CONSTANTA HEATING INVESTMENT PROGRAM

FINAL REPORT

Prepared for

East European Regional Housing Sector Assistance Project
Project 180-0034
U.S. Agency for International Development, ENI/DG/LGUD
Contract No. EPE-C-00-95-001100-00, RFS No. 813

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April 2000
UI Project 06610-813

ACRONYMS AND SPECIAL TERMS

BRD	Romanian Development Bank
CONEL	National Energy Company of Romania
Congaz	Gas distribution company in Constanta
CRA	Commercial Public Company
DH	District heating
DM	German Mark
EBRD	European Bank for Reconstruction and Development
ECO	Energy conservation opportunity
ESCO	Energy Services Company
EE	Energy efficiency
Electrotek	Private U.S. energy consulting firm
EU	European Union
GB	Gas boilers
Gcal	Gigacalories
ISPA	Instrument for Structural Policies for Pre-Accession, an EU program
I&C	Instrumentation and control, as applied to the district heating system
KWh	Kilowatt hours
Leu (plural *Lei*)	Name of currency in Romania
Local Council *	Elected local council of the Municipality of Constanta
MoF	Ministry of Finance of Romania
Municipality *	Municipality of Constanta
Regia Autonome	Public Company
RADET	Constanta District Heating Company
ROL	Romanian Leu (or Lei)
TE	National Thermoelectric Energy Company, a subsidiary of CONEL
TEC	Constanta Thermoelectric Energy Company, a subsidiary of TE
TEC Palas	“Palas” Thermoelectric Energy Plant (Constanta), owned by TEC
TRV	Thermostatic radiaton valve(s)
USAID	United States Agency for International Development
USD	United States dollar
VAT	Value added tax

* In this report, these generic terms, when capitalized, have the specific meaning described in this table.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

EXECUTIVE SUMMARY

Objective of this report

The objective of this report is twofold. The first is to summarize the findings of an engineering analysis concerning energy efficiency measures in Constanta. [1] This includes both measures to improve the district heating system in Constanta and other measures to improve energy efficiency in public buildings in that city. The analysis includes the estimated costs of the investments and of the savings that will accrue when they have been completed. The second objective of this report is to evaluate options and recommend a plan for financing and implementing these proposed investments.

The team of consultants completed an assessment of the improvements required for different components of the district heating system and of measures to improve energy efficiency in public buildings in Constanta. Based on the results, officials of the Constanta District Heating Company (RADET) and the Municipality of Constanta (Municipality) worked with the team to develop a proposed investment program. The total estimated cost of the investments is $19.5 million, as shown in the following table.

Summary of the Constanta Heating Investment Program

Item No.	Description	Investment				
		Materials	Labor	Design	Total Cost	Total Cost
			(USD)			(ROL 000's) [1]
1	Substations	$8,127,550	$1,991,250	$319,469	$10,438,269	193,107,976
2	Secondary pipes	$2,732,561	$4,242,661	$215,729	$7,190,950	133,032,575
3	Completion of GB 37&47	$45,100	$10,100		$55,200	1,021,200
4	Municipal buildings	$1,265,420	$497,003		$1,762,423	32,604,825
	Total	$12, 170,631	$6,741,014	$535,197	$19,446,842	359,766,577

[1] 18,500 ROL = 1 USD

The following table summarizes the annual savings of $4,750,000 that are anticipated once the investments planned for the Constanta district heating system have been completed. Of these, $4,405,000 corresponds to improvements to the district heating system. The balance would come from energy efficiency measures in school buildings in Constanta.

[1] USAID contracted for two separate technical assessments. As part of the contract to prepare this report, the Urban Institute looked in general terms at the overall condition of the district heating system. The second technical analysis was conducted through a contract between USAID and Electrotek, a private U.S. firm. Electrotek prepared a detailed analysis of the district heating system itself and of alternative energy efficiency measures at the level of public end users, such as schools. Electrotek provided to the Urban Institute the estimates of the cost and phasing of the initial investment program described in this report, as well the estimates of related energy savings. Electrotek has documented their analysis in two reports – the first issued in March 1999, and the second in April 2000. The reader should consult these reports for a more detailed discussion of the technical aspects of the Constanta District Heating System.

Summary of the Savings for the Constanta Investment Program

Item No.	Description	Annual Savings					Simple Payback
		Heat (Gcal)	Electricity (KWh)	Water (m3)	Estimated value (ROL 000's) [1]	(USD) [2]	(years)
1	Substations	257,582	3,835,866		76,494,327	4,134,829	2.5
2	Secondary pipes	13,466		96,732	4,205,468	227,323	31.6
3	Completion of GB 37&47	2,897			822,748	44,473	1.2
4	Municipal Schools	14,477			6,355,403	343,535	5.1
	Total	288,422	3,835,866	96,732	87,877,946	4,750,159	4.1

[1] Monetary conversion (ROL/unit) for each investment type is presented in Annex A-3.
[2] 1 USD = 18,500 ROL

Heating Prices and Subsidies [2]

Throughout this report, we use two scenarios to describe the anticipated evolution of heating prices in Constanta. Scenario A uses the current national average transfer price for thermal energy. That is, it assumes that the policy of cross subsidizing high- and low-cost production in the heating plants belonging to the National Thermoelectric Company (TE) across the country will continue. In this scenario, the price charged by RADET for distribution of heat to end users increases to 127,000 ROL/Gcal to adjust for increases in costs since the Competition Office approved the price.[3] This scenario describes the prices as they should be during the current winter season (1999/2000). Scenario B assumes that prices will be based on the local costs for production of thermal energy in Constanta. For scenario B, we have used an estimate provided by the subsidiary of TE in Constanta (TEC) that the transfer price they charge for thermal energy in Constanta will increase by 40 percent. This reflects the impact both of the higher local production costs and the use of fuels with lower sulfur content as required by environmental regulations. Note that the price charged by RADET will have to increase from 127,000 ROL/Gcal to 155,000 as a consequence of the higher transfer prices charged for thermal energy.[4] This scenario describes anticipated prices for the next winter season (2000/2001).

The following table shows the anticipated evolution of heating prices in Constanta under the two scenarios.

[2] Note: In this report, "price" is used with three different meanings. The "transfer" price is the amount charged by producers for the thermal energy they deliver to the district heating companies. The "distribution" price is the amount charged by the district heating companies for the additional costs they incur in delivering heat to end users. The "retail" price is the sum of the transfer and distribution prices. This terminology reflects current practice in Romania for the approval of heating "prices." For further information, the reader may want to refer to the chapter of this report on Evolution of Heating Prices.

[3] Please refer to Annex C "Financial Analysis of RADET" for a more detailed explanation of the need to increase RADET's prices from 112 to 127.

[4] RADET assumes a 90 percent loss during distribution of the thermal heat it buys from TEC. The difference represents a cost that must be included in the price RADET charges. As the TEC price increases, so does the corresponding cost of the 10 percent loss of heat during distribution assumed by RADET. Please refer to Annex C for a more detailed explanation of this issue.

Constanta: Projected Heating Prices for the Year 2000
All figures represent Constant 1999 Thousand ROL per Gigacalorie

Price components	1999 Prices	Scenario A	Scenario B
Transfer	203	203	284
Distribution	112	127	155
Retail	315	330	439

Households served by district heating systems, such as the one in Constanta, pay the approved retail price for that system (the sum of transfer and distribution prices for heat) or a national reference price, whichever is lower. The local governments must make up the difference if the approved retail price for a local district heating system is higher than the national reference price. Households that obtain heating from other sources do not receive a subsidy. Payments on these subsidies are claiming an increasing share of the annual budget expenditures of the Municipality, as shown in the following table.

Constanta: Budgetary implications of heating subsidy – 1996 to 1999

Constant 1999 ROL Millions	1996	1997	1998	1999
Heating subsidy paid by Municipality	46,737	51,519	46,971	85,847
Overall expenditures of Municipality	361,678	296,837	258,888	413,818
Heating subsidy as percentage of overall expenditures	12.9	17.4	18.1	20.7

As heating prices continue to increase in real terms, as in Scenario B, the cost of the subsidy is likely to grow. Clearly, it is going to be very difficult for the Municipality to meet its obligations to provide heating subsidies under the current system. The problem with the current system of subsidies is that it does not differentiate between those that do and do not need assistance in paying their heating bill. All the population benefits from the general price subsidy under the current system. We have tried to find an alternative that provides a subsidy only to those segments of the population that need assistance. This is more equitable and might reduce the overall financial burden on the Municipality. In addition, we believe the subsidy should not be for heating only. Rather, the concern should be whether a given family can afford to pay for all basic public services. This includes water, electricity, heating, gas and solid waste.

The following table shows that the implementation of a new targeted approach to subsidy would be both more equitable to the general population and more advantageous financially for the Municipality. The table compares the costs and benefits of the two approaches assuming an increase in prices as in Scenario B, above.

Current and alternative subsidies—Who benefits? (Scenario B) (ROL millions)

Average annual household income	Net Household Payments for Heating			Total Subsidy Paid by the Municipality		Percent of Total Subsidy	
	Current Subsidy	Targeted Subsidy	Net change	Current Subsidy	Targeted Subsidy	Current Subsidy	Targeted Subsidy
15,480	40,572	(43,774)	(207.9)%	41,588	121,214	22.3%	78.0%
19,800	24,633	10,143	(58.8)%	24,084	36,874	12.4%	22.0%
>19,800	148,695	283,814	90.9%	135,819	0	65.3%	0.0%
Total	213,900	250,182		201,460	158,088	100.0%	100.0%

Note that families in the lowest income category, those most in need, receive only 22 percent of total subsidies in the current system. That increases to 78 percent when the subsidies are based on need. At the same time, families with the highest incomes shown in the table, equivalent to the minimum wage or higher, receive two-thirds of total subsidies under the current system. They receive none when subsidies are based on need. Payments for heating by these families increase by over 90 percent over what they pay in the current system. Finally, note that the total cost to the Municipality of the targeted subsidy approach is 20 percent lower than under the present system.

The change in the total cost of the subsidies as prices increase is greater under the current subsidy system than it would be under a system of targeted subsidies. This difference will be important if heating prices have to increase to cover all or part of the costs of the proposed investments in energy efficiency measures to improve the Constanta district heating system. Under the current system of subsidies the Municipality will have to absorb all the increases unless the national reference price increases. Under the targeted subsidy approach, most of the increased cost would be passed on to the seventy percent of customers of the district heating system that are not eligible for a subsidy. Families in the lowest income categories would not confront any increase in their payments. The Municipality would face somewhat higher subsidy payments, but not nearly as much as under the present system.

Illustrative Prices and Subsidy Levels Under the Proposed Investment Program

	2000 Scenario A	2001 Scenario B	2002	2003	2004
	Price/Gcal (1999 ROL Thousands)				
Transfer price	203	284	284	284	284
Distribution price	127	155	155	165	265
Retail price	330	439	439	449	549
	Gcal Consumed Heat and Hot Water (Gcal)				
Average/family/year	12.65	12.65	12.65	12.65	9.36
	Total bill for heat and hot water (1999 ROL Thousands)				
Average/family/year	4,158,000	5,531,400	5,531,000	5,657,400	5,118,876
	Total Paid (1999 ROL Millions0				
Current subsidy	100,090	201,460	201,460	210,760	226,626
Targeted subsidy	127,186	158,088	158,088	160,923	148,806

Framework for Financial Planning

The fundamental question for this program is not just what is needed, but what the Municipality and RADET can afford and are willing to invest. A simple framework is proposed for financial planning to approach the question of what the Municipality can afford. Funds available to amortize the investment program will derive mainly from: (a) energy and operating cost savings that RADET would enjoy due to lower wholesale thermal energy purchases, plus (b) additional financial contributions the Municipality can make from its own budget. Also, and significantly, if and when price reform is enacted, RADET can consider increasing retail prices to raise a portion of revenues required to amortize the investment program. These financial flows will occur over time. In addition, a portion of the investment costs may be paid from (i) Municipal capital contributions, (ii) international grants that the Municipality may obtain, and (iii) capital contributions from commercial partners.

Two institutional questions have to be reviewed carefully now by the Municipality. The first is: when will the Municipality convert RADET from an Regia Autonome (RA) to a Commercial Regia Autonome (CRA), and what are the implications for this conversion? The law (207/97) mandates this conversion, but there is uncertainty in the law and subsequent amendments allow for delays and exceptions. Thus, the Municipality appears to be under no immediate legal pressure to effect this conversion, although the eventual conversion still appears to be required. The second institutional question concerns the Municipality's preference of whether or not to retain operational management control over the RADET system or to turn over these responsibilities to a commercial contractor via a concession or service contract.

Financially, RADET is a creature of the Municipality. Approximately one-third of RADET's budget derives from Municipal subsidies. RADET is still limited by national regulation that caps the price that residential customers pay for heat. Municipal subsidies must make up the difference between payments that RADET receives from customers and its total costs. Through this budget mechanism, the Municipality inherently assumes financial risks of RADET operations. The Municipality stands to benefit from improved operating efficiencies via (a) reduced subsidies, and (b) positioning RADET for future privatization or commercial operations whereby certain RADET operating risks can be transferred to commercial parties.

There are a number of reasons why the Municipality would want to involve a private sector energy efficiency (EE) and district heating services contractor (hereinafter "contractor" generically). They include: obtaining technical assistance/expertise to complete development and then to implement the investment program; obtaining technical assistance/expertise, technologies and systems to improve operating and management efficiencies; mobilizing capital for the investment program; and, to manage and assume certain project and operating risks. How can capable firms be attracted to the program? What risks will they be willing to take? How will they be compensated? What forms of contract structures can they offer? These questions are discussed in the review of commercial options, below.

A successful transaction must meet the objectives of all parties, in this case, the Municipality and RADET, the financial institution and the participating contractor. The selected path forward must:

- Be feasible legally, financially, commercially, politically;
- Address the interests and objectives of all parties, including RADET, the Municipality, the lending financial institutions and the commercial contractor/partner, and, possibly, TEC;
- Achieve a proper distribution of program roles, responsibilities and risks between the parties, address all relevant risk factors and provide the security anticipated to be required for program debt financing.

Many contract techniques are available to achieve precise results and objectives. The chosen solution should also have replication potential for other Romanian cities. Because the Municipality and RADET face so many issues all at once, it will be important to remember basic business adages in choosing a way forward: keep it simple, take action soon (being mindful of the costs of delay), and keep future options open.

Recommended Commercial/Finance Structure for District Heating Investments

Direct financial and credit support from the Municipality for the overall investment program and the initial tranche is essential if the program is to move forward. This principle still allows for creative hybrids and does not preclude financing from commercial partners to be combined, now or in the future. Even an investment program designed to be repaid wholly from estimated savings will require a financial commitment by the Municipality because RADET is not creditworthy. This commitment might include some or all of the following: (i) a capital contribution, (ii) direct payment of all or part of the annual debt service, and (iii) a guaranty on a RADET borrowing or at least a formal, binding commitment to meet its subsidy payment obligations to RADET. Under these circumstances it probably is simpler to have the Municipality serve directly as the borrower.

The important point is for the Municipality to *start* the investment program and have a plan for how to implement it in full over time. It is likely that potential lenders, such as the European Bank for Reconstruction and Development (EBRD), will want to assess the full $19 million investment program. However, phasing of the program in tranches probably would be feasible and, indeed, desirable. This would allow the Municipality and the lender to make incremental decisions as key issues affecting program financing develop over time. Key developments include: (i) success with the Municipality's program of financial improvements, which frees funds for investment and debt service; (ii) price and subsidy reform, which would allow the Municipality to reduce subsidy payments and increase retail prices to RADET customers; (iii) verification of achieved energy savings from the first phase(s) of the investment program; (iv) realization of financial savings from the energy efficiency gains; and, (v) success in obtaining grant funding.

The recommended initial tranche of the program should be approximately $6.55 million. This reflects the capital cost of initial investments as recommended by the engineers including the priority investments in the secondary network identified by RADET.

It also includes an additional $1 million in substation projects to reduce the average simple payback for the combined initial tranche. This tranche of the program has estimated annual energy cost savings of $1.2 million Therefore, it is possible to pay for all or most of it out of savings.

Recommended Initial Program Tranche

	Project components	Capital Cost	Energy Cost Savings
1	Install substation instrumentation and control	$628,222	Included. In line #3
2	Replace secondary pipes S1, N1	$3,334,500	$105,411
3	Upgrade 20 substations in south	$1,534,425	$674,485
4	Gas boiler controls	$55,200	$44,473
5	*Subtotal*	*$5,552,347*	*$824,372*
6	Additional substation projects	$1,000,000	$396,122
7	**Total**	**$6,552,347**	**$1,220,494**

This recommended initial program tranche looks as follows in a simplified financial planning framework.

Recommended Financial Planning Framework for Initial Program Tranche

	Key components	**(USD)**	**Assumptions**
1	Project Costs	$6,552,347	
2	Additional Soft Costs	$524,188	8.0%
3	Total Project Capital Costs	$7,076,535	Estimated hypothetical
	Sources of Funds for Investments		
4	EBRD loan	$5,661,228	80.0%
5	Municipal capital contribution	$1,415,307	20.0%
6	Other	$0	0%
7	Total Sources of Funds	$7,076,535	
	Estimated EBRD Loan Terms		
8	Term/years	10	
9	Interest rate	11.0%	
	Annual Debt Service Payments		Level payments of P&I
10	EBRD loan only	$961,205	
11	Municipal contribution	$240,321	
12	Combined Annual Debt Service Payments	$1,201,526	
	Sources of Funds for Debt Payments		
13	Energy cost savings	$1,220,494	
14	Additional funds required (net savings achieved)	($18,968)	
15	Total	$1,201,526	

The Municipality should contract with outside experts who would be responsible for recommending the final design and financing structure for the overall program and the initial tranche, based on the Municipality's stated requirements and approval, and taking the engineering studies done to date as a benchmark. Inherently, the process of defining the overall investment program and its tranches will be an iterative process involving discussions between the engineering and financial staff of the Municipality and RADET, outside experts and elected decision-makers. The current estimates of the engineers should be taken as indicative and used as the basis for planning.

Actual prices and refined savings estimates will be generated in the process of procuring the program, during which the engineering work to date will be used as a benchmark by bidding contractors and alternative, potentially less expensive technical solutions developed. Allowing the bidding contractors to propose alternative technical solutions would be consistent with having them assume some or all of the technical and performance risks associated with achieving energy savings, at least with respect to the substation component and as appropriate for other components. This contracting approach should lead to improved design and performance of the investment program.

The Municipality has a threshold question to make concerning whether to retain operational management control over the RADET system or to turn over these responsibilities to a commercial contractor via a concession or service contract. It is recommended that this decision be further studied by the Municipality and, in the absence of any overriding reasons for one solution or the other, that the decision itself be made in the context of the procurement.

The financing terms that might be offered by a commercial contractor probably will be priced higher and be for a shorter term than those the Municipality can obtain on a loan from EBRD, but this assumption should be tested. Most importantly, contractor financing for some component of the investment program, such as for the higher payback substation projects, may be essential as a means of supplementing or substituting for the Municipality’s capital contribution. The procurement can be designed to consider offers of financing from prospective contractors. Making contractor financing a requirement may create a barrier to entry from many otherwise capable and attractive contractors. If this were to eliminate some contractors from the bidding, it could result in inferior, less competitive offers. Thus, it is recommended that contractor financing not be required, but that the Municipality indicate in the tender that it would consider such offers favorably.

Recommended Municipal Decision-Making Process

After this report has been presented to RADET and the Municipality, a team from both institutions should prepare a brief summary of the technical, investment and commercial options and recommendations. They should then proceed to brief Municipal management and political leadership, from all parties, including candidates for the upcoming election, on the findings and recommendations of the report. Assistance from the Romanian members of the team that prepared this report could be well applied in this education process, to assure that the results of the report are communicated and understood objectively and neutrally.

Once the new Municipal government in seated, then the Municipality should convene a special committee of relevant executive, Local Council and RADET decision-makers to proceed to review the technical, financial and commercial options and develop a financing and procurement plan for the heating investment program. The foundation for the program is political leadership by the Municipality of Constanta, which is based on meeting the Municipality's and citizens' needs and objectives. EBRD interest in this program is crucial. The Municipality is well advised to exploit this interest by constituting a committee of relevant decision-makers and continuing a dialogue with EBRD to develop and negotiate a plan for the program that meets EBRD criteria.

Recommendations regarding Energy Efficiency Investments in Municipal Buildings

The engineers have identified energy efficiency investments in Municipal buildings. Those that can be implemented on a positive cash flow basis, i.e., savings greater than annual debt service, should be considered as priorities for implementation. This principle was reviewed with Municipal financial management and they generally agreed with its logic.

The projects for the school buildings are most economic and *almost* meet the positive cash flow criteria. Savings have been calculated based on a value to the Municipality of 439,000 lei/Gcal. This is the retail price as projected in Scenario B in the discussion of prices and subsidies. If the projects also meet deferred maintenance needs, they represent a priority for the Municipality beyond their energy cost savings value and therefore should be considered for implementation now as their costs can be largely offset by savings.

CONSTANTA HEATING INVESTMENT PROGRAM
FINAL REPORT

INTRODUCTION

Objective of this report

The objective of this report is twofold. The first is to summarize the findings of an engineering analysis concerning energy efficiency measures in Constanta. [5] This includes both measures to improve the district heating system in Constanta and other measures to improve energy efficiency in public buildings in that city. The analysis includes the estimated costs of these investments and of the savings that will accrue when they have been completed. The second objective is to evaluate options and recommend a plan for financing and implementing the proposed investment program. Various commercial options were considered. They include: (i) privatization of RADET; (ii) partial privatization of a portion of the RADET system, including, possibly, new gas-fired thermal plants; (iii) long-term concession contract for RADET operations, including the investment program; and, (iv) energy services company (ESCO) contracting combined, possibly, with financing provided directly to the Municipality and/or RADET. Recommendations are made concerning (a) options that appear feasible and (b) a strategy to move forward under very difficult economic conditions to develop the program.

The Context

Background Conditions

Change and reform are underway at virtually every level impacting the district heating system in Constanta, including:

- Reform in the corporate structure of RADET;
- Significant increases and changes in the structure of transfer prices for thermal energy driven by changes in price regulations, environmental regulations, increasing fuel costs and the corporate structure of (TEC);
- Changes in retail heating prices and the system of local government subsidies for district heating systems;
- Lack of metering and needed/planned introduction of direct metering for both RADET retail sales to customers and RADET wholesale purchases from TEC which could negatively impact RADET costs and revenues;

[5] USAID contracted for two separate technical assessments. As part of the contract to prepare this report, the Urban Institute looked in general terms at the overall condition of the district heating system. The second technical analysis was conducted through a contract between USAID and Electrotek, a private U.S. firm. Electrotek prepared a detailed analysis of the district heating system itself and of alternative energy efficiency measures at the level of public end users, such as schools. Electrotek provided to the Urban Institute the estimates of the cost and phasing of the initial investment program described in this report, as well the estimates of related energy savings. Electrotek has documented their analysis in two reports – the first issued in March 1999, and the second in April 2000. The reader should consult these reports for a more detailed discussion of the technical aspects of the Constanta District Heating System.

- Recent and continuing change in municipal finances and intergovernmental fiscal relations between national and local governments which impact the Municipal budget and therefore its capacities to provide subsidies and investment support to RADET; and
- An evolving legal framework for privatization, concessions for public utilities, and municipal debt finance rules.

RADET further is caught in a chain of unpaid bills: Municipal subsidy commitments from RADET remain unpaid; and, in turn, RADET is not paying TEC in whole for its wholesale thermal purchases.

RADET faces a major institutional restructuring and reform agenda to transform its operations on a commercial basis. The program must proceed in this context. This agenda includes: (i) implement metering both for its sales and purchases; (ii) institute new programs for management, staffing and operational efficiencies; (iii) acquire technical assistance as needed from commercial partners; (iv) restate its relationship and "Whole Thermal Energy Purchase Contract" with TEC, including terms for delivery specifications and performance, metered deliveries, and pricing, and resolve or reschedule outstanding debt to TEC.; (requires resolution of Municipal payments to RADET); (v) restructure its retail prices on full cost recovery basis (pending enabling national legislation); (vi) change the formula and method of Municipal subsidies to target subsidies based on income class and need (also pending enabling national legislation); and (vii) eventually convert from a regia autonome (RA) to commercialized, i.e., corporatized, regia autonome (CRA). (This conversion is required by law, with certain exceptions and delays allowed. It may occur sooner if certain commercial options, e.g., privatization or concession contracts, are chosen.)

Financial and long-term investment planning in the midst of this uncertainty is challenging, at best. However, the financial uncertainty must not result in paralysis, for a prudent investment program, sized consistent with the Municipality's resources, is part of the solution to improve the Municipality's and RADET's finances.

Municipality and RADET Objectives and Priorities

The Municipality and RADET have several primary objectives for the program. Foremost is to improve heat services to RADET customers. Second, is to improve energy and operating efficiency of the district heating system, thereby saving RADET costs and, ultimately, required Municipal subsidies to operate the system. These priorities are logical and clearly agreed by Municipal and RADET officials.

The Municipality and RADET also recognize the need to transform RADET into a fully commercial operation. A plan or vision to do this is not yet developed nor is one in advanced levels of discussion beyond recognition of the need. To accomplish this transformation, RADET and the Municipality appear open to creating constructive partnership(s) with commercial energy efficiency and district heating (EE/DH) company(ies) to improve RADET operating efficiency. It must be emphasized that, in addition to mobilizing capital for the investment program, RADET needs technical and managerial assistance to improve its operation. RADET management recognized this need.

An additional Municipal objective expressed by Mayor Mihaiesi and Municipal Councilman Moshoyu, chair of the public utilities committee, is to "break the monopoly" of TEC on thermal supply. They translate this objective into an investment priority for new gas thermal plants to be located at existing RADET substations. The merits of the gas thermal option are discussed below.

The Municipality's objective could possibly be restated as a need to reestablish the RADET/TEC relationship on sound, rational, commercial terms which would take the form of a new wholesale thermal supply contract between RADET and TEC. TEC management indicated openness to develop such a new contract. Further review and renegotiation of the existing wholesale thermal contract and other issues in the RADET/TEC relationship are recommended.

European Bank for Reconstruction and Development (EBRD)

EBRD is a primary audience for this report. EBRD staff with the Energy Efficiency Finance Unit in London indicated that the EBRD is prepared to consider loan/investment for the RADET program using a range of commercial options. They also indicated that they may help arrange funding (as much as US$350,000) for program development technical assistance through an existing Phare facility. EBRD's criteria for proceeding to consider the program include the following. The program must:

- Represent priority investments and be part of a well-conceived "least cost" technical solution for the RADET system;
- Advance and be undertaken in the context of the RADET institutional reform agenda;
- Incorporate significant private sector involvement; again, a range of commercial options for meeting this criterion are possible, and are discussed below;
- Offer adequate loan security *without* a sovereign national government guarantee;
- Be developed with firm commitment of the Municipality's leadership and RADET management.

EBRD represents a primary source of financing for the program. While a comprehensive search for available financing was not done as part of this report, several other financial institutions, including both domestic and international banks, were interviewed in Bucharest to assess availability of financing and experience with municipal finance. In general, it appears that little long-term financing by commercial banks for municipal district heating is being done. BRD (Romanian Development Bank) did provide two examples of recent five-year term loans to cities in ROL for district heating system investments of less than US$750,000. The Ministry of Finance Public Debt Department, which has responsibility for approving all loans from external (foreign) banks to local governments in Romania, was interviewed concerning their procedures and experience. They have not processed to conclusion *any* loans yet under the new Law on Local Public Finances.

Private Sector EE and DH Contractors

There are several reasons for the Municipality to involve a private sector energy efficiency (EE) and district heating services contractor (hereinafter "contractor" generically). They include: obtaining technical assistance/expertise to complete development and then to implement the investment program; obtaining technical assistance/expertise, technologies and systems to improve operating and management efficiencies; mobilizing capital for the investment program; and, to manage and assume certain project and operating risks. How can capable firms be attracted to the program? What risks will they be willing to take? How will they be compensated? What forms of contract structures can they offer? These questions are discussed in the review of commercial options, below.

Criteria for Choosing a Commercial Option

A successful transaction must meet the objectives of all parties, in this case, the Municipality and RADET, the financial institution and the participating contractor. The selected path forward must:

- Be feasible legally, financially, commercially, politically;
- Address the interests and objectives of all parties, including RADET, the Municipality, the lending financial institutions and the commercial contractor/partner, and, possibly, TEC;
- Achieve a proper distribution of program roles, responsibilities and risks between the parties, address all relevant risk factors and provide the security anticipated to be required for program debt financing.

Many contract techniques are available to achieve precise result and objectives. The chosen solution should also have replication potential for other Romanian cities. Because the Municipality and RADET face so many issues all at once, it will be important to remember basic business adages in choosing a way forward: keep it simple, take action soon (being mindful of the costs of delay), and keep future options open. Recommendations on a plan for the program's overall development and finance are formulated with these points in mind. At some point soon in reviewing commercial options, the Municipality and RADET must also address sensitive issues of control, management and overstaffing. The extent to which these are addressed in this program is a political question. A further examination of potential RADET savings from implementing a program of management and staffing efficiencies is recommended.

The foundation for the program is political leadership of Municipality of Constanta, which is based on meeting Municipality's and citizens' needs and objectives. Also, EBRD interest in this program is crucial. The Municipality is well advised to exploit this interest by constituting a committee of relevant decision-makers and continuing a dialogue with EBRD to develop and negotiate a plan for the program that meets EBRD criteria.

PROPOSED INVESTMENT PROGRAM

Background

The district heating system in Constanta, the second largest city in Romania, provides heat and hot water to the vast majority of its 380,000 residents and industry. The purpose of the system is to provide reliable heat and hot water to end users at the minimum attainable cost. The County Prefecture of Constanta founded RADET, the company that operates the district heating system, in 1991. Since 1992, RADET has operated under the authority of Municipality of Constanta.

End users of the district heating system

Residential customers account for 63 percent of the total amount billed by RADET. They are grouped in 808 accounts of residents' associations in apartment buildings and 1,395 accounts of a single household. Firms and public institutions account for 37 percent of the total amount billed. This category includes 38 health institutions, 100 educational institutions and 1,162 public and private capital institutions (including regii and other budgetary institutions).

The structure of the district heating system is as follows:

- A thermoelectric power plant (TEC Palas) that produces thermal and electric energy, owned and operated by TEC;
- Two main lines that serve as the primary heating network, with a length of 79 Km, owned and operated by TEC;
- 134 substations connected to the primary network that supply heating to the secondary network;
- 2 heat stations operated with natural gas;
- 133 secondary distribution lines, with a length of 233 km, by which heat is distributed to end users;
- Distribution systems in end user property.

Heating is produced using a primary thermal agent (hot water at 70-150 Celsius degrees) supplied by TEC. The peak requirement of the RADET substations is about 480 Gcal/hour, and 60 Gcal/hour is lost in the primary network.

The total customer base has grown by 35 percent in recent years. The number of residential accounts, including both associations and individual households has grown by (46 percent). Non-residential accounts have grown by 16 percent. However, the quantity of heat billed has remained constant at around 1,000,000 Gcal/year. In this regard, it is important to note that consumption remains unchanged because the losses are not measured but estimated between certain fixed percents. Also, consumption by key categories of users remains unchanged.

Current condition of the district heating system

The district heating system was built in the 1970s with the expected useful life of about 30 years. With few upgrades over the last 30 years, the physical life expectancy of the primary pipes, heat substations, and secondary pipes is near its end.[6] As a result, operation of the system is becoming increasingly difficult, resulting in high maintenance costs, substantial heat and water losses, low quality of service and unreliable heat and domestic hot water supply. The result is an imbalance between areas with and without heat. Some areas of the town are under-heated at certain times, while others are overheated. The system lacks even basic operational controls, which makes operation inefficient, and accounting and technical analysis of system problems extremely difficult.

The condition of the district heating system components in most of the buildings occupied by residential end users reflects both the lack of maintenance of the system as a whole and the low initial quality of construction of the buildings themselves. There are no heat controls for individual apartments or for the building. Because the system is hydraulically unbalanced and lacks petcocks on the radiators, heating capacity is reduced. While the end user system is generally unsatisfactory due to lack of instrumentation and controls (I&C), installation of more effective control mechanisms is not possible prior to solving the fundamental technical problems in the primary and secondary networks.

Scope of the technical analysis prepared for this report [7]

The technical assessment prepared for this report included:

- *An evaluation of TEC Palas's available capacity and equipment.* This assessment looked only at whether there was a risk of insufficient and/or unreliable thermal energy supply for RADET.

- *An evaluation of primary side piping network, with emphasis on available transmission capacity.* This evaluation considered only the energy efficiency of the equipment and its operation only to the extent of its impact on the secondary system.[8]

- *An assessment of the substations considering efficient operation and required capacity and consumption assuming balanced operations.* The assessment

[6] Appendix A-1 shows the layout of the district heating system in Constanta.

[7] USAID contracted for two separate technical assessments. As part of the contract to prepare this report, the Urban Institute looked in general terms at the overall condition of the district heating system. The second technical analysis was conducted through a contract between USAID and Electrotek, a private U.S. firm. Electrotek prepared a detailed analysis of the district heating system itself and of alternative energy efficiency measures at the level of public end users, such as schools. Electrotek provided to the Urban Insitute the estimates of the cost and phasing of the initial investment program described in this report, as well the estimates of related energy savings. Electrotek has documented their analysis in two reports – the first issued in March 1999, and the second issued in April 2000. The reader should consult these reports for a more detailed discussion of the technical aspects of the Constanta District Heating System.

[8] Electrotek performed hydraulic calculations for several scenarios to verify the heat transmission capacity, hydraulic and thermal characteristic of the network.

included detail technical evaluation of the existing equipment, required upgrades and need for operational controls.

- *An evaluation of the condition of the secondary network.* Replacement of critically damaged (leaking) pipes was included in the analysis, because a functional secondary network is crucial for efficient operation of the system. Secondary pipe replacement was viewed as a "necessary cost." On the assumption that only limited amount of pipes will be replaced, they were sorted into groups based on urgency of the replacement, as determined by RADET.

- *Identification of energy efficiency improvements in municipally owned and operated school buildings and measures to reduce the heat consumption for space and water heating.* This evaluation considered only simple, low-cost measures with short payback periods.

- *An evaluation of existing and proposed gas boilers.* The analysis focused on the cost of producing thermal energy in the two gas boilers that are currently on-line, as compared to the transfer price of thermal energy obtained from TEC. RADET has identified 29 additional substations for installation of gas boilers.

Proposed heating investment program

Substation Upgrade: Install controls and upgrade all 134 substations

Currently, the substations have no individual controls because heat regulation was designed to occur at TEC Palas, by controlling the supply water temperature. Substations are not equipped with even basic I&C for controlling the heat input according to end user needs, and operators lack proper documentation to set manual controls. Over the last two years, RADET has upgraded all substations with new, state-of-the-art plate heat exchangers and associated piping replacement. This upgrade improved the heat transfer at the substations and reduced primary water losses. Additionally, TEC, the primary side operator, recently installed primary side heat meters in all but two of the substations.

New heat exchangers were installed in the substations to rectify the severe shortage of heat and/or reduce the leaks from the primary to secondary system. Unfortunately, feed water from the city main is currently being used in the secondary system to make up for leakage in the system. This water is quite hard and likely to cause damage to the new heat exchangers.

During the first year of the program, pressure differential valves and manual flow restricting valves will be installed in each substation and the primary system will be balanced. Feed water flow meters will be installed at each substation. Trained operators will calibrate supply side and will enter heat consumption data in a database to evaluate system performance. Obsolete equipment will continue to be replaced and re-piped to accommodate proper operation of controls.

Secondary system: replace 22 kilometers of secondary network pipes

A total of 233 kilometers of secondary network connect the substations to the end user buildings. Heat for space heating and domestic water heating is supplied through a four-pipe system (two pipes for the space heating and two pipes for domestic water heating, with recirculation). Space heating is operated only during the winter season, while domestic water heating is operated all-year round, though most end users have hot water less than 8 hours per day, especially during the winter season. The majority of the secondary network is installed in small non-crawl-through channels on brackets or footings.

The technical condition of the secondary network is poor due to:

- *Hydraulic leakage* **-** Leaks can be remedied by replacing the damaged piping sections and leaking valves.

- *Heat loss* - Heat loss can be minimized by replacing insulation, repairing pipe channels, and/or using prefabricated pre-insulated piping systems.

- *Poor quality feed water* - After hydraulic sealing, high quality water should be used in the secondary network to minimize pipe corrosion. Each substation should treat its water or provide piping so relatively good quality water from the primary circuit can be delivered.

- *Lack of measurement and controls* - After eliminating water leakage and improving the quality of the feed water, implement controls (e.g., heat meters at the outlets from substations, heat meters at building inputs, and control valves) for heat distribution.

Twenty-two kilometers of network will be replaced. RADET specified which part of the secondary network was most in need of repair, including only those sections of the system where the leakage and heat loses are critical and replacement is necessary for uninterrupted heat supply to the end users. The work will be divided between twelve groups of piping - six in the south section of the network (S1-S6), and six in the north section of the system of the network (N1-N6). Replacement of secondary pipes segments should be, where possible, implemented at the same time with the particular substation it serves.

Metering of feed water for the secondary system must be installed in the first phase of the program, since results of the feed water metering will determine the most problematic parts of the system. Based on real metering, RADET can then prepare a more accurate pipe replacement schedule, that is prioritized according to poorest pipe quality.

Complete gas boiler installation

The district heating system generally suffers from poor heating at the northern end of the primary system. In an effort to alleviate this problem, the Municipality is considering converting substations in that sector of the district heating system to natural gas. Two substations have already been converted. Since June 1999, substations PT47 and PT37 have been using natural gas as their fuel source.

RADET has prepared a list of 29 additional substations (38 were on the original list) that may be disconnected from the primary system and converted to natural gas, depending on the economics of this alternative. The program would probably be implemented in three phases, with 8 substations in the first phase.

Even though PT47 and PT37 are new, controls are minimal. These gas boiler houses will be equipped with proper control systems [e.g., 3-way modulating valves, temperature sensors (water, ambient), communication cards] to optimize their operation. No environmental monitoring equipment was included in the upgrade.

Improve municipal school buildings

The Municipality of Constanta is responsible for paying the operating expenses, including heating costs, of 123 schools, which include high schools (with and without dormitories), general schools and kindergartens.

Eleven potential energy conservation opportunities (ECO's) were identified for these schools, including:

1. Roof insulation
2. Floor insulation
3. External wall insulation
4. Window replacement
5. Replacement of boilers in schools not connected to the RADET system.
6. Weather-stripping
7. Insulation of heating pipes
8. Building level controls
9. Thermostatic radiator valves (TRVs) and system balancing
10. Low flow showerheads and aerators
11. Heat meters

The proposed school improvements total $1.8 million, with annual savings estimated at $343,535. Measures 5 through 11 are attractive investments for high schools and have been ‘packaged’ together in order to provide the best return on investment.

Improvements to the heating plant and primary network

Insufficient heat supply over a number of years has created the perception that the primary system owned and operated by TEC, TEC Palas and the primary piping network, do not have sufficient capacity to supply the required heat for Constanta. The main reason for installation of gas boilers was to replace presumed insufficient capacity of the primary side and to improve the heat supply quality to the users. However, an evaluation of the hydraulic conditions in the primary network revealed that the insufficient capacity is due to a severely unbalanced system and incorrect operational conditions, not the lack of production capacity at TEC Palas or transmission capacity of the primary pipes.

The evaluation did not identify investments necessary to upgrade the power plant. TEC has upgraded or replaced approximately one-half of the 78 kilometers of primary network. It plans to replace about 7 percent of the remaining network each year. These figures are not included in the proposed investment program, as the investments would be funded by TEC, without any financial support from RADET or the Municipality.

Summary investment program

Based on this assessment of the improvements required for different components of the district heating system, the team of consultants and officials of RADET and the Municipality of Constanta have developed a proposed investment program with a total cost of $19.5 million. Table A.1 summarizes the components of the investment program.

Table A.1
Summary of the Constanta Heating Investment Program

Item No.	Description	Investment				
		Materials	Labor	Design	Total Cost	Total Cost
			(USD)			(ROL 000's) [1]
1	Substations	$8,127,550	$1,991,250	$319,469	$10,438,269	193,107,976
2	Secondary pipes	$2,732,561	$4,242,661	$215,729	$7,190,950	133,032,575
3	Completion of GB 37&47	$45,100	$10,100		$55,200	1,021,200
4	Municipal buildings	$1,265,420	$497,003		$1,762,423	32,604,825
	Total	$12, 170,631	$6,741,014	$535,197	$19,446,842	359,766,577

[1] 18,500 ROL = 1 USD

Subject to availability of financing, this program could be carried out over a three year implementation period, with much of the construction occurring in the summer months to minimize any inconvenience to end users (in large apartment buildings, schools and municipal buildings). Table A.2 provides a summary of the proposed construction phases.

Table A.2
Proposed Program Phasing

Item	Description	Materials	Labor	Design	Total Cost
Year 1					
1	Install controls in all 134 substations	$511,100	$106,900	$10,222	$628,222
2	Replace secondary pipes S1, N1	$1,267,110	$1,967,355	$100,035	$3,334,500
3	Complete gas boilers PT47, PT37	$45,100	$10,100		$55,200
4	Upgrade 20 substations in south	$1,194,750	$292,714	$46,962	$1,534,425
	First Year Total	$3,018,060	$2,377,069	$157,219	$5,552,347
Year 2					
1	Improve school municipal buildings	$1,265,420	$497,003		$1,762,423
2	Upgrade 40 substations	$2,389,500	$585,427	$93,924	$3,068,851
3	Replace secondary pipes S2,3,4; N2,3,4	$772,616	$1,199,588	$60,996	$2,033,200
	Second Year Total	$4,427,536	$2,282,019	$154,920	$6,864,474
Year 3					
1	Upgrade 74 substations	$4,032,200	$1,006,209	$168,361	$5,834,992
2	Replace secondary pipes S5,6; N5,6	$692,835	$1,075,718	$54,698	$1,823,250
	Third Year Total	$4,725,035	$2,081,926	$223,059	$7,030,020
Total					$19,446,842

Anticipated energy savings

When fully implemented, this program will generate an estimated $4.8 million in savings annually. These savings will accrue from:

— Reduced water losses (reduced heat consumption and water usage)
— Reduced heat losses
— Reduced electric power consumption

The following discussion looks at the source and volume of savings from these sources for each of the key components of the proposed investment program.

Substation Savings

Since a few substations had recently been upgraded, the team had hoped to collect actual savings data for the substations based on before and after heat consumption and power usage data. However, due to lack of metering, the energy saving potential was instead assessed by two methods:

- Supplied capacity demand deviation — Equipment condition and operation characteristics were evaluated to determine the supplied capacity demand deviation calculated on a degree-days basis. Based on this method, the calculated savings in the substations are estimated to range from 30 percent to 40 percent.

- Heat consumption — Actual heat consumption was metered. From the limited available data, the required capacity of the system at predetermined temperatures was recalculated. Assuming proper control of the heat input to the secondary system, the calculated savings are estimated to range from 36 percent to 44 percent (217,936 Gcal/year to 257,582 Gcal /year).

In 1999, domestic hot water supplied for 8-hours of delivery consumed 486,221 Gcal. The required heat for the same supply of hot water in an efficient domestic water heating system would be only 256,725 Gcal. Even with domestic hot water delivery 24-hours a day, the heat demand would be 322,441 Gcal, showing that a 32 percent savings can be achieved even with 24-hour hot water availability.

Considering the results of these two assessment methods and conversations with RADET, the energy saving potential, considering both space heat and hot water savings, is believed to be approximately 26 percent. Savings can be accomplished by introducing controls, metering and real time management of the system.

Secondary Network Savings

Energy savings from the secondary network are attributed to improved pipe insulation and from reduction of secondary water leaks. The heat loss through the insulation is expected to reduce by almost 50 percent, representing a saving of approximately 8,900 Gcal/year. Heat savings from replacing the 22 kilometers of secondary pipe channels (x4 pipes) represent almost 1 percent of the total annual heat consumption for the system.

Replacement of the worst sections of the secondary piping will eliminate most of the significant water leaks. The savings will result from:

— Reduced consumption of water
— Lower payment for heat content

Currently, the system feed water is partially from the primary circuit (treated), and partially from the city water main (untreated). Untreated water accelerates corrosion of both the heat exchangers in the substations and the secondary network, thus securing a treated feed water source should be a high priority for RADET. Water treatment (demineralization) at each substation has approximately the same cost as purchasing water from the primary system operated by TEC.

The savings from heat content due to reduced water loss represent 2,942 Gcal/year, or about 0.3 percent of the total heat supply. Replacement of pipes will reduce leakage by approximately 62,300 m3/year. While secondary pipe replacement is essential to district heating system efficiency and long-term operation of the system, the estimated savings in space heating will be achieved regardless of the secondary pipes replacement as long as the pipes are capable of transporting water between the substation and end user.

The simple payback on the investment to upgrade secondary pipes would be approximately 32 years, which is longer that the useful life of the pipes themselves. However, this investment is essential for proper functioning of the district heating system. The condition of the network is gradually worsening. Maintenance and direct materials costs are rapidly increasing, as is the risk of system collapse. As such, this investment must not be viewed simply in terms of its payback, because the upgrade of the secondary network secures the functionality of the district heating system for the future. The cost of secondary pipe replacement can be depreciated and included in the retail price of heat.

Gas Boiler Savings

Even though gas substations PT37 and PT47 are new, they lack controls to be operated efficiently. We estimate reduced heat consumption of 2,897 Gcal annually once the investment is made.

Municipal School Building Savings

As noted, the proposed school improvements in aggregate have a cost of $1.8 million with annual savings of $343,535. The package with the best savings, therefore the most attractive payback, combines weather-stripping, building level controls, TRVs and system balancing, showerheads and aerators, heat meters, and replacement of local boilers. Measures 1 through 4 generate minimal savings (poor paybacks) and therefore are considered viable only as 'social investments' to improve comfort in the schools.

Summary Savings and Payback

Table A.3 summarizes the annual savings that are anticipated once the investments planned for the Constanta district heating system has been completed.

Table A-3
Summary of the Savings for the Constanta Investment Program

Item No.	Description	Annual Savings					Simple Payback
		Heat (Gcal)	Electricity (KWh)	Water (m3)	Estimated value (ROL 000's) [1]	(USD) [2]	(years)
1	Substations	257,582	3,835,866		76,494,327	4,134,829	2.5
2	Secondary pipes	13,466		96,732	4,205,468	227,323	31.6
3	Completion of GB 37&47	2,897			822,748	44,473	1.2
4	Municipal Schools	14,477			6,355,403	343,535	5.1
	Total	288,422	3,835,866	96,732	87,877,946	4,750,159	4.1

[1] Monetary conversion (ROL/unit) for each investment type is presented in Annex A-3.
[2] 1 USD = 18,500 ROL

Anticipated benefits

The anticipated savings will generate two types of benefits:

- Process benefits from:
  - Reduced energy and water losses
  - More efficient equipment
  - Reduced number of staff
  - Reduced costs for repairs and maintenance

- Business benefits from:
- Improved quality of heat supplies
- Longer service life of the district heating system

Reduced energy and water losses will benefit a variety of program stakeholders (RADET, TEC, the Municipality and end users). RADET will buy less make-up water from TEC or the Municipality, due to less leakage. For space heating, reduced losses (due to better pipe insulation and less water heating) will primarily benefit end users who should experience better heating in their flats. These consumers should have increased daily hot water service because less water will be lost during transmission. Also, in very cold weather, RADET often must chose between supplying space heating and supplying hot water. With less heat loss, end users should have improved hot water service (increased number of delivery hours) in winter months. For example, in February 1999, an average of only nine hours per day of hot water was delivered system-wide. This should improve to 24-hours per day (continuous hot water service), with energy savings of nearly 34 percent.

