An Investigation of the Market Opportunities, Impediments and System Options for Electricity-Generating Heating Systems in Light of National and International Technological Developments in the Area of Micro-CHP Plants and with Regard to Anticipated Future Restructuring and Reorganisation of the Electricity Supply System in Germany

Summary Report in English

Concurrent generation of electricity and heat using combined heat and power (CHP) plants is one of the efficient technologies of rational energy utilisation. Electricity-generating boiler (EGB) systems provide an opportunity to utilise this potential without expanding district heating systems. The first systems of this sort are already commercially available. The market study carried out as part of this research project indicated that additional systems are currently being evaluated in promising field trials and are close to the market launch stage.

However, it was also clear that certain general conditions must be fulfilled before the use of EGB systems can be regarded as economically viable. In buildings with high energy efficiency and correspondingly low annual heat demand, the investigated systems usually do not achieve sufficient full-load operating hours to enable economic generation of electricity in the context of current market prices and/or investment costs. In the case of buildings and properties with relatively high annual heat demand, the conditions necessary for economic use of available electricity-generating boiler systems are generally more easily achieved due to the larger number of operating hours attained. However, operation may turn out to be uneconomical even in situations with a large number of operating hours if the investment, maintenance or energy costs on the heating side are too high. Nevertheless, EGB systems that are suitable for use with extremely energy-efficient buildings with low annual energy consumption are already available, and they may become commercially successful if they can be implemented with only slight additional investment costs or better operational remuneration (CO_2 bonus).

Based on an estimate of the future market potential, with an EGB share of 15% of annual heating system installations in Europe the annual demand for EGB systems would be approximately 500,000 units.

On the electrical side, EGB systems could create an opportunity for decentralisation of the electricity distribution network. Several field trials in this area are already being carried out.

In terms of the policy objective of significantly increasing the proportion of CHP in Germany, EGB systems offer an opportunity to achieve this without further expansion of district heating networks.

With regard to feeding power into the electricity grid, there are no significant limitations with the current grid structure, even with a large percentage of EGB systems. This arises from the fact that the power levels are low (electrical power less than 5 kW) and most of the electricity that is generated is used for internal consumption. With the increased use of electricity-generating boiler systems, the primary result would thus be a reduction in grid loading.

Consequently, the impediments to electricity-generating boiler systems are not to be found in the technology area, but instead almost entirely in the areas of pricing and administrative burdens.

A critical factor for improved market presence is the long-term elimination of bureaucratic obstacles in terms of the following aspects:

- Operating an EGB system presently involves too much unnecessary effort; applications must be submitted to a variety of government bodies or institutions, and they require substantial familiarisation with the subject or unnecessarily high ancillary costs.
- Subsidy programmes are currently initiated at excessively short intervals; this is extremely critical with regard to investment security for users and manufacturers, as the investment conditions are unclear.
- With regard to already developed EGB systems as well as system technologies still to be developed, it is desirable for them to benefit from the same sort of long-term market stimulation programme as solar power technology in its day.

As soon as the market comes alive:

- Long-term development can begin for other application areas with high market potential, especially in the southern hemisphere, such as systems for combined heat, power and cooling.
- The advertising industry will identify the presently stagnant boiler market as a new sales area for EGB systems.
- Manufacturers will publicise EGB technology at trade fairs and trade associations will promote EGB technology in training courses.

OUTLOOK

Technologies for electricity-generating boiler (EGB) systems are approaching the market launch threshold. In the opinion of the authors, a stimulus programme similar to that for the utilisation of renewable energy sources will be necessary in order to achieve a rapid, broad-scale launch.

Fixed rates for feeding power into the grid have proved effective in stimulating the market for the utilisation of renewable energy sources. This instrument has the potential to accelerate technology-specific innovations in the EGB area and to develop a mass market for electricity-generating boiler systems.

For this reason, in addition to comprehensive information about the opportunities and limits of this technology, in authors' opinion a stimulus programme (possible title: '100,000 Cellars') is also necessary in order to create a positive image among consumers and to initiate research and development activities in industry. The current programme in the Netherlands, which provides subsidies for the first 10,000 installed EGB systems, could serve as an example here.

However, in the long term the use of EGB systems and the associated reduction in CO_2 emissions should be rewarded by assured financial remuneration.

In light of the product life cycle of low-temperature boilers and latent-heat recovery systems, with this stimulus funding there is a good chance that in twenty years EGB systems could be the predominant heat source for domestic energy supply systems. In this connection, a reduction in CO_2 emissions arises in two ways: from efficiency gains and from the displacement of carbon-based middle-load power (fuel shift).