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

CONTENTS

Annexes

SECTION A. General description of the project

A.1. Title of the project:

>>
Coal Mine Methane Capture and Utilization at KWK Borynia Coal Mine, Poland
Version-2.4, November 6, 2009

A.2. Description of the project:

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At BORYNIA Coal Mine, CMM is productively used in little degree for captive heat generation by two CMM-fired boilers (1.2MW x 2) and the rest is released to the atmosphere. The proposed project is aimed at use of captured methane for energy production instead venting to the air. CMM will power newly constructed Jenbacher J 612 GS gas engine employed to Combined Heat and Power System (CHP) to produce 1819 kW of electrical and 1877 kW of thermal power. As the result 2,179 tonnes of CH_4 will be destroyed. Additionally further emission reduction will be achieved through replacement of import fossil grid energy heat and power to date used in the BORYNIA Coal Mine with in-plant power generation. The rest of CMM continues to be released to the atmosphere as well.
All electricity and heat generated by this project will be consumed within Borynia Coal Mine. In addition, Borynia Coal Mine will continue to purchase electricity from the Grid because net electricity generation in this project (planned value: 11,787(MWh/yr)) is far below total demand of electricity in Borynia Coalmine.

Table A-1 Historical data on Electricity demand in Borynia Coalmine (2004-2006)

Year	Electricity Demand(MWh)
2004	158,554
2005	130,751
2006	133,862
Average	141,056

A.3. Project participants:

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Party involved	Legal entity project participant (as applicable)	Please indicate if the Party involved wishes to be considered as project participant (Yes/No)
Poland (Host Party)	Jastrzębska Spółka Węglowa S.A. (Jastrzebie Coal Company)	No
	Kopalnia Węgla Kamiennego „BORYNIA" (The BORYNIA Coal Mine)	
	Główny Instytut Górnictwa (The Central Mining Institute)	
Japan	The Chugoku Electric Power Co., Inc.	No

Jastrzębska Spółka Węglowa S.A. (Jastrzebie Coal Company) – project owner, and project implementation entity. State treasury sole propriety Company. Company manages five coal mines:

"Borynia", "Jas-Mos", "Pniówek", "Zofiówka", "Krupiński" and the Material Logistics Plant. Total mining area - 122 km^2, Operational coal deposits - 285.81 million tons, Share capital - PLN 497 620 100, employment – 19002C399 workers.

Kopalnia Węgla Kamiennego „BORYNIA" (The BORYNIA Coal Mine) –owner of project site and responsible for project management. Coal mining plant, affiliate to JSW SA. Mining area - 17,4 km^2. Operational coal deposits - 35 864 thous. tones, employment – 3,431 workers.

Główny Instytut Górnictwa (Central Mining Institute) – institute employed for JI procedure performance and implementation. Scientific institute directly subordinated to the Minister of Economy, working for the benefit of the mining industry.

The Chugoku Electric Power Co., Inc– Japanese Power Company pursuing implementation of the project, participates in preparation of the JI project. The company acquires all ERUs generated in this project.

A.4. Technical description of the project:

A.4.1. Location of the project:

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A.4.1.1. Host Party(ies):

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Host country: Poland

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

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Slaskie Province (Województwo Śląskie)

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

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Jastrzebie Zdroj City (Jastrzębie Zdrój)

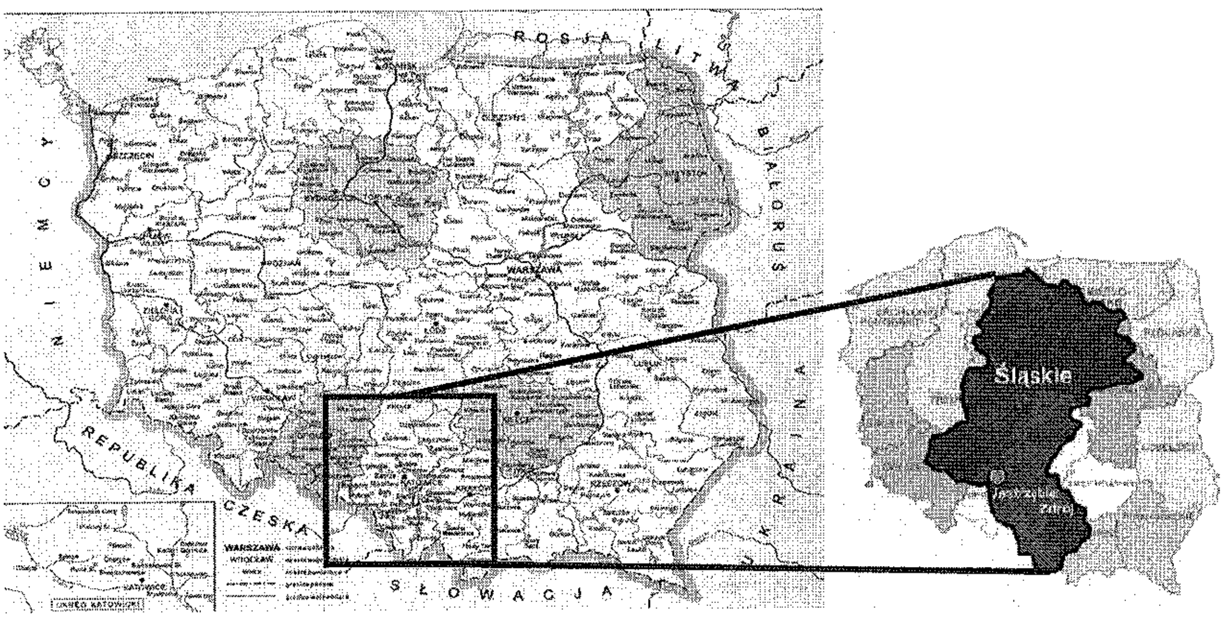

Figure A-1. Map of Poland, indicating Borynia Mine

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

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BORYNIA Coal Mine's Mining Area is located in Upper Silesian Coal Basin (Górnośląskie Zagłębie Węglowe) covering catchments areas of city Jastrzębie Zdrój (95,500 inhabitants, 19,800 employed in industry) and communities: Świerklany, Mszana, and Pawłowice. Total of 17,4 km^2 BORYNIA mining area is predominately rural with low-density housing, farmlands, meadows, and woodlands. Residential area with high-density housing or medium-density housing in Jastrzębie Szeroka district occupies small part of the mining area.

Upper Silesian Coal Basin lies in the historical regions of Upper Silesia in southern Poland and Czech Republic. The basin constitute homogeneous geological and geographical area covering 5,4 thous. km^2 and containing the largest coal deposit both in Czech and Poland. Deposit on level 1000 m is estimated at 70 million tones of which around 10-15% have been extracted to date. Except coal zink and lead are mined in the region. Polish part of Upper Silesian Coal Basin is 4,5 thous. km^2 being the most industrialized and urbanized part of Poland. There are 50 mines, 17 foundries and steelworks, and 8 smelting plants, numerous coking plant, and power plants and other giving the heavies gas and dust pollution not only in Poland, but all over Central Europe.

BORYNIA Coal Mine's reserves are estimated of around 34,0 million tones. Currently it employs 3,431 people. The main is equipped with six shafts: the No 1 shaft (of 937m) is used for the output extraction at the rate of up to 9,600 tonnes a day, the No 2,3,5 shafts are used for conveyance of men and materials. Mineral is extracted from levels of 713m, 838m and 950m meters below ground. All seams are gassy and classified to the third level of methane explosion hazard.

A.4.2. Technology(ies) to be employed, or measures, operations or actions to be implemented by the project:

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The recovered methane shall be utilized in a newly constructed CHP located in BORYNIA Coal Mine site. System will consist of gas engine, cooling system, control system and heat recovery unit. Extracted CMM will power the Jenbacher gas engine (J 612 GS) of 4401 kW of power input, and 1819 kW and 1877 kW of electrical and thermal output respectively. Electrical efficiency is anticipated at 41.3%, and thermal efficiency at 42.7% giving a figure of 84.0% of total system efficiency. CHP location is planned on the coal mine area approx. 800 m distance away from methane recovery station. Thus the pipeline connection needs to be constructed. Connections to switching station and to the pipeline are already provided. The Methane Recovery Station is already installed, however, it needs to be renovated as it becomes aging and probably causes several problems, especially gas engine failure as a result of leaking compressor oil into CMM pipeline. CMM is captured by methane recovery station in volume of 20 m^3/min per pure CH_4. The methane content in recovered CMM ranges from 30% to 70%. Proposed Jenbacher gas engine is designed to run on unprocessed CMM. Jenbacher gas engine is one of the best available gas engine in the world which can be run with low concentration of methane.

A schematic for the CMM extraction and utilization is shown below:

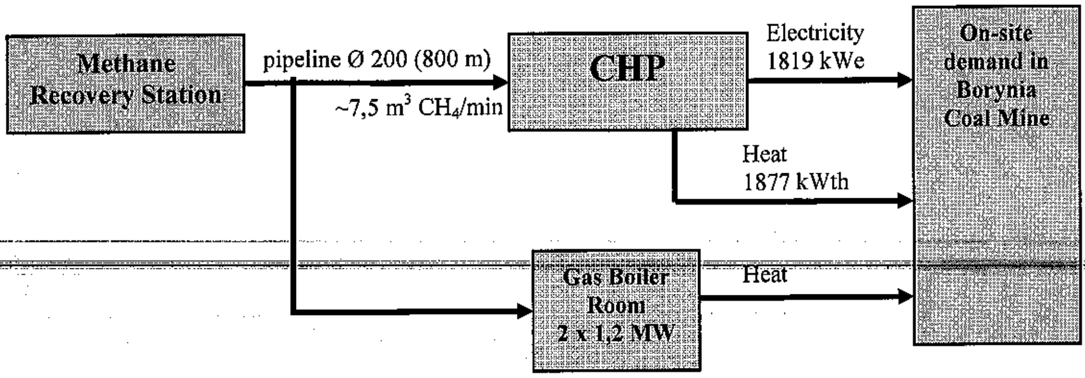

Figure A-2. Schematic view of the CMM collection and treatment system.

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 reductions would not occur in the absence of the proposed project, taking into account national and/or sectoral policies and circumstances:

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Borynia Coal Mine (the mine) possesses obsolete methane draining system, which consists of underground pipeline network and a vacuum pump station on the surface. This draining system currently captures CMM that is partially consumed by mine's boiler house, while the remaining part of CMM is emitted to the atmosphere. The mine neither captures nor uses CBM or PMM. Recovering Coal Mine Methane (CMM) is a normal safety practice in a coal mining activity. There are no national, local or sectoral legislation requiring compulsory extraction of the CMM. Up to date BORYNIA Coal Mine uses captured methane in little extend to fire the boiler for bath house. Installed degasification system serves only for safety reason. The mine does not possess equipment for utilization of all captured CMM due to the lack of public funds and investments in coal sector.

Apart from destroying captured CMM the proposed project will contribute to GHG mitigation by replacement of grid energy consumption with in-plant energy generated in CHP. According to the mine methane emission forecast significant gas surpluses are anticipated only in first years of project operation. Upon the presented forecast for BORYNIA Coalmine the significant decrease in absolute methane emission is anticipated in 2010-2013 in comparison to IV quarter of 2009, when the emission forecast amounts to 135 m^3CH_4/min. From 2010 onwards methane emission in BORYNIA Coalmine should rapidly diminish to the figures of 105 m^3CH_4/min in Ist quarter 2010, and 53 m^3CH_4/min in IVth quarter 2010. It is anticipated the downward trend continue in subsequent years. In 2012 decrease dynamics stabilizes at the level of 50-60 m^3CH_4/min.

Considering economic situation in the sector and other above mentioned factors it is very unlikely that any advanced technology will be applied at the project mine site in addition to existing boiler house. Thus, it is very likely that current practice will continue if project is not applied. No reduction of methane emissions will occur. Detailed explanation of why BAU is the most probable scenario representing the baseline is provided in Section B "Application of a baseline methodology".

A.4.3.1. Estimated amount of emission reductions over the crediting period:

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Length of the crediting period	4 years and 9 months (31 March 2008 – 31 December 2012)
Year	Estimate of annual emission reductions in tones of CO_2 equivalent

Year 2008	33,971
Year 2009	45,294
Year 2010	45,294
Year 2011	45,294
Year 2012	45,294
Total estimated emission reductions over the crediting period (tones of CO_2 equivalent)	215,147
Annual average of estimated emission reductions over the crediting period/period within which ERUs are to be generated (tones of CO_2 equivalent)	43,029

A.5. Project approval by the Parties involved:

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The acceptance of the project by the host party, Poland with a Letter of Approval is expected.
The acceptance of the project by the investor party, Japan with a Letter of Approval is expected.

SECTION B. Baseline

B.1. Description and justification of the baseline chosen:

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ACM0008 "Consolidated baseline methodology for coal bed methane and coal mine methane capture and use for power (electrical and motive) and heat and/or destruction by flaring" version 03 approved by CDM Executive Board on 22 December 2006.

~~URL: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html~~

Approved consolidated baseline methodology ACM0008.

The following tables B-1 and B-2 explain the reason why the methodology applies to this project:

Table B-1 Comparison of proposed extraction activities with applicability of the methodology

ACM0008 Applicability	Proposed extraction activities
surface drainage wells to capture CBM associated with mining activities	Excluded
underground boreholes in the mine to capture pre mining CMM	Included
surface goaf wells, underground boreholes, gas drainage galleries or other goaf gas capture techniques, including gas from sealed areas, to capture post mining CMM	Excluded
Ventilation CMM that would normally be vented	Included

Table B-2 Comparison of proposed CMM utilization activities with applicability of the methodology

ACM0008 Applicability	Proposed CMM utilization activities
The methane is captured and destroyed through flaring	Excluded
The methane is captured and destroyed through utilization to produce electricity, motive power and/or thermal energy; emission reductions may or may not be claimed for displacing or avoiding energy from other sources	CMM is collected and destructed by combustion in the process of heat and power production.
The remaining share of the methane to be diluted for safety reason may still be vented	Part of CMM is still vented in the proposed project
All the CBM or CMM captured by the project should either be used or destroyed, and cannot be vented	CMM collected in the project will be utilized for heat and power production.

Besides the applicability, ACM0008 also defines the types of activities that could not be applied for this methodology. The proposed project does not involve any of those activities. (Table B-3)

Table B-3 Comparison of proposed project with inapplicable activities stated in the methodology

ACM0008 Applicability	Proposed project activities
Operate in open cast mines	Underground operated coal mine
Capture methane from abandoned/decommissioned coalmines	Both coal production and CMM extraction are under way in the coal mine
Capture/use of vitgin coal-bed methane, e.g. methane of hibh quality extracted from coal seams independently of any mining activities	Extraction activities are concomitance with coal production

Use CO2 or any other fluid/gas to enhance CBM drainage before mining takes place	No CBM extraction activities are involved in the project

The applicable conditions, key assumptions, scope of data, data source in the methodology fit the project. The methodology is certain to lead to a transparent and conservative estimate of the emission reduction of the project activity.