Energy savings are also achieved by installation of controls and better process management. Currently, water temperature is controlled manually, and very inaccurately. Sometimes the water temperature reaches as high as 60 C. Circulation should be only "as-needed", mainly in off-peak hours when there is no significant consumption. This will result in substantial savings.

Reduced power consumption due to more efficient pumps will reduce RADET's operating costs, as will process improvements. While fewer operational staff will be necessary at RADET, staff reductions are probably more a political issue than an operational one. Historically low salaries at RADET make staffing reductions less significant from a financial perspective.

Both RADET and TEC will benefit from a business perspective if service quality improves in Constanta. End users should be more inclined to pay their bills on time if they are receiving good space heating and hot water service. If consumers pay RADET in a timely and complete manner, RADET can in turn pay TEC.

Longer service life of the district heating system will benefit all stakeholders.

Impact of the current condition of the system on the investment program

The quality of service provided by the district heating in Constanta between 1970 and 2000 has decreased significantly. In the 1980s, the quality of service declined dramatically due to reduced expenditures for maintenance and repairs. Without additional investment, the system and its quality of services will continue to decline, thereby risking a major system breakdown in the coming decade. The poor current condition of the district heating system due to lack of investment and maintenance over the last 30 years has resulted in a sizeable need for investments to upgrade the system fully. The estimated cost of these investments is almost $94 million.[9] Clearly, neither RADET nor the Municipality is in a position to commit to such a large investment program at this time, thus the proposed investment program is less ambitious. However, the measures included in the proposed heating investment program will not be sufficient to allow the system to operate in a sustainable way for another 10 to 20 years. It is important that RADET and the Municipality keep the broader investment needs in mind as they plan the future of the district heating system.

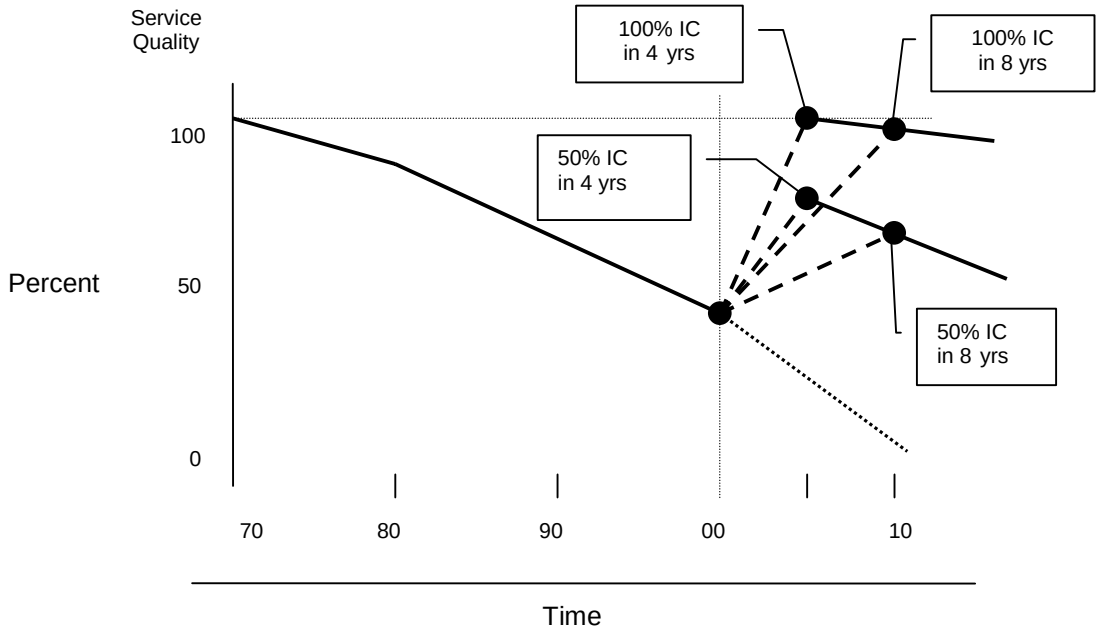
Secondary pipe replacement is one of the key elements to efficient operation of the system in the long-term. If secondary pipe replacement does not proceed as needed, a gradual process of deterioration will cause more and more water leaks. In the worst case, the capacity of the feed water system (which provides replacement water for the leaked water) will become insufficient. In this case, the loss of heat will become so great that the substations will not be able to heat the supply water and the heating system will cease working. Leaky secondary pipes can cause other problems. Excessive supply of feed water (untreated city water) to secondary pipes causes lime deposits to accumulate inside secondary pipes and building heating systems (e.g., pipes, radiators), resulting in clogged systems. Also, regulation elements (e.g., TRV's) inside buildings are in danger of not functioning properly when the secondary pipes are "dirty and leaky". The approach of the proposed investment program is to replace a smaller number of pipes with the worst leaks, thus minimizing the initial investment cost. It is vital, however, that the improvement to the secondary distribution network continue in future years after the proposed program has been completed.

Another key to efficient operation of the system in the long-term is the balancing of the primary and secondary systems. Without system balancing, the substation upgrades will not produce the anticipated service benefits. Without the balancing, the substations will sometime receive adequate heat and sometimes not, making the district heating system unreliable. In an unbalanced system (under current operating conditions), substations closer to the TEC Palas initially consume too much heat, while those more distant receive heat with delay. The desirable scenario is to have the needed flow at each substation, which proper balancing will ensure. System balancing requires teamwork - a joint effort between TEC and RADET.

[9] Annex A-2 summarizes the complete investment program for the Constanta District Heating System, which includes improvements to the primary system, secondary system, municipal schools and end user buildings.

To ensure long-term, efficient operation of the Constanta district heating system, RADET and the Municipality must continue investing in the district heating system after the proposed program has been completed. Figure A.1 illustrates the trade-off between the level of investments and the quality of service. As figure A.1 shows, ideally RADET and the Municipality will be able to complete the investments to upgrade the system fully in about eight years. Otherwise, service quality will improve for some time after the proposed investment program has been completed, then begin to decline again. Because the system is in extreme disrepair, the longer the wait to upgrade the system fully, the more costly it will become.

Figure A-1
Sensitivity Analysis Service Quality, Cost of upgrade vs. Time (IC = Investment Costs)



EVOLUTION OF HEATING PRICES

Impact of energy price policies on heating prices

The legal, regulatory and policy framework governing prices for heating in Romania is complex. At present, prices for heating, as with all public services, must be approved by the Office of Competition. There are specific procedures in place for calculating the price of heating at the level of individual production and distribution companies. In addition, those residential consumers served by district heating systems receive a direct subsidy based on a uniform national reference price. In recent years, other subsidies also have affected the price structure for heating. These have included cross subsidies between prices of electricity and heating, between high- and low-cost producers across regions of the country and between industrial and residential consumers. The current policy is to phase out all these cross subsidies.

The best way to understand the system of prices for heating is to look first at how the prices are set at the level of the production and distribution companies, then to look at how households pay for heating. In Constanta, the retail price of heating to the consumer really consists of two parts. The first is the transfer price charged by TEC for thermal energy delivered to RADET for distribution to the eventual consumer. The second is the additional price charged to cover the distribution and other operating costs incurred by RADET in delivering heat to the end users. The sum of the two is what the end users should pay. The Law on Competition approved in 1996[10] established the basic procedures for setting prices for all public services. This means that the Office of Competition participates in approving both parts of the retail price for heating. However, there are different institutions involved in the initial process of setting the transfer price for thermal energy (TEC) and the price for distribution to the end user (RADET). Each district heating system has its own approved price structure.

Setting the transfer price for thermal energy

The National Energy Sector Regulatory Agency, established in 1998[11], currently has the authority to set the transfer prices for thermal energy charged by TEC to RADET, with the concurrence of Office of Competition. The local governments have no role in this process. An emergency government ordinance approved in 1998[12] defines the procedures for setting these prices. It states that the transfer price for thermal energy will be based on the cost of production, the type of installation and the type of fuel used. Once established, these prices may be adjusted quarterly based on the average exchange rate ROL/USD as determined by the National Bank of Romania. This adjustment is not automatic and requires prior approval by the Office of Competition.

Prior to 1998, the transfer prices had been agreed to in negotiations between the National Energy Company of Romania (CONEL) and the Government. It was during this early period that there was a policy to cross-subsidize the transfer price through different mechanisms that since have been discontinued.

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[10] Law No. 21 of 1996

[11] Emergency Ordinance No. 29/1998

[12] Emergency Ordinance No. 7/1998, subsequently approved through Law No. 88/1999

For example, the TEC Palas plant produces both thermal and electric energy in Constanta. Since the consumption of thermal energy is mostly for domestic use, a part of the costs incurred for production of thermal energy had been allocated to the price of electricity. For similar reasons, the prevailing policy nation-wide had been to charge higher transfer prices to industrial end users. An ordinance dealing with procedures for setting transfer prices for electricity and heating approved in 1998 ended these practices, with a corresponding increase in the transfer prices charged by TEC to RADET for thermal energy.[13] In fact, as the production of electricity by TEC has decreased, there has been a tendency to allocate an increasing share of the fixed costs of TEC to the transfer price of thermal energy. Because of the cross subsidy that had existed between residential and non-residential consumption in the past, the greatest impact of the revised pricing policies has been on the transfer price charged for thermal energy delivered for residential consumption.

There remains one cross subsidy in the transfer price for thermal energy. Up to now, the price has been based on the average national price of production in all the stations run by TE. In effect, this is a subsidy across regions of the country. This practice will end in the second half of 2000.

Environmental regulations will have an indirect impact on the transfer price for thermal energy in coming years. Under these regulations, TEC Palas will be required in 2000 to use fuels that have a lower sulfur content. The alternative fuels have a higher cost that automatically will lead to an increase in the transfer price for thermal energy. Officials at TEC estimated that the end of cross-regional subsidies coupled with the increased fuel costs will represent an increase of about forty percent in real terms in the transfer price for thermal energy delivered to RADET in 2000.

Setting the price for heat distribution

Each heating distribution company in the country, such as RADET in Constanta, prepares an estimate of its distribution costs. The corresponding local authorities must accept this estimate. The Office of Competition then reviews and approves the proposed price to cover the heating distribution costs. The principal problem with this process has been that it takes too long. By the time the Office of Competition approves the proposed price, the costs of the distribution companies have increased due to inflation. The result is that the price covers only part of the costs and the companies tend to operate at a loss.

The current basis for estimating the distribution costs of RADET, such as substation equipment efficiency, dates to 1994. Since that time, the change in the price charged by RADET to cover its costs has consisted of adjusting those initial estimates for inflation. The planned costs, calculated by multiplying elements of cost approved by Office of Competition with total quantity of heating billed for each distinct period of the year for the year 1998 are shown in the Appendix B, both in nominal values and in unitary values (per Gcal). As presented, the actual costs are higher than those planned and approved by the Office of

[13] Emergency Ordinance No. 63/1998, article 40

Competition. This can be explained by the impact on actual costs in an hyperinflationary environment during the time it takes to approve the prices. In this system RADET will always operate at a loss, even if theoretically the approved distribution prices should fully cover its costs.

To date, households also have been exempt from payment of the VAT on public services (water, heating, electricity and gas). This ended on April 1, 2000 when all these services became subject to a 19 percent VAT.[14]

Historic evolution of heating prices in Constanta

Tables B1 and B2 show the impact of the changing national legal and policy framework for setting heating prices in the specific case of Constanta.

Table B1
Evolution of residential heating prices and subsidies in Constanta - 1997 to 2000
All figures represent Constant 1999 Thousand ROL per Gigacalorie

As of January	Transfer (TEC)	Distribution (RADET)	Retail (Total)	Reference Price	Subsidy
1997	112	116	227	137	90
1998	98	125	223	170	53
1999	140	105	245	143	102
2000	203	112	315	230	85

Table B2
Evolution of non-residential heating prices in Constanta (w/o VAT) – 1997 to 2000
All figures represent Constant 1999 Thousand ROL per Gigacalorie

As of January	Transfer (TEC)	Distribution (RADET)	Retail (Total)
1997	247	116	363
1998	331	125	456
1999	199	105	304
2000	198	112	310

[14] Emergency Government Ordinance No. 215/99, dated December 29, 1999

Note the following important developments:

- Heating prices for residential consumers have increased in real terms, especially in the last year. Prices for non-residential consumers decreased dramatically in real terms from 1998 to 1999. Since then they have remained relatively stable. As a result, prices for residential and non-residential consumers have converged.

- The distribution costs of RADET have remained relatively stable in real terms. The transfer price charged by TEC to RADET for domestic consumption accounts for the overall increase in residential retail prices.

The level of subsidy has varied with no apparent pattern, both in absolute terms and relative to the price of heating.

Anticipated heating costs in Constanta in 2000 and beyond

Table B3, below, shows the anticipated evolution of heating prices in Constanta under two scenarios. Both scenarios are based on a "going concern principle." That is, they assume that there will be no new investments and that production measured as quantities billed will remain the same for TEC and RADET. Both assume that RADET will operate on a break-even basis. Both assume that the cost elements and structure will not suffer major modifications except for the transfer prices from TEC.

Scenario A uses the average transfer price for TEC. That is, it assumes that the policy of cross subsidizing high- and low-cost production in the plants belonging to TE across the country will continue. In this scenario, the price charged by RADET increases to 127,000 ROL/Gcal to adjust for increases in RADET costs since the Competition Office approved their price.[15] This scenario describes the prices as they should be during the current winter season (1999/2000). Scenario B assumes that prices will be based on the local costs of TEC. For scenario B, we have used an estimate provided by TEC that the transfer price they charge for thermal energy will increase by 40 percent. This reflects the impact both of the higher local production costs and the use of fuels with lower sulfur content as required by environmental regulations. Note that the price charged by RADET will have to increase from 127,000 ROL/Gcal to 155,000 as a consequence of the higher prices charged by TEC.[16] This scenario describes anticipated prices for next winter season (2000/2001).

[15] Please refer to Annex C "Financial Analysis of RADET" for a more detailed explanation of the need to increase RADET's prices from 112 to 127.

[16] RADET assumes a 90 percent loss during distribution of the thermal heat it buys from TEC. The difference represents a cost that must be included in the distribution price RADET charges. As the TEC transfer price increases, so does the corresponding cost of the 10 percent loss of heat during distribution assumed by RADET. Please refer to Annex C for a more detailed explanation of this issue.

Table B3
Constanta: Projected Heating Prices for the Year 2000
All figures represent Constant 1999 Thousand ROL per Gigacalorie

Price components	1999 Prices	Scenario A	Scenario B
Transfer (TEC)	203	203	284
Distribution (RADET)	112	127	155
Retail (Total)	315	330	439

Cost of Subsidies

The price paid by residential consumers

Households served by district heating systems pay the approved retail price for that system (the sum of transfer and distribution prices) or a national reference price whichever is lower. The government must make up the difference if the approved price for a local district heating system is higher than the national reference price. Households that obtain heating from other sources do not receive a subsidy. An emergency ordinance approved in 1999[17] further provides that the national reference price will be set by a Government Decision based on a recommendation of the National Energy Sector Regulatory Agency with the approval of the Office of Competition. Initially, the local authorities received dedicated transfers from the State budget to pay for heating subsidies. Starting in 1999, as part of the overall reform in the system of local finances, the local authorities must cover the full burden of paying for the subsidies from their own revenues.

A 1999 ordinance set the national reference price for heating provided to residential consumers through district heating systems at 230,000 ROL per Gigacalorie.[18] This same ordinance also expanded the system of heating subsidies for the current winter season, that is, the period from November 1999 to March 2000. Families now qualify for an additional subsidy based on income, as follows:

Per capita Monthly Income	Additional subsidy (ROL)
• <450,000	335,000
• 450,000 to 600,000	200,000
• 600,000 to 750,000	100,000

Current and projected subsidies

Table B4 shows the subsidies paid by the Municipality to RADET in absolute amounts and as a share of overall expenditures from 1996 to 1999. Table B5, below,

[17] Emergency Ordinance No. 162/1999, article 2, paragraph 1

[18] Government Decision No. 879/1999

shows the anticipated evolution of subsidies in Constanta under scenarios A and B described above. The national reference price remains at its current level.

Table B4
Constanta: Budgetary implications of heating subsidy – 1996 to 1999

Nominal ROL Millions	**1996**	**1997**	**1998**	**1999**
Heating subsidy paid by Municipality	8,544	23,741	30,304	46,851
Special funding allocation received from the State budget (1999 only) [1]	n/a	n/a	n/a	39,263
Total heating subsidy	8,544	23,741	30,304	85,847
Overall Expenditures of Municipality	66,120	136,791	167,024	413,818
Heating subsidy as percentage of overall expenditures	12.9	17.4	18.1	20.7

Constant 1999 ROL Millions	**1996**	**1997**	**1998**	**1999**
Heating subsidy paid by Municipality	46,737	51,519	46,971	46,581
Special funding allocation received from the State budget (1999 only) [1]	n/a	n/a	n/a	39,263
Total heating subsidy	46,737	51,519	46,971	85,847
Overall Expenditures of Municipality	361,678	296,837	258,888	413,818
Heating subsidy as percentage of overall expenditures	12.9	17.4	18.1	20.7

[1] This allocation came in an amendment to the State budget. The sole purpose of providing additional funds to the local governments was to enable them to reduce their pending obligations for past-due subsidy payments to the district heating companies. These companies, in turn, were expected to reduce their pending obligations to the thermal energy producers. Finally, the producers were expected to pay CONEL for past-due amounts owed for electricity. In the end, the beneficiary was CONEL, whose balance sheet improved from the reduction in accounts receivable. Thus, the special allocation was essentially a pass-through from the local government, to the district heating company, to the thermal energy producer and finally to CONEL.

Table B5
Constanta: Projected heating prices for the year 2000
All figures represent Constant 1999 Thousand ROL per Gigacalorie (except as noted)

	1999 Prices	**Scenario A**	**Scenario B**
Transfer (TEC)	203	203	284
Distribution (RADET)	112	127	155
Retail (Total)	315	330	439
Reference Price	230	230	230
Subsidy	85	100	209
Total cost of subsidy (ROL billions)	43.5	93	194

The increase in subsidies per Gcal under Scenario A is relatively small. Even so, we have estimated that this will represent total payments by the Municipality of Constanta of 93 billion ROL in budget year 2000. The combined effect of the increase in transfer prices and increase in RADET prices in Scenario B will more than double the amount of the subsidy per Gcal. The total amount paid in this case would rise to 194 billion ROL.

In addition to the subsidy based on the national reference price, there also will be the subsidy for certain families based on income, as discussed in the prior section. As shown in Table B6, below, about 29,500 families, or one-third of the population of Constanta, have applied for the subsidy as of December 1999. This is slightly lower than the number of families that applied during the winter of 1997-98, when a similar system of supplementary heating subsidies was implemented.

Table B6
Constanta: Number of families that have applied for subsidies as of December 1999

Family monthly income	Level of monthly subsidy	Number of families	Total Subsidy (Million ROL)
<450000	335,000	14,000	4,690
450000-600000	200,000	8,500	1,700
600000-750000	100,000	7,000	700
		29,500	7,090

Table B7 shows the sum of the subsidies based on reference price and income for scenarios A and B.

Table B7
Constanta: Estimated total cost of subsidies during the winter of 1999 to 2000

	Subsidy (Million ROL)		
	Based on reference price	Based on family income	Sum of both subsidies
Scenario A	93,000	7,090	100,090
Scenario B	194,370	7,090	201,460

The two subsidies together will represent 100 billion ROL and 201 billion ROL in 2000 under Scenarios A and B, respectively, compared with 46.9 billion paid in 1999. This is a major problem for the Municipality, which we discuss further in the next section of this report.

Finally, a decree approved late in 1999[19] by the Government extended the payment of the 19 percent VAT to public services, effective April 1, 2000. Residential district heating consumers must pay the VAT. This means that their heating bill will increase by 26 percent, as shown in Tables B8, below. Note that we have used the current prices as the basis for calculating the impact of the VAT.[20]

Table B8
Constanta: Estimated impact of the VAT if paid by consumers

Formula	Calculation	Result
Retail Price x VAT	315,000 * .19	59,850
VAT + Reference Price	59,850 + 230,000	289,850
Percent increase	289,850 / 230,000	1.26

Using means tested subsidies

Clearly, it is going to be very difficult for the Municipality to meet its obligations to provide heating subsidies under the current system. The problem with the current system of subsidies is that it does not differentiate between those that do and do not need assistance in paying their heating bill. All the population benefits from the general price subsidy under the current system. We have tried to find an alternative that provides a subsidy only to those segments of the population that need assistance. This is more equitable and might reduce the overall financial burden on the Municipality. In addition, we believe the subsidy should not be for heating only. Rather, the concern should be whether a given family can afford to pay for all basic public services. This includes water, electricity, heating, gas and solid waste removal.

Table B10, below, shows the average annual payment for each of these services in Constanta at the end of 1999. Then it shows what a family in which the head of household is unemployed, a pensioner or a minimum wage earner[21], respectively, would pay as a percent of income. Given that a family spends over 50 percent of its budget on food and medicine, it is clear that the payment of public service represent a heavy burden for all three categories of families.

[19] Emergency Government Ordinance No. 215/99, dated December 29, 1999

[20] These numbers would be considerably larger under either Scenario A or B. For example, under Scenario B, the effective tax on current revenues would be 21 percent. Or, the increase in the amount paid by residential consumers would be 36 percent.

[21] All data on incomes and family budgets in this section is from "Incomes, expenditures and consumption of the population", Report no. 2/1999, updated for December 1999 of the National Commission on Statistics. The data on the cost of services was prepared for this report. See Appendix B, Table 8, for the method of calculation.

Table B9
Average annual national family income by category (ROL)

Unemployed	Pensioner	Wage Earner
15,540,348	19,726,980	23,409,060

Table B10
Constanta: Payment for public services as a percent of family income (Scenario A)

Typical Annual Payment for Public Services In Constanta (ROL)		Unemployed	Pensioner	Minimum Wage
		As a percent of family income		
Water	1,927,476	12%	10%	8%
Heating	2,227,500	14%	11%	9%
Hot water	1,930,500	12%	10%	8%
Gas	1,200,000	8%	6%	5%
Electricity	600,000	4%	3%	2%
Transport	1,031,250	7%	5%	4%
Solid waste	48,000	0%	0%	0%
Total	8,964,726	58%	45%	37%

The key question is how to establish what a family should be able to pay for public services. We took as the base what an average family of minimum wage earners pays for food and medicine in Romania in general. Using data from the National Commission for Statistics, we estimate that these expenses represent about 60 percent of the average income for that family or about 13.8 million ROL a year. In the calculations that follow, this amount becomes the point of reference for all families. Any income in excess of that amount becomes available to pay for public services. Any shortfall requires a subsidy up to the full cost of all public services.

The next issue is how to determine how many families in Constanta would be eligible for a subsidy. We already know that 29,500 families have applied for the supplemental heating subsidy. The upper range of monthly family income of this group is 2.2 million ROL (750,000 times the average family size of three). This would represent an annual income of over 26 million ROL. Since this is in excess of the threshold of 13.8 million ROL, we know that the pool of applicants for the supplemental subsidy includes many families that would be eligible for a subsidy based on the proposed alternative system. The problem with using the proposed pool of applicants as the basis for estimating the volume of subsidies under the new, targeted approach is that it includes only those families that are connected to the district heating company. Those families that obtain their heat from other sources are not eligible for the current supplemental heating subsidy. So, they would have no reason to apply at the Municipality.

Using data available on the number of the unemployed in Constanta and of the pensioners with an income less than 750,000 ROL/ month, we estimate that the universe of families in Constanta that might actually be eligible for a subsidy under the proposed alternative system consists of about 37,000 families. This includes all 29,500 families in the pool of applicants for the supplemental subsidy and 8,000 others that have not applied because they use alternative heating sources. The cost of alternative heating, such as from

firewood is not necessarily lower than the cost of district heating. It would make eminent sense from a public policy perspective to extend the subsidy to all families that need assistance in paying for public services. However, that is not the scope of this report. In order to maintain a basis of comparison with the current system of heating subsidies, we have calculated the alternative subsidies based only on the 29,500 families that applied to the Municipality for the supplemental heating subsidy.

The following three tables show what the total subsidy would be under the proposed new targeted approach. We use as a "basic family budget" the amount that a minimum wage earner pays for food and medicine. The first two tables are based, respectively, on the retail heat price projections included in Scenario A and B. The cost of public services of 8.965 million ROL per year shown in Table B11a is based on Scenario A. Under Scenario B, this would increase to 10.338 million ROL per year, as shown in Table B11b. The third table simply adds the 19 percent VAT to the figures from Scenario B.

Table B11a
Constanta: Alternative subsidy estimates based on a targeted approach (Scenario A) (ROL millions)

Monthly per capita Income	Number of families	Average annual income	Basic family budget	Available for public services	Annual cost of public services	Necessary subsidy/ family	Total subsidy
<450000	14,000	15.480	13.800	1.680	8.965	7.285	101,986
450000-600000	8,500	19.800	13.800	6.000	8.965	2.965	25,200
600000-750000	7,000	24.300	13.800	10.500	8.965	0	0
TOTAL	29,500						127,186

Table B11b
Constanta: Alternative subsidy estimates based on a targeted approach (Scenario B) (ROL millions)

Monthly per capita Income	Number of families	Average annual income	Basic family budget	Available for public services	Annual cost of public services	Necessary subsidy/ family	Total subsidy
<450000	14,000	15.480	13.800	1.680	10.338	8.658	121,214
450000-600000	8,500	19.800	13.800	6.000	10.338	4.338	36,874
600000-750000	7,000	24.300	13.800	10.500	10.338	0	0
TOTAL	29,500						158,088

Table B11c
Constanta: Alternative subsidy estimates based on a targeted approach
(Scenario B plus VAT applied to utilities)

Monthly per capita Income	Number of families	Average annual income	Basic family budget	Available for public services	Annual cost of public services	Necessary subsidy/ family	Total subsidy
<450,000	14,000	15.480	13.800	1.680	12.302	10.622	148,708
450,000-600,000	8,500	19.800	13.800	6.000	12.302	6.302	53,567
600,000-750,000	7,000	24.300	13.800	10.500	12.302	1.802	12,614
TOTAL	29,500						214,889

Under Scenario A, the cost increases from 100 to 127 billion ROL. However, under Scenario B, the cost decreases from 201 to 158 billion ROL. The reason for this is apparent in the next tables. They compare the level of subsidy by family income categories.

Table B12a
Current and alternative subsidies – Who benefits?
(Scenario A) (ROL millions)

Average annual household income	Net Household Payments for Heating			Total Subsidy Paid by the Municipality		Percent of Total Subsidy	
	Current Subsidy	Targeted Subsidy	Net change	Current Subsidy	Targeted Subsidy	Current Subsidy	Targeted Subsidy
15,480	40,572	(43,774)	(207.9)%	22,330	101,986	22.3%	80.6%
19,800	24,633	10,143	(58.8)%	12.410	25.200	12.4%	19.2%
>19,800	148,695	213,345	45.3%	65,350	0	65.3%	0.0%
Total	213,900	179,714		100,090	127,186	100.0%	100.0%

Table B12b
Current and alternative subsidies – Who benefits?
(Scenario B) (ROL millions)

Average annual household income	Net Household Payments for Heating			Total Subsidy Paid by the Municipality		Percent of Total Subsidy	
	Current Subsidy	Targeted Subsidy	Net change	Current Subsidy	Targeted Subsidy	Current Subsidy	Targeted Subsidy
15,480	40,572	(43,774)	(207.9)%	41,588	121,214	22.3%	78.0%
19,800	24,633	10,143	(58.8)%	24,084	36,874	12.4%	22.0%
>19,800	148,695	283,814	90.9%	135,819	0	65.3%	0.0%
Total	213,900	250,182		201,460	158,088	100.0%	100.0%

The reason why total subsidies increase when applying a targeted approach to Scenario A is that the lowest income category of families, those who are unemployed, receive a subsidy that is five times greater than at present. In fact, these families receive a subsidy that covers over 80 percent of their payments for all public services, including water and public transportation, as well as heating. Since subsidies in the targeted approach are

based on need, this means that families at this income level are severely under subsidized in the current system. Note that these families receive only 22 percent of total subsidies in the current system. That increases to 81 percent when the subsidies are based on need. At the same time, families earning a minimum wage or higher receive two-thirds of total subsidies under the current system. They receive none when subsidies are based on need.

In Scenario B, payments for heating by those families not covered by the targeted subsidy increase by over 90 percent in direct proportion to the increase in heating prices. In the current system it is total subsidy payments that increase in direct proportion to the increase in heating prices because the national reference price has not changed.

Payments made by those families covered by the targeted subsidy remain the same because their income has not changed. The total targeted subsidy increases, but by much less than the increase in heating prices. The increase in this case is in direct proportion to the increase in the total cost of all basic services, of which heating represents only about half.

The change in the total cost of the subsidies as prices increase is greater under the current subsidy system than it would be under a system of targeted subsidies. This difference will be important if heating prices have to increase to cover all or part of the costs of the proposed investments in energy efficiency measures to improve the Constanta district heating system. Under the current system of subsidies the Municipality will have to absorb all the increases unless the national reference price increases. Remember that all the calculations done in this report are in constant 1999 ROL. Thus, any increase in the reference price would be in real terms. This means that families in the lowest income categories would face an even more severe hardship than at present. Under the targeted subsidy approach, most of the increased cost would be passed on to the seventy percent of customers of the district heating system that are not eligible for a subsidy. Families in the lowest income categories would not confront any increase in their payments. The Municipality would face somewhat higher payments, but not nearly as much as under the present system.

Table B13 shows the difference in total subsidies paid under the two approaches, assuming that the full investment program described in the previous chapter is carried out on the following terms:

- RADET receives from the Municipality a loan for $14,080,000 and $3,520,000 in capital contributions to finance $17,600,000 in energy efficiency measures. The loan from the Municipality is for ten years at 11 percent, with interest only paid during construction.

- Construction begins in 2001 and is completed in four years.

- After the investments have been completed, the net energy savings allow RADET to reduce purchases from TEC by 26 percent, while providing improved heating and hot water services to all its customers.

- Starting prices are those in Scenario B. TEC transfer prices remain constant during the entire period, even after the reduction in purchases from RADET.

- RADET increases its price to cover financing and other investment costs. Once the investments have been completed, RADET adjusts its price per Gcal to recover its full costs (net of purchases from TEC) at the lower level of Gcal billed to end users (74 percent of present volume).

- Customers receive and pay a bill for the full costs of heat and hot water. The targeted subsidy is implemented beginning in 2000.

Table B13
Illustrative prices and subsidy levels under the full investment program

	2000	**2001**	**2002**	**2003**	**2004**
	Scenario A	**Scenario B**			
Price components	Price/Gcal (1999 ROL Thousands)				
Transfer (TEC)	203	284	284	284	284
Distribution (RADET)	127	155	155	165	265
Retail (Total)	330	439	439	449	549
	Gcal Consumed Heat and Hot Water (Gcal)				
Average/family/year	12.65	12.65	12.65	12.65	9.36
	Total bill for heat and hot water (1999 ROL Thousands)				
Average/family/year	4,158,000	5,531,400	5,531,000	5,657,400	5,118,876
	Total Cost of the Subsidy to the Municipality (1999 ROL Millions0				
Current subsidy	100,090	201,460	201,460	210,760	226,626
Targeted subsidy	127,186	158,088	158,088	160,923	148,806

The table shows that:

- RADET will have to increase it price per Gcal first to cover the added investment and financing costs, then to adjust for the lower volume of Gcal billed to its customers.

- The average bill for heat and hot water for residential customers will increase in real terms until the investments have been completed in 2004. At that point, the average bill will decrease. Note that the reduction in Gcal consumed more than offsets the impact of the increased price per Gcal charged by RADET. RADET would have the option to raise prices further in 2004, so the total amount paid remains constant or decrease by a smaller percent. This would allow RADET to capture all or part of the benefits of the savings from the energy efficiency measures to finance additional investments in the district heating system.

- The implementation of the targeted subsidy approach minimizes the impact on the finances of the Municipality of the price increases. It also produces a reduction in the total subsidy paid starting in 2004.

FINANCING AND COMMERCIAL STRUCTURE

Framework for Financial Planning

The fundamental question for this program is not just what is needed, but what the Municipality and RADET can afford and are willing to invest. A simple framework is proposed for financial planning to approach the question of what the Municipality can afford. Funds available to amortize the investment program will derive mainly from: (a) energy and operating cost savings that RADET would enjoy due to lowered purchases from TEC, plus (b) additional financial contributions the Municipality can make from its own budget. Also, and significantly, if and when price reform is enacted, RADET can consider increasing retail thermal prices to raise a portion of revenues required to amortize the investment program. These financial flows will occur over time. In addition, a portion of the investment costs may be paid from (i) Municipal capital contributions, (ii) international grants that the Municipality may obtain, such as from ISPA, and (iii) capital contributions from commercial partners. This framework is illustrated below.

Table C1
Illustration of Financial Planning Framework

	Key components	(USD)	Assumptions
1	Project Costs	$16,192,000	
2	Additional Soft Costs	$1,408,000	8.00%
3	Total Project Capital Costs	$17,600,000	Estimated hypothetical
	Sources of Funds for Investments		
4	EBRD Loan	$14,080,000	80.0%
5	Municipal Capital Contribution	$1,760,000	10.0%
6	Other (grant)	$1,760,000	10.0%
7	Total Sources of funds	$17,600,000	
	Estimated EBRD Loan Terms		
8	Term/years	10	
9	Interest rate	11.0%	
10	Annual Debt Service	$2,988,505	Level payments of P&I
	Sources of Funds for Debt Payments		
11	Energy Cost Savings	$2,000,000	
12	Annual contribution from Municipality	$988,505	
13	RADET revenues, retail price increases	$0	
14	Total	$2,988,505	

Defining the investment program and its phases or tranches will be an iterative process of matching available financial resources within this framework to the economics of various possible combinations of program measures. The logic and each value of this framework are explained below.

Total program capital costs

Program capital cost estimates provided by the engineers cover equipment and materials, labor and installation and engineering and construction management. Additional capital costs for construction period interest, program development, finance and legal fees, and other costs remain to be added. It is prudent at this stage of planning to add approximately 8 to 10 percent to the capital cost estimates to account for these additional soft costs. Further, actual construction costs will likely be subject to competitive bidding, which could potentially reduce the costs and offer alternative technical solutions. Finally, the capital cost calculation must be further modified to the extent that VAT is applicable.

Estimated EBRD financing terms

EBRD bankers were interviewed to estimate terms of EBRD financing. Terms will vary depending on whether the loan is made (a) to the Municipality or RADET directly, or (b) to an ESCO that has a contract with RADET. Estimated financing terms for a loan directly to the Municipality, or to RADET with a guarantee by the Municipality, follow. All terms are subject to change, due diligence and structuring by EBRD and in no way represent a commitment or official communication of EBRD on this subject. They are indicated for financial planning purposes only at this early stage of program development.

Term: Ten years plus a grace period of up to two years.

Rate: Libor plus 450 basis points, floating. Libor is currently at approximately 6.3 percent, so a rate of 11 percent is used for planning purposes.

Co-Financing: To be determined. EBRD can provide all debt required on a loan to the Municipality without any co-financing from other local or international banks. A capital contribution from the Municipality or other source will be required. The typical maximum portion of the total program cost that EBRD would fund is 80 percent.

Disbursement: As needed for phased program construction.

Payment Schedule: To be determined. Interest only payments during the grace period (for construction) and level payments of principal and interest are assumed for planning purposes.

Currency: Euro, dollars or DM; foreign exchange rate risk to be borne by the borrower.

Security Requirements: To be determined. A general obligation from the Municipality, backed by an appropriately structured revenue pledge is presumed. Collateral in the form of public assets is not available due to the Patrimony Law. Further discussion of possible security and revenue pledge is provided below.

Municipal Debt Limit: The total amount of the loan must comply with and be prudently sized with respect to the statutory debt limits.

This framework assumes that the chosen commercial structure includes a loan to the Municipality, or alternatively a loan to RADET secured by a guarantee from the Municipality. This option can be combined with privatization, concession and energy services contract arrangements. If the program debt is provided to a commercial entity, not to the Municipality, then a main consequence will likely be a shorter debt term, which will require either (a) higher annual payments, or (b) a smaller investment program.

Gas thermal option

Overshadowing the decisions concerning design of the proposed investment program is a stated intent by current Municipal political leadership to "break the monopoly" of TEC on thermal supply by installing gas-thermal energy production capacity. There are three possible reasons why the Municipality should install independent gas thermal plants: (i) to serve areas of the Municipality that can not be served properly otherwise; (ii) to save money if the gas thermal plant option offers a cheaper source of wholesale thermal energy than TEC Palas; and (iii) to gain bargaining power over TEC to improve the terms of TEC supply. Each of these reasons for gas thermal options has been explored during the mission and preparation of this report.

We investigated whether the TEC Palas plant has adequate capacity to serve the entire city. The unequivocal assessment of the engineers is that, with recommended investments in balancing of the system and in heat substations that allows RADET to control thermal flows into their substations, TEC can provide adequate supply throughout the Constanta, including the northern zone.

The costs of thermal supply from independent gas thermal plants for fuel and operations, *exclusive of capital costs*, have been calculated at approximately 242,000 lei/Gcal. This calculation assumes current gas prices of 920,000 lei per cubic meter. These gas prices are estimated to increase soon by 14 percent, and possibly again as gas prices are liberalized and full impact of lei devaluation is restored to the gas price. Adding the 14 percent gas price increase raises the cost of gas thermal, exclusive of capital costs, to 257,000 lei/Gcal. These values compare to the current transfer price for thermal energy charged by TEC, which is 203,000 lei/Gcal now but expected to rise to approximately 290,000 lei/Gcal on July 1, 2000 as TEC is allowed to pass through its local costs and fuel price increases.

Capital costs for installing new gas boilers at eight substations (several in the northern zone, out of a total 134 system-wide, which have been indicated as priorities by the Municipality) are estimated at approximately $3 million. If these were financed with debt at 11 percent over a *15*-year term, including an 8 percent allowance for additional soft costs, debt service principal and interest would be $454,000 per year and add 174,000 lei per Gcal to the costs of service from these plants. Adding operating, fuel and capital costs together, estimated costs of gas thermal are 474,000 lei/Gcal. Capital cost estimates do not include the costs of new gas distribution pipelines to the heating substations. The local gas distribution company in Constanta (Congaz) indicated that they would pay for new gas pipelines as part of their infrastructure investment.

An interview was conducted with Congaz, to discuss gas prices, gas thermal options and plans for future development of gas distribution infrastructure. Regarding gas prices, according to Congaz, current prices relevant for RADET as a district heating enterprise are 900,000 lei per 1000 cubic meter. This Ministry of Industry nationally regulates this price. It established the price in *lei* based on a dollar price of $62 per 1000 cubic meters and an exchange rate of 14,500 ROL/USD. The Ministry intends to restore the deterioration in the gas price caused by Leu devaluation to almost 18,900 ROL/SUD. An increase in gas price to 1.02 million lei per 1000 cubic meter is anticipated imminently. A further increase to 1.2 million lei is required to fully restore the price of gas to reflect current exchange rates, so further gas prices increases are expected also.

In general, the price of gas will follow the price of fuel oil but there may occur market conditions, such as those at present, where gas is cheaper. Gas certainly has environmental advantages. It is important to note that TEC is also contemplating installation of a gas delivery pipeline. TEC indicates that their heat-only boilers currently have dual fuel (oil or gas) capacity and that their investment plans call for adding dual fuel capability to their cogeneration plant. Thus, TEC itself could take advantage of any attractive price spreads between gas and fuel oil, and pass these economies on to RADET. Further, TEC will likely be able to purchase gas at a lower price than RADET. They are a larger volume customer. Their purchasing arrangements can be negotiated via the nationwide TE system. And, TEC qualifies under the new Gas Law for direct purchase from gas producers, with payment of a transmission charge to the distribution company. These points were raised and confirmed in the interview with Congaz.

Conclusions on Gas Thermal Option The values provided by engineers should be taken as indicative and not as the last, definitive word on gas thermal generation economics. However, the cost estimates performed to date certainly indicate that gas thermal does not currently offer a lower cost of wholesale thermal energy. Therefore, the investment priorities in system balancing and substations recommended by the engineers should be implemented. If adequate thermal service can then be provided system-wide as the engineers confidently predict, then the main reason to implement distributed gas thermal options would be if it provides cost savings. The ability of private sector companies to achieve lower prices and efficiencies, to take advantage of potential economies of cogeneration (as opposed to heat only boilers) at the substations, and other advantages of gas thermal, including promotion of gas distribution infrastructure in Constanta, can continue to be explored. The proposed investment program represents a higher priority use of funds, is necessary, will be valid and will provide value to RADET regardless of which future thermal supply option — TEC or independent gas or a combination of the two — is selected. It therefore represents a prudent course of action, and further work investigating thermal supply options can continue to be done by RADET and in partnership with prospective commercial partners.

Another option is for RADET or another commercial party to acquire the TEC plant. The Municipality may want to explore this as an alternative means of securing a reliable supply of thermal energy for the district heating system. A RADET acquisition would redraw the boundaries of the system and give RADET every incentive to find the economically

optimal solution. A commercial acquisition would provide an opportunity to restate the wholesale thermal supply contract on commercial terms and create a vehicle for further investment in efficiency in the TEC plant and primary network.

Program Commercial and Financing Options

This section reviews the various options available to the Municipality and RADET, including the following:

- Privatization of RADET, with program financing coming from and secured by the new commercial owners;
- Partial privatization of a portion of the RADET system, including, possibly, new gas-fired thermal plants, also with program financing coming from and secured by the new commercial owners;
- Long-term concession contract for RADET operations, including the investment program; and,
- Energy services contract combined with loan financing provided direct to the Municipality and/or RADET.

Many variations and combinations are possible. For the reasons cited above, direct financial and credit support from the Municipality for the proposed investment program is essential and is therefore recommended as a starting point for moving forward. This principle still allows for creative hybrids and does not preclude financing from commercial partners to be combined, now or in the future.

Discussion of commercial options often tends to focus more on issues of ownership, control and contract form. These have to be addressed. However, other key questions to be answered in designing the financing and commercial plan for the program, which are perhaps more fundamental at this stage, include:

- What are the sources of funds available for amortizing the investment program, however it is structured?, (discussed above);
- What will be the security for the financing?, (see below);
- What operational and management services will be provided by the commercial contractor, in addition to turnkey implementation of the investment program?, (question deserves further research, see description of service menu, below);
- What is the preferred distribution of program and RADET operational roles and risks?, (discussed below);
- How will the commercial party be compensated for their services and investment? (discussed below).

Key institutional questions

Two institutional questions have to be reviewed carefully now by the Municipality. The first is: when will the Municipality convert RADET from an Regia Autonome (RA) to a Commercial Regia Autonome (CRA), and what are the implications of this conversion? The law (207/97) mandates this conversion, but there is uncertainty in the law and subsequent amendments allow for delays and exceptions. Thus, the Municipality appears to be under no immediate legal pressure to effect this conversion, although the eventual conversion still appears to be required. Once the conversion occurs, the Municipality can retain ownership of shares in the CRA. Thus, the conversion does not necessarily affect the Municipality's control and ownership of RADET. The law is clear that, upon conversion, the Municipality retains ownership of the district heating system assets and a concession contract, with up to a maximum 49 year term, between the Municipality and the CRA for operating these assets needs to be effected within thirty (30) days of the conversion. [22] Conversion to a CRA is required for implementing certain commercial options. A proper concession contract will take months of development and negotiation. Therefore, it is recommended that the Municipality develop plans for conversion of RADET into a CRA in the context of implementing this investment program. The Municipality should prepare properly for the conversion by developing in advance the appropriate concession contract. Such a concession could be, but is not necessarily, a vehicle for undertaking the investment program.

The second institutional question concerns the Municipality's preference of whether or not to retain operational management control over the RADET system or to turn over these responsibilities to a commercial contractor via a concession or service contract. An intermediate solution is for the Municipality to retain operational control and current management but to procure certain operation and management services from the commercial contractor. The bases for this decision include the Municipality's and RADET's: preferences for control, assessment of the quality of its current management and staff, assessment of the potential for achieving operational and management efficiencies through various contracting and concession options, and its ability to effectively negotiate and manage such a contract. We recommend that the Municipality further review all of these topics. The operations management audit recommended above, could inform these discussions. The Municipality should retain outside experts in the development and negotiation of applicable contracts. The Municipality may be able to source funding via the EBRD to retain such expertise.

Other issues

Procurement A major topic to be addressed is how the program and its related contracts will be tendered and procured. At this stage, the Municipality needs to make its own internal assessments, define its preferences and the range of options it will consider. Some questions concerning precise commercial option and contract form could be left to be decided in the procurement process in response to commercial proposals.

[22] See Emergency Government Ordinance No. 30 of 1997, Article 4.3)

Legal feasibility EBRD commissioned an "Institutional Restructuring Study in the Field of District Heating: Analysis of Legislation", published in February 1999.[23] The study provides excellent summaries of relevant legislation, as well as recommendations for secondary legislation, and has been consulted for the purposes of this report to confirm the legal feasibility of various options. The reader is strongly recommended to consult this Study for a detailed presentation on the legal framework in Romania.

Precedents exist for several of the options. The Municipality has undertaken a long-term solid waste disposal services contract. Several municipal water concession contracts in Romania are in advanced stages of development. The small local council of Ovidiu, near Constanta, has contracted for partial privatization of its district heating system, including a new gas thermal plant, with an affiliate of Congaz. The Romanian Development Bank (BRD), a recently privatized commercial bank, has made two small loans for district heating system upgrades to municipalities. Dalkia Romania has existing service contracts and is negotiating a long-term concession contract with the Municipality of Ploiesti. It is recommended that these and other precedents be researched further as part of the Municipality's assessment of commercial options, and to learn from experience of the Municipality's peers.

Privatization

Privatization normally implies sale/transfer of system assets to a commercial party to operate. Because of the Patrimony Law, district heating system assets remain inalienable public property. Therefore, privatization would be effected through sale or transfer by the Municipality, in whole or in part, of ownership shares in a commercialized RA. The new operator would need to undertake a concession (or modify an existing concession) between the Municipality and the CRA. Municipal control and rights with respect to the district heating system operation can be effected via the concession. The operation would also continue to be subject to relevant regulation, including price-setting rules. The new owner/operator would make investments in system upgrades and efficiency as required by the concession contract terms or as otherwise dictated by financial self-interest. The normal method for the private owner to earn compensation and a return on their investment is, like other businesses, the difference between their revenues and their expenses.

In general, privatization is a feasible alternative when the system is in a position to be operated profitably. At this stage, RADET is far from this position. It is not realistic at this time for a commercial company to take all operating, investment and commercial risks normally associated with privatization. RADET currently operates at a loss and it is not ready for commercial operation. The price and subsidy systems need to be reformed. The legal framework is still evolving[24]. And, investment requirements in the system to meet deferred maintenance needs are too high. For these reasons, full privatization appears

[23] "Institutional Restructuring Study in the Field of District Heating: Analysis of Legislation", Stadtwerke Frankfurt/Oder (SWF) on behalf of the German Technical Cooperation Company (GTZ), February 1999.

