0. Executive Summary

0.1. Project area and beneficiaries

The municipality of Timisoara and its operator of district heating services Colterm SA intend to renovate the production and distribution facilities for district heating in the city. The project takes place in the city of Timisoara, West Development Region of Romania.

The direct beneficiary population in the project area is represented by the consumers connected to the district heating system. The total number of inhabitants connected to the district heating system is 224.613, representing approx. 73% of the population in Timisoara Municipality.
Other direct beneficiaries in the project area are the public institutions, services and industry connected to the district heating system, as presented in the table below:

Table 0-1: Consumers of district heating, 2007.

Consumers	2007
Inhabitants	224.613
Public institutions	277
Sector Services	1.006
Industry	23

The indirect beneficiary of the project is the entire population of Timisoara (307.347 inhabitants), as they indirectly benefit from reduction of air pollution, leading to improved health conditions.

The project is based on the present heat demand of 4,056 TJ per year. The project does not include interventions in reduction of heat demand and losses. The project assumes that demand reductions that might occur as a result of tariff increases are counterbalanced by economic growth, and therefore assumes that heat demand remains unchanged.

0.2. Project Objectives

The overall objective of the project is reduction of negative environmental impact and mitigation of climate change effects caused by the district heating system in order to improve human health condition in Timisoara by 2015 and to ensure environmental compliance in line with the Accession Treaty requirements.

The strategic objective of the project is to ensure a sustainable district heating system at an affordable tariff level for the population in Timisoara.

The specific objectives of the project are:

- To introduce Best Available Technologies (BAT) for the purpose of reducing SO2, NOx and dust emissions from the district heating system
- To introduce energy efficiency measures to reduce emission of CO2

- Ensure access to heat supply public service for poor
- Improve reliability of heating and hot water supply

The main performance indicators for the project are the following:

Table 0-2: Main performance indicators for the project

Performance indicator	Unit	Without the project	After implementation of the project	Reduction as a result of the project
Locations in which air quality is improved due to rehabilitated DH systems	No.	0	1	1
SO_2 emissions from DH systems due to SOP interventions	t/y	4.730	779	3951
NOx emissions from DH systems due to SOP interventions	t/y	924	451	473

Source: Table T-11-1. Note: Emissions in year 2013.

0.3. Project description and costs

Several options for achieving immediate reductions of emissions were analyzed with a view to identify the least cost solution. The options were compared to a do-minimum scenario of continued operation of existing facilities.

The description of the four options (O1, O8, O10 and O11) assessed under the centralized heating system scenario as well as the associated investments are presented in the following table. For easy reference, the table also illustrates the decentralized heating system option (O12).

Table 0-3: The five alternative options and their costs.

Option	Description	Priority investment, undiscounted, million Euro
1	2	3
O1	CET South is dismantled. CET Center is retrofitted, and the fuel used is natural gas.	15,74
O8	The actual structure is kept operating. CET South is continuing at a lower charge with steam boilers, using a combination of bio-mass and lignite. CET Center is retrofitted, and the fuel used in CET Center is gas. A flue gas desulphurization plant is installed.	50,68
O10	Steam boilers 1, 2, 3 at CET South are closed, one new lignite fuelled FBC steam boiler co-fired with bio-mass is installed at CET South. CET Center is retrofitted and continues operating hot water boilers on gas.	82,33
O11	Steam boilers 1, 2, 3 at CET South are closed, one new lignite fuelled Fluidized Bed Combustion (FBC) hot water boiler co-fired with bio-mass is installed at CET South. CET Center is retrofitted, and the fuel used in CET Center is gas.	70,33
O12	The central units are closed, and heat is produced by gas fired heat only boilers installed in the former substations.	130,50

Option O8 was selected as the most cost-effective solution. The main interventions in Option O8 are:

- Retrofit of hot water boilers no.2 and 4 in CET Center and steam boilers no. 1,2 and 3 in CET South in order to reduce NOx emissions ;
- Installation of a new desulphurization plant in CET South in order to reduce SO2 emissions;
- Retrofit of heat transport pumps in CET Center and CET South in order to increase energy efficiency.

The proposed project includes the following components and costs:

Table 0-4: Project components and costs

Components	Costs (million Euro)	Type of expenditure
Component 1 – Rehabilitation of two hot water boilers, CAF2 and CAF4, in CET Center	7,57	Compliance with environmental requirements and improvement of energy efficiency
Component 2 – Rehabilitation of three steam boilers, CAE1, CAE2 and CAE3, in CET South	17,58	Compliance with environmental requirements and improvement of energy efficiency
Component 3 – New desulphurization (DESOX) plant in CET South	21,68	Compliance with environmental requirements
Component 4 – Rehabilitation of transport pumps in CET Center and CET South	2,09	Improvement of energy efficiency
Component 5 - Public awareness, Technical Assistance and Supervision	1,76	Public awareness, capacity building, technical assistance and supervision
Total components	50,68	

0.4. Financial analysis

The project was assessed against a "do-minimum" option without investments.

The main assumptions with the project are:

- Final heat demand: 4,056 TJ per year.
- Average household consumption: 3,23 GJ/month (12 month basis).
- Cost of gas fuel: Rising gradually from 300 Euro per 1000 m3 in 2009 to 399 Euro per 1000 m3 in 2012, then remaining constant.
- Electricity production at 78.000 MWh per year in 2009-2011, and 241.000 MWh per year in 2012 onwards.
- Electricity price: For 2009-2014: 60-66 Euro per MWh according to ANRE methodology. For 2015 onwards: Market price, 68 Euro per MWh.

The project has two effects on the operating costs:

- The desulphurization plant will result in additional operational costs of 1,20 million Euro per year, starting in year 2013, increasing the annual production costs by 1,6%.
- The energy efficiency investments will result in reduced operational costs of 0,60 to 0,69 million Euro per year, starting in year 2010, representing a reduction of the annual production costs by 0,8 to 0,85%.

The Financial Net Present Value of the investment project (FNPV/C) at the financial discount rate of 5% is minus 45,92 million Euro. The cash flow of the project is configured in such a way that there is no financial rate of return (FRR/C).

The Financial Net Present Value to the owners of the project (FNPV/K), taking into account the community support, is minus 23,68 million Euro.

The benefit/cost ratio of the project is 1,01.

Thus, from a financial point of view, the project is eligible for community support.

The main financial parameters are shown in Table 0-5.

Table 0-5: Main financial parameters

Parameter	Value
Size of investment	50,68 million Euro
FNPV/C	-45,92 million Euro
FRR/C	Not defined
FNPV/K	-23,68 million Euro
FRR/K	Not defined
B/C ratio	1,01

0.5 Co-financing rate and sources

The eligible costs are 50,68 million Euro, and the discounted investment costs are 44, 01 million Euro. The discounted net revenue from operations is minus 1,91 million Euro. This amount cannot be added to the discounted investment costs, thus the eligible expenditure is 44,01 million Euro. The funding gap rate is 100%, and the maximum co-funding rate is 50%. As a result, the project can receive an EU grant of 50% of 50,68 million Euro, or 25,34 million Euro.

Co-funding is expected from the central government budget of Romania, covering 45% of the investment, or 22,81 million Euro, and from Timisoara municipality, covering 5% of the investment, or 2,53 million Euro.

The co-financing rate and sources are presented in Table 0-6.

Table 0-6: Main indicators on co-financing

		Discounted values, million Euro, percentages	Undiscounted values, million Euro
Option O8			
EC	Total eligible cost (EC),		50,68
DIC	Discounted investment cost (DIC)	44,01	
DNR	Discounted net revenue (DNR)	-1,91	
EE	Eligible expenditure, (EE = DIC-DNR)	44,01	
R	Funding-gap rate (R = EE/DIC)	100%	
DA	Decision amount (DA = EC*R)		50,68
Crpa	Maximum co-funding rate	50%	

EU grant	Maximum EU grant = DA*Crpa		25,34
Central government	Co-financing	45%	22,81
Timisoara municipality	Co-financing	5%	2,53

0.6 Tariffs, affordability and subsidies

The tariffs set for Timisoara 2007-2009 are illustrated in Table 0-7.

Table 0-7: Tariffs in current prices and in constant 2009-prices, 2007-2009 (incl. VAT).

		2007	2008	2009
1	Tariff, RON/Gcal, current prices	157,03	147,84	162,62
2	Tariff, (€/GJ), 2009, constant prices	12,09	10,52	9,14

As shown in Annex 1, in 2007 the households paid 6,24% of their disposable income for DH services, in 2008 the payment reduced to 5,12%, and in 2009 it increased to 5,54%, on average. This did not cover the full costs of the DH services. In 2008 the operator received 48,55 MEuro in operational subsidies.

It is assumed that households can afford to pay up to 8,50% of their disposable income for heating.

In order to avoid a price shock, a gradual tariff increase is proposed, aiming at full cost recovery after a transitional period. It is proposed that the tariff is increased between 8,4% and 12,6% per year until 2015. This way, the set maximum affordability limit of 8,50% would be reached in 2015. Full costs will exceed the set limits until 2015. Thus, there will be a need for transitional subsidies for the period 2009-2015. The yearly figures are presented in Annex 1.

Annual transitional subsidy estimations

Historically, two types of operational subsidies have been applied: A fuel subsidy, and a subsidy covering the difference of heat price and consumer tariff. In 2007 and 2008, the fuel subsidy has increased from 7 to 12 million Euro per year, while the tariff subsidy has increased from 22 to 37 million Euro per year, as shown in Table 0-8. In 2008 total operational subsidies amounted to 48,55 million EUR.

Table 0-8: Subsidies in 2007 and 2008, million RON and million EUR, current prices.

Type of subsidy	2007 Mill. RON	2007 MEUR	2008 Mill. RON	2008 MEUR
Fuel subsidy	27,6	7,80	40,37	11,37
Subsidy covering difference of heat price and tariff	79,7	22,51	132,02	37,19
Total operational subsidy	107,3	30,31	172,39	48,55

Source: Colterm SA.

As from 2009 the fuel subsidy will no longer be applied, whereas the tariff subsidy is expected to remain in force as a transitional subsidy as long as necessary to keep district heating services affordable and to avoid disconnections. The necessary transitional subsidy is shown in Annex 1 and it is calculated as the difference between the operating costs and the total revenues from heat and electricity sales.

Social subsidies

The system of social subsidies is assumed to remain in place. The subsidy provides a reduction of the heat bill of between 10 and 90% in accordance to a scale of per capita household income. In the heating season of 2008-2009 the lowest subsidy, 10% of the heat bill, was provided for per capita incomes below 615 RON per month, and down to 540 RON per month. Below 540 RON per month, the household would be entitled to a 20% reduction of the heat bill, and so on, step for step. Incomes below 155 RON per capita per month would be entitled to a social subsidy of 90% of the heat bill.

The social subsidy system will ensure that during the coming years the lowest incomes will pay no more than approximately 8,5% of their household income for heat. The subsidy will benefit households with less than the average income.

0.7 Economic analysis

The economic analysis starts from the financial analysis by removing transfers like the 28% surcharge on salaries and the CO2 penalties. Secondly, quantifiable external benefits, i.e. the benefit of CO2 and SO2 reductions are assessed and added to the financial flow, using shadow prices. Third, non-quantifiable environmental effects were assessed and added, including reductions of NOx and dust, as well as the benefits in terms of service quality with less disruptions in heat and hot water services. The size of the external benefits, quantifiable plus non-quantifiable, was calculated to 4,59 million Euro in 2013, the first year after the investment, growing to 5,74 million Euro per year from 2025 onwards. These benefits are the main reason behind the economic feasibility of the project. Fourth, it was considered whether there were price distortions in the operating costs of the district heating system affecting the financial cash flow. This was found not to be the case.

The Economic Net Present Value (ENPV) of the preferred option, at an economic discount rate of 5,5% is plus 2,69 million Euro. The Economic Rate of Return (ERR) is 6%.

The economic parameters are presented in Table 0-9.

Table 0-9: Economic parameters

Parameter	Value
ENPV	2,69 million Euro
ERR	6%

0.8. Sensitivity and risk analysis

The sensitivity of the results of the analyses (as measured by the FNPV/C) to changes in parameters was tested by assessing the effect on key performance indicators from changes of +/- 1% in each parameter. The analysis shows that the sensitivity of the performance indicators is relatively high for changes in sales revenue and gas prices. Changes in other operating cost items have a low or medium size impact on the indicators, while the sensitivity to changes in investment costs is low. Sensitivities as measured by the ENPV are similar to those of the FNPV/K. The following table shows the sensitivities of the FNPV/K.

Table 0-10: Sensitivities.

Variable (+/-1%)	**FNPV/K, % change**	**Sensitivity judgment**
Sales revenue (-)	39,9%	High
Gas price (+)	35,6%	High
Other fuels price (+)	4,5%	Low
Electricity costs (+)	2,2%	Low
DESOX (+)	0,6%	Low
Labour costs (+)	6,5%	Medium
Maintenance costs (+)	5,1%	Medium
Investment costs (+)	1,3%	Low
Financial discount rate (-1 pct-point)	-4,6%	High
Economic discount rate (-1 pct-point)	0,0%	High

Source: Table T-10-7

The project would have some sensitivity to deviations in sales revenue, i.e. the collection of billed fees. The gradual increase of tariffs is expected to result in slightly lower collection of fees, especially in the beginning, while consumers are becoming accustomed to the tariff increases.

The collection of fees should be distinguished from the effect of tariff increases on consumption of heat. It was assessed that a 1% increase in tariffs would result in a 0,2% reduction in consumption of heat. This effect was assessed to be counterbalanced by increasing heat demand due to real income growth.

The sensitivity to changes in gas prices, is considerable, too, but this has been taken into account already by incorporating an upward trend of the gas price from a starting point at 300 Euro per 1000 m3 to a level of 400 Euro per 1000 m3.

The project is somewhat sensitive to changes in labor and maintenance costs. These costs should be supervised and controlled throughout the reference period to avoid cost escalation.

The project is less sensitive to changes in investment costs, These costs are easier to predict, also bearing in mind that all investments are to be carried out during the initial years of the reference period.

All deviations in revenues and costs will be absorbed by transitional subsidies provided by the municipality.

0.9. Conclusions

Main conditions:

- Tariffs to be gradually increased to max. 8,5% of average household income in 2015 in order to apply the “polluter pays” principle.

- Transitional subsidy to be gradually phased out until year 2015.
- Affordability is ensured for all households.

Main risks:

- Heat sales revenue risk due to payment arrears. Mitigation: Awareness campaign and customer relations.
- Fuel cost risk due to fluctuations in fuel prices. Mitigation: Fuel supply contracts of longer duration, and fuel flexibility that enables the operator to shift between fuels.

Tasks for the municipality and operator

The main tasks for the municipality include:

- Decision regarding future *tariff policy* (gradual increase from 5.54% in 2009 to maximum 8,50% of average household. A steeper increase of tariffs would result in lower transitional subsidies, but would also result in higher annual heat bill increases.
- Ensuring the capacity of the municipality to cover the required *transitional subsidy* in time.
- Improving the *fee collection* rate
- Improve *cost-reducing reforms* at the operator with a view to reduce costs;
- Improve *cost planning, budgeting and control* of the operator.

Introduction

The municipality of Timisoara and its operator of district heating services Colterm SA intend to renovate the production and distribution facilities for district heating in the city. The heat is produced in co-generation and the surplus electricity is sold to the electricity grid. The project takes place in the West Development Region of Romania, being eligible for the Cohesion Fund.

The service catchment area covers a total of 92.400 households, with a population of 224.000 inhabitants, or 73% of the entire population of 300.000. The area served is 6,28 million m2.

The project will not require additional land space, as it aims at renovating existing facilities.

The district heating is presently provided by an ineffective production process with high emissions of CO2, SO2, NOx and dust. The project will reduce emissions considerably. Most importantly, the SO2 emissions will be reduced by more than 80%, and the CO2 emissions may be reduced further via reductions of losses in transmission and distribution networks, as well as demand side management measures. This, however, is beyond the scope of the present project.

Various options for achieving reductions of emissions were tested with a view to identify the least cost solution. The selected option (O8 as presented further in this report) was compared to a do-minimum scenario of continued operation of existing facilities. A do-nothing option with closure of the district heating system and transition to gas-based apartment heating would risk leaving the poorest segments of the population without heating and was therefore discarded as politically unacceptable.

The structure of the Cost Benefit Analysis

The Cost Benefit Analysis is structured along the EU Guidelines (2002) as revised in 2008[1]. In addition, the Cost Benefit Analysis responds to requirements of the National Guidelines for District Heating sector (2009)[2].

Initially, an economic analysis is carried out, and the most attractive option is selected. This is followed by a financial analysis focusing on the funding gap, the eligibility for EU grant, the financing and the affordability. The analysis is concluded by a risk assessment.

---

[1] Guide to cost-benefit analysis of investment projects (2002, 2008).

[2] Guidelines for Cost Benefit Analysis of District Heating Projects to be supported by the Cohesion Fund and the European Regional Development Fund in 2007-2013, revised draft, March 2009.

Based on detailed assumptions, a model for financial and economic calculations was prepared. All calculations were carried out with the use of this model, consisting of the following worksheets and tables:

- Input: Tables T-0-1 to T-0-31 (excel sheet "Input ").
- Investments: Tables T-1-1 to T-1-5 (excel sheet "Invest").
- Operations: Tables T-2-1 to T-2-5 and T-2-1 B (excel sheet "Operat").
- Economic analysis: Tables T-3-1 to T-3-6 (excel sheet "Econ").
- FNPV/C and FRR/C: Table T-4-1 to T-4-3 (excel sheet "FNPVC").
- FNPV/K and FRR/K: Table T-5-1 (excel sheet "FNPVK").
- Eligibility for funding: Table T-6-1 (excel sheet "Eligibility").
- Financial sustainability: Table T-7-1 to T-7-7, and Figure 4-2 (excel sheet "Finsust").
- Sources of finance: Table T-8-1 (excel sheet "Sources").
- Affordability: Tables T-9-1 to T-9-7, and Figure 4-1 (excel sheet "Afford").
- Risk: Tables T-10-1 to T-10-6 (excel sheet "Risk").
- Environment: Tables T-11-1 to T-11-8 (excel sheet "Envir").
- Investments and operations non-incremental : Table T-12-1 to T-12-6 (excel sheet "Opt non-inc").
- Cost allocation to heat and electricity: Tables T-13-1 to T-13-8 (excel sheet "ANRE").
- Summary tariffs and subsidies: Tables T-14-1 to T-14-2.

