Project Design Document

Geothermal Energy in Oradea - Area II and Beius

July 2004 – Version 2.3

GRUE & HORNSTRUP CONSULTING ENGINEERS

Østergade 18 . DK 7500 Holstebro . Denmark . TEL. +45 96 10 13 30 . Fax +45 97 40 45 20 . www.grue-hornstrup.dk

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Introduction

This PDD shall enable Romania and Denmark to enter a CO_2 trading agreement according to the Kyoto Protocol in year 2003. The CO_2 trading agreement is based on the ERUs generated by a fuel switch projects in the city of Oradea and in the town of Beius by substituting fossil fuels with geothermal energy. In this PDD the two individual fuel switch projects will be seen as one project.

This PDD has been elaborated according to guidelines in the Project Manual - Joint Implementation - May 2003 publicised by the Danish Energy Authority, Kyoto Protocol, Marrakech Accords and experience from validation of former PDDs.

Contents PDD - Danish Project Manual, May 2003

- ✓ Approval of the Parties Involved
- ✓ Additionality
- ✓ Baseline study and monitoring plan
- ✓ Analysis of the environmental impacts
- ✓ Description of project
- ✓ Summary of any national stakeholder process

Website Danish Manual Joint Implementation:
http://www.ens.dk/graphics/publikationer/klima_uk/jimanual/pdf/helepubl.pdf

The Romanian Ministry of Agriculture, Forest, Waters and Environment has been contacted to clarify if specific criteria from the host country should be respected when elaborating this PDD. The Romanian authorities emphasise that the requirements in the Kyoto Protocol, Marrakech Accords and decisions from COPs shall be respected.

When completing this PDD the project approval and purchasing agreements was signed by the parties and the consultation of stakeholders in both countries was completed. The approval and purchasing agreements are contracts which are not open to the public. There were no comments directed to the project during the public stakeholder consultation process.

The baseline study presents baselines describing the most likely future development for the existing DH systems in Oradea - Area II and Beius. The most likely baseline has been developed using historical data, outcome of financial analyses, energy policies, EU enlargement programmes and environmental requirements.

Development of the most likely scenario is also affected by the historical development in relation to exploitation of geothermal resources in Romania in general and in the Oradea area especially.

Romania is basically rich on geothermal resources and rather intensive research activities have been performed mainly before 1989; where a large numbers of exploratory wells have been drilled. The drilling programs have been an element in the activities performed by the Romanian agency for Mineral Resources. The main scope has been to map the geothermal resources. However many wells have been drilled with specifications like production wells; and as the geothermal resources as mentioned are very rich with wellhead temperature often close to 100 °C or even higher facilities for exploitation have been implemented to a smaller extend during time . This is also the case in Bihor County where in the past quite large areas with greenhouses have been heated through utilisation of geothermal resources. The current status is however that a number of wells and facilities have been closed down during the last years. This despite gas prices which are going up and heat energy generally is considered to be expensive.

From a normal west European point of view it seems difficult to understand that even though geothermal wells with very high wellhead temperature are ready to be exploited the trend is to close them down instead. From the viewpoint we (Grue & Hornstrup) has gained through active involvement in project development in Romania in more than ten (10) years this is the paradox often seen in Romania. The development potential is obvious however the lack of funding prevents projects from being implemented. I.e. the need for external technical and financial assistance is highly needed. Please also refer to the letters issued by Transgex which are included in the annexes.

The monitoring plan included in this document describes methodologies for monitoring of ERUs generated by the project and monitoring obligations to be respected by the local operator (new DH system) responsible for conducting the monitoring procedures. It is expected that a framework agreement for acceptance of monitoring obligations will be signed by the local operators and endorsed by the local EPA during the implementation of the project.

This PDD has been elaborated during a co-operation between S.C. Transgex S.A and Grue & Hornstrup Consulting Engineers A/S. S.C. Transgex S.A. has due to its knowledge and activities within the exploitation of geothermal energy resources and operation of geothermal DH system provide information and evaluation of geophysical conditions. Grue & Hornstrup has due to its experience within the Romanian DH sector and development of projects using the flexible JI mechanism being responsible for elaboration of this PDD according to guidelines for JI - projects.

1. Description of the Existing DH System

1.1 Oradea

The existing DH system in Oradea was established during the 1960's aiming to supply both heat and electricity to the area. The district heating system consists of the CET I (located in the western part of Oradea) and CET II (located in the eastern part of Oradea) both combined heat and power plants. Original CET I and CET II supplied hot district heating water to 194 substations through a transmission network (primary network) 74.0 km long utilising insulated steel pipe mounted in underground concrete channels. But CET II was closed down some years ago due to mechanical defects and drop in the electricity demand meaning that only CET I is in operation today. CET I supplies hot water to the 194 substations located in eight different areas (see Annex IV) with different heat demands and different number of substations.

CET I - West and CET II was original owned and operated by the national power company CONEL, but some years ago the ownership was handed over to the municipality of Oradea similar to CONEL practise in other parts of Romania.

The CET I power plant is equipped with four lignite fired steam boilers and two natural gas fired steam boilers and in autumn 2003 the third lignite fired steam boiler will be rebuild for combustion of natural gas. The natural gas boilers are planned to cover most of the base load demand (heat) during the heating season and the entire heat demand during the summer period. The lignite fired steam boilers are planned to cover part of the base load (heat) and will not operate during the summer period. No rehabilitation of the remaining lignite fired boilers has been planned. Today heavy oil is used during operation of the lignite fired boilers but in the future heavy oil is not expected to be used.

CET I	Unit	Information
Operation from October - to May		Three natural gas boilers (rebuild lignite boilers) and three lignite fired boilers shall cover the heat- and electricity demands. The natural gas boilers shall cover up to 70 % of the base load demands, while the lignite boilers shall cover up to 40 % of the total heat demand (base load and peak load).
Operation from May to October		Only natural gas fired boilers are used
Effectiveness of gas fired boilers	%	Up to 85
Effectiveness of lignite fired boilers	%	Up to 83
Fuel used at the CET I		Lignite and natural gas
Lignite consumption year 2002	Tons/year	1,010,183
Natural gas consumption 2002	Nm^3/year	3,260,000
Heavy oil	Tons/year	19,608
Heat production year 2002	Gcal/year	1,060,095
	GJ/year	4,438,618
Electricity production year 2002	MWh/year	344,780

Table 1: Information CET I

Today supply of natural gas to the gas fired steam boilers at CET I is not stable due to pressure problems in the main supply gas pipeline, and no information about solving this problem has been obtained. Another aspect is the expected increase in natural gas prices that may keep the lignite fired steam boilers covering a bigger part of the heat demand.

Fuel used at CET I	Unit	Information
Lignite	GJ/year	7,685,249.01
Natural gas	GJ/year	114,099.34
Heavy oil	GJ/year	792,170.32
Total	GJ/year	8,591,519.27

Table 2: Fuel consumption CET I, year 2002

Apaterm has provided us with the below information about the district heating system in Oradea in general. Apatem is dividing Oradea in the areas presented in the below table.

Trangex on the other hand has divided Oradea in areas based on the geothermal resources and not heat supply.

Area (Apaterm)	Heat Supply			
	Unit	2000	2001	2002
Area I	GJ/year	795,173.62	2,354,079.92	142,871.02
Area II	GJ/year	865,421.99	2,526,509.19	150,306.24
Area III	GJ/year	332,442.31	1,008,238.55	68,145.43
Area IV	GJ/year	349,130.49	1,065,523.31	75,784.28
Area V	GJ/year	497,898.41	1,453,228.02	90,318.24
Area VI	GJ/year	365,714.24	1,096,387.73	78,111.51
Area VII	GJ/year	324,396.15	948,469.29	58,634.51
Area VIII	GJ/year	628,382.44	1,819,050.84	110,921.56
Total	GJ/year	4,158,559.65	12,271,486.85	775,092.79

Table 3: Heat supply to substations in Oradea

The five substations under this project are located in what the utility company Apaterm defines as Area V (Area II - Transgex definition). The heat supply from CET I to the five substations is presented in the table below.

Substation	Unit	Year 2000	Year 2001	Year 2002
510	GJ/year	32.126,52	29.250,76	25.121,92
511	GJ/year	29.942,37	28.327,48	20.602,13
512	GJ/year	35.203,00	35.615,08	32.024,52
513	GJ/year	58.720,58	50.464,99	44.346,44
514	GJ/year	66.701,88	57.239,01	52.570,13
Total	GJ/year	222.694,35	200.897,33	174.665,14

Table 4: Heat supply substations in Area II (Transgex definition)

As mentioned CET I is the only facility supplying heat to the district heating system in Oradea. This CHP plant will be affected by the Directive of the European Parliament and of the council amending Directive 2003 - (EC establishing scheme for greenhouse gas emission allowance trading within the community, in respect of the Kyoto Protocol's project mechanism). The EU directive presents requirements how the EU member states shall handle trading of GHGs using among others the flexible mechanisms like the JI - mechanism. The CO2 emission reduction which will be the result from implementation of this project is based upon a reduced emission from CET I. The EU directive describes that double counting of GHG emission reduction is not allowed. Therefore it shall be secured when the project specific agreement is defined that no double counting will be the case when CET I probably later will be affected by the EU directive, this even Romania probably first will enter the European Union in year 2007.

1.1.1 Substations in Area II

The five substations (no. 510, 511, 512, 513 and 514) located in Area II divides the primary distribution pipe network connecting the CET I from the secondary distribution network connecting the five substations with the buildings (consumers). Hot water for space heating purposes and production of hot potable water is supplied from the substations to buildings. The five substations are part of the existing district heating system including CET I and CET II established approx. 30 years ago.

The heat installations in all five substations are based on the same technical design comprising plate heat exchanger units for dividing the primary network from the secondary pipe network. The plate heat exchanger units in substations are approx. 2 years old and manufactured by the company Schmidt. At secondary side the substations are equipped with main supply pump units (without variable speed drive), expansion system, classic Romanian distributor units (pipe network), no automation and heating meter and computers for registration of the energy supply.

From substations hot potable water is supplied to consumer installations (taps) but pipes for recirculation of hot potable water does not exist.

Subject	Primary Network (°C)		Secondary Network (°C)		
	Supply water	Return water	Space heating - Supply	Space heating - Return	Hot Potable water
Substation (general)	80 - 130	60 - 80	80 - 85	60 - 65	55 - 60

Table 4: Temperature existing pipe networks

The five substation buildings are with concrete walls and windows mounted at the top of the longitudinal exterior walls. The conditions of the substation buildings are making from a construction point of view makes them useable in a future energy project and only minor rehabilitation works are foreseen.

1.1.2 Utilisation of Geothermal Energy

In Oradea hot geothermal water has been extracted from the Oradea reservoir for years to be used for production of hot potable water in substations. The exploitation of geothermal energy resources in the Oradea area is based on extraction of hot geothermal water from a subsurface reservoir located approx. 2280 meters below surface in the eastern part of Oradea sloping to approx. 3200 meter in the western part of Oradea. The temperature of the geothermal water varies from approx. 70 °C (well in eastern part or reservoir) to 115 °C (western part of reservoir – well no. 1709).

The existing geothermal wells in Oradea were drilled already before 1989 as part of a research program aiming to map the geothermal energy potential in Romania. The program did not include exploitation of the geothermal resources even the geothermal wells were drilled with specifications like production wells. After the revolution in 1989 only supply of hot geothermal water for heating of one hospital, some swimming pools and one plant for supply of domestic hot water have been implemented. This even the know-how for utilising geothermal water is available and a number of wells are ready to be utilised. Below you will find three (3) tables holding the key data for the wells drilled in Oradea.

1. In Table 5 temperature and flow rate is specified.
2. In Table 6 annual heat production is specified.
3. In Table 7 the year when the wells were drilled and pressure data is specified.

Area	Geothermal doublet	Status of well	Temperature (°C) of geothermal water at the reservoir zone (2400 m below surface of the earth)	Flow rate (m^3/h) with pump unit	Temp. (°C) geothermal water at wellhead
Area I (Nafarul)	4797	Production	79	45	75
	4081	Injection			
Area II (Iosia)	4767	Production	109	75	106
	1717	Injection			
Area III (Calea Aradului)	4795	Production	110	10	96
	4005	Injection			
Area IV (Dacia)	4004	Production	97	25	82
	4006	Injection			
Area V (Episcopia)	1709	Production	115	15	102
1715					
University	4796	Production	110	40	90
4796					
Calea Clujului	1715	Production	78	40	73
	4006	Injection			

Table 5: Maximum capacity of geothermal wells

Geothermal hot water has been used for years in Oradea for production of hot potable water in Area I, heating of swimming pools in Area II, heating of hospital and greenhouses in Area III etc. However, no strategy for large scale exploitation of the local geothermal energy resources has been developed and local intentions to increase utilisation of geothermal energy resources for space heating and hot potable is ongoing. However, based on the development of the JI - project in Area II it is assumed that grants and project partners with experience in JI - projects is needed if utilisation of geothermal energy shall be increased in Oradea.

In Area II the hot geothermal water from well 4767 has been used for heating of a swimming pool while well 1717 has been used to heat hot potable water in a school. Today geothermal water from well 4767 and well 1717 is discharged into the river passing Oradea, which is allowed due to the chemical composition of the geothermal water. Only one well (4081) is used for re-injection of geothermal water.

The concession and exploitation permission to all geothermal wells located in the Bihor County belongs to the private company S.C. Transgex S.A., who is operating all the geothermal wells and substations supplied with geothermal water in Oradea. Some years ago S.C. Transgex S.A. was transformed from being a State owned company into a private owned company through a tendering procedure and here taken over by the Romanian Dafora Group.

Today S.C. Transgex S.A. is having an agreement with the local authorities to utilise the local geothermal energy. The agreement does not specify the quantity of geothermal energy to be exploited and which areas to be supplied.

Due to the considerable investment costs needed; at least when seen from a local Romanian point of view; exploitation of the local geothermal energy resource has been limited so far. This means that an income from selling of CO_2 emission reduction generated by a JI - project could assist increasing the utilisation of geothermal energy in the Oradea area.

It should be mentioned that the Romanian government has provided no support to any area in Romania aiming to utilise the geothermal energy for space heating purposes or for production of hot potable water. This even the geothermal wells have been made available through the long lasting research program. During the nineties German and Icelandic consultants have tried to develop projects aiming to utilising part of the geothermal energy potential in Oradea (also Area II), but without being able to secure the necessary funding. Until now it has not been possible to identify any financial instrument in the Romanian government, the European Union or the World Bank which would support implementation of geothermal projects in Oradea. Therefore this JI initiative is extremely important if break through shall be seen.

Well	Unit	Geothermal Energy Supplied in year 2002
1709 (Oncea)	Gcal/year	507.06
1715 (Sicoop)	Gcal/year	3,053.94
1716 (Airport)	Gcal/year	2,046.18
1717 (Iosia)	Gcal/year	1,239.50
4004 (Dacia)	Gcal/year	4,006.69
4006 (Strand municipality)	Gcal/year	1,250.30
4767 (Strand Iosia)	Gcal/year	1,500.00
4796 (University)	Gcal/year	19,000.00
4795 (Scaz)	Gcal/year	151.01
4797 (doublet)	Gcal/year	20,000.00
4005 (Calea Aradului)	Gcal/year	1600.00
Total	Gcal/year	54,354.68
	GJ/year	227,583.05

Table 6: Geothermal energy supplied in year 2002 as information was provided by Transgex

The potential of the wells already drilled in Oradea in terms of geothermal energy has been estimated to approx. 300,000 Gcal/year. To be able to exploit the wells to this extend line shaft pumps must be installed.

If the necessary number of wells were drilled Transgex expects that the entire heat demand in Orade could be covered by the geothermal resources.

S.C. Transgex S.A. would like to extent exploitation of the geothermal energy resources in Oradea by improving the geothermal facilities through installation of line shaft pumps in the existing wells and improving substations facilities. Development of the geothermal facilities in Oradea may comprise establishing of a number of geothermal doublets (one production well and one re-injection well) partly by using the existing twelve (12) geothermal wells and partly by drilling of new wells if an optimal solution shall be sought. Re-injection has been the strategy normal utilised in projects supported by DEPA. Discharging the geothermal water into a river is like mining the resources and Re-injection is introducing a perspective of sustainability and making the energy resource renewable. With the actual problems financing projects which basically seem feasible it will be necessary not to make re-injection a must for the time being.

Implementing this project will introduce re-injection in Oradea however the Beius facility will still miss the possibility for re-injection and discharge in the nearby river is therefore the only option.

Area	**Well Number**	**Well was put into operation in year**	**Artesian potential of well when it was put into operation (Gcal/hour)**	**Yield of well Today (Gcal/year)**
Area I (Nafarul)	4797	1981	5.15	17,917.51
	4081	1973		Injection
Area II (Iosia)	4767	1975	5.15	2,291.73
	1717	1982	0.89	1,228.57
Area III (Calea Aradului)	4795	1982	0.31	306.96
	4005	1963	1.08	1,004.02
Area IV (Dacia)	4004	1969	1.30	3,720.86
	4006	1964	0.82	1,377.96
Area V (Episcopia)	1709	1983	1.25	442.75
University	4796	1981	4.20	19,790.29
Calea Clujului	1715	1983	1.81	2,268.12
Airport	1716	1983	1.81	1,646.04

Table 7: Well data regarding the year when the wells were established and the natural artesian flow rate as well as the annual production mapped.

Today most of the wells are in operation up to 180 - 200 days per year depending on the outdoor temperature.

It should be mentioned that S.C. Transgex S.A. has been involved in development of geothermal energy projects in several locations in the Bihor County like the town of Beius where a heavy oil fired DH system was substituted by a new district heating system based on hot geothermal water (see paragraphs 1.2 and 2.2).

1.1.3 Heat Prices

Today hot water as mentioned is supplied from CET I to heat exchanger units in the five substations located in Area II. Hot water for space heating purposes and hot potable water is distributed from the five substations to heat consumers in Area II. The heat production price at CET I is 1,200,000 ROL/Gcal in year 2003. However, the consumer price is maximised to 800,000 ROL/Gcal according to the Romanian legislation. This means the municipality of Oradea together with the Romanian Government subsides the heat production price of 1,200,000 ROL/Gcal (CET I) with 400,000 ROL/Gcal.

Subject	Heat selling price in ROL/GCAL	Heat selling price in EUR/GJ
Heat consumer	800,000	5.16
Municipality of Oradea and the Romanian Government (subsidising)	400,000	2,58
CET I production price	1,200,000	7,74

Table 8: Existing heat price

The municipality of Oradea, and probably also the Romanian Government, would like to decrease its support (subsidises). Implementation of more economical heat production technology like geothermal energy systems would make it possible to decrease the subsidising of heat prices for Area II.

1.2 Beius

The town of Beius (Bihor County) is located in the Western part of Romania (Transylvania) approx. 50 km south of the city of Oradea populated with approx. 13,000 inhabitants.

The existing geothermal well 3001 was drilled before 1989 as part of the research drilling program mentioned above aiming to map the geothermal energy resources in Romania. Also as mentioned above this program for mapping the geothermal energy resources in Romania did not include financial support for development of heating systems based on geothermal energy. Today the Romanian government is continuing the research drilling plan launched before 1989 only with much less wells on the program annually. The new well 3003 has been financed by the Romanian Agency for Mineral Resources under the Romanian Ministry of Research as part of the research program as mentioned before. The total investment cost for drilling the well 3003 and for installation of a new line shaft pump unit is according to Transgex approx. 1,000,000 EUR.

Due to low heat consumer prices in Beius Transgex has not had the opportunity to identify financial funds for making use of all the capacity of well 3001 and the new well 3003.

The heat price in Beius is extremely low compared to Oradea. At the planning level the heat selling prices considered are 2.18 EUR/GJ in Beius versus 4.77 EUR in Oradea, where the Beius price is equal to the actual price and in Oradea the price is lowered from 7,74 EUR/GJ when referring to the actual heat selling price before subsidises are paid; or 5,16 EUR/Gj when referring to the actual consumer heat selling price after subsidies have been deducted. The low price in Beius is partly because of the low production pieces and partly because the population is very poor in Beius. The Transgex strategy by keeping the heat

price low is to make it possible for all to pay for heat, and not to end like in many other small Romanian towns were the capability to pay for heating is limited, some consumers denies to pay, the other consumers are becoming unsatisfied width the situation that only some are paying for heat and consequently they also denies to pay even basically the capability is present. In this way payment for heat is going down every year and it is extremely difficult to come back to normal again.

Therefore only financing of pipe network connecting a limited number of block of flats has been possible while financing the connection of public buildings like schools, kindergartens etc. has not be possible to identify.

The existing geothermal based DH system in the town of Beius was commissioned in year 2001 supplying hot geothermal water from the geothermal well 3001 to the substations CTI, CTII, CTIII and CTIV. The existing geothermal DH system comprises technical installations like primary pipe network, secondary pipe network, CTII, CTIII and CTIV which basically is approx. 20 years old.

The hot geothermal water is lead to heat plate exchanger units in each of the four substations for production of hot water for space heating purposes and for production of hot potable water. The four substations are connected to buildings by one supply pipe and one return pipe for space heating purposes, and one supply pipe for distribution of hot potable water, recirculation of hot potable water is not implemented.

The geothermal water is after utilisation lead from the substations to the river crossing the town. Geothermal water with a temperature higher than 40 °C must not be discharged into the river. During summer time the low heat demand (only hot potable water) and the minimum production capacity of the line shaft pump unit (minimum 12 l/s) makes it difficult to meet the temperature requirement of 40 °C for discharging. .

The existing geothermal DH system in Beius is planned to be extended and drilling of one new production well (3003) is already completed under the research program mentioned, and testing of the well is ongoing. Several buildings with individual boilers combusting fossil fuels (heavy oil and natural gas) are located close to the existing primary pipe network connecting the geothermal well 3001 and the four substations. Buildings with individual boiler systems could be connected to the geothermal system but no financial resources are available for connecting new heat consumers to the geothermal system. When the new production well 3003 is ready for production the total flow rate of well 3001 and 3003 together is estimated to approx. 120 l/s with a temperature of 84 °C.

Subject	**Unit**	**Data**
Temperature of the geothermal water well 3001	°C	84.0
Maximum flow rate of well 3001 today	l/s	45.0
Future flow rate of well 3001 by lowering the line shaft pump unit.	l/s	90.0
Distance from the surface of the earth to the top of the geothermal reservoir well 3001.	M	2200
Distance from the surface of the earth to the bottom of the geothermal reservoir well 3001	M	2480
Distance from the surface of the earth to the possible new line shaft pump unit well 3001.	M	150
Number of apartment and inhabitants supplied by CTI	Ap./Inhabitants	441/1380
Number of apartment and inhabitants supplied by CTII	Ap./Inhabitants	560/1860
Number of apartment and inhabitants supplied by CTIII	Ap./Inhabitants	427/1520
Number of apartment and inhabitants supplied by CTIV	Ap./Inhabitants	129/323

Total number of apartments and inhabitants supplied by substations.	Ap./Inhabitants	1557/5083

Table 9: Existing geothermal DH system in Beius

The existing geothermal DH system in Beius is as mentioned owned and operated by the private company S.C. Transgex S.A. and is based on a supply agreement between the company and the municipality of Beius.

Today the heat price for individual boiler systems is 1,484,913 ROL/Gcal (heavy oil) and 1,136,473 ROL/Gcal (liquid gas). The relatively high heat prices make it attractive for owners of individual boiler systems to connect to heat production technology which generate lower heat price compared to current heat price level.

2. Description of the JI - Project

The project is a fuel switch project addressing the DH heating systems in Area II in the city of Oradea and the existing DH system in the town of Beius aiming to substitute fossil fuels (lignite, oil and natural gas) with local geothermal energy resources.

In January 2003 DEPA inspired the local partners (Oradea Municipality, Apaterm, Transgex and local gas company) to meet and discuss how to extend the utilisation of geothermal energy in Oradea. Before this meeting a German consultant and a Icelandic consultant have tried to develop geothermal projects in Oradea, but without being able to secure the realisation of such.

Development of geothermal project in Oradea - Area II has not been supported by European Union - programmes, World Bank programmes, regional programme etc.. Utilisation of the JI mechanism for financing part of a geothermal energy project in Oradea was introduced in January 2003 as a possibility for the first time.

The discussion on development of the JI - project has provided new knowledge to the Oradea area in terms of implementing a geothermal project in Area II using the JI - mechanism.

2.1 Oradea

The idea of the project is to increase the use geothermal energy resources in the city of Oradea by erecting a new geothermal heating plant and rehabilitation of existing DH system (pipe network, substation installations etc.) in Area II. After the new geothermal heating plant is put into operation heat supply from CET I to the five substations in Area II will stop. As mentioned in paragraph 1.1 geothermal energy to a limited extend is used in several parts of Oradea, but in Area II geothermal energy is only used for production of hot water for a swimming pool. The heat output capacity of well 4767 allows much higher heat production with a flow rate up to 75 l/s. However a flow rate of maximum 65 l/s is expected due to geophysical limits of the re-injection well 1717. Today well 1717 is a production well which will utilized as a re-injection well in the future geothermal energy system.

Today the lignite and natural gas fired power plant CET I supplies hot water to five existing substations in Area II. All substations are equipped with plate heat exchangers for production of hot water for space heating purposes and for production of hot potable water. The plate heat exchanger units are connected to buildings by two pipes for space heating purposes and one pipe for hot potable water. A map of Oradea is provided in Annex IV. This map shows the spatial boundaries of Oradrea Area II, where the five substations are located, and the locations of wells 1717 and 4767.

2.1.1 Project Details

The new geothermal system in Area II consists of a geothermal loop (one production well 4767 and one re-injection well 1717), new geothermal heating plant (new peak load boilers, new plate heat exchanger units, pump units etc.) and new primary distribution

pipe network (between the geothermal heating plant and substations). The existing geothermal flow line connecting production well 4767 with re-injection well 1717 will be used in the new geothermal system.

Geothermal Loop: The geothermal loop consists of one existing production well 4767, one re-injection well 1717 (today existing production well) and a new line shaft pump unit will be installed in order to increase the flow rate from production well 4767. This means the hot geothermal water extracted from well 4767 will after utilisation at the new geothermal heating plant be re-injected in well 1717. The Oradea reservoir is one big subsurface reservoir with correspondence between well 4767 and well 1717. The two geothermal wells will be connected to plate heat exchanger units installed in the new geothermal heating plant.

Geothermal heating plant: The new geothermal heating plant building shall be used for the well head facility (production well 4767), new plate heat exchanger units dividing geothermal loop from primary network, new natural gas fired boilers, pump units, switchboards, meters etc.

Primary pipe network: A new primary pipe network connecting the geothermal heating plant with the five substations will be installed. The new pipe network will consist of pre-insulated district heating piping components including straight pipes, valves, reduction units etc.

Five substations (510, 511, 512, 513 and 514): In all five substations rebuilding of the existing heat exchanger units for production of hot water for space heating purposes and for production of hot potable water will take place. This means new plates will be installed to increase the capacity of the existing plate heat exchanger units because the new geothermal system will supply hot water with a lower temperature (100 ˚C) compared to current situation where the temperature of the hot water supplied from CET I is up to 130 ˚C. The existing main supply pump units will be replaced by new main supply pump units with variable speed drive, but existing pipe installations, expansion systems, meters etc. are expected to be used to the extend possible

Secondary pipe network: Part of the secondary pipe network connecting the substations with consumer installations in buildings has been rehabilitated during the last years. However two alternatives has been considered the first to continue with the secondary pipe network untouched and the second is where the secondary pipe network is substituted by a complete new pre-insulated DH pipe network. Transgex has decided to focus on the second alternative.