[24] For example, the EBRD Study raises the question of how to provide adequate security for commercial investment in the face of the Patrimony Law and political risks of expropriation under the evolving legal framework; while this issue is likely solvable, it does represent a barrier.

unfeasible at this time. Because of the Patrimony Law, it is more appropriate to think of privatization in terms of (a) commercial shareholding of the CRA, and (b) a long-term concession contract.

Partial privatization

In this option, only a portion of the system is "privatized", as described above. The new owner/operator would receive a concession to operate a portion of the system, with an intent to make investments and upgrade service in that portion only. An important variant or component to partial privatization would be private development and operation of new thermal or cogeneration plant(s). These new thermal plants could serve the privatized components of the system[25] or provide thermal energy to RADET under long-term thermal sales agreements.

The same concerns regarding full privatization apply to partial privatization but they might be made manageable by smaller size or a pilot program. If gas thermal options are to be developed in the future, private ownership and operation of these plants on a privatized basis should definitely be considered. The main concern with partial privatization is that it concentrates commercial investments in one portion of system, whereas the most economically attractive investment options are likely system wide, e.g., substations. Thus, the economics of partial privatization would likely be unattractive for a commercial party, and investment is better focused where it will generate the greatest returns via savings. Partial privatization could be part of hybrid solution, but is likely not to offer the simplest legal solution.

Concession contract

A long-term concession contract could be granted to a commercial operator to operate the RADET system. The contracting party could be the RADET RA, or CRA (which in turn would have a concession agreement with the Municipality), or, to simplify matters, the concessionaire could participate in ownership of the CRA and the commercial concession contract would be combined within the Municipality/CRA concession contract.

There are many ways to structure compensation for the concessionaire: fee-for-service, fixed fee, or share of profits. It is most likely that at this stage the concessionaire would require a fee-for-service compensation structure. The contract could include commitment by the concessionaire to make investments in the system. Concessionaire compensation for this investment would need to come from the service fee income. The concessionaire could assume technical performance risks associated with achieving savings and efficiencies from the investment and operations management efficiency program. Given the current price and subsidy system, it is not commercially realistic at this stage for the concessionaire to earn their compensation through the difference between district heating system revenues and expenses. This might change if the Municipality were to make a long-term pledge agreeing to support a given level of revenues for the CRA. The

[25] We understand that this is how the contract between the Municipality of Ovidiu and Congaz has been structured.

concessionaire would have to accept the Municipality's credit risk or require the Municipality to provide other security backing this pledge, e.g., the types of revenue pledges described below.

The revenue formula would likely have fixed cost and variable (per Gcal thermal sales) components. The Municipal level of revenue commitment would be adjusted according to the retail price for heat that the concessionaire could charge according to applicable regulations. The concessionaire would probably not be willing to assume risks associated with customer payment and collections. It is estimated that this risk would not be commercially acceptable at this time, but this point remains to be determined.

If the Municipality is interested in turning over operational management responsibilities for the district heating system to a commercial contractor as a means to improve the operations and management efficiency of the system, then a concession contract should definitely be considered. The concessionaire would lead development of operating and management efficiencies as well as undertake the investment program. The concession contract creates a long time horizon that allows for rational investment planning. The ability of the concessionaire to make investment is a function of (a) profitable operation of system, or (b) Municipal subsidy or credit support. A concessionaire will not be able or willing to fund the entire investment program in the current price and subsidy environment and given the large investment needs of the system. The Municipality will need to provide funding for a portion of those investments. There are many ways to distribute the risks and roles, such as customer collection risks, in a concession contract. This requires a detailed evaluation and discussion of all RADET functions to determine what risks the Municipality can and should accept and which the concessionaire could assume. Unfortunately, we could not complete this analysis for this report. The Municipality and RADET should conduct a thorough discussion of these issues.

Hybrid option: Concession contract combined with loan to Municipality

Dalkia Romania has expressed interest in the Constanta program. In an interview with their management in Bucharest, a hybrid option was explored as follows. RADET would be converted into a CRA. Dalkia would purchase majority shareholding in the CRA. The CRA, under Dalkia's management, would conclude a concession contract with the Municipality to operate the system. Dalkia would effectively take over the operations and management of the whole system. The concession contract would contain compensation provisions on a fee-for-service basis, with appropriate service standards. The Municipality would formalize their subsidy commitments in the concession contract, but determine the subsidy based on (i) an overall system budget, and (ii) a revenue formula that is adjusted based on retail heat prices. Dalkia would be responsible for investment in the substations, which could be funded out of energy and operational cost savings. The Municipality would undertake a loan and debt service obligation for the investment program in other essential elements of the system, i.e., the secondary network and metering, in particular. Many more details on this option need to be defined, but it serves to illustrate (a) the types of hybrids that could be developed, (b) the commercial interest of a candidate contractor, and (c) the assessment by this company that some Municipal financing is needed for essential investments that cannot be paid from savings.

The provision of some financing by a commercial partner could lower the total Municipal loan amount and lower the required Municipal up-front capital contribution. Because of these benefits, a commercial contribution could be an important part of a project financing plan. It must be remembered that the commercial partner will need to repaid for these investments, and the funds for repayment, even when based on savings, must come from RADET or Municipal budget sources. Further, the time horizon over which the contractor must be repaid is likely to be seven years rather than the ten years estimated as an EBRD loan term. All these factors must be balanced in developing the financing plan for the proposed investment program.

Other energy service companies were interviewed in preparation of this report including Honeywell, Landis & Staefa and MVV (Manheim). All three of these would be interested in turnkey project installation and possibly provision of operations services. None are yet established to offer project financing in Romania.

Loan with turnkey Energy Project and Services Contract (ESCO)

This option involves two contracts: (i) an energy service contract between a commercial contractor (ESCO) and RADET; and (ii) a loan to the Municipality or RADET for the project financing. An ESCO is broadly defined to mean a commercial for-profit company specializing in EE projects and services and district heating system operations. The energy services contract would have two main components. First, would be a turnkey contract for development and installation of the project. Second, would be provision of certain services to be determined.

Compensation for the turnkey project would be structured on a fixed price basis, with the ESCO assuming responsibility and risks to deliver the project on time and on budget. The Municipality/RADET could pay for the entire program cost, but have the ESCO assume responsibility and risk for the technical performance of the project under an extended warranty and/or guaranteed energy savings arrangement. Turnkey construction would be paid in phases, according to a negotiated construction disbursement schedule, out of the proceeds of the loan. Compensation for services would likely be structured on a fee-for-service basis. Some bonus compensation based on performance and/or achieved savings could also be included in the formula. (See Diagram 1) Alternatively,. it is possible for the ESCO to provide its own financing for that portion of the program which can be paid from savings, in which case, the energy services contract would specify the repayment schedule and formula for such compensation. This requirement could significantly reduce the number of prospective ESCO bidders interested in the program as many may be interest in providing turnkey project installation and services but not yet be willing to take on credit risks associated with providing financing (See Diagram 2)

The ESCO contract arrangement can be structured flexibly and provide a framework for the Municipality and RADET to procure exactly what they want, i.e., a turnkey project with certain services, while retaining operational and management control over the system. RADET can remain organized as it is and be converted to a CRA at a later date. The key advantage of an ESCO arrangement is its flexibility and transparency and the ability to

move forward with a project with a commercial partner immediately, even under the current management regime. If the Municipality is not prepared to undertake a full concession contract, the ESCO contract offers an intermediate option that can be custom designed to meet the Municipality's and RADET's needs. An ESCO energy services contract could potentially be structured to evolve into a long-term concession contract and/or privatization. For example, the ESCO could be given an option for future purchase of CRA shares. This creates shared incentive for performance and an alternative means for the ESCO to profit from improving the operations/management efficiency of RADET.

Diagram 1
LOAN with ENERGY SERVICES CONTRACT

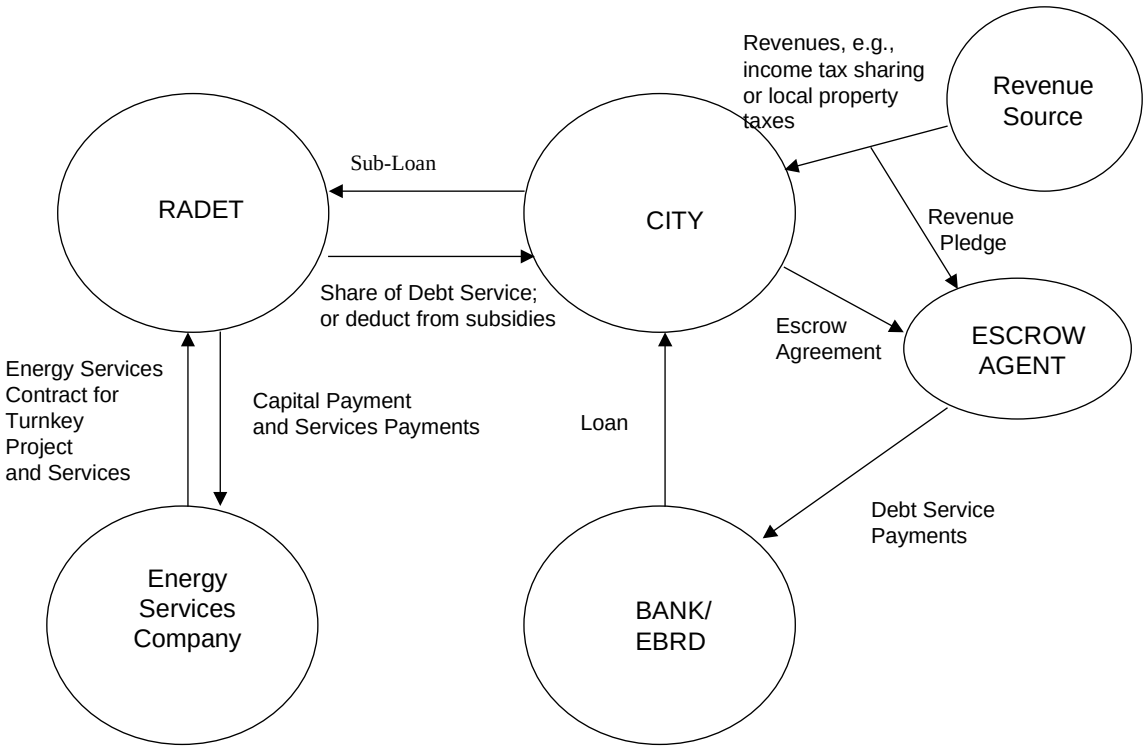
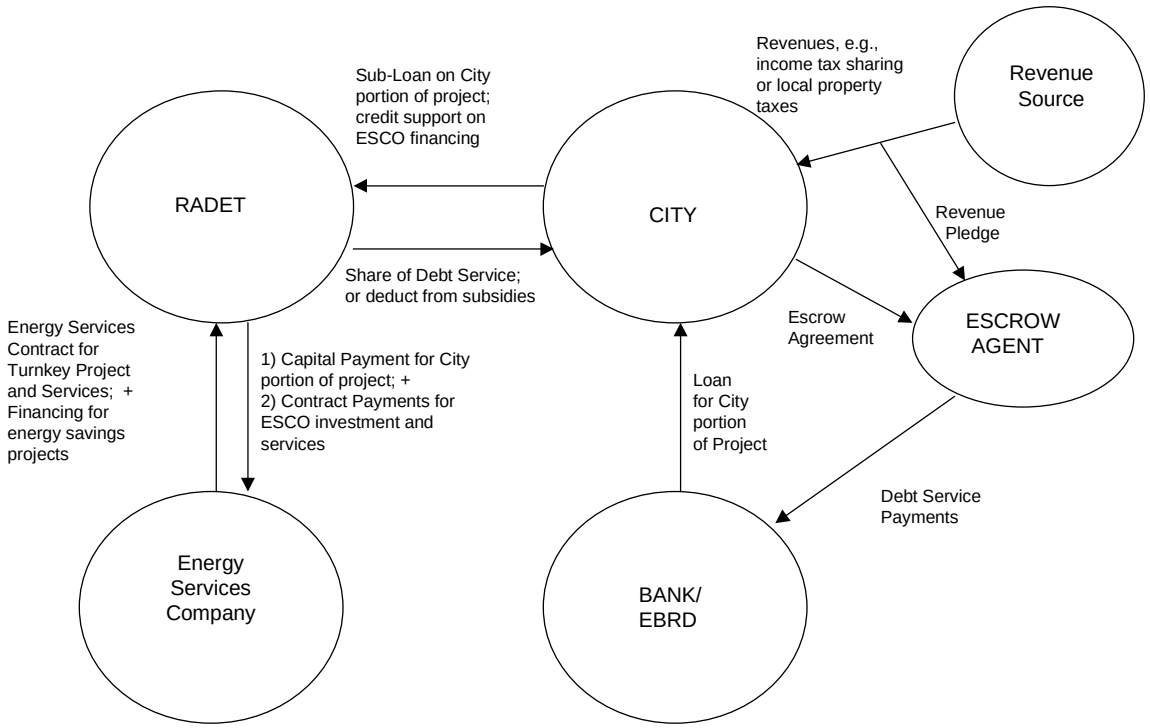


Diagram 2 Hybrid:
Loan to City with ESCO Financing & Services Contract



Municipal Finance Rules

The Local Public Finance Law (189/1998) passed in 1998 allows Local and County Councils to contract for domestic and external loans for local public investments. These loans can be secured by the local councils through a pledge of any income source excepting budget transfers for special destinations.

Municipal debt limit and borrowing capacity

Local governments in Romania are subject to a debt limit as follows: total annual debt service, both principal and interest, can not exceed 20 percent of annual local revenues, from all sources. This debt limit was established in the Law on Local Public Finances passed in 1998. Further details on calculation methodology have not been available. It is noted that debt limits, which have annual debt service in the numerator, may be subject to manipulation and lose effectiveness by deferral of principal payments. The Municipality should investigate the extent to which borrowing by RADET, or assumption of debt service obligations by RADET to be paid from its own revenues, could result in having the debt treated as "off-balance sheet" for the Municipality. In this case, the debt would not count toward the debt limit.

The Municipality does not have any long-term debt currently. Its annual revenues (1999, fiscal year = calendar year) were 321,824 million lei (US$17 million). Twenty percent of this amount is approximately $3.4 million. Assuming a loan of 10 year term, at 11 percent interest, with level payments of principal and interest, the maximum loan size which these funds could service is approximately $20 million. This calculation needs to be adjusted reflecting the current (year 2000) budget and exchange rates. Further, it is obviously imprudent for Municipality to (a) devote all its borrowing capacity solely to the RADET investment program, and (b) to maximize its borrowing and reach its debt limit immediately. A margin for Leu devaluation should also be included, as external debt service will be in dollars or other foreign currency.

Ministry of Finance Public Debt Department

National approval is required for all external (foreign) loans to local authorities. The Ministry of Finance has established an "Interdepartmental Committee to Authorize External Loans Granted by Banks to Municipalities." The staff to this committee is a recently formed Public Debt Department within the MoF. The committee has representatives from four agencies: the MoF, the Ministry of Public Administration, National Bank of Romania and the Federation of Municipalities. Main criteria applied by this committee are: (i) enforcement of the municipal debt limit ceiling; (ii) overall management of the nation's external debt; and (iii) confirmation of proper local authorization of the borrowing. The committee does not review the technical merits of how proposed loan proceeds will used. Only one loan has been processed by the Public Debt Department to date, but it did not close. It is not specifically stipulated that these procedures must be followed if the loan is contracted by a company or regia subordinated to the local authority which guarantees the loan, but it is safe to assume that they would apply.

Private public property

The Patrimony Law makes a distinction between inalienable public property and *private* public property, i.e., assets of the Municipality which do not constitute inalienable public property because by their nature they do not serve essential public functions. Land and buildings that are not required to perform essential public services could fall in this category for example. The Municipality has yet to inventory and distinguish their private public property that they would be able to mortgage as additional security for a loan. This prospect will not likely represent a significant component of the financing solution for this program, but it does represent a task that the Municipality should perform as part of their financial management program.

Loan Security

Municipal revenue pledge

The primary means which the Municipality has to secure a loan is to provide a revenue pledge. The Patrimony Law prohibits the Municipality from providing a mortgage or lien on public assets that constitute inalienable public property. District heating system assets explicitly fall in this category. The mechanisms for pledging revenues were reviewed

in a meeting with the Municipality and the Directorate General of Public Finance in Constanta. This office is an agency of the Ministry of Finance and has responsibility for monitoring budgetary execution of all public authorities. This office does *not* have budgetary approval authority; however, *all* Municipal income flows through accounts managed by this office. This office would also have responsibility to review and approve loan documents and could likely be involved in managing disbursement of proceeds during project construction. Further, special Municipal sub-accounts have been and can be established at the Municipality's direction for private companies that do business with the Municipality so as to assure their proper payment. While no exact precedents exist for using the revenue pledge mechanism to secure loan debt service obligations[26], the representative of the Ministry of Finance expressed confidence that it was feasible and easily effected within the parameters of the system she is already managing. It is important to note that this mechanism may also be applicable to secure payments due by RADET to a service contractor where the Municipality agrees to either (a) guarantee the service contract payments, or (b) make the payments directly in lieu of subsidy payments to RADET.

Main revenue sources that the Municipality can pledge include: (i) wage income tax revenues shared by the national government, and (ii) local property taxes. In reviewing this security mechanism with domestic and international banks in Bucharest, preference was expressed for local revenues to be pledged, as uncertainty remains, change has been frequent and confidence is low concerning the level of national revenues that are shared with local governments.

There are two general options for effecting the revenue pledge mechanism, which will be termed "escrow" and "stand-by". With the first method, the Municipality directs the flow of funds of the given revenue stream to an escrow account managed on behalf of the lender and the Municipality. This account is used to make debt service payments on a priority basis to the lender. The quantity of revenues directed to this account can also be stipulated in some ratio to the debt service requirements. Minimum account balances, representing an agreed number of monthly debt service payments, e.g., three to six, can be established, and excess funds would be remitted periodically to the Municipality. With the second method, documents are effected which give the lender the right to intercept or direct the flow of funds from defined revenue sources should the Municipality fail to meet its debt service payments. All revenues flow to the Municipality's normal accounts as long as the Municipality is current on debt service payments. The revenue pledge remains in a "stand-by" position to be effected if necessary. The escrow method is generally perceived as being stronger as it segregates Municipal revenues at their source. The choice of mechanism will be made between the loan parties. The local staff of the Ministry of Finance were very cooperative and knowledgeable and are recommended for early contact in the course of future discussions/negotiations on loan structure and security, including security for service contract payments, as applicable.

[26] BRD (Romanian Development Bank) may have experience with the stand-by revenue pledge mechanism as part of the security for the two municipal loans they cited.

Municipal guarantee of loan to RADET

An important alternative finance structure is for the Municipality to guarantee a loan made to RADET. If RADET is the borrower, it is certain, that a Municipal guarantee would be required as part of the deal. Our initial research indicates that this is possible legally and that the Municipality can offer the same security supporting a guarantee that it can offer for a loan. It is not clear whether or not: (i) debt service due on a loan to RADET which is guaranteed by the Municipality would count toward the Municipality's debt limit; and (ii) a Municipal guarantee is subject to the same MoF approval processes as those which apply for external loans. The relevant laws do not appear to address the guarantee possibilities directly, either to prohibit or authorize. At this time, this option should still be considered under the assumption that the guarantee liability would count toward the Municipality's debt limit, require a revenue pledge to support it and need MoF approval. The guarantee option should be further researched. The advantages and disadvantages of RADET as borrower versus Municipality as borrower are assessed as follows.

Having the Municipality as borrower is simpler and would avoid legal complications, uncertainties and potential expense associated with a guarantee. It is also more direct and reflects the reality that the Municipality has financial responsibility for RADET and would assume responsibility for debt service through the guarantee and its financial commitments to RADET. RADET is loss making and the Municipality is more creditworthy. If the guarantee structure imposed additional or perceived risks on the lender, it could cause the loan interest rate to be higher.

Having RADET as borrower is logical because the proceeds are being used for RADET. It could build greater credit history for RADET and so contribute to RADET's development as a self-supporting enterprise. It could also possibly result in the debt being considered "off-balance sheet" for the Municipality, i.e., not counting toward the Municipality’s debt limit, and thus preserve Municipal borrowing capacity for other purposes, although this interpretation is deemed unlikely. If the Municipality serves as borrower, it may be possible to refinance the Municipality’s debt later with a borrowing by RADET once RADET has achieved a viable financial position.

Risks and Roles

Risk evaluation, allocation and mitigation plans are a key element of program planning and commercial contract arrangement. A table illustrating the typical distribution of roles and risks, in this case under the ESCO option combined with a loan to the Municipality, is provided below. This transaction structure is the one described in Diagram 1, above. Commentary on each risk also follows.

Table C2
Roles and Risks

Risk/Role	Assumed by
Credit risk of Municipality	Lender, secured with revenue pledge
Credit risk of RADET	Municipality
Foreign exchange rate risk	Municipality, passed on to RADET and customers[27]
Project construction risks, completion on time and on budget	Contractor/ESCO
Project technical and performance risks	Contractor/ESCO and RADET, according to energy services contract terms
Energy price risks	RADET and customers and Municipality
Customer collections performance risk	RADET, or possible by concessionaire or new owner under concession contract or privatization
Wholesale thermal delivery performance risk	TEC, under wholesale thermal contract

Any lender willing to finance the program will want to make sure that the Municipality is creditworthy. A revenue pledge, or priority drawing right on Municipal accounts with the Treasury, is estimated to be required to secure the loan. Because RADET is financially dependent on the Municipality, the Municipality must serve as borrower and/or provide credit support for RADET obligations. Municipal credit support is estimated to be required even in the case of commercial service contracts with RADET. The loan is anticipated to be mostly if not wholly in foreign currency and the Municipality must accept this risk.

Project construction risks can be borne by the contractor. A turnkey contract approach is recommended whereby the contractor commits to complete the project for a fixed price and schedule. The ability of the contractor to commit to a fixed price in these rehabilitation circumstances where unforeseen conditions can arise remains to be determined. The contractor also should participate in determining the final technical design solution.

Project technical performance risks, including proper functioning of the new equipment and achievement of estimated energy savings (under given estimated load and operating conditions), should also be borne by the contractor if possible. Extended warranties on continued functioning of new equipment should also be explored.

Energy price risks are outside the control of the contractor and therefore will likely have to be borne by RADET and the Municipality, and, in turn, the customers when retail price caps are lifted. At this stage in Romania, these risks include significant regulatory risks associated with the system of retail and reference price regulation. In more mature markets, it is possible to hedge future energy price risks. (Enron offers these services in Hungary, for example).

Customer collection risks are estimated to be acceptable to be assumed by a contractor under a full concession arrangement and given future rights to terminate service

[27] Regarding foreign exchange rate risk, approved prices can be indexed to the ROL/USD exchange rate, allowing RADET to pass the risk and costs associated with devaluation onto their customers, (EBRD Study, page 7).

in the event of non-payment. For now, it is estimated that RADET and the Municipality will continue to bear this risk.

Wholesale thermal delivery risk *should* be borne by TEC. Use of proper metering equipment is required to assure that this is the case and to assure that RADET pays properly for thermal energy delivered and that TEC meets delivery specifications.

Procurement

Any contracting for private-sector services related to district heating modernization would have to comply with local and national procurement requirements. Depending on the type contract between the Municipality and the private company, different procurement procedures will apply. There are relevant regulations related to concession contracting. Concessions can be granted through open public tenders, open tenders with pre-selection or direct negotiation:

Open public tender This is the traditional method of tendering with public announcements and solicitation of bids. Romanian or foreign companies can make an offer. According to national law, the regia offering the concession has the obligation to publish the tender announcement in the Romanian Official Gazette, Part IV, as well as in a local and national newspaper. Proposals can be accepted up to 20-60 days.

Open public tender with previous selection Under this scenario, the authority issuing the concession has pre-selected a limited number of qualifying companies based on previously stated criteria. Only these pre-selected companies can submit offers. The notification requirements are the same as with the open public tender.

Concession through direct negotiation If an open tender process is unable to select a winner, because no proposals were submitted or for any other reason, the concedent can offer the concession to the Romanian or foreign legal bodies of its choosing. The intention of direct negotiation will be published in a national and local newspaper.

Sale of shares of a CRA does not appear to require competitive bidding. Further, a CRA can enter into direct negotiation with the Municipality for a concession contract. Thus, it appears possible that the Municipality, if it chose, could develop a concession contract on a direct negotiation basis. However, a competitive procurement is recommended. The process of preparing the tender documents, soliciting proposals, and evaluating proposal is important to educate the Municipality and prepare the Municipality to negotiate a contract.

Currently, the Government of Romania is developing procurement regulations that comply with the international bidding procedures of the World Bank. These guidelines set out the procedure for publication of solicitations as well as the methodology for assessing bids and awarding contracts. These regulations, if they are determined to be relevant for the Municipality or valuable as a guide, are available from the World Bank at its website, www.worldbank.org.

The Municipality of Constanta also has its own procurement rules, the most important of which is that sizable contracts for goods or services have to be approved by

the Local Council. Large investments, dealing with public works and even feasibility studies for large projects, require council approval. Once the feasibility study is completed, the investment project goes on a list, which the Mayor and Local Council authorize by putting it in a line item in the budget. The challenge, of course, is that Constanta uses such a small percentage of its revenue for capital investment projects.

One potential solution to this low level of investments is to use an energy service contract, where investments can be amortized over time through the energy savings generated by a district heating renovation. In principle, current procurement rules do not pose a barrier to developing contracts with energy service companies (ESCO's). There is, however, one practical barrier. Municipal procurement regulations do not allow for a contract to be issued for both a feasibility study and project implementation. Thus, if an ESCO does the feasibility work, they are not guaranteed the project work because that the implementation would have to be tendered separately. This regulation means that ESCO's will have no incentive to carry out a feasibility study, the cost of which the ESCO would otherwise incorporate into the overall energy services agreement. Thus, the procurement document should include sufficient engineering information about the RADET system to allow bidders to prepare proposals with an acceptable level of effort so as to lower barriers to entry for prospective ESCO's and assure the Municipality a most competitive procurement.

Feasibility of Municipality's Financial Role

Financially, RADET is a creature of the Municipality. Approximately one-third of RADET's budget derives from Municipal subsidies. RADET is still limited by national regulation in the retail price that it can charge its customers for heat. Municipal subsidies must make up the difference between thermal revenues and total costs. Through this budget mechanism, the Municipality inherently assumes financial risks of RADET operations. The Municipality stands to benefit from improved operating efficiencies via (a) reduced subsidies, and (b) positioning RADET for future privatization or commercial operations whereby certain RADET operating risks can be transferred to commercial parties. RADET is wholly owned by the Municipality, and, even as RADET is corporatized and commercialized, the Municipality will continue to own the inalienable public assets of the district heating system. As an enterprise, RADET is loss making and therefore not creditworthy to borrow in the absence of direct Municipal credit or financial support. Certain EE investments are justified based on savings. RADET could pay for these out of its own budget if the Municipality were meeting all its obligations to RADET. Currently, it is not. Other parts of the investment program do not generate attractive cost savings but are still essential. The main source of investment funds possible for RADET in addition to RADET's own budget, and the only source of credit support, is the Municipality.

The Municipality's financial contribution in the financial planning framework presented above consists of three main aspects: (i) capital contribution; (ii) annual debt service contribution; and (iii) serving as borrower or guarantor to provide adequate security for the project loan. The Municipality's capacity and willingness to make these contributions is key to the program.

Sizing the Municipality's annual financial contribution

The capital contribution of 20 percent of total program cost expected to be required by EBRD or other lenders may be very difficult for the Municipality to raise all at once. Several points can be made on how to solve this problem. First, because the program construction will be phased, the capital contribution can be phased. If the Municipality can contribute $1.0 to 1.5 million per year to the investment program, this can be sufficient to meet the capital contribution requirements over a multi-year construction period. Second, capital contributions can be sought from other sources. The Instrument for Structural Policies for Pre-Accession (ISPA), a program of the European Union, is one potential source is grant funding. It is recommended that this and other grant programs be investigated and pursued. Third, the contractor under certain commercial options may provide funding. This funding must earn a return, so it must be repaid, but it could be part of the formula and satisfy the EBRD co-financing requirement.

The Municipality is currently experiencing a financial crisis caused in large part by recent changes in intergovernmental fiscal relations shifting responsibility for certain large social expenditures to local governments. At the same time, the Municipality acknowledges they can do better in several areas of financial management. In particular, significant additional revenues could be generated via improved property tax collection and collection of fees for solid waste disposal services, and expenses can be reduced via improved economies in public transport.

We estimate that a concerted effort in these three areas could allow the Municipality to devote in the range of $1.0 to 1.5 million per year to RADET for capital investment purposes, i.e., as a capital contribution or to debt service. This level of Municipal contribution to RADET for capital investment is consistent with recent experience. In 1999, the Municipality originally budgeted 30 billion lei ($1.6 million) for investment in the district heating system. Actual expenditures in 1999 were 11.3 billion lei ($600,000). The Municipality’s capital budget for RADET for 2000 is 1.3 billion lei (<$70,000), reflecting the Municipality's current financial crisis. Municipal investment in RADET has typically represented 40 percent of total Municipal capital expenditures, reflecting the high priority of heat services in the Municipality’s budget.

The level of local taxes collected is over 10 percent less in Constanta on a per capita basis, than in other cities of similar population, like Cluj. Yet, the number of properties is slightly higher in Constanta. Improving property tax collections by 10 percent alone results in a potential revenue increase of over $1 million. The Municipality has already started a new inventory of properties that should be finished by May 2000.

Regarding the solid waste collection fee, citizens and businesses are paying a solid waste disposal fee that is constant in nominal terms while the Municipality's payments for solid waste collection services are indexed to the ROL/USD exchange rate. The difference results in added expense to the Municipality. For example, in the month of December 1999, the Municipality billed approximately 1.7 billion lei for solid waste disposal services (and had an 80 percent collection rate, resulting in revenues of 1.4 billion lei), while its cost of service was approximately 3 billion lei. The difference of

1.3 billion lei per month in lost revenues, times 12 months, even assuming modest further lei inflation, results in extra Municipal expense approaching $1,000,000 per year. Restatement and indexation of solid waste service fees to reflect actual cost of service could save an equivalent amount. These are the primary two sources of immediate revenue increase.

It is reasonable to propose that the Municipality return to its prior level of annual budgeted capital investment in RADET once Municipality's finances have stabilized. The Municipality would be prudent to withhold final decision triggering a financial commitment to the RADET investment program until they (i) implement and see success with the financial management improvements indicated above, and (ii) gain further experience with the new intergovernmental fiscal structure, including new changes anticipated in the State budget law for 2000, such that financial projections can be made. We estimate that with focused effort, such results could occur in 6 to 9 months. As part of its financial planning for the program, the Municipality should establish realistic targets for improving its finances. The improvements would generate funding for the proposed heating investment program. The Municipality's capital contribution to the program can be phased as project construction is phased.

ISPA funding

One option for grant financing for the Municipality of Constanta is the EU ISPA program. ISPA is designed to help eastern European countries looking to join the EU improve their infrastructure to comply with EU standards. The program focuses on air pollution, water quality, wastewater treatment, and transportation.

ISPA provides financing for project implementation, as well as feasibility studies and other project development measures. The project to be supported by ISPA should be *no less than* 5 million Euros. The program will support up to 75 percent, and in unusual cases, 85 percent of the total project costs. Proposals that offer a substantial amount of co-financing from the local authority or other private investor will be given preferential treatment. Applications are submitted by country governments, so in the case of Constanta, it would have to work with the appropriate national agency to send a proposal to ISPA. The applications must include the following items: (i) name of body responsible for implementation and description of the project with timetable; (ii) assessment of the environmental benefits; (iii) a financing plan, assessing the economic viability of the project, including a detailed financial analysis and a specified amount being requested from ISPA or other international institutions. All this should be accompanied with evidence of strong support from the national government, particularly as the project relates to fulfilling national environmental objectives.

The district heating program in Constanta would be a good candidate for ISPA funding. It would fall under the air pollution provision (Air Framework Directive 96/62 of the European Commission), which states that projects that reduce pollution, particularly those that reduce the emission of greenhouse gases, are a "Commission priority." In addition, the directive concentrates on supporting projects in dense urban areas of more than 200,000

people. The ISPA fund will offer one billion Euros *per year* and will operate from 2000-2006. The distribution of funds will be spread across the countries based on population size and per capita GDP. We recommend that the Municipality pursue ISPA funding, beginning with contacting the EU representative in Bucharest or the appropriate Ministry (Finance, Foreign Relations, etc.), to learn about how to work through the national government to submit a proposal to ISPA. At the margin, an ISPA contribution, even as small as 10-20 percent of the program cost, could be very significant for this program, offsetting the Municipality's capital contribution requirements. A well-prepared proposal by the Municipality to ISPA, via the appropriate national authorities, which requests a minority portion of the program cost and is supported by significant co-financing from the Municipality, its lender and commercial partner, could be attractive to ISPA and have a strong prospect for award.

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Heating price and subsidy reforms

Another important factor the Municipality may consider in determining the size and timing of its financial commitment to the program concerns reform in price and subsidy regulation. The Municipality currently has no flexibility in setting heating prices that are charged to customers. Revenues from customers are capped by the national regulation, which sets the retail price at 230,000 lei/Gcal. The Municipality must cover all RADET costs in excess of those that can be paid from customer revenues. Price reform which allows retail prices to increase and approach full cost recovery levels will provide the Municipality another source of revenues for amortizing the investment program: revenues raised from retail price increases. The Municipality could choose to stage a portion of the investment program, and its financial commitment to the program, contingent upon price reforms, and, accordingly, develop a financial plan for increasing retail prices, once permitted, to fund a portion of the investment program.

Reform in the system of subsidies, allowing subsidies to be targeted to households based on need, could also result in reductions in Municipality's subsidy obligations to RADET.

Changes in retail price regulation and the subsidy system require national executive and legislative action. It is strongly recommended that the Municipality develop a financial plan for the program that can proceed even prior to national government action on price and subsidy reform.

Paid-from-Savings Option

An important option the Municipality can consider in developing a financial plan for the program is to finance only what can be paid out of savings. This approach is not

recommended technically as some investments are critically needed yet do not generate savings. A limited set of these low- or no-savings investments could still be implemented on a paid-from-savings basis by blending them with the high payback substation projects. Also, it must be repeated that most risks associated with achieving cost savings will be borne by the Municipality, so the Municipality must be prepared support project loan debt service payments to the extent that estimated savings do not materialize. Further, this approach also presumes that the Municipality is fully current with its subsidy payments to RADET, and RADET is current in its payments to TEC, so that RADET has budget resources to save that can be devoted to amortizing the investment.

Uncertainties in savings calculations

There are uncertainties inherent in the savings calculations. The engineers have estimated savings to be achieved by RADET from this proposed investment program. Savings are achieved primarily from the heat substation upgrades. These energy savings estimates were questioned by staff from both RADET and TEC who said they believed that these savings may be offset by the increased thermal deliveries to customers who currently are under supplied. The engineers acknowledged this point but have restated their *high level of confidence* in the energy savings calculations *and* in the ability of the TEC Palas plant to serve all areas of the RADET system adequately provided the system is hydraulically balanced.

There is a further question of how energy savings translate into financial savings for RADET and the Municipality. The mechanism for RADET to achieve financial savings is as follows: (a) improved efficiency and reduced losses at the substations result in reduced deliveries of wholesale thermal energy from TEC, (b) thereby reducing payments by RADET to TEC for wholesale thermal energy, (c) all while maintaining and in many cases improving heat and hot water delivery services to customers, who continue to make the same payments.

In practice, RADET is not metering either their retail sales of heat or their wholesale purchases of thermal energy. Investment in metering is required to rationalize their system, and is called for in the recommended investment program. TEC indicates that they have 75 percent of RADET substations metered. However, according to the engineers, these are not calibrated properly and are not being used to determine quantities of thermal energy delivered to RADET for the purposes of calculating payments due by RADET to TEC. Rather, TEC meters gigacalories entering the primary network at the exit point from the TEC Palas plant. TEC uses this value, adjusted by approximately 7 percent to account for losses in the primary network, to determine quantities of thermal energy delivered to the RADET substations to bill to RADET. RADET then uses this net value, minus 10 percent to reflect estimated distribution system losses, to calculate quantities of heat to bill to their residential customers, which constitute 90 percent of RADET's total loads, (non-residential customers are typically metered). Allocation of heat sales amongst residential customers is determined primarily based on square meters of radiators in the buildings. Thus, in the immediate term, reduction in RADET gigacalory purchases from TEC will result in reduced gigacalory sales to customers which causes a loss in RADET customer revenue, and which means savings accrue to customers. Increasing the price/Gcal to customers at present as

this price is set by regulation at 230,000 lei/Gcal can not offset this loss. Change in regulation would allow some or all of this loss to be recovered from customers.

RADET must shift to metered billing both for their sales to customers and purchases from TEC. Given the current system, it appears unlikely that RADET is overestimating thermal deliveries from TEC, though some uncertainties remain. However, it seems quite possible that once metering begins with customers, RADET will discover that they have been over billing customers in quantity. Revenues lost in the reduction in actual quantity billings to customers must be made up by either (i) an increase in price charged to customers, which is currently subject to a cap set by national regulation, or (ii) an increase in Municipal subsidies. However RADET and the Municipality are able to make up this possible revenue loss, it remains clear that, under any billing regime, reduction in thermal deliveries from TEC to RADET will reduce RADET's cost of delivering a given level of services.

The metering and billing risks associated with these calculations will have to be borne by the Municipality/RADET. A commercial contractor can likely assume technical performance risks associated with achieving a metered level of energy savings, given a proper baseline, but the contractor generally will not take risks associated with how saved energy translates to financial savings. In general, because the Municipality will ultimately take the risks associated with the RADET budget and achievement of financial savings, for financial planning purposes, a conservative estimate of energy cost savings is recommended.

Savings have been valued based on the current transfer price for thermal energy from TEC. When transfer prices for thermal energy increase, then savings associated with the proposed investment program also increase, making the program more economic and urgent. An increase in the transfer price also has a negative effect. The revenues that RADET can collect from its customers are capped by the national reference prices of 230,000 lei/Gcal. Therefore, any increase in RADET costs increases the cost of the subsidies to the Municipality. This, in turn, reduces the financial resources available to the Municipality to fund the investments.

A further concern about savings calculations is whether TEC may respond to reduced thermal energy purchases by RADET by raising the transfer price per Gcal to distribute its fixed costs over a smaller sales volume. The current cost structure in the TEC Palas plant consists of 72 percent for fuel and 12 percent for water and chemicals, both of which are variable costs. Thus, this impact may be minimal, but the potential still needs to be noted. On the other hand, if TEC finds other buyers for the thermal energy not delivered to RADET, there might be no change in its transfer price per Gcal.

SUMMARY RECOMMENDATIONS

These recommendations are formulated based on currently available information and the limited level of dialogue with Municipal officials and are offered for consideration and discussion by the Municipality.

Recommended District Heating Program

Program phasing

Because the investment program consists of a package of measures implemented at many sites, it will of necessity be phased in implementation. Decisions on the order and timing of implementing different measures have both technical and financial dimensions. The engineers have recommended a phasing sequence over a three-year period. Financial elements to these decisions include choosing high payback projects and implementing projects according to available resources and staged levels of Municipal financial commitment. This principle of phasing should be applied to allow the Municipality to proceed to implement some measures soon, and then increase the investment size as Municipal and RADET financial circumstances allow. In general and within reason, loan disbursements can be designed to track a phased implementation plan.

The important point is for the Municipality to *start* the investment program and have a plan for how to implement it in full over time. It is likely that potential lenders, such as the European Bank for Reconstruction and Development (EBRD), will want to assess the full $19 million investment program. However, phasing of the program in tranches probably would be feasible and, indeed, desirable. This would allow the Municipality and the lender to make incremental decisions as key issues affecting program financing develop over time. Key developments include: (i) success with the Municipality's program of financial improvements, which frees funds for investment and debt service; (ii) price and subsidy reform, which would allow the Municipality to reduce subsidy payments and increase retail prices to RADET customers; (iii) verification of achieved energy savings from the first phase(s) of the investment program; (iv) realization of financial savings from the energy efficiency gains; and, (v) success in obtaining grant funding.

Initial program tranche

The recommended initial tranche of the program should be approximately $6.55 million. This reflects the capital cost of initial investments as recommended by the engineers, including the priority investments in the secondary network identified by RADET. It also includes an additional $1 million in substation projects to reduce the average simple payback for the combined initial tranche. This tranche of the program has estimated annual energy cost savings of $1.2 million. Therefore, it is possible to pay for all or most of it out of savings. This savings estimate is based on transfer prices used for Scenario B in the chapter on Evolution of Heating Prices.

Table D1
Recommended initial program tranche

	Project components	Capital Cost	Energy Cost Savings
1	Install substation I&C	$628,222	Incl. In line #3
2	Replace secondary pipes S1, N1	$3,334,500	$105,411
3	Upgrade 20 substations in south	$1,534,425	$674,485
4	Gas Boiler controls	$55,200	$44,473
5	*Subtotal*	*$5,552,347*	*$824,372*
6	Additional substation projects	$1,000,000	$396,122
7	**Totals**	**$6,552,347**	**$1,220,494**

This recommended initial program tranche looks as follows in the simplified financial planning framework explained above.

Table D2
Recommended financial planning framework for initial program tranche

	Key components	**(USD)**	**Assumptions**
1	Project Costs	$6,552,347	
2	Additional Soft Costs	$524,188	8.0%
3	Total Project Capital Costs	$7,076,535	Estimated hypothetical
	Sources of Funds for Investments		
4	EBRD Loan	$5,661,228	80.0%
5	Municipal Capital Contribution	$1,415,307	20.0%
6	Other	$0	0.0%
7	Total Sources	$7,076,535	
	Estimated EBRD Loan Terms		
8	Term/years	10	
9	Interest rate	11.00%	
	Annual Debt Service Payments		Level payments of P&I
10	EBRD loan only	$961,205	
11	Municipal contribution	$240,321	
12	Combined Debt Service	$1,201,526	
	Sources of Funds for Debt Payments		
13	Energy Cost Savings	$1,220,494	
14	Additional funds required (net savings achieved)	($18,968)	
15	Total	$1,201,526	

If energy savings are achieved as estimated, and these are realized as financial savings for RADET, the debt service on both the EBRD loan and the Municipal capital contribution is fully repaid from energy cost savings. Indeed, there would a net saving.

A primary difficulty in financing the initial program tranche will be raising the necessary Municipal capital contribution of approximately $1.45 million. Options discussed above, including pursuing grant funding and funding from a commercial contractor as a substitute for a direct Municipal contribution, or rapid implementation of Municipal financial improvements, can be explored to address this issue. Should the Municipality require a loan or funding from a commercial contractor, it appears that the corresponding cost would be covered from savings. If the Municipality receives a grant from outside sources to finance its capital contribution or if it is willing to provide the capital from its budget as a grant to RADET, then the additional financial savings can be used either to reduce heating prices or to create a source of financing for future investments in the system.

However, if not all the energy savings are realized, or if not all are realized as financial savings for RADET, then some portion of the Municipal capital contribution, if debt financed, might not be covered. Assuming that the current system of subsidies has been replaced with a targeted subsidy based on family income, there would be the option to increase RADET prices to recover the additional costs. Should the current system of subsidies based on the price per Gcal continue, then any increase in RADET prices simply converts to additional subsidy payments by the Municipality. If so, it might be simpler to treat the Municipal capital contribution as a grant to RADET. The Municipality would pay all or part of the corresponding debt service directly from its budget. If this amount proves too large for the Municipality, then the amount of Municipal financial capital contribution should be revised, and an initial program tranche sized on this basis.

Related recommendations

- Implement a concerted program of Municipal financial management improvements. Establish targets for (a) what level of financial improvement (sum of increased revenues and reduced expenses), i.e., budget scenarios, which correspond to (b) a given level annual financial commitment by the Municipality to the proposed investment program. This schedule can be used to develop a plan for implementing subsequent tranches of the program. If this plan can be developed, then the EBRD loan should be structured accordingly, to finance all tranches. The loan itself would be disbursed as needed.

- Seek ISPA and other grant funding for the program. For financial planning purposes, assume for the time being that no grants are obtained.

- Do not commit all available borrowing capacity on this investment program; phase the financial commitments as financial circumstances develop; but find the level of financial commitment now to start and take action.

- Because of the uncertainties associated with the translation of energy savings into realized financial savings for RADET and the Municipality use a conservative estimate of energy cost savings in financial planning.

- Regarding increasing retail prices to RADET customers as a means to raise funds available for amortizing the investment program, it is recommended that this value be assumed to be zero for now. Price and subsidy reform is required first; and, transfer price increases and the impact of adding the VAT to what customers must pay have to be absorbed. Once reform has been passed and RADET is free to adjust its retail prices, then this option should be evaluated.

Necessary services

In addition to the investment program, RADET needs to undertake a "structural improvement program" to improve operation and management systems and efficiency. The planning by the Municipality and RADET needs to include both the investment program *and* the structural improvement program. For this, RADET needs technical assistance and services from commercial partners. This point is critical and RADET management acknowledges it. Technical assistance could be required in a number of areas:

— Investment planning
— Development and engineering of the proposed investment program
— Management information systems
— Metering
— Automation and control systems
— Financial accounting and management
— Billing and collections
— Maintenance planning and systems
— Staffing efficiencies and staff training
— Customer service
— Media and public relations
— Risk management, including guarantees and warranties on performance of EE projects

This list is not exhaustive. The mission schedule did not allow an assessment of RADET operation and management systems nor a thorough discussion with RADET management concerning their perceived needs in all of these areas, but the brief discussions held on this subject did reveal interest from RADET management to explore these subjects. Overstaffing issues were also acknowledged. Implementation of an operation and management improvement program will require investment in certain systems, e.g., metering, and automation, information and control systems. These types of services will offer further opportunities for savings and can be acquired via the privatization, concession and/or energy services contract arrangements discussed above.

Recommended Commercial/Finance Structure for the Heating Investment Program

Municipal financial role and loan to the Municipality

Direct financial and credit support from the Municipality for the overall investment program and the initial tranche is essential if the program is to move forward. This principle still allows for creative hybrids and does not preclude financing from commercial partners to

be combined, now or in the future. Even an investment program designed to be repaid wholly from estimated savings will require a financial commitment by the Municipality because RADET is not creditworthy. This commitment might include some or all of the following: (i) a capital contribution, (ii) direct payment of all or part of the annual debt service, and (iii) a guaranty on a RADET borrowing or at least a formal, binding commitment to meet its subsidy payment obligations to RADET. Under these circumstances it probably is simpler to have the Municipality serve directly as the borrower.

The important point is for the Municipality to *start* the investment program and have a plan for how to implement it in full over time. It is likely that potential lenders, such as the European Bank for Reconstruction and Development (EBRD), will want to assess the full $19 million investment program. However, phasing of the program in tranches probably would be feasible and, indeed, desirable. This would allow the Municipality and the lender to make incremental decisions as key issues affecting program financing develop over time. Key developments include: (i) success with the Municipality's program of financial improvements, which frees funds for investment and debt service; (ii) price and subsidy reform, which would allow the Municipality to reduce subsidy payments and increase retail prices to RADET customers; (iii) verification of achieved energy savings from the first phase(s) of the investment program; (iv) realization of financial savings from the energy efficiency gains; and, (v) success in obtaining grant funding.

Contractor alternatives for a final technical design solution

The Municipality should contract with outside experts who would be responsible for recommending the final design and financing structure for the overall program and the initial tranche, based on the Municipality's stated requirements and approval, and taking the engineering studies done to date as a benchmark. Inherently, the process of defining the overall investment program and its tranches will be an iterative process involving discussions between the engineering and financial staff of the Municipality and RADET, outside experts and elected decision-makers. The current estimates of the engineers should be taken as indicative and used as the basis for planning.

