

DISTRICT ENERGY — A PATH TOWARDS ECO-EFFICIENT CITIES

District Heating and Cooling:

- Makes the most of energy that would otherwise have been lost.
- Drives sustainable and eco-efficient city development.
- Combats climate change and strengthens our economies.
- Contributes to a healthy urban environment.
- Is a key resource for energy security.

ECO-EFFICIENT CITIES

Time to tap the potential of district energy

foto Superstudio

A view of Borås, Sweden's 13th largest municipally with around 64,000 people inhabitants.



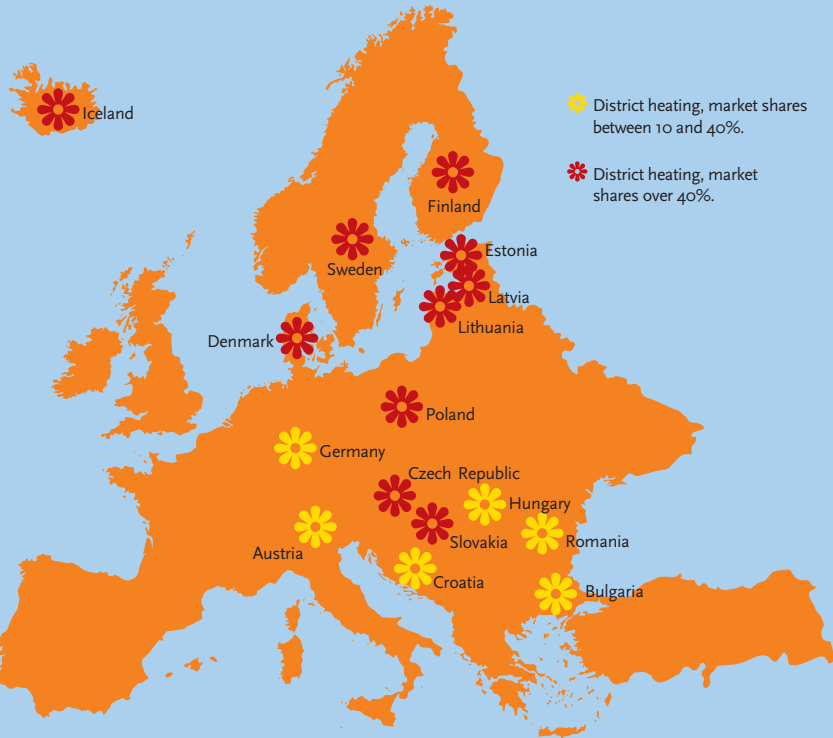
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District Heating – heating buildings without heating the world

District heating is an intelligent, environmentally friendly way to heat homes, schools, other premises, etc. As the name implies, district heating comes from somewhere within the district. Instead of every building having its own boiler, district heating is supplied by a central plant which can use advanced methods to run on many different fuels or recover heat from other sectors, thus benefiting households, industry and the environment. It's said that the district heating plant is at the heart of a district, spreading warmth right the way around it.

In many processes large parts of energy are set free in the form of surplus heat. The fundamental idea behind



modern district heating is to recycle this surplus heat which otherwise would be wasted – from electricity production, from fuel- and biofuel-refining,

and from different industrial processes. Furthermore district heating can make use of many kinds of renewables (biomass, geothermal, solar thermal).

SVENSK FJÄRRVÄRME

Svensk Fjärrvärme (Swedish District Heating Association) is a trade organisation for companies in Sweden which generate district heating, combined heat and power and district cooling. The association has more than 130 member companies at locations all over Sweden.

Svensk Fjärrvärme's members are responsible for 98% of the district heating supplied throughout Sweden, and district heating has become the single most common form of heating in Sweden. The very first district heating network was built in Karlstad as early as 1948.

