MIZUHO Value Communication

Biomass Utilization CHP Project at unused Sugar Factory in Rejowiec , Poland

Project Design Document

(Draft)

March, 2005

Mizuho Information & Research Institute, Inc.

Introduction

The promotion of Joint Implementation by Japan and Poland has been confirmed in the joint statement issued after a meeting between Junichiro Koizumi, Prime Minister of Japan, and Leszek Miller, Prime Minister of the Republic of Poland in Warsaw when Mr. Koizumi visited the Republic of Poland in August 2003.

Recognizing that the Kyoto Protocol is an extremely significant first step in strengthening international actions against climate change, both sides confirmed their willingness to strongly urge other countries that have not yet ratified the Kyoto Protocol to do so promptly.

Both sides expressed their intention to cooperate to establish a common rule in which all countries participate in order to ensure the effectiveness of actions against climate change. Both sides also expressed the expectation for bilateral cooperation in joint implementation and emission trading under Kyoto mechanism.

Excerpt from
JOINT STATEMENTTOWARDS
STRATEGIC PARTNERSHIPBETWEEN
JAPAN AND THE REPUBLIC OF POLAND
(Source: The Ministry for Foreign Affairs of Japan)

The system and organization for the Joint Implementation are defined in Poland as follows.

- FOCAL POINT in Poland is JI SECRETARY in The National Fund for Environmental Protection and Water Management
- The law with regard to Emission trading and Joint Implementation is under review. NATIONAL GUIDELINE and approval procedure for JI is not decided yet at present.

March 2005

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Biomass Utilization CHP Project at unused Sugar Factory in Rejowiec , Poland

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A.2.1. Outline of the project activity

Biomass Utilization CHP Project at unused Sugar Factory in Rejowiec – hereinafter called "This Project", is the Combined Heat and Power Plant (CHP) project which generates electricity and heat with the agricultural biomass as a fuel at the unused sugar factory of Polish governmental Sugar Company, which has stopped sugar production since 2001. This project is planned to satisfy both demands of effective utilization of the factory site and existing equipment from company, and of continuous purchase of beet from farmers.

In this project, rape straw, rapeseed cake and beet pulp are utilized for the fuel of CHP. In regard to beet, a contract is going to be made with the neighboring farmer to cultivate the beet whose growth rate is higher than the one they are cultivating at present and to supply them. Generated electricity is to be sold to the National grid and heat is to be sold to the district heating company or the local heat consumers.

The amount of fuel consumption, electricity sale and heat sale planning in this project are shown below.

Table The amount of fuel consumption, electricity sale and heat sale planning in this project

Production in a month		1	2	3	4	5	6	7	8	9	10	11	12	Total
Labour hours		744	672	744	720	744	0	216	744	720	744	720	744	7512
fuel consumption	t/month	5546	5009	5546	5367	5546	0	1610	5546	5367	5546	5367	5546	55994
Sold electrical energy	MWh	7531	6802	7531	7288	7531	0	2186	7531	7288	7531	7288	7531	76038
Sold heat	MWh	7198	6501	6398	4644	3999	0	1161	3999	4644	6398	6966	7198	59104

A. 2.1. General condition of the project site

This Rejowiec sugar factory is situated in the north-western part of Rejowiec community. Since its foundation the sugar factory has been modernized many times. Overall beet processing in the last sugar campaigns fell between 140,000 and 150,000 tons of beets with sugar production of about 15,000 tons. Since 2002 sugar production has been stopped from the reason of currently uncompetitive production, and there is no plan to restart in the future.

The reasons of selecting this factory for the CHP project site are pointed as following:

① Power engineering equipment presents an important part of the technological assets of sugar refinery and consists of:
   a) power boilers yielding steam of parameters fit for low-power turbine generators.
   b) low-power turbine generators equipped with compressing steam turbine
   c) Installation of connection of plant to power distribution fit for emission and admission of electrical energy
   d) Heat engineering installations – heat connection system
   e) Water supply and sewage system
   f) Access to water reservoirs or/and rivers

② Sugar refinery is provided with logistic structure, where farmers provides sugar beets. Apart from beets farmers cultivates rape, wheat, and maize, which can be used as a biomass for proposed project needs. Hence there is potential well-organized source base for renewable power engineering.

③ Clerks and workers of power engineering, conservators, traffic services, workers supervising storage of the beets, and purchase supervisors employed in a refinery have much experience and job seniority. Aforementioned staff can be employed at:

a) Storage and conversion of biomass
b) Electrical energy, and heat generation
c) Logistic services (obtaining and purchasing of the biomass raw materials)
d) Administration

④ Sugar refinery holds a license for production and sale of the electrical energy and heat. According to the site planning the refinery is located on the site destined for industrial activity and it has settled property relations. Hence there is no need to apply to new licenses, concessions and permits but applying to conveyance of rights to a new business entity.

A.2.2. Biomass resource

The basic sources of biomass supply for this project are the agricultural communes of the Zamojski district. The total areas under cultivation amounts to 25,000 ha.

Resources of the local biomass supply market are presented below.

Rape straw and Oil cake are the by-products of rapeseed oil production, which is one of the main industries in this area, so it is possible to obtain them from the local market. As for beet pulp, because the sugar production has been stopped in this sugar factory, it is necessary to make a contract with neighboring farmer to cultivate beet for this project.

Table Potential resources of raw materials for production of fuel in Rejowiec area

Sort of biomass	Biomass production in a following months (estimation for Rejowiec area):											
	1	2	3	4	5	6	7	8	9	10	11	12
Rape straw							40.000	40.000				
Oil cake	3000	3000	3000	3000				3000	3000	3000	3000	3000
Beet pulp										5000	5000	4000
Total	3000	3000	3000	3000	0	0	40.000	43.000	3000	8000	8000	7000

As shown in the Table above, total potential biomass resource is 121,000t in Rejowiec area. Required biomass for this project needs amounts to about 56,000t, that is about 46 % of available biomass in this area can satisfy the this project's demand.

A.3. Project participants:

- The Agro Power Engineering Complex Rejowiec (Kompleks Agro-Energetyczny Rejowiec: KAE Rejowiec) ＜Tentative name : Establishment scheduled in the future＞

This company is the Special Purpose Company (SPC) for this project planning to be established as Joint Venture by investors shown below and other venture capitals or investors from Japan.

- Krajowej Spółki Cukrowej „Polski Cukier" S.A.

This company is the Polish governmental sugar company owning the Rejowiec sugar factory and is going to supply the properties of Rejowiec factory (site, boiler facilities and so on) to this project as investment in kind.

- Enterprise for Realization of Renewable Energy (Przedsiębiorstwo Realizacji Energetyki Odnawialnej (ENOD), Co., Ltd.

This company is the owner of the patent and the prime contractor responsible for the successful management of all works connected with idea of the project, planning, preparing investment to realization, including supervision of implementation.

Investment from Europe are now been negotiating.

- Mizuho Information & Research Institute
  As a performance of carbon finance by ERU acceptance and a JI adviser

  Investment from Japan and advance payment for ERU are now been negotiating.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1 Host country Party (ies): Poland

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

A.4.1.3 City/Town/Community etc: Rejowiec

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

Existing facilities are not included in the project because it is a newly planned project. The layout of the facilities is shown below.

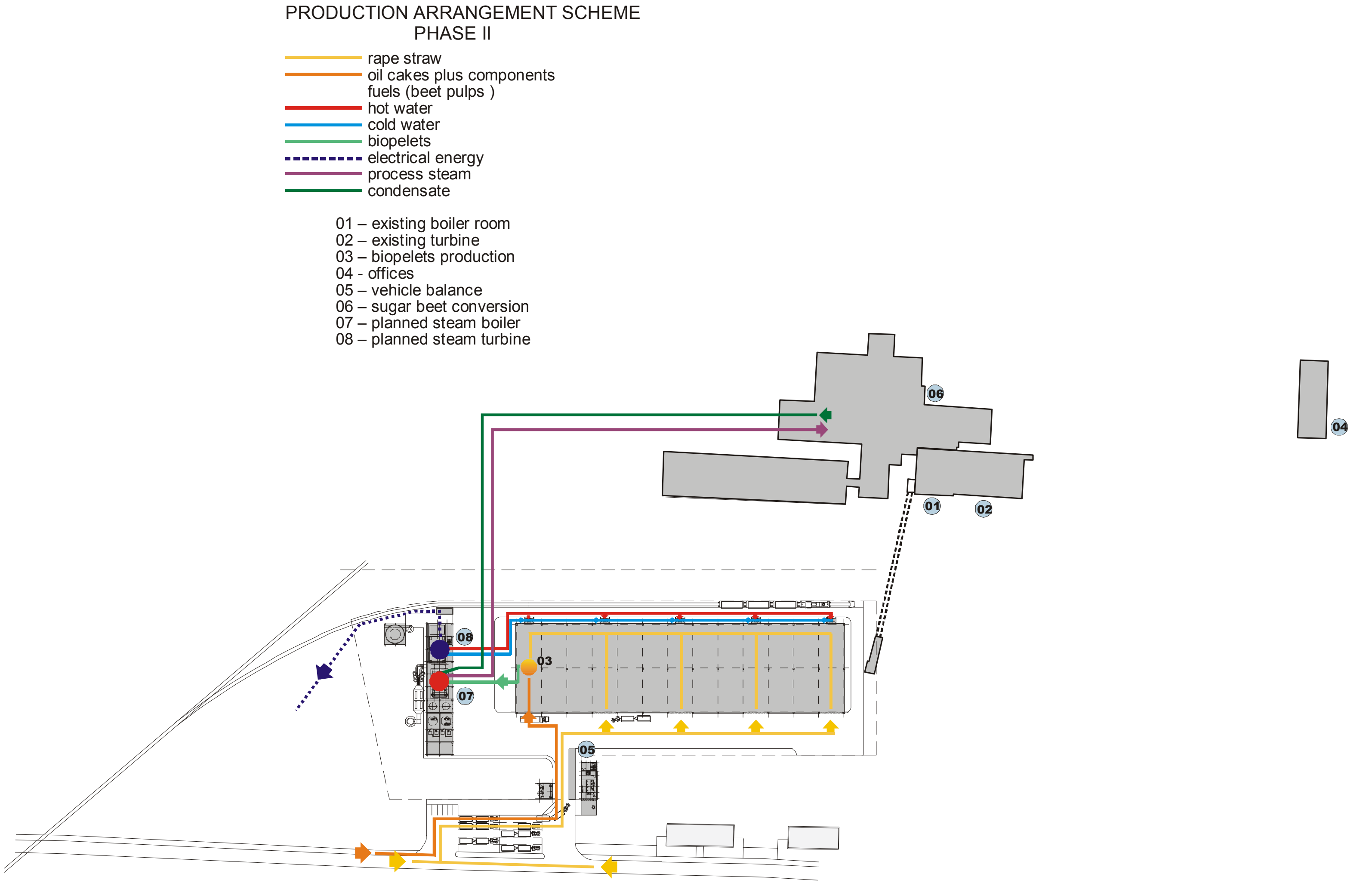


Figure Location of the engineering facilities at Sugar Refinery Rejowiec site

A.4.2. Category (ies) of project activity

This project is a biomass CHP project. Electricity is sold to the Grid, and heat is sold to district heating company or neighbor consumers.

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

This project consists of those major components below:

- Straw store-drying installation
- Biomass processing and fuel pallet production installation
- Installation for fuelling of the existent boilers
- Steam boiler
- Turbine and electric generator
- Installation for fertilizer conversion from ash

① Construction of straw store-drying installation
It is planned to construct the straw store-drying installation equipped with:

- Air heaters
- Heating air distribution system
- Unloading belt conveyor
- Manipulators for arranging and dismounting of straw bales
- Rape oil cake store.

