Ministry of Environment Sponsoring Project FY2004

CDM/JI Project Study FY2004

Study for Cogeneration Project with Herbal Biomass utilizing Inactive Sugar Factories in Poland

Report Summary

March 2005

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(1)Basic data for project implementation

■Outline of the proposed project and the background of planning

This project is to implement a cogeneration project with herbal biomass (beet, rape residue) as fuel, utilizing the existing cogeneration facilities in Rejowiec factory, a state-run sugar factory in Poland which has been closed since 2001. This project is being promoted because the factory desires to effectively utilize the industrial site and existing facilities and also the neighboring farmers strongly seek that purchase of beet will be continued.

In this project, instead of beet with a high sugar content which the neighboring farmers are now producing, a beet with higher growing rate is raised under contract and it is utilized as fuel for cogeneration project, together with rape residue (strained lees and straw) defecated from the neighboring farms. The power to be produced will be sold to power supply companies and the heat to heat supply companies or neighboring heat consumers.

In Poland, it is aimed to use 7.5% of domestic production of electricity for power selling based on renewable energy in 2010, in response to EU Directive for introduction of renewable energy. So this project should also be consistent with the country's policies.

■Overview of the host country

The Republic of Poland is largest among Central and Eastern European countries in population, land area and economics. The country is located along the coast of Baltic Sea and shares a common border with Germany, Czech Republic, Slovak Republic, Ukraine, Republic of Belarus, Republic of Lithuania and Russia Federation.

The country was founded in 10th century and used to have big power in Eastern Europe from 15th to 17th century. In the end of 18th century, it was divided into the three neighboring countries, Germany, Austria and Russia, resulting in that the country had disappeared for 123 years until the end of World War Ⅰ. During World War Ⅱ, it was divided and occupied by Soviet and Germany. The number of persons killed in WWⅡ including casualties in Auschwitz camp reached one-fifth of the population, which is the highest rate over the world. The country was incorporated in Soviet bloc after WWⅡ, but it actively carried on a campaign for liberalization such as "Solidarity" movement (1980-1981), leading the democracy movement in Eastern Europe. In September 1989, the first non-socialist administration began in the former Soviet bloc.

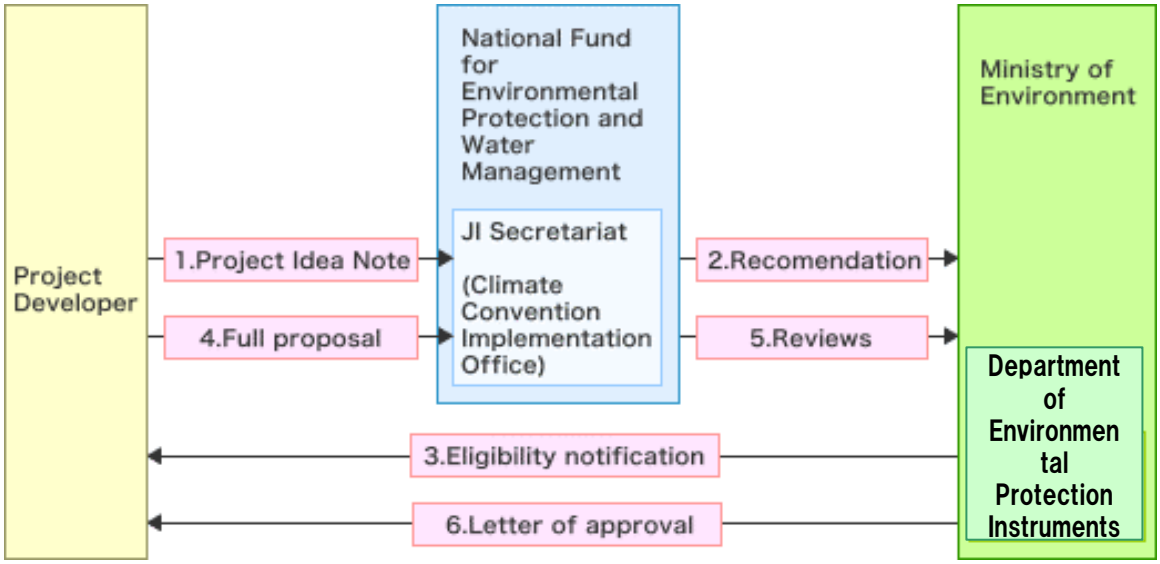
The country became a member of NATO in March, 1999, with a goal of "Integrated into Europe" and also of EU in May, 2004.