EUROHEAT & POWER

Euroheat & Power unites the combined heat and power, district heating and cooling sector throughout Europe and beyond, with members from over thirty countries: including all existing national district heating associations in EU countries and the majority of new EU Member States; utilities operating DHC systems; industrial associations and companies; manufacturers; research institutes; consultants and other organizations involved in the CHP/DHC business.



France's largest North Sea port, Dunkirk enables annual savings of 26,000 tonnes of CO₂.

Dunkirk's district heating network – heat produced on recovered industrial heat

With its unique environmental and cost performance, the Dunkirk heating network is clearly an essential component of the region's environmental policy. In this way, the heating network has enabled the community to maintain and enhance the region's reputation as a leading industrial area.

Following the oil crises of 1973 and 1979, the cities of Dunkirk and Saint Pol sur Mer needed to find an alternative to fossil fuels. Together, they decided to build a heating network that would be supplied primarily by recovered by-product heat from a local industrial process. Construction of the heating network began in early May 1985.

Built in 1963, the ArcelorMittal steel works is specialized in the production of flat carbon steel. As France's largest steel mill, it accounts for approximately 1.5 percent of the country's total energy consumption.

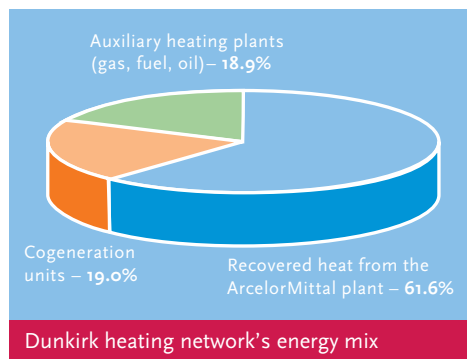
A capture hood to recover heat at the ArcelorMittal steel works was brought on stream in early 1986. The principle of hot air capture is simple. A large hood placed over the cooling

bed draws hot air through an heat exchanger where it heats water that is then distributed via the network. By 1990, the heating network was already supplying 120 substations.

In 1986, when the heating network was first built, the cooling bed was fitted with a capture hood that recovered 20 MW of heat. Since then, heat capture has been the main source of energy for the Dunkirk heating network. In April 2008, a new hood was installed on the cooling bed which increased heating capacity by 8 MW.

The Dunkirk district heating network's environmental performance is impressive:

- The use of recovery of industrial heat replaces 2,500 tonnes of heavy fuel oil with a



pollution-free energy source.

- More than 80 percent of the energy used in the network is recovered energy (two recovery units at ArcelorMittal and three cogeneration plants).
- This recovery of industrial heat enables annual savings of 26,000 tonnes of CO₂ compared with a gas-fired solution.

DUNKIRK

France's largest North Sea port, Dunkirk is both a local and regional administrative centre. With 210,000 inhabitants, of whom nearly 30% are under 20, the Dunkirk urban community is Europe's leading energy hub.

As a recipient of a European "Sustainable Cities" award, Dunkirk is committed to aligning its industrial development and environmental management policies both today and tomorrow.

"Man ska inte gå över ån efter vatten"*

* ""Dont cross the brook for water". Swedish proverb.

A part of the solution to the global climate challenge already exists, and it is closer than we realize. Europe's energy systems are currently wasting a huge amount of energy that could be recycled. By using primary resources more efficiently, district heating is an important tool to fight climate change.

Urbanization and economic growth in large cities should be seen as a possibility rather than a threat to our environment. An eco-efficient economy can be built by cities with efficient energy systems. More use of district heating and cooling can play a significant role in reforming energy systems.

At EU level, district heating is still very much an untapped solution. With more than 5000 district heating systems in Europe, the sector accounts for less than 10 percent of heat demand in the residential and service sectors.

An international study financed by IEE, the Ecoheatcool project, has documented the potential for huge additional CO₂ reductions, savings and reduction of energy imports that

would result from doubling the share of district heating at EU level.