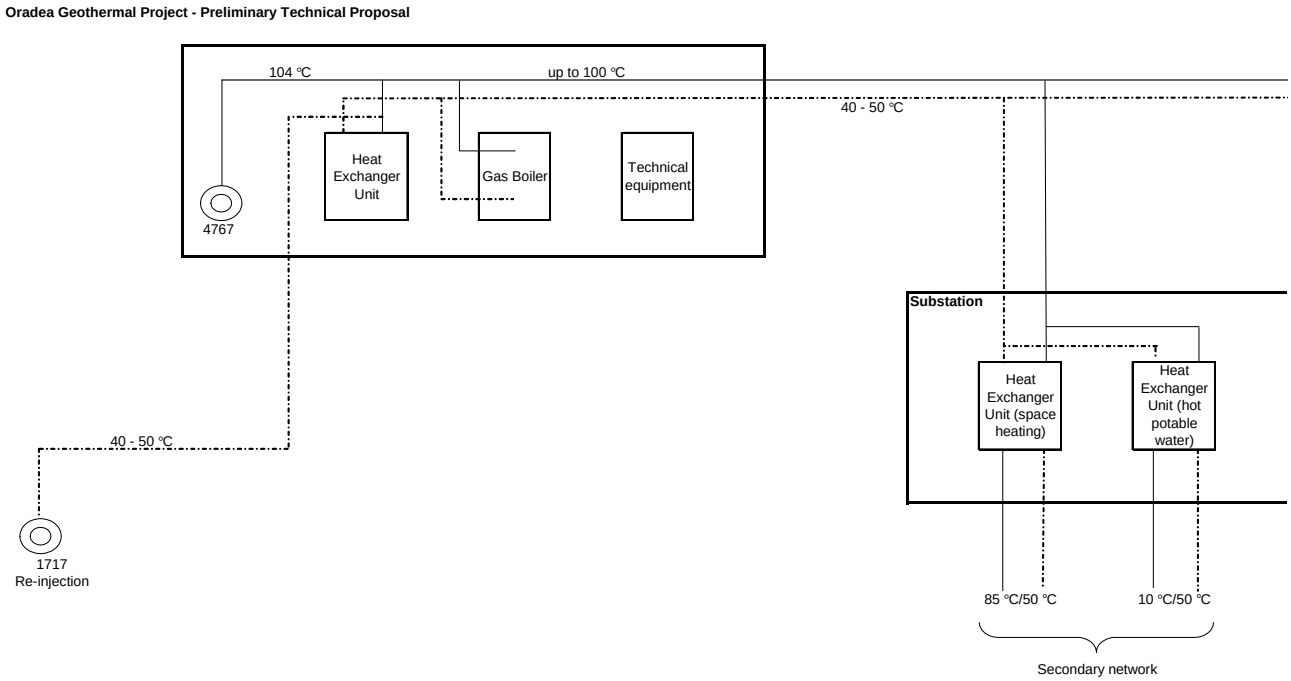


Figure 1: Sketch of geothermal system in Area II (temperatures not valid)

Hot geothermal water will be lead to heat exchanger units mounted in the geothermal heating plant for production of hot water, which will be distributed through the primary pipe network to heat exchanger units mounted in the five substations. In all substations heat exchanger units are in place for production of hot water for space heating purposes and for centralised production of hot potable water.

Investment component	Investment and implementation
Establishment of the geothermal doublet (well 4767 and well 1717), well site facilities, new line shaft pump units.	Not financed.
New geothermal heating plant building, heat exchanger units, gas boilers, main circulation pump units, internal piping, expansion system, circulation pump units etc.	Not designed or financed.
New primary pipe network between the geothermal heating plant and the five substations in Area II.	Not designed or financed.
Rehabilitation of heat exchanger units, piping, pump units etc.	Not designed or financed.
Costs related to design, tender procedures, implementation etc.	S.C. Transgex S.A.

Table 10: Project Idea Oradea

2.1.2 Geothermal Reservoir

The below information about the geothermal resources has been provided by Trasgex.

The new geothermal heating plant will be designed so that the existing production well (4767), new gas boilers (peak load situations), expansion system, pump units etc. will be covered in the new geothermal heat plant building. Hot geothermal water (107 ˚C) will be extracted from production well (4767) and lead to heat exchanger units in the geothermal heating plant, and the geothermal water will after utilisation (40˚C) be re-injected in well 1717.

The Oradea reservoir is located in Trassic limestone and dolomites, at 2200 - 3400 metres depth, covering an area about 113 Km^2.

In Oradea S.C. TRANSGEX S.A. has an experience for more than 35 years in using this renewable and environmental friendly energy source. During this period 12 wells were drilled in the Oradea area, from which 11 are production wells with temperatures ranging from 70 °C up to 105 °C degrees and one re-injection well. However, the exploitation of geothermal energy from the Oradea reservoir has been limited due to lack of local cooperation and financial resources.

EFICACITY TEST

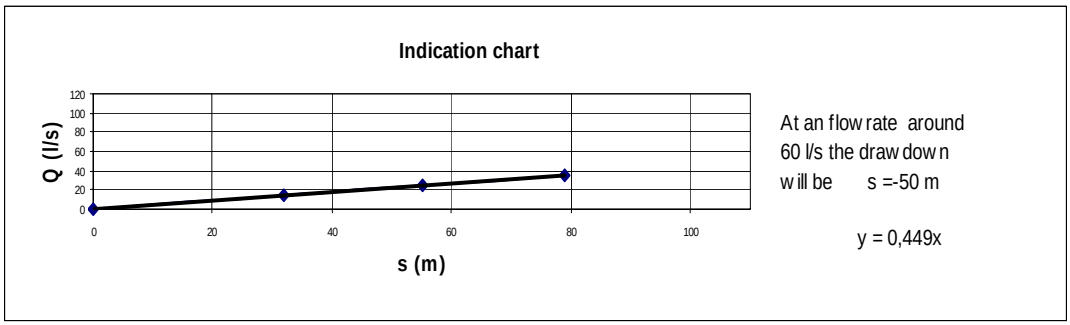
PW 4767Oradea

	Q	s			Q	s/Q	s/Q
	l/s	m^3/s	gi/min	(m)	(l/s/m)	$(m/m^3/s)$	(m/gi/min)
Ps = 8 bar	15	0,015	197,978	32	0,469	2133,33	0,1616342
	25	0,025	329,963	55	0,455	2200,00	0,1666853
	35	0,035	461,948	79	0,443	2257,14	0,1710148

Q = flow rate Q = specific yield gi = imperial gallon

s = drawdown M^3 = cubic meters

Ps = static pressure



The geothermal gradient varies between 2.6 - 4.1 °C/100 m. Properties such as ionic composition, high radioactivity and the content of rare gasses indicate an active circulation along paths partially in contact with the crystalline basement. The water is about 20,000 years old, the recharge area being in the Western Carpathian Mountains 20 - 30 Km East of Oradea.

The maximum artesian flow rate of wells is 35 l/s (measured at well head). To obtain a higher flow rate deep line shaft pump will be installed. During efficiency test shown in the table above the drawdown will be approx. -50 m at a flow rate of 60l/s.

A line shaft pump unit will be installed in the production well 4767. The deep line shaft pumps are usually used in geothermal wells because the electric motor and the electric cable remain at surface. Installation of a submersible pump unit in the geothermal well 4767 is considered to be more risky when the electrical cable could be damage at temperatures higher than 90˚C. To avoid situations that may be "killing" the well including expensive operation costs installation of a deep line shaft pumps is preferred.

Today both well 1717 and 4767 are production wells and the flow rate of well 1717 is approx. 4.0 l/s. The well will be prepared for re-injection. This means that an acid treatment will be carried out, in order to increase the injection capacity of the well. After this operation it is expected that the receptivity of the well will increase. In the same way due to high pumping flow rate of the well 4767 approx. 60 l/s (twice of the artesian flow rate) the reservoir will be slightly depleted and the re-injection flow rate would increase. In situations with temperatures of more than 40˚C the geothermal water could be offered to consumers located near the re-injection well or lead to the swimming pool. For re-injection of the geothermal water the existing production flow line from well 1717 which meets the existing production pipe from well 4767 near the former milk factory will be used.

2.2 Beius

Today a new geothermal well (3003) is being drilled through a research programme initiated by the Ministry of Research as mentioned earlier. The heat output capacity of the new well 3003 together with the existing well 3001 should be able to supply hot water to four existing substations and two new substations. The six substations would be connected to approx. 600 - 800 apartments. A table of the energy consumption of the buildings to be connected under the project is presented in Annex IV, these buildings represent the spatial boundaries of the Beius portion of the project.

The project idea is to increase the supply of geothermal energy from the new geothermal DH system (well 3001 and 3003) and also to include supply af public buildings in Beius. This has not been planned earlier due to lack of financial resources and low heat prices in Beius. The increase in the utilisation of geothermal energy in Beius could be implemented by connecting public buildings to the new geothermal system which today are equipped with individual fossil fuel fired boilers. Hereby combustion of fossil fuels will be substituted with a CO_2 neutral energy resource like geothermal energy.

Investment component	Investment and implementation
Extension of the existing primary pipe network for connection of well 3003 to the existing geothermal system.	Not designed or financed by the Ministry of Research
New branch pipes for connecting of buildings with individual boilers to the new and existing primary pipe network.	Not designed or financed by the Ministry of Research
Installation of new heat exchanger units (space heating and hot potable water) in buildings with individual boiler systems, to be connected to the new and existing primary pipe network.	Not designed or financed by the Ministry of Research
Costs related to design, tender procedures, implementation etc.	S.C. Transgex S.A.
Installation of heat meters in buildings connected to the new and existing primary pipe network.	Not designed or financed by the Ministry of Research

Table 11: Project Idea Beius

According to the negotiations performed it is foreseen that S.C. Transgex S.A. will be responsible for developing the financial basis for the project in Beius using CO_2 Credits together with own funds, commercial loans, possible grant support.

Full exploitation of the production well 3003 cannot be achieved before new heat consumers have been connected to the existing geothermal DH system.

Subject	Substations supplied today	Substations to be supplied in the JI - project (future)
Geothermal water supplied from well 3001 to substations	CTI, CTII, CTIII and CTIV	CTI and CTIV
Geothermal water supplied from well 3003 to substations		CTII and CTIII

Table 12: Supply of geothermal water in Beius

Based on information from owners of the different buildings affected by this JI - project proposal for Beius the annual fuel consumption is presented in the table below.

Fuel Consumption	Unit	Information
Heavy oil (twenty one buildings)	GJ/year	119,099,20
Natural gas (three buildings)	GJ/year	2989,56
Total	GJ/year	122,088.76

Table 13: Fuel consumption buildings with individual boiler systems

Implementing the JI project the production well 3001 and well 3003 will supply hot geothermal water to substations and heat consumer installations where the geothermal water will be utilised for heating of water for space heating purposes. After the utilisation the geothermal water will be discharge in the river crossing the town of Beius. Discharging of geothermal water has been approved by the environmental authorities if cooled below 40 °C.

2.3 Project Characteristics

The project characteristics of the projects are presented in the tables below.

Oradea

Component	Unit	Oradea - Area II
Existing thermal sources		CET I
Total heat output capacity of CET I for Area II - Space heating	MW	10,23
Total heat output capacity of CET I for Area II - hot potable water	MW	4,39
Existing heat output capacity, specified	W/m^2	260
Supply of hot water for space heating	Yes/No	Yes
Supply of hot water for production of hot potable water	Yes/No	Yes
Number of staircases connected to secondary pipe network	No	215
Number of persons supplied with heat from existing substations	No	10.140
Total heated floor surface individual buildings	m^2	39.337
Total heated floor surface per person	m^2/person	3,88
Total length of existing secondary pipe network	km	20,655

Table 14: Characteristics of the DH system to be included in the JI - project in Area II

Beius

Subject	Unit	Beius
Number of buildings with individual boiler system	No	24
Number of buildings heated using heavy oil	No	21
Number of buildings heated using natural gas	No	3
Total annual net energy value of fuels	GJ/year	126.805,56

Table 15: Characteristics of buildings to be included in the JI - project in Beius

2.4 Project Sustainability

2.4.1 Sustainability of Resources

Oradea (Information obtained from Transgex)

The S.C. Transgex S.A. has extensive experience in exploiting the Oradea reservoir, which S.C. Transgex S.A. describes as a reservoir located in Triassic limestone and dolomites, at 2200 - 3400 metres depth covering an area of approx. 113 Km^2. During 35 years 12 wells have been drilled by S.C. Transgex S.A., from which 11 are production wells with temperatures ranging from 70 °C up to 105 °C degrees and one re-injection well. However, in the future several existing production wells will be used as re-injection well like the existing production well 1717, which in the future will be utilised for re-injection puposen.

The geothermal gradient varies between 2.6 - 4.1°C/100 meters. Properties such as ionic composition, high radioactivity and the content of gasses indicate an active circulation along paths partially in contact with the crystalline basement. The water is about 20,000 years old, the recharge area being in the Western Carpathian Mountains 20 - 30 Km East of Oradea.

The reservoir modelling of Oradea reservoir has been carried out. The main target of the reservoir simulation was to set up a numerical computer model which is able to match the drawdown pressure variations and temperature observed during exploitation and to predict pressure and temperature trends in the reservoir for future development schemes. Based on the available data a 2D (two dimensions) computer model was considered for the Oradea reservoir. The assumptions used for modelling are presented below:

- ✓ Reservoir is situated at 2400 m below sea level
- ✓ Reservoir is one horizontal layer, with constant thickness of 900 m
- ✓ Reservoir is closed at North, South and West
- ✓ Eastern boundary was set as a constant pressure boundary at 246.9 bar and 70^0C
- ✓ Internal faults of reservoir have not been considered in the simulation.

The Oradea reservoir was divided into 1934 elements. A regular grid of 200 x 200 m was set up in the production area and in the outer part of the production area an irregular grid was set up. At the Eastern boundary of the reservoir, a block with a volume of zero was set up to simulate the constant pressure boundary of the reservoir. In order to assign double porosity behaviour to the model, the primary grid was pre-processed with the MINC (Multiple Interacting Continua) procedure of simulator. It was considered that there are two interacting media, the matrix and the fracture, and type of flow in the reservoir is mainly fracture flow. It was assumed that the fracture represents 10% of a unit volume of rock and fractures have 100 m spacing. After pre-processing, a model with 3869 elements resulted. The producer/injector blocks were not discredited in order to simulate accurately the well within the producer block. The permeability structure of the fractures in the reservoir was assigned based on the contour map of the permeability distribution obtained from well test data. The computer models have been calibrated on the measurements carried out during the interference test in 1984. These simulations showed that the reservoir behaved very stable during the past 11 years of exploitation. The development schedule assumes that the utilization will be developed to maximum by setting line shaft pumps in eight wells and re-injecting in six wells. Re-injection will be carried out in four selected wells and in two future injection wells to be drilled in the future. By following this scheme the exploitation of geothermal energy will be carried out by operating eight doublets in Oradea. The simulation has been performed for a period of 30 years. For the first 10 years, the time step chosen was 30 days and after 10 years it was changed to 120 days. The simulation shows that the reservoir pressure distribution will be stable at its initial value, except the blocks in the north-western part of the reservoir, which have lower permeability. The temperature in the injection blocks will

decrease during 30 years of exploitation from their initial value close to the injection temperature.

Beius

The subsurface geothermal reservoir to be used in Beius for supply of hot water to buildings heated by individual boilers has been exploited for years by operation of well 3001 and the geophysical conditions are well known.

During testing of well 3003 more information about the geophysical conditions of the subsurface reservoir will obtained. No modelling of the subsurface reservoir to predict the potential of the geothermal resources has been conducted due to many years of exploitation of the reservoir as mentioned before. The potential of the subsurface reservoir is considered to be sufficient to a much higher flow rate than 120 l/s for a time period of many decades.

2.4.2 Environmental sustainability

The environmental sustainability in terms of environmental benefits comprises reduction of GHG, SO_2 and dust from the Romanian DH sector is high from the project. The environmental sustainability is considered to be high when the local geothermal energy resources in the Oradea and Beius area has been exploited in a small scale and investigated for years, and is well know.

In Oradea - Area II re-injection of cooled geothermal water will contribute to a higher environmental sustainability of the JI - project, as discharging of cooled geothermal water into rivers is like mining the resources as mentioned earlier and discharge in rivers might introduce ecologically changes even it is approved by the Romanian Authorities.

In Beius there is no possibility for establishing the re-injection alternative as no wells are available. Therefore the cooled geothermal water also in the future will be discharged into the river crossing the town. However, it should be mentioned that the modifications of the geothermal loop considered in this project will assist to keep the discharge temperature well below the limit value. In this respect the discharged water temperature will be monitored on a regular bases along with any noticeable longer term impacts. The determination of long term environmental impacts will be the responsibility of the local EPI. It has also to be emphasized that discharging of cooled geothermal water in the river has been approved by the local EPI and several surveys has been performed.

According to the local environmental authorities the chemical composition of the geothermal water should only have an insignificant affect on the environment conditions in the river; and discharging of geothermal water into rivers in both Oradea and Beius has been monitored by the EPI in Oradea during years. As mentioned in paragraph 2.4.1 the long term strategy defined by Transgex is to introduce re-injection into the geothermal reservoir. It is however also evident that the financial recourses for drilling new injection wells are not available for the time being.

2.4.3 Economic sustainability and Financial Analysis

The feasibility of the project has been analysed and the main outcomes of this analyses are presented below.

The major technical content of the two scenarios is described in the table below.

Scenario	Technical Concept used in Scenarios
Scenario I – II Oradea	- Establishing of the geothermal loop (production- and re-injection well) by using existing production well 4767 and existing well 1717 as re-injection well. Rehabilitation of well site installations will also take place. - New geothermal heating plant comprising erection of new building, installation of new line shaft pump unit, new gas boilers, new plate heat exchanger units (dividing geothermal loop from primary network), new pump units, computer control system etc. - New primary distribution pipe network connecting the geothermal heating plant with the five substations. - Rehabilitation of existing secondary pipe network connecting the five substations with buildings by replacing all parts of the existing pipe network with new pre-insulated piping components that has not been subject to rehabilitation with in the last years. I.e. the result will be a secondary network all with pre-insulated DH pipes.
Scenario I – II Beius	- Extension of the geothermal facilities as well as the DH systems correspondingly making it possible to connect 24 buildings.

Table 16: Description of scenarios

In **Scenario I and Scenario II**, the investment cost has been calculated to 2,030,218 EUR. The investment cost of Oradea is 1,820,218 EUR and the investment cost of Beius is estimated to be 210,000 EUR.
The basic figures used in the analysis are highlighted in the table below.

Subject	Unit	Assumption
Total investment costs (Scenario I - II)	EUR	2,030,218
Total operating costs (year 2 to year 8)	EUR	325,596
Applied heat sale price to consumer in Oradea	EUR/GJ	4.77
Applied heat sale price to consumer Beius	EUR/GJ	2.18
Total heat sale to consumers	GJ/year	201,302
Total heat sale to consumers in Beius	GJ/year	126,806
Annual heat sales income	EUR/year	1,236,648
Interest of the commercial loan	%	6.0
Maturity of the commercial loan	Years	8

Table 16: Basic figures

As mentioned in paragraph 1.1.3 the heat selling prices in Oradea is lowered to a level below the subvention level; i.e. both the consumers, the Municipality and the State are saving money; in Beius the existing very low heat selling price is maintained.

For the appraisal of the investment project, two discounting methods are used.

The Net present value (NPV) method discounts all expected cash flows to the present, using a minimum desired rate. The discount rate should basically reflect the opportunity cost of capital, which corresponds to the possible returns an investor would obtain on the

same amount of capital if invested elsewhere. In other words, the discount rate should be the minimum rate of return. The discount rate used is 12%.

The Internal rate of return (IRR) is the discount rate that makes the net present value of the investment equal to zero. If the IRR equals or exceeds the minimum desired rate of return the project can be accepted, if not the project should be rejected. The IRR represents the exact profitability of the project.

A nine years time horizon is used (one year for implementation and eight operating years) and in all calculations the currency used is EURO.

It is expected that an important part of the financing will be secured by a bank loan and in Scenario II the bank loan is included. Naturally, it is important to know if a potential bank loan can be paid back in time.

When all cash inflows and all cash outflows (except the debt service) are listed, the available cash amounts for paying the repayments and interests (total debt service) can be calculated. The Debt Service coverage ratio is defined as the Available cash to total debt service. In this analysis the Annual Available Cash = Annual Sales Income + Annual CO_2 Credit – Annual Operating Costs. Ratios of 1.5 - 3.0 range between acceptable and satisfactory.

A number of other aspects are of course important from a banks point of view such as the management of the company, the overall financial strength of the lender, liquidity and ability to create operating profit. In this respect, both historical data and budgets for income statements, balance sheet statements and cash flow statements are important documents to analyse. It should be noted, that these statements are not included in this Feasibility Study. In addition should possibilities for offering and accepting guarantees, collateral etc. be taken into consideration when considering the loan possibilities?

In **Scenario I and Scenario II**, the investment cost has been calculated to 2,030,218 EUR (please see table 16)

In **Scenario I**, the Total investment cost is included as a cash payment in Year 0. As cash outflow is included the Annual Operating costs and as cash inflow is included the Annual Sales income based on the heat sales price of 4.77 EUR/GJ in Oradea and 2,18 EUR/GJ in Beius.

The project is feasible. The Internal rate of return is 36.8% and the Net present value is 2,005,838 EUR when using a 12% discount rate.

If the CO_2 credit up-front payment and annual CO_2 credit payments are included as cash inflows for the project, the feasibility will improve. The Internal rate of return would then be 43.9% and the Net present value is 2,442,462 EUR (12% discount rate).

It is expected that an important part of the financing will be secured by a bank loan and in the remaining four scenarios a bank loan is included as an important financing source.

The loan is assumed to be an Annuity, 8 years and with a 6% interest rate.

In **Scenario II**, the financing will be covered by the CO_2 Up-front Credit payment (7.5% of the needed financing is foreseen) and a bank loan (92,5% of the needed financing). By comparing the Annual Debt service (Repayment and Interest) with the difference between (Annual Sales Income + Annual CO_2 credit) and the Annual Operating costs it is possible to assess if a potential loan can be paid back. The ratio applied for such an assessment is:

Debt Cover ratio = Annual Net Cash Flow / Total Annual Debt Service.

Annual Net Cash Flow = (Annual Sales Income + Annual CO_2 credit payment) – Annual Operating costs

Annual Debt Service = Annual Interest + Annual Repayments.

If the Annual Net Cash Flow is equal to the Annual Debt Service, there is precisely enough cash net flow to pay back the loan and the Debt Cover ratio is 1.0. If there is not enough cash flow to pay back the loan the ratio is below 1.0 and above 1.0 if the Annual Net Cash flow is higher that the Annual Debt Service.

In Scenario II, the Debt Cover ratio is 2.9 and this is a high ratio. The heat sales price applied is 4.77 EUR/GJ in Oradea and 2.18 EUR/GJ in Beius

The results of the analyses are highlighted at the next page.

Summary of the financial analysis of the Oradea Geothermal Project

Scenario	**Investment Costs** (**see** Fejl! Henvisningskilde ikke fundet.**)**	**Financing**	**Result**	**Debt Cover ratio At heat price = 4.77 EUR/GJ**	**Necessary heat price EUR/GJ for securing a Debt Cover ratio = 3.0**
Scenario I	2,030,218 EUR	All cash	IRR = 36.8% NPV = 2,005,838 EUR		
Scenario II	2030,218 EUR	CO_2 up-front + Loan		3.8	2.9 EUR/GJ

Table 17: Summary of the financial analysis

The above table highlights the result of the financial analysis.

The calculations are showing a high Debt cover ratio indicating that there is a good chance for financing the project.

2.4.4 Cost Benefit Analysis

Market Players

The aim of this analysis is to assess and evaluate how the different market players are affected economically if the Geothermal Project in Oradea will be implemented as described in the Project Design Document for the project.

Following market players can be listed:

- ✓ The joint venture Geoterm S.A. has been established by Transgex S.A. and the Municipality of Oradea (The ownership share of the joint venture is 88,45% share for Transgex and 11.55% for the Municipality of Oradea)
- ✓ Municipality of Oradea
- ✓ Citizens in the Municipality of Oradea
- ✓ Town of Beius

Inputs

The project can be described by Inputs and Outputs.

In this analysis, Inputs consists of Investments and Operating Costs.

The investment of the total project consists of investments in Oradea and in Beius.

The investment cost in Oradea is 1,820,218 EUR and the investment cost in Beius is 210,000 EUR. The total Investment cost is 2,030,218 EUR. (as in Scenario I and ScenarionII)

The Operating costs include, electricity costs, cost for discharge of cooled geothermal water, salary costs, natural gas costs and maintenance cost stipulated to a level equal to what is normal in a similar West European installation using a fixed percentage of the investment cost. In the Operating costs also monitoring costs are foreseen.

Outputs

Two major categories of Outputs will be secured by implementing the Geothermal Project:

1) The Geothermal project produces heat energy
2) The project will create environmental benefits as evaluated in the Baseline Study.

In this way, the Oradea Geothermal Project creates values for the society and for the respective market players.

By implementing the project, a decrease of the CO2-equivalen emissions will be realized.

It is foreseen in the Project Design Document, that the CO2 payments will be paid to the project. The actual price will be subject negotiation between representatives from the Danish and the Romanian governments. This negotiation has not been finalised yet and therefore the calculations performed so far is based upon standardised basic figures utilised also in other projects. The amounts of CO2 reductions in the PDD have been applied to calculate the monetary value of the CO2 credit payment. CO2 credits will be paid for the first 8 years of the planning horizon. The monetary values are all included as positive cash flows for the joint venture company Geoterm S.A.

25% of the total 8 years monetary value is included as an up-front cash payment, while the remaining amount is allocated equally during the next 8 years.

Another Output category is the heat production.

The heat sale has been divided in two groups. The annual heat sale to Oradea is 201,302 GJ and the annual heat sale in Beius is 126,806 GJ.

Today, the heat selling price in Oradea is 7.75 EUR/GJ before deduction of subsidises (please see paragraph 1.1.3)

Of this price, the citizens of Oradea are paying 5.16 EUR/GJ and the Municipality of Oradea is paying 2.58 EUR/GJ.

After the Geothermal project has been implemented, the final heat sales price in Oradea is 4,77 EUR/GJ. As it can be seen from the above, this final price is less than the price per GJ that the citizens of Oradea are paying today.

One question is if the subsidies should be included in the calculations. Today, the Municipality of Oradea is paying the subsidy to a municipal company. When the Geothermal project is implemented, the subsidy is no longer paid. However, today this subsidy can be considered as both an income source and a cost for the same organization. Therefore the subsidy is not included in the calculation of effects.

For Beius, we have figures for the total annual heat demand and the total annual heat costs with the existing heating systems. The current average heat price in Beius is 9.53 EUR/GJ when speaking about the cost based on the utilisation of gas or oil in own boilers.

After the Geothermal project has been implemented, the heat purchase price for the consumers in Beius is set to be 2.18 EUR/GJ.

Fixed prices (both sale and cost) are used in all calculations.

Economic Net Effect of the Geothermal project

All monetary and environmental impacts of the project can now be put in one table.

Following items are included:

Input : Investment in Oradea

Input : Investment in Beius

Input : Operating costs related to Oradea and to Beius

Input : Operating costs related to Beius

Output : Value of energy production to Oradea (current heat costs and quantities are used)

Output : Value of energy production to Beius (current heat costs and quantities are used)

Output : Environmental benefit related to Oradea (value according to JI project payment)

Output : Environmental benefit related to Beius (value according to JI project payment)

The net effect of the project is highlighted in the excel sheet.

