

# Competition in the market for space heating. District heating as the infrastructure for competition among fuels and technologies

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## Abstract

None of the EU directives on liberalisation of the electricity and gas markets are considering the district heating systems, although the district heating networks offer the possibility of competition between natural gas and a range of other fuels on the market for space heating. Cogeneration of electricity and heat for industrial processes or district heating is a technology option for increased energy efficiency and thus reduction of CO<sub>2</sub> emissions. In the mid-1990s less than 10% of the electricity generation in the European Union was combined production with significant variations among Member States. These variations are explained by different national legislation and relative power of institutions, rather than difference in industrial structure, climate or urban physical structure. The 'single energy carrier' directives have provisions that support the development of combined heat and power (CHP), but they do not support the development and expansion of the district heating infrastructure. The article is partly based on a contribution to the Shared Analysis Project for the European Commission DG Energy, concerning the penetration of CHP, energy saving, and renewables as instruments to meet the targets of the Kyoto Protocol within the liberalised European energy market. The quantitative and legal differences of the heat markets in selected Member States are described, and the consequences of the directives are discussed. Finally, we summarise the tasks for a European policy concerning the future regulation of district heating networks for CHP, emphasising the need for rules for a fair competition between natural gas and district heating networks. © 2003 Elsevier Science Ltd. All rights reserved.

*Keywords:* Infrastructure; District heating; Competition; Energy market

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## 1. Introduction

The primary intention of the EU electricity and gas directives is to make the electricity and natural gas markets part of the internal market. The overall objective has been to increase the availability of electricity and gas at more competitive prices for the benefit of the final consumers. The same objective was the motivation for the nationalisation of the electricity and other energy industries in several Western European countries—notably France, UK and Italy—a few decades ago.

All these measures share the same strengths and weaknesses: They may increase the efficiency of energy

supply by a single energy carrier—electricity or gas—by economies of scale, rational organisation and standardisation, or by introducing competition into an industry that is dominated by monopolies. On the other hand, they may be obstacles to a synergetic use of the various energy carriers at the local or regional level. The best illustration is the very different penetration of combined heat and power (CHP) for district heating in north-west Europe.

The article is partly based on a contribution to the Shared Analysis Project<sup>1</sup> for the European Commission DG Energy, concerning the penetration of CHP, energy

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<sup>1</sup>The Shared Analysis Project (energy analysis and forecast study) was carried out by a consortium of nine European institutes, 1998–1999. A major objective was to develop a common framework of energy analysis and modelling concerning EU-wide issues important for energy policy putting particular emphasis on: strategic energy policy responses to the Kyoto process (European Commission, 1999a).

saving, and renewables as instruments to meet the targets of the Kyoto Protocol within the liberalised European energy market (Grohnheit, 1999). We shall focus on obstacles and lost opportunities for the development of district heating systems as a necessary infrastructure for further penetration of these technologies, emphasising the legal issue systems (Gram Mortensen, 1998, 2000).

We discuss the methods to introduce competition in the market for space heating, where the real choice of consumers is limited, either by traditional regulation or by past investment and sunk cost.

We are using Denmark as the main example, because the penetration of district heating has gone much further than in the large countries in north-west Europe, in spite of no significant difference in climate and the urban physical structure. The main explanation is the relative power of various institutions. Most of the features of development in Denmark are also found in Germany, but their relative importance has been different. The institutions in countries, where the utilities were nationalised (in particular France and the UK) are very different from those in Germany and Scandinavia. The main difference is the role of local government. Further, we describe the existing and potential European market for district heating emphasising the possibilities for a quantitative evaluation of the impact of new technologies, and finally, we summarise the tasks for a European policy concerning the future regulation of district heating networks for CHP.

## 2. Infrastructure for space heating and competition among fuels and technologies

The infrastructure for electricity is universal and mature, while the natural gas is still expanding both in the market for space heating and other end user markets as well as a fuel for electricity generation. The natural gas infrastructure is dependent on a single fuel, which must be imported to the European Union in increasing amounts. The district heating infrastructure can exist in all scales, but requires higher heat densities than gas networks and water-based heating systems in buildings.

### 2.1. The urban heat market

Fig. 1 describes the urban heat market as a hierarchy of building levels and heating technologies. Half a century ago solid fuelled stoves in single rooms were dominant even in urban areas. The customers were independent of collective systems and could be free to choose their supplier of coal, coke, fuel wood or paraffin. Today, these systems are found only in outdated flats. Electric heating is an

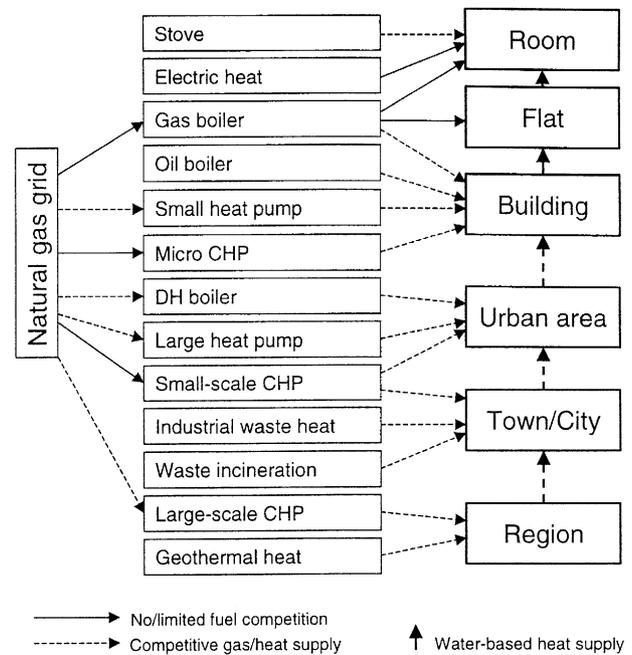


Fig. 1. The urban heat market.

additional choice that requires limited investment, but it may be too expensive for the—often poor—residents. In many cities the introduction of natural gas has improved the standard of living at moderate costs.

In some countries—in particular the United Kingdom—natural gas is frequently used for water-based radiator systems supplied from an individual boiler in each flat. This system is dominant for single-family houses in areas with natural gas supply in most countries in north-west Europe. The introduction of competition in the gas sector will give the customer free choice among several gas suppliers. Also, new technologies may become available for gas customers in the near future, which may increase fuel efficiency and competition, in particular micro-scale CHP in the form of gas engines or fuel cells. However, most of these new technologies are gas-only technologies with limited flexibility concerning base and peak load.

The principal advantage of the larger water-based heat distribution systems is that they enable more competition among fuels and technologies both in the short and long term, and also makes possible cheaper heat supply. On the other hand, these systems require investment in infrastructure over decades and regulation, which may reduce the short-term choice of the individual consumers.

District heating for single-family houses is best established as a part of the development of sites for detached or terraced houses together with electricity, water and sewage. At this level, competition from a

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