CAPITALIZATION OF RENEWABLE ENERGY SOURCES: ROMANIAN CASE STUDIES

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One of the major challenges of the recent integration of Romania in the European Union is the extension of use, at national scale, of Renewable Energy Sources (RES). Targeting private operators and municipalities, authors have as objective to deliver an investigation on the interesting 'Acquis' in financing and implementing RES projects in Romania. Using as method of investigation the accurate screening of their experience as well as the extended international experience in the field, authors have reviewed in the present paper different possibilities in RES investment financing, frequent obstacles and barriers, and ways for overcoming them. Recent results are motivating authors to consider the national experience of an encouraging success and to act towards the capitalization of such investments replication potential to a national and regional scale.

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

1. Introduction

The Romanian Energy Efficiency Fund (the Fund) is a financial institution providing financing for investments aiming the rational use of energy (RUE) and the use of renewable energy sources (RES). Since its official launching mid-2003, the Fund concluded 18 financing agreements and started to revolve the initial US$ million 8 available for awarding and contracting new loans [1]. Presently, the Fund is running 4 financing agreements of US$ million 2.187 for RES investments amounting to US$ million 4.012 [2]. Methods of project financial support may include debt financing, equipment leasing, and payment for services, and/or various combinations of these. The financing is flexible both in terms of product mix and terms such that the Fund can offer the financial products which the evolving market demands [3]. 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 [4]. To date, only debt investments have taken place to energy end-users and energy services companies.

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2. RES case studies

Transgex Oradea is involved in geological explorations and surveys for geothermal water resources, drilling of geothermal wells and provision of sanitary hot water and heat to the general public (private, public and institutions). The company holds concession licenses for geothermal areas representing approximately 50% of the whole country's resources. Before project implementation, geothermal energy covered 50,000 Gcal/year, about 5% of the annual consumption of heat in Oradea city, the remaining 95% being supplied by local CHP plant. The financial gap between the heat price in CHP and the price paid by final consumers is currently subsidized from the local budget.

Transgex decided to develop the geothermal heat supply business and to invest, based on an association contract concluded with Oradea Local Council, in district heating system modernization. The investment consisted in the connection of 5 thermal substations in Oradea city (Iosia Nord living area) to the geothermal

Figure 1 Geothermal station before modernization [3]

Figure 2 Geothermal station after modernization [3]

well no. 4767, the realization of a geothermal substation next to the well (figures 1 and 2) and the full modernization of five thermal substations by using plane heat exchangers, high energy efficiency pumps and automation equipment. The project first stage initiated in 2004, requested an investment of USD 706,000. The second phase, consisting of USD 472,000, raised the investment size to USD 1,178,000, all inclusive. Additionally two hot-water winter peak load boilers were installed. The project was expected to lead to primary energy saving of 42,000 Gcal/year, by using RES instead fossil fuel and labor, maintenance financial savings [5].

The analysis of the cash flow for 10 years has been performed based on 2004/2005 energy prices. The project feasibility was assessed by computing the Payback Period, the Internal Rate of Return (IRR), and the Net Present Value (NPV), based on a discount rate of 12%. Considering the total investment size and annual financial savings of USD 472,000, the simple payback period was estimated at 2.5 years. The financing first phase was 60% covered by a loan and

the rest by Transgex and others; the second phase of investment was covered by Transgex. The USD 425,000 loan had a maturity of 3 years and a 6 months grace period. For covering a part of the first phase investment Transgex concluded ”an emission reduction purchase agreement” with the Danish Environmental Protection Agency, for the project "Geothermal Energy in Oradea - Area II and Beius". The "crediting period" is from January 1st, 2005 to December 31st, 2012. The total amount to be paid by the Danish party to Transgex is EUR 473,400, consisting of (i) an advance payment of EUR 54,600 (which Transgex already received) and (ii) 8 equal annual payments of EUR 52,350 each, starting in 2006.

