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:

Displacement of electricity generation with fossil fuels in the electricity grid by an electricity generation project with introduction of Steel Mill Waste Gas Firing Turbine power generation system
Version of the document: 09
Date of the document: 24 December 2007

A.2. Description of the project:

The proposed JI project activity consists of implementation captive power generation plants using off-gases of steel making converters (LDG), blast furnaces (BFG), and coke ovens (COG) in Alchevsk Iron & Steel Works, AISW, one of the major integrated steelmaking works of Industrial Soyuz of Donbass, ISD, located in the city of Alchevsk in the state of Luhansk, Ukraine. Two units of the state of the art Gas Turbine Combined Cycle, CCGT, whose individual capacity is 150 MW, will be installed in a phased manner during the proposed project activity.

AISW is currently (2006) producing 3.7 million tonnes of crude steel annually with three blast furnaces, six open hearth and five electric arc steelmaking furnaces, three rolling mills. Coke is supplied by the dedicated coke plant of Alschevsk Coke owned by ISD and closely located to AISW. The steel works consumes the electricity of approximately 160 MW that is fully supplied by the national grid of Ukraine at present.

AISW is now undertaking modernization and energy efficiency programme of its up stream production facilities including replacement of open hearth furnaces with two sets of LD converters having the capacity of 300 tonnes a charge, introduction of two slab continuous casters, reconstruction of blast furnaces, and capacity expansion of sintering plant and coke oven batteries. As the result of the programme implementation, crude steel production capacity will be expanded to 7.5 million tonnes by 2010. The programme also includes modernization of utility system for efficient use of energy within the steel works and CCGT power generation from waste gases is implemented as a part of it.

The first 150 MW CCGT power generation unit fabricated in Japan will start to operate in September 2008, the second is in 2009. Total power generation of 300 MW (2x150MW) will meet the anticipated power demand of the steel works. In case the electricity is generated more than the demand, the surplus electricity will be sold to the national grid.

Apart from the open hearth furnace, high calorific (7.11 MJ/m3N) waste gas (LDG) is generated from LD converters. Currently total nineteen (19) sets of LD converters are in operation in Ukraine to produce approximately 50% of its total crude steel production in 2004 as indicated in Table Ann 2.1 in Annex 2. However, none of the existing LD converters has waste gas recovery system in Ukraine. AISW plans to introduce the state of the art technology of LDG recovery system on the installation of the converters as the energy conservation measure. Almost all available LDG is collected and stored in a dedicated gas holder to secure the constant supply to CCGT in the proposed project activity.

While BFG has relatively low caloric value of approximately 3.2 MJ/m3N, most of it is utilized as fuel in the production lines and for generating steam for captive use in AISW under the current situation. Due to its low calorific value BFG is mixed with either COG or natural gas to improve combustibility for its utilization. The demand of BFG would also increase throughout the capacity expansion plan but most part of BFG from new blast furnace that becomes operational in 2008 would be surplus and therefore be flared in the absence of the proposed JI project activity. As it is witnessed by the State Inspection for Energy Saving on 25th of September 2007 in its Expert Conclusion (see attachments) surplus amount of BFG in amount of 500 ths. nm3/hour is expected to be flared without energy recovery.

Off-gas of coke oven, COG, having a calorific value of 17.15 MJ/m3N is supplied by the Alchevsk Coke. Under current situation around 21 ths. nm3/hour of COG will be flared without utilization as it is written in the above mentioned Expert Conclusion. The amount of COG to be flared would further increase after the modernization and expansion programme without proposed JI project activity since the coke production will increase by 40% thorough the programme.

Utilization of BFG and COG as fuel for heating and steam generation will be given the first priority over the utilization of them for power generation during the project activity. Since total amount of each gas consumption is smaller than its generation, both activities are eventually independent to each other.

The calorific value is to be modified by mixing of waste gases from three different sources above, LDG, BFG, and COG, up to 4.4 MJ/m3N to meet the specifications of CCGT unit in the project activity.

Ukraine is one of the most energy intensive countries in the world[1)] in terms of primary energy consumption per Gross Domestic Production adjusted by purchasing power parity, and exchange rates. However, Ukraine is heavily depends on import of natural gas and crude oil such that domestic production of oil and natural gas is only 15.6% and 28%, respectively.[2)] Reflecting the above situation and recent economic growth, Ukrainian government approved Energy Strategy of Ukraine till 2030 as of March 2006. The Strategy consists of seven priorities including integration of national energy system with the Europe, increasing energy export, strengthening energy security, and reduction in industrial energy consumption. It is stated in the Strategy that Ukraine's GDP rate will increase by three times by 2030 but energy consumption will only grow by 47.5%. Proposed JI project activity is therefore considered in line with the long-term energy strategy of Ukraine.

Since the national grid electricity will be replaced by the captive power generation from the waste gas otherwise flared in the proposed JI project activity, fossil fuel consumption in the power plants serving to the grid will be reduced. The proposed JI project activity is thus in line with the national energy policy of Ukraine.

A.3. Project participants:

Party involved*	Legal entity project participant (as applicable)	Please indicate if the Party involved wishes to be considered as project participant (Yes/No)
Ukraine (host Party)	· JSC Ekoenergiya · Ukraine Institute For Environment and Energy Conservation	No
Japan	· Sumitomo Corporation	No
* Please indicate if the Party involved is a host Party.		

A.4. Technical description of the project:

1) Country Analysis Brief, March 2006, Energy Information Administration, Department of Energy, USA.

2) Energy Balances of Non-OECD Countries, 2002-2003, IEA.

A.4.1. Location of the project:

Alchevsk Iron & Steel Works

A.4.1.1. Host Party(ies):

Ukraine

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

Luhansk Region

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

Alchevsk

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

The proposed project activity will be implemented in Alchevsk Iron & Steel Works, AISW, core production unit of ISD, in the city of Alchevsk in the state of Luhansk, the eastern part of Ukraine. Alchevsk is located approximately 40 km West of Luhansk, capital of state of Luhansk and its global position is, 48°29′N-38°47′E. AISW is an integrated steel works with six strands sintering plant, three blast furnaces, six open hearth and five electric arc steelmaking furnaces, blooming-slabbing mill, two plate rolling mills, and one heavy section mill. Coke is supplied by the dedicated coke plant of Alschevsk Coke, closely located to the steel works and owned by ISD. AISW has an annual crude steel production capacity of 3.8 million tonnes and mainly produces long products and plate grade steels. AISW has a direct rail line to Kommunarsk station, and has rail way accesses to Mariupol and Odessa, on the Azov and Black Seas, respectively.

Location of Alchevsk where the proposed project activity will be implemented is shown in the map below.

Fig. A.1 Location of proposed JI Project site, Alchevsk Iron & Steel Works (Lugansk Region is in the yellow line).

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

CCGT power generation unit includes both gas and steam turbines that are aligned on a single shaft to generation electricity. Gas turbine is driven by high pressure combustion gas. Gas mixture of LDG, BFG, and COG is combusted to drive gas turbine, and the sensitive heat of the waste gas from gas turbine is utilized for steam generation by the heat recovery steam generator, HRSG. Steam is then fed to the steam turbine. High thermal efficiency is attained through such double driven system in CCGT power generation unit. Natural gas is commonly used as a fuel of CCGT. Apart form the conventional natural gas fuelled CCGT power generation system, the utilization of off-gas from steelmaking processes for is associated with several technical issues stated below. Mitsubishi Heavy Industry (MHI) successfully dissolved these issues to develop energy efficient CCGT technology.

Low calorific value: Typical composition of BFG is, 25% of carbon monoxide, 17% of carbon dioxide, 6% of hydrogen, and balance of nitrogen and changes over time according to the operational conditions of the blast furnace. As can be seen from the composition, its calorific value is as low as 3.2 MJ/m3N that results in less flammability.

Low feed pressure and dust content: As compared natural gas that is commonly used for CCGT, pressure of LDG and BFG is approximately atmospheric and high dust content that may lead to dust build up and/or unexpected erosion of the mechanical parts of CCGT.

The original combustor for natural gas based CCGT was modified along with air compressor in order to use low calorific gas feed of less than 4.2 MJ/m3N. Considering high dust content of feed gas, wet type electrostatic precipitator was added to eliminate dust prior to use in CCGT. CCGT unit for BFG application were already operated in major Japanese integrated steel mills and basic performances of MHI's CCGT were well demonstrated since 1958. Since its first application of waste gas base CCGT in steelworks, MHI has kept improving thermal efficiency CCGT mainly by further development of combustor and gas turbine for higher inlet gas temperature at gas turbine. The CCGT to be employed in the proposed JI project is categorized as one of the most advanced type by MHI. It was reported by JFE Steel Co., one of the Japanese steelworks that employed the same type of CCGT as the proposed JI project, that the thermal efficiency of 46% was reached though it may change by the operational conditions. Considering that the thermal efficiency of conventional boiler turbine generator is approximately 40%, remarkable improvement in efficiency can be anticipated. This means that more electricity can be generated for the same amount of fuel input.

In the proposed project activity, calorific value of gas feed, BFG and LDF, is to be modified to approximately 4.4 MJ/m3N by mixing COG. Schematic process flow of the CCGT is represented in Fig. A.2. Total gas feed for a CCGT unit is 250,000-300,000 m3N/h and consists of 80-85% of BFG, 10-12% of LDG, and several percent of COG, the ratios of which will be controlled by their flow rates to tune the calorific value in the specified value. Rated power generation capacity of each CCGT unit to be installed is 150MW.

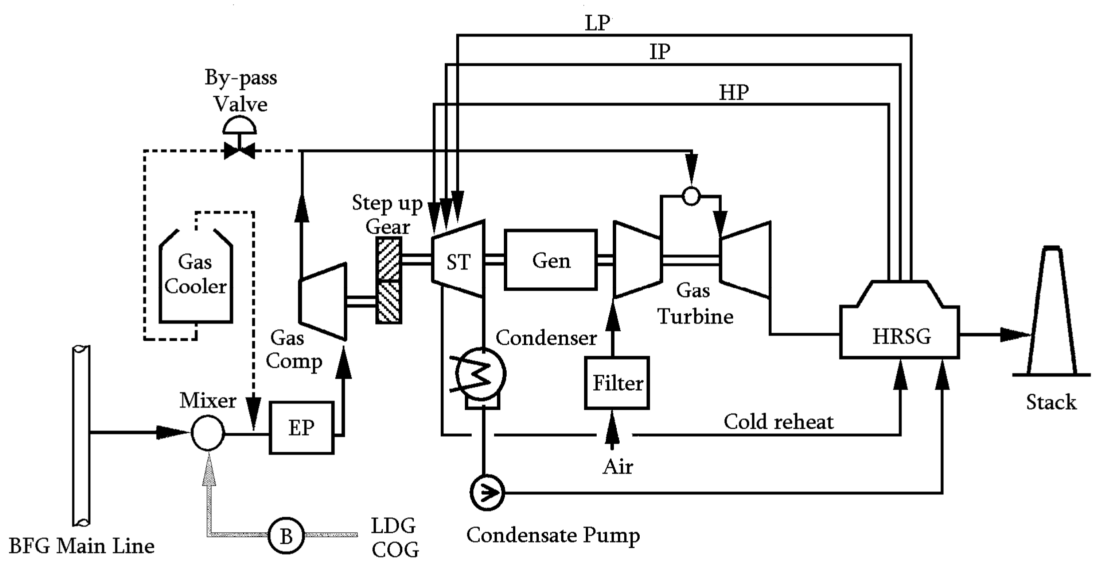

Fig. A.2 Schematic flow of CCGT power generation system.[3]

[3] Original figure can be reached as, http://www.mhi.co.jp/power/e_power/topics/2004/nov_04b.pdf.

