Feasibility Studies on Climate Change Mitigation Projects
for
Clean Development Mechanisms and Joint Implementation
in 2003

Feasibility Study on Wind Power Generation including financial study
(Hungary, Monsonmagyarvar)

Summary Report

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1. Key information with regard to the project (Status of procedure to JI by the Hungarian Government)

A law (called JI law in abbreviation) including approval and procedure of JI project in Hungary is being prepared and to be performed in 2004. The Hungary Government has designated its own items stated in the project design documents, and they are to be described in the above JI law. The project plan requires that the following information should be described.

General information / technical and financial information / survey of the baseline / survey of acceptance / monitoring plan / analysis of influence / social communication

2. Outline of the project

The purpose of the project is to perform wind power generation project with 24MW capacity (scheduled to install 12 facilities of wind power generation with 2.0MW) in Mosonmagyarovar located in the Northwest area of Hungary, near the border of Austria and Slovakia. The main bodies of the project performance are Northwest Hungarian Electricity Delivery Company Ltd. (called EDASZ, hereinafter), which is a power distribution company to the above area and Eon, a German electric power company which is its parent company.

3. Simulations of wind conditions in the area where the project is performed and power generation there

3.1 Simulation of wind conditions

In accordance with a numerical model and the wind data measured in Mosonszolnok, the wind conditions were forecast in Kimle where windmills will be installed. A simulation of wind conditions was conducted by using WAsP, a representative numerical model, developed by RISO research laboratory in Sweden. An availability factor was reviewed with the specification of E-66 (2MW) designed by ENERON, a German company. Note that there is no relation between the windmill selected for the simulation and a windmill to be actually selected.

3.2 Results

Annual power generation [kWh/year]	3,457,807
Availability factor [%]	87.4
Utilization factor [%]	19.7

The data of wind conditions for simulation have been measured by anemometers, which can also measure the direction of wind, on nacelle. The data smaller than actual values are expected because the anemometers worked in the after current. For this reason, there is a possibility that the simulation results will bring the simulated power generation lower than the actual power generation. Measured wind direction can also be a little bit biased from the actual direction by rotation of the after current because the wind direction is in the after current of nacelle.

4. Baseline study and greenhouse gas reduction effect

4.1 Methodology of baseline applied to the project activity

"CO2 emission quantity increased with power generation which will be increased in the grid" without the project becomes the baseline emission gas quantity, because the project is the wind power generation project connected to the national grid of Hungary. Hence, the project uses CO2 emission factor gained by multi-projects for the electric power sector in Hungary as a baseline. For estimation of the coming CO2 emission factor, the project also has used the power generation scenario for individual power station estimated in "Baseline scenario in Hungarian electric power sector" which the Hungarian power companies (MVM) developed.

4.1.1 Baseline scenario in the Hungarian electric power sector

(1) Outline

For the development of the baseline scenario, the project utilized "ENPEP / IMPACTS" model and "ENPEP / BALANCE" developed by Argonne national laboratory (Chicago, USA), used for making the Hungarian power source development program.

(2) Premises of the scenario (assumption)

- Period: 2001 - 2012 - 2020
- Electric demand: +1% to 2005, +2% later than 2005
- Peak load: +0.9% to 2005, +1.8% later than 2005
- Base year: 2000 (peak load 5750MW, power demand 38.5 TWh)
- Ratio of import / export of electric power: 3%
- Introduction of best available technology in renewal or new construction of power plants

