



**OPET CHP/DHC**



Energy Centre Hungary

## AES Borsod Biomass Retrofit Project



### Project background

The Borsod Heating Power Plant was established between 1951 and 1957 for the use of brown coal stocks of Borsod and to supply the Borsod industry region with energy. The power plant provided condensational electricity for the national joint grid system as well as for the surrounding plants, mines and settlements and it also produced industrial steam and hot water for the surrounding industrial buildings and Kazincbarcika city. When its contract-time expired in 2003 energy supply and heating functions of the plant ended. Within the competitive market conditions that were created by the introduction of liberalisation in the energy market the power plant was not suitable in its original form for operating on commercial basis neither from environmental nor from a business-based point of view: available low quality brown coal did not meet the environmental standards because of its high ash and sulphur content, furthermore high fuel costs and low efficiency made it impossible to sell the electricity produced. At the same time the site's infrastructure and operational facilities of equipments could be converted with relatively low cost making it possible to switch to up-to-date energy production. This conversion was also due to the favourable geopolitical conditions of fuel supply, namely the opportunity to switch to the use of firewood gained during maintenance tasks of nearby forests carried out within the regional forestry-plan.



## Project targets

Due to fuel switch the power plant produces electricity from renewable fuel and also fulfills several other tasks related to such production. The plant increases the proportion of green electricity production in Hungary by approximately 0,75% contributing to the accomplishment of the country's climate policy. Firewood gained from nearby forests – mainly found on nature reservation and national park areas – can be processed in a more economic way. The plant also creates demand for utilisation of agricultural by-products, encourages cultivation of energy plantations and improves the employment rate of the region.

## How did it begin?

Before the contract-time of coal based electricity production expired the Borsod Power Plant made some attempts to change fuel. In 2002 the plant introduced energy production from sawdust, which contributed to gaining experiences in the field of biomass utilisation. Later on wood chips and sunflower shell were also used as raw material and during the years 2002-2003 green electricity production reached a capacity of 70 GWh with the old technology. Based on these experiences a decision was made to convert two boilers to fluid technology where long-term and sustainable fuel supply can be solved from the region's forests.

## Highlights and main results of the project

Achievement of the Biomass Retrofit Project – switching to wood fuel – was made possible by the Hungarian legislation that regulate the execution of climate protection tasks. At the same time the project has other useful consequences as well, such as widening the domestic raw material source for electricity supply, stabilizing the economy of forest cultivation, increasing small region employment benefits, creating market facilities for agricultural by-products and - through energy plantations – also for producers who had to give up their agricultural activities. Another beneficial environmental effect is the significant reduction of emissions, especially of sulphur dioxide.

The renewable energy project has favourable effect on the nearby and farther regional employment conditions both in the short- and long-term via forestry activities, supplying companies and the power plant itself. Depending on the fuel supply it will be possible to convert more equipment for wood firing, therefore creating a good opportunity for growing quick rotation and high yield energy plantations – such as the energy grass bred in Hungary – which has significant importance in the North-Borsod region. Energy plantations on one hand absorb a great amount of carbon dioxide that causes greenhouse effect and on the other hand they create jobs in the region's labour market. AES Borsod Energy Ltd. signed a long-term contract with Energy-profit Ltd. for the receipt of the necessary amount of energy grass as raw material to supply a further boiler. Consequently, sowing for seed production purposes was carried out in the autumn of 2003 on 400 hectares.

## Presentation of the project

In December 2001 feasibility study was prepared, which was followed by a tender for the conversion of the boilers. In May 2002 the contractor was selected and the contract was signed in December. In April 2003 a contract was signed for the establishment of the wood chipper. The institution financing the investment was selected in 2002 August and fuel con-

tracts were signed in March 2003. Designing of the boilers began in 2003 January. The first boiler began production in September 2003, the second one in November.

### Main innovation

Most of the production equipments are based on the technology used in the past decades. The most significant transformation was on the boilers, which was based on the patent of the contractor who has many years of operation experience in the field of energy production from coal. Fuel supply is carried out by a high power knife-mill wood chipper and highly automated log table and conveyors made in Hungary that dose the fuel into it. The hammer mills directly in front of the boiler chop the wood into fine fraction in order to meet the technology needs.



Fig. 1. Wood processing and the mill-house

### Presentation of the plant

The Borsod Power Plant is located in the Northeast of the country between Sajószentpéter and Kazincbarcika. The region is heavily industrialized with industrial buildings of various sizes in the neighbouring area. During the privatisation in 1996 the owner became the American AES, the world's biggest independent electricity company.

