the straight line) and multiplied by amount of hydrocarbons transported between each well site. Then the result was multiplied by emission factor: kg CO<sub>2</sub>/ton LPG-km (kg CO<sub>2</sub> per 1 ton heavy hydrocarbons transported 1km). To find this factor the following data was used:

Truck load, tons	40
Diesel consumption per truck, l/100km	40
Diesel consumption per km, l/km	0,4
Emission factor for Diesel, kgCO <sub>2</sub> /l	3,169
Emission factor for 1km driven, kg CO <sub>2</sub> /km	1,268

This gives emission factor of **0,032** kg CO<sub>2</sub>/ton LPG-km. The results are presented in Table 3.

Table 3 Emissions related to LPG transportation

	Amount of LPG transported, t	Distance from Vilkyciai, km	cargo distance factor, ton-km	Emissions, tCO <sub>2</sub> /year
Vilkyciai	0	0	0	0
Pietu Siupariai	1.075	13,4	43.201	1,37
Diegliai	867	5,7	14.818	0,47
Siupariai	44	13,4	1.755	0,06
Sakūčiai	410	7,9	9.716	0,31
Pociai	352	10,0	10.557	0,33
<b>Total</b>	<b>2.747</b>	<b>50,4</b>	<b>80.048</b>	<b>2,54</b>

Hence, the result is only 2,54t CO<sub>2</sub>/year and is insignificant compared to the total project emissions so does not have to be included into calculations nor to be monitored after the project implementation.

**As the result is under 1% of the project emissions per year then it is considered as negligible. So emission for truck transport are will not be accounted for.**

*CH<sub>4</sub> emissions from transport of the gas in pipelines when accidental event occurred*

These emissions will be measured in line with AM0009 version 2.

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.

*CH<sub>4</sub> emissions from the transport of the gas in pipelines when accidental event occurred can be calculated as*

$$PE_{CH_4, pipeline, accident} = GWP_{CH_4} \cdot \frac{1}{1000} (V_{A, accident} + V_{remain, accident}) \cdot W_{CH_4, pipeline, accident} \quad (8)$$

with:

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

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

where

$PE_{CH_4, pipeline, accident}$	Are the CH <sub>4</sub> emissions from the project activity due to transport of the recovered gas in the pipeline when the accidental event happens in tons of CO <sub>2</sub> equivalent.
$GWP_{CH_4}$	Is the approved Global Warming Potential for methane.
$V_{A, t, accident}$	Is the volume of gas supplied from the oil well at point A in Figure 1 from the time the gas leakage started until the shutdown valves closed the pipeline in m <sup>3</sup> .
$V_{remain, accident}$	Is the volume of gas remaining in the pipeline after the shutdown valves close the pipeline in m <sup>3</sup> .
$W_{CH_4, pipeline, accident}$	Is the average methane weight fraction in the gas recovered at point A in Figure 1 in kg-CH <sub>4</sub> /m <sup>3</sup> .
$t_{accident}$	Is the time difference between t <sub>1</sub> and t <sub>2</sub> determined as “retention time” in seconds.
$t_1$	Is the time the gas leakage caused by the accident occurred. “t <sub>1</sub> ” is determined based on the continuous monitoring data such as pressure etc.
$t_2$	Is the time that the shutdown valves closed both the upstream and downstream pipeline. “t <sub>2</sub> ” 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 m <sup>3</sup> /second.
$d$	Is the radius of the pipeline in meters. The data is derived from P & I (Piping and Instrument).
$\pi$	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).



13 May 2003

$P_p$	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 $m^3$ .
$V_{xi, d, accident}$	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 $m^3$ .

In summary, CH<sub>4</sub> emissions from pipeline caused by accidental events will be estimated based on the above formulae and data.

### Leakage

In line with the AM0009, version 2

CO<sub>2</sub> 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:

This is not applicable for this project because no transport outside the control of the project participant occurs.

**B.2 Description of how the anthropogenic emissions of greenhouse gases by sources are reduced below that would have occurred in the absence of the JI Project:**

Emissions are reduced below the level that would occur in the absence of this project by using previously flared gas for electricity and LPG generation.

**Assessment of other alternative baseline scenarios**

Heat production was also considered during the project screening phase, but the idea was abandoned due to economic considerations. The neighboring areas do not have enough potential users of district heating, and the cost of DH network development would be too high for the project. Another drawback would be security of heat supply – it would be impossible to guaranty the continuous heat supply at the stable temperature to the DH network, due to fluctuations in amounts of associated gas. In case of gas network, there also would be not enough users in the surrounding areas to make a development of gas network economically viable. Hence, the power generators without heat utilization (co-generation) will be installed at the selected well sites.

In conclusion, the only plausible scenarios are the baseline scenario i.e the flaring of all associated gas, and the project scenario i.e. the use of parts of the gas for the production of electricity and LPG.

**Financial Barrier**

The problem is to sell produced excess power to the grid. Power suppliers at the moment, according the Lithuanian law are not obliged to buy in power produced from associated gas as it is not considered renewable energy source<sup>2</sup> nor as energy produced from waste gas. Hence, Minoil would have to negotiate with local power supplier JSC “Vakaru Skirtomieji Tinklai” (VST) about the possibility to sell power to the national grid.

The negotiations between Minoil and VST have been ongoing for more than a year but have not yet given any results. There is no economic interest from the VST side to purchase power produced from associated gas as the supply reliability of such power would be rather low.

A different situation is with LPG production. There is an increasing demand on the market for LGP as a car fuel due to growing prices for gasoline and diesel oil. This trend makes a situation that LPG can be easily sold on the market. Considering this, the maximum Propane-butane extraction is assumed for the project.

**LPG & Electrical Production On-Site:**

<b>Net Benefits of Scenario 2 (No ERUs)</b>	<b>6.2</b>	<b>million USD</b>	<b>IRR Scenario 2 (No ERUs)</b>	<b>8%</b>
<b>Net Benefits of Scenario 2 (w ERUs)</b>	<b>8.6</b>	<b>million USD</b>	<b>IRR Scenario 2 (w ERUs)</b>	<b>13%</b>

In the Scenario with electricity and LPG production, the project goes just over 10% with ERUs and without ERUs is less than 10% which would not make the project receivable for investment by the Board of Minijos Nafta.

**Technological Barrier**

The production of LPG from flared gas is the first of its kind in Lithuania. All major equipment had to be imported from Russia and the EU. The equipment was bought in 2004 but only installed in 2006 due to delays during the approval of design documentation and pending permission. Also, the electricity generators are specifically designed to burn a mixture of associated gas.

<sup>2</sup> Power suppliers are obliged to buy in power produced from the renewable sources, according to given quotas for each supplier (Decision no 1474, 5 December 2001, Lithuanian government)

**Regulatory Barrier**

The energy strategy of Lithuania (Energy Strategy 2002) highlights the importance of reduction of national dependence on one fuel supplier (Russia). For this purpose power producers are given incentives to use several kinds of fuel and especially to use indigenous and renewable energy sources. Since the oil extracted in Lithuania is considered as indigenous energy source – it is supported by the government. As a result, oil extracting companies are not imposed with any additional financial burdens related to use of the natural resources i.e. they are not charged for carbon release. This situation is not likely to change in the near future. Another argument for additionality is that the oil extracting companies are not included into the Phase 1 of the EU emission trading scheme (EU ETS), so they do not have an incentive for reducing their carbon emissions.

**Current Practice Barrier**

There is no incentive from the government to reduce gas flaring – and CO<sub>2</sub> emissions from gas flaring. The licenses of Minijos Nafta (Minoil) allow flaring without any restriction. Hence without the JI project the CO<sub>2</sub> emission would not be reduced.

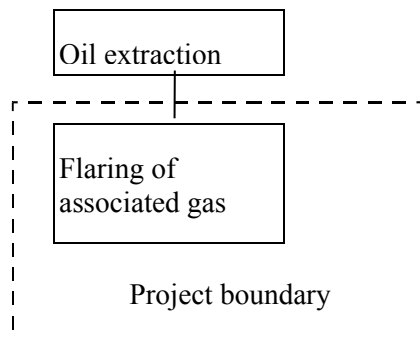
Due to these barriers, Minijos Naphta contacted carbon consultants already in 2003, in order to provide much needed support to the project.

*Therefore given the above descriptions of barriers the project is additional.*

**B.3 Description of How the definition of the project boundary is applied to the project:**

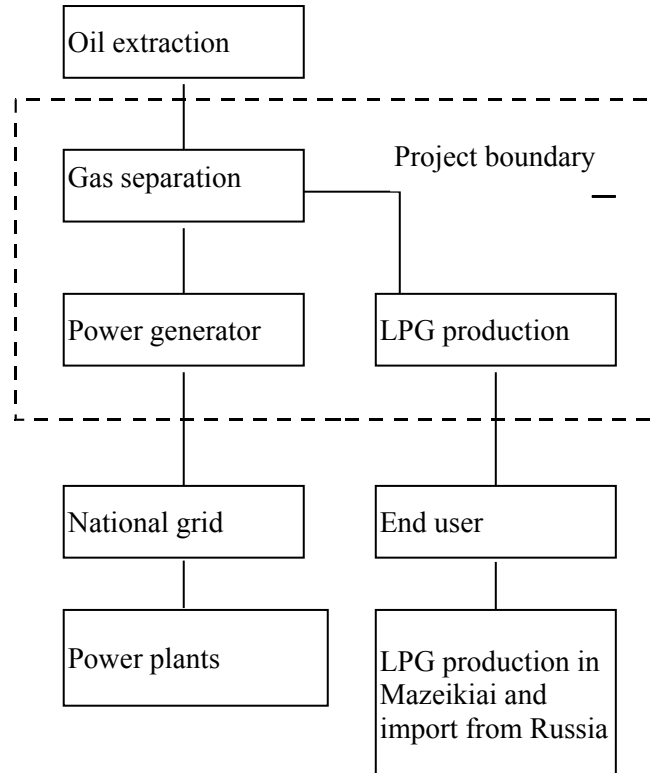
Figure 3-2 illustrates the project boundaries in baseline case (the situation before project implementation). Flaring processes is included within the boundaries.

**Figure 3-2 Baseline case**



Project boundaries in project case (after project implementation) will include power and LPG production from recovered flare gas at the selected oil wells (Figure 3-3). This includes associated gas (AG) collection system, gas separation unit and power generators. End users of LPG and power plants on the national power grid are outside the project boundary because emissions from those points are not possible to monitor i.e. they are outside of the project operator's control.

Figure 3-3 Project case



The difference between the project boundaries and the baseline emission boundaries should be noted. Project boundaries, as mentioned above, should include those emissions that are attributable to project activity, are significant and can be controlled by a project proponent. In case of Minoil project will influence electricity production on the national grid which would affect CO<sub>2</sub> emissions. The amount of power produced can be monitored, so the power production is included within the project boundaries. However, the emission changes related to power generation on the national grid is outside the control of the project proponent hence the national power grid is not included within the project boundaries. Similarly LPG production, import and consumption cannot be measured by the project proponent so these are not included into the project boundaries. Emissions from the power generated on the national power grid will be included within the emission baseline boundaries in order to define the baseline emission values for power generation.