During steady state operation none of the extra fuel input is necessary other than BFG, LDG, and COG. However, small amount of high pressure steam is necessary only in the start-up of CCGT that is estimated once in every 1.5 year.

It shall be noted that the design of CCGT facility to be installed will fully meet international standards and all the requirements of Ukrainian Regulation and EU Directives.

The employees of the Project Company will have adequate theoretical and practical training on-site in accordance with National Regulations (Laws of Ukraine " On Power Industry", "On Labour Protection" etc), and provisions of the Contracts with suppliers of the equipment. The latter also contain provisions regarding maintenance needs of the facility.

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:

Since CCGT power generation system to be installed in the proposed project activity uses off-gas that would be otherwise flared without any energy recovery in the absence of the proposed JI project, electricity generated in the proposed project activity can be considered carbon neutral. This is justified by the facts listed below,

(1) Even under the current situation, i.e. before modernization and energy efficiency programme, only part of both waste gases, BFG and COG, are utilized as fuel for heating and generation of steam and rest of them are flared and Open Hearth steelmaking does not produce any combustible element bearing waste gas.

(2) After modernization and energy efficiency program that leads crude steel production capacity increase, the amount of fuel and steam consumption likely increase and will be supplied by BFG and COG. However, large remaining surplus amounts of BFG, and COG will be flared without energy recovery. LDG is also flared without recovery for energy use as other steelmakers in Ukraine that LD steelmaking converters are already installed.

As all of the electricity consumed in the AISW is supplied by the national grid of Ukraine in the absence of the project activity, the electricity generated by the project activity would replace the equivalent amount of grid electricity. The proposed project activity shall thus avoid GHG emissions from the power plants serving to the national grid of Ukraine. Considering realistic availability of CCGT and auxiliary power consumption in the project activity, annual net power generation by a unit is estimated to be 1.242 TWh/y. Total net power generation over the crediting period of 4.25 years can be estimated to be 9.477 TWh, On the basis of emission factor of national power grid of Ukraine assessed by TUEV SUED, 2007, "Standardized emission factors for the Ukrainian electricity grid", Annex 2 of "Ukraine – Assessment of new calculation of CEF", total emission reduction can be calculated as 8,491 kilo tonnes CO2e over the crediting period.

Economy of Ukraine had been continuously declining since its independence in 1991 but hit its bottom by 2001 and recorded more than 12% growth in 2004. Considering reconstruction of economy and ensuring energy securities, Ukrainian government approved Energy Strategy of Ukraine till 2030 as of March 2006. The Strategy includes, reducing industrial energy consumption, as well as several points to strengthen Ukraine's energy security. It is stated in the Strategy that Ukraine's GDP rate will increase by three times by 2030 but energy consumption will only grow by 47.5%. Though Ukraine as a whole has large power generation capacity and exports part of its electricity to neighbouring countries, it is necessary to add new power generation capacity by using domestic fuel resources to meet future growing demand reflecting the state's development of the economy and the recent natural gas supply conflict with Russia. Proposed project activity is thus considered in line with the long-term energy strategy of Ukraine. The proposed project activity also participates in improvement of the local economy and environment besides mitigation of global warming.

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

	Years
Length of the crediting period	4.25
Year	Estimate of annual emission reductions in tonnes of CO2 equivalent
2008	268,146
2009	1,787,640
2010	2,145,168
2011	2,145,168
2012	2,145,168
Total estimated emission reductions over the crediting period (tonnes of CO2 equivalent)	8,491,290
Annual average of estimated emission reductions over the crediting period (tonnes of CO2 equivalent)	1,698,258

Summary of the "Standardized emission factors for the Ukrainian electricity grid assessed by TUEV SUED, 2007" is given in Table Ann. 2.2 in Annex 2.

A.5. Project approval by the Parties involved:

Letter of Endorsement of the Government of Ukraine was received in November 2006. According to Ukrainian regulations the final PDD should be sent along with the positive determination report to the Government of Ukraine for Letter of Approval (LoA), which usually expected within 30 days. A similar procedure will be used to obtain the LoA of the Japanese Government

SECTION B. Baseline

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

Taking account of paragraphs 1-3 of appendix B of the decision 9/CMP.1, “Guidelines for the implementation of Article 6 of the Kyoto Protocol”, baseline of the proposed JI project activity was determined. The approach and algorithm to determine emission reductions including baseline identification for the proposed JI project were eventually identical to those employed in the approved consolidated CDM baseline methodology, ACM0004-version 02 (Consolidated baseline methodology for waste gas and/or heat and/or pressure for power generation) that was withdrawn due to consolidation in ACM0012 (Consolidated baseline methodology for GHG emission reductions for waste gas or waste heat or waste pressure based energy system) as of 06 July 2007. However, the approach and algorithm to determine emission reductions of ACM0004- version 02 was fully carried over to ACM0012 for its “power generation” component. The approach and algorithms to determine emission reductions including monitoring methodology employed in the proposed JI project t is therefore deemed appropriate, and meet all requirement Guidance on criteria for baseline setting and monitoring for JI project.

Waste gases from blast furnaces, LD converter, and coke ovens that are otherwise flared will be used for electricity generation in the proposed project activity. The project site, AISW, currently purchases all the necessary electricity from the national grid, to which fossil fired power plants are in service. All the electricity to be generated by the project activity will be used within AISW. The project activity thus displaces electricity generation with fossil fuels in the electricity grid. No fuel switch is done in the relevant industrial facilities, blast furnaces, LD converters, and coke ovens, where the waste gas is produced, after implementation of the project activity. The proposed project activity includes power generation by newly installed power generation units with waste gases from newly installed facilities including parts of capacity expansion. The approach or algorithm employed is in line with approved consolidated CDM methodology, ACM0004.

The approved consolidated methodology, ACM0002 (Consolidated methodology for grid-connected electricity generation from renewable sources) could be employed to determine the emission factors of the relevant electricity grid. However, the information of the Ukrainian electricity grid is hardly available to allow the project proponents to do so. Instead, the “Standardized emission factors for the Ukrainian electricity grid assessed by TUEV SUED, 2007” was employed for the proposed project activity. Detailed explanations on the approach developed for Ukrainian grid is provided in Annex 2.

Identification of alternative baseline scenarios

Followings are all possible options that generate electricity or supply energy at the project site in the absence of the JI project activity for captive use and/or other consumers except those that do not comply with legal and regulatory requirements or cases that need key resources that are not available at the project site.

Alternative (1) - Waste gas based power plant without JI benefits

AWIS may generate electricity with waste gases from blast furnaces, LD converters, and coke ovens by using CCGT units for its own use as well as for exporting to the local grid without benefits of JI project.

There is no legal requirement for AISW to implement the project activity though this alternative is in compliance with all applicable legal and regulatory requirements. However, this alternative has associated barriers to its implementation (please refer to Step 3: Barrier Analysis in Section B.2 below).

Alternative (2) - Import of electricity from the grid

In the absence of JI project activity, AISW may need to import the necessary electricity to operate the works from national grid of Ukraine. This would result in an equivalent amount of GHG emissions from the fossil fuel firing power plants serving to the grid. Since this scenario is in the status quo, Alternative (2) is further considered in determining the baseline scenario.

Alternative (3) - On-site captive power generation with fossil fuel (coal)
Renewable energy sources such as wind, or solar are not realistic options because of the capacity and reliability of power generation as a source of steel works that are 24 hours a day basis operation. Fossil fuels such as coal, natural gas, and oil could be possible candidates for fuel of the captive power plant. However, natural gas and oil cannot be realistic choice of fuels because of the hike in their price and national trade policies of Ukraine.
Though captive power generation with coal does not contribute GHG emission reduction from power generation, this alternative is further considered in determining the baseline scenario.

Alternative (4) - Other uses of waste heat and waste gas
Waste gases, BFG, LDG, and COG, could be used for heating or steam generation within the steel works other than power generation. Eventually this is already conducted under the current operation and will continue after the modernization and energy efficiency programme. However, anticipated steam and fuel balance after the modernization and energy efficiency programme, large amount of waste gases would be surplus and flared without energy recovery. Therefore, this alternative is not realistic and can be excluded from further consideration.

Alternative (5) - A mix option of Alternative (2) and Alternative (3)
Since both Alternative (2), import of electricity, and Alternative (3), captive power generation from coal, are not excluded, this option may need to consider as an alternative scenario.

The above discussion clearly demonstrates that alternatives (2), (3), and (5) are available to AISW as the credible and realistic alternatives that do not face any prohibitive barriers and could be a part of the baseline. Alternative (1) could also be the credible and realistic alternatives but faces several prohibitive barriers as stated in the Section B.2.

The methodology now requires the project proponents to conduct an analysis based on the economic attractiveness of these alternatives to arrive at the baseline scenario. The most economically attractive alternative should be considered as the baseline scenario.

Economical attractiveness of the alternatives (1) through (3) was evaluated by financial analysis. For the alternatives (1) and (3) investment analysis was conducted on the basis of hypothetical assumption that all of the electricity generated in the propose project activity were sold to the grid operator at the price of $0.045/kWh without captive use. Considering rather high selling price of electricity as the assumption, investment benefit is maximized to secure the conservativeness in assessing the additionality of the proposed JI project. Taking account of the facts that more than 50% of the electricity is generated by nuclear and hydro power plants and only 21% of it is from natural gas and oil in Ukraine, it was assumed that the dramatic hike in the electricity tariff would not be expected.