In all tables, cells marked by yellow background denote exogenous information that is entered in those cells, while cells marked by green background include information that is generated from other cells.

Background on eligibility

In the General Regulation for the Structural and Cohesion Funds, major projects are defined as those with a total cost exceeding 25 million Euro in the case of the environment and 50 million Euro in the case of all the other sectors (Article 39 Regulation 1083/2006).

The present project is an environmental project. It fulfils one of the criteria of being a 'major project', as it is an economically indivisible series of tasks related to a specific technical function and with identifiable objectives. The objective of the project is to ensure that district heating complies with environmental requirements, and the technical function is to contribute to the provision of affordable heating to the majority of inhabitants of a major city of Romania. The tasks constituting the project are economically indivisible, as the proposed package of interventions is necessary to achieve the environmental impact.

The project is an investment into a revenue-generating public service. After a transition period, it is expected that consumers of heat will be charged the full cost of service in compliance with the polluter-pays principle. Full cost recovery tariffs are phased in during a transition period, taking account of affordability constraints.

1. Identification of investments and definition of objectives, including specification of reference period

The CBA takes into account the municipal heating strategy, in which the objectives of the SOP intervention were identified, followed by the identification of investments that would lead to the fulfillment of the objectives.

The municipal heating strategy in Timisoara identifies the sector policy targets as well as the long term development option.

1.1 Local heating energy sector policy targets

The national target in the DH sector, linked to SOP-ENV targets is reduction of negative environmental impact and mitigation of climate change caused by urban heating systems in most polluted localities by 2015.

The local targets, in line with the local strategy for district heating in Timisoara are:

- Reduction of SO2, NOx and dust emissions from the large combustion plants by compliance deadlines up to the compliance limits set in the Accession Treaty;
- Reduction of CO2 emissions, thus contributing to mitigation of climate change effects;
- Reduction of primary and final energy consumption;
- Increased efficiency of production units to min. 86%;
- Reduction of losses in primary and secondary networks to max. 15%; and
- 100% coverage of future heat demand and supply continuity.

1.2 The scope of the analysis

The present analysis refers to the assessment of the investments included in the SOP project, investments that are identified as priorities according to the local heating strategy and aim at compliance with the Accession Treaty environmental requirements.

1.3 Methodology for the options analysis

The starting point for the options analysis was the urban heating strategy of Timisoara municipality, prepared in line with the Accession Treaty and other relevant national strategic documents (National Strategy for Atmosphere Protection, National Strategy for Heat Supply, National Programme for Urban Heating 2006-2015, National Allocation Plan for participating in the EU-ETS, Energy Strategy for Romania 2007-2020).

The local heating strategy in Timisoara is focused on major strategic options for the long term development of the municipal heating system as a whole. Main options took into account the following elements:

- o Centralized vs. decentralized system or more individual system;
- o Various types of fuels (coal, fuel oil, gas etc.); and
- o Heating energy production only vs. co-generation alternative.

With the view to identify the most feasible options, the first step of the analysis was based on a multi-criteria screening and qualitative justification, eliminating thus some unrealistic options. The most feasible options were then compared in order to select the optimal scenario and to phase the deriving investments on short, medium and long term.

The economically optimal scenario identified by the local heating strategy in Timisoara is to maintain and rehabilitate the existing centralised heating system. Under this scenario, 4 (four) options have been assessed and compared (in the feasibility stage). Each option included a breakdown of measures that are deemed necessary to bring the DH systems into compliance with the emission limits, as well as measures to increase the efficiency of the DH plants and to contribute to loss reductions in the transmission and distribution networks. The detailed economical analysis of the options is presented in chapter 3 of this report.

The description of the four options (O1, O8, O10 and O11) assessed under the centralized heating system scenario as well as the associated investments and operational costs are presented in the following table. For easy reference, the table also illustrates the decentralized heating system option (O12) and a do-minimum option (DM).

In the do-minimum scenario the actual system continues operating without the investments necessitated by the legal requirements to reduce present emissions of CO2, SO2, NOx and dust, and without the planned investments in rehabilitation of the District Heating network.

Table 1-1: Overview of options.

Option no. (according to the local heating strategy)	**Description**	**Priority investment, undiscounted, million Euro**	**Priority investment, discounted (5%), million Euro**	**Dynamic unit cost of operations, Euro per GJ**	**Dynamic unit cost of priority investments, Euro per GJ**	**Total dynamic unit costs, Euro per GJ**
1	2	3	4	5	6	7=5+6
O8	The actual structure is kept operating. CET South is continuing at a lower charge with steam boilers, using a combination of bio-mass and lignite. CET Center is retrofitted, and the fuel used in CET Center is gas. A flue gas desulphurization plant is installed.	50,89	46,41	15,35	0,87	16,22
O11	Steam boilers 1, 2, 3 at CET South are closed, one new lignite fuelled Fluidized Bed Combustion (FBC) hot water boiler co-fired with bio-mass is installed at CET South. CET Center is retrofitted, and the fuel used in CET Center is gas.	70,45	61,11	16,31	1,21	17,52
O12	The central units are closed,	131,00	121,78	17,06	2,41	19,47

	and heat is produced by gas fired heat only boilers installed in the former substations.					
O1	CET South is dismantled. CET Center is retrofitted, and the fuel used is natural gas.	15,90	13,55	17,84	0,27	18,11
O10	Steam boilers 1, 2, 3 at CET South are closed, one new lignite fuelled FBC steam boiler co-fired with bio-mass is installed at CET South. CET Center is retrofitted and continues operating hot water boilers on gas.	82,45	71,48	14,99	1,41	16,41
DM	Do minimum	0,00	0,00	17,05	-	17,05

Sources: Tables T-0-1 and T-12-1 to T-12-6.

Total investment costs range between 15 and 131 million Euro per option (column 3). In terms of their present value, the investments lie between 13 and 122 million Euro per option (column 4).

Columns 5, 6 and 7 of Table 1-1 calculate the dynamic unit costs of the options retained. Dynamic unit costs measure the (discounted) costs per (discounted) GJ of heat supply over the entire reference period. They provide an indication of the financial ranking of the options since an option with lower dynamic unit costs would be preferable to an option with higher dynamic unit costs (assuming that both options meet the same level of final heat demand while complying with the imposed emission standards). Column 5 shows the total dynamic unit costs related to the supply of heat, while column 6 shows the dynamic unit costs of the investments. Column 7 combines the two components into a measure of the overall dynamic unit costs of the five investment options and the do-minimum option. The values in column 7 indicate that option O8 has the lowest overall dynamic unit costs, and therefore should be preferred.

While under option O8 the operator continues to supply heat to its customers using existing equipment, option O11 introduces a hot water fluidized bed combustion boiler replacing existing steam boilers at CET South, co-fired with biomass. Option O12 represents the replacement of the two centralized boiler plants by a number of small gas-fired “island boilers”. Option O1 closes CET South and transfers the entire heat production to CET Center, while option O10 replaces existing steam boilers at CET South with one FBC steam boiler co-fired with biomass.

Option O8 was chosen as the optimal option, being the most cost-effective option which leads to environmental compliance by transition deadlines and secures safe heat supply at an affordable price for the population.

The following tables provide a breakdown of the priority investment (which form the basis for applications to the EU Cohesion Fund) with respect to purpose.

Table 1-2: Breakdown of the priority investment on elements with revenue and cost effects, million Euro

Components	Costs (million Euro)	Type of investment	Type of effect
Component 1 – Rehabilitation of two hot water boilers, CAF2 and CAF4, in CET Center	7,57	-Environmental compliance - Energy efficiency	Revenue
Component 2 – Rehabilitation of three steam boilers, CAE1, CAE2 and CAE3, in CET South	17,58	-Environmental compliance - Energy efficiency	Revenue
Component 3 – New desulphurization (DESOX) plant in CET South	21,68	- Environmental compliance	Cost
Component 4 – Rehabilitation of transport pumps in CET Center and CET South	2,09	- Energy efficiency	Revenue
Component 5 - Public awareness, Technical Assistance and Supervision	1,76	-	Neutral
Total components	50,68		

The major part of the investment relates to heat production facilities which has as main purpose environmental compliance by reducing SO2, NOx and dust emissions from large combustion plants. Relatively small investments are included for rehabilitating the transmission pumps, which will improve the efficiency of the entire DH system. The new desulphurization plant is included in the category of “cost-investments” and it adds 1,20 million Euro of annual operating costs, starting in year 2013.

The SOP project represents phase 1 of a long-term investment programme, according to the local heating strategy. Other phases of investments included in the long-term programme include rehabilitation of networks and substations, as well as further investments in the central heating plants.

The proposed investments may be classified as specified in the following table:

Table 1-3: Classification of the investments of Option O8.

Components	Classification
Rehabilitation of existing coal fired LCPs to become highly efficient and reduce air pollution and equipping them with Flue Gas Desulphurization units (FGD’s), new, high-performance particle filters, replacing the existing burners with new ones, low NOx.	A) Co-generation or Heat Production

Source: National CBA Guidelines for DH sector, March 2009

2. Option Analysis

2.1 Absolute and incremental approach, and sequencing of financial and economic analysis

The absolute revenues and costs of the options considered provide the fundamental basis for further analysis. Projections of revenues and costs in absolute terms are provided in excel tables T-12-1 to T-12-6, including the do-minimum option and all investment options considered. The choice of preferred option must be based on an incremental approach, comparing each do-something option with the do-minimum option, i.e. comparing each item of a do-something option, year by year, with the same item in the do-minimum option. The rationale behind the incremental approach is that it provides a tool for assessing whether additional investment costs are justified in terms of additional benefits.

The present cost benefit analysis takes the point of view that the choice of option should be based on economic analysis, rather than on financial analysis. This is because the main purpose of the investment is the achievement of environmental benefits, which are not captured by the financial analysis because they do not enter into the accounts of the operator of heat services.

The incremental approach is applied to select the economically most advantageous project among the five options. Once the preferred option is selected, the incremental approach is also applied to this option to determine the funding gap, the financial return on the national capital invested, and the size of the EU grant to which the project will be eligible.

The project's sustainability, funding requirements, affordability and risks, however, are based on absolute values of revenues and costs.

2.2 Definition of the do-minimum option

The do-minimum option is defined as a hypothetical benchmark against which the do-something options are assessed. Needless to say, due to environmental legislation and the deadlines for achieving the emission reductions, the do-minimum option is not a realistic option under present circumstances, but this option is still useful as an illustration of how the district heating system might evolve in the absence of such environmental requirements.

In the do-minimum scenario the actual system continues operating without the investments necessitated by the legal requirements to reduce present emissions of CO2, SO2, NOx and dust, and without the planned investments in rehabilitation of the District Heating network. In this situation the present fuel mix stays unchanged, and the DH network is repaired when leakages occur. Maintenance of the DH system in the do-minimum option is envisaged without investments, as all measures to maintain the system are incorporated in the operational maintenance costs.

The do-minimum option preserves the existing DH system. A more radical do-nothing option could be imagined, whereby the DH services were to be discontinued altogether and replaced by individual household and/or housing block heating. This option would make the present centralized

DH operator redundant, but would require private investments of all households – individually or commonly in each housing block, to establish sufficient heating. Apart from small electric heaters, investments, such as gas-based heating for each individual apartment or for each housing block, would be unattainable for the lower income segments lacking the financial means. Presently, the municipal authorities have no tools available to provide financial support for such investments. Consequently, it could be foreseen that the lowest income segments of the population presently connected to the DH system would have no common heating solution and would lack the means for investing in individual solutions. Although this radical do-nothing option would adequately describe what would happen if really nothing were done, it was considered unacceptable to the municipal authorities and the government. On the basis of the local heating strategy the fully decentralized solution was therefore excluded from the present study. In addition it could be argued that the consumers failing to install their individual heating solutions would become more vulnerable to diseases during winter. This would result in loss of income, even in casualties (lung inflammation), as well as increased health treatment costs. The economic effect hereof is not immediately quantifiable. Also, this radical option is not acceptable from the macro-economic and national policy point of view as it would increase gas consumption and reduce the use of domestic coal.

The economic analysis aims at assessing the incremental cash flow on economic terms[3]of each option compared to the do-minimum option. It includes all revenues, i.e. sales of heat, sales of electricity and CO2 trade (CO2 penalties with a negative sign).

The economic analysis is carried out net of taxes and subsidies. It includes quantified external effects such as environmental benefits from reductions of CO2 and SO2, for which market prices exist, and adds non-quantified effects such as reduced emissions of NOx and dust (for which market prices do not exist) as well as the social effects of better heat service quality. Further, it takes into account necessary corrections for distorted prices. Thus, it serves to illustrate the value to society of each investment option, compared to doing the minimum. The selection of the preferred option is based on the economic analysis.

Penalties for non-compliance with respect to environmental legislation (if applicable) are not taken into account in the case of the "do-minimum" case. Such penalties would constitute a transfer of income, which, as such, shall not enter economic analysis. In economic analysis, what is relevant in the do-minimum case is the economic cost related to additional emissions. Information substantiating the economic damage inflicted by increased emissions is not available for all type of pollutants (see above). Consequently, the unquantifiable economic effects of (avoided) emissions are taken into account in the economic analysis by adding a 100% premium to the quantifiable CO2-effect.

Once the preferred option is selected, the remaining do-something options are left out of attention, and the analysis is carried out only for the preferred option compared to the situation without the project.

[3] The economic analysis computes benefits and costs to society at economic prices, i.e. the unit values of resources made available and tied up by a project, at the shadow prices of those resources, i.e. at the value of their best alternative use.

The selected preferred option is assessed with respect to the needs for funding, the return on domestic capital, and the eligibility for funding by EU grants. Furthermore, the selected option is assessed in detail with respect to funding, i.e. whether available funds will be sufficient for financing the investment. After this, the analysis will focus on financial sustainability and affordability, looking into tariffs and subsidies. Finally, a risk assessment is provided.

2.3 Assumptions

The analyses are based upon a number of assumptions that are described below.

The reference period is 20 years, from 2009 to 2028. Cash flow projections for another 15 years, i.e. until year 2043 were added for calculating the residual value of the investment that will be operated beyond the end of the reference period.

The cash flow projections are expressed in Euro in prices of 2009, excluding VAT. Financial Sustainability is also calculated in Romanian Lei (RON) in (2009) prices, and tariffs and subsidies are calculated in RON and Euro, in constant and current prices. For the core of the analysis all prices are assumed to remain constant at their 2009-level, with the exception of natural gas and electricity for which prices are assumed to increase gradually during the period 2009-2013[4] and then foreseen to remain unchanged for the following years. The shadow prices of CO2 and SO2 are determined on the basis of expected future prices[5].

The income growth rate of the population is modeled in three scenarios for the affordability analysis: A pessimistic, an optimistic and an equilibrium scenario. The income distribution among the population, presented in deciles, is assumed to remain unchanged over the reference period. Thus, the incomes of all deciles are expected to grow proportionally.

For the analysis of the priority investment project, final heat demand is kept unchanged at the level of the last year before the reference period (2008). In a larger perspective, the final heat demand could be expected to become reduced gradually, due to a number of factors, such as:

- Development in the population;
- Improved thermal insulation of dwellings;
- Establishment of meters in all dwellings and housing blocks;
- Establishment of thermostatic valves in all dwellings;
- Billing according to meters;
- Global warming.

---

[4] Based on projections of the European Investment Bank provided to the Consultant by Jaspers.
[5] These price projections are identical to projections applied in the Craiova desulphurization project, the FGD system installed at unit 8 – Isalnita Power plant - Craiova -Power Complex.

The unchanged final demand implies unchanged service coverage, i.e. the served area of the housing stock is kept constant. It is the same in all options, but in the do-minimum option the sales are reduced by 2% per year until year 2020 due to disconnections. This is due to the poorer service quality assumed in the do-minimum option. In the investment options, service quality improvements are accompanied by tariff increases; however, the benefits of better service quality are assessed to match the additional cost effects, resulting in an unchanged service coverage.

Investments in the heat production units are carried out during years 2010-2012, varying from option to option. Investment costs are calculated by the Consultant as part of the Feasibility Study. The investment costs of the do minimum option are zero, assuming that the system is kept operative on the basis of normal maintenance and repair.

Residual values at the end of the reference period are based on the net operating revenues the assets would generate in their remaining lifetime after the reference period[6].

Fuel costs cover gas and other fuels. In all options the fuel cost modeling is based on final heat consumption, plus losses in the DH network, transformed into fuel costs via a least cost load distribution on different production units estimated for each year of the reference period.

In the do-minimum case, gas fuel costs are assumed to be identical to the fuel costs of the option using the present set-up (Option O8). This is used as a fix point of the analysis. It is to be seen in connection with the final demand which is constant in Option O8, and reducing until 2020 in the do-minimum case. Thus, identical fuel consumption in the two options represent a deterioration of fuel efficiency in the do-minimum option. In the do-minimum option, the costs of other fuels are assumed to be 2% lower than in Option O8, as a result of the investments.

Other operating costs cover electricity for transmission and own use, electricity for distribution, desulphurization, fixed maintenance, and staff. In the do-something options these costs are modeled according to the technological solutions. A social tax on labor is included in the basis information on staff expenses. This tax is estimated at an average of 28% of net salaries.

In the do-minimum option the electricity costs for transmission and internal services are 10% higher than in Option O8; maintenance costs are assumed to be 2% higher than in Option O8, while staff costs are set at a level 3% higher than that in Option O8. These differences reflect assumptions about lower effectiveness with respect to the said inputs in the do-minimum option compared to Option O8 and other investment options.

[6] The net present value of the net operating revenues in this last operating period is based on an assumption that each of the do-something options will continue to generate revenue, modeled as an annual net revenue of 5% of the combined fuel and O&M costs, while the do-minimum option, due to the shorter lifetime of the assets, is assumed to generate only 4% on the sum of fuel and O&M costs. These are expert assumptions based on the point of view that the system would remain capable of generating a profit.

