

Helsingborg March 30, 2011

Our reference

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## **APPLICATION**

# **INTERNATIONAL DISTRICT ENERGY CLIMATE AWARDS 2011**

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Energy Company:	Öresundskraft AB, Sweden
City:	Helsingborg, Sweden
Owner:	City of Helsingborg (public owned)



## 2. MOTIVATIONAL LETTER

### 2.1 SYSTEM DESCRIPTION

The system is a municipal scheme with more than 10000 users.

The city of Helsingborg is located in the expanding Öresund region (Denmark-Sweden). The city has 129 177 residents. Already in 1964 the concept of district heating was implemented as the city's main energy system, a pioneer in Sweden.

#### System size

For 78% of the residents in Helsingborg (of a total of 129 177) their household heating and warm water is produced using district heating.

The number of customers per category (B2C, B2B) are:

B2C 8435; small houses privat owned

B2B 1788; apartment buildings and industry

#### Yearly energy delivery

Energy volume heat per customer category

B2C:	180 GWh	(20%)
B2B:	720 GWh	(80%)
Total	900 GWh	

The district heating also includes generation of electricity, yearly volume 350 GWh.

#### Production

Today's system is integrating all available excess heat in the city combined with a bio fuelled main production plant. This is a highly complex production system but with skilled management we can always balance production for minimum environmental impact at lowest cost.

The system comprise (see also appendix A, p3):

- available waste heat from local industry,
- local landfill gas fuelled boiler,
- heat pumps in sewage purification tank
- cogeneration power plant 100% bio fuelled (wooden pellets)
- peak load unit (CHP gas turbine).

Additionally the system comprise an accumulator tank of 18000 m<sup>3</sup>.

This district heating system today is based on 98% bio fuel and only 2% fossil fuel. This is the largest district heating system in Sweden with extreme low dependency of fossil fuel.



### **Distribution Network**

The length of the distribution network is 560 km. The water volume is approx 17500 m<sup>3</sup>.  
The output temperature is approx 95°C and return temperature approx 50°C

### **Customer base expansion**

The city is growing, in average the yearly expansion of the district heating system is 100 new B2C customers and some 400 apartments in apartment buildings.

Customers in Helsingborg are improving their energy efficiency thus reducing their energy need. This is partly compensated by the expansion. But in general this district heating delivery volumes is reduced by 1-2% yearly.

## **2.2 AWARD CATEGORY**

c) Modernization of existing scheme.

## **2.3 WHY AND HOW THE PROGRAMME WAS IMPLEMENTED**

For the City of Helsingborg the main idea has been an sustainable energy system there household heating is using available excess heat in the city, the main focus has been the use of primary energy for heating.

This strategy has been very successful and today 78% of all residents are part of the district heating system. Over the years the main focus of this energy system was the CO<sub>2</sub> emission. It was stated in the mid nineties that a major change was necessary. A new programme was implemented

Goal: Starting from year 2007 the production should be minimum 95% based on renewables.

This resulted in:

- This programme indeed came effective in 2006 with a 98% production based on renewables.
- The CO<sub>2</sub> emissions in Helsingborg from the district heating system was reduced by **340 000 tonnes**. See figure 1.