As the result, Internal Rate of Return of the alternative (3) could be calculated as 12% for 20 years of the business and payback period for the investment could be as long as 10 years. Considering the result for the alternative (3) that includes capital investment of the same order of magnitude but less than CCGT and may give more financially attractive results than the alternative (1), it can be concluded that the alternative (1) and (3) are not economically attractive option in comparison with alternative (2). If one considers the fact that the smaller generator costs more than the larger one for a unit amount of power generation, Alternative (5) is not realistic either. Therefore alternative (2) is only realistic scenario for the continuation of the current situation of AISW after modernization programme. The Alternative (2) is thus justified as the most realistic and credible baseline scenario for AISW. At the same time, it is demonstrated that the proposed project activity is the economically or financially less attractive than other alternatives without the revenue from the sale of certified emission reduction units (ERUs). Therefore, alternative (2), Import of electricity from the grid, shall be considered as the baseline scenario for the proposed project activity as per baseline methodology employed.

Demonstration of Additionality of the Project Activity
The additionality of the proposed JI project activity is demonstrated with "Tool for the demonstration and assessment of additionality (version 3)", as described in Section B.2. Basic assumptions for financial analysis of the alternative baseline scenario are listed in Table Ann. 2. 4 in Annex 2.

Emission source
Table B.1 illustrates which emissions sources are included and which are excluded from the project boundary for determination of both baseline and project emissions in the scheme of baseline setting.

Table B.1: Overview on emissions sources included in or excluded from the project boundary

	Source	Gas		Justification / Explanation
Baseline	Grid electricity generation	CO_2	Included	Main emission source
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Captive electricity generation	CO_2	Included	Main emission source
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
Project Activity	On-site fossil fuel consumption due to the project activity	CO_2	Included	May be an important emission source
		CH_4	Excluded	Excluded for simplification.
		N_2O	Excluded	Excluded for simplification.
	Combustion of waste gas for electricity generation	CO_2	Excluded	It is assumed that this gas would have been burned in the baseline scenario.
		CH_4	Excluded	Excluded for simplification.
		N_2O	Excluded	Excluded for simplification.

Greenhouse gases involved in the proposed JI project are identified as only carbon dioxide due to the following reasons.
(1) Flammable constituents of waste gases from LD converters, blast furnaces are carbon monoxide, and hydrogen and those of coke oven gas contains methane.
(2) Carbon monoxide and hydrogen produce carbon dioxide and water after combustion.
(3) Some part of methane in coke oven gas may lead methane emissions if it were combusted rather in efficient combustion conditions. However, coke oven gas will be fully combusted in well designed combustor in CCGT to generated only carbon dioxide and water. None of the N_2O may not be associated in the proposed JI project.

Project Emissions
Since none of the auxiliary fuels are fired for generation start up, in emergencies, or to provide additional heat gain to waste gases before entering the Waste Heat Recovery Boiler in the proposed JI project, project emission is not relevant to the project.

Baseline Emissions
Since baseline scenario of the proposed JI project is the import of grid electricity as indicated in the section B.2, baseline emissions shall be determined with the emission factor defined by the consolidated

baseline methodology, ACM0002 in the similar manners for CDM projects. However, due to insufficient grid information on the project site emission factor of grid electricity "Standardized emission factors for the Ukrainian electricity grid" prepared by Global Carbon B.V. for 2006 through 2012, hereafter denoted as "Standardized Emission Factors", is employed for the proposed JI project activity. The "Standardized Emission Factors" has been assessed by the Carbon Management Srevice of TUEV SUED Industrie Service GmbH as of 01 February 2007. Though ACM0002 does not handle transmission and distribution losses in the electricity distribution system, "Standardized Emission Factors" take account of the transmission and distribution losses. They provide baseline carbon emission factors for JI projects generating electricity (supply to the grid) and reducing electricity consumption (captive consumption) for Ukraine as represented in Table Ann 2.2 of Annex 2. The emission factor of the electricity is differentiated between that for captive use, reduction of consumption, and for sold to the grid, generation, to determine the baseline emission for the proposed JI project activity as per "Standardized Emission Factors".

Baseline emission of the proposed JI project in tonnes CO2e for the year y, $BE_{electricity,\,y}$ can be expressed as,

$$BE_{electricity,\,y} = \sum_i (EG_{captiveuse,i,y} \times EF_{reduction,\,y}) + \sum_i (EG_{sold,i,y} \times EF_{generation,\,y}) \text{ ------------- (B.1)}$$

where,
$EG_{captive\ use,\ i,\ y}$ is quantity of electricity from i-th CCGT unit that consumed as the captive use during the year y in (MWh),
$EF_{reduction,\ y}$ is the carbon emission factors for the project of reducing electricity consumption for the year y provided in the "Standardized Emission Factors" in (tCO2/MWh),
$EG_{sold,i,y}$ is quantity of electricity from i-th CCGT unit that supplied to the electricity grid during the year y in (MWh),
$EF_{generation,\ y}$ is the carbon emission factors for the project of generating electricity for the year y in (tCO2/MWh) provided in the "Standardized Emission Factors".

"Standardized emission factors for the Ukrainian electricity grid" explained in the section 5 of Annex 2 will be employed for both of the carbon emission factors, $EF_{reduction,\,y}$ *and* $EF_{generation,\,y}$, and will be fixed to calculate baseline emissions of the proposed JI project over the crediting period.

Net quantity of electricity supplied to the manufacturing facility by the project during the year y, EG_y, shall be expressed as the sum of $EG_{captive\ use,\ i,\ ,y}$ and $EG_{sold,i,\ y}$ as shown in the equation B.2.

$$EG_y = \sum_i (EG_{captiveuse,i,y} + EG_{sold,i,y}) \text{ --------------- (B.2)}$$

The net quantity of electricity supplied, EGy, shall be determined by subtracting of auxiliary electricity consumption for operation of CCGTs from the total amount of electricity generated. Both $EG_{captive\ use,\ i,\ y}$ and $EG_{sold,\ i,\ y}$ above can directly be monitored along with the auxiliary electricity that is supplied from the national grid, if any, as indicated in Figure Ann. 3.1 in Annex 3.

Leakage
Basically none of the factors for leakage has to be taken into account. However, part of BFG and COG are used as fuels for heating and high pressure steam generation for steel production in steel works other than power generation with CCGT. Utilizations of BFG and COG as fuel for steel production shall be given the first priority in comparison with power generation and is independent to the proposed JI project

activity. Therefore this part of activity shall be outside of the project boundary as represented in Figure B.2.

Though none of the fossil fuels is used in the proposed project activity as described in the Project Emission described above, small amount of steam is used at the start up of CCGT unit. Since the start up steam is supplied from outside of the project boundary, it may be handled as a source of the leakage. This can be calculated with the following equation.

$$L_y = \sum_i (G_{i,y} \times CF_y) \times \frac{44}{12} \text{ --------------- (B.3)}$$

where, L_y is a leakage from CCGT start-up steam utilization during the year y in (tCO2), $G_{i,y}$ is the quantity of steam used for start-up of i-th CCGT unit during the year y in (MJ), CF_y is the specific carbon consumption per unit amount of steam for the year y in (tC/MJ steam).

G_{iy} shall be a specified value by the CCGT manufacturer and CF_y shall be calculated by the specific fuel consumption for steam generation assuming oxidation factor as 1.0.
It is empirically known from the operational data of this type of CCGT unit that the amount of the steam for starting up the unit is negligible compared with of the electricity to be generated. Though it is reasonably subtracted from the anticipated emission reduction from electricity generation as the leakage emission to determine the net emission reduction of the project activity, it is assumed as zero in the ex-ante estimation of emission reduction.

It shall be noted that the leakage effect is most unlikely material under the planned operational conditions including commissioning period as estimated in section D.1.3.2 below. However, such leakage effect shall be taken into account to maintain the conservativeness and integrity of the of Joint Implementation scheme under UNFCCC.

Emission Reduction
The emission reduction ER_y by the proposed JI project activity during a given year *y* is the difference between the baseline emissions though substitution of electricity generation with fossil fuels ($BE_{electricity,y}$) and leakage (L_y), as follows:

$$ER_y = BE_{electricity,y} - L_y \text{ --------------- (B.4)}$$

where:
ER_y is the emission reduction of the project activity during the year *y* in (tCO2),
$BE_{electricity,y}$ is the baseline emission due to displacement of electricity during the year *y* in (tCO2),
L_y is the leakage during the year *y* in (tCO2).

Assuming that the auxiliary consumption of electricity associating with CCGT operation is 3.5% of the total electricity generation and the power utilization balance in the AISW, emission reduction over the crediting period of the proposed project activity is summarized as Table Ann 2.3 of Annex 2. It shall be noted that the quantities of electricity for both captive use in AISW and supply to the grid are monitored to determine the emission reduction during the project activity as indicated in the section D.

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:

The additionality of the proposed JI project activity is demonstrated with "Tool for the demonstration and assessment of additionality (version 3)", February 2007. The flowchart presented in below provides a step-by-step approach to establishing additionality of the project activity.

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

Sub-step 1a. Define alternatives to the project activity:
As described in the Section B.1, following four alternative scenarios could be available to supply electricity or energy other than proposed JI project activity at AISW.

Alternative (1) - Waste gas based power plant without JI benefits
Alternative (2) - Import of electricity from the grid
Alternative (3) - On-site captive power generation with fossil fuel (coal)
Alternative (4) - Other uses of waste heat and waste gas
Alternative (5) - A mix option of Alternative (2) and Alternative (3)

Waste gases, BFG, LDG, and COG, could be used for heating or steam generation within the steel works other than power generation. Eventually this is already conducted under the current operation and will continue after the modernization and energy efficiency programme. However, anticipated steam and fuel balance after the modernization and energy efficiency programme, large amount of waste gases would be surplus and flared without energy recovery. Therefore, the alternative (4) is not realistic and can be excluded from further consideration.

Sub-step 1b. Consistency with mandatory laws and regulations:
All the alternatives above comply with mandatory law and regulations.
Under the current national and/or sectoral policies and circumstances and regulations of the proposed project site, alternative (1), (2), (3) and (5) can be selected as the credible and realistic alternatives.

The national policy and legislation of Ukraine do not require utilising waste gases. National policy of Ukraine regarding the emissions of gases into atmosphere is determined by the Law of Ukraine "On protection of atmospheric air" of 21 June 2001 #2556-III. However the Law does not provide specific requirements to emissions of steel gases. They are set out in the Decree of the Ministry of Environment of Ukraine "On approval of admissible level of emissions of polluting substances from stationary sources". The Decree also establishes the limits for emissions of pollutants. Besides according to the paragraph 10.1 of Safety Regulations for Gas Supply Facilities in Iron and Steel Industry in order to emit the surpluses of Blast Furnace Gas, Coke Oven Gas and Converter Gas special gas-collecting systems have to be installed. According to the paragraph 10.7 of Safety Regulations steel gases need to be burnt in gas-collecting systems. These requirements are not contradicting with above stated.

Step 2. Investment analysis
Sub-step 2a. Determine appropriate analysis method
Since proposed JI project activity generates benefits other than those from JI related income, simple cost analysis (Option I), is not applicable as per provision of the "Tool for the demonstration and assessment of additionality (version 3)" for this section. The investment comparison analysis (Option II) is not applicable either because identified baseline scenario, "Import of electricity from the grid", does not associate investment. Project proponents therefore selected the benchmark analysis (Option III) to demonstrate and assess the additionality of the proposed JI project activity.

