



CASE STUDY: REFINERY "STEUA ROMANA" SA, Câmpina

Projects Name	New saturated steam boiler fired with light fuel oil and natural gas Modernization and rehabilitation of atmospheric distillation installation oven
Sector	Petrochemical industry
Borrower	Private company, REFINERY "STEUA ROMANA" S.A., Câmpina
Lender	Romanian Energy Efficiency Fund
Financing Starting Date	September 2006
Project Size/Loan Amount	USD 759,000 / 603,000

Summary

S.C. Refinery "Steaua Română" S.A. is one of the most important crude oil processors in Romania. "Steaua Română" S.A has been



founded in 1895. The company's object is the production and marketing of fuels, solvents, paraffin, special lubricating oils and petroleum jelly, and recently biodiesel. The company is processing every year 400,000 tones of high content paraffin crude oil extracted in the region.

The company is operating a thermal heat plant (THP) equipped with 3 boilers for superheated steam generation with a rated capacity of 28t/h and a steam turbine with the rated power of 2.5 MW. This facility generated during 2005 about 6,176 MWh of electricity. As the refinery is consuming more, the rest of the electricity (about 3,518 MWh) was bought from the national grid. The overall electricity consumption of the refinery during 2005 is estimated to about 9,694 MWh.

The refinery is also consuming steam on three pressure levels: 27 ata, 12 ata and 10 ata.

The boilers of the THP facility are fueled with light fuel oil produced in the refinery, and only in particular cases with natural gas. In 2005, the light fuel oil consumption of the company was about 14,887 tones/year (i.e. the equivalent of 13,994 toe).

The steam generated in the THP is mostly used for the technologic processing of crude oil within the refinery and in a small extent for heating and domestic hot water supply.

The atmospheric distillation installation oven is used to distillate an annual amount of 276,000 tones of crude oil. In 2005, for distillation purposes, the oven consumption was about 5,129 tones of light fuel oil (i.e. the equivalent of 4,821 toe).

The company's representatives intend to diminish further more the operational costs. Hence, by implementing the two projects, partially financed (79.5%) by F.R.E.E., the company will undergo important energy savings and will lower its environmental impact, by diminishing GHG emission.

Projects' description

The installation of new saturated steam boiler fired with light fuel oil and natural gas will generate energy savings of at least 27% out of the total light fuel consumption of the THP. However, one should note that the removal from operation of the superheated steam turbine will increase with 76% the electricity purchased by the refinery from the electricity suppliers.

The modernization and rehabilitation (including the thermal rehabilitation) of atmospheric distillation installation oven will generate energy savings of at least 4% out of the total light fuel consumption of the oven.

Aim of the projects

The aim of the projects is to diminish the energy consumption of the company and to cut the related costs. The installation of new saturated steam boiler will contribute to the increase of energy efficiency of steam generation. The steam turbine removal will eliminate the poor efficiency of electricity generation.

The modernization and thermal rehabilitation of atmospheric distillation installation oven are aiming at reducing the steam consumption by reducing heat wastes and at increasing its productivity. The main resulting features of the projects are given hereunder:



- **Light fuel oil savings.** The fuel savings expected to be encountered after the implementation of the monitoring system are about 17%.
- **Pollutant emissions reduction.** The reduction of natural gas will lead to diminishing of CO₂ emissions.

Economic evaluation of the project

The installation of new saturated steam boiler will be finished before mid of 2007. The modernization and rehabilitation (including the thermal rehabilitation) of atmospheric distillation installation oven



will start during May 2007 and will last for about 7 months. The total investment for the two projects is detailed in Table 1.