**B.4. Further Baseline information, including the date of baseline setting and the name(s) of the person(s)/entity(ies) setting the baseline:**

**Date of Setting the Baseline:** 15<sup>th</sup> November 2006

**Entity Setting the baseline:** LitPronergija – R.F. VERGNES, engineering consultant and PDD Developer for the Minoil II project. [rfv@lit-energy.com](mailto:rfv@lit-energy.com) – fax: +370 5278 4213

The baseline has been calculated according to the above mentioned standards, for which we can give the following bibliography:

The PDD and the baseline calculation has been performed by the engineers of LitPronergija UAB – [www.lit-energy.com](http://www.lit-energy.com) .

- **CDM Methodology AM0009 / Version 02** -Sectoral Scope: 10 - 13 May 2005 – “**Recovery and utilization of gas from oil wells that would otherwise be flared**” - UNFCCC - CDM
- BASREC (2003). BASREC Regional Handbook on the Procedures for Joint Implementation in the Baltic Sea Region. BASREC, Ad Hoc Group on Climate Change.
- Dutch Ministry of Environmental Protection “Emissiefactoren: Lekverliezen van apparaten...” 8 April 1993
- CDM - EB (2004). Approved baseline methodology AM0009 “Recovery and utilization of gas from oil wells that would otherwise be flared”, UNFCCC - CDM Executive Board. [www.unfccc.int](http://www.unfccc.int). [http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF\\_AM\\_577581847](http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_577581847)
- Elkraft System, COWI, et al. (2002). Economic analyses in the electricity sector in Lithuania (Draft Final Report). Prepared by: Elkraft System, COWI, Lietuvos Energija, Lithuanian Energy Institute.
- Energy Strategy (2002). "National Energy Strategy of Lithuania." IX-1130.
- LEI (2004). Energy in Lithuania 2003. Kaunas, Lithuanian Energy Institute.
- NAP (2004). Lithuania's National Allocation Plan for Greenhouse Gas Emission Allowances for the period 2005 to 2007.
- OECD – Practical Baseline Recommendations for Greenhouse gas mitigation projects in the electric power sector – 2002. [www.oecd.org/env/cc](http://www.oecd.org/env/cc)



**SECTION C. Duration of the project / Crediting Period**

Duration: 5 Years – Crediting Period: 2008-2012  
And more if allowed by the UNFCCC.

**C.1 Starting Date of the Project:**

Starting Date of the Project: 1<sup>st</sup> January 2008 – or earlier if equipment erected and/or operation permitted.

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EoI - Outline Project Implementation Plan - 2.B.6

<b>Minoil Flare Gas Reduction Project</b>		2006									
<b>Minoijs Nafta UAB (Minoil) – Lithuania</b>		January	February	March	April	May	June	July	August	September	October
<b>Project preparation and implementation</b>											
Prefeasibility study											
Feasibility study											
Detailed design											
Tendering											
Permits											
Implementation											
Commissioning											
Operations											
<b>DanishCarbon tender participation</b>											
Submissions of EoI											
Submissions of Proposal											
Negotiation and contracting											
First emission reduction realised											
<b>Project documentation availability</b>											
LoI - Project Idea Note											
LoI - Letter of Endorsement											
LoI - Background on Project Host and Project Developer											
LoI - Outline Project Implementation Plan											
LoI - Outline Project Financing Plan											
Proposal - Project Design Document (PDD, BS and MP)											
Proposal - Statement of Social Responsibility											
Proposal - Letter on Exclusion Criteria											
Proposal - Business Plan											
Proposal - Project Implementation Plan											
Proposal - Letter of Approval											
Determination/Validation Report											
Marked up version of ERPA											

**C.2 Expected Operational Lifetime of the Project:**

LifeTime of the project : 25 Years

**C.3 Length of the Crediting Period:**

Starting Date: 2008-JAN-01 or earlier if permitted.  
Length: 5 Years - Crediting period:2008-2012 and further if Kyoto Protocol and the parties allows it.

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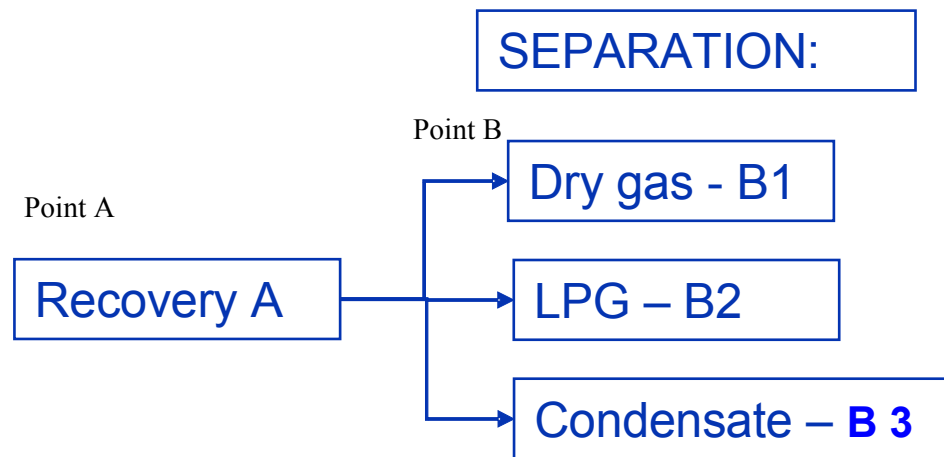
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**SECTION D. Monitoring plan**

**D.1 Description of Monitoring plan choosen:**

Monitoring Plan will be based on the AM0009 version 2 Monitoring approved CDM Monitoring methodology.



**Figure 1.**



Monitoring methodology AM0009/ Version 02: “Recovery and utilization of gas from oil wells that would otherwise be flared”.

The monitoring methodology involves monitoring of the following:

- The composition and quantity of recovered gas at point A as well as the composition and quantity of products (dry gas, LPG, condensate) from the gas processing plant at point B;
- The quantity of any additional consumption of other fossil fuels than the recovered gas;

**D.1.1. Option 1 - Monitoring of the emissions in the Project Scenario and the Baseline Scenario:**

**D.1.1.1 Data to be collected in order to monitor the Emissions from the project, and how these data will be archived:**

ID Nr.	Name	Data Type	Data Variable	Data Unit	Source of Data	Measured(m) Calculated ( c) Estimated ( e)	Recording Frequency	Proportion of Data Monitored	How will data be archived?(electronic/paper)	For how long is archived data kept	Comment
DC-5	$V_{B,dry\ gas,y}$	Volume	Volume of dry gas produced in the gas processing plant (point B in Figure 1)	M3	Measurement with meters	m	continuously	100.00%	electronic	until two years after the end of the crediting period	Measurement with meters
DC-6	$w_{carbon,dry\ gas,B,y}$ $K_{CO_2,dry\ gas,B,y}$	Composition	Composition of the dry gas at point B in figure 1	% and Kg/m3	Measurement with gas chromatography	m	Semi-annually summer / winter.	100.00%	electronic	until two years after the end of the crediting period	Measurement with gas chromatography
DC-7	$m_{LPG,B,y}$	Mass	Quantity of LPG produced in the gas processing plant (point B in Figure 1)	T	Measurement with coriolis meters	m	continuously	100.00%	electronic	until two years after the end of the crediting period	Measurement with coriolis meters
DC-8	$w_{carbon,LPG,B,y}$ $K_{CO_2,LPG,B,y}$	Composition	Composition of LPG Produced in the gas processing plant(Point B in figure 1)	% and Kg/Kg	Measurement with gas chromatography	m	Semi-annually summer / winter.	100.00%	electronic	until two years after the end of the crediting period	Measurement with gas chromatography
DC-9	$m_{condensate,B,y}$	Mass	Quantity of Condensate produced in the gas processing plant (point B in Figure 1)	T	Measurement with coriolis meters	m	continuously	100.00%	electronic	until two years after the end of the crediting period	Measurement with coriolis meters
DC-10	$w_{carbon,condensate,B,y}$ $K_{CO_2,condensate,B,y}$	Composition	Composition of condensate at point B in figure 1	% and Kg/Kg	Measurement with gas chromatography	m	Semi-annually summer / winter.	100.00%	electronic	until two years after the end of the crediting period	Measurement with gas chromatography
DC-11	<i>Not in use</i>		<i>Not in use</i>		<i>Not in use</i>		<i>Not in use</i>		<i>Not in use</i>		<i>Not in use</i>
DC-12	$w_{gas\ generator}$	Composition	Composition of gas used in the electrical generator	% and Kg/Kg	Measurement with gas chromatography	m	Semi-annually summer / winter.	100.00%	electronic	until two years after the end of the crediting period	Measurement with gas chromatography
DC-13	$T_{equipment}$	Time	Operation time of each equipment in the gas recovery facility and the gas processing plant	Hours	Only required if the EPA approach is used	m,c or e	Annually	100.00%	electronic	until two years after the end of the crediting period	Only required if the EPA approach is used
DC-14	$V_{generator,y}$	Volume	Volume of gas used in the electrical gas generator	M3	Measurement with meters	m	continuously	100.00%	electronic	until two years after the end of the crediting period	Measurement with meters
DC-15	$KWH_{project\ equipment,\ gas\ plant}$	Electricity (KWH)	Quantity of Electricity used by the Project equipments and Gas Processing plants and surrounding equipments	KWH	Measurement with automated electrical meters	m,c or e	Annually	100.00%	electronic	until two years after the end of the crediting period	Measurement with automated electrical meters

\***Note for Chromatography:** If the measurements are within a stable range after two years, conservative assumptions can be applied so as to avoid the costs of gas chromatography. The conservativeness of the assumptions will be verified by the AE.

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**D.1.1.2 Description of formulae used to estimate project emissions (for each gas, sources, etc..; emissions in units of CO2equivalent):****TOTAL Project Emissions:**

$$PE_y = PE_{CO_2, gas, y} + PE_{CO_2, generators, y} + PE_{CH_4, accident} \quad (13)$$

With

$PE_y$  Project Emission for the year y in Tco2eq

$PE_{CO_2, gas}$  is the Project Emission from the gas processing and related components

$PE_{CH_4, plant, y}$  is the CH4 emission from the gas processing and related components

$PE_{CH_4, accident}$  is the emission, venting, leakage of CH4 in case of accidents

**Project Emissions for the Gas Processing plant**

$$PE_{CO_2, gas, y} = [m_{carbon, A, y} - V_{B, dry\ gas, y} * W_{carbon, dry\ gas, B, y} - m_{LPG, B, y} * W_{carbon, LPG, B, y} - m_{condensate, B, y} * W_{carbon, condensate, B, y}] \cdot \frac{44}{12} \cdot \frac{1}{1000} \quad (1)$$

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

with

$PE_{CO_2, gas, y}$  Are the CO<sub>2</sub> emissions from the project activity due to combustion, flaring or venting of recovered gas during the period y in tons of CO<sub>2</sub>.

$m_{carbon, A, y}$  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.

$m_{carbon, dry\ gas, B, y}$  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.

$V_{B, dry\ gas, y}$  Is the quantity of dry gas that is produced in the gas processing plant (point B Figure 1) during the period y in m<sup>3</sup>.

$m_{LPG, B, y}$  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 m<sup>3</sup>.