District heating is a local or regional matter when it comes to development and solutions, since it is locally produced and locally used. But the climate benefits are European and global. Therefore, it should be a top priority for national governments and the EU. How can financial and political support at EU-level boost the development of district heating in more countries and in more cities?

It is time to rethink the European energy policy. It is time to think district heating.

This brochure shows the value of district heating. We present how three cities in three countries in Europe through district heating becomes more eco-efficient, locally. As winners of the Global District Energy Climate Awards they are also great examples of district heating's contribution to meet the global climate challenge.

We hope you will enjoy it!



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District heating and cooling – a neglected opportunity in climate politics

Curbing greenhouse gas emissions by switching from fossil fuels to more sustainable energy production is difficult but essential. Many national governments shy from the task. Fortunately, cities and communities are pointing another way forward. Managed properly, the transition to a low carbon, low waste economy brings great benefit to commerce and industry, as much as to household

“Roughly two-thirds of the energy used to produce power in Europe is wasted, mainly because of huge losses that occur in thermal electricity production in centralized power plants”

budgets and quality of life. There are thousands of successful local examples which demonstrate that cutting carbon and other greenhouse gas emissions is both practical to do and attractive economically. In most cases, it is simply a question of deploying proven, dependable and cost-effective energy systems and technologies. Significant cuts in national and urban CO₂-emissions can be made within a decade if these best practices are rolled out across the European continent.

There are many greenhouse gas reduction solutions knocking on the door, all needed, but one – combined heat and power integrated with district heating and cooling – has been too neglected by policymakers. Combined heat and power systems, also called CHP, together with industrial surplus heat and renewable energy sources such as biomass and geothermal, and energy generated from non-recyclable waste streams, can provide thermal energy to multiple household, commercial

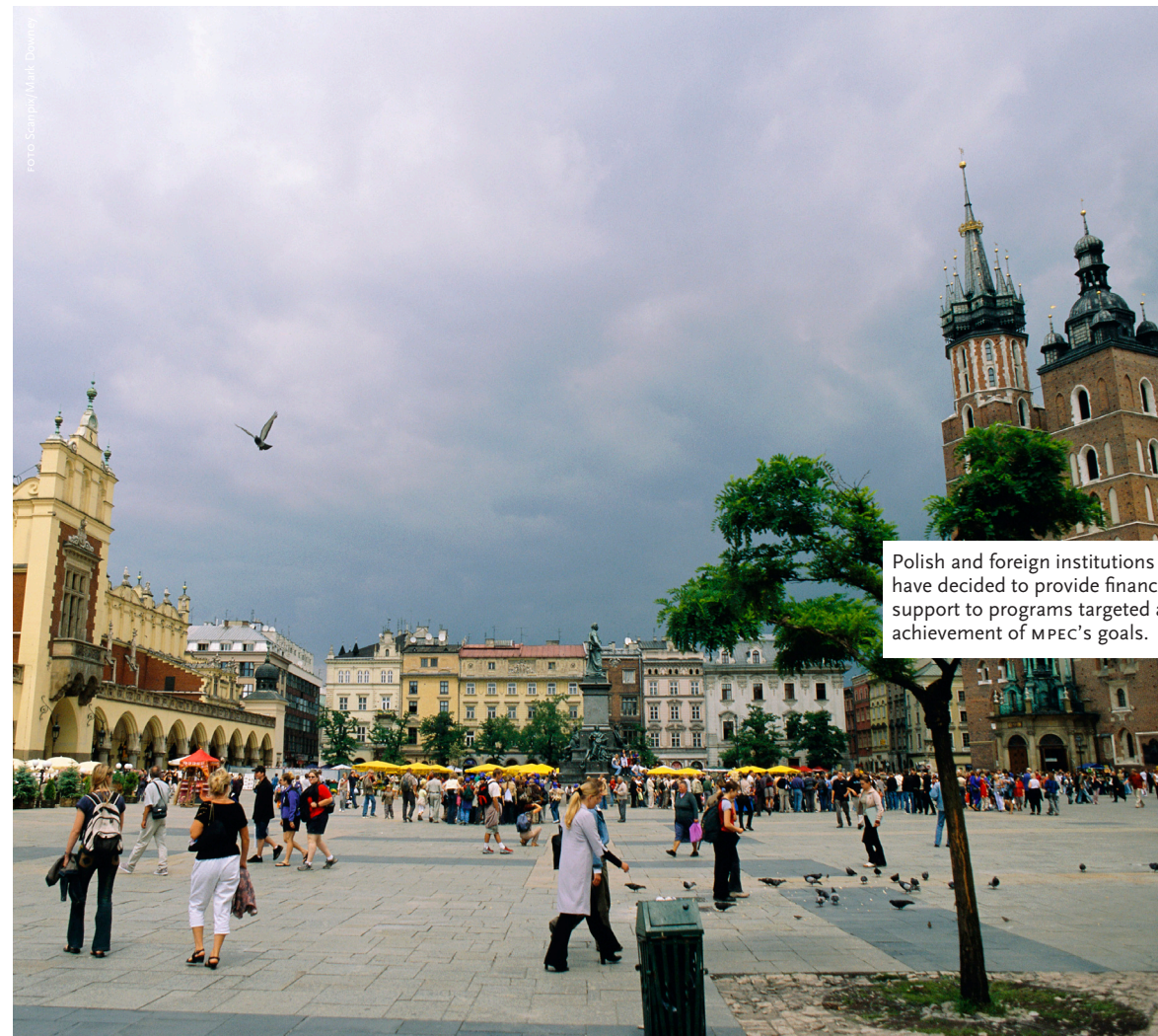
and municipal users. So called district heating and cooling (DHC) systems are the foundation of the energy economy of cities and towns across Europe.

