

OPET WORKSHOP- April 2002 SHP CASE STUDY PROJECTS IN ROMANIA

November 2001

A. Project BUSTENI SHP – 1.45 MW –

This project includes rehabilitation works for an old hydropower plant. The project, beside to be a refurbishment project, is interesting from the “historical” point of view and public demonstration as well.

1.1.General presentation of project Initiator

Project Initiator is the *Commercial Society HARTIA* from *Busteni* small town. Karl and Samuel SCHIEL brothers put this company in operation in 1882, producing paper and paper goods. The old name of this Society was “*Fabrica de hârtie C. & S. Schiel*” just to 1944. Due to the fact that for the production of paper asks a lot of power, there have been installed here from the beginning, power units with thermo or hydro turbines.

After the Second World War, the owner of this society was the Romanian state. The factory development made necessary the connection to the national grid. This connection provided the necessary power but the maintenance and repair of own hydro units were neglected. This was a general cause explaining why the majority of hydro units achieved between 1910 and 1933 were maintained in operation as they were, without refurbishment or replacement with new ones.

Now the company is privatized. The capital is 33.58 billion ROL. (some 1,300 thousand Euros). The company produces paper for writing, technical paper or vellum paper, and other goods from paper, as well. The company management is interested now in reducing the cost of power bought from the national grid.

1.2. Project's history

The plant named *Turbine 7* was achieved in 1911 and it is using both the hydraulic available potential of industrial water sources and the drinking water sources.

Another unit known as *Turbina 6* was installed in 1933. The *Turbine 7* unit is still in operation.

1.3. The site particularity

The Busteni city is situated on the Prahova river's shores and it is situated in a mountain area with many brooks, which are going down from high altitude. This particularity makes the available hydroelectric potential the most important renewable energy sources of the city. Also the refurbishment project has a good replicating potential.

The paper mill factory is the most important company of the city. Its evolution deeply influences the local social and economical life.

To provide the industrial water necessary in the industrial process, the company built an extensive collecting net of all water within its territory.

The small hydroelectric power station *Busteni 1* is situated at the superior limit of city, at the first step to broke the pressure of water's additions from mountains.

From here leaves a pipe with industrial water to the surge tank of production department.

Many tourists cross the plant to the wooded, high altitude recreation areas. The plant building should integrate in the natural surroundings.

1.4. Present status

The unit *Turbina 7* are composed by 3 Pelton rotors (turbines) situated along an horizontal shaft of 30 m length, which are rallying a synchronous generator rated 5 kV voltage and 60 A maximum current. The first two rotors were installed between 1910-1911 and the third in 1926. All turbines were been supplied by VOITH.

SIEMENS supplied the generators.

One of the turbines is using the hydraulic potential of drinking water pipe for the Busteni town and the others are using the industrial water pipes for the paper factory.

Being fabricated in different years, the turbines have different characteristics which don't reach optimum hydraulic available data. All three turbines produce, at present,

a maximal power of 200 kW, even the rated power is more than 700 kW. Because of unavailability period, which is very long, the maximum yearly energy of *Turbina 7* is about 1 GWh, even in high level hydraulically years.

The present unit *Turbina 6* consists of two Francis turbines with steel spiral chamber and horizontal shaft direct connected with the generator. The turbines were supplied by VOITH and SIEMENS as well. This unit is installed on the area named *Fabrica 1* where the available head is only of 41.8 m instead of 56.6 rated head of turbines. Now the unit is out of operation.

1.5. Proposed project *Busteni 1 SHP*

Based on the analysis of actual technical state of *Turbina 7*, it was established the most efficient solution for refurbishment. It consists in complete replacement of this unit with 2 groups characterized thus:

-One unit: Francis turbine with horizontal shaft, rated power 750 kW at 0.8 m³/s maxim flow and net head of 116 m. All these data correspond to the real potential on site for the industrial water pipes.

-One unit: Banki turbine with horizontal shaft, rated power 105 kW at 0,21 m³/s maxim flow and net head of 69 m. These characteristics are available on drinking water pipe.