Sub-step 2b. – Option I. Apply simple cost analysis
Not applicable.

Sub-step 2b. – Option II. Apply investment comparison analysis
Not applicable.

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

Project IRR was chosen to demonstrate the additionality of the proposed JI project. Economical attractiveness of the alternative (1), Waste gas based power plant without JI benefits, was evaluated by financial indicator, IRR. Base conditions and assumptions for the analysis are listed in Table Ann. 2.4 in Annex 2. Benchmark selected was a typical interest rate of the Ukrainian bank in good standing. According to the National Bank of Ukraine the average integral credit rate by banking sector of Ukraine decreased from 14.6% (in 2005) to 13.7% in 2006[4]. Therefore the reasonable benchmark can be considered at the level of 13.7% and applied for the proposed project activity. As indicated in Table Ann. 2.4, risk associated with the proposed JI project is not considered as a conservative assumption.

Besides investment decisions for the realisations of large scale projects are also taken by the owners with respect to minimum required financial rate of return (so called benchmark analysis).

The benchmark takes into account the economic and financial context in Ukraine, as well as the relevant opportunity cost of capital (alternative investment opportunities). The Industrial Soyuz of Donbass (the owner of the Company) also needed to maintain competitiveness in the context of average profit margin of the Ukrainian steel companies in 2005 and 2006 estimated at the level of 20%[5]. The profit margins of the Ukrainian steel companies was sustained at the high level due to the extensive use of existing equipment in view of maximizing short term returns in the favorable price context. At the same time, limited access to financial resources in Ukraine, implied clear priority for less capital-intensive projects with the highest IRR and the shortest pay-back period. This is additional evidence that proposed project activity is not a continuation of baseline scenario.

Besides the fact that mentioned benchmark value for steel sector of Ukraine is higher than project IRR indicates that project activity is not financially attractive and would not be selected as a feasible investment option for the IUD management.

Sub-step 2c. Calculation and comparison of financial indicators (only applicable to options II and III):

The IRR for the operational period of twenty (20) years of the proposed project activity without JI benefit can be calculated as 11.4 % respectively for the sales price of electricity of $45/MWh. The IRR does not reach the benchmark value. Therefore, the investment to the proposed project activity without ERU benefits cannot be justified.

Sub-step 2d. Sensitivity analysis (only applicable to options II and III):

The IRR values for the change in electricity price are calculated as listed in Table Ann. 2.5 in Annex 2. The IRR values for potential ERU sales values are also calculated in the table for reference. Even IRR value for the sales price of electricity of $50/MWh does not reach the benchmark value for 20 years time horizon. Considering that $50/MWh is higher than the current prevailing power price in Ukraine, the additionality of the proposed project activity assessed in the previous section shall be robust. Such result may be reinforced by the fact that IRR for potential ERU sales values as $15/ton or $25/ton for the power price of $45/MWh and 20 years horizon will reach the benchmark value. Considering such IRR calculation listed in Table Ann. 2.5, it can then be concluded that the results of financial analysis stated above is robust.

[4] http://www.bank.gov.ua/Fin_ryn/Mon_review/2006/4_2006.pdf

[5] According to the independent studies prepared on the basis of governmental data and published at web-sites http://www.avtoaliyans.com.ua/files/File/metallurgiya-obzor(1).pdf and (http://www.ugmk.info/?art=1173098018

Step 3. Barrier analysis

Sub-step 3a. Identify barriers that would prevent the implementation of the proposed CDM project activity:

1. Financial barriers

The economic activity of Ukraine was stagnant since its independence in 1990 mainly due to high inflation and world financial instabilities in 1998. Iron & steel sector was not the exception of such background and the investment in the sector was very limited. Ukraine produces approximately 40 thousands metric tones of crude steel and is world seventh largest crude steel producer in 2005. However, the production heavily, more than 43% of its crude steel production, relies on the open hearth furnace process that used to be a major production process only in the early 20th century. The investment mind in the iron & steel sector is well demonstrated by these facts.

Ukraine is endowed with energy resources, which has made the iron & steel sector difficult to invest in the energy efficient measure as proposed JI project activity. This is another side of the circumstances of the iron & steel sector in Ukraine. However, the financial barrier will be overcome due to JI project scheme as indicated in the step 2. above.

2. Technological barriers

Proposed JI project activity includes waste gas recovery system for LD steelmaking converters. LD converter is operated in batch-wise and the furnace body needs to be rotated from upright position at the beginning of refining for charging hot metal and at the end of refining for tapping the refined steel. Waste gas from LD converter, LDG, mainly consists of carbon monoxide that is generated as the results of reaction between oxygen blown in the furnace and dissolved carbon in the hot metal. It has the temperature higher than 1600 degree C, and possible timing to recover the waste gas is therefore limited to oxygen blowing period in the upright position. LDG recovery system is thus operated in a batch-wise mode and shall be capable of allowing the furnace to rotate at the beginning and end of refining. Since relatively large amount of air is entrained in these periods, LDG shall be flared instead of sending to the dedicated LDG gas holder to avoid unexpected explosion. This is conducted by accurate monitoring the oxygen content of recovered LDG and pressure control of the system to avoid excessive entrainment of air during operation. LDG recovery system is also capable of quenching and de-dusting LDG.

Since LDG recovery system is a kind of sophisticated devise and need large capital investment, none of the steel works in Ukraine employed the technology so far. Technology transferred through proposed JI project enables to implement the LDG recovery system for the first time in Ukraine by the proposed JI project activity.

As is already explained in the preceding section, the application of BFG as a fuel is also limited due to low calorific value.

The utilization of BFG and LDG for power generation is quite a unique not only in Ukraine, but also in the CIS countries. This is the first project in the CIS region. The novelty and effectiveness of the project is supported by the letter from the Ministry of Industrial Policy of Ukraine[6].

Sub-step 3 b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity):

Both financial and technological barriers obviously do not prevent the baseline scenario identified from occurring but the proposed JI project. However, these barriers will be alleviated by the scheme of JI as stated in the Step 2 above. As explained in the Section A.4.2, implementation of CCGT power generation unit may face several barriers due to the nature of feed gas though it is successfully operated in Japan

[6] The Letter was submitted to the Validator at determination stage and further can be disclosed upon request.

since 1958. In terms of power generation capacity for BFG application, CCGT is demonstrated up to 181 MW. To overcome expected technology barriers and for successful implementation of the project activity, dedicated training programme will be provided for operation of the CCGT system including maintenance by Japanese technology owner.

At the same time there are no legal and other obstacles for the AISW to continue purchasing the electricity from the national grid which presents the Alternative 2. This Alternative in not only real but also it is actual practice for the AISW. All the electricity is currently purchased by the AISW from the national grid.

Once the proposed JI project activity is successfully implemented in AISW, ISD plans to disseminate the technology to other own steel works and shall result in significant energy saving in those steel works as well. It is anticipated from the Energy Strategy of Ukraine till 2030 that current JI project will contribute to the improvement of the energy efficiency in the steelmaking sector in Ukraine as well. Therefore, proposed JI project activity shall give great impact on energy saving not only to the project site but also other steel plant in near future.

Step 4. Common practice analysis

Sub-step 4a. Analyze other activities similar to the proposed project activity:
None of the similar practice is observed in Ukraine.

Sub-step 4b. Discuss any similar options that are occurring:
According to the International Iron & Steel Institute[4)], the crude steel production of Ukraine is 38.6 million metric tonnes in 2005, and is the 7th largest in the world. Most of it is on the blast furnace process that is combined with 49.9% LD converters and 40.2% open hearth furnace. Only 9.8% of it is from scrap based electric arc furnace process. Historically open hearth steelmaking was the major process up to the middle of the last century but replaced by the oxygen steelmaking process, so called LD, or BOF steelmaking process by 2000. The application of the open hearth furnace is now limited to few nations including Ukraine, Russia, and India among major steel producing countries. This tells how modernization of steel industry of Ukraine is aspired.

BFG shows less flammability because of its low calorific value of 3.5 MJ/m3N and is usually flared in Ukraine. However, once it is mixed with coke oven gas, COG, having calorific value of 17.1 MJ/m3N, it can be used as fuel for steam generation or reheating furnaces in the steel works. Therefore, utilization of BFG is limited to only few cases in Ukraine. Off-gas of LD steelmaking converter, LDG, has a calorific value of 9.4 MJ/m3N and could also be used as fuel without mixing with any other additives of high calorific values. However its utilization is limited to the location where energy price is high enough to install the recovery equipment. Total 19 LD converters in operation in Ukraine but none of the converter is equipped with LDG recovery system due to the financial barriers and to the fact that LDG in Ukraine and CIS countries is not stable, its composition is changeable and it remains highly explosive as. CO content can vary from 12.5 to 75%[7].

It can now be concluded that the proposed project activity would reduce the GHG emissions that would be occurred without the project activity and hence it is additional.