A cost item is included to reflect a 5% return on capital to an assumed public equity provider. This item is calculated on the basis of the sum of investments minus the accumulated depreciation. If no equity is provided this item will be zero.

As the priority investment is funded by a grant, depreciation hereof is not capitalized to the operating costs considered in financial and economic analysis.

Historic depreciation is calculated as per the amortization plan/rules of the operator and is included for tariff determination (revenue requirements) only, following the tariff setting regulations of ANRE

Revenues from sales of electricity stem from the surplus of electricity produced by the co-generation process. These revenues are seen as a by-product of heat production and should ideally be subtracted from the plant's operating costs to arrive at a net cost for heat supply. Due to the regulations in force in Romania, DH operators must apply separate tariffs for heat and electricity, based on a cost-allocation mechanism determined by ANRE. While this mechanism is in conflict with reality inasmuch as electricity is normally sold to the grid at market prices (the DH provider is a price-taker), the mechanism is accepted in the present study as a basis for revenue calculation up until year 2014. For the period beyond 2014 it is assumed that the ANRE tariff mechanism will be adjusted, so that the market price for electricity will apply and the heat tariff be based on the net costs remaining after deduction of electricity sales revenues from total costs. In the do-minimum option. the sales of electricity is assumed to be identical to the electricity sales of Option O8, to reflect that the production is identical.

For the period until 2014 the revenues from electricity sales are based on projected future electricity prices following the tariff setting methodology currently in force in Romania. For the period beyond 2014, however, projected market prices are applied.

Penalties (payments) related to CO2 are included in the financial analysis, but excluded from economic analysis, as they are transfers rather than economic costs to the country. The same argument applies to sales of unused CO2 allowances. In financial terms, both items are of minor importance in the case of Timisoara. Selling of CO2 allowances may be feasible for DH companies, but only until the end of 2012. After 2012 the CO2 policy arrangements will change and there will no longer be CO2 quotas available for the DH companies.

The affordability and sustainability analyses look into impact of various consumer affordability assumptions on the need for operational subsidies.

As is explained above, the revenues from heat sales are by the formula "tariffs times sales of heat", using the regulated ANRE tariffs, based on the currently applicable ANRE rules (until 2014) and a new methodology (beyond 2014), respectively.

The prices applied to heat, electricity and fuels are presented in the following table.

Table 2-7: Heat, electricity and fuel price projections, 2009-2020, onwards, (ANRE).

Year	Heat, Euro per GJ	Electricity, Euro per MWh	Natural gas, Euro per 1000 m3	Coal, Euro per ton
2009	16,09	96,74	299,93	30,00
2010	16,94	99,92	329,92	30,00
2011	17,99	103,56	362,91	30,00
2012	17,77	80,68	399,20	30,00
2013	16,11	76,81	399,20	30,00
2014	16,09	76,78	399,20	30,00
2015	16,07	68,00	399,20	30,00
2016	15,55	68,00	399,20	30,00
2017	15,47	68,00	399,20	30,00
2018	15,43	68,00	399,20	30,00
2019	15,37	68,00	399,20	30,00
2020 onwards	15,32	68,00	399,20	30,00

Sources: Tables T-0-5, T-0-15 and T-0-16.

For the economic analysis, projections were prepared for all five do-something options, including investments, fuel costs, O&M costs, as well as sales of electricity and (avoided) economic costs of CO2 emissions. Also, taxes and subsidies included in the financial analysis were removed and external benefits added. The need for applying correction factors (shadow prices) was examined. Due to Romania's consolidation of its market economy, now becoming more and more integrated into the EU, which accounts for more than 70% of Romania's foreign trade, it was concluded that all market-based cost figures should be regarded as undistorted. Hence, none of the (financial) costs/expenses were corrected (except for taxes and subsidies).

According to the Romanian National Allocation Plan for 2007 and the period[7] 2008-2012, the following CO2 allowances are allocated to Timisoara:

- Colterm CET Center: 717.921 tonnes over the period 2008-2012, i.e. 143.584 tonnes per year;
- Colterm CET South: 1.049.055 tonnes over the period 2008-2012, i.e. 209.811 tonnes per year.
- Total allowance: 1.766.975 tonnes over the period 2008-2012, i.e. 353.395 tonnes per year.

These allocations are valid through 2012. Thereafter, allowances will no longer be extended. Rather, penalties will be issued in case of non-efficient production. Options O12 and O1 would comply with the emission limit defined by the allowances, whereas options O8, O11 and O10 would exceed the limit, resulting in CO2 penalties shown in Table T-0-18.

Economic benefits include measurable and non-measurable items. The value of total non-measurable benefits is assessed to match the value of measurable benefits.

[7] Romanian National Allocation Plan for 2007 and 2008-2012 periods, Ministry of Environment and Sustainable Development, Bucharest, 2007, Table 8.2.

The applied economic discount rate in real terms is 5,5%, and the applied financial discount rate in real terms is 5,0%, as recommended by the EU for the Cohesion Countries and adopted by the Romanian authorities[8].

VAT is not included in the cash flow projections. VAT is a transfer that should not be part of the economic analysis. (The VAT rate is 19%).

However, as VAT paid is a cost to the project and may not be fully deductable from VAT on sales, the project beneficiary might face a financing gap related to such VAT payments. The National CBA DH Guideline includes the following phrase: "The part of VAT related to the non-funding gap contribution, which is ensured through a co-financing loan, as well as to other non eligible expenditures shall be considered as a non eligible cost, and the Funding Gap adjusted using a pro-rata. The Beneficiaries are requested to present the project financing plan following the model attached in Annex 6."

The financial analysis of the present CBA includes such a financing plan.

VAT is included in the consumer tariffs.

Affordability is assessed against disposable income, whereby taxes are deducted from total income. The average tax paid was assumed at 12,7% of total income, based on data of the Romanian Statistical Yearbook, 2007 (Table 4.18).

2.4 The tariff setting methodology

Tariff setting for electricity and heat in combined heat and power plants can be modeled in two conceptually different ways: The "balancing tariff methodology" and the "allocated cost methodology". Under the balancing tariff methodology, the heat tariff is determined on the basis of the full costs of the cogeneration process minus the revenues from sales of electricity. This methodology is in line with the concept of treating heat as the main product supplied (i.e,. heat supply is the main business), while considering electricity as a by-product of the cogeneration process. Revenues from electricity are generated by the sale of (excess) electricity to the national grid at market prices that the CHP plant cannot influence. This methodology ensures that all costs are allocated to heat and that the regulated tariff of heat (which is based on the company's revenue requirements) is reduced in direct proportion to extra-revenues from electricity sales (which reduce the revenue requirements for the heat supply business).

---

[8] Methodologie Cost Benefit Analysis 2007-2013, p.22. Draft WORKING DOCUMENT 4, Guidance on the methodology for carrying out Cost-Benefit Analysis, EC Directorate General Regional Policy, CDRR-06-0006-01-EN.

The methodology presently applied by ANRE[9] – and hence presently in use at all DH facilities – is different from the balancing tariff methodology in that it allocates cogeneration costs among DH and electricity. In particular, it assigns 1 MWh of fuel to each MWh of heat produced and assigns the remainder fuel used to electricity. Other variable inputs are allocated in a similar proportion, while fixed costs (salaries, maintenance, depreciation and environmental costs) are allocated between heat and electricity according to the amounts of MWhs produced in the form of thermal and electric energy. (For details see Section 7.7). ANRE indicated that the current methodology may be reviewed during 2009[10]. It is assumed, however, that the current ANRE methodology will remain in force until the end of 2014 and thereafter be succeeded by a new methodology in line with the "balancing approach".

The consequences of applying the ANRE Methodology and the balancing tariff methodology are discussed in relation to affordability and financial sustainability in Chapter 4.

3. Economic analysis

The economic analysis assesses whether the project has a positive net contribution to society and thus deserves co-financing by EU funds. A selected project alternative increases economic welfare when its economic and social benefits exceed its costs. This is expressed by the Economic Net Present Value (ENPV). The ENPV is based on the flows of economic benefits and costs. The economic benefits are the cost savings achieved by the project plus external effects such as reductions in emissions to the atmosphere. External effects are assessed at economic prices, which reflect their value to society. Future benefits and costs are discounted to the present using a social discount rate of 5,5%.

In the economic analysis taxes and other transfers represent no net benefit to society, as they are a cost to one entity and a revenue to another.

As explained above, the economic analysis takes the incremental financial flows as its starting point. It then removes transfers, adds external benefits or subtracts external costs, and finally introduces conversion factors to correct perceived price distortions if required.

As regards transfers, VAT was excluded a priori. Other transfers to be removed from the estimates used in financial analysis are the 28% surcharge on salaries and the CO2 penalties. The latter place the do-minimum option at a disadvantage (compared with all do-something options), while the

[9] "The Methodology for Establishing of Electricity Regulated Prices and Quantities Sold by Generators through Regulated Contract and of Thermal Energy Prices for the Heat Provided by Cogeneration Units", Ordinarie 57 08, Methodologie Preturi, ANRE, June 2008.

[10] This statement was made at a meeting with ANRE on the 18 February, 2009.

former affects all options in direct proportion to their salary bills. It is worth noting that the removal of these two types of transfers does not change the ranking of the options.

Concerning the externalities, the focus is on the reduction of emissions in each of the do-something options compared to doing the minimum. Positive external effects from reducing the emissions of CO2 and SO2 are accounted for as economic benefits. For some options part of the CO2 reductions stem from a lower level of electricity production, compared with the do-minimum option. It is assumed that reduced electricity production at Timisoara will be compensated for by additional generation and, thus, higher CO2 emissions elsewhere in Romania (no change in overall electricity demand), so that the CO2 effect of reduced electricity production is cancelled out. Similarly, in case of higher electricity production at Timisoara, the effect of additional CO2 emissions is offset by less electricity generation elsewhere. The CO2 effect of electricity production is assumed to be 650 kg CO2 per MWh of electricity.

The assumed shadow prices of CO2 and SO2 are shown in Table 3-1. No shadow prices are attached to NOx and dust. Instead, the effect of lower emissions of NOx and dust is taken into account together with that other non-quantified benefits by imputing a lump-sum bonus.. The lump-sum bonus is assumed to equal 100% of the quantifiable benefits related to CO2 and SO2. Ii is a proxy for the avoided damaging effects of NOx and dust emissions as well as the benefits from better service quality and reliability of supply (less disruptions in heat and hot water services).

Table 3-1: Shadow prices for emissions.

Year	Shadow price, Euro per ton CO2	Shadow price Euro per ton SO2	Shadow price, Euro per ton NOx	Shadow price, Euro per ton Dust
2009	25	250	0	0
2010	25	250	0	0
2011	26	250	0	0
2012	27	250	0	0
2013	28	250	0	0
2014	29	250	0	0
2015	30	250	0	0
2016	31	250	0	0
2017	32	250	0	0
2018	33	250	0	0
2019	34	250	0	0
2020	35	250	0	0
2021	36	250	0	0
2022	37	250	0	0
2023	38	250	0	0
2024	39	250	0	0
2025	40	250	0	0
2026	40	250	0	0
2027	40	250	0	0
2028	40	250	0	0

Table 3-2 shows the discounted option-specific reductions of CO2 and SO2 emissions, valued at the shadow prices specified in Table 3-1.

Table 3-2: Present values of emission reductions.

	CO2	SO2	Total
	PV, Million Euro	PV, Million Euro	PV, Million Euro
	1	2	3=1+2
O8	15,65	9,36	25,01
O11	27,01	9,54	36,55
O12	82,32	13,21	95,53
O1	56,15	14,03	70,18
O10	14,83	8,81	23,64

Note: Discount rate 5,5%.
Source: Table T-11-8, columns 2, 4 and 6.

The estimates suggest that all options considered would result in considerable emission reduction benefits. The economic value of the emission reductions is highest for the decentralized option (O12) and the solution that produces all heat on the basis of gas (O1). Judged by this isolated result, the options O12 and O1 appear to be most desirable. However, in an overall assessment, one has to account for all benefits (not only the avoided CO2 and SO2 emissions) and has to compare the benefits with the costs of implementing the respective option. This analysis will be done below.

It is also worth noting that the options with fuel flexibility (O8, O11 and O10) enable the DH operator to mitigate effects of unexpected price hikes (e.g. for gas) by switching to alternative fuels. This advantage has not been included in the economic analysis, but should be taken into account in its own right.

If domestic prices were distorted, additional corrections would be necessary for converting financial cash flows into economic cash flows. Typically, such distortions are found in closed economies where domestic prices deviate significantly from those prevailing in international markets. Due to the openness of the Romanian economy, however, the market prices underlying the cash flow projections were assessed to contain no distortions. This is equivalent to conversion factors of 1 for all resources.

The overall results of the comparative economic analysis, in terms of Economic Net Present Value (ENPV) and Economic Rate of Return (ERR), are shown in Table 3-3. The social discount rate applied is 5,5%. The results are obtained from incremental analysis (vis-à-vis the do-minimum option), taking into account the following incremental flows:

- Social tax on labor (calculated, fiscal correction);
- Quantified environmental effects (CO2 and SO2) (calculated, external benefits);

- Non-quantifiable environmental effects (estimated, external benefits);
- Sales revenues (benefits);
- External costs (none);
- Operating costs (O&M);
- Investment costs.

Table 3-3: Economic indicators of the options.

Option (incremental to the do-minimum option)	ENPV(5,5%)	ERR
	Million Euro	%
O8	2,69	6%
O11	-50,23	-10%
O12	-77,47	-2%
O1	-37,16	Not defined
O10	-13,57	2%

Source: Table T-3-6.

Note: The ERR of Option O1 is not defined, due to the configuration of the underlying cash flow – all entries are negative.

Judged by the ENPV criterion, option O8 is clearly the best solution. In fact, it is the only option with a positive ENPV. The second-best option is O10.

An additional comparison between the two top-ranking options, O8 and O10, was carried out in terms of FNPV/C. The results, which are based on a discount rate of 5%, are presented in Table 3-4.

Table 3-4: Financial indicators of the two top-ranking options.

Option (incremental to the do-minimum option)	FNPV/C(5,0%)	FRR/C
	Million Euro	%
O8	-45,92	Out of range
O10	-60,72	Out of range

Sources: Tables T-4-1 and T-4-2.

The financial rates of return are "out of range" due to the configuration of the underlying cash flows with mainly negative entries throughout the reference period.

In sum, the results presented in Table 3-3 and Table 3-4 support the conclusion that Option O8 is the preferred solution on economic grounds and that it is also most desirable from a financial perspective. Therefore, the subsequent analyses will deal exclusively with Option O8.

The main economic benefits and costs of the selected option O8, compared with the do-minimum scenario, are the following:

Economic benefits:

Economic benefits consist of measurable and non-measurable items. The measurable items are listed first, followed by the non-measurable ones.

- Increased production efficiency (reduced operating costs per unit of output), which will lead to less emissions per GJ of heat produced. This effect is measurable;
- Reduced emission of SO2, NOx and dust. This benefit would positively impact the health situation among employees of the DH company, as well as among the entire population of Timisoara. The reductions are measurable, although a shadow price different from zero is applied to SO2, while the shadow prices of NOx and dust are set at zero. Investigations were made into the availability of health statistics that might shed light on the number of cases of respiratory illnesses and other diseases that could be attributed to the pollution of the DH system. No statistical information was available. Next, it was considered whether neighboring countries or other places would provide examples from which to assess the effect of pollution, but also this exercise did not lead to any results of sufficiently convincing quality to be used as a basis for this analysis, mainly due to the huge range of results obtained, and the lack of basis for deciding the correct comparison with Romanian conditions.
- Reduced emissions of CO2. The monetary value of this benefit is calculated via the use of shadow prices;
- Fuel flexibility: Some of the proposed options allow switching between fuels and combining e.g. gas with lignite and/or bio-fuels. This benefit is not directly measurable and difficult to value, but can be regarded as an "insurance policy" against excessive increases in fuel costs due to unilateral dependence on natural gas. This assumes that the price of lignite and bio-fuels will be less volatile than that of natural gas. This aspect may have considerable impact. For example, a gas price increase by 2% adds 1 million Euro to operating costs.
- Reduced growth of the ash deposit outside CET South. This effect was not measured, but obviously a large area of land on and around the deposit is out of agricultural use. The ash deposit is assumed to remain, but further deterioration of the surrounding environment is assumed to be avoided by the project. This would have a marginal effect on the land use close to the ash deposit;
- Access to heat services of the connected households across all income classes. This benefit is achieved via a social subsidy system that is already in place. Thus, the project has no distributional effect, so there is no reason to apply distributional weights to assess this effect;
- Better heat and hot water service quality. This will improve the wellbeing of the consumers, and reduce illnesses linked to poor heating of their dwellings. It is an improvement over the past performance and is expected to remove the incentive for the more wealthy segments of the users to disconnect and install individual gas-based heat and hot tap water solutions. The effect is embedded in the assumptions that disconnections will cease to occur. Further economic effects, such as an impact on the value of the apartments, would certainly exist, however there is no benchmark against which to assess it.

Economic costs:

- The investment costs (measured);

- The cost of consumables for the flue gas desulphurization plant, in options where it is included (measured).

Thus, the main economic advantage is the assumed benefit to society from lower emissions. The effect is calculated in each case compared to the emissions that would be released without the project. All other economic benefits are captured by adding an effect identical to the measurable effect of reduced emissions. This was done in the absence of reliable measurement of these effects. The justification for the chosen approach is the assessment the combined effect of these effects has no less of an economic impact compared to the measured effects.

A summary of the benefits in terms of technical parameters and service quality of the selected option is provided in Table 3-5, comparing the situation in year 2013 with and without the project.

3-5: A summary of project effects, option O8.