The "Consolidated baseline methodology for coal bed methane and coal mine methane capture and use for power (electrical and motive) and heat and/or destruction by flaring" is applied to the Borynia Coal Mine in accordance with following steps:

1. Identification of the baseline scenario
2. Calculation of emissions reductions

<u>1. Identification of the Baseline Scenario</u>
Step 1. Identify technically feasible options for capturing and/or using CMM

Step 1a. Options for CMM extraction

Possible options technically feasible to capture CMM and comply with safety regulations could include:
A. Ventilation air methane;
B. Pre mining CMM extraction including CBM to Goaf drainage and/or Indirect CBM to Goaf only;
C. Post mining CMM extraction;
D. Possible combinations of options A, B, and C with the relative shares of gas specified.

Extraction of methane through option A (ventilation air methane) alone does not provide enough relief to working conditions at the mine face to ensure safety. Options B (pre mining CMM), and C (post mining CMM) are never utilized as a stand-alone remedies for reducing methane emission from coal mines or stand-alone method to ensure the mining safety. In addition, low permeability coals in the mining area prohibit option C from being technically feasible. Therefore, option B is the only technically feasible option for CMM extraction.

In Borynia Coal Mine the coal seams a very low permeability. Therefore it is not possible to extract CBM before strata is de-stressed due to mining of the coal unless applying special measure to enhance CBM drainage. This is confirmed by the following statement. *"On account of low gas permeability of polish coals (around 1mD and lower) coal bed degasification are performed mainly in excavation headings through surface or underground injector recovery stations."*[1]

Also, it is unusual in Poland to utilize Post-mining CMM because of mainly economically reason. This is confirmed by the following statement. *"It is highly debatable to forecast both quantity and quality of Abandon Mine Methane (AMM) emission, which results in increase of project economical risk. Also negative impact of ventilation from neighboring coal mines on abandon excavations cannot be excluded."*[2]

[1] Source: Paweł KRZYSTOLIK , "UTILIZATION OF COALMINE METHANE IN COMBINED POWER MANAGEMENT –OPPORTUNITY FOR COAL MINING COST-CUT.", Chapter 2, Course materials 2002 of School of Underground Mining.

[2] Skorek, J. and Kalina, J., "POSSIBILITY OF UTILIZATION OF COAL BED METHANE IN POLISH AND GERMAN MINES", Chapter 2.3. The Silesian University of Technology

Due to the low concentration of methane in the ventilation air and technical unavailability, this methane can not be utilised in Poland. So that the ventilation air methane is not considered in the PDD.

Therefore in the case of Borynia Coal Mine, option B is only one option that is technically feasible to extract CMM for utilizing purpose, which is the current situation at the Borynia Coal Mine.

Step 1b. Options for extracted CMM treatment

Several approached can be taken to treat the captured CMM at Borynia Coal Mine:

i. Venting;
ii. Using/destroying ventilation air methane rather than venting it;
iii. Flaring of CMM;
iv. Use for additional grid power generation;
v. Use for additional captive power generation;
vi. Use for additional heat generation;
vii. Feed into gas pipeline (to be used as fuel for vehicles or heat/power generation);
viii. Possible combinations of options i to vii with the relative shares of gas treated under each option specified.

Some of these options were considered as possible alternatives for the baseline scenario. In Step 3 of this section some of these options will be further developed into baseline scenario alternatives. The generation of own energy is one of the requirements for developing this project. The destruction of ventilation air methane (option ii) was not considered as the concentration of methane in the ventilation air is too low to make destruction technical feasible.
The project activity is covered by the option viii. – the combination of option i. venting of CMM, option v. captive power production, and option vi. heat generation.

Step 1c. Options for energy production

The Borynia Coal Mine has two CMM-fired boilers (1.2MW x 2) generating heat that covers a part of on-site heat demand. Regarding heat production, as there is no barriers exist, continuing heat generation by these existing boilers is considered as a baseline in each alternative scenario.
Realistic and credible alternatives available for the relevant forms of energy production are:

Electricity

E1. Continue to use electricity from the National Power Grid
E2. Electricity from a new captive CHP on CMM

Heat

H1. Continue to use heat from existing CMM-fired boilers and the heat grid
H2. Heat from a new captive CHP, existing CMM-fired boilers and the heat grid

Step 2. Eliminate baseline options that do not comply with legal or regulatory requirements

All options are comply with Polish regal or regulatory requirements. (There is no law or regulation that would restrict any of there options. Only if construction in implied than Sanitary norms and regulations must be met and projects have to be reconciled with pertinent authorities (e.g. fire department, etc))

Step 3. Formulate baseline scenario alternatives
As mentioned Step 1a., a combination of CMM ventilation and pre mining CMM extraction is the only option that is technically feasible to extract CMM for utilizing purpose.

The following alternatives can be considered for implementation at the Borynia Coal Mine and these alternatives are in compliance with the options as listed in step 1b and step 1c. For all possible alternatives the mine has to extract the CMM from the mine for safety reasons. Therefore the alternatives below assume extraction as described in step 1a and describe in detail the alternatives for treatment and utilization.
Alternatives for CMM treatment includes:

Alternative 1.Venting of CMM along with existing heat generation (i+E1+H1)
Recovered CMM would be partially used for on-site heat generation by the on-site existing boilers and the rest of CMM will be vented to the atmosphere. The Borynia Coal Mine continues to use electricity from the Power Grid. This is a Business As Usual scenario in the Borynia Coal Mine.

Alternative 2. Flaring of CMM along with existing heat generation (iii+E1+H1)
The surplus CMM from on-site heat generation by the on-site existing boilers may simply be destroyed through flaring. While this option has not gained widespread acceptance in the coal mining community, it has been successfully demonstrated in two industrialized countries: Australia and the United Kingdom. The Borynia Coal Mine continues to use electricity from the Power Grid.

Alternative 3. Using CMM for additional on-site electricity and heat generation as well as for existing heat generation (v+vi+E1+E2+H2)
The surplus CMM from on-site heat generation by the on-site existing boilers could be consumed in a new CHP that generate electricity and heat for use directly at the coal mine. The shortage of electricity will be supplied from the Power Grid.

Alternative 4. Using CMM for additional heat generation as well as for existing heat generation (vi+E1+H2)
Recovered CMM could be consumed in a new boiler and the on-site existing boilers that generate heat for captive use. This thermal energy could be in form of hot water, hot air, or steam. The Borynia Coal Mine continues to use electricity from the Power Grid.

Alternative 5. Feeding CMM into the gas grid along with existing on-site heat generation (vii+E1+H1)
The surplus CMM from existing on-site heat generation could be to supply to the regional gas grid. The gas can be used for heat generation and/or electricity generation for commercial/household use. This alternative would require a piping infrastructure to transport the CMM to an existing CMM gas grid. The Borynia Coal Mine continues to use electricity from the Power Grid.

Alternative 6. Using CMM for additional on-site electricity and heat generation and feeding the surplus CMM into the gas grid (i+iv+v+E1+E2+H2)
Recovered CMM will be utilized in a new CHP that generate additional heat and electricity for on-site use at the coal mine, and also in the existing boilers. The surplus CMM will be fed into the regional gas gird. This alternative constitutes the proposed JI project activity without the incentive of the project as a JI. The shortage of electricity will be supplied from the Power Grid.

Step 4. Eliminate baseline scenario alternatives that face prohibitive barriers
Barriers that are specific to alternative scenario are as follows:

Alternative 1. Venting of CMM along with existing heat generation (i+E1+H1)
This is BAU scenario. No barrier exists for this alternative.

Alternative 2. Flaring of CMM along with existing heat generation (iii+E1+H1)
Flaring of the CMM is not required by the existing Polish regulation. Flaring also requires additional cost without any revenue can be created. It has been successfully demonstrated in two industrialized countries: Australia and the United Kingdom. So obviously, it faces barriers from investment, technology and prevailing practice. Finally, the flaring of methane at coal mines is not viewed favourable by workers underground due to the additional risk of fire and explosion.

Alternative 3. Using CMM for additional electricity and heat generation as well as for existing heat generation (iv+v+E1+E2+H2)
This alternative is the project scenario without a JI incentive. In Poland, there is no favorable regulation on tax reduction for CMM power generation. In addition, the capital cost will be huge and then the IRR for this alternative is quite low as shown in Section B.2 of this PDD. Without the financial assistance from JI, such investment in Poland is obviously not feasible. Therefore this alternative faces significant problems.

Alternative 4. Using CMM for additional on-site heat generation as well as for existing heat generation (vi+E1+H2)
The Borynia Coal Mine already has a boiler house and supplies a part of necessary hot water, hot air and steam. There is no reason for the project owner to put additional investment to install another gas fuelled boilers without any JI incentive. So this alternative is not feasible.

Alternative 5. Feeding CMM into the CMM pipeline for off-site energy generation along with existing on-site heat generation (vii+E1+H1)
In this case a new connection to an existing pipeline has to be made. The costs of the lacking piping infrastructure make this alternative economically not viable as shown in Section B.2 of this PDD. Therefore this alternative faces a prohibitive barrier and is eliminated.

Alternative 6. Using CMM for additional on-site electricity and heat generation and feeding the surplus CMM into the gas grid (i+iv+v+E1+E2+H2)
This alternative is a combination of Alternative 3 and Alternative 5. As mentioned above, this alternative faces some barriers and is economically not attractive. This is proven in section B.2 of this PDD

As a result, a continuation of the existing situation which is to vent CMM into the atmosphere, generate heat with the existing boilers, purchase of electricity from the grid (*Alternative1*) is the only plausible baseline scenario candidates if without JI assistance.

2. Calculation of emissions reductions

The emissions reductions created from the project is the net difference between the baseline emissions and the project emissions for a given year. In order to calculate the difference, the baseline and project emissions must first be determined.

2.1 Project Emission

According to ACM0008/Version 03 Equation (1), project emissions are defined in Equation (B1.1).

$PE_y = PE_{ME} + PE_{MD} + PE_{UM}$ (B1.1)

Where:

PE_y - Project emissions in year y (tCO_2e)
PE_{ME} - Project emissions from energy use to capture and use methane (tCO_2e)
PE_{MD} - Project emissions from methane destroyed (tCO_2e)
PE_{UM} - Project emissions from un-combusted methane (tCO_2e)

2.1.1. Combustion emissions from additional energy required for CMM capture and use

Project emissions, which are generated from the use of energy for capturing and utilizing methane emitted in the project, are defined in ACM0008/Version 03 Equations (2) to (B1.2). Additional heat consumption $CONS_{HEAT,PJ}$ and additional fossil fuel consumption $CONS_{FOSSFUEL,PJ}$ for capturing and utilizing methane have been deleted from ACM0008/Version 03 Equation (B1.2). However, in the proposed project, the existing system for heat and fossil fuel would be used and the project activity does not need additional heat or fossil fuel, there is no additional heat or fossil fuel consumption. Regarding with additional electricity consumption, the project activity needs electricity for operating the Methane Recovery Station and the CHP.

$PE_{ME} = CONS_{ELEC,PJ} * CEF_{ELEC}$ (B1.2)

Where:

PE_{ME} - Project emissions from energy use due to capture and use of methane (tCO_2e)
$CONS_{ELEC,PJ}$ - Additional electricity consumption for capture and use of methane, if any (MWh)
CEF_{ELEC} - Carbon emission factors for electricity grid applicable to Poland (tCO_2e/MWh)

2.1.2. Combustion emissions from use of captured methane

Project emissions from destructed methane are defined in ACM0008/Version 03 Equation (3) to (B.1.3). Incidentally, methane that is destructed through flaring, i.e. MD_{FL}, and after being supplied to the gas grid or used in vehicles, i.e. MD_{GAS}, have been deleted from ACM0008/Version 03 Equation (3) because corresponding equipment does not exist.

$PE_{MD} = (MD_{ELEC} + MD_{HEAT}) *(CEF_{CH4} + r * CEF_{NMHC})$ (B.1.3)

With:

$r = PC_{NMHC} / PC_{CH4}$ (B.1.4)

Where:

PE_{MD} - Project emissions from CMM/CBM destroyed (tCO_2e)
MD_{ELEC} - Methane destroyed through power generation (tCH_4)
MD_{HEAT} - Methane destroyed through heat generation (tCH_4)

CEF_{CH4} - Carbon emission factor for combusted methane (2.75 tCO_2e/tCH_4)
CEF_{NMHC} -Carbon emission factor for combusted non methane hydrocarbons (the

concentration varies and, therefore, to be obtained through periodical analysis of captured methane) ($tCO_2eq/tNMHC$)

r - Relative proportion of NMHC compared to methane
PC_{CH4} - Concentration (in mass) of methane in extracted gas (%)
PC_{NMHC} - NMHC concentration (in mass) in extracted gas (%)

$MD_{ELEC} = MM_{ELEC} * Eff_{ELEC}$ (B.1.5)

Where:

MD_{ELEC} - Methane destroyed through power generation (tCH_4)
MM_{ELEC} - Methane measured and sent to CHP (tCH_4)
Eff_{ELEC} - Efficiency of methane destruction/oxidation in CHP (taken as 99.5% from IPCC)

$MD_{HEAT} = MM_{HEAT} * Eff_{HEAT}$ (B.1.6)

Where:

MD_{HEAT} - Methane destroyed through heat generation (tCH_4)
MM_{HEAT} - Methane measured sent to heat plant (tCH_4)
Eff_{HEAT} - Efficiency of methane destruction/oxidation in heat plant (taken as 99.5% from IPCC)

2.1.3. Un-combusted methane from flaring and uses

Project emissions of non-combusted methane are defined in ACM0008/Version 03 Equation (9) to Equation (B.1.7). Incidentally, the measured amount of methane MM_i used for the objective of i in ACM0008/Version 03 Equation (9) shall be the measured amount of methane MM_{ELEC} sent to the power plant, and the measured amount of methane MM_{HEAT} sent to the heat generating plant.