Actual prices and refined savings estimates will be generated in the process of procuring the program, during which the engineering work to date will be used as a benchmark by bidding contractors and alternative, potentially less expensive technical solutions developed. Allowing the bidding contractors to propose alternative technical solutions would be consistent with having them assume some or all of the technical and performance risks associated with achieving energy savings, at least with respect to the substation component and as appropriate for other components. This contracting approach should lead to improved design and performance of the investment program.

Combine turnkey investment program with service contract

The development and implementation of the turnkey project should be procured in conjunction with a service or concession contract. That contract should include the types of operational and management improvement program described above.

Concession or service contract

The Municipality has a threshold question to make concerning whether to retain operational management control over the RADET system or to turn over these responsibilities to a commercial contractor via a concession or service contract. It is recommended that this decision be further studied by the Municipality and, in the absence of any overriding reasons for one solution or the other, that the decision itself be made in the context of the procurement.

Project financing from commercial contractor

The financing terms that might be offered by a commercial contractor probably will be priced higher and be for a shorter term than those the Municipality can obtain on a loan from EBRD, but this assumption should be tested. Most importantly, contractor financing for some component of the investment program, such as for the higher payback substation projects, may be essential as a means of supplementing or substituting for the Municipality's capital contribution. The procurement can be designed to consider offers of financing from prospective contractors. Making contractor financing a requirement may create a barrier to entry from many otherwise capable and attractive contractors. If this were to eliminate some contractors from the bidding, it could result in inferior, less competitive offers. Thus, it is recommended that contractor financing not be required, but that the Municipality indicate in the tender that it would consider such offers favorably.

Recommended Municipal Decision-Making Process

After this report has been presented to RADET and the Municipality, a team from both institutions should prepare a brief summary of the technical, investment and commercial options and recommendations. They should then proceed to brief Municipal management and political leadership, from all parties, including candidates for the upcoming election, on the findings and recommendations of the report. Assistance from the Romanian members of the team that prepared this report could be well applied in this education process, to assure that the results of the report are communicated and understood objectively and neutrally.

Once the new Municipal government in seated, then the Municipality should convene a special committee of relevant executive, Local Council and RADET decision-makers to proceed to review the technical, financial and commercial options and develop a financing and procurement plan for the heating investment program. The foundation for the program is political leadership by the Municipality of Constanta, which is based on meeting the Municipality's and citizens' needs and objectives. EBRD interest in this program is crucial. The Municipality is well advised to exploit this interest by constituting a committee of relevant decision-makers and continuing a dialogue with EBRD to develop and negotiate a plan for the program that meets EBRD criteria.

Recommendations regarding Energy Efficiency Investments in Municipal Buildings

The engineers have identified energy efficiency investments in Municipal buildings. Projects that can be implemented on a positive cash flow basis, i.e., savings greater than annual debt service, should be considered as priorities for implementation. This principle was reviewed with Municipal financial management and they generally agreed with its logic.

The projects for the school building are most economic and *almost* meet the positive cash flow criteria. Savings have been calculated based on a value to the Municipality of 439,000 lei/Gcal. This is the thermal price as projected in Scenario B in the discussion of prices and subsidies. If the projects also meet deferred maintenance needs, they represent a priority for the Municipality beyond their energy cost savings value and therefore should be considered for implementation now as their costs can be largely offset by savings.

Table D3
Financial Planning Framework: Municipal School Buildings

	Key Components	(USD)	Assumptions
1	Project Costs	$1,631,873	
2	Additional Soft Costs	$130.550	8.0%
3	Total Project Capital Costs	$1,762,423	
	Project Sources of Funds		
4	EBRD Loan	$1,409,938	80.0%
5	Municipal Capital Contribution	$352,485	20.0%
6	Other	$0	0.0%
7	Total Sources of funds	$1,762,423	
	Estimated EBRD Loan Terms		
8	Term/years	10	
9	Interest rate	11.00%	
10	Annual Debt Service	$239,410	Level payments of P&I
	Sources of Funds for Debt Payments		
11	Energy Cost Savings	$343,535	
12	**Additional funds required (net savings achieved)**	($104,125)	
13	Total	$239,410	

NEXT STEPS

Policy Issues to be Addressed

Policy decisions adopted by the Government at the national level have had a dramatic effect on heating prices in Constanta in recent years. National energy policy has affected the transfer price for thermal energy delivered by TEC to RADET by eliminating cross subsidies between electricity and heat, between industrial and residential consumption and most recently between low- and high-cost producers across the country. National environmental policy will require that TEC Palas use fuels with a lower sulfur content. These fuels are more costly than those currently in use at the plant. In 2000, the cumulative effect of national energy and environmental policy decisions will increase the transfer price for thermal energy delivered by TEC to RADET by about forty percent in real terms over current prices.

The Government also controls the process of setting all the components of the price for heating. The National Energy Sector Regulatory Commission determines the transfer prices for thermal energy charged by TEC to RADET, with the concurrence of the Office of Price Competition. That same office also has final say in the prices that RADET may charge for distributing heat to residential and non-residential consumers. The sum of the two prices is what consumers should pay.

However, the Government also controls the maximum amount that residential consumers pay for heat. That "national reference price" presently is set at 230,000 lei per Gcal. By law, the Municipality of Constanta must compensate the local district heating company for the difference between this national reference price and the prices established by the Office of Price Competition. In 1999, the approved retail price for heat in Constanta was 315,000 lei per Gcal. Thus, the Municipality pays RADET 85,000 for each Gcal of heat billed to residential consumers. Payments for this subsidy from the Municipality to RADET were 43.5 billion ROL in calendar year 1999. This represented twelve percent of current revenues of the Municipality in that year. In calendar year 2000, subsidy payments, if funded fully, will represent over forty percent of current revenues after factoring in the forty-percent increase in the transfer price for thermal energy.

Finally, a decree approved late in 1999 by the Government extended the payment of the 19 percent VAT to public services, effective April 1, 2000. As a result, the amount that residential consumers are now paying for heat has increased by 26 percent. This is a dramatic change.

It will be very difficult to implement the proposed heating investment program in Constanta in the context of these national policies. The policies also affect other municipalities that operate district heating systems. There is a need for a reform of these policies that achieves the following:

- There should be no national reference price that caps the amount paid for district heating by residential consumers.

- The district heating companies should be able to charge all their customers, including residential customers, a price that approaches full cost recovery levels, including the amortization of investments.

- The subsidies to households for public services, including heating, should focus on need not price. That is, the subsidy should be means tested, using household income and expenditures as the basis for determining who qualifies and for what amount.

This would require a revision of Emergency Government Ordinance 162, as well as of Government Decision 879, both of 1999. In addition, given the large existing and anticipated outlays for subsidies for heating, it is not clear that it was appropriate to extend the payment of the VAT to these services at this time. This would require a revision of Emergency Ordinance 215 of 1999.

Financing Implementation Plan

The first step that the Municipality of Constanta needs to take to develop the proposed heating investment program is to establish a joint committee to make decisions and recommendations on the program itself and on the institutional reform of RADET. Final decisions will of course be subject to approval by the Local Council. That committee should focus on the following short-term decisions that precede any further action on the heating investment program:

- Identifying the investment needs and priorities in the district heating system, including both measures that can generate energy savings (e.g., substations) and those that address critical/emergency requirements (e.g., metering and priority secondary network improvements).

- Deciding on the types of operations and management technical assistance that is needed by RADET (see following section).

- Implementing immediately a program of financial improvements to increase the revenues of the Municipality and decrease operating expenditures.

- Adopting a financial planning framework for the heating investment program as described in this report and set goals, including target amounts, timing and preconditions, for:
  — The capital contribution of the Municipality, and
  — Annual financial contribution of the Municipality.

- Immediately beginning the process of researching and developing application for ISPA grant application.

Once these decisions are reasonably well defined, the Committee should initiate discussions with the EBRD concerning loan requirements and terms. It will be very

important that the discussions demonstrate and communicate to EBRD the Municipality's commitment to move forward with the proposed investment program. The most effective way to achieve this will be to informing the EBRD about the decisions being taken regarding the program and the measures to strengthen both the Municipality's finances and the operations and management of RADET. In this context, it would be appropriate to request EBRD assistance in identifying sources of funding for further program development assistance.

Based on the program definition and size agreed to by the Local Council, the Committee should begin to develop a tender document for the initial tranche. The tender should be prepared in conjunction with outside expertise. The EBRD may be able to assist in arranging funding for and identifying qualified providers of such assistance. The tender should provide a full description of the proposed investment program to the prospective bidders, including:

- Technical background on the RADET system;
- Summary reports assessing engineering and economics of the proposed investment program;
- Required project elements both with respect to the investment program and needed services;
- The results of the RADET management review;
- Description of the Municipality's preferred financing and commercial option(s) including both required and the range of acceptable contract terms;
- Statements on the Municipality's financial commitments to the project in terms of capital contribution, annual financial contribution and credit support;
- Background information on all relevant institutional and legal factors and reform efforts including those affecting prices, subsidies and transfer prices for thermal energy and plans of the Municipality for conversion of RADET to a CRA;
- Summary information on Municipal and RADET budget and credit, as needed by the prospective bidders to assess the financial viability of the program and the creditworthiness of the borrower; and
- Environmental studies.

The tender must also include a framework for submittal of the technical and financial/commercial proposals, indicate the proposal evaluation method and criteria, and the Municipality's decision-making process and schedule, including any pre-conditions.

Recommended Additional Assistance to Municipality/RADET

Immediate Assistance

In the short run, RADET and the Municipality need immediate assistance in order to move forward with the proposed energy efficiency project. This includes:

- Development and engineering of the proposed investment program and related financing plan;

- Preparation of model contracts, other agreements, including financial, technical and legal aspects of those documents;

- Tender structure and procedures;

- Evaluation of offers and negotiations with prospective lenders and/or investors; and

- Communication with residents, national authorities and prospective bidders

The EBRD has standard terms of reference for these services that have been developed as part of its energy conservation project in Romania. [28] This document can assist the Municipality in understanding in greater detail the types of assistance that might be required. It also will help guide them in selecting advisors to assist in the process of implementing the heating investment project.

Longer-term assistance

In addition to the investment program, RADET needs to implement a number of measures to improve operation and management systems and efficiency. To do so, RADET needs technical assistance and services from commercial partners. This point is critical and RADET management acknowledges it. Technical assistance will be required in a number of areas:

- Investment planning
- Development and engineering of a long-term investment program
- Management information systems
- Metering
- Automation and control systems
- Financial accounting and management
- Billing and collections
- Maintenance planning and systems
- Staffing efficiencies and staff training
- Customer service
- Media and public relations
- Risk management, including guarantees and warranties on performance of EE projects

Implementation of these operation and management improvement measures also will require investment in certain systems, e.g., metering, and automation, information and control systems.

[28] "Romania District Heating Concession Financing Technical Cooperation: Terms of Reference for Municipal Services." EBRD Thermal Energy Conservation Project TECP-THE 02.

This list is not exhaustive. It is based on observations made by the team of engineers and financial analysts who reviewed the Constanta district heating system. It also is based on a preliminary audit of RADET operation and management systems.[29] Discussion with RADET management concerning their perceived needs in all of these areas reveals interest from RADET management to explore these subjects. Overstaffing issues were also acknowledged.

The implementation of these measures should be integrated into (a) the design of the investment program, and (b) the chosen commercial option. These types of services will offer further opportunities for savings and can be acquired via the privatization, concession and/or energy services contract arrangements discussed below.

[29] Please refer to Annex C for a more detailed analysis of RADET and a more complete set of recommendations regarding improvements to the organization and operations of RADET.

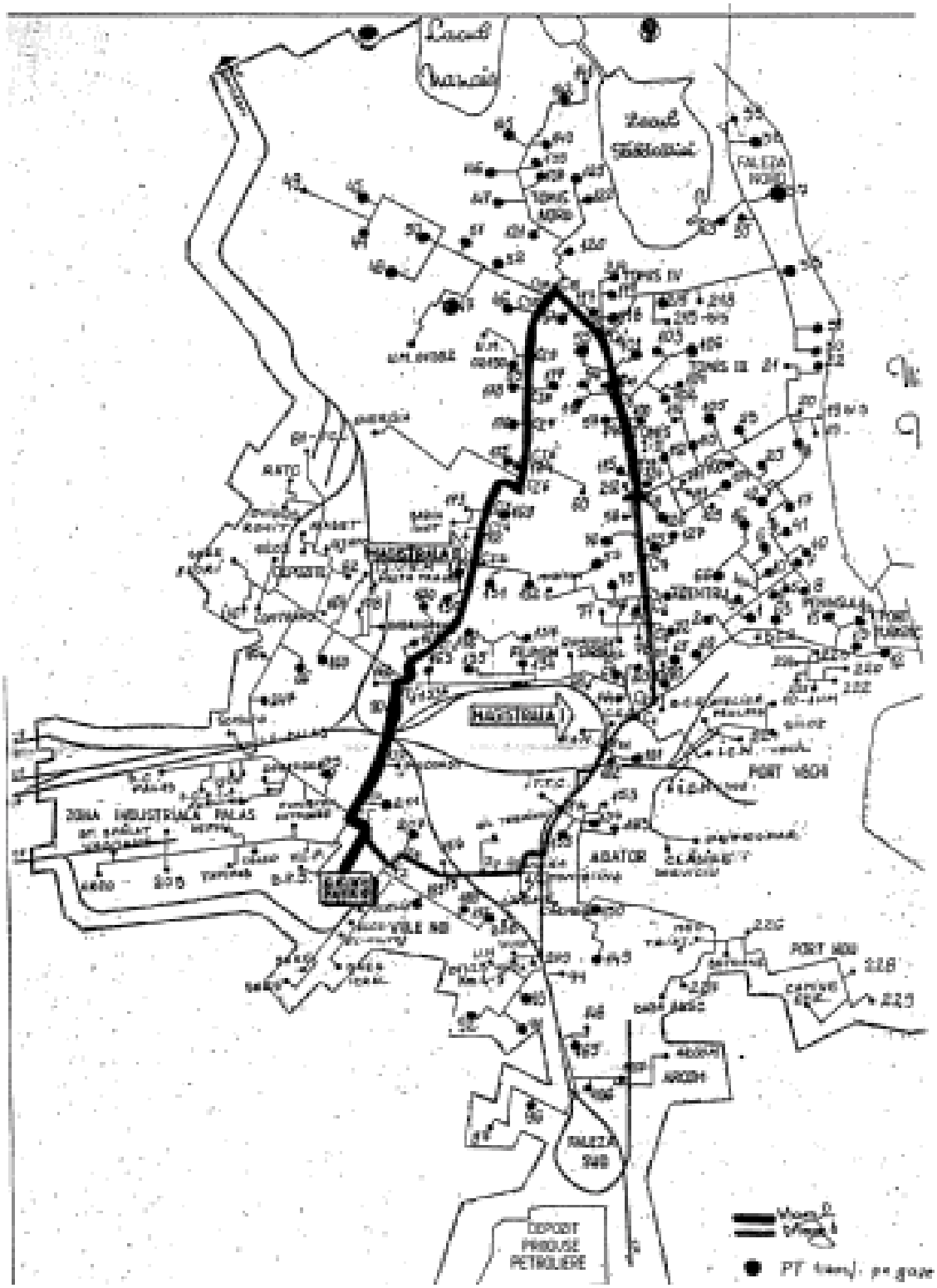
ANNEXES

TABLE OF CONTENTS

ANNEX A – TECHNICAL INFORMATION

ANNEX A-1

MAP OF CONSTANTA



ANNEX A-2

DESCRIPTION OF COMPLETE UPGRADE OF CONSTANTA DISTRICT HEATING SYSTEM

The current investment recommended for upgrading Constanta's district heating system is $19.4 million. The recommended investment was selected considering financial constraints of the Municipality, the potential investor's desire for short payback periods, and the greatest improvement in service for the end user. We also evaluated what investment would be necessary if achieving the best operating condition of the district heating system was the highest priority. This investment consists of the following components:

Table A-1
Summary of Full Investment Program for Constanta District Heating System

Owner	Location	Description	Cost($M)
TEC	***TEC PALAS***	Replace pumps/motors	0.9
		Finish hot water boilers reconstruction, including new burners installation	1.2
		Install I&C system for hot water boilers	0.3
		Design	0.1
	Primary Network	Complete repairs of existing primary network	4.0
		Conduct primary network hydraulic balancing	0.1
		Install measurement system at nodes	0.1
		Design	0.2
		Subtotal Primary System	*4.4*
RADET	Substations	Upgrade all 134 substations[30]	*10.4*
	Heat/Hot water Control	Establish dispatching center for PALAS	0.3
		Establish data transfer center at PALAS	0.1
		Establish dispatching center for substations	0.3
		Establish data transfer center at substations	0.4
		Design	0.2
		Subtotal I&C	*1.3*
	Secondary Network	Repair selected secondary network	17.8
		Replace selected secondary network	37.2
		Install control valves	0.8
		Install measurement system at heat inlets	5.8
		Design	4.3
		Subtotal Secondary Network	*65.9*
Municipality	Municipal Schools	Energy conservation measures	*1.8*
End users	Private Apartments		*10.0*
Total			93.8

[30] INCLUDES PRIMARY SIDE IMPROVEMENTS, SECONDARY SIDE IMPROVEMENTS, DOMESTIC WATER HEATING SYSTEM UPGRADE, AND PIPE INSULATION THROUGHOUT THE SUBSTATION.

TEC:	Thermaelectrica Constanta
TEC PALAS:	Power plant providing heating and hot water for Constanta
RADET:	District heating utility created in early 1990's
I&C:	Instrumentation and Control

The description of the existing conditions of the Constanta District Heating System is presented in the main body of the report and Electrotek's April 2000 report. The rationale for the proposed investment project is described in the following section.

Overall Investment Needs

This proposal outlines the key investment needs for the district heating system infrastructure, and includes rehabilitation at TEC PALAS (limited to heat delivery systems), primary heat distribution, substations, secondary heat distribution, I&C systems and end user investments. The technical requirements for the scope and details of the project are also included. Investment demands of these reconstruction and energy savings are evaluated.

This investment does not include full reconstruction at TEC PALAS, reconstruction of substations not owned by RADET, nor investments in buildings owned by individuals.

Investments in Major System Components

Recommended Power Plant Investments

Investments in the power plant TEC PALAS will include partial reconstruction of the primary circuit pumping station, addition of recirculating pumps, new burners for hot water boilers, boiler control valves in the hot-water boiler house, fitting hot-water boilers with the automatic controls, and finally construction of a new dispatching center, used to control and check heat supplies to the primary heating network.

Partial reconstruction of the pumping station will consist of installing three motor/pump sets (where Q = 4000 m^3/h, H = 140 m) with the possibility of smooth control of revolutions of drives by means of frequency converters. During the heating season, two pumps will always be in operation (1 in reserve). In summer months, only one pump will be running. The pressure difference at the source outlet will be controlled through variable revolutions of the pumps.

Completion of the hot-water boiler house will include installation of control valves, additional recirculating pumps, new burners and, in particular, new control systems for the boilers, which will allow for control of the outlet water temperature according to requirements of the dispatcher. The new burners should enable TEC to better comply with environmental emission standards.

The main effects of improved technical conditions at the source will not be energy savings but the possibility for efficient control of the secondary substations, resulting in improved quality of the heating service. The construction time sequence requires first installing I&C devices and subsequently establishing the control dispatching centre.

Recommended Primary Network Investments

Recently, TEC partially renovated approximately 50% of the primary heating network. They plan to renovate or replace the rest of the network at a rate of approximately 7% per year.

Costs are minimized by retaining those portions of the existing system that are in relatively good condition. Renovation of the existing network will generally consist of:

— Uncovering some channel sections
— Replacing damaged and moistened insulation, corroded piping sections, and non-functional valves
— Cleaning and repairing the channels, which include sealing the shafts against penetration of surface water

This restoration will be conducted on about 20 km of networks laid in channels with an average piping diameter of 250 mm. During reconstruction, measuring points will be installed at selected node points to transfer basic data on pressures back to the dispatching centre in the power plant (data will be transferred via fixed lines or through wireless). The transferred data will provide the dispatcher with an actual survey on the status of the primary network and/or failures on some of its sections, and will be used to control the entire primary system.

Approximately 7 km of primary network (with the average diameter of 100 mm) will be replaced with prefabricated, pre-insulated piping systems with failure detection. New construction in the primary heating network will include: finding new routes, digging ditches, assembling and laying new piping in a sand bed, and backfilling. The primary benefit of this reconstruction would be improved transfer capacity of the primary heating network, and reduced heat loss due to less water leakage and improved insulation.

Recommended Secondary Substation Investments

All 134 substations require improvements. Substations will be equipped with the following components and parts:

Primary side:

- Install heat metering for space heating.
- Install metering for domestic water heating
- Install metering on cold secondary feed water for space heating secondary pipes.
- Install pressure differential control valves and flow restrictors for primary pipes.
- Install control equipment with safety control functions for space heating loops and domestic hot water
- Install safety controls for the primary side (emergency shutoffs).

Secondary side:

- Optimize heat exchangers for specified heat load. Clean and re-size existing heat exchangers for proper capacity. Install back-up capacity.
- Install circulating pumps with electric motors. Pumps must be sized properly.
- Optimize static pressure.

- Install control equipment for secondary side.
- Install metering equipment in each secondary loop from substations.

Domestic water heating system

- Optimize heat exchangers for specified heat load. Clean and re-size existing heat exchangers for proper capacity. Install backup capacity.
- Install circulating pumps for domestic hot water circulation.
- Install control equipment for proper regulation of domestic hot water.
- Install metering equipment for water flow entering the domestic water heating system.

Electric installation

- Install new electric wiring.
- Install control parts, sensors, electric distribution, and control wiring.
- Install DDC communication controllers and data transfer equipment.
- Install electrical equipment selected for low power usage.
- Install insulation on all substation pipes to reduce the heat loses within the building.

Recommended Secondary Network Investments

While the secondary heating networks currently in satisfactory condition will be reconstructed, it is preferable to erect new routes. New networks will be prefabricated, pre-insulated piping systems that will be laid directly into the earth. The four-pipe distribution design will be preserved: 2 pipes for steam and 2 pipes for the hot water service.

The inner piping of the central heating circuits will be made of steel (necessary for circulation of treated water), while the inner piping of hot water service circuits will be plastic. In total, the new construction will require about 100 km of new routes. This construction, especially along busy or congested streets and thoroughfares, may be the most demanding task in the district heating system reconstruction.

Repairs of the secondary system will require uncovering of some channel sections, replacement of damaged and moistened insulation, replacement of leaking and corroded piping sections, replacement of non-functional valves, cleaning and repairs of channels, sealing of shafts against penetration of surface water. We estimate that approximately 80 km of the secondary heating networks will require repair.

The investment will include system controls. Approximately 2500 mechanically adjustable values for return water will be installed. Meters for measuring heat consumption will be installed at inlets to buildings.

The main benefit of reconstructing the secondary heating networks will be a reduction of heat losses in distribution systems, prevention of escapes of circulating water and a dramatic increase in reliability of heat supply.

The district heating system in Constanta lacks I&C that, if properly selected, could financially benefit all interested parties (i.e., TEC, RADET, and end-users). An effective I&C system should accomplish the following:

- Substations—measurement of energy consumption for heating hot water in the substations
- Buildings—measurement of energy consumption for central heating
- Secondary Network—measurement of water pumped from the primary circuit to fill the secondary circuit
- Cold Water Pumps—measurement of electric power consumption

Controls are also required at:

- Primary circuit pumping stations
- Hot-water boilers
- Substations—for hot water and heating
- Buildings—control valves entering the building and for individual apartments

The complete control of heat supplies will be organized in two independent control centers: (1) dispatching center for controlling the source, and (2) dispatching center for controlling substations and the secondary heating networks.

Investments by/for End users

Private End users

District heat is supplied to over 100,000 conventional apartments (with 2.5 rooms on average); hot water is distributed to over 380,000 citizens. The total number of buildings connected to Constanta's district heating system is estimated at 2,000 to 3,000. More than 90 percent of residential apartments are privately owned.

The condition of the district heating system in the buildings reflects the system's lack of maintenance and the low quality during the construction of the buildings. There are no heat controls for individual apartments or for the building as a whole. Because the system is hydraulically imbalanced and lacks petcocks on the radiators, heating capacity is reduced.

Generally, the end-user system is unsatisfactory due to lack of I&C. However, installation of effective control mechanisms is not possible prior to solving the fundamental technical problems in the primary and secondary networks.

The March 1999 Electrotek report assesses the benefits of investment by end-users. The recommended investments on the demand side focus on low-cost measures rather than measures that would maximize energy savings.

Investments common to all heated buildings include:

— Installation of air-holes (petcocks) where necessary to remove air from radiators
— Installation/repair of mechanical valves
— Hydraulic balancing of the central heating of the building

Controls that can be installed in individual apartments include:

— Weather-stripping of windows and main doors
— Low-flow showerheads and aerators

The installed meters will enable RADET to bill individual customers. While measurement of heat consumption does not decrease heat losses (in physical terms), they do motivate the customers to use the heat more efficiently.

The total end-user investment in a conventional apartment range between $60 and $170, depending on the actual condition of each building, with a total end-user investment of about $10 million for all heated buildings in Constanta.

We suggest that we install the I&C systems at the substations first, then install meters at the end-users' premises.

Municipal Schools

The March 1999 Electrotek Report summarizes the most energy efficient improvements to Municipal School buildings. These investments total $1.8 million.

Investment Summary

Due to the historical under-investment and lack of O&M, the district heating system is in a very poor condition and requires major upgrades and investments to remain competitive in the future. The most expensive part of the project is the piping upgrade, especially those parts of the secondary network that need to be replaced.

The quality of service provided by the district heating in Constanta between 1970 and 2000 has significantly decreased. In the 1980s, the quality of service declined dramatically due to reduced expenditures for maintenance and repairs. Without additional investment, the system and its quality of services will continue to decline, thereby risking a major system breakdown in the coming decade. Because the system is in extreme ill-repair, the longer we wait to upgrade the system, the more costly it will become.

The complete reconstruction of the district heating system will prolong the service life of the entire system for another 20 to 30 years. Additionally, end users should experience a dramatic increase in the quality of heat/hot water service and energy savings if the investment is realized. The total investment is estimated at $94 million. Our estimate does not taxes, insurance fees, interests, or other miscellaneous costs.

ANNEX A-3

ADDITIONAL TECHNICAL DATA

ANNEX A-3A

ENERGY COSTS

Heat purchase from Conel (1999 through 2000)				
				lei/Gcal
Winter:	10% of heat purchased at :			198,000
	90% of heat purchased at:			203,000
Summer:	3% of heat purchased at:			198,000
	97% of heat purchased at:			203,000

Heat sale by RADET (January to June 2000)						
Type		**Purchase**	**Radet cost**	**Tariff**	**User**	**Subsidy**
					Pays	**by state/city**
		lei/Gcal				
Residential		203,000	111,940	314,940	230,000	84,940
Non-residential		198,000	111,940	309,940	309,940	0

Energy costs to RADET (2000)					
Electricity	Active	lei/kWh	871		
	Reactive	lei/kVArh	87		
Gas		lei/m3	920		
		$/1000m3	49.73		
	HV	kcal/m3	9188		
Oil (Palas)		$/ton	77		
City Water		lei/m3	3940		
		$/m3	0.213		
Cost of replacement of secondary pipes ($/m)					325
(from EGU, Ortep and C-Term), average					

ANNEX A-3B

MONETARY EQUIVALENT OF SAVINGS

Description	Annual Savings			Monetary Conversion Units			Monetary Savings					Investment	
	Heat	Electricity	Water	Heat	Electricity	Water	Heat	Electricity	Water	Total		Cost	Payback
	Gcal	KWh	m3	lei/Gcal	lei/KWhi	lei/m3	Lei	lei	lei	lei	$	$	yrs
Substations	257,582	3,835,866		284,000	871		73,153,288,000	3,341,039,286		76,494,327,286	4,134,829	10,438,269	2.5
Secondary pipes	13,466		96,732	284,000		3940	3,824,344,000		381,124,080	4,205,468,080	227,323	7,190,950	31.6
Municipal buildings	14,477			439,000			6,355,403,000			6,355,403,000	343,535	1,762,423	5.1
GB 37, 47	2,897			284,000			822,748,000			822,748,000	44,473	55,200	1.2
Total	**288,422**	**3,835,866**	**96,732**				**84,155,783,000**	**3,341,039,286**	**381,124,080**	**87,877,946,366**	**4,750,160**	**19,446,842**	**4.1**
Assumes TEC and RADET prices per Scenario B (40% increase over current TEC prices, and RADET prices increasing from 112 Gcal/lei to 155 Gcal/lei)													

ANNEX B – HEATING PRICES

Detailed tables – historic evolution of prices

Detailed tables – cost of subsidies

Table B1 Tariff for residents (Historical ROL)

Period	Transfer price from TEC	Distribution price of RADET	Total price of heating	Tariff for population	Subsidy
01.08.1996-12.02.1997	17.743	18.400	36.143	21.800	14.343
12.02.1997-01.03.1997	17.743	19.741	37.484	21.800	15.684
01.03.1997-01.05.1997	17.743	46.200	63.943	21.800	42.143
01.05.1997-01.11.1997	42.370	46.200	88.570	62.000	26.570
01.11.1997-01.02.1998	46.099	58.770	104.869	80.000	24.869
01.02.1998-11.05.1998	46.099	58.770	104.869	80.000	24.869
11.05.1998-01.09.1998	74.148	64.700	138.848	87.000	51.848
01.09.1998-09.10.1998	74.148	64.700	138.848	89.000	49.848
09.10.1998-15.02.1999	93.204	69.800	163.004	95.000	68.004
15.02.1999-01.03.1999	119.115	85.840	204.955	95.000	109.955
01.03.1999-01.05.1999	119.115	85.840	204.955	112.000	92.955
01.05.1999-01.06.1999	119.115	85.840	204.955	156.500	48.455
01.06.1999-15.10.1999	166.761	102.700	269.461	156.500	112.961
15.10.1999-01.11.1999	203.000	102.700	305.700	156.500	149.200
01.11.1999-31.12.1999	203.000	111.940	314.940	230.000	84.940

Table B2 Tariff for residents (Constant ROL)

Period	Transfer price from TEC	Distribution price of RADET	Total price of heating	Tariff for population	Subsidy
01.08.1996-12.02.1997	111.645	115.779	227.424	137.173	90.251
12.02.1997-01.03.1997	64.491	71.753	136.244	79.237	57.007
01.03.1997-01.05.1997	64.491	167.924	232.415	79.237	153.178
01.05.1997-01.11.1997	110.213	120.176	230.389	161.275	69.114
01.11.1997-01.02.1998	98.055	125.007	223.062	170.164	52.898
01.02.1998-11.05.1998	85.811	109.397	195.208	148.915	46.293
11.05.1998-01.09.1998	120.811	105.417	226.228	141.751	84.477
01.09.1998-09.10.1998	114.386	99.811	214.197	137.298	76.899
09.10.1998-15.02.1999	139.999	104.845	244.844	142.697	102.147
15.02.1999-01.03.1999	160.582	115.723	276.305	128.072	148.233
01.03.1999-01.05.1999	156.096	112.490	268.586	146.772	121.814
01.05.1999-01.06.1999	139.969	100.868	240.837	183.899	56.938
01.06.1999-15.10.1999	186.068	114.591	300.659	174.619	126.040
15.10.1999-01.11.1999	203.000	102.700	305.700	156.500	149.200
01.11.1999-31.12.1999	203.000	111.940	314.940	230.000	84.940

Table B3 Tariff for industrial customers (Historical ROL)

Period	Transfer price from TEC			Distribution price of RADET			Heating price for industry		
	Value	VAT	Total	Value	VAT	Total	Tariff	VAT	TOTAL
01.08.1996-12.02.1997	39.279	7.070	46.349	18.400	3.312	21.712	57.679	10.382	68.061
12.02.1997-01.03.1997	39.279	7.070	46.349	19.741	3.553	23.294	59.020	10.623	69.643
01.03.1997-01.05.1997	114.089	20.536	134.625	46.200	8.316	54.516	160.289	28.852	189.141
01.05.1997-01.11.1997	147.522	26.554	174.076	46.200	8.316	54.516	193.722	34.870	228.592
01.11.1997-01.02.1998	155.636	28.014	183.650	58.770	10.579	69.349	214.406	38.593	252.999
01.02.1998-11.05.1998	155.636	34.240	189.876	58.770	12.929	71.699	214.406	47.169	261.575
11.05.1998-01.09.1998	139.045	30.590	169.635	64.700	14.234	78.934	203.745	44.824	248.569
01.09.1998-09.10.1998	139.045	30.590	169.635	64.700	14.234	78.934	203.745	44.824	248.569
09.10.1998-15.02.1999	132.788	29.213	162.001	69.800	15.356	85.156	202.588	44.569	247.157
15.02.1999-01.03.1999	169.703	37.335	207.038	85.840	18.885	104.725	255.543	56.220	311.763
01.03.1999-01.05.1999	169.703	37.335	207.038	85.840	18.885	104.725	255.543	56.220	311.763
01.05.1999-01.06.1999	169.703	37.335	207.038	85.840	18.885	104.725	255.543	56.220	311.763
01.06.1999-15.10.1999	178.168	39.197	217.365	102.700	22.594	125.294	280.868	61.791	342.659
15.10.1999-01.11.1999	198.000	43.560	241.560	102.700	22.594	125.294	300.700	66.154	366.854
01.11.1999-31.12.1999	198.000	43.560	241.560	111.940	24.627	136.567	309.940	68.187	378.127

Table B4 Tariff for industrial customers (Constant ROL)

Period	Transfer price from TEC			Distribution price of RADET			Heating price for industry		
	Value	VAT	Total	Value	VAT	Total	Tariff	VAT	TOTAL
01.08.1996-12.02.1997	247.157	44.488	291.645	115.779	20.840	136.619	362.936	65.328	428.264
12.02.1997-01.03.1997	142.768	25.698	168.466	71.753	12.916	84.669	214.521	38.614	253.135
01.03.1997-01.05.1997	414.682	74.643	489.325	167.924	30.226	198.150	582.606	104.869	687.475
01.05.1997-01.11.1997	383.735	69.072	452.807	120.176	21.632	141.808	503.911	90.704	594.615
01.11.1997-01.02.1998	331.046	59.588	390.634	125.007	22.501	147.508	456.053	82.089	538.142
01.02.1998-11.05.1998	289.707	63.736	353.443	109.397	24.067	133.464	399.104	87.803	486.907
11.05.1998-01.09.1998	226.549	49.841	276.390	105.417	23.192	128.609	331.966	73.033	404.999
01.09.1998-09.10.1998	214.501	47.190	261.691	99.811	21.958	121.769	314.312	69.148	383.460
09.10.1998-15.02.1999	199.457	43.881	243.338	104.845	23.066	127.911	304.302	66.947	371.249
15.02.1999-01.03.1999	228.780	50.332	279.112	115.723	25.459	141.182	344.503	75.791	420.294
01.03.1999-01.05.1999	222.390	48.926	271.316	112.490	24.748	137.238	334.880	73.674	408.554
01.05.1999-01.06.1999	199.413	43.871	243.284	100.868	22.191	123.059	300.281	66.062	366.343
01.06.1999-15.10.1999	198.796	43.735	242.531	114.591	25.210	139.801	313.387	68.945	382.332
15.10.1999-01.11.1999	198.000	43.560	241.560	102.700	22.594	125.294	300.700	66.154	366.854
01.11.1999-31.12.1999	198.000	43.560	241.560	111.940	24.627	136.567	309.940	68.187	378.127

Table B5 Evolution of prices for heating residential/industry

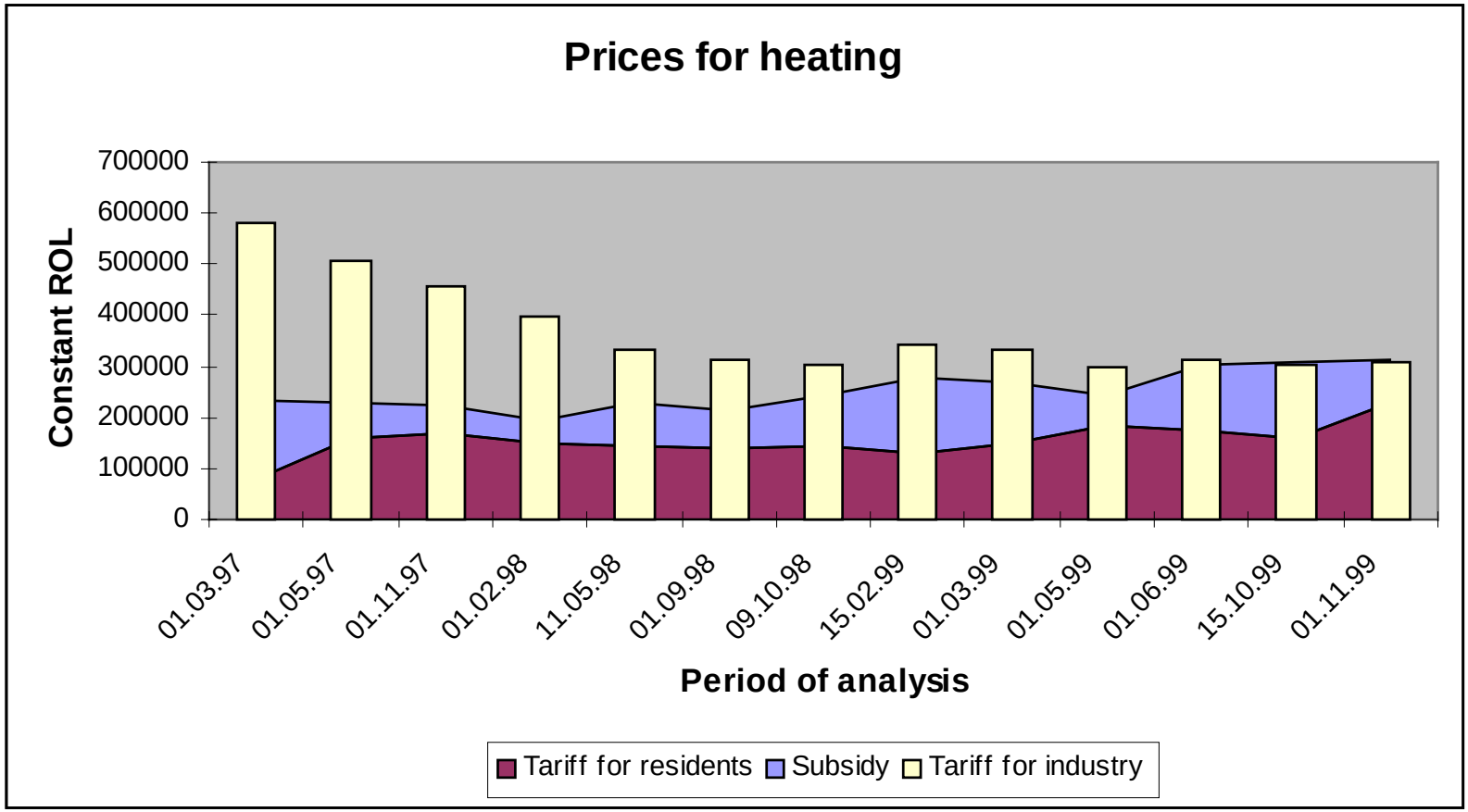


Table B6 Difference between actual and planned distribution costs of RADET (Historical ROL)

	Actual	Planned	Differences
Year		**1998**	
Services rendered	98.046.891.145		
Revenues from subsides	41.095.088.819		
Total revenues from thermal energy	139.141.979.964		
Technological consumption on secondary network	*5.981.657.000*		
Total potential revenues	145.123.636.964		
Expenses with thermal agent bought	*85.504.862.548*		
Technological consumption on primary network	7.909.911.023		
Added value	67.528.685.439	64.254.477.170	-3.274.208.269
Row materials and materials, of which	39.601.390.857	29.366.287.453	-10.235.103.404
Electrical energy	9.541.171.797	10.867.901.580	1.326.729.783
Materials	9.531.193.285	6.538.043.980	-2.993.149.305
Depreciation	710.493.765	2.613.688.140	1.903.194.375
Maintenance	19.818.532.010	9.346.653.753	-10.471.878.257
Payroll, of which	23.724.269.411	22.112.417.932	-1.611.851.479
Salaries	17.685.531.672		
Social insurance	4.086.154.308		
Paid for unemployment	893.730.335		
Health fund	885.455.525		
Solidarity fund	173.397.571		
Other expenses, of which	4.210.158.321	645.491.519	-3.564.666.802
Net other operating expenses (expenses-revenues)	1.323.531.740	645.491.519	-678.040.221
Net financial expenses (C-V)	-73.623.467	0	73.623.467
Net extraordinary expenses (C-V)	2.960.250.049	0	-2.960.250.049
Reserve for profit	-13.898.701.173	3.060.015.024	16.958.716.197
Technological consumption, of which	13.891.568.023	9.070.265.242	-4.821.302.781
Technological consumption on primary network	7.909.911.023	5.668.915.776	-2.240.995.247
Technological consumption on secondary network	5.981.657.000	3.401.349.466	-2.580.307.534
Total costs	67.528.685.439	64.254.477.170	-3.274.208.269
Loss achieved versus profit planned			-16.958.716.197
Added value supplementary			3.274.208.269
Losses from operation			-20.232.924.466

Table B7 Necessary/approved price per Gcal (Historical ROL)

Items	Actual	Minimal necessary price	Approved price	Difference
Period		**1998**		
Production [gcal]	1.009.146	1.009.146	1.009.146	1.009.146
Added value	81.427.386.612	80.689	63.672	17.017
Raw materials and materials, of which	39.601.390.857	39.242	29.100	10.142
Electrical energy	9.541.171.797	9.455	10.769	-1.314
Materials	9.531.193.285	9.445	6.479	2.966
Depreciation	710.493.765	704	2.590	-1.886
Maintenance	19.818.532.010	19.639	9.262	10.377
Payroll, of which	23.724.269.411	23.509	21.912	1.597
Salaries	17.685.531.672	17.525		
Social insurance	4.086.154.308	4.049		
Paid for unemployment	893.730.335	886		
Health fund	885.455.525	877		
Solidarity fund	173.397.571	172		
Other expenses, of which	4.210.158.321	4.172	640	3.532
Net other operating expenses (expenses-revenues)	1.323.531.740	1.312		
Net financial expenses (C-V)	-73.623.467	-73		
Net extraordinary expenses (C-V)	2.960.250.049	2.933		
Reserve for profit	-13.898.701.173	-13.773	3.032	-16.805
Technological consumption, of which	13.891.568.023	13.766	8.988	4.778
Technological consumption on primary network	7.909.911.023	7.838		
Technological consumption on secondary network	5.981.657.000	5.927		
Total costs	81.427.386.612	80.689	63.672	17.017

Table B8 Average annual family payments for basic public services in Constanta (Assumes Scenario A for prices of heat and hot water)

		Unemployed	Pensioners	Employeds
Average yearly revenue/family		**15.540.348**	**19.726.980**	**23.409.060**
Water	1.927.476	12%	10%	8%
Heating	2,227,500	14%	11%	9%
Hot water	1,930,500	12%	10%	8%
Gas	1.200.000	8%	6%	5%
Partial total 1	4,158,004	46%	37%	29%
Electricity	600.000	4%	3%	3%
Transport	1.031.250	7%	5%	4%
Garbage	48.000	0%	0%	0%
Partial total 2	1.679.250	11%	8%	7%
Grand total	8,964,726	58%	45%	37%

Cold water and sewerage

Average specific consumption	m^3/family/month	27
Price of 1 m^3	ROL	5.949
Period	months	12
Yearly consumption	m^3/year	324
Yearly bill	ROL/year	1.927.476

Heating

Average specific consumption	Gcal/family/month	1,50
Price of 1 Gcal	ROL	330,000
Period of using heating	months	4,5
Yearly consumption	Gcal/year	6,75
Yearly bill	ROL/year	2,227,500

Hot water

Average specific consumption	Gcal/family/month	0,59
Price of 1 Gcal	ROL	330,000
Period of using hot water	months	10
Yearly consumption	Gcal/year	5,85
Yearly bill	ROL/year	1,930,500

Gas

Average specific consumption	Pcs/family/month	1
Price of 1 Tank	ROL	100.000
Period of using	months	12
Yearly consumption	Pcs/year	12,00
Yearly bill	ROL/year	1.200.000

Electricity

Average specific consumption	kWh/family/month	50
Price of kWh	ROL	1.000
Period of using	months	12
Yearly consumption	kWh/year	600
Yearly bill	ROL/year	600.000

Transport

Average number of rides	rides/day/person	1,5
Price of ride	ROL	2.500
Period of using	days	25
	months	11
Yearly consumption	rides/year	412,50
Yearly bill	ROL/year	1.031.250

Garbage

Average specific consumption	m^3/family/month	1
Price of unit	ROL	4.000
Period	months	12
Yearly consumption	m^3/year	12,00
Yearly bill	ROL/year	48.000

Other payments – not included in Table B8

Property tax

Assumptions	90% of households are owning a flat	0,9
Typical yearly tax (for 3 rooms)	ROL	500.000
Yearly bill	ROL/year	450.000

Car tax

Assumptions	12.5% of households are owning a car	0,125
Yearly car tax	ROL	70.000
Yearly road tax	ROL	70.000
Yearly bill	ROL/year	17.500

ANNEX C – ANALYSIS OF THE MUNICIPALITY OF CONSTANTA AND RADET

Financial Analysis of the Municipality of Constanta

Financial Analysis of RADET

Institutional Analysis of RADET

FINANCIAL ANALYSIS – MUNICIPALITY OF CONSTANTA

Structure and organization of the municipality.

The Municipality of Constanta is organized in eight departments, as shown in Figure C2.1. Under each department there are multiple offices. There are 489 persons working directly for the Municipality in one of the eight departments.