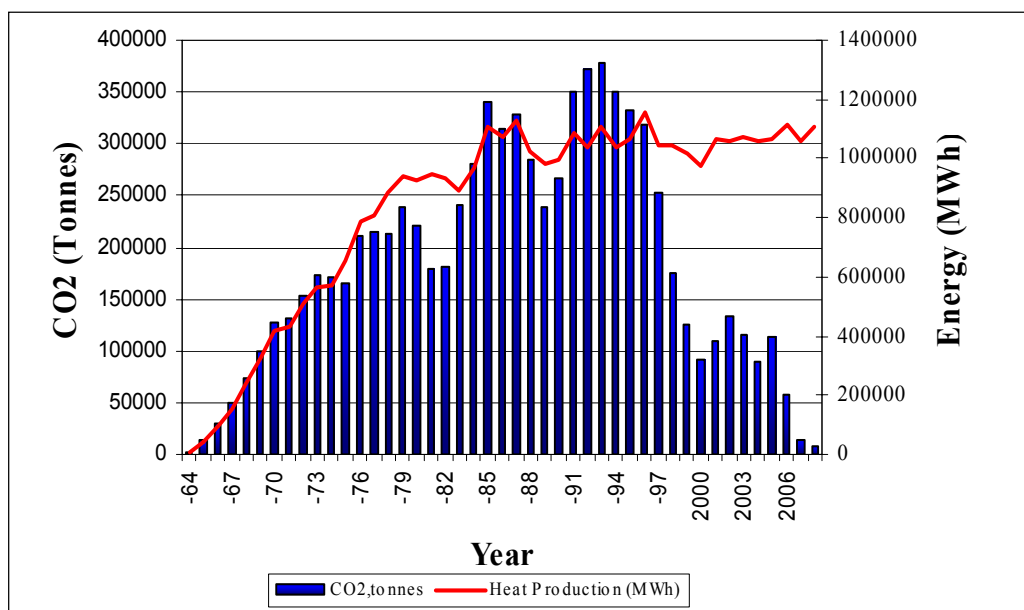


Figure 1. CO<sub>2</sub> emissions and heat production in Helsingborg since start of operation 1964.

#### How this was this achieved:

In 1997 bio fuels was introduced in the system in order to replace the coal. The heat and power plant, built in 1983, was finally fully bio fuelled converted in 2006 when it was 100% bio fuel rebuilt (wooden pellets). From 2006 the main production unit was using bio fuels which in combination with land filled gas heat production and taking care of waste heat was the new era of district heating in Helsingborg.

The last three years we have achieved stunningly low CO<sub>2</sub> emissions levels per produced heat energy with respect to the size of the system, 900 GWh heat, table 1.

Year	2007	2008	2009
CO emission (kg/kWh)	0,008	0,008	0,023
Deviation from normal ambient temperature	+15%	+12%	+5%

Table 1. Yearly CO<sub>2</sub> emissions and ambient temperature.

A new production strategy was implemented with objective to optimize the system with respect to CO<sub>2</sub> emissions. The five heat production units together with the accumulator tank are operated are today operated as one system and based on weather forecasting.

The peak load unit is needed when ambient temperature falls below -6°C- to -9°C. The use of the peak load unit (CHP gas turbine fuelled with CNG), is handle with utmost care with respect to CO<sub>2</sub>.





*Figure 4. Sky wiew of Sustainable Helsingborg.*



### 3. 250 WORDS SUMMARY AND LOGOS

The City of Helsingborg has through its environmental strategy achieved a local sustainable energy system for heating of buildings. All available local energy initiatives (waste heat, sewage, land fill) are integrated into the local energy system together with a large scale biomass fuelled cogeneration plant constituting an sustainable energy system with very low CO<sub>2</sub> emission.

As a system operator Öresundskraft AB has the responsibility that at all times optimize this complex energy system based on demand situation and minimizing emissions. The main production unit today has 170 000 hours of operation and a very high availability of 97,8%. We assure customers a reliable energy supply.

The CO<sub>2</sub> emissions has been reduced by 340 000 tonnes. The system is today using 98% renewables. The CO<sub>2</sub> emission per produced energy unit in 2009 was 0,023 kg/kWh.

Since district heating is used for 78% of housings in the City of Helsingborg comprising over 10 000 customers (collection points) this has made a huge impact on environment.

The residents of Helsingborg using district heating are making a real change for the environment. Our next challenge is to replace electrical energy with heat where possible, e.g. household machines.

Additionally, the sustainable system of Helsingborg is also financially beneficial for customers; it is cost competitive in comparison to heat pumps and geo thermal energy. Also the energy cost in Helsingborg is lower than the average for district heating in Sweden. This is a firm condition stipulated by the owner, the City of Helsingborg.



*Figure 2. Logo of applicant:  
Öresundskraft AB, Energy Company*



*Figure 3. Logo of municipality:  
City of Helsingborg.*



## 4. WRITTEN DESCRIPTION

Company: Öresundskraft AB  
Starting year: 1859  
CEO: Mr Anders Östlund  
Employees: 435 employees

District Heating Systems in two cities; Ängelholm and Helsingborg (this application).

Businesses: Electricity Trading, bio gas sales, broadband, District Heating, District Cooling,

Further information in [Appendix B, p5-7](#)

### 4.1 SYSTEM HISTORY

Mile stones

- 1964 Start of system operation
- 1974 Integrating waste heat from local industry
- 1983 Building cogeneration plant (oil)
- 2006 100% bio fuelled cogeneration plant
- 2009 Remote metering at all collection points
- 2013 *Waste Incineration plan will be taken into operation*

The city of Helsingborg is located in the expanding Öresund region (Denmark-Sweden). The city has 129 177 residents. Already in 1964 the concept of district heating was implemented as the city's main energy system, a pioneer in Sweden. The aim was to replace all the small oil and coal fuelled decentralized heating systems with a larger state of the art centralized power station.