② Construction of biomass processing and fuel pellet production installation
Biomass processing and fuel pallet production installation is planned to be constructed near the farms where biomass is cultivated, and is equipped with:

- Shredders for straw initial breaking up
- Mills for straw secondary crumbling
- Installation for batching and mixing of biomass fuel components
- Pellet manufacturer
- Pellets cooling conveyor
- Silo fuel pellets store

③ Construction of installation for fuelling of the existent boilers
Fuel supply equipment in order to supply the pellet fuel to the boiler is planed to be constructed.

④ Steam boiler modernization for adaptation of new fuel
In order the fuel to change to the biomass pellet fuel from the coal, it is necessary to make the existing boiler, especially burner, modernize to adapt to the biomass pellet fuel.

⑤ Construction of additional turbine and electric generator
Because the capacity of existing steam turbine set in this factory is small, it is planned to be renewed to the new equipment whose capacity is approximately 10MWe.

The amount of electricity generation, heat generation and biomass consumption planning in this project are as follows.

- Electricity : 76,038MWh/year
- Heat : 212,774 GJ/ year
- Biomass consumption : about 56,000t/ year

⑥ Construction of installation for fertilizer conversion from ash

Installation for fertilizer conversion from ash is planned to be constructed to sold the fertilizer for cultivating biomass. The ash contains Ca and K, so it becomes the superior fertilizer when nitrogen and phosphorus is added.

A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed JI project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances

In this project, electricity and heat are generated with CHP utilizing rape straw, rape seed cake and beet pulp as fuel. Because those fuels are biomass, CO2 emission can be counted zero. To sell the electricity from this project to the National Grid makes the quantity of the existing thermal power plant and then the fossil fuel consumption of the power plant can be decreased. Also generated heat can make the fossil fuel consumption of heat boilers decrease by sold to the district heating company. Therefore this project contributes to the reduction of CO2 emission in Poland.

B. Baseline methodology

B.1. Description of the methodology:

The project is a CHP project with the fuel of biomass (rape residue). The power generated in the project is sold to the national grid and the heat produced is supplied to factories and greenhouse located near the CHP. Hence the gas emission for greenhouse effect can be reduced from the national grid and heat user. The methodology of the baseline is mentioned with regard to the power generation and heat supply.

B1.1 Baseline regarding generated power

(1) Overall description

The project is the power generation project connected to the national grid of Poland. The baseline emission is "CO2 emission amount accompanied with the generated power to be increased in the grid" without the project.
"CO2 emission amount accompanied with the generated power to be increased in the grid" without the project means CO2 amount emitted from marginal plants among the plants connected to the grid. The baseline emission amount is calculated by the sold power to the grid, and the baseline is the multi-project CO2 emission factor targeting the marginal plants.

(2) Key parameters/assumptions and data sources considered and used

- Consumption and heat of brown coal, coal and natural gas in the power station: [Source: STATISTICS OF POLISH POWER INDUSTRY 2003 (Agencja Rynku Eergii S.A.)]
- Carbon emission factor of brown coal, coal, oil and natural gas: [Source: IPCC]
- Oxidization rate: [Source: IPCC]

The data for each fuel is shown in Annex 2.

B1.2 Baseline with regard to heat

(1) Overall description

The baseline with regard to heat sale is defined as the emission amount, which is expected on the basis of heat generation or heat purchasing by heat purchasers, considering the existence of pipelines for natural gas in the neighboring area and most economical heat generation or heat purchasing in the future. The baseline emission amount is calculated on the basis of heat sales to the heat user, so the baseline is the gas emission for greenhouse effect per unit heat based on fuel used and boiler efficiency.

The baseline with regard to heat sale is defined, on the basis of current condition of heat generation or heat purchasing by heat purchasers, as the emission amount in the case of most economical heat generation or heat purchasing in the future, e.g. considering whether pipelines for natural gas exist or not in the neighboring. The baseline emission amount is calculated on the basis of heat sales to the heat user, so the baseline is the gas emission for greenhouse effect per unit heat based on fuel used and boiler efficiency.

(2) Key parameters/assumptions and data sources considered and used

- The boiler efficiency is assumed to be at the highest level available in the present polish market.＜Source：INSTITUTE FOR CHEMICAL PROCESSING OF COAL (INSTYTUT CHEMICZNEJ PRZERÓBKI WĘGLA)＞
- Carbon emission factor of Coal [Source: IPCC]

- Oxidization rate of Coal [Source: IPCC]

The data for each fuel is shown in Annex 2.

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

B2.1 Baseline with regard to power generation

The MARRAKESH ACCORDS defines the criteria for baseline setting to co-operation business as follows.

- On a project-specific basis and/or using a multi-project emission factor;
- In a transparent manner with regard to the choice of approaches, assumptions, methodologies, parameters, data sources and key factor;
- Taking into account relevant national and/or sectoral policies and circumstances, such as sectoral reform initiative, local fuel availability, power sector expansion plans, and the economic situation in the project sector;
- In such a way that ERUs cannot be earned for decreases in activity levels outside the project activity or due to force majeure;
- Taking account of uncertainties and using conservative assumptions

We consider that our baseline setting to the project satisfies the above criteria for the next reasons;

- The CO2 emission factors applied are the multi-project factors for the electrical sector in Poland.
- The data from actual power stations are clearly presented.
- There is no occurrence of ERU caused by activity level decreases outside the project activity or due to irresistible force.
- It is included in the scenario to put the power generation activity in Poland into the free market and make environmental regulations such as SO2 emission regulation more severe. (Environmental regulations such as the SO2 emission regulation will be strengthen after 2008, but under the condition that they are scrapped until 2015 a moratorium treatment is considered that a certain amount of operation is permitted in 2008 ~ 2015.)

B2.2 Baseline with regard to heat sales

The MARRAKESH ACCORDS defines the criteria for baseline setting to co-operation business as follows.

- On a project-specific basis and/or using a multi-project emission factor;
- In a transparent manner with regard to the choice of approaches, assumptions, methodologies, parameters, data sources and key factor;
- Taking into account relevant national and/or sectoral policies and circumstances, such as sectoral reform initiative, local fuel availability, power sector expansion plans, and the economic situation in the project sector;
- In such a way that ERUs cannot be earned for decreases in activity levels outside the project activity or due to force majeure;
- Taking account of uncertainties and using conservative assumptions

We consider that our baseline setting to the project satisfies the above criteria for the next reasons;

- The CO2 emission factors are dependent on each industry the heat is supplied to.
- The data are clearly presented for heat production or heat purchasing.
- Where pipelines for natural gas in the neighbor area exist or not is considered.
- There is no occurrence of ERU caused by activity level decreases outside project activity or due to irresistible force.
- The setting is conservative since a boiler with high efficiency is considered.

We think that the above criteria are satisfied for these reasons.

B.3. Description of how the methodology is applied in the context of the project activity

It is required that the baselines for power and heat sales are set because the project is the CHP project as follows.

B.3.1 Baseline with regard to power sector

The baseline emission is the emission produced in a power plant, which generates power in the grid without this project (“Marginal plant”). Several ideas are considered and the following is the idea for this time.

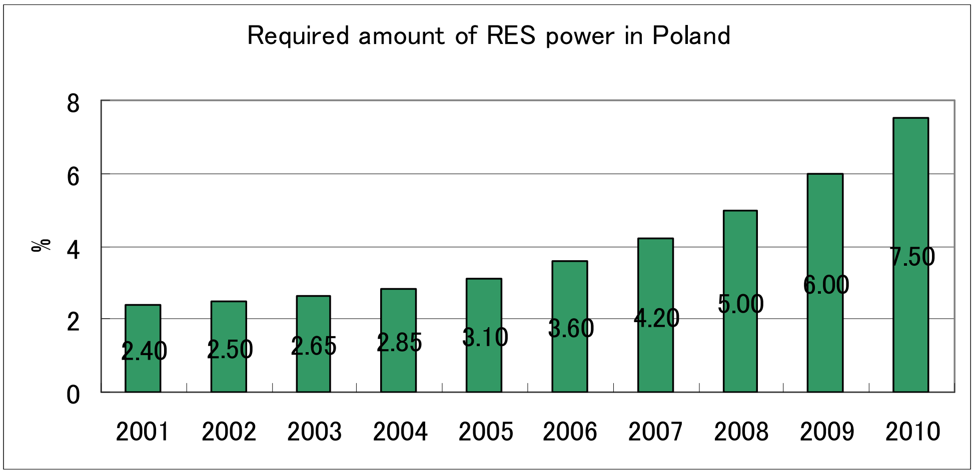
(1) How to consider the Marginal Plant

The transmission company (PSE) or the distribution company have obligation to purchase power generated in co-generation facilities, and those regarded as “must run plants” are excluded from the ”Marginal Plant”

The following is a related part excerpted from “ORDINANCE OF MINISTER OF ECONOMY of 15 December 2000 concerning an obligation to purchase electric energy and heat from unconventional and renewable sources and the scope of such an obligation”

> **§ 1, items 4**: The energy company involved in transfer and distribution of electric energy, as well as in trading in this energy, shall purchase all offered electric energy co-generated with heat from sources connected to the grid owned by that company, no matter the installed electrical capacity of the source.
>
> **§ 3.** The obligation mentioned in § 1 does not apply to:
> 1) electric energy or heat generated outside the territory of the Republic of Poland,
> 2) electric energy co-generated with heat with the total gross efficiency of fuel chemical energy conversion into electric energy and heat not less than 65%, calculated as an average annual figure in a calendar year in which electric energy purchase is effected

In Poland the distribution company or power companies, which directly sell electricity to demanders through the third party access, must buy the required amount of renewable energy power. So renewable power plants are considered as “must run plants” and excluded from the ”Marginal Plant”



(Source: MINISTRY OF ECONOMY of Poland)

(2) Baseline concept

Poland has already started free sales of electric power by the third party access. 100% of regulation-free retailing including ordinary houses in 2007 or so will be scheduled to start under a EU Directive. Because only the market mechanism decides sales price of electricity in the free electricity market, a power plant with higher cost does not always become “Marginal” plant. Because we cannot specify the "Marginal Plant” at the plant level in advance for this reason, we use an average CO2 emission factor of "Marginal Plant” as the baseline.

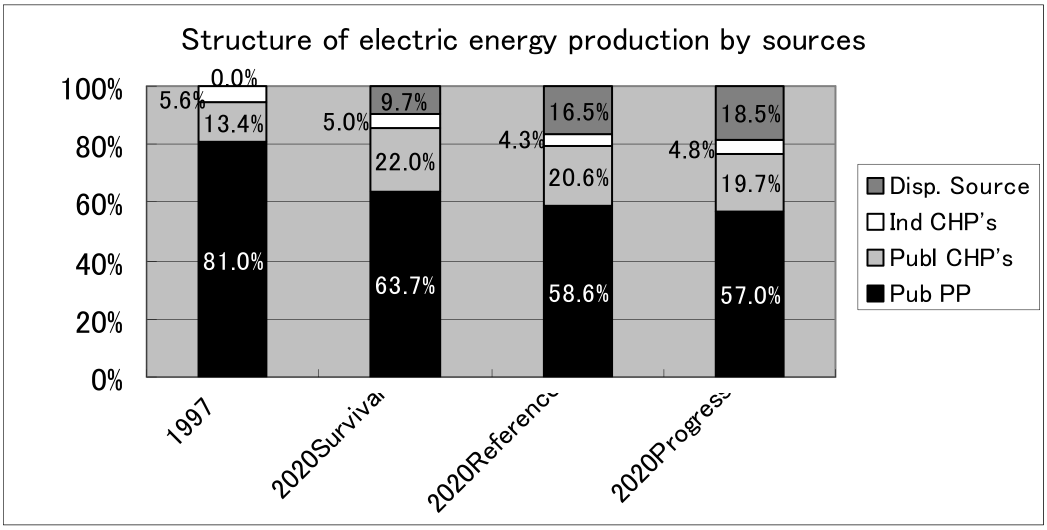
Poland holds excess capacity of about 30% in their total power capacity. In accordance with the government prospect of electric demand, they need no development of large-scale electric source up to 2012.