[4)] World Steel in Figures- 2006, International Iron and Steel Institute

[7] As it explained at web-site http://esco-ecosys.narod.ru/2005_12/art89.htm

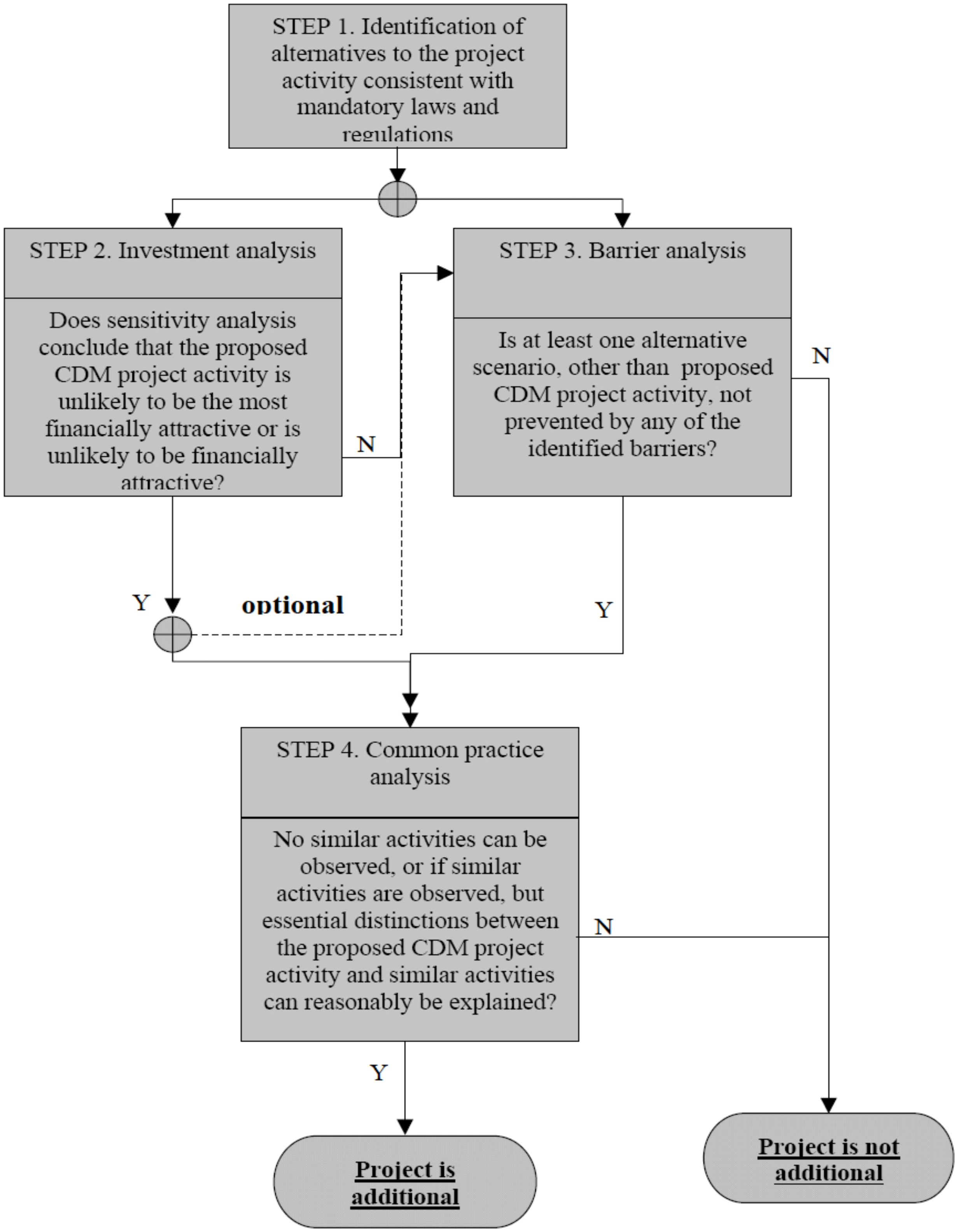

Fig. B.1 Additionality scheme defined in “Tool for the demonstration and assessment of additionality (version 03)”

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

The project boundary covers the points of waste gas supplies to the points of power generation for use of the AISW plant and for export to the grid where the project proponent has a full control as the on-site project boundary. Since operations of LD converters, blast furnaces and coke ovens are neither affected nor controlled by the proposed JI project, these facilities can be eliminated from the on-site project boundary. Moreover, combustion of BFG and COG for heating and steam generation for AISW shall be independent and not be affected by the proposed JI project activity, this activity is also excluded from the coverage of the project boundary. For the purpose of calculation of baseline emissions, national grid of Ukraine is also included in the project boundary. Schematic drawing on the project boundary is represented in Fig. B.2.

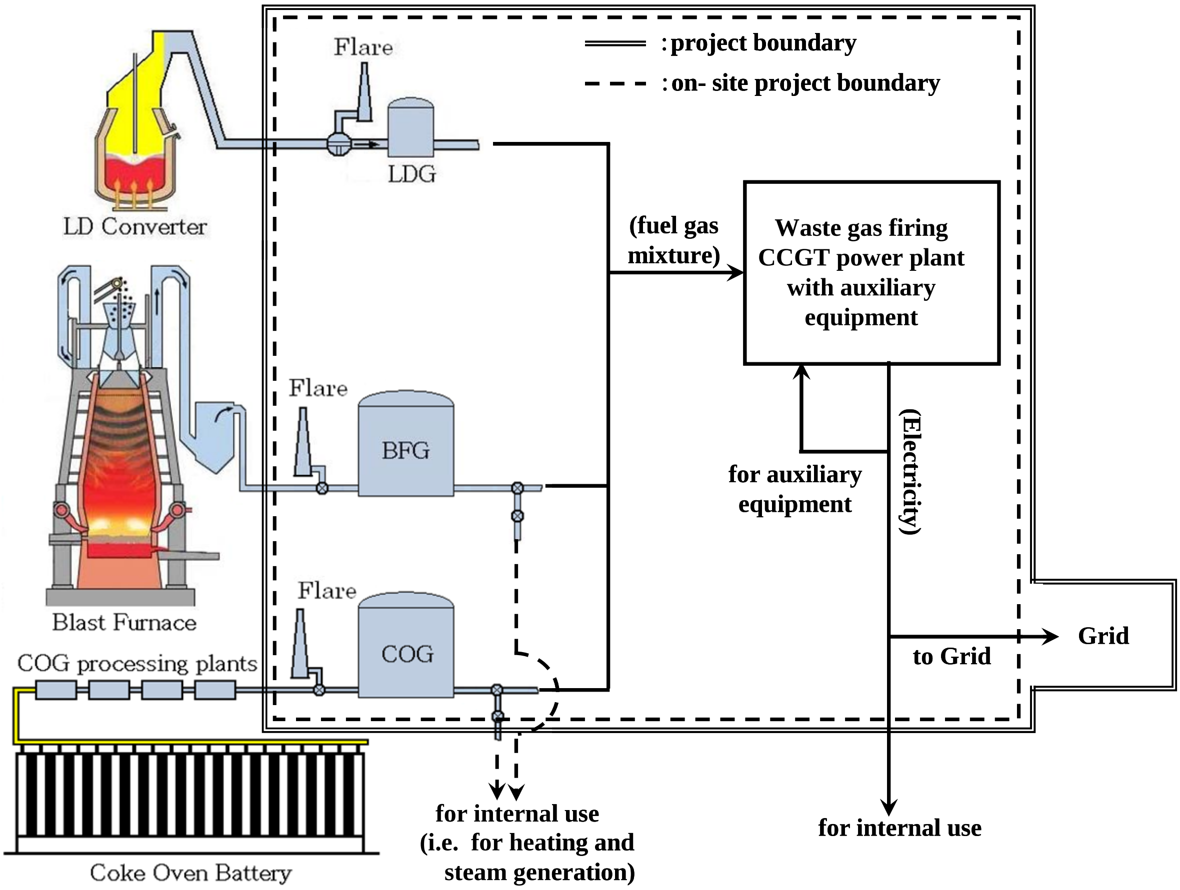

Fig. B.2 Project boundary of the proposed JI project.

On-site project boundary is shown in the broken line and total project boundary that includes all affected emission sources is indicated double solid lines in Figure B.2.

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

Date of completing the baseline: 28.08.2006
Name of the person/entity of baseline setting:
Corporate Name: Sumitomo Corporation
Address: 1-8-11 Harumi, Chuo-ku
CEP / City: Tokyo
Country: Japan
Contact: Taizo HAYAKAWA
Position: Manager
Telephone: +81-3-5144-920 4
Fax:: +81-3-5144-9290
E-mail: taizo.hayakawa@sumitomocorp.co.jp

Sumitomo Corporation is also a project participant.

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

Start of manufacturing Equipment: June 2006, Start of power generation: October 2008.

C.2. Expected operational lifetime of the project:

20 years.

C.3. Length of the crediting period:

Four (4) years and three (3) months

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

Monitoring plan for the proposed JI project was established in order to obtain all necessary data to determine the baseline and project emissions, thus emission reductions of the proposed JI project as specified in the previous sections. It is therefore in line with those required by the approved consolidated CDM monitoring methodology, ACM0004-Version 02.

D.1.1. Option 1 – Monitoring of the emissions in the project scenario and the baseline scenario:

Since none of the auxiliary fuels for generation start-up, in emergencies, or to provide additional heat gain before entering the Waste Heat Recovery Boiler is required, project emission is not applicable to the proposed JI project activity.

D.1.1.1. Data to be collected in order to monitor emissions 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

Not applicable.

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

Not applicable.

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

ID number *(Please use*	Data variable	Source of data	Data unit	Measured (m), calculated (c),	Recording frequency	Proportion of data to be	How will the data be	Comment

numbers to ease cross-referencing to D.2.)				estimated (e)		monitored	archived? (electronic/ paper)	
For electricity generation by project activity								
1. EG_y	Net quantity of the electricity supplied to the manufacturing facility by the project during the year y	Logged data	MWh	Calculated form $EG_{captive\ use,\ i,\ y}$ and $EG_{sold,\ i,\ y}$	Calculated on the basis of daily recorded data and aggregated monthly.	100%	Electronic, Data will be kept for two years after the end of the crediting period or the last issuance of ERUs, for this project activity, whichever occurs later.	
2. $EG_{captive\ use,\ i,\ y}$	Quantity of electricity from i-th CCGT unit that consumed as the captive use during the year y	Logged data	MWh	Online measurement	Continuously measured and daily recorded and aggregated monthly.	100%	Electronic, Data will be kept for two years after the end of the crediting period or the last issuance of ERUs, for this project activity, whichever occurs later.	Monitoring will be conducted as per Metrological product quality assurance developed in accordance with ISO 9001. Manager in-charge would be responsible for regular calibration of each meter.

3. $EG_{sold, i, y}$	Quantity of electricity from i-th CCGT unit that supplied to the electricity grid during the year y	Logged data	MWh	Online measurement	Continuously measured and daily recorded and aggregated monthly.	100%	Electronic, Data will be kept for two years after the end of the crediting period or the last issuance of ERUs, for this project activity, whichever occurs later.	Monitoring will be conducted as per Metrological product quality assurance developed in accordance with ISO 9001. Manager in-charge would be responsible for regular calibration of each meter.

4. $EG_{aux,i,y}$	Quantity of electricity consumed by i-th CCGT unit that supplied by the electricity grid during the year y	Logged data	MWh	Online measurement	Continuously measured and daily recorded and aggregated monthly.	100%	Electronic, Data will be kept for two years after the end of the crediting period or the last issuance of ERUs, for this project activity, whichever occurs later.	Monitoring will be conducted as per Metrological product quality assurance developed in accordance with ISO 9001. $EG_{aux, i, y}$ is only applicable when captive power plats are not operational and the auxiliary equipment is operated by the imported electricity from grid. Manager in-charge would be responsible for regular calibration of each meter.