$PE_{UM} = GWP_{CH4} * [MM_{ELEC} * (1-Eff_{ELEC}) + MM_{HEAT} * (1-Eff_{HEAT})]$ (B.1.7)

Where:

PE_{UM} - Project emissions from un-combusted methane (tCO_2e)
GWP_{CH4} - Global warming potential of methane (21 tCO_2e/tCH_4)
MM_{ELEC} - Methane measured sent to CHP (tCH_4)
Eff_{ELEC} - Efficiency of methane destruction/oxidation in CHP (taken as 99.5% from IPCC)
MM_{HEAT} - Methane measured and sent to heat plant (boiler house) (tCH_4)
Eff_{HEAT} - Efficiency of methane destruction/oxidation in heat plant (boiler house) (taken as 99.5% from IPCC)

2.2 Baseline Emissions

$BE_y = BE_{MD,y} + BE_{MR,y}$ (B.2.1)

Where:

BE_y - Baseline emissions in year y (tCO_2e)
$BE_{MD,y}$ - Baseline emissions from destruction of methane in the baseline scenario in year y (tCO_2e)
$BE_{MR,y}$ - Baseline emissions from release of methane into the atmosphere in year y that is avoided by the project activity (tCO_2e)

2.2.1. Methane destruction in the baseline

$$BE_{MD,y} = (CEF_{CH4} + r*CEF_{NMHC}) *CMM_{BLth,y} \quad (B.2.2)$$

Where:

$BE_{MD,y}$	- Baseline emissions from destruction of methane in the baseline scenario in year y (tCO2e)
$CMM_{BL,th,y}$	- Pre-mining CMM that would have been captured and destroyed by thermal demand in the baseline scenario (tCH_4)
CEF_{CH4}	- Carbon emission factor for combusted methane (2.75 tCO_2e/tCH_4)
CEF_{NMHC}	- Carbon emission factor for combusted non methane hydrocarbons (varies, and should be obtained through periodical analysis of captured methane) ($tCO_2eq/tNMHC$)
r	- Relative proportion of NMHC compared to methane

With:

$r = PC_{NMHC} / PC_{CH4}$

PC_{CH4}	- Concentration (in mass) of methane in extracted gas (%)
PC_{NMHC}	- NMHC concentration (in mass) in extracted gas (%)

Furthermore, $CMM_{BL,th,y}$ is obtained from ACM0008/Version 03 Equation (12). Since ACM0008/Version 03 allows "Use of monthly data in cases where daily measured data cannot be utilized," use of monthly data shall be assumed in the project because daily data are not available.

$$CMM_{BL,th,y} = \sum_{k=1}^{12} TH_{BL,k} \quad (B.2.3)$$

Where:

$CMM_{BL,th,y}$	- Pre-mining CMM that would have been captured and destroyed by thermal demand in the baseline scenario (tCH_4);
$TH_{BL,k}$,	- Methane used to serve estimated thermal energy demand in the baseline for month k in year y;
TH	- index for thermal use of CMM in the baseline, which includes on-site consumption.

$$TH_{BL,k} = (TH_{BL,y}/12)*d^{max}_{k} \quad (B.2.4)$$

Where:

$TH_{BL,y}$	- Projected annual baseline thermal demand for year y (tCH_4)
d_k	- Scalar adjustment factor for month k to reflect seasonal variations, such that $\Sigma d_k=12$
d^{max}_{k}	- maximum scalar adjustment factor for month k over the 5 years prior to the start of the project (i.e. $\Sigma d^{max}_{k}>12$)

The above contents can be arranged according to Equations (B.2.2), (B.2.3) and (B.2.4).

$$BE_{MD,y} = (CEF_{CH4}+r*CEF_{NMHC}) * \sum_{k=1}^{12} (TH_{BL,y}/12)d^{max}_{k} \quad (B.2.5)$$

In Borynia Coal Mine, a part of recovered CMM is utilized and therefore destroyed in the baseline scenario thorough heat generation by the existing boilers only for on-site consumption. In order to estimate the demand for CMM in the baseline scenario, ex-ante projections are calculated based on 5-year historical data of CMM consumption at the existing boilers.

In order to account for methane in the monthly fluctuation in CMM demand, the maxim scalar adjustment factor (d^{max}_k) is calculated based on 5-year monthly historical data of CMM consumption at the existing boilers.

2.2.2. Methane released into the atmosphere

Baseline atmospheric emissions of methane that are prevented by the project activities in year y are defined in ACM0008/Version 03 Equation (14) to Equation (B.2.6). Incidentally, since CBM and PMM in ACM0008/Version 03 Equation (14) are not pertinent to the project, the related equations are omitted.

$$BE_{MRy} = GWP_{CH4} * \sum_i (CMM_{Pj,i,y} - CMM_{BLi,y}) \quad (B.2.6)$$

Where:

- $BE_{MR,y}$ - Baseline emissions from release of methane into the atmosphere in year y that is avoided by the project activity (tCO_2e)
- i - Use of methane (flaring, power generation, heat generation, supply to gas grid to various combustion end uses)
- $CMM_{PJ,i,y}$ - Pre-mining CMM captured, sent to and destroyed by use *i* in the project in year y (expressed in tCH_4)
- $CMM_{BL,i,y}$ - Pre-mining CMM that would have been captured, sent to and destroyed by use *i* in the baseline scenario in year y (expressed in tCH_4)
- GWP_{CH4} - Global warming potential of methane (21 tCO_2e/tCH_4)

Since $CMM_{BL,i,y}$ only indicates the portion of combusted methane by boiler house in the project scenario, this shall be treated as $CMM_{BL,th,y}$, and moreover (E 2.3) shall be substituted.

$$BE_{MRy} = GWP_{CH4} * [(CMM_{PJ,ELEC,,y} + CMM_{PJ,HEAT,,y}) - \sum_{k=1}^{12} (TH_{BL,y}/12) d^{max}_k] \quad (B.2.7)$$

2.3 Leakage

The leakage of JI project emissions may be a result of:

1. Displacement of baseline thermal energy uses
2. JI drainage from outside the de-stressed zone
3. Impact of JI project activity on coal production
4. Impact of JI project activity on coal prices and market dynamics.

Considering the proposed project:

1. Baseline thermal energy demand fall into "Where regulations require that local thermal demand is met before all other uses, which is common in, then this leakage can be ignored."
2. No CBM drainage involves

3. No noticeable impact of JI Project activity on coal production since the degasification activities are independent from the JI project.
4. No reliable scientific information is currently available to assess the risk of impact of JI project on coal prices and market dynamics.

Therefore, no leakage effects need to be accounted for the proposed project.

2.4 Emission Reductions

The emissions reductions ensuing from the project are net difference between baseline emissions and project emissions for a given year.
The emission reduction *ERy* by the project activity during a given year *y* is the difference between the baseline emissions (*BEy*) and project emissions (*PEy*), as follows:

$$ER\,y = BE\,y - PEy \quad \text{(B.4.1)}$$

Where:

ERy -emissions reductions of the project activity during the year *y* (tCO2e)
BE,y -baseline emissions during the year *y* (tCO2e)
PEy - project emissions during the year *y* (tCO2e)

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

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Application of additionality test to project activity

The baseline methodology indicates *The additionality of the project activity shall be demonstrated and assessed using the version 3 of the "Tool for the demonstration and assessment of additionality" agreed by the Executive Board.*

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations

ACM0008 indicate that *step 1 of the tool for the demonstration and assessment of additionality can be ignored*, therefore skip step1.

Step 2. Investment analysis

Sub-step 2a. Determine appropriate analysis method:

For this project activity entitles related revenue from the sale of power in addition to ERU. Therefore, simple cost analysis (Option I) cannot be applied, this means that either investment comparison analysis (Option II) or benchmark analysis (Option III) is adopted. Here, Option III is adopted.

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

Benchmark analysis complies with this step, and the most appropriate financial indicator in this case is internal rate of return (IRR). The IRR is a key indicator adopted by project investor. It can be influenced by perceived technical and/or political risk and by the cost of money.

As a benchmark for judging the feasibility of investment (hurdle rate), a stockholder expected rate of return, which is calculated based on CAPM (Capital Asset Pricing Model) with reflecting a risk premium and is generally used abundantly in Discount Cash Flow Method (DCF Method), is used. In addition, since this project will be carried out as a self-financed project, it is not necessary to take into consideration a funding cost for debt.

The calculation formula of the stockholder expected rate of return based on CAPM is as follows.

$$Re = Rf + \beta \times (Rm - Rf)$$

Where:

Re : Expected rate of return (hurdle rate)

Rf: Rate of return against the investment considered to be risk-free (usually long-term government bond etc.)

β : Coefficient indicating a uncertain-return risk related to the enterprise characteristic

Rm : Average expected rate of return of a stock market

Each setting value and its explanation, and the result of a stockholder expected rate of return are shown in the following table.

Table B-4. Calculation of Expected rate of return

Factor	Value	Explanation
Rf	6.5%	Assumed as the interests of the ten-year national bond of Poland as 6.5%.
β	1.0	Generally "β" of the power industry is set as 1 or less. However, since this project will utilize CMM which has uncertainty in supply, I think this β setting is conservative enough.
Rm	11.31%	Cited Average expected rate of return of Warsaw Stock Exchange Market from Mizuho Research Institute's report[3]
Re	11.31%	hurdle rate

Thus a hurdle rate that might be assumed for this project using this method is 11.31%.

The key determinants of the project economic analysis are capital cost, operating and fuel costs and the income (electricity tariff, etc). Table B-5 presents key economic parameters and the IRRs of the project scenario without a JI incentive (scenario 3) and other scenarios which generate financial benefits (Scenario 4, 5 and 6).

Table B-5. Key economic parameters and the IRRs of the relevant scenarios

Indicator	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Total initial Cost	9,700(1000 PLN)	6,248(1000PLN)	5,600(1000 PLN)	11,800(1000 PLN)

[3] MIZUHO Report(11th, May, 2006) 「Global comparison on stock markets -Change of the growth possibility and the scale of world stock market, and performance after risk adjustment-」

Install Capacity				
- Electricity	1.819 (MWe)	-	-	1.819 (MWe)
- Heat	1.877 (MWth)	4.8 (MWth)	-	1.877 (MWth)
- CMM Sales	-	-	All captured CMM (MAX 56m3-mix/min)	All captured CMM (MAX 56m3-mix/min)
Electrical energy saving cost	184.91 PLN/kWh	-	-	184.91 PLN/kWh
Heat energy saving cost (In case of replacing the purchased heat)	22.05 PLN/GJ	22.05 PLN/GJ	-	22.05 PLN/GJ
Heat energy saving cost (In case of replacing the gas boiler's heat)	0.14 PLN/GJ	0.14 PLN/GJ	-	0.14 PLN/GJ
CMM sales unit price	0.11 PLN/m3-CH4	-	0.11 PLN/m3-CH4	0.11 PLN/m3-CH4
IRR(Pre tax)	1.1%	0.0%	-	-13.1%

Remarks: "-" in IRR row mean that the profitability is too low to calculate IRR with excel function.

The results indicate that the above scenarios in Table B-5 are not financially attractive when compared to the benchmark value of 11.31%.

Sub-step 2c. Sensitivity analysis

In the case of the scenarios 3, 4, 5 and 6, total initial cost, income (cost saving) and operating time are parameters that are the mot influential factors to the IRR calculation and with uncertainty. Therefore, the sensitivity analysis is preformed by raising and reducing these parameters from the assumption within the range of 10%.

Table B-6. IRR(Pre tax) sensitivity analysis for the expected parameters

Scenario	Sensitivity factors	-10%	-5%	0%	5%	10%
Scenario 3	Initial cost	4.2%	2.6%	1.1%	-0.2%	-1.4%
	Income(Cost Saving)	-2.6%	-0.7%	1.1%	3.0%	4.8%
	Operating time	-1.2%	0.0%	1.1%	2.2%	3.4%
Scenario 4	Initial cost	3.3%	1.6%	0.0%	-1.4%	-2.7%
	Income(Cost Saving)	-3.0%	-1.5%	0.0%	1.5%	3.1%
	Operating time	-3.0%	-1.5%	0.0%	1.2%	2.0%
Scenario 5	Initial cost	-18.3%	-19.4%	-	-	-
	Income(Cost Saving)	-	-	-	-19.0%	-17.7%
	Operating time	-	-	-	-	-
Scenario 6	Initial cost	-7.5%	-10.3%	-13.1%	-16.2%	-
	Income(Cost Saving)	-	-	-13.1%	-9.3%	-6.2%
	Operating time	-	-	-13.1%	-10.1%	-7.9%

Remarks: "-" mean that the profitability is too low to calculate IRR with excel function.

From the calculation outcomes as shown in Table B-6, the IRR for the each scenario will vary to different degrees with these three uncertain elements. The income is the most important factor affecting the IRR among the two major uncertain elements, though it is unlikely to change largely during the project period

In addition, the percent variations of sensitivity factors at which the IRR of the proposed project equals the hurdle rate of 11.31 are" Initial cost: -26.3%%" , " Income(Cost Saving):26.9%" and " Operating time: 46.0%" . It is unrealistic to take place these amounts of variation rate.

As a conclusion, the proposed project without ERU revenue is still not financially attractive enough considering this sensitivity analysis.

Step 3. Barrier analysis

Since Step 2 was implemented, Step 3 can be skipped.

Step 4. Common practice analysis

There are 40 coalmines at Silesia Region in Poland. But there are only five CMM CHP projects under proposed technology in Poland – Halemba Coal Mine (0.54MWe), Bielszowice Coal Mine (0.54MWe), Krupiński Coal Mine (3.0MWe + 3.9MWe) and Pniowek Coal Mine (3.9MWe). But these five CMM CHP projects were installed using public funding such as EU PHARE aid. Therefore the proposed activity is not common practice.

In addition to these five CMM CHP projects, the preparation for two CMM CHP projects in Sosnica-Makoszowy coalmine and Szczyglowice coalmine are under way as JI.

In conclusion, it is obvious that the scenarios 3, 4, 5 and 6 are not baseline scenario. Therefore without additional support possible from JI, the project scenario (Scenario 3) will not occur. The proposed project has strong additionality and can reduce the greenhouse gas emission. If the proposed project fails to be registered as a JI project, this portion of emission reduction can not be realized.

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

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A schematic overview of the special project boundary is presented in Figure B-1 below.