Specific Objectives	**Values without project (*) or Baseline**	**Expected value after completion of the priority project**
Year	**2013**	**2013**
Technical parameters		
Emissions of SO2 (t/y)	4.730	779
Emissions of NOx (t/y)	924	451
Emissions of Dust (t/y)	62,0	59,9
Emissions of CO2 (t/y)	524.978	477,252
Maintenance costs (million Euro)	7,19	7,05
Labour costs (million Euro)	9,41	9,13
Quality of services		
Access to basic services for the low income households	Full access	Full access
Reliability of heating and hot water distribution	Not satisfactory	Fully satisfactory
Disconnections	2% p.a. until year 2020	None

(*) Refers to the projected situation at the date of the foreseen completion of the project if the Project is not implemented (business as usual)

Sources: Table T-0-12, T-0-13, T-11-1.

An overview of the stream of economic costs and benefits associated with the preferred option in period 2009 - 2016 is given in Table 3-6.

Table 3-6: An overview of the flow of economic costs and benefits, option O8.

Option O8	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Social tax on labour	-	- 0,07	- 0,07	- 0,07	- 0,06	- 0,06	- 0,06	- 0,05
CO2 allowances (+), penalties (-)	- 0,73	- 0,73	- 0,72	0,39	-	-	-	-
Fiscal correction	**-0,73**	**-0,80**	**-0,78**	**0,32**	**-0,06**	**-0,06**	**-0,06**	**-0,05**

Quantified environmental effects	-	0,39	1,46	1,64	2,32	2,37	2,42	2,47
Non-quantified environmental effects	**100%**							
Non-quantified environmental effects	**-**	**0,39**	**1,46**	**1,64**	**2,32**	**2,37**	**2,42**	**2,47**
Total external benefits	**0,00**	**0,78**	**2,92**	**3,27**	**4,65**	**4,74**	**4,84**	**4,93**
Sales of electricity, CO2 allowances and penalties	0,73	0,73	0,72	-0,39	0,00	0,00	0,00	0,00
Total benefits	**0,00**	**0,71**	**2,85**	**3,21**	**4,59**	**4,68**	**4,78**	**4,88**
External costs	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Total external costs	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
Total operating costs	0,00	-0,68	-0,69	-0,69	0,55	0,55	0,55	0,60
Total investment costs	0,00	18,07	19,33	13,28	0,00	0,00	0,00	0,00
Total costs	**0,00**	**17,39**	**18,64**	**12,59**	**0,55**	**0,55**	**0,55**	**0,60**
Net cash flow	**0,00**	**-16,68**	**-15,79**	**-9,39**	**4,04**	**4,14**	**4,23**	**4,29**

Source: Table T-3-1.

Table 3-6 shows that the main (incremental) benefits consist of quantified and non-quantified environmental improvements. There are no additional sales revenues during construction on top of CO2 allowance savings, which are offset by the corrections for CO2 allowances and penalties. There is a small effect from savings in staff costs, via reduced (corrected) social tax on labor.

The incremental costs consist of additional operating costs and investment costs. Initially, the operating costs are reduced due to savings in fuels and electricity, but from 2013 onwards (i.e., upon completion of the priority investments) these savings are more than offset by additional operating costs caused by the desulphurization plant.

The resulting net cash flow is dominated by the investment costs in the construction period, followed by positive economic net benefits attributable to the project's positive environmental impacts.

4. Financial analysis

The purpose of the financial analysis is to determine whether the project is eligible for EU grant funding, to calculate the EU grant, and to assess the financial sustainability of the project with appropriate funding, its affordability, and the requirement for future operational subsidies.

4.1 A brief financial overview of Colterm S.A

This section provides a brief overview of Colterm S.A by way of stating the consolidated costs and revenues as well as the main items on the balance sheet of the latest three years.

Table 4-1: Total costs and total revenue of Colterm (RON, EUR), 2005-2008.

	2005	2006	2007	2008
Total costs, RON	187,069,156	201,089,882	202,593,011	224,040,434
Total revenue, RON	187,372,142	201,591,879	209,670,552	213,516,905
Total costs, EUR	52,844,395	56,805,051	57,229,664	56.218.116
Total revenue, EUR	52,929,984	56,946,858	59,228,969	53.577.463
Operating ratio	0,999	0,998	0,966	1,049

Source: Colterm

As indicated in the table above, in 2008 total operating costs of Colterm were 224,0 million RON or 56,2 million Euro, and total revenue was 213,5 million RON, or 53,6 million Euro. Thus, the operating ratio was 224,0/213,5 = 1,049. This was a deterioration compared with the three preceding years, all of which saw an operating ratio in the range of 0,966-0,999.

Costs include materials, electricity, staff, maintenance, depreciation and other operational costs, as well as financing costs. Revenues include sales of electricity, sales of heat, financial revenues and other revenues.

Specifications of the allocation of costs, including depreciation, on the different parts of the system, i.e. electricity production, production of heat (centralized, substations), and heat transportation are available from Colterm S.A. This information would form the basis for detailed negotiations related to the unbundling of Colterm S.A, but this issue is not pursued further in the present analysis.

Table 4-2: The balance sheet of Colterm end of 2008 (RON, EUR), main items.

	Colterm Balance sheet 2008	RON	EUR	%
1	Advanced expenses	76,538	19,206	0%
2	Current assets	108,914,916	27,329,849	17%
3	Long term assets	274,553,932	68,893,389	83%
4	**Total assets**	**383,545,386**	**165.135.833**	**100%**
5				
6	Current liabilities	129,734,367	32.554.042	20%
7	Advances (subventions)	46,841,441	11.753.849	7%
8	Long term liabilities	65,300,142	16.385.662	10%
9	Capital and reserves	141,669,436	35.548.890	63%
10	**Total liabilities**	**383,545,386**	**165.135.833**	**100%**

Source: Colterm

The balance sheet indicates that by the end of 2008 the ratio of Colterm's current assets to its current liabilities, the **current ratio,** was 0,84. Advances (subventions) are not included in the current liabilities. Advances are pre-paid "income" from operational subsidies, and would thus be available for meeting the current liabilities. The balance sheet indicates that by the end of 2008 Colterm was in possession of significant capital and reserves (63% of liabilities). The long-term liabilities (10%) were considerably smaller than the capital and reserves.

The following sections deal with eligibility, financial sustainability, funding and affordability.

4.2 Eligibility: FNPV/C < 0

The purpose of the first test is to establish whether the preferred option fulfils the requirements of eligibility for funding under the EU Cohesion Fund. The test is performed on an incremental basis, i.e. in comparison to the do-minimum option.

Basically, in order to qualify for external grant support, the Financial Net Present Value of the investment (FNPV/C) at the financial discount rate of 5% must be negative. The following Table 4-3 provides an extract of Table T-4-1 where the FNPV/C of the selected option is computed.

Table 4-3: Extract of the financial net cash flow of option O8, 2009-2016, million Euro.

Option O8		2009	2010	2011	2012	2013	2014	2015	2016
Sales (CO2 allowances, penalties)		0,73	0,73	0,72	-0,39	0,00	0,00	0,00	0,00
Total revenues		**0,73**	**0,73**	**0,72**	**-0,39**	**0,00**	**0,00**	**0,00**	**0,00**
Total operating costs		0,00	-0,68	-0,69	-0,69	0,55	0,55	0,55	0,60
Total investment costs		0,00	18,07	19,33	13,28	0,00	0,00	0,00	0,00
Total expenditures		**0,00**	**17,39**	**18,64**	**12,59**	**0,55**	**0,55**	**0,55**	**0,60**
Net cash flow		**0,73**	**-16,66**	**-17,93**	**-12,98**	**-0,55**	**-0,55**	**-0,55**	**-0,60**
FRR/C		**Out of range**							
FNPV/C (5%)		**-45,92**							

Source: Table T-4-1.

Table 4-3 shows that the financial net present value of the project is negative (-45,92 million Euro). The FRR/C is out of range due to the numeric properties of the net cash flow. Thus, the project passes this test, indicating that without support the project is unlikely to be undertaken, as its net cash flow to the investor is negative.

The table also illustrates, apart from the changing flows related to CO2 allowances and penalties in 2009-2012, that the project faces changes in operating costs that in the period 2009-2012 consist of savings only, but from 2013 onwards result in additional costs from operating the desulphurization plant, which more than offset the cost savings elsewhere in the system.

4.3 Distribution of savings

The project results in efficiency gains, i.e. in savings in operation costs. Savings occur with respect to:

- Fuels;
- Electricity consumption;
- Salaries;
- Maintenance;
- CO2 penalties.

On the other hand, additional costs occur for the following operations

- Desulphurization.

All of the savings in operational costs reduce total operational costs and are thus allocated in favour of the consumers/the providers of operational subsidies.

A breakdown of the investments and their impact on operating costs is provided in the following table.

Table 4-4: Cost investments and revenue investments, and their effects, option O8, 2009-2016, million Euro.

Option O8	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Total investments	-	18,16	19,42	13,31	-	-	-	-
Of which desulphurization	-	7,37	7,37	7,37	-	-	-	-
Operational costs desulphurization	-	-	-	-	1,20	1,20	1,20	1,20
Operational cost effect of investments	**-**	**-**	**-**	**-**	**1,20**	**1,20**	**1,20**	**1,20**
Investments with revenue effects	-	10,79	12,05	5,94	-	-	-	-
Cost savings:								
- Other fuel costs	-	-0,10	-0,10	-0,10	-0,13	-0,13	-0,13	-0,13
- Electricity Transmiss and Internal	-	-0,09	-0,10	-0,11	-0,11	-0,11	-0,11	-0,11
- Electricity Distribution	-	-	-	-	-	-	-	-
- Fixed Maintenance	-	-0,17	-0,17	-0,17	-0,14	-0,14	-0,14	-0,13
- Staff Costs	-	-0,32	-0,32	-0,32	-0,27	-0,27	-0,27	-0,24
Total cost savings	**-**	**-0,68**	**-0,69**	**-0,69**	**- 0,65**	**- 0,65**	**- 0,65**	**- 0,60**
Net effect investments with revenue impacts	**-**	**0,68**	**0,69**	**0,69**	**-0,55**	**-0,55**	**-0,55**	**-0,60**
Net cash flow	**0**	**-17,48**	**-18,73**	**-12,62**	**-0,55**	**-0,55**	**-0,55**	**-0,60**

Source: Table T-4-3.

Table 4-4 shows that the positive effects on operating expenses (savings) dominate until 2013. Thereafter, the negative effect of the desulphurization plant (additional operating costs) more than offset the savings in operating costs.

4.4 Eligibility: Assessment of the financial return on national capital

In what follows, the financial return on national capital, the FRR/K, is assessed. In order for the project to be eligible for grant funding, the FRR/K must not exceed the normal required return on equity for companies operating in the sector. The rationale behind this requirement is that EU taxpayer funds should not contribute to extraordinarily high returns in the recipient country. The components for calculating the FRR/K in the initial period 2009-2016 are presented in the following table:

Table 4-5: Incremental revenues and costs to the owner of the DH system, 2009-2016, million Euro

Option O8	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Sales	0,73	0,73	0,72	-0,39	0,00	0,00	0,00	0,00
Residual value	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Total revenues	**0,73**	**0,73**	**0,72**	**-0,39**	**0,00**	**0,00**	**0,00**	**0,00**
Total operating costs	0,00	-0,68	-0,69	-0,69	0,55	0,55	0,55	0,60
Interests IFI	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Repayment IFI	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Reimbursement short-term loans	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Public equity	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Total national public grant contribution	0,00	9,04	9,67	6,64	0,00	0,00	0,00	0,00
Total expenditures	**0,00**	**8,36**	**8,98**	**5,95**	**0,55**	**0,55**	**0,55**	**0,60**
Net cash flow	**0,73**	**-7,63**	**-8,26**	**-6,34**	**-0,55**	**-0,55**	**-0,55**	**-0,60**
FRR/K	**Out of range**							
FNPV/K (5%)	**-23,68**							

Source: Table T-5-1.

As is indicated in Table 4-5, the FRR/K of the project is out of range due to the numerical properties of the cash flow. The FNPV/K, however, is minus 23,68 million Euro, confirming that there is no supernormal payoff to the owners of the DH system. This is because a negative FNPV implies that the internal rate of return is below the assumed discount rate of 5%. It can therefore be concluded that the project's (sufficiently low) rate of return on national capital allows the project to obtain EU grant funding.

4.5 Eligibility: Funding gap

Once the eligibility has been established, the maximum size of the EU grant is calculated for the priority investment on the basis of incremental cash flows, according to a formula that determines a funding-gap rate based on discounted investment costs and discounted net revenue from operations.

It should be noted that normally and according to the CBA guidelines (WD4), EU finances part of the investments for eligible projects according to the funding gap analysis. However, the COCOF Note 07/0074/01 states that when the revenues (directly paid by users) fall short operating costs are then a funding gap calculation is no longer needed (there is no point in applying the funding gap method). Instead, an analysis of the financial sustainability is required to verify that throughout the project's reference period there is enough cash to cover the related expenditure.

Keeping in mind the COCOF Note, the funding gap analysis is carried out for the sake of transparency only since it is clear at the outset that the (discounted) net revenues of the project are negative, i.e. that the net revenues contribute nothing to (re-) cover the investment costs. Consequently, the sustainability analysis becomes more relevant.

The funding-gap rate is applied to the total undiscounted value of investment costs to arrive at the so-called Decision Amount. The co-funding rate is applied to the Decision Amount to arrive at the maximum EU grant. This mechanism is shown in the following Table 4-6..

Table 4-6: Eligibility for EU grant.

Abbreviated name	Name	Discounted values, million Euro	Undis-counted values, million Euro
EC	Eligible cost (EC)		50,68
DIC	Discounted investment cost (DIC)	44,01	
DNR	Discounted net revenue (DNR)	-1,91	
EE	Eligible expenditure, (EE = DIC-DNR)	44,01	
R	Funding-gap rate (R = EE/DIC)	100%	
DA	Decision amount (DA = EC*R)		50,68
Crpa	Maximum co-funding rate	50%	
EU grant	Maximum EU grant = DA*Crpa		25,34

Source: Table T-6-1.

Table 4-6 takes at a starting point the priority investments identified for the preferred Option O8, i.e., 50,68 million Euro undiscounted and 44,01 million Euro discounted. The incremental revenues consist of fuel cost savings, electricity cost savings and the additional costs are incurred by the operation of the desulphurization plant. The present value of the resulting net revenues is minus 1,79 million Euro excluding the residual value of the investment, and minus 1,91 million Euro if the residual value is included. The eligible expenditure is even more than 44,01 million Euro. Consequently, the ratio of this Eligible Expenditure to Discounted Investment Cost, which is also termed the Funding-gap ratio, is 100%. This ratio is applied to the total eligible investment costs, resulting in a funding gap, termed the Decision Amount, of 50,89 million Euro. Under SOP 3 the EU may co-finance up to 50% of this amount, in the present case 25,34 million Euro, assuming co-financing by the Romanian state budget of 45% and by the local municipality budget of 5%.

4.6 Funding

Table 4-7 describes the sources of funds needed to implement Option O8. . The financing plan assumes that the project is fully funded by the EU grant and by state and local budget contributions.

Table 4-7: Funding sources.

Sources	2009	2010	2011	2012	2013	2014	2015	Total
	Million Euro	Million Euro	Million Euro	Million Euro	Million Euro	Million Euro	Million Euro	Million Euro
Local budget contribution (5%)		0,90	0,97	0,66				2,53
State budget contribution (45%)		8,13	8,70	5,98				22,81
EU grant (50%)		**9,04**	**9,67**	**6,64**				25,34
Total		**18,07**	**19,33**	**13,28**				**50,68**
Memo: VAT		3,43	3,67	2,52				**9,62**

Source: Table T-8-1.

Table 4-8 provides the financing plan according to a template that includes the VAT of the local budget investment contribution as a reclaimable, but ineligible cost. It is understood that the municipality may reclaim these funds from the state budget.

Table 4-8: Project Financing Plan, Timisoara, million Euro, undiscounted fixed prices.

<table>
<tr><td rowspan="7">1)Eligible plus non-eligible costs:
60,30
100%</td><td rowspan="4">1.1)Eligible cost:
50,68
84,05 % of 1</td><td rowspan="3">1.1.1)Funding gap:
50,68
100,0% of 1.1</td><td colspan="2">EU grant: 25,34
50% of 1.1.1</td></tr>
<tr><td colspan="2">State budget: 22,81
45% of 1.1.1</td></tr>
<tr><td colspan="2">Local budget: 2,53
5% of 1.1.1</td></tr>
<tr><td colspan="3">Non Funding Gap: 0,00
0,0% of 1.1</td></tr>
<tr><td rowspan="3">1.2)Ineligible:
VAT: 9,62
15,95% of 1</td><td rowspan="3">Local budget
9,62
100% of 1.2</td><td rowspan="2">VAT 9,62</td><td>Reclaimed 0,48</td></tr>
<tr><td>Non-reclaimed 9,14</td></tr>
<tr><td colspan="2">Others: 0,0</td></tr>
</table>

The two above tables show that in addition to the EU grant of 25,34 million Euro, co-financing shall be sourced from the central government contributing and the municipality in the amounts of 22,81 million Euro and 2,53 million Euro, respectively.

It is assumed that funds are available in the central government budget for its co-financing contribution. It is further assumed that the municipal budget shall have the capacity to contribute VAT on the share of investment financed by its contribution. The municipality's contribution of 2,53 million Euro plus VAT would be sourced from the municipality's investment budget, with a distribution over three years. As indicated by Tables 4-7 and Table 4-8, the maximum annual VAT amount will be 19% of 19,33 million Euro in 2011, or 3,67 million Euro. This will constitute 2,3% of the own revenue of the municipality (159,44 million Euro in 2008).

If required, the municipality is entitled to take up external credits for the funding of investments, as long as the debt service, i.e. interest plus principal repayments on all obligations remains below 30% of the annual budget revenue. This depends on the overall commitments of the municipality.

Selected figures from the annual accounts for 2007 and 2008 of Timisoara municipality, and derived indicators, are shown in the following table.

Table 4-9: Financial indicators of the accounts of the Timisoara municipality, 2007 and 2008.