Ulerom Vaslui was established in 1974 and produces oil for food industry using sunflower and soybeans. For the sunflower and soybeans processing the company operates 4 saturated steam boilers, 3 of them on natural gas while the 4th by using sunflower peels. Initially, the company’s capacity of sunflower processing was 5,000 tons per month for a period of 5 months per year. This activity generated about 450 tons/month of sunflower peels. The company increased its processing capacity up to 8,000 tons/month, one of the effects being the generation of 1,200 tons/month of sunflower peels. Imminent step would be the capacity increase up to 9,000 tons/month, leading by consequence, to a quantity of 1,350 tons/month of sunflower peels.

Ulerom decided to invest for extension of sunflower peels use for steam generation, and consequently to diminish the energy bills by reducing natural gas consumption [5]. The project consisted in the installation of a new sunflower peels fired boiler with the rated capacity is 10 t/h of saturated steam at 15 bar. By installing the new boiler the entire quantity of sunflower peels will be used for steam production, the old sunflower peels based boiler being kept in a stand-by

Figure 3 Natural gas fired old steam boiler

Figure 4 Sunflower peels fired new steam boiler

mode (figures 3 and 4). Some other smaller RUE projects were also implemented: installation of steam and water meters, pressure and temperature regulators, power factor compensation units and a 55 kW blower for sunflower peels transportation.

The project was implemented during April-October 2005. The total investment size has been estimated at USD 560,000. The following savings were expected: (i) fuel savings as the installation of the new boiler based on sunflower peels will lead to 557,000 Nm^3 of natural gas savings in the first year; in the following years the savings will reach 835,000 Nm^3/year (ii) maintenance, salaries etc. financial benefits; savings are also generated by a better peels management.

The cash flow analysis has been performed for the next 20 years based on 2004 and 2005 energy and fuel costs. The Simple Payback Period, the Internal Rate of Return and the Net Present Value were calculated for an actualization rate of 12%. The analysis has also taken into consideration the 2 stages of capacity increase that company intends to perform. For the total investment size and considering the annual savings, the Simple Payback Period was estimated at about 4.3 years. Thus, the company decided to invest for the installation of a new sunflower peels fired steam boilers. Being an energy efficiency project Ulerom applied for a loan of about USD 448,000 (80%), the own participation being of USD 112,000 (20%). The loan was for 4 years, with a 12 months grace period.

Oradea County Clinic Hospital is the largest medical care center form Bihor County. The hospital's 'Stationary I' 700-bed hospital building is located in Oradea city and was built in 1987. The building itself is structured in three different corps A1 and A2 (9-floor buildings) and A3 (a 5-floor building) and is equipped with heat plant for steam generation, built in 1988, and a thermal substation connected to district heating system. The heat was generated in three light fuel oil fired steam ABA boilers (figure 5), each of 1 tone/hour and 16 bar.

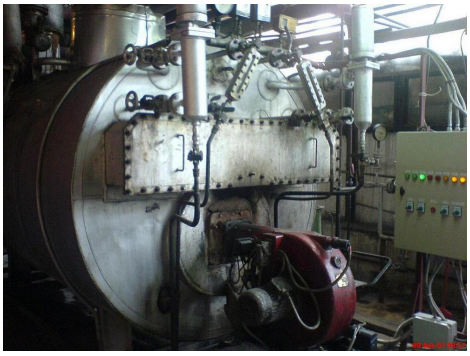

Figure 5 Old light fuel oil fired ABA type boiler

Figure 6 New wooden pellets fired BINDER type boiler

The Executive Board of the Hospital decided to install two new wooden pellets fired steam boilers [5], in order to diminish the energy costs by total removal of light fuel oil use. The project consisted in dismantling two from three existing outdated steam type ABA boilers fuelled with light fuel oil and in installing two new modern boilers fired with wooden pellets (figures 6): one with

the rated power of 0.5 MW_t will generate steam for sanitary purposes and the second with the rated power of 1.4 MW_t and will generate hot water for heating. For safety reasons, the current connection of the hospital to the city district heating system will be kept functional and operated only to the peak of the heat demand curve (during severe winter conditions). The main features of the project were the total removal of light fuel oil consumption, by installing the new wooden pellets fuelled boilers for steam and for hot water generation for use and heating purposes, and pollutant emissions reduction through the diminishment of CO_2 emissions. The project was implemented during October 2006 – June 2007. The total cost of the project was estimated at USD 405,000. The following savings were expected: (i) fuel savings, as the installation of the new boilers based on wooden pellets will save 199 tones of light fuel oil; (ii) maintenance, salaries etc.