$W_{carbon, A, y}$  Is the average content of carbon in the gas recovered at point A in Figure 1 during the period y in kg-C/m<sup>3</sup>.

$W_{carbon, dry\ gas, B, y}$  Is the average content of carbon in dry gas at point B in Figure 1 during the period y in kg-C/m<sup>3</sup>.

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

The carbon content of the products ( $W_{Carbon, dry\ gas, B, y}$ ,  $W_{Carbon, LPG, B, y}$ ,  $W_{Carbon, condensate, B, y}$ ) is homogeneous in their composition, and are monitored to check carbon content on a regular basis.

*Project Emission from Electricity Generators*

*With:*

$$PE_{CO_2,generators,y} = \sum V_{gas,generators,y} * W_{carbon,y} \cdot \frac{44}{12} \cdot \frac{1}{1000} \quad (15)$$

where

$PE_{CO_2,generators,y}$  are the CO2 emissions due to all generators at all fields during the period y in tons of CO2

$V_{gas,generators,y}$  is the Volume of gas used for Electricity production from generators at a given well site.

where

$W_{carbon,y}$  Is the average content of carbon in the gas going into the generator -based on chromatography's result during the period y in Kg.

*Note: Electricity produced by generators is considered as export electricity as it will replace electricity from the grid at areas outside of the JI Project activity areas.*

$K_{CO_2,generators}$  is the CO2 coefficient of CO2 emission for per Kwh for generators at each Oil Fields.

$K_{CO_2,generators}$  is the CO2 emission coefficient of TCO2eq per KWHelectrical produced obtained for each oil field either by measurement – if available, if not by 100% oxidisation of the quantity of gas consumed by the generator ( CH4 or flare gas).

$KCO_2geneartor = [V_{gas,generators,y} * W_{carbon,y} \cdot \frac{44}{12} \cdot \frac{1}{1000}] / Kwh\ generator$  . This can be used to check exhaust gas measurement.



**D.1.1.3 Relevant data necessary for determining the baseline of anthropogenic emissions of greenhouse gases by sources within the project boundary, and how such data will be collected and archived:**

ID Nr.	Name	Data Type	Data Variable	Data Unit	Source of Data	Measured(m) Calculated ( c) Estimated (e)	Recording Frequency	Proportion of Data Monitored	How will data be archived?(electronic/paper)	For how long is archived data kept	Comment
DC-1	$V_{A,y}$ $V_{A,t \text{ accident}}$ $V_{A,d \text{ accident}}$	Volume	Quantity of recovered gas at Point A in Figure 1	M3	Measurement with meters	m	continuously	100%	electronic	until two years after the end of the crediting period	Measurement with meters
DC-2	$w_{carbon,A} (KgC/M3)$ , $w_{CH4,A,y}$ $K_{co2,A} (kgCO2eq/M3)$ $w_{CH4,pipeline}$ $w_{CH4,pipeline,accident}$	Gas Composition	Composition of recovered gas at Point A in Figure 1	% and Kg/m3	Measurement with gas chromatography	m	Semi-annually summer / winter.	100%	electronic	until two years after the end of the crediting period	Measurement with gas chromatography
DC-3	$KWH_{generators}$	Electricity (KWH)	Quantity of Electricity generated by all the electrical gas generators	KWH	Measurement with automated electrical meters	m,c or e	Annually	100.00%	electronic	until two years after the end of the crediting period	Measurement with automated electrical meters

**Notes:**

DC-1 and DC-5,  $V_A$  and  $V_B$  are value recorded at gas processing plant level and on the pipeline level. As well,  $V_A$  is already a recorded value and supplied to the ministry of environment on a 3-month basis. Data record are monthly production. Maintenance and Health & Safety Department and Financial Department keep track of these Data. (paper & electronic)

DC-3 will be known and recorded by the generator's interface which include digital electricity meter monthly statement is issued ( paper and electronic). - Maintenance and Financial Department keep track of these data.

DC-15 Power consumption at oil field is know through the electricity digital meter already installed for each oil fields – there is a monthly statement is issued ( paper and electronic). - Maintenance and Financial Department keep track of these datas.



D.1.1.4 Description of formulae used to estimate baseline emissions (for each gas, sources, etc; emissions in units if CO2 equivalent):
---

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.<sup>4</sup> 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:

$$BL_y = BL_{A,y} + BLDE_y \quad (11)$$

where:

$BL_{A,y}$  Are the baseline emissions during the period  $y$  in tons of CO<sub>2</sub> equivalents.

$BLDE_y$  is the baseline for displaced electricity from the grid

$BL_{A,y}$  Is the Base Line calculated based on the gas recovered  $V_A$  from the oil fields at point A in Figure 1 during the period  $y$  – calculation is done according to the AM0009 version as described in Chapter B and in the Annex 2.

where

*Flared gas*

The project intends to measure the gas flow and the carbon content of the gas previously flared. The project uses the approach from the previously approved CDM methodology AM0009 version 2 and assumes full oxidization.

$$BL_{A,y} = V_{A,y} * w_{carbon,A,y} * \frac{44}{12} \cdot \frac{1}{1000} \quad (11.1)$$

where:

$BL_{y,A}$  Are the baseline emissions during the period y in tons of CO<sub>2</sub> 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<sup>3</sup>.

$w_{carbon,A,y}$  Is the average content of carbon in the gas recovered at point A in Figure 1 during the period y in kg-C/m<sup>3</sup>.

And where:

$$BLDE_y = (\sum Kwh_{,displaced,y}) \cdot KCO2_{,grid} \quad (11.2)$$

$Kwh_{,displaced,y} = (\sum Kwh_{,generators}) - Kwh_{,gas\ plant,\ project,y}$  is the electricity displaced from the grid in KWH

$Kwh_{,generators}$  is the total Kwh generation by electrical generator for the year y on the oil fields,

$Kwh_{,gas\ plant,\ project,y}$  is the KWH generation use for all equipments related to the project ( ie gas processing plant, pumps, pipeline pumps, security equipment etc..)

$KCO2_{,grid}$  is the CO<sub>2</sub> Lithuanian grid factor equivalent in Ton of Co<sub>2</sub> for per Kilowatt of electrical power displaced from the Lithuanian grid. Either in force in Lithuania and/or in the EU and/or calculated as proposed in the PDD while doing the monitoring. (table 4 – chapter B)



**D.1.2 – Option 2 - Direct monitoring of emission reductions from the project (values should be consistent with those in section E.):**

Not Applicable

**D.1.2.1 Data to be collected in order to monitor emission reductions from the project, and how these data will be archived:**

Not Applicable

**D.1.2.2. Description of formulae used to calculate emission reductions from the project (for each gas, source etc.; emissions/emission reductions in units of CO2 equivalent):**

Not applicable

**D.1.3 Treatment of Leakage in monitoring plan**

*No leakage expected as all equipments are new.*

*Leakage may occur during accident – in this case leakage should follow evaluation made during accident and leakage time.*



D.1.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project:										
ID Nr.	Name	Data Type	Data Variable	Data Unit	Source of Data	Measured(m) Calculated ( c) Estimated (e)	Recording Frequency	Proportion of Data Monitored	How will data be archived?(electronic/paper)	For how long is archived data kept
DC-17	$t_{1,2}$	Time	Time the gas leakage caused by the accident occurred, Time that the shutdown valves closed both the upstream and downstream pipeline	day/hours/minutes/seconds	Measurement with operation controller	m	continuously	100.00%	electronic	until two years after the end of the crediting period
DC-18	$P_p$	Pressure	Pressure in the pipeline	Atm	Measurement with pressure meters	m	continuously	100.00%	electronic	until two years after the end of the crediting period
DC-19	$T_p$	Temperature	Temperature in the pipeline	Centigrade	Measurement with Temperature Meters	m	continuously	100.00%	electronic	until two years after the end of the crediting period

Parameter F is included in table 1.1.3. and Parameter  $V_{xi,d,accident}$  is not to be use in the case that of our project at should be set at 1 - unless such connection exists in the future.

#### D.1.3.2. Description of formulae used to estimate leakage (for each gas, source etc.; emissions in units of CO<sub>2</sub> equivalent):

##### *CH<sub>4</sub> 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. *CH<sub>4</sub> emissions from the transport of the gas in pipelines when accidental event occurred can be*



$$PE_{CH_4, pipeline, accident} = GWP_{CH_4} \cdot \frac{1}{1000} (V_{A, accident} + V_{remain, accident}) \cdot W_{CH_4, pipeline, accident} \quad (8)$$

with:

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

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

calculated as:

where:

$PE_{CH_4, pipeline, accident}$  Are the CH<sub>4</sub> emissions from the project activity due to transport of the recovered gas in the pipeline when the accidental event happens in tons of CO<sub>2</sub> equivalent.

$GWP_{CH_4}$  Is the approved Global Warming Potential for methane.

$V_{A, t, accident}$  Is the volume of gas supplied from the oil well at point A in Figure 1 from the time the gas leakage started until the shutdown valves closed the pipeline in m<sup>3</sup>.

$V_{remain, accident}$  Is the volume of gas remaining in the pipeline after the shutdown valves close the pipeline in m<sup>3</sup>.

$W_{CH_4, pipeline, accident}$  Is the average methane weight fraction in the gas recovered at point A in Figure 1 in kg-CH<sub>4</sub>/m<sup>3</sup>

$t_{accident}$  Is the time difference between t<sub>1</sub> and t<sub>2</sub> determined as “retention time” in seconds.

$t_1$  Is the time the gas leakage caused by the accident occurred. “t<sub>1</sub>” is determined based on the continuous monitoring data such as pressure etc.

$t_2$  Is the time that the shutdown valves closed both the upstream and downstream pipeline. “t<sub>2</sub>” 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 m<sup>3</sup>/second.

$d$  Is the radius of the pipeline in meters. The data is derived from P & I (Piping and Instrument).



$\pi$  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 m<sup>3</sup>.

$V_{xi, d, accident}$  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 m<sup>3</sup>.

#### **D.1.4 Description of formulae used to estimate emission reduction for the project (for each gas, source, etc.:emissions/emission reduction in units of CO2 eq):**

$$EF_y = BL_y - PE_{CO_2, gas} - PE_{CO_2, generators, y} - PE_{CH_4, pipeline, accident} \quad (12)$$

where:

$EF_y$  Are the emissions reductions of the project activity, adjusted for leakage, during the period y in tons of CO<sub>2</sub> equivalent.

$BL_y$  Are the baseline emissions during the period y in tons of CO<sub>2</sub> equivalent.

$PE_{CO_2, gas, y}$  Are the CO<sub>2</sub> emissions from the project activity due to combustion, flaring or venting of recovered gas during the period y in tons of CO<sub>2</sub>.

$PE_{CO_2, generators, y}$  are the CO<sub>2</sub> emissions due to all generators at all field Xi during the period y in tons of CO<sub>2</sub>

$PE_{CH_4, pipeline, accident}$  Are the CH<sub>4</sub> emissions from the project activity due to transport of the recovered gas in the pipeline when the accidental event occurs in tons of CO<sub>2</sub> equivalent.

