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Promoting Energy efficiency to Local Organisations
through dissemination Partnerships in Europe
Best Actions for Collaboration in Countries
for a High efficient Use of energy in Structural funds

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Systematic implementation of small and medium CHP plants - Frankfurt - Germany

Since 1991 the implementation of decentralized CHP plants was promoted. In 2002 more than 70 plants (5 - 4000 kWel) operate, including micro-CHP, a Stirling – engine, a micro-turbine, a fuel-cell and innovative condensing techniques. Planning tools and an annual market survey are available.

Target Groups	Sector	Field
<ul style="list-style-type: none"> - Local authority - Decision makers - Energy utilities 	<ul style="list-style-type: none"> - Energy supply - Buildings (including municipal properties) 	<ul style="list-style-type: none"> - CHP - Third Party Financing - Contracting

ANALYSIS

BACKGROUND OF THE PROJECT

As founding member of the Climate Alliance Frankfurt is aiming at a 50% CO₂-reduction. The promotion of small and medium decentralized CHP plants has been a strategic task. Implementing CHP plants for on-site production of electricity and heat will result in a 30% reduction of the CO₂-emissions.

INITIAL SITUATION

At the start of the project the local utility was not in favour of decentralized CHP plants operated by their customers. In year 1992 the City parliament decided on a general remuneration fee for electricity from CHP of 0,07 Euro/kWh, because the regular fee of the utility was too low for economical operation of CHP plants. This local law lasted until 1998. There have been many obstacles as weak information and poor motivation of architects and planning engineers on CHP.

PROJECT DESCRIPTION

The Energy Department was systematically looking for buildings and city districts, where CHP may be implemented, offered consultation assistance and set up more than 140 feasibility studies. Together with the City of Hanover a planning tool (ENWING) was developed for technical and economical design of CHP in buildings and district heating. Regularly we set up a German CHP market survey. We organized workshops on CHP and have created a exchange-of-experience group of owners of CHP plants.

RESULTS OF THE PROJECT

Until year 2002 there are 70 decentralized CHP plants with a total power of 24.000 kW electrical power. The motors, mostly based on natural gas, range from 5 kW to 4000 kW. Small and medium CHP plants are operated in municipal buildings, kindergartens, old people's homes, industry and some district heating networks. In office buildings and hospitals CHP plants are often combined with absorption cooling machines (tri-generation). A 50 kWel CHP plant in an old people's home uses a condensing heat exchanger. The 800 kW CHP plant in the botanical garden is combined with a new invented "high temperature condensing unit" based on an absorption process raising total efficiency to more than 95%. In a field test the utility MAINOVA operates a 4-9 kW Stirling engine. There is an 200 kWel ONSI fuel cell and an 100 kWel micro-gas turbine in two swimming pools.



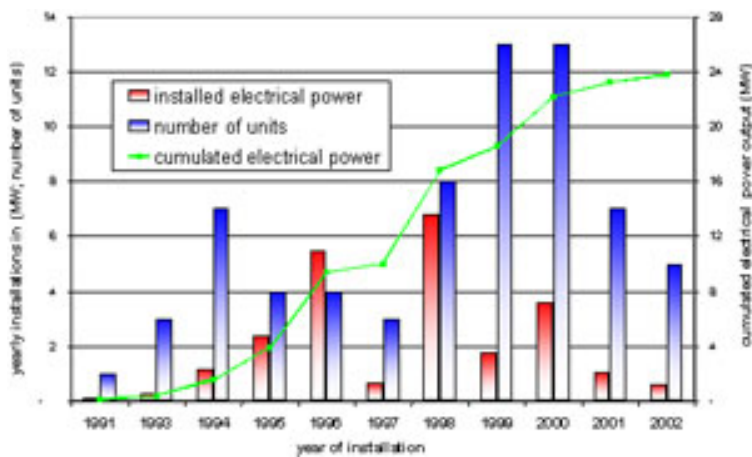
CHP FROM THE BOTANICAL GARDEN

COST AND BENEFITS

The total annual CO₂-reduction of all decentralized CHP plants (24.000 kW) is 60.000 to CO₂/year. The total investment costs are about 40 Mill. Euro. This is equivalent to about 2000 person years of labour. Some of the small CHP plants have been subsidised by the regional government and the local utility. All of them have been designed with economical conditions, resulting in a "free of charge"- CO₂-reduction.