By looking at the results over a nine (9) years planning horizon (construction in year 0 and hereafter eight (8) years as mentioned), it is clear that the project has a positive economic impact.

The investment made the first year is causing a negative effect for the first year, but already in the second year, the positive effect is higher than the negative effect for the first year. The economic net effects for the first 3 years are highlighted in the table below.

Figures in EUR	0	1	2
Investment Oradea	-1.820.218	0	0
Investment Beius	-210.000	0	0
Operating costs		-410,807	-427,107
Value of energy production Oradea	0	1.039.521	1.039.521
Value of energy production Beius	0	1.209.000	1.209.000
Environmental impact Oradea	86,895	32.586	32.586
Environmental impact Beius	65,618	24.607	24.607
Economic Net Effect	**-1.877,705**	**1,894,907**	**1,878,607**

Table 18: Economic Net Effect of the Oradea Geothermal Project.

The annual economic net effects are the same for all years from year 2 to year 8.

To have a figure indicating the total economic net effect of the project for the total planning period, the annual economic net effect has been discounted and the accumulated net present value of the effects has been calculated.

A 6% discount rate is resulting in a net present value of 9,803,435 EUR.

A 12% discount rate is resulting in a net present value of 7,469,092 EUR.

Distribution of economic net effects between the market players:

Benefit to the citizens of Oradea Municipality

The citizens in the Oradea Municipality are using 201,302 GJ/year.

Currently they are paying 5.16 EUR/GJ. With the Geothermal project, the new heat price will be 4.77 EUR/GJ.

The benefit for the citizens is determined by the heat demand and the price difference.

The fuel cost saving is 79,311 EUR/year.

A 12% discount rate is resulting in a net present value of 393,987 EUR

Benefit to the town of Beius

The consumption in Beius is 126,806 GJ/year.

The average heat price is 9.53 EUR/GJ without the project and it has been decided that the price for Beius with the geothermal project will be only 2.18 EUR/GJ.

The difference of current and future fuel prices determines the feasibility of the Beius town of being included in the Geothermal project.

The fuel cost saving is 932,564 EUR/year.

A discount rate of 12% is resulting in a net present value of 4,632,643 EUR for the planning horizon.

The environmental benefit of Beius is about 43.0 % of the total environmental benefit of the project.

Effect for the Municipality of Oradea

As mentioned above, currently the Municipality of Oradea is paying subsidy to a municipal company. This is not included in the economic net effect in Table 1. The annual subsidy amount will not be paid after the geothermal project has been implemented. The annual subsidy amount is 519,761 EUR.

The Municipality of Oradea is part of the new established joint venture company Geoterm S.A. The municipality owns 11.55% of the company, while the company Trangex owns the remaining 88.45%.

Effect for Geoterm S.A.

The Municipality of Oradea is part of the new established joint venture company Geoterm S.A. The municipality owns 11.55% of the company, while the company Trangex owns the remaining 88.45%.

The effect for the Geoterm S.A. has been calculated.

Geoterm S.A. is paying the investment and the operating costs. Geoterm S.A. sells heat to Beius at 2.18 EUR/GJ and to the citizens of Oradea at 4.77 EUR/GJ.

In addition, the CO_2 up-front payment and annual payments are included as positive effects.

For the planning horizon, a 12% discount rate is resulting in a net present value of 2,442,462 EUR.

Conclusion

It can be concluded that all listed market players will have a net benefit when the geothermal project is implemented.

The economic net effect of the project has been calculated and the specific effects for the relevant market players have been evaluated.

In conclusion, following table can be established:

	Year			
Figures in EUR	0	1	2	3
Savings Beius		932,564	932,564	932,564
Saving Oradea		0	0	0
Savings citizens		79,311	79,311	79,311
Cash flow for Joint Venture	-1,877,705	883,032	866,732	866,732
Net Effect	-1,877,705	1,894,906	1,878,607	1,878,607

Oradea Municipality is part of Geoterm S.A.

Table 19: Summary of benefits of market players

The annual net economic effects are the same for all years from year 1 to year 10.

For a ten years planning horizon, the resulting net present values for the relevant market players are as follows:

Net Present Value (at 12%)	EUR
NPV Beius	4,632,643
NPV Oradea	0
NPV Citizens	393,987
NPV Geoterm S.A.	2,442,462
NPV Total Project	7,469,092

Table 20: Net present values (at 12 %) for market players

2.4.5 Project Outcome

The project outcome comprises upgrading of existing district heating systems in Oradea Area II and Beius by introducing new technology like new geothermal heating plants, new pre-insulated pipe components, pump units with variable speed drive, control systems for operation of the upgraded DH systems.

The main modifications of the existing DH systems under the project are presented below.

Site	Outcome
Oradea Area II	Rehabilitation of well site 4767 and 1717 to increase the heat output capacity of well 4767. New geothermal heating plant building equipped with new technical installations like line shaft pump unit, peak load gas boilers, heat exchanger units and control system. New primary distribution pipe network (pre-insulated piping components) connecting the geothermal heating plant with the five substations. Rehabilitation of technical installations in five existing substations. Rehabilitation of most of the secondary distribution network the part not rehabilitated during the last years. I.e. the result will be a complete pre-insulated secondary DH network connecting substations and consumers
Beius	New primary network (pre-insulated piping components) connecting 3001 with CTII and CTIII. New heat exchanger units in buildings for connection of buildings to new primary network. Installation of new branch pipes for connection of buildings to primary network. Installation of new heat meters for measurement of heat consumption for space heating and for production of hot potable water.

Table 21: Project Output.

The technologies to be used when implementing the project is considered to be environmental friendly and sound technology based on modern geothermal technology and DH technology.

The new technology implemented by the project will result in better performance (more efficient) compared to the existing technologies used today in Oradea Area II and Beius.

The expected lifetime of the equipment installed under the project will when speaking of the line shaft pump unit be minimum 8 - 10 years, natural gas boilers minimum 15 years and new pre-insulated piping components from 25 - 40 years.

It shall be emphasised that the lifetime of the different equipment and installations will strongly depend on execution of proper maintenance and service.

Training of the operational staff responsible for operating the new DH systems based on geothermal energy will be done during implementation of the project. The training will among others comprise operation procedures, maintenance procedures and monitoring procedures.

2.5 Time Schedule

The development of and implementation of the project in Oradea - Area II and in Beius is expected to follow the below time schedule.

Time Schedule Oradea - Area II

Activitity	2003	2004
Approval of PDD, BS and MP		
Approval of CO2 project Specific Agreement		
Approval of project by authorities		
Design of geothermal based DH system - Area II		
Elaboration of tender dossiers supply contracts		
Elaboration of tender dossiers works contract		
Procurement and tender opening session		
Signing of contracts		
Geothermal loop (wells, well site installations)		
Geothermal loop (pipeline between well 4767 and 1717)		
New geothermal plant		
Installation of new primary network		
Rehabilitation of the five substations		
Testing of new district heating system		
Commissioning of new district heating system		

Table 22: Time schedule Oradea Area II

Time Schedule Beius

Activitity	2003	2004
Approval of PDD, BS and MP		
Approval of CO2 project Specific Agreement		
Approval of project by authorities		
Design of geothermal based DH system - Beius		
Elaboration of tender dossiers supply contracts		
Elaboration of tender dossiers works contract		
Procurement and tender opening session		
Signing of contracts		
Geothermal loop (pipeline between well 3001 and primary network)		
Installation of new primary network		
Connection of new buildings to geothermal system		
Testing of DH system		

Table 23: Time schedule Beius

2.6 Project Stakeholders

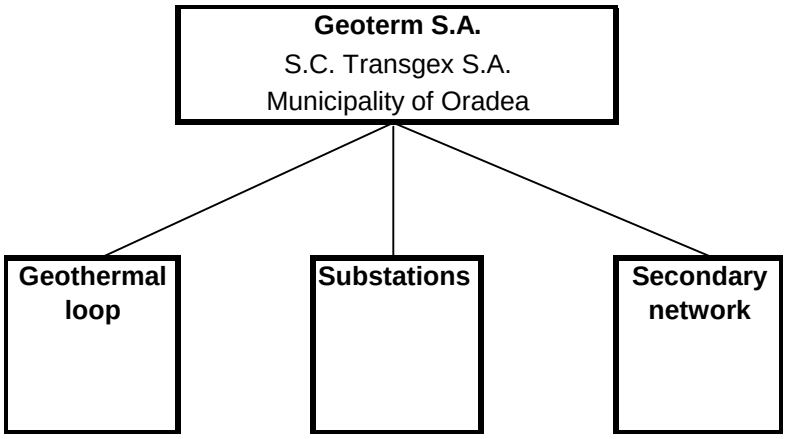
This paragraph presents the stakeholders involved in the project in the geothermal project in Oradea - Area II and Beius.

Oradea - Area II
Since January 2003 local support (municipality, CET I and S.C. Transgex S.A.) partly inspire by DEPA to increase the exploitation of the local geothermal resources in Oradea has been growing. One outcome of the local effort is the founding of the Joint Venture company named Geoterm S.A. formed by the municipality of Oradea and S.C. Transgex S.A. aiming to develop geothermal energy projects in Oradea. Another outcome is the agreement about the financing of the geothermal project and heat sale to consumers.

Stakeholders in the joint venture company Geoterm S.A.:

Municipality of Oradea: Stakeholder in new joint venture aiming to support implementation of geothermal projects in Oradea, and to finance 10 % of the investment costs of the geothermal project in Area II. The municipality of Oradea will own 11.55 % of the new joint venture company.

S.C. Transgex S.A.: Private company, stakeholder in the new joint venture and responsible for the operation of the geothermal loop, new geothermal heating plant, substations and secondary network in Area II. S.C. Transgex S.A. will own 88.45 % of the new joint venture company.



The Joint Venture aims to secure sufficient heat production and heat supply to heat consumers in Area II, but also to secure implementation of the geothermal project.

The new joint venture company will be responsible for generation of ERUs from the new geothermal system and for execution of the monitoring obligations.

Beius
The utility company responsible for the geothermal DH system in Beius is the private company S.C. Transgex S.A who will be the only stakeholder in the project. S.C. Transgex S.A. will be responsible for the financing scheme, design, implementation, operating and maintaining of the geothermal system.

2.6.1 Stakeholder Comments

Declarations from the Key stakeholders, namely Transgex CO and Oradea City Hall, are provided in Annex VII.

The PDD, version 2.2, has been issued for a 30 day public hearing at the Danish Environmental Protection Agency website in Denmark, at the Ministry of Agriculture,

Waters, Forest and Environment website in Bucharest, and by advertisement at the Mayors office in Oradea.

The public hearing in Demark was closed on November 27, 2003 and no comments or questions have been received. In Romania the public hearing was closed on December 5, 2003 and again there were no comments or questions.

3. Approval of the Parties involved

A JI project has to be approved by the parties involved, but the JI guidelines do not provide specific guidance concerning the form or content of the approval from the parties involved. Parties have to appoint a JI Focal Point to approve the project which should be listed at the www.unfccc.int. According to information Denmark has not yet listed a JI Focal Point at the UNFCCC, but the process in ongoing.

Due to no specific guidelines for obtaining an approval from parties involved the following procedures have been selected to secure approval by the parties,

- ✓ Letter of approval signed by the Romanian government and Danish government
- ✓ Consultation of stakeholders in Romania and Denmark will be performed by announcements in newspapers, websites or direct contact to relevant organisation like NGOs.
- ✓ Purchasing agreement signed by the Romanian government and Danish government will be developed.

Consultation of stakeholder will respect the requirements in the Marrakech Accords Decision 16/CP.7.

3.1 Host Country Party to Kyoto Protocol

Romania is party to the Kyoto Protocol according to Romanian law no 3/2001

3.2 Memorandum of Understanding

The MoU between Romania and Denmark was official signed on the 28 January year 2003 according to the principles of the Kyoto Protocol.

3.3 Letter of Intend

Transgex has as the main investor issued a letter of Intent which is include under the annexes

Assuming the drop in electricity production at CET I will be substituted by electricity supplied by other power plants, implementation of the project will indirectly affects production at other power plants. To avoid selling of CO_2 credits from the project described in this PDD (doublet counting) in future projects the Romanian government should secure this in the purchasing agreement.

3.4 Emissions Trading Agreement and Purchasing Agreement

The Emissions Trading Agreement for this JI project between the Danish and Romanian governments has been signed, and should act as the final document of approval for this JI project. In addition to this an Emissions Reduction Purchase Agreement has been signed between Transgex and the Danish government for the implementation of the project. These documents and any additional approvals are the final project approvals for this project, and are considered proprietary contractual information. The independent entity may gain access to these final approval documents through the contracting authority, the Danish Environmental Protection Agency.

3.5 Crediting Period

The crediting period describes the number of years over which GHG emission reduction generated by the project can be claimed. As mentioned below a crediting period on 8 years lasting from year 2005 until 2012 is the precondition for this PDD. The first period

is from commissioning of project to year 2008 (early crediting); the second period is from 2008 – 2012 (first commitment period)

In the **Baseline Study** a 10 years (2008 – 2017) period is utilised to demonstrate the impact caused by the project when speaking about the GHG emission.

–The crediting period used in the **Monitoring Plan** is starting when the project is commissioned and will run until the time limit defined in the letter of approval.

3.6 Criteria Host Country PDD, BS and MP

The Romanian Ministry of Agriculture, Forest, Waters and Environment has been consulted for identification of eligible criteria to be respected when elaborating the PDD, BS and MP.

The eligible criteria to be respected are identical with the requirements and guidelines presented in the Kyoto Protocol, Marrakech Accords, Romanian legislation, Romanian regulations and Romanian climate policy.

3.7 Impact Assessment

3.7.1 Environment Impact Assessment and Transboundary Impacts

During development of the projects contact to the Environmental Protection Agency (EPA) of Bihor County has been taken to clarify the legislative requirements concerning environmental impact assessments and transboundary impact assessment. The environmental requirements to be fulfilled according to Romanian legislation comprise environmental impact assessment (EIA), but no transboundary impact assessment. Transgex has been asked to develop a EIA in cooperation with the EPA.

The geothermal projects in Oradea – Area II and Beius will generate environmental benefits within the area of reducing the emission of SO_2, NO_x and particles from existing fossil fired boilers. Relevant data on the emission from the CET plant is not available; however it is evident that the old lignite fired boilers are far from being environmental friendly. Further to the CO2 emission reduction local visible benefits will be the result from implementing this JI projet.

Today the cooled geothermal water from production well 4767 and 1717 located in Oradea – Area II is discharged in a river, which will be stoped when this JI project is implemented . The JI – project comprises one production well (well 4767) and one re-injection well (well 1717) as mentioned earlier. This means hot geothermal water from production well 4767 is lead to substations for production of hot water (space heating purposes and for production of hot potable water) and after urilisation the geothermal water is lead to re-injection well 1717.

Oradea

On the 8 October 2001 the EPA of Bihor County issued an environmental authorisation (Autorizatia De Mediu – no. 1237 din 08 10 2001) for exploitation of geothermal water from all geothermal wells located in the city of Oradea.

Analyses of the geothermal water from the Oradea reservoir have been performed.

The environmental impact assessment to be conducted for Area II comprises two individual environmental impact assessments conducted by the Romanian environmental authorities (local EPAs) as described in the below.

Environmental Approval (Acord De Mediu): When design of the new geothermal DH system has been completed in the autumn 2003 the Acord De Mediu will be obtained, which is a preliminary environmental approval.

Environmental Permit (Autorizatie De Mediu): After commissioning of the new DH system in year 2004 the local EPA will conduct an environmental assessment of the new DH system and the final environmental permits can be issued.

Beius

On the 8 October 2001 the EPA of Bihor County issued an environmental authorisation (Autorizatia De Mediu – no. 1238 din 08 10 2001) for the entire geothermal project commissioned in year 2001 in the town of Beius. This means that discharging of cooled geothermal water from well 3001 and future well 3003 has been investigated and approved by the relevant Romanian authorities before the environmental approval was issued.

When the final environmental permits have been issued for the DH system in Area II under a copy of the approvals will be forwarded to the Validator, Romanian Ministry of Agriculture, Forest, Waters and Environment, and the Danish Ministry of Environment.

3.7.2 Social Impacts

The social impacts affected by implementing the project in Oradea – Area II and Beius would be within the following areas.

The emission of NO_x, SO_2, particles from combustion of fossil fuels will be reduced improving the **air quality** in Oradea – Area II and in Beius.

Utilisation of a local energy resource would generate **lower energy prices** for heat consumers in the future generating better indoor comfort in dwellings when inhabitant's ability to purchase heat has been improved. According to information the price of natural gas in Romania is expected to increase with up to 40 % in Romania in year 2003/2004 meaning that heat and electricity supplied from CET I will become more expensive and unstable.

Utilisation of a local energy resource means **less import of foreign fossil fuels** like natural gas and heavy oil. This means emission of particles, SO_2, NO_x etc. from combustion of energy needed to distribute fuels from foreign countries will be decreased.

Experience generated by the project would prove that utilisation of local geothermal energy resources in Romanian is possible. This means **multiplication of the social impacts** described in this paragraph could be possible in Romania.

Today the heat production price is 1,200,000 ROL/Gcal and the consumers are paying 800,000 ROL/Gcal and subsidies from the municipality of Oradea and from the state budget is covering the difference equal to 400,000 ROL/Gcal. Implementing the project the municipality of Oradea and the Romanian state will **decrease its subsidising** of heat prices.

During implementation of the project **new jobs** will be created in the construction sector (civil works) and industrial sector (manufacturing of new equipment).

For operating the new geothermal system **new operational staff** members will be needed in both Oradea – Area II and in Beius.

3.7.3 Monitoring of Environmental and Social Impacts

Environmental Impacts

Monitoring of the environmental impacts from the project comprise monitoring activities like emission measurements from CET I and the Beius DH system. When the final impact assessment from the new DH geothermal systems has been completed S.C. Transgex S.A. will receive an environmental approval from the local EPA including requirements related to monitoring procedures. Today the local EPA decides the frequency for the monitoring of the emission from CET I, industrial facilities etc.

The local EPAs elaborates environmental reports describing environmental aspects like air quality, water quality, waste management, dumping of waste, discharged water etc.,

which in the future probably will include the project's environmental impact on its surroundings.

The local EPAs is expected every third month during the entire crediting period to conduct inspection of the monitoring procedures conducted by the operational staff at the geothermal heating plant. In former projects in the Romania DH sector the local EPAs have been interested in monitoring the new DH system and similar EPA involvement is expected in this project.

Social Impacts

No plans has been elaborated to monitor the social impacts generated by the project, but it is obvious that geothermal energy will generate lower heat consumer prices in Area II compared to heat consumer prices based on natural gas and lignite combusted at CET I. Lower heat consumer prices is expected to increase the comfort level in buildings when inhabitants demand for space heating and for hot potable water can be fulfilled.

According to information the number of inhabitants in Area II – Oradea which have installed own heating unit (gas- or coal fired) is zero. The number of inhabitants disconnecting from the project after its implementation would be monitored and included in the monitoring plan.

Future monitoring of the social impacts will be conducted when speaking about higher comfort level in buildings because monitoring of fuel consumptions (new geothermal heating plants), heat productions (new geothermal heating plants) and heat consumptions (dwellings, public buildings etc.) will be conducted monthly.

4. Additionality Assessment

According to the Kyoto Protocol and JI guidelines, any JI project has to generate emission reductions that are additional to what which would have occurred in the absence of the JI project. This must be demonstrated through comparison the JI – project with the most likely baseline scenario.

International rules and procedures do not provide further guidance for how the JI – project should address additionality requirements. This PDD includes additionality requirements recommended in various publications, reports and manuals, plus additionality test methodologies as developed under the Dutch ERUPT 4 programme.

- ✓ **GHG emissions additionality:** Additionality is fulfilled when GHG emission reduction would not occur in the absence of this project. Thus there are no other viable technologies or financial programmes available that will reduce GHG emissions outside of a JI project.
- ✓ **Programme additionality:** Additionality is fulfilled when there are no initiatives by host country or international organizations to improve efficiency, reduce levels of certain pollutants, or to exploit finite indigenous resources. A component of this is social and cultural additionality which is fulfilled when there are social and cultural constraints (on decisions making) due to prevailing practices that have prevented the use of a technology or implementation of a project.
- ✓ **Financial additionality:** Additionality fulfilled when the project is not financially viable without CO2e credit sales, when the project does not present a significant financial profit over other alternatives, or when investment barriers persist for the project activity without CO2e credit sales.
- ✓ **Accession to the European Union:** Fulfilment of the Acquis Communautaire will not necessarily disqualify the emission reduction generated by the project for the crediting period.

The additionality requirements listed above will be reviewed below to clarify the project's fulfilment of additionality requirements.

4.1 Emission Additionality

The GHG emission reduction generated by the project will not occur without the project activity. There are no national- or local initiatives to substitute fossil fuels with a CO_2 neutral fuel like geothermal in the Oradea – Area II and Beius (buildings with individual boiler systems). There are also no alternative technologies to the existing situation that are affordable in the local situation. The down turned economy and very poor investment climate are significant barrier to the implementation of cleaner energy production technologies.

4.2 Programme Additionality

No regional policies, local policies or national policies for increasing the effectiveness of the CET I in Oradea has been identified. However, on the operation company's own initiative new natural gas boilers have been introduced at CET I in order to increase efficiency. At the national level, the new Romanian energy strategy for the years 2004 – 2015 and current Government Decisions are developed to include of EU legislation. Government Decision nr. 443 April 2003 takes into account the EU goal of providing that 12% of domestic energy consumption should come from renewable energy resources. In this respect it must be mentioned that Romania has a high potential for Hydro-power production from existing facilities. However, in meeting the goal of Government Decision nr. 443 a National Strategy for Renewable Energy Resources 1535 December 2003 was developed. This Strategy presents only guidelines for achieving the goals and does not contain any mandatory obligations imposed within it or specific financial support tools.

The exploration of geothermal energy in Romania dates back to before 1989, when a programme for the mapping of geothermal energy was developed under a renewable energy programme (please refer to the letter from Transgex in Annex VII). In this context Transgex (once part of a state owned company) was one of a few companies performing the drilling of smaller exploratory wells and obtaining exploitation licenses. Under this programme a large number of exploratory wells were drilled and less than half of these have been utilised to some extent. The utilisation of these wells has been limited to mostly single agricultural production facilities such as greenhouses, cattle, and poultry farms, and the heating of small portions of hot potable water. Since 1989 the majority of these facilities have stopped using the geothermal energy due to operation and maintenance costs or company insolvency. As indicated in the UN Economic and Social Council – "Environmental Performance Review of Romania" (2001) the former national programme for renewable energy sources, of which geothermal was a component, was reported to be "unsuccessful." In addition a new programme is under funded, and has only a few Biomass demonstration sites under its belt. There is only one small (2 MW) example of the utilisation of geothermal energy for district heating in Romania. This facility was developed by Transgex in 2002 as a demonstration project, however Transgex does not have the financial resources to extend this activity on a larger scale. This picture indicates that geothermal energy, knowledge and technology has not taken permanent hold in Romania, and that there is a perceived risk associated with it due to past failures. In addition, the level of utilised technology in Romania has not reached that which is needed for larger district heating purposes.

The geothermal wells in Oradea and Beius have existed since before 1989, and they have never been used for large scale district heating in the area. The national and municipal governments have not strongly emphasised or financially backed the large scale use of such resources in the area, due the risks and lack of knowledge and technology as mentioned above, the investment issues as mentioned in the next section, and the over all lack of interest in such activities. Therefore, this JI project activity is considered additional in regards to governmental initiatives and programmes.

4.3 Financial Additionality

The project has been assessed towards regional policies, local policies, national policy and EU legislation. No financing component under the EU enlargement programme for Romania or national local programmes supporting utilisation of geothermal energy resources in Oradea or Beius has been identified.

The project will not receive any financial grant support from any EU based instrument or national grant funding component. The project activity goes beyond national financing programmes and the EU enlargement programme for Romania indicating the additionality of the project in connection to programme additionality.

There is an investment barrier for implementing the project outside of the JI project activity. Under the JI project agreements DEPA will provide Transgex with an upfront payment on the CO2e credits to be generated. The DEPA upfront payment and the municipal upfront payment will contribute to approximately 15% of the estimated required investment (2,030,000 Euros) for the project. This and the guaranteed income from emission reductions trading, of course, reduces the financial risk of Transgex, thus allowing them to takeout a favourable loan to cover the remaining investment requirements. There is no potential of covering the investment of the project outside of this JI project agreement due to the local perceived risk of implementing this geothermal project and the difficulty in gaining loans in Romania for such municipal projects. In this matter please refer to the letter from Transgex in Annex VII.

This poor investment climate is highlighted in the European Bank for Reconstruction and Development (EBRD) report entitled, "The Investment Climate for Climate Investment: Joint Implementation in Transition Countries," (Jan. 2003). This report ranks the thirteen European transition countries as to their investment climate and associated business risk of doing business in the countries. In this report, Romania is listed amongst the bottom three countries in regards to investment climate and business risk.

As indicated in section 2.4.3 once the investment barrier is overcome, the project activity with and without CO2e credit sales is financially viable. The project, without JI, has a Net Present Value exceeding 2,000,000 Euros for a 9 year period at a 12% discount rate. The profitability is higher when including the JI activity. The profitability is due to the sale of heat to consumers, despite the much lower delivery prices which they will pay under project agreements. These lower prices are a stipulation for project implementation from the municipalities and are a part of Transgex business policy. This has always been the case for implementing a district heating geothermal project in Oradea and Beius. An attempt to develop a geothermal district heating system was made in the recent past with a joint venture between Oradea and a German company but the deal fell through due to the lack of investment resources for the project.

In this respect, this JI project activity can be considered financially additional since the JI project activity will bring in the investment portion needed to actually implement the project, and the guaranteed JI income has allowed Transgex to obtain a loan for the remaining investment portion. These financial aspects, coupled with the issues of local perceived risk, historic failure and lack of willingness to utilise geothermal energy, and the introduction of newer viable technology in Romania, presents a clear picture that this JI project activity is additional to that which would other wise occur.

4.4 Accession to the European Union

The CET I is a power plant and part of the Directive of the European Parliament and of the council amending Directive 2003 – (EC establishing scheme for greenhouse gas emission allowance trading within the community, in respect of the Kyoto Protocol's project mechanism).

As specified in the Kyoto Protocol double-counting shall be avoided and the GHG emission avoided by implementation of this project which is based upon a reduced heat production at CET I shall be taken into account in possible future JI projects launched at CET I. Romania does not have an up-to-date climate change policy or a National Action Plan. It is widely known that Romania will have a surplus in assigned amount units under the Kyoto Protocol and it is expected that any energy production facilities under a National Action Plan will have sufficient emission allowances to cover current an future emissions of GHGs. In regards to power production, the reduced power production at CET I caused by the reduced heat production shall be taken into account when the effect of this project on emissions is calculated under the baseline study.

5. Baseline Study

The baseline assessment has been conducted as an integrated part of the PDD and this paragraph provides information about historical data, estimations and calculations used to predict the most likely baseline and the net emission reduction generated by the JI - project.

It has to be emphasised that no official body for JI - projects under the UNFCCC has yet been established to which baselines can be submitted or for clarification of issues used when developing a baseline.

Assumptions have been selected to develop a conservative baseline for the project this to avoid overestimation of the number of ERUs generated by the project.

5.1 Project Category

The geothermal projects in Oradea Area II and Beius are renewable energy projects.