Table 4.1-1 Tendency of power source plan and power capacities

Power station		Fuel	Power Efficiency	Plan for power source	Electric power capacity (MW)					
					2000	2008	2009	2010	2011	2012
Paks		nuclear			1,752	1,800	1,800	1,800	1,800	1,800
	Paks	nuclear	31%	abolition by 2001	1,752	-	-	-	-	-
	Paks, hosszabb.	nuclear	31%	renewal of facility in 01 - 02	-	1,800	1,800	1,800	1,800	1,800
Dunamenti		oil, gas			1,872	1,452	1,452	1,452	1,452	1,452
	Dunamenti F	oil	29%	abolition by 02	420	-	-	-	-	-
	Dunamenti F	gas	36%		1,230	1,230	1,230	1,230	1,230	1,230
	Dunamenti G2	gas	48%		222	222	222	222	222	222
Tisza II.		oil, gas			833	884	884	884	884	884
	Tisza II.	oil	36%	abolition by 01	612	-	-	-	-	-
	Tisza II. R	gas	51%	increase of facility in 01 - 02	221	884	884	884	884	884
Mátra		lignite			748	576	576	576	576	576
	Mátra	lignite	29%	abolition by 03	172	-	-	-	-	-
	Mátra R	lignite	31%		576	576	576	576	576	576
Tiszapalkonya		coal	23%	abolition by 00	48	-	-	-	-	-
Oroszlány		coal		abolition by 03	211	-	-	-	-	-
	Oroszlány	coal	27%		49	-	-	-	-	-
	Oroszlány	coal	27%		162	-	-	-	-	-
Bánhida		coal	30%	abolition by 00	87	-	-	-	-	-
Pécs		coal			111	25	25	25	-	-
	Pécs	coal	26%	abolition by 01	86	-	-	-	-	-
	Pécs	coal	26%		25	25	25	25	-	-
Borsod		coal	22%	abolition by 01	78	-	-	-	-	-
Ajka		coal	23%	abolition by 00	25	-	-	-	-	-
Inota		coal		abolition by 02	24	-	-	-	-	-
	Inota	coal	16%		14	-	-	-	-	-
	Inota	coal	16%		10	-	-	-	-	-
Inota-GT		gt-oil	28%	abolition by 02	170	-	-	-	-	-
Csepel		gas	45%	new installation of facility in 01	-	378	378	378	378	378
Litér, Sajószöged		gt-oil	32%	abolition by 04	170	-	-	-	-	-
Ujpest II.		gas	57%	new installation of facility in 01	-	100	100	100	100	100
Debrecen		gas	55%	new installation of facility in 03	-	92	92	92	92	92
Csúcs, gáz		gas	36%	new installation of facility in 11	-	-	-	-	160	160
Kispest II.		gas	74%	new installation of facility in 05	-	116	116	116	116	116

Tisza, Fonix		gas	37%	new installation of facility in 05	-	188	188	188	188	188
Új, kapcs., fluid		coal	43%	new installation of facility in 12	-	-	-	-	-	130
Total					11,680	10,348	10,348	10,348	10,458	10,588

(Source: MVM)

4.1.2 Identification of Marginal Plant and calculation method of CO2 emission factor

As to the power plants to generate the increase of electricity in the grid in case that this project does not exist ("Marginal Plant") and the calculation method of CO2 emission factor, we consider as follows.

- Exclude the power plant Paks from "Marginal Plant" because it is a "must run" plant which supports the base power.
- Assume that in Hungary co-generation power plants with the thermal efficiency of 65% or more (75% or more in case of natural gas) are no "Marginal Plant" because electric power delivery company (MVM) or power supplies company has an obligation of buying electricity.
- In Hungary, free retailing of electricity by the third party access started on January 2003 and expansion of free retailing to demanders other than family that will start on July 2004 was decided. In addition to it, 100% free retailing including family demand is expected in 2007 based on EU requirement. Because electricity price is decided by the market mechanism in such free market of electricity, power plants with higher electricity prices do not always become "Marginal". Accordingly, as we cannot decide "Marginal Plant" in advance, we assume the average CO2 emission unit from selected power plants as the baseline.

That is, we focus only on the fossil power plants in the above power plants and as the baseline use the average CO2 emission unit from total fossil power plants except the co-generation plants with 65% or more of thermal efficiency (75% or more in case of natural gas). But the plant efficiency of the above mentioned power plants are assumed conservative, and the co-generation plants (65% or more thermal efficiency, 75% or more in case of natural gas) whose power is purchased with obligation do not exist. So, we finally use the average CO2 emission unit from total fossil power plants as the baseline. Ministry of Economy of Hungary does not necessarily agree to the exclusion of co-generation plants from the baseline. If co-generation plants to be considered exist, we need to negotiate with Hungary Government.

4.2 Justification of selection of the method and reason for applying it to the project

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;

- Using CO2 emission factors for multi-projects applied to Hungarian electrical sector.
- Using the algorithm based on the open "ENPEP / IMPACTS" model and ENPEP / BALANCE", and showing premises (assumptions) and data clearly.
- Containing in scenario liberalized market of electricity in Hungary, enforcement of environmental regulation such as SO2 emission regulation, abolition / renewal / new construction program considering aged facilities and economical situation.
- Setting low electricity import ratio (3%) as a conservative estimation in the model calculation and setting conservative plant efficiency, which is largely dependent on plant availability. (Note: By considering the lower electricity import ratio, CO2 emission unit becomes smaller, because earlier introduction of the newest plants is expected in Hungary.