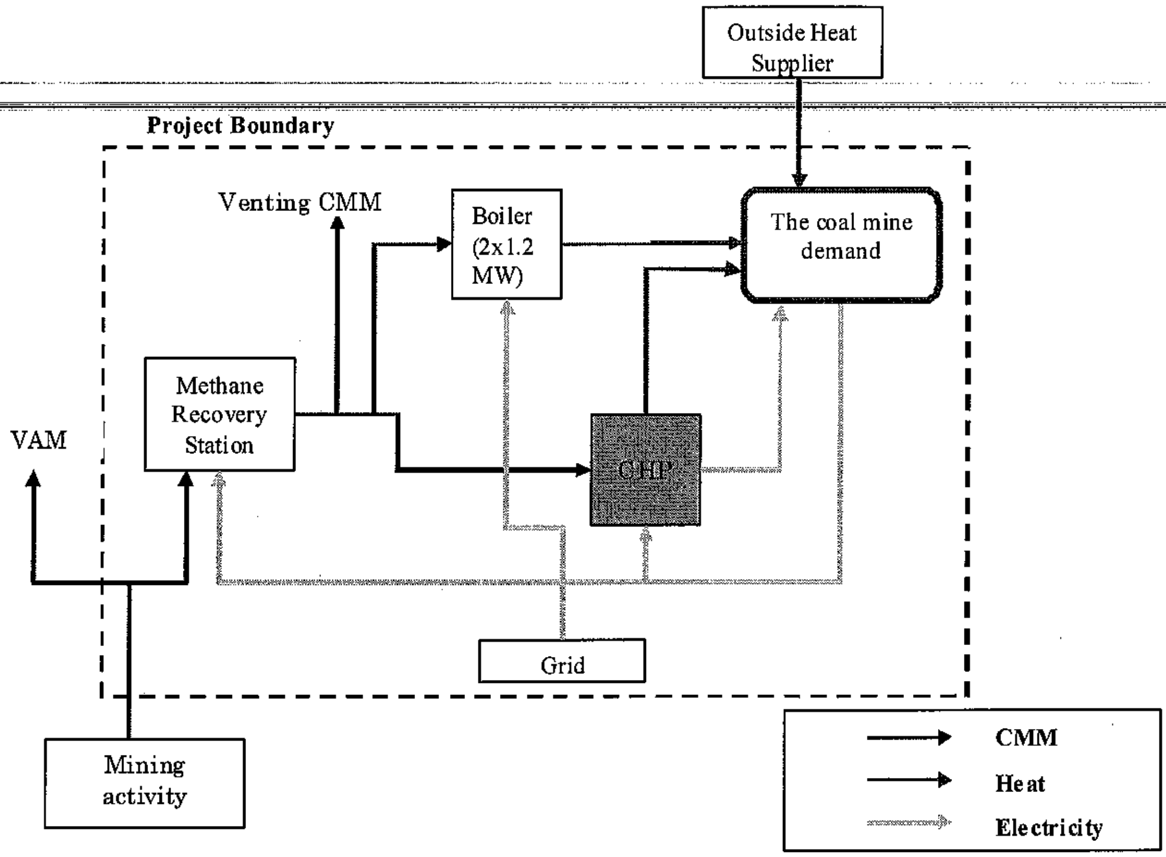

Figure B-1. Project boundaries

Table B-7 below, taken from ACM0008, illustrates which emissions sources are included and which are excluded from the project boundary for determination of both baseline and project emissions.

Table B-7 Overview on emission sources included on or excluded from the project boundary

Source	**Gas**	**Include or exclude**	**Note**
Baseline			
Emissions of methane as a result of venting	CH_4	Include	Main emission source.
Emission from destruction of methane in the baseline	CO_2	Included	CMM is used for heat generation for captive consumption in the baseline scenario.
	CH_4	Excluded	Excluded for simplification. This is conservative.
	N_2O	Excluded	Excluded for simplification. This is conservative.
Grid electricity generation (electricity provided by the gird)	CO_2	Excluded	Excluded for avoiding the indirect double counting under the EU-ETS. This is conservative.
	CH_4	Excluded	Excluded for simplification. This is conservative.
	N_2O	Excluded	Excluded for simplification. This is conservative.
Captive power/heat and	CO_2	Excluded	No fossil-fuel is applied in the baseline scenario.

vehicle fuel use	CH_4 N_2O		
Project activity			
Emissions of methane as a result of continued venting	CH_4	Excluded	Only the change in CMM emission release will be taken into account by monitoring the methane used or destroyed by the project activity.
On-site fuel consumption due to the project activity, including transport of the gas	CO_2	Included	If additional equipments such as compressors are required on top of what is required for purely drainage, energy consumption from such equipment should be accounted for.
	CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.
	N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.
Emissions from methane destruction	CO_2	Included	From the combustion of methane in heat/power generation.
Emissions from NMHC destruction	CO_2	Included	Only if NMHC exceeds 1% by volume of extracted CMM.
Fugitive emissions of unburned methane	CH_4	Included	Small amount of methane will remain unburned in heat/power generation.
Fugitive methane emissions from on-site equipment	CH_4	Excluded	Excluded for simplification.
Fugitive methane emissions from gas supply pipeline or in relation to use in vehicles	CH_4	Excluded	Excluded for simplification, but taken into account in leakage.
Accidental methane release	CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.

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

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Details of the baseline study are included in Annex 2.
Date of completion: 27/1/2009.
The baseline was determined by:

Name/origination Project participant	Project Participate Yes/No
Hideo Yata The Chugoku Electric Power Co., Inc. 4-33, Komachi, Naka-ku, Hiroshima, 730-8701, Japan Tel +81-82-523-6424 Fax +81-82-523-6422	Yes
Teruyuki Okada Mizuho Corporate Bank, Ltd. 5-1, Marunouchi 2-chome, Chiyodaku, Tokyo 100-8333, Japan Tel +81-3-5220-7179 Fax +81-3-3201-6582	No

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

>>

The starting date of project implementation is on August 28th, 2007

C.2. Expected operational lifetime of the project:

>>

15 years 0 months

C.3. Length of the crediting period:

>>

4 years and 9 months (from March 31, 2008 to December 31, 2012)

If this JI project will be eligible for ERU trading during next commitment period, the crediting period will be extended by another 5 years and 3 months.

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

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1) Monitoring methodology reference

The monitoring methodology appropriate to this project is ACM0008 version 03 approved by CDM Executive Board on 22 December 2006. The title of the methodology: **"Consolidated monitoring methodology for virgin coal bed methane and coal mine methane capture and use for power (electrical or motive) and heat and/or destruction by flaring"**

URL: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

2) Justification of the choice of the methodology and why it is applicable to the project:

The applicability criteria in the methodology state that the methodology applies to following project activities:

The following tables D-1 and D-2 explain the reason why the methodology applies to this project:

Table D-1 Comparison of proposed extraction activities with applicability of the methodology

ACM0008 Applicability	**Proposed extraction activities**
Surface drainage wells to capture CBM	Not include in project activity
underground boreholes in the mine to capture pre mining CMM	Yes
surface goaf wells, underground boreholes, gas drainage galleries or other goaf gas capture techniques, including gas from sealed areas, to capture post mining CMM	Not include in project activity
Ventilation CMM that would normally be vented	Yes

Table D-2 Comparison of proposed CMM utilization activities with applicability of the methodology

ACM0008 Applicability	**Proposed CMM utilization activities**
The methane is captured and destroyed through flaring	Not include in project activity

The methane is captured and destroyed through utilization to produce electricity, motive power and/or thermal energy; emission reductions may or may not be claimed for displacing or avoiding energy from other sources	The proposed project is CMM power generation and waste heat recovery

Besides the applicability, ACM0008 also defines the types of activities that could not be applied for this methodology. The proposed project does not involve any of those activities. (Table D-3)

Table D-3 Comparison of proposed project with inapplicable activities stated in the methodology

ACM0008 Applicability	Proposed project activities
Capture methane from abandoned/decommissioned coalmines	Both coal production and CMM extraction are under way in the coal mine
Capture/use of virgin coal-bed methane, e.g. methane of high quality extracted from coal seams independently of any mining activities	All necessary parameters are measurable
Operate in opencast mines.	Underground operated coal mines

The applicable conditions, key assumptions, scope of data, data source in the methodology fit the project. The methodology is certain to lead to a transparent and conservative estimate of the emission reduction of the project activity.

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 emissions from the project, and how these data will be archived:

Overall

ID number (*Please use numbers to ease cross-referencing to D.2.*)	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
P1	PEy	Project emissions in yearly y	tCO_2e	c	monthly	100%	electronic	(Archived data to be kept for Crediting period +2 yrs)
P2	PE_{ME}	Project emissions from energy use to capture and use methane	tCO_2e	c	monthly	100%	electronic	(Crediting period +2 yrs)
P3	PE_{MD}	Project emissions from methane destroyed	tCO_2e	c	monthly	100%	electronic	(Crediting period +2 yrs)
P4	PE_{UM}	Project emissions from un-combusted methane	tCO_2e	c	monthly	100%	electronic	(Crediting period +2 yrs)

Combustion emissions from additional energy required for CMM capture and use

ID number (*Please use numbers to ease cross-referencing to D.2.*)	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
P5	$CONS_{ELEC.PJ}$	Additional electricity consumption by project	MWh	m	Hourly	100%	electronic	The sources of additional electricity consumption include CHP and

								Methane Recovery Station.. (Archived data to be kept for Crediting period +2 yrs)
P6	$CEF_{ELEC\ PJ}$	Carbon emission factor of $CONS_{ELEC\ PJ}$	tCO_2/ MWh	c	Ex ante	100%	electronic	The calculation is described in Annex2 (Crediting period +2 yrs)

Combustion emissions from use of captured methane

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
P7	MD_{ELEC}	Methane destroyed by CHP	tCH_4	c	Calculated monthly	100%	electronic	(Crediting period +2 yrs)
P8	MM_{ELEC}	Methane sent to CHP	tCH_4	m	Continuous	100%	electronic	Flow meters will record gas volumes, pressure and temperature. Density of methane under normal conditions of temperature and pressure is 0.67kg/m3(2006 IPCC Guideline) (Crediting period +2 yrs)
P9	Eff_{ELEC}	Efficiency of methane destruction/oxidation in CHP		e	Ex ante			Set at 99.5% (IPCC)
P10	MD_{HEAT}	Methane destroyed by heat generation	tCH_4	c	Calculated monthly	100%	electronic	(Crediting period +2 yrs)

P11	MM_{HEAT}	Methane sent to the existing boiler	tCH4	m	Continuous	100%	electronic	Flow meters will record gas volumes, pressure and temperature. Density of methane under normal conditions of temperature and pressure is 0.67kg/m3(2006 IPCC Guideline) (Crediting period +2 yrs)
P12	Eff_{HEAT}	Efficiency of methane destruction/oxidation in heat plant	-	e	Ex ant			Set at 99.5%(IPCC)
P13	CEF_{CH4}	Carbon emission factor for CH_4						Constant value: tCO_2e / tCH_4= 2.75
P14	CEF_{NMHC}	Carbon emission factor for combusted non methane hydrocarbons (various)						To be obtained through periodical analysis of the fractional composition of captured
P15	PC_{CH4}	Concentration methane in extracted gas	%	m (concentration, optical and calorific)	Hourly	100%	electronic	Average of 6 measurements during one hour (Crediting period +2 yrs)
P16	PC_{NMHC}	NMHC concentration in coal mine gas	%	m (concentration, optical and calorific)	Annually	100%		Used to check if more than 1% of emission and to calculater (Crediting period +2 yrs) To be analysed under the

								responsibility of the GIG
P17	r	Relative proportion of NMHC compared to methane	%	c	Annually	100%		To be analysed under the responsibility of the GIG

Un-combusted methane from end uses

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
P18	$GWPc_{H4}$	Global warming potential of methane		e	Ex ante			Set at 21
P19	MM_{ELEC}	Methane sent to CHP	tCH_4	m	Hourly	100%	electronic	Flow meters will record gas volumes, pressure and temperature (Archived data to be kept for Crediting period +2 yrs)
P20	Eff_{ELEC}	Efficiency of methane destruction/oxidation in CHP		e	Ex ante			Set at 99.5% (IPCC)
P21	MM_{HEAT}	Methane sent to the existing boilers	tCH_4	m	Hourly	100%	electronic	Flow meters will record gas volumes, pressure and temperature. (Crediting period +2 yrs)
P22	Eff_{HEAT}	Efficiency of methane destruction/oxidation in heat plant	-	e	Ex ant			Set at 99.5%(IPCC)

D.1.1.2. Description of formulae used to estimate project emissions (for each gas, source etc.; emissions in units of CO_2 equivalent):

>>

Project Emissions:

$$PE_y = PE_{ME} + PE_{MD} + PE_{MU}$$

Where:

PE_y - Project emissions in year y (tCO_2e)
PE_{ME} - Project emissions from energy use to capture and use methane (tCO_2e)
PE_{MD} - Project emissions from methane destroyed (tCO_2e)
PE_{UM} - Project emissions from un-combusted methane (tCO_2e)

Project emissions from additional energy required for CMM capture and use:

$$PE_{ME} = CONS_{ELEC,PJ} * CEF_{ELEC}$$

Where:

PE_{ME} - Project emissions from energy use to capture and use methane (tCO_2e)
$CONS_{ELEC,PJ}$ - Additional electricity consumption for capture and use of methane, if any (MWh)
CEF_{ELEC} - Carbon emissions factor of electricity used by coal mine (tCO_2e/MWh)

Project emissions from methane destroyed:

$$PE_{MD} = (MD_{ELEC} + MD_{HEAT}) * (CEF_{CH4} + r * CEF_{NMHC})$$

With:

$$r = PC_{NMHC} / PC_{CH4}$$

Where:

PE_{MD} - Project emissions from CMM/destroyed (tCO_2e)
MD_{ELEC} - Methane destroyed through power generation (tCH_4)
MD_{HEAT} - Methane destroyed through heat generation (tCH_4)

CEF_{CH4} - Carbon emission factor for combusted methane (2.75 tCO_2e/tCH_4)
CEF_{NMHC} - Carbon emission factor for combusted non methane hydrocarbons (the concentration varies and, therefore, to be obtained through periodical analysis of captured methane) ($tCO_2eq/tNMHC$)
r - Relative proportion of NMHC compared to methane
PC_{CH4} - Concentration (in mass) of methane in extracted gas (%)
PC_{NMHC} - NMHC concentration (in mass) in extracted gas (%)

$$MD_{ELEC} = MM_{ELEC} * Eff_{ELEC}$$

Where:

MD_{ELEC} - Methane destroyed through power generation (tCH_4)
MM_{ELEC} - Methane measured sent to power plant (tCH_4)
Eff_{ELEC} - Efficiency of methane destruction/oxidation in power plant (99.5% from IPCC)

$$MD_{HEAT} = MM_{HEAT} * Eff_{HEAT}$$

Where:

MD_{HEAT} - Methane destroyed through heat generation (tCH_4)
MM_{HEAT} - Methane measured sent to heat plant (tCH_4)
Eff_{HEAT} - Efficiency of methane destruction/oxidation in heat plant (taken as 99.5% from IPCC)

Un-combusted methane from flaring and end uses:

$$PE_{UM} = GWP_{CH4} * [MM_{ELEC}*(1-Eff_{ELEC}) + MM_{HEAT} * (1-Eff_{HEAT})]$$

Where:

PE_{UM} - Project emissions from un-combusted methane (tCO_2e)
GWP_{CH4} - Global warming potential of methane (21 tCO_2e/tCH_4)

MM_{ELEC} - Methane measured sent to power plant (tCH_4)
Eff_{ELEC} - Efficiency of methane destruction/oxidation in CHP (taken as 99.5% from IPCC)
MM_{HEAT} - Methane measured sent to heat plant (tCH_4)
Eff_{HEAT} - Efficiency of methane destruction/oxidation in heat plant (taken as 99.5% from IPCC)

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:

