

COMMERCIAL FINANCING IN THE FIELD OF RATIONAL USE OF ENERGY (RUE) - POSSIBLE AND NECESSARY

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In the light of the recent European Commission ambitious objective of saving 20% of total primary energy consumption at Member States level by 2020, the Rational Use of Energy (RUE) represents simultaneously a purpose for Romania and a direction to follow for both economic operators and municipalities in Romania. Adopting as working method the critical investigation of the up to date experience accumulated by the Romanian Energy Efficiency Fund in the commercial co-financing of RUE projects, authors observed that investments aiming more efficient energy consumption imply moderate scale financial resources and generate spectacular results, firstly manifested in terms of financial savings. In this context and based on the evaluation of the results obtained by implementing a relevant for the paper scope portfolio investment projects, authors are proposing a technical and economic analyze of commercial co-financing by loans of RUE, and upon on the analyze results, conclusions and recommendations are stand out for an integrated approach of building large scale investment programs.

Keywords: Investment, loan, cash flow, savings, profitability

1. Introduction

The Romanian Energy Efficiency Fund (the Fund) is a financial institution providing commercial financing for investment projects mainly aiming the rational use of energy (RUE). Based on an initial grant provided by GEF to Romania, the Fund currently started to revolve US\$ million 8, part of the interest payments and principal repayments being used for new loans. The essential characteristic of the Fund in selecting and awarding its clients with project financial support is that the decision relies first on the attractiveness of the project and only second, on the client creditworthiness [1]. The Fund operation guiding aim is to promote a demonstrative effect, through the successful implementation of this GEF/IBRD project, and to increase the interest of the banking sector in supporting RUE investments in Romania. Officially launched in mid-2003, the Fund concluded 18 financing agreements amounting to US\$ million 8.837 for investments of about US\$ million 18. Today, the Fund is currently running 14 financing agreements of US\$ million 6.650 for RUE investments amounting to US\$ million 13.988.

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2. Financing RUE

The methods of project financial support may include debt financing, equipment leasing and services payment, and/or various combinations of these. The Fund is flexible both in terms of product mix and terms such that the Fund can offer the financial products demanded by the evolving market [2]. Before deploying all these methods the Fund is using its own expertise in assessing the ‘capability’ of the project to generate enough financial benefits which come from energy savings, with the main purpose to provide the project sponsor with the comfort that the investment generates enough income to easily cover its debt service. To date, only debt investments have taken place to energy end-users and energy services companies.

3. RUE case studies

UNIO Satu-Mare is one of the most important Romanian companies in machine building industry, important quantities of compressed air being required. A central compressed air station supplies with compressed air all factory departments where air is used for control actuators and cleaning operations. Initially, the station was equipped with three water cooled, two-cylinder



Figure 1 Old compressed air station [3]



Figure 2 New compressed air station [3]

reciprocating compressors 3V45 Reșița type (figure 1), installed in the ‘60s and driven by 300 kW electrical motors. The overall operating efficiency was estimated at 10% and the annual electricity consumption of the plant was about 4,464 MWh, i.e. an equivalent of US\$ 294,600. Moreover, the maintenance costs were high and spare parts were difficult to find on the market. On an average, the compressed air was supplied 200 h/month by three compressors and 300 h/month by two compressors. In both cases, compressors run at full load, the previous annual operating cost was US\$ 309,360.

The UNIO executive decided to modernize the compressed air station by installing four new Ingersoll screw compressors, three of SSR-ML 160 type and

one IRN-90K-CC type [3]. Three of them are driven by 160 kW asynchronous electrical motors (figure 2). The fourth compressor was specially designed to increase efficiency when running at partial loads and to diminish the starting current. It is driven by a variable speed 90 kW electrical motor powered via a frequency changer. This new configuration for the compressed air station would optimize the company's electricity consumption. The project was implemented during September 2004 – January 2005. The total investment size was estimated at US\$ 290,000. The expected results were: (i) about 34% electricity savings related to previous electricity consumption (440 toe), i.e. US\$ 102,000 per year; (ii) overall annual maintenance and personnel financial savings of US\$ 9,000; (iii) 1,530 tons of CO₂ or 27 tons of SO₂ emissions reduction.