However, the majority of metropolitan regions haven't followed suit. Roughly two-thirds of the energy used to produce power in Europe is wasted, mainly because of huge losses that occur in thermal electricity production in centralized power plants. Modern CHP plants also expand the use of renewables, and improve security of supply, since a variety of locally available renewable resources can be used, like solar, geothermal and residues from forestry and agriculture, depending on availability and price.

Since 1990, Sweden has cut its greenhouse gas emissions by 9 percent while the economy has grown by 40 percent. The main reason for this success in climate politics is the nation-wide expansion of efficient district heating, supplied by non-fossil energy sources. For example, Gothenburg's district heating system stretches over 1,000 kilometres of pipeline, and supplies over 80 percent of all homes, as well as official and commercial buildings, with heat recovered from industrial activities such as refineries and power production. By using energy twice in this way, Gothenburg city saves some 3 billion kWh of primary energy and over one million tons of carbon dioxide emissions annually.

Stockholm, the capital of Sweden, is appointed European Green Capital for 2010. An major reason is Stockholm's big use of district heating. Stockholm is also world leading when it comes to using district cooling. For example, Stockholm's Hammarby Seafront district has its buildings cooled by seawater.

Amongst other measures, governments are



Polish and foreign institutions have decided to provide financial support to programs targeted at achievement of MPEC's goals.

completed projects and successful achievement of outstanding results were only possible with engagement of third party funds. Considering the exceptional character of the City of Krakow, and with regard to MPEC trustworthiness, numerous Polish and foreign institutions have decided to provide financial support to programs targeted at achievement of the above specified goals.

The most significant project executed by MPEC in Krakow since

2006 is the project entitled “Heat Distribution System of the City of Krakow”, co-financed by the European Union under the Cohesion Fund. With regard to Krakow's historical and cultural significance, and because the city centre is listed by UNESCO, the project promotes international activities for regional environmental protection solutions.