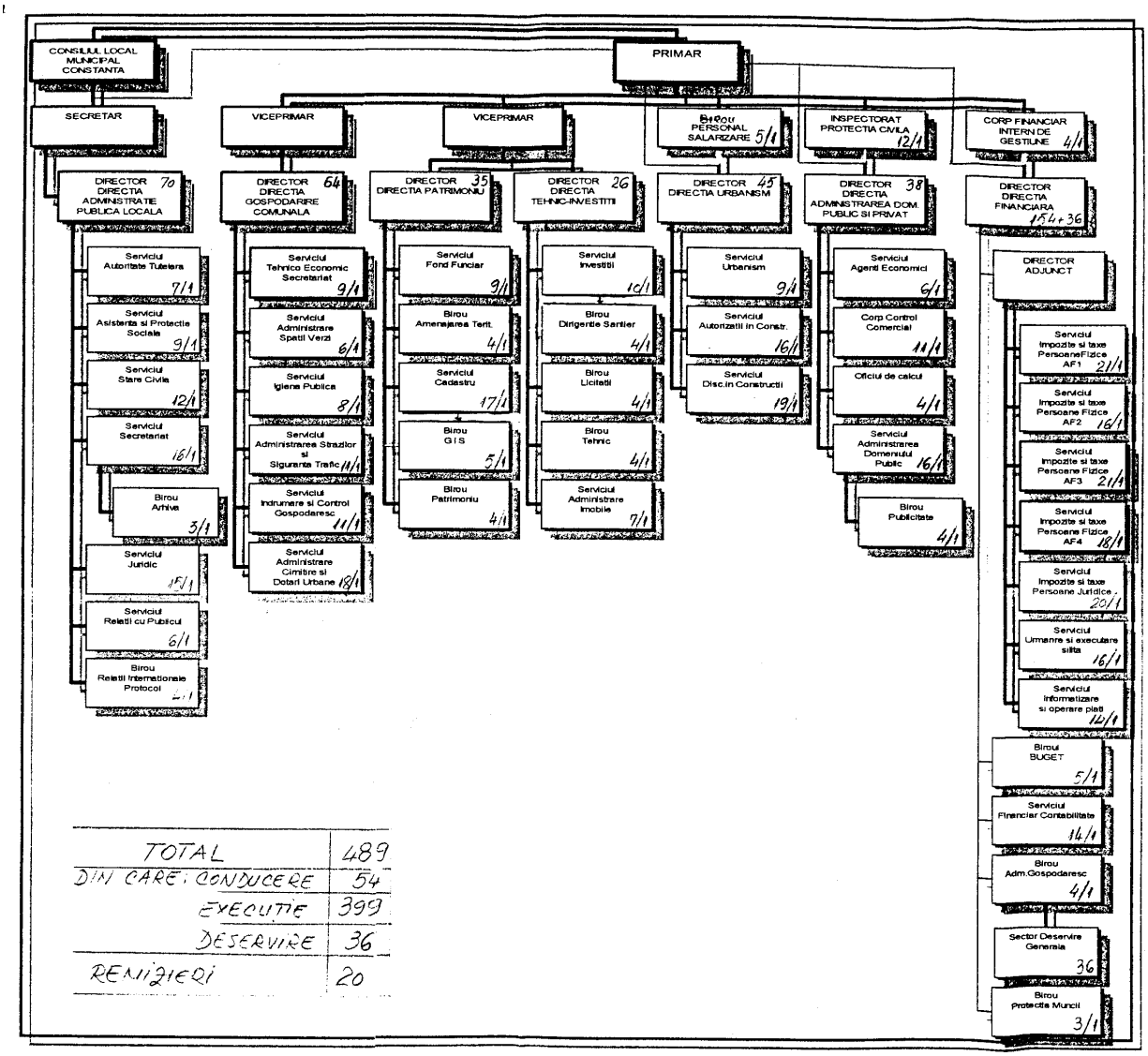


Figure C2. 1

The Municipality also provides partial or total income support to a wide variety of other organizations, including:

- Social assistance institutions, such as centers for the elderly and social centers and social canteens, for which the Municipality pays all the.

- Cultural and educational institutions, such as kindergartens, primary schools, high schools, day care centers, theaters and museums, for which the Municipality pays a part of the expenditures.
- The public guardians corps;
- Public companies ("Regia Autonoma") responsible for the provision of public services, directly subordinated to the City Hall, such as RADET (heating), RATC (public urban transportation), RA Confort Urban (street maintenance), that receive subsidies from the Municipality to offset part of the cost of the services they provide.
- Finally, the Municipality has contracts with private commercial companies for specific public services, including:
  - Polaris - garbage collection
  - Ecosal – garbage disposal
  - Clares – cemeteries
  - Edil Urban, Gorum Mamaia, Model, Paulonia and others – maintenance of public areas, such as parks

As seen below, the sum of these commitments represents a heavy financial burden for the Municipality.

Analysis of the historical revenues and expenditures

Table C2.1, below summarizes the key categories of revenues and expenditures for the Municipality of Constanta over the last four years. Data shown for the period from 1996 to 1998 represents actual results at the end of each year. The data for 1999 represents the sum of actual results through November and estimates for December prepared by the Budget Office of the Municipality.

Table C2.1
Municipality of Constanta – Revenues and Expenditures by Major Category for the Period from 1996 to 1999 (Data expressed in millions of nominal ROL)

	1996	1997	1998	1999
Current Revenues Total	56,725	121,517	152,439	321,834
Operating Expenditures Total	57,502	125,623	150,612	318,354
Other Sources of Financing for Current Expenditures	3,004	7,129	6,721	21,463
Net Operating Surplus (Deficit)	2,227	3,022	8,548	24,943
Other Sources of Financing for Capital Expenditures	6,393	8,538	8,100	1,150
Capital Expenditures Total by Chapter	8,619	11,168	16,413	26,093
Yearly Surplus (Deficit)	1	392	235	0

The figures appear to show a large, sustained increase in the volume of activity of the Municipality from year to year. This data is distorted by the high rates of inflation that have characterized the Romanian economy during the same period. In order to provide a more realistic comparison of the historical financial results for the Municipality, we have transformed nominal ROL to constant 1999 ROL using the annual inflation rates shown in Table C2.2.

Table C2.2
Romania - Annual Inflation 1996 to 1999

	1996	1997	1998	1999
Year to Year Inflation	56.9%	151.4%	40.3%	55.0%
Adjustment factor	5.47	2.17	1.55	1.00

Table C2.3 shows the revenues and expenditures of the Municipality in constant 1999 ROL. This picture is quite different than that presented in Table C2.1.

Table C2.3
Municipality of Constanta – Revenues and Expenditures by Major Category for the Period from 1996 to 1999 (Data expressed in millions of constant 1999 ROL)

	1996	1997	1998	1999
Current Revenues Total	310,119	264,256	236,280	369.230
Operating Expenditures Total	314,366	273,187	233,449	364,963
Other Sources of Financing for Current Expenditures	16,421	15,503	10,418	21,783
Net Operating Surplus (Deficit)	12,174	6,573	13,249	26.056
Other Sources of Financing for Capital Expenditures	34,951	18,568	12,555	658
Capital Expenditures Total by Chapter	47,119	24,287	25,440	24,378
Yearly Surplus (Deficit)	6	853	365	2,337

The results up to 1998 are quite similar to those of other municipalities in Romania. Revenues decreased in real terms until 1998 because local governments did not have the authority to adjust local taxes and fees for inflation, while the State was forced by the general fiscal crisis to limit the growth of transfers from the State budget. This changed with the adoption of new or amended legislation in 1998 that transformed the system of local finances. The first full year under the new system is 1999. As seen in Table C2.3, local revenues increased dramatically in real terms. Again, this was true for many other municipalities, particularly those in areas characterized by high employment, as local governments now receive a percentage share of the wage taxes.[31]

What is striking about the figures for Constanta is that operating expenditures increased in the same amount as current revenues. That is, the Municipality used all its additional revenues to pay for current services. Investments remained at the same level as in 1997 and 1998, measured in constant 1999 ROL. This is especially significant in the context of this analysis of the borrowing and investment capacity of the Municipality, so we looked in greater depth at the operating expenditures to try to understand the large increase in operating expenditures. We found the following:

[31] This is a highly simplified explanation. For a more in depth description and discussion of the trends in local finances and the factors that explain them, please refer to the report *Romania: The Impact of the Reform of Intergovernmental Transfers*, UI Project 06610/811, October 1999.

- Spending in the chapter for Culture and Sports increased from less than one billion ROL in 1998 to over 19 billion in 1999. In 1999, the Municipality became responsible for providing income support to a large number of cultural organizations in Constanta that had been supported by the County Council up to 1998.

- Spending in the chapter for Public Works and Housing doubled from 117 billion ROL in 1998 to over 232 billion in 1999. This is the result of two unrelated developments. The first is an increase of nearly 11 billion ROL in spending for street maintenance and repairs. The second is an increase of just under 70 billion ROL in payments to the private contractors responsible for garbage collection and disposal. The first could be a one-time development that reflects the deferred spending on streets in prior years. The second, however, appears to be a more permanent change that is the result of the new contracts signed with the firms by the Municipality in 1998. The contract for garbage collection is for five years. Payments are adjusted monthly for inflation. The contract for garbage disposal is for 30 years. Payments in this contract are indexed to the USD/ROL exchange rate.

- Spending in the chapter for Transportation decreased from 55.5 billion ROL in 1998 to 45.5 billion in 1999. This appears to represent a decision by the Municipality to cut back on the subsidies to the *regia* responsible for public transportation.

The Municipality will end the budget year 1999, with accumulated accounts payable of about 70 billion ROL, up from 54 billion in 1998.[32] This represents largely amounts owed to vendors and contractors responsible for solid waste and street maintenance and subsidies owed to public companies for heating and transportation, precisely the chapters discussed above. This is of concern as it suggests that the Municipality may be committed to an even higher rate of spending for these services than is reflected in the cash-based financial reporting of expenditures used as the basis for Table C2.3.

Assumptions used in forecasting revenues and expenditures to 2004

Given the uncertain economic prospects for Romania, we prepared three different forecasts of the revenues and expenditures of the Municipality for the next five years, that is, up to the year 2004. Each forecast is based on a different set of assumptions about key macroeconomic variables, as shown in Table C2.4, below. We have labeled them as "optimistic," "pessimistic," and "moderate." These variables are outside the control of the Municipality. Yet, they have an impact on both its revenues and expenditures. For example, the real growth in wages in general in the economy (*real LUC wages - % growth*) will affect the yield of the wage tax, which is now a major source of revenues of the Municipality. The real growth in public sector wages in the country (*real LUC budgetary wages - % growth*) will affect not only the payroll of the Municipality itself, but also the level of income support it must provide to the large number of subordinated organizations. Note that the key ratios are expressed either in terms of growth relative to general inflation or of

[32] Local governments in Romania follow cash accounting practices. That is, they record revenues when they actually receive cash. They record expenditures when they make the actual payment. They are not required to report accounts payable or receivable. The Budget Department of the Municipality provided the estimates of accounts payable used in this paragraph.

growth in real terms. This is because all the financial data included in the forecasts is expressed in constant 1999 ROL.

Table C2.4
Romania – Key macroeconomic variables – 2000 to 2004

Scenarios	2000 Opt.	2000 Mod.	2000 Pes.	2001 Opt.	2001 Mod.	2001 Pes.	2002 Opt.	2002 Mod.	2002 Pes.	2003 Opt.	2003 Mod.	2003 Pes.
Real GDP growth	-0.50%	-1.50%	-3.50%	1.00%	0.00%	-1.00%	2.00%	1.00%	0.00%	3.00%	2.00%	1.00%
Inflation (CPI)	25.00%	35.00%	45.00%	20.00%	30.00%	55.00%	19.00%	25.00%	40.00%	18.00%	23.00%	35.00%
Inflation on Food over general	-2.49%	-6.21%	-11.4%	-0.61%	-3.08%	-16.2%	-1.24%	-2.66%	-9.38%	-0.92%	-1.94%	-6.79%
Inflation on Non Food over general	0.87%	2.45%	4.73%	0.20%	1.20%	6.33%	0.47%	1.00%	3.10%	0.33%	0.69%	2.02%
Inflation on Services over general	1.63%	3.50%	6.08%	0.40%	1.50%	6.88%	0.66%	1.25%	3.50%	0.51%	0.92%	2.37%
Real LCU wages (% growth)	4.00%	-2.22%	-2.07%	6.67%	0.00%	-1.94%	5.88%	0.80%	-1.43%	6.78%	2.44%	0.74%
Real LCU budgetary wages (% growth)	12.04%	-0.80%	-0.49%	8.55%	1.44%	-2.56%	5.75%	2.23%	-0.29%	7.47%	3.87%	2.71%

The forecasts also reflect changes in national policy that affect the finances of the Municipality. These include the following:

- An emergency ordinance approved on December 29, 1999[33] established the share of wage tax that the Municipality will receive in 2000 at 40 percent, up from 35 percent in 1999. We assume that this share would remain in effect in each year of projection in the moderate and pessimistic scenarios. We have increased it to 45 percent for the optimistic scenario. The added revenues from this source will be offset to a large extent by the loss of revenues from other taxes that are now included in the global income tax of which local governments receive no share.

- The State budget for 2000 will transfer significant new expenditure responsibilities to local governments. This will add 35 billion ROL to the operating expenditures of the Municipality of Constanta starting in 2000, as follows:
  - Payment of wages of personnel that accompany the handicapped. This involves about 1000 persons in Constanta. It will increase personnel costs in the chapter on Social Assistance by approximately 14billion ROL.
  - Payment of tickets for urban transportation of handicapped persons. This will introduce a new subsidy of 7 billion ROL under the chapter for Transportation.
  - An allocation of $90 monthly per child covered by child protection services, payable to the County Council. In Constanta this represents about 744 children. This will

[33] Emergency Government Ordinance No. 216/99.

increase spending in the chapter on Social Assistance by an additional 14 billion ROL.

As discussed in Chapter B of the main body of the report, the subsidy for heating will increase as a result of policy changes in the pricing of heat supplied by Termo Electrica. This will represent an increase of over 53 billion ROL over 1998 subsidy levels reflected in the chapter on Public Works and Housing.

Finally, the forecasts also reflect certain decisions that are within the scope of control of the Municipality. These were discussed with the Finance Director to ensure that they represent fairly the policy of the Municipality. The main local policies included in the forecast are as follows:

- For factors that affect revenues, there is a single set of assumptions used in all three scenarios, as follows:
  - Where the law allows local discretion in adjusting either the tax base or rate for inflation, all adjustments will reflect 100 percent of the inflation in the prior year
  - Where the law allows local discretion in setting tax rate or determining fees, the rate or the fee will be the highest allowed by law

- Rents and leases paid to the Municipality will remain at the same level as in 1999

- The forecast includes a contingency reserve of 2%, 0.2% and 0.1% of current revenues, depending on the scenario.

- There are no expenditures for debt service payments on new loans included in any scenario.

Results of the forecast of revenues and expenditures—2000 to 2004

Table C2.5 summarizes the results of the forecasts of the revenues and expenditures of the Municipality of Constanta for the period from 2000 to 2004 for the three scenarios using only the external assumptions. That is, the figures do not show the impact of the decisions regarding revenues and expenditures that are under the control of the Municipality.

Table C2.5
Municipality of Constanta Forecast for the period from 2000 to 2004 based on economic and external policy assumptions only (Data expressed in Millions of 1999 ROL)

Optimistic Scenario	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
Current revenues	369.230	403,925	423,790	443,800	468,931	490,742
Operating Expenditures	364,963	417,246	422,443	427,089	432,000	435,332
Surplus/ (Deficit)	4,267	(5,601)	13,136	30,945	53,450	73,321

Moderate Scenario	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
Current revenues	369.230	355,897	355,972	359,070	367,198	376,863
Operating Expenditures	364,963	411,799	415,536	419,570	422,980	426,327
Surplus/ (Deficit)	4,267	(55,902)	(59,563)	(60,450)	(55,782)	(49,464)

Pessimistic Scenario	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
Current revenues	369.230	353,735	348,030	344,710	347,431	350,813
Operating Expenditures	364,963	422,223	439,030	450,331	459,541	465,819
Surplus/ (Deficit)	4,267	(68,489)	(91,000)	(105,620)	(112,110)	(115,005)

Clearly, the Municipality will confront a difficult challenge in 2000 under any set of assumptions. This reflects largely the immediate impact of the increases in operating expenditures in social assistance, public works and transportation that are determined by external policy decisions, as discussed above. Starting in 2001, if everything goes well with the Romanian economy, the Municipality will find itself in a progressively more favorable financial situation. However, should the economy perform according to either the moderate or pessimistic economic scenario, the challenges will continue throughout the period of the forecast.

The Municipality needs to address this situation before contemplating any major new financial commitments, including the proposed energy investment project. As Table C2.6 shows, the Municipality does have options. The forecast reflected in this table assumes that the Municipality will decrease the budget for expenditures in all chapters in all three scenarios in 2000, except for those expenditures mandated by external policies (as discussed above) or by existing contracts, as in the case of solid waste services. Expenditures after 2000 will vary by chapter, with some increasing and those in the chapter for Public Works continuing to decrease. This would eliminate the current deficit and free up funds for investments in all years under all scenarios.

Table C2.6
Municipality of Constanta Forecast for the period from 2000 to 2004 based on economic and external policy assumptions and assumptions of additional measures adopted bye the Municipality (Data expressed in Millions of 1999 ROL)

Optimistic Scenario	1999	2000	2001	2002	2003	2004
Current Revenues	321,834	402,716	422,584	442,580	467,674	489,436
Operating Expenditures	318,354	370,593	386,980	399,711	408,153	397,873
Operating Surplus (Deficit)	3,480	32,123	35,605	42,868	59,521	91,563
Other Sources of Financing	35,680	7,483	7,599	7,718	7,841	7,968
Funds Available for Investment	39,060	39,606	43,203	50,587	67,362	99,531
Moderate Scenario	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
Current Revenues Total	**321,834**	**355,897**	**355,973**	**359,070**	**367,198**	**376,863**
Operating Expenditures Total	**318,354**	**351,284**	**345,740**	**348,856**	**351,467**	**343,966**
Operating Surplus (Deficit)	**3,480**	**4,613**	**10,233**	**10,214**	**15,731**	**32,897**
Other Sources of Financing	**21,463**	**7,088**	**7,125**	**7,164**	**7,202**	**7,241**
Funds Available for Investment	**39,060**	**11,701**	**17,359**	**17,378**	**22,933**	**40,139**
Pessimistic Scenario	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
Current Revenues Total	**321,834**	**345,382**	**339,761**	**336,441**	**339,079**	**342,336**
Operating Expenditures Total	**318,354**	**344,909**	**337,820**	**334,819**	**335,581**	**315,140**
Operating Surplus (Deficit)	**3,480**	**474**	**1,940**	**1,622**	**3,498**	**27,196**
Other Sources of Financing	**22,613**	**6,713**	**6,675**	**6,639**	**6,602**	**6,566**
Funds Available for Investment	**26,093**	**7,186**	**8,616**	**8,260**	**10,100**	**33,763**

Investment Priorities

Should the Municipality decide to implement the reductions in services required to free up funds to finance investments, the next question will be what projects to finance. We attempted to obtain from the Municipality a list of priority investments for the next several years. The list provided to us really represents the sum of the investments that each individual department or subordinated organization would like to carry out. In many cases, the projects are very small, so we have grouped them by major categories or chapters, such as culture or housing. The list tends to follow the pattern of investments made in 1999, although the total cost would be twenty-five times the level of investments in 1999. Also, it

is possible, indeed likely, that in the near future new projects might appear. Table C2.7 shows the list of projects we received.

Table C2.7
Investments by chapter actual 1999 and projected 2000
(Data expressed in Millions of 1999 ROL)

Chapters	1999 Actual	Proposed
Education	**786**	**10,000**
Culture and Sports	**1,165**	**11,000**
Housing	**—**	**50,000**
Public works	**19,968**[a]	**33,000**
RADET	**—**	**283,000**
Transportation	**2,200**	**120,000**
Other investments of City Hall	**1,975**	**100,000**
Total	**26,093**	**609,000**

Note a: The 1999 Public Works figure includes housing investments and those that benefit RADET as well.

In order to get some idea of the investment priorities, we asked the technical and financial staff of the Municipality to participate in a ranking exercise following a procedure developed and tested in other local governments in Romania.[34] The result of the exercise provides only a first approximation of the relative importance of the various proposed projects. This was a new experience for the staff. Apparently, they had not met together in the past to compare projects across sectors. In addition, there was virtually no information on the proposed investment projects. The group had to rely on verbal summaries provided by the person representing the department or institution that has proposed the investment. Finally, the entire exercise was conducted in one meeting. Usually, this is a process that would take much longer to complete.

Whatever the considerations, Table C2.8 below shows the rank order of proposed investment projects. Note that the investments in heating (RADET) ranked third behind transportation and public works projects. This does not mean that the proposed energy efficiency project is not important to the Municipality. The best way to interpret the results of the ranking exercise is to recognize that there are other capital improvements that are at least equally as important to the Municipality. In the end, this is a decision that the local council and the Mayor must make. Given the difficult choices that will need to be made, we recommend that the Municipality consider completing a comparative evaluation of investment needs in the near future based on more complete technical and financial analysis of proposed investments.

[34] For further information, please refer to the *Capital Investment Planning Guide*, Urban Institute Project 06610/811, October1999.

Table C2.8 Proposed investment projects, as ranked in order of importance by the technical and financial staff of the Municipality2000 (Data expressed in Millions of 1999 ROL)

Chapters	Estimated Cost	Score
Transportation	120,000	57
Public works	33,000	52
RADET	283,000	48
Housing	50,000	38
Culture and Sports	11,000	37
Education	10,000	23

Financing the Heating Investment Program

Chapter B provides estimates of the impact on heating price of the proposed heating investment program. What is critical for the Municipality is the level of subsidies required to sustain the various price increases, as shown also in Chapter B. The ability and willingness of the Municipality to reduce expenditures for other services and investments to pay for these subsidies will determine what price level is feasible. This, is turn, will determine what portion of the heating investment program is feasible.

Table C2.9, below, provides examples of the types of budget adjustments that would be required to implement the proposed price increases and to pay the corresponding heating subsidies.

Table C2.9
Additional Budgetary Adjustments Required to Fund Heating Investment Program (Data expressed in Millions of 1999 ROL)

Optimistic Scenario	**2001**	**2002**	**2003**	**2004**
Operating Expenditures	386,980	399,711	408,153	397,873
Additional Adjustments	45,000	37,000	21,500	—
Percent Operating Expenses	12%	9%	5%	—
Funds Available for Other Investment	7,599	7,718	7,841	7,968

Moderate Scenario	**2001**	**2002**	**2003**	**2004**
Operating Expenditures Total	345,740	348,856	351,467	343,966
Additional Adjustments)	70,000	70,000	64,300	57,100
Percent Operating Expenses	20%	20%	18%	17%
Funds Available for Other Investment	7,125	7,164	7,202	7,241

Pessimistic Scenario	**2001**	**2002**	**2003**	**2004**
Operating Expenditures Total	337,820	334,819	335,581	315,140
Additional Adjustments	80,000	80,000	76,000	53,000
Percent Operating Expenses	24%	24%	23%	17%
Funds Available for Other Investment	6,675	6,639	6,602	6,566

Should events follow the assumptions made for the optimistic scenario, it seems reasonable to assume that the municipality may want to undertake the heating investment program. The choices are more difficult in the other two scenarios. However, the numbers shown in the tables assume that the Municipality would carry out the complete eight year heating investment program. Obviously, there is an option to complete a smaller part of the program, making the choices less difficult.

In the end, though, the issue is the relative priority of services over investments and the willingness to reduce key services, such as street maintenance and support for cultural and educational institutions, to free funds to finance the investments. This will be a key question for Municipal officials to address.

Financial analysis – RADET

Operating and financial results – 1997 to 1999

The evolution of both the financial and operating results of RADET is highly influenced by energy supplied to residential consumers that represents 90% of the total. During the period from 1997-1999 the volume of activity of RADET, measured by the quantities of heating billed, have remained almost constant. Revenues remained at the same level in 1997 and 1998, in real terms, and increased by 13 percent in 1999.

Table C1.1 shows that RADET recorded financial losses in each year from 1997 to 1999. In 1998 the value of the loss was third times larger than in 1997. While in 1998 an important part of loss (25%) was due to extraordinary items, in 1999 most of the loss was generated by its operations. The table also shows the extent to which RADET relies on subsidies paid by the Municipality on behalf of residential consumers.

Table C1.1
RADET P&L Statement – 1997 to 1999 (Data expressed in Millions of ROL as of 06.30.99)

Income Statement - Constant Prices	**Prices at 30.06.1999**		
	1997	**1998**	**30.06.1999**
OPERATING INCOMES, (of which) [a]	**229.952**	**216.607**	**130.079**
FROM HEAT DISTRIBUTION	**159.740**	**152.051**	**81.988**
FROM SUBSIDIES	**69.828**	**63.730**	**47.415**
OPERATING EXPENSES, (of which) [b]	**239.924**	**233.684**	**139.389**
energy, water, electricity	**145.735**	**147.397**	**98.062**
third parties services	**34.762**	**33.001**	**13.416**
salaries	**31.286**	**27.427**	**13.800**
social insurance	**8.765**	**9.096**	**5.451**
depreciation	**8.295**	**1.102**	**1.275**
GROSS OPERATING PROFIT	**(9.973)**	**(17.078)**	**(9.310)**
FINANCIAL INCOME	**565**	**345**	**131**
Other financial incomes	**237**	**250**	**120**
FINANCIAL EXPENSES	**822**	**231**	**134**
GROSS PROFIT/ FINANCIAL LOSS	**(257)**	**114**	**(3)**
EXTRAORDINARY INCOME	**4.408**	**0**	**-**
EXTRAORDINARY EXPENSES	**2.882**	**4.591**	**74**
GROSS PROFIT/ EXTRAORDINARY LOSS	**1.526**	**(4.591)**	**(74)**
TOTAL GROSS PROFIT	**(8.703)**	**(21.554)**	**(9.387)**
tax on profit	**-**	**-**	**-**
NET PROFIT/ LOSS	**(8.703)**	**(21.554)**	**(9.387)**

Notes to the table:
a. Only major categories of operating income shown.
b. Only major categories of operating expenses shown.

For complete financial statements, please refer to Appendices 19, 20 and 21

The structure of expenses has remained almost the same during the period. As a result of the increases in the TERMO ELECTRICA transfer price for bulk heat, the share of energy in total expenses increased from 61 to 70 percent. Other significant cost components include salaries and social insurance and third party services, each representing roughly 10 to 15 percent of the total.

A review of the balance sheet and key financial ratios[35] shows the following:

- Very low level of liquidity;
- Very low weight of owner's equity in total liabilities. There is a strong trend to increase the weight of debt against the weight of capital, which means that practically all of RADET's activity is financed by creditors (primarily TERMO ELECTRICA);
- The debt collection period (3-4 months) is shorter than debt repayment period (almost 9 month). The first period is reasonable while the second is too long. In a hyperinflationary environment this would produce a financial gain.

The debt due by customers decreased from 50 billion lei in 1997, 47 billion lei in 1998 and 18 billion lei as of September 30,1999. As a percentage of revenues this represents a reduction from 32 percent in 1997 to 13 percent as of September 1999, although it is important to note that this last result does not include the last three months of the year, which are peak months for heating consumption. These results have been achieved through a sound debt management policy. Information regarding the level, structure and aging of outstanding debt is monitored continuously. A system has been developed in order inform, warn or take other tougher measures to address delinquent accounts. Legal action in court is an extreme measure. There are 39 legal collection actions in court.

The benefits from the reduction in trade receivables have been offset by a much more significant increase in subsidies not paid by the Municipality and VAT not reimbursed. These receivables increased fourfold between 1997 and 1998. This has greatly affected the liquidity of RADET.

To compensate for the large increase in receivables, RADET has accumulated a large debt with TERMO ELECTRICA. The value of RADET debt stood at 101,7 billion lei as of June 30, 1999. Of this amount, RADET owed 93 percent to TERMO ELECTRICA and two percent to CONEL distribution (electric energy supplier). Just 5,2 billion lei (5%) represent other liabilities (salaries, liabilities to the budget, special funds debts). All these debts, excluding salaries, may generate penalties for late payments.

Government Ordinance 215/99 establishes a unique charge of 19% for the VAT. It also exempts the payment of the VAT by the population for the utilities: water and wastewater, electricity, gas, district heating. This exemption is valid through March 31, 2000 (Art. I, k) 12.). Therefore, starting April 1, 2000 the services delivered to the population by these

[35] Please refer to Appendix 22

utilities will be charged with a VAT of 19% that will be included in the bill paid by them.[36] This includes RADET.

As a rule, RADET (like any other utility provider) will collect the VAT from the population and will pay it to the Fiscal Administration. RADET will issue the invoice with the amount as before (let's say 100) and adding to it the VAT (19). The customer pays 119 to RADET that in turn pays 19 to the Financial Administration. RADET may deduct from the 19 the amounts paid as VAT to its suppliers. This is how the process currently works with the companies that already are subject to the VAT.

In theory, this process has no impact on the income of RADET. In practice, the implementation of the VAT on district heating will reduce the liquidity of RADET. The VAT is due to be paid to the Financial Administration by the 25th day of the month following the invoice date (even if the invoice is not collected) while the bills are collected on average on a longer period. In addition, if the VAT is not paid on time to the Fiscal Administration, automatic penalties apply. This will only make worse an already difficult financial situation for RADET.

In the example above, the income is 100, as before. This is true on an accrual basis. The impact is quite different on a cash basis. First, RADET will have to pay the amount owed as VAT to the Financial Administration whether or not they collect from their customers. Second, it is likely that the VAT will increase the level of receivables in one of two ways. If the percent of bills not paid on time remains the same, the overall value of the receivables will increase by the amount of the VAT. On the other hand, the increased level of bills for heating may create problems of affordability that could lead to an increase in late payments.[37]

From a financial perspective, the two most important measures required to strengthen RADET are as follows:

The price that RADET may charge to cover its own costs needs to be set at a level that covers its expenses, as discussed in more detail in Part B of this report.

The level of subsidies must be coordinated between RADET and the Municipality in advance of any pricing decisions. This, in turn, must lead to a payment of the subsidies on time by the Municipality so as not to affect the liquidity and overall financial condition of RADET.

[36] It is not clear at this time whether the additional VAT payment is subject to the national reference price, which sets a maximum amount that residential consumers of district heating are required to pay. If it is subject to this reference price, then the burden of paying the VAT will fall on the Municipality of Constanta. If not, it will fall on the residential consumers. In either case, the impact on RADET is as discussed in this section.

[37] Again, this applies whether the VAT is paid by the Municipality as a subsidy to RADET or as an added charge by the consumer. In both cases, there are issues of delayed payment of amounts owed to RADET and of affordability.

Financial Scenarios

We looked at the impact on the finances of RADET of two scenarios that reflect alternative structures for financing the improvements to the Constanta district heating system. The two are as follows:

First scenario

- RADET receives from the Municipality a loan for $14,080,000 and $3,520,000 in capital contributions to finance $17,600,000 in energy efficiency measures. The loan from the Municipality is for ten years at 11%, with interest only paid during construction.
- Construction begins in 2001 and is completed in four years.
- After the investments have been completed, the net energy savings allow RADET to reduce purchases from TEC by 26 percent, while providing improved heating and hot water services to all its customers.
- Starting prices are those in Scenario B. TEC prices remain constant during the entire period, even after the reduction in purchases from RADET.
- RADET increases its prices to cover financing and other investment costs. Once the investments have been completed, RADET adjusts its price per Gcal to recover its full costs (net of purchases from TEC) at the lower level of Gcal billed to end users (74 percent of present volume).
- Customers receive and pay a bill for the full costs of heat and hot water. The targeted subsidy is implemented beginning in 2000.

Second scenario

- Through an ESCO agreement a private firm carries out the improvements in the substations only for a total of $11,275,000 using its own financing. RADET pays the firm based on actual cost of investments amortized over 7 years at 14%. Assume that the ESCO portion is.
- RADET receives from the Municipality a loan for $5,060,000 and $1,265,000 in capital contributions to finance the balance of the investment package, that is, $6,325,000 00. The loan from the Municipality is for ten years at 11%, with interest only paid during construction.
- Construction begins in 2001 and is completed in four years. Assume that the private firm operating under the ESCO agreement completes the investments in phases, with one-third completed each year starting in year 2. Payments from RADET to the firm start in year two on the completed third and so on.
- After the investments have been completed, the net energy savings allow RADET to reduce purchases from TEC by 26 percent, while providing improved heating and hot water services to all its customers.
- Starting prices are those in Scenario B. TEC prices remain constant during the entire period, even after the reduction in purchases from RADET.
- RADET increases its prices to cover financing and other investment costs, as well payments under the ESCO agreement. Once the investments have been completed, RADET adjusts its price per Gcal to recover its full costs (net of purchases from TEC) at the lower level of Gcal billed to end users (74 percent of present volume).

- Customers receive and pay a bill for the full costs of heat and hot water. The targeted subsidy is implemented beginning in 2000.

Appendix 26 to 29 provide the P&L statement, Balance and Sheet and Cash Flow for RADET under the First Scenario. Appendix 30 to 32 provide the same statements for the Second Scenario.

Institutional Analysis – RADET

Summary

An Administration Board appointed by the Local Council of Constanta runs RADET. There are nine members of whom eight also are members of the Local Council. The Administration Board appoints general director, who then becomes the ninth member of the Board. The general director appoints the balance of the management team, the chief engineer and the chief accountant.

RADET is over staffed for its present level of activity. On the other hand, it may not have all the qualified personnel it needs. There is no formal staff evaluation system. Yet, there have significant increases in salaries, although the organization operates at a loss. The current organization chart is not well suited to the needs of RADET.

In general, there is little financial analysis used in the management of RADET. Although there is a relatively complex structure, there is no management accounting of cost or profit centers. This impairs the ability of the organization to calculate its costs and set prices.

There also is limited planning. Operating activity is strongly influenced by equipment obsolesce and lack of investments. This is reflected in the high level of expenses for materials and maintenance. The operating strategy has been to ensure a minimum level of operations for the overall distribution system. There is no ongoing activity related to improving the quality of services. Due largely to the perennial lack of funds to finance investments, RADET does not have an investment strategy.

Customer service is one of the strengths of RADET and is reflected in the low level of customer debts.

We recommend the following measures to strengthen the management of RADET[38]:

- General
  - Develop a new organization structure compatible with present needs, including units responsible for mass-media relationships, the environment, and financial analysis, among others;
  - Resize the number of personnel consistent with current needs and level of activity and develop a new compensation plan based on performance

- Financial management
  - Implement the use the managerial accounting based on cost centers and a system of internal reports;
  - Develop a chart of accounts adapted to the specific activities of RADET

[38] These are only the most important measures. UI will issue a separate report providing a more detailed analysis of RADET and a more complete set of recommendations.

- MIS
  - Develop and implement a plan for a full management information system;

- Mass media relationship
  - Set up a mass media department
  - Design a strategy for promoting the RADET brand

Background

The headquarters of *Regia Autonoma de Distribuire a Energiei Termice* (RADET) is in Constanta city, Constanta County. Located in the SE part of the country at 230 km from Bucharest, with a population of 380.000 inhabitants, Constanta is the main Romanian harbor on the Black Sea. The headquarters of RADET is located in Tomis Bld. no. 107.

The heating system operated by RADET has 131 substations, 2 methane gas stations and 215 km of secondary heating network, which are supplied with heat through two main networks. A specific feature of the system is the eccentrically disposal of the power plan (TEC Constanta). The map of the network is shown in Appendix 1. The district heating network provides heating to 100,000 conventional apartments (2,5 rooms) and warm water to 380,000 inhabitants.

The County Prefecture of Constanta founded RADET on the basis of decision no. 47/25.01.1991. Since 1992 the Regia has operated under the authority of Local Council of Constanta on the basis of Government Decision no.597/1992. RADET is registered with the Constanta Industry and Trade Chamber, Trade Register Office under the number J13/98/1991. Its fiscal code is no.R1909840. Legally, this is a public company under local authority.

RADET is run by an Administration Board headed by the General Manager. The Regia has the right to use land and buildings included in the public patrimony and has ownership of other assets. The Regia is subordinated to the Local Council of Constanta and co-operates with the County Council of Constanta and the County Prefecture of Constanta. The Regia also co-operates with other institutions, such as Termoelectrica-Constanta, Electrica Constanta, R.A.J.A. Constanta and the Office of Competition.

The ongoing legal reforms that affect both the corporate structure of RADET and the ownership of assets have generated certain legal issues concerning its major assets, as summarized in the following table.

Legal Issue	Main Causes	Effects
The existence of assets in usage without title of ownership	The ongoing process of transformation of the Regia and of the public property regime	Constraints on investment in assets without clear title of ownership
Location of part of the heating network on private property	The ongoing process of transfer of property to private owners	Possible requirement to reroute the network Possible demand for compensation from the owners

Overall organization and personnel structure

The Regia is organized in three operational sections (two for main operations, one for maintenance), support sections, offices and work teams according to the organizational chart presented in Appendix 2. The Administration Board is appointed by the Local Council Constanta and consists of nine members, of whom eight are local councilors and one is the General Manager. The Administration Board appoints the General Manager, who, in turn is authorized to select his managerial team, consisting of the chief engineer and the chief accountant.

RADET has 854 employees of whom 242 are women (Appendix 3). Two-thirds of the staff are assigned to operational functions and one-third is working in maintenance and auxiliaries. (Appendix 5) The women work mainly in auxiliary activities, such as (TESA), surveillance and labs, with about 10% working in the maintenance and repairs section. (The staff structure by gender is presented in Appendix 7.)

Generally, the personnel structure has remained the same with only a small increase in recent years. Thirty-nine persons have been added to the structure, largely as a result of a restructuring largely to address the increased work load caused by the dissolution of the associations that had represented large blocks of customers living in State housing. With privatization of this stock, RADET must now deal directly with a larger number of customers. (Appendix 6) The restructuring also added personnel to deal with increased breakdowns in the heating system.

Eighty-one percent of the staff have good experience in heating distribution, having worked for RADET for ten or more years. More than 50% of staff have been working within the company for more than 20 years. As a result, the number of personnel older than 50 is 151. (Appendix 4) The average age of personnel is around 41 years. Given the very limited number of new personnel, the continued aging of the existing staff could present problems in the future.

Academic qualifications

More than half of the staff (56%) are vocational school graduates, 34% are high school graduates, only 6% are faculty graduates and 4% are post high-school graduates, as shown in Appendix 9. Only 18 of the post high school graduates staff (generally foremen) have jobs according to their studies. The low level of education has to be analyzed in correlation with the low level of skills required for most activities of the regia. However, the low level of education has a negative impact on service quality because most of the fine tuning of heat delivery is done manually.

There does not appear to have been a specific strategy or policy regarding the qualifications of personnel. Training activities have been limited to:

- The participation of all foremen and other personnel in a course for obtaining an “ISCIR” license, organized annually for those without this license and to improve the general performance of the technical staff;
- participation of two employees in a chartered accountant course and exam;

- specialization of 4 employees in Italy, organized by the supplier of the gas boilers being installed in part of the system.

The compensation system is mainly based on time in the job. The base salaries are negotiated every year with the management. Other sums are added to the salary, such as a bonus, compensations for services, vacation allocations. There is no formalized personnel appraisal system. The Regia's personnel assessment is usually done once a year concurrently with salary negotiations. The discussions focus on ability, personal features, values system, physical qualities, interests and motivation of staff based on the opinion of the closest supervisor.

About 85% of the total time worked by the staff was on job related matters in 1998 and 1999 (Appendix 11) Holidays represent 10%. The remaining 5% are different kind of absences, which is within normal figures. Over time hours in 1999 were equivalent to 15% of the normal work schedule. All these show a high degree of work discipline.

Strengths and weaknesses of organization and personnel structure

The following tables summarize first the strengths then the weaknesses of the organization and related personnel structure of RADET.

Strengths	As defined by	Causes	Effects
A high degree of stability in the personnel working for RADET	Length of time with RADET	Activities with low complexity; Reasonable wages	Accumulation of an important experience
Low turnover of staff	Number of persons hired to replace departing staff Number of persons hired to fill new positions	Limited alternative job opportunities Work with low professional insatisfactions Limited dismissals for cause	Accumulation of professional experience Low expenses with new recruits
Existence of a good management team	The experience and professional level of management staff	Professional qualification and experience	Provides the basis for Regia's modernization
The existence of ISCIR licensing as the basis for training foremen working with the installations	Other Regia's with similar situations	The requirement that staff be licensed	Having a good replacement team New income sources by organizing courses for other employees
High work discipline	The proportion of time absent to total work time	Work monitoring	Low level of technical problems caused by shortage of staff

Weaknesses	As defined by	Causes	Effects
The structure of the organization does not address all the activities required to operate RADET	The organizational chart compared to operating and management needs	The absence of departments for financial analysis, administrative accounting, mass-	The quality of services provided and the performance of the Regia are

Weaknesses	As defined by	Causes	Effects
		media relations, etc…	affected
The members of the Administration Board know very little about the Regia's Activity	Only one member is a Regia employee (the general manager)	Decision of the Local Council	The quality and objectivity of the decisions are low
Increasing average age of the staff	The average age of the staff	Limited turnover Limited new hires Limited dismissals for cause	Constrains capacity to innovate and transfer of experience
High proportion of support staff (40% of total staff)	Comparison with the staffing pattern of a modern district heating system	High number of maintenance and auxiliary staff	Negative impact on wages
The operational staff is oversized	Comparison with the staffing pattern of a modern district heating system	The absence of automatization	Negative impact on wages and system performance
Lack of a finance manager	Comparison with other similar Regias	Old management structure	Poor analysis, administration and forecast activities
Low level of staff academic qualifications	Comparison with the staffing pattern of a modern district heating system	Staff recruiting policy	Constraints in using advanced technology to improve service quality
The absence of a staff training program	Comparison with the practices of a modern district heating system	Limited focus on HRD in existing management system	Decreased service quality
The absence of a performance appraisal system based on objective criteria	Comparison with the practices of a modern district heating system	Limited focus on HRD in existing management system	Low level of satisfaction among staff and poor performance Low incidence of dismissal for cause
Remuneration based largely on time in service	Comparison with the practices of a modern district heating system	Limited focus on HRD in existing management system	No incentive to innovate and improve Decreased service quality
Oversized personnel structure Poor policy on wages	Total wages paid in real terms by year	Limited focus on HRD in existing management system	Constant excess of wages paid over the amount established in the budget Increase in real terms of total wages paid at a time when the Regia is operating at a loss

Recommendations

RADET should consider the following measures to strengthen it overall organization and address weaknesses in the current personnel system:

- Developing an organization structure and related staffing pattern suited to its needs;
- The modification of the Regia's Administration Board by increasing the representation of the management of RADET on the Board;
- Implementation of new human resource management policies and practices, focused on improved staff recruitment, appraisal, training and advancement;
- Implementation of a new wage system that rewards good performance and is based on factors other than just time in service.

Operation of the heating system

RADET is responsible for the distribution of thermal energy in the form of both heat and hot water. This includes the following functions:

- Monitoring of the thermal energy distribution system as a whole;
- Operation and maintenance of the equipment in the stations and substations;
- Operation and maintenance of the secondary distribution lines;
- Maintenance of the installations in apartment buildings;
- Installation of heating meters.

The structure of the district heating system is as follows:

- A thermal power plant (TEC) that provides bulk heat, owned and operated by CONEL;
- Two main lines that serve as the primary heating network, with a length of 123 Km, owned and operated by CONEL;
- 131 substations connected to the primary network that supply heating to the secondary network;
- 2 heat stations operated with methane gas;
- 133 secondary distribution lines, with a length of 215 km, by which heat is distributed to end users;
- distribution systems in end-user property.

Heating is produced using a primary thermal agent (hot water at 70-150 Celsius degrees) supplied by Termoelectrica Constanta. The peak requirement of the RADET substations is about 675 Gcal/h, of which 570Gcal/h for heating and 105 Gcal/h for hot water. Appendix 12 provides historical data on bulk heating bought from Termoelectrica, losses in the system and heat billed to customers by RADET. Of the total amount billed, heating was about 58% in 1998 and 55% in the first 9 months of 1999. The analysis of the data shows that total heat used in the system has remained constant at around 1,000,000 Gcal/year. In this regard, it is important to note that consumption remains unchanged because the losses are not measured but estimated between certain fixed percents. Also consumption by key categories of users remains unchanged.

Customer service and media relations

Residential customers account for 63% of the total amount billed. They are grouped in 808 accounts of residents' associations in apartment buildings and 1395 accounts of a single household. Firms and public institutions account for 37% of the total, of which, there are 38 health institutions, 100 educational institutions and 1162 public and private capital institutions (including regias and other budgetary institutions. The structure and evolution over time of the customers of RADET is presented in Appendix 14.

The total customer base has grown by 35%. The number of residential accounts, including both associations and individual households has grown by (46%). Non-residential accounts have grown by 16%. However, the quantity of heat billed has remained the same, as shown in Appendix 15.

Although the organization chart shows two different departments for residential and commercial accounts, in fact the two function together under the direction of a customer service chief. The activities are as follows:

- Meter reading (at the level of individual stations and at the end user level where this exists);
- Other data gathering on production;
- Maintenance of the customer data base (numbers of persons served, contract modifications, etc);
- Billing, including distribution and maintenance of related records and files;
- Monitoring of delinquent bills, including identifying delinquent accounts on a monthly basis and taking steps to recover amounts owed;
- Public relations;
- Receipt, recording and assignment to the proper office of customer complaints;
- Issuing production reports for the accounting service.

Management of customer complaints

A team of twelve employees in the office is responsible for registering and addressing customer complaints. Each of the employees on the team co-ordinates a customer service intervention team of other RADET employees serving particular service areas within the system. Moreover, for an operative customer complains briefing, every employee is on duty (through rotation) in a public relation office to provide briefings and answer questions presented by the customers.

All the complains are recorded in a register organized by substation, then the complaints are recorded in a second register that shows the date, the customer's name, the substation serving the customer, the employee in charge of solving the problem and the date when the complaint was addressed. All customers complaints are quickly received, recorded and followed up until they have been completely addressed. As a result, the average period for addressing the complaints is less than 4-5 days.

Billing

Heating and hot water supply services are based on a contract signed with the customers. RADET has signed contracts with 95% of its customers. Only a few associations in the blocks of flats have not a signed contract. Requests to be disconnected from the system are considered important issues and are recorded in a special register that includes the personal details of the petitioner, the situation and the date of the disconnection.

The billing and debt collection operations can be grouped as presented in scheme from Appendix 14. Billing of consumption is made monthly for two categories of accounts, metered and non metered. It is important to emphasize that the number of accounts with a metered customers at the beginning of their own installation is very low (<1%), so we will use the term "metered customers" as well to include metering at the level of substations. Bills based on heating consumed as measured at the substation are subdivided based on the number of persons that receive hot water for residential accounts and number of taps for hot water for companies and based on the radiant surface of heating devices for heating.

For unmetered customers billing is done in "pausal" system, distinct for hot water and for heating. In this system, the bill for hot water is based on the average consumption for the whole town. For heating, the bill is based on the average consumption for heating in those substations that are metered that have similar output parameters (triangle diagram) of the one serving particular customers. Seventy-four percent of accounts receive bills are issued using this system. The wide variety of factors used to determine the bill explains why RADET places such emphasis on maintaining an updated customer data base.

The revenues billed from 1997 to September 1999 are presented in appendix 17.

Delinquent accounts

Monitoring of trade receivables is done on a continuing basis. The approach used to deal with delinquent accounts varies according to the aging of the debt. In this respect, a notification system has been developed, each notification being more and more aggressive until the service is cut off and a legal action is initiated. The process works as follows:

- Customers with higher number of bills unpaid are selected manually based on monthly bookkeeping reports;
- Those that have more than 3-4 unpaid bills are notified through 2-3 successive letters;
- If the customer still does not pay, they receive a final written warning;
- Then the service is cut off and legal action is initiated (in the case of companies only for those that are thought to have sufficient liquidity);
- Some of the customers come to negotiate debt payment rescheduling;
- If the conditions imposed at negotiation are respected, the customer is re-connected.

Legal action is an extreme measure. In that case, the debt can only be recovered after the court issues a final verdict. If the customer is insolvent, costs of regia increase with judgement expenses. For this reason, RADET takes legal action only with companies from which they feel there is a reasonable chance to recover the debt. In the recent past RADET took 39 delinquent accounts to court, of which 18 were won, 2 customers compensated their debt with electronically devices (a barter) and one customer paid the debt while the case was in court. The remaining 18 are in progress.

The following table shows delinquent debt as a percent of total amount billed.

	1997	1998	1999*
Trade receivables (%)	32%	24%	13%

Note:
***For only 9 months (January - September).**

Media relationships

RADET maintains contacts with the media in order to inform inhabitants about current developments in the system, such as changes in current tariffs or areas affected by leakage, supply cut-off or planned general maintenance. There is no department in charge of media relationships. Parts of this function may be assumed by the department dealing with customers, by the management of Regia or by dispatchers. The Regia's management is available to answers questions from the media at any time.