	2007, Million RON	**2007, Million EUR**	**2008, Million RON**	**2008, Million EUR**
Own revenue of 2007	378,56	106,94	565,14	159,64
Derived indicator: 30% of total revenue	113,57	32,08	169,54	47,89
Current debt service on long term loans	30,01	8,48	43,78	12,87
	Percentage	Percentage	**Percentage**	**Percentage**
Current debt service as a percentage of own revenue	7,93%	7,93%	8,76%	8,76%

Source: Municipality of Timisoara.

Table 4-9 indicates that the municipality of Timisoara will be in a position to take up additional credit funding. Information was provided by the municipality[11] indicating the current debt service on known commitments with projections to year 2026.

The debt service level on existing commitments for the years 2009-2015 is shown in the following table, as a percentage of own revenue.

[11] Anexa 1.3 la nome si procedure.

Table 4-10: Debt service level of Timisoara municipality, 2009-2015, % of own revenue. (legal annual limit is 30%)

Year	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Debt service level %	15,41	19,50	20,35	19,26	16,47	14,83	14,07

Source: Timisoara municipality.

The maximum percentage of debt service to own income would occur in 2011, when the debt service percentage would reach 20,35% of own income.

4.7 Affordability

The next step in the project appraisal focuses on affordability. This section discusses the gap between present consumer payments for heat and the full cost recovery tariffs, and proposes a gradual closure of this gap over time, taking into account expected developments in household incomes over the reference period, with special emphasis on the nearest future and considering the likely impact of the current economic recession.

While affordability (ability to pay) depends solely on consumer incomes, the precise tariff gap depends also on the full cost tariff determination model applied, i.e. whether full cost tariffs are determined by ANRE's allocated cost model or by the balancing tariff methodology. This is because the two methodologies allocate costs among heat and electricity differently, although the difference is limited.

The tariff gap results in a revenue gap which must be covered by transitional subsidies to render the heat supply financially viable. The term "transitional" subsidy is used in this context because it is assumed that the funds needed to finance the project's investments will be available (see Section 4.6), i.e. that after EU and local investment grant contributions there is no further requirement for funds for implementing the investments of Option O8. What is needed is funding of the difference between operating costs and operating revenues, until the revenues have been increased to the full cost recovery level. It is assessed that there is a need for such funding until 2015. This is discussed in the next section on financial sustainability.

The affordability analysis starts from the current cost of DH services. The following table shows the absolute and relative consumer tariffs for 2007 and 2008, which form the basis for discussing future affordability.

Table 4-11: Historical tariff levels (including VAT)

	Unit	2007	2008	2009
Historic tariffs, current prices	RON/GCal	157,03	147,84	162,62
Historical consumer tariff, constant 2009-prices	Euro/GJ	12,09	10,52	9,14
Household consumption	GJ/HH/month	3,23	3,23	3,23
Monthly cost for DH services per household, constant 2009-prices	Euro/HH/month	39,04	33,98	29,51
Monthly disposable household income (average household, constant 2009-prices)	Euro/HH/month	625	664	533
Affordability	Percentage of average disposable household income	6,24%	5,12%	5,54%

Sources: Tables T-9-1 and T-9-2.

The historic tariffs were obtained from the web site of ANSRC[12]. These tariffs are those applied to the population, hence can be termed consumer tariffs, and they are significantly lower than the full cost tariffs. The consumer tariffs are stated in RON/GCal in current prices, and were transformed into Euro/GJ in constant 2009-prices. Household consumption is based on statistical information about the total heated area and the number of households. The household consumption is provided on a 12-month basis, i.e. the entire consumption during the heating season divided by 12. The monthly cost for DH services is obtained by multiplying the household consumption and the tariff. The monthly disposable household income is calculated by deducting tax payments, which were calculated to 12,7% of the pre-tax income. The affordability is obtained by dividing the monthly household cost for DH services by the monthly disposable household income.

The table shows that in 2007 the average household paid 6,24% of its income to DH services, in 2008 the level decreased to 5,12%, and in 2009 it increased to 5,54%. It should be borne in mind that lower decile income households will have higher DH bills in terms of percentage of their income. A social subsidy is in place to mitigate this.

Full cost recovery tariffs

The full cost recovery tariffs are determined either by deducting all revenues from costs and dividing the resulting net costs by the number of gigajoules sold (the "balancing tariff"), or by a cost allocation mechanism (the "allocated costs" tariff). Allocated costs tariffs are determined by ANRE. Three scenarios are shown in the following table: With the project: the ANRE tariff, the balancing tariff, and without the project: the ANRE tariff. In the final calculations it is assumed that ANRE will apply its present cost allocation model for the period 2009-2015, and then will change to the balancing tariff model.

[12] http://www.anrsc.ro/main.php?mn=6&cont=date_stare_energetica

Table 4-11 B: Full cost recovery tariffs, Euro per GJ, including VAT, constant 2009-prices, 2009-2016.

	2009	2010	2011	2012	2013	2014	2015	2016
With the project: Balancing tariff	20,11	21,13	22,37	21,96	19,92	19,89	19,86	19,24
With the project: ANRE tariff	19,94	20,95	22,19	21,67	20,34	20,32	20,29	19,67
Without the project: ANRE tariff	20,23	21,44	23,15	23,08	21,44	21,85	22,27	22,01

Source: Table T-9-1

The table shows that the full cost recovery tariff with the project reaches a peak in 2011 of between 22,19 and 22,37 Euro per Giga Joule including VAT, and then is reduced gradually, whereas without the project the tariff reaches 23,15 Euro/GJ and continues at a higher level.

The maximum affordability

The next step in the affordability analysis it to establish the maximum affordability. This issue was analyzed in a separate affordability study[13], which recommended that the affordability limit would be 8,50% of the average household income.

For the do-minimum option it is assumed that the consumer tariff cannot be increased, i.e., it will remain at 5,54% of the average household income. This assumption is decisive for the size of operational subsidies required without the project.

The current economic recession is assumed to result in the following macro-economic growth pattern for the period 2009-2016.

[13] Studiu de Suportabilitate, Sectorul de producere si distributie a energiei termice in sistem centralizat in Romania, BDO Accountants and Consultants, Bucharest, April 2009.

Table 4-12: Economic growth rate assumptions for the current economic recession.

	2009	2010	2011	2012	2013	2014	2015	2016
Equilibrium scenario	-4,00%	0,10%	2,40%	3,70%	4,40%	5,20%	6,00%	5,70%
Pessimistic scenario	-7,00%	-2,90%	-0,60%	0,70%	1,40%	2,20%	3,00%	2,70%
Optimistic scenario	-1,00%	3,10%	5,40%	6,70%	7,40%	8,20%	9,00%	8,70%

Sources: Tables T-9-2, T-9-3 and T-9-4. For the period 2009-2013, for the equilibrium scenario: Source: Comisia Nationala de Prognoza, "Prognoza pe termen mediu 2009-2013 varianta de primavera 2009".

For the preferred option it is suggested that the affordability rate is increased gradually from the historical level of 5,54% (2009) to a level of 8,50% in 2015, as follows.

In the do-minimum option it is assumed that the affordability rate is kept constant at 5,54% of average household income.

A gradual approach to tariff increases is recommended. A suggested profile of increasing tariffs is shown in the following Table 4-14.

Table 4-14: Suggested tariff increases, 2009-2016.

	Unit	2009	2010	2011	2012	2013	2014	2015	2016
GDP growth rates, equilibrium scenario	Percentage growth per year	-4,00%	0,10%	2,40%	3,70%	4,40%	5,20%	6,00%	5,70%
Affordability rate	Percentage of average disposable household income	5,54%	6,00%	6,50%	7,00%	7,50%	8,00%	8,50%	8,50%
Average disposable household income	Euro/month	533	539	556	584	617	661	700	740
Affordable household bill	Euro/HH/ month	29,51	32,36	36,16	40,87	46,28	52,84	59,51	62,91
Proposed Tariff	Euro/GJ	9,14	10,02	11,20	12,66	14,33	16,36	18,43	19,24
Proposed household bill	Euro/HH/month	29,51	32,36	36,16	40,87	46,28	52,84	59,51	62,13
Proposed household bill	Percentage of average household income per month	5,54%	6,00%	6,50%	7,00%	7,50%	8,00%	8,50%	8,40%
Tariff increases, constant prices, Euro per GJ	Percentage increase on previous year	3,34%	9,66%	11,73%	13,03%	13,23%	14,18%	12,63%	4,40%

Sources: Tables T-9-1 and T-9-2.

The suggested tariff increases are guided by the proposed increases in affordability rates. It can be seen from the above table that the tariff increases will range between 9,66% p.a. (2010) and 14,18%

p.a. (2014). The table also shows that the tariff increases will exceed the real growth rates in all years from 2009 to 2015, and will drop below the growth rate in 2016.

The tariff increases are stated in constant prices. Thus, the nominal tariff increases should be obtained by multiplying the tariff increase by an inflation index. This is illustrated in the following Table 4-15.

Table 4-15: Real and nominal tariff increases, 2009-2016.

	2009	2010	2011	2012	2013	2014	2015	2016
Tariff increases in Euro, real terms	3,34%	9,66%	11,73%	13,03%	13,23%	14,18%	12,63%	4,40%
Tariff increases in RON, real terms	**3,97%**	**8,37%**	**10,93%**	**11,68%**	**11,86%**	**12,21%**	**12,63%**	**4,40%**
Inflation rates	5,80%	3,50%	3,20%	2,80%	2,50%	2,30%	2,00%	2,00%
Tariff increate in RON, nominal terms	10,00%	12,17%	14,48%	14,80%	14,65%	14,79%	14,88%	6,48%

Source: Table T-9-1.

Going back to constant prices, it might also be useful to examine the impact of different growth scenarios on the affordability of the full costs of the DH services. This information is provided in the following Table 4-16, showing the full cost of DH services (balancing method) as a percentage of the average household income.

Table 4-16: Cost of DH services in different growth scenarios (percentage of average household income, with the project, 2009-2016.

	2009	2010	2011	2012	2013	2014	2015	2016
Equilibrium scenario	12,09%	12,54%	**12,88%**	11,99%	10,64%	9,93%	9,36%	8,40%
Pessimistic scenario	12,91%	13,80%	14,60%	13,99%	12,79%	12,29%	11,91%	11,00%
Optimistic scenario	11,56%	11,64%	11,62%	10,51%	9,07%	8,23%	7,54%	6,58%
Memo: Affordability constraint	5,54%	6,00%	6,50%	7,00%	7,50%	8,00%	8,50%	8,50%

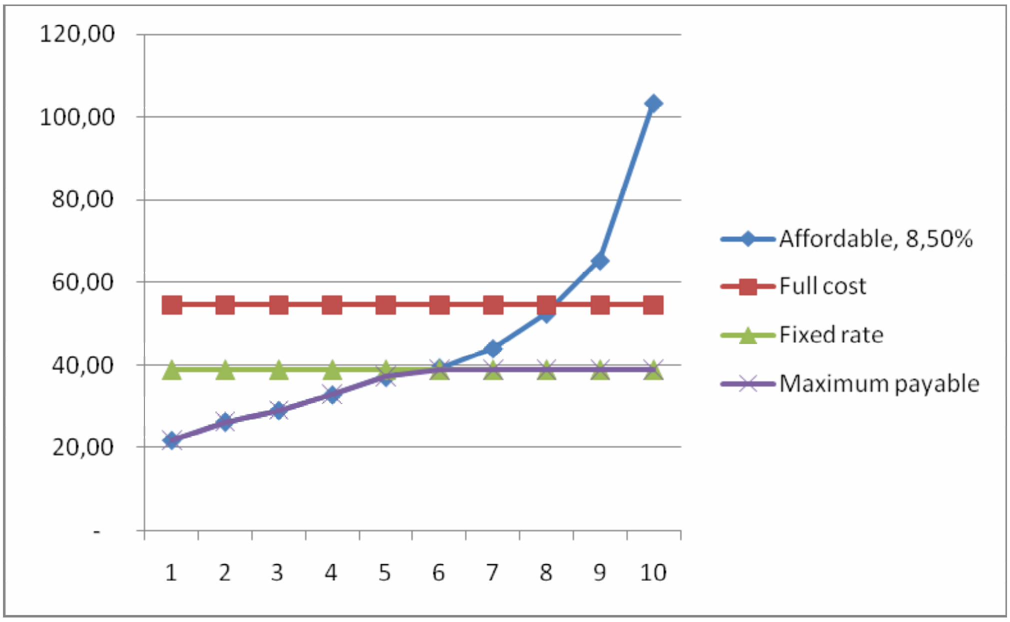
Sources: Tables T-9-1, T-9-2, T-9-3 and T-9-4.

Table 4-16 indicates that in the equilibrium scenario the cost of DH services peaks at 12,88% of the average disposable income in 2011, and decreases over time. Similar patterns are observed for the pessimistic and the optimistic scenarios, whereby the relative cost of DH services are higher for the pessimistic scenario, and lower for the optimistic scenario.

This is further illustrated in the following two tables, where the focus is shifted towards the size of transitional, operational subsidies required to cover the gap between the affordability constraint and the full cost. Here, the analysis distinguishes between two tariffs: The “allocated cost” tariff determined by the current ANRE tariff methodology, and the "balancing tariff" based on the DH provider acting as a price taker on the electricity market.

In terms of Figure 4-1, illustrating the situation in 2009, the transitional operational subsidy covers the area between the full cost tariff and the fixed rate tariff. The lower incomes, those in deciles 1-4, need social subsidies to cover the triangular area in the left-hand side of the figure, between the fixed rate and the maximum payable tariffs.

Figure 4-1: Affordability, 10 income deciles, and tariffs, 2009.



Source: Table T-9-6.

The social subsidy

The consumer paid revenue is composed of own contributions of the consumers and social subsidy contributions.

The social subsidy is based on average individual income in each household, and is 10% of the heat bill in the first interval from 440 to 500 RON per capita per month. Incomes below this level are broken down into eight more intervals, and in each interval the subsidy increases by 10%-points, i.e. to 20%, 30% etc.etc. up to 90% of the DH bill for households with incomes of 0 to 125 RON per capita per month, or 0 to 103 Euro per household per month. In 2007, when the full cost household bill was 27,10 RON per month, the DH bill for households in the lowest interval would be 10% of that, or 2,71 Euro per month.

In 2007, the social subsidy took care of incomes below 500 RON per capita per household per month. For later years, the cut-off rates of the intervals are adjusted upwards following the inflation.

4.8 Financial Sustainability

Financial sustainability is achieved if the accumulated financial cash flow is non-negative in every year throughout the entire reference period. In what follows, this requirement is imposed by the constraint that the cumulative cash flow be zero in every year[14].

Financial flows are shown first for the do-minimum option and then for the preferred option to demonstrate that both options are financially sustainable, provided they are supported by sufficient operational subsidies.

Table 4-17: Financial sustainability of the do-minimum option, cash flows 2009-2016, million Euro.

Do Minimum	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Investment grants and co-financing	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Sales of heat - not incremental	31,15	31,55	31,89	32,80	33,97	35,64	37,02	38,35
Sales of electricity - not incremental	4,86	5,13	5,42	16,04	14,94	14,93	14,93	14,91
Total inflows	**36,01**	**36,68**	**37,31**	**48,84**	**48,91**	**50,57**	**51,95**	**53,26**
Total operating costs (fuel and O&M) - not incremental	73,82	78,20	82,75	91,60	83,73	83,64	83,53	81,37
Dividend to equity provider	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Total investment costs - not incremental	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Interest on IFI loan		0,00	0,00	0,00	0,00	0,00	0,00	0,00
Loans reimbursement - IFI	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Loans reimbursement - short term	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Taxes	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Total outflows	**73,82**	**78,20**	**82,75**	**91,60**	**83,73**	**83,64**	**83,53**	**81,37**
Total cash flow before operating subsidies	**-37,81**	**-41,52**	**-45,44**	**-42,76**	**-34,81**	**-33,06**	**-31,58**	**-28,11**
Operating subsidies, general part	37,81	41,52	45,44	42,76	34,81	33,06	31,58	28,11
Cumulated total cash flow	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**

Sources: Table T-7-1.

[14] In reality any organization would aim at a certain positive cash flow to allow for “operational capital expenses”, i.e. such capital expenses which could be foreseen, but are not budgeted.

Table 4-18: Summary financial sustainability, 2009-2016, million Euro.

Do Minimum - Summary	2009	2010	2011	2012	2013	2014	2015	2016
Total operating costs	73,82	78,20	82,75	91,60	83,73	83,64	83,53	81,37
Transitional subsidy	37,81	41,52	45,44	42,76	34,81	33,06	31,58	28,11
Sales of heat paid by the users	31,15	31,55	31,89	32,80	33,97	35,64	37,02	38,35
Sales of electricity	4,86	5,13	5,42	16,04	14,94	14,93	14,93	14,91

Source: Table T-7-1 B.

Tables 4-17 and 4-18 show that in the do-minimum case, i.e. in the situation without the project, transitional subsidies required to keep the cumulated total cash flow in balance start in 2009 at 37,81 million Euro, peaking in 2011 and then gradually reducing. The continued requirement for subsidies is closely linked to the assumption that consumer tariffs in the do-minimum case cannot be increased above the level of 5,54% (of household income).

Table 4-19: Financial sustainability of Option O8, cash flows 2009-2016, million Euro, allocated cost tariff 2009-2014, and balancing tariffs 2015 onwards.

