

# MINI-HYDROELECTRIC PLANT

# COTTBUS (Germany)

Hydraulic energy has been used as a renewable energy source throughout time. Having in the past driven the wheels in a grain mill, hydraulic energy largely contributed to electrification in Europe before being superseded by fossil and nuclear fuels. Taking advantage of technological advances and the support offered by different governments, small hydroelectric plants can be (re) exploited at low cost. So, in 1996, the Cottbus public services (Stadtwerke) decided to build a power station where the electricity produced is injected to the local electricity company's network.

## THE CITY

Along the Polish border, near the famous Spreewald county, Cottbus, with a population of 108,000, is the main city in the Basse-Lusace region. A crossroads for ancient trade routes as well as culture. For almost 1,500 years, it has been home to a Slavic minority: the Sorabes.

Even though the fabric of the regional economy has long been known for its textile industry as well as underground lignite mining, Cottbus now houses several administrative centres and service-oriented companies along with a university campus specialized in science.

### Climatic information:

Average yearly temperature: 8.9°C



## CONTEXT

Development, while respecting the environment and preserving their cultural heritage, has always been the centre of Cottbus' concerns. Although the urban landscape has profoundly changed, the growth of the mining and textile industries in the 19<sup>th</sup> century did not reduce amenity space in the region. One third of the urban area is currently dedicated to parks and groves, making Cottbus a very well known Green City.

Leading the new *Länder* in the field, Cottbus has moulded its urban policies to the goals set in Agenda 21. Awareness and participation of each and every citizen, whatever his or her age, has largely contributed to the success of the operations carried out. The following are only the most recent operations:

- "Construction of a photovoltaic facility for a grammar school". Renewable energies have found their place in the physical science programme and students are attracted to the availability of natural resources.
- "Energy efficiency in Cottbus schools". Water and energy consumption programmes established on the basis of awareness of the current resources available.
- "ÖKOPROFIT Cottbus". In order to reach a compromise between economic profitability and environmental consciousness, several companies in Cottbus, through a national network, have set their sights on reducing consumption as well as volumes of waste by participating in training sessions and exchanges (this project concerns about twenty German cities).

The municipality is involved at different levels, but mostly encourages Cottbus companies to join the network in supporting partnerships (local authorities, chamber of commerce, consulting firms, etc.) and planning and coordinating the different action plans.

## EXPERIENCE OF COTTBUS

The energetic potential of the Spree River has been exploited in Cottbus since the 16<sup>th</sup> century. Long ago, the river, used water wheels to drive the hammers of a forge and from 1801, to drive the millstone for an oil and cereal mill. The mill and a diversion dam situated upstream have been listed Historic Monuments since 1986.

In 1995, the municipality decided to build a "run-of-river" hydroelectric power plant next to the old dam, with the aim of injecting the electricity produced into the local electricity network. This project comes within the framework of the THERMIE programme and was subsidised by the European Commission within the context of renewable energies.

Civil engineering works were carefully laid out (water intake, power plant building, fish pass) to respect the existing countryside and environment, and was approved by the Historical Monuments body. The power plant has a Kaplan-type turbine, with a near-horizontal axis, connected to a generator by a compensated thermal expansion coupling. Greasing and cooling units form a secondary independent circuit and prevent the by-products used from coming into contact with the river water.



Commissioned in December 1996, the hydroelectric facility produces up to 2,500 MWh per year, equal to the consumption of 650 households. It stops atmospheric emissions of 2,000 tons of CO<sub>2</sub>, 14.2 tons of SO<sub>2</sub>, 5.6 tons of NO<sub>x</sub>, 1.8 tons of CO as well as 360 kg of ash compared to fossil fuel combustion. Although the power plant is highly reliable and technically available, the amount of electricity produced is closely linked to the flow of the Spree River which is severely influenced by open-cast lignite mining.

<b>Owner and operator of the power station</b>	Elektroenergie-Versorgung Cottbus GmbH (Wholly-owned subsidiary of the Cottbus <i>Stadtwerke</i> )	
<b>Technical data</b>	Maximum electrical power:	290 kW
	Hydraulic head:	2.5 m
	Supply flow:	15 m <sup>3</sup> /s
<b>Economic data</b>	Total investment:	2.23 million €
	- European Commission:	1.27 million € (57%)
	- The Brandenburg <i>Land</i> :	0.20 million € (9%)
	- <i>Stadtwerke</i> :	0.76 million € (34%)
	Period of depreciation:	15 years

The electricity produced is sold at 0.077 €/KWH in accordance with German law on renewable energies (EEG) which went into effect on 1 April 2000. The power plant operator also offers a "green tariff" to customers, households or industries wishing to encourage the production of "ecological" energy. The profits from these sales helped finance a photovoltaic facility for a local grammar school.

At the same time, several awareness campaigns have been carried out with school classes and other groups interested in learning more about the hydroelectric power plant. Guided tours and presentations are given for the Open House as well as the National Mill Day on Whit Monday.



## EVALUATION AND OUTLOOK

Many positive elements have contributed to the success of the Cottbus experience and they can be said to have guaranteed success:

- the fact that there was a diversion dam already present on the river made civil engineering work much simpler in terms of cost and authorizations;
- using innovative technology for the hydroelectric equipment increased the facility's technical availability and ensured lower kWh production costs;
- a legislative framework easing the sale of "green" electricity produced from hydraulic sources;
- the different local operators concentrated on awareness campaigns early in the planning stages as well as during operating stages, which accelerated procedures and increased public approval.

While only 60% of the hydraulic power is exploited in Germany, it shows the important role communities, like the Cottbus example presented here, will have to play in the development of the mini-hydroelectric field in the decades to come.

## FURTHER INFORMATION

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