**D.1.5 Where applicable, in accordance with procedure as required by the host party, information on the collection and archiving of information on the environmental impacts of the projects**

*Data handling and management of the monitoring plan will be done according the existing regulation in force in Lithuania and set by the Ministry of Environment of Lithuania. Project Emission and Baseline Emission information will be based on legal declaration made by the company to the Lithuanian Ministry of environment (monthly, quarterly and yearly); according to :*

*\*Oil Extraction Licenses*

*\*Reference of the Monitoring legislation in Lithuania:*

- 1. LIETUVOS RESPUBLIKOS APLINKOS MONITORINGO -STATYMAS 1997 m. lapkricio 20 d. Nr. VIII-529- Vilnius*
- 2. LIETUVOS RESPUBLIKOS APLINKOS MINISTRO ĮS A K Y M A S D Ė L UKIO SUBJEKTU APLINKOS MONITORINGO VYKDYMO TVARKOS - PATVIRTINIMO 2003 m. geguzes 15 d. Nr. 230*

**D.2 Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:**

<b>Id.Nr.</b>	<b>Uncertainty Level of data (High /Medium/Low)</b>	<b>Are QA/QC procedure planned for these data ?</b>	<b>Outline explanation how QA/QC procedures are planned</b>
DC-1	Low	Yes	Cross-check with data from previous month and with measurements from other wells of the same oil field if possible
DC-2	Medium	Yes	Cross-check with data from previous month and with measurements from other wells of the same oil field if possible
DC-3	Low	Yes	Consistency checks of measurements with Grid data
DC-4	Not in use	Not in use	Not in Use
DC-5	Low	Yes	Consistency checks of measurements with commercial data
DC-6	Medium	Yes	Check with previous half year gas chromatography
DC-7	Low	Yes	Consistency checks of measurements with commercial data
DC-8	Low	Yes	Check with previous half year gas chromatography
DC-9	Low	Yes	Chec with previous months
DC-10	Low	Yes	Check with previous half year gas chromatography

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<b>Id.Nr.</b>	<b>Uncertainty Level of data (High /Medium/Low)</b>	<b>Are QA/QC procedure planned for these data ?</b>	<b>Outline explanation how QA/QC procedures are planned</b>
DC-11	Not in use		
DC-12	Medium	Yes	Check with previous half year gas chromatography
DC-13	Medium	Yes	Check with previous months
DC-14	Medium	Yes	Check previous months
DC-15	Low	Yes	Consistency checks of measurements with operational data
DC-16	Low	Yes	Consistency checks with operational data
DC-17	Low	Yes	Consistency checks with operational data
DC-18	Low	Yes	Consistency checks with operational data
DC-19	Low	Yes	Consistency checks with operational data

**D.3. Please describe the operational and management structure that the project operator will apply in implementing the monitoring plan:**

*In order to assure quality of monitoring the responsibilities will be split among the employees. The responsible person will be assigned to make all necessary calculations and estimations. A responsible person will be one of the Minoil staff who worked on the project before its implementation so he could understand the issue best. The responsible person will have an engineering background allowing him to understand and to interpret in the right way the project functioning and monitoring. Minoil has already QA and legal requirement from the Ministry of environment and the Ministry of work and as well apply the local Health and Safety regulation for Oil & Gas. List of Operators which will be trained and in charge of archiving monitoring data and obtaining such datas:-**according Lithuanian legislation.** “skystų dujų degalinių operatoriai”.*

Eil. Nr.	Vardas	Pavardė
1	Darius	Gedvilas
2	Martynas	Žilaitis
3	Andrius	Šimkus
4	Šarūnas	Milašius
5	Darius	Galinskas
6	Romanas	Kolodejevas
7	Darius	Rutkus
8	Vitas	Grinčelaitis
9	Mindaugas	Tilvikas
10	Vytautas	Liutkus
11	Virginijus	Kibelkis
12	Vytenis	Jasas



**D.4 Name of person(s)/entity establishing the monitoring plan**

Date of establishing: 23<sup>rd</sup> October 2006

Entity: LitPronergija – R.F. VERGNES, engineering consultant and PDD Developer for the Minoil project. - [www.lit-energy.com](http://www.lit-energy.com) – email: [rfv@lit-energy.com](mailto:rfv@lit-energy.com) / fax:+370 5 2784213.

**SECTION E. Estimation of greenhouse gas emission reductions****E.1 Estimated Project Emissions :***Project Emission Electricity Generation*

$$PE_{CO_2,generators,y} = \sum V_{gas,generators,y} * w_{carbon,y} \cdot \frac{44}{12} \cdot \frac{1}{1000} \quad (1.1)$$

where

$PE_{CO_2,generators,y}$  are the CO2 emissions due to all generators at all fields during the period y in tons of CO2

where

$w_{carbon,y}$  Is the average content of carbon in the gas going into the generator -based on chromatography's result during the period y in Kg. Is equal to  $w_{carbon, dry gas, B}$  as we assume that all the Flare gas will be processed and all the dru gas will be used to generate electricity.

$V_{carbon,generators,y}$  Is the quantity of carbon in the gas burnt by the generator at a specific oil site during the period y in kg per M3. - is equal to  $V_{B, dry gas, y}$  as we assume that all the Flare gas will be processed and all the dru gas will be used to generate electricity.

Kwh generator is based on the meter reading and can be used to cross check the figures.

*Note: Electricity produced by generators is considered as export electricity as it will replace electricity from the grid at areas outside of the JI Project activity areas.*

Project Emissions from Electricity Generation

*Formula (1.1)*

Years	$Pe_{electricity}$ generation, y (T)	$V_{B,dry gas,y}$ (M3)	$w_{carbon,dry gas, B,y}$ (Kg/M3)
2008	<b>15,485</b>	6,020,562	0.701
2009	<b>13,612</b>	5,292,546	0.701
2010	<b>12,196</b>	4,741,925	0.701
2011	<b>11,082</b>	4,308,802	0.701
2012	<b>10,193</b>	3,963,224	0.701
<b>TOTAL</b>	<b>62568.13</b>		

*Project Emissions for the Gas Processing plant*

$$PE_{CO_2, gas, y} = [m_{carbon, A, y} - V_{B, dry\ gas, y} * w_{carbon, dry\ gas, B, y} - m_{LPG, B, y} * w_{carbon, LPG, B, y} - m_{condensate, B, y} * w_{carbon, condensate, B, y}] \cdot \frac{44}{12} \cdot \frac{1}{1000} \quad (1)$$

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

with

$PE_{CO_2, gas, y}$  Are the CO<sub>2</sub> emissions from the project activity due to combustion, flaring or venting of recovered gas during the period y in tons of CO<sub>2</sub>.

$m_{carbon, A, y}$  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.

$m_{carbon, dry\ gas, B, y}$  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.

$V_{B, dry\ gas, y}$  Is the quantity of dry gas that is produced in the gas processing plant (point B Figure 1) during the period y in m<sup>3</sup>.

$m_{LPG, B, y}$  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 m<sup>3</sup>.

$w_{carbon, A, y}$  Is the average content of carbon in the gas recovered at point A in Figure 1 during the period y in kg-C/m<sup>3</sup>.

$w_{carbon, dry\ gas, B, y}$  Is the average content of carbon in dry gas at point B in Figure 1 during the period y in kg-C/m<sup>3</sup>.

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

The carbon content of the products ( $w_{Carbon, dry\ gas, B, y}$ ,  $w_{Carbon, LPG, B, y}$ ,  $w_{Carbon, condensate, B, y}$ ) is homogeneous in their composition, and are monitored to check carbon content on a regular basis.

Project Emissions from Gas Process Activity

*Formula (1)*

Years	$PE_{CO_2, gas, y}$ (T)	$m_{carbon, A, y}$ (KgC)	$V_{B, dry\ gas, y}$ (M3)	$w_{carbon, dry\ gas, B, y}$ (Kg/M3)	$m_{LPG, B, y}$ (Kg)	$w_{carbon, LPG, B, y}$ (KgC/KgLPG)	$m_{condensate, B, y}$ (Kg)	$w_{carbon, condensate, B, y}$ (KgC/Kgcondst)
2008	<b>5,338</b>	13,902,952	6,020,562	0.7014	7,825,849	0.822	2,152,060	0.833
2009	<b>4,693</b>	12,221,784	5,292,546	0.7014	6,879,535	0.822	1,891,829	0.833
2010	<b>4,205</b>	10,950,268	4,741,925	0.7014	6,163,809	0.822	1,695,009	0.833
2011	<b>3,821</b>	9,950,079	4,308,802	0.7014	5,600,812	0.822	1,540,188	0.833
2012	<b>3,514</b>	9,152,056	3,963,224	0.7014	5,151,612	0.822	1,416,661	0.833
<b>TOTAL</b>	<b>16232.36</b>							

**TOTAL Project Emissions:**

$$PE_y = PE_{CO_2, gas, y} + PE_{CO_2, generators, y} + PE_{CH_4, accident} \quad (13)$$

With

$PE_y$  Project Emission for the year y in Tco2eq

$PE_{CO_2, gas}$  is the Project Emission from the gas processing and related components

$PE_{CH_4, accident}$  is the emission, venting, leakage of CH4 in case of accidents

**Total Project Emissions**

*Formula (13)*

Years	$PE_y$	$Pe_{\text{electricity generation, y (T)}}$	$PE_{CO_2, gas, y (T)}$
2008	20,823	15,485	5,338
2009	18,305	13,612	4,693
2010	16,401	12,196	4,205
2011	14,903	11,082	3,821
2012	13,707	10,193	3,514
<b>TOTAL</b>	<b>84,139</b>		

**For 5 Years Period E.1 = 84 139 tCO2**

**E.2 Estimated leakage:**

No leakage effects were identified for this project. It is not likely that the demand for power or LPG will increase due to the project activity. It is not likely either that any of the production activities will be outsourced.

**E.2 = 0**

**E.3 The sum of E.1 and E.2 :**

$$E.3 = 84\,139 \text{ tCO}_2\text{eq}$$

**E.4 Estimated Baseline Emissions:***Flared gas*

The project intends to measure the gas flow and the carbon content of the gas previously flared. The project uses the approach from the previously approved CDM methodology AM0009 version 2 and assumes full oxidization.

$$BL_y = BL_{A,y} + BLDE_y \quad (11)$$

where:

$BL_{A,y}$  Are the baseline emissions during the period  $y$  in tons of CO<sub>2</sub> equivalents.

$BLDE_y$  is the baseline for displaced electricity from the grid

$BL_{A,y}$  Is the Base Line calculated based on the gas recovered  $V_A$  from the oil fields at point A in Figure 1 during the period  $y$  – calculation is done according to the AM0009 as described in Chapter B and in the Annex 2.

where

*Flared gas*

The project intends to measure the gas flow and the carbon content of the gas previously flared. The project uses the approach from the previously approved CDM methodology AM0009 version 2 and assumes full oxidization.

$$BL_{A,y} = V_{A,y} * w_{carbon,A,y} * 44/12 * 1/1000 \quad (11.1)$$

Where:

$BL_{A,y}$  Are the baseline emissions during the period  $y$  in tons of CO<sub>2</sub> 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<sup>3</sup>.

$w_{carbon,A,y}$  Is the average content of carbon in the gas recovered at point A in Figure 1 during the period  $y$  in kg-C/m<sup>3</sup>.

The average methane content in the gas  $w_{CH_4,A,y}$  is determined from regular measurements of the composition of the gas, taking into account the molecular weight of all fractions of the gas.