The initiatives undertaken during the recent years have led to development of 310 km of heat distribution networks with-

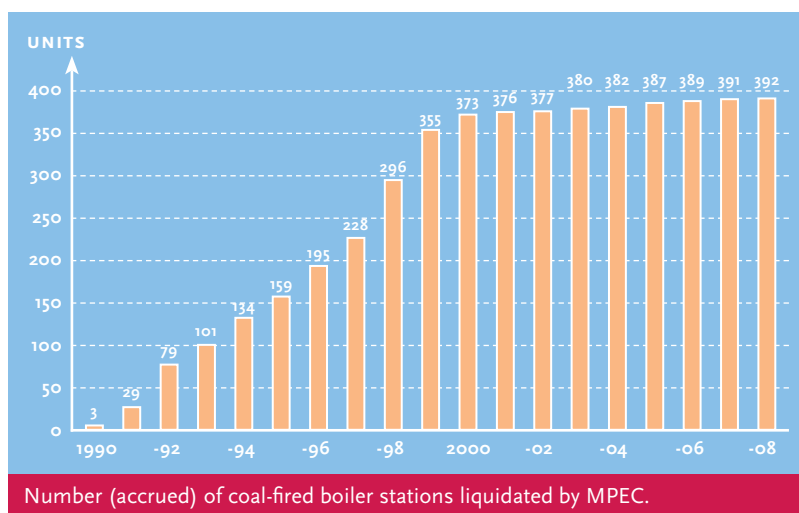
in a state-of-the-art pre-insulated tubing system (including replacement of 120 km of old duct systems with pre-insulated pipelines) and installation of more than 3,650 exchanger-type heat transfer units with automatic weather controls. The remaining boiler rooms were liquidated and the buildings supplied thereby have been connected to the heat distribution network.

Krakow's focus: environmental protection and continuous improvement

Transformation of Poland's social and economic system in early 1990s has strongly influenced the functioning of district heating companies in Poland. The heat market has steadily grown more and more competitive, with the customer's needs continuously increasing. The level of social awareness of environmental protection issues has become higher.

Miejskie Przedsiębiorstwo Energetyki Ciepłej, MPEC [Municipal Heat Engineering Joint Stock Company] is based on more than fifty years of experience in supplying heat to apartments, enterprises and institutions. The energy produced is used not only for heating but also for preparation of domestic hot water, for air conditioning and ventilation purposes, and for other specific process purposes.

The enterprise was established in 1953 and its first function was to provide maintenance of local heat sources on housing estates and maintenance of heat distribution networks linked to these sources. At that time, the company's assets were not significant – 7 boiler rooms serving the purposes of housing estates in Nowa Huta district, 5 stations of the same type in other districts of Krakow, and approximately 30 km of heat distribution network. Today, MPEC has 730 employees and is recognized as a leader



among the most advanced heat industry operators in Poland.

In order to meet the new and increased market demands and at the same time improve the environmental record, MPEC decided to incorporate two strategic goals: improvement of operating parameters of its networks and minimizing

emissions of pollutants through liquidation of inefficient heat sources.