TABL. MAXIMAL-DEMAND-DAY BALANCES OF POWER (2001-2003)

Specification	2001 13.12	2002 12.12	2003 23.12
	MW		
AVAILABLE POWER			
public power stations	31,012	31,394	31,933
heat power plants	28,848	29,237	29,719
hard coal	20,685	20,998	21,209
brown coal	8,163	8,239	8,510
hydro plants	2,164	2,156	2,214
LOAD			
public power stations	23,060	23,855	23,450
heat power plants	21,581	22,823	22,185
hard coal	14,217	15,889	14,504
brown coal	7,364	6,935	7,682
hydro plants	1,479	1,032	1,265

(Source: STATISTICS OF POLISH POWER INDUSTRY 2003 (Agencja Rynku Eergii S.A.))

Especially for the future electricity supply, the Poland government forecasts that the ratio of coal and brown coal power generation, which form major part of Marginal Plant, tends to decrease in Public Power Plant (see the following tables).



(Source: GUIDELINES FOR ENERGY POLICY OF POLAND UNTILL 2020 (The Council of Ministers of Poland))

On the other hand, the electricity supply perspective in "GUIDELINES FOR ENERGY POLICY OF POLAND UNTIL 2020" tells that the increase of electric supply in Public Power Plant is only 8 % at 2012, based on 2002.

TABL. Electricity supply forecast in Public Power Plant (TWh)

	1,997	2002	2005	2010	2012	2015	2020	Increase at 2012 based on 2002
Survival	113.8	117.0	119.0	122.2	123.5	125.4	128.6	5.5%
Reference	113.8	118.8	121.8	126.7	128.7	131.7	136.7	8.4%
Progress	113.8	118.4	121.1	125.6	127.5	130.2	134.7	7.7%

(Source: 1997, 2005, 2010, 2015, and 2020 figures are quoted from GUIDELINES FOR ENERGY POLICY OF POLAND UNTIL 2020 (The Council of Ministers). The data of 2002 and 2012 are calculated by Mizuho Information & Research Institute, on the basis of those data (linear approximation).

For all of these reasons this methodology does not choose the idea of Build Margin, but Operating Margin for the baseline calculation.

As the baseline emission is decided by electricity sales amount of the project to the grid, we define CO2 emission factor of "Marginal" plants as the baseline.

We finally calculate as the baseline the average CO2 emission unit of all fossil power plants among the electric sector connected to the grid, without the co-generation plants with thermal efficiency of 65% or more and plants based on renewable energy.

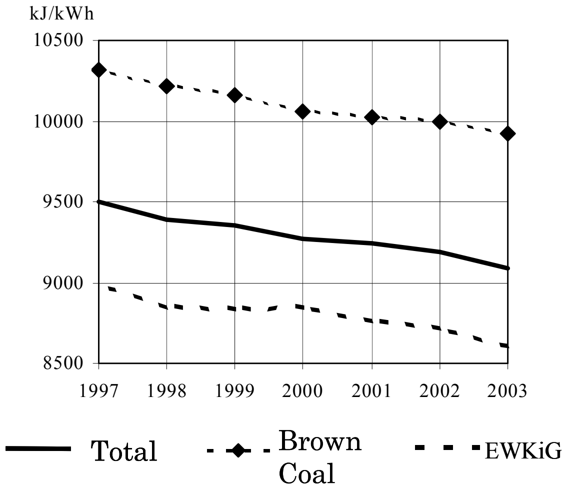
But even if they are co-generation plants they are to be included in the baseline calculation in the case that their thermal efficiency cannot be specified to be more than 65% with limitation of available data.

(3) "Ex-ante" or "Ex-post" ?

As shown in the following graph, the energy consumption per electricity generation tends to decrease in the power plants in Poland. So, it is considered that carbon emission factors have the same decreasing tendency.

Accordingly, in the calculation of the carbon emission factor the calculation method of "Ex-post" based on the data acquired in future is applied. This is a conservative setting.

Rysunek 7. SPECIFIC FUEL CONSUMPTION FOR ELECTRICITY GENERATION



(Source: STATISTICS OF POLISH POWER INDUSTRY 2003 (Agencja Rynku Eergii S.A.))

(4) Calculation method of the baseline emission regarding electricity

(4-1) Calculation method of CO2 emission from fuel on each power plants

CE(i)(tCO2) = fuel consumption(i)(TJ) x C emission factors(tCO2/TJ) x oxidation factors dependent on fuels x 44/12
(When several sorts of fuel exist, the each value is summarized.)

The notations above are as follows.
CE(i): CO2 emission from the subject plant (i) in the baseline

(4-2)Calculation method of CO2 emission factor as the baseline

The CO2 emission factor is calculated to divide total CO2 emission from the subject power plants by total generated power on the yearly basis. The formula is shown below.

$CEF_X = \Sigma CE_X(i) \div \Sigma Op_X(i)$<D.5.3>

The notations above are as follows.
CEF_X: Weighted average CO2 emission factor from the subject power plants in the baseline in the year X
$CE_X(i)$: CO2 emission from the subject plant (i) in the baseline in the year X
$Op_X(i)$: Power generated by the subject plant (i) in the baseline in the year X

(4-3) Calculation method of baseline emission

The annual CO2 baseline emission is calculated by the multiplication of the above "CO2 emission factor " by annual sales of electricity in the project. The following is the formula.

Baseline emission in the year X = OpP_X x CEF

The notations above are as follows.

OpP_X: Annual sales of electricity in the year X

B.3.2 Baseline for heat demand

(1) Baseline concept

This project is the plan to sell 59,104 (MWh) X 3.6 = 212,774 (GJ) of heat per year. There are many heat consumers in this region such as neighboring apartment and business building and the warehouse for sugar storage who are purchasing heat from coal-fired boilers of the district heating company at present. Although the boiler efficiency of the district heating company is not high enough, the most highest boiler efficiency is applied to a baseline scenario in this project for conservative reason.

<Outline of environmental regulations with regard to coal fired boilers>

The current environmental regulation to atmosphere applied in Poland was established in 1998, and the emission standard values are classified with kinds of fuels, installation times, sizes, and times of application

The installation times are divided into the following three classes, and the coal fired boiler mentioned above was constructed before 1987 and corresponds to "emission source of an old facility".

- Emission sources of newly constructed plants
- Emission sources of the plants approved after 1987
- Emission sources of old facilities

The followings are the emission standards with regard to emission sources of coal fired and old facilities.

Table　Emission standards (old facilities, kinds of fuel : coal) in Poland　<unit mg/m3 >

Plant Size (MWe)	Until 2005.12.31			2006.1.1 ~ 2010.12.31		
	SO_2	NOx	Dust	SO_2	NOx	Dust
5	2,000	400	1,900	1,500	400	700
5－50	2,000	400	1,000	1,500	400	400
50－100	2,000	540	350	1,500	540	200
100－300	2,000	540	350	1,500	540	200
300－500	2,350	540	350	250	540	200
500	2,350	540	350	250	540	100

Note: 6% O2 dry gas base

(2) Calculation method of the baseline emission regarding heat

Followings here show several parameters.

- Alternative fuel: Hard coal
- Boiler efficiency: 85%＜Source：INSTITUTE FOR CHEMICAL PROCESSING OF COAL (INSTYTUT CHEMICZNEJ PRZERÓBKI WĘGLA)＞
- Carbon emission factor : 25.8 (tC/TJ) ＜Source：IPCC＞
- Oxidization rate: 0.98 ＜Source：IPCC＞
- N2O and CH4 excluded for a conservative setting

The following is the formula.

Baseline emission regarding heat = Heat utilized by customers / Boiler efficiency x Carbon emission factor x Oxidization rate x (44/12)

B.4. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered JI project activity *(i.e. explanation of how and why this project is additional and therefore not the baseline scenario)*

The project is about the CHP business, which sells electric power to the grid and heat to the heat purchasers near the project site. The fuel, which is the biopellets made of rapeseed cake, rape straw and beet pulp, is the carbon neutral fuel and can reduce GHG emission.

We review next the barrier for the project investment to evaluate whether the project is additional or not.

(1) Risk of fuel procurement

The project's aim is to utilize the annual-harvested biomass such as rapeseed cake, rape straw and beet pulp to make the biopellets for the fuel of the CHP plant. However, cultivation and harvest of the crops depend largely on weather and unusual weathers such as gale, heavy rain, lack of water and too hot weather bring a big impact on the production of crops the project commissioned for, and might invite a great lack of harvest.

Since the project is required to procure these crops under self-responsibility, the fuel (biomass) procurement risk is higher than the ordinary fossil fuel.

(2) Technology barrier

In Poland, burner-boilers for the biopellets made of several crops are not widely applied yet and there are barriers for training of operation and management techniques when they are introduced.

For the reasons above, the project is considered to be an additional project because the risk for fuel procurement is high and technical barriers exist and will not be executed without the acquisition of ERU as JI project. Therefore the project activity is not considered as the baseline scenario.

B.5 Description of how the definition of the project boundary related to the baseline methodology is applied to the project activity*:*

B.5.1 Baseline

(1) Power generation in the grid

The project is included inside the boundary because it is connected to the national grid in Poland.

- CO2: Included
- N2O: Excluded for simplification and conservative
- CH4: Excluded for simplification and conservative

(2) Heat production for heat customers

The project is the CHP project supplying heat to the neighbor factories, etc. Hence the heat generation or heat purchasing to the heat purchaser is included in the boundary.

- CO2: Included
- N2O: Excluded for simplification and conservative
- CH4: Excluded for simplification and conservative

B.5.2 Project Activity

(1) Electricity Generation and Heat Generation

The entire site for the CHP plant is included inside the boundary.

- CO_2: Zero emission (CO_2 from biomass (rapeseed cake, rape straw and beet pulp) is carbon neutral.
- N_2O: Included
- CH_4: Included

(2) Production of the biopellets

The biopellets are produced at 12 distributed sites and this production activity is also inside the boundary.

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- CO_2: Included
- N_2O: Included.
- CH_4: Included.

(3) Biomass and biopellets storage

The biomass such as rapeseed cake, rape straw and beet pulp is stored temporarily until the biopellets are made. Also the biopellets are stored before inputted into the CHP plant. They are also considered inside the boundary.

- CH_4: Methane is released during the putrescence/decomposition of organic matter under the particular circumstances, namely: in moisture, appropriate temperature, and the absence of oxygen. The rape straw and beet pulp are stored on the open-air fields. Those storage conditions are not conducive to methane emission.
  In the case of the biopellets, they are already dried in the producing process, so methane is not released during the storage of the biopellets, too.
  Therefore none, or only very small amount if occur, of methane will emitted from the storage of both biomass and biopellets and therefore it is to be "Excluded".

(4) Transportation of biopellets to the CHP plant

In this project, the biopellets are produced at the distributed facilities close to farms, and then transferred to the CHP plant. Hence transportation of the biopellets from production facilities to the CHP plant is included in the boundary.

- CO_2: Included.
- N_2O: Included.
- CH_4: Included.

B.6. Details of baseline development

B.6.1 Date of completing the final draft of this baseline section *(DD/MM/YYYY)*:

December 2004

B.6.2 Name of person/entity determining the baseline:

Climate Change Solution
Mizuho Information & Research Institute
2-3, Kandanishiki-cho, Chiyoda-ku, Tokyo 101-8443, Japan
Tel +81-(0)3-5281-5457
Fax +81-(0)3-5281-5443

(Please provide contact information and indicate if the person/entity is also a project participant listed in Annex 1.)