Option O8	2009	2010	2011	2012	2013	2014	2015	2016
Investment grants and co-financing	0,00	18,07	19,33	13,28	0,00	0,00	0,00	0,00
Sales of heat - not incremental	31,15	34,16	38,17	43,14	48,85	55,77	62,81	65,58
Sales of electricity - not incremental	4,86	5,13	5,42	16,04	14,94	14,93	16,39	16,39
Total inflows	**36,01**	**57,36**	**62,92**	**72,46**	**63,79**	**70,71**	**79,21**	**81,97**
Total operating costs (fuel and O&M) - not incremental	73,10	76,79	81,35	91,30	84,27	84,18	84,08	81,97
Dividend to equity provider	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Total investment costs - not incremental	0,00	18,07	19,33	13,28	0,00	0,00	0,00	0,00
Interest on IFI loan		0,00	0,00	0,00	0,00	0,00	0,00	0,00
Loans reimbursement - IFI	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Loans reimbursement - short term	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Taxes	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Total outflows	**73,10**	**94,86**	**100,68**	**104,58**	**84,27**	**84,18**	**84,08**	**81,97**
Total cash flow before operating subsidies	**-37,09**	**-37,51**	**-37,77**	**-32,12**	**-20,48**	**-13,47**	**-4,87**	**0,00**
Operating subsidies	37,09	37,51	37,77	32,12	20,48	13,47	4,87	0,00
Cumulated total cash flow	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**

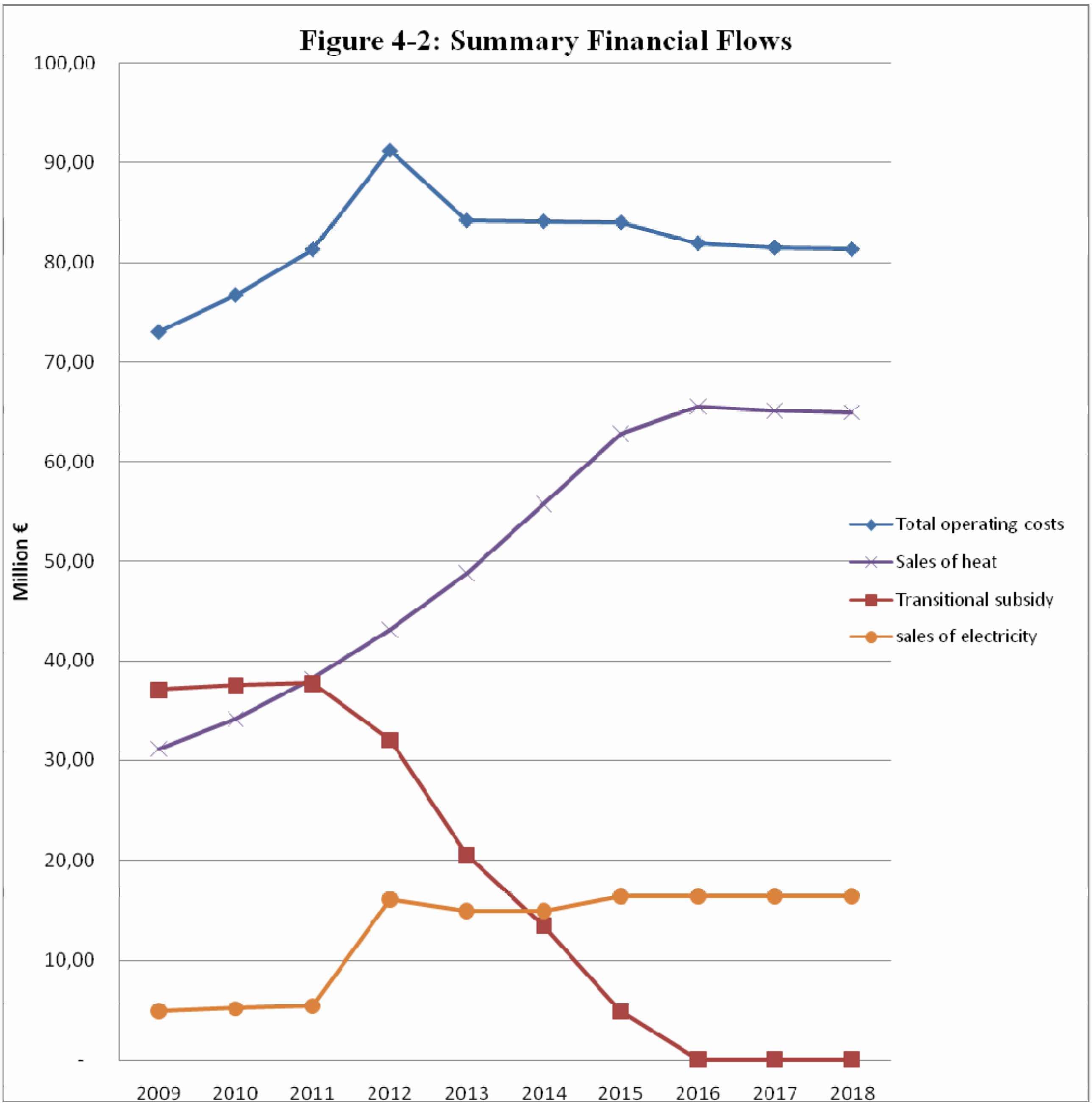
Source: Table T-7-4.

Table 4-20: Summary financial sustainability, 2009-2016, million Euro

Option O8 - Summary excl investments	2009	2010	2011	2012	2013	2014	2015	2016
Total operating costs, ex VAT	73,10	76,79	81,35	91,30	84,27	84,18	84,08	81,97
Sales of heat paid by the users, ex VAT	31,15	34,16	38,17	43,14	48,85	55,77	62,81	65,58
Sales of electricity, ex VAT	4,86	5,13	5,42	16,04	14,94	14,93	16,39	16,39
Total cash flow before transitional subsidy	-37,09	-37,51	-37,77	-32,12	-20,48	-13,47	-4,87	-
Transitional subsidy	37,09	37,51	37,77	32,12	20,48	13,47	4,87	-

Source: Table T-7-4 B.

Tables 4-19 and 4-20 refer to the preferred Option O8 and assume that ANRE's allocated cost model for tariff determination will prevail until 2014 and thereafter be replaced with the balancing tariff model. In this case, the required transitional subsidies are those of the allocated costs model from 2009 to 2014 and those of the balancing tariff model in the years 2015 and 2016. The required transitional subsidies start in 2009 at 37,09 million Euro, peak in 2011, and go down fairly. This is also illustrated in the figure below.



Source: Table T-7-4 B.

Although the two scenarios described in the above tables are almost identical in terms of total inflows (driven by total costs), the composition of inflows is different. While in the do-minimum scenario the subsidies are reduced slowly during the period considered, because of the freezing of the affordability at 5,54%, Option O8 is linked to increasing the affordability from 5,54% to 8,50% until 2015. This allows the local authorities to reduce the subsidies more quickly and to achieve full cost recovery (no subsidies required) by 2016. Thus, in 2016 the savings to the local administration (avoided subsidies of the do-minimum option) would be 28,11 million Euro. The annual savings to the local administration from carrying out the project compared to the do-minimum option is illustrated in the two tables below, which cover the period from 2009 to 2024.

Table 4-21: Annual savings to the local administration from carrying out the project compared to the do-minimum option, 2009-2016, million Euro.

Option O8 - Summary excl investments	2009	2010	2011	2012	2013	2014	2015	2016
Transitional subsidy without the project	37,81	41,52	45,44	42,76	34,81	33,06	31,58	28,11
Transitional subsidy with the project	37,09	37,51	37,77	32,12	20,48	13,47	4,87	-
Savings from carrying out the project	0,73	4,01	7,68	10,63	14,33	19,59	26,71	28,11
Accumulated savings, 2013 onwards					14,33	33,92	60,63	88,75

Source: Table T-7-7.

Table 4-22: Annual savings to the local administration from carrying out the project compared to the do-minimum option, 2017-2024, million Euro.

Option O8 - Summary excl investments	2017	2018	2019	2020	2021	2022	2023	2024
Transitional subsidy without the project	26,54	25,29	23,92	21,65	19,69	17,55	15,40	13,06
Transitional subsidy with the project	-	-	-	-	-	-	-	-
Savings from carrying out the project	26,54	25,29	23,92	21,65	19,69	17,55	15,40	13,06
Accumulated savings, 2013 onwards	115,29	140,58	164,50	186,15	205,84	223,39	238,79	251,86

Source: Table T-7-7.

Tables 4-21 and 4-22 indicate that the savings to the local administration from carrying out the project will exceed 100 million Euro in 2017, when calculating the savings from year of commissioning of the investment, year 2013 onwards.

The assessment of the financial capacity of the municipality to cover the transitional subsidy is based on latest historical information. This is provided in Table 4-23 below.

Table 4-23: Extracts of municipality budgets, 2007 and 2008, million RON and million Euro.

	2007, Million RON	2008, Million RON	2007, Million EUR	2008, Million EUR
Own revenue	378,56	565,14	106,94	159,64
Fuel subsidies from central government budget (income)	27,60	40,37	7,80	11,40
Heat subsidies from municipality budget (expenditure)	79,70	132,02	22,51	37,29
- Of which: for rehabilitation of DH assets		8,21		2,32

Source: Municipality of Timisoara.

Table 4-23 shows that in 2008 the fuel subsidies from the central government budget reached 11,40 million Euro, while heat subsidies from the municipality budget for the DH system and its consumers amounted to 37,29 million Euro. When comparing the required future transitional subsidies with the historical subsidies, it appears that the required future subsidies are within the framework of funds allocated from the expense budget of the municipality, also , once the future subsidy starts to reduce, appear to allow allocation of funds for rehabilitation of the DH system.

4.9: The royalty issue

In the Institutional Analysis, the future roles and responsibilities of the local administration and the operator of DH services are discussed in detail. It was felt necessary to include in the present cost-benefit analysis a section on future payments between the owner and the operator.

Assuming that the entire production facilities as well as the transmission and distribution networks are owned by the municipality, and provided that the contractual relations between the municipality and the DH provider be changed into a classical concession relationship, the financial flows between the DH provider and the municipality would consist of a royalty, which should be modeled to cover:

- Historic depreciation of the assets;
- Depreciation of new assets (in addition to those funded by grants); and
- Financial costs such as fees and interests.

In addition, and probably to be managed separately from the above, a dividend payment could be linked to the net assets. This presupposes that the owner will require that the operations generate a competitive dividend on the capital provided:

- Dividend on net assets owned.

These royalty items are included in Table 4-24.

Table 4-24: Depreciation, financial costs and dividend, Million Euro, 2009-2016

	2009	2010	2011	2012	2013	2014	2015	2016
Historic depreciation	4,26	3,67	3,47	3,23	3,08	2,99	2,89	2,76
Depreciation on additional assets	X	X	X	X	X	X	X	X
Financial costs	X	X	X	X	X	X	X	X
Dividend	X	X	X	X	X	X	X	X

Source: Table T-0-2.

As the table illustrates, at present only historic depreciation is known. Depreciation on additional assets should be added in accordance with the lifetime of such new assets, while financial costs would consist of fees and interests for credits taken by the municipality to finance investments in the DH system. Finally, dividend payments should be modeled subject to the dividend policy to be applied.

At present only the historic depreciation is known. The three other items depend on the restructuring of the agreements between the municipality and the operator.

Adding the three items would have to be matched by additional transitional subsidies, until the tariff constraint of 8,50% of disposable household income is no longer a binding constraint. This is expected to happen in 2016. Therefore, for the period 2009-2015, royalty and dividend must be funded by transitional subsidies, until efficiency effects start having an effect on operating costs. Then, the efficiency effects are expected to be sufficient, and over time – more than sufficient - to finance the royalty and dividend costs. Thus, the royalty and dividend costs will extend the period of transitional subsidies, but only until efficiency effects are achieved.

4.10 Separation of financial flows

In the following lines, the financial flows are separated according to two sets of criteria: Production and distribution, and heat and electricity.

Production and distribution

For transparency reasons and as background information, a separation of the future financial flows of the selected option along the main types of services was carried out. Ideally, a breakdown would distinguish between costs for production, transmission, distribution and supply, but in the present case such degree of detail is not achievable. Table 4-25 shows a breakdown between production (including transmission) and distribution. Supply services are embedded in other accounts. The table illustrates how the eventual separation between production (including transmission) and distribution would look like. However, it does not take into account a breakdown between heat and electricity.

Table 4-25: Separation of financial flows: Production and distribution, million Euro, 2009-2016.

	2009	2010	2011	2012	2013	2014	2015	2016
Production								
Fuel	47,00	51,19	55,80	64,75	60,80	60,80	60,80	60,80
Transmission pumping and internal services	0,90	0,95	1,01	1,05	1,05	1,05	1,05	1,05
DESOX	-	-	-	-	1,20	1,20	1,20	1,20
Historic depreciation	2,73	2,59	2,50	2,38	2,32	2,28	2,26	2,16
Maintenance	5,30	5,30	5,30	5,30	3,97	3,97	3,97	3,97
Salaries	5,65	5,65	5,65	5,65	5,65	4,24	4,24	4,24
Total	**61,57**	**65,67**	**70,25**	**79,13**	**74,99**	**73,54**	**73,52**	**73,43**
Distribution								
Pumping	1,81	1,86	1,94	1,95	1,95	1,95	1,95	1,95
Historic depreciation	1,54	1,08	0,97	0,85	0,76	0,71	0,63	0,59
Maintenance	3,01	3,01	3,01	3,08	3,08	3,08	3,08	2,32
Salaries	4,90	4,90	4,90	4,90	3,49	4,90	4,90	3,67
Total	**11,25**	**10,85**	**10,81**	**10,78**	**9,28**	**10,64**	**10,56**	**8,54**
Grand total	**72,82**	**76,52**	**81,07**	**89,91**	**84,27**	**84,18**	**84,08**	**81,97**

Source: Table T-2-1 B.

Heat and electricity

The allocation of costs to heat and electricity, following the ANRE methodology, is illustrated below.

Table 4-26: Costs allocated to DH services (ANRE methodology), million Euro, 2009-2014.

	2009	2010	2011	2012	2013	2014
Cost of gas	39,19	43,10	47,41	46,94	42,29	42,29
Cost of other fuel	3,85	3,85	3,85	3,85	5,22	5,22
Staff	10,14	10,14	10,14	9,72	8,52	8,52
Maintenance	7,90	7,90	7,90	7,61	6,48	6,48
Electricity costs transmission	0,82	0,86	0,92	0,96	0,96	0,96
Electricity costs distribution	1,81	1,86	1,94	1,95	1,95	1,95
Electr. Costs internal services	0,08	0,09	0,09	0,09	0,09	0,09
DESOX	-	-	-	-	1,20	1,20
CO2 penalties	-	-	-	-	-	-
Historic depreciation to heat	4,18	3,59	3,40	2,74	2,61	2,53
Total, excluding profit	**67,96**	**71,39**	**75,64**	**73,87**	**69,33**	**69,25**

Source: Table T-13-3.

Table 4-27: Costs allocated to electricity production (ANRE methodology), million Euro, 2009-2014.

	2009	2010	2011	2012	2013	2014
Cost of gas	2,69	2,96	3,25	12,86	11,78	11,78
Cost of other fuel	1,28	1,28	1,28	1,11	1,50	1,50
Staff	0,41	0,41	0,41	0,83	0,62	0,62
Maintenance	0,40	0,40	0,40	0,76	0,57	0,57
Electricity costs transmission	-	-	-	-	-	-
Electricity costs distribution	-	-	-	-	-	-
Electr. Costs internal services	-	-	-	-	-	-
DESOX	-	-	-	-	0,00	0,00
CO2 penalties	0,27	0,27	0,28	1,39	-	-
Historic depreciation to heat	0,08	0,08	0,07	0,48	0,47	0,46
Total, excluding profit	**5,14**	**5,40**	**5,71**	**17,43**	**14,94**	**14,93**
Memo: Electricity produced, MWh	83.135	83.135	83.135	246.293	246.293	246.293

Sources: Table T-13-4 and Table T-0-30.

By deducting the costs allocated to electricity from the total costs allocated to production of heat and electricity, i.e. combining Table 4-25 and Table 4-27, it is possible to calculate the unit costs for heat production and heat distribution. This is shown in Table 4-28 (the costs) and Table 4-29 (the unit costs).

Table 4-28: Financial flows – production and distribution of heat, 2009-2016, million Euro.

HEAT PRODUCTION	2009	2010	2011	2012	2013	2014	2015	2016
Fuel	43,03	46,95	51,26	50,78	47,51	47,51	47,51	47,51
Transmission pumping and central consumption of electricity	0,90	0,95	1,01	1,05	1,05	1,05	1,05	1,05
DESOX	-	-	-	-	1,20	1,20	1,20	1,20
Historic depreciation	2,64	2,51	2,43	1,89	1,85	1,82	1,80	1,72
Maintenance	4,90	4,90	4,90	4,54	3,40	3,40	3,40	3,40
Salaries	5,24	5,24	5,24	4,82	5,03	3,62	3,62	3,62
Total	**56,71**	**60,54**	**64,83**	**63,09**	**60,05**	**58,60**	**58,59**	**58,51**
HEAT DISTRIBUTION	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Pumping	1,81	1,86	1,94	1,95	1,95	1,95	1,95	1,95
Historic depreciation	1,54	1,08	0,97	0,85	0,76	0,71	0,63	0,59
Maintenance	3,01	3,01	3,01	3,08	3,08	3,08	3,08	2,32
Salaries	4,90	4,90	4,90	4,90	3,49	4,90	4,90	3,67
Total	**11,25**	**10,85**	**10,81**	**10,78**	**9,28**	**10,64**	**10,56**	**8,54**
Grand total	**67,96**	**71,39**	**75,64**	**73,87**	**69,33**	**69,25**	**69,15**	**67,06**

Source: Table T-13-7.

Table 4-29: Computed unit costs for production and distribution of heat, 2009-2016, Euro/GJ.

	2009	2010	2011	2012	2013	2014	2015	2016
Heat production costs, million Euro	56,71	60,54	64,83	63,09	60,05	58,60	58,59	58,51
Heat distribution costs, million Euro	11,25	10,85	10,81	10,78	9,28	10,64	10,56	8,54
Total heat demand, TJ	4056	4056	4056	4056	4056	4056	4056	4056
Full cost recovery unit cost, heat production, EuroGJ	13,98	14,93	15,98	15,55	14,80	14,45	14,45	14,43
Full cost recovery unit cost, heat distribution, Euro/GJ	2,77	2,67	2,67	2,66	2,29	2,62	2,60	2,11
Total unit cost, Euro/GJ	16,76	17,60	18,65	18,21	17,09	17,07	17,05	16,53

Source: Table T-13-8.

Table 4-28 and 4-29 provide an indication of the costs of production and distribution of heat, and the related unit costs (excluding VAT), which would be applied in a situation where production costs and distribution costs were to be separated.