The analysis of the cash flow for the next 10 years was performed based on 2004/2005 energy prices. The Simple Payback Period, the Internal Rate of Return (IRR), and the Net Present Value (NPV) have been computed based on a discount rate of 12%. For the total investment size of US\$ 290,000 and annual financial savings of about US\$ 111,000, the Simple Payback Period was estimated at 2.6 years with an IRR of 38%. As UNIO decided to invest for the compressed air station modernization, a loan of US\$ 130,000 (45%), in addition to the company's own contribution of US\$ 160,000 (55%), was obtained. The loan maturity was three years with 12 months grace period [3].

CET IASI SA, one of the largest municipal co-generation heat and power producers, operates two combined heat and power plants, CET I (using oil fuel)



Figure 3 Old district heating thermal sub-station in Iasi [3]



Figure 4 New district heating thermal sub-station in Iasi [3]

and CET II (using coal). The total installed power of the two plants is about 250 MWe. The thermal installed capacity is about 907 MWt, from which 260 MWt as steam for industrial consumers and 647 MWt as hot water for domestic consumers [3]. The fuel consumption structure of the company is as follows: 44% natural gas, 25% fuel oil and 31% coal. The company initiated a complex modernization project of the entire district heating system from Iasi city,

the major challenge being the improvement of its services, especially those ones provided to the domestic consumers. The project dealt with the modernization of 3 old thermal points (figure 3) and their related secondary network. New thermal points (figure 4) were equipped with new plate heat exchangers instead of tubular ones, pumps with variable speed drivers and automation and metering system. The thermal sub-stations buildings and all electrical equipment were modernized, too. The district heating ducts were extended for installation of the recirculation warm water pipe. All the pipes were replaced with the new pre-insulated ones.

The project was implemented during January 2005 – August 2005. The total investment size was estimated at US\$ 1,250,000. The expected results were: (i) fuel: the replacing of heat exchangers and pipes from the distribution network will diminish the heat losses; the company will save about 9,273 tons of coal during 2005-2011 (937 toe, annually) and related CO₂ emissions will decrease with approximately 25,500 tons in the same period [3]; (ii) power: the thermal sub/stations pumps were replaced with ones equipped with variable speed drivers and also having a higher efficiency, leading to electricity savings; as water flows will decrease, additional power savings will occur; (iii) maintenance, salaries etc.: new installed reliable equipment is completely automated; maintenance costs will decrease and, at the same time, salary costs, too.

The cash flow analysis has been performed for the next 25 years based on the energy and fuel costs in 2004 and 2005. The Simple Payback Period, the Internal Rate of Return and the Net Present Value were computed with an actualization rate of 12%. For the total investment size and considering annual energy savings varying from US\$ 206,000 to US\$ 229,000 depending upon the evolution of the domestic consumers' number estimated by the company, the Simple Payback Period was estimated at 6 years. Thus, the company decided to invest US\$ 1,250,000 for modernization of 3 thermal points and their related distribution network. Being an energy efficiency project, the company applied for a loan of US\$ 980,000 (78%), the company participation being of US\$ 270,000 (22%). The loan was for 2 years, with 6 months grace period [3].

SOMES Dej is a pulp and paper mill that carries on its activity since 1963. The company business is the manufacturing and marketing of bleached and unbleached kraft pulp, bleached and unbleached packing paper and paper for writing and printing. The annual production is 40,000 t of paper and 70.000 t of pulp, out of which 40,000 t are sold abroad. The company is operating a CHP plant, equipped with 3 steam turbines of 15 MW. The overall electricity consumption of the company during 2004 is estimated to about 97,286 MWh. The mill is also consuming steam on three pressure levels: 40 ata, 13 ata and 4 ata. The boilers of the CHPP facility are fueled with natural gas, wood waste and black lye. The annual natural gas consumption was 31,908,000 Nm³/year (equivalent of

25,688 toe), while the renewable energy consumption (wood waste and black lye) is the equivalent of 43,470 toe. The main steam consumer is the paper machine (figure 5). The steam is condensed inside 30 cylinders used to dry the paper/pulp. The cylinders are grouped on three levels of pressure/temperature. The condensate resulting from the first group is expanded and the resulting steam is used to heat the second group of cylinders, and so on. The final condensate is collected and sent back to the heat plant for recovery purposes.