C. Duration of the project activity / Crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

01/09/2006

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

30 years

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

C.2.1. Renewable crediting period of ERU

C.2.1.1. Starting date of the first crediting period (DD/MM/YYYY):

01/01/2008

(Note: It is desired that the emission reduction which happened before 2008 will be effectively handled as AUU, which will be transferred by International Emission Trading after 2008.)

C.2.1.2. Length of the first crediting period:

5 years

(In addition, the longest period for emission reduction as AUU, which will be transferred by International Emission Trading, is 1 year and 4 months for 2006~2007.

(The credit period after 2013 is scheduled to be postponed to 2026, based on an international treaty.)

D. Monitoring methodology and plan

D.1. Description of the methodology:

This monitoring methodology monitors the following data regarding to gas emission for greenhouse effect

D.1.1 Monitoring regarding to the emission in the project

(1) Calculation method regarding the emission in the project

Calculation method regarding the emission in the project is as follows.

(1-1) Combustion of the biopellets

According to the guideline of IPCC, CO2 emission from biomass can be counted zero, then CO2 emission from combustion of the biopellets becomes also zero in the project.

In addition, calculation of both CH4 and N2O emissions by burning of biopellets are as follows respectively.

Parameters and Assumption:

- Default Emission Factor of CH4 from Other Biomass and Wastes Combustion: 30 (kg/TJ) <Source: IPCC>
- Default Emission Factor of N2O from Other Biomass and Wastes Combustion: 4 (kg/TJ) <Source: IPCC>
- Calorific value of biopellets: 16 MJ/kg <Source: ENOD>
- Biopellets input: 55,994t (rapeseed cake: 11,700t + rape straw: 38,164t + beet pulp 6,130t) <Assumption>

➢ CH4 emission ;

CH4 emission (tCO2-equivalent) = Biopellets input(t) x 1,000kg/1t x Calorific value of biopellets(MJ/kg) x 1TJ/1,000,000MJ x Default Emission Factor of CH4 from Other Biomass and Wastes (kg/TJ) x 1t/1000kg x 21

➢ N2O emission ;

N2O emission (tCO2-equivalent) = Biopellets input (t) x 1,000kg/1t x Calorific value of biopellets(MJ/kg) x 1TJ/1,000,000MJ x Default Emission Factor of N2O from Other Biomass and Wastes (kg/TJ) x 1t/1000kg x 310

As shown in E1.1, emissions of CH4 and N2O are extremely small compared with emission reduction in the whole project. Hence the emission is calculated, based not on actual data of input amount of biopellets, but on planned input of biopellets.

(1-2) Combustion of fuel at the start-up of the CHP plant

The CHP plant is going to use coal for the fuel to start up. GHG emission from coal combustion at the start-up is calculated with the following formula.

Parameters:

- Default C emission factor from coal: 25.8 (t/TJ) <Source: IPCC>
- Default Emission Factor of CH4 from coal: 0.7 (kg/TJ) <Source: IPCC >
- Default Emission Factor of N2O from coal: 1.6 (kg/TJ) <Source: IPCC >
- Oxidation factor for coal: 0.98 <Source: IPCC >
- Net Caloric Value of coal: 22.95 (MJ/t) <Source: IPCC >

GHG emission (tCO2-eq) = coal consumption(t)<D.3.1> x calorific value of coal(MJ/t) x 1TJ/1000MJ x oxidation factor for coal x (C emission factor from coal(tCO2/TJ) x 44/12 + Default Emission Factor of CH4 from coal(kg/TJ) x 1t/1000kg x 21 + Default Emission Factor of N2O from coal(kg/TJ) x 1t/1000kg x 310)

(1-3) Electricity use from grid to produce biopellets

Electric power is purchased through the grid to produce biopellets. GHG emission from biopellets producing is calculated as follows.

GHG Emission (tCO2-eq) = Total Electricity purchased from grid <D.3.2> x CO2 emission coefficient of electricity purchased from grid< D.3. 3>

(1-4) Transportation of biopellets from the facilities to the CHP plant

The biopellets are produced at the distributed facilities close to farms and transported to the CHP plant. The greenhouse gas emitted by the transportation to the CHP is counted for the project emission.
The emission regarding biopellets transportation to CHP plant is calculated with the following formula.

Parameters:

- Emission Factor for transportation (European Diesel Heavy-Duty Vehicles): 781(gCO2-eq/km) (=770gCO2/km + 0.06gCH4/km x 21 + 0.03gN2O/km x 310) <Source: IPCC >
- Average round transportation distance: 60(km) (30km for one way) <Assumption>

Annual Emission (tCO2-eq) = Emission factor for transportation(gCO2-eq/km) x 1t/1,000,000g x Average round transportation distance(km) x Annual frequency of transportation

As showed in E1.4, the emission with regard to transportation of biopellets is very small compared with the emission reduction in the whole project. Then the emission is calculated based not on monitoring data, but on estimated values of the transportation distances and frequency by trucks.

(2) Monitoring concept

The monitoring with regard to the project emission is implemented for the data regarding coal consumption for start-up of CHP and use of electricity purchased from the grid to produce biopellets..

D.1.2 Monitoring regarding leakage

(1) Calculation method regarding leakage

Biomass necessary for this project is cultivated and transported to the biopellets production facilities by the farmers whom the project makes a contract. This agricultural activity and transportation, however, are not included inside the project boundary. Therefore GHG emissions from these activities below need to be considered as leakage emission.

(1-1) Cultivation

Emission from cultivation is mainly from fuel consumption by tractors and harvesters. GHG emission from cultivation is calculated with the following formula.

Parameters:

- Default Emission Factor of CO2 from European non-road agricultural mobile: 3140 (g/kg) <Source: IPCC >
- Default Emission Factor of CH4 from European non-road agricultural mobile: 0.17 (g/kg) <Source: IPCC >
- Default Emission Factor of N2O from European non-road agricultural mobile: 1.3 (g/kg) <Source: IPCC >
- fuel consumption by tractors and harvesters for rape : 2.1 (kg/t) <Source: Institute for Building, Mechanization and Electrification of Agriculture >
- fuel consumption by tractors and harvesters for beet : 3.0 (kg/t) <Source: Institute for Building, Mechanization and Electrification of Agriculture >
- rape straw input for CHP: 38,164 (t) <Assumption >
- beet pulp input for CHP: 6,130 (t) <Assumption >

GHG emission (tCO2-eq) = (rape straw input for CHP (t) x fuel consumption by tractors and harvesters for rape(kg/t) + beet pulp input for CHP (t) x fuel consumption by tractors and harvesters for beet(kg/t)) x (Default Emission Factor of CO2 from European non-road agricultural mobile(g/kg) + Default Emission Factor of CH4 from European non-road agricultural mobile (g/kg) x 21 + Default Emission Factor of N2O from European non-road agricultural mobile(g/kg) x 310) x 1t/1,000,000g

As shown in E2.1, GHG emissions from cultivation are small compared with emission reduction in the whole project. Hence the emission is calculated, based not on actual data of input amount of biopellets, but on planned input of biopellets.

(1-2) Fertilization

N2O emission is occurred by fertilizing crop fields. N2O emission from cultivation is calculated with the following formula.

Parameters:

- Default Emission Factor for direct emission of N2O-N from agricultural soils: 0.0125 (kgN2O-N/kgN-input) <Source: IPCC >
- Default Emission Factor for indirect emission (leaching) of N2O-N from agricultural soils: 0.025 (kgN2O-N/kgN-leaching) <Source: IPCC >
- Default values of parameter of leaching for indirect emission of N2O-N from agricultural soils: 0.3 (kgN-leaching/kgN-input)
- Average fertilizer (ammonium niter) input for rape : 1.24 (kg/t) <Source: Institute for Building, Mechanization and Electrification of Agriculture >
- Average fertilizer (ammonium niter) input for beet : 3.6 (kg/t) <Source: Institute for Building, Mechanization and Electrification of Agriculture >
- Average fertilizer (uera) input for beet : 2.6 (kg/t) <Source: Institute for Building, Mechanization and Electrification of Agriculture >
- Average N content of ammonium niter: 34 (%) <Source: Institute for Building, Mechanization and Electrification of Agriculture >
- Average N content of uera: 46 (%) <Source: Institute for Building, Mechanization and Electrification of Agriculture >
- rape straw input for CHP: 38,164 (t) <Assumption >
- beet pulp input for CHP: 6,130 (t) <Assumption >

N2O emission (tCO2-eq) = { rape straw input for CHP (t) x Average fertilizer (ammonium niter) input for rape(kg/t) x Average N content of ammonium niter x beet pulp input for CHP (t) x (Average fertilizer (ammonium niter) input for beet(kg/t) x

Average N content of ammonium niter + Average fertilizer (uera) input for beet(kg/t) x Average N content of uera) } x (Default Emission Factor for direct emission of N2O-N from agricultural soils(kgN2O-N/kgN-input) + Default values of parameter of leaching for indirect emission of N2O-N from agricultural soils(kgN-leaching/kgN-input) x Default Emission Factor for indirect emission (leaching) of N2O-N from agricultural soils(kgN2O-N/kgN-leaching)) x 1t/1000kg x 40/12 x 310

As shown in E2.2, GHG emissions from cultivation are small compared with emission reduction in the whole project. Hence the emission is calculated, based not on actual data of input amount of biopellets, but on planned input of biopellets.

(1-3) Transportation of biomass to the biopellet-production facility

The emission regarding biomass transportation to the biopellet-production facility is calculated with the following formula.

Parameters:

- Emission Factor for transportation (European Diesel Light-Duty Vehicles): 286(gCO2-eq/km) (=280gCO2/km + 0.005gCH4/km x 21 + 0.02gN2O/km x 310) <Source: IPCC >
- Average round transportation distance: 12(km) (6km for one way) <Assumption>

Annual Emission (tCO2-eq) = Emission factor for transportation(gCO2-eq/km) x 1t/1,000,000g x Average round transportation distance(km) x Annual frequency of transportation

As stated in E2.3, the emission with regard to transportation of biomass to the biopellet-production facility is very small compared with the emission reduction in the whole project. Then the emission is calculated based not on monitoring data, but on estimated values of the transportation distances and frequency by trucks.

(2) Monitoring concept

Because the emission regarding the leakage is very small as shown in E.2 compared with emission reduction in the whole project, the emission regarding the leakage is calculated with biomass input for CHP or annual transportation distances acquired not by monitoring data, but by assumed values. For this reason, monitoring will not be done for leakage.

D.1.3 Monitoring regarding the baseline emission

(1) Calculation method regarding the baseline emission

Calculation method regarding the baseline emission is as below.

(1-1) Calculation method of the baseline emission regarding electricity

STEP1:Calculation method of CO2 emission from fuel on each power plants

CE(i)(tCO2) ＝ fuel consumption(i)(TJ) x C emission factors(tCO2/TJ) x oxidation factors dependent on fuels x 44/12

(When several sorts of fuel exist, the each value is summarized.)

The notations above are as follows.

CE(i): CO2 emission from the subject plant (i) in the baseline

STEP2: Calculation method of CO2 emission factor as the baseline

The CO2 emission factor is calculated to divide total CO2 emission from the subject power plants by total generated power on the yearly basis. The formula is shown below.

$CEF_X = \Sigma CE_X(i) \div \Sigma Op_X(i)$ <D.5.3>

The notations above are as follows.

CEF_X: Weighted average of CO2 emission factor from the subject power plants in the baseline in the year X

$CE_X(i)$: CO2 emission from the subject plant (i) in the baseline in the year X

$Op_X(i)$: Power generated by the subject plant (i) in the baseline in the year X

STEP3:Calculation method of baseline emission

The annual CO2 baseline emission is calculated by the multiplication of the above "CO2 emission factor " by annual sales of electricity in the project. The following is the formula.