**Flared Gas – Baseline (Formula 11.1)**

Years (y)	$w_{carbon, A}$	$V_{A,y}$	$BL_{A,y}$
2008	1.09	12,755,399	50,977
2009	1.09	11,212,995	44,813
2010	1.09	10,046,429	40,151
2011	1.09	9,128,797	36,484
2012	1.09	8,396,643	33,558
<b>TOTAL</b>		<b>51,540,262</b>	<b>205,983</b>

*Electricity displaced from the grid*Emissions related to power consumed for the on-site oil extraction

At the present power consumed for oil extraction is supplied from the national grid. After the project implementation the power produced by the generators will substitute power from the power grid. Hence the same baseline that was estimated for the national power grid will be used to estimate emission reductions related to power consumed for on-site oil extraction. Power produced by on-site generators using methane-ethane will result in different amount of CO<sub>2</sub> compared to the flaring of associated gas, due to the different composition of gases flared. The emission factors for the on-site power production will be calculated.

*The baseline emissions from displacing electricity from the grid are calculated as follows:*

$$BLDE_y = (\sum Kwh_{displaced,y}) \cdot KCO2_{grid,y} \quad (11.2)$$

$Kwh_{displaced,y} = (\sum Kwh_{generators,y}) - Kwh_{gas\ plant,\ project,y}$  is the electricity displaced from the grid in KWH

$Kwh_{generators,y}$  is the total Kwh generation by electrical generator for the year y on the oil fields

$Kwh_{gas\ plant,\ project,y}$  is the KWH generation use for all equipments related to the project ( ie gas processing plant, pumps, pipeline pumps, security equipment etc..)

$KCO2_{grid,y}$  is for the year y, the CO<sub>2</sub> Lithuanian grid factor equivalent in Ton of Co<sub>2</sub> for per Kilowatt of electrical power displaced from the Lithuanian grid. Either in force in Lithuania and/or in the EU and/or calculated as proposed in the PDD while doing the monitoring.

**Baseline from Electricity Displaced (Formula 11.2)**

Years(y)	$\Sigma \text{Kwh}_{\text{generators}^*}$	$\text{Kwh}_{\text{gas plant}}^{***}$	$\text{Kwh}_{\text{displaced, y}}$	$\text{K}_{\text{CO2, grid, y}}^{**}$	$\text{BLDE}_y$
2008	22,298,378	8,865,002	13,433,375	0.457	6,139
2009	19,602,020	7,793,031	11,808,989	0.457	5,397
2010	17,562,687	6,982,268	10,580,419	0.457	4,835
2011	15,958,525	6,344,514	9,614,012	0.496	4,769
2012	14,678,609	5,835,667	8,842,942	0.514	4,545
<b>TOTAL</b>	<b>90,100,219</b>	<b>35,820,482</b>	90,100,219		<b>25,685</b>

\* Generator 20M3 per Hours (Methane/Ethane) – source: Schmitt-Enertec Doc.FMB190GMK

Power Ratio 3.33 KWH/NM3

\*\*From KCO2grid from Table 4 – calculated

\*\*\*PeterburgNiimach- Technical Documentation

Gas Processing Recovery Efficiency 0.7 KWH/M3flareGas

**Total Baseline Evaluation (Formula 11)**

Years (y)	$\text{BL}_{A, y}$	$\text{BLDE}_y$	$\text{BI}_y$
2008	50,977	6,139	57,117
2009	44,813	5,397	50,210
2010	40,151	4,835	44,986
2011	36,484	4,769	41,252
2012	33,558	4,545	38,103
<b>TOTAL</b>	205,983	25,685	<b>231,668</b>

**E.4. = 251 668tCO<sub>2</sub>eq (5 Years)**

**E.5 Difference between E.4 and E.3 representing the emission reductions of the project :**

Total project emission reductions for 2008-2012 are:

*Total project emission reductions = Baseline emissions – emissions from project activity*

$$EF_y = BL_y - PE_{CO_2, gas} - PE_{CO_2, generators, y} - PE_{CH_4, pipeline, accident} \quad (12)$$

where:

$EF_y$  Are the emissions reductions of the project activity, adjusted for leakage, during the period y in tons of CO<sub>2</sub> equivalent.

$BL_y$  Are the baseline emissions during the period y in tons of CO<sub>2</sub> equivalent.

$PE_{CO_2, gas, y}$  Are the CO<sub>2</sub> emissions from the project activity due to combustion, flaring or venting of recovered gas during the period y in tons of CO<sub>2</sub>.

$PE_{CO_2, generators, y}$  are the CO<sub>2</sub> emissions due to all generators at all field Xi during the period y in tons of CO<sub>2</sub>

$PE_{CH_4, pipeline, accident}$  Are the CH<sub>4</sub> emissions from the project activity due to transport of the recovered gas in the pipeline when the accidental event occurs in tons of CO<sub>2</sub> equivalent.

$L_y$  Are any leakage emissions during the period y in tons of CO<sub>2</sub> equivalent.

Emission Reductions

*Formula (12)*

Years(y)	$EF_y$	$BL_y$	$PE_{Co_2, gas}$	$PE_{CO_2, generators}$
2008	36,293	57,117	5,338	15,485
2009	31,905	50,210	4,693	13,612
2010	28,586	44,986	4,205	12,196
2011	26,350	41,252	3,821	11,082
2012	24,395	38,103	3,514	10,193
<b>TOTAL</b>	<b>147,529</b>	231,668	21,571	62,568

**E.5 = E.4 – E.3 = 147 529 tCO<sub>2</sub>** for the 5 Years crediting Period.

**E.6 Table providing values obtained when applying formulae above:**

E.6.

Year	Estimated project emissions (tonnes of CO2 eq.)	Estimated leakage (tonnes of CO2 equivalent)	Estimated baseline emissions (tonnes of CO2 eq.)	Estimated emission reductions (tonnes of CO2 eq.)
2008	20,823	NA	57,117	36,293
2009	18,305	NA	50,210	31,905
2010	16,401	NA	44,986	28,586
2011	14,903	NA	41,252	26,350
2012	13,707	NA	38,103	24,395
Total (Tonnes of CO2 equivalent)	84,139		231,668	147,529

**SECTION F. Environmental impact**

F.1. Documentation on the analysis of the environmental impacts of the project, including transboundary impacts, in accordance with procedures as determined by the host Party:

The Monitoring Plan (MP) and the Base Line Study are based on the assumption that the project will reduce emission of GHG, which are emitted from the Flaring Activities of oil extraction and from the electricity consumption from the national electricity grid – used for the extraction of oil. As mentioned earlier the reduced environmental impacts will be recorded in order to monitor that the expected environmental benefits are achieved.

Local community can at any time submit comments to the project's environmental impact managers.

Moreover, a local environmental impact analysis in order to inform the local community has taken place according to the law of Lithuania. Important comments -if any- and their solutions will be included in the annual monitoring report. Finally, the Lithuanian Ministry of Environment – Region of Klaipeda Office - gave its approval for the EIA on the document Nr. (9.14.2)-V4-3052 dated 2005.08.25.

New wells and new technologies improving CO2 saving can be included according to the PDD.

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

Not Applicable.

**SECTION G. Stockholders Comments****G.1. Information on stakeholders' comments on the project, as appropriate:**

The procedure of EIA has been followed as requested locally by the regulation and a public mention in newspaper were published and the PDD was published on the DanishCarbon and DNV web sites without any comment received. The management of Minijos Nafta has approved the project by the signature of the agreement with the DEPA and no comment were received from any party.

**Annex 1: Contact information on project participants**

<b>Organisation:</b>	UAB Minijos Nafta
<b>Street/P.O.Box:</b>	Gamyklos g.11
<b>Building:</b>	P.d. 12
<b>City:</b>	Gargzdai
<b>State/Region:</b>	Klaipėdos raj.
<b>Postal code:</b>	LT-96002
<b>Country:</b>	Lithuania
<b>Phone:</b>	+370 46 40 50 60
<b>Fax:</b>	+370 46 40 50 55
<b>E-mail:</b>	Mail AT minoil DOT lt
<b>URL:</b>	<a href="http://www.minijosnafta.lt">www.minijosnafta.lt</a>
<b>Represented by:</b>	
<b>Title:</b>	Director
<b>Salutation:</b>	Mr.
<b>Last name:</b>	HASELTON
<b>Middle name:</b>	
<b>First name:</b>	Thomas
<b>Department:</b>	
<b>Phone (direct):</b>	
<b>Fax (direct):</b>	
<b>Mobile:</b>	
<b>Personal e-mail:</b>	Tmh AT minoil DOT lt

<b>Organisation:</b>	DEPA – Danish Carbon
<b>Street/P.O.Box:</b>	Strandgade 29
<b>Building:</b>	
<b>City:</b>	Copenhagen
<b>State/Region:</b>	
<b>Postal code:</b>	DK-1401
<b>Country:</b>	Denmark
<b>Phone:</b>	+45 32660100
<b>Fax:</b>	
<b>E-mail:</b>	Pep AT mst DOT dk
<b>URL:</b>	<a href="http://www.danishcarbon.dk">www.danishcarbon.dk</a>
<b>Represented by:</b>	
<b>Title:</b>	Regional Manager
<b>Salutation:</b>	Mr.
<b>Last name:</b>	PEDERSEN
<b>Middle name:</b>	
<b>First name:</b>	Peter
<b>Department:</b>	
<b>Phone (direct):</b>	
<b>Fax (direct):</b>	
<b>Mobile:</b>	
<b>Personal e-mail:</b>	Pep AT mst DOT dk

**Annex 2: Baseline information****Annex 2.1 Oil extraction 2005 and Forecast of associated gas flow**

Letter 15 November 2006

15 November, 2006 No.

Mrs. Susanne Haefeli

Det Norske Veritas  
International Climate Change Services

C.c. Mr. Robert Vergnes

UAB Litproenergija

Attached please find UAB Minijos Nafta oil production estimate for the years 2008 – 2012. Since there are no possibilities to evaluate oil production directly, the estimate is based on a conservative assessment of the history of oil production from Minijos Nafta's oil fields (green color on the graph). Future production development projects are not taken into account. The estimate is prepared using OFM<sup>TM</sup> 2005 software and existing data on reservoir properties.

What concerns discharge of carbon dioxide during the above mentioned period of time it is agreed that oil production will drop down in all oil fields proportionally.

Oil/gas ratio, production history on 2005 used for calculations is indicated also (Annex 2).