Due to installation of new pump units with variable speed drive, new gas fired boilers, control systems and new pre-insulated piping components heat losses power consumption will be reduced.

5.2 Losses and Energy Supplies

5.2.1 Losses Existing DH Systems

Oradea - Area II
The losses from the existing DH system are presented below based on actual meter data (existing boilers and fuel combination) obtained during meetings with representatives from CET I. Experience from similar JI - projects within the Romanian DH systems has been used to verify the losses.

Existing DH system	Unit	Information
Fuel efficiency of gas fired boilers	%	Up to 85.0
Fuel efficiency of lignite fired boilers	%	Up to 83.0
Overall fuel efficiency of CET I - heat production - lignite boiler system	%	51.66
Overall fuel efficiency of CET I - electricity production - lignite boiler system	%	14.45
Overall fuel efficiency of CET I - heat production - gas boiler system	%	62.60
Overall fuel efficiency of CET I - electricity production - gas boiler system	%	17.60
Losses the entire existing primary distribution network in Oradea (CET I - 194 substations)	%	10.8

Table 24: efficiency and losses in the existing systems

Beius
The losses from the existing buildings with individual boilers systems to be connected to the geothermal system in Beius has not been estimated when the fuel consumption and the net energy value of the fuel has been measured. When counting the actual fuel

consumption all losses are identified (included) at the same time and in this way more complicated calculations can be avoided.

5.2.2 Energy Supply

Oradea - Area II

The heat supply for the last three years for Oradea - Area II has been measured in the five substations by ultrasonic flow heat meters and saved on computers by the local utility company Apaterm.

Basic information about the gross fuel used is presented in the following tables, and was used developing the baselines.

CET I	Fuel Consumption year 2002		Calorific Value	Calorific Value	Calorific Value	Gross Energy Value of Fuel Consumed in year 2002	Share of Fuel Consumption
	Tons/year	Tons/Nm3	Kcal/kg	GJ/ton	GJ/1000 Nm3	GJ	%
Lignite	1.010.183,0		1.817,0	7,61		7.685.249,01	89,45
Heavy oil	19.608,0		9.649,0	40,40		792.170,32	9,22
Naturaæ Gas		3.206.000,00	8.500,00		35,59	114.099,94	1,33
Total						8.591.519,27	100,00

Table 25: Fuel data CET I for year 2002

The fuel efficiency of heat - and electricity production has not been measure but can be calculated using the fuel consumption and actual energy supply (heat and electricity) for year 2002.

CET I	Energy produced	Energy produced	Share of Net Energy value of fuel consumed in year 2002
	Gcal/year	GJ/year	%
Electricity	296.457,0	1.241.265,5	14,45
Heat energy	1.060.095,0	4.438.617,8	51,66
Total	1.356.552,00	5.679.883,22	

Table 26: Effectiveness of heat- and electricity production

The effectiveness of the CET I in terms of electricity production can be compared with the power plant in the city of Zalau where the fuel efficiency of electricity production is 15.0% according to information from there.

Beius

The fuel consumption in the twenty four individual buildings to be connected has been measured for year 2002 according to bills paid.

Buildings to be connected to the geothermal system in Beius	Type of Fuel	Annual fuel consumption		Calorific Value		Total Net Energy value of fuel	
		Measured ton/year	Measured Nm3/year	GJ/ton	GJ/1000 Nm3	GJ/year	Gcal/year
Twenty one	Heavy fuel	2.948,00		42,00			
Three	Natural gas		84.000,00		35,59		
Total						123.816,00	29.578,40

Table 27: Fuel consumption - Beius

The buildings to be connected is public buildings (schools, hospital etc.) based on designs from the time before 1989 meaning insulation of buildings is poor. The exact age of the existing boiler installations have not been identified but the conditions of the boiler installations should be good.

5.3 Project Boundaries

The proposed project boundaries for the project are assumed to be valid for the entire crediting period.

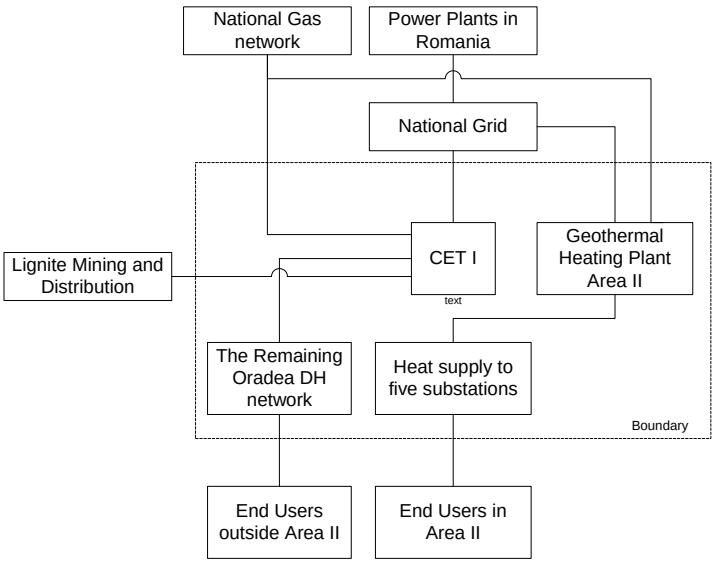


Figure 2: Project boundaries for Oradea - Area II

The direct on-site emission generated by the project is CO_2 emission from operation of natural gas boilers in peak load situations (Area II).

The direct off-site emissions generated by the project involves upstream emissions related to production of electricity for the line shaft pump units, and downstream emissions (Area II) related to substituting of electricity production at CET I with electricity production by other co-generation facility.

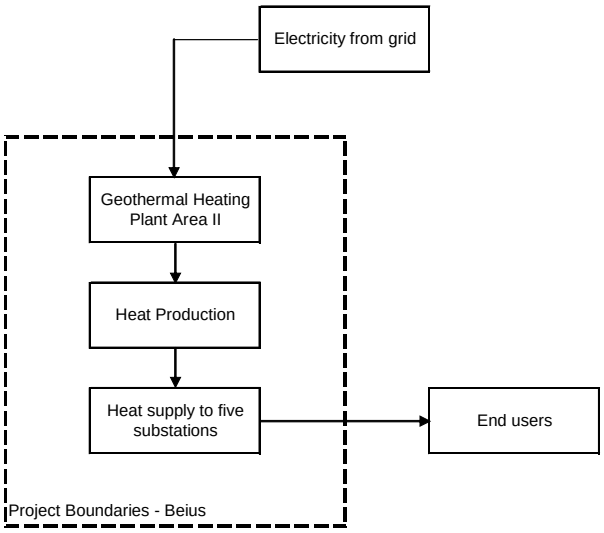


Figure 3: Project boundaries for Beius

5.4 Assessment of leakages

The leakages generated by the project in Oradea - Area II and Beius relates to electricity consumption of the line shaft pump units, which will be in operation when the artesian pressure in not enough to supply the hot geothermal water needed.

The annual electricity consumption of the new line shaft pump units in Area II has been estimated to approx. 162,000 KWh/year, which will generate an annual CO_2 emission of approx. 94 tons/year.

The annual electricity consumption of the line shaft pump unit to be installed in the new well 3003 in Beius has been estimated to approx. 160,000 kWh, which will generate an annual CO_2 emission of approx. 93 tons/year.

The above leakages generated by the project in terms of GHG emission are not considered to be substantial enough to disqualify the project.

The key leakage generated by the project is the reduced power production at CRT I linked to the reduced heat production. The missing power production needs to be substituted by power produced at other power plants (see paragraph 5.6.2). This is considered essential and Emission factors from the ERUPT system has been used to predict the GHG emissions from leakages described in this paragraph. The ERUP figures are considered to be very conservative as commissioning of more production lines at nuclear power plants in Romania are in progress. This will reduce the CO_2 emission connected to power production in Romania.

5.5 Baseline

Today JI-guidelines do not provide specific guidelines for selecting a baseline methodology. In this respect CDM guidelines have been used in this document developing baseline(s). The only guideline is that establishment of baselines (emission baselines) shall be transparent when selecting the choice of approaches, assumptions, methodologies, parameters, emission factors etc.

According to CDM guidance the baseline approach forms the basis for the baseline methodology.

5.5.1 Baseline Approach

The Marrakech Accords define three different baseline approaches for CDM projects that can be applied for JI - projects. For development of baseline(s) for Oradea - Area II and Beius approach of historical or actual data has been used.

Historical data and economical viability (attractive course of action) have been selected to develop the baseline(s) for Oradea Area II and Beius. The historical data are available based upon metering data collected continuously during several years and the reliability is considered to be good

5.5.2 Baseline Methodology

The assumptions made concerning heat consumption in both Oradea and Beius in the calculations below are for presentation purposes only. It should be stressed that net-heat consumption can vary both up and down in future years depending on the weather, potential energy savings, increased comfort levels, the price of heat energy, conversion of boilers to use natural gas and other factors. In this respect numerous baselines could be developed for this JI project. The emission reductions claimed under this project, once implemented, will be directly connected the metered heat consumption and the actual running conditions at the CET plant. As Heat prices are slightly lowered in Oradea this could be an argument for a higher consumption and therefore a higher emission reduction calculated than in the baseline scenario; however at the same time the secondary network is renewed to modern standard and the net looses will definitely be lowered which easily compensate for higher end-user consumption. The baseline presented in this PDD combines a number of these factors and is therefore considered conservative since it assumes lower emissions from heat production. To reflect variation the actual Baseline does not fix net heat consumption, and variations in heat consumption will be recorded in the Monitoring Plan and where the finally determination of the actual number of ERUs will be determined.

Oradea

Historical data for the energy supply from substations to buildings in Oradea - Area II has been obtained for year 2000, 2001 and 2002. Actual measured (ultrasonic flow meter) energy supply from substations to buildings has been mapped at a computer based energy management program; and herby made available for further analyses. At CET I the fuel entering the power plant and the energy (heat and electricity) supplied to the primary network and the grid has been measured for year 2002.

CET I has decided that natural gas in the future is expected to substitute part of the lignite and all heavy oil used today. The objective is to optimise the heat and power production at CET I.

CET I expects that the lignite- and natural gas fired boilers will operate during the entire heating season while only the natural gas boilers will operate during the summer season. Based on information from representatives from the CET I most of the base load demands should be covered by the natural gas boilers and lignite fired boiler should be used in base load- and peak load situations.

The net energy available in the DH system has been estimated for both the lignite boilers and for the natural gas boilers (see paragraph 5.2.1). For more than one year heat meters have been in operation in all staircases (space heating) and apartments (hot potable water and potable water) as basis for payment of the energy consumption. In this respect it is assumed that the energy supply to Area II could only decrease in the future if losses from the existing DH system are reduced. This will however be clarified in the monitoring report.

The information about the Romanian electricity sector has been limited, but some information about the Romanian energy strategy for year 2004 - 2015 which is currently

under the final revision has been obtained. When calculating the ERUs generated by the JI - project the information presented below have been used.

- Total opening for the non residential electricity market until the 1st of January 2006.
- Reduction of electricity production price of Termoelectrica from 39.0 USD/MWh to 32-34.0 USD/MWh.
- Commissioning of Cernavoda NPP Unit 2 in 2005 and resuming the operation of the other three units, aiming to reach a share of 20 - 40 % when speaking about the power production based upon the nuclear resource.

However, it has not been possible to obtain sufficient information about the Romanian national electricity grid as mentioned earlier to prove if a decrease in the electricity production at CET I will be substituted by an electricity production unit(s) with lower GHG emission factors than the standardised ERUPT GHG emission factors which are used developing the baselines in this document.

Estimating (calculating) the ERUs generated by the JI - project will be that 65 % of the fuel used at CET I is natural gas while 35 % of the fuel used at CET I is lignite. Combustion of heavy oil is assumed to stop.

Besides higher prices of natural gas and unstable supply of natural gas from the national gas grid makes it reasonable to assume that the natural gas boilers could cover approx. 65 % of all the fuel used at CET I while approx. 35 % of the fuel used at CET I would be lignite for heat- and electricity production.

Beius

Historical data of the fuel consumption and calorific value of fuel combusted in the existing individual boiler systems has been obtained for year 2002.

During development of the baseline study it is assumed that the fuel consumption will be constant while the real situation of course can differ from this assumption. However, monitoring procedures will establish and verify the real quantity of ERUs generated by the project.

The actual measured energy supply from the individual boiler systems to the buildings has not been conducted the estimations so far is based upon the fuel consumption which is mapped.

The operation of the individual boilers is expected to continue, but some rehabilitation of the existing technical installations is expected in the future to keep today's heat production and effectiveness of the systems.

5.5.3 Baseline Conditions for Emission Baseline Oradea - Area II

The prediction of the emission baseline for Oradea - Area II is based on the methodologies described in this paragraph.

Item	Geothermal Project	Emission Baseline Development
B.I.A	Time period for emission baseline	The crediting period for the baseline is selected to ten years (2008 -2017)
B.I.B	Starting point for emission baseline is year 2008	The gross calorific value of the fuels entering the lignite boilers and natural gas boilers at the CET I would be equal to 260,706.57 GJ/year.
B.I.C	Year 2008 - 2017	From October to May 65 % of the heat supply from CET I to the five substations in Area II would be based on combustion of natural gas. From October to May 35 % of the heat supply from CET I to the five substations in Area II

		would be based on combustion of lignite. From May to October 100 % of the heat supply from CET I would be based on combustion of natural gas. The gross calorific value of the fuel is stable.

Table 28: Emission baseline

5.5.4 Baseline Conditions for Emission Baseline - Beius

The prediction of the emission baseline for Beius is based on the methodologies described in this paragraph.

Item	Geothermal Project	Emission Baseline Development
B.II.A	Time period for emission baseline	The crediting period for the baseline is selected to ten years (2008 -2017)
B.II.B	Starting point for emission baseline is year 2008	The net energy of the fuel entering the heavy oil fired boilers would be equal to 119,099.20 GJ/year. The net energy of the fuel entering the natural gas fired boilers would be equal to 2,989.56 GJ/year.
B.II.C	Year 2008 - 2017	Heavy oil fired boilers in 21 buildings will continue to operate when no alternative heat source can be identified. Natural gas fired boilers in 3 buildings will continue to operate if no alternative heat source can be identified.

Table 29: Emission baseline

5.6 Calculation of Emission Baseline (s)

The calculation of the net emission reductions generated by the project is briefly described in this paragraph and paragraph 6 - Annex I (calculation of net emission reduction).

Today the lignite fired CET I has the fuel efficiency illustrated on the figure below and is used calculating the emission from lignite fired boilers.

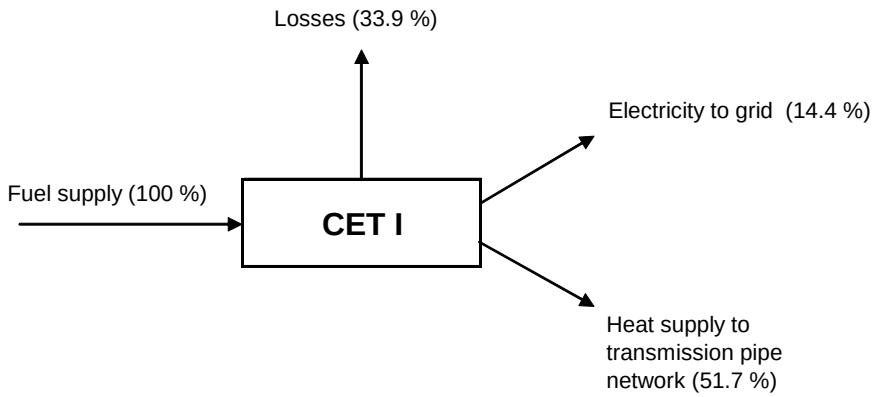


Figure 4: Existing boiler system CET I.

When four of the lignite fired boilers have been renovated and converted for natural gas firing the fuel efficiency for CET I is assumed to be as illustrated on the figure below.

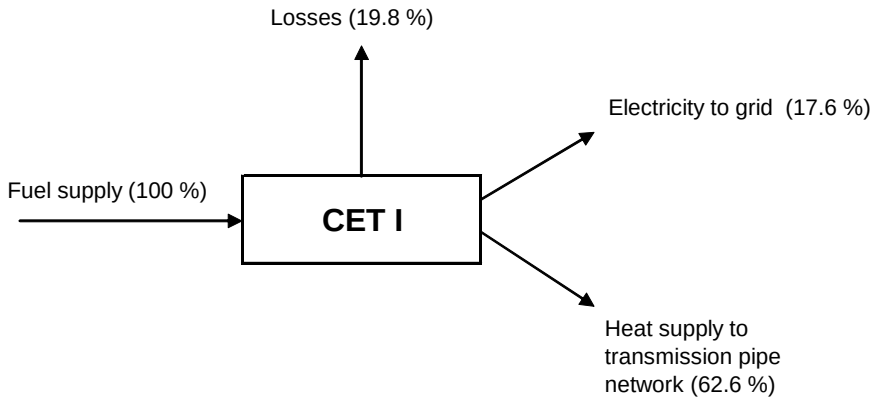


Figure 5: Future boiler system CET I.

It shall be emphasised that the fuel efficiency for the rebuild boilers (part of boiler installation based on natural gas) is considered to be optimistic in order to develop a conservative baseline. Theoretical calculation of the fuel efficiency of the rebuild boilers has not been available.

However, is shall be mentioned that monitoring procedures will reveal differences between the emission baseline predicted in this document and the actual emission baseline.

5.6.1 Emission Factors

The emission factors and GWP used for each source are IPCC default values, see paragraph 6 - Calculation of net emission reduction.

Fuel	Unit	Data
Lignite	Kg CO_2/GJ used fuel	101,12
Natural gas	Kg CO_2/GJ used fuel	56,06
Heavy oil	Kg CO_2/GJ used fuel	77,30

Table 30: Emission factors which is deemed conservative

Emission from power plants producing electricity to the Romanian grid is based on the default values from the ERUPT system plus twenty (20) percent which is deemed conservative.

Subject	Unit	ERUPT FACTOR PLUS 20 % (year 2005)
Electricity production	Kg CO_2/GJ used fuel	203.67

Table 31: Emission factors electricity production

5.6.2 Calculation of emission reductions, Oradea Area II

The starting point for the methodology for prediction of emission baseline for Oradea Area II is based on the energy supplied in substations (see paragraph 6 - Annex II) in year 2002.

Conservative assumptions used in predicting the CO_2 emission reduction generated by the project.

- The only GHG emission reduction generated by the project is CO_2 emission
- The natural gas boilers will operate the entire year. From January to December the natural gas boilers will cover approx. 65 % of the energy supply from CET I and from October to April approx. 100 %.
- The lignite fired boilers will operated during (October - April) covering 35 % of the energy supply from CET I.
- After rebuilding some of the existing lignite fired boilers to natural gas boilers will have a higher fuel efficiency meaning that 62.6 % of fuels entering CET I will become heat supplied to the primary network, while 17.6 % will become electricity supplied to the grid.
- Of the fuels entering the lignite boilers 51.66 % will become heat supplied to the primary network, while 14.45 % will become electricity supplied to the grid.
- Losses from the primary network connecting CET I with the five substations is 10.8 %.
- ERUPT emission factors (JI - projects generating electricity)

The calculation in the spreadsheet (paragraph 6 - Annex II) uses several decimals than the calculations presented in the steps below. Therefore very small differences in figures occur, but this has been accepted to illustrate the methodology used.

Step I

The energy supplied in the five substations is equal to 199,418.94 GJ/year (average of year 1999, 2000 and 2001) and the heat losses in the primary network connecting CET I have been measured to 10.8 %.

Step II
The energy supplied from CET I to the primary network can now be estimated.

$$\text{Heat energy supplied from CET I to primary network} = \frac{199{,}418.94 \text{ GJ/year}}{(100 - 10.8)/100}$$

$$= 223{,}563.83 \text{ GJ/year}$$

Step III
The energy to be supplied from CET I with the selected baseline is produced by natural gas fired boilers and lignite boilers (information and estimations are presented in paragraph 6 - Annex II).

$$\text{Heat energy supplied from CET I by natural gas fired boilers} = 156{,}694.02 \text{ GJ/year}$$

$$\text{Heat energy supplied from CET I by lignite fired boilers} = 66{,}869.81 \text{ GJ/year}$$

Step IV
The gross calorific values of fuels entering CET I can be estimated by dividing the heat energy supply from CET I with the fuel efficiency of CET I for heat production from natural gas boilers (62.6 %) and for heat production from lignite fired boilers (51.66 %).

$$\text{Gross energy entering CET I based} = \frac{156{,}694.02 \text{ GJ/year}}{62.6/100} + \frac{66{,}869.81 \text{ GJ/year}}{51.66/100}$$

$$= 250{,}309.94 \text{ GJ/year} + 129{,}442.15 \text{ GJ/year}$$

$$= 379{,}752.08 \text{ GJ/year}$$

Step V
The emission from combustion of natural gas and lignite at CET I can be estimated using the emission factors in paragraph 5.6.1). Because geothermal energy is a CO_2 neutral fuel the avoided emission from CET I is equal to the immediate emission reduction generated by the JI - project.

$$\text{Emission Reduction of } CO_2 = \frac{250{,}309.94 \text{ GJ/year} \times 56.06 \text{ kg } CO_2\text{/GJ used fuel}}{1000} + \frac{129{,}442.15 \text{ GJ/year} \times 101.12 \text{ kg } CO_2\text{/GJ used fuel}}{1000}$$

$$= 27{,}121.56 \text{ tons } CO_2\text{/year}$$

Step VI

When substituting heat production at CET I with geothermal energy the electricity production at CET I will also decrease because a power plant installation is considered to be one production system. The electricity not produced by CET I is assumed to be produced by other fossil fired power plants supplying electricity to the grid, which means the emission of GHG from these power plants will increase with an average emission equals to ERUPT default value for year 2005 plus 20%.

Estimation of the electricity produced by other power plant is based on the following assumptions.

$$\text{Emission of } CO_2 \text{ from power plants} = \frac{250{,}309.94 \text{ GJ/year} \times 17.6/100 \times 203.67 \text{ kg } CO_2\text{/GJ used fuel}}{1000} + \frac{129{,}442.15 \text{ GJ/year} \times 14.4/100 \times 203.67 \text{ kg } CO_2\text{/GJ used fuel}}{1000}$$

$$= 12{,}782.11 \text{ tons } CO_2\text{/year}$$

Step VII

Operating the new natural fired peak load boilers at the geothermal heating plant CO_2 will be emitted to the atmosphere.

$$\text{Emission of } CO_2 \text{ peak load natural gas fired boilers} = \frac{4{,}019{,}33 \text{ GJ/year} \times 56{,}06 \text{ kg } CO_2\text{/GJ used fuel}}{1000}$$

$$= 225.32 \text{ tons } CO_2\text{/year}$$

Step VIII

The emission reduction generated by implementing the JI - project can be estimated.

$$\text{Emission Reduction} = \text{Step V} - (\text{Step VI} + \text{Step VII})$$

$$= 27{,}121.56 - (12{,}782.11 + 225.32)$$

$$= 14{,}114.13 \text{ tons } CO_2\text{/year}$$

5.6.3 Methodology for prediction of emission baseline Beius

The starting point for the methodology for prediction of emission baseline for Beius is based on the energy supplied in substations (see paragraph 6 - Annex II) in year 2002.

The purpose of the methodology is to establish the net energy of fuels entering the individual heavy oil fired boilers and natural gas fired boilers in Beius, which hopefully is described in a transparent ways by the steps below.

The net energy supply of fuels entering individual boilers are presented in Annex II paragraph 6.

Step I
The energy supplied to individual boiler systems to be supplied with geothermal energy in Beius is equal to 119,099.20 GJ/year (heavy oil) and 2989.56 GJ/year (natural gas).

Step II
The emission from combustion of heavy oil and natural gas can be estimated using the emission factors in paragraph 5.6.1). Because geothermal energy is a CO_2 neutral fuel the emission from existing individual fossil fired boilers is equal to the emission reduction generated by the JI - project.

$$\text{Emission Reduction of } CO_2 = \frac{119{,}099.20 \text{ GJ/year} \times 77.30 \text{ kg } CO_2\text{/GJ used fuel}}{1000} + \frac{2{,}989.56 \text{ GJ/year} \times 56.06 \text{ kg } CO_2\text{/GJ used fuel}}{1000} = 9{,}373.96 \text{ tons } CO_2\text{/year}$$

5.6.4 Net GHG Emission Reduction

The net GHG emission reduction generated by the project (baseline Area II and baseline Beius) has been calculated using the assumption in paragraph 5.5.

Emission Baseline	Unit	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
Emisson Baseline I - Area II	Ton CO2	14.114,98	14.114,98	14.114,98	14.114,98	14.114,98	14.114,98	14.114,98	14.114,98	14.114,98	14.114,98	141.149,79
Emisson Baseline II - Beius	Ton CO2	9.738,57	9.738,57	9.738,57	9.738,57	9.738,57	9.738,57	9.738,57	9.738,57	9.738,57	9.738,57	97.385,72
Total	Ton CO2	23.853,55	23.853,55	23.853,55	23.853,55	23.853,55	23.853,55	23.853,55	23.853,55	23.853,55	23.853,55	238.535,50

Table 32: Net emission reduction

The calculation of the net emission reduction is presented in paragraph 6 - Annex I - Calculation of net emission reduction.

5.7 Conclusion

The baseline developed for the geothermal project in Oradea - Area II and Beius is considered to be the most likely conservative baseline, which fulfils the criteria for a JI - project according to the Kyoto Protocol, Marrakech Accords and different COPs.

Emission Baseline
The baseline for Area II is based on the assumption that lignite and natural gas combusted at the CET I will be substituted by geothermal energy from the Oradea reservoir and natural gas for peak load situations. The decrease in electricity supplied to the grid by CET I has to be substituted by other co-generation existing units in Romania.

The baseline for Beius is based on the assumption that heavy oil and natural gas used in individual boiler systems in schools, office buildings, factories etc. will be substituted by geothermal energy from an existing geothermal DH system.

The total net emission reduction for a ten years period has been predicted to approx. 238,535.50 tons CO_2/10 years.

Risk
The net emission reduction generated by the baseline is strongly connected to the assumption that the quantity of natural gas combusted at the CET I will increase substantial in the future as informed by representative from CET I. Assuming the increase in natural gas consumption at CET I will not increase with the quantity predicted the net emission reduction will be higher than predicted in this PDD.

The DH system in Area II and Beius will not be closed down in the future because the DH system is maintained, inhabitants paid for the energy supply, energy prices are compatible and strong support from both municipality administrations.