### Technological details

The 100 t/h steam capacity, 72 MW capacity boilers produce steam with a pressure of 75 bar and temperature of 495 °C. Originally they are „Bergman-Borsig” coal dust fired boilers that have been previously converted and equipped several times with electrofilters in the end of the 1970s and beginning of the 1980s. The two boilers operating in the frames of the project have been converted to fluid combustion during the biomass retrofitting and the existing feeding system has been transformed as well. Vibrating feeders to the conveyors empties wood chips from the intermediate fuel-storing granaries. The material then moves on by gravitation to plate feeders that pass fuel into the boiler. 50% of the chips move on to further chopping and the refined granulated fuel chips are blown into the boiler by transport-ventilators. Ther-

mal efficiency of the boilers reach 90%.

Fuel for a period of two months capacity is usually stored as wood log. Besides logs a quantity of about a two-week capacity is stored in the form of wood chips. Wood logs are delivered to the power plant from 50 km district by road transport or railway. The wood is picked down from the transport vehicle by log-gripping machines. Dumping from the carriages and delivery to the wood chipper is done by a high power straddle crane with a wingspan of 49 metres. After chipping the fuel is carried on a cassette conveyor directly to the granaries placed in the boiler room. Wood chip reserves that are produced by a lower efficiency chipper are stored in the plant's existing fuel storage field. This fuel is transported to the old conveyors and boiler granaries by a bridge crane with grab that was used formerly in coal production. Continuous fuel supply is carried out by a wood chipper and its service system which together reach a capacity of 120 t/h. Size of the chips can be varied by changing the speed of the feeding system.