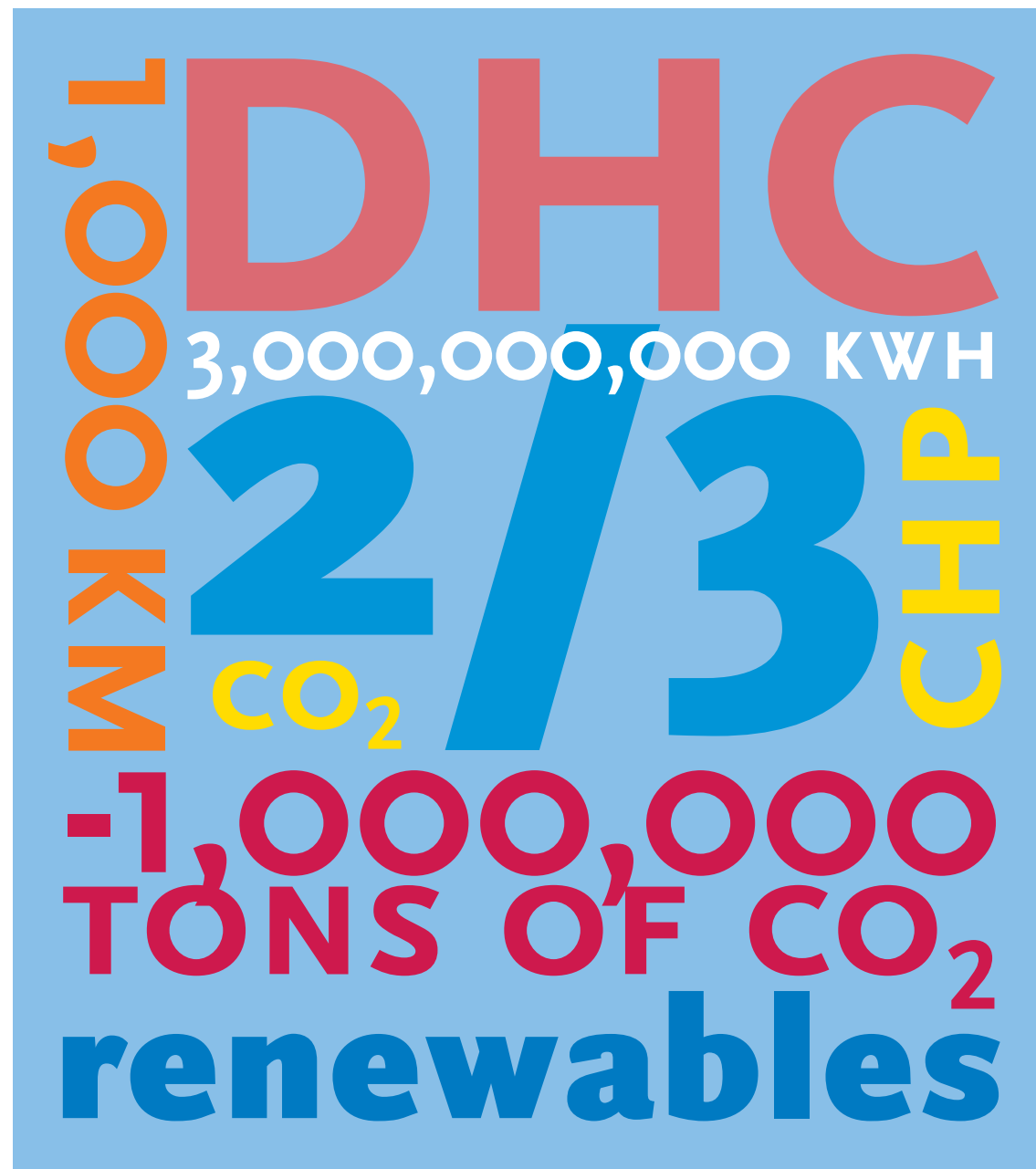
In order to ensure successful achievement of both goals the company has been engaged in continuous modernization of the heat distribution system since the beginning of the 1990s.

Both the extensive scope of

KRAKOW

Krakow is Poland's second largest city with approximately 760,000 inhabitants. The old part of the city, in the city centre, is since 1978 a World Heritage Site. Miejskie Przedsiębiorstwo Energetyki Ciepłej, MPEC, supplies heat to customers from

Krakow, Skawina and Wieliczka. It heats 8,001 buildings / premises (public service facilities, hospitals, office buildings, shopping centres and historical monuments) with a total capacity of 70,986 thousand m³. It operates 750 km of heat distribution network.



trying to bump-start the global economy through massive public expenditure on new, sometimes prototype infrastructure, energy and building programmes. Projected spending on demonstration plants for carbon capture and storage systems, for example, is some 16 billion Euros over the next decade. By contrast, little investment is targeting decentralized, sustainable energy solutions such

as district heating and cooling – with the exception of relatively modest public spend by a handful of countries like South Korea and Japan.