6. Annexes

Annex I Calculation of Net Emission Reduction

BASELINE ORADEA - AREA II

Item	Input Data	Unit	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
A	Annual decrease in heat demand	%	-	-	-	-	-	-	-	-	-	-
B	Emission factor lignite	kg CO2/GJ used fuel	101,12	101,12	101,12	101,12	101,12	101,12	101,12	101,12	101,12	101,12
C	Emission factor natural gas	kg CO2/GJ used fuel	56,06	56,06	56,06	56,06	56,06	56,06	56,06	56,06	56,06	56,06
D	Emission factor emissions for power plants substituing missing electricity production at CET I (ERUPT - generating + 20 %)	g CO2/KWh	733,20	733,20	733,20	733,20	733,20	733,20	733,20	733,20	733,20	733,20
E	Emission factors from power plants supplying to grid (ERUPT)	kg CO2/GJ used fuel	203,67	203,67	203,67	203,67	203,67	203,67	203,67	203,67	203,67	203,67
F	Effectiveness electricity production CET I - lignite boilers	%	14,45	14,45	14,45	14,45	14,45	14,45	14,45	14,45	14,45	14,45
G	Effectiveness electricity production CET I - natural gas boilers	%	17,60	17,60	17,60	17,60	17,60	17,60	17,60	17,60	17,60	17,60

NET ENERGY ENTERING CET I AND SUBSTITUTED BY THE PROJECT - ORADEA AREA II

Item	Subject	Unit	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
H	Lignite substituted with geothermal energy	GJ	129.442,15	129.442,15	129.442,15	129.442,15	129.442,15	129.442,15	129.442,15	129.442,15	129.442,15	129.442,15	1.294.421,47
I	Natural gas substituted with geothermal energy	GJ	250.309,93	250.309,93	250.309,93	250.309,93	250.309,93	250.309,93	250.309,93	250.309,93	250.309,93	250.309,93	2.503.099,30
J	Electricity produced by other power plants that CET I - lignite	GJ	18.701,24	18.701,24	18.701,24	18.701,24	18.701,24	18.701,24	18.701,24	18.701,24	18.701,24	18.701,24	187.012,40
K	Electricity produced by other power plants that CET I - natural gas	GJ	44.054,55	44.054,55	44.054,55	44.054,55	44.054,55	44.054,55	44.054,55	44.054,55	44.054,55	44.054,55	440.545,48
L	New natural gas boilers for peak load situtations	GJ	4.019,33	4.019,33	4.019,33	4.019,33	4.019,33	4.019,33	4.019,33	4.019,33	4.019,33	4.019,33	40.193,28

NET EMISSION REDUCTIONS AND EMISSIONS GENERATED BY THE PROJECT - ORADEA AREA II

Item	Subject	Unit	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
	Emission Reduction												
M = (B x H) / 1000	Lignite substituted with geothermal energy	Ton CO2	13.089,19	13.089,19	13.089,19	13.089,19	13.089,19	13.089,19	13.089,19	13.089,19	13.089,19	13.089,19	130.891,90
N = (C x I) / 1000	Natural gas substituted with geothermal energy	Ton CO2	14.032,37	14.032,37	14.032,37	14.032,37	14.032,37	14.032,37	14.032,37	14.032,37	14.032,37	14.032,37	140.323,75
	Emission												
O = (E x J) / 1000	Electricity produced by other power plants than CET I - lignite	Ton CO2	3.808,82	3.808,82	3.808,82	3.808,82	3.808,82	3.808,82	3.808,82	3.808,82	3.808,82	3.808,82	38.088,19
P = (E x K) / 1000	Electricity produced by other power plants than CET I - natural gas	Ton CO2	8.972,44	8.972,44	8.972,44	8.972,44	8.972,44	8.972,44	8.972,44	8.972,44	8.972,44	8.972,44	89.724,43
Q = (C x L) / 1000	New natural gas boilers for peak load situtations	Ton CO2	225,32	225,32	225,32	225,32	225,32	225,32	225,32	225,32	225,32	225,32	2.253,24
R = (M+N) - (O+P+Q)	Net Emission (Emission Reduction - Emission)	Ton CO2	14.114,98	14.114,98	14.114,98	14.114,98	14.114,98	14.114,98	14.114,98	14.114,98	14.114,98	14.114,98	141.149,79

BASELINE II - BEIUS

Item	Input Data	Unit	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
A	Annual decrease in heat demand	%	-	-	-	-	-	-	-	-	-	-
B	Emission factor heavy oil	kg CO2/GJ used fuel	77,30	77,30	77,30	77,30	77,30	77,30	77,30	77,30	77,30	77,30
C	Emission factor natural gas	kg CO2/GJ used fuel	56,06	56,06	56,06	56,06	56,06	56,06	56,06	56,06	56,06	56,06

NET ENERGY ENTERING THE DISTRICT HEATING SYSTEM

Item	Subject	Unit	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
D	Heavy oil substituted with geothermal energy	GJ	123.816,00	123.816,00	123.816,00	123.816,00	123.816,00	123.816,00	123.816,00	123.816,00	123.816,00	123.816,00	1.238.160,00
E	Natural gas substituted with geothermal energy	GJ	2.989,56	2.989,56	2.989,56	2.989,56	2.989,56	2.989,56	2.989,56	2.989,56	2.989,56	2.989,56	29.895,60

NET EMISSION REDUCTIONS AND EMISSIONS - BEIUS

Item	Subject	Unit	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
F = (B x D) / 1000	Lignite substituted with geothermal energy	Ton CO2	9.570,98	9.570,98	9.570,98	9.570,98	9.570,98	9.570,98	9.570,98	9.570,98	9.570,98	9.570,98	95.709,77
G = (C x E) / 1000	Natural gas substituted with geothermal energy	Ton CO2	167,59	167,59	167,59	167,59	167,59	167,59	167,59	167,59	167,59	167,59	1.675,95
H = F + G	Net Emission (Emission Reduction - Emission)	Ton CO2	9.738,57	9.738,57	9.738,57	9.738,57	9.738,57	9.738,57	9.738,57	9.738,57	9.738,57	9.738,57	97.385,72

Annex II Data for Emission Baseline

MONTHLY ENERGY CONSUMPTION EXISTING DH SYSTEM IN AREA II (Gcal)

510	January Gcal	February Gcal	March Gcal	April Gcal	May Gcal	June Gcal	July Gcal	August Gcal	September Gcal	October Gcal	November Gcal	December Gcal	Total Gcal
2000	1404,19	1195,64	1265,16	542,28	311,99	248,21	230,41	162,41	148,11	327,76	740,56	1096,2	7.672,92
2001	1065,69	965,59	1043,47	731,24	229,57	218,35	172,96	163,64	157,19	153,85	984,94	1099,6	6.986,09
2002	1382,69	702,34	699,26	608,17	168,88	166,9	129,72	121,83	143,33	136,36	731	1009,5	5.999,98

511	January Gcal	February Gcal	March Gcal	April Gcal	May Gcal	June Gcal	July Gcal	August Gcal	September Gcal	October Gcal	November Gcal	December Gcal	Total Gcal
2000	1.347,82	1.172,23	1.201,62	545,16	309,60	133,49	204,36	189,44	155,54	296,94	657,19	937,88	7.151,27
2001	1.075,01	928,57	991,63	737,45	263,02	221,21	171,05	155,76	150,02	147,63	914,23	1.010,00	6.765,58
2002	1.223,36	732,68	681,08	416,86	127,33	119,92	84,33	84,81	98,90	209,10	544,19	597,94	4.920,50

512	January Gcal	February Gcal	March Gcal	April Gcal	May Gcal	June Gcal	July Gcal	August Gcal	September Gcal	October Gcal	November Gcal	December Gcal	Total Gcal
2000	216,40	1.658,61	1.828,22	510,75	435,74	298,37	350,93	337,07	229,10	378,40	884,61	1.279,49	8.407,69
2001	1.314,61	1.194,21	1.220,25	922,35	305,78	280,22	245,58	189,68	182,27	139,03	1.207,83	1.304,30	8.506,11
2002	1.674,38	1.052,79	1.012,39	690,39	172,24	160,77	74,06	121,60	131,87	325,70	859,77	1.372,60	7.648,56

513	January Gcal	February Gcal	March Gcal	April Gcal	May Gcal	June Gcal	July Gcal	August Gcal	September Gcal	October Gcal	November Gcal	December Gcal	Total Gcal
2000	2.625,88	2.282,59	2.169,12	988,52	612,99	528,90	521,02	425,46	336,60	622,31	1.217,62	1.693,49	14.024,50
2001	1.880,06	1.729,56	1.766,35	1.385,08	491,87	356,90	340,42	316,38	298,37	332,77	1.489,48	1.665,54	12.052,78
2002	2.261,81	1.549,68	1.465,11	905,87	391,06	315,50	288,34	235,78	210,22	356,32	1.044,67	1.567,10	10.591,46

514	January Gcal	February Gcal	March Gcal	April Gcal	May Gcal	June Gcal	July Gcal	August Gcal	September Gcal	October Gcal	November Gcal	December Gcal	Total Gcal
2000	2.800,27	2.556,60	2.620,15	996,41	727,86	600,81	537,26	483,27	357,86	681,55	1.384,37	2.184,30	15.930,71
2001	2.051,11	1.925,69	2.071,65	1.046,82	539,17	552,31	408,02	363,36	322,26	355,71	1.903,95	2.130,60	13.670,65
2002	2.766,82	1.819,39	1.652,64	972,52	352,36	360,01	257,28	231,72	255,13	464,24	1.138,55	2.284,90	12.555,56

SUMMARY	January Gcal	February Gcal	March Gcal	April Gcal	May Gcal	June Gcal	July Gcal	August Gcal	September Gcal	October Gcal	November Gcal	December Gcal	Total Gcal
2000	8.394,56	8.234,76	8.535,77	3.633,53	2.209,49	1.761,28	1.714,74	1.477,74	1.191,61	1.981,12	5.403,93	7.137,66	53.187,09
2001	7.386,48	6.743,62	7.093,35	4.822,94	1.829,41	1.628,99	1.338,03	1.188,82	1.110,11	1.128,99	6.500,43	7.210,04	47.981,21
2002	9.309,06	5.856,88	5.510,48	3.593,81	1.211,87	1.123,10	833,73	795,74	839,45	1.491,72	4.318,18	6.832,04	41.716,06

MONTHLY ENERGY CONSUMPTION EXISTING DH SYSTEM IN AREA II (GJ)

Substation 510	January GJ	February GJ	March GJ	April GJ	May GJ	June GJ	July GJ	August GJ	September GJ	October GJ	November GJ	December GJ	Total GJ
2000	5.879,34	5.006,14	5.297,22	2.270,53	1.306,30	1.039,26	964,73	680,01	620,14	1.372,33	3.100,72	4.589,79	32.126,52
2001	4.462,04	4.042,93	4.369,01	3.061,70	961,21	914,23	724,18	685,16	658,15	644,17	4.123,94	4.604,03	29.250,76
2002	5.789,32	2.940,70	2.927,80	2.546,41	707,10	698,81	543,14	510,10	600,12	570,94	3.060,70	4.226,78	25.121,92

Substation 511	January GJ	February GJ	March GJ	April GJ	May GJ	June GJ	July GJ	August GJ	September GJ	October GJ	November GJ	December GJ	Total GJ
2000	5.643,32	4.908,13	5.031,18	2.282,58	1.296,30	558,92	855,66	793,19	651,25	1.243,29	2.751,65	3.926,90	29.942,36
2001	4.501,07	3.887,92	4.151,95	3.087,70	1.101,26	926,21	716,19	652,17	628,13	618,13	3.827,88	4.228,87	28.327,48
2002	5.122,21	3.067,73	2.851,68	1.745,39	533,13	502,11	353,09	355,10	414,09	875,50	2.278,52	2.503,57	20.602,13

Substation 512	January GJ	February GJ	March GJ	April GJ	May GJ	June GJ	July GJ	August GJ	September GJ	October GJ	November GJ	December GJ	Total GJ
2000	906,07	6.944,60	7.654,76	2.138,51	1.824,44	1.249,28	1.469,34	1.411,31	959,24	1.584,36	3.703,86	5.357,22	35.203,00
2001	5.504,27	5.000,16	5.109,19	3.861,88	1.280,30	1.173,28	1.028,24	794,19	763,16	582,12	5.057,18	5.461,10	35.615,08
2002	7.010,63	4.408,03	4.238,88	2.890,66	721,17	673,14	310,09	509,14	552,14	1.363,71	3.599,86	5.747,08	32.024,52

Substation 513	January GJ	February GJ	March GJ	April GJ	May GJ	June GJ	July GJ	August GJ	September GJ	October GJ	November GJ	December GJ	Total GJ
2000	10.994,56	9.557,20	9.082,11	4.138,93	2.566,59	2.214,50	2.181,51	1.781,40	1.409,34	2.605,61	5.098,17	7.090,64	58.720,58
2001	7.871,81	7.241,67	7.395,71	5.799,33	2.059,46	1.494,34	1.425,34	1.324,68	1.249,28	1.393,31	6.236,45	6.973,62	50.464,99
2002	9.470,20	6.488,51	6.134,42	3.792,88	1.637,37	1.321,00	1.207,28	987,21	880,19	1.491,91	4.374,03	6.561,45	44.346,44

Substation 514	January GJ	February GJ	March GJ	April GJ	May GJ	June GJ	July GJ	August GJ	September GJ	October GJ	November GJ	December GJ	Total GJ
2000	11.724,73	10.704,48	10.970,57	4.171,97	3.047,55	2.515,59	2.249,51	2.023,45	1.498,36	2.853,65	5.796,36	9.145,66	66.701,88
2001	8.588,00	8.062,86	8.674,00	4.383,04	2.257,50	2.312,52	1.708,38	1.521,39	1.349,30	1.489,36	7.971,84	8.920,82	57.239,01
2002	11.584,68	7.617,79	6.919,60	4.071,94	1.475,33	1.507,36	1.077,23	970,21	1.068,23	1.943,77	4.767,11	9.566,88	52.570,13

SUMMARY	January GJ	February GJ	March GJ	April GJ	May GJ	June GJ	July GJ	August GJ	September GJ	October GJ	November GJ	December GJ	Total GJ
2000	35.148,02	34.478,94	35.739,27	15.213,58	9.251,13	7.374,48	7.179,62	6.187,30	4.989,27	8.294,95	22.626,25	29.885,38	222.694,34
2001	30.927,19	28.235,54	29.699,86	20.193,65	7.659,74	6.820,58	5.602,33	4.977,59	4.648,03	4.727,08	27.217,30	30.188,44	200.897,33
2002	38.977,03	24.522,76	23.072,38	15.047,28	5.074,10	4.702,42	3.490,83	3.331,76	3.514,78	6.245,83	18.080,22	28.605,75	174.665,14

MONTHLY ENERGY SUPPLIED FROM CET I TO PRIMARY NETWORK FOR AREA II (Gcal)

510	January Gcal	February Gcal	March Gcal	April Gcal	May Gcal	June Gcal	July Gcal	August Gcal	September Gcal	October Gcal	November Gcal	December Gcal	Total Gcal
2000,00	1574,20	1340,40	1418,34	607,94	349,76	278,26	258,31	182,07	166,04	367,44	830,22	1228,92	8601,93
2001,00	1194,72	1082,50	1169,81	819,78	257,37	244,79	193,90	183,45	176,22	172,48	1104,19	1232,74	7831,94
2002,00	1550,10	787,38	783,92	681,80	189,33	187,11	145,43	136,58	160,68	152,87	819,51	1131,73	6726,43

511,00	January Gcal	February Gcal	March Gcal	April Gcal	May Gcal	June Gcal	July Gcal	August Gcal	September Gcal	October Gcal	November Gcal	December Gcal	Total Gcal
2000,00	1511,01	1314,16	1347,11	611,16	347,09	149,65	229,10	212,38	174,37	332,89	736,76	1051,43	8017,12
2001,00	1205,17	1041,00	1111,69	826,74	294,87	247,99	191,76	174,62	168,18	165,50	1024,92	1132,29	7584,73
2002,00	1371,48	821,39	763,54	467,33	142,75	134,44	94,54	95,08	110,87	234,42	610,08	670,34	5516,26

512,00	January Gcal	February Gcal	March Gcal	April Gcal	May Gcal	June Gcal	July Gcal	August Gcal	September Gcal	October Gcal	November Gcal	December Gcal	Total Gcal
2000,00	242,60	1859,43	2049,57	572,59	488,50	334,50	393,42	377,88	256,84	424,22	991,72	1434,41	9425,66
2001,00	1473,78	1338,80	1367,99	1034,02	342,80	314,15	275,31	212,65	204,34	155,86	1354,07	1462,22	9536,00
2002,00	1877,11	1180,26	1134,97	773,98	193,09	180,24	83,03	136,32	147,84	365,13	963,87	1538,79	8574,62

513,00	January Gcal	February Gcal	March Gcal	April Gcal	May Gcal	June Gcal	July Gcal	August Gcal	September Gcal	October Gcal	November Gcal	December Gcal	Total Gcal
2000,00	2943,81	2558,96	2431,75	1108,21	687,21	592,94	584,10	476,97	377,35	697,66	1365,04	1898,53	15722,53
2001,00	2107,69	1938,97	1980,21	1552,78	551,42	400,11	381,64	354,69	334,50	373,06	1669,82	1867,20	13512,09
2002,00	2535,66	1737,31	1642,50	1015,55	438,41	353,70	323,25	264,33	235,67	399,46	1171,15	1756,84	11873,83

514,00	January Gcal	February Gcal	March Gcal	April Gcal	May Gcal	June Gcal	July Gcal	August Gcal	September Gcal	October Gcal	November Gcal	December Gcal	Total Gcal
2000,00	3139,32	2866,14	2937,39	1117,05	815,99	673,55	602,31	541,78	401,19	764,07	1551,98	2448,77	17859,54
2001,00	2299,45	2158,85	2322,48	1173,57	604,45	619,18	457,42	407,35	361,28	398,78	2134,47	2388,57	15325,84
2002,00	3101,82	2039,67	1852,74	1090,27	395,02	403,60	288,43	259,78	286,02	520,45	1276,40	2561,55	14075,74

SUMMARY	January Gcal	February Gcal	March Gcal	April Gcal	May Gcal	June Gcal	July Gcal	August Gcal	September Gcal	October Gcal	November Gcal	December Gcal	Total Gcal
2000,00	9410,94	9231,79	9569,25	4073,46	2477,01	1974,53	1922,35	1656,66	1335,89	2220,99	6058,22	8001,86	59626,78
2001,00	8280,81	7560,11	7952,19	5406,88	2050,91	1826,22	1500,03	1332,76	1244,52	1265,68	7287,48	8083,00	53790,59
2002,00	10436,17	6566,01	6177,67	4028,93	1358,60	1259,08	934,67	892,09	941,09	1672,33	4841,01	7659,24	46766,88

MONTHLY ENERGY SUPPLIED FROM CET I TO PRIMARY NETWORK FOR AREA II (GJ)

Substation 510	January GJ	February GJ	March GJ	April GJ	May GJ	June GJ	July GJ	August GJ	September GJ	October GJ	November GJ	December GJ	Total GJ
2000	6.591,19	5.612,27	5.938,59	2.545,43	1.464,46	1.165,08	1.081,53	762,34	695,22	1.538,49	3.476,15	5.145,50	36.016,27
2001	5.002,29	4.532,43	4.897,99	3.432,40	1.077,59	1.024,92	811,86	768,12	737,84	722,16	4.623,26	5.161,46	32.792,33
2002	6.490,27	3.296,75	3.282,29	2.854,72	792,71	783,42	608,90	571,86	672,78	640,07	3.431,27	4.738,54	28.163,58

Substation 511	January GJ	February GJ	March GJ	April GJ	May GJ	June GJ	July GJ	August GJ	September GJ	October GJ	November GJ	December GJ	Total GJ
2000	6.326,59	5.502,38	5.640,34	2.558,94	1.453,25	626,59	959,25	889,22	730,10	1.393,82	3.084,81	4.402,36	33.567,67
2001	5.046,04	4.358,66	4.654,66	3.461,55	1.234,60	1.038,35	802,90	731,13	704,19	692,97	4.291,35	4.740,89	31.757,27
2002	5.742,39	3.439,16	3.196,95	1.956,72	597,68	562,90	395,84	398,09	464,23	981,50	2.554,40	2.806,70	23.096,56

Substation 512	January GJ	February GJ	March GJ	April GJ	May GJ	June GJ	July GJ	August GJ	September GJ	October GJ	November GJ	December GJ	Total GJ
2000	1.015,77	7.785,43	8.581,57	2.397,43	2.045,34	1.400,53	1.647,25	1.582,19	1.075,38	1.776,19	4.152,31	6.005,86	39.465,24
2001	6.170,71	5.605,56	5.727,79	4.329,46	1.435,31	1.315,34	1.152,74	890,35	855,57	652,60	5.669,49	6.122,31	39.927,22
2002	7.859,45	4.941,74	4.752,10	3.240,65	808,49	754,65	347,63	570,78	618,99	1.528,82	4.035,71	6.442,91	35.901,93

Substation 513	January GJ	February GJ	March GJ	April GJ	May GJ	June GJ	July GJ	August GJ	September GJ	October GJ	November GJ	December GJ	Total GJ
2000	12.325,74	10.714,35	10.181,73	4.640,06	2.877,34	2.482,63	2.445,64	1.997,09	1.579,98	2.921,09	5.715,44	7.949,15	65.830,25
2001	8.824,90	8.118,46	8.291,15	6.501,49	2.308,81	1.675,27	1.597,91	1.485,07	1.400,53	1.562,00	6.991,54	7.817,96	56.575,10
2002	10.616,81	7.274,11	6.877,15	4.252,11	1.835,61	1.480,94	1.353,45	1.106,74	986,76	1.672,55	4.903,62	7.355,88	49.715,74

Substation 514	January GJ	February GJ	March GJ	April GJ	May GJ	June GJ	July GJ	August GJ	September GJ	October GJ	November GJ	December GJ	Total GJ
2000	13.144,32	12.000,54	12.298,84	4.677,09	3.416,54	2.820,17	2.521,87	2.268,44	1.679,78	3.199,16	6.498,16	10.252,99	74.777,90
2001	9.627,80	9.039,09	9.724,21	4.913,72	2.530,83	2.592,51	1.915,22	1.705,59	1.512,67	1.669,68	8.937,04	10.000,92	64.169,30
2002	12.987,30	8.540,12	7.757,40	4.564,96	1.653,96	1.689,87	1.207,66	1.087,68	1.197,57	2.179,12	5.344,29	10.725,20	58.935,12

SUMMARY	January GJ	February GJ	March GJ	April GJ	May GJ	June GJ	July GJ	August GJ	September GJ	October GJ	November GJ	December GJ	Total GJ
2000	39.403,61	38.653,52	40.066,45	17.055,58	10.371,23	8.267,35	8.048,90	6.936,43	5.593,35	9.299,27	25.365,76	33.503,79	249.657,33
2001	34.671,74	31.654,19	33.295,80	22.638,62	8.587,15	7.646,39	6.280,64	5.580,26	5.210,80	5.299,42	30.512,67	33.843,54	225.221,22
2002	43.696,23	27.491,88	25.865,90	16.869,15	5.688,45	5.271,77	3.913,48	3.735,16	3.940,33	7.002,05	20.269,30	32.069,23	195.812,94

MONTHLY ENERGY SUPPLIED FROM CET I FOR AREA II (Gcal) - DIVIDED ON BOILER SYSTEMS

510	Fuel	January Gcal	February Gcal	March Gcal	April Gcal	May Gcal	June Gcal	July Gcal	August Gcal	September Gcal	October Gcal	November Gcal	December Gcal	Total Gcal
2000	Lignite	550,97	469,14	496,42	212,78	-	-	-	-	-	128,61	290,58	430,12	2.578,62
	Natural gas	1.023,23	871,26	921,92	395,16	349,76	278,26	258,31	182,07	166,04	238,84	539,65	798,80	6.023,31
2001	Lignite	418,15	378,88	409,43	286,92	-	-	-	-	-	60,37	386,47	431,46	2.371,67
	Natural gas	776,57	703,63	760,38	532,85	257,37	244,79	193,90	183,45	176,22	112,11	717,73	801,28	5.460,27
2002	Lignite	542,54	275,58	274,37	238,63	-	-	-	-	-	53,50	286,83	396,10	2.067,56
	Natural gas	1.007,57	511,79	509,55	443,17	189,33	187,11	145,43	136,58	160,68	99,37	532,68	735,62	4.658,88

511	Fuel	January Gcal	February Gcal	March Gcal	April Gcal	May Gcal	June Gcal	July Gcal	August Gcal	September Gcal	October Gcal	November Gcal	December Gcal	Total Gcal
2000	Lignite	528,85	459,96	471,49	213,91	-	-	-	-	-	116,51	257,87	368,00	2.416,58
	Natural gas	982,16	854,20	875,62	397,26	347,09	149,65	229,10	212,38	174,37	216,38	478,89	683,43	5.600,53
2001	Lignite	421,81	364,35	389,09	289,36	-	-	-	-	-	57,93	358,72	396,30	2.277,56
	Natural gas	783,36	676,65	722,60	537,38	294,87	247,99	191,76	174,62	168,18	107,58	666,20	735,99	5.307,17
2002	Lignite	480,02	287,49	267,24	163,57	-	-	-	-	-	82,05	213,53	234,62	1.728,50
	Natural gas	891,46	533,90	496,30	303,77	142,75	134,44	94,54	95,08	110,87	152,37	396,55	435,72	3.787,75

512	Fuel	January Gcal	February Gcal	March Gcal	April Gcal	May Gcal	June Gcal	July Gcal	August Gcal	September Gcal	October Gcal	November Gcal	December Gcal	Total Gcal
2000	Lignite	84,91	650,80	717,35	200,41	-	-	-	-	-	148,48	347,10	502,04	2.651,09
	Natural gas	157,69	1.208,63	1.332,22	372,18	488,50	334,50	393,42	377,88	256,84	275,74	644,61	932,36	6.774,58
2001	Lignite	515,82	468,58	478,80	361,91	-	-	-	-	-	54,55	473,92	511,78	2.865,36
	Natural gas	957,96	870,22	889,20	672,12	342,80	314,15	275,31	212,65	204,34	101,31	880,15	950,44	6.670,64
2002	Lignite	656,99	413,09	397,24	270,89	-	-	-	-	-	127,80	337,35	538,58	2.741,94
	Natural gas	1.220,12	767,17	737,73	503,09	193,09	180,24	83,03	136,32	147,84	237,34	626,51	1.000,21	5.832,68

513	Fuel	January Gcal	February Gcal	March Gcal	April Gcal	May Gcal	June Gcal	July Gcal	August Gcal	September Gcal	October Gcal	November Gcal	December Gcal	Total Gcal
2000	Lignite	1.030,33	895,64	851,11	387,87	-	-	-	-	-	244,18	477,77	664,49	4.551,39
	Natural gas	1.913,48	1.663,32	1.580,64	720,33	687,21	592,94	584,10	476,97	377,35	453,48	887,28	1.234,05	11.171,15
2001	Lignite	737,69	678,64	693,07	543,47	-	-	-	-	-	130,57	584,44	653,52	4.021,41
	Natural gas	1.370,00	1.260,33	1.287,14	1.009,31	551,42	400,11	381,64	354,69	334,50	242,49	1.085,38	1.213,68	9.490,68
2002	Lignite	887,48	608,06	574,88	355,44	-	-	-	-	-	139,81	409,90	614,89	3.590,47
	Natural gas	1.648,18	1.129,25	1.067,63	660,11	438,41	353,70	323,25	264,33	235,67	259,65	761,25	1.141,95	8.283,37

514	Fuel	January Gcal	February Gcal	March Gcal	April Gcal	May Gcal	June Gcal	July Gcal	August Gcal	September Gcal	October Gcal	November Gcal	December Gcal	Total Gcal
2000	Lignite	1.098,76	1.003,15	1.028,09	390,97	-	-	-	-	-	267,42	543,19	857,07	5.188,65
	Natural gas	2.040,56	1.862,99	1.909,30	726,08	815,99	673,55	602,31	541,78	401,19	496,65	1.008,79	1.591,70	12.670,89
2001	Lignite	804,81	755,60	812,87	410,75	-	-	-	-	-	139,57	747,07	836,00	4.506,65
	Natural gas	1.494,64	1.403,25	1.509,61	762,82	604,45	619,18	457,42	407,35	361,28	259,21	1.387,41	1.552,57	10.819,19
2002	Lignite	1.085,64	713,89	648,46	381,59	-	-	-	-	-	182,16	446,74	896,54	4.355,01
	Natural gas	2.016,18	1.325,79	1.204,28	708,67	395,02	403,60	288,43	259,78	286,02	338,29	829,66	1.665,01	9.720,73