The cash flow analysis has been performed for the next 20 years based on the 2005 and 2006 energy and fuel costs. The Simple Payback Period, the Internal Rate of Return and the Net Present Value were calculated for an actualization rate of 12%. For an investment size of USD 405,000 and considering the annual savings, the Simple Payback Period was estimated at about 5.6 years. Thus, the hospital's management decided to invest USD 405,000 for installation of new wooden pellets boilers for hot water and steam generation. Being an energy efficiency project the Executive Board applied for a loan of about USD 324,000 (80%), the hospital contribution to investment being of USD 81,000 (20%). The loan has a maturity of 3 years, with a grace period of 6 months. The loan reimbursement will be made on a quarter rate basis.

Omnimpex Hârtia Busteni operated as a private paper mill since 1882 up to its recent privatization in 2000. The company had in operation 3 horizontal Pelton type hydro units for power generation, other 2 horizontal Francis type hydro units being currently out of operation. All Voith hydro power units have been supplied at the beginning of last century. Together with Omnimpex Hârtia, the Refinery "Steaua Română", belonging to the same holding, is one of the most important crude oil processors in Romania. The refinery presently holds a license of Independent Power Producer (I.P.P.), issued by the National Electricity Regulatory Body (A.N.R.E.), as in the refinery power generation facilities are in operation. Both Omnimpex Hârtia and the refinery have concluded a renting management contract, the whole generated power in Busteni being totally sold by the refinery to the regional electricity supplier. Presently, Omnimpex Hârtia revenues are generated from a monthly flat fee and from another 'power generated' related payment, both paid by the refinery.

The Executive Board of Omnimpex Hârtia decided to invest in the installation of new hydropower equipments and the replacement of the existing water source caching facilities and driving pipelines [5]. The aim of the project is

the increase of Omnimpex Hârtia S.A. revenues (after being qualified as green electricity producer and supplier) as result of an increased amount of 'green' electricity supplied exclusively to the refinery. A reduction of the refinery's exposure (including financially) to the electricity supplied from the national grid will be provided. The project consists in the modernization of existing hydro power generation facilities from location Busteni 1 'Fierastrau', the dismantlement of existing equipments from location Busteni 2 and the installation of new facilities in the location Busteni 2 'Downtown'. The new hydro power facility installed in Busteni 1 location will be a hydro power Pelton type vertical turbine with the rated power of 700 kW and the new hydro power facility in the new Busteni location 2 called 'Downtown' will be similar with the previous described, respectively a Pelton type vertical turbine, but the rated power will be 450 kW. The main features of the project are: (i) an increased amount of 'green' electricity supplied exclusively to the refinery; (ii) environment impact mitigation. The project will be implemented starting with January 2008 and up to mid-2009. The investment, having a total estimated size of USD 1,869,000, will lead to fossil fuel savings of 1,012 tones of oil equivalent.

The cash flow analysis has been performed for the next 20 years (against a standard lifetime of hydropower units of 30 years) based on the electricity prices in 2007. The Simple Payback Period, the Internal Rate of Return and the Net Present Value were calculated for an actualization rate of 12%. Knowing that the total investment was about USD 1,869,000 and considering the annual financial savings earned after the project completion, the Simple Payback Period was estimated at about 4.4 years. Thus, the company's management decided to invest USD 1,869,000 for installation of new hydro power units. Being committed to modernize the existing hydro power generation facilities in order to increase the annual electricity production to cover own demand and partly, the refinery electricity demand, Omnimpex Hârtia applied for a loan of USD 990,000 (53%), the company participation of USD 879,000 (47%) being covered with financial resources from a bank or from structural funds. The loan maturity is 5 years, with 9 months grace period, reimbursements being made on a quarter rate basis.