Attachments:

Annex 1 and Annex 2

2 pages

Sincerely,

Acting Deputy Director

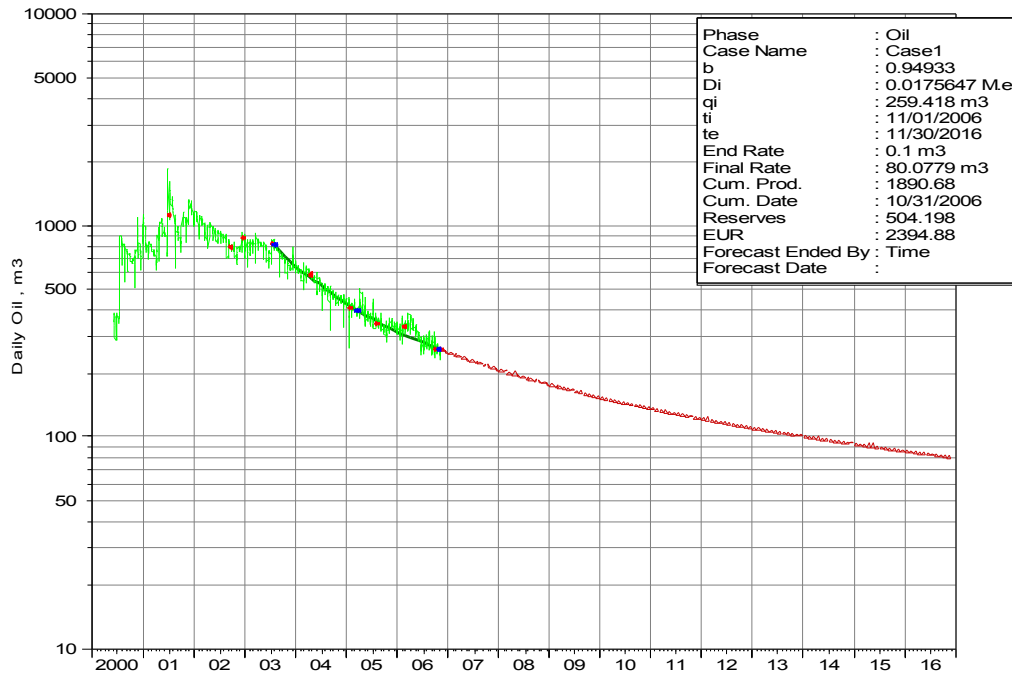
Bronius Radeckas

Robertas Klestornas, tel.: + 370 699 54983



Minoil-Annex 1

Oil production estimate from UAB Minijos Nafta license area in 2008 – 2012



Date	M3/day	Date	M3 /day	Date	M3 /day	Date	M3 /day
1/31/2008	204	4/30/2009	168	7/31/2010	143	10/31/2011	124
2/29/2008	202	5/31/2009	166	8/31/2010	141	11/30/2011	123
3/31/2008	199	6/30/2009	164	9/30/2010	140	12/31/2011	122
4/30/2008	196	7/31/2009	163	10/31/2010	139	1/31/2012	121
5/31/2008	193	8/31/2009	161	11/30/2010	137	2/29/2012	120
6/30/2008	191	9/30/2009	159	12/31/2010	136	3/31/2012	119
7/31/2008	188	10/31/2009	157	1/31/2011	135	4/30/2012	118
8/31/2008	186	11/30/2009	155	2/28/2011	133	5/31/2012	117
9/30/2008	183	12/31/2009	154	3/31/2011	132	6/30/2012	116
10/31/2008	181	1/31/2010	152	4/30/2011	131	7/31/2012	115
11/30/2008	179	2/28/2010	150	5/31/2011	130	8/31/2012	114
12/31/2008	177	3/31/2010	149	6/30/2011	128	9/30/2012	113
1/31/2009	174	4/30/2010	147	7/31/2011	127	10/31/2012	112
2/28/2009	172	5/31/2010	146	8/31/2011	126	11/30/2012	111
3/31/2009	170	6/30/2010	144	9/30/2011	125	12/31/2012	110



Based on existing oil production history and with assistance of OFM<sup>TM</sup> 2005 software UAB Minijos Nafta oil production estimate for 2008 – 2012 (m<sup>3</sup>/day) was computed (possible oil production from new oil fields is not included).

**Minoil-Annex 2**

G.O.R - Gas to Oil Ratio			
Gas factor of oil fields m <sup>3</sup> gas/ m <sup>3</sup> on ton of oil *	m <sup>3</sup> /ton	m <sup>3</sup> /m <sup>3</sup>	Oil density, t/m <sup>3</sup>
Vilkyčiai	42.39	34.17	0.81
Pietu Siupariai	63.82	51.69	0.81
Degliai	64.1	51.28	0.80
Siupariai	67.0	55.3	0.83
Sakuciai	58.7	48.7	0.83
Pociai	34.3	27.783	0.81
Agluonėnai	63.82	86,025	0,8
Uoksai	42.39	52,33	0,81

## Oil and associated gas production on 2005

Oil field	Production M3	GOR m <sup>3</sup> /m <sup>3</sup>	Gas production
Vilkyčiai	49848.283	34.17	1703306
Pietų Šiupariai	25859.021	51.69	1336653
Diegliai	14203.684	51.28	728365
Šiupariai	8402.404	55.3	464653
Sakučiai	18139.107	48.7	883374
Pociai	15750.227	27.783	437588
Agluonėnai	1687.001	86,025	145124
Uoksai	772.272	52,33	40413



17 November, 2006 No.

Mrs. Susanne Haefeli  
Det Norske Veritas  
International Climate Change Services

C.c. Mr. Robert Vergnes  
UAB Litproenergija

Please, be informed, that our company has a plans to drill an exploration well in to new formation Pangiriai. To receive required permit for the exploration was conduct a impact in to environment study during exploration and production period. A study was positive approved by Lithuania ministry of environment ( letter 2004 11 04 Nr. 9.14.2) – V4-4348).

The study was based on maximal annual production rate : 36500 m3.

Associated gas composition was accepted equal as Vilkyčiai oil field.

Sincerely,

Acting Deputy Director

Bronius Radeckas

Robertas Klestornas, tel.: + 370 699 54983



24 Nov 2006 15:33

UAB "Minijos nafta"

+37046405055

p. 1

**UAB Minijos Nafta**

Mrs. Susanne Haefeli  
Det Norske Veritas  
International Climate Change Services

24 November, 2006 No. *435*

C.c. Mr. Robert Vergnes  
UAB Litproenergija

Dear Mrs. Haefeli,

After implementation of secondary recovery plan and build up of new generation oil reservoir models aimed at increasing oil production it is expected that our recoverable reserves could raise from 359 000 m<sup>3</sup> to 2 218 000 m<sup>3</sup>.

The above mentioned development measures could result in a higher production level in comparison to the statistical forecast based on production history, as mentioned in our oil fields development plans.

Hence we agree that Mr. Vergnes, our PDD developer, use these figures for calculations, necessary to plan the forecast 2008-2012, which is needed for the PDD.

Yours Sincerely,

Acting Deputy General Manager

Bronius Radeckas

Robertas Klestomas, tel.: + 370 699 54983

UAB Minijos Nafta  
Company code 110699717  
Gamyklos 11, P.O.Box 12, LT-96002 Gargzdai, Lithuania  
Tel: +370 46 40 50 60 Fax: +370 46 40 50 55 E-mail: mail@minoil.lt



**Annex 2.2: Calculation of CO<sub>2</sub>e emission factors for emissions from gas flaring – 100% oxidation & Hydrocarbon Mass**

Chromatography – Flare gas content, % volume											*2005 production weight
Composition of flare gas	Density, kg/m <sup>3</sup>	Heating value, MJ/kg	Vilkyčiai %	Siupariai %	Degliai %	Sakuciai %	Pociai %	Pietu Siupariai %	Agluonenai %	Uoksai %	Typical Minoil Gas (Weighted Average) *
Chromatographic Document Ref.			Preusag-energie-TPC-Dr.Kz/HH-25092001	Siupariai-PrilopenieNr.61-1969/1901/1950	Preusag-energie-TPC-Dr.Kz/HH-25092001	Sakuciai-Prilopenie30-Avrg 2027/2030/2038M	Pociai Prilopenie-28/ckv nr 4-5 and ckv nr 1-3/1990M	Preusag-energie-TPC-Dr.Kz/HH-25092001	Archives -Accepted Pietu Siupariai	Archives -Accepted Pietu Vilkyčiai	Calculated
CH <sub>4</sub>	0.717	52.58	37.66%	36.00%	45.25%	41.43%	27.60%	30.39%	30.39%	37.66%	36.42%
C <sub>2</sub> H <sub>6</sub>	1.342	49.68	16.29%	20.75%	10.36%	19.80%	10.70%	16.32%	16.32%	16.29%	16.02%
C <sub>3</sub> H <sub>8</sub>	2.020	46.35	19.18%	22.83%	14.67%	17.97%	13.90%	22.07%	22.07%	19.18%	19.06%
C <sub>4</sub> H <sub>10</sub>	2.597	45.72	12.93%	8.00%	9.67%	7.15%	6.44%	15.62%	15.62%	12.93%	11.43%
C <sub>5</sub> H <sub>12</sub>	3.223	45.35	5.93%	3.75%	7.15%	2.03%	3.06%	8.75%	8.75%	5.93%	5.82%
N <sub>2</sub>	1.250	0.00	6.59%	7.10%	11.84%	10.30%	37.00%	5.70%	5.70%	6.59%	9.96%
CO <sub>2</sub>	1.977	0.00	1.13%	1.50%	0.78%	1.17%	0.80%	0.72%	0.72%	1.13%	0.99%
H <sub>2</sub> S	1.620	16.99	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
noble gas		0.00	0.29%	0.07%	0.28%	0.15%	0.53%	0.45%	0.45%	0.29%	0.31%
<b>Total</b>		256.67	100%	100%	100%	100%	100%	100%	100%	100%	100%
<i>(error level chksum)</i>			0.0000%	0.0000%	0.0000%	0.0000%	0.0300%	0.0000%	0.0000%	0.0000%	-0.002%

Carbon content in flare gas, kg C/m <sup>3</sup>											*2005 production weight
Flare gas content	mass, kg/m <sup>3</sup>	Carbon content in gas, %	Vilkyčiai Carbon content, kgC/m <sup>3</sup>	Siupariai Carbon content, kgC/m <sup>3</sup>	Degliai Carbon content, kgC/m <sup>3</sup>	Sakuciai Carbon content, kgC/m <sup>3</sup>	Pociai Carbon content, kgC/m <sup>3</sup>	Pietu Siupariai Carbon content, kgC/m <sup>3</sup>	Aglupnenai Carbon content, kgC/m <sup>3</sup>	Uoksai Carbon content, kgC/m <sup>3</sup>	Typical Minoil Gas (Weighted Average)* w <sub>carbon,A</sub> KgC/m <sup>3</sup>
CH <sub>4</sub>	0.717	<b>0.75</b>	0.202	0.194	0.243	0.223	0.148	0.163	0.163	0.202	0.196
C <sub>2</sub> H <sub>6</sub>	1.342	<b>0.80</b>	0.175	0.223	0.111	0.213	0.115	0.175	0.175	0.175	0.172
C <sub>3</sub> H <sub>8</sub>	2.020	<b>0.82</b>	0.317	0.377	0.242	0.297	0.230	0.365	0.365	0.317	0.315
C <sub>4</sub> H <sub>10</sub>	2.597	<b>0.83</b>	0.278	0.172	0.208	0.154	0.138	0.336	0.336	0.278	0.246
C <sub>5</sub> H <sub>12</sub>	3.223	<b>0.83</b>	0.159	0.101	0.192	0.055	0.082	0.235	0.235	0.159	0.156
N <sub>2</sub>	1.250	<b>0.00</b>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CO <sub>2</sub>	1.977	<b>0.27</b>	0.006	0.008	0.004	0.006	0.004	0.004	0.004	0.006	0.005
H <sub>2</sub> S	1.620	<b>0.00</b>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
noble gas		<b>0.00</b>	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
<b>Total</b>			<b>1.138</b>	<b>1.074</b>	<b>1.001</b>	<b>0.947</b>	<b>0.718</b>	<b>1.278</b>	<b>1.278</b>	<b>1.138</b>	<b>1.090</b>