SUMMARY	Fuel	January Gcal	February Gcal	March Gcal	April Gcal	May Gcal	June Gcal	July Gcal	August Gcal	September Gcal	October Gcal	November Gcal	December Gcal	Total Gcal
2000	Lignite	3.293,83	3.478,68	3.564,46	1.405,93	0,00	0,00	0,00	0,00	0,00	905,20	1.916,51	2.821,72	17.386,32
	Natural gas	6.117,11	6.460,41	6.619,70	2.611,02	2.688,54	2.028,90	2.067,24	1.791,09	1.375,80	1.681,08	3.559,22	5.240,34	42.240,46
2001	Lignite	2.898,28	2.646,04	2.783,27	1.892,41	0,00	0,00	0,00	0,00	0,00	442,99	2.550,62	2.829,05	16.042,65
	Natural gas	5.382,52	4.914,07	5.168,92	3.514,47	2.050,91	1.826,22	1.500,03	1.332,76	1.244,52	822,69	4.736,86	5.253,95	37.747,94
2002	Lignite	3.652,66	2.298,10	2.162,18	1.410,13	0,00	0,00	0,00	0,00	0,00	585,32	1.694,35	2.680,73	14.483,47
	Natural gas	6.783,51	4.267,91	4.015,48	2.618,81	1.358,60	1.259,08	934,67	892,09	941,09	1.087,02	3.146,66	4.978,50	32.283,41

MONTHLY NET ENERGY OF FUEL ENTERING CET I FOR COVERING EXISTING HEAT DEMAND OF AREA II (Gcal)

510	Fuel	January Gcal	February Gcal	March Gcal	April Gcal	May Gcal	June Gcal	July Gcal	August Gcal	September Gcal	October Gcal	November Gcal	December Gcal	Total Gcal
2000	Lignite	1.066,53	908,13	960,94	411,88	-	-	-	-	-	248,95	562,48	832,60	4.991,52
	Natural gas	1.634,56	1.391,79	1.472,72	631,24	558,73	444,51	412,63	290,85	265,24	381,53	862,05	1.276,04	9.621,90
2001	Lignite	809,43	733,40	792,55	555,40	-	-	-	-	-	116,85	748,10	835,19	4.590,93
	Natural gas	1.240,52	1.124,00	1.214,66	851,20	411,13	391,03	309,75	293,06	281,50	179,09	1.146,53	1.280,00	8.722,47
2002	Lignite	1.050,20	533,45	531,11	461,93	-	-	-	-	-	103,57	555,22	766,75	4.002,24
	Natural gas	1.609,53	817,56	813,98	707,94	302,44	298,89	232,31	218,18	256,68	158,73	850,93	1.175,12	7.442,30

511	Fuel	January Gcal	February Gcal	March Gcal	April Gcal	May Gcal	June Gcal	July Gcal	August Gcal	September Gcal	October Gcal	November Gcal	December Gcal	Total Gcal
2000	Lignite	1.023,72	890,35	912,67	414,07	-	-	-	-	-	225,54	499,16	712,35	4.677,86
	Natural gas	1.568,94	1.364,54	1.398,75	634,59	554,45	239,06	365,98	339,26	278,55	345,66	765,01	1.091,75	8.946,54
2001	Lignite	816,51	705,28	753,18	560,12	-	-	-	-	-	112,13	694,39	767,13	4.408,75
	Natural gas	1.251,37	1.080,91	1.154,31	858,43	471,03	396,16	306,33	278,94	268,66	171,85	1.064,22	1.175,70	8.477,91
2002	Lignite	929,19	556,50	517,31	316,62	-	-	-	-	-	158,82	413,33	454,16	3.345,92
	Natural gas	1.424,06	852,88	792,82	485,25	228,03	214,76	151,02	151,88	177,12	243,40	633,47	696,04	6.050,73

512	Fuel	January Gcal	February Gcal	March Gcal	April Gcal	May Gcal	June Gcal	July Gcal	August Gcal	September Gcal	October Gcal	November Gcal	December Gcal	Total Gcal
2000	Lignite	164,36	1.259,78	1.388,60	387,93	-	-	-	-	-	287,41	671,89	971,82	5.131,79
	Natural gas	251,90	1.930,72	2.128,15	594,54	780,35	534,34	628,47	603,64	410,29	440,48	1.029,74	1.489,40	10.822,01
2001	Lignite	998,49	907,05	926,82	700,56	-	-	-	-	-	105,60	917,39	990,66	5.546,58
	Natural gas	1.530,28	1.390,13	1.420,44	1.073,67	547,61	501,83	439,80	339,69	326,42	161,84	1.405,98	1.518,28	10.655,97
2002	Lignite	1.271,75	799,63	768,95	524,38	-	-	-	-	-	247,38	653,03	1.042,54	5.307,66
	Natural gas	1.949,07	1.225,51	1.178,48	803,65	308,46	287,92	132,63	217,77	236,16	379,13	1.000,82	1.597,78	9.317,38

513	Fuel	January Gcal	February Gcal	March Gcal	April Gcal	May Gcal	June Gcal	July Gcal	August Gcal	September Gcal	October Gcal	November Gcal	December Gcal	Total Gcal
2000	Lignite	1.994,45	1.733,71	1.647,53	750,82	-	-	-	-	-	472,67	924,83	1.286,27	8.810,27
	Natural gas	3.056,67	2.657,06	2.524,98	1.150,69	1.097,78	947,18	933,07	761,94	602,80	724,40	1.417,38	1.971,32	17.845,29
2001	Lignite	1.427,97	1.313,66	1.341,61	1.052,02	-	-	-	-	-	252,75	1.131,31	1.265,04	7.784,37
	Natural gas	2.188,50	2.013,31	2.056,13	1.612,31	880,87	639,16	609,64	566,59	534,34	387,36	1.733,84	1.938,78	15.160,83
2002	Lignite	1.717,93	1.177,04	1.112,80	688,04	-	-	-	-	-	270,64	793,47	1.190,27	6.950,19
	Natural gas	2.632,88	1.803,92	1.705,47	1.054,48	700,33	565,02	516,38	422,25	376,47	414,78	1.216,06	1.824,19	13.232,22

514	Fuel	January Gcal	February Gcal	March Gcal	April Gcal	May Gcal	June Gcal	July Gcal	August Gcal	September Gcal	October Gcal	November Gcal	December Gcal	Total Gcal
2000	Lignite	2.126,91	1.941,83	1.990,10	756,81	-	-	-	-	-	517,66	1.051,48	1.659,06	10.043,85
	Natural gas	3.259,67	2.976,03	3.050,00	1.159,88	1.303,49	1.075,96	962,16	865,47	640,88	793,36	1.611,49	2.542,65	20.241,04
2001	Lignite	1.557,89	1.462,63	1.573,49	795,10	-	-	-	-	-	270,17	1.446,12	1.618,27	8.723,68
	Natural gas	2.387,61	2.241,61	2.411,52	1.218,56	965,58	989,11	730,71	650,73	577,12	414,07	2.216,31	2.480,14	17.283,05
2002	Lignite	2.101,50	1.381,89	1.255,24	738,66	-	-	-	-	-	352,61	864,77	1.735,47	8.430,14
	Natural gas	3.220,74	2.117,87	1.923,77	1.132,07	631,03	644,73	460,75	414,98	456,90	540,40	1.325,34	2.659,75	15.528,32

SUMMARY	Fuel	January Gcal	February Gcal	March Gcal	April Gcal	May Gcal	June Gcal	July Gcal	August Gcal	September Gcal	October Gcal	November Gcal	December Gcal	Total Gcal
2000	Lignite	6.375,98	6.733,80	6.899,84	2.721,51	-	-	-	-	-	1.752,22	3.709,84	5.462,10	33.655,29
	Natural gas	9.771,74	10.320,14	10.574,61	4.170,95	4.294,80	3.241,06	3.302,30	2.861,16	2.197,76	2.685,43	5.685,66	8.371,15	67.476,77
2001	Lignite	5.610,30	5.122,03	5.387,66	3.663,20	-	-	-	-	-	857,51	4.937,32	5.476,29	31.054,31
	Natural gas	8.598,28	7.849,96	8.257,06	5.614,18	3.276,21	2.917,29	2.396,22	2.129,01	1.988,05	1.314,21	7.566,87	8.392,90	60.300,22
2002	Lignite	7.070,57	4.448,52	4.185,41	2.729,63	-	-	-	-	-	1.133,02	3.279,82	5.189,19	28.036,15
	Natural gas	10.836,27	6.817,74	6.414,51	4.183,40	2.170,29	2.011,31	1.493,09	1.425,06	1.503,33	1.736,45	5.026,61	7.952,88	51.570,94

MONTHLY NET ENERGY OF FUEL ENTERING CET I FOR COVERING EXISTING HEAT DEMAND OF AREA II (GJ)

510	Fuel	January GJ	February GJ	March GJ	April GJ	May GJ	June GJ	July GJ	August GJ	September GJ	October GJ	November GJ	December GJ	Total GJ
2000	Lignite	4.465,58	3.802,35	4.023,44	1.724,55	-	-	-	-	-	1.042,34	2.355,11	3.486,11	20.899,48
	Natural gas	6.843,89	5.827,44	6.166,27	2.643,02	2.339,40	1.861,16	1.727,69	1.217,80	1.110,58	1.597,47	3.609,42	5.342,78	40.286,91
2001	Lignite	3.389,09	3.070,75	3.318,42	2.325,48	-	-	-	-	-	489,27	3.132,29	3.496,93	19.222,22
	Natural gas	5.194,07	4.706,19	5.085,77	3.563,99	1.721,39	1.637,26	1.296,91	1.227,02	1.178,66	749,85	4.800,50	5.359,35	36.520,98
2002	Lignite	4.397,20	2.233,57	2.223,77	1.934,09	-	-	-	-	-	433,65	2.324,71	3.210,39	16.757,39
	Natural gas	6.739,10	3.423,14	3.408,13	2.964,16	1.266,32	1.251,47	972,68	913,52	1.074,73	664,61	3.562,83	4.920,21	31.160,89

511	Fuel	January GJ	February GJ	March GJ	April GJ	May GJ	June GJ	July GJ	August GJ	September GJ	October GJ	November GJ	December GJ	Total GJ
2000	Lignite	4.286,31	3.727,90	3.821,37	1.733,70	-	-	-	-	-	944,32	2.089,98	2.982,63	19.586,22
	Natural gas	6.569,15	5.713,34	5.856,58	2.657,05	2.321,48	1.000,95	1.532,36	1.420,48	1.166,29	1.447,26	3.203,08	4.571,14	37.459,15
2001	Lignite	3.418,73	2.953,02	3.153,56	2.345,22	-	-	-	-	-	469,49	2.907,42	3.211,98	18.459,42
	Natural gas	5.239,50	4.525,76	4.833,11	3.594,26	1.972,21	1.658,70	1.282,59	1.167,94	1.124,90	719,53	4.455,87	4.922,64	35.497,02
2002	Lignite	3.890,51	2.330,05	2.165,96	1.325,69	-	-	-	-	-	664,98	1.730,62	1.901,56	14.009,36
	Natural gas	5.962,54	3.571,01	3.319,52	2.031,74	954,76	899,20	632,33	635,93	741,58	1.019,13	2.652,33	2.914,30	25.334,39

512	Fuel	January GJ	February GJ	March GJ	April GJ	May GJ	June GJ	July GJ	August GJ	September GJ	October GJ	November GJ	December GJ	Total GJ
2000	Lignite	688,19	5.274,68	5.814,07	1.624,28	-	-	-	-	-	1.203,38	2.813,22	4.069,01	21.486,82
	Natural gas	1.054,71	8.083,91	8.910,57	2.489,35	3.267,32	2.237,27	2.631,38	2.527,46	1.717,86	1.844,29	4.311,51	6.236,11	45.311,74
2001	Lignite	4.180,70	3.797,80	3.880,62	2.933,24	-	-	-	-	-	442,14	3.841,12	4.147,91	23.223,52
	Natural gas	6.407,29	5.820,47	5.947,38	4.495,45	2.292,84	2.101,18	1.841,44	1.422,28	1.366,72	677,62	5.886,85	6.357,04	44.616,54
2002	Lignite	5.324,83	3.348,06	3.219,58	2.195,56	-	-	-	-	-	1.035,78	2.734,22	4.365,12	22.223,16
	Natural gas	8.160,77	5.131,20	4.934,29	3.364,90	1.291,51	1.205,50	555,33	911,80	988,80	1.587,43	4.190,44	6.689,92	39.011,89

513	Fuel	January GJ	February GJ	March GJ	April GJ	May GJ	June GJ	July GJ	August GJ	September GJ	October GJ	November GJ	December GJ	Total GJ
2000	Lignite	8.350,77	7.259,05	6.898,19	3.143,67	-	-	-	-	-	1.979,06	3.872,25	5.385,60	36.888,60
	Natural gas	12.798,29	11.125,13	10.572,09	4.817,95	4.596,39	3.965,86	3.906,77	3.190,23	2.523,93	3.033,08	5.934,57	8.253,91	74.718,21
2001	Lignite	5.978,93	5.500,31	5.617,31	4.404,80	-	-	-	-	-	1.058,27	4.736,82	5.296,72	32.593,16
	Natural gas	9.163,24	8.429,71	8.609,02	6.750,75	3.688,20	2.676,15	2.552,58	2.372,32	2.237,27	1.621,89	7.259,59	8.117,69	63.478,39
2002	Lignite	7.192,96	4.928,26	4.659,31	2.880,83	-	-	-	-	-	1.133,16	3.322,24	4.983,66	29.100,43
	Natural gas	11.023,85	7.552,99	7.140,81	4.415,13	2.932,29	2.365,72	2.162,06	1.767,95	1.576,30	1.736,67	5.091,62	7.637,90	55.403,29

514	Fuel	January GJ	February GJ	March GJ	April GJ	May GJ	June GJ	July GJ	August GJ	September GJ	October GJ	November GJ	December GJ	Total GJ
2000	Lignite	8.905,36	8.130,45	8.332,55	3.168,76	-	-	-	-	-	2.167,45	4.402,55	6.946,47	42.053,59
	Natural gas	13.648,25	12.460,63	12.770,36	4.856,41	5.457,72	4.505,06	4.028,55	3.623,71	2.683,35	3.321,81	6.747,29	10.646,07	84.749,22
2001	Lignite	6.522,90	6.124,04	6.588,22	3.329,08	-	-	-	-	-	1.131,22	6.054,90	6.775,69	36.526,06
	Natural gas	9.996,92	9.385,63	10.097,03	5.102,10	4.042,87	4.141,40	3.059,46	2.724,59	2.416,41	1.733,70	9.279,67	10.384,34	72.364,11
2002	Lignite	8.798,99	5.785,99	5.255,69	3.092,79	-	-	-	-	-	1.476,37	3.620,79	7.266,39	35.297,01
	Natural gas	13.485,22	8.867,54	8.054,81	4.739,97	2.642,11	2.699,47	1.929,17	1.737,51	1.913,05	2.262,66	5.549,19	11.136,39	65.017,07

SUMMARY	Fuel	January GJ	February GJ	March GJ	April GJ	May GJ	June GJ	July GJ	August GJ	September GJ	October GJ	November GJ	December GJ	Total GJ
2000	Lignite	26.696,21	28.194,43	28.889,62	11.394,96	-	-	-	-	-	7.336,55	15.533,11	22.869,82	140.914,71
	Natural gas	40.914,29	43.210,44	44.275,88	17.463,78	######	13.570,30	13.826,75	11.979,69	9.202,01	11.243,91	23.805,86	35.050,01	282.525,23
2001	Lignite	23.490,34	21.445,93	22.558,13	15.337,82	-	-	-	-	-	3.590,39	20.672,54	22.929,23	130.024,38
	Natural gas	36.001,01	32.867,77	34.572,32	23.506,56	######	12.214,68	10.032,97	8.914,15	8.323,96	5.502,59	31.682,48	35.141,06	252.477,04
2002	Lignite	29.604,49	18.625,93	17.524,32	11.428,96	-	-	-	-	-	4.743,94	13.732,59	21.727,12	117.387,36
	Natural gas	45.371,48	28.545,88	26.857,56	17.515,89	9.086,98	8.421,36	6.251,57	5.966,71	6.294,46	7.270,50	21.046,40	33.298,72	215.927,53
Total	Lignite													129.442,15
	Natural gas													250.309,93

MONTHLY ENERGY SUPPLIED FROM CET I FOR AREA II (GJ) - DIVIDED ON BOILER SYSTEMS

510	Fuel	January GJ	February GJ	March GJ	April GJ	May GJ	June GJ	July GJ	August GJ	September GJ	October GJ	November GJ	December GJ	Total GJ
2000	Lignite	2.306,92	1.964,29	2.078,51	890,90	-	-	-	-	-	538,47	1.216,65	1.800,93	10.796,67
	Natural gas	4.284,27	3.647,98	3.860,09	1.654,53	1.464,46	1.165,08	1.081,53	762,34	695,22	1.000,02	2.259,50	3.344,58	25.219,60
2001	Lignite	1.750,80	1.586,35	1.714,30	1.201,34	-	-	-	-	-	252,76	1.618,14	1.806,51	9.930,20
	Natural gas	3.251,49	2.946,08	3.183,69	2.231,06	1.077,59	1.024,92	811,86	768,12	737,84	469,41	3.005,12	3.354,95	22.862,13
2002	Lignite	2.271,60	1.153,86	1.148,80	999,15	-	-	-	-	-	224,02	1.200,95	1.658,49	8.656,87
	Natural gas	4.218,68	2.142,89	2.133,49	1.855,57	792,71	783,42	608,90	571,86	672,78	416,04	2.230,33	3.080,05	19.506,72

511	Fuel	January GJ	February GJ	March GJ	April GJ	May GJ	June GJ	July GJ	August GJ	September GJ	October GJ	November GJ	December GJ	Total GJ
2000	Lignite	2.214,31	1.925,83	1.974,12	895,63	-	-	-	-	-	487,84	1.079,69	1.540,83	10.118,24
	Natural gas	4.112,29	3.576,55	3.666,22	1.663,31	1.453,25	626,59	959,25	889,22	730,10	905,98	2.005,13	2.861,53	23.449,43
2001	Lignite	1.766,11	1.525,53	1.629,13	1.211,54	-	-	-	-	-	242,54	1.501,97	1.659,31	9.536,14
	Natural gas	3.279,93	2.833,13	3.025,53	2.250,01	1.234,60	1.038,35	802,90	731,13	704,19	450,43	2.789,38	3.081,58	22.221,13
2002	Lignite	2.009,84	1.203,71	1.118,93	684,85	-	-	-	-	-	343,53	894,04	982,34	7.237,24
	Natural gas	3.732,55	2.235,45	2.078,02	1.271,87	597,68	562,90	395,84	398,09	464,23	637,98	1.660,36	1.824,35	15.859,33

512	Fuel	January GJ	February GJ	March GJ	April GJ	May GJ	June GJ	July GJ	August GJ	September GJ	October GJ	November GJ	December GJ	Total GJ
2000	Lignite	355,52	2.724,90	3.003,55	839,10	-	-	-	-	-	621,67	1.453,31	2.102,05	11.100,09
	Natural gas	660,25	5.060,53	5.578,02	1.558,33	2.045,34	1.400,53	1.647,25	1.582,19	1.075,38	1.154,52	2.699,00	3.903,81	28.365,15
2001	Lignite	2.159,75	1.961,95	2.004,73	1.515,31	-	-	-	-	-	228,41	1.984,32	2.142,81	11.997,27
	Natural gas	4.010,96	3.643,61	3.723,06	2.814,15	1.435,31	1.315,34	1.152,74	890,35	855,57	424,19	3.685,17	3.979,50	27.929,95
2002	Lignite	2.750,81	1.729,61	1.663,24	1.134,23	-	-	-	-	-	535,09	1.412,50	2.255,02	11.480,49
	Natural gas	5.108,64	3.212,13	3.088,87	2.106,42	808,49	754,65	347,63	570,78	618,99	993,73	2.623,21	4.187,89	24.421,44

513	Fuel	January GJ	February GJ	March GJ	April GJ	May GJ	June GJ	July GJ	August GJ	September GJ	October GJ	November GJ	December GJ	Total GJ
2000	Lignite	4.314,01	3.750,02	3.563,61	1.624,02	-	-	-	-	-	1.022,38	2.000,40	2.782,20	19.056,65
	Natural gas	8.011,73	6.964,33	6.618,13	3.016,04	2.877,34	2.482,63	2.445,64	1.997,09	1.579,98	1.898,71	3.715,04	5.166,95	46.773,60
2001	Lignite	3.088,72	2.841,46	2.901,90	2.275,52	-	-	-	-	-	546,70	2.447,04	2.736,28	16.837,63
	Natural gas	5.736,19	5.277,00	5.389,25	4.225,97	2.308,81	1.675,27	1.597,91	1.485,07	1.400,53	1.015,30	4.544,50	5.081,67	39.737,47
2002	Lignite	3.715,89	2.545,94	2.407,00	1.488,24	-	-	-	-	-	585,39	1.716,27	2.574,56	15.033,28
	Natural gas	6.900,93	4.728,17	4.470,15	2.763,87	1.835,61	1.480,94	1.353,45	1.106,74	986,76	1.087,16	3.187,36	4.781,32	34.682,46

514	Fuel	January GJ	February GJ	March GJ	April GJ	May GJ	June GJ	July GJ	August GJ	September GJ	October GJ	November GJ	December GJ	Total GJ
2000	Lignite	4.600,51	4.200,19	4.304,60	1.636,98	-	-	-	-	-	1.119,71	2.274,36	3.588,55	21.724,89
	Natural gas	8.543,81	7.800,35	7.994,25	3.040,11	3.416,54	2.820,17	2.521,87	2.268,44	1.679,78	2.079,45	4.223,80	6.664,44	53.053,01
2001	Lignite	3.369,73	3.163,68	3.403,47	1.719,80	-	-	-	-	-	584,39	3.127,96	3.500,32	18.869,36
	Natural gas	6.258,07	5.875,41	6.320,74	3.193,92	2.530,83	2.592,51	1.915,22	1.705,59	1.512,67	1.085,29	5.809,08	6.500,60	45.299,93
2002	Lignite	4.545,56	2.989,04	2.715,09	1.597,73	-	-	-	-	-	762,69	1.870,50	3.753,82	18.234,44
	Natural gas	8.441,75	5.551,08	5.042,31	2.967,22	1.653,96	1.689,87	1.207,66	1.087,68	1.197,57	1.416,43	3.473,79	6.971,38	40.700,69

SUMMARY	Fuel	January GJ	February GJ	March GJ	April GJ	May GJ	June GJ	July GJ	August GJ	September GJ	October GJ	November GJ	December GJ	Total GJ
2000	Lignite	13.791,26	14.565,24	14.924,38	5.886,64	0,00	0,00	0,00	0,00	0,00	3.790,06	8.024,41	11.814,55	72.796,54
	Natural gas	25.612,35	27.049,74	27.716,70	10.932,33	11.256,93	8.495,01	8.655,54	7.499,28	5.760,46	7.038,68	14.902,47	21.941,31	176.860,79
2001	Lignite	12.135,11	11.078,97	11.653,53	7.923,52	0,00	0,00	0,00	0,00	0,00	1.854,80	10.679,43	11.845,24	67.170,59
	Natural gas	22.536,63	20.575,22	21.642,27	14.715,10	8.587,15	7.646,39	6.280,64	5.580,26	5.210,80	3.444,62	19.833,23	21.998,30	158.050,62
2002	Lignite	15.293,68	9.622,16	9.053,06	5.904,20	0,00	0,00	0,00	0,00	0,00	2.450,72	7.094,26	11.224,23	60.642,31
	Natural gas	28.402,55	17.869,72	16.812,83	10.964,95	5.688,45	5.271,77	3.913,48	3.735,16	3.940,33	4.551,33	13.175,05	20.845,00	135.170,63
Total	Lignite													66.869,81
	Natural gas													156.694,02

Annex III Summary of any national stakeholder process

GRUE & HORNSTRUP CONSULTING ENGINEERS
Østergade 18 . DK 7500 Holstebro . Denmark . TEL. +45 96 10 13 30 . Fax +45 97 40 45 20 . www.grue-hornstrup.dk

Holstebro,
Job no. 02912

MEMO

Job: Geothermal Energy in Oradea - Area II and Beius

Subject: Summary of the "National Stakeholder Process"

Date: July 27, 2004

To: Attached to the Project Design Document

1. Introduction

The memorandum presents a summary of the "National Stakeholder Process" for the Joint Implementation project entitled "Geothermal Energy in Oradea - Area II and Beius." Letters regarding project participation from the two main project stakeholders Transgex and the Oradea City Hall can be found in Annex VII. A 30 day public hearing was held by the Danish Environmental Protection Agency in Denmark, the Ministry of Agriculture, Waters, Forest and Environment in Bucharest, and by the Mayors office in Oradea.

2. Public hearing in Denmark

The Project Design Document, version 2.2, was posted by the Danish Environmental Protection Agency on its website in Denmark, and was open for public comment. The public hearing in Demark was closed on November 27, 2003 and no comments or questions have been received.

3. Public hearing in Romania

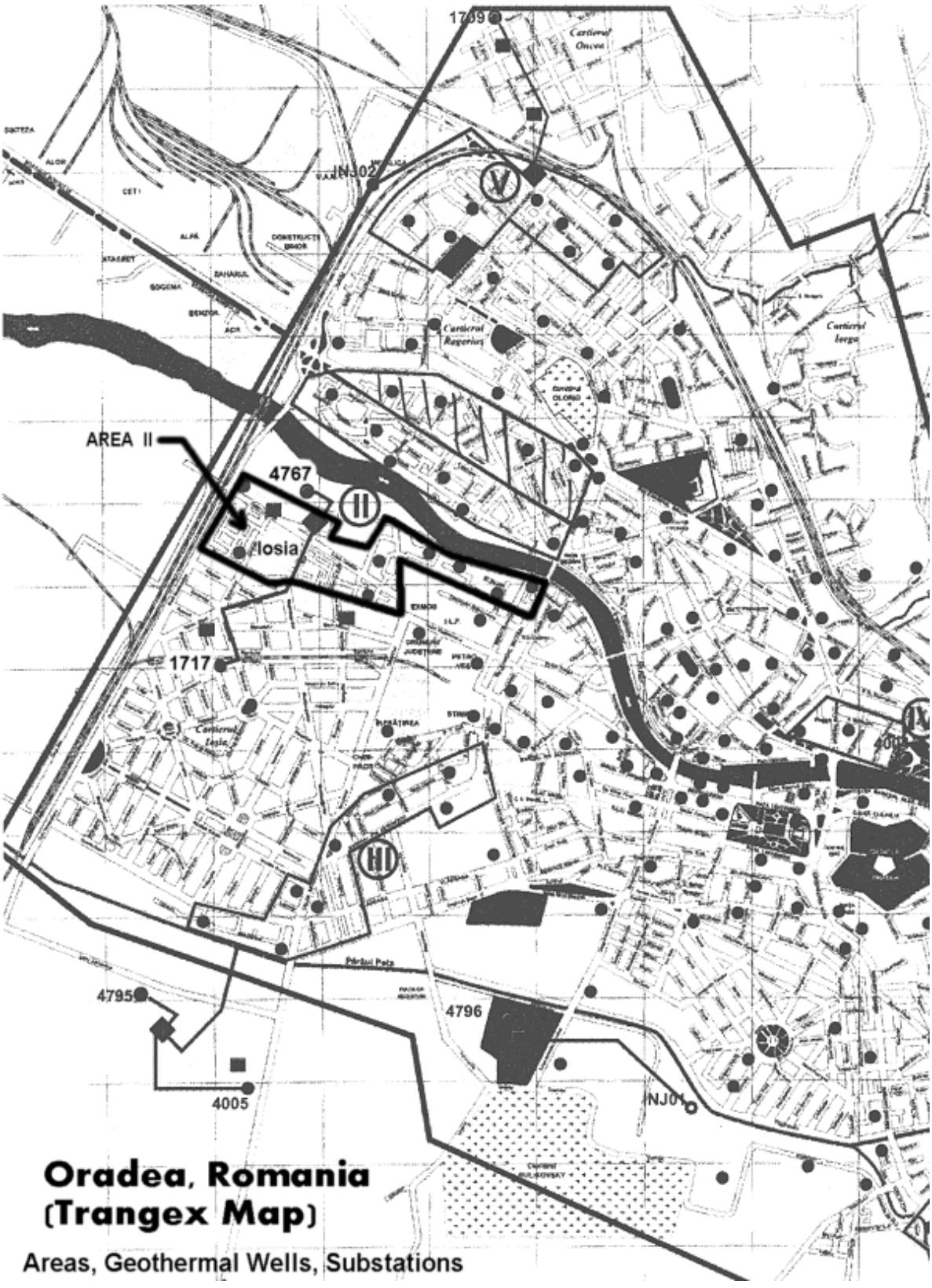
The Project Design Document, version 2.2, was posted by the Ministry of Agriculture, Waters, Forest and Environment on its website in Bucharest, and was open for public comment. At the local level the Project Design Document, version 2.2, was also advertised by the City Hall of Oradea. The advertisement indicated that the public could review the Project Design Document at the City Hall, upon request. Both public hearings in Romania were closed on December 5, 2003 and again there were no comments or questions.