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

The net quantity of electricity generation, EG_y will be calculated based on the monitored data for i-th CCGT power generator, $EG_{i, aux, y}$ during the year y by the following equation,

$$EG_y = \sum_i (EG_{captiveuse,i,y} + EG_{sold,i,y}) \text{ ---------------------- (D.1)}$$

In determining baseline CO2 emission, net quantity of electricity generated in the proposed JI project activity is divided into the quantity of electricity for captive use and the quantity of electricity supplied to the electricity grid as per "Standardized Emission Factors" for JI projects. Emission factor for each quantity of electricity is applied to determine baseline emission for the year y, $BE_{electricity,y}$ as indicated below,

$$BE_{electricity,y} = EG_{captive\,use,y} \times EF_{reduction,y} + EG_{sold,y} \times EF_{generation,y} \text{ ---------------------------- (D.2)}$$

where,
$EG_{captive\ use,y}$ is quantity of electricity that consumed as the captive use in AISW except the equipment to generate electricity during the year y in (MWh),
$EF_{reduction,y}$ is the carbon emission factors for the project of reducing electricity consumption for the year y provided in the " Standardized Emission Factors" in (tCO2/MWh),
$EG_{sold,i,y}$ is quantity of electricity from i-th CCGT unit that supplied to the electricity grid during the year y in (MWh),
$EF_{generation,y}$ is the carbon emission factors for the project of generating electricity for the year y provided in the "Standardized Emission Factors" in (tCO2/MWh).

For the proposed JI project, carbon emission factors for both, $EF_{reduction,y}$, and $EF_{generation,y}$ are fixed over the crediting period as provided in the "Standardized Emission Factors" for JI projects.

The quantity of electricity consumed as the captive use during the year y, $EG_{captive\ use,y}$ is calculated for each generator by the following equation,

$$EG_{captive\,use,y} = \sum_i EG_{captive\,use,i,y} \text{ -- (D.3)}$$

where,
$EG_{captive\ use,i,y}$ is the quantity of electricity supplied for captive use from the i-th generator during the year y in MWh.

The quantity of electricity supplied to the electricity grid during the year y, $EG_{sold,y}$ is calculated for each generator by the following equation,

$$EG_{sold,y} = \sum_i (EG_{sold,i,y} - EG_{aux,i,y}) \text{ --- (D.4)}$$

where,
$EG_{sold,i,y}$ is the quantity of electricity supplied to the electricity grid from the i-th generator during the year y in MWh.

$EG_{aux, i, y}$ is the quantity of electricity consumed grid electricity by the auxiliary equipments of i-th generator.

In case none of the electricity supplied, i.e. $EG_{sold,y} = 0$, the total quantity of electricity consumed grid electricity during the year y, if any, $\sum_i (EG_{aux,i,y})$, shall be subtracted from the quantity of electricity consumed as the captive use during the year y, $EG_{captive,y}$, for the purpose of emission reduction calculation.

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):

Emission reductions from the proposed JI project will be determined as follows:
$ER_y = BE_y - PE_y - L_y$ -- (D.5)

Since none of the auxiliary fossil fuel is consumed in the project activity, project emission is not considered.

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

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
5. Giy	Quantity of high pressure steam consumed in starting up power generators	Logged data	MJ	Measured	yearly	100%	Electronic, Data will be kept for two years after the end of the crediting period or the last issuance of ERUs, for this project activity, whichever occurs later.	

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

Though none of the fossil fuels is used in the proposed project activity as described in the Project Emission, small amount of steam that is generated from waste gas is used at the start up of CCGT unit. Since the start up steam is supplied from outside of the project boundary, it may be handled as a source of the leakage. This can be calculated with the following equation.

$$L_y = \sum_i (G_{i,y} \times CF_y) \times \frac{44}{12} \text{ --------------- (D.6)}$$

where, L_y is a leakage from CCGT start-up steam utilization during the year y in (tCO2), $G_{i,y}$ is the quantity of steam used for start-up of i-th CCGT unit during the year y in (MJ), CF_y is the specific carbon consumption per unit amount of steam for the year y in (tC/MJ steam).

G_{iy} shall be a specified value by the CCGT manufacturer and CF_y shall be calculated by the specific fuel consumption for steam generation assuming oxidation factor as 1 for conservativeness. It is empirically known from the operational data of this type of CCGT unit that the amount of the steam for starting up the unit is negligible compared with of the electricity to be generated.

According to the manufacturer's specifications, maximum steam consumption for each start-up of CCGT, $G_{i,y}$, is estimated to be 340 GJ. The steam for start-up of CCGT would be generated by either BFG or COG. Considering that emission factors of BFG and COG are 66.0 tC/TJ and COG, 13.0 tC/TJ[6], respectively, steam for start-up is assumed to be generated solely from BFG with boiler efficiency of as low as 80% as a conservative assumption.

The specific carbon consumption per unit amount of steam can be determined as,

CF_y = 66/1000/0.8 = 0.0000825 (tCO2/MJ steam)

Therefore, Ly for each CCGT shall be calculated as,

L_y = 340 x 1000 x 0.0000825 x 44/12 = 102.85 (tCO2)

If shut down of CCGT is once* a year, L_y for 2008 (only one set of CCGT) would be 103 tCO2/y, and 2009 afterward, (2sets of CCGT) would be 205.7 tCO2/y as a most conservative figure.
Considering the figure of ex-ante estimation of emission reduction, maximum share of the leakage effect can be estimated for 2008 as 0.04 %.
(*: This assumption is conservative since shut-down will be estimated at only once every 1.5 year)

Considering the marginal amount of leakage effect from consumption of high pressure steam during start-up of CCGT units, carbon consumption factor, CF_y, will be fixed as 0.0000825 tCO2/MJ as stated above, and only amount of high pressure steam will be monitored during proposed JI project.

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):

Emission reduction of the proposed project activity during the year y is the difference between the baseline emissions through substitution of electricity generation with fossil fuels (BEy) and leakage effect, if it were such value that more than one (1) percent of the baseline emissions, BE_y, as follows,

$ER_y = BE_y - L_y$ -- (D.7)

[6] Revised 1996 IPCC Guidelines for national Greenhouse Gas Inventories: Workbook, page 1.6.

where,
ER_y: CO2 emission reduction during the year y in tCO2,
L_y : CO2 emission as a leakage effect for the year y in tCO2.

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 facility would be able to utilize all the recovery gases expected to be available after modernization of the AISW.

Therefore the gases won't be flared into the atmosphere causing great damage to the environment. The utilization of the gases will enable production of electricity which displaces equivalent electricity in the grid and therefore reduces emissions of pollutants.

The installation of the CCGT will also lead to reduction of significant portion of noxious discharge at AISW (more than 2 times).

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.
2. $EG_{captive\ use,\ i,\ y}$, 3. $EG_{sold,\ i,\ y}$, 4. $EG_{aux,i,y}$	low	The data will be monitored with the watt meters certified under the industrial standard of Ukraine and of accuracy level of 0.5%. Watt meters are subject to the regular maintenance the procedure of which is complied with the ISO 9001 and industrial standard of Ukraine.
1. EG_y	low	The value will be calculated from the above, 2. $EG_{captive\ use,\ i,\ y}$, 3. $EG_{sold,\ i,\ y}$, 4. $EG_{aux,i,y}$, uncertainty level is also low.
5. Giy	low	Since the leakage shall marginally affect the emission reduction calculation, QA/QC procedures is not undertaken.

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

Monitoring of data provided in the previous section will be conducted as a part of operation of the power generation from the waste gases. The Director General of the CCGT assigns responsible stuff for the operation of CCGT units that includes operation and maintenance of CCGT unit and auxiliary equipment and stable and efficient power generation with CCGT. This part of function also includes logging all the data that are necessary to monitor the operational conditions of CCGT and auxiliary equipment. The stuff of the Plant will be also control the optimum operation of CCGT especially during maintenance of LD converters and blast furnaces. Monitoring of power generation group will be lead by Chief inspector on Labour Protection and conducted in close collaboration with the operation group and is responsible to monitoring, review, and archiving all the data specified in the previous section. Calculation of ERU is also conducted by the group. Daily power generation data will be reviewed against all the relevant logged data representing operation of CCGT unit provided by the operation group and are verified their validities. In case any inconsistencies among the data are identified, the source of them will be investigated in collaboration with the operation group. If any inappropriateness of monitored data is revealed, corrective measures will be conducted either on the monitoring system for the item specified above or monitoring of operation of CCGT. In such case, monitored data will be corrected in a conservative manner. All the information of corrective measures taken on the monitoring system and monitored data itself will be archived along with original monitored data for future verification of emission reductions. Responsibility and scheme of the monitoring were stipulated in the "Monitoring Decree of the Director General of the Company" signed as of 18 October 2007. Chief Inspector on Labour Protection is responsible to prepare and archive the monitoring report while the Head of Commercial Unit is responsible to monitoring generation and consumption of electricity from CCGT. Director General will review monthly aggregated monitored data with relevant documentations at least once a month. JI project developer will assist monitoring practice, if necessary.

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

Name of the person/entity establishing monitoring plan:
Corporate Name: Sumitomo Corporation
Address: 1-8-11 Harumi, Chuo-ku
CEP / City: Tokyo
Country: Japan
Contact: Taizo HAYAKAWA
Position: Manager
Telephone: +81-3-5144-920 4
Fax:: +81-3-5144-9290
E-mail: taizo.hayakawa@sumitomocorp.co.jp

Sumitomo Corporation is also a project participant.

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

Not applicable to the proposed project activity.

E.2. Estimated leakage:

As explained in the section D.1.3.2. leakage effect will be monitored and evaluated with the equation (D.5) for the proposed project activity. However, it shall be only negligible impact to the emission reduction if one considered that the starting period of the CCGT facility that requires high pressure steam generated outside of the project boundary is considered at most two (2) hours in the steady power generation period of 8,100 hours. Thus leakage effect can be neglected for the ex-ante estimation of the emission reduction of the project activity.

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

Not applicable to the proposed project activity.

E.4. Estimated baseline emissions:

According to the equation (D1) through (D5), baseline emission can be calculated and represented as below. All the numerical handling to calculate baseline emissions and emission reductions is provided in the Table Ann. 2.3 in Annex 2.

Year	Estimate of annual baseline emission in tonnes of CO2 equivalent
2008	268,146
2009	1,787,640
2010	2,145,168
2011	2,145,168
2012	2,145,168

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

Year	Estimate of annual emission reductions in tonnes of CO2 equivalent
2008	268,146
2009	1,787,640
2010	2,145,168
2011	2,145,168
2012	2,145,168
Total estimated emission reductions over the crediting period (tonnes of CO2 equivalent)	8,491,290
Annual average of estimated emission reductions over the crediting period (tonnes of CO2 equivalent)	1,698,258

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

Indicated in the section E.5.

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:

An “Environmental Impact Assessment Study” for the proposed project has been undertaken and its reports are available in EBRD home page http://www.ebrd.com/projects/eias/36625.htm.

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:

The environmental impact of the proposed project activity is not considered significant by the project participants. However, as per local development controls and Ukrainian Environmental Regulation and also Environmental Policy and Procedures of European Bank for Reconstruction and Development, EBRD , environmental impact assessments during construction and operation of CCGT power generation facility was conducted.