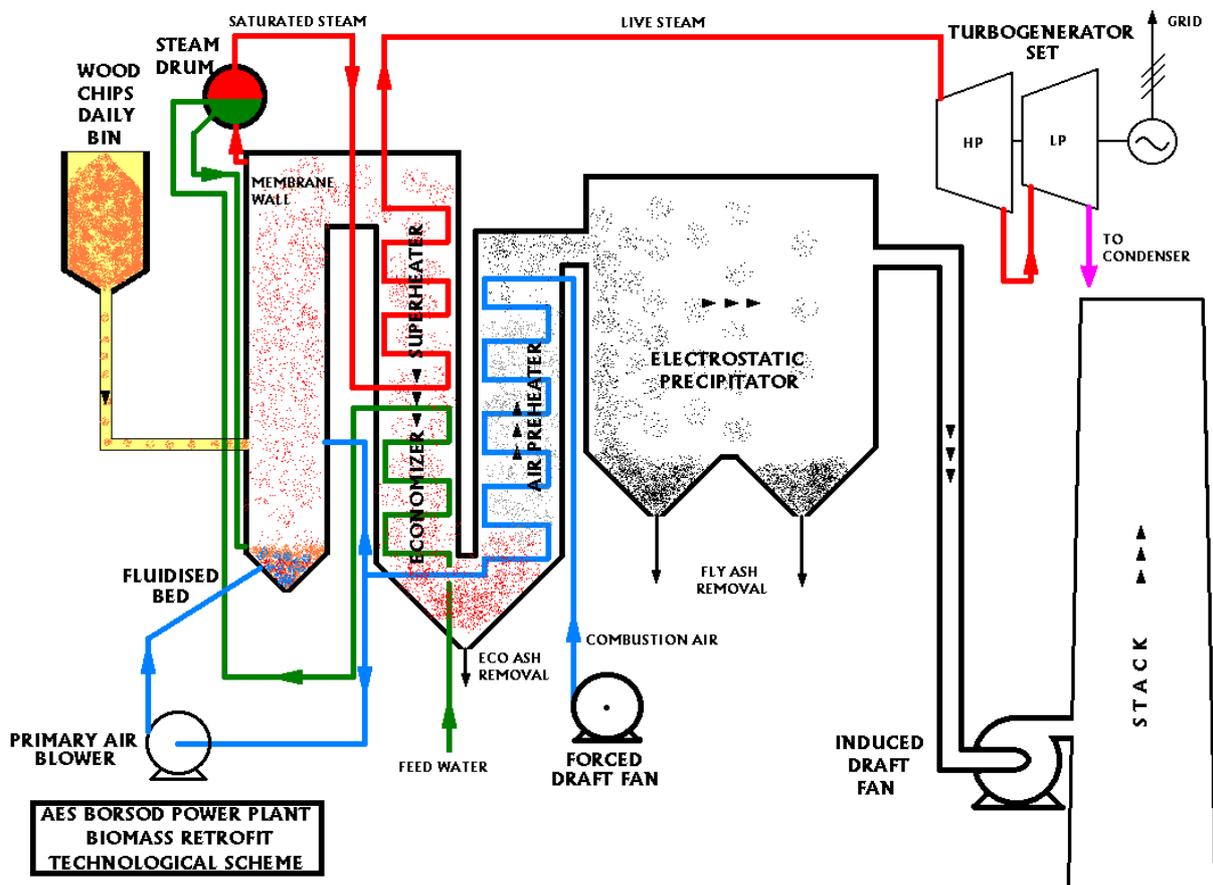


Fig. 2. Circuit diagram of the biomass plant

Continuous operation in the entire power plant requires 151 persons from which 2/3 work in the green electricity unit. A separate company of 15 employees carries out moving of material.

The plant operates continuously in three shifts according to a schedule that takes into consideration the alternation of peak- and valley hours.

## Energy figures

Biomass based electricity production connected to the national grid is 220 GWh/year. With enough fuel supply production can grow up to 300 GWh.

Heat capacity of converted boilers is almost 140 MW<sub>th</sub> while electric capacity may reach 40 MW<sub>e</sub>.

## Fuels/Raw materials

For basic fuel supply the Borsod Heating Power Plant signed long-term contracts (of 10 years duration) with four state-owned forestry corporations operating in the region. Two corporations located directly in the neighbourhood provide 70-80% of the firewood determined in the contract. 90-95% of the forests in Northern Hungary have hard crown (oak, beech, turkey oak, hornbeam) whose density may reach 1 t/m<sup>3</sup>. General humidity of firewood is around 35% with a heat value of 12 MJ/kg.

Firewood is delivered by road transport or railway to the plant. Delivery distance is 40 km in average but a smaller amount (3-4%) is transported by railway from more than 200 km.

According to the contracts 170-270 000 tonnes of fuel is delivered annually by the forestry corporations. Further 20-80 000 tonnes of firewood is expected from other suppliers. Amount of sawdust is about 30-40 000 tonnes and about 20 000 tonnes of sunflower shell is fired as well.

## Economic figures

Investment costs reach EUR 8,5 million (about HUF 2,2 billion)

Due to the Joint Implementation Agreement between the Dutch and Hungarian Government 20% of investment is financed by the Dutch partner. 45% of investment sources are guaranteed by investment loans and 23% is covered by a leasing contract.

## Environmental impact

The project is neutral considering CO<sub>2</sub> emissions. Other sources substituted by electricity production can be counted as the CO<sub>2</sub> emission saving achieved by the project.

With the fuel switch to firewood SO<sub>2</sub> emission will decrease with two units compared to coal firing. Other components will be within the emission standards. Emission levels are the following:

SO <sub>2</sub>	30 mg/Nm <sup>3</sup>
NO <sub>x</sub>	400 mg/Nm <sup>3</sup>
CO	150 mg/Nm <sup>3</sup>
Dust	30 mg/Nm <sup>3</sup>

Because of the low ash content of the fuel the amount of ash produced is almost two units below the level produced in coal firing. It is also environment friendly and can be utilised in agricultural-biological processes, therefore there is no need for dumping and problems of soil- and live water pollution can be avoided.

### Ownership of the plant

AES Corporation is the world's greatest independent electricity producing company. It has 150 operating power plants in 23 countries and carries out electricity supplying activity in several places. AES owns four firewood based power plants operating with different technologies in the USA.

### Main manufacturers and distributors/maintainers

Conversion of boilers was carried out by the TRANSELEKTRO-VEIKI consortium. The wood chipper manufactured by the Italian GLOBUS was put into operation by GÉPSYSTEM Ltd. who provided their self-designed and -manufactured service equipments.

Company	TRANSELEKTRO	VEIKI	GÉPSYSTEM
Contact person	Géza Voltay	György Pláveczky	Elek Horváth
Telephone	20/924-8911	30/984-7519	30/979-1612

### Additional information

Project director: Dr. István Ávéd  
Tel.: 30/953-4151  
E-mail: [istvan.aved@aes.com](mailto:istvan.aved@aes.com)