Figure 5 The paper machine in Söms Dej pulp and paper mill [3]



Figure 6 Steam/condensate system of the paper machine [3]

Söms decided to invest in the modernization of the steam/condensate system of the paper machine (figure 6) and in the implementation of an energy monitoring system. The diminishment of energy bill and the mitigation of overall environment impact of pulp and paper processing were major goals. The modernization of the steam/condensate system of the paper machine consisted in regrouping the drying cylinders on levels of pressure and temperature. This would ensure a better control of the drying temperature for pulp/paper and a higher quality of the products and productivity of the paper machine, accordingly. The energy monitoring system should survey and record electricity consumption, natural gas flows, water and steam/condensate flows; high energy consumption equipments should be detected and enhancement of operators' attitude to save energy should be provoked. Projects were implemented between September 2005 and October 2006.

The total investment size was estimated at US\$ 940,000. The main resulting features of the projects are (i) annual natural gas savings, generated by the two projects, have been estimated at 1,403,650 Nm³/year (equivalent of 1,130 toe); annual electricity savings were estimated at 486,4 MWh/year, i.e. equivalent of 140 toe [3]; (ii) monitoring and recording of water and steam/condensate flows will help operators to save energy and to select equipments that could be optimized; (iii) pollutant emissions, mainly CO₂ emissions, should decrease with 2,800 t/year [3].

The cash flow analysis has been performed for the next 20 years based on 2004 and 2005 energy prices. The Simple Payback Period, the Internal Rate of Return and Net Present Value were calculated for an actualization rate of 12%. For the first investment of US\$ 540,000 and financial savings of US\$ 446,200, the Simple Payback Period was 1.2 years. For the second investment of US\$ 400,000 and financial savings of US\$ 113,400, the Simple Payback Period was 3.5 years. The company's management decided to invest US\$ 940,000 for implementation of the two energy efficiency projects and applied for a loan of US\$ 752,000, the company assuring the rest of 20%, i.e. US\$ 188,000 from own sources. The loan maturity is 4 years, with 12 months grace period.

Rovinari city, located in Gorj County, has a population of about 14,000 inhabitants. Initially, the street public lighting was provided by 214 devices and the ambient lighting by 733 devices. The lighting system had an installed capacity of 106 kW. It is important to notice that the street lighting covered only 71.5% comparing to the existing poles, and the ambient lighting covered 100%. The maintenance costs of the public lighting system were significant, especially due to short life span of the lighting devices.

The Local Council has decided to modernize the public lighting system, including street and ambient lighting, by installing new lighting devices on every pole in the city [3]. The new high pressure sodium lighting devices with the rated power varying between 36 W and 250 W are high efficient and have a great lighting efficiency. The life span of new lighting devices is between 12,000 and 24,000 hours. The installed capacity of the modernized system is about 61 kW. The new lighting devices with installed capacities over 150 W were equipped with „dimmer” type relays, which can generate savings of up to 35%. The project was implemented during November 2005 – May 2006.

The total investment size was estimated at US\$ 125,000. The expected results were: (i) electricity savings of about 164 MWh per year (47 toe annually), i.e. 15,000 US\$/year; (ii) financial savings due to the maintenance costs decreasing of 12,000 US\$/year in the first 5 years of operation; (iii) annual CO₂ emissions decrease of approximately 182 tones.

The cash flow analysis was performed over 20 years based on 2005 electricity prices. The Simple Payback Period, the Internal Rate of Return and the Net Present Value were computed with an actualization rate of 12%. For the total investment size and considering annual energy savings of US\$ 27,000, the Simple Payback Period was estimated at 4.6 years. The Local Council of Rovinari has decided to invest US\$ 125,000 for the modernization of the public lighting system. In this respect, the Local Council has applied for a loan of US\$ 100,000, the own contribution being of US\$ 25,000 [3]. The loan was for 4 years, with 12 months grace period.