Savings

After the implementation of the two projects the estimated savings are presented below:

- Electricity.** The installation of new saturated steam boiler will lead to electricity savings of 197 toe/year being an equivalent of 687 MWh/year, i.e. 80,572 USD/year. The removal of steam turbine will increase the amount of electricity purchased with about 1,818 toe/year being an equivalent of 6,339 MWh/year, i.e. an additional expenditure of 732,189 USD/year.
- Light fuel oil.** In 2005 the company consumed about 18,815 toe as fuel. The light fuel oil savings generated by installation of new saturated steam boiler have been estimated at 2,989 toe/year, being an equivalent of 3,180 tonnes/year, i.e. 1,067,491 USD/year. Modernization and rehabilitation of atmospheric distillation installation oven will generate savings of about 233 toe/year, being an equivalent of 248 tonnes/year, i.e. 96,072 USD/year. Every year it will be an equivalent of 3,428 tonnes/year of light fuel oil savings. The total financial savings will reach 1,163,563 USD/year.
- Maintenance, works.** Realization of two projects will finally lead to diminishing of the maintenance costs by increasing its reliability and the personnel costs by installing the automation system. The savings have been estimated at about 51,893 USD/year.

Financial evaluation

The feasibility evaluation of the projects has been performed using the following criteria: the simple payback period, internal rate of return and net present value calculated for an actualization rate of 12% and a study period of 20 years for the first project and 10 years for the second project. Tables 2 and 3 present a synthesis of the financial analysis, the calculations being performed considering exclusively the financial savings coming from energy savings.

The company's management has decided to invest USD 759,000 for implementation of the two energy efficiency projects. The Romanian Fund for Energy Efficiency finances 79.5% of the entire investment, i.e. with a credit of USD 603,000, the company assuring the rest of 20.5%, i.e. USD 156,000 from the own sources. The FREE credit is for 4 years having a grace period of 9 months. Credit disbursement will be made every 3 months using equal installments, as the company has requested.

Expected Impact

The annual light fuel oil savings, generated by the two projects, have been estimated at 3,428 tonnes (equivalent of 3,222 toe) but the increase of annual electricity consumption with 5,652 MWh/year (equivalent of 1,621 toe) will finally lead to energy savings of 1,601 toe/year. After the projects implementation the CO₂ emissions will decrease with about 3,812 t/year.

Table 1

Item	USD*
Installation of new saturated steam boiler fired with light fuel oil and natural gas	580,000
Modernization and rehabilitation of atmospheric distillation installation oven	179,000
Total projects	759,000

* - The figures are VAT excluded.

Table 2

	Year										
	0	1	2	3	4	5	6	7	...	19	20
	kUSD	kUSD	kUSD	kUSD	kUSD	kUSD	kUSD	kUSD	kUSD	kUSD	kUSD
Initial investment	-580	-	-	-	-	-	-	-	-	-	-
Cash Flow	-580	282	282	282	282	282	282	282	...	282	282
Accumulated Cash Flow	-580	-298	-16	265	547	829	1,111	1,392	...	4,774	5,055
Discount Factor	1.00	0.89	0.80	0.71	0.64	0.57	0.51	0.45	...	0.12	0.10
Present Value of the Cash Flow	-580	-328	-104	97	276	436	578	706	...	1,495	1,525
Payback Period	2.1	years									
Discount Payback Period	2.5	years									
Net Present Value	1,525	kUSD									
Internal Rate of Return	49	%									

Table 3

	Year										
	0	1	2	3	4	5	6	7	8	9	10
	kUSD	kUSD	kUSD	kUSD	kUSD	kUSD	kUSD	kUSD	kUSD	kUSD	kUSD
Initial investment	-179	-	-	-	-	-	-	-	-	-	-
Cash Flow	-179	96	96	96	96	96	96	96	96	96	96
Accumulated Cash Flow	-179	-83	13	109	205	301	397	493	589	685	781
Discount Factor	1.00	0.89	0.80	0.71	0.64	0.57	0.51	0.45	0.40	0.36	0.32
Present Value of the Cash Flow	-179	-94	-17	51	112	167	215	259	298	332	363
Payback Period	1.9	years									
Discount Payback Period	2.2	years									
Net Present Value	363	kUSD									
Internal Rate of Return	53	%									

FREE financing advantages

- FREE is a unique Romanian financier in energy efficiency field;
- FREE offers low cost financing for companies;
- FREE offers flexible and attractive ways to guarantee the loans;
- FREE is actively supporting the companies during the energy efficiency project analysis;
- FREE offers technical assistance.