Actually the political and economical framework for CHP is getting worse due to falling electricity prizes caused by liberalisation of the market. The new German CHP-law guarantees a bonus payment per kWh, but this is rather low. First CHP plants up to 1000 kWel have been subsidised by a guaranteed fee of 0,07 Euro/kWh. Now the German law only offers an additional bonus of 0,02-0,05 Euro/kWh to the typical remuneration of 0,02 Euro/kWh. Today mainly small CHP plants with on-site use of electricity will still have good economical conditions. The best political solution would be a CHP-certification scheme based on a quotation of CHP electricity with raising the fraction of CHP electricity (as it will be implemented in Flanders in 2004)

Most of the CHP plants are operated by the owner of the building. Some CHP plants have been planned and are operated by a contractor, i.e. the local utility MAINOVA. Contracting is a good technical and economical opportunity for implementing CHP plants.



PARTNERSHIP

There are local partnerships with all owners of CHP plants and the local utilities MAINOVA AG and SÜWAG AG. Together with the City networks of Climate Alliance and Energie-Cités we have often organized visit tours for German and foreign visitors to Frankfurt CHP plants. There have been some visitors even from Japan, China, Mongolia to visit CHP plants. The City of Frankfurt is member in the German CHP association. Together with the ASUE, an association of natural gas suppliers the CHP market survey is edited. There is a local network of all owners of CHP plants in Frankfurt for the exchange of technical experience. The results have been presented in many German conferences and some conferences (Cogen Europe) and workshops in Great Britain and France.

RECOMMENDATIONS

A main obstacle of implementing CHP is poor knowledge and motivation of planners and architects. Sometimes electricity utilities are advising building owners against the use of CHP. Another main obstacle are poor political frameworks in Germany as well on the European level. As an intermediate technique between “efficiency” and renewable energy CHP should play a key role as a powerful tool for environmental friendly electricity production. It offers high CO₂-reduction at an economical level. Most of the potential users of small and medium CHP don't know about their opportunities.

The technical and economical conditions of heat and electricity are more complicated than just implementing a new boiler. The legal and economical conditions have to be explained in each project from the beginning. Therefore setting up an advisory and consultation group or local agency for promoting CHP has turned out to be an important success factor.

All buildings, where there is a base load of heat demand (i.e. for hot domestic water in hospitals, old people's homes, swimming pools etc.) are suitable for CHP. Typically, the thermal power of the CHP plant should be in the range of 10-20% of the maximum thermal demand of the building. This will result in annual running hours of 5000-7000 of the motor. In such a case more than 75% of the total annual heat consumption can be delivered from CHP.

The evaluation of the experience of the individual CHP plants in Frankfurt organized in a group of owners gives good feedback to them and gives important information for potential users of CHP plants. Visiting tours are another success factor – to convince people within 5 minutes showing them CHP plants better than several hours of reports. Producing its own electricity is an attraction of its own.

The main failure is to believe persons advising against CHP plants, who never had an own experience with them. Most of the CHP plants running successfully have been wrongly designed several times before, until it has been found out that a right designed machine can be operated economically.

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USEFUL INFORMATION

List of Publications

MICRO-CHP TECHNOLOGIES /	Peter Schilken /	Energie-Cités /	German /	2002
			English /	
			French /	
SYSTEMATIC IMPLEMENTATION OF CHP PLANTS /	Wendelin Friedel and Dr. Werner Neumann /	Proceedings Nizza conference IEEBC 2002 /	English /	2002

List of Internet sites

[German and some articles in English and French / http://www.energiereferat.stadt-frankfurt.de](#)

[German / http://www.bhkw-infozentrum.de](#)

[German CHP association / http://www.bkwk.de](#)

[German association for efficient use of energy / http://www.asue.de/veroff/bhkw/v_bhkw.htm](#)

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