Overall

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
Bl	BEy	Baseline emissions in year y	tCO_2	c	yearly	100%	electronic	(Archived data to be kept for Crediting period +2 yrs)
B2	$BE_{MD,y}$	Baseline emissions from destruction of methane in the baseline scenario in year y	tCO_2	e	Estimated ex-ante	100%	electronic	(Crediting period +2 yrs)
B3	$BE_{MR,y}$	Baseline emissions from release of methane into the atmosphere in year y that is avoided by the project activity	tCO_2	c	yearly	100%	electronic	(Crediting period +2 yrs)

Methane destruction due to thermal demand in baseline

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

B4	$CMM_{Bli,y}$	CMM that would have been captured, used and destroyed by thermal demand in the baseline scenario in year y	tCH_4	e	Estimated ex-ante at start of project	100%	electronic	(Archived data to be kept for Crediting period +2 yrs)
B5	$TH_{BL,y}$	Projected annual baseline CMM demand for <u>thermal energy uses</u>	tCH_4	e	Ex ante	100%	electronic	Estimated by procedure defined in the corresponding baseline methodology (Crediting period +2 yrs)
B6	CEF_{CH4}	Carbon emission factor for methane	tCO_{2e}/tCH_4					tCO_2e/tCH_4 =2.75
B7	d_k^{max}	Scalar adjustment factor for month k, based on the seasonal load shape (Σ dkmax > 12)		c	Ex ante	100%	electronic	(Crediting period +2 yrs)

Baseline emissions from methane released into the atmosphere

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
B8	$CMM_{PJ,ELEC,y}$	Pre-mining CMM captured, sent to and destroyed by use power *Generation* in the project activity in year y	tCH_4	m	Hourly	100%	electronic	(Crediting period +2 yrs)

B9	$CMM_{PJ,HEAT,y}$	Pre-mining CMM captured, sent to and destroyed by use Heat *Generation* in the project activity in year y	tCH_4	m	Hourly	100%		electronic	(Crediting period +2 yrs)
B10	GWP_{CH4}	Global warming potential of methane	tCO2e/tCH4	e	Ex ante				21 tCO2e/tCH4
B11	CEF_{CH4}	Carbon emission factor for combusted methane	tCO2e/tCH4	e	Ex ante				2.75 tCO2e/tCH4

D.1.1.4. Description of formulae used to estimate baseline emissions (for each gas, source etc.; emissions in units of CO_2 equivalent):

>>

Baseline Emission:

$$BE_y = BE_{MD,y} + BE_{MR,y}$$

Where:

BE_y - Baseline emissions in year y (tCO_2e)
$BE_{MD,y}$ - Baseline emissions from destruction of methane in the baseline scenario in year y (tCO_2e)
$BE_{MR,y}$ - Baseline emissions from release of methane into the atmosphere in year y that is avoided by the project activity (tCO_2e)

Baseline methane destruction emissions:

$$BE_{MD,y} = (CEF_{CH4} + r * CEF_{NMHC}) * \sum^{12} (TH_{BL,y}/12^{*1}) d^{max}_k$$

*1 The use of monthly data is admitted by the methodology: "Consolidated monitoring methodology for virgin coal bed methane and coal mine methane capture and use for power (electrical or motive) and heat and/or destruction by flaring"

$k=1$

Where:

$BE_{MD,y}$	- Baseline emissions from destruction of methane in the baseline scenario in year y (tCO_2e)
$TH_{BL,y}$	- Projected annual baseline thermal demand for year y (tCH_4)
d_k	- Scalar adjustment factor for day k to reflect seasonal variations, such that $\Sigma d_k=12$
d^{max}_k	- Maximum scalar adjustment factor for day k over the 5 years prior to the start of the project activity (i.e. $\Sigma d^{max}_k>12$)
CEF_{CH4}	- Carbon emission factor for combusted methane (2.75 tCO_2e/tCH_4)
CEF_{NMHC}	- Carbon emission factor for combusted non methane hydrocarbons (various. To be obtained through periodical analysis of captured methane) ($tCO_2eq/tNMHC$)
r	- Relative proportion of NMHC compared to methane

With:

$r = PC_{NMHC} / PC_{CH4}$

PC_{CH4}	- Concentration (in mass) of methane in extracted gas (%)
PC_{NMHC}	- NMHC concentration (in mass) in extracted gas (%)

Baseline methane release:

$$BE_{MRy} = GWP_{CH4} * [(CMM_{PJ,ELEC,y} + CMM_{PJ,HEAT,y}) - \sum_{k=1}^{12} (TH_{BL,y}/12) d^{max}_k]$$

Where:

$BE_{MR,y}$	- Baseline emissions from release of methane into the atmosphere in year y that is avoided by the project activity (tCO_2e)
$TH_{BL,y}$	- Projected annual baseline thermal demand for year y (tCH_4)
d_k	- Scalar adjustment factor for day k to reflect seasonal variations, such that $\Sigma d_k=12$
d^{max}_k	- Maximum scalar adjustment factor for day k over the 5 years prior to the start of the project activity (i.e. $\Sigma d^{max}_k>12$)
$CMM_{ELEC,y}$	- CMM that would have been captured, used and destroyed by use *Generation* in the baseline scenario in year y

$CMM_{HEAT,y}$ -CMM that would have been captured, used and destroyed by use *heat Generation* in the baseline scenario in year y

GWP_{CH4} -Global warming potential of methane ($tCO_2e/tCH_4 = 21$)

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:

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

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 CO_2 equivalent):

>>
Not applicable

D.1.3. Treatment of leakage in the monitoring plan:

Not applicable

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 number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.1.3.2. Description of formulae used to estimate leakage (for each gas, source etc.; emissions in units of CO_2 equivalent):

>>
Not applicable

D.1.4. Description of formulae used to estimate emission reductions for the project (for each gas, source etc.; emissions/emission reductions in units of CO_2 equivalent):

>>
The emission reduction *ERy* by the project activity during a given year *y* is the difference between the baseline emissions (*BEy*) and project emissions (*PEy*), as follows:

$$ER\,y = BE\,y - PE\,y$$

Where:

ERy - Emissions reductions of the project activity during the year *y* (tCO2e)
BE,y - Baseline emissions during the year *y* (tCO2e)
PEy - Project emissions during the year *y* (tCO2e)

D.1.5. Where applicable, in accordance with procedures as required by the host Party, information on the collection and archiving of information on the environmental impacts of the project:

>>
The host Party has not established any specific procedures on information collection and archiving on project's environmental impacts.

D.2. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:		
Data *(Indicate table and ID number)*	Uncertainty level of data (high/medium/low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.

P5,P8,P11,P19,P21 B4, B8,B9	Low	Corresponding measuring equipment (flow meters, meters, thermometers, manometers) will be subject to regular maintenance regime to ensure accuracy. Each device is to be checked regularly by a specialized company in the presence of a state verifier in accordance with the regulation stated in Poland and the Cheeking Schedule mentioned in Section D. The exceptional verification is to be carried out after obtaining of unfeasible data.
P15,P16	Low	Gas analysis will be conducted by a licensed company to ensure accuracy.
P9,P14 B10,B11		The data are calculated on other monitored data, or the data are IPCC defaults values, so QA/QC procedures are not necessary.

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

>>

Data handling

A transparent system for collection and storage of measured data in the electronic and paper form are established. A transparent system for computation in the form of Excel sheets is established.

Quality assurance:

-A department that is responsible for operation of the CHP is a Power Engineering Department of the Coalmine Borynia. In the staff of this department a person will be assigned responsible for a data monitoring. It is assumed to implement automatic and manual monitoring, collection and processing of data every hour. In any case all automatic measuring equipment has at least half a year independent (including energy independent) archive of measured data, which can be extracted and processed any time.

- The Coalmine Borynia will designate a system manager to be in charge of and accountable for the generation of ERs including monitoring, record keeping, computation and recording of ERs, validation and verification
- The system manager will officially sign off on all worksheets used for the recording and calculation of ERs
-Well-defined protocols and routine procedures, with good, professional data entry, extraction and reporting procedures will make it considerably easier for the validator and verifier to do their work
- Proper management processes and systems records will be kept by the project. The verifiers can request copies of such records to judge compliance with the required management system.
- The monitoring manual will be compiled and working staff in the monitoring department will fulfill their responsibilities using this manual.

Reporting:

- The project manager will prepare reports, as needed for audit and verification purposes.

Training:

- Required capacity and internal training will be equipped to the operational staff and the monitoring staff to enable them to undertake the tasks required by this Monitoring Plan. Appropriate staff training will be provided before this project starts operating and generating ERs.

All measured data are to be stored in the non-processed electronic form in the memory of automatic measuring devices for at least half a year. Besides the processed measured and calculated values are to be stored in the electronic form in EXCEL sheets, and in paper.

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

>>

Name/origination Project participant	Project Participate Yes/No
Hideo Yata The Chugoku Electric Power Co., Inc. 4-33, Komachi, Naka-ku, Hiroshima, 730-8701, Japan Tel +81-82-523-6424 Fax +81-82-523-6422	Yes
Teruyuki Okada Mizuho Corporate Bank, Ltd. 5-1, Marunouchi 2-chome, Chiyodaku, Tokyo 100-8333, Japan Tel +81-3-5220-7179 Fax +81-3-3201-6582	No

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

>>

The project emission are calculated in the way that clarified in Section B. The detailed calculation results for the crediting period are shown in Table E-1

Calculus in 2009

Project emissions from additional energy required for CMM capture and use:

$$PE_{ME} = CONS_{ELEC,PJ} * CEF_{ELEC}$$

Where:

PE_{ME}	- Project emissions from energy use to capture and use methane (tCO_2e)
$CONS_{ELEC,PJ}$	- Additional electricity consumption for capture and use of methane, if any (MWh)
CEF_{ELEC}	- Carbon emissions factor of electricity used by coal mine (tCO_2e/MWh)

The project emission from additional electricity required for CMM capture and use is very small compared with the emission reductions from the whole project. This emission will be monitored and calculated during the project activity, however, is not included in the estimation of this Section.

Project emissions from methane destroyed:

$$PE_{MD} = (MD_{ELEC} + MD_{HEAT})*(CEF_{CH4} + r*CEF_{NMHC})$$

With:

$$r = PC_{NMHC} / PC_{CH4}$$

Where:

PE_{MD}	- Project emissions from CMM/destroyed (tCO_2e)
MD_{ELEC}	- Methane destroyed through power generation (tCH_4)
MD_{HEAT}	- Methane destroyed through heat generation (tCH_4)
CEF_{CH4}	- Carbon emission factor for combusted methane (2.75 tCO_2e/tCH_4)
CEF_{NMHC}	- Carbon emission factor for combusted non methane hydrocarbons (the concentration varies and, therefore, to be obtained through periodical analysis of captured methane) ($tCO_2eq/tNMHC$)
r	- Relative proportion of NMHC compared to methane
PC_{CH4}	- Concentration (in mass) of methane in extracted gas (%)
PC_{NMHC}	- NMHC concentration (in mass) in extracted gas (%)

$$MD_{ELEC} = MM_{ELEC} * Eff_{ELEC}$$

Where:

MD_{ELEC}	- Methane destroyed through power generation (tCH_4)
MM_{ELEC}	- Methane measured sent to power plant (tCH_4)
Eff_{ELEC}	- Efficiency of methane destruction/oxidation in power plant (99.5% from IPCC)

$$MD_{HEAT} = MM_{HEAT} * Eff_{HEAT}$$

Where:

MD_{HEAT} - Methane destroyed through heat generation (tCH_4)
MM_{HEAT} - Methane measured sent to heat plant (tCH_4)
Eff_{HEAT} - Efficiency of methane destruction/oxidation in heat plant (taken as 99.5% from IPCC)

- Borynia Coal Mine has good prospect that generating CMM is 5,596 (tCH_4)
- The CHP will destroy MM_{ELEC} 2,179 (tCH_4) and supply Electric power 11,787 (MWh) (Assumption if CHP works 7,200 hours per year at power generation efficiency of 41.3%)
- Before the project activity, the existing boilers have destroyed CMM 841 (tCH_4) and the existing boilers will destroy MM_{HEAT} 1,567 (tCH_4) (Assumption if the existing boilers work 8,600 hours per year in order to CH_4 destruction as well as necessary heat generation even though the whole generated heat will not be utilized on-site.)
- PC_{NMHC} is less than 1(%), therefore actual measurements

Then:

$MD_{ELEC} = 2{,}179\ tCH_4 * 99.5\% = 2{,}168.2\ tCH_4$
$MD_{HEAT} = 1{,}567\ tCH_4 * 99.5\% = 1{,}558.9\ tCH_4$

$PE_{MD} = (2{,}168.2\ (tCH_4) + 1{,}558.9\ (tCH_4)\ ) * 2.75 = 10{,}249.7\ (tCO_2e)$

Un-combusted methane from flaring and end uses:

$PE_{UM} = GWP_{CH4} * [\ MM_{ELEC}*(1-Eff_{ELEC}) + MM_{HEAT} * (1-Eff_{HEAT})]$

Where:

PE_{UM} - Project emissions from un-combusted methane (tCO_2e)
GWP_{CH4} - Global warming potential of methane (21 tCO_2e/tCH_4)

MM_{ELEC} - Methane measured sent to power plant (tCH_4)
Eff_{ELEC} - Efficiency of methane destruction/oxidation in CHP (taken as 99.5% from IPCC)
MM_{HEAT} - Methane measured sent to heat plant (tCH_4)
Eff_{HEAT} - Efficiency of methane destruction/oxidation in heat plant (taken as 99.5% from IPCC)

$PE_{UM} = 21 * [2{,}179\ (tCH_4)*0.5\% + 1{,}567\ (tCH_4)*0.5\%\ ] = 393\ (tCO_2e)$

Estimated project emissions:

$PE_{2009} = PE_{MD} + PE_{UM}$

Where:

PE_{2009} - Project emissions in year 2009 (tCO_2e)

$PE_{2009} = 10{,}249.7\ (tCO_2e) + 393\ (tCO_2e) = 10{,}643\ (tCO_2e)$

Table E-1. Greenhouse Gas Emissions by Sources in Project scenario (t CO_2e)

Year	PE_{MD}	PE_{UM}	PE
2008	7,687	295	7,982
2009	10,250	393	10,643
2010	10,250	393	10,643
2011	10,250	393	10,643
2012	10,250	393	10,643

E.2. Estimated leakage:

>>
As stated in Section B, no leakage effects need to be accounted for under this proposed project.

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

>>
Table E-2 shows the overall project emission at the Project for the crediting period. The actual project activity emission would be represented by the small amounts of uncombusted CH_4 and CO_2 emissions produced from the utilization activities.

Table E-2. Estimated GHG project emissions with the account of leakage

Year	Leakage	PE
2008	0	7,982
2009	0	10,643
2010	0	10,643
2011	0	10,643
2012	0	10,643

E.4. Estimated baseline emissions:

>>
The GHG emission in the baseline are equal to the methane CMM extracted from the coal mine drainage systems (that would have been released to the atmosphere) but is sent to the utilization activities, plus any GHG emission produced without the proposed project. The baseline emissions are calculated using the equations and parameters clarified in Section B. the estimated baseline GHG emissions at the project is shown in Table E-3.