If additional verification of the "National Stakeholder Process" is required, please contact Inge Gerhardt-Pedersen at the Danish Environmental Protection Agency (igp@mst.dk; +45 32 66 01 00) or Vlad Trusca at the Romanian Ministry of Environment and Water Management (vlad@mappm.ro; +402 (1) 410 0287)

Sincerely,

Douglas A. Marett
Phone: +45 30 63 78 90
e-mail:dam@grue-hornstrup.dk

Annex IV Map of Oradea and Heated Buildings in Beius



Oradea, Romania
(Trangex Map)

Areas, Geothermal Wells, Substations

Beius: Building included in the project

NET ENERGY OF FUELS ENTERING EXISTING BOILER SYSTEMS - BEIUS

Buildings to be connected to the geothermal system in Beius	Type of Fuel	Annual fuel consumption		Calorific Value		Total Net Energy value of heavy oil	Total Net Energy value of natural gas
		Measured ton/year	Measured Nm3/year	GJ/ton	GJ/1000 Nm3	GJ/year	GJ/year
Stationary hospital	Heavy fuel	413,00		42,00		17.346,00	
State orphanage	Heavy fuel	360,00		42,00		15.120,00	
Vulcan high school	Heavy fuel	300,00		42,00		12.600,00	
Elmoberon	Heavy fuel	37,00		42,00		1.554,00	
Town hall	Heavy fuel	171,00		42,00		7.182,00	
Drilling machine	Heavy fuel	120,00		42,00		5.040,00	
Elmoberon	Heavy fuel	480,00		42,00		20.160,00	
Fragaria	Heavy fuel	30,00		42,00		1.260,00	
Albatex	Liqued gas		12.000,00		35,59		427,08
Patritex	Liqued gas		36.000,00		35,59		1.281,24
Military barracks	Heavy fuel	350,00		42,00		14.700,00	
Primary school	Heavy fuel	40,00		42,00		1.680,00	
N. Bolcas College	Heavy fuel	90,00		42,00		3.780,00	
law court	Heavy fuel	20,00		42,00		840,00	
prosecutor's office	Heavy fuel	20,00		42,00		840,00	
Edilul	Heavy fuel	12,00		42,00		504,00	
Public fineness	Heavy fuel	5,00		42,00		210,00	
SC Verronela	Heavy fuel	60,00		42,00		2.520,00	
SC Cedru	Heavy fuel	200,00		42,00		8.400,00	
SC Oradium	Liqued gas		36.000,00		35,59		1.281,24
bus terminal	Heavy fuel	50,00		42,00		2.100,00	
Museum	Heavy fuel	60,00		42,00		2.520,00	
Church	Heavy fuel	60,00		42,00		2.520,00	
School workshop	Heavy fuel	70,00		42,00		2.940,00	
Total						123.816,00	2.989,56

Annex V References

/1/ Danish Energy Authority - Project Manual Joint Implementation - May 2003-07-24

/2/ SGS Group (Sociétié Générale de Surveillance) - Document Eligibility Criteria

/3/ The Combined Heat & Power Generation for District Heating Purpose - In Country Report, Romania - April 2003.

/4/ Feasibility Study - Romania - Oradea Geothermal Energy Area II, August 2003

/5/ Operational Guidelines for Baseline Studies, Validation, Monitoring and Verification of Joint Implementation Projects - Volume 2a Baseline Studies, Monitoring and Reporting - A guide for project developers version 2 - Ministry of Economic Affairs Netherlands - October 2001.

/6/ Carboncredits.nl (ERUPT 4) – Senter International – "Additionality Test" – Ref. DER0421038 – March 2004

/7/ UN Economic and Social Council – "Environmental Performance Review of Romania" (2001). http://www.unece.org/env/epr/studies/romania/welcome.htm ISBN 92-1-101055-1

/8/ European Bank for Reconstruction and Development (EBRD), "The Investment Climate for Climate Investment: Joint Implementation in Transition Countries," Working Paper No. 77, January 2003.

Annex VI Glossary of terms

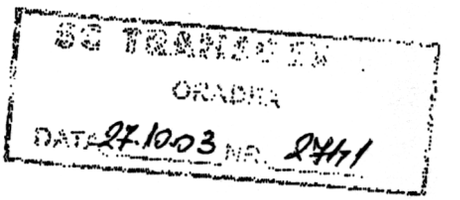
Annex B countries	Emssion capped industrialised countries and economies in transition listed in Annex B - Kyoto Pro
Annex I countries	Industrialised countries and economies in transition listed in Annex I of the UNFCC.
AIJ	Activities Implemented Jointly. In the first UNFCC Conference of Parties (COP 1) in Berlin 1995 a pilot phase for bilateral GHG mitigation projects was created with the name Activities Implemented Jointly. During the AIJ phase experience shall be established, but without allowing carbon credit transfer between countries.
AAU	Assigned Amount Unit is tradable units of the Assigned Amount of an Annex B country as issued pursuant to the rules of article 17 of the Kyoto Protocol, expressed as one metric ton of CO2.
ARCE	Romanian Agency for Energy Conservation
Baseline	A description of the most likely future development in the considered GHG emission or sequestrating system without the JI or CDM project.
BAU	Buisness As Usual. The BAU scenario describes the future development of the existing fossil fuel based district heating sytem if it was continued to be in operation.
BS	Baseline Study
CDE	Carbon Dioxide Equivalent
CDM	Clean Development Mechanism
CEECs	Central and East European Countries
CER	Certified Emission Reduction
CH_4	Methane
CO_2	Carbon Dioxide
DEPA	Danish Evironmental Protection Agency
DH	District Heating
EPA	Enviromental Protection Agency with offices in each county
ERU	Emission Reduction Unit describes the technical term for GHG emission reduction output of JI - Project according to the Kyoto Protocol.
EUR	Euro (currency European Union)
Gcal	Giga-calorie (1.0 Gcal = 4.187 GJ)
GES	Gross Energy Supply (total energy demand of DH system including losses boiler system, distribution pipe network, under buildings and in buildings).
GHG	Greenhouse Gasses
GJ	Giga Joule (1.0 GJ = 277.78 kWh)
GWP	Global Warming Potential
Host Contry	Country in which the JI or CDM project is implemented
IPCC	Intergovernmetal Panel on Climate Change
JI	Joint implementation Porject according to Article 6 - Kyoto Protocol.
kWh	Kilowatt hour (1.0 KWh = 3,600,000 Joule)
Leakage	The net change of anthropogeni GHG emission which occur outside the project boundary.
L/S	Litre per second
MDP	Romanian Ministry of Development and Prognosis
MOU	Memorandum of Understanding between countries
MP	Monitoring Plan
MWh	Megawatt hour (1.0 MWh = 3,600,000,000 Joule)
N_2O	Nitrous Oxide
NED	Net Energy Demand (energy demand in buildings, excluding losses in basements).
PCF	Prototype Carbon Fund of the World Bank
PDD	Project Design Document
QA	Quality Assurance
QC	Quality Control
ROL	Romanian Lei (currency)
RMWEP	Romanian Ministry of Waters and Environmental Protection
SINK	A procees, activity or mechanism, which removes anthropogenic GHG from the atmosphere.
UNFCC	United Nations Framework Convention on Climate Change

Annex VII Letters of intent and letters from Transgex explaining the historical development.

RO –Oradea, jud. Bihor
str.Vasile Alecsandri nr.2, cod 410072
Cod unic de înregistrare: 202255
Cont: SV3255930500 BRD Oradea

S.C. TRANSGEX S.A. Oradea
Tel/Fax : 040-259-416284, 040-259-413022
e-mail. transgex@rdsor.ro

To:
Mrs. Inge Gerhardt-Pedersen
Danish Ministry of the Environment
Danish Environmental Agency



Subject: Utilization of Geothermal Energy in Oradea and Beius

Dear Mrs. Pedersen

SC TRANSGEX SA is a private company which owns the Exploitation License for the geothermal water stored in Oradea Reservoir. The thermal potential of this reservoir is around 300 000 Gcal/year, but only 50 000 Gcal represents the yearly production. The missing funds represent a barrier in the development of using the geothermal energy.

At the beginning of this year the Danish Consulting Agency Grue & Hornstrup has prepared a screening Report in order to establish if the geothermal Resources and local commitment can meet the criteria for developing a JI-project (Joint implementation) according to the Kyoto Protocol Article 6 regarding financing, time schedule and fulfillment of the provisions of the UNFCCC, Kyoto Protocol and the Memorandum of Understanding (MoU) signed between the government in Romania and the government in Denmark.

Grue & Hornstrup prepared the Feasibility Study with very accurate financial analyses. Seven scenarios have been elaborated to describe the economical viability of using different financing sources for implementing different technical solutions. Among the scenarios, the most feasible are the scenario including the financial imputs reflecting the value of the CO_2 Credits. This funding is very important in order to implement the project whose total value is around 1,8 millions Euro. The value of the CO_2 credits is assumed to cover a considerable part of the total investment.

At Grue&Hornstrup's suggestion TRANSGEX set up together with the Local Council the Public Services of Local Interest named GEOTERM. The aim of this association is to supply heat and hot sanitary water to consumers in Oradea - Area II, from the geothermal well 4767 using pipes network and substations. Geoterm has gathered the District Heating administration and management of production well, substations, pipes

network. In this way the relationship between producer and consumers is being more transparent.

The total cost of investment, 1.8 Millions Euro will be covered using funds from Transgex,, Municipality and CO_2 credits.

The value of the CO_2 credits represent an important share of the total cost of investment. Without this credits Transgex and the Municipality have not the financial power to implement the project.

On September this year Grue&Hornstrup has finished the Project Design Document (PDD) and submitted this to Transgex and to the Romanian Ministry of Environment. Additional the PDD includes the GHG of Beius where Transgex is in progress with one geothermal project.

By issuing this letter Transgex will like to express the willingness to participate in the project described in the PDD.

Yours Sincerely

General Director
Ec. Iacobescu Alin

SOCIETATEA COMERCIALA TRANSGEX S.A. ORADEA

Oradea City Hall
Piata Unirii, nr. 1-2, Oradea
Tel. (0259)437000,
E-mail: primarie@oradea.ro.
Nr. 106701 / 14.10.2003

To: Mrs. Inge Gerhardt - Pedersen
Ministry of Enviroment
Danish Environmental Protection Agency

Municipality of Oradea set up together with TRANSGEX the public services of public interest, named GEOTERM. The target of this association is production, transportation and distribution of thermal energy, for heat space and supply with hot sanitary water the inhabitants of Oradea city located in Area II. SC TRANSGEX SA is one company which under the law of mines, and has concession licences for exploitation of geothermal water in Oradea. Municipality is the owner of pipes network and substations. Production well, substations, and pipes network had been gathered under one administration, such the intermediate between producer and consumers were eliminated.

The association between Municipality and TRANSGEX in order to supply geothermal water to five substations from Area II was born following an idea belonging to Grue&Hornstrup reprezentative.

The Local Council of Oradea city agrees the results from the feasibility study prepared by Grue&Hornstrup and will finance 10% of the total costs.

The Romanian version of joint implementation project was received by the Local Council and it is thought that the project could be implemented only with external financial support. Without CO2 Credits obtained from The Danish Government the implementation of the project is not possible. The only one feasible scenario is the scenario in wich the investment is assumed to be financed by TRANSGEX, Municipality, CO2 Credits (up – front payment) and commercial loan.

Respectfully,

MAYOR
PETRU FILIP

RO –Oradea, jud. Bihor
str.Vasile Alecsandri nr.2, cod 410072
Cod unic de înregistrare: 202255
Cont: SV3255930500 BRD Oradea

S.C. TRANSGEX CO S.A. Oradea
Tel/Fax : 040-259-416284, 040-259-413022
e-mail. Transgex Co@rdsor.ro

SC TRANSGEX SA
ORADEA
DATA 27.10.03 NR. 2740

To:
Mrs. Inge Gerhardt-Pedersen
Danish Ministry of the Environment
Danish Environmental Agency

Dear Mrs. Pedersen

TRANSGEX CO is a private company which owns 5 Exploitation License and 11 Exploration License for geothermal water, in different geothermal fields in the western part of Romania. The total number of geothermal wells is 47, but only 24 are in use. Almost all the geothermal wells were drilled before 1989, as part of a research program aiming to map the geothermal energy potential in Romania. Before '89 the number of production wells was more than 24. Due to the sharply dropping down of the Romanian Economy a lot of wells were shut down. On the Sacuieni field -50 Km North far from Oradea, there are 7 geothermal wells. Now, only one is in use.

The green houses, the cattle farm, the furniture factory which used the geothermal energy were closed too. On the Bors field, all the wells are shut down. The geothermal water has been used to heat up around 40.000 some of green houses. The using of geothermal water scaled down. The high prices of inhibitors, of electricity, of re-injection, led to a high price of the geothermal energy.

Now, there are in use less than 50% from a total surface of 1.000.000 sqm of green houses. A new technology is required to refit this geothermal field. At Oradea the milk factory folded. At Salonta, 50Km South far from Oradea, there are two geothermal wells. None of them is in production, and we have to mention that the substations of the city are closed because the inhabitants don't have the financial power to pay the high price of the heating.

There are drilled 4 geothermal wells on Ciumeghiu field, 10 Km far from Salonta. All the wells are shut down, even if the temperature of geothermal water is higher than 100 °C. We can mention that there is natural gas dissolved into the water, which can raise the water teperature at around 150 °C. One of these 4 wells was used before to heat up a poultry farm but it is closed now. Transgex Co incomes and the investment funds as well, decreased during the last years due to the shut down wells. The exploitation of the geothermal resources has been limited so far because of the considerable investment costs required.

The most important target of Transgex Co is to extend the exploitation of the geothermal energy resources in Oradea by improving the geothermal facilities through installation of line shaft pumps in the existing wells. The development schedule assumes that the utilization will be developed to maximum by setting line shaft pumps in eight wells and re-injecting in six wells. Re-injection will be carried out in four selected wells and in two injection wells to be drilled in the future.

Transgex Co together with the Municipality founded a public services company Geoterm. Thus production wells, pipes and substations are under one administration.

In order to maintain a reasonable price for the thermal energy, the sale price will be kept at a level were subsidies are not needed. The Municipality of Oradea is paying today the subsidy to CET 1. The policy of Geoterm is to keep the price of thermal energy obtained by geothermal energy will be maximized to 4.77 Eur/Gj.

Transgex Co and the Municipality could not implement the geothermal project in Area II by themselves, without CO_2 credits obtained from Danish Environment Protection Agency. This is due to the high price of the investment and the missing funds. Trangex Co intends to purchase a part of the materials from its suppliers within one crediting period of 6 months, in order to have the capacity to pay them.

Until now, the Romanian energy strategy for years 2004 – 2015 and energy laws do not encourage to increase the use of renewable energy resources like geothermal energy. Therefore no subventions were granted from Romanian Government.

Transgex Co is progressing with a geothermal project at Beius. A geothermal well was drilled here and Transgex Co is the owner of the exploitation License. The substations were granted three years ago from the EDILUL (local Company which supplied thermal energy before the granting). The entire local network must be rehabilitated in order to avoid the losses of the thermal energy. The secondary pipes network is 20 years old. Due to the low capacity of the inhabitants to pay the thermal energy, and also in order to keep the market, Transgex Co intends to maintain the price of the thermal energy as low as possible. No significant rise of price is planed here.

Today, the Romanian Government continues the research drilling program. The new 3003 Beius geothermal well has been financed by the Romanian Agency for Mineral Resources, as a part of this research program. The research program is only to map the underground resources, (to know the reservoir parameters). The Romanian Agency for Mineral Resources manage the mineral resources and the national geologic fund - property of the state, however the Agency doesn't finance the exploitation of resources. This new well will increase the amount of available geothermal energy.

From the Environment Protection point of view, there are to be brought a lot of advantages by the implementing of this project. The quantity of GHG, SO_2, and dust will be reduced. Partially, the cooled down geothermal water will be re-injected, not discharged on the surface emissary.

The revenues from the actual heat sales is far away to give to Transgex Co Co the power to implement an 1,8 million Euro project without the CO2 credit support .

Hopping that this letter creates a picture of the Transgex Co policy of developing the use of geothermal energy, do not hesitate to contact us for further information.

Yours Sincerely

General Director
Ec. Iacobescu Alin

SOCIETATEA COMERCIALA TRANSGEX S.A. ORADEA * C.U.I. 20226 *

Søren Jellesø

Fra: Transgex [transgex@rdsor.ro]
Sendt: 14. maj 2004 13:28
Til: Søren Jellesø
Emne: epa approval

Dear Soren,

Please find attach the scanned copy of approval submitted by local EPA regarding the Iosia Project.

An English version of this document you may see below.

Next week, Tuesday 18.05.2004 at 10:30 a.m. was arrange the meeting between Mr. Iacobescu and
the ambassador of Danish Kingdom.Trusca will participate at this meeting. Tuesday at 8:30 Mr Iacobescu will be at Environment Ministry and from there together with Trusca they will go to the Danish embassy.

Do you know the rule regarding the invoice which will be submitted by TRANSGEX to DEPA ?
It contain or not VTA? How will have to fill it up ? The purpose of trading? Do you have a draft of invoice from your previous contract in Romania with sawdust at Huedin or other project ?.

Best regards,

Miron

To:
SC TRANSGEX SA Oradea
Vasile Alecsandri str.2

Referring at your address 1445/27.04.2004 registered at EPA Bihor under nr. 3361/05.2004 we inform you:

1. Favorable notice regarding the Project " Connect 5 substations from Iosia district at the geothermal well 4767 Oradea
2. The project not request transfronatlier approval from neighbor countries.
3. A technical documentation in conformity with 860/2002 order of MAPM will be submitted in order to obtain "ACORD DE MEDIU" for each specification included in project (Building Geothermal Plant, thermal network, rehabilitation of substations)

Annex VIII Monitoring Plan

Monitoring Plan

Geothermal Energy in Oradea - Area II and Beius

July 2004 – Version 2.3

GRUE & HORNSTRUP CONSULTING ENGINEERS

Østergade 18 . DK 7500 Holstebro . Denmark . TEL. +45 96 10 13 30 . Fax +45 97 40 45 20 . www.grue-hornstrup.dk

Table of Contents

1. Monitoring Requirements

1.1 Objective of the Monitoring Plan

The objective of the MP is to provide a practical framework for collection and management of performance data in order to monitor and verify the GHG emission reduction generated by the Joint Implementation Project named Geothermal Energy in Oradea - Area II and Beius. The project comprises substitution of the fossil fuels lignite, heavy oil and natural gas. The MP shall after its validation act as an integrated part of the contractual agreement for CO_2 trading between the Romanian government and the Danish government.

This MP provides monitoring methodologies for monitoring and estimation of GHG emission reduction referring to the emission baseline in the BS included in the PDD - Geothermal Energy in Oradea - Area II and Beius - July 2004 - Version 2.3

This MP includes one monitoring methodology for Oradea Area II and one monitoring methodology for Beius to be followed by the organisations responsible for execution of the monitoring. The methodologies described in paragraph 2.

The monitoring results shall be filled in the forms in paragraph 4 (Annexes) for the entire monitoring period of ten years. The proposed monitoring methodology, data collection, data management and guidelines can only be changed after agreement with the Romanian Government, the Danish government and the Verifier.

1.2 Requirements for the Monitoring Activities

1. Monitoring of the GHG emission reduction generated by the project shall be performed by data collection at CET I, in Oradea - Area II and in the town Beius.

2. Monitoring reports include the actual GHG emission reduction and GHG emission generated by the project and should be issued annually during the entire crediting period of ten years.

3. The monitoring period of ten years is defined as following.

    - From the date of commissioning of project to the end of year 2007 the mechanism for Early Credits will be used for transfer of AAUs.

    - From year 2008 to the end of year 2012 (fist commitment period) the JI - mechanism will be used for transfer of ERUs.

    - From year 2012 to the end of year 2017 the Danish government have an option for purchasing ERUs generated by the project.

4. Based on monitoring results the GHG emission reductions and GHG emissions shall be calculated and submitted for verification as approved ERUs. Issues regarding environmental and social impacts shall be elaborated.

5. Persons trained in the monitoring procedures shall conduct the monitoring of the GHG emission reductions and GHG emissions generated by the project.

6. QA system shall be implemented to secure accurate and transparent monitoring of GHG emission reductions and GHG emissions.

7. The governing language is English when speaking about monitoring reports.

8. The outcome of the MP shall make it possible for a legal entity to accrediting the ERUs generated by the project according to requirements of the Executive Board/JI Supervisory Committee, the Romanian government and the Danish government.

9. The monitoring procedures shall follow the guidelines in the Project Manual - Joint Implementation - May 2003 publicised by the Danish Energy Authority, Kyoto Protocol and Marrakech Accords.

10. Draft version of the annual monitoring report shall be submitted to the Romanian government and Danish government or theirs representative before issuing the final version. For a time period of ten (10) years the Romanian government, Danish government and verifier shall annually received the reports presented in Table 1.

Receiver of annual reports	**Draft version monitoring report**	**Final version monitoring report**
Romanian Government	Two (2) copies	Two (2) copies
Danish Government	Two (2) copies	Two (2) copies
Verifier		Two (2) copies

Table 1: Monitoring reports

1.3 Frequency of Monitoring and Verification Procedures

The overall time period for the monitoring procedures is defined in the PDD - Geothermal Energy in Oradea - Area II and Beius - July 2004 - Version 2.3 after agreement between the Romanian government and the Danish government. The time schedule for monitoring- and verification surveying will as starting point have the same frequency.

Time period	Monitoring	Verification
MP time period	10 years	10 years
Commissioning of project to the end of year 2007	Continuously during every year and the mechanism for Early Credits will be used for transfer of AAUs.	End of every year
From year 2008 to the end of year 2012	Continuously during every year and the JI - mechanism will be used for transfer of ERUs.	End of every year
From year 2012 to the end of year 2017	Continuously during every year and the Danish government have an option purchasing of ERUs generate by the project.	End of every year

Table 2: Time Period for monitoring- and verification procedures

1.4 Baseline Reference

1.4.1 Project Design Document

The MP is referring to the below PDD:

PDD - Geothermal Energy in Oradea - Area II and Beius - July 2004 - Version 2.3

1.4.2 Key elements of the baseline - Oradea - Area II

- The annual energy supply to Oradea - Area II for a time period of ten years.
- In Oradea - Area II the baseline is addressing CO_2 emission reduction from substituting fossil fuels with geothermal energy with correction for CO_2 emission from operation of new peak load boilers (natural gas) and from other power plants substituting reduced electricity production at CET I.
- 65 % of the energy supply to five substations in Area II from October to May would be from CET I based on combustion of natural gas.

  35 % of the energy supply to five substations in Area II from October to May would be from CET I based on combustion of lignite.

  100 % of the energy supply to the five substations in Area II from May to October would be from CET I based on combustion of natural gas.

1.4.3 Key elements of the baseline - Beius

- The annual energy supply to the new buildings connected to the existing geothermal DH system in Beius for a time period of ten years.

- In Beius the baseline is addressing CO_2 emission reduction originating from substituting fossil fuels with geothermal energy.

- Heavy oil fired boilers in 21 buildings will continue to operate when no alternative heat source can be identified.

  Natural gas fired boilers in 3 buildings will continue to operate when no alternative heat source can be identified.

2. Verification and Basic Assumptions

The MP provides a practical approach and describes the methodology in order to quantify the project performance in terms of the GHG emission reduction as mentioned before. The precondition is that baseline described in the BS is accepted as the model for this project. Monitoring of the GHG emission reductions and GHG emissions shall be based on transparent data management and calculation methods.

One of the key assumptions is that the geothermal energy resources used to substitute fossil fuels in Oradea - Area II and Beius would be sufficient to meet the heat demands of the new DH systems. The available quantity of geothermal energy resources has been estimated by S.C. Transgex S.A. who has extensive experience in exploitation of the geothermal reservoirs in the city of Oradea and in the town of Beius.

The new geothermal DH system in Oradea - Area II and the existing geothermal DH system in Beius shall be proper operated and maintained to secure the highest possible heat production for a time period of minimum ten years.

The combustion of heavy oil at CET I will stop in the future according to information received.

The monitoring plan for the GHG emission reductions and GHG emissions generated by the project has been divided into CO_2 emission from substitution of fossil fuels and GHG emission from peak load boilers and additional electricity production by power plants.

2.1 CO_2 Emission Reduction Substituting Fossil Fuels in Area II

2.1.1 Basic Assumptions

The MP is based on the basic assumption that the CO_2 emission reduction per unit of fossil fuel (emission factors) substituted by geothermal energy will be constant. The total quantity of fossil fuels substituted by geothermal energy is expected to vary from year to year during the entire crediting period. The emission baseline developed in the PDD is assumed to be equal to the BAU scenario.

2.1.2 Methodology

The steps presented below describe the methodology used calculating the CO_2 emission reduction generated by substituting fossil fuels with geothermal energy in Oradea - Area II:

Step I: The specific type of fossil fuel, the calorific value of lignite (GJ/ton) and natural gas (GJ/Nm^3) used shall be described. The utility company responsible for the monitoring procedures shall contact the relevant supplier of lignite and natural gas to obtain precise and reliable data.

Step II: CO_2 emission factor for lignite (ton CO_2/GJ) and natural gas (ton CO_2/GJ) from the relevant suppliers. This means the CO_2 emission factor for lignite and natural gas will be settled one time and used during the entire crediting period.

Step III: The net energy supply (GJ) from the geothermal well 4767 to the new geothermal DH system supplying the five substations in Area II shall be measured.

Step IV: The net energy of the fuel entering CET I (GJ) shall be measured to monitor the total consumption of natural gas and lignite.

Step V: The net energy supplied by CET I in terms of heat (GJ) and electricity (GJ) shall be measured to calculate the overall effectiveness of CET I.