4.11 Key conclusions of the financial analysis

The preferred investment option fulfils the requirements of eligibility for funding under the EU Cohesion Fund, as the financial net present value is negative (minus 45,92 million Euro). After the commissioning of the project, the resulting effect on the net cash flow will be negative, because the additional operating costs relating to the new flue gas desulphurization plant exceed savings to be achieved in the heat production unit.

The EU grant will not result in supernormal payoff to the owners of the DH system, as the net present value of cash flows to the owners is negative (minus 23,68 million Euro).

The revenues directly paid by users fall short of operating costs, and a funding gap calculation is therefore not required. Still, the funding gap calculation was carried out for transparency reasons. The project is eligible to an EU grant of 25,34 million Euro, which is 50% of the investment costs. The remaining 50% are expected to be covered by the state (45%) and the municipality (5%). The municipality is also expected to cover the VAT costs of the investments (9,62 million Euro). Based on information on the level of own revenue of the municipality it is assumed that the municipality budget will have the capacity to cover both its contribution to the investment and the VAT on the entire investment amount.

The consumer tariffs are set to start from a level of 5,54% of the average household income in 2009, and to be increased gradually to 8,50% in 2015. The full cost of the DH services will exceed 8,50% until year 2016; thereafter it will decrease. This means that consumers will face tariff increased of up to 15% p.a. (in current prices) until 2015, followed by stable tariffs.

Lower income households will be protected by the existing social subsidy.

While consumer tariffs are being increased, the DH system still requires transitional subsidies. These will remain at a level of approximately 37 million Euro per year for 2009-2011, and will then reduce to zero in 2016.

5. Sensitivity analysis

5.1 Introduction and approach

The regulations of the Cohesion Fund require a risk assessment for major infrastructure and productive investment projects (Article 40 1083/2006 EU Regulations).

The risk assessment consists of studying the probability that the project will achieve a satisfactory performance in terms of net present value and cash flow.

The risk assessment is carried out through the following analytical steps:

- Sensitivity analysis to identify the critical variables and their potential impact in terms of changes in the financial indicators.
- Assessment of the probability distribution of the critical variables.
- Risk analysis to estimate the expected changes in financial indicators, based on the probability distribution of the critical variables.
- Assessment of acceptable levels of risks.
- Recommended actions for prevention of risks.

5.2 Sensitivity analysis

Sensitivity analysis was carried out on the effect of variations in selected variables on the financial net present value in absolute terms. The calculation aimed at determining how much the FNPV/C would change as a result of a 1% variation in an exogenous variable. As the FNPV/C in absolute terms is quite small, variations due to changes in variables are relatively high. Thus, it is assessed that a change of more than 20% would signal high sensitivity, a change around 5-10% would be a sign of medium-size sensitivity, whereas a change closer to 0% would indicate a low sensitivity. The results are shown in the following table.

Table 5-1: Sensitivities.

	FNPV/K, % change	ENPV, % change	B/C ratio, % change	Sensitivity judgment
Base case	- 17,16	-9,17	1,01	
Variable (+/-1%)				
Sales revenue (-)	39,9%	71,1%	-1,0%	High
Gas price (+)	35,6%	68,6%	-1,0%	High
Other fuels price (+)	4,5%	8,1%	0,0%	Low
Electricity costs (+)	2,2%	3,8%	0,0%	Low
DESOX (+)	0,6%	1,1%	0,0%	Low
Labour costs (+)	6,5%	11,6%	0,0%	Medium
Maintenance costs (+)	5,1%	8,1%	0,0%	Medium
Investment costs (+)	1,3%	4,7%	0,0%	Medium
Financial discount rate (-1 pct-point)	-4,6%	0,0%	0,0%	Medium
Economic discount rate (-1 pct-point)	0,0%	-19,3%	0,0%	High
Switching value financial discount rate				-1,4%
Switching value economic discount rate				2,2%

Source: Table T-10-7

5.3 Critical variables

As illustrated by the above table, critical values include sales revenue and gas price, while price changes in labor, maintenance and investment costs would have less impact on the financial indicator.

The base case values of FNPV/K, ENPV and the B/C ratio are calculated on absolute terms, hence these values of the FNPV/K and the ENPV differ from those calculated in the part of the analysis based on incremental values compared to the do-minimum option.

Changes in other fuels costs, electricity costs and desulphurization costs would have a low impact on the project's performance indicators, while the impact of labor and maintenance costs would be characterized as medium.

The B/C ratio of the base case is 1,01.

6. Risk Analysis

6.1 Probability distribution of the critical variables

The probability distribution of the critical variables to be Gaussian was assessed. This is equivalent to assuming that the future values of critical variables will be identical to their estimated values – year by year – with a stochastic error. The relative magnitude of this error is expressed by the standard deviation or variance. In the following each variable will be assessed with respect to possible biases as well as the magnitude of the standard error.

For sales revenue, i.e. the effect of tariff increases on consumption of heat, one would expect a negative elasticity, say of 20%. A reduction in consumption, however, will result in reduced variable costs, hence will have a limited impact on the cash flow of the operator.

For the gas price, the probability distribution would have a larger standard deviation. The expected upward movement of the gas price over time has been incorporated by assuming an upward trend of the gas price from a starting point at 300 Euro per 1000 m3 to a level of 400 Euro per 1000 m3, following recommendations by EIB. Due to this assumption the gas price would not be biased.

Investment costs, as well, are assessed to be easier to predict, also bearing in mind that all investments are to be carried out during the initial years of the reference period. The mean values would be close to the estimates, and the standard deviation small.

Table 5-2: Distributions, biases and standard deviations of main variables.

Variables	Applied to	Distribution	Any bias	Standard deviation
Sales revenue	Financial	Gaussian	Downward, (short run)	Medium
Gas price	Financial	Gaussian	None	High
Investment costs	Financial	Gaussian	None	Low

Estimated values were calculated, while standard deviation values were not calculated.

6. 2 General assessment of risks

The main risks to the sales revenue would be linked to competition to district heating from other solutions, such as individualized heating based on gas boilers in each housing block, heat pumps, electric heaters, etc.

Secondly, non-payment of bills is assessed a risk during initial years, linked to the gradual introduction of the full cost recovery mechanism. In general, lower collection rates could occur if the heating services were to become unaffordable for significant segments of the consumers.

Besides, a lasting reduction in the heat consumption is likely to take place due to changes to the consumers' behavior caused by the jump in heat price (lower room temperatures and reduced hot tap water consumption), but the risk due to this is limited, as variable costs will change downward with consumption.

Being a raw material, the price of natural gas has higher fluctuations, materializing largely in parallel with the international business cycle. The interest concentrates on the risk for upward movement in the gas price, which would occur during upturns of the international business cycle, and might also occur as a result of general economic growth in the longer term. The cost risk associated with higher gas prices has been taken into account in the design of the DH production facility, being in a position to switch to alternative fuels such as lignite, hard coal and bio-fuels, the unit costs of which would be less sensitive to changes in the business cycle.

Other operating costs are seen as more controllable, although deviations from the technologically determined minimum could occur if the cost control and auditing were ineffective. Cost increases can be transferred to the tariffs, and there would be scope for close monitoring of the costing mechanism, based on domestic as well as international benchmarks. As long as tariffs are affordable, cost increases pose little risk. If costs result in tariff increases beyond affordable levels, then collection rates might be at risk.

Investment costs could deviate from the expected levels, if deviations from normal, internationally accepted procurement rules were tolerated. Due to the design of the procurement process in the present case the risk of this type of events is assessed to be quite limited.

In addition to the above-mentioned major risks within the cost-benefit analysis, a number of mainly short-term risks related to the timeliness of agreements and financing arrangements, are discussed in the Institutional Report.

6.3 Assessment of acceptable levels of risks

Due to the budgeting model whereby the tariff is established on a cost-plus basis with an in-built profit margin on costs of 5%, all cost changes occurring in one year would be compensated in the following year. Thus, the tariff model works as a risk minimizing mechanism.

While sales decreases and cost increases are recovered by tariff increases, the real risk is in the escalation of the tariff level during the first years of the reference period. Thus, actions must be taken first of all to minimize reductions in sales revenue, and also to prevent increases in operating costs and investment costs.

Mainly due to tariff considerations, a reduction in sales revenue of, say, 5%, could be accepted for a single year, but should be eliminated during the following one or two years. Similarly, increases on operating costs of, say, 10%, could be accepted for a single year, but should be eliminated over the following one or two years. For investment costs, a somewhat higher risk would be acceptable, say a 20% overrun during a single year – again, such overruns should be eliminated during the subsequent years.

Overall conclusions of the CBA

Option O8 is the preferred option, and it is feasible, but only affordable, if it is combined with a social subsidy system that covers costs of phasing in the full cost recovery tariff.

The municipality of Timisoara will be eligible for a grant under the Cohesion Fund, provided that it ensures additional equity funding to the project.

The maximum EU grant is calculated to 25,34 million Euro, based on a tariff starting at 5,54% of the average household income, increasing gradually towards the full cost recovery level, but never exceeding 8,50%.

The main problem remains the practical steps that have to be taken by the local authority, namely local decisions, risk mitigation measures or actions to ensure the sustainability of the investments. This issue is dealt with extensively in the Institutional Analysis. From a financial point of view, and in line with the above financial risk assessment, the following is concluded:

The **main risks** and the **recommended actions** (in connection with the institutional analysis) include:

1. **Sales revenue risk** should be addressed by the following:

- Decision regarding future *tariff policy* (gradual increase from 5,54% in 2009 to maximum 8,50% of average household income in 2015).
- Ensuring the capacity of the municipality to cover the required *transitional subsidy* without delay.

- There could be a case of ensuring *timely payment* of the transitional subsidy to avoid liquidity problems of the DH operator;
- Improving the *fee collection* (mechanism to deal with the unpaid bills) – action local authority to be prepared by the local authority together with the operator;
- Design and implementation of an *awareness campaign* (mainly informing the consumers about the anticipated changes of the heating costs).

2. **Risk on operating costs** should be mitigated as follows:

- Initiate *cost-reducing reforms* at the operator with a view to reduce costs;
- Initiate *improved cost planning, budgeting and control* of the operator; action plan required in parallel with the submission with the application (but before the financing contract is signed);

7. Tariff Study

7.1 Competition and tariff setting

District heating is supplied to a market in competition with alternative heating solutions, notably the individualized solution. In order to avoid disconnections and thus loss of customers the DH must be competitive on price. The unit cost of the alternative to district heating is the unit cost of the decentralized solution. In the pre-feasibility Local heating strategy Study the unit costs of district heating solutions were compared to the unit costs of the decentralized solution. The district heating solutions based on co-generation were found to be competitive, assuming that electricity sales revenues were incorporated in the heat tariff setting mechanism.

7.2 Implementation of the polluter pays principle

The polluter pays principle refers to a situation where the final consumers pay the full costs of the services including the costs of mitigating the environmental effects of the services.

Coming from a past where the producers of heat paid only part of the cost of the inputs necessary for producing the heating services, and where the final consumers also paid only part of the full costs, the government of Romania decided to remove these subsidies to producers and consumers. While the fuel subsidy was removed as from 2009, the tariff subsidy remained in place and is not expected to continue over a transitional period up until 2015.

7.3 Affordability

The full cost recovery analysis is based on information on average income per person and average number of persons per household. Statistical data on household income distribution as a national average are available up until year 2005. For 2007 data were extrapolated on the basis of the growth in GDP per capita[15] .

The information is shown in the following table.

[15] GDP per capita in current prices: in 2007 was 18.736 RON, and in 2005 was 13.333 RON. The ratio between the two was 1,40.

Table 7-1: Household income distribution, deciles, 2005 and 2007, national figures - and 2007, figures for Timisoara.

Deciles (range of income per person, 2005)	RON per household per month, 2005	EUR per household per month, 2005	RON monthly, per household, 2007	EUR per household per month, national, 2007	EUR per household per month, 2007, Timisoara
1	2	3	4	5	6
Decile # 10 (689 +)	2.772	766	3.881	1.162	1.638
Decile # 9 (500-688)	1.751	484	2.451	734	1.035
Decile # 8 (404-500)	1.408	389	1.971	590	832
Decile # 7 (340-404)	1.181	326	1.653	495	698
Decile # 6 (289-340)	1.055	291	1.477	442	623
Decile # 5 (241-289)	997	275	1.396	418	589
Decile # 4 (194-241)	883	244	1.236	370	522
Decile # 3 (152-195)	781	216	1.093	327	461
Decile # 2 (104-152)	706	195	988	296	417
Decile # 1 (1-104)	587	162	822	246	**347**
Average, 2005 (412)	1.212	335	x	x	
Average, 2007 (577)	x	x	**1.697**	508	680

Reference: Local heating strategy Timisoara, Table 2.5.1-8.
Source, rows 2 and 4: Romanian Statistical Yearbook 2006, Tables 4.1, 4.2, 4.3, 4.4.
Source, row 6: Table T-9-2.

On the basis of an average household size of 2,94 persons in 2005 the average household income was RON 1.212 per month. The lowest income decile, i.e. the ten percent of the population with the lowest per capita income, had an average household income of RON 587 per month, or **roughly half of the average**, while the highest income decile had an average household income of RON 2.772 per month.

Based on GDP projections, from 2005 to 2007 the average household income increased by a factor 1,4. Thus, in 2007 the average household income had increased to 1.697 RON per month, and the income of the lowest decile had reached 822 RON per household per month.

The income distribution is taken a step further in the following table, where households are classified according to main source of income, i.e.: “Employees”, “Unemployed” and “Pensioners”.

Table 7-2: Household income distribution, national, breakdown on household categories, deciles, year 2005 and 2007, RON per month.

Deciles (range of income per person)	All households	Employees	Unemployed	Pensioners
Decile # 10	10%	20,9%	2,0%	3,9%
Decile # 9	10%	17,6%	3,3%	6,6%
Decile # 8	10%	14,5%	4,6%	9,0%
Decile # 7	10%	11,2%	5,0%	11,6%
Decile # 6	10%	9,4%	6,1%	12,8%
Decile # 5	10%	9,0%	9,7%	11,9%

Decile # 4	10%	7,1%	12,6%	12,4%
Decile # 3	10%	5,1%	12,1%	12,7%
Decile # 2	10%	3,9%	16,1%	11,4%
Decile # 1	10%	1,3%	27,7%	7,7%
Totals	**100%**	**100%**	**100%**	**100%**
Average income, 2005, RON/month	**1.212**	**1.682**	**828**	**922**
Average income, 2007, RON/month	**1.697**	**2.355**	**1.159**	**1.291**
Deviation from average	**0%**	**+39%**	**-34%**	**-24%**

Reference: Local heating strategy Timisoara, Table 2.5.1-9.

Source: Romanian Statistical Yearbook, Tables 4.1 and 4.4.

While by definition the decile distribution of all households allocates 10,0% of all households to each income decile, the distribution patterns of the four household categories deviate significantly, as illustrated in the table. Cells with more than 10% are highlighted. The table illustrates that 50% of households categorised as "Employees" are located in the three highest deciles, more than 80% are in deciles 5-10, and only 5% are in the two lowest deciles.

Similarly, more than 75% of all "Unemployed" households have incomes in the four lowest income deciles. Incomes of "Pensioner" households are more evenly distributed over the income deciles.

The average income of the West Development Region in 2007 was 664 RON per capita per month. Assuming a household size of 2,94 persons, the average household income in 2007 was **1.952 RON per month**.

Table 7-3: Household incomes in the West Development Region and in Timisoara, 2007.

	West Development Region, RON per household per month	**Timisoara, "employee" households, RON per household per month**	**Timisoara, "pensioner" households, RON per household per month**	**Timisoara, average household, RON per household per month**	**Timisoara, average household, EUR per household per month**
Relative level, 2007	100%	139%	76%	X	X
Actual level, 2007	1.952	2.713	1.484	X	X
Share of population	x	75%	25%	X	X
Average household income	x	X	x	2.406	680

Reference: Local heating strategy Timisoara, Table 2.5.2-8.

As illustrated in the above table, based on the assumption that the city population is combined of approximately three quarters of "Employees" households and one quarter of "Pensioners"[16], in 2007 these two consumer segments had average household incomes of 2.713 RON and 1.484 RON per month, respectively. The resulting average household income in Timisoara was 2.406 RON per month (680 EUR per month), or **41% above the national average** (1.697 RON per month).

7.4 Consumption

Law No. 933/2004 established a deadline of 30 June 2006 for all housing blocks to be equipped with housing block heat consumption meters, and a deadline of 31 July 2007 for all individual apartments to be equipped with meters for hot tap water. The law was modified by Government Decision no. 609/2007, extending the deadline for establishing individual metering to June, 2009. For Timisoara, by the end of 2006, all housing blocks had heat metering at the entrance, whereas the consumption of cold and hot water was metered individually in each apartment. During 2007 and 2008 more modern hot water meters were purchased. [17]

On the basis of the above, it is assumed that in Timisoara in 2009 the majority of households will have individual hot tap water consumption meters, and that the coverage will approach 100% within a few years time.

[16] Disregarding the segments of agriculture and unemployed.
[17] Source: www.primariatm.ro.

The average heat consumption, on an annual basis, is calculated on the basis of total heat demand, total heated area and the average size of a household of 60 m2. Reduced heat demand over time is taken into account.[18]

The following table shows the affordability of the average consumption for the average household income and for the household income in decile 1.

Table 7-4: Production costs, consumer costs and affordability, Timisoara, 2007.