Calculus in 2009,

Baseline methane destruction emissions:

$$BE_{MD,2009}= (CEF_{CH4} + r * CEF_{NMHC}) * \sum^{12} (TH_{BL,y}/12^{*1})d^{max}{}_{k}$$

---

*1 The use of monthly data is admitted by the methodology: "Consolidated monitoring methodology for virgin coal bed methane and coal mine methane capture and use for power (electrical or motive) and heat and/or destruction by flaring" k=1

Where:

$BE_{MD,2009}$ - Baseline emissions from destruction of methane in the baseline scenario in year y (tCO_2e)

$TH_{BL,2009}$ - Projected annual baseline thermal demand for year y (tCH_4)

d_k - Scalar adjustment factor for day k to reflect seasonal variations, such that $\Sigma d_k=12$

d^{max}_k - Maximum scalar adjustment factor for day k over the 5 years prior to the start of the project activity (i.e. $\Sigma d^{max}_k>12$)

CEF_{CH4} - Carbon emission factor for combusted methane (2.75 tCO_2e/tCH_4)

CEF_{NMHC} - Carbon emission factor for combusted non methane hydrocarbons (various. To be obtained through periodical analysis of captured methane) ($tCO_2eq/tNMHC$)

r - Relative proportion of NMHC compared to methane

With:

$r = PC_{NMHC} / PC_{CH4}$

PC_{CH4} - Concentration (in mass) of methane in extracted gas (%)

PC_{NMHC} - NMHC concentration (in mass) in extracted gas (%)

- Projected annual baseline thermal demand for 2008 is 694 (tCH_4). This figure is average of thermal demand from Sep. 2002 to Aug. 2007 in Borynia Coal Mine. Heat demand of Borynia Coal Mine is all consumption in house. They do not have any plans to sell CMM to new customer at all. Therefore, they prospect that thermal demand from 2008 to 2012 is almost same as average thermal demand from 2008 to 2012.
- Calculus of d^{max}_k is shown in ANNEX2 Table 4.
- PC_{NMHC} / PC_{CH4} is less than 1(%), therefore actual measurements

$$BE_{MD,y} = (CEF_{CH4} + r * CEF_{NMHC}) * \sum_{k=1}^{12} (TH_{BL,y}/12^{*1}) d^{max}_k$$

$$BE_{MD,y} = 2.75\ (tCO_2e/tCH_4) * 1{,}245\ (tCH_4) = 3{,}425\ (tCO_2e)$$

Baseline methane release:

$$BE_{MRy} = GWP_{CH4} * [(CMM_{PJ,ELEC,y} + CMM_{PJ,HEAT,y}) - \sum_{k=1}^{12} (TH_{BL,y}/12) d^{max}_k]$$

Where:

$BE_{MR,y}$ -Baseline emissions from release of methane into the atmosphere in year y that is avoided by the project activity (tCO_2e)

$CMM_{ELEC,y}$ - Identical with MM_{ELEC} 2,179 (tCH_4) in project activity.

$CMM_{HEAT,y}$ - Identical with MM_{HEAT} 1,567 (tCH_4) in project activity.

[*1] The use of monthly data is admitted by the methodology: "Consolidated monitoring methodology for virgin coal bed methane and coal mine methane capture and use for power (electrical or motive) and heat and/or destruction by flaring"

GWP_{CH4} -Global warming potential of methane ($tCO_2e/tCH_4 = 21$)

BE_{MR2009} =21 * [2179 (tCH_4)+ 1,567 (tCH_4)) -1,245 (tCH_4)]= 52,513 (tCO_2e)

Baseline Emission:

$BE_{2009} = BE_{MD,2009} + BE_{MR,y2009\ 2009}$

Where:

BE_{2009} - Baseline emissions in year 2009 (tCO_2e)

BE_{y2009}= 3,425 (tCO_2e)+ 52,513 (tCO_2e) = 55,937 (tCO_2e)

Table E-3. Baseline Greenhouse Gas Emission by Sources (t CO_2e)

Year	BE_{MD}	BE_{MR}	BE
2008	2,568	39,384	41,953
2009	3,425	52,513	55,937
2010	3,425	52,513	55,937
2011	3,425	52,513	55,937
2012	3,425	52,513	55,937

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

>>

The emissions reductions created from the project activity are the net difference between the baseline emission and the project emissions for a given year. Ex-ante emissions at the project is projected for estimating proposes only since any actual emissions will be measured ex-post according to the monitoring methodology. The total baseline emissions are shown in Table E-4.

Table E-4. Emission reduction units (tCO_2e)

Year	BE	PE	ER
2008	41,953	7,982	33,971
2009	55,937	10,643	45,294
2010	55,937	10,643	45,294
2011	55,937	10,643	45,294
2012	55,937	10,643	45,294

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

>>

Year	Estimated project emissions (tonnes of CO2 equivalent)	Estimated leakage (tonnes of CO2 equivalent)	Estimated baseline emissions (tonnes of CO2 equivalent)	Estimated emission reductions (tonnes of CO2 equivalent)
Year 2008	7,982	0	41,953	33,971
Year 2009	10,643	0	55,937	45,294
Year 2010	10,643	0	55,937	45,294
Year 2011	10,643	0	55,937	45,294
Year 2012	10,643	0	55,937	45,294
Total (tonnes of CO_2 equivalent)	50,554	0	265,702	215,147

SECTION F. Environmental impacts

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:

>>

Since this proposed project is carried out in the site of KWK Borynia Coal Mine, a decision has been issued that Environmental Impact Assessment on this project is not required to conduct and report.

The corresponding part of the decision (in English) issued from the Mayor of Jastrzebie Zdroj city is cited below.

Jastrzębie Zdrój, 10/07/2007

DECISION No. OŚ.II.76240-17/07
on environmental determinants of permission.

Upon the art. 104 of Administrative Code and art. 46 sec. 1 par. 1, art. 46a sec. 1,7 par. 4, art. 48 sec. 2 ar. 1a, art. 56 of Environment Protection Act on 27 April 2001, in connection with art. 3 sec. 1 par. 33 of Government Order on 9 November 2004 of subjection of undertakings having significant impact on environment to the compulsory assessment and reporting on their environmental impact, after examining the application of JSW SA (Jastrzebie Coal Company) Borynia Coal Mine (…) of proposed "CHP fired with CMM project" (…) and after taking into account opinion of Regional Sanitary Inspectorate as well as government orders on 9 November 2004, the Mayor of the City of Jastrzebie Zdroj **decided no to subject** the proposed undertaking to environmental impact assessment and reporting. (…)

Additionally, INTROL S.A, which has contracted construction of this project from Borynia Coal Mine, carried out a preliminary environmental impact assessment and they obtained the result that there is no remarkable negative influence in implementation of this project.

The outline of the result of the preliminary environmental impact assessment (in English) is shown below.

[Introl, Co. logo]
[Introl, Co.; Str. Addr.: Kościuszki 112; 40-519 Katowice]

[MLM, Co. Ltd logo]
[MLM, Co. Ltd; Str. Addr.: Murarska 15; 43-100 Tychy]

Investor: Jastrzębie Coal Company (Jastrzębska Spółka Węglowa)
Borynia Coal Mine (KWK Borynia)

Subject: CHP Powered with Coal Mine Methane Construction

Item: Project Environmental Impact Assessment

Sector: Technology
Date: March 2007

Stage: Preliminary Study
Project No.: 255-00/936/06

by: Zbigniew Matusik, MSc, Eng., licence no: 320/93
[seal]

(...)

Summary

The presented data show that proposed "CHP Powered with Coal Mine Methane" Project should not have significant negative impact on environment, contrariwise It should help to mitigate waste coal mine gas emission to the atmosphere occurring during safety degasification process through its use for in-plant power generation. (...) Upon the Governmental Order on 9 November 2005 of determination of undertakings having significant impact on environment and subjection to the compulsory reporting on and assessment of their environmental impact, the presented undertaking may be qualified to the art. 3.1 par. 4 group (4,4 MW of input energy) and art. 3.1. par. 33 (gas connection of >0.5 MPa) thereof, and as such has no significant negative impact on environment.

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:

>>

Environmental impacts of the Project are considered as insignificant.

SECTION G. Stakeholders' comments

G.1. Information on stakeholders' comments on the project, as appropriate:

>>

Jastrzebie Coal Company and Borynia Coal Mine have introduced this project to The Provincial Council of Silesia Prefecture, The Municipal Council of Jastrzebie Zdroj City and 7 labour unions of Borynia Coal Mine to receive each stakeholder's comment by the method shown in the following table:

Stakeholders	How comments was invited	Nature of the comments
The Provincial Council of Silesia Province	Jastrzebie Coal Company submitted the document describing the project outline and their intention of JI to the Provincial Council of Silesia Prefecture and asked for comment from Silesia Prefecture in written document.	Positive
The Municipal Council of Jastrzebie Zdroj City	Jastrzebie Coal Company submitted the document describing the project outline and their intention of JI to the Municipal Council of Jastrzebie Zdroj City and asked for comment from Jastrzebie Zdroj City in written document.	Positive
7 labour unions of Borynia Coal Mine (listed below) • Związku Zawodowego Górników (Miner's Trade Union) • NSZZ „Solidarność" KWK „Borynia" JSW S.A. (Independent Self-Governing Trade Union „Solidarność") • Zarządu Zakładowego Związku Zawodowego „Przeróbka" („Przeróbka" Trade Union Board) • Związek Zawodowy Maszynistów Wyciągowych (Extraction Engines Drivers Trade Union) • Związek Zawodowy (Trade Union) • Związek Zawodowy „KADRA" („KADRA" Trade Union) • Związek Zawodowy „KONTRA" („KONTRA" Trade Union)	Borynia Coal Mine carried out the briefing session on implementation of this project for seven labour unions of Borynia Coal Mine and asked for comment in written document from them.	Positive

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

Project Participant 1

Organisation:	Jastrzębska Spółka Węglowa S.A. (Jastrzebie Coal Company)
Street/P.O.Box:	Ul. Armii Krajowej 56
Building:	N/A
City:	Jastrzębie Zdrój
State/Region:	Województwo Śląskie
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Country:	Poland
Phone:	+48 32 756 43 45
Fax:	+48 32 756 43 44
E-mail:	N/A
URL:	http://www.jsw.pl/
Represented by:	Jarosław ZAGÓROWSKI
Title:	Director
Salutation:	Mr.
Last name:	Gatner
Middle name:	N/A
First name:	Kazimierz
Department:	N/A
Phone (direct):	+48 32 756 43 45
Fax (direct):	+48 32 756 43 44
Mobile:	N/A
Personal e-mail:	N/A

Project Participant 2

Organisation:	Kopalnia Węgla Kamiennego „BORYNIA" (The BORYNIA Coal Mine)
Street/P.O.Box:	Ul. Weglowa 4
Building:	N/A
City:	Jastrzębie Zdrój
State/Region:	Województwo Śląskie
Postal code:	44-268
Country:	Poland
Phone:	+48 32 75 61 600
Fax:	+48 32 47 18 630
E-mail:	N/A
URL:	http://www.jsw.pl/zaklady/borynia/historia.php
Represented by:	Zbigniew Czernecki
Title:	Director
Salutation:	Mr.
Last name:	Kubaczka
Middle name:	N/A
First name:	Czeslaw
Department:	N/A

Phone (direct):	+48 32 75 61 600
Fax (direct):	+48 32 47 18 630
Mobile:	N/A
Personal e-mail:	N/A

Project Participant 3

Organisation:	Główny Instytut Górnictwa (Central Mining Institute)
Street/P.O.Box:	Plac Gwarkow 1
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Phone:	+48 32 259 22 67
Fax:	+48 32 259 65 33
E-mail:	soxk@gig.katowice.pl
URL:	http://www.gig.katowice.pl/
Represented by:	Józef DUBIŃSKI
Title:	Head
Salutation:	Mr.
Last name:	Stanczyk
Middle name:	N/A
First name:	Krzysztof
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Annex 2

BASELINE INFORMATION

1. Summary of coal production from 2002 to 2012 (t/year)

Year	Borynia Mine
2002	2,467,200 t
2003	2,363,700 t
2004	2,334,300 t
2005	2,227,300 t
2006	2,200,700 t
2007	2,036,000 t (Plan)
2008	2,277,700 t (Plan)
2009	2,226,800 t (Plan)
2010	2,226,800 t (Plan)
2011	2,226,800 t (Plan)
2012	2,226,800 t (Plan)

2. Historical data for the baseline calculation

Table 2. Monthly volume of captured methane (in nm^3 CH_4) by Methane Recovery Station in 2002-2007

Month/Year	2002	2003	2004	2005	2006	2007
January	82,700	23,904	252,332	527,963	653,975	857,808
February	72,300	0	188,590	545,223	574,704	648,144
March	154,500	0	171,260	596,780	802,656	585,072
April	272,200	0	90,000	441,021	653,760	389,808
May	232,200	0	204,884	359,994	699,696	538,992
June	173,700	113,859	210,863	250,554	1,274,112	588,240
July	131,400	174,669	173,996	487,905	1,098,576	453,168
August	77,700	151,867	84,528	767,952	1,325,088	444,520
September	61,200	386,252	105,408	720,864	1,446,336	
October	66,900	409,533	193,577	792,258	1,154,160	
November	63,500	395,130	232,554	804,240	903,168	
December	44,100	280,973	521,327	653,184	939,888	
Total	1,432,400	1,936,187	2,429,319	6,947,938	11,526,119	

Table 3 CMM collection data in 2002 - 2007

Month	Amount of collected methane	Amount of sold / utilized methane	Emission to atmosphere	Average concentratio n of	Percentage of methane utilisation

							CH_4	
	Collected gas	CH_4	Collected gas	CH_4	Collected gas	CH_4		
	m^3 / month						%	%
1	2	3	4	5	6	7	8	9
2007								
I	1,545,548	857,808	224,348	125,280	1,321,200	732,528	55.5%	14.6%
II	1,222,992	648,144	208,944	110,736	1,014,048	537,408	53.0%	17.1%
III	1,086,053	585,072	243,221	113,184	842,832	411,888	53.9%	19.3%
IV	718,416	389,808	214,707	116,640	503,709	273,168	54.3%	29.9%
V	1,018,656	538,992	204,624	108,576	814,032	430,416	52.9%	20.1%
VI	1,144,662	588,240	158,544	81,792	986,118	506,448	51.4%	13.9%
VII	888,344	453,168	160,704	84,096	727,640	369,072	51.0%	18.6%
VIII	921,456	444,520	170,640	82,800	750,816	361,720	48.2%	18.6%
IX	1,138,752	583,120	201,888	102,816	936,864	480,304	51.2%	17.6%
X								
XI								
XII								
∑I- XII								
Average I- XII								