The overall objective was to improve the environment in the city and give local industry access to reliable process heat supply. The exhaust gas purification technologies at the time was only possible, both with respect to financing and technology, using a centralized large scale production facility. This is still a valid condition.

In year 1983, after almost 20 years, a new heat and power plant was built. This was a huge leap forward. Until year 1996 the main fuel was fossil, in the beginning oil and later on changed to coal. Seven years ago the most important decision concerning this district heating system was taken; to convert the entire heat and power plant to bio fuels. [See also appendix B, p5](#) for fuel mix 1964-2009.

We at Öresundskraft AB are very proud that we today has a first class plant with respect to CO<sub>2</sub> emissions.

Our yearly heat delivery is 900 GWh. In the city of Helsingborg close to 70 of all houses are enjoying the comfortable heat supplied by Öresundskraft. The city is continuously growing and we are expanding the district heating network every year.

In the area there we can provide district heating this is the obvious choice with respect to our environment. This is efficient both regarding use of primary energy and CO<sub>2</sub>.



## 4.2 DATA SUPPORTING THE SYSTEMS OVERALL ENERGY EFFICIENCY

### Primary Energy Input 2009

Useful Energy Delivered to Customer (MWh)	1 133 766
Electrical Energy (MWh)	353 269
Heat Energy (MWh)	1 133 766
Primary fossil primary energy input (MWh)	177 349
<b>Ratio Useful Delivered Energy / Primary Fossil (-)</b>	<b>8,4</b>

### Fuel Input

Fuel energy input mix, see appendix A, page 5.

Share of biofuel in percentage, see appendix A, page 7.

## 4.4 HOW THE PROGRAMME HAS REDUCED THE GREEN HOUSE GAS EMISSIONS

### CO2 Emissions 1964-2009

A reduction by 340 000 tonnes. A sustainable low level mainly caused by the very cold days when peak load production is required (below -6 to -9 degrees C).

See graph in Appendix A, page 6

### Discharge Levels 2001-2009

The levels of Sulphur and Nitric Oxides has reduced significantly with the new bio fuelled cogeneration plant.

See graph in appendix A, page 7.

## 4.5 WHAT MAKES YOUR PROGRAMME OUTSTANDING AND INNOVATIVE

- The combined heat system where available local source are operated in combination with larger cogeneration plant. Making use of what is available in the region
- Significantly reduced CO2 emissions.
- Offering customers a highly sustainable product at a competitive price.





#### **4.6 HOW HAS THE PROGRAMME IMPROVED QUALITY OF LIFE OF YOUR COMMUNITY**

Residents of Helsingborg has a sustainable way of living. Our main focus today is to improve energy efficiency, i.e. our use of resources.

Our main concern is to reduce our electricity use, this uses a lot of primary energy and generates CO<sub>2</sub>, especially in wintertime. The residents of Helsingborg who want to make a change should invest in local energy production.

#### **4.7 WHAT WERE THE CHALLENGES YOU FACED**

- Using solid fuels in a larger cogeneration plant may impact availability and reliability of the plant. The two key requirements by our customers. Customers can not accept failures in energy supplies, not even if it depends on our sustainable fuel mix.
- Setting up a management system in order to combine all available production facilities in an optimum way with respect to production cost and environment.
- Convincing customers that this is the correct way to solve one of our environmental issues in region. The solution is not to convert to electricity powered heat pumps. Customers to understand CO<sub>2</sub> impact and primary energy use.

#### **4.8 HOW WAS THE PROGRAMME FINANCED**

The programme has been financed by the company itself. The company is operated in a way to generate financial resources for necessary reinvestment and future development.

#### **4.9 FUTURE DEVELOPMENT**

Öresundskraft is continuing its efforts in building a sustainable system for the region.

In 2013 a waste incineration plant will be taken into operation. This will supply approx 35% of the energy demand in Helsingborg. Today's cogeneration plant will then only operate part of the year, winter season. The region will from 2013 have a closed loop system for the residents.

In year 2010 Öresundskraft launched a new business segment focusing on Energy Efficiency. This highly specialized unit will assist customers, private and commercial, in optimizing their heating systems with the aim to reduced energy use. This business team also offer customers performance contracts, we larger the energy reduction the higher the payment.

Öresundskraft is an active part in the strive for the new sustainable Europe.



## APPENDICES

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# Appendix A - District Heating System City of Helsingborg, Sweden

**ÖRESUNDS  
KRAFT**