3. Expected Results and Discussions

In Transgex Oradea project, annual savings were estimated at 5,800 toe and the annual CO_2 emission reductions to 14,300 tons. As long as subsidies for domestic heating are provided, the use of a cheaper heat source will also lead to financial savings for municipality and heat customers. In Ulerom Vaslui project, the annual savings have been estimated at 557,000 Nm^3 in the first year (470 toe). In the next years the project will generate savings of 835,000 Nm^3/year, 710 toe equivalent. CO_2 emissions will be reduced by approximately 1,000 tons in the first

year and by 1,500 tons/year in the following years. In Oradea County Clinic Hospital project, the annual savings have been estimated at 199 tones (187 toe) and CO_2 emissions reduction at 445 tons. In Omnimpex Hârtia Busteni project, the total estimated energy savings will be 3,530 MWh/year (1,012 toe equivalent) and the reduction of CO_2 emissions to 2,409 tones a year. The estimation regards the refinery Steaua Româna and excludes the amount of green electricity used by Omnimpex Hârtia, for covering its own electricity demand. For all projects, annual performances are presented in Table 1.

Table 1

RES Projects Annual Performances

Project & Commissioning Date	Estimated Annual Performances			Realized Annual Performances		
	GPT (years)	Energy (toe)	CO_2 (tones)	GPT (years)	Energy (toe)	CO_2 (tones)
Transgex Oradea: modernization of geothermal substation and 5 DH substation and related networks (commissioned in 2005)	2.5	5,774	14,160	2.6	5,627	22,169
Ulerom Vaslui: new sunflower husk steam boiler (commissioned in March 2006)	4.3	676	1,487	2.6	1,110	2,441
Oradea County Clinic Hospital: new 0.5 MW Steam and 1.5 MW Hot Water Boilers fired with Wooden Pellets (commissioned in August 2007)	5.6	187	445	n.a.	n.a.	n.a.
Omnimpex Hârtia Busteni: installation of new hydropower equipments for industrial use in Refinery Steaua Româna (commissioned in June 2009)	4.4	1,012	2,409	n.a.	n.a.	n.a.
Overall RES Investments	**4.1**	**7,649**	**18,501**	**2.6**	**6,737**	**24,610**

n.a. – not available

For two from presented projects, the host companies have monitored the energy savings resulted after project completion [1]. In the particular case of Transgex Oradea, the reduction units of CO_2 emissions have been monitored by a Hungarian specialized company as those reduction units have been transferred to the Danish Government in the frame of emission trading contract concluded with Transgex [2]. The discrepancies between emission estimations and results could come from the different approaches used by Fund experts and Hungarian experts in assessing the conversion efficiency from fossil fume to heat in the CHPP. For Ulerom Vaslui case, things are simpler; the extended use of sun flower husks for steam and hot water purposes lead to a decrease of natural gas consumption grater than initially considered by the Fund's experts and cheaper natural gas bills.

For the projects which are currently under implementation, the first results are to come by the end of 2007 and 2009, respectively [1].

4. Conclusions

The Romanian Energy Efficiency Fund is currently running 4 financing agreements of US$ million 2.187 for investments in renewable energy sources capitalization amounting to US$ million 4.012. Transgex Oradea has modernized a geothermal station and 5 related thermal substations, Ulerom Vaslui has installed a sunflower husks fired boiler, County Clinic Hospital Oradea has installed two wooden pellets fired boilers and Omnimpex Hârtia Busteni will replace existing micro hydro power generation facilities. In each case, after performing technical and financial analyses of possible investment, the project sponsors have been comforted that, based on financial benefits which come from energy savings and the investment generates enough income to easily cover their debt services. In other words, investments are profitable. Guidance is provided not only in the initial stage of performances evaluations but also during the contracting phase, implementation, commissioning, 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 RES projects (i.e. the case of Oradea county clinic hospital). To date, the Fund is the unique financial institution performing an operational procedure centered on the technical and financial analyze of proposed. 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 the client to entirely cover the debt service. Based on the information gathered from the existing Fund project portfolio, one should note that the profitability of RES investments was revealed.

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