4. Expected Results and Discussions

In Unio Satu-Mare project, annual electricity savings are estimated at about 440 toe, the environmental impact being reduced as emissions should be decreased with 1,530 tons of CO₂ and 27 tons of SO₂; one should also note that the lubricating oil of new air compressors is biodegradable. In CET Iasi project, the fuel savings over the period 2005 – 2001 should be of 9,273 tons of coal during 2005-2011 (937 toe, annually) and related CO₂ emissions will decrease with approximately 25,500 tons (3,550 tones per annum), for the same period. In Somes Dej project, the annual natural gas savings generated by the two projects were estimated at 1,403,650 (equivalent of 1,130 toe annually), the annual electricity savings were estimated at 486.4 MWh/year, i.e. equivalent of 140 toe and the pollutant emissions, mainly CO₂ emissions, should decrease with 2,800 tones/year, accordingly. In Rovinari Local Council project the annual electricity savings were estimated at 164 MWh per year (47 toe annually) and the annual CO₂ emissions at approximately 182 tones per annum. For each previously considered project, estimated and the achieved annual performances in 2006 are presented in Table 1.

Table 1

RUE Projects Annual Performances in 2006

Project & Commissioning Date	Estimated Annual Performances			Achieved Annual Performances		
	GPT (years)	Energy (toe)	CO ₂ (tones)	GPT (years)	Energy (toe)	CO ₂ (tones)
Unio Satu-Mare: Replacement of old air compressors with highly efficient screw air (commissioned in January 2005)	2.6	440	1,530	1.6	711	2,227
CET Iasi: Modernization of 4 district heating substations and the related distribution networks (commissioned in September 2005)	6.0	937	3550	12.6	447	6,843
Somes Dej: Paper machine steam & condensate system modernization. Energy Monitoring System (commissioned in October 2006)	1.7	1,130	2,807	2.5	774	1,701
Rovinari Local Council: Modernization of public outdoor lighting system (commissioned in May 2006)	4.6	47	182	6.4	34	130

In Unio Satu – Mare project the achieved Gross Payback Period smaller than the loan maturity. In CET Iasi project the loan maturity is far from the achieved Gross Payback Period. One explanation for the decision to reimburse the loan in two years could be the important cash flow availability as CET Iasi is an important power producer. In Somes Dej project the achieved Gross Payback Period smaller than the loan maturity. In Rovinari Local Council project the Gross Payback Period exceeds the loan maturity.

For all projects, the project sponsors have monitored the energy savings resulted after project completion. The discrepancies between estimations and results could come from less severe winters in the heating season, in the case of CET Iasi, or from an operation less than one year.

6. Conclusions

The Romanian Energy Efficiency Fund is currently running 14 financing agreements of US\$ million 6.650 for RUE investments amounting to US\$ million 13.988. Four of already completed energy efficiency investments have been presented.

In each case, after performing technical and financial analyses of possible investment, the project sponsors were comforted by the Fund experts that based on financial benefits which come from energy savings the investment generates enough income to easily cover their debt services with one exception: CET Iasi [1]. In other words, investments are profitable or social impact is to be considered. Guidance was provided not only in the initial stage of performances evaluations but also during the contracting phase, implementation and commissioning and operation and monitoring results till the complete payment of debt service. Under such approach, including public institutions, without having specialized personnel, decided and succeed to invest in RUE projects (i.e. the case of Rovinari Local Council). Estimations presented to project sponsors were more pessimistic than the results monitored in the operation stage.

To date, the Fund is the unique financial institution performing an operational procedure centered on the technical and financial analyze of proposed project [2]. Decision for awarding commercial co-financing is primarily taken only after deciding if the annual generated cash – flow after project implementation is enough to help client to properly cover the debt service. Based on the information gathered from the existing Fund project portfolio, one should note that the profitability of RUE investments was certainly revealed.

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