The erection of these units is possible to make through connection to the existing pipes. The building of the power station should be renovated and restructured. Part of the building will be used for the hydroelectric units and their control systems. It remains a significant space available for other purposes. The project aims, in collaboration with OPET Romania ENERO and another local NGO, to organise this place for training, exhibition and demonstration purposes, as a public demo center for renewables.

For the maintenance works of the new units, it is possible to reuse the existing manual crane. Even as old as the hydro unit, the crane is proper to be used at erection and maintenance works.

The power station will be entirely automated and the supervision will be made by a dispatching center, within the factory.

The average energy production is estimated to 3,930 MWh/year for industrial water and 562 MWh/year for drinking water.

The capital cost of this project was estimated to 1,530,000 Euro and the annual maintenance expenses reaches some 90,000 Euro.

1.6. Proposed project *Busteni 2 SHP*

The proposed project has in view that:

- The water pipes are in operation and their condition permits connection of hydro units;
- The intakes have all devices for collecting and evacuation of solid particles from water;
- From surge tank of *Turbina 6* to the *Fabrica 2* site the existing pipes have 65 m net head available for 1.0 maximum flow;
- On the existing pipe from Prahova river intake to the *Fabrica 2* site, the available net head is of 16.9 m at 0.5 cm/s flow.

It is foreseen to retrofit the unit *Turbina 6* due to the fact that its rated characteristics correspond with available hydraulic characteristics from surge tank to *Fabrica 2* site. This unit shall be placed into new house renamed *Busteni 2*. This house will be equipped with 2 units characterized thus:

-One unit: Francis turbine with horizontal shaft with rated parameters:

- Net rated head 65 m
- Installed flow 1.0 cubic meter/s
- Installed power 540 kW
- Synchronous speed 1000 rot/min
- Nominal voltage of generator 0.4 kV

-One unit: Banki turbine with horizontal shaft, rated power 60 kW at 0,5 cm/s maximum flow and net head of 16.9 m. These characteristics are available on *Prahova* water pipe. This unit has an induction generator at 0.4 kV.

The estimated average production of energy is 2,843 MWh/year for the Francis unit and 318 MWh/year for the Banki unit.

The necessary investments are 1,450,000 Euro and the annual costs reach 75,000 Euro.

B. Project LESPEZI SHP 4.2 MW

The specificity of this new project is to be part of a potable water system.

1.1.General presentation

Project Initiator of this project is *Trade Company RAM PROD* from *Branesti, Dâmbovita County*. The company started its activity with one concrete line tiles in 1998. In 1998 they bought a small hydropower plant located in *Moroieni Commune*, performed some rehabilitation works on the water intake, and supply power to the grid under a contract with the utility *Electrica*.

In August 2000 the company bought an Exploration Licence for mineral water spring on *Scropoasa* area. Taking into account the specific requirements for the water quality, the company ordered a feasibility study to put in value the mineral water potential from all points of view. The studies pointed out the following outputs:

- Drinking water, supplying all localities situated between *Moroieni* village and *Târgoviste* capital of Dâmbovita County;
- Bottling PET water;
- Producing of juice and nonalcoholic drinks;
- Power supply from the available hydro potential of the main water pipe.

As the total cost for this project is about 56 millions Euro *RAM PROD* is looking to foreign investors in order to realize as soon as possible all objectives of the project.

1.2. Present status

Since August 2000, the *RAM PROD* performed from own financial resources the works to capture the main springs. Water quality tests and other civil works are in progress..

From the high altitude springs area to the site of the water consumers there is an altitude difference of 550 meters. The first consumers are 50 m lower, and the last consumers are even 250 m lower.

1.3. Proposed project

The proposed project has in view to use available hydraulic potential of water pipe from spring area to the first consumers. Two pipes will be installed, one for drinking water and second for bottled water. So the project has in view to install two units for drinking water pipe and one unit for bottled water pipe.

The main data are:

- Drinking water units:
- Type of turbines Pelton with horizontal shaft

-Net rated head	520 m
-Installed flow per each turbine	0.5 cm/s
-Installed power per each turbine	2050 kW
-Synchronous speed	1000 rot/min
-Nominal voltage of the generator	0.4 kV

-Bottled water:

Pelton turbine with horizontal shaft, at 110 kW rated power, 25 l/s maxim flow and net head of 450 m.