Baseline emission in the year X = OpP_X x CEF

The notations above are as follows.

OpP X: Annual sales of electricity in the year X

(1-2) Calculation method of the baseline emission regarding heat

Followings here show several parameters.

- Alternative fuel: Hard coal
- Boiler efficiency: 85%＜Source：INSTITUTE FOR CHEMICAL PROCESSING OF COAL (INSTYTUT CHEMICZNEJ PRZERÓBKI WĘGLA)＞
- Carbon emission factor : 25.8 (tC/TJ) ＜Source：IPCC＞
- Oxidization rate: 0.98 ＜Source：IPCC＞
- N20, CH4 are excluded as a conservative manner

The following is the formula.

Baseline emission regarding heat = Heat utilized by customers / Boiler efficiency x Carbon emission factor x Oxidization rate x (44/12)

(2) Monitoring concept

Because the project is for the sales of electric power to the grid and the sales of heat to the neighbor heat purchasers, the project monitors the data regarding baseline emissions with the grid and heat purchasers.

Especially, the baseline for sales of electricity requires also monitoring with regard to the subject power plants connected to the grid because it is calculated with "Ex-post".

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

(1) Monitoring regarding project emission

Since the biopellets as the fuel of the project is made of biomass, the gas emission for greenhouse effect can be counted zero.

The gas emissions for greenhouse effect in the project are brought by coal consumption for the plant start-up, electricity purchased from the outside for producing biopellets. Therefore the amounts of coal consumption and electricity purchase need to be monitored.

The biopellets are produced at the 12 facilities apart from CHP in the project, and the transportation is done in accordance with the plan. Therefore, the gas emission is considered as the project emission.

But the emission is very small compared with emission reduction of the project, so the transportation distances are calculated with assumed values, but not monitored.

(2) Monitoring regarding leakage

As calculated in “Calculation of GHG emissions by sources”, the GHG emission regarding leakage is much smaller than emission reduction by the project. So the project takes an appropriate assumption for the above-mentioned data.

In the case that biomass is bad harvested in Rejowiec region and purchased from other reagion at emergency, the transportation distances are monitored because they are largely increased, and the emission is calculated based on the monitored data.

(3) Monitoring regarding baseline emission

Because in the baseline of the grid the emission coefficient for the greenhouse gas (CO2-t/kWh) from the grid is set as the baseline by “Ex-post”, the subject power plants with regard to the baseline, which is connected to the grid, is monitored in addition to the electric power sold by the project, as for the monitoring data deciding the baseline emission.

Because the emission coefficient for the greenhouse gas (CO2-t/GJ) of the heat purchaser is set as the baseline by “Ex-ante”, the parameters deciding the baseline emission is only the heat sold to the heat customers from the project.

D.3. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data to be kept?	Comment
D.3. 1	Quantitative	Amount of biopellets for CHP	t	m	Month	100%	Electronic/ paper	Till completion of crediting period	*Measurement just before input into a boiler*
D.3. 2	Quantitative	Amount of coal for plant start-up	t	m	Year	100%	Electronic/ paper	Till completion of crediting period	*Measurement just before input into a boiler*
D.3. 3	Quantitative	Total Electricity used in plant	kWh	m	Weekly	100%	Electronic/ paper	Till completion of crediting period	*Measurement at electric console from distribution grid*
D.3. 4	Quantitative	CO2 emission coefficient of electricity purchased from grid	t-CO2/kWh	c	Year	100%	Electronic/ paper	Till completion of crediting period	Use of grid average. Data are received from a related institute.

D.4. Potential sources of emissions which are significant and reasonably attributable to the project activity, but which are not included in the project boundary, and identification if and how data will be collected and archived on these emission sources.

When the shortage of biomass procurement happens, the project has to buy biomass from other region etc. Then, the data related to the transportation is monitored.

ID number	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data to be kept?	Comment
D.4.1	Transportation distance	Rapeseed residue transport distance	km	m	Daily	100%	Electronic/ paper	Till completion of crediting period	The transportation distance, sort of fuel, storage facilities and amount of the straw are recorded with issue of ID card which kind of the trucks and driver's name are registered in.

D.5. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHG within the project boundary and identification if and how such data will be collected and archived.

ID number	Data type	Data variable	Data unit	Will data be collected on this item? (If no, explain)	How is data archived? (electronic/ paper)	For how long is archived data to be kept?	Comment
D.5.1	Power	Electricity exported to grid	kWh	Yes	Electronic/Paper	Till completion of crediting period	*Measurement of sales of electricity at trans*
D.5.2	Heat	Heat exported to heat customers	MJ	Yes	Electronic/Paper	Till completion of crediting period	*Measurement of sales of heat at heat demanders*
D5.3	Power	Electricity Production of each power plant in the Grid	kWh	Yes	Electronic/Paper	Till completion of crediting period	Agencja Rynku Eergii S.A.
D.5.4	Fuel	Fuel use amount of each power plant in the Grid	GJ	Yes	Electronic/Paper	Till completion of crediting period	Agencja Rynku Eergii S.A.

D.6. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored. ***(Data items in tables contained in section D.3., D.4. and D.5. above, as applicable)***

Data	**Uncertainty level of data (High/Medium/Low)**	**Are QA/QC procedures planned for these data?**	**Outline explanation why QA/QC procedures are or are not being planned.**
D.3.1	Low	Yes	This data will be measured by measuring instrument meter. Meters will be subject to a regular maintenance.
D.3. 2	Low	Yes	This data will be measured by measuring instrument meter. Meters will be subject to a regular maintenance. Their reading will be double-checked by the electricity distribution company.
D3. 3	Low	Yes	This data will be calculated with public statistic data published by Energy Market Agency (AGENCJA RYNKU EERGII S.A.)
D.4.1	Medium	Yes	This data will be measured by measuring instrument meter. And this data will be double-checked by map.
D.5.1	Low	Yes	This data will be measured by measuring instrument meter. Meters will be subject to a regular maintenance.
D.5.2	Low	Yes	This data will be measured by measuring instrument meter. Meters will be subject to a regular maintenance.
D.5.3	Low	No	This data will be calculated with public statistic data published by Energy Market Agency (AGENCJA RYNKU EERGII S.A.)
D.5.4	Low	No	This data will be calculated with public statistic data published by Energy Market Agency (AGENCJA RYNKU EERGII S.A.)

D.7 Monitoring for Environment Impact:

A local administration performs the management and inspection with regard to environmental influences, and inspectors of a prefecture for environments generally conduct the inspection once a year.

The inspection items with regard to the environmental influences in the project are classified as drain water, noise, vibration, and emission of gases, and the number of detailed items becomes several hundreds. Measurement devices are settled for their corresponding inspection items. And the installations of the devices are to be examined at the time of construction approval and at the start of plant operation.

Energy Regulation Office (URE) does the inspection with regard to the environmental influences for electrical business approval. This inspection is different from the inspection of the local administration.

The outlines of measurements by a plant operator are shown below for environmental influences.

Measurement items	Outline of measurement
Gas emission	Measurement device on the top of a chimney measures SO2, NOx, CO and CO2 besides release of gas emission (m3/s). The emission of dioxin is measured and analysed by a gas chromatograph..
Drain water	Drain water is re-circulated through a drain disposal device and recovered solid material is not discarded, but reused as a fuel.
Noise	Noise is measured at trial run. After that, it is re-measured only at a time when a claim comes. Measurement points are a spot at 1m from machine wall, a place where people stay at any time and the outer surface of wall at site.
Vibration	A measurement device for vibration is installed near a turbine. The vibration is continuously measured for the monitoring of operation.

D.8 Project Management Planning:

With regard to the monitoring after the operation start of the project, management rules with regard to the project management described below are provided until the operation start of the project.

Authority and responsibility	➢ Authority and responsibility for registration, monitoring, measurement and reporting ➢ Procedures for calibration of monitoring equipment ➢ Procedures for maintenance of monitoring equipment and installations ➢ Procedures for monitoring, measurements and reporting ➢ Procedures identified for day-to-day records handling ➢ Procedures for dealing with possible monitoring data adjustments and uncertainties ➢ Procedures for internal audits of GHG project compliance with operational requirements where applicable ➢ Procedures for project performance reviews ➢ Procedures for corrective actions
Ability and Training	➢ Procedures for training of monitoring personnel
Emergency	➢ Procedures for emergency preparedness where emergencies can result in unintended emissions

D.9 Name of person/entity determining the monitoring methodology:

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E. Calculation of GHG emissions by sources

E.1 Description of formulae used to estimate anthropogenic emissions by sources of greenhouse gases of the project activity within the project boundary: (for each gas, source, formulae/algorithm, emissions in units of CO2 equivalent)

The following emission gas for greenhouse effect is considered by the project performance.

1) Emissions by combustion of biopellets
2) Emissions by combustion of fuel at the plant start-up
3) Emissions by electricity from grid use to produce the biopellets
4) Emissions by trucks regarding the transportation of biopellets to the CHP plant

E1.1 Combustion of rape residue

Emissions of CH4 and N2O by burning of biopellets estimated with the calculation method in D.1 are as follows.

Parameters and Assumption:

- Default Emission Factor of CH4 from Other Biomass and Wastes Combustion: 30 (kg/TJ) <Source: IPCC>
- Default Emission Factor of N2O from Other Biomass and Wastes Combustion: 4 (kg/TJ) <Source: IPCC>
- Calorific value of biopellets: 16 MJ/kg <Source: ENOD>
- Biopellets input: 55,994t (rapeseed cake: 11,700t + rape straw: 38,164t + beet pulp 6,130t) <Assumption>

(1) CH4 emission

CH4 emission (tCO2-equivalent) = Biopellets input (t) x 1,000kg/1t x Calorific value of biopellets(MJ/kg) x 1TJ/1,000,000MJ x Default Emission Factor of CH4 from Other Biomass and Wastes (kg/TJ) x 1t/1000kg x 21

= 55,994t x 1,000kg/1t x 16 MJ/kg x 1TJ/1,000,000MJ x 30 kg/TJ x 1t/1000kg x 21

= 564 t CO2-eq

(2) N2O emission

N2O emission (tCO2-equivalent) = Biopellets input (t) x 1,000kg/1t x Calorific value of biopellets(MJ/kg) x 1TJ/1,000,000MJ x Default Emission Factor of N2O from Other Biomass and Wastes (kg/TJ) x 1t/1000kg x 310

= 55,994t x 1,000kg/1t x 16 MJ/kg x 1TJ/1,000,000MJ x 4 kg/TJ x 1t/1000kg x 310

= 1,111 t CO2-eq

As stated in D.1, the emissions of CH4 and N2O in the project are very small compared with the emission reduction from the whole project. Then the emissions of CH4 and N2O by burning of biopellets are not based on monitoring data, but are the calculation results mentioned above.

E1.2 Combustion of fuel at the start-up of the CHP plant

GHG emission from coal combustion at the start-up is calculated with the following formula.

Parameters:

- Default C emission factor from coal: 25.8 (t/TJ) <Source: IPCC>
- Default Emission Factor of CH4 from coal: 0.7 (kg/TJ) <Source: IPCC >
- Default Emission Factor of N2O from coal: 1.6 (kg/TJ) <Source: IPCC >
- Oxidation factor for coal: 0.98 <Source: IPCC >
- Net Caloric Value of coal: 22.95 (MJ/t) <Source: IPCC >

GHG emission (tCO2-eq) = coal consumption(t)<D.3.1> x calorific value of coal(MJ/t) x 1TJ/1000MJ x oxidation factor for coal x (C emission factor from coal(tCO2/TJ) x 44/12 + Default Emission Factor of CH4 from coal(kg/TJ) x 1t/1000kg x 21 + Default Emission Factor of N2O from coal(kg/TJ) x 1t/1000kg x 310)

This GHG emissions regarding CHP start-up are dependant on the monitoring data of the amount of coal consumption. Therefore the calculation of GHG emissions regarding CHP start-up cannot be executed at present.