	Timisoara, average household income, per month	**Heat production unit cost per MWh and per GJ**	**Consumer tariffs per MWh and per GJ**	**Heat production cost per household per month**	**Consumer cost per household per month**	**Production cost, % of household income**	**Consumer cost, % of household income**
1	**2**	**3**	**4**	**5**	**6**	**7=5/2**	**8=6/2**
Average household		**Per MWh**	**Per MWh**	**Consumption = 3,225 GJ or 0,90 MWh**	**Consumption = 3,225 GJ or 0,90 MWh**	**Consumption = 3,225 GJ or 0,90 MWh**	**Consumption = 3,225 GJ or 0,90 MWh**
Currency: RON	2.406	189,73	106,83	170,76	96,15	7,10%	4,00%
Currency: EUR	680	**53,60**	**30,18**	**48,24**	**27,16**	7,10%	4,00%
Decile # 1 household							
Currency: RON	1.228	189.73	106.83	170,76	96,15	13,91%	7,83%
Currency: EUR	347	53.60	30.18	48,24	27,16	13,91%	7,83%
Tariffs per GJ		**Per GJ**	**Per GJ**				
Currency: RON		52.70	29.68				
Currency: EUR		**14.89**	**8.38**				

Note: Exchange rate: 3,54 RON/EUR

The table above compares heat production costs with household incomes for the average income level and income decile # 1, i.e. the 10% of the population with the lowest income. It does not take into account any social subsidies, but illustrates in columns 3 and 4 the difference between unit costs and consumer tariffs. In columns 5 and 6 the difference between production costs and consumer costs are provided for the average household consumption, and in columns 7 and 8 the affordability is shown. The upper third part of the table deals with the average income household, while the middle part deals with the decile 1 household. The low income part transforms the production unit costs and consumer tariffs from MWh to GJ.

On the basis of Table 7-4 the following conclusions can be drawn for the situation in 2007:

- The unit cost was 53,60 Euro per MWh, or 14,89 Euro per GJ.
- The consumers were charged 30,18 Euro per MWh or 8,38 Euro per GJ.

[18] Please refer to the Local heating strategy, chapter 3.4.2.

- With a consumption of 3,225 GJ or 0,90 MWh per month (on a 12 months basis) households were charged a heating fee of 27,16 Euro per month.
- The heating fee charged was equivalent to 4,0% of the income of the average household, and to 7,83% of the income of the decile 1 household.
- The full cost of heat was equivalent to 7,10% of the income of the average household, and to 13,91% of the income of the decile 1 household.

The above calculations should be corrected for VAT and income taxes. With a VAT rate of 19% the heating fee including VAT would be 32,32 Euro per month. With income taxes of 12,7% of total income the heating fee would be equivalent to 32,32 / (680 * 0,873) = 32,32 / 594 = 5,44% of the average disposable household income. Similarly, for decile 1, the heating fee would be 32,32 / 303 = 10,67% of disposable household income.

7.5 The present and the future subsidy systems

The present subsidy system includes a producer subsidy and a consumer subsidy. The consumer tariff is set autonomously as a Local Reference Price (LRP) (GO 36/2006, based on ANRE and ANRSC decision). The LRP is set up according to a methodology published in the Official Gazette No 815/03.10.2006 based on the following formula:

LRP = Ph – S/la – S/sb

where

- Ph is the cost of heat including production, transport and distribution, approved by ANRE (RON/Gcal)
- S/la is the subvention from the Public Local Authorities (minimum 10% of the Ph) (RON/Gcal)
- S/sb is the subvention from the Central State Budget to the producer for compensating the fuel costs (maximum 45% of the fuel costs incurred by the producer when producing the total heat quantities).

S/la and S/sb are producer subsidies.

On the basis of the LRP, the ANSRC establishes the final consumer tariff, which may differ from the LRP.

The consumers are paying to the DH Companies only the final tariff, while the DH Company will request the difference by charging the amounts to the municipal budget. The fuel subsidy is removed as from 2009, while the tariff subsidy is expected to remain active for a transitional period up until 2015.

In addition, the consumers are entitled to consumer subsidies on social grounds. The legal basis for the consumer subsidies is Emergency Governmental Ordinance EGO57/30.08.2006 with changes to the EGO5/20.12.2003 regarding facilities to be granted to the population for payment of the heat consumption.

The consumers are entitled to receive the subsidy according to the Local Authorities' Decisions. The Decisions are based on the income statements per household collected by the representatives of the Owners/Tenants Associations or per individual house if the case.

Besides, consumers are entitled to social subsidies that are not directly linked to specific costs like heating. Such subsidies are expected to remain in place also after 2008.

In the season 2007-2008, the social subsidies were provided by the municipal budget according to the following schedule (Left-hand part of Table 7-5 showing the first half of the season in Autumn 2007). Heat bills based on full costs and social subsidies are calculated (Column 7 of Table 7-5).

Table 7-5: Subsidies for heating, percentage of heat bill according to net income per family member, 2007.

	Average income per person, lower bracket, RON per month	**Average income per persons, upper bracket, RON per month**	**Average income per person, lower bracket, EUR per month**	**Average income per person, upper bracket, EUR per month**	**Subsidy percentage**	**Heat cost based on subsidised fee**	**Heat cost based on full cost recovery fee**
	1	**2**	**3**	**4**	**5**	**6**	**7**
Interval Number	**Autumn 2007**					**Subsidised heat cost = 27,16 Euro**	**Full cost recovery heat cost = 48,24 Euro**
1	0	125	0,00	35,31	90%	2,72	4,82
2	125.1	170	35,31	48,02	80%	5,43	9,65
3	170.1	210	48,02	59,32	70%	8,15	14,47
4	210.1	250	59,32	70,62	60%	10,86	19,30
5	250.1	290	70,62	81,92	50%	13,58	24,12
6	290.1	345	81,92	97,46	40%	16,30	28,94
7	345.1	390	97,46	110,17	30%	19,01	33,77
8	390.1	440	110,17	124,29	20%	21,73	38,59
9	440.1	500	124,29	141,24	10%	24,44	43,42

Reference: Local heating strategy Timisoara, Table 2.6.5-11.
Source: HG 1197/2007, published in OJ 687/2007.

This table links subsidies to personal incomes. Columns 6 and 7 calculate the heat costs after subsidies for each of the ten income groups.

The heat cost is based on an average dwelling of 60 m2.

According to Table 7-5, by comparing column 7 with column 1, it can be concluded that no household would pay more than 12% of their income for heat[19].

7.6 The future affordability of DH

The first step of the affordability analysis is the calculation of heat consumption per household, based on an average household size of 60 m2. The average heat consumption per household is 3,23 GJ per month (Table T-9-1).

The second step is the calculation of income growth scenarios, where an equilibrium scenario, a pessimistic and an optimistic scenario are computed on a deciles basis (upper part of Tables T-9-2, T-9-3 and T-9-4).

The third step is the calculation of the affordability ratio, i.e. the heat cost in percentage of the household income. This is done on a deciles basis (lower part of Tables T-9-2, T-9-3 and T-9-4).

The fourth step is the analysis of the affordability ratios.

The fifth step is the calculation of the required transitional subsidy. This is done in Table T-7-4.

7.7 A comment on tariff methodologies.

The basic principles for the formation of full cost recovery tariffs are illustrated in the table below. The full cost recovery tariffs together with the consumer tariffs determine the subsidies that operators will be entitled to. The full cost recovery tariffs are calculated according to an ANRE methodology, while the consumer tariffs are established by ANRSC on the basis of local reference prices (LRP).

Column 1 describes the cost items. Column 2 describes the model according to the balancing tariff methodology, whereby heat is treated as the main product, and electricity is a by-product. Columns 3 and 4 describe how costs are allocated to heat and electricity under the current ANRE methodology.

---

[19] Calculation, for interval 9, columns 7 and 1: 43,42 Euro/HH/month / 440,1 RON/person/month/2,94 persons per HH /3,54 RON/EUR = 0,118 = 11,8%. Similar calculation for remaining intervals.

Table 7-6: Tariff methodologies.

1	2	3	4
Cost item	**Balancing tariff methodology**	**ANRE methodology for Heat tariff**	**ANRE methodology for Electricity tariff**
Fuel costs	All fuel costs for cogeneration	1 MWh fuel per MWh heat produced, say X	Residual fuel cost, say Y
Allocation model for other variable costs	N/A	Kh = X/(X+Y)	Ke = Y/(X+Y)
Other variable costs	All other variable costs, say Z	Zh = Z*Kh	Ze = Z*Ke
Fixed costs	All fixed costs	A share proportional to production	A share proportional to production
Electricity sales revenue	Deduct all electricity sales including high efficiency co-generation bonus	No deduction	Deduct co-generation bonus only
Net cost	Gross cost minus revenues from electricity sales	Allocated cost, no deduction of revenues from electricity sales	Allocated costs minus revenues from the co-generation bonus
Tariff including a 5% profit for the Operator	Net cost divided by amount of heat sold	Allocated cost divided by the amount of heat sold	Allocated cost divided by the amount of electricity sold
Tariff methodology	Balancing	Allocated cost	Allocated cost

The causality of components in the tariff calculation under the two alternative tariff methodologies is illustrated in the following table.

Table 7-7: Causalities in tariff methodologies.

Methodology	Entity	Level 1	Level 2	Level 3	Level 4
Balancing					
	Total operating costs	X			
	Electricity price (exogenous, market or agreement)	X			
	Revenues from sales of electricity	X			
	Amount of heat sold	X			
	Heat tariff		X		
Allocated costs					
	Fuel costs for heating	X			
	Fuel costs for electricity		X		
	Other variable costs for heating			X	
	Other variable costs for electricity			X	
	Fixed costs for heating	X			
	Fixed costs for electricity	X			
	Bonus from sales of electricity	X			

	Amount of heat sold	X			
	Amount of electricity sold	X			
	Heat tariff				X
	Electricity tariff				X

Under the balancing tariff methodology all costs of co-generation, the electricity price and revenues from sales of electricity precede the heat tariff, and the model does not generate a tariff for electricity, as electricity is sold to the grid at exogenously determined market (or agreement) prices. Thus, under this methodology there is only one product, heat, for which a tariff is determined, as illustrated in the above table, where heat tariff is determined at level 2.

Under the allocated cost methodology[20], variable costs are allocated according to a key determined by the total fuel input in terms of MWh, whereby 1MWh of fuel is allocated to each MWh heat produced. The residual fuel cost is allocated to electricity. The allocation key hereby established is applied to other variable costs, while the allocation of fixed costs is made "proportionally to delivered quantities"[21]. Revenues from sales of electricity are not taken into account, as they result from the tariff calculated, but revenues from the high efficiency co-generation bonus, where tariffs are predetermined, are allocated fully to the electricity production. Under this methodology two tariffs are set in parallel: One for heat, and one for electricity. Thus, this methodology allows the producer to sell electricity at a cost-plus tariff, while under the balancing tariff methodology the surplus electricity would be sold at an exogenous price (market price or agreement price) not linked to the specific production. Clearly there is a conflict between setting a cost-plus tariff and being a price-taker on the electricity market.

All in all, under the balancing methodology there is one product, while under the allocated cost model there are two products.

The result of applying the balancing or the cost allocation model depends on the relative magnitudes of the costs and the electricity sales. The cost allocation model would allocate an estimated 40-50% of all costs to heating, but would not allow any deduction of revenue from sales of electricity. The balancing model would allocate 100% of costs to heat production, and would allow full deduction of revenues from electricity sales before calculating the tariff.

[20] Please refer to Art. 33 of the Methodology.
[21] Please refer to Art. 33 c) of the Methodology.

Annex 5. Basic macro-economic assumptions

The following tables are provided for reference of past and future growth rates, household consumption, population growth, population served, number of households served and service coverage. This information forms part of the assumptions for the cost-benefit calculations.

Table A.5.1-1: Macro-economic assumptions, 2005-2008

		2005	2006	2007	2008
Real GDP growth, equilibrium scenario	pct.	4,10	7,70	6,10	6,50
Real GDP growth, pessimistic scenario	pct.	n/a	n/a	n/a	n/a
Real GDP growth, optimistic scenario	pct.	n/a	n/a	n/a	n/a
Exchange rate	RON/Euro			3,54	3,55
Inflation rate (Romania)	Pct.p.a.			4,84%	7,85%

Table A.5.1-2: Macro-economic assumptions, 2009-2018

		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Real GDP growth, equilibrium scenario	pct.	-4,00%	0,10%	2,40%	3,70%	4,40%	5,20%	6,00%	5,70%	5,30%	4,90%
Real GDP growth, pessimistic scenario	pct.	-7,00%	-2,90%	-0,60%	0,70%	1,40%	2,20%	3,00%	2,70%	2,30%	1,90%
Real GDP growth, optimistic scenario	pct.	-1,00%	3,10%	5,40%	6,70%	7,40%	8,20%	9,00%	8,70%	8,30%	7,90%
Exchange rate	RON/Euro	4,25	4,20	4,17	4,12	4,07	4,00	4,00	4,00	4,00	4,00
Inflation rate (Romania)	Pct.p.a.	5,80%	3,50%	3,20%	2,80%	2,50%	2,30%	2,00%	2,00%	2,00%	2,00%

Table A.5.1-3: Macro-economic assumptions, 2019-2028

		2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Real GDP growth, equilibrium scenario	pct.	4,80%	5,00%	4,40%	4,40%	4,40%	4,40%	4,40%	4,40%	4,40%	4,40%
Real GDP growth, pessimistic scenario	pct.	1,80%	2,00%	1,40%	1,40%	1,40%	1,40%	1,40%	1,40%	1,40%	1,40%
Real GDP growth, optimistic scenario	pct.	7,80%	8,00%	7,40%	7,40%	7,40%	7,40%	7,40%	7,40%	7,40%	7,40%
Exchange rate	RON/Euro	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00	4,00
Inflation rate (Romania)	Pct.p.a.	2,00%	2,00%	2,00%	2,00%	2,00%	2,00%	2,00%	2,00%	2,00%	2,00%

Table A.5.2-1: Demand assumptions, 2009-2018

		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total demand	TJ/year	4.056	4.056	4.056	4.056	4.056	4.056	4.056	4.056	4.056	4.056
Total heated area	Million M2	6,28	6,28	6,28	6,28	6,28	6,28	6,28	6,28	6,28	6,28
Heat intensity	GJ/100m2	64,59	64,59	64,59	64,59	64,59	64,59	64,59	64,59	64,59	64,59
Heat intensity per household	GJ/60m2	38,75	38,75	38,75	38,75	38,75	38,75	38,75	38,75	38,75	38,75
Heat consumption, GJ/HH/month	GJ/HH/month	3,23	3,23	3,23	3,23	3,23	3,23	3,23	3,23	3,23	3,23

Table A.5.2-2: Demand assumptions, 2019-2028

		2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Total demand	TJ/year	4.056	4.056	4.056	4.056	4.056	4.056	4.056	4.056	4.056	4.056
Total heated area	Million M2	6,28	6,28	6,28	6,28	6,28	6,28	6,28	6,28	6,28	6,28
Heat intensity	GJ/100m2	64,59	64,59	64,59	64,59	64,59	64,59	64,59	64,59	64,59	64,59
Heat intensity per household	GJ/60m2	38,75	38,75	38,75	38,75	38,75	38,75	38,75	38,75	38,75	38,75
Heat consumption,	GJ/HH/month	3,23	3,23	3,23	3,23	3,23	3,23	3,23	3,23	3,23	3,23

Annex 6: List of assumptions

The “with project” and “without project” scenario assumptions are presented below, specifying demand, investments, O&M costs and revenues.

Table A.6-1: Assumptions regarding demand

Excel table	With project	Without project
T-9-1, T-0-	Unchanged demand. Tariff increases are balanced by economic development.	Demand decreasing by 2% p.a. until 2020, due to disconnections.
T-9-2, T-9-3, T-9-4	Population income scenarios: Pessimistic, optimistic, equilibrium	Population equilibrium income scenario applied.

Table A.6-2: Assumptions regarding investments

Excel table	With project	Without project
T-0-1 and T-1-1 to T-1-5	Priority investments	No investments (included in maintenance)
T-0-25 and T-0-26	Residual value at end of reference period calculated on a 5% profit rate during 15 years after the reference period	Residual value at end of reference period calculated on a 5% profit rate during 15 years after the reference period

Table A.6-3: Assumptions regarding operations and maintenance costs

Excel table	With project	Without project
All	Fixed 2009-prices, except for natural gas and electricity which have specific price projections.	Fixed 2009-prices, except for natural gas and electricity which have specific price projections.
T-11-1 to T-11-5	Shadow prices of CO2 and SO2 assumed to grow in real terms.	Shadow prices of CO2 and SO2 assumed to grow in real terms. CO2 emissions 10% higher than with the project.
T-0-6	Fuel costs based on final consumption plus losses. Savings on other fuels: 2%	Fuel costs based on final consumption plus losses. No savings on other fuels.
T-0-13	Staff costs reduced gradually.	Staff costs 3% higher than in preferred option.
T-3-1 to T-3-5	A social tax on labor, estimated at 28% on top of net salaries, is removed in the economic analysis.	A social tax on labor, estimated at 28% on top of net salaries, is removed in the economic analysis.
T-0-9 and T-0-10	Electricity costs according to technical effectiveness.	Electricity costs 10% higher for transmission and internal services.
T-0-4	No return on capital (no capital provided).	No return on capital (no capital provided).
T-0-2	Depreciation of investments: 30 years. No items have shorter life time.	All present assets are assumed to have a life time of at least 30 years due to maintenance.
T-0-2	Historic depreciation is included in accordance with the depreciation plan of the operator.	Historic depreciation included.
T-0-18	CO2 penalties and possible sales of unused CO2 allowances are excluded from the economic analysis and included in the financial analysis.	CO2 penalties and possible sales of unused CO2 allowances are excluded from the economic analysis and included in the financial analysis.
T-0-12	Fixed maintenance costs gradually reduced.	Fixed maintenance costs gradually reduced; remaining 2% higher than in with project case.

Table A.6-4: Assumptions regarding revenue

Excel table.	With project	Without project
T-9-1	Two revenue tracks are assessed: Balancing tariff and allocated cost tariffs.	Not relevant.
T-0-17 and T-0-17 B	Revenue from electricity sales: Produced amount of electricity times assumed electricity price.	Revenue from electricity sales identical to the with-project revenue.

Table A.6-5: Assumptions regarding financial sustainability

Excel table.	With project	Without project
T-7-1, T-7-7, T-8-1	Cumulated cash flow set to zero each hear in the reference period.	Not relevant.

Table A.6-6: Assumptions regarding funding sources

Excel table.	With project	Without project
T-8-1	EU grant of 25,34 million Euro, central government grant of 22,81 million Euro, and municipality grant of 2,53 million Euro.	Not relevant.