MINI –HYDROELECTRIC PLANT

XANTHI (Greece)

As a renewable energy source, hydraulic energy has always been exploited. Benefiting from technological progress and a policy of government support in many countries, small hydroelectric installations can be run for little outlay. Making this one of the corner stones of its durable development strategic plan, and with the constant objective of providing incentive for local initiatives, the municipality of Xanthi in Greece has decided to build a mini-hydraulic plant and inject the current produced into the National Grid.

THE CITY

Situated at the foot of the Rhodope mountains, in a rural region of Greece, Xanthi (33,800 inhabitants) is the regional capital of the prefecture bearing the same name.
After a tormented past linked to the history of Thrace, the town grew as a commercial, cultural and spiritual centre in the region. The tobacco industry, which developed there from the 18th century, helped to spread its renown across Europe and led it onto the road to prosperity.
Demokritos University and its different engineering departments is a real growth engine for regional economic activity.

Weather Information:
Average annual temperature: 14 °C (plain)

CONTEXT

Classified as a priority development area by the Greek government, the Thrace region is increasing its actions to promote its return to the centre of the political and economic stage. For this purpose, local authorities and Xanthi town council in particular, are combining forces to encourage the decentralization of decision-making structures and give more power to the regions. Informing their citizens and encouraging their active contribution in drawing up a durable local development plan form the basis of this strategy, which will give the town an essential part to play.

The master plan for this development, presented by the town council within the framework of local Agenda 21, covering the development of an urban area in its cultural, functional and environmental fields, was awarded a European prize (*European Prize for Sustainable Development* - Lisbon 1996, cited by Council of European Municipalities and Regions as one of the 18 best examples of durable development in Europe) as well as a global prize (*1998 Dubaï International Award for best practices*).

As part of the same scheme, a Regional Energy Office for Eastern Macedonia and Thrace (REO - EMT), which is headed by the Mayor of Xanthi, crystallized the town's hopes for a more decentralized energy policy. Local authorities are asked to take an active part in the region's economic development by promoting the implementation of programmes for energy efficiency and the use of renewable energy sources.

A few of the most representative operations include:

- organization and participation in the 4th national conference on RES (1992) and in a symposium held to present the regional energy situation and potential use of endogenous energy sources (in partnership with ELFORES -*Greek Renewable Energies Forum*- and the CRES -*Centre for Renewable Energy Sources*-, July 1996).
- preparation of a series of annual meetings on scientific research applied to environmental protection (June 2000),
- participation in programmes to promote energy efficiency in public buildings (restoration of the historic centre of Xanthi), biological treatment of wastewater and waste management with waste to energy recovery.

THE XANTHI EXPERIENCE

Translating the municipality's objective of setting an example in the field of local energy policy into a concrete project, the mayor of Xanthi took the initiative in the construction of a mini-hydroelectric power plant in the early 1990s. The design of the installation and work management were provided by Xanthi town hall's technical departments.

The power plant was built close to the towns of Chrysoulopli and Xeria, along an irrigation channel which supplies the farms in the plain with water collected 12 km upstream in the river Nestos. At this point, the channel has two successive falls causing a sudden 9.50 m drop in level. To exploit this hydraulic head, a 200 m long outflow channel was developed to supply water to a Kaplan horizontal shaft turbine (type "S"). The power plant is a "run-the-river" plant, with no reservoir dug because of its potential impact on the environment. The speed of flow in the irrigation channel can reach 24 m3/s but is subject to wide seasonal variations. For this reason, the turbine was sized so that it can run at a rate oscillating between 5 and 12 m3/s. Space for the installation of a second turbine with the same characteristics has also been planned. This should go into commission once the Thesaurus dam on the Nestos river is completed, and, among other things, should stabilize flow in the irrigation channel at 24 m3/s.

The civil engineering part of the project began in 1992 and electrical engineering was completed in March 1995. An electricity line was drawn over 150 m to connect the plant to the national *Public Power Corporation (PPC)* medium voltage network (20 kV). To meet the quality, reliability and safety requirements of the interconnected operation, measurements were taken to ensure that the effect of connecting the turbine to the network would comply with the manager's instructions. An electronic device is used for remote control and monitoring of the installation. Only one person is employed for maintenance and daily inspections.

The annual production of electricity of 5,200,000 kWh (the equivalent of about 1350 households' consumption), is all sold back to the PPC.
The municipality obtained joint financing from the European Union and the Greek Government for the project as part of the Development Programme for Eastern Macedonia and Thrace.

Technical data		*Economic data*	
Turbine:	Kaplan type "S" 938 kW	**Total investment:**	2.344 million €
Hydraulic head:	9.50 m	**- EU share:**	1.758 million € (75%)
Speed	5 - 12 m3/s	**- REO – EMT share:**	0.586 million € (25%)
Annual production:	5,200,000 kWh	**Annual income:**	312500 €

The power plant was inaugurated on 6 July 1996, officially closing the conference organized by Xanthi on the "development of endogenous energies in the region of Eastern Macedonia and Thrace". In June 1999, the project was awarded the first prize, presented by the CRES, in the competition for REN in Greece, as best initiative backed by a local government.

EVALUATION AND PROSPECTS

Xanthi has acquired a certain reputation in the Thrace region, by making itself the local relay for a national energy policy which is still largely centralized. Its participation in the creation of a Regional Energy Office has been a successful experiment in decentralizing decision-making structures in the sector, a real spearhead for a durable development strategy.

The installation of a mini-hydraulic power plant, decided by the town council, also provides the possibility of using irrigation channels for energy purposes, as long as there is an adequate hydraulic head available. The project's largely positive results, have been distributed at conferences or in the form of articles in local and regional press, in a move to incite healthy emulation by other local authorities in the region.

When you know that Greece has a high aeolian potential, an average of 300 days of sun per year and Europe's greatest geothermal potential, it seems that, on the one hand, the renewable energy sector in Greece seems set for a promising future, and on the other, local authorities will have a decisive role to play in the country's economic development.

The Development Programme instigated by the national electricity company PPC (1994 - 2003), quantifying the increased capacity of energy production based on renewable energy sources (in particular 17 MW extra for the mini-hydraulic plant and 37 MW for the wind powered production), simply confirm the way to go ...

FOR FURTHER INFORMATION

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INFORMATION ON ENERGIE-CITES

Author of the paper:	Sébastien Despont
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Sources:	paper on opening the Regional Energy Office of Thrace "Renewables and energy technologiy R&D", articles on the Xanthi geothermic basin, description of FYSIS "waste management" project and master plan for development of the town of Thrace.
Documents received:	"Small Hydroelectric Station of the Xanthi municipality" project e-mail with further information from Mr. Michos.
Other installations:	