E1.3 Electricity use from grid to produce biopellets

GHG emission from biopellets producing is calculated as follows.

GHG Emission (tCO2-eq) = Total Electricity purchased from grid <D.3.2> x CO2 emission coefficient of electricity purchased from grid< D.3.3>

This GHG emissions regarding biopellets production are dependant on the monitoring data of the amount of electric purchase from the grid. Therefore the calculation of GHG emissions regarding biopellets production cannot be executed at present.

E1.4 Transportation of biopellets from the facilities to the CHP plant

The emissions with regard to the transportation of biopellets from the facilities to the CHP plant are as follows, based on the calculation method stated in D.1.

Parameters:

- Emission Factor for transportation (European Diesel Heavy-Duty Vehicles): 781(gCO2-eq/km) (=770gCO2/km + 0.06gCH4/km x 21 + 0.03gN2O/km x 310) <Source: IPCC >
- Average round transportation distance: 60(km) (30km for one way) <Assumption>

Annual Emission (tCO2-eq) = Emission factor for transportation(gCO2-eq/km) x 1t/1,000,000g x Average round transportation distance(km) x Annual frequency of transportation

Annual frequency of transportation is estimated as follows,

Annual frequency of transportation = Biomass input to the CHP<Assumption> / Load weight on truck
= 55,994(t) / 10(t)
= 5,599.4

The annual emission regarding the transportation of biopellets from the facilities to the CHP plant is shown below

Annual Emission (tCO2-eq) = Emission factor for transportation(gCO2-eq/km) x 1t/1,000,000g x Average round transportation distance(km) x Annual frequency of transportation
= 781(gCO2-eq/km) x 1t/1,000,000g x 60(km) x 5,599.4
= 262 tCO2-eq

As stated in D.1, the emissions with regard to transportation of biopellets are very small compared with the emission reduction from the whole project. Then the emissions are calculated based not on monitoring data, but on the estimated values the transportation distances and frequency by trucks.

E.2 Description of formulae used to estimate leakage, defined as: the net change of anthropogenic emissions by sources of greenhouse gases which occurs outside the project boundary, and that is measurable and attributable to the project activity: *(for each gas, source, formulae/algorithm, emissions in units of CO_2 equivalent)*

The emissions of greenhouse effect gases for leakage are as follows, based on the calculation method stated in D.1.2.

E.2.1 Emission regarding Cultivation

GHG emission from cultivation is calculated with the following formula.

Parameters:

- Default Emission Factor of CO2 from European non-road agricultural mobile: 3140 (g/kg) <Source: IPCC >
- Default Emission Factor of CH4 from European non-road agricultural mobile: 0.17 (g/kg) <Source: IPCC >
- Default Emission Factor of N2O from European non-road agricultural mobile: 1.3 (g/kg) <Source: IPCC >
- fuel consumption by tractors and harvesters for rape : 2.1 (kg/t) <Source: Institute for Building, Mechanization and Electrification of Agriculture >
- fuel consumption by tractors and harvesters for beet : 3.0 (kg/t) <Source: Institute for Building, Mechanization and Electrification of Agriculture >

- rape straw input for CHP: 38,164 (t) <Assumption >
- beet pulp input for CHP: 6,130 (t) <Assumption >

GHG emission (tCO_2-eq) = (rape straw input for CHP (t) x fuel consumption by tractors and harvesters for rape(kg/t) + beet pulp input for CHP (t) x fuel consumption by tractors and harvesters for beet(kg/t)) x (Default Emission Factor of CO_2 from European non-road agricultural mobile(g/kg) + Default Emission Factor of CH_4 from European non-road agricultural mobile (g/kg) x 21 + Default Emission Factor of N_2O from European non-road agricultural mobile(g/kg) x 310) x 1t/1,000,000g

= (38,164 t x 2.1 (kg/t) + 6,130t x 3.0 (kg/t)) x (3140 (g/kg) + 0.17 (g/kg) x 21 + 1.3 (g/kg) x 310) x 1t/1,000,000g

= 346 tCO_2-eq

As stated in D.1, the emissions with regard to cultivation are very small compared with the emission reduction from the whole project. Then the emissions are calculated based not on monitoring data, but are the calculation results mentioned above.

E.2.2 Emission regarding Fertilization

N_2O emission is occurred by fertilizing crop fields. N_2O emission from cultivation is calculated with the following formula.

Parameters:

- Default Emission Factor for direct emission of N_2O-N from agricultural soils: 0.0125 (kgN_2O-N/kgN-input) <Source: IPCC >
- Default Emission Factor for indirect emission (leaching) of N_2O-N from agricultural soils: 0.025 (kgN_2O-N/kgN-leaching) <Source: IPCC >
- Default values of parameter of leaching for indirect emission of N_2O-N from agricultural soils: 0.3 (kgN-leaching/kgN-input)
- Average fertilizer (ammonium niter) input for rape : 1.24 (kg/t) <Source: Institute for Building, Mechanization and Electrification of Agriculture >
- Average fertilizer (ammonium niter) input for beet : 3.6 (kg/t) <Source: Institute for Building, Mechanization and Electrification of Agriculture >
- Average fertilizer (uera) input for beet : 2.6 (kg/t) <Source: Institute for Building, Mechanization and Electrification of Agriculture >
- Average N content of ammonium niter: 34 (%) <Source: Institute for Building, Mechanization and Electrification of Agriculture >
- Average N content of uera: 46 (%) <Source: Institute for Building, Mechanization and Electrification of Agriculture >
- rape straw input for CHP: 38,164 (t) <Assumption >
- beet pulp input for CHP: 6,130 (t) <Assumption >

N_2O emission (tCO_2-eq) = { rape straw input for CHP (t) x Average fertilizer (ammonium niter) input for rape(kg/t) x Average N content of ammonium niter x beet pulp input for

CHP (t) x (Average fertilizer (ammonium niter) input for beet(kg/t) x Average N content of ammonium niter + Average fertilizer (uera) input for beet(kg/t) x Average N content of uera) } x (Default Emission Factor for direct emission of N2O-N from agricultural soils(kgN2O-N/kgN-input) + Default values of parameter of leaching for indirect emission of N2O-N from agricultural soils(kgN-leaching/kgN-input) x Default Emission Factor for indirect emission (leaching) of N2O-N from agricultural soils(kgN2O-N/kgN-leaching)) x 1t/1000kg x 40/12 x 310

= {38,164(t) x 1.24 (kg/t) x 0.34 + 6,130 (t) x (3.6 (kg/t) x 0.34 + 2.6 (kg/t) x 0.46) } x (0.0125(kgN2O-N/kgN-input) + 0.3(kgN-leaching/kgN-input) x 0.025(kgN2O-N/kgN-leaching)) x 1t/1,000kg 40/12 x 310

= 639 tCO2-eq

As stated in D.1, the emissions with regard to transportation of biopellets are very small compared with the emission reduction from the whole project. Then the emissions are calculated based not on monitoring data, but are the calculation results mentioned above.

E.2.3 Transportation of biomass to the biopellet-production facility

The emissions with regard to the transportation of biopellets from the facilities to the CHP plant are as follows, based on the calculation method stated in D.1.2

Parameters:

- Emission Factor for transportation (European Diesel Light-Duty Vehicles): 286(gCO2-eq/km) (=280gCO2/km + 0.005gCH4/km x 21 + 0.02gN2O/km x 310) <Source: IPCC >
- Average round transportation distance: 12(km) (6km for one way) <Assumption>

Annual Emission (tCO2-eq) = Emission factor for transportation(gCO2-eq/km) x 1t/1,000,000g x Average round transportation distance(km) x Annual frequency of transportation

Annual frequency of transportation is estimated as follows,

Annual frequency of transportation = Biomass input to the CHP<Assumption> / Load weight on truck

= 55,994(t) / 4(t)

= 13998.5

The annual emission regarding the transportation of biopellets from the facilities to the CHP plant is shown below

Annual Emission (tCO2-eq) = Emission factor for transportation(gCO2-eq/km) x 1t/1,000,000g x Average round transportation distance(km) x Annual frequency of transportation

= 286(gCO2-eq/km) x 1t/1,000,000g x 12(km) x 13998.5 = 48 tCO2-eq

As stated in D.1, the emissions with regard to transportation of biomass are very small compared with the emission reduction from the whole project. Then the emissions are calculated based not on monitoring data, but on the estimated values the transportation distances and frequency by trucks.

E.2.4 Transportation of rape residue from the other region

When biomass is purchased from other region at emergency, the emissions are calculated with the formula below because the transportation distance may be much longer.

Annual Emission (tCO2-eq) = Emission factor (tCO2-eq/km) x Annual transportation distances (km)<D.4.1>

E.3 The sum of E.1 and E.2 representing the project activity emissions:

Net emissions by project activity = 564 + 1,111 + 262 + 346 + 639 + 48
= 2,971 (tCO2) per year.

E.4 Description of formulae used to estimate the anthropogenic emissions by sources of greenhouse gases of the baseline: *(for each gas, source, formulae/algorithm, emissions in units of CO_2 equivalent)*

E4.1 Calculation of the baseline emission regarding electricity

The baseline emission regarding electricity is the CO2 emission factor brought by the operating margin, which refers to the marginal plant as, mentioned before.

But as mentioned before, the carbon emission factor in the grid tends to decrease in the future; therefore the baseline is set with “Ex-post” under a conservative thought. The measurement data of each power plant necessary for calculation will be acquired from Energy Market Agency (AGENCJA RYNKU EERGII S.A: ARE). .

The baseline emissions are calculated based on the data for the past 3 years (2001 ~ 2003) <Source : AGENCJA RYNKU EERGII S.A.> for reference here.

The followings are the fuel consumption of brown coal and hard coal plants except cogeneration and renewable energy plants in 2001, 2002 and 2003.

Table Fuel consumption in brown coal and hard coal plants (2001)

<Source : AGENCJA RYNKU EERGII S.A.>

Specification	Electricity Production		Coal			gas fuels			liquid fuels		
			quantity (kt)	average heat quantity (kJ/kg)	consumption (GJ)	quantity (k. M3)	average heat quantity (kJ/m3)	consumption (GJ)	quantity (kt)	average heat quantity (kJ/kg)	consumption (GJ)
'Power plants on brown coal	50,557	GWh	58,348	8,652	504,827	-	-	-	44	40,975	1,782
'Power plants on hard coal	62,167	GWh	27,710	20,933	580,053	340,396	18,771	6,390	96	41,796	4,017
Total	112,724	GWh	86,058		1,084,880	340,396		6,390	140		5,799

Note: See Annex 2 for a list of Power plants

Table Fuel consumption in brown coal and hard coal plants (2002)

<Source : AGENCJA RYNKU EERGII S.A.>

Specification	Electricity Production		Coal			Gas fuels			Liquid fuels		
			Quantity (kt)	Average heat quantity (kJ/kg)	Consumption (GJ)	Quantity (k. M3)	Average heat quantity (kJ/m3)	Consumption (GJ)	Quantity (kt)	Average heat quantity (kJ/kg)	Consumption (GJ)
'Power plants on brown coal	48,880	GWh	56,905	8,557	486,936	-	-	-	43	40,514	1,726
'Power plants on hard coal	62,463	GWh	27,487	21,117	580,443	303,604	18,755	5,694	93	41,410	3,851
Total	111,343	GWh	84,392		1,067,379	303,604		5,694	136		5,577

Note: See Annex 2 for a list of Power plants

Table Fuel consumption in brown coal and hard coal plants (2003)

<Source : AGENCJA RYNKU EERGII S.A.>

Specification	Electricity Production		Coal			Gas fuels			Liquid fuels		
			Quantity (kt)	Average heat quantity (kJ/kg)	Consumption (GJ)	Quantity (k. M3)	Average heat quantity (kJ/m3)	Consumption (GJ)	Quantity (kt)	Average heat quantity (kJ/kg)	Consumption (GJ)
'Power plants on brown coal	50,557	GWh	59,297	8,568	508,071	-	-	-	43	40,756	1,734
'Power plants on hard coal	66,151	GWh	28,930	21,289	615,904	336,781	18,748	6,314	90	41,496	3,736
Total	116,707	GWh	88,228		1,123,975	336,781		6,314	133		5,470

Note: See Annex 2 for a list of Power plants

(1) Calculation method of CO2 emission from fuel on each power plants

CE(i)(tCO2) = fuel consumption(i)(TJ) x C emission factors(tCO2/TJ) x oxidation factors dependent on fuels x 44/12

(When several sorts of fuel exist, the each value is summarized.)