Step VI: The forms in paragraph 4 (Annexes) for registration of performance data shall bee filled in and signed by the utility in charge.

2.2 CO_2 Emission from Substitution of Fossil Fuels at the CET I

2.2.1 Basic Assumptions

The MP is based on the basic assumption that the direct CO_2 emission generated by the emission baseline is equal to the BAU scenario and that this will prevail in the entire monitoring period. Another assumption is that the electricity produced by the CET I will decrease when the new geothermal DH system in Area II will be in operation and the reduction in the electricity production will be compensated by other power plants connected to the grid. When the energy supply for heating purposes from CET I to Area II is stopped the co-generation technology at CET I has to produce less heat and a related smaller quantity of electricity. However, the electricity demand will not decrease because CET I decreases its electricity production and therefore other power plants is assumed to supply additional electricity to the grid causing higher GHG emission.

2.2.2 Methodology

The steps presented below describe the methodologies used calculating the CO_2 emission generated by substituting fossil fuels at CET I with geothermal energy in Oradea - Area II:

Step I: The electricity production (GJ) calculated in paragraph 2.1.2 shall be supplied by other power plants supplying electricity to the grid. The utility shall contact the relevant supplier of electricity to the grid to obtain precise and reliable data.

Step II: CO_2 emission factor (ton CO_2/GJ) from the Dutch Erupt program or other valid emission factors shall be used for calculating the GHG emission (tonnes) from power plants substituting the electricity supply from CET I.

Step III: The forms in paragraph 4 (Annexes) for registration of performance data shall bee filled in and signed by the utility in charge.

2.3 CO_2 Emission from Peak Load Boilers - Oradea - Area II

2.3.1 Basic Assumptions

The MP is based on the basic assumption that the new natural gas fired peak load boilers will operate a few days per year emitting GHG to the atmosphere and this GHG shall be calculated for estimation of the project total GHG emission reduction effect.

2.3.2 Methodology

The steps presented below describe the methodology used calculating the CO_2 emission from operation of the new peak load natural gas fired boilers at the new geothermal heating plant in Area II:

Step I: The specific type of fossil fuel, the calorific value of natural gas (GJ/Nm^3) used shall be described. The utility company responsible for the monitoring procedures shall contact the relevant supplier of natural gas to obtain precise and reliable data.

Step II: CO_2 emission factor for natural gas (ton CO_2/GJ) from the relevant supplier of natural gas.

Step III: The net energy supply (GJ) supplied by the new natural gas boilers shall be measured by heat energy meters and metered gas consumption at the new geothermal heating plant in Area II.

Step IV: The forms in paragraph 4 (Annexes) for registration of performance data shall bee filled in and signed by the utility in charge.

2.4 CO_2 Emission Reduction Substituting Fossil Fuels in Beius

2.4.1 Methodology

The steps presented below describe the methodology used calculating the CO_2 emission reduction generated by substituting fossil fuels with geothermal energy in Beius:

Step I: The specific type of fossil fuel, the calorific value of heavy oil (GJ/ton) and natural gas (GJ/Nm^3) used shall be described. The utility company responsible for the monitoring procedures shall contact the relevant supplier of heavy oil or natural gas to obtain precise and reliable data.

Step II: CO_2 emission factor for heavy oil (ton CO_2/GJ) and natural gas (ton CO_2/GJ) from relevant suppliers.

Step III: The net energy supply (GJ) supplied from the geothermal wells 3001 and 3002 to the buildings connected to the existing geothermal DH system shall be metered . Metering of the energy supply to each building shall be performed by energy meters mounted in each building.

Step IV: The forms in paragraph 4 (Annexes) for registration of performance data shall bee filled in and signed by the utility in charge.

2.5 Unintended Emissions in Case of Emergencies

Unintended emissions in the case of emergencies are not included in monitoring procedures and QA activities since all emissions generated will originate at CET I. CET I is controlled by a separate organization and staff than those involved in this project. The staff and organization responsible for the implementation and running of the geothermal based heat supply (this project) does not have any influence on the operating conditions at the CET I facility. In the case of emergencies occurring with the geothermal based heating system, e.g. shut down, the natural gas fired peak load boilers will be utilized to provide the heat demand. In this case the monitoring plan will automatically account for these emissions as described in monitoring procedures.

Natural gas fired peak boilers will only be operated if/when the geothermal resources can not cover the heat demand and/or if maintenance on the geothermal system will be needed in the heating season. When- and for how many hours the peak load boiler will operate will be a decision taken by the operation staff.

2.6 Environmental Impacts

2.6.1 Basic Assumptions

The MP and the corresponding Baseline Study is based on the assumption that the project will reduce emission of GHG and dust, which is emitted from CET I and individual fossil fired boilers in Beius today. As mentioned earlier the reduced environmental impacts shall be recorded in order to monitor that the expected environmental benefits are achieved. In relation to the environmental impact of discharge water temperature in Beius, the discharge temperature shall be recorded along with its long term impact.

Local stakeholders can at any time submit comments to the project's environmental impact. Important comments and its solution will be included in the annual monitoring report.

2.6.2 Methodology

The environmental impacts caused by the project will be recorded by local EPAs and described in EPA inspection reports and forms (paragraph 4) following the guidelines presented in paragraph 3.2.3 and 3.2.5. The Romanian UNFCCC Focal Point, who is also the national environmental authority, is discussing to what extent and according to what standard an extended environmental impact assessment shall be elaborated. It seems that the EIA will be the responsibility of the local EPA, who has approved the project.

2.7 Operation- and Monitoring Obligation

This paragraph describes requirements for collection of the key performance parameters necessary to achieve verifiable emission reduction data. This will call for certain operational obligations and data collection obligations to be fulfilled by the utilities in Oradea - Area II and Beius.

The utilities shall take all reasonable actions to optimise the operation of the new geothermal systems even this in fact will minimise the GHG emission reduction.

1. The utilities shall ensure supply of geothermal energy to the new geothermal heating plant in Oradea - Area II and to buildings in Beius.

2. The utilities shall as a minimum fulfil the obligations concerning monitoring- and data management which are described in this document. The monitoring procedures shall act as an integrated element in the day-to-day management system for the new geothermal DH systems in Oradea - Area II and in Beius.

3. The utilities operating the DH systems shall notify the Romanian government and the Danish government if the new DH systems are stopped or supply of geothermal energy has dropped significantly or stopped.

4. The Romanian government and the Danish government shall notify relevant organisations if new directives or legislation coming into force will affect the GHG emission reduction generated by the project.

3. Management of the Monitoring Plan

Management of the MP shall ensure registration of performance data for verification of the GHG emission, which shall executed by an independent entity.

3.1 Responsibilities

The management and operation of the DH systems is the responsibility of the local utilities operating the new DH systems as mentioned earlier. The utilities shall ensure environmental credibility through systematic and accurate performance of monitoring procedures for the entire lifetime of the MP.

3.2 Management

The utilities are responsible for implementation of the management system according to the guidelines in this MP. The management system shall be based on the guidelines mentioned in paragraph 3.2.3, 3.2.4, 3.2.5, 3.2.6 and the forms included in the Annexes (paragraph 4).

3.2.1 Monitoring Equipment and Maintenance

Monitoring equipment used in this project will predominately be heat meters. The heat meters will be standardised West European electronic heat meters manufactured in accordance with relevant EU norms and standards like EN 1434 and the meters will be supplied inclusive verification certificates. If further verification is needed during the crediting period this will be a part of the final instruction.

Maintenance of monitoring equipment is limited to the maintenance of the heat meters as the remaining part of the monitoring and emissions calculations depends on the calculations based on heat meter readings and the utilisation of general operation data from CET I, which is the place where emissions occur. The emissions calculation will depend on the operation conditions at CET I which will reflect upon the actual fuel consumption.

3.2.2 Data handling

Data handling shall be conducted in a transparent way to secure high quality data recording and data filing. The forms included in the MP shall be used as a protocol for daily data handling, which as a minimum comprise written recording of monitoring data. The handling and processing of monitoring data as well as calculation of the emissions will based upon spreadsheet models. All electronic data shall be backed up on electronic media, e.g. CDs, Zip or Tape drives. Data backup shall be performed on a weekly bases when metering data has been registered, and backup media shall be stored at an off site location.

Data and information obtained from third party concerning e.g. fossil fuels used before implementation of the project shall be in writing and confirmed with the necessary stamps and signatures.

Uncertainty related to data handling shall be recorded by the utilities and the verifier shall be noticed about this, and if necessary monitoring procedures shall be modified according to agreement with the verifier.

Data recorded in the first three (3) months of the monitoring period (first monitoring year) shall be forwarded to the verifier immediately after expiry of this three months period for identification of possible mistakes or irregularities.

The heat which is delivered to substations and distribution networks will be monitored at numerous points within the system. It is assumed that if data is missing from one point, that the points data can be estimated based on data from the other points occurring during the same time period. In the case that the previously mentioned is not applicable for determining missing data and/or for quality control purposes (data errors and uncertainties) an estimated data series for raw data will be calculated at the end of each fiscal year when the verification report is made. It is recommended that the estimated data series also be continued during every day of operation to monitor for errors in daily readings. Missing data will be replaced with the estimated data and actual data will be compared with the estimated data for quality control purposes. A combined spread sheet will be developed for both of these purposes once installation is complete.

There are two methods of estimation used for missing data and quality control. The first method is used when data is missing for only a short period of time (e.g. less than one week) and consist of the mean value from data 10 days prior and after the missing data period (20 days total). This first method allows for the most accurate and probable data estimation during normal operation, when short periods of data are missing.

The second method for data estimation is developed from the normal mean ratio method for data estimation and is presented in the equation below. This method of estimation is used for longer periods of missing data. The method uses mean values over given periods of time in the calculations. The annual values are also weighted against each other in order to normalize the data. These calculations are used to insure that periodic variations over annual periods are taken into account. These variations include increased and decreased production due to changes in weather and efficiency changes in production. The mean value of data from the previous years (M_i) is determined from accurate data 30 days prior and after the missing data. The daily mean value of data for the previous year(s) and the year of missing data (N) must be calculated prior to use in the below equation.

$$P_X = \frac{1}{i} \sum \left(\frac{N_x}{Ni} \cdot Mi \right)$$

P_X = corrected value for the data; N_X = Daily mean value of data for the year of missing data; N_i = Daily mean value of data from the previous year(s); M_i = Mean value of data for previous year(s) – 30 days prior and after the missing data.

Hypothetical Example

The natural gas meter at the CHP is broken and replaced after the Christmas holidays resulting in 11 days of missing data for the volume of gas used for thermal energy at the CHP. The dates of missing data are 21 Dec. 2006 to 31 Dec. 2006. The mean daily natural gas usage is determined for 2004, 2005, and 2006. Then the mean value of data for previous year(s) is determined for each day of the missing period plus 30 days prior and after the missing period (total of 61 days). The equation used to determine the estimated daily usage value is given below.

$$P_{2006} = \frac{1}{2} \left(\frac{N_{2006}}{N_{2005}} \cdot M_{2005} + \frac{N_{2006}}{N_{2004}} \cdot M_{2004} \right)$$

3.2.3 Quality Assurance System

The quality assurance system shall secure that monitoring procedures and requirements are followed. The QA system will not be according to any ISO 9000 or similar standards. The QA system comprises inspection of the monitoring procedure by an independent third party. It is recommended that the local EPAs will be responsible for this party activity, but now formal agreement has been made. The EPAs are operating as branch offices under the Ministry of Agriculture, Forest, Waters and Environment in Bucharest.

QA – Procedure		Time for inspection	Inspection
1.0	**Calibration of ultrasonic heat meters.**	One (1) time every sixth year.	Utility
2.0	**Identification of calorific value of fossil fuels used before commissioning of new geothermal DH system in Oradea - Area II and connection of new buildings to existing geothermal system in Beius.**	One (1) time, when commissioning the new DH system.	Utility
2.1	Description of chemical composition and heat value.		
2.2	Suppliers (name, official company registration number, address phone and fax number).		
4.0	**Identification of calorific value of the geothermal energy resources used in the DH systems.**	One (1) time per year.	Local EPA
4.1	Description of hot geothermal water used		
4.2	Samples taking of geothermal water used		
4.3	Establishing the chemical composition of the hot geothermal water used.		
5.0	**Reading of Heat Meters and Discharge Water Temperature**	Weekly.	Utility
6.0	**Calculation of GHG emission reductions and GHG emissions**	One (1) time per year.	Utility
6.1	Calculate the quantity of GHG emission reductions and GHG emissions using the forms in the paragraph 4.		
8.0	**Environmental and social impact**	One (1) time per year.	Utility and local EPA
8.1	Environment impacts (degree of improvements, air quality, discharged water temperature, sustainability of impact, etc.)		
8.2	Social impact (comfort level in buildings, number of jobs created, new business areas)		

The QA-system in Oradea and Beius will in general focus on the procedures presented before and the QA system shall be in force during the entire crediting period.

QA – Procedure		Time for inspection	Inspection
9.0	**Observations and comments**	One (1) time per year.	Local EPA
9.1	Staff conducting monitoring (errors, correctness etc.)		
9.2	Sundries		
10,0	**Training of staff members**	Before commissioning of project and hereafter after one (1) time per year.	Utility
10.1	Monitoring procedures		

The QA system can be changed according to request from the Verifier.

3.2.4 Training of operational staff

Training of operational staff members shall be conducted before commissioning of project. Training shall be replicated when the DH systems are entering into operation to secure full understanding of the monitoring procedures and to secure the highest possible reliability of the monitoring results.

Training Procedures (guidelines)

Training Procedures		**Time for training and responsibility**
1.0	**Review of MP (before commissioning of DH systems)**	Timing: Before the DH systems are commissioned. Responsibility: The utility and project developer will be responsible for training
1.1	Objectives of MP Requirements of MP Monitoring methods to be used Data handling and elaboration of annual emission reduction report QA – system The role of local EPA and Verifier	
2.0	**Characteristics of fossil fuels used before the project**	Timing: Before the new DH system is commissioned. Responsibility: The utility and the project developer will be responsible for training
2.1	Characteristics of existing fossil fuels used	
3.0	**Monitoring CO_2 emission reduction**	Timing Before the new DH system is commissioned. Responsibility: The utility and project developer will be responsible for training
3.1	Quantity of geothermal energy resources used	
3.2	Calorific value of geothermal energy resources used	
3.3	Environmental Impact: Discharge water temperature at Beius	

It is the responsibility of the utilities to ensure that the operational staff members receive the necessary training enabling them to fulfil the requirements as specified in this MP. The training described in this MP may be changed according to request from the verifier, the Romanian government or the Danish government.

Training Procedures		**Time for training and responsibility**
3.4	Filling in forms and calculating CO_2 emission reduction	
4.0	Changes in Monitoring Procedures	Timing: Before the new DH system is commissioned. Responsibility: The utility and project developer will be responsible for training
5.0	Operation of peak load boilers	
6.0	Instruction of EPA in QA system	

3.2.5 Instruction of EPAs

As part of the QA – system the local EPAs will frequently visit Oradea Area II and Beius to conduct inspection of the monitoring procedures described in this MP. The local EPAs are a public authority under the Romanian Ministry of Agriculture, Forest, Waters and Environment who is responsible for environmental issues related to the local society (county level) like inspection of the exploitation of the geothermal resources wood processing industry, forestry, air quality and wastewater quality.

In this respect the EPAs seems qualified to act as a third party to secure that monitoring procedures are respected within the issues listed in paragraph 3.2.3. Also the EPAs as branch offices for the Ministry are in direct contact with Romanian Counterpart in this project when speaking about emission reduction trading. Local utilities in Oradea Area II and Beius and the project developer will instruct the EPAs in the procedures to be conducted by them.

The EPAs will conduct inspection one (1) time every year during the entire crediting period and in this way secure that the monitoring procedures in Oradea Area II and Beius will be based on the forms presented in paragraph 4 (Annexes) and the guidelines for EPA inspection report is described below.

EPA Inspection Report (headlines)

Paragraph (issues)		**Language**
1.0	**Basis information** 1.1 Name Inspection Report Name of EPA elaborating the inspection report Name of utility and town Name/address/phone utility Time for inspection Name/address/phone inspector	Romanian/English
2.0	Quantity of geothermal energy used in Oradea - Area II and Beius.	
3.0	Reading of Heat Meter	
4.0	Calculation of GHG emission reductions and GHG emissions	
5.0	Operation of peak load boiler	
6.0	Environmental and social impact	
7.0	Observations and comments	

3.2.6 Monitoring Report

The utilities shall every year during the entire crediting period elaborate the monitoring reports mentioned in paragraph 1.2 (Table 1) with the content following the guidelines presented below. The number of monitoring reports per year can be changed according to request of the verifier, the Romanian government or the Danish government.

Contents of annual monitoring reports (guidelines)

Paragraph (issues)		**Language**
1.0	**Basis information**	English
1.1	Name Monitoring Report Name of utility elaborating the monitoring report Name of utility and town Name/address/phone operator Time period for monitoring Name/address/phone verifier	English
2.0	**Description of DH systems Performance**	English
2.1	Overall description of performance of DH-system during the respective heat season from January (year X) to January (year X +1).	English
2.2	Description of performance new geothermal system	English
2.3	Description of geothermal energy consumption	English
2.4	Description of geothermal energy supplied ed(text)	English
2.5	Description and presentation of fossil fuels used before the implementation of the project.	English
3.0	**Monitoring Procedures**	English
3.1	Description of monitoring methods	English
3.2	Description of adjustments of monitoring methods	English
3.3	Description of errors	English
3.4	Filled in forms (see Annexes)	English
4.0	**Changes in Monitoring Procedures**	English
4.1	Description of changes in operation of the new DH – system	English
4.2	Description of changes in the supply of geothermal energy.	English
4.3	Description of changes conducted according to agreement with verifier.	English

3.2.7 Instruction of operational staff

The utilities are responsible for necessary instruction of the operational staff members enabling them to carry out monitoring procedures according to this MP. The instruction shall be performed before the beginning of the heating season to secure highest possible quality of monitoring activities. The utilities shall conduct an instruction meeting minimum one (1) month before the beginning of the heating season and the first monitoring period starts.

3.2.8 Verification

Verification of the management procedures and monitoring procedures for carrying out a satisfactory MP must be approved before the project can begin generating ERUs.

3.2.9 Summary - Management of the monitoring plan

The summary aims to highlight the key elements and responsibilities of the management of the MP.

Obligations	Utility	Verifier
MP	• Review of the MP and comments. • Review management of monitoring plan. • Preparation of monitoring procedures. • Training of staff members performing monitoring procedures. • Updating of MP if necessary. • Preparation for data collection, data handling and data storing.	• Review of MP and comments. • Review of management system.
Data Collection	• Review of methods and system for data collection system including updating of these if necessary.	• Review of methods and system for data collection including comments.
Data Handling	• Appointment of person (s) responsible for data handling.	• Review of data handling systems.
Data storing	• Establishment of data storing system for written- and digital data. • Establishment of backup system for data storing.	• Review of data storing system including backup systems.
Monitoring	• Timetable for monitoring activities.	• Review and assists elaborating timetables, monitoring sheets etc.
Reporting	• Establish framework for reporting which fulfil requirements of MP.	• Review of framework for reporting.
Instruction	• Responsible for instruction of staff members to perform the different monitoring procedures.	• Assist during performance of the training.

4. Annexes

Annex I Characteristics Fossil Fuels Used in Oradea - Area II and Beius

Name of city/town	:
Name District Heating Company	:
Address District Heating Company	:
Name of Operator	:

A	B	C	D	E	F	G
			Lignite or Natural gas	**GJ/kg or GJ/Nm3**	**kg CO2/GJ**	

Name and address of supplier of fossil fuel	Operator's Initials (performing monitoring)	Date information of existing fossil fuel	Type of fossil fuel	Calorific Value of fossil fuel	CO2 emission factor	Comments
			Lignite			Fuels used at CET I
			Natural Gas			Fuels used at CET I

Annex II CO_2 Emission Reduction Substituting Fossil Fuels in Area II

Name of city/town	:
Name District Heating Company	:
Address District Heating Company	:
Name of Operator	:
From Year to Year	:

A	B	C	D	E	F	G = D / F x 100	H = E / F x 100	I	J	K = (C x G x I) / 1000	L = (C x H x J) / 1000	M = K + L
		GJ	GJ	GJ	GJ	GJ	GJ	kg CO2 / GJ fuel used	kg CO2 / GJ fuel used	Ton	Ton	Ton CO2

Month	Operator's Initials (performing monitoring)	Geothermal energy supplied from production well 4767	Net energy value of lignite entering CET I	Net energy value of natural gas entering CET I	Total Net energy value of lignite and natural gas enetering CET I	Share of net energy covered by lignite at CET I	Share of net energy covered by natural gas at CET I	Emission Factor Lignite	Emission factor Natural Gas	CO2 emission reduction substituting lignite with geothermal energy	CO2 emission reduction substituting natural gas with geothermal energy	Total CO2 emission reduction
January												
February												
March												
April												
May												
June												
July												
August												
September												
October												
November												
December												
Total												

Annex III CO_2 Emission from substitution of Fossil Fuels at the CET I

Name of city / town	:
Name District Heating Company	:
Address District Heating Company	:
Name of Operator	:
From Year to Year	:

A	B	C	D	E	F =D + E	G	H	I =(G / F) x 100	J = (H / F) x 100	K = C x J	L	M = (K x L) /1000
		GJ	GJ	GJ	GJ	GJ	GJ	%	%	GJ	kg CO2 / GJ	Ton

Month	Operator's Initials (performing monitoring)	Geothermal energy supplied from production well 4767	Net energy value of lignite entering CET I	Net energy value of natural gas entering CET I	Total Net energy value of lignite and natural gas enetering CET I	Heat supply to primary netework from CET I	Electricity supply to grid from CET I	Effectiviness of heat production at CET I	Effectiviness of electricity production at CET I	Decrease of electricity production which is substituted by other power plant	Emission factor ERUPT system	Equivalent CO2 from increasing the comfort level in buildings
January												
February												
March												
April												
May												
June												
July												
August												
September												
October												
November												
December												
Total												

Annex IV CO_2 Emission Operating Peak Load Boilers - Oradea - Area II

Name of city/town	**:**
Name District Heating Company	**:**
Address District Heating Company	**:**
Name of Operator	**:**

A	B	C	D	E	F = D X E	G	H = (F X G) / 1000
		Natural gas	**1000 m3**	**GJ/1000 Nm3**	**GJ**	**kg CO2/GJ**	**Tons CO2**

Month	Operator's Initials	Type of fossil fuel	Fuel consumption peak load boiler	Calorific Value of fossil fuel	Fuel consumption peak load boiler	CO2 emission factor	CO2 emission
January							
February							
March							
April							
May							
June							
July							
August							
September							
October							
November							
December							

Total	

Annex V CO_2 Emission Reduction Substituting Fossil Fuels in Beius

Name of city/town	:
Name District Heating Company	:
Address District Heating Company	:
Name of Operator	:

A	B	C	D	E	F	G	H	I	J	K = ((G x I) + (H x J)) / 1000
		Natural gas	GJ/1000 Nm3	Heavy oil	GJ/ton	GJ	GJ	kg CO2/GJ	kg CO2/GJ	Tons CO2

Month	Operator's Initials	Type of fossil fuel	Calorific Value of fossil fuel	Type of fossil fuel	Calorific Value of fossil fuel	Fuel consumption in buildings where natural gas boilers use to be used	Fuel consumption in buildings where heavy oil boilers use to be used	CO2 emission factor natural gas	CO2 emission factor heavy oil	CO2 emission
January										
February										
March										
April										
May										
June										
July										
August										
September										
October										
November										
December										
						Total				

Annex VI Changes

Name of city/town	**:**	
Name District Heating Company	**:**	
Address District Heating Company	**:**	
Name of Operator	**:**	
From Year to Year	**:**	

A	B	C	D	E
Description of irregularity		**Year/month/day**	**Description (where, what and why)**	**Year/month/day**

Irregularity DH System	Operator's Initials (performing monitoring)	Date for occurence of irregularity	Changes to be implemented	Date for implementing change

Annex VII Emission Factors

A	B	C = B x 3,6	D	E
	kg CO2/GJ	kg CO2/MWh		
Name of fuel	**CO2 emission factor**	**CO2 emission factor**		
Lignite	101.12	364.03		
Natural Gas	56.06	201.82		
Heavy oil	77.30	278.28		

Annex VIII Discharge Temperature

Name of city/town	:	
Name District Heating Company	:	
Address District Heating Company	:	
Name of Operator	:	

A	B	C	D	D	E
		C		Description (where, what and why)	Year/month/day

Month	Operator's Initials	Discharge water temperature	Comments	Changes to be implemented	Date for implementing change
January					
February					
March					
April					
May					
June					
July					
August					
September					
October					
November					
December					

Annex IX Glossary of Terms

Annex B countries	Emssion capped industrialised countries and economies in transition listed in Annex B - Kyoto Pro
Annex I countries	Industrialised countries and economies in transition listed in Annex I of the UNFCC.
AIJ	Activities Implemented Jointly. In the first UNFCC Conference of Parties (COP 1) in Berlin 1995 a pilot phase for bilateral GHG mitigation projects was created with the name Activities Implemented Jointly. During the AIJ phase experience shall be established, but without allowing carbon credit transfer between countries.
AAU	Assigned Amount Unit is tradable units of the Assigned Amount of an Annex B country as issued pursuant to the rules of article 17 of the Kyoto Protocol, expressed as one metric ton of CO2.
ARCE	Romanian Agency for Energy Conservation
Baseline	A description of the most likely future development in the considered GHG emission or sequestrating system without the JI or CDM project.
BAU	Buisness As Usual. The BAU scenario describes the future development of the existing fossil fuel based district heating sytem if it was continued to be in operation.
BS	Baseline Study
CDE	Carbon Dioxide Equivalent
CDM	Clean Development Mechanism
CEECs	Central and East European Countries
CER	Certified Emission Reduction
CH_4	Methane
CO_2	Carbon Dioxide
DEPA	Danish Evironmental Protection Agency
DH	District Heating
EPA	Enviromental Protection Agency with offices in each county
ERU	Emission Reduction Unit describes the technical term for GHG emission reduction output of JI - Project according to the Kyoto Protocol.
EUR	Euro (currency European Union)
Gcal	Giga-calorie (1.0 Gcal = 4.187 GJ)
GES	Gross Energy Supply (total energy demand of DH system including losses boiler system, distribution pipe network, under buildings and in buildings).
GHG	Greenhouse Gasses
GJ	Giga Joule (1.0 GJ = 277.78 kWh)
GWP	Global Warming Potential
Host Contry	Country in which the JI or CDM project is implemented
IPCC	Intergovernmetal Panel on Climate Change
JI	Joint implementation Porject according to Article 6 - Kyoto Protocol.
kWh	Kilowatt hour (1.0 KWh = 3,600,000 Joule)
Leakage	The net change of anthropogeni GHG emission which occur outside the project boundary.
L/S	Litre per second
MDP	Romanian Ministry of Development and Prognosis
MOU	Memorandum of Understanding between countries
MP	Monitoring Plan
MWh	Megawatt hour (1.0 MWh = 3,600,000,000 Joule)
N_2O	Nitrous Oxide
NED	Net Energy Demand (energy demand in buildings, excluding losses in basements).
PCF	Prototype Carbon Fund of the World Bank
PDD	Project Design Document
QA	Quality Assurance
QC	Quality Control
ROL	Romanian Lei (currency)
RMWEP	Romanian Ministry of Waters and Environmental Protection
SINK	A procees, activity or mechanism, which removes anthropogenic GHG from the atmosphere.
UNFCC	United Nations Framework Convention on Climate Change