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## Mass of Hydrocarbon per Year in the Flare Gas

Composition of flare gas	Density, kg/m <sup>3</sup>	Heating value, MJ/kg	Typical Minoil Gas (Weighted Average) *	Quantity of Hydrocarbon t/year						
				2008	2009	2010	2011	2012	TOTAL	
				$V_{A,y}$ (M <sup>3</sup> )	12,755,399	11,212,995	10,046,429	9,128,797	8,396,643	<b>51,540,262</b>
<b>CH<sub>4</sub></b>	0.717	52.58	<b>36.42%</b>	<b>CH<sub>4</sub></b>	3331.17	2928.36	2623.70	2384.06	2192.85	<b>13,460</b>
<b>C<sub>2</sub>H<sub>6</sub></b>	1.342	49.68	<b>16.02%</b>	<b>C<sub>2</sub>H<sub>6</sub></b>	2742.41	2410.80	2159.98	1962.69	1805.28	<b>11,081</b>
<b>C<sub>3</sub>H<sub>8</sub></b>	2.020	46.35	<b>19.06%</b>	<b>C<sub>3</sub>H<sub>8</sub></b>	4910.43	4316.65	3867.56	3514.30	3232.44	<b>19,841</b>
<b>C<sub>4</sub>H<sub>10</sub></b>	2.597	45.72	<b>11.43%</b>	<b>C<sub>4</sub>H<sub>10</sub></b>	3784.96	3327.28	2981.12	2708.82	2491.57	<b>15,294</b>
<b>C<sub>5</sub>H<sub>12</sub></b>	3.223	45.35	<b>5.82%</b>	<b>C<sub>5</sub>H<sub>12</sub></b>	2391.18	2102.03	1883.34	1711.32	1574.07	<b>9,662</b>
<b>N<sub>2</sub></b>	1.250	0.00	<b>9.96%</b>	<b>N<sub>2</sub></b>	0.00	0.00	0.00	0.00	0.00	<b>0</b>
<b>CO<sub>2</sub></b>	1.977	0.00	<b>0.99%</b>	<b>CO<sub>2</sub></b>	0.00	0.00	0.00	0.00	0.00	<b>0</b>
<b>H<sub>2</sub>S</b>	1.620	16.99	<b>0.00%</b>	<b>H<sub>2</sub>S</b>	0.00	0.00	0.00	0.00	0.00	<b>0</b>
<b>noble gas</b>		0.00	<b>0.31%</b>	<b>noble gas</b>	0.00	0.00	0.00	0.00	0.00	<b>0</b>
<b>Total</b>		256.67	<b>100.00%</b>	<b>TOTAL</b>	<b>17160.151</b>	<b>15085.117</b>	<b>13515.708</b>	<b>12281.194</b>	<b>11296.209</b>	<b>69338.378</b>

<b>Maximum Recovery</b>	<b>T/Year (average)</b>	<b>Total 5 years</b>	<b>2008 (T/year)</b>	<b>2009 (T/Year)</b>	<b>2010 (T/Year)</b>	<b>2011 (T/Year)</b>	<b>2012 (T/Year)</b>
<i>Methane-Ethane (mass)</i>	4,908	24,541	6074	5339	4784	4347	3998
<i>Butane-Propane(mass)</i>	7,027	35,135	8695	7644	6849	6223	5724
<i>Condensate (mass)</i>	1,932	9,662	2391	2102	1883	1711	1574

**Gas Plant Recovery (T/Year)**

As Production Figures are very conservative:

We assume full recovery of the hydrocarbon for Baseline and Project Emissions with a Gas Plant Efficiency at 90%

<b>Gas Plant Recovery (T/Year)</b>	<b>T/Year (average)</b>	<b>Total 5 years</b>	<b>2008 (T/year)</b>	<b>2009 (T/Year)</b>	<b>2010 (T/Year)</b>	<b>2011 (T/Year)</b>	<b>2012 (T/Year)</b>
Methane-Ethane (mass)	4,417	22,087	5,466	4,805	4,305	3,912	3,598
Butane-Propane(mass)	6,324	31,622	7,826	6,880	6,164	5,601	5,152
Condensate (mass)	1,739	8,696	2,152	1,892	1,695	1,540	1,417

*Consistency Check*

*0.000*

*0.000*

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*0.000*

*0.000*

<b>Gas Plant Recovery (M3/year)</b>	<b>M3/Year (average)</b>	<b>Total 5 Years</b>	<b>2008 (M3/Year)</b>	<b>2009 (M3/Year)</b>	<b>2010 (M3/Year)</b>	<b>2011 (M3/Year)</b>	<b>2012 (M3/Year)</b>
Methane-Ethane (Volume Gas)	4,865,412	24,327,059	6,020,562	5,292,546	4,741,925	4,308,802	3,963,224
Butane-Propane(Volume Gas)	2,828,187	14,140,937	3,499,658	3,076,474	2,756,407	2,504,639	2,303,760
Condensate (Volume Gas)	539,656	2,698,280	667,782	587,032	525,959	477,919	439,588



Methane/Ethane after the separation (Volume)

	Before Separation	After Separation	Density, kg/m <sup>3</sup>	Carbon content in gas, %	Typical Minoil Gas (Weighted Average)* $w_{\text{carbon,DryGas,B}}$ KgC/m <sup>3</sup>
<b>CH<sub>4</sub></b>	36.42%	<b>69.45%</b>	<b>0.717</b>	<b>0.750</b>	<b>0.3735</b>
<b>C<sub>2</sub>H<sub>6</sub></b>	16.02%	<b>30.55%</b>	<b>1.342</b>	<b>0.800</b>	<b>0.3280</b>
				$w_{\text{carbon,DryGas,B}}$ KgC/m <sup>3</sup>	<b>0.701</b>

Butane/Propane after Separation (mass)

	Before Separation	After Separation	Density, kg/m <sup>3</sup>	Carbon Content in gas %	Typical Minoil Gas (Weighted Average)* $w_{\text{carbon,DryGas,B}}$ KgC/m <sup>3</sup>	Typical Minoil Gas (Weighted Average)* $w_{\text{carbon,DryGas,B}}$ KgC/KgLPG
<b>C<sub>3</sub>H<sub>8</sub></b>	19.06%	<b>62.52%</b>	<b>2.020</b>	<b>0.818</b>	<b>1.033</b>	<b>0.511</b>
<b>C<sub>4</sub>H<sub>10</sub></b>	11.43%	<b>37.48%</b>	<b>2.597</b>	<b>0.828</b>	<b>0.806</b>	<b>0.310</b>
				$w_{\text{carbon,DryGas,B}}$ KgC/m <sup>3</sup>	<b>1.839</b>	<b>0.822</b>
				$w_{\text{carbon,DryGas,B}}$ KgC/KgLPG	<b>0.822</b>	

Condensate after Separation (mass).

	Before Separation	After Separation	1.620	Carbon Content in gas %	Typical Minoil Gas (Weighted Average)* $w_{\text{carbon,DryGas,B}}$ KgC/m <sup>3</sup>	Typical Minoil Gas (Weighted Average)* $w_{\text{carbon,DryGas,B}}$ KgC/KgLPG
<b>C<sub>5</sub>H<sub>12</sub></b>	5.82%	100.00%	3.223	<b>0.83</b>	<b>2.686</b>	<b>0.833</b>
				$w_{\text{carbon,condensate,B}}$ KgC/m <sup>3</sup>	<b>2.686</b>	
				$w_{\text{carbon,condensate,B}}$ KgC/KgCndst	<b>0.833</b>	

**Annex 2.3 – Result of the Balmorel Model for Lithuania.**

Technology name	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Total generation:	17651	17808	18080	15551	14233	13016	13154	13245	13409	10199	10855	11477	12253	12912	13497	14409	14668	15072	15372	15459
Kruonis HSPP gen	79	69	110	73	216	435	416	484	614	408	363	374	386	398	430	475	471	500	519	526
Kruonis HSPP pump	-110	-96	-153	-102	-300	-604	-578	-672	-852	-566	-504	-520	-536	-553	-597	-660	-654	-694	-721	-731
Hydro PP	364	364	364	364	364	364	364	364	364	364	364	364	364	364	364	364	364	364	364	364
Ignalina NPP	15168	15188	15227	7742	7742	7742	7742	7742	7742	0	0	0	0	0	0	0	0	0	0	0
Lithuanian PP	0	0	232	4069	3035	2006	1831	1818	1549	4974	5730	6409	7246	7965	8575	9662	9928	10270	10489	10489
Vilnius CHP-3	1438	1467	1486	1735	1683	1688	1828	1863	1859	1930	1833	1775	1716	1656	1637	1624	1622	1633	1663	1692
Kaunas CHP	457	557	572	636	506	296	281	277	272	540	541	542	544	544	545	546	548	549	550	563
Mazeikiai CHP	192	195	209	223	226	231	233	269	273	274	256	257	259	260	262	264	265	275	284	286
Small CHP	63	64	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New CCGT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Small scale new CHP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New CCGT CHP	0	0	0	810	760	859	1036	1102	1591	2275	2272	2275	2277	2277	2280	2134	2124	2175	2226	2270
New GT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Heat pump	0	0	0	0	-1	-1	-1	-1	-2	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	0

Source: “Economic analyses in the electricity sector in Lithuania”



**Annex 2.4: Fuel mix used in power plants**

Weighted fuel mix average in 2003 in %

	Natural gas	HFO	Orimulsion
Condensing TPP	81%	3%	16%
CHPs	72%	28%	0%
New CHPs	100%	0%	0%

Weighted fuel mix average forecast for 2005 in %

	Natural gas	HFO	Orimulsion
Condensing TPP	75%	5%	20%
CHPs	55%	41%	5%
New CHPs	100%	0%	0%

Source: NAP

Weighted fuel mix average forecast for 2006 in %

	Natural gas	HFO	Orimulsion
Condensing TPP	55%	5%	40%
CHPs	55%	41%	5%
New CHPs	100%	0%	0%