4.3 Description of application method to the project activity

The emission of greenhouse gas from the project does not exist because the project is a wind power generation project, and the baseline emission quantity corresponds to the reduced quantity of emission gas, which produces greenhouse effect, in the project.

The baseline emission quantity is defined as "CO2 emission gas quantity accompanied with power increase in grid" in case of no existence of the project as mentioned above, and we calculate CO2 emission unit for the baseline according to the baseline methodology above. Then we can get annual reduction quantity, which produces greenhouse effect, by multiplying the unit by the annual power production expected in the project.

4.4 Description with regard to the reduction of artificial GHG emission gas quantity, compared with the case that the project does not exist.

Because the project is for the system connected to the Hungarian national grid, the generating power by the project is an alternative of the power from other power stations, which are connected to the grid.

Because the project is for the wind power generation the emission gas is zero for the greenhouse effect. The power stations in the Hungarian national grid consist mainly of fossil fuel plants with natural gas, coal and oil, and the emission gas for the greenhouse effect is reduced from those plants.

4.5 Additionality

The wind power generation project is widely applied and the presently planned 2MW facility is in the phase of actual use. When such a wind power generation project is operated in the region where regulations (for land use, for environmental restriction, etc) and the impact to the environment are resolved, higher or lower competitiveness in the local electrical market will be only a barrier for the project. When we consider additionality of the JI project, we can think the project has the additionality required for JI project if it has no competitive power in the regional electrical market.

In Hungary, there exists higher price purchasing system for the power generated by renewable energy and we make use of it for the project. Therefore we cannot prove the additionality in case of the power generating cost comparison. For this reason, we decided to evaluate the additionality by the evaluation of IRR and capital investment recovery year.

The followings are the IRR which credit is not considered for and the evaluation result of the capital investment recovery year.

- IRR: 10.32%
- Capital investment recovery year: 9.78 yr

We discussed the IRR and the capital investment recovery mentioned above with EDASZ, a main body for the business and their evaluation was "Longer period than 9 years for the capital investment recovery is not sufficient for the 20 year project. From this viewpoint, we consider that this project has additionality.

4.6 Description of how to set the project boundary with regard to the baseline method

As mentioned above, the baseline methodology for the project adopts a static baseline and the average CO2 emission unit from plants other than "must run" power plants in the Hungarian national grid. Accordingly, as the project boundary related to the baseline methodology, we consider other activities except the project activity as follows.

- Apply CO2 emission unit as the baseline and consider the grid within the project boundary because selling power to the grid determines the absolute value of the baseline emission gas quantity.

- Do not contain the GHG emission quantity related to the manufacture, transportation and construction of wind power generation facility in the project boundary because it is much smaller than the GHG reduced by the project performance.
- Do not contain the import / export of power from / to other domestic plants or plants in other countries in the project boundary because the baseline methodology applies a static method.
- Do not consider the status of power consumption in the project boundary because it gives no impact to the baseline emission.

4.7 Leakage (Change of the emission gas quantity produced in the outside of the business area)

There is no change of emission gas quantity (leakage) produced outside the area where the project is performed.

4.8 The reduction of the greenhouse effect gas emission

The wind power generation does not produce the gas for the greenhouse effect and leakage. So, in the project the baseline emission gas quantity corresponds to the reduced quantity of the gas for the greenhouse effect. The calculation of the baseline emission gas is shown below.

4.8.1 Calculation of the average CO2 emission unit for all fossil power plants

(1) Calculation method of fuel consumption of each power plant

CO2 emission quantity (TJ) = generating power (GWh) ÷ plant efficiency (%) $\times 3.6 \times 10^6$ (in case that several fuels exist, sum of each fuel)

(2) Calculation method of CO2 emissions quantity for each plants and each fuel

CO2 emission quantity = fuel consumption × C emission factor × 44/12 (in case that several fuels exist, sum of each fuel)

(3) Calculation method of CO2 emission unit for the baseline

Divide total CO2 emission quantity from each plant in each year by total generating power

$CEFx = \sum CEx(i) \div \sum Opx(i)$

Here,

CEFx : Average CO2 emission unit from power plants included in the baseline in year X

CEx(i) : CO2 emission quantity from power plants (i) included in the baseline in year X

Opx(i): Generating power from power plants (i) included in the baseline in year X

(4) Calculation results

The results of CO2 emission unit calculated by the above method are shown as follows.