The notations above are as follows.

CE(i): CO2 emission from the subject plant (i) in the baseline

Followings are the above calculating results of the CO2 emission from Power plants on brown coal and hard coal in 2001, 2002 and 2003.

Table CO2 emission from Power plant on brown coal and hard coal (2001) (kt-CO2)

Specification	Coal	Gas fuels	liquid fuels	Total
'Power plants on brown coal	50,067	-	129	50,196
'Power plants on hard coal	53,776	357	292	54,424
Total	103,842	357	421	104,620

Table CO2 emission from Power plant on brown coal and hard coal (2002) (kt-CO2)

Specification	Coal	Gas fuels	Liquid fuels	Total
Power plants on brown coal (EWB)	48,292	-	125	48,418
Power plants on hard coal (EWK)	53,812	318	280	54,409
Total	102,104	318	405	102,827

Table CO2 emission from Power plant on brown coal and hard coal (2003) (kt-CO2)

Specification	Coal	Gas fuels	Liquid fuels	Total
'Power plants on brown coal	50,388	-	126	50,514
'Power plants on hard coal	57,099	352	271	57,723
Total	107,488	352	397	108,237

(2) Calculation method of CO2 emission factor as the baseline

The CO2 emission factor is calculated to divide total CO2 emission from the subject power plants by total generated power on the yearly basis. The formula is shown below.

$$CEF_X = \Sigma CE_X(i) \ / \ \Sigma Op_X(i)$$ <D.5.3>

The notations above are as follows.

CEF_X: Weighted average of CO2 emission factor of the subject power plants in the baseline in the year X

$CE_X(i)$: CO2 emission from the subject plant (i) in the baseline in the year X

$Op_X(i)$: Power generated by the subject plant (i) in the baseline in the year X

The CO2 emission unit value in 2001, 2002 and 2003 was calculated by the above method and the results are shown below.

$\mathbf{CEF_{2001}}$ = 104,620 (ktCO2) / 112,724 (GWh) = 0.93 (tCO2/MWh)

$\mathbf{CEF_{2002}}$ = 102,827 (ktCO2) / 111,343 (GWh) = 0.92 (tCO2/MWh)

$\mathbf{CEF_{2003}}$ = 108,237 (ktCO2) / 116,707 (GWh) = 0.93 (tCO2/MWh)

0.92 (t-CO2/MWh) in 2002, which is the lowest value among carbon emission factors for the past 3 years above, is used as a reference value.

(3) Calculation method of baseline emission

The annual CO2 baseline emission is calculated by the multiplication of the above "CO2 emission unit value" by annual sales of electricity in the project. The following is the formula.

Baseline emission in the year X = OpP_X <D.5.1> x CEF

The notations above are as follows.

OpP_X: Annual sales of electricity in the year X

We use the values annually achieved as the power generation / year in calculating the baseline emission regarding the electric power. But we calculate here the baseline emission for reference by applying 76,038(MWh) of power sold to the Grid / year planned at present.

0.92 (tCO2/MWh) x 76,038 (MWh) = 69,955 (tCO2)

E4.2 Baseline regarding heat

As mentioned above, annual amount of selling heat is 59,104(MWh) x 3.6 = 212,774 (GJ). Candidate heat purchasers in Rejowiec are housing developments and individual buildings, and they are purchasing heat generated by hard coal boilers. Therefore the current hard coal boilers are suited as the baseline.

We use the values annually achieved as the heat generation / year in calculating the baseline emission regarding the heat. But we calculate here the baseline emission for reference by applying 212,774 (GJ) of heat generation / year planned at present.

Followings here show several parameters.

- Alternative fuel: Hard coal
- Boiler efficiency: 85%＜Source：INSTITUTE FOR CHEMICAL PROCESSING OF COAL

(INSTYTUT CHEMICZNEJ PRZERÓBKI WĘGLA)＞

- Carbon emission factor : 25.8 (tC/TJ) ＜Source : IPCC＞
- Oxidization rate: 0.98 ＜Source : IPCC＞
- N2O and CH4 are excluded as conservative settings.

The following is the formula.

Baseline emission regarding heat = Heat utilized by customers<D.5.2> / Boiler efficiency x Carbon emission factor x Oxidization rate x (44/12)

The emission in the case that the whole planned heat of 212,774 (GJ)is sold is calculated as a reference value below.

Baseline emission regarding heat = 212,774 (GJ) x 10^{-3} / 0.85 x 25.8(tC/TJ) x 0.98 x (44/12)
= 23,319 (tCO2)

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

The emission reduction due to the difference between the baseline emission and the project emission are calculated with the following formula.

Emission reduction = Emission from Grid regarding electric sale
+ Emission from hard coal boiler regarding heat sale
- Emission from project activity
- Emission from leakage

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

In the table below we present the reduction of the gas emission for greenhouse effect in the project, based on the baseline and project emission during the credit period. (We assume that early credit can be obtained in 2006 and 2007. As to 2006, the term from September to December is assumed as a credit period.)

Table Baseline and project emission during the credit period（t-CO2e/y）

Year	Year	Baseline emissions		Project emissions		Emissions reductions
		Electricity	Heat	Project	Leakage	
1	2006	23,318	7,773	646	344	30,101
2	2007	69,955	23,319	1,938	1,033	90,303
3	2008	69,955	23,319	1,938	1,033	90,303
4	2009	69,955	23,319	1,938	1,033	90,303
5	2010	69,955	23,319	1,938	1,033	90,303
6	2011	69,955	23,319	1,938	1,033	90,303
7	2012	69,955	23,319	1,938	1,033	90,303

F. Environmental impacts

F.1. Documentation on the analysis of the environmental impacts, including transboundary impacts *(Please attach the documentation to the JI-PDD.)*

Environmental Impact Assessment due to the project activity is carried out. The summary of the Environment Impact Asses report is as follows.

1) Emission of pollution into the atmosphere including SO_2, NO_2, CO and dust

From the analysis of the calculated pollution concentrations during biomass combustion process, it results that:

- Nitrogen dioxide concentration does not exceed the emission standard
- Sulphur dioxide concentration is close to the emission standard (exceeding it minimally)
- PM10 dust concentration is higher than the emission standard – to reach this level dust extractor efficiency of 96% is needed (currently the boilers are equipped with dust extractors of the efficiency of 80%).

Analyzing the results of the concentration distributions calculations, it can be stated that for the assumed emission parameters it is possible for the projected object to keep the current air pollution concentration levels in atmospheric air.

2) Noise emission

The anticipated sugar factory modernization shall not change substantially the extent of the sugar factory's acoustic noxiousness. From the analysis presented it results that the standard of noise penetrating to the environment for one-family housing areas, with services and areas with roads or rails is currently possible to be kept. However, in order to keep the standard at night-time it seems necessary to recommend the fulfillment of the following conditions:

- the use of windows of acoustic insulating power of over 25 dB in the main production building (sugar end),
- acoustic baffle construction along the boundary of the area of the sugar factory, near beet unloading unit,
- keeping the noise in the main production building from exceeding 85 dB,
- silencing or the use of high absorption acoustic baffles near the washer and beet purification station.

3) Production of sewage

In case of use of rape renewable biomass in the renewable electric energy production no industrial sewage shall be generated. Only sanitary sewage shall be generated, the quantity of which is estimated at about 8 m3/day. In case of beet biomass use in the production the quantity of sewage shall be practically equal to the quantity of sewage generated in sugar production i.e. about 77000 m3/year. The planned investment will cause the situation of the waste water economy only to improve.

The exploited technology does not cause odor emission and the stabilized excessive deposit produced during biological treatment constitutes, after dehydration, a biomass component in energetic fuel production.

4) Production of waste material

The significant reduction of the quantity of solid fuel combustion products resulting from the sugar factory's modernization is an unquestionable profit for the environment. With the current coal consumption in the quantity of about 14000 t/year the current production of noxious waste of coal ash is about 2520 t/year. As a result of the investment project consisting of changing coal to biomass fuel waste production is changed into production of artificial fertilizer component in quantity of 3170 to (ultimately) 3710 t/year.

The solid waste is returned to closed natural circulation effectively and with environmental benefit.

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

none

G. Stakeholders comments

G.1. Brief description of the process on how comments by local stakeholders have been invited and compiled:

We received comments from stakeholders, that is, relevant local municipalities and labor union of the Rejowice sugar factory. Followings are how to get those and the summary of comments.

(1) Date: October 25, 2004
(2) Place: Meeting room in Rejowiec branch of Lubelski Agricultural Consultancy Center
(3) How to get comments: Visit and hearing
(4) Interviewer: Mizuho Information & Research Institute

G.2. Summary of the comments received:

(1) Local government A
This business has promising future on both the environmental aspect and the profit aspect.
We would like to cooperate to the realization of this project pleasantly.

(2) Local government B
This project meets the prefecture's expectation about creation of employment and increase of earnings.

(3) Local government C
It is possible to produce all grains and rapes that this project demands in our district.
I hope this project will make a good influence on local people.

(4) Local government D
I believe that the project effects well on the agricultural circumstance of our area.
It is possible for farmers to convert the crop to the industrial one if it is profitable.

(5) Labor union
Because the possibility of new employment is quite high, labor union expected greatly on this project..

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

None

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Enterprise for Realization of Renewable Energy (Przedsiębiorstwo Realizacji Energetyki Odnawialnej (ENOD), Co., Ltd..
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Annex 2

TABLE: BASELINE DATA

TABL The key element for the baseline calculation

	unit	Lignite	Coking Coal	NG	Oil	Source
C emission factor	tC/TJ	27.6	25.8	15.3	20.0	IPCC
Fraction of Carbon Oxidised	%	0.98	0.98	0.995	0.99	IPCC

TABL. 3. 14. (32) FUEL INPUT FOR ELECTRICITY GENERATION cont.