■Policies and situation on CDM/JI, including the acceptance criteria for CDM/JI and establishment of DNA of the host country

The JI Secretariat at the National Fund for Environmental Protection and Water Management is considered as the primary focal point. In the approval stage, the Department of Environmental

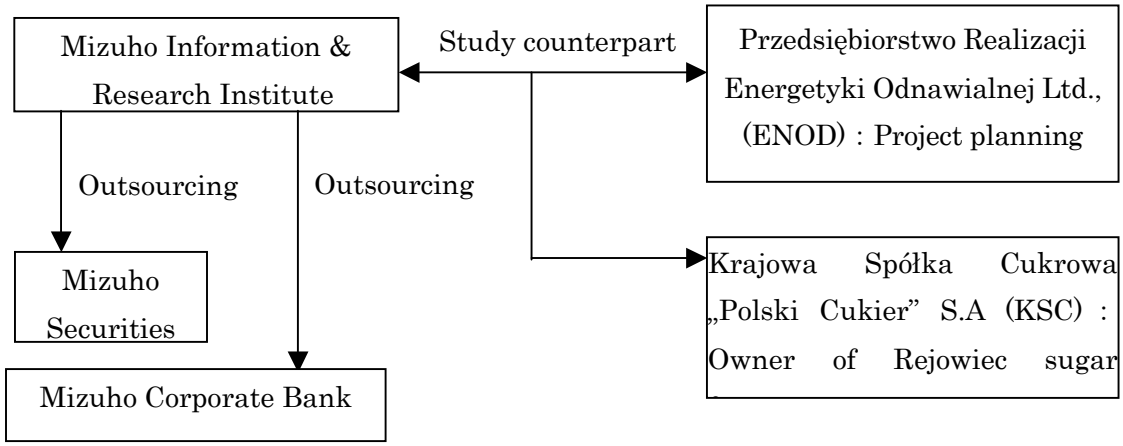
Protection Instruments(DEPI) in the Ministry of Environment conducts the final approval.

Although the official criteria for JI approval has not been defined in Poland, the Ministry of Environment sets up-front payment (investment and/or payment in advance for emissions) for the project by a donor country as a condition for JI approval.



（Source: The data from The Regional Environmental Center for Central and Eastern Europe is quoted with partial amendment）

■System of the study(domestic, host country, etc.)



(2) Description of the project

■Details of the project

1)Biomass fuel procurement

Considering the characteristics of the local agriculture, it is planned to use sugar beet pulp or feed beet biomass, rape straw and strained rape lees as main biomass fuel for this project. The table below shows the biomass procurement plan of the year.

Table: Procurement plan of fuel biomass in the project

Type of biomass	Jul-Oct and Mar-May		Nov-Feb		Year
	t/h	t/period	t/h	t/period	t/a
Rape straw	5.59	25,904	4.26	12,261	38,164
Beet pulp	0	0	2.13	6,130	6,130
Oil cake	1.86	8,635	1.06	3,065	11,700
Total	7.45	34,538	7.45	21,456	55,994

2)Production of renewable energy

It is planned to implement the installation and rehabilitation of the facilities as stated below, utilizing the existing electric power system of the sugar factory.

(1) Installation of straw storage and drying facility

(2) Installation of facility for biomass processing/fuel pallet production

The facilities for biomass processing/fuel pallet production are planned to be installed diversified near the biomass-producing area. They are to be equipped with the followings.

(3) Fuel distribution equipment for boiler

(4) Rehabilitation of boiler

In the early stage of the project, it is planned to use the existing boiler and so fuel for fire grate furnace is to be switched from coal to biomass pallet.

(5) Installation of turbine and power generator

Since the existing steam turbine set in the sugar factory has small capacity, it is planned to renew to the one with 10MWe.

(6) Installation of ash fertilizing equipment

The table below shows planned consumption of biomass fuel, power sold and heat sold in the project.

Table: Planned power and heat selling in the 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

■Project Boundary, Baseline setting, Additionality

1) Baseline 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.

①Baseline regarding generated power

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.

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.

②Baseline with regard to heat

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. 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)Project boundary

<Baseline>

①Power generation in the grid

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

②Heat 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.

< Project Activity>

③Electricity Generation and Heat Generation

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

④Production of the biopellets

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

⑤Biomass 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.

⑥Transportation 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.

3) Additionality

①Risk 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.

②Technology 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.

■Greenhouse gas emission and leakage by project activity

1) Greenhouse gas emission by the project activity

・Emissions regarding combustion of rape residue: CH4 emission= 564 t CO2-eq、N2O emission= 1,111 t CO2-eq

・Emissions regarding combustion of fuel at the start-up of the CHP plant: 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.

・Emissions regarding electricity use from grid to produce biopellets: 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.

・Emissions regarding transportation of biopellets from the facilities to the CHP plant: = 262 tCO2-eq

2)Leakage

・Emission regarding Cultivation:= 346tCO2-eq

・Emission regarding Fertilization:= 639tCO2-eq

・Emission regarding transportation of biomass to the biopellet-production facility:= 48 tCO2-eq

3)Baseline emissions regarding electricity

①Calculation of the baseline emission regarding electricity

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

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

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

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.