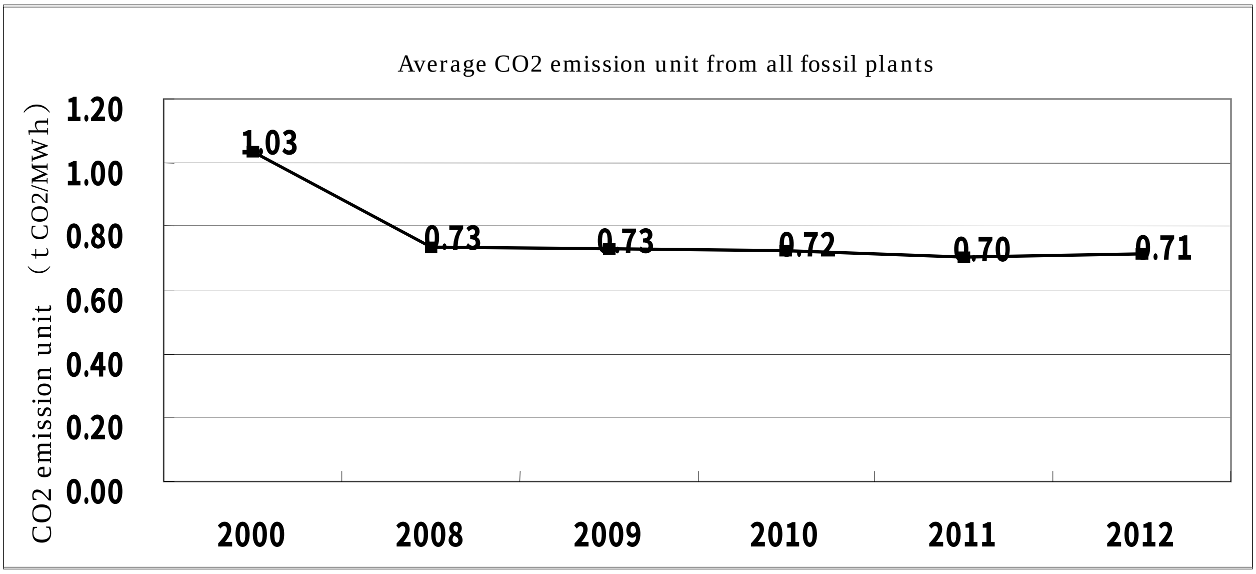

Fig 4.8-1 Baseline of the project

4.8.2 Calculation of the baseline emission gas quantity

(1) Calculation method of the baseline emission gas quantity

Annual CO2 baseline emission quantity can be calculated by "CO2 emission unit" shown in Fig. 4.8-1, times annual selling generating power produced in the project as follows.

Baseline emission quantity = OpPx × CEFx

Here,

OpPx : Annual generating power with the project in the year X

(2) Calculation results

Annual CO2 reduction quantity calculated by the above method, are shown below.

Table 4.8-1 Annual CO2 reduction quantities

	CO2 emission unit (t-CO2/MWh)	Annual generating power (kWh)	Annual CO2 reduction quantity (t-CO2)
2008	0.73	3,457,807	30,473
2009	0.73	3,457,807	30,280
2010	0.72	3,457,807	30,010
2011	0.70	3,457,807	29,173
2012	0.71	3,457,807	29,603

5. Monitoring plan

5.1 Monitoring method applied to the project

We monitor only the data related to the baseline emission gas quantity because greenhouse gas is not emitted from the project.

Because the baseline methodology in the project makes use of the static method and CO2 emission factor is decided in advance, we monitor only the selling generating power in the project necessary for the calculation of the baseline emission gas quantity.

5.2 Justification of selection of the method and reason for applying it to the project

The above methodology can be applied to the project due to the following reasons.

(1) There is no greenhouse gas emission from the project because the wind power generation does not require fossil fuels.

(2) The project is connected to the Hungarian national grid.