The media also carries stories on important customer complaints. In this regard the picture of RADET in the media is not quite favorable. This is influenced to some extent by the political diversity of the media and social pressure groups, a fact leading sometimes to subjectivism in the media materials. In recent times, there has been a strong campaign in the media against steps taken by RADET to cut off heating service to delinquent accounts.

Strengths and weaknesses of customer and media relations

The following tables shows the strengths first, then the weaknesses in the areas of customer and media relations in RADET.

Strengths	Term of Comparison	Main Causes	Effects
Existing contracts with 95% of consumers	The situation of other similar regias	Viewed as essential to relations with customers by management	The weight of unpaid bills has decreased considerably
Effective debt collection	Delinquent amounts as percent of amount billed	Active measures of debt recovery; Service organizations	Increases cash levels
The existence of a monitoring system for customer complaints	The situation of other similar regias	Viewed as essential to relations with customers by management	Ensures the database for a reporting system
The existence of public relations office	The situation of other similar regias	Viewed as essential to relations with customers by management	Elements of improving customer service
The existence of a contact person for each of the 12 work formations	The situation of other similar regias	Viewed as essential to relations with customers by management	The increase of operatively in complains solving and leakages
Unitary decision system	The situation of other similar regias	Uncertainty elimination	Quick problem solving

Weakness	Term of Comparison	Main Causes	Effects

Weakness	Term of Comparison	Main Causes	Effects
Lack of computerized customer data base	Performance public relation system	Lacking of funding to buy IT software and hardware	Customer data base management is difficult
The absence of an institutionalized system of permanent reporting of delinquent accounts	Normal reporting system	Communication between financial and accounting office and customers	Makes the monitoring of delinquent accounts more burdensome
The absence of a media relation department	The situation of other similar regias	The relation with mass-media was not considered as priority	The image of Regia is not favorable
Lack of summary reports on billing and delinquent accounts	The situation of other similar regias	The existing database is not utilized and does not create summary reports	The absence of an important element in decision making
Lack of a system to measure and report customer satisfaction	Best practices in service quality monitoring	The non computerized information registration	The absence of an important element in decision making

Recommendations

To address the weaknesses in its customer and media relations functions, RADET should consider the following measures:

- Computerizing the customer data base;
- Implementation of an institutionalized system of permanent reporting on delinquent accounts;
- Establishing a system to measure and report on customer satisfaction;
- Implementing a summary reporting system for management (MIS) on billing, collections and customer satisfaction;
- Creation of a media relation department, that as a first task should establish a strategy for promoting RADET's image, the importance of heating and justifying actions taken by RADET to improve system operations and collections.

Financial and accounting activity

Overview

The Regia maintains its accounting records in accordance with the Accounting Law no.82/1991, updated and completed through G.O. no.22/1996, and other further regulations concerning this activity. Although RADET has a relatively complex financial structure, it does not have and use a management accounting based on cost or profit centers. This detracts from the ability of RADET to determine and defend appropriate tariff levels or to identify any financial weakness.

Accounting information processing is done through a computerized system but in individual desktop units, not in a network. The ability to exchange information among different computers in the system is limited because of differences in software and data management approach.

Despite the fact that a financial analysis and planing department is included in the organization chart it has never operated in fact. Coordination with the technical department of the Regia is not good. Therefore, an important element of cost, technological consumption, is not shown in the financial statements. There is no periodic reconciliation with the main supplier, Termoelectrica. There is no internal reporting system for top management of Regia.

Financial statements

The Regia's main financial statements (Balance Sheet, Profit and Loss Account) for the period January 1997 – June 1999, in historical and comparable prices (30/Jun/1999), are shown in Appendixes 18-21. All the data provided by the Regia is synthesized in monthly, quarterly, half-yearly and annual reports, as shown in the following table. All these statements use standardized forms, according to legal provisions.

Statement	Addressee	Frequency
Deduction related to V.A.T.	Public Finance General Central Board	Monthly
Statement of amounts owed for to the wage tax for employees	Public Finance General Central Board	Monthly
Statement of amounts owed for health insurance for employees	Public Finance General Central Board	Monthly
Statement related to State Insurance Budget	Working and Social Safety Central Board	Monthly
Statistics of number of employees and wages	Statistics Central Board	Monthly
Statement of amounts owed for the profit tax	Public Finance General Central Board	Quarterly
Accounting Balance Sheet	Public Finance General Central Board	Half yearly and annually
Report on economic activity	Local Council of Constanta City Administration Board of Regia	Half yearly and annually Monthly
Statement of local taxes and fees owed	Public Finance General Central Board	Annually
Annual Statistics	National Commission for Statistics	Annually

Strengths and weaknesses of financial and accounting activities

The following tables show the strengths first, then the weaknesses, in the financial and accounting activities of RADET.

Strengths	Term of Comparison	Main Causes	Effects
The existence of hardware and partial software resources	Classic accounting system	Normal development of traditional system	Represents an important step forward in creating a unitary information management system

Weakness	Term of Comparison	Main Causes	Effects

Weakness	Term of Comparison	Main Causes	Effects
The absence of managerial accounting	Comparison with the practices of a modern district heating system	Not seen as a need by management	Difficulties in cost analysis
The absence of financial and managerial analysis department	Comparison with the practices of a modern district heating system	Not seen as a need by management	No financial planing; no basis for identifying and defending tariffs
The absence of cost management system	Comparison with the practices of a modern district heating system	Not seen as a need by management	The impossibility of real cost analysis Weakness of the system
The absence of internal summary reports	Comparison with the practices of a modern district heating system	Currently decisions are based on past experience	Inadequate information to support operational and strategic decisions
Financing of activities through accumulation of payables to suppliers	Change in value of payables	Lack of financial resources	Possible penalties and increased delays in making payments
Essential technological costs not broken out in accounting system	Accepted accounting standards and practices	Accounting system inappropriate to the Regia's activities	Difficulties in cost analysis ; no basis for identifying and defending tariffs
Use of same analytical accounts for purchased heating from Termoelectrica and for consumed electrical energy (CONEL)	Accepted accounting standards and practices	Heating purchased from Termoelectrica is not considered as raw material but energy	Difficulties in analyzing two important cost elements
The absence of a procedure for correlating financial and technical activities	Comparison with the practices of a modern district heating system	The absence of a co-ordination and a data communication system	The appearance of bad function in technological consume
No reconciliation with Termoelectrica	Balances as shown in the financial statements of the two companies	Inadequate internal procedures	Different figures reported to top entities
The absence of a single operational database for financial information	Comparison with the practices of a modern district heating system	Software purchased from different sources The absence of a network supervisor	The partial utilization of the existing system. The absence of information processing in real time

Recommendations

To address the weaknesses in its financial and accounting activities, RADET should consider the following measures:

- Implementing a new cost management system;
- Establishing a financial analysis and planing department headed by a financial director;
- Developing an internal summary financial reporting system to support management decisions;

- Implementing a chart of accounts suited to the management needs of the Regia;
- Implementation of new procedures for periodical reconciliation with suppliers/customers;
- Setting up new work procedures for correlating financial and technical information
- Implementation of a single database administration system.

Investments

Because RADET ended the last three years with losses, the main investment sources are depreciation and allocations from the State budget and from the Municipality of Constanta. The value of actual investments, in historical and constant ROL (30.09.1999), completed from 1997 to 1999 is presented in Appendix 23. The value of investments by sources and by categories is presented in Appendix 24 and 25. The main investments planned by RADET are presented below. Actual investments were limited by availability of funds to just a limited modernization of some substations and the transformation of two substations in station using methane gas.

- rehabilitation of 79 substations through replacing 322 tube heating exchangers, installing 19 new electric pumps
- pre-feasibility studies for heating networks rehabilitation;
- pre-feasibility studies for station monitoring and automatization;

transformation of two substations in stations using methane gas

Strengths and weaknesses of investment activities

The following tables show the weaknesses in the investment activities of RADET.

Weakness	Term of Comparison	Main Causes	Effects
The low level of investments	Level of investments required based on technical analysis of the system	Poor financial situation	Obsolete equipment, deteriorating service quality
Limited funding of investment from own funds	Comparison with the practices of a modern district heating system	Poor financial situation	Obsolete equipment, deteriorating service quality
No use of external investment funds	The existence of external investment funds	Regia is under the authority of Constanta Local Council	Limited system modernization

Recommendations

To address the weaknesses in its financial and accounting activities, RADET should consider the following measures:

- Develop a complete assessment of investment needs;
- Develop a plan that would prioritize and phase the investments over time based on system needs and availability of investment;
- Identification of alternative financing scenarios.

Environment issues

Recommendations

RADET should consider setting up a department specialized in environmental issues that affect and are affected by the operation of the district heating system.

Management Information System

RADET has focused its computer hardware and software purchases on meeting its financial and accounting recording and reporting requirements in the context of constantly changing legislation and complex reporting requirements of different state institutions. The computers are working as local entities. A computer network exists but it is not operational.

The following table lists the hardware currently available to RADET.

Item	Pieces
COMPUTERS	
486	6
Pentium 120	5
Pentium 100	4
Pentium 166	5
DX4/100 MHz	4
P11 Atlanta 233 MHz	3
Electric Pcat 80486	2
Laptop Logimax	2
PC AT 286	2
TOTAL	33
PRINTERS	
Epson matrix	13
HP 690	4
HP 6L	5
Jet Printer	3
Matrix Printer	1
TOTAL	26
SCANNER	
Color Scanner A4	2

RADET has developed and implemented the following applications:

- Payroll administration program;
- Fixed asset management program;
- Materials administration program;
- Cash registration program;
- Bank payment administration program;
- Suppliers management program;
- Staff evidence program;
- Evidence and control of technical parameters program;
- Customer data base

The information flow is designed only on paper without existence of a proper computerized system for registration, processing and storing. The information exchange between programs is low. The way the system works in practice does not allow real time historical information analysis as a tool to support and improve decision making.

Strengths and weaknesses of management information systems

The following tables show the strengths first, then the weaknesses, in the management information systems of RADET.

Strengths	Term of Comparison	Main Causes	Effects
Hardware and software currently available	RADET inventory	Part of improvement measures adopted by management	Provides the foundation on which to build an integrated network and MIS
Appearance of a clear working procedure in customers and mechanic-electrical departments.	Existing MIS applications	Part of improvement measures adopted by management	Provides the foundation on which to build an integrated network and MIS

Weakness	Term of Comparison	Main Causes	Effects
The absence of an integrated information system	Hardware and software structure in use	The absence of resources; Not a priority	Insufficient information for each department
Flow of information ends at early stages	Necessary system of reports for company management	The information is not registered on hard disk or floppy disk.	The absence of essential elements in decision making process
Computer network not implemented	Current status of hardware installed in RADET	The absence of a clear strategy	Adds to the work required for data processing and detracts from usefulness of computer applications
The split between technical and economical data	Right co-operation between the two departments	The absence of communication and co-ordination procedure	The reports are not issued timely and completely. Not reliable information

Recommendations

To address the weaknesses in its financial and accounting activities, RADET should consider the following measures:

- Design and implement an integrated management information system;
- Develop and implement an internal reporting system to improve the flow of information;
- Complete installation of a computer network that integrates in a single system all the hardware and software resources available to RADET.

APPENDIX 3

	Staff,					Staff structure by level of training									
Departments	**of which**					**High school graduates**				**Post-secondary s. g.**				**Secondary s. g.**	
	Total	**Management**	**Expert**	**Executive**	**Administration**	***Total***	***Tehnical***	***Economic***	***Other***	***Total***	***Tehnical***	***Economic***	***Other***	*	**total**
Top Management	***3***	3	0	0	0	***3***	2	1		***0***					3
NORTH Section	***294***	**4**	**6**	**284**	**0**	***2***	**2**	**0**	**0**	***11***	**11**	**0**	**0**	**281**	**294**
Middle management	***4***	4	0	0		***2***	2			***2***	2				4
Team no. 1	***50***		1	49		***0***				***2***	2			48	50
Team no. 2	***36***		1	35		***0***				***2***	2			34	36
Team no. 3	***44***		1	43		***0***				***2***	2			42	44
Team no. 4	***47***		1	46		***0***				***1***	1			46	47
Team no. 5	***40***		1	39		***0***				***1***	1			39	40
Team no. 6	***52***		1	51		***0***				***1***	1			51	52
Team no. 7 dispatcher	***21***	0		21		***0***				***0***				21	21
SOUTH section	***295***	**3**	**6**	**286**	**0**	***2***	**2**	**0**	**0**	***8***	**8**	**0**	**0**	**285**	**295**
Middle management	***3***	3				***2***	2			***1***	1				3
Team no. 1	***45***		1	44		***0***				***2***	2			43	45
Team no. 2	***51***		1	50		***0***				***2***	2			49	51
Team no. 3	***35***		1	34		***0***				***1***	1			34	35
Team no. 4	***50***		1	49		***0***				***1***	1			49	50
Team no. 5	***39***		1	38		***0***				***1***	1			38	39
Team no. 6	***52***		1	51		***0***				***0***				52	52
Team no. 7 dispatcher	***20***			20		***0***				***0***				20	20
MAINTENANCE section	***178***	**4**	**6**	**0**	**168**	***3***	**3**	**0**	**0**	***10***	**10**	**0**	**0**	**165**	**178**
Middle management	***4***	4				***3***	3			***1***	1				4
Mecanics	***29***		1		28	***0***				***1***	1			28	29
Electricians	***29***		1		28	***0***				***2***	2			27	29
AMC	***15***		1		14	***0***				***2***	2			13	15
Laborator	***7***		0		7	***0***				***0***	0			7	7
Build-assembly	***27***		1		26	***0***				***1***	1			26	27
Transportation	***46***		1		45	***0***				***1***	1			45	46
Mecanic processing	***21***		1		20	***0***				***2***	2			19	21
Human resources	***7***	1			6	***2***		2		***1***			1	4	7
Law department	***1***	1				***1***			1	***0***					1

APPENDIX 3

	Staff,					Staff structure by level of training									
Departments	**of which**					**High school graduates**				**Post-secondary s. g.**				**Secondary s. g.**	
	Total	**Management**	**Expert**	**Executive**	**Administration**	***Total***	***Tehnical***	***Economic***	***Other***	***Total***	***Tehnical***	***Economic***	***Other***	*	**total**
Civil defence general staff	***1***	1				***0***				***0***				1	1
Provisioning	***8***	1			7	***1***	1			***0***				7	8
Planing, maintenance	***4***	1			3	***3***	3			***1***	1				4
Tehnical office	***9***	1			8	***8***	7		1	***1***	1				9
Investment office	***4***	1			3	***4***	4			***0***					4
Customer service	***12***	1			11	***8***	8			***0***				4	12
Trading office	***15***				15	***15***	15			***0***					15
Bookkeeping office	***13***	1			12	***2***		2		***0***				11	13
Auditor	***1***				1	***0***				***0***				1	1
Central dispatcher	***9***				9	***0***				***0***				9	9
TOTAL	**854**	**23**	**18**	**570**	**243**	**54**	**47**	**5**	**2**	**32**	**31**	**0**	**1**	**768**	**854**

APPENDIX 4 Staff structure by age

TOTAL RADET	TOTAL	%	Male	%	Female	%
under 30 years	156	18%	124	20%	32	13%
between 30-40 years	216	25%	142	23%	74	31%
between 41-50 years	321	38%	210	34%	111	46%
between 51-60 years	151	18%	126	21%	25	10%
over 60 years	10	1%	10	2%	0	0%
TOTAL	**854**	**100%**	**612**	**100%**	**242**	**100%**

NORTH SECTION	TOTAL	%	Male	%	Female	%
under 30 years	50	18%	47	22%	3	4%
between 30-40 years	57	20%	44	20%	13	19%
between 41-50 years	117	41%	78	36%	39	58%
between 51-60 years	55	19%	43	20%	12	18%
over 60 years	5	2%	5	2%	0	0%
TOTAL	**284**	**100%**	**217**	**100%**	**67**	**99%**

SOUTH SECTION	TOTAL	%	MALE	%	FEMALE	%
under 30 years	56	20%	40	21%	16	16%
between 30-40 years	70	24%	37	20%	33	33%
between 41-50 years	98	34%	57	30%	41	41%
between 51-60 years	59	21%	50	27%	9	9%
over 60 years	3	1%	3	2%	0	0%
TOTAL	**286**	**100%**	**187**	**100%**	**99**	**99%**

III-rd SECTION	TOTAL	%	MALE	%	FEMALE	%
under 30 years	36	21%	35	23%	1	6%
between 30-40 years	59	35%	50	33%	9	56%
between 41-50 years	55	33%	49	32%	6	38%
between 51-60 years	18	11%	18	12%	0	0%
over 60 years	0	0%	0	0%	0	0%
TOTAL	**168**	**100%**	**152**	**100%**	**16**	**100%**

OTHER	TOTAL	%	MALE	%	FEMALE	%
under 30 years	14	12%	2	4%	12	20%
between 30-40 years	30	26%	11	20%	19	32%
between 41-50 years	51	44%	26	46%	25	42%
between 51-60 years	19	16%	15	27%	4	7%
over 60 years	2	2%	2	4%	0	0%
TOTAL	**116**	**100%**	**56**	**101%**	**60**	**101%**

APPENDIX 5 **Staff structure by categories**

	NORTH SECTION	SOUTH SECTION	SECTION III	OTHERS	TOTAL
TOTAL STAFF	**294**	**295**	**178**	**87**	**854**
management	4	3	4	12	**23**
foremen	6	6	6	0	**18**
workers	284	286	0	0	**570**
administrative staff	0	0	168	75	**243**

0.667447307

APPENDIX 6	**Evolution of Staff**					
	Number of Persons			**Percent of total**		
Function	**1997**	**1998**	**1999**	**1997**	**1998**	**1999**
Operations	530	550	570	65%	66%	66%
N section	264	274	284	32%	33%	33%
S section	266	276	286	33%	33%	33%
Maintenance	159	164	168	20%	20%	20%
Other activities	126	121	116	15%	14%	14%
TOTAL	**815**	**835**	**854**	**100%**	**100%**	**100%**
	Percent change year to year					
	$I_{97/97}$	$I_{98/97}$	$I_{99/97}$			
Operations	100%	104%	108%			
N section	100%	104%	108%			
S section	100%	104%	108%			
Maintenance	100%	103%	106%			
Other activities	100%	96%	92%			
TOTAL	**100%**	**102%**	**105%**			

APPENDIX 7 Staff structure by gender

	Male	Female	Total	
RADET	**612**	**242**	**854**	72%
NORTH section	*217*	*67*	*284*	76%
Team no. 1	43	6	49	88%
Team no. 2	26	9	35	74%
Team no. 3	30	13	43	70%
Team no. 4	30	16	46	65%
Team no. 5	34	5	39	87%
Team no. 6	38	13	51	75%
Team no. 7 dispatcher	16	5	21	76%
SOUTH section	*187*	*99*	*286*	65%
Team no. 1	32	12	44	73%
Team no. 2	29	21	50	58%
Team no. 3	27	7	34	79%
Team no. 4	31	18	49	63%
Team no. 5	26	12	38	68%
Team no. 6	27	24	51	53%
Team no. 7 dispatcher	15	5	20	75%
MAINTENANCE section	*152*	*16*	*168*	90%
Mechanics	28	0	28	100%
Electricians	28	0	28	100%
AMC	10	4	14	71%
Laboratory	0	7	7	0%
Building installing	24	2	26	92%
Transportation	45	0	45	100%
Mechanic processing	17	3	20	85%
OTHER	*56*	*60*	*116*	48%
Unqualified	1	1	2	50%
Central dispatcher	9	0	9	100%
Masters	17	0	17	100%
TESA	29	59	88	33%

APPENDIX 8	**Staff structure by length of service**						
Years	**0-3**	**3-5**	**5-10**	**10-15**	**15-20**	**+20**	**Total**
RADET	**32**	**24**	**103**	**145**	**95**	**455**	**854**
NORTH section	*14*	*6*	*28*	*49*	*24*	*163*	*284*
Team no. 1	5	1	8	12	4	19	49
Team no. 2	1	1	3	5	3	22	35
Team no. 3	2	1	2	8	4	26	43
Team no. 4	0	1	2	8	3	32	46
Team no. 5	2	0	4	7	5	21	39
Team no. 6	2	1	8	7	3	30	51
Team no. 7 dispatcher	2	1	1	2	2	13	21
SOUTH section	*11*	*11*	*38*	*52*	*30*	*144*	*286*
Team no. 1	1	2	12	5	2	22	44
Team no. 2	4	1	7	9	2	27	50
Team no. 3	0	1	5	6	4	18	34
Team no. 4	1	4	6	11	5	22	49
Team no. 5	0	1	5	8	5	19	38
Team no. 6	4	2	2	9	8	26	51
Team no. 7 dispatcher	1	0	1	4	4	10	20
MAINTENANCE section	*7*	*6*	*26*	*24*	*23*	*82*	*168*
Mechanics	0	1	7	6	5	9	28
Electricians	0	1	1	3	2	21	28
AMC	0	0	1	3	3	7	14
Laboratory	1	0	0	0	1	5	7
Building installing	2	1	9	3	2	9	26
Transportation	2	1	6	9	7	20	45
Mechanic processing	2	2	2	0	3	11	20
OTHER	*0*	*1*	*11*	*20*	*18*	*66*	*116*
Unqualified	0	1	0	1	0	0	2
Central dispatcher	0	0	0	1	1	7	9
Masters	0	0	0	0	0	17	17
TESA	0	0	11	18	17	42	88

APPENDIX 9	**Manpower structure in accordance with professional qualification**	
Highest level of education	**Number**	**%**
Technical school graduates	478	56%
Secondary school graduates	290	34%
College graduates, of which	54	6%
-engineers	20	2%
-dipl. Engineers, economist, etc	34	4%
Post- graduate degrees	32	4%
Total	854	100%

APPENDIX 10		Total Payroll Costs		
		1997	**1998**	**Sep-99**
Total salary costs	**ROL (thousands)**	**10,733,172**	**17,560,245**	**18,252,563**
work time		6,005,664	10,609,572	10,212,515
benefits		2,754,608	3,754,211	3,780,618
holidays		1,247,199	2,178,850	2,453,965
sick leaves		96,803	294,930	251,789
bonus		546,388	596,548	1,380,600
other rewards		82,510	126,134	173,076
No. Of employee (NE)	**Persons**	**815**	**835**	**854**
Average salary/person/month	**Historical ROL**	**1,097,461**	**1,752,519**	**2,374,781**
Average salary/person/month	**Percent**	**100%**	**160%**	**216%**
Average salary/person/month	**Constant ROL**	**2,142,348**	**2,433,724**	**2,374,781**
Inflation		**100%**	**141%**	**184%**

APPENDIX 10 b				
		1997	**1998**	**Sep-99**
Total salary costs	**Percent**	**100%**	**100%**	**100%**
work time		55%	61%	56%
benefits		26%	21%	21%
holidays		12%	12%	13%
sick leaves		1%	2%	1%
bonus		5%	3%	8%
other rewards		1%	1%	1%
No. Of employee (NE)	**Persons**	**100%**	**102%**	**105%**
Average salary/person/month	**Percent increase**	**100%**	**160%**	**216%**

APPENDIX 11 **Analysis of hours paid and worked**

Item	U/M	1998		1999(9 months)	
Calendar days	days	364		273	
Weekend days	days	104		78	
Effective work year	days	260		195	
Average length of work/day	hours	8		8	
Effective work year	hours	2080		1560	
Average number of workers	persons	835		854	
Total work hours available per existing staff	Person hours	**1736800**		**1332240**	
Actual annual hours at work	Person hours	**1481516**	**85%**	**1125380**	**84%**
Actual annual hours not at work	Person hours	**255284**	15%	**206860**	16%
holidays	Person hours	166224	10%	150992	11%
sick leave	Person hours	18352	1%	11800	1%
maternity leave	Person hours	14704	1%	13272	1%
permissions	Person hours	320	0.02%	72	0.01%
without leave	Person hours	448	0.03%	384	0.03%
leave of absence	Person hours	1576	0.09%	584	0.04%
other	Person hours	53660	3%	29756	2%
TOTAL	Person hours	255284		206860	
Overtime charged, of which		268564	15%	161104	12%
At night	Person hours	76959	4%	35633	3%
Saturday	Person hours	54922	3%	34549	3%
Sunday	Person hours	122361	7%	83557	6%
Total overtime hours per week	Person hours	14322	1%	7365	1%
Average length of work day	Hours	8.06		7.73	

APPENDIX 12
Constanta town heating supply

	1997		1998		1999 (9 months)	
	Gcal	%	Gcal	%	Gcal	%
Bulk heat purchased from Termoelectrica	**1,174,336**	**100%**	**1,174,067**	**100%**	**805,089**	**100%**
Losses on primary network	107,265	9%	106,830	9%	84,832	10%
Lossses on secondary network	47,596	4%	58,090	5%	44,359	6%
Total bulk heat billed, of which	**1,019,475**	**87%**	**1,009,147**	**86%**	**675,898**	**84%**
Individual households and apartment building associations	929,646	79%	928,367	79%	623,648	77%
All other (commercial, public institutions)	89,829	8%	80,780	7%	52,250	7%

	$I_{97/97}$	$I_{98/97}$	$I_{99/97}$ (9months)
	Gcal	Gcal	Gcal
Bulk heat purchased from Termoelectrica	**100%**	**100%**	**69%**
Losses on primary network	100%	100%	79%
Losses on secondary network	100%	122%	93%
Total bulk heat billed, of which	**100%**	**99%**	**66%**
Individual households and apartment building associations	100%	100%	67%
All other (commercial, public institutions)	100%	90%	58%

APPENDIX 13

Secondary networks

Life time usage	Number
less than 18%	50
less than 30%	17
less than 40%	14
less than 50%	24
less than 64%	19
Total	124
Total life time usage	35%

Heating station

Life time usage	Number
less than 10%	7
less than 20%	21
less than 30%	21
less than 40%	30
less than 50%	23
less than 60%	28
less than 70%	1
Total	131
Total life time usage	40%

APPENDIX 14 **Structure of RADET Customers by Category**

Customer structure	1997		1998		1999	
	number	%	number	%	number	%
Residential, of which	1,508	61%	1,714	62%	2,203	65%
Apartment building associations	707	28%	729	26%	808	24%
Individual households	801	32%	985	36%	1,395	41%
All others, of which	1,120	45%	1,190	43%	1,300	39%
Companies, private and state ownership	981	39%	1,052	38%	1,162	35%
Health units	39	2%	38	1%	38	1%
Schools	100	4%	100	4%	100	3%
TOTAL	2,489	100%	2,766	100%	3,365	100%

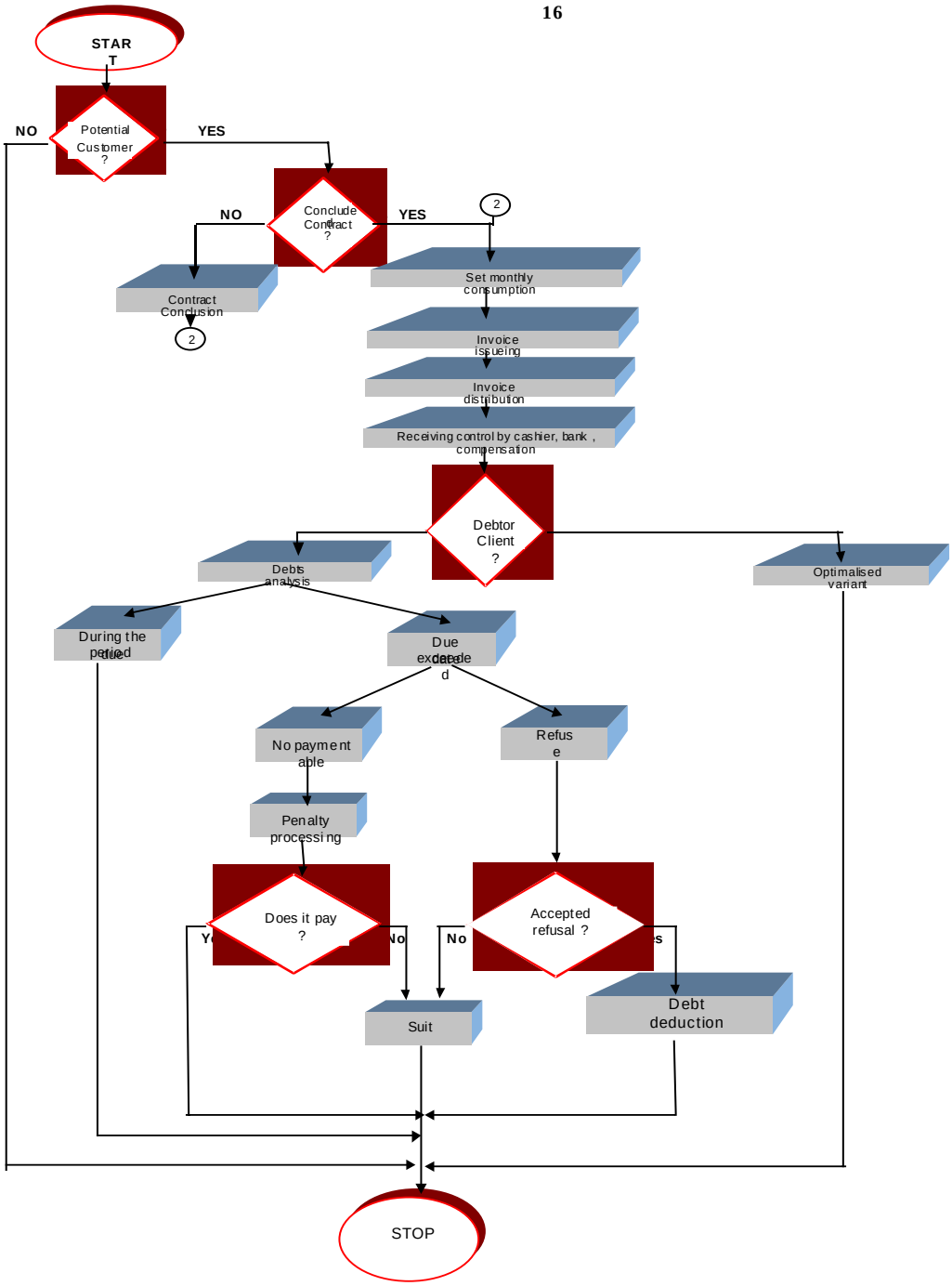
Appendix 14 b **Structure of RADET Customers by Category Change year to year**

Customers structure	$I_{97/97}$	$I_{98/97}$	$I_{99/97}$
Residential, of which	100%	114%	146%
Apartment building associations	100%	103%	114%
Individual households	100%	123%	174%
All others, of which	100%	106%	116%
Companies, private and state ownership	100%	107%	118%
Health units	100%	97%	97%
Schools	100%	100%	100%
TOTAL	100%	111%	135%

APPENDIX 15	Total Heating Billed (Gcal) by Category of Customers								
	1997			1998			1999		
	Associations	Companies	TOTAL	Associations	Companies	TOTAL	Associations	Companies	TOTAL
January	154,703	18,757	173,460	136,282	15,559	151,841	161,863	17,969	179,832
February	139,944	17,119	157,063	125,557	13,826	139,384	131,090	15,178	146,268
March	113,069	12,864	125,933	117,510	12,902	130,412	105,344	10,939	116,283
April	82,962	8,163	91,126	49,445	2,389	51,835	60,519	4,064	64,583
May	33,197	1,334	34,531	40,642	1,149	41,791	38,755	1,016	39,772
June	32,123	1,157	33,280	39,095	1,064	40,159	36,994	959	37,952
July	37,596	1,189	38,786	38,746	976	39,722	36,641	899	37,540
August	28,729	954	29,683	34,871	764	35,634	38,640	856	39,496
September	23,673	267	23,940	30,420	810	31,229	15,374	442	15,816
October	54,867	3,796	58,663	37,979	1,096	39,075			0
November	80,492	8,957	89,449	115,300	12,370	127,670			0
December	148,290	15,268	163,557	162,519	17,876	180,395			0
TOTAL	**929,647**	**89,824**	**1,019,471**	**928,367**	**80,780**	**1,009,147**	**625,220**	**52,322**	**677,542**

	Dynamics of heat billed								
	$I_{98/97}$			$I_{99/98}$			$I_{99/97}$		
	Associations	Companies	TOTAL	Associations	Companies	TOTAL	Companies	Industrial customers	TOTAL
January	-12%	-17%	-12%	19%	15%	18%	5%	-4%	32%
February	-10%	-19%	-11%	4%	10%	5%	-6%	-11%	16%
March	4%	0%	4%	-10%	-15%	-11%	-7%	-15%	-1%
April	-40%	-71%	-43%	22%	70%	25%	-27%	-50%	31%
May	22%	-14%	21%	-5%	-12%	-5%	17%	-24%	-2%
June	22%	-8%	21%	-5%	-10%	-5%	15%	-17%	-3%
July	3%	-18%	2%	-5%	-8%	-5%	-3%	-24%	-3%
August	21%	-20%	20%	11%	12%	11%	34%	-10%	13%
September	28%	203%	30%	-49%	-45%	-49%	-35%	66%	-48%
October	-31%	-71%	-33%						
November	43%	38%	43%						
December	10%	17%	10%						
TOTAL	**0%**	**-10%**	**-1%**						

APPENDIX 16


STAR T
Potential Customer ?
NO
YES
Conclude Contract ?
NO
YES
2
Contract Conclusion
2
Set monthly consumption
Invoice issueing
Invoice distribution
Receiving control by cashier, bank , compensation
Debtor Client ?
Debts analysis
Optimalised variant
During the period
Due
No payment able
Refus e
Penalty processing
Does it pay ?
Accepted refusal ?
Suit
Debt deduction
STOP

Appendix 17 Delinquent payments as a percent of amount billed Historical ROL

	Owed	Billed	%
1997	25,401,872,013	78,742,699,755	**32%**
1998	33,955,492,031	139,141,979,964	**24%**
9 luni 1999	18,018,947,744	138,405,814,950	**13%**

Constant ROL

	Owed	Billed	%
1997	49,586,863,046	153,713,217,146	**32%**
1998	47,154,013,769	193,226,557,666	**24%**
9 luni 1999	18,018,947,744	138,405,814,950	**13%**

BALANCE SHEET - HISTORICAL PRICES **APPENDIX 18**

Thousands ROL

	31.12.1997	**31.12.1998**	**30.06.1999**
Set-up expenses	-	-	-
Intangibles	-	73,579	66,221
Intangibles in progress	-	-	-
I. INTANGIBLES	**-**	**73,579**	**66,221**
Land	-		
Fixed assets	643,556	628,524	24,845,427
Investments in progress	25,030,795	24,915,683	6,180,224
Trucks and cars	4,934,592	5,867,217	244,353
Other moveable tangible assets	1,045,941	850,228	604,801
Assets in progress	4,788,127	8,008,676	9,569,780
II. PROP., PLANT. & EQUIP.	**36,443,011**	**40,270,328**	**41,444,585**
III. FINANCIAL ASSETS	-		
IV. NET FIXED ASSETS (I+II+III)	**36,443,011**	**40,343,907**	**41,510,806**
Materials	2,234,406	2,255,973	4,949,832
Third parties inventories	-	-	-
Work in progress	-	-	-
Finished goods	-	-	-
Animals	-	-	-
Goods	-	-	-
Packages	-	-	-
V. INVENTORIES	**2,234,406**	**2,255,973**	**4,949,832**
Suppliers prepayments	247,530	66,087	406,333
Clients	25,401,872	34,816,108	30,133,617
Other accounts receivables	4,395,055	25,866,184	44,682,674
	-	-	-
VI. OTHER ASSETS	**30,044,457**	**60,748,379**	**75,222,624**
Treasory bonus	-	-	-
Bank accounts in ROL	1,046,574	1,009,302	1,339,028
Bank accounts	-	-	-
Bank accounts abroad	-	-	-
Cash in hand in ROL	4,712	16,066	339,402
Cash in hand in hard currency	-	-	-
Acreditives in ROL	-	-	-
Acreditives in hard currency	-	-	-
Valuable bonuses	-	8,624,508	
Other valuables	3,850	13,108	363,653
VII. CASH	**1,055,136**	**9,662,984**	**2,042,083**
VIII. TOTAL WORKING CAPITAL (V+VI+VII)	**33,333,999**	**72,667,336**	**82,214,539**
Expenses in advance	5,867	5,867	5,867
Payments in operation	261	11,279	62,760
Conversion differences for assets	-	-	-

IX. ADJUSTMENT ACCOUNTS	**6,128**	**17,146**	**68,627**
X. PRIMES	**-**	**-**	**-**
TOTAL ASSETS (IV+VIII+IX+X)	**69,783,138**	**113,028,389**	**123,793,972**
Subscribed capital	(33,896,599)	(33,896,599)	(33,896,599)
Individual account	-	-	-
Prime de capital	-	-	-
Reevaluation	-	-	-
Reserves	-		
Undistributed profit	-	-	-
Unrecovered loss	18,648,393	21,633,639	35,532,340
Profit			
Loss	2,985,246	13,898,701	8,207,964
Profit distribution			
Funds	(6,486,070)	(12,932,409)	(13,382,409)
Developement fund repartition		-	-
Subsidies	-	-	
Regulary provisions	-	-	-
XI. OWNER's EQUITY	**(18,749,030)**	**(11,296,668)**	**(3,538,704)**
Risk provisions	-	-	-
Provisions for expenses	-	-	-
XII. Risk & expenses provisions	**-**	**-**	**-**
Credits	-	-	(21,462,425)
Suppliers	(49,655,551)	(99,705,284)	(96,326,664)
Prepayments from clients	(35,178)	(35,178)	(35,178)
Other liabilities	(1,343,379)	(1,991,259)	(2,431,001)
XIII. LIABILITIES	**(51,034,108)**	**(101,731,721)**	**(120,255,268)**
Incomes in adavnce	-	-	
Payments in operation	-	-	-
Conversion differences for liabilities		-	-
XIV. ADJUSTMENT ACCOUNTS	**-**	**-**	**-**
TOTAL LIABILITIES & O.E. (XI+XII+XIII+XIV)	**(69,783,138)**	**(113,028,389)**	**(123,793,972)**

BALANCE SHEET - CONSTANT PRICES	Prices at 30.06.1999		APPENDIX 19
Millions ROL			
	31.12.1997	**31.12.1998**	**30.06.1999**
Set-up expenses	-	-	-
Intangibles	-	96	66
Intangibles in progress	-	-	-
I. INTANGIBLES	**-**	**96**	**66**
Land	-	-	-
Fixed assets	1,183	822	24,845
Investments in progress	46,023	32,590	6,180
Trucks and cars	9,073	7,674	244
Other moveable tangible assets	1,923	1,112	605
Assets in progress	8,804	10,475	9,570
II. PROP., PLANT. & EQUIP.	**67,006**	**52,674**	**41,445**
III. FINANCIAL ASSETS	-	-	-
IV. NET FIXED ASSETS (I+II+III)	**67,006**	**52,770**	**41,511**
Materials	4,108	2,951	4,950
Third parties inventories	-	-	-
Work in progress	-	-	-
Finished goods	-	-	-
Animals	-	-	-
Goods	-	-	-
Packages	-	-	-
V. INVENTORIES	**4,108**	**2,951**	**4,950**
Suppliers prepayments	455	86	406
Clients	46,705	45,540	30,134
Other accounts receivables	8,081	33,833	44,683
	-	-	-
VI. OTHER ASSETS	**55,241**	**79,459**	**75,223**
Treasory bonus	-	-	-
Bank accounts in ROL	1,924	1,320	1,339
Bank accounts	-	-	-
Bank accounts abroad	-	-	-
Cash in hand in ROL	9	21	339
Cash in hand in hard currency	-	-	-
Acreditives in ROL	-	-	-
Acreditives in hard currency	-	-	-
Valuable bonuses	-	11,281	-
Other valuables	7	17	364
VII. CASH	**1,940**	**12,639**	**2,042**
VIII. TOTAL WORKING CAPITAL (V+VI+VII)	**61,290**	**95,049**	**82,215**
Expenses in advance	11	8	6
Payments in operation	0	15	63
Conversion differences for assets	-	-	-

IX. ADJUSTMENT ACCOUNTS	**11**	**22**	**69**
X. PRIMES	-	-	-
TOTAL ASSETS (IV+VIII+IX+X)	**128,307**	**147,841**	**123,794**
Subscribed capital	(62,324)	(44,337)	(33,897)
Individual account	-	-	-
Prime de capital	-	-	-
Reevaluation	-	-	-
Reserves	-	-	-
Undistributed profit	-	-	-
Unrecovered loss	34,288	28,297	35,532
Profit	-	-	-
Loss	5,489	18,180	8,208
Profit distribution	-	-	-
Funds	(11,926)	(16,916)	(13,382)
Development fund repartition	-	-	-
Subsidies	-	-	-
Regulary provisions	-	-	-
XI. OWNER's EQUITY	**(34,473)**	**(14,776)**	**(3,539)**
Risk provisions	-	-	-
Provisions for expenses	-	-	-
XII. Risk & expenses provisions	**-**	**-**	-
Credits	-	-	(21,462)
Suppliers	(91,299)	(130,415)	(96,327)
Prepayments from clients	(65)	(46)	(35)
Other liabilities	(2,470)	(2,605)	(2,431)
XIII. LIABILITIES	**(93,834)**	**(133,065)**	**(120,255)**
Incomes in adavnce	-	-	-
Payments in operation	-	-	-
Conversion differences for liabilities	-	-	-
XIV. ADJUSTMENT ACCOUNTS	**-**	**-**	**-**
TOTAL LIABILITIES & O.E. (XI+XII+XIII+XIV)	**(128,307)**	**(147,841)**	**(123,794)**

INCOME STATEMENT - HISTORICAL PRICES **APPENDIX 20**

Thousands ROL

	1997	1998	30.06.1999
OPERATING INCOMES	**78,874,375**	**139,674,776**	**113,737,804**
REVENUE FROM HEAT DISTRIBUTION	54,791,402	98,046,891	71,687,750
SUBSIDIES	23,951,298	41,095,089	41,458,258
CHANGE IN STOCKS			
OTHER OPERATING REVENUES	131,675	532,796	591,796
OPERATING EXPENSES	**82,295,001**	**150,686,942**	**121,877,929**
cost of merchandise	3,013	19,829	-
raw materials	31,923	37,904	52,100
consumables	3,042,243	8,624,619	5,502,164
energy, water	49,987,801	95,046,034	85,742,380
other material expenses	358,355	848,841	646,193
third parties services	11,923,525	21,280,152	11,730,158
taxes	364,927	255,040	257,358
salaries	10,731,299	17,685,532	12,066,673
social insurance	3,006,539	5,865,340	4,766,451
depreciation	2,845,376	710,586	1,114,452
other operating expenses	-	313,065	-
GROSS OPERATING PROFIT	**(3,420,626)**	**(11,012,166)**	**(8,140,125)**
FINANCIAL INCOME	**193,754**	**222,539**	**114,759**
Investments	-	-	-
Exchange differences	-	-	-
Interests	112,299	61,437	9,409
Other financial incomes	81,455	161,102	105,350
FINANCIAL EXPENSES	**281,952**	**148,916**	**117,429**
Exchange differences	-	-	-
Interests	240,224	29,574	-
Other financial expenses	41,728	119,342	117,429
GROSS PROFIT/ FINANCIAL LOSS	**(88,198)**	**73,623**	**(2,670)**
EXTRAORDINARY INCOME	**1,512,080**	**122**	**-**
EXTRAORDINARY EXPENSES	**988,502**	**2,960,280**	**64,579**
GROSS PROFIT/ EXTRAORDINARY LOSS	**523,578**	**(2,960,158)**	**(64,579)**
TOTAL GROSS PROFIT	**(2,985,246)**	**(13,898,701)**	**(8,207,374)**
tax on profit	-		
NET PROFIT/ LOSS	**(2,985,246)**	**(13,898,701)**	**(8,207,374)**

INCOME STATEMENT - CONSTANT PRICES	Prices at 30.06.1999		APPENDIX 21
Millions ROL			
	1997	**1998**	**30.06.1999**
OPERATING INCOMES	**229,952**	**216,607**	**130,080**
REVENUE FROM HEAT DISTRIBUTION	159,740	152,051	81,988
SUBSIDIES	69,828	63,730	47,415
CHANGE IN STOCKS	-	-	-
OTHER OPERATING REVENUES	384	826	677
OPERATING EXPENSES	**239,924**	**233,684**	**139,389**
cost of merchandise	9	31	-
raw materials	93	59	60
consumables	8,869	13,375	6,293
energy, water	145,735	147,397	98,062
other material expenses	1,045	1,316	739
third parties services	34,762	33,001	13,416
taxes	1,064	396	294
salaries	31,286	27,427	13,800
social insurance	8,765	9,096	5,451
depreciation	8,295	1,102	1,275
other operating expenses	-	485	-
GROSS OPERATING PROFIT	**(9,973)**	**(17,078)**	**(9,310)**
FINANCIAL INCOME	**565**	**345**	**131**
Investments	-	-	-
Exchange differences	-	-	-
Interests	327	95	11
Other financial incomes	237	250	120
FINANCIAL EXPENSES	**822**	**231**	**134**
Exchange differences	-	-	-
Interests	700	46	-
Other financial expenses	122	185	134
GROSS PROFIT/ FINANCIAL LOSS	**(257)**	**114**	**(3)**
EXTRAORDINARY INCOME	**4,408**	**0**	**-**
EXTRAORDINARY EXPENSES	**2,882**	**4,591**	**74**
GROSS PROFIT/ EXTRAORDINARY LOSS	**1,526**	**(4,591)**	**(74)**
TOTAL GROSS PROFIT	**(8,703)**	**(21,554)**	**(9,387)**
tax on profit	-	-	-
NET PROFIT/ LOSS	**(8,703)**	**(21,554)**	**(9,387)**

Financial Ratios **Appendix 22**

constant million ROL	31.12.1997	31.12.1998	30.06.1999
Liquidity			
Current ratio			
Current assets (A)	**61,290**	**95,049**	**82,215**
Current liabilities (B)	**93,834**	**133,065**	**98,793**
A/B	**0.7**	**0.7**	**0.8**
Quick ratio			
Current assets (A)	**61,290**	**95,049**	**82,215**
Inventories (B)	**4,108**	**2,951**	**4,950**
Current liabilities (C)	**93,834**	**133,065**	**98,793**
(A-B)/C	**0.6**	**0.7**	**0.8**
Leverage			
Debt-Assets			
Total liabilities (A)	**93,834**	**133,065**	**120,255**
Total assets (B)	**128,296**	**147,819**	**123,725**
A/B	**0.7**	**0.9**	**1.0**
Financial leverage			
Total Assets (A)	**128,296**	**147,819**	**123,725**
Owners' equity (B)	**34,473**	**14,776**	**3,539**
A/B	**3.7**	**10.0**	**35.0**
EBIT - paid interests ratio			
EBIT (A)	**-9,973**	**-17,078**	**-9,310**
Interests (B)	**822**	**231**	**134**
A/B	**-12.1**	**-73.9**	**-69.3**
Debt service coverage			
EBIT (A)	**-9,973**	**-17,078**	**-9,310**
Interests (B)	**822**	**231**	**134**
Principal Due (C)	**0**	**0**	**21,462**
A/(B+C/(1-Tax on profit))	**-12.1**	**-73.9**	**-0.7**
Profitability			
Net Profit Margin			
Net profit (A)	**-8,703**	**-21,554**	**-9,387**
Turnover (B)	**229,568**	**215,781**	**129,403**
A/B	**-3.8%**	**-10.0%**	**-7.3%**
Return on total assets			
Net profit (A)	**-8,703**	**-21,554**	**-9,387**
Total Assets (B)	**128,296**	**147,819**	**123,725**
A/B*2	**-6.8%**	**-14.6%**	**-15.2%**
Return on Equity			
Net profit (A)	**-8,703**	**-21,554**	**-9,387**
Owners' equity (B)	**34,473**	**14,776**	**3,539**
A/B*2	**-25.2%**	**-145.9%**	**-530.5%**