Month	Amount of collected methane		Amount of sold / utilized methane		Emission to atmosphere		Average concentration of CH_4	Percentage of methane utilisation
	Collected gas	CH_4	Collected gas	CH_4	Collected gas	CH_4		
	m^3 / month						%	%
1	2	3	4	5	6	7	8	9
2006								
I	1,321,162	653,975	243,782	120,672	1,077,380	533,303	49.5%	18.5%
II	1,175,264	574,704	171,387	83,808	1,003,877	490,896	48.9%	14.6%
III	1,592,571	802,656	233,714	117,792	1,358,857	684,864	50.4%	14.7%
IV	1,342,423	653,760	209,643	102,096	1,132,780	551,664	48.7%	15.6%

V	1,374,648	699,696	240,754	122,544	1,133,894	577,152	50.9%	17.5%
VI	2,251,081	1,274,112	172,240	97,488	2,079,841	1,176,624	56.6%	7.7%
VII	2,154,071	1,098,576	108,988	55,584	2,045,082	1,042,992	51.0%	5.1%
VIII	2,370,462	1,325,088	153,016	85,536	2,217,445	1,239,552	55.9%	6.5%
IX	2,382,761	1,446,336	166,305	100,947	2,216,456	1,345,389	60.7%	7.0%
X	2,068,387	1,154,160	233,032	130,032	1,835,355	1,024,128	55.8%	11.3%
XI	1,576,387	903,168	201,049	115,200	1,375,162	787,968	57.3%	12.8%
XII	1,672,399	939,888	218,819	122,976	1,453,580	816,912	56.2%	13.1%
∑I- XII	21,281,438	11,526,119	2,352,727	1,254,675	18,928,711	10,271,444		
Average I- XII							54.2%	10.9%

Month	Amount of collected methane		Amount of sold / utilized methane		Emission to atmosphere		Average concentration of CH_4	Percentage of methane utilisation
	Collected gas	CH_4	Collected gas	CH_4	Collected gas	CH_4		
	m^3 / month						%	%
1	2	3	4	5	6	7	8	9
2005								
I	839,369	527,963	229,935	144,629	609,434	383,334	62.9%	27.4%
II	982,384	545,223	239,431	132,884	742,953	412,339	55.5%	24.4%
III	1,107,199	596,780	262,790	141,644	844,408	455,136	53.9%	23.7%
IV	946,397	441,021	210,582	98,131	735,815	342,890	46.6%	22.3%
V	717,120	359,994	142,871	71,721	574,249	288,273	50.2%	19.9%
VI	555,552	250,554	133,776	60,333	421,776	190,221	45.1%	24.1%
VII	1,062,974	487,905	145,357	66,719	917,617	421,186	45.9%	13.7%
VIII	1,609,962	767,952	220,075	104,976	1,389,887	662,976	47.7%	13.7%
IX	1,616,287	720,864	190,493	84,960	1,425,794	635,904	44.6%	11.8%
X	1,711,140	792,258	230,773	106,848	1,480,367	685,410	46.3%	13.5%
XI	1,628,016	804,240	254,769	125,856	1,373,247	678,384	49.4%	15.6%
XII	1,398,681	653,184	219,854	102,672	1,178,827	550,512	46.7%	15.7%
∑I- XII	14,175,080	6,947,938	2,480,707	1,241,373	11,694,374	5,706,565		

Average I- XII							49.0%	17.9%

Month	Amount of collected methane		Amount of sold / utilized methane		Emission to atmosphere		Average concentration of CH_4	Percentage of methane utilisation
	Collected gas	CH_4	Collected gas	CH_4	Collected gas	CH_4		
	m³ / month						%	%
1	2	3	4	5	6	7	8	9
2004								
I	469,892	252,332	211,365	113,503	258,527	138,829	53.7%	45.0%
II	339,191	188,590	198,388	110,304	140,802	78,286	55.6%	58.5%
III	320,112	171,260	231,056	123,615	89,056	47,645	53.5%	72.2%
IV	179,641	90,000	107,054	53,634	72,587	36,366	50.1%	59.6%
V	359,446	204,884	196,586	112,054	162,860	92,830	57.0%	54.7%
VI	421,726	210,863	225,334	112,667	196,392	98,196	50.0%	53.4%
VII	344,547	173,996	161,974	81,797	182,572	92,199	50.5%	47.0%
VIII	177,580	84,528	75,250	35,819	102,330	48,709	47.6%	42.4%
IX	190,267	105,408	51,321	28,432	138,946	76,976	55.4%	27.0%
X	333,753	193,577	205,319	119,085	128,434	74,492	58.0%	61.5%
XI	400,265	232,554	241,033	140,040	159,232	92,514	58.1%	60.2%
XII	823,584	521,327	263,055	166,514	560,526	354,813	63.3%	31.9%
ΣI- XII	4,360,001	2,429,319	2,167,736	1,197,464	2,192,265	1,231,855		
Average I- XII							55.7%	49.3%

Month	Amount of collected methane		Amount of sold / utilized methane		Emission to atmosphere		Average concentration of CH_4	Percentage of methane utilisation
	Collected gas	CH_4	Collected gas	CH_4	Collected gas	CH_4		
	m³ / month						%	%
1	2	3	4	5	6	7	8	9
2003								

I	64,224	23,904	0	0	64,224	23,904	37.2%	0.0%
II	0	0	0	0	0	0	-	0.0%
III	0	0	0	0	0	0	-	0.0%
IV	0	0	0	0	0	0	-	0.0%
V	0	0	0	0	0	0	-	0.0%
VI	211,246	113,859	84,601	45,600	126,645	68,259	53.9%	40.0%
VII	320,925	174,669	157,725	85,771	163,200	88,898	54.4%	49.1%
VIII	319,050	151,867	151,908	72,308	167,142	79,559	47.6%	47.6%
IX	623,462	386,252	110,804	68,698	512,658	313,554	62.0%	17.8%
X	740,877	409,533	254,050	140,490	486,827	269,043	55.3%	34.3%
XI	695,407	395,130	180,987	102,801	514,420	292,329	56.8%	26.0%
XII	597,932	280,973	233,112	109,563	364,820	171,410	47.0%	39.0%
∑I- XII	3,573,123	1,936,187	1,173,187	625,231	2,399,936	1,306,956		
Average I- XII							54.2%	32.3%

Month	Amount of collected methane		Amount of sold / utilized methane		Emission to atmosphere		Average concentration of CH_4	Percentage of methane utilisation
	Collected gas	CH_4	Collected gas	CH_4	Collected gas	CH_4		
	m^3 / month						%	%
1	2	3	4	5	6	7	8	9
2002								
I	184,200	82,700	64,800	31,200	119,400	51,500	44.9%	37.7%
II	184,300	72,300	69,700	28,900	114,600	43,400	39.2%	40.0%
III	220,700	154,500	82,900	72,700	137,800	81,800	70.0%	47.1%
IV	312,100	272,200	166,400	144,800	145,700	127,400	87.2%	53.2%
V	319,300	232,200	163,300	118,500	156,000	113,700	72.7%	51.0%
VI	290,700	173,700	145,000	86,600	145,700	87,100	59.8%	49.9%
VII	278,600	131,400	72,400	41,300	206,200	90,100	47.2%	31.4%
VIII	204,600	77,700	0	0	204,600	77,700	38.0%	0.0%
IX	165,100	61,200	0	0	165,100	61,200	37.1%	0.0%

X	146,500	66,900	39,700	18,100	106,800	48,800	45.7%	27.1%
XI	156,200	63,500	55,500	22,600	100,700	40,900	40.7%	35.6%
XII	119,200	44,100	0	0	119,200	44,100	37.0%	0.0%
ΣI- XII	2,581,500	1,432,400	859,700	564,700	1,721,800	867,700		
Average I- XII							55.5%	39.4%

Table 4. Methane consumption by boiler house (in nm^3 CH_4), indicating thermal demand by maximum monthly consumption in 2002-2007.

Month/Year	2002	2003	2004	2005	2006	2007
January	31,200	0	113,503	144,629	120,672	125,280
February	28,900	0	110,304	132,884	83,808	110,736
March	72,700	0	123,615	141,644	117,792	113,184
April	144,800	0	53,634	98,131	102,096	116,640
May	118,500	0	112,054	71,721	122,544	108,576
June	86,600	45,600	112,667	60,333	97,488	81,792
July	41,300	85,771	81,797	66,719	55,584	84,096
August	0	72,308	35,819	104,976	85,536	82,800
September	0	68,698	28,432	84,960	100,947	
October	18,100	140,490	119,085	106,848	130,032	
November	22,600	102,801	140,040	125,856	115,200	
December	0	109,563	166,514	102,672	122,976	
Total	564,700	625,231	1,197,464	1,241,373	1,254,675	

Table 5. Projection of methane consumption by the existing boilers, indicating thermal demand by maximum monthly consumption in 2001-2005 Used to determine dmax

CH4(m3)	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	Total
Sep. 2006 - Aug. 2007	100,947	130,032	115,200	122,976	125,280	110,736	113,184	116,640	108,576	81,792	84,096	82,800	1,292,259
Sep. 2005 - Aug. 2006	84,960	106,848	125,856	102,672	120,672	83,808	117,792	102,096	122,544	97,488	55,584	85,536	1,205,856
Sep. 2004 - Aug. 2005	28,432	119,085	140,040	166,514	144,629	132,884	141,644	98,131	71,721	60,333	66,719	104,976	1,275,108
Sep. 2003 - Aug. 2004	68,698	140,490	102,801	109,563	113,503	110,304	123,615	53,634	112,054	112,667	81,797	35,819	1,164,945
Sep. 2002 - Aug. 2003	0	18,100	22,600	0	0	0	0	0	0	45,600	85,771	72,308	244,379
												ave.	1,036,509

dk	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	total
Sep. 2006 - Aug. 2007	0.94	1.21	1.07	1.14	1.16	1.03	1.05	1.08	1.01	0.76	0.78	0.77	12.0
Sep. 2005 - Aug. 2006	0.85	1.06	1.25	1.02	1.20	0.83	1.17	1.02	1.22	0.97	0.55	0.85	12
Sep. 2004 - Aug. 2005	0.27	1.12	1.32	1.57	1.36	1.25	1.33	0.92	0.67	0.57	0.63	0.99	12
Sep. 2003 - Aug. 2004	0.71	1.45	1.06	1.13	1.17	1.14	1.27	0.55	1.15	1.16	0.84	0.37	12
Sep. 2002 - Aug. 2003	0.00	0.89	1.11	0.00	0.00	0.00	0.00	0.00	0.00	2.24	4.21	3.55	12
dmax	0.94	1.45	1.32	1.57	1.36	1.25	1.33	1.08	1.22	2.24	4.21	3.55	22
heat demand projection with dmax	80,969	125,001	113,836	135,356	117,566	108,019	115,140	93,556	105,334	193,408	363,789	306,687	1,858,660

3. Grid emission factor

The data source of electricity production and fuel consumption is Eurostat Energy Monthly Statistics.

3.1 Operating Margin

2004 (1-12) Source	Electricity Production (GWh)	Fuel Consumption (TJ)	Emission Coefficient (tCO2/TJ)	Emissions (tCO2)	Carbon Emission Factor (tC/TJ)	Conversion Factor (tCO2/tC)	Oxidation Factor (%)
Hydro and wind	4,194						
Conventional Thermal	149,839						
Hard coal		929,190	96.301	89,482,236	26.8	3.67	98.0
Lignite		514,052	99.176	50,981,621	27.6	3.67	98.0
Natural gas		39,816	55.820	2,222,509	15.3	3.67	99.5
Derived gases		9,366	47.428	444,214	13.0	3.67	99.5
Imports	5,313	0					

2005 (1-12) Source	Electricity Production (GWh)	Fuel Consumption (TJ)	Emission Coefficient (tCO2/TJ)	Emissions (tCO2)	Carbon Emission Factor (tC/TJ)	Conversion Factor (tCO2/tC)	Oxidation Factor (%)
Hydro and wind	5,302						
Conventional Thermal	151,567						
Hard coal		907,337	96.301	87,377,763	26.8	3.67	98.0
Lignite		533,605	99.176	52,920,809	27.6	3.67	98.0
Natural gas		41,351	55.820	2,308,192	15.3	3.67	99.5
Derived gases		8,040	47.428	381,324	13.0	3.67	99.5
Imports	5,004	0					

2006 (1-12) Source	Electricity Production (GWh)	Fuel Consumption (TJ)	Emission Coefficient (tCO2/TJ)	Emissions (tCO2)	Carbon Emission Factor (tC/TJ)	Conversion Factor (tCO2/tC)	Oxidation Factor (%)
Hydro and wind	5,186						
Conventional Thermal	156,753						
Hard coal		962,648	96.301	92,704,286	26.8	3.67	98.0
Lignite		525,428	99.176	52,109,847	27.6	3.67	98.0
Natural gas		40,460	55.820	2,258,457	15.3	3.67	99.5
Derived gases		9,550	47.428	452,941	13.0	3.67	99.5
Imports	4,789	0					

2007 (1-5) Source	Electricity Production (GWh)	Fuel Consumption (TJ)	Emission Coefficient (tCO2/TJ)	Emissions (tCO2)	Carbon Emission Factor (tC/TJ)	Conversion Factor (tCO2/tC)	Oxidation Factor (%)
Hydro and wind	2,394						
Conventional Thermal	63,421						
Hard coal		405,411	96.301	39,041,620	26.8	3.67	98.0
Lignite		204,965	99.176	20,327,609	27.6	3.67	98.0
Natural gas		18,218	55.820	1,016,920	15.3	3.67	99.5
Derived gases		4,595	47.428	217,933	13.0	3.67	99.5
Imports	3,946	0					

$\Sigma F_{i,j,2004-2007} * COEF_{i,j}$	(tCO2)	494,248,281
$\Sigma GEN_{j,2004-2007}$	(GWh)	557,708
$EF_{OM,2004-2007}$	(tCO2/GWh)	886

3.2 Build Margin

Fuel Consumption rate by source (kJ/kWh)		Total consumption in 2006 (TJ)	Power generation in 2006 (GWh)
Hard Coal	12,481	1,150,009	92,114
Lignite	13,375	716,380	53,559
Gas	11,936	54,227	4,543

2006 (1-12) Source	Electricity Production (GWh)	Fuel Consumption (TJ)	Emission Coefficient (tCO2/TJ)	Emissions (tCO2)	Carbon Emission Factor (tC/TJ)	Conversion Factor (tCO2/tC)	Oxidation Factor (%)
Hydro and wind	5,186						
Conventional Thermal	156,753						
Hard coal	77,132	962,648	96.301	92,704,286	26.8	3.67	98.0
Lignite	39,284	525,428	99.176	52,109,847	27.6	3.67	98.0
Natural gas	3,390	40,460	55.820	2,258,457	15.3	3.67	99.5
Derived gases	800	9,550	47.428	452,941	13.0	3.67	99.5
Imports	4,789	0					

	Electricity production	Fuel consumption rate	Fuel consumed	Emission Coefficient	Emissions
	(GWh)	(kJ/kWh)	(TJ)	(tCO2/TJ)	(tCO2)
Polish grid	130,581				
20% of Polish grid	26,116				
Imports is included	4,789				
Hydro and wind is included	5,186				
All gas is included	3,390	11,936	40,460	55.820	2,258,457
	800	11,936	9,550	47.428	452,941
20% is completed with hard coal	11,951	12,481	149,160	96.301	14,364,338
Build margin emissions					17,075,735

$\Sigma F_{i,m,2006}$*$COEF_{i,m}$	(tCO2)	17,075,735
$\Sigma GEN_{m,2006}$	(GWh)	26,116
$EF_{OM,2004-2007}$	(tCO2/GWh)	654

3.3 Combined Margin

EF_{CMCP}	(tCO2/GWh)	770

4. Key input data

The following data and factors were used for baseline analysis. This information relates to the practical application of a new proposed baseline.