Specification		waste fuel energy content	input fuel energy content	input fuel use indicator
		TJ		kJ/kWh
TOTAL	**2002**	**1,470**	**1,215,153**	**9,191**
	2003	**2,133**	**1,274,746**	**9,091**
EWB	2002	-	488,679	9,998
	2003	-	509,782	9,926
EWK	2002	1,129	591,099	9,463
	2003	51	624,665	9,443
EC_1	2002	-	66,679	5,826
	2003	-	69,218	5,703
EC_2	2002	-	34,955	6,349
	2003	-	38,318	6,419
EC_3	2002	321	13,251	7,161
	2003	1,565	12,075	7,254

EC_4	2002	-	3,975	6,365
	2003	1	4,098	6,597
ECN	2002	21	16,516	11,509
	2003	516	16,590	11,503

TABL. ELECTRICITY GENERATED AND SUPPLIED TO THE GRID

Specification		Total	In this combined	Self-cons. for el.energy generation	Self-cons. for heat generation	Remaining cons. and direct sale to consumets	Energy supplied to the grid
		GWh					
TOTAL	2002	132,351	18,497	9,979	1,958	2,575	117,839
	2003	140,218	19,072	10,551	1,972	5,456	122,239
EWB	2002	48,880	533	3,780	77	931	44,091
	2003	51,358	526	4,031	76	1,492	45,759
EWK	2002	62,463	1,684	5,003	189	481	56,789
	2003	66,151	1,739	5,219	202	2,603	58,127
EC1	2002	11,446	9,270	619	909	33	9,885
	2003	12,137	9,758	651	928	46	10,512
EC2	2002	5,506	4,493	309	376	175	4,646
	2003	5,969	4,721	315	385	308	4,961
EC3	2002	1,850	1,480	111	219	7	1,513
	2003	1,665	1,287	105	203	7	1,349
EC4	2002	625	411	42	83	3	498
	2003	621	398	43	77	23	477
ECN	2002	1,435	506	108	104	945	279
	2003	1,442	531	101	101	978	263

EWB: Power plants on brown coal
EWK: Power plants on hard coal
EC1: Heat Power Plants (installed capacity of a power from 200 MW)
EC2: 'Heat Power Plants (installed capacity of a power from 100 MW to 199 MW)
EC3: Heat Power Plants (installed capacity of a power from 50 MW to 99 MW)
EC4: Heat Power Plants (installed capacity of a power to 49 MW)
ECN: Independent Heat Power Plants

TABL PUBLIC HEAT POWER STATIONS BY TYPE (2003)

Name of group	Installed power	Available power	Elctricity production	Symbol of group
	MW	MW	GWh	2003 (2002)
TOTAL	**30520.6**	**29730.9**	**140,218**	
Power plants on brown coal	**9,324.0**	**8,532.0**	**51,358**	**EWB**
El. Bełchatów S.A.	4,420.0	4,420.0	28,276	EWB
El. Turów	2,166.0	1,789.0	9,991	EWB
El. Pątnów	1,600.0	1,200.0	7,174	EWB
El. Adamów	600.0	600.0	3,490	EWB
El. Konin	538.0	523.0	2,426	EWB
Power plants on hard coal	**15,869.7**	**16,129.0**	**66,151**	**EWK**
PKE S.A.	5,052.7	4,930.0	18,822	EWK
El. Jaworzno 3	*1,345.0*	*1,345.0*	*4,991*	*EWK*
El. Łaziska	*1,155.0*	*1,155.0*	*4,426*	*EWK*
El. Łagisza	*840.0*	*710.0*	*3,038*	*EWK*
El. Siersza	*786.0*	*805.0*	*2,837*	*EWK*
El. Jaworzno 2	*290.0*	*290.0*	*972*	*EWK*
El. Halemba	*200.0*	*200.0*	*476*	*EWK*
El. Blachownia	*165.0*	*158.0*	*628*	*EWK*
Ec. Katowice	*135.5*	*135.0*	*902*	*EWK*
Ec. Bielsko-Biała	*81.2*	*77.0*	*261*	*EWK*
Ec. Bielsko-Północ	*55.0*	*55.0*	*291*	*EWK*
El. Kozienice S.A.	2,820.0	2,845.0	11,154	EWK
El. Połaniec S.A.	1,600.0	1,800.0	7,308	EWK
El. Rybnik S.A.	1,775.0	1,775.0	9,695	EWK
El. Dolna Odra	1,600.0	1,742.0	4,745	EWK
El. Opole S.A.	1,466.0	1,506.0	8,359	EWK
El. Ostrołęka B	626.0	626.0	2,130	EWK

El. Skawina S.A.	590.0	575.0	2,730	EWK
El. Stalowa Wola S.A.	340.0	330.0	1,208	EWK
Heat Power Plants (installed capacity of a power from 200 MW)	**2,790.2**	**2,778.1**	**12,137**	**EC_1**
Ec. Siekierki	622.0	619.0	2,542	EC_1
Ec. Kraków S.A.	460.0	446.0	1,817	EC_1
Ec. Żerań	250.2	298.0	1,449	EC_1
Ec. Poznań-Karolin	275.5	275.5	1,455	EC_1
Ec. Wrocław	255.0	250.0	1,065	EC_1
Ec. Gdańska 2	243.1	232.6	1,059	EC_1
Ec. Lublin Wrotków Sp. z o.o.	231.0	231.0	1,567	EC_1
Ec. Chorzów ELCHO 2	238.4	226.0	280	EC_1 *(-)*
Ec. Łódź 4	215.0	200.0	903	EC_1
Heat Power Plants (installed capacity of a power from 100 MW to 199 MW)	**1,460.3**	**1,378.9**	**5,969**	**EC_2**
Ec. Łódź 3	198.5	198.5	810	EC_2
Ec. Bydgoszcz 2	227.0	183.0	984	EC_2
Ec. Białystok S.A.	196.7	167.0	644	EC_2
ZEC. Bytom S.A.	133.8	130.0	221	EC_2
El. Pomorzany	120.0	130.0	628	EC_2
Ec. Nowa Sarzyna Sp. z o.o.	112.8	128.9	774	EC_2
Ec. Gorzów S.A.	127.5	122.5	674	EC_2
Ec. Czechnica	132.0	110.0	310	EC_2
Ec. Gdyńska 3	110.0	108.0	593	EC_2
Ec. Rzeszów	102.0	101.0	331	EC_2 *(-)*
Heat Power Plants (installed capacity of a power from 50 MW to 99 MW)	**578.6**	**483.9**	**1,665**	**EC_3**
Ec. Zabrze S.A.	106.0	98.0	220	EC_3
Ec. Łódź 2	128.1	81.0	345	EC_3
Ec. Szczecin	88.0	78.0	220	EC_3
Ec. Będzin S.A.	81.5	77.4	444	EC_3
Ec. Ostrołęka A	93.5	75.0	281	EC_3
Ec. Chorzów ELCHO 1	81.5	74.5	154	EC_3
Heat Power Plants (installed capacity of a power to 49 MW)	**162.0**	**133.5**	**621**	**EC_4**
Ec. Elbląg Sp. z o.o.	49.0	42.0	148	EC_4
Ec. Tychy S.A.	40.0	40.0	290	EC_4
Ec. Zielona Góra S.A.	23.3	22.5	109	EC_4

Ec. Bydgoszcz 1	14.0	10.0	25	EC_4	
Ec. Pruszków	6.3	8.0	24	EC_4	
Ec. Kalisz Piwonice S.A.	8.0	7.0	26	EC_4	
Ec. Bydgoszcz 3	21.4	4.0	0	EC_4	
Independent Heat Power Plants	**335.8**	**295.5**	**1,442**	**ECN**	
Ec. Zofiówka	64.0	64.0	474	ECN	ECN_1
Ec. ENERGETYKA "BORUTA" Sp. z o.o.	36.3	36.3	39	ECN	ECN_2
Ec. Marcel Spółka z o.o.	34.5	34.5	204	ECN	ECN_2
Ec. Moszczenica	36.0	29.0	137	ECN	ECN_2
Ec. Mielec Spółka z o.o.	30.4	24.4	48	ECN	ECN_2
Ec. Dębieńsko	33.5	23.0	173	ECN	ECN_2
Ec. Knurów	15.5	13.5	78	ECN	ECN_2
EC-WSK Spółka z o.o. Rzeszów	12.0	12.0	62	ECN	ECN_2
Ec. ENERGOBALTIC Sp. z o.o.	11.0	11.0	19	ECN	
ZE H.Cz. Ec. ELSEN Sp. z o.o.	24.0	9.5	41	ECN	ECN_2
Ec. Zduńska Wola Spółka z o.o.	8.0	8.0	23	ECN	ECN_2
Ec. Pniówek	6.4	6.4	40	ECN	
Ec. GIGA Spółka z o.o.	6.0	6.0	23	ECN	ECN_2
Ec. "OPEC-GRUDZIĄDZ" Sp. z o.o.	6.0	6.0	26	ECN	ECN_2
Ec. ANDROPOL Spółka z o.o.	4.7	4.7	6	ECN	ECN_2
Ec. H.Cegielski "ENERGOCENTRUM" Sp. z o.o.	4.2	4.2	8	ECN	ECN_2
Ec. Suszec	2.7	2.7	24	ECN	ECN_2
Ec. GAZOENERGIA Sp. Cywilna Kosarzyn	0.6	0.3	0	ECN	
Ec. ENERGOTOR Toruń S.A.	0.0	0.0	18	ECN	ECN_2
TOTAL on hard coal	**20,708.7**	**20,713.6**	**86,103**		

ANNEX 3

The subject power plants for baseline monitoring and data expected to be collected

Table 1 shows the subject power plants for the baseline monitoring with regard to the grid for sales of electricity. New power plants will be added for monitoring in an appropriate time.

Monitoring is performed per each unit of plants and the data in Table 2 will be collected from National Emission Centre.

Table1 Monitoring Target Power Plant

Power plants on brown coal El. Bełchatów S.A. El. Turów El. Pątnów El. Adamów El. Konin
Power plants on hard coal PKE S.A. *Ec. Katowice* *El. Jaworzno 2* *El. Jaworzno 3* *El. Łaziska* *El. Łagisza* *El. Siersza* *El. Blachownia* *El. Halemba* *Ec. Bielsko-Biała* *Ec. Bielsko-Północ* El. Kozienice S.A. El. Połaniec S.A. El. Rybnik S.A. El. Dolna Odra El. Opole S.A. El. Ostrołęka B El. Skawina El. Stalowa Wola S.A.
Heat Power Plants (installed capacity of a power from 200 MW) Ec. Siekierki Ec. Kraków S.A. Ec. Żerań Ec. Poznań-Karolin Ec. Wrocław Ec. Gdańsk 2 Ec. Lublin Ec. Łódź 4
Heat Power Plants (installed capacity of a power from 100 MW to 199 MW) Ec. Łódź 3 Ec. Bydgoszcz 2 Ec. Białystok S.A. El. Pomorzany ZEC. Bytom S.A. Ec. Nowa Sarzyna Sp. z o.o. Ec. Gorzów S.A. Ec. Czechnica Ec. Gdynia 3
Heat Power Plants (installed capacity of a power from 50 MW to 99 MW) Ec. Zabrze S.A. Ec. Łódź 2 Ec. Szczecin Ec. Będzin S.A. Ec. Ostrołęka A Ec. Chorzów S.A.
Heat Power Plants (installed capacity of a power to 49 MW) Ec. Elbląg Sp. z o.o. Ec. Tychy S.A. Ec. Zielona Góra S.A. Ec. Bydgoszcz 1 Ec. Pruszków Ec. Kalisz Piwonice S.A. Ec. Bydgoszcz 3 Ec. Poznań - Garbary

Independent Heat Power Plants (installed capacity of a power from 50 MW) Ec. VICTORIA Spółka z o.o. Ec. Zofiówka	Ec. PZL Mielec Spółka z o.o. Ec. Elsen Ec. Suszec Ec. Zduńska Wola Spółka z o.o. Ec. GIGA Spółka z o.o. Ec. ENERGOTOR Toruń S.A. Ec. "OPEC-GRUDZIĄDZ" Ec. ANDROPOL Spółka z o.o. Ec. "ENERGOCENTRUM" H. Cegielski Spółka z o.o. Ec. Kosarzyn Spółka Cywilna
Independent Heat Power Plants (installed capacity of a power to 49 MW) Ec. ENERGETYKA "BORUTA" Sp. z o.o. Ec. Marcel Spółka z o.o. Ec. Moszczenica Ec. Dębieńsko Ec. Knurów Ec. WSK-Rzeszów Spółka z o.o.	