Financial Ratios **Appendix 22**

Operating			
Raw materials turnover (times)			
Total material expenses (A)			**799**
Raw materials stocks (B)			**4,950**
A/B	**0.3**	**0.5**	**0.2**
Collection period			
Trade receivable (A)	**46,705**	**45,540**	**30,134**
Daily turnover (B)	**631**	**593**	**711**
A/B	**74.1**	**76.8**	**42.4**
Payable period			
Current liabilities (A)	**93,834**	**133,065**	**98,793**
Daily turnover (B)	**631**	**593**	**711**
A/B	**148.8**	**224.5**	**138.9**
Fixed Assets Turnover			
Turnover (A)	**229,568**	**215,781**	**129,403**
Net fixed assets (B)	**67,006**	**52,674**	**41,445**
A/B	**3.4**	**4.1**	**3.1**
Total Assets Turnover			
Turnover (A)	**229,568**	**215,781**	**129,403**
Total Assets (B)	**128,296**	**147,819**	**123,725**
A/B	**1.8**	**1.5**	**1.0**

APPENDIX 23 Investments by financing sources

Historical ROL

kROL

	State Budget		Local Budget		Special funds		External Credit		Own Sources		Total	
	I-st half	II-nd half	I-st half	II-nd half	I-st half	II-nd half	I-st half	II-nd half	I-st half	II-nd half	I-st half	II-nd half
Detailed	712,709	2,183,773	0	415,189	0	0	0	0	1395367	185,252	2,108,076	2,784,214
TOTAL 1997	2,896,482		415,189		0		0		1,580,619		4,892,290	
Detailed	2,681,814	448,625	1395100	1,637,660	0	0	0	0	2629577	182,722	6,706,491	2,269,007
TOTAL 1998	3,130,439		3,032,760		0		0		2,812,299		8,975,498	
Detailed	0	0	356128	10,943,872	0	0	0	0	974453	1,225,547	1,330,581	12,169,419
TOTAL 1999	0		11,300,000		0		0		2,200,000		13,500,000	

Constant ROL

kROL

	State Budget		Local Budget		Special funds		External Credit		Own Sources		Total	
	I-st half	II-nd half	I-st half	II-nd half	I-st half	II-nd half	I-st half	II-nd half	I-st half	II-nd half	I-st half	II-nd half
Detailed	1,391,276	4,262,932	0	810,488	0	0	0	0	2,723,889	361,629	4,115,165	5,435,049
TOTAL 1997	5,654,208		810,488		0		0		3,085,518		9,550,214	
Detailed	3,724,237	623,006	1,937,376	2,274,220	0	0	0	0	3,651,695	253,746	9,313,308	3,150,972
TOTAL 1998	4,347,243		4,211,596		0		0		3,905,441		12,464,280	
Detailed	0	0	356,128	10,943,872	0	0	0	0	974,453	1,225,547	1,330,581	12,169,419
TOTAL 1999	0		11,300,000		0		0		2,200,000		13,500,000	

Appendix 24 Investments by financing source

mill constant ROL

Investment	1997	1998	1999 (6 months)
State budget	5,654	4,347	0
Local budget	810	4,212	11,300
Own sources	3,086	3,905	2,200
TOTAL	**9,550**	**12,464**	**13,500**

APPENDIX 25 **Investments by categories**

Historical ROL

Investment	**1997**	**1998**	**1999(6 months)**
Investments in progress	1,100,000	5,501,408	1,300,000
New investments	1,895,000	0	10,000,000
Inventory and other investments	445,000	1,064,736	0
Other	1,580,619	2,812,299	2,200,000
TOTAL	**5,020,619**	**9,378,443**	**13,500,000**

Constant ROL 30.09.1999

Investment	**1997**	**1998**	**1999(6 months)**
Investments in progress	2,147,304	7,639,809	1,300,000
New investments	3,699,220	0	10,000,000
Inventory and other investments	868,682	1,478,600	0
Other	3,085,518	3,905,441	2,200,000
TOTAL	**9,800,724**	**13,023,850**	**13,500,000**

Appendix 26: First Scenario
P&L Statement (Millions real ROL)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Operating Income	**229,952**	**216,607**	**260,158**	**333,300**	**438,340**	**438,340**	**453,490**	**410,323**	**399,112**	**399,112**	**395,375**	**391,638**
Operating Expenditures	**230,104**	**237,174**	**258,727**	**330,172**	**420,163**	**420,540**	**420,921**	**339,270**	**339,659**	**340,051**	**340,448**	**340,848**
Materials&others	11,082	15,662	14,772	14,772	14,772	14,772	14,772	14,772	14,772	14,772	14,772	14,772
Electricity & water	17,488	14,740	25,303	25,303	25,303	25,303	25,303	25,303	25,303	25,303	25,303	25,303
External	34,762	33,001	26,832	26,832	26,832	26,832	26,832	26,832	26,832	26,832	26,832	26,832
Salaries	40,051	36,523	38,502	37,732	37,732	38,109	38,490	38,875	39,264	39,657	40,053	40,454
Heating	128,247	132,657	153,170	225,533	315,524	315,524	315,524	233,488	233,488	233,488	233,488	233,488
Extraordinary/ savings	-1,526	4,591	148	0	0	0	0	0	0	0	0	0
EBDIT (Earnings Before Depreciation, Interest and Tax)	**-152**	**-20,567**	**1,431**	**3,128**	**18,177**	**17,800**	**32,569**	**71,053**	**59,453**	**59,060**	**54,927**	**50,789**
Depreciation	8,295	1,102	2,548	1,400	1,167	6,175	10,348	14,283	11,902	9,919	8,265	6,888
Operating Profit	-8,447	-21,669	-1,117	1,728	17,011	11,625	22,220	56,770	47,551	49,142	46,661	43,901
Net financial Income	-257	114	-6	0	0	0	0	0	0	0	0	0
Interest on Long Term Debt	0	0	0	0	4,619	13,856	23,374	26,254	22,215	18,176	14,137	10,098
Administration fee	0	0	0	0	840	1,679	2,570	2,203	1,836	1,469	1,102	734
Financial loss due to late collection	0	0	0	0	0	0	0	0	0	0	0	0
			0									
Profit Before Tax	-8,704	-21,555	-1,123	1,728	11,552	-3,910	-3,724	28,313	23,500	29,497	31,423	33,069
			0									
Taxation	0	0	0	432	2,888	0	0	7,078	5,875	7,374	7,856	8,267
			0									
Profit After Tax	**-8,704**	**-21,555**	**-1,123**	**1,296**	**8,664**	**-3,910**	**-3,724**	**21,235**	**17,625**	**22,123**	**23,567**	**24,802**

Appendix 27: First Scenario
Balance Sheet (Millions real ROL)

	31.12.1997	31.12.1998	31.12.1999	31.12.2000	31.12.2001	31.12.2002	31.12.2003	31.12.2004	31.12.2005	31.12.2006	31.12.2007	31.12.2008
Fixed Assets	**67,006**	**52,770**	**41,511**	**40,111**	**142,998**	**240,876**	**343,709**	**329,426**	**317,524**	**307,605**	**299,340**	**292,452**
Gross Value	67,006	52,770	41,511	40,111	142,998	240,876	343,709	329,426	317,524	307,605	299,340	292,452
Accumulated Depreciation	0	0	0	0	0	0	0	0	0	0	0	0
Current Assets	**61,300**	**95,071**	**82,284**	**50,214**	**57,671**	**58,390**	**60,936**	**57,630**	**53,535**	**51,611**	**50,898**	**50,672**
* Stock	4,108	2,951	4,950	4,950	4,950	4,950	4,950	4,950	4,950	4,950	4,950	4,950
* Accounts Receivable	47,160	45,626	30,540	33,330	43,834	43,834	45,349	41,032	39,911	39,911	39,537	39,164
* Other Receivable	8,092	33,855	44,752	2,238	2,238	2,238	2,238	2,238	2,238	2,238	2,238	2,238
Cash	1,940	12,639	2,042	9,697	6,649	7,368	8,399	9,410	6,437	4,513	4,173	4,321
Current Liabilities (Due less than one year)	**93,834**	**133,065**	**120,255**	**85,489**	**83,115**	**81,569**	**77,490**	**75,385**	**71,404**	**68,282**	**65,080**	**62,027**
* Accounts Payable	93,834	133,065	120,255	85,381	82,393	81,569	77,490	73,616	69,935	66,438	63,116	59,961
* Other Creditors	0	0	0	108	722	0	0	1,770	1,469	1,844	1,964	2,067
Short Term Portion of Long Term Debt			0	0								
Net Current Assets	-32,534	-37,994	-37,971	-35,275	-25,444	-23,179	-16,554	-17,755	-17,869	-16,671	-14,182	-11,355
Fixed Assets plus Net Current Assets	34,472	14,776	3,540	4,836	117,554	217,697	327,155	311,671	299,655	290,935	285,158	281,097
Long Term Liabilities	**0**	**0**	**0**	**0**	**83,973**	**167,946**	**257,030**	**220,312**	**183,593**	**146,875**	**110,156**	**73,437**
EBRD (Due greater than one year)	0	0	0	0	83,973	167,946	257,030	220,312	183,593	146,875	110,156	73,437
Other	0	0	0	0	0	0	0	0	0	0	0	0
Net Assets	**34,472**	**14,776**	**3,540**	**4,836**	**33,581**	**49,751**	**70,124**	**91,359**	**116,062**	**144,060**	**175,002**	**207,660**
Equity	**34,472**	**14,776**	**3,540**	**4,836**	**33,581**	**49,751**	**70,124**	**91,359**	**116,062**	**144,060**	**175,002**	**207,660**
Capital	74,250	61,253	47,279	47,279	47,279	47,279	47,279	47,279	47,279	47,279	47,279	47,279
Retained Earnings	-34,288	-28,297	-35,532	-43,739	-42,443	-33,779	-37,689	-41,412	-20,178	-2,553	19,570	43,138
Grants & Subsidies for investments					20,081	40,161	64,258	64,258	71,336	77,211	84,585	92,441
Profit/ loss for the year	-5,490	-18,180	-8,207	1,296	8,664	-3,910	-3,724	21,235	17,625	22,123	23,567	24,802

Appendix 28: First Scenario
Cash Flow Statement (Millions real ROL)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
EBDIT	1,431	3,128	18,177	17,800	32,569	71,053	59,453	59,060	54,927	50,789
(Earnings Before Depreciation, Interest and Tax)										
Movements in Working Capital	-10,620	4,958	-12,878	-1,546	-5,593	2,212	-2,861	-3,122	-2,828	-2,679
Operating Cash Flow	**-9,189**	**8,087**	**5,299**	**16,254**	**26,975**	**73,265**	**56,592**	**55,938**	**52,099**	**48,110**
Tax on profit	0	-432	-2,888	0	0	-7,078	-5,875	-7,374	-7,856	-8,267
Profit Share paid to staff	0	0	0	0	0	0	0	0	0	0
Net Financial Income		0	-5,458	-15,535	-25,944	-28,457	-24,051	-19,644	-15,238	-10,832
Capital Expenditure	0	0	0	0	0	-36,719	-29,640	-30,844	-29,344	-28,863
Investments	0	0	-104,054	-104,054	-113,181	0	0	0	0	0
Less Loan Disbursements	0	0	83,973	83,973	89,084	-36,719	-36,719	-36,719	-36,719	-36,719
Less Grants/Subsidies Received	0	0	20,081	20,081	24,097	0	7,078	5,875	7,374	7,856
Free Cash	**-9,189**	**7,655**	**-3,047**	**719**	**1,031**	**1,011**	**-2,974**	**-1,924**	**-339**	**148**
Debt Service	0	0	0	0	0	0	0	0	0	0
Loan Repayments	0	0	0	0	0	0	0	0	0	0
Interest not capitalized	0	0	0	0	0	0	0	0	0	0
Net Cash Generated	**-9,189**	**7,655**	**-3,047**	**719**	**1,031**	**1,011**	**-2,974**	**-1,924**	**-339**	**148**
Cash B/F	12,639	2,042	9,697	6,649	7,368	8,399	9,410	6,437	4,513	4,173
Cash C/F	3,450	9,697	6,649	7,368	8,399	9,410	6,437	4,513	4,173	4,321

Appendix 29
Second Scenario: P&L Statement (Millions real ROL)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Operating Income	**229,952**	**216,607**	**260,158**	**333,300**	**443,390**	**443,390**	**458,540**	**414,060**	**410,323**	**402,849**	**399,112**	**391,638**
Operating Expenditures	**230,104**	**237,174**	**258,727**	**330,172**	**420,163**	**420,540**	**420,921**	**339,270**	**339,659**	**340,051**	**340,448**	**340,848**
Materials&others	11,082	15,662	14,772	14,772	14,772	14,772	14,772	14,772	14,772	14,772	14,772	14,772
Electricity & water	17,488	14,740	25,303	25,303	25,303	25,303	25,303	25,303	25,303	25,303	25,303	25,303
External	34,762	33,001	26,832	26,832	26,832	26,832	26,832	26,832	26,832	26,832	26,832	26,832
Salaries	40,051	36,523	38,502	37,732	37,732	38,109	38,490	38,875	39,264	39,657	40,053	40,454
Heating	128,247	132,657	153,170	225,533	315,524	315,524	315,524	233,488	233,488	233,488	233,488	233,488
Extraordinary/ savings	-1,526	4,591	148	0	0	0	0	0	0	0	0	0
EBDIT (Earnings Before Depreciation, Interest and Tax)	-152	-20,567	1,431	3,128	23,227	22,850	37,619	74,790	70,664	62,797	58,664	50,789
Depreciation	8,295	1,102	2,548	1,400	1,167	6,175	10,348	14,283	11,902	9,919	8,265	6,888
Operating Profit	**-8,447**	**-21,669**	**-1,117**	**1,728**	**22,061**	**16,675**	**27,270**	**60,507**	**58,762**	**52,879**	**50,398**	**43,901**
Net financial Income	-257	114	-6	0	0	0	0	0	0	0	0	0
Interest on Long Term Debt	0	0	0	0	5,632	16,895	28,487	31,988	27,066	22,145	17,224	12,303
Administration fee	0	0	0	0	840	1,679	2,570	2,203	1,836	1,469	1,102	734
Financial loss due to late collection	0	0	0	0	0	0	0	0	0	0	0	0
Profit Before Tax	-8,704	-21,555	0 -1,123	1,728	15,589	-1,899	-3,787	26,316	29,859	29,265	32,073	30,864
Taxation	0	0	0 0	432	3,897	0	0	6,579	7,465	7,316	8,018	7,716
Profit After Tax	**-8,704**	**-21,555**	**-1,123**	**1,296**	**11,692**	**-1,899**	**-3,787**	**19,737**	**22,395**	**21,949**	**24,055**	**23,148**

Appendix 30
Second Scenario: Balance Sheet (Millions real ROL)

	31.12.1997	31.12.1998	31.12.1999	31.12.2000	31.12.2001	31.12.2002	31.12.2003	31.12.2004	31.12.2005	31.12.2006	31.12.2007	31.12.2008
Fixed Assets	**67,006**	**52,770**	**41,511**	**40,111**	**142,998**	**240,876**	**343,709**	**329,426**	**317,524**	**307,605**	**299,340**	**292,452**
Gross Value	67,006	52,770	41,511	40,111	142,998	240,876	343,709	329,426	317,524	307,605	299,340	292,452
Accumulated Depreciation	0	0	0	0	0	0	0	0	0	0	0	0
Current Assets	**61,300**	**95,071**	**82,284**	**50,214**	**60,951**	**63,428**	**65,911**	**60,982**	**61,680**	**60,760**	**60,531**	**58,635**
* Stock	4,108	2,951	4,950	4,950	4,950	4,950	4,950	4,950	4,950	4,950	4,950	4,950
* Accounts Receivable	47,160	45,626	30,540	33,330	44,339	44,339	45,854	41,406	41,032	40,285	39,911	39,164
* Other Receivable	8,092	33,855	44,752	2,238	2,238	2,238	2,238	2,238	2,238	2,238	2,238	2,238
Cash	1,940	12,639	2,042	9,697	9,424	11,901	12,869	12,389	13,460	13,287	13,432	12,283
Current Liabilities (< one year)	**93,834**	**133,065**	**120,255**	**85,489**	**83,367**	**81,569**	**77,490**	**75,261**	**71,801**	**68,267**	**65,121**	**61,890**
* Accounts Payable	93,834	133,065	120,255	85,381	82,393	81,569	77,490	73,616	69,935	66,438	63,116	59,961
* Other Creditors	0	0	0	108	974	0	0	1,645	1,866	1,829	2,005	1,929
Short Term Portion of Long Term Debt		0		0								
Net Current Assets	-32,534	-37,994	-37,971	-35,275	-22,416	-18,141	-11,580	-14,278	-10,121	-7,508	-4,590	-3,255
Fixed Assets plus Net Current Assets	34,472	14,776	3,540	4,836	120,582	222,736	332,129	315,148	307,403	300,098	294,750	289,197
Long Term Liabilities	**0**	**0**	**0**	**0**	**83,973**	**167,946**	**257,030**	**220,312**	**183,593**	**146,875**	**110,156**	**73,437**
EBRD (Due greater than one year)	0	0	0	0	83,973	167,946	257,030	220,312	183,593	146,875	110,156	73,437
Other	0	0	0	0	0	0	0	0	0	0	0	0
Net Assets	34,472	14,776	3,540	4,836	36,609	54,790	75,099	94,836	123,810	153,223	184,594	215,760
Equity	**34,472**	**14,776**	**3,540**	**4,836**	**36,609**	**54,790**	**75,099**	**94,836**	**123,810**	**153,223**	**184,594**	**215,760**
Capital	74,250	61,253	47,279	47,279	47,279	47,279	47,279	47,279	47,279	47,279	47,279	47,279
Retained Earnings	-34,288	-28,297	-35,532	-43,739	-42,443	-30,751	-32,650	-36,438	-16,701	5,694	27,643	51,697
Grants & Subsidies for investments	0	0	0	0	20,081	40,161	64,258	64,258	70,837	78,302	85,618	93,636
Profit/ loss for the year	-5,490	-18,180	-8,207	1,296	11,692	-1,899	-3,787	19,737	22,395	21,949	24,055	23,148

Appendix 31
Second Scenario: Cash Flow Statement (Millions real ROL)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
EBDIT	**1,431**	**3,128**	**23,227**	**22,850**	**37,619**	**74,790**	**70,664**	**62,797**	**58,664**	**50,789**
(Earnings Before Depreciation, Interest and Tax)										
Movements in Working Capital	-10,620	4,958	-13,131	-1,798	-5,593	2,218	-3,086	-2,787	-2,773	-2,484
Operating Cash Flow	**-9,189**	**8,087**	**10,096**	**21,052**	**32,025**	**77,008**	**67,578**	**60,011**	**55,891**	**48,305**
Tax on profit	0	-432	-3,897	0	0	-6,579	-7,465	-7,316	-8,018	-7,716
Profit Share paid to staff	0	0	0	0	0	0	0	0	0	0
Net Financial Income		0	-6,471	-18,574	-31,058	-34,191	-28,902	-23,614	-18,326	-13,037
Capital Expenditure	**0**	**0**	**0**	**0**	**0**	**-36,719**	**-30,140**	**-29,254**	**-29,402**	**-28,700**
Investments	0	0	-104,054	-104,054	-113,181	0	0	0	0	0
Less Loan Disbursements	0	0	83,973	83,973	89,084	-36,719	-36,719	-36,719	-36,719	-36,719
Less Grants/Subsidies Received	0	0	20,081	20,081	24,097	0	6,579	7,465	7,316	8,018
Free Cash	**-9,189**	**7,655**	**-273**	**2,477**	**968**	**-480**	**1,072**	**-173**	**145**	**-1,148**
Debt Service	0	0	0	0	0	0	0	0	0	0
Loan Repayments	0	0	0	0	0	0	0	0	0	0
Interest not capitalized	0	0	0	0	0	0	0	0	0	0
Net Cash Generated	**-9,189**	**7,655**	**-273**	**2,477**	**968**	**-480**	**1,072**	**-173**	**145**	**-1,148**
Cash B/F	12,639	2,042	9,697	9,424	11,901	12,869	12,389	13,460	13,287	13,432
Cash C/F	3,450	9,697	9,424	11,901	12,869	12,389	13,460	13,287	13,432	12,283

ANNEX D – ENVIRONMENTAL ASSESSMENT

TABLE OF CONTENTS

1.0 INTRODUCTION

Constanta, the second largest city in Romania, provides heat and hot water to its residents and industry via a district heating system built in the early 1970's. USAID, working with European Bank for Reconstruction and Development (EBRD), asked an Urban Institute team to assess if the condition of the district heating system in Constanta was worthy of investment and subsequent upgrade. This report is the Environmental Assessment of the proposed investment, prepared considering Romanian and EBRD requirements.

2.0 INVESTMENT DESCRIPTION

About 90% of residents in the city of Constanta are supplied with heat and hot water from the central district heating system. Built in 1970's, the district heating system has not been well maintained, and, as such, is near the end of its useful life. The Urban Institute and Electrotek Concepts (Electrotek) worked with Municipal officials in Constanta and identified that an investment of $19.4 million is necessary if the district heating system is to remain operational.

We recommend a three-year project implementation period, with much of the construction occurring in the spring and autumn to minimize any inconvenience to the tourist community and end users (in large apartment buildings, schools, and municipal buildings). A summary of the investment and a proposed construction schedule follows:

Table D-1
Summary of the Investment Project for Constanta

Item	Description	Material ($)	Labor ($)	Design ($)	Total ($)
Year 1					
1	Install controls in all 134 substations	$511,100	$106,900	$10,222	$628,222
2	Replace secondary pipes S1, N1	$1,267,110	$1,967,355	$100,035	$3,334,500
3	Complete gas boilers PT47, PT37	$45,100	$10,100		$55,200
4	Upgrade 20 substations in south	$1,194,750	$292,714	$46,962	$1,534,425
	First Year Total	**$3,018,060**	**$2,377,069**	**$157,219**	**$5,552,347**
Year 2					
1	Improve school municipal buildings	$1,265,420	$497,003		$1,762,423
2	Upgrade 40 substations	$2,389,500	$585,427	$93,924	$3,068,851
3	Replace secondary pipes S2,3,4; N2,3,4	$772,616	$1,199,588	$60,996	$2,033,200
	Second Year Total	**$4,427,536**	**$2,282,019**	**$154,920**	**$6,864,474**
Year 3					
1	Upgrade 74 substations	$4,032,200	$1,006,209	$168,361	$5,834,992
2	Replace secondary pipes S5,6; N5,6	$692,835	$1,075,718	$54,698	$1,823,250
	Third Year Total	**$4,725,035**	**$2,081,926**	**$223,059**	**$7,030,020**
Total					**$19,446,842**

Most of the improvements will require light construction, thus should have minimal environmental impact. As a result of the improvements, environmental conditions should improve in Constanta. Details of the proposed investment program are presented in the Urban Institute's main report – Constanta Heating Investment Program (March 2000) and Electrotek's technical reports (March 1999 and April 2000).

3.0 OVERVIEW OF ROMANIAN ENVIRONMENTAL REGULATIONS

Since the early 1990's, Romania has gradually adopted increasingly stringent environmental regulations – most are on par with Western Europe and the United States. This section gives an overview of the environmental regulations that have jurisdiction over the activities planned for upgrade of the Constanta district heating system.

3.1 ENVIRONMENTAL IMPACT ASSESSMENT REQUIREMENTS FOR NEW AND EXISTING CONSTRUCTION

The central Romanian environmental authority is the Ministry of Water, Forest and Environmental Protection (MAPPM) and the local authorities are Environmental Protection Agencies (EPA). Each county (42) in Romania, as well as Bucharest, has its own EPA. These are directly subordinated to the MAPPM. The central MAPPM and local EPA authorities are in charge of authorizing all existing and future activities in Romania from an environmental view point.

All environmental issues are managed according to the Environmental Protection Law (EPL) no. 137/1995. The environmental authorization procedure is based on the Ministry Order (MO) no. 125/1996 and applies to all activities includes in Annex 2 of the EPL. The EPL requires that every owner, individual or juridical body, that performs an activity requiring an environmental authorization, must establish either an environmental protection department that has a self-monitoring system in place or appoint an environmental coordinator in charge of environmental protection issues. RADET Constanta (RADET) has hired an external independent consultant to manage their environmental affairs[39].

Environmental legislation [Government Decision (GD) no. 1001/1994 and GD no. 138/1994] that specifies the principle "polluter pays" is enforced in Romania. Payments or fines are established through this legislation, according to the pollution violation relative to the maximum admissible limits. In exceptional cases, penalties are established by the Court of Law.

To conform with the MO no. 125/1996 of MAPPM, a company must obtain an environmental permit to build a facility, and an environmental authorization to operate it - both must be issued by the local (or central) environmental authority. For RADET, the local authority is the EPA in Constanta (EPA Constanta). The activities performed by RADET require an environmental permit followed by an environmental authorization. To obtain these approvals, RADET must prepare two files as follows:

For the construction phase – the permitting file must include:[40]

- company's profile and production processes;
- City Planning Certificate and site location map;

[39] MR. EUGEN SECARA, MEMBER OF THE SCIENTIFIC BOARD OF THE ROMANIAN WATER ASSOCIATION, BUCHAREST, IS RADET'S ENVIRONMENTAL CONSULTANT.

[40] AS PER ORDER NO. 125/1996.

- agreements with the utilities suppliers (e.g., energy, water and heating);
- copy of the public announcement (in the local newspaper) describing the planned construction;
- water management authorization, issued by the "Romanian Waters" agency, which regulates a company's water management activities;
- sanitary authorization, issued by the Ministry of Health through its county Public Health Department – the Ministry of Health certifies that a company is providing hygienic workplace conditions;
- all contracts and approvals necessary for the construction to proceed;
- sales-purchase contract for the land housing the investment; and
- environmental impact study (optional) - only if required by the EPA.

After submitting this file to the local EPA, the company can not begin construction until receives its environmental permit.

For the operation phase – the authorization file must include:

- company presentation prepared, signed and stamped, according to Annex 8 in Order no. 125/1996;
- copy of the public announcement (in the local newspaper) regarding the commencement of the investment operation;
- investment ownership document;
- construction authorization and site location map;
- sanitary authorization;
- contracts for water supply and wastewater discharge service;
- water management authorization;
- contract for a specialized company for sanitation services;
- company identity certificate, issued by the Register of Trade;
- environmental permit; and
- environmental balance - Level 0, 1 or 2.

Depending on the complexity of the environmental problems, the EPA may require that the company prepare an environmental balance (EB), which is an assessment of the current environmental situation of a company[41]. The rigor of the EB is determined by the level:

— Level 0 EB - a one-page questionnaire with yes/no answers. The company representative must answer questions regarding the company profile, type of activities according to Appendix No. 2 of EPL no. 137/1995; number of personnel, environmental emissions, use of hazardous substances (e.g., PCB's, asbestos), number of storage tanks, site history and site location.

— Level 1 EB - focuses on evaluating negative environmental impacts of an operation, based on existing analytical data. It presents a thorough description of the following issues: site location, history, geology and hydrology, soil and groundwater contamination, waste storage, PCB's in condensers and transformers, occupational health and safety issues, emergency plans, wastewater discharge, air emissions, noise and vibrations, types of networks on site, and environmental management structure. The report also includes conclusions and recommendations.

— Level 2 EB - required if the Level 1 EB identifies practices that have resulted in significant on-site pollution and it is necessary to further define the level and extent of the contamination. A Level 2 EB may include collection and analyses of soil, surface water, groundwater, soil gases and vapors, construction materials (for asbestos) and air emissions. The final report must include two parts:

1. discussion of the analytical results and comparison with maximum admissible values, and

2. findings and recommendations for future actions.

If after evaluating the authorization file, the local EPA determines that a company has some remaining environmental compliance issues, it will probably issue an environmental authorization, that is contingent on a negotiated compliance program. The compliance program may specify compliance measures, company responsibilities, and compliance costs, and it must be implemented by the company in a defined timeframe. The initial environmental authorization is usually issued for a period equal to the period necessary for the implementation of the compliance program, which cannot exceed 5 years[42].

Following the initial authorization period, the company submits a request for authorization renewal with the EPA, who determines whether the compliance program has been fulfilled. If the company is now in compliance, the environmental authorization is renewed. If compliance issues still exist, a new compliance program can be negotiated or if no

[41] THE STANDARD PROCEDURES FOR DEVELOPING AN ENVIRONMENTAL BALANCE (LEVEL 0, 1 OR 2) ARE STIPULATED IN ORDER NO. 184/1997, ISSUED BY THE MINISTRY OF WATERS, FORESTS AND ENVIRONMENTAL PROTECTION.

[42] AS PER ORDER NO. 125/1996, ART. 5.12.1.

agreement can be reached between EPA and the company's representatives, EPA can close-down all or part of a company's activities.

RADET has submitted to EPA Constanta an application for obtaining an environmental authorization for operation of its existing district heating system, which includes a Level 1 Environmental Balance.[43] However, RADET has not yet obtained the environmental authorization to operate its existing district heating system because it has not submitted to EPA Constanta a financially sound compliance plan[44] for negotiation. RADET's existing Compliance Plan lacks a financial estimation of its environmental compliance costs[45]. Additionally, EPA Constanta has determined that RADET operates its secondary network using high water and energy consumption rates.[46] Previously, RADET established target consumption rates for each substation. Due to leakage and low equipment efficiency, RADET's substations do not these expectations. Measures to fix these non-compliance issues must be included in the Compliance Program that will be negotiated with EPA Constanta.

RADET's environmental authorization is still pending, but its operations have not been interrupted by EPA Constanta, because EPA considers facility closures based on a priority list that identifies the most critical environmental problems generated by major polluting sources. Since RADET is not a major source, it is not a priority item on EPA's list. Moreover, RADET provides public services, which can not be shut down. To date, RADET has followed the legal procedure to obtain an environmental authorization. As soon as EPA Constanta sends an official request to RADET, RADET must resume negotiation with EPA Constanta for establishing an acceptable compliance program and obtaining its environmental authorization.

RADET's environmental authorization will be strictly related to its current activities, thus will not cover future investment projects. In June 1999, RADET completed two investment projects that entailed converting two substations into natural gas boiler houses, which supply the energy source for heat and hot water service in northern neighborhoods of the district heating system. RADET prepared an environmental impact study for each of the two investment projects and obtained two environmental permits for their construction. The

[43] "ENVIRONMENTAL BALANCE FOR THE EXISTING ACTIVITIES OF RADET CONSTANTA", PREPARED BY AGRARO SRL IN 1997 AND REGISTERED WITH THE EPA CONSTANTA ON FEBRUARY 2, 1998.

[44] THE DRAFT COMPLIANCE PROGRAM IS AN ANNEX OF THE PENDING ENVIRONMENTAL AUTHORIZATION.

[45] INFORMATION OBTAINED FROM MS. CATIUSA TOMPOS, DIRECTOR - REGULATORY DEPARTMENT, EPA CONSTANTA, DURING A VISIT BY THE KPMG ENVIRONMENTAL TEAM ON JANUARY 27, 2000.

[46] AS PER MS. CAIUSA TOMPOS, EPA CONSTANTA HAS DETERMINED RADET HAS HIGH ENERGY CONSUMPTION RATES BY MAKING A COMPARISON BETWEEN RADET'S ENERGY USAGE AND INVOICES PAID BY CONSUMERS.

natural gas substations are currently in a one-year testing period, with a contractor[47] operating them under the existing environmental permit.

When RADET takes over the operation[48] of the natural gas substations, RADET must request that EPA Constanta extend the scope of its pending environmental authorization to include the activities performed in the new investments. Since the natural gas substations are an emissions source, as specified under Appendix 2 of EPL no. 137/1995, they must be included in the environmental authorization.

3.2 CONSTANTA'S "AUTHORIZATION REGLEMENTATION"

The Romanian legislation imposes maximum admissible limits for air emission concentrations through the following standards:

- Ministerial Ordinance no. 462/1993 of MAPPM stipulates the maximum admissible limits for air emissions, regardless of source type (see Annex 1 – Table 1F and Table 1G);

- Romanian standard STAS 12574/87 stipulates the maximum admissible limits for ambient air in protected areas (see Annex 1 – Table 1E).

In compliance with these regulations, the maximum admissible values for the air emissions generated by RADET Constanta and TEC Palas[49] must meet the norms presented in Annex 1.

The "authorization reglementation" is a grandfather agreement that relaxes air quality regulations for Romania's four largest cities. According to the agreement, TEC Palas and RADET are allowed to generate air emission concentrations that exceed the maximum admissible limits until September 2000. After that date, TEC Palas and RADET must meet the applicable norms. The primary reason that TEC's emissions currently exceed applicable air quality standards is its usage of high sulfur oil[50] as a fuel source. The maximum allowable sulfur concentration in fuel is of 1%, as specified by MO no. 462/1993.

[47] THE NATURAL GAS SUBSTATION CONTRACTOR IS SC PETROPROIECT SA; 1-3 EGRETEI ST., BLOCK C1, GROUND FLOOR, CONSTANTA, ROMANIA.

[48] AS PER MR. EPURAS, RADET PLANS TO TAKE OVER THE TWO NEW GAS BOILER SUBSTATIONS IN JUNE 2000.

[49] TEC PALAS BELONGS TO THE NATIONAL COMPANY FOR ELECTRICITY CONEL; TERMO ELECTRICA CONSTANTA (TEC) IS PART OF THE CONEL GROUP.

[50] TEC IMPORTS BLACK OIL, WITH A SULFUR CONTENT RANGING BETWEEN 2.7% AND 3.3%.

3.3 DESCRIPTION OF FINES FOR NON-COMPLIANCE

From the information obtained from RADET[51], TEC[52] and the local EPA Constanta[53], neither RADET or TEC has paid penalties for environmental emissions that exceed the specified norms.

4.0 ENVIRONMENTAL ASSESSMENT OF SUBSTATION UPGRADE

The $10.4 million investment to RADET's substations is planned over a three-year period.

The upgrade will include improvements to:

- primary side of the substations [e.g., meters (heat, domestic hot water, feed water) and instrumentation and controls (I&C)],
- secondary side of the substations (e.g., heat exchangers upgrade, new pumps, meters and I&C),
- domestic water heating system (e.g., heat exchanger upgrade, new pumps, meters and I&C),
- electric installation (e.g., new wiring and I&C), and
- pipe insulation – where applicable, all pipes in the substation buildings will be insulated.

This section describes the environmental regulations that pertain to these investment activities.

4.1 ENVIRONMENTAL IMPACT OF EXISTING SUBSTATION OPERATIONS

We've identified the following environmental concerns and possible impacts generated by RADET's current substation operations:

Table D-2
Potential Environmental Impacts associated with Current Substation Operations

Environmental concerns	**Potential environmental impact**	**Remarks**
Lack of water metering.	Uncontrolled consumption of water and energy.	Additional water is pumped through the secondary network, which accelerates pipe deterioration.

[51] AS PER MR. EPURAS, RADET GENERAL DIRECTOR.

[52] AS PER THE ENVIRONMENTAL DEPARTMENT AT TEC.

[53] AS PER MS. CATIUSA TOMPOS, DIRECTOR - REGULATORY DEPARTMENT, EPA CONSTANTA.

Environmental concerns	Potential environmental impact	Remarks
Water treatment (softening) at substations is not available (does not exist or is out of operation). Hard water excelerates the corrosion of secondary network pipes and leads to increased water leakage.	Rise in groundwater elevation. Rise in soil temperature along the secondary network.	Surface and subsurface soils can become contaminated via rising levels of contaminated groundwater.
	Indirect pollution of soils and groundwater.	Soil contaminants can pollute rising groundwater, which can transport chemicals downgradient.
Substations are generally in poor technical shape.	Uncontrolled consumption of water and energy.	High energy consumption rates during operation.
	Additional volume of solid waste resulting from parts replacement at substations.	Solid waste resulting from spent equipment may contain hazardous substances (e.g., lubricants, insulation materials).
	Air pollution.	Maintenance, repair and other activities may generate environmental impacts (welding operations, transportation activities, etc.)
Substation buildings are not well maintained.	Negative visual impact	No maintenance has been performed on building exteriors.

Once the substation upgrade has been implemented, future environmental impacts due to substation operations will depend on the following parameters:

- efficient operation of new substation equipment;
- monitoring system performance; and
- RADET's capacity to monitor the operation and maintenance of the upgraded facilities, and to allocate sufficient resources (both financial and personnel) for facility maintenance.

We expect the environmental impacts presented in Table D-2 to be minimized as a result of the investment.

4.2 POTENTIAL ENVIRONMENTAL IMPACT OF SUBSTATION CONSTRUCTION

All 134 substations will undergo renovation. While much of the upgrade will occur inside the substation buildings, during reconstruction, equipment delivery vehicles will frequent the substation neighborhoods and a significant quantity of solid waste will be generated due to removal of old, obsolete equipment.

During the construction stage, the potential environmental impact of the investment will depend on the following three main parameters:

- construction period (length of time);
- types of raw materials used; and
- capacity of the contractor to manage and control his construction activities in order to minimize the negative impacts on the environment and ensure health and safety precautions are taken during construction.

Waste material (primarily metal wastes) resulting from the construction stage can be sold to solid waste salvage companies. Non-recyclable wastes will be deposited appropriately in the city landfills. To facilitate waste management, we recommend that wastes be sorted and temporarily stored separately, as it is generated.

4.3 ENVIRONMENTAL BENEFITS OF SUBSTATION UPGRADE

In Subsection 4.1, we presented qualitatively the environmental concerns and possible impacts generated for current substation operating conditions. Implementation of the new investment project should solve the non-compliance issues environmental concerns, as follows:

- meters - continuous monitoring of substation operating parameters;
- new heat exchangers - increased efficiency of the primary heat carrier;
- new pumps, pipes repair – reduced consumption rates of water and energy;
- pipe repair (less use of City water) - improved physical and chemical parameters of recirculated water;
- new pumps, building repair - compliance with the maximum admissible limits for noise (and vibrations);
- general upgrade:
  - — decreased substation maintenance, thus less disruptive activities in substation neighborhoods;
  - — reduced generation of solid wastes, thus less waste recycling through specialized companies;
- building repair - elimination of the negative visual impact of the buildings and harmonization of the buildings with the local architecture.

4.4 RELEVANT ENVIRONMENTAL REGULATIONS

The Romanian environmental legislation that is applicable to the substation upgrade at RADET Constanta is based on framework law EPL no. 137/1995.

The following actions are compulsory:

Table D-3
List of Romanian Environmental Regulations having Jurisdiction over

Substation Upgrades

Action	Regulations	Remarks
Obtain environmental permit for the substation upgrade.	EPL no. 137/1995 MO no. 125/1996	RADET must file the necessary environmental permits with EPA Constanta when the project is in its design stage.
Obtain environmental authorization.	EPL no. 137/1995 MO no. 125/1996	RADET must request an environmental authorization from EPA Constanta when the new investment is in operation.
Compliance with maximum admissible limits for all environmental emissions (e.g., air, wastewater, solid waste, soil, surface water, groundwater and noise).	Technical norms and standards (see Annex 1)	RADET must comply with all the maximum admissible limits imposed by EPA Constanta for all environmental emissions. EPA Constanta may impose more restrictive limits for pollutant concentrations considering the sensitivity of the receiving body (e.g. air, water).

5.0 ENVIRONMENTAL ASSESSMENT OF UPGRADE OF THE SECONDARY SYSTEM

This section summarizes the current conditions of the secondary distribution network and the investment planned for the network. It evaluates the possible environmental impacts associated with existing and future operations and construction activities, and presents relevant environmental regulations.

Replace 22 km of secondary network pipes – A total of 233 km of secondary network connects the substations to the end user buildings. Heated water for space heating and domestic hot water are supplied through a four-pipe system with recirulation (two pipes for the space heating and two pipes for domestic hot water). The majority of the secondary network is installed in small, non-crawl-through channels on brackets or footings. The condition of the secondary network is poor due to hydraulic leakage, heat loss, poor quality feed water, and lack of measurement and controls**.**

The upgrade will include only those sections of piping where leaks and heat loses are critical and replacement is necessary for uninterrupted service to the users. The work will be divided between twelve groups of piping - six in the south section of the network, and six in the north section of the system of the network.

5.1 POTENTIAL ENVIRONMENTAL IMPACT OF EXISTING SECONDARY NETWORK OPERATIONS

The current operation of the secondary network has the following potential environmental impacts:

Table D-4
Potential Environmental Impacts associated with the Current Secondary Network

Environmental concern	Potential environmental impact	Remarks
No water metering system is in place.	High water consumption rates.	Lack of water metering leads to inefficient use of water resources.
Excessive leakage due to: Secondary network in poor technical shape. Obsolete valves.	Elevated groundwater levels.	Secondary pipes are at the end of their useful life (30 years) and should be replaced.
	Rise in soil temperatures along the network route.	Surface and subsurface soils can become contaminated via rising levels of contaminated groundwater.
	Indirect pollution of soils and groundwater.	Soil contaminants can pollute rising groundwater, which can transport chemicals downgradient.
Water re-circulated in the secondary network is hard.	Surfaces in contact with hard water become corroded. Higher energy use necessary to overcome restricted pipe diameters.	Useful life of pumps could be minimized.
	Corrosion can lead to pipe breaks and leakage.	Additional leakage further impacts soils and groundwater.
Channels housing the secondary pipes are deteriorated.	Promotes pipe corrosion.	All 233 m of secondary network should be eventually replaced.

Once the initial investment to the secondary network has occurred (replacing 22 km of the most leaky pipes), the continued environmental impact due to operation of the secondary network will depend on the following parameters:

- RADET's ability to secure a softer feed water source, either from TEC or via onsite water treatment,
- effective operation of new metering systems promoting less water use,

- technical characteristics of the new pipes and equipment,
- performance of the new monitoring system, and
- RADET's capacity to monitor the operation and maintenance of the upgraded network and to allocate sufficient resources (both financial and personnel) for continual replacement of the secondary network as lines fall into ill-repair.

We expect the environmental impacts presented in Table D-4 to be minimized as a result of the investment.

5.2 ENVIRONMENTAL IMPACT OF CONSTRUCTION (DISPOSAL OF EXISTING PIPES, ROAD DISTURBANCE)

The potential environmental impact generated by the replacement of 22 km of secondary network can be evaluated taking into account:

- construction period (length, season)[54];
- types of raw materials[55] used; and
- the capacity of the constructor to diminish the negative impacts of construction activities by:
  - phasing the construction works,
  - limiting the impact area,
  - restricting the lateral area of impact generated by the construction activities along the digging route,
  - reducing the temporary storage period for construction materials and waste in the working area,
  - compacting soils after pipe replacement, so that surface soils appear undisturbed,
  - carefully repairing pavement affected by construction,
  - ensuring worker and public health and safety conditions during construction (e.g., marking excavation areas; ensuring traffic safety in the working area), and

[54] SINCE CONSTANTA IS A SUMMER TOURIST AREA, EPA GENERALLY FORBIDS CONSTRUCTION DURING THE SUMMER SEASON. DURING THE WINTER, EXCAVATION CAN BE VERY DIFFICULT, AND IS THEREFORE AVOIDED BY CONTRACTORS. WE RECOMMEND IMPLEMENTING THE PROJECT DURING THE SPRING AND AUTUMN.

[55] PVC PIPES ARE RECOMMENDED. THEY DO NOT CONTAIN ASBESTOS, HAVE A LONG USEFUL LIFE, ARE RESISTANT TO CORROSION, AND CAN ULTIMATELY BE RECYCLED FOR SALVAGE.

— researching the excavation area to ensure that other underground utilities will be avoided during excavation.

The existing secondary network does not lie in the vicinity of other utilities networks (e.g., water supply, sewerage system, electric network, communication network)[56], thus its replacement should not impact other utilities. The secondary network parallels main roads and is situated behind the first block of flats in residential areas.

Waste material from the old trenches (e.g., waste masonry, and rubble) will be deposited in Constanta's solid waste landfill, which reportedly has sufficient capacity to handle these waste types. An alternative to landfilling, proposed by EPA Constanta, is to use non-toxic waste as fill for potholes in city streets. The contractor will need to secure an exact solution to solid waste disposal at the commencement of the contract.

5.3 ENVIRONMENTAL BENEFITS OF THE SECONDARY NETWORK UPGRADE

In Table D-4, environmental concerns and potential impacts generated by the operation of the secondary network were presented qualitatively for normal conditions of operation. The new investment project will improve the environmental performance of the network[57], because the investment promotes the following:

- continuous monitoring of water use,
- increased heat carrier efficiency,
- reduced leaks in the network and control points (e.g. valves),
- improved resistance of pipes to corrosion,
- fewer repairs, and
- reduced waste quantities, sorting of waste, and recovering of waste by solid waste companies.

5.4 RELEVANT ENVIRONMENTAL REGULATIONS

The Romanian environmental legislation that is applicable to the proposed investment in the secondary line upgrade is framed by Environmental Protection Law (EPL) no. 137/1995 and detailed in Table D-5. The general environmental requirements to be observed by RADET during the secondary network construction are described in Table D-5. EPA Constanta may also include in the environmental permit additional environmental obligations that derive from other types of regulations issued by Ministries other than MAPPM (e.g. development of contigency plans for potential accidents).

Table D-5

[56] AS PER MR. AUREL BUTURUGA, CHIEF ENGINEER AT RADET CONSTANTA, FEBRUARY 27, 2000.

[57] THE INVESTMENT WILL REDUCE THE CURRENT HIGH WATER AND ENERGY CONSUMPTION RATES.

List of Romanian Environmental Regulations having Jurisdiction over Secondary Network Upgrade

Action	Regulations	Remarks
Obtain environmental permit for upgrade of secondary network.	EPL no. 137/1995 MO no. 125/1996	RADET must file necessary environmental permits with EPA Constanta when the project is in its design stage.
Request for environmental re-authorization to EPA (we expect that by the time of the investment, RADET will have received its initial authorization).	EPL no. 137/1995 MO no. 125/1996	According to Order no. 125/1996, RADET must send a written request to EPA for the environmental re-authorization when the new investment is in operation.
Comply with maximum admissible limits for all environmental emissions (e.g., air, wastewater, soil, groundwater solid waste and noise).	Technical norms and standards (see Annex 1)	The constructor must comply with all applicable norms for construction (e.g., site organization, work tasks, equipment used and site clean-up). Site clean-up norms are stipulated in Order no. 25/1996 and will be specified in the environmental permit. The building-site should be returned to its pre-construction condition.

Specific regulations that will apply to the secondary network construction will be established according to: (a) the feasibility study and associated technical drawings of the project of the project, and (b) the route of the pipe network (if the network intersects railways, electric network, telephone wires, roads, etc.). These regulations are out of the scope of environmental protection domain. They may be Municipal ordinances and/or Government decrees or orders issued by the Ministry of Public Works and Territorial Planning, Ministry of Industry, Ministry of Agriculture, and Ministry of Transportation.