The EIA study can be summarized as followings.
Potential changes in concentrations of nitrogen dioxide, sulphur dioxide and carbon monoxide both inside and outside the Protection Zone through which the area of steelworks contact with the residential area of Alchevsk were evaluated by the air dispersion modeling. According to the sudy, none of the adverse effect can be expected due to the implementation of CCGT facility as summarized below.

The modeling showed that, following implementation of the CCGT Project and the expansion of the AMK site (part of a separate project associated with increased steel production), the maximum levels of SO2 attributable to the CCGT-associated plant will decrease to between 27% and 37% of their present levels outside the Protection Zone, and 27% to 48% within the Protection Zone. Similarly, levels of NO2 will decrease to between 26% and 37% of their present levels outside the Protection Zone, and 23% to 27% within. Levels of CO will decrease to around 54% of their present levels outside the Protection Zone, and between 67% and 100% within the Protection Zone.

Other operational impacts such as noise, landscape and visual, material use and waste management, ecological issues, and water and wastewater management were also studied but they are considered to be negligible when placed within the context of the AMK steelworks as whole.

The results of the study can be reached as the “Alchevsk Steel CCGT Facility Environmental Impact Assessment” as referred to http://www.ebrd.com/projects/eias/ukraine/36625e.pdf, the website of EBRD.

SECTION G. Stakeholders’ comments

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

Public Consultation and Disclosure process is prescribed as the Ukrainian project planning and permitting procedures as set out in the Ukrainian EIA implementation regulation (State Construction Standard DBN A.2.2-1-2003). EIA denoted above is to include the rationale of the proposed project and assess the environmental effects on the natural, social and built environment. It should also describe possible alternatives, establish the environmental baseline, develop mitigation measures to minimise environmental effects, and ensure the project is compliant with environmental, sanitary and other relevant legislation.

The EIA report that included all those information above was made publicly available to invite public comments from the relevant stakeholders of the proposed project activity by means of local newspapers , AMK website, local radio and television. Dedicated telephone line was also established for public consultation of the project.

Public consultations are held periodically. So far four rounds of public consultations have been held. (one in 2006 – on 21th of April and three in 2007 – on 23rd of January, on 27th of Feruary and on 11th of October). The results of the public consultations are summarised and made available on the web site of the Company[a]. Objective evidences of replies to stakeholder comments are presented in the minutes of public consultations. The results of public consultations are also published in the newspapers.

The EIA needs to be updated in line with the comments received. The outcomes are incorporated in the project planning and design. The EIA is updated in line with comments received.

The EIA report that included all those information above was made publicly available to invite public comments from the relevant stakeholders of the proposed project activity by means of local newspapers ("Za Metal" on 27th April 2006 and "Put" on 26th April 2006), AMK website, local radio and television. Dedicated telephone line was also established for public consultation of the project.

The main stakeholder groups and organisations identified are given below:

- AMK employees – particularly those working in the existing thermal power plant;
- Trade union representatives;
- District Committee Representatives of "micro-districts" living adjacent to the plant (Zsilovka, Staryj Gorod, Vasil'evka, Novyj Gorod);
- St Nicholas Church on Krasnooktyabrskaya Street;
- School No.8 on Kotovskogo Street 12;
- AMK Hospital on Gorkogo Street;
- Alchevsk Environmental Inspectorate;
- Public Health Inspectorate;
- Alchevsk Executive Committee (also called the Municipal administration)

Initial meetings were held (4th-7th April) with State Environmental Inspectorate, AMK management, technical specialists and workers from the power department. Further small meetings were held on the 5th and 6th July with representatives of district committees, Father Alexander the church representative, the principal medical officer of the hospital, the school headmistress, the Environmental Inspectorate, Public Health Inspectorate and Trade union representatives.

In meetings, stakeholder representatives felt that they were all aware of the current plans for the CCGT. Generally stakeholders have positive opinions about the CCGT project, expecting environmental improvement.

In addition to above stated, a separate environmental study has been developed by EBRD. The study contains information on influence of the project activities on local communities. For more information, see http://www.ebrd.com/enviro/disclose/disclose.htm.

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[a] Further information is located at web-site www.amk.lg.ua.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

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Annex 2

BASELINE INFORMATION

1. Historical data on Ukraine Iron & Steel Industry

Table Ann. 2.1 Statistics on crude steel production of Ukraine
(Source: Statistical Steel Yearbook, 2005, International Iron & Steel Institute)

Year→ Process ↓	2000	2001	2002	2003	2004
Basic Oxygen Furnace	14,899	16,223	16,656	18,000	19,292
EAF	985	927	992	2,000	2,634
Open Hearth Furnace	15,883	15,958	16,400	16,930	16,812
total crude steel production	31,767	33,108	34,048	36,930	38,738
Yearly growth rate, %	15.71	4.22	2.84	8.46	4.90
World total OHF steel	36,747	35,199	33,361	33,113	33,895
Shear of Ukraine OHF out of world total OHF steel, %	43.22	45.34	49.16	51.13	49.60

"Basic Oxygen Furnace" is referred to LD steelmaking process in the current project design.
"EAF" above is referred to the electric arc furnace steelmaking process.
"OHF" above id referred to the open hearth steelmaking process.

2. Baseline carbon emission factor of Ukrainian power grid.

The baseline emission factor of the Ukrainian electricity system that the proposed JI project directly connected can be summarized as indicated in Table Ann. 2.2 for both components of power delivery to the grid and conservation of power consumption in AISW. The approach and assumptions employed are broadly similar to those stipulated in the approved consolidated CDM methodology, ACM0002, taking account "Guidance on criteria for baseline setting and monitoring for JI projects" issued by JISC, "Operational Guidelines for the Project Design Document, ERUPT" issued by the Ministry of Economic Affairs of the Netherland, and also country specific circumstances of Ukraine. The estimation of baseline emission factor is assessed by TUEV SUED for its validity. The scheme of the estimation is represented section 5.

Table Ann. 2.2 Baseline carbon emission factors for JI projects for Ukrainian grid 2006 - 2012.
(Source: "Standardized emission factors for the Ukrainian electricity grid", Annex 2 of "Ukraine – Assessment of new calculation of CEF", assessed by TUEV SUED, 2007.)

Year	unit	2008	2009	2010	2011	2012
Baseline carbon emission factor for generation	[tCO2/MWh]	0.807	0.807	0.807	0.807	0.807
Baseline carbon emission factor for reduction of consumption	[tCO2/MWh]	0.896	0.896	0.896	0.896	0.896

3. Summary of emission reduction of the proposed JI project

Table Ann. 2.3 Summary of ex-ante calculation of emission reduction.

	Unit	2008	2009	2010	2011	2012
Total electricity generation	MWh/y	310,575	2,070,500	2,484,600	2,484,600	2,484,600
Net generation*	MWh/y	299,270	1,995,134	2,394,161	2,394,161	2,394,161
Captive Use, (A)	MWh/y	299,270	1,995,134	2,394,161	2,394,161	2,394,161
Supply to the grid, (B)	MWh/y	0	0	0	0	0
CO2 emission factor for captive use (A)	tCO2/MWh	0.896	0.896	0.896	0.896	0.896
CO2 emission factor for supply to the grid (B)	tCO2/MWh	0.807	0.807	0.807	0.807	0.807
Emission reduction from (A)	tCO2/y	268,146	1,787,640	2,145,168	2,145,168	2,145,168
Emission reduction from (B)	tCO2/y	0	0	0	0	0
Project emission	tCO2/y	0	0	0	0	0

*: Considering auxiliary consumption, net generation of electricity is assumed to be 96.36 % of total electricity generation in the ex-ante estimation of emission reduction in accordance with the financial feasibility study by Ecoenergia.

4. Financial analysis of the proposed JI project.

Table Ann. 2.4 Major basic parameters for financial analysis to demonstrate additionality.

parameters	assumed figure	Remarks
Investment	$400 million	
Operation & Maintenance costs	9.85% of Investment	Including gas supply cost
Selling price of electricity	$45/MWh	Higher than the current market price as a conservative assumption.
Profit tax	25%	
Sales price of ERU per ton CO2 equivalent	$0, $15,$25	

Loan interests in Ukraine shall be higher than 7% that is the interest one year deposit as referred, "http://www.ingbankukraine.com/?tid=83&lang=en".

Table Ann. 2.5 IRR calculation with variations of sales price of electricity and ERU.

Selling price of electricity→ Sales price of ERU ↓	$40/MWh	$45/MWh	$50/MWh
0 $/ton CO2 equivalent	9.1%	11.4%	13.7%
15 $/ton CO2 equivalent	11.8%	14.0%	16.2%
25 $/ton CO2 equivalent	13.6%	15.9%	18.0%

*: IRRs for 20 years are indicated in each cell

5. Further explanation on the "Standardized emission factors for the Ukrainian electricity grid"

Consolidated baseline methodology, ACM0002, takes combination of the Operating Margin, OM, and the Build Margin, BM, to estimate the emission in absent of the CDM project activity. OM accounts for the reduction in power generation plants that provide the electricity to the grid while BM accounts the potential delay in construction of future addition of power plants in the grid.

For OM calculation, it is therefore necessary to identify the group of power plants operating “on margin” that could most likely reduce their output when additional power is delivered to the grid. On the other hand, strict application of BM calculation specified in ACM0002 is not realistic and lead to distorted picture of the Ukrainian grid since most recent capacity addition to be identified is nuclear plants. Therefore, the Operating Margin only will be used to develop the baseline emission factor.

Following assumptions to calculate emission factor of Ukrainian grid are employed,

1) the grid must constitute of all power plants servicing the grid,
2) there is no significant electricity import to the grid,
3) electricity export is not accounted and not excluding from the calculations.

All of above are in compliance with ACM0002.

Following four options are provided for calculation of OM in ACM0002,

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

Though “Dispatch Data Analysis” (c) is the first methodological choice as per ACM0002, this option is not applicable because of the data availability.[b] Simple adjusted OM” (b) is not applicable either for the same reason. The “Average OM” (d) would not present a realistic picture since nuclear power plants always work as the base load and constitute up to 48% of overall electricity generation during past five years as indicated in Table Ann. 2.6, and 2.7, respectively.

Table Ann.2.6 Electricity demand and generation in Ukrainian on March 2005[c].

		Minimum demand (03:00)	Peak demand (19:00)
Consumption (MW)		21,287	27,126
Generation (MW)		22,464	28,354
	Thermal power palnts	10,049	13,506
	Hydro power plants	527	3,971
	Nuclear power plants	11,888	10,877
Balance import/export (MW)		-1,177	-1,228

Table Ann.2.7 Share of power generation by source in the annual power generation.[d]

[b] Dource: State Committee of Statistics of Ukraine. Fuel and Energy resources of Ukraine 2001-2003, Kyiv, 2004.