Data	Unit	Value	Source
Expected debit of CH4 capture from 2008	m^3/min	20	Expected debit of captured CH_4 in 2008 and following years.
CMM			
CH_4 content in drained CMM in 2006	%	54.2	annual average in 2006
CH_4 content in drained CMM in 2005	%	49.0	annual average in 2005
CH_4 content in drained CMM in 2004	%	55.7	annual average in 2004
Methane factors			
Methane GWP	-	21	IPCC 2006
CEF_CH_4	tCO_2/tCH_4	2.75	Molecular mass ratio
Methane density	t/m^3	0.00067	IPCC 2006
Equipment parameters			
Installed electric capacity	kW_{el}	1819	Producer
Installed thermal capacity	kW_{th}	1877	Producer
Electric efficiency	%	41.3	Producer
Thermal efficiency	%	42.7	Producer

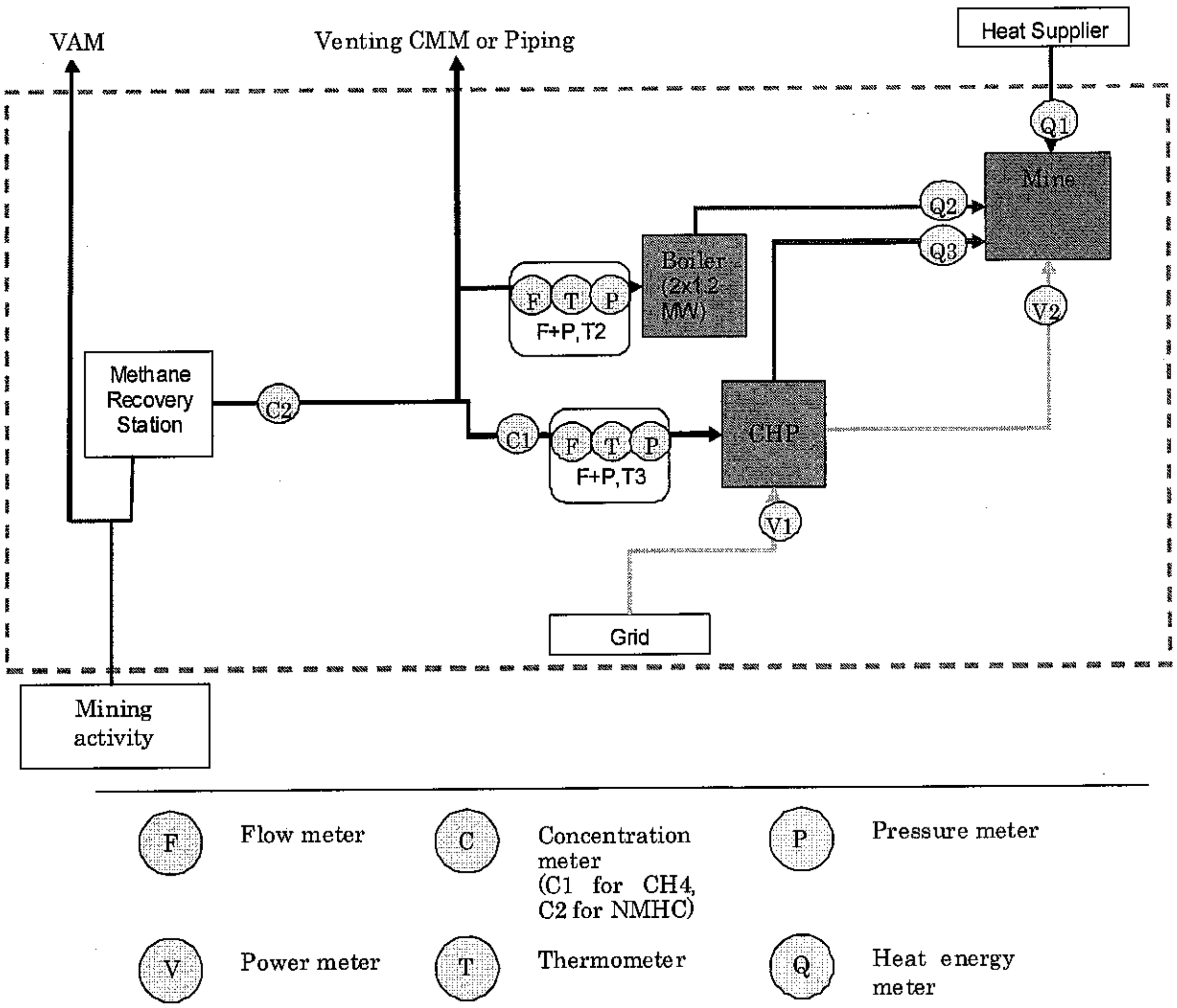
Annex 3

MONITORING PLAN

The detailed monitoring structure is described in another paper: "Monitoring and Reporting" and the detailed monitoring procedure is described in another paper: "Monitoring and Procedure Book". But outline for the monitoring plan for this project is summarized as below.

The implementation of the monitoring plan is to ensure that real, measurable, long-term Greenhouse Gas Emission Reduction can be monitored, recorded and reported. It is a crucial procedure to identity the final ERUs of the proposed project. This monitoring plan for the proposed project activity will be implemented by the project owner, Borynia Coal Mine.

1. What data will be monitored?
As is shown in Section D, there are two series of data that need to be monitored: Project related emissions and Baseline related emission. The detailed meters installation is illustrated in the following figure;



2. How will the data be monitored, recorded and managed?

According to Section D, the control and monitoring system can be divided into a gas part, a heat part and an electrical part.

A. Monitoring of gaseous components

Measurements of CMM destruction

For the purpose of monitoring the emission reduction the following parameters are to be measured:

1. CMM consumed at the CHP unit (MM_{ELEC}/$CMM_{PJ,ELEC,,y}$),
2. CMM supplied to the boiler house 2 x 1,2 MW (MM_{HEAT}/$CMM_{PJ,HEAT,,y}$).

The amounts of consumed methane are calculated on the basis of the coal gas volumes supplied and the average CH_4 concentrations. The total volumes of coal methane gas consumed by the CHP unit and the boiler house are measured directly at each module by flow meters. Methane concentration is measured in one point (at gas engine inlet) and data obtained are used both for the CHP and the boiler house methane consumption calculations. In the table below the methane metering equipment and adequate monitoring procedures were presented.

Measured parameter	Figure reference	Data variable	Measuring instrument	Uncertainty level	Monitoring procedure
Volume of coal methane gas supplied to the CHP unit	F_1	$V_{ELEC}/V_{PJ,ELEC,,y}$	Volume meter CPT-01 coupled with p, T volume corrector Manufacturer: COMMON S.A.	1,5%	Procedure PM-1
Volume of coal methane gas supplied to the boiler house 2 x 1,2 MW	F_2	$V_{HEAT}/V_{PJ,HEAT,,y}$	Volume meter CPT-01 coupled with p, T volume corrector Manufacturer: COMMON S.A.	1,5%	Procedure PM-2
Gas temperature	T	-	Thermocouple	±0,2%	Procedure PM-1/PM-2
Gas pressure	p	-	Pressure gauge	±0,3%	
Methane concentration	C_1	PC_{CH4}	Infra red gas analyzer: G1/CH_4/IR-DP-OS Manufacturer: Nanosens	1%	Procedure PM-1

Measurements of NMHC content

Apart from measurements of the CMM destruction, amount of non-methane hydrocarbons (NMHC) is to be monitored. The NMHC analysis frequency is once a year. The measurement characteristics are presented in the table below:

Measured parameter	Figure reference	Data variable	Measuring technique	Uncertainty level	Monitoring procedure
Concentration of non-methane hydrocarbons	C_2	PC_{NMHC}	Direct sampling at pipeline and chromatographic determination	2%	Procedure PM-3

B. Electrical measurements

For the purpose of monitoring the emission reduction the following parameters are to be measured:

1. Net electricity consumption of the CHP unit ($CONS_{ELEC,PJ}$),
2. Net electricity generation of the CHP unit (GEN_V).

In the table below the applied electricity meters and corresponding monitoring procedures were presented:

Measured parameter	Figure reference	Data variable	Measuring instrument	Uncertainty level	Monitoring procedure
Electricity consumed by the CHP unit	V_1	$CONS_{ELEC,PJ}$	SEA Manufacturer: Z.E.U.P POZYTON	1%	Procedure PM-4
Electricity generated in the CHP unit	V_2	GEN_V	C52 adg Manufacturer: Pafal, Poland	1%	Procedure PM-4

C. Heat measurements

For the purpose of monitoring the emission reduction the following parameters are to be monitored:

1. Heat generated by the boiler house 2 x 1,2 MW ($GEN_{HEAT, boil}$)
2. Heat generated by the CHP unit ($GEN_{HEAT, CHP}$)

In the table below the applied heat meters and corresponding monitoring procedures were presented:

Measured parameter	Figure reference	Data variable	Measuring instrument	Uncertainty level	Monitoring procedure
Heat generated by boilers 2x1,2 MW	Q_1	$GEN_{HEAT, boil}$			Procedure PM-5
Heat generated by CHP unit	Q_2	$GEN_{HEAT, CHP}$	Multical 601 coupled with flow meter Ultraflow Manufacturer: KAMSTRUP, Denmark	$\pm(0,5 + \Delta\Theta_{min}/\Delta\Theta)\%$	Procedure PM-6

All meters installed in the proposed project are accorded with national standards. All measuring equipment of the monitoring system is covered by a supervision system according to requirements of standard PN-EN ISO/IEC 17025:2005 and rules of Polish measurement legislation. All elements of the monitoring system are included in an equipment register which contains labeling and meter location. Each apparatus has its own card file, in which all important events concerning reparations, maintenance and excluding from the operation are noted (*Monitoring and Reporting Book*, Chapter 5).

All the equipment used will be maintained and serviced in accordance with the original manufactures instructions. Technical conditions of the particular elements of the monitoring system undergo periodical technical survey according to established plan of surveys. Frequency of surveys is set once a month. Results of the survey are recorded in the technical survey form (*Monitoring and Reporting Book*, Chapter 7).

Frequency of the monitoring data recording depends on measured parameter and measuring technique and are included in the particular monitoring procedures (PM 1 – PM 6). For meters equipped with data memory, the collected data will be stored electronically by installed data logger as well as an excel file and on paper in appropriate monitoring form (FMs). In remaining cases the collected data will be stored as an excel file and on paper as monitoring form (FMs). All responsibilities related to the project monitoring plan realization belong to the Project Technical Manager (Borynia Coalmine Chief Power Engineering). He appoints the personnel in charge of monitoring tasks and supervises its work.

The collected data should be stored and archived in a central data base. The administrator of the data base is responsible for proper work of the data base, routine backups and save storage. The Project Technical Manager is responsible for correctness of the logged data and administration of the data base. He should regularly verify the recorded data and check the stored data plausibility, errors and deviations. All inconsistencies should be discussed with the service and the operation teams.

All stored data will be kept during the whole operation period of the plant and furthermore for 5 years.

The Project Technical Manager is responsible for preparation of the standardized monthly reports, which should be revised by the Project Coordinator (GIG). On the basis of the monthly reports detailed annual report should be prepared by the Project Coordinator and confirmed by the verifier.

3. Calibration of Meter and Metering

The following procedure will be undertaking to calibration the equipment in the proposed project:

1) The metering equipment shall have sufficient accuracy so that error resulting from such equipment shall not exceed manufacturer standard requirement. The accuracy of current flow meters in is following list. Their equipments have enough accuracy for this project. Therefore, manufacture will change these models, functionally-equivalent equipments will be adopted. .

V – power meters

1. For the CHP unit needs:

Type: SEA (manufactured by Z.E.U.P POZYTON, Poland www.pozyton.com.pl/indexen.html)

Meets requirements of EU Directive 89/336/EWG and has CE mark.

Accuracy class: 1 (according to: PN-EN 62053-21)

2. For production of electricity in the CHP unit:

Type: C52 adg and C52 abdg (manufactured by Pafal, Poland; http://www.apator.com.pl/?set_lang=en)

Q – heat meter for CHP heat production

Type: Multical 601 coupled with flow meter Ultraflow (manufactured by KAMSTRUP, Denmark; (www.kamstrup.com)

Meets requirements of EN 1434:2004 standard (class C and MID) and OIML R75:2002

Range of temperatures: 2°C - 180°C

Accuracy: $E_C \pm(0,5 + \Delta\Theta_{min}/\Delta\Theta)\%$

F + p, T – turbine flow meter with p, T correction

Type: CPT-01 coupled with volume corrector CMK-02 (both manufactured by COMMON S.A. , Poland www.common.pl

DN 100 for CHP CMM gas supply line

Range: $20 \div 650\ m^3/h$

Errors of indication:

- volume flow measuring:
  ±3 % for Qmin< Q < Qt
  ±1,5 % for Qt < Q < Qmax
  where Qt = 0,15 Qmax
- temperature measuring channel - ±0.2%;
- pressure measuring channel - ±0.3%.

4. Verification Procedure

The main objective of the verification is to independently verify whether the emission reductions reported in the PDD has been achieved by the proposed project. It is expected that the verification could be done annually.

Main verification activities for the project included:

1) The project owner, Borynia Coal Mine will sign a verification service agreement with specific AIE in accordance with relevant JISC regulations:
2) The project owner will provide the completed data records.
3) The project owner will cooperate with AIE to implement the verification process, i.e. the personnel in charge of monitoring and data handling should be available for interview and answer questions honestly;

To be summarized, the project owner Borynia Coal Mine will implement a proper monitoring plan to make sure that the emission reduction for the proposed project would be measured accurately.