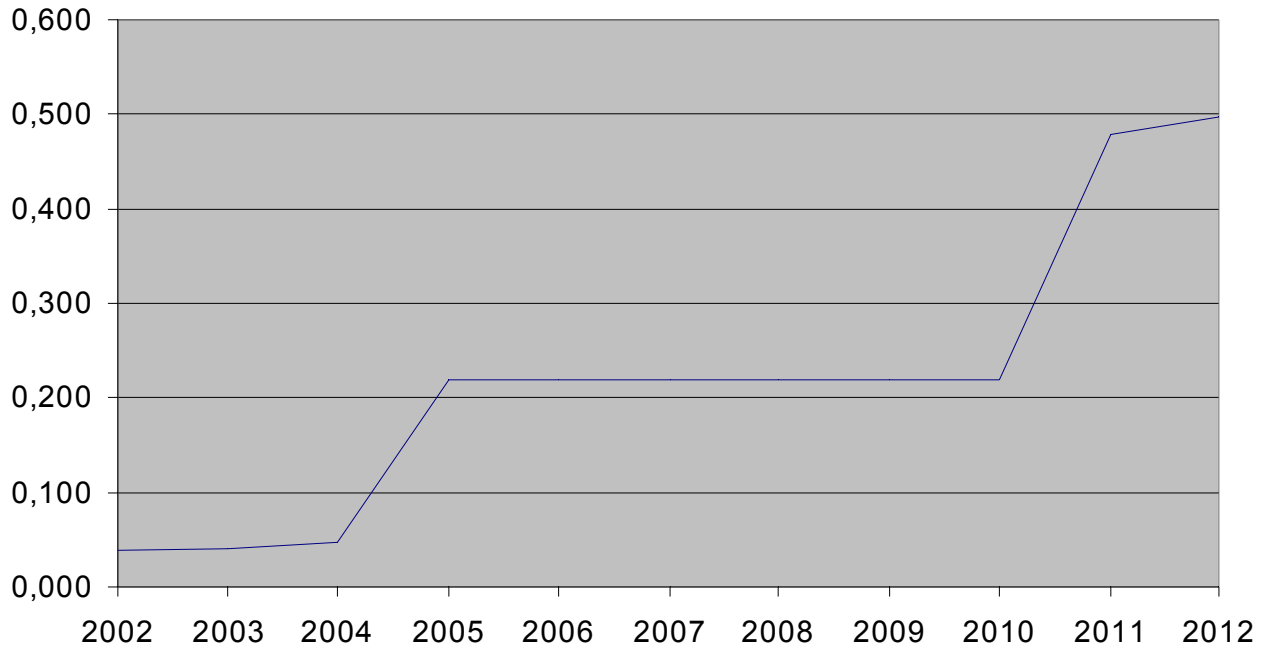
Weighted fuel mix average forecast for 2007 in %

	Natural gas	HFO	Orimulsion
Condensing TPP	15%	5%	80%
CHPs	55%	41%	5%
New CHPs	100%	0%	0%

Source: National Allocation Plan for Lithuania under EUETS. Calculated by Ekostrategija

**Annex 2.5: Marginal fuel prices<sup>3</sup> and CO2 allowance costs**

## INPP and HPP included



<sup>3</sup> To calculate marginal prices – natural gas is assumed to have zero emissions, and other fuels are compared against it  
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**Annex 2.6: Geological Stability of Flare Gas Composition – Letter from Geological Institute**

**INSTITUTE OF GEOLOGY AND GEOGRAPHY**

25 09 2006 No. 01-18-254

Ref. Letter No. 341 of 20 09 2006

General Manager

UAB Minijos Nafta

RE dissolved petroleum gas

Referring to your letter of 20 September 2006 with request to assess possible change of oil/gas ration and composition of dissolved gas at different stages of oil production in Sakuciai, Pietu Siupariai, Siupariai, Vilkyciai, Agluonenai, Pociai, and Diegliai oil fields we hereby forward you a report on the issue prepared by an employee of the Institute Dr. Zdanaviciute.

Director

/signature/

Algirdas Zuzevicius

Onyte Zdanaviciute, 85 2104701; e-mail: [zdanaviciute@geo.lt](mailto:zdanaviciute@geo.lt)



### **Consistent patterns of change of dissolved gas factor and gas composition during the course of field exploitation**

(Sakuciai, Pietu Siupariai, Siupariai, Vilkyčiai, Agluonenai, Pociai,  
and Diegliai oil fields)

During the process of oil production fluids (oil and formation water) are lifted from the underground layer together with the dissolved gas. Due to that formation pressure drops down and more gas may be discharged, i.e. oil production creates premises for a decline of gas factor (amount of dissolved gas in 1 m<sup>3</sup> or 1 tone of oil). However, edge or bottom water to the large extend compensates the amount of fluid pumped out. Moreover, the measures for sustaining formation pressure are used to ensure an efficient oil production, i.e. formation water lifted together with oil is pumped back to the reservoir, etc. Thus during the first years of oil production formation pressure remains quite stable, later it falls down at a quite slow rate. Especially that the gas factor in Lithuanian oil fields is not high, i.e. amount of dissolved gas is not big. The initial gas factor in the above mentioned fields was as follows: Sakuciai – 48.7, Pietu Siupariai – 63.82, Siupariai – 55.3, Vilkyčiai – 42.5, Pociai – 34.3, and Diegliai – 64.1 m<sup>3</sup>/m<sup>3</sup>. Solubility of gas depends on temperature, pressure, and chemical composition of oil and gas. Formation temperature is stable, while the pressure decline is insignificant, as mentioned above, therefore the gas factor changes slightly during the course of oil production in the above mentioned oil fields.

Composition of dissolved gas during the exploitation of oil fields alter even less that the gas factor. The initial composition of dissolved gas is indicated in the table. The table also contains data on composition of dissolved gas, when deep oil samples were used for the analysis. Data retrieved from the surface gas samples (taken at well head, separator or oil pipeline) will differ from the one indicated in the table as it will contain a larger amount of heavy hydrocarbons (propane and butane) (Богомолов и др., 1989, Соколов и др., 1972). In all oil fields, except Pociai, the saturated hydrocarbons make the basic compound element of the dissolved gas (92.5 – 97.6%). Three gaseous hydrocarbons, i.e. methane, ethane, and butane, predominate in the saturated hydrocarbons. During the exploitation of oil fields as formation pressure goes down, the light hydrocarbons (methane, density 0.554 (according to the air) and ethane, density 1.049) are discharged first of all. Later, heavier hydrocarbons (propane, density 1.554 and butane (izo- and normal) with density over 2) are discharged (Соколов и др., 1972). In Pociai oil field content of nitrogen in gas is rather big, i.e. over 37%, while in other oil fields amount of nitrogen vary between 1.8 – 5.6%. Besides nitrogen helium and argon in small amounts as well as carbon dioxide (0.7 – 1.9%) was found in the gas.

The above mentioned regularities of alteration of composition of the dissolved gas in a process of oil production are based on the data of gas survey under formation conditions. As mentioned above, gas composition under surface conditions may be slightly different dependent on peculiarities of surface conditions and ambient temperature. That should be established by monitoring the composition of gas, however, such data is not available to the author. Thus it is recommended to survey the composition of dissolved gas every year. To evaluate the impact of surface conditions on composition of gas it is recommended to perform the survey in winter time one year and in summer time the next year. In case the composition of gas has little variation in the course of exploitation the surveys may be carried out at rare intervals, i.e. every two years, however, alternately in summer and winter periods.

Dr. Zdanavičiute, Department of Deep Geology, Institute of Geology and Geography

26 09 2006.



**Annex 2.7: Laboratory test of the natural gas (sample)**

**ITS Caleb Brett**

**Nederland B.V.**

Certified by FOSFA and NIOP  
Member ASTM, IP and NOFOTA  
Certified acc. ISO 9002

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Telex 62090



Laboratory Report No. 04-008435-0-RDAM( 3)			
<b>Your Reference</b>	Mr. Sergej Polukarov		
<b>Description</b>	Natural Gas		
<b>Our Reference</b>	I		
<b>Received on</b>	18-AUG-2004	<b>Reported on</b>	24-AUG-2004

Lab Reference	Sample Description
001-00	From Shakuchiai 15 to Lithuania - Shipper: Minijos Nafta - Ref.no.: 013/01/04 MN KSF 1F 12-AUG-2004

**Authorised on** : 24-AUG-2004

**Authorised by** : A.D. Romein

LABORATORY REPORT	
<b>Sample ID</b>	001-00
<b>Description</b>	From Shakuchiai 15 to Lithuania - Shipper: Minijos Nafta - Ref.no.: 013/01/04 MN KSF 1F 12-AUG-2004
<b>Product</b>	Natural Gas
<b>Seals</b>	Sekargas LT 17
<b>Packing</b>	Bombe Stainless Steel (> 250 ml)



Test	Method	Unit	Result
Composition	COMGLC__25		
Methane		%mol	33.042
Nitrogen + Argon		%mol	7.507
Carbon Dioxyde		%mol	1.330
Ethane		%mol	14.733
Propane		%mol	23.354
Hydrogen		%mol	0.020
Carbon Monoxyde		%mol	<0.001
Oxygen		%mol	1.009
iso-Butane		%mol	3.826
n-Butane		%mol	8.957
iso-Pentane		%mol	1.900
n-Pentane		%mol	2.470
n-Hexane		%mol	1.589
n-Heptane		%mol	0.248
n-Octane		%mol	0.009
n-Nonane		%mol	<0.001
n-Decane		%mol	<0.001
Helium		%mol	0.049
Benzene		%mol	0.01
Toluene		%mol	<0.01
Xylene		%mol	<0.01
Aircontent		calculated	5.65
Caloric Value (gross) Hs [0.V(0;1.01325)		kJ/m3	74178
Caloric Value (nett) Hi [0.V(0;1.013250]		kJ/m3	68079
HI/HS			0.9178
Wobbe Index		kJ/m3	66861
Density (relative) d			1.2308
Density (vol.mass) d.V(0:1.01325)		kg/m3	1.5914
Hydrogen Sulphide	Draeger	mg/kg	<1
Water	Moist.Anal	mg/kg	>1000
Mercaptan Sulphur	Draeger	ppm	<5

NOTE 1 : Alkalicontent not detectable ( no free water present)

2 : Manometer Vapour Pressure not detectable ( no liquid phase present)

3: Liquid rest at 40 oC not present.

**Annex 2.8: Certification of gas analysis (sample)**

17 Jan 2006 11:02

URB "Minijos nafta"

+37046405055

p. 2

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Datum 25.09.2001  
01kz:1925

**Gasanalysen**

Sehr geehrter Herr Lindlar,

als Anlage übersenden wir Ihnen wunschgemäß die Erdölgasanalysen folgender Probenahmestellen:

PS-2; AS-1; V-15,

die am 06.09.01 genommen worden sind.

Unter dem Begriff „Rest Alkane“ sind folgende Kohlenwasserstoffe zusammengefasst:

- verzweigte
- |     |               |
|-----|---------------|
| 2,2 | Dimethylbutan |
| 2,3 | Dimethylbutan |
| 3   | Methylpentan  |
|     | Cyclohexan    |
- höhere KW
- |        |
|--------|
| Heptan |
| Octan  |

Die Aufteilung ist der nachfolgenden Tabelle zu entnehmen:

	AS-1	PS-2	V-15
2,2-DM Butan	0,7261	1,0267	0,6517
2,3-DM Butan	0,2999	0,4554	0,2799
3-Methylpentan	0,0000	0,0000	0,0000
Cyclohexan	0,0038	0,0635	0,0373
Heptan	0,3130	0,5200	0,3183
Octan	0,0000	0,0010	0,0000
<b>Summe</b>	<b>1,3428</b>	<b>2,0666</b>	<b>1,2872</b>

Vorsitzender des Aufsichtsrates:  
Günter KrailmannGeschäftsführung:  
Wulf Hagemann (Vorsitzender)  
Dr. Georg von HantelmannSitz Lingen (Ems)  
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**Annex 3: Monitoring plan**

**As per AM0009 – revision 2 – Monitoring methodology adapted for the project.**