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)

②Baseline emissions regarding heat

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.

We calculate here the baseline emission for reference by applying 212,774 (GJ) of heat generation / year planned at present.

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)

4) The reduction of the gas emission for greenhouse effect in the project（t-CO2e/y）

Year	Year	Baseline emissions		Project emissions		Emissions reductions
		Electricity	Heat	Project	Leakage	
1	2008	69,955	23,319	1,938	1,033	90,303
2	2009	69,955	23,319	1,938	1,033	90,303
3	2010	69,955	23,319	1,938	1,033	90,303
4	2011	69,955	23,319	1,938	1,033	90,303
5	2012	69,955	23,319	1,938	1,033	90,303

■Monitoring methodology and plan

1) Monitoring regarding to the emission in the project

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..

2) Monitoring regarding leakage

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.

3) Monitoring regarding the baseline emission

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”.

■Environmental impacts / Indirect influence

Preliminary Environmental Impact Assessment due to the project activity is carried out.

1) Emission of pollution into the atmosphere including SO_2, NO_2, CO and dust
2) Noise emission
3) Production of sewage
4) Production of waste material

■Stakeholders comments

We received comments from stakeholders, that is, relevant local municipalities and labor union of the Rejowiec sugar factory.

(3) Issues and tasks for the project activity

■Implementation system of the project (domestic, host country, etc.)

Project participants (candidates)	Role, burden, etc.
KAE Rejowiec	Main body of the project
ENOD	Investment in KAE Rejowiec, technology in general, preparation and implementation of the project
EJK Co., Ltd.	Design
Facility supplier (TBD)	Supply of the facilities and training for the relevant part
Financial institution, government organization	Financing, credit offering (under negotiation)
External investor (TBD) （under negotiation with an European venture capital）	Investment
Mizuho Information and Research Institute	Advice for JI application and approval, finding of Japanese participants
Japanese credit customer (TBD)	Purchase of credits by up-front payment
Japanese investor (TBD)	Acquisition of credits by investment

The table includes matters under negotiation and consideration.

■Financing plan for project implementation

Required resource		Supplier	
【1st phase】		Up-front payment for credits	1,746
Technology	1,135		
Drying facility	5,120	Borrowing-1st phase	7,854
Boiler and turbine	2,100	Borrowing-2nd phase	21,600
Fuel processing facility	1,480	（Bank, Environmental Fund of	
Repair of existing boiler	1,600	Poland, etc.）	
Cash reserve	565	Total borrowing	29,454
Total of 1st phase	12,000		
		Investment from investors including the investment fund	7,800
【2nd phase】			
Technology	1,375	Other than those above, various methods such as publicly subsidized/loan system, borrowing utilizing guarantee agreement are under negotiation.	
Boiler and turbine	24,430		
Cash reserve	1,195		
Total of 2nd phase	27,000		
Total investment	39,000		39,000

Matters under negotiation and consideration are included.

■Cost-effectiveness

1)Internal Rate of Return（IRR）Internal rate based on CF before rate payment or deduction of tax

Crediting period	Without credit	US$5/t-CO2
5 years from 2008	23.53%	25.79%
21 years from 2008		26.88%

The table above shows the calculation with a hypothesis based on the project plan, so the real result could be different from it.

2)Years of payout time

Crediting period	Without credit	US$5/t-CO2
5 years from 2008	6.25 years	5.52 years
21 years from 2008		5.52 years

The table above shows the calculation with a hypothesis based on the project plan, so the real result could be different from it.

■Prospects and problems for actual operation of the project

This project is proposed by Przedsiębiorstwo Realizacji Energetyki Odnawialnej Ltd., (ENOD) to Krajowa Spółka Cukrowa „Polski Cukier" S.A (KSC), a state-own sugar company in Poland and the feasibility of the project is now studied by KSC.

KSC has not reached the conclusion yet, but positively considers implementing the project. So it is planned to promote raising funds and procedure for JI application and approval as soon as the project implementation is determined. Technical study is now conducting by ENOD vigorously and, as for financing, the negotiation is moved forward with investors specializing in European renewable energy and public financial institutions in Poland.

However, there are problems as below for implementing the project.

- As stated above, there is the fuel supply basis in the area of the project because the beet used to be grown for sugar production and other annual herbs including rape are grown there. But while sugar production takes only two months per year, the project operates for more than 10 months. So it is necessary to construct a stable system for fuel procurement/supply to bear the longer operation.
- KSC is planned to invest in kind with land and available equipments for the project. Such property value can be the basis for negotiation for investment ratio when the project company is set up. So it is necessary to assess the property in the future.
- According to the policy of the government of Poland (the Ministry of Environment), the investment and/or up-front payment for emissions are considered as the condition for JI approval. Therefore, it is necessary to find Japanese participants as risk takers.