(3) The project stands on the baseline with total fossil power average in the Hungarian national grid, and the baseline is static. Hence, the parameter, which decides the emission gas quantity, is the selling power from the project only.

5.3 Data acquired for monitoring the emission quantity released from the project activity, and their saving method

There is no greenhouse gas in the project.

5.4 Identification, acquisition and saving method of the related data necessary for baseline setting.

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 data archived to be kept?	Comment
D-1	Selling generating power		MWh	Yes	Electronic	At least 1 year after ERU issued	

5.5 Procedures for QC and QA in monitoring

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.
D5-1	Low	Yes	Monitoring of selling generation power and maintenance of instruments are performed from the standpoint of the project management, but not from the operation of JI project.

6. Plan of fund in case of the project execution

6.1 Plan of fund in case of the project execution (How to procure fund demanded and national fund)

There is a high possibility that EDASZ / Eon supply the fund. However, details of the execution scheme are under review by Eon / EDASZ, and the role of Japan side is also under negotiation with EDASZ. EDASZ seems to consider that the fund is procured with no problem because Eon, a German company, is the parent company.

Table 6.1-1 Fund demanded for the project

Item	（1,000Yen）	（1,000HUF）
Wind power generator and attached equipment	3,300,000	6,600,000
Transforming, Connecting, Managing and others	450,000	900,000
Total	3,750,000	7,500,000

6.2 Information with regard to national fund source

The budget for financial assistance applied to this area is 1.2 billion HUF under the assistance system called KIOP (Grant) and the upper limit is 0.3 billion HUF per one business. The amount of money supplied per one business is small and the total budget is 0.3 billion HUF times 4 items. The possibility to be applied is lower and the effect will be restricted.

7. Comparison of revenues

7.1 Premises

In Hungary, the associated organizations accord with the obligation to buy the power generated by renewable energy, with higher price.

Table 7.1-1 Purchasing prices of power produced by renewable energies

(by Ministry of Economy and HEO)

	2003	2004
High time	24.0 HUF/kWh	25.3 HUF/kWh
Low time	15.0 HUF/kWh	15.8 HUF/kWh

Weighted average of the prices above per time of one week is 18.34 HUF / kWh and the future prices are assumed to raise per consumer index, based on the 18.34 HUF / kWh.

7.2 Results of trial calculation

Table 7.2-1 IRR (Credit acquisition period --- 5 years, unit: %)

CO2 credit price (US $/t-CO2)		
No credit	10$	15$
10.32	10.65	10.81

Table 7.2-2 IRR (Credit acquisition period --- 18 years, unit: %)

CO2 credit price (US $/t-CO2)		
No credit	10$	15$
10.32	10.96	11.28

Table 7.2-3 Capital investment recovery year
(Credit acquisition period --- 5 years, unit: year)

CO2 credit price (US $/t-CO2)		
No credit	10$	15$
9.78	9.50	9.35

Table 7.2-4 Capital investment recovery years
(Credit acquisition period --- 18 years, unit: year)

CO2 credit price (US $/t-CO2)		
No credit	10$	15$
9.78	9.36	9.16

8. Review of the fund introduction from Japan and business scheme

8.1 Review of the project from fund introduction standpoint

(1) According to the current fund plan, it is more possible that Hungary side supplies the fund. When some company that will acquire credit is interested in the investment, the Hungary side will review the package of both credit and investment.

(2) In the project, considering the present fund plan, it is more likely that the Hungary side will select deferred payment than in-advance payment, if the credit is purchased. The reason is that credit trade with good prices in the deferred payment is preferred to cash acceptance needs in the in-advance payment.

8.2 Review of scheme for the fund introduction from Japan

(1) Japanese companies will individually make credit purchase agreement with the project side. But, when companies, which want the credit increase to 5 to 10, the workload of the project side may increase for negotiations of the contract, dealing conditions, etc.

(2) SPE is settled and the SPE makes the contract of credit purchasing with the project side. The SPE sells the credit to Japanese companies. The SPE will perform the credit purchasing not only with this project but also with other projects.

(3) The following cases can be considered with the investment to the business although the realization is less possible in the project. ① the dividend is paid by the credit itself to investment, ② SPC possesses the facilities and leases them to local companies which conduct power generation business. However, various matters should be solved prior to the realization. ③ investment plan to several JI projects besides this project. The credit is independently purchased in accordance with another purchasing plan, and money return is expected.