It is time to recognize district heating and cooling as a vital resource for combating climate change and strengthening our economies. The European Union has a particular opportunity and responsibility.

Borås' dream – a city free from fossil fuel

Borås City is a pioneer when it comes to working in harmony with the biological cycle, and they look on combustible household refuse as a valuable energy resource – energy that would otherwise be wasted. Whenever the inhabitants sort their household waste, travel on biogas buses, relax at home with comfortable district heating or spend time at an office with pleasant district cooling, they play an important role as part of the biological cycle.

Borås' inhabitants sort their municipal waste into differently coloured plastic bags – white for combustible waste and black for biodegradable waste. Recyclables, e.g. packaging such as metal cans and plastic bottles, are separated and deposited at one of the company's recycling centres.

When the black bags and white bags arrive at the Sobacken waste management plant, they are automatically optically separated. The white bags are used as fuel for generating district heating, while the contents of the black bags are converted into biogas.

Borås Energi och Miljö has several different district heating plants. The main unit, Ryaverket, is a combined heat and power plant. It has two boilers using solid biomass, two waste boilers and two generators. There is also an electrical heater plus two propane/biomass/oil-fired boilers used as back-ups.

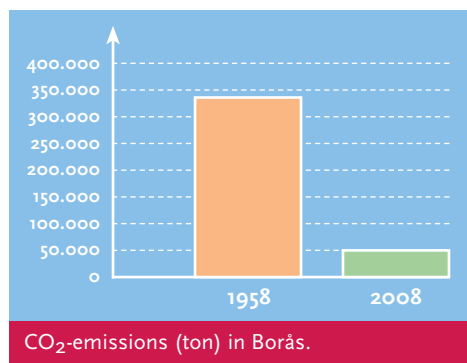
District heating is distrib-

uted via underground pipes to homes and other properties in Borås and is used partly to heat water circulating through radiators, and partly for heating tap water.

Construction of the Borås district heating grid began in 1959. Today there are around 300 km of district heating piping. There were 3,992 customers at the beginning of 2009, compared to 1,892 at the beginning of 2000. Approximately 35,000 inhabitants rely on district heating.

Construction at Ryaverket began in 1965 and over the years the plant was modified several times towards more eco-friendly production. In the beginning, production was mainly based on fossil oil and a small percentage of waste.

All use of fuels to generate district heating, cooling and electricity, leads to greenhouse gas emissions. By making decisions based on awareness of the en-



vironment, the size and effects of those emissions can be reduced.

In Sweden, the amount of trees being planted exceeds the number being harvested. Therefore the use of forest fuel is not seen as a threat to the environment. The cleanest fuel with the lowest climate impact from greenhouse gas emissions is forest fuel. In Borås, though forest fuel makes up more than 52 percent of the energy input, and fuel oil or LPG only makes up 3 and 4 percent of energy input

BORÅS

Borås is Sweden's 13th largest municipally. Around 64,000 people live in Borås City, and over 100,000 throughout the municipality. Borås Energi och Miljö AB (BEM) is a municipally owned

company that handles refuse and the production of district heating, cooling and electricity in the municipality of Borås. The company has a vision of a city free from fossil fuels.



Construction of the Borås district heating grid began in 1959. Today there are around 300 km of district heating piping.

respectively, the emissions of greenhouse gases are higher for fuel oil and LPG. In taking care of waste products and converting them into something useful, Borås Energi och Miljö have a positive effect on emissions.

There are many benefits from district heating compared to individual heating, both for the environment and the consumer.

- By replacing a number of individual heating systems, e.g. oil or wood furnaces, all emissions are concentrated in one place for treatment by organizations with the necessary expertise and equipment, which results in more advanced, efficient flue gas cleaning and pollution control.
- Ryaverket is a combined heat and power plant, which makes

it more energy efficient than separate production of heat and electricity due to simultaneous production of heat and electricity.

- This provides a stable heating/cooling system that requires less effort from the customer. The customer does not need to purchase and transport fuel.