[c] Ukrenergo

Year	2001	2002	2003	2004	2005
Nuclear plant generation	44.23	45.08	45.32	47.99	47.92
Thermal power generation	38.81	38.32	37.24	32.50	33.22
Combined heat and power	9.92	11.02	12.28	13.04	12.21
Hydro power generation	7.04	5.58	5.15	6.47	6.65

In Ukraine the low-cost must-run power plants are nuclear power plants and their contribution to the total electricity generation is below 59% as indicated in Table Ann.2.7. Therefore, the "Simple OM" is only applicable option for the Ukrainian grid.

$$EF_{OM,y} = \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j,y}}{\sum_{j} GEN_{j,y}} \qquad (A.1)$$

Where:

$F_{i,j,y}$ is the amount of fuel *i* (in a mass or volume unit) consumed by power plant source *j* in year(s) *y* (2001-2005),

j refers to the power sources delivering electricity to the grid, not including low-operating cost and must run power plants, and including imports to the grid;

$COEF_{i,j\,y}$ is the CO_2 emission coefficient of fuel *i* (tCO_2e /mass or volume unit of the fuel), taking into account the carbon content of the fuels used by power sources *j* and the percent oxidation of the fuel in year(s) '*y*', and

$GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source *j* in year(s) '*y*'.

$$COEF_i = NCV_i \cdot EF_{CO_2,i} \cdot OXID_i \qquad (A.2)$$

Where:

NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel *i*;

$OXID_i$ is the oxidation factor of the fuel;

$EF_{CO2,i}$ is the CO_2 emission factor per unit of energy of the fuel *i* (tCO_2e /TJ).

Individual data for power generation and fuel properties was obtained from the individual power plants.[e]

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[d] "Overview of data on electric power plants in Ukraine 2001-2005", Ministry of Fuel and Energy of Ukraine, 31 October 2006 and 16 November 2006.

[e] "Overview of data on electric power plants in Ukraine 2001-2005", Ministry of Fuel and Energy of Ukraine, 31 October 2006 and 16 November 2006.

The local NCV values of individual power plants for natural gas and coal were used. For heavy oil, the IPCC [f] default NCV was used. Local CO2 emission factors for all types of fuels were taken for the purpose of the calculations and Ukrainian oxidation factors were used.

The Simple OM is applicable to the JI project that delivers additional amount of electricity to the grid, "generation JI project". However, the project that reduces on-site consumption of electricity, referred to as "reducing project", reduces losses in the grid. Losses in the Ukrainian grid are classified as technical losses and non-technical losses that include no-payment and other losses of unknown reasons. For the purpose to determine emission factor of the Ukrainian grid for "reducing project", only technical losses were considered. Statistical data on the losses are indicated in Table Ann.2.8.[d]

Table Ann.2.8 Grid losses in Ukraine.

Year	Technical losses (%)	Non-technical losses (%)	Total (%)
2001	14.2	7	21.2
2002	14.6	6.5	21.1
2003	14.2	5.4	19.6
2004	13.4	3.2	16.6
2005	13.1	1.6	14.7

Though technical losses decrease over years and are expected to reach 22% in 2012, technical losses of ten (10) percent are applied for the period during 2006 through 2012 as a conservative assumption.

As conclusions, emission factors for "generation JI projects" and "reducing JI projects" in Ukraine are summarized as follows,

$$EF_{grid,produced,y} = EF_{OM,y} \quad \text{(A.3)}$$

and

$$EF_{grid,reduced,y} = \frac{EF_{gid,produced,y}}{1 - loss_{grid}} \quad \text{(A.4)}$$

Where,
$EF_{grid,produced,y}$ is the emission factor for JI projects supplying additional electricity to the grid (tCO2e/MWh);
$EF_{grid,reduced,y}$ is the emission factor for JI projects reducing electricity consumption from the grid (tCO2e/MWh);
$EF_{OM,y}$ is the simple OM of the Ukrainian grid (tCO2e/MWh);
$Loss_{grid}$ is the technical losses in the grid (%).

Basic data employed for the assessment of carbon emission factor of the Ukrainian grid are summarized in Table Ann.2.9.

Table Ann.2.9 Key data for OM factor calculation of the Ukrainian grid.

	Generation (MWh)	CO2 emissions (tCO2)	Technical losses (%)	for producing project, $EF_{grid,produced}$	for reducing project, $EF_{grid,reduced}$
2003	98,214,112	80,846	14.2		

[f] Revised 1996 IPCC guidelines for national greenhouse gas inventories.

2004	94,330,765	74,518	13.4	(tCO2/MWh)	(tCO2/MWh)
2005	96,526,887	78,203	13.1		
total	**289,071,764**	**233,567**	**10**	**0.807**	**0.896**

The results of the calculation are summarized as indicated in Table Ann.2.10.

Table Ann.2.10 Emission factors for the Ukrainian grid for 2006-2012.

Type of JI project	parameter	EF (tCO2e/MWh)
Producing projects	$EF_{grid,produced,y}$	0.807
Reducing projects	$EF_{grid,reduced,y}$	0.896

Annex 3

MONITORING PLAN

According to the Decree of Director General of the Company signed on 18th of October 2007, the monitoring will be conducted on monthly basis according to monitoring plan described below. Two operational managers will be in charge for monitoring of GHG emissions and ERU and preparation of annual monitoring reports.

The data required to monitor the project will be routinely collected within the normal operation of the Company and therefore monitoring will be also an integral part of routine monitoring. All data will be collected into electronic database of the Company. Data will be complied in day-to-day records, monthly records and annual records. All records are finally stored in Commercial Unit. The appropriate data for GHG monitoring will be fed into the Monitoring Database as envisaged by the Decree attached.
The Project Developers will also supervise the implementation of the Monitoring Plan for the project at regular intervals.

The quantities of electricity supplied to the grid and to the manufacturing facilities in AISW, i.e. internal use, are to be monitored by using watt meters, “M1” and “M2”, respectively as represented in the Figure Ann 3.1 below. When CCGT units are not operational and auxiliary equipment are operated by the grid electricity, the amount of electricity fed by the grid is monitored by the watt meter, Ma. The amount of electricity measured by “Ma” shall subtracted from the amount of electricity delivered to grid or manufacturing facilities as indicated in Equation D.4 in the section D.1.1.4. Precision of watt meters are of 0.5% class. All the monitoring equipment including watt meters are on the ISO 9001 and national standard of Ukraine.

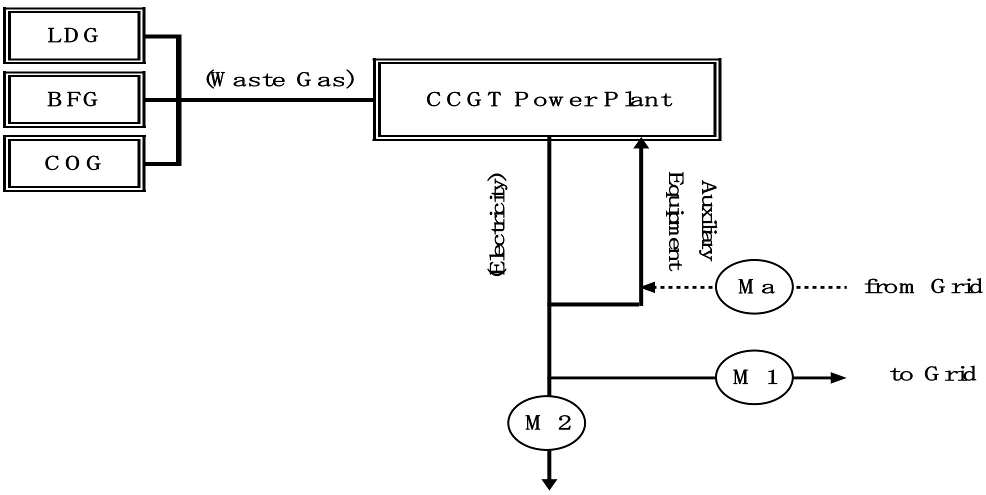

Figure Ann 3.1 Monitoring points

Data for power generation, i.e. M1, M2, and, Ma, are continuously measured and monthly aggregated are electronically recorded and also documented. The amount of electricity delivered to the grid and purchased from the grid for operation of the auxiliary equipment are cross-checked by the monthly receipt or bill issued by the grid operator. In case material discrepancy were revealed, monitoring system and equipment would be checked for any malfunctions or data handling for both AISW and grid operator. If any reason(s) for the discrepancy were detected, it would be eliminated for future data handling. This may lead extra calibration of the specific watt meter and correction of the archived data. In case appropriate corrective measure were not implemented to solve the data discrepancy, conservative estimate would be conducted for correction of data on the basis of performance review of the captive power plants. Any corrective action of either monitoring system or data itself were conducted, they will be archived with the monitored data for verification of ERU.

Quantity of high pressure steam along with its parameters, i.e. pressure and temperature, for start-up the CCGT units. The operational norm for generation of high pressure steam is also logged for determination of carbon dioxide emission intensity.

Specifications of all the meters are in compliance with the industrial standard of Ukraine and their calibration will also be conducted on the basis of the standard to ensure their accuracies.

Management structure of captive power generation under the proposed JI project activity is indicated in Figure Ann 3.2. Operation and maintenance of all the equipment including that for data monitoring and instrumentation are responsible to the Manager of Operation. Manager of Monitoring is responsible to day-to-day handling of monitored data and analysis. ERU calculation and performance review of the project are major parts of the analysis. General Manager of captive power plant is responsible to both operation and monitoring and accountable for ERU determination. Internal audit system will be introduced by assigning specific officer as indicated in Figure Ann 3.2.

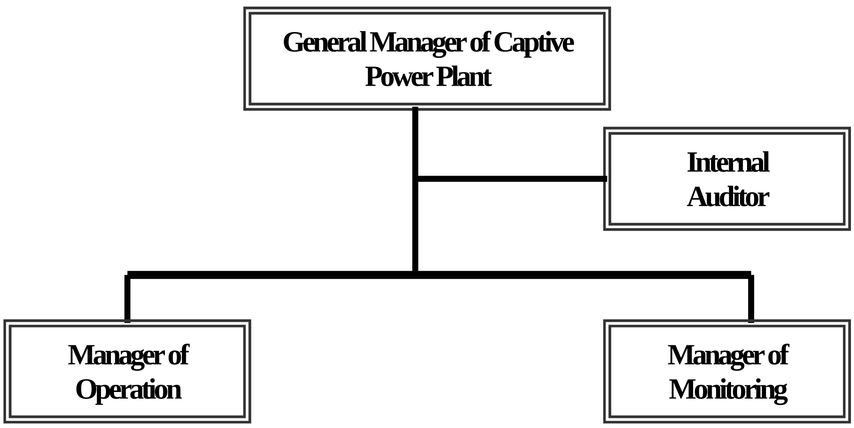

Figure Ann 3.2 Management structure of operation and monitoring of captive power generation.