6.0 NATURAL GAS SUBSTATIONS

In June of 1999, the Municipality converted two substations (i.e., PT-37 and PT-47) in the northern part of the district heating network to natural gas in response to poor heating and domestic hot water service in this area for many years. RADET is considering converting 29 additional substations to natural gas in other poor service areas, though the proposed investment in the district heating system should significantly improve service throughout the system. Electrotek reviewed the economic feasibility of converting the 29 substations to natural gas[58]. Based on an analysis of eight substations, they found that converting additional substations is not economically viable at this time, thus are not recommending this investment. However, relatively small changes in fuel prices of oil and/or natural gas could sway preferences.

Substations fueled by natural gas are individual emission sources (unlike those connected to the primary system), though still use the secondary network to service end users. While

[58] ELECTROTEK'S APRIL 2000 TECHNICAL REPORT OF THE CONSTANTA DISTRICT HEATING SYSTEM PRESENTS A DETAILED EVALUATION OF THE ECONOMIC VIABILITY OF NATURAL GAS SUBSTATIONS.

PT-37 and PT-47 are new, they lack controls for efficient operation. We recommend investing $55,200 to optimize their operation.

6.1 ENVIRONMENTAL IMPACT OF EXISTING NATURAL GAS SUBSTATIONS

We've identified the following environmental concerns and possible impacts generated by RADET's current natural gas substation operations:

Table D-6
Potential Environmental Impacts associated with Current Natural Gas Substations

Environmental concern	Potential environmental impact	Remarks
Lack of metering for water consumption.	Uncontrolled consumption of water and energy.	Additional water is pumped through the secondary network, which accelerates pipe deterioration.
Water treatment (softening) at substations is not available (does not exist or out of operation). Hard water excelerates the corrosion of secondary network pipes and leads to increased pipe leakage.	Rise in groundwater elevation. Rise in temperature of soils located along the secondary network.	Surface and subsurface soils can become contaminated via rising levels of contaminated groundwater.
	Indirect pollution of soils and groundwater.	Soil contaminants can pollute rising groundwater, which can transport chemicals downgradient.
Emissions due to burning of natural gas.	Air pollution (emissions of NOx, CO, particulates - see max. admissible limits in Annex 1- Table 1G, Ambient Air Quality)	Both substations are in residential areas.
Noise level exceeds the maximum admissible values[59]	Noise pollution.	Elevated noise levels is both a labor protection and environmental protection issue. The substations are located in residential areas, though no complaints have been filed to EPA Constanta by inhabitants living in that area. RADET has not paid penalties for the noise exceeding norms.

Upon completion of the investment, we expect these environmental concerns to be eliminated or minimized.

[59] COMPANY PRESENTATION REPORT - SEPTEMBER 1998, CH. 3: MEASURED NOISE LEVEL OF 74-78 DB(A) COMPARED TO THE MAXIMUM ADMISSIBLE VALUE OF 45 DB(A), ACCORDING TO THE ROMANIAN STANDARD STAS 10009/1988 "URBAN ACOUSTICS" AND SR ISO 1996/1995.

6.2 POTENTIAL ENVIRONMENTAL IMPACT OF INVESTMENT AND EXPANSION OF NATURAL GAS

The proposed investment project recommends that additional meters and controls (I&C) be installed at PT-37 and PT-47 to ensure efficient operation. All work associated with the investment should be confined to within the substation building. These activities are expected to have minimal environmental impact, except possibly for equipment delivery trucks entering a residential area.

If additional substations are converted to natural gas (a maximum of 29 are currently being considered), significant construction would be necessary because, in some cases, existing substation buildings would be demolished and replaced with new gas boilers substations and all associated equipment. Since we are not recommending this investment at this time, we present only an initial assessment of the impact of conversion of 29 substations and relevant environmental legislation (see Section 6.4).

The following activities could cause environmental concern during construction:

- connection of the gas boilers to the gas network;
- reconstruction of the existing substations to ensure the appropriate space for the gas boilers (when retrofitting old substation buildings for new gas boilers);
- demolition of existing substations and reconstruction into new gas boiler substations; and
- installation of appropriate gas venting systems (e.g. ventilation devices, stacks) according to project design.

During operations, RADET must address the following:

- comply with the maximum admissible limits imposed by the applicable legislation for the air emissions and ambient air,
- comply with the maximum admissible norms for noise[60] and vibrations,
- monitor emissions generated by the new installations, and
- develop emergency plans, as required by the EPL no. 137/1995.

6.3 ENVIRONMENTAL BENEFITS AND CONCERNS OF EXPANDING NATURAL GAS USE IN CONSTANTA

Converting an additional 20% RADET's substations to natural gas will reduce Constanta's reliance on the existing oil-fired TEC Palas. Since natural gas is a cleaner fuel than oil, overall air emissions city-wide should be reduced. However, currently all air emissions at

[60] RADET HAS ALREADY CONVERTED TWO SUBSTATIONS INTO NATURAL GAS SUBSTATIONS. DURING THE VISIT MADE BY THE KPMG TEAM, ELEVATED NOISE LEVELS WERE OBSERVED AT BOTH PLANTS, WHICH REPORTEDLY WAS DUE TO THE VENTILATION SYSTEM.

TEC Palas are emitted from two locations - the 104 meter stack and 250 meter stack at TEC Palas - which are located near the sea in an industrial zone. Conversely, the natural gas substations will be scattered throughout neighborhoods, mostly in the northern reaches of the district heating distribution network.

Also, RADET reporting will be more complex. Currently, since substations do not emit air emissions, no air quality monitoring is required. At the new gas substations, RADET will need to monitor air emissions and file[61] records with Constanta EPA. The submission frequency of the monitoring reports will be established by the EPA and specified in the environmental authorization. Current operators will require training to perform these new monitoring and reporting functions. None of the $55,200 proposed investment has been allocated for air quality monitoring.

While the new natural gas substations would no longer be dependent on TEC Palas to service buildings within its network, the substations would remain connected to the primary system as a back-up. Placing the approximately 10 km of primary network [62] in stand-by should minimize environmental impacts (e.g., groundwater and soil contamination, energy losses) caused by operating this portion of primary network. Also, TEC maintenance on this part of the primary network would probably be minimal.

While construction impacts associated with upgrading the 29 substations would be eliminated, possibly greater environmental impacts could result when building the new gas substations or performing a total retrofit of old substation buildings with natural gas boilers. However, once on-line, the potential environmental impacts of substation operations (see Table D-2) should be minimal at the new natural gas stations substations, because all of the equipment and piping will be new and in proper working order. Existing substation operators will require training to efficiently operate the new gas substations.

6.4 RELEVANT ENVIRONMENTAL REGULATIONS

RADET has already converted PT-37 and PT-47 into natural gas substations. To convert the additional 29 substations, RADET must undergo the same permitting procedure as used for the first two investments.

In the design stage, RADET must:

- prepare an environmental impact study for each substation (if there is only one investment project for all 29 substations, then only one environmental impact study is necessary);

- prepare a permitting file, which includes the environmental impact study(ies) and submit it to EPA Constanta for issuance of the environmental permit;

[61] MONITORING WILL BE CONDUCTED BY AN INDEPENDENT CONSULTANT, MR. SECARA. MR. SECARA WAS HIRED BY RADET TO MANAGE THEIR ENVIRONMENTAL AFFAIRS.

[62] 10 KM IS THE APPROXIMATE LENGTH OF PRIMARY NETWORK SERVICING THE 29 SUBSTATIONS.

- obtain formal agreements from the gas, electricity and water suppliers for connecting the new equipment to the gas, electricity and water networks; and

- obtain the environmental permit[63] for construction of the investment project.

For the operation stage, RADET must:

- obtain contracts with the gas, electricity and water suppliers for servicing the substations;

- update its global environmental authorization (currently pending) to include the new investments;

- comply with the MO 462/1993 and STAS 12547/1987 (see Annex 1, Tables 1E, 1F and 1G).

7.0 ENVIRONMENTAL ASSESSMENT OF THE SOURCE

The following section provides a description of the environmental emissions originating from TEC Palas, as well as applicable regulations and its compliance record.

7.1 EXISTING CONDITIONS

The basic energy source in Constanta is TEC's thermal power plant "PALAS", which includes three power generation blocks and two groups of peak boilers. The two main blocks, built in 1971, consisting each of a 420 ton/h steam boiler (140 bar, 570^0C) and a DSL – 50 MW adjustable bleeder condensing turbine. The remaining 150 MW block, built in 1979, is currently on stand-by. The three oil-fired boilers have a total gross installed capacity of 250 MW.

The first group of peak boilers includes four medium pressure steam boilers (4x100 ton/h, 17 bar, 250^0C, 1975-1977), the second group consists of five hot waters boilers (5x100 Gcal/h – online since 1970, 1971, 1975, 1982, 1993, respectively) that produce heat carrier for the district heating system. The closed cooling system uses three cooling towers, and neutralized wastewaters from the towers are discharged to the municipal sewer system. Two main chimneys (104 meters and 250 meters, which is under construction) and five 55 meter chimneys vent burned gas from the heat carrier boilers.

TEC Palas' primary heating network has two main lines: MAGISTRAL I – 2XDN800 mm and MAGISTRAL II (2XDN1000 mm). Both lines run from south to the north branching frequently. MAGISTRAL I is in the eastern part of town, and MAGISTRAL II is in the western part. In the northern part of the city, both main lines meet, forming a circular heating network.

The total length of the primary heating network is about 79 km, or 158 km of piping (2x79). The network was designed for a rated pressure of 16 bar and a temperature drop of $150/70^0$C. However, it is operated at 8 to 10 bar (maximum) at the outlet of the network, with a maximum temperature drop of $135/50^0$C. Ninety five percent of the primary heating

[63] THE ENVIRONMENTAL PERMIT ALSO REGULATES CONSTRUCTION SITE WORK.

network exists underground, installed in channels either on footings or brackets. The remaining 5% is above ground – on footings or supports.

The following table presents the utilities consumed at TEC Palas over a 3-year period to produce electricity and service the Constanta district heating system.

Table D-7
Utility Consumption at TEC PALAS 1997-1999

Utility	Unit	1997	1998	1999
oil	tones	371,157	316,204	264,502
water	tones	10,643,000	7,388,500	6,012,945
electric energy	GWh	376	302	208
medium electrical power	MW	43	45	48
consumed electrical power	GWh	99	85	69
consumed fuel for electrical power*	g cc/KWh	288	286	277
Thermal power	Gcal	2,291	2,026	1,797
• steam	Gcal	492	355	293
• hot water	Gcal	1,799	1,671	1,503
• consumed fuel for thermal power*	kg/Gcal	168	165	163

* specific quantity of conventional combustible (e.g., oil, coal) consumed to produce thermal power/electrical power; see Annex 2, Table 2D.

7.2 EXISTING ENVIRONMENTAL REPORTING

The major negative environmental impact caused by TEC Palas operations is SO_2 and particulate air emissions, due to burning high sulfur (2.7%) and high coke content fuel oil. There are no continuous monitoring systems to measure stack air emissions. The only measurements stack measurements routinely performed are for O_2 and CO_2 with an ORSAT device, and for SO_2, NO_x and CO_2 with a SENONIC portable gas analyzer. Periodic measurement of CO_2, SO_2, NO_x and particulates are required under TEC Palas' authorization permit to confirm that applicable norms are being achieved. All measurements are made by TEC Palas' Environmental Department and are submitted to EPA Constanta for filing.

Currently, to reduce the SO_2 emissions, fuel oil is burned in an oxygen rich environment (more than 3% excess oxygen), though this practice reduces the efficiency of the boiler. The use of liquid fuel with a lower sulfur content is presently unaffordable for TEC. Particulates are not currently being measured because TEC does not have the necessary instrumentation. However, only solid combustibles (e.g., coal) generally produce particles above the Romanian limits.

Water used in TEC operations is from the municipal fresh water supply system. The Municipal water treatment plant produces water suitable for drinking, but it is too hard for successful long-term use in the primary system because it corrodes pipes and machinery. TEC has no water supply holding tanks, because the supply process is continuous. TEC treats Municipal water for industrial use as follows:

- pretreatment (chlorination and suspended solids removal) – for all industrial water prior to use;
- demineralization (using ion exchange) - for pretreated industrial water prior to use as steam (for electric power) and recovered condensation water;
- water softening - for pretreated industrial water prior to use in the cooling system and municipal heating system;
- neutralization - for wastewater from the ion exchange unit at the demineralization plant, softening plant and cooling towers, prior to discharge to the Municipal sewer system and subsequent treatment at Constanta's wastewater treatment plant.

Wastewater discharged to the municipal sewer system is monitored daily by the TEC Palas Environmental Department[64] for the parameters specified in Table D-10. Reportedly, TEC Palas is in compliance for its wastewater discharge. However, we believe oil contaminated wastewater (from machinery) occasionally enters the sewer system. The quantity of wastewater discharged is not measured.

Soil and groundwater is monitored weekly for pH also by the TEC Palas Environmental Department. Samples are collected from six monitoring wells in the oil and lubricant tank area.

[64] THE ENVIRONMENTAL DEPARTMENT IS A PART OF TEC PALAS, LOCATED AT THE FACILITY. ITS PRIMARY FUNCTIONS INCLUDE: COLLECT AND ANALYZE ENVIRONMENTAL SAMPLES, RESEARCH AND IMPLEMENT MEASURES TO MINIMIZE EMISSIONS, COMMUNICATE WITH EPA CONSTANTA REGARDING ENVIRONMENTAL COMPLIANCE ISSUES, AND DEVELOP NEW ENVIRONMENTAL INITIATIVES FOR THE COMPANY.

Health and safety precautions are taken for handling hazardous materials throughout the TEC Palas facility.

The total quantity of environmental emissions from TEC Palas is presented in Table D-8.[65]

Table D-8
Total Quantity of Environmental Emissions from TEC Palas

Emissions	**Unit**	**1997**	**1998**	**1999**
SO_2	tones	19,816	17,101	15,576
NO_X	tones	4,819	2,441	2,294
CO_2	tones	1,731,800	892,712	834,231
Particulates	tones	134	131	192
Solid wastes	tones	350	247	65
Recycled wastes	tones	594	456	432
Wastewater[66]	tones	6,364,000	1,366,676	3,394,940

7.3 COMPLIANCE RECORD

TEC Palas was issued an environmental authorization permit in 1999 to operate its facilities within compliance of Romanian environmental standards. Routine emission testing by TEC Palas' Environment Protection Department, assisted by EPA Constanta, show that TEC Palas is in compliance except for SO_2 emissions (see Section 7.7). Tables D-9 and D-10 present a single day's emission record for TEC Palas.

Table D-9
Air Analysis for July 22, 1999 - 09:17:19

Parameter	**Unit**	**Measured value[67]**	*Norm[68]*
Gas temperature	^0C	256	-
NO_x (expressed in NO_2)	mg/m^3	456	450
SO_x (expressed in SO_2)[69]	mg/m^3	1,991.78	1,700
Ambient Temperature	^0C	31	-

[65] VALUES ARE FROM THE ANNUAL ENERGY BALANCE, PREPARED BY TEC PALAS ENVIRONMENTAL DEPARTMENT; SEE ANNEX 2, TABLE 2A.

[66] WHILE TEC DOES NOT MEASURE THE QUANTITY OF WASTEWATER DISCHARGED, IT DOES MEASURE THE QUANTITY OF WATER IT BUYS FROM THE MUNICIPAL WATER SYSTEM. KNOWING THE QUANTITY OF INPUT WATER, IT IS ABLE TO ESTIMATE ITS WASTEWATER DISCHARGE, KNOWING THE QUANTITY OF WATER USED FOR STEAM, HOT WATER, ETC.

[67] MEASURED INSIDE TEC PALAS' 250 METER STACK, 5 METERS FROM ITS BASE AT THE GROUND SURFACE.

[68] SEE ANNEX 1, TABLE 1G.

[69] NOTE THAT THE SO_2 NORM WAS RECALCULATED FOR 3% EXCESS AIR. THE REPORTED VALUE EXCEEDS THE LEGAL LIMIT BY 20%.

Table D-10
Water Analysis for July 22, 1999 - 09:17:19

No.	Date	Parameter	Analysis method	Unit	Measured value	Norm
53	07.10.1999	Temperature		^{0}C	23	40
		pH	STA 8619/3-90	pH	8.00	6.50-8.50
		Suspended solids	STAS 6953-81	mg/l	48	300
		Extractable substances	STAS 7587-96	mg/l	2.60	20
55	14.10.1999	Temperature		^{0}C	21	40
		pH	STA 8619/3-90	pH	8.00	6.50-8.50
		Suspended solids	STAS 6953-81	mg/l	20	300
		Extractable substances	STAS 7587-96	mg/l	1.00	20
56	21.10.1999	Temperature		^{0}C	24	40
		pH	STA 8619/3-90	pH	7.50	6.50-8.50
		Suspended solids	STAS 6953-81	mg/l	24	300
		Extractable substances	STAS 7587-96	mg/l	1.30	20
58	28.10.1999	Temperature		^{0}C	24	40
		pH	STA 8619/3-90	pH	7.00	6.50-8.50
		Suspended solids	STAS 6953-81	mg/l	74	300
		Extractable substances	STAS 7587-96	mg/l	2.40	20

1 mg/dm^3=1 mg/l

The wastewater discharge is the result from the treatment processes described in Section 7.2. All wastewater is discharged to the Municipal sewer system.

7.4 PLANNED INVESTMENTS

TEC plans to implement some modest upgrades at TEC Palas and the primary network over the next few years. TEC has recently replaced approximately half of its primary lines and plans to continue replacing the remaining 19 km (x2) at approximately 7% annually. Anticipated upgrades include[70]:

Table D-11
Summary of Planned Investment by TEC

Location	Description	Cost($M)
TEC PALAS	Replace pumps/motors	0.9
	Finish hot water boilers reconstruction, including new burners installation	1.2
	Install I&C system for hot water boilers	0.3
	Design	0.1
Primary Network	Complete repairs of existing primary network	4.0
	Conduct primary network hydraulic balancing	0.1
	Install measurement system at nodes	0.1
	Design	0.2
	Total Primary System	*4.4*

[70] AS PER DORU OSLOBEANU, TEC DIRECTOR.

7.5 ENVIRONMENTAL IMPACT OF CONSTRUCTION

The construction work necessary to implement the TEC portion of the investment project (primary network replacement, new equipment at TEC Palas) may have a negative impact on the environment. Such impacts could include:

- destruction of green spaces,
- improper waste disposal,
- dust emissions, and
- environmental emissions (e.g., CO, CO_2, oil and fuel) by heavy construction machinery.

Careful planning for the construction and promoting environmental restoration can minimize this potential negative impact.

7.6 ENVIRONMENTAL BENEFITS AT TEC PALAS

Environmental conditions will improve at TEC Palas due overall improvements in the Constanta District Heating system and upgrades at TEC Palas. The principal benefit of the planned investment is reduced SO_2 emissions to the atmosphere.

The anticipated reduction of SO_2 emissions will be due to:

- reduced heavy oil (2.7% sulfur) consumption due to reduced losses in the primary/secondary network, thus less energy necessary for water heating;
- less energy requirements if additional substations are converted to natural gas; and
- reduced consumption of electrical energy by using more efficient pumps.

Quantitatively, the resulting reduction in emissions can be estimated using an energy balance of TEC Palas (see Section 8.0).

Other environmental benefits for TEC are expected to include:

- Reduced water use and treatment – fewer losses in primary lines, so less use and treatment of Municipal make-up water will be necessary.
- Reduced wastewater – overall reduction of water use will result in less wastewater generated. Also, less sludge will be generated, thus minimizing solid waste disposal.
- Reduced contamination of soils along the primary pipe network - less leakage will occur after pipe repair.
- Less thermal contamination of soils - due to less water leakage. Warm soil channels are believed to be a possible source of infection, because varmints (e.g., insects, rats) can live in warm, humid medium surrounding the thermal channels.
- Reduced maintenance and repairs – less construction impacts (e.g., disturbance of green space, dust production, equipment emissions) because primary pipes and TEC Palas equipment are new or in good repair.

7.7 RELEVANT ENVIRONMENTAL REGULATIONS

TEC Palas must comply with the Romanian legislation for pollution emissions (see Annex 1). EPA Constanta evaluates whether TEC Palas is compliance by calculation or through direct emission measurements, and issues an authorization permit accordingly. TEC Palas' 1999 authorization permit requires it to perform periodic monitoring and reporting. Collection

and analyses of wastewater samples occurs daily, air measurements are taken at least weekly, depending on the availability of the instrumentation. EPA Constanta occasionally will collect their own samples to verify TEC's environmental reports. TEC Palas files its environmental report annually with EPA Constanta.

EPA Constanta (and all local EPAs) has the authority to close facilities that are out of compliance with applicable Romanian environmental standards. For example, two metallurgical facilities were closed recently, due to gross compliance violations. These facilities will reopen after the agency is confident that measures for environment protection are/will be taken. Often, an EPA will grant a facility legal authorization to operate even if its emissions are greater than the required norms, especially if extreme social hardship will result in closing the facility.

As previously described, when a facility is out of compliance, the local EPA will issue an authorization permit to operate that is conditional - the permit includes a compliance plan that specifies actions and target dates that the facility must meet in order to remain in operation. If the facility fails to meet the goals established in the compliance plan, the local EPA will begin to issue penalties. Since TEC PALAS is located in the in the "authorization reglementation", (see Section 3), it is able to emit SO_2 emissions that are greater than the specified norms until June 2000. As such, TEC Palas has not paid any penalties to EPA Constanta for compliance violations.

TEC Palas' compliance plan for 1999 specifies that the facility undergo the following actions by December 2000[71] [72]:

1. Reduce NO_x emissions to the atmosphere by upgrading burners (420 tons/hour boiler). Approximate cost - 22,200,000,000 lei (~$1.2 million).

2. Improve emission disbursement by repairing main chimneys – Approximate cost: 11,200,000,000 lei (~$605,400).

3. Reduce wastewater discharge to Municipal sewer system – upgrade of the primary lines will reduce wastewater generation. Approximate cost: 3,100,000,000 lei (~$168,000).

4. Repair TEC Palas' sewage collection network – Approximate cost: 573,500,000 lei (~$31,000).

8.0 ENERGY BALANCE

An energy balance can be used to estimate the total amount of energy consumed by a system with knowledge of energy use throughout the system (in this case: electrical energy, thermal energy for industrial steam and hot water, and losses). We performed an energy balance for 1997, 1998 and 1999 in metric tons (1 tone = 1000 kg) of liquid fuel (oil) utilized and then calculated the amount of saved fuel and reduced environmental emissions due to implementation of the proposed investment program.

[71] THESE ENVIRONMENTAL INVESTMENTS ARE IN ADDITION TO THOSE SPECIFIED IN TABLE D-11, EXCEPT FOR THE BURNER UPGRADE.

[72] CONVERSION RATE OF 18,500 = 1 USD.

8.1 BALANCE OF LIQUID FUEL CONSUMED

The energy balance of the TEC Palas given in tons of liquid fuel, over the last three years is presented below[73]:

Table D-12
Energy Balance for TEC Palas

Fuel Parameter	**1997**	**1998**	**1999**
	tones oil consumed		
Oil consumed Where:	371,157	316,204	264,502
For electrical energy	81,557	65,088	43,570
For industrial steam	62,222	44,028	36,065
For hot water Where:	227,378	207,088	184,867
Losses at TEC	15,533	11,121	7,395
Other clients	13,938	9,588	5,546
Municipality Where:	197,907	186,379	171,926
Losses in primary network	48,032	37,276	30,947
Losses in secondary network	25,027	24,229	22,350

The reduction in energy use from 1998 to 1999 was primarily due to a reduction in industrial clients. The electrical energy balance is made considering the circulation pumps from primary network, supplied directly from the TEC Palas.[74]

[73] SEE ANNEX 2 FOR SUPPORTING CALCULATIONS.

[74] CIRCULATION PUMPS AT THE SUBSTATIONS ARE NOT INCLUDED IN THE ELECTRIC ENERGY BUDGET BECAUSE THESE PUMPS USE ELECTRICITY FROM THE NATIONAL ENERGY GRID (E.G., FROM HYDROELECTRIC, NUCLEAR OR THERMAL POWER PLANTS).

8.2 ESTIMATED AMOUNT OF FUEL SAVED

The energy savings anticipated due to implementation of the investment program is estimated below:

Table D-13
Estimated Energy Savings due to Implementation of the Proposed Investment Program

Location	Gcal/yr saved[75]	Annual Oil Savings	
		tones/yr[76] saved	% of total oil consumed by TEC[77]
Substations	257,582	31,683	8.54-11.98
Secondary pipes	13,466	1,656	0.45-0.63
Municipal Buildings	14,477	1,781	0.48-0.67
Completion of GB 37&47	2,897	356	0.10-0.13

8.3 ESTIMATED REDUCTION OF ENVIRONMENTAL EMISSIONS

The reduction in air emissions is estimated in the table below.

Table D-14
Estimated Reduction in Air Emissions due to Implementation of the Proposed Investment Program[78]

	Tones/yr emission reduction			
Location	SO_2	NO_x	CO_2	Particulates
Substations	1692-1866	275-411	99,926-147,829	11-23
Secondary pipes	88-98	14-22	5224-7728	0.6-1.2
Municipal buildings	94-105	15-23	5616-8308	0.65-1.3
Completion of GB 37&47	19-21	3-5	1124-1663	0.13-0.26
Total reduction by contaminant	1894-2089	305-456	111,990-165,529	13-26

Considering the three-year average oil consumption rate and the expected savings, we are able to estimate an overall reduction of the emissions from TEC PALAS at 12%, if the investment program is implemented – approximately 11% is due to fuel savings at the substations, 0.5% is due to fuel savings in the secondary network, 0.6% is due to fuel savings at municipal buildings, and 0.1% is due to fuel savings at PT-37 and PT-47.

[75] SEE TABLE A-3 IN CONSTANTA INVESTMENT PROGRAM FINAL REPORT.

[76] ASSUMES 123 KG/GCAL; SEE ANNEX 2, TABLE 2D.

[77] RANGE OF SAVINGS, USING 1997 AND 1999 TOTAL OIL CONSUMPTION DATA; SEE ANNEX 2, TABLE 2C.

[78] CALCULATED USING DATA FROM 1997 AND 1999; SEE ANNEX 2, TABLE 2B.

9.0 CONCLUSION

Romania's environmental regulations have been restructured considerably since 1991, and are approaching the completeness and complexity of those promulgated in Western Europe and the United States. Existing operations must be in compliance with relevant norms and new construction must be performed in a manner that minimizes environmental impact.

After reviewing the proposed investments for substations, the secondary network and TEC Palas, we concluded that as long as construction was performed in an environmentally responsible manner, and RADET and TEC Palas continues to comply with relevant norms, environmental conditions should improve in Constanta. Reduced network pipe leakage will save water, reduce wastewater treatment, and begin to curb the risk of groundwater contamination along the piping network. Ambient air quality should improve near TEC Palas because less fuel oil will be necessary to operate the district heating network – we estimate that air emissions at TEC Palas could be reduced by 12% annually if the investment program is implemented. However, TEC Palas is unlikely to meet norms for SO_2 emissions consistently until it begins using fuel oil with a lower sulfur content.

ANNEX 1: APPLICABLE ROMANIAN ENVIRONMENTAL STANDARDS

Wastewater

NTPA 001/1997 - Norms regarding the polluting load of the wastewater discharged in the water resources, stipulate the following

Table 1A
Maximum Admissible Limits for Wastewater Discharge to Natural Water Bodies

Type of indicator	No.	Quality Indicator	Unit	Admissible max. limits	Method of analysis
Physical indicators	1*	Temperature	^0C	30 ^0C	-
Chemical indicators	2	Hydrogenion concentration (pH)	pH unit.	6.5 - 8.5	STAS 8619/3-90
	3	Total suspended matter (T.S.M.)	mg/dm^3	60	STAS 6953-81
	4	Biochemical oxygen demand in 5 days (BOD)	mg/dm^3	20	STAS 6560-82
	5	Chemical oxygen demand-Potassium hypermanganate method (COD-Mn)	mg/dm^3	40	STAS 9887-74
	6	Chemical oxygen demand-Potassium biochromate method (COD-Cr)	mg/dm^3	70	STAS 6954-82
	7	Ammonium nitrate (NH_4^+)	mg/dm^3	2.0	STAS 8683-70
	8	Total nitrate (N)	mg/dm^3	10	STAS 7312-83
	9	Nitrates (NO_3^-)	mg/dm^3	25	STAS 8900/1-71
	10	Nitrites (NO_2^-)	mg/dm^3	1.0	STAS 8900/2-71
	11	Sulfides and hydrogen sulfide (H_2S)	mg/dm^3	0.1	STAS 7510-66
	12	Sulfites (SO_3^{2-})	mg/dm^3	1.0	STAS 7661-89
	13	Phenols carried by water vapors (C_5H_5OH)	mg/dm^3	0.05	STAS 7167-92
	14	Substances that can be extracted by petroleum ether	mg/dm^3	5.0	STAS 7587-66
	15**	Oil products	mg/dm^3	1.0	STAS 7877-87
	16	Phosphates (PO_4^{3+})	mg/dm^3	4.0	STAS 10064-75
	17	Total phosphorus (P)	mg/dm^3	1.0	STAS 10064-75
	18	Anion active synthetic, biodegradable detergents	mg/dm^3	0.5	STAS 7576-66
	19***	Arsenic	mg/dm^3	0.05	STAS 7885-67

Type of indicator	No.	Quality Indicator	Unit	Admissible max. limits	Method of analysis
	20	Aluminum (Al^{3+})	mg/dm^3	8.0	STAS 9411-83
	21	Calcium (Ca^{2+})	mg/dm^3	300	STAS 3662-90
	22***	Lead (Pb^{2+})	mg/dm^3	0.2	STAS 8637-79
	23***	Cadmium (Cd^{2+})	mg/dm^3	0.1	STAS 7852-80
	24***	Trivalent chrome (Cr^{3+})	mg/dm^3	1.0	STAS 7884-91
	25***	Hexavalent chrome (Cr^{6+})	mg/dm^3	0.1	STAS 7884-91
	26	Total ionic iron ($Fe^{2+} + Fe^{3+}$)	mg/dm^3	5.0	STAS8634-70
	27***	Copper (Cu^{2+})	mg/dm^3	0.1	STAS 7795-80
	28***	Nickel (Ni^{2+})	mg/dm^3	0.1	STAS 7987-67
	29***	Zinc (Zn^{2+})	mg/dm^3	0.5	STAS 8314-87
	30***	Mercury (Hg^{2+})	mg/dm^3	0.005	STAS 8014-79
	31	Silver (Ag^{+})	mg/dm^3	0.1	STAS 8190-68
	32	Fluorides (F)	mg/dm^3	0.1	STAS 8910-71
	33	Molybdenuen (Mo^{2+})	mg/dm^3	0.1	STAS 11422-84
	34	Selenium (Se^{2+})	mg/dm^3	0.1	STAS 12663-88
	35	Manganese (Mn^{2+})	mg/dm^3	1.0	STAS 8662-70
	36	Magnesium (Mg^{2+})	mg/dm^3	100	STAS 6674-77
	37	Cobalt (Co^{2+})	mg/dm^3	1.0	STAS 8288-69
	38	Cyanides (CN^{-})	mg/dm^3	0.05	STAS 7685-79
	39	Free chlorine (Cl_2)	mg/dm^3	0.05	STAS 6364-78
	40	Chlorides (Cl^{-})	mg/dm^3	500	STAS 8663-70
	41	Residue filtered at 105 ^0C	mg/dm^3	2000	STAS 9187-84
Bacteriological indicators	42	Total colifom bacteria	no./100 cm^3	1 mil.	STAS 3001-91
	43	Fecal coliform bacteria	no./100 cm^3	10000	STAS 3001-91
	44	Fecal streptococci	no./100 cm^3	5000	STAS 3001-91
	45	Salmonella	no./100 cm^3	None	STAS 3001-91

mg/dm^3 = mg/l

* Wastewater discharge can not generate an increase in the receiving water body temperature more than 2-5 ^0C, and not in excess of 30 ^0C.

** Oil should not be visible on the surface of the receiving water body in which wastewater is discharged.

*** The sum of heavy metal ions should not exceed a concentration of 1 mg/dm^3 and the individual values presented in the table. In areas where there is no water treatment plant, drinking water contains zinc concentrations higher than 0.5 mg/dm^3. This value is also accepted for the wastewater discharged into rivers in these areas.

NTPA 002/1997 - Norms regarding the polluting load of the wastewater discharged in the city sewerage network.

Table 1B
Maximum Admissible Limits for Wastewater Discharge into the Municipal Sewerage System

No.	Quality indicator	Unit	Admissible limit value
1	Temperature	^0C	40
2	Hydrogen ions concentration	pH unit	6.5 - 8.5
3	Suspended matters	mg/dm^3	300
4	BOD	mg/dm^3	300
5	COD-Cr	mg/dm^3	500
6	NH_4^+	mg/dm^3	30
7	Total phosphorus (P)	mg/dm^3	5.0
8	Cyanides (CN^-)	mg/dm^3	0.5
9	Sulfides and hydrogen sulfide (S^{2-})	mg/dm^3	0.5
10	Sulfites (SO_3^{2-})	mg/dm^3	10
11	Sulfates (SO_4^{2-})	mg/dm^3	400
12	C_6H_5OH	mg/dm^3	30
13	Substances that can be extracted by petroleum ether	mg/dm^3	20
14	Anion active synthetic, biodegradable detergents	mg/dm^3	30
15	Lead (Pb^{2+})	mg/dm^3	0.5
16	Cadmium (Cd^{2+})	mg/dm^3	0.1
17	Trivalent chrome (Cr^{3+})	mg/dm^3	1
18	Hexavalent chrome (Cr^{6+})	mg/dm^3	0.1
19	Copper (Cu^{2+})	mg/dm^3	0.1
20	Nickel (Ni^{2+})	mg/dm^3	1
21	Zinc (Zn^{2+})	mg/dm^3	1
22	Manganese (Mn^{2+})	mg/dm^3	1
23	Free chloride (Cl_2)	mg/dm^3	1

Surface water
STAS 4706/1983 - Surface water - quality conditions

Table 1C
Admissible Limits of Chemical Substances in Surface Water

Type of indicator	Admissible limits By Quality Categories			Method of analysis
	I	II	III	
Ammonium nitrate (NH_4^+), (mg/dm^3, max.)	1	3	10	STAS 8683-70
Ammonia (NH_3), (mg/dm^3, max.)	0.1	0.3	0.5	STAS 8683-70
Nitrates (NO_3^-), (mg/dm^3, max.)	10	30	-	STAS 8900/1-71
Nitrites (NO_2^-), (mg/dm^3, max.)	1	3	-	STAS 8900/2-71
Calcium (Ca^{2+}), (mg/dm^3, max.)	150	200	300	STAS 3662-62
Free chlorine (Cl_2), (mg/dm^3, max.)	0.005			STAS 6364-78
Chlorides (Cl^-), (mg/dm^3, max.)	250	300	300	STAS 8663-70
Free Carbon Dioxide (CO_2), (mg/dm^3, max.)	50			STAS 3263-61
Phenols carried by water vapors (C_5H_5OH), (mg/dm^3, max.)	0.001	0.02	0.05	STAS 7167-65
Total ionic iron (Fe^{2+}), (mg/dm^3, max.)	0.3	1	1	STAS 8634-70
Phosphorus (P) (mg/dm^3, max.)	0.1			STAS 10064-75

Type of indicator	Admissible limits By Quality Categories			Method of analysis
	I	II	III	
Sulfides and hydrogen sulfide (H_2S), (mg/dm^3, max.)	none	None	0.1	STAS 7510-66
Magnesium (Mg^{2+}), (mg/dm^3, max.)	50	100	200	STAS 6674-77
Manganese (Mn^{2+}), (mg/dm^3, max.)	0.1	0.3	0.8	STAS 8662-70
Water dissolvent oxygen (O_2), (mg/dm^3, min.)	6	5	4	STAS 6536-88
Oil products, (mg/dm^3, max.)	0.1			STAS 7877-87
Residue filtered at 105 °C, (mg/dm^3, max.)	750	1000	1200	STAS 9187-84
Sodium (Na^+), (mg/dm^3, max.)	100	200	200	STAS 8295-69
Organic substances (O_3) a) Biochemical oxygen demand in 5 days (BOD)	5	7	12	STAS 6560-82
b) Chemical oxygen demand – Potassium hypermanganate method (COD-Mn)	10	15	25	STAS 9887-74
c) Chemical oxygen demand-Potassium biochromate method (COD-Cr)	10	20	30	STAS 6954-82
Sulfate (SO_4^{2-}), (mg/dm^3, max.)	200	400	400	STAS 8601-70

This STAS establishes three water quality types which are a function of the concentration of pollutants in the respective surface water (e.g., river, stream, lakes):

- Category I - water that can be used as a public drinking water supply, in the food industry and/or for irrigation of agriculture.
- Category II - water that can be used as raw water in industry, for public fountains, etc.
- Category III - more polluted water that can be used as raw water only for certain types of industries.
- There is a fourth category of water, known as **highly degraded water** (NOT Category IV); it can not be used for any purpose (some portions of some Romanian rivers fall into this category).

Table 1D
Admissible Limits of Dangerous Pollutant Concentrations in Surface Water

Type of indicator	Admissible limits for Quality Categories I, II and III	Method of analysis
Silver (Ag^{+})	0.01	STAS 8190-68
Arsenic (As)	0.01	STAS 7885-67
Barium (Ba^{2+})	1.0	STAS 10258-75
Cadmium (Cd^{2+})	0.003	STAS 7852-80
Cyanides (CN^{-})	0.01	STAS 7685-79
Cobalt (Co^{2+})	1	STAS 8288-69
Trivalent chrome (Cr^{3+})	0.5	* STAS 7884-67
Hexavalent chrome (Cr^{6+})	0.05	**
Copper (Cu^{2+})	0.05	STAS 7795-80
Anion active detergents	0.5	STAS 7576-66
Fluorides (F^{-})	0.5*	STAS 8910-71
Policyclical flavored hydrocarbons	0.0002	**
Mercury (Hg^{2+})	0.001	STAS 8045-79
Molybdenuen (Mo)	0.05	STAS 11422-84
Nickel (Ni^{2+})	0.1	STAS 7987-67
Pesticides - Herbicides -triazines	0.001	**
-triazinones	0.001	**
-toluidines	0.001	**
- insecticides -organic chlorinated	0.0001	STAS 12650-88
-organic phophorides	None	**
-organometallics	None	**
- nitrogen compounds (dinitro-orto-crezol, dinitro-sec-butilphenol)	None	**
Lead (Pb^{2+})	0.05	STAS 8637-79
Selenium (Se^{2+})	0.01	STAS 12663-88
Zinc (Zn^{2+})	0.03	STAS 8314-87

* For surface water surface Category I used for drinking water supply, the admissible maximum is 1.2 mg/dm^3.
** Methods of analysis are according with the National Water Council.

mg/dm^3 = mg/l

Groundwater

Under the current Romanian legislation in force, no specific regulations for the groundwater quality are stipulated.

Air

Air emission and ambient air concentration limits imposed by the Romanian regulations are the following:

Ambient air quality STAS 12547/87

Table 1E
Ambient Air Quality Conditions in Protected Areas (residential areas)

Chemical of Concern	Maximum admissible concentration, mg/m^3				Analysis Methods
	Short term average	Long term average			
	30 min	daily	Monthly	Yearly	
Nitric acid	0.1	-	-	-	Y)
Chloric acid	0.3	0.1	-	-	Y)
Acroleine	0.03	0.01	-	-	STAS 10913-77
Aldehyde (HCHO)	0.035	0.012	-	-	STAS 14331-70
Ammonia	0.3	0.1	-	-	STAS 14332-70
Phosphorous anhidryde	0.3	0.1	-	-	STAS 10312-76
Arsen	-	0.003	-	-	Y)
Benzene	1.5	0.8	-	-	10934-77
Cadmium	-	0.00002	-	-	Y)
Chlorine	0.1	0.03	-	-	Y)
Chromium (CrO_3)	-	0.0015	-	-	STAS 10916-77
Nitrogen dioxide	0.3	0.1	-	0.04	STAS 11103-78
Sulfur dioxide	0.75	0.25	-	0.06	STAS 10329-75
Phenol	0.1	0.03	-	-	STAS 10194-75
Flour:			-	-	STAS 11027-77
- inorganic gaseous compounds and aerosols easy soluble (F^-)	0.015	0.005			STAS 10330-75
- inorganic gaseous compounds and aerosols hard soluble (F^-)	-	0.03	0,0012	-	Y)
Soot	0.15	0.05	-	-	Y)
Furfurol	0.15	0.05	-	-	Y)
Hydrogen sulfide	0.015	0.008	-	-	Y)
Manganese - (Mn compounds)	-	0.01	-	-	STAS 10814-76
Methanol	1.0	0.5	-	-	STAS 10815-85
Methylmercaptane	-	0.00001	-	-	STAS 11105-78
Carbon monoxide	6.0	2.0	-	-	Y) olfactive level 0,004
Oxidants (O_3)	0.1	0.03	-	-	Y)
Lead	-	0.0007	-	-	STAS 11010-78
Suspended sulfates including sulfuric acid aerosols (SO_4^{2-})	0.03	0.012	-	-	STAS 10810-76
Carbon sulfite	0.03	0.005	-	-	STAS 11194-79
Trichlorethylene	4.0	1.0	-	-	STAS 11104-78
Suspended particles	0.5	0.15	-	0.075	Y) STAS 10813-76

Y) Analysis methods will be approved by the Ministry of Health.

Air emissions

MO 462/1993 of MAPPM – For protection of air quality, the following maximum admissible limits are specified for pollutant concentration at stacks:

Table 1F
Maximal Admissible Concentration of Pollutants when burning Gasous Fuels

Pollutants / **Thermal energy source size MW/tone**		**Maximum admissible concentration**			
		< 100	100-300	300-500	≥ 500
	Unit				
Particles	mg/Nm^3	5	5	5	5
Carbon monoxide	mg/Nm^3	100	100	100	100
Sulfur oxides	mg/Nm^3	35	35	35	35
Nitrogen oxides	mg/Nm^3	350	350	350	350
Note: all limit concentrations are related to the content of flue gas oxygen	% vol.	3	3	3	3

mg/Nm^3: m^3 under normal conditions - temperature (20 ^{0}C) , pressure (1 atm and 1 atm = 1.013 bar).

Table 1G
Maximal Admissible Concentration of Pollutants when Burning Liquid Fuels

Pollutants / **Thermal energy source size MW/tone**					
		< 100	**100-300**	**300-500**	**≥ 500**
	Unit				
Particles	mg/Nm^3	50	50	50	50
Carbon monoxide	mg/Nm^3	170	170	170	170
Sulfur oxides	mg/Nm^3	1700	1700	400	400
Nitrogen oxides	mg/Nm^3	450	450	450	450
Note: all limit concentrations are related to the content of flue gas oxygen	% vol.	3	3	3	3

mg/Nm^3: m^3 under normal conditions - temperature (20 ^{0}C) , pressure (1 atm and 1 atm = 1.013 bar).
Notes:
(1) The limit for sulfur oxide is observed when the black oil sulfur content is less than 1% (% weight);
(2) Heavy black oil is not allowed to be used in installations with a power source < 5 MW/t.

Noise:

- **STAS 6156/86** Protection against noise in civil and social-cultural constructions (e.g., schools, kindergartens, and cultural houses). Maximum admissible limit: 90 dB.

- **STAS 10009/88** Protection against noise in urban areas. Maximum admissible limit for the residential areas: 65 dB.

Solid waste[79]

- **Emergency Ordinance no. 33/1995** "Waste Collection, Recycling and Recovery in the Production Process" - this ordinance requires companies to collect, deposit and immediately deliver recyclable wastes to solid waste recycling centers or sell them to various consumers in order to avoid their degradation (art.7).

- **Government Decision no. 155/1999** "European Catalogue for Waste"- this decision requires all companies to record all types of waste they generate.

Soil and subsoil quality

- **Annex no. 1 of MO no. 756/1997** "Environmental Impact Assessment"- this contains the reference values for the concentration of chemical substances in the soil (inorganic compounds, aromatic and poly-aromatic hydrocarbons, petroleum hydrocarbons, chloride organic compounds, PCB's, and pesticides). It also indicates alert and intervention thresholds.

[79] ROMANIAN ENVIRONMENTAL LEGISLATION DOES NOT SPECIFY SOLID WASTE REGULATIONS. THE CITED FRAMEWORK LAWS CAN BE APPLIED.

ANNEX 2: SUPPORTING DATA FOR EMISSION SAVINGS CALCULATIONS

Table 2A - Total Quantity of Air Emissions from TEC Palas

Emissions	Unit	1997	1998	1999	Ave
SO2	tones	19,816.23	17,100.91	15,576.13	17,497.76
NOX	tones	4,818.67	2,441.27	2,294.15	3,184.70
CO2	tones	1,731,799.82	892,712.27	834,231.02	1,152,914.37
Particles	tones	134.38	131.05	191.92	152.45
Total	*tones*	*1,758,566.10*	*914,383.50*	*854,292.22*	*1,173,749.27*
Total less CO2	*tones*				*20,834.90*

Table 2B - Estimated Annual Reduction in Air Emissions due to Implementation of the Proposed Investment Program

Location	SO_2		NO_x		CO_2		Particul
	1997	1999	1997	1999	1997	1999	1997
	tones	tones	tones	tones	tones	tones	tones
Substations	1,691.55	1,865.74	411.33	274.80	147,829.35	99,925.88	11.47
Secondary pipes	88.43	97.54	21.50	14.37	7,728.30	5,223.98	0.60
Municipal Buildings	95.07	104.86	23.12	15.44	8,308.52	5,616.18	0.64
Completion of GB 37&47	19.02	20.98	*	*	1,662.62	1,123.86	0.13
TOTAL REDUCE	1,894.07	2,089.12	455.95	304.61	165,528.79	111,889.90	12.84
% REDUCE	9.56%	13.41%	9.46%	13.28%	9.56%	13.41%	9.56%

Values for 1998 not included because within the range established by 1997 and 1999 values.

** Estimated at 3-5 tones/year, due to greater efficiency of natural gas burners as compared to burners at TEC Palas.*

Table 2C - Estimated Annual Fuel Savings due to Implementation of the Proposed Investment Program

			% Savings[2]		
Location	**Gcal Saved per year**	**Oil Savings[1] (tones/yr)**	**1997 [3] 371,157**	**1999 [3] 264,502**	**Ave % Savings**
Substations	257,582	31,682.59	8.54%	11.98%	10.26%
Secondary pipes	13,466	1,656.32	0.45%	0.63%	0.54%
Municipal Buildings	14,477	1,780.67	0.48%	0.67%	0.58%
Completion of GB 37&47	2,897	356.33	0.10%	0.13%	0.12%
TOTAL	*288,422*	*35475.91*	*9.56%*	*13.41%*	11.49%

*[1] calculated by: Gcal/yr saved * 123 kg/Gcal (see Annex 2, Table 2D)/1000.*
[2] oil savings / total oil consumed.
[3] 371,157 is the tones oil consumed in 1997; 264,502 is the tones total oil consumed in 1999.

Table 2D -
Data used to calculate the conversion value of 123 kg/Gcal for oil saved

year	**specific quantity consumed of conventional combustible**	**caloric value of conventional combustible**	**caloric value of liquid fuel**	**caloric value of liquid fuel**	**specific quantity consumed of liquid fuel**	**calculation value[1]**
	kg/Gcal	kcal/kg	kJ/kg	kcal/kg	kg/Gcal	kg/Gcal
1997	167.90	7,000	38,786	9,263.88	126.87	
1998	164.49	7,000	38,786	9,263.88	124.29	
1999	162.72	7,000	38,786	9,263.88	122.96	123

[1] 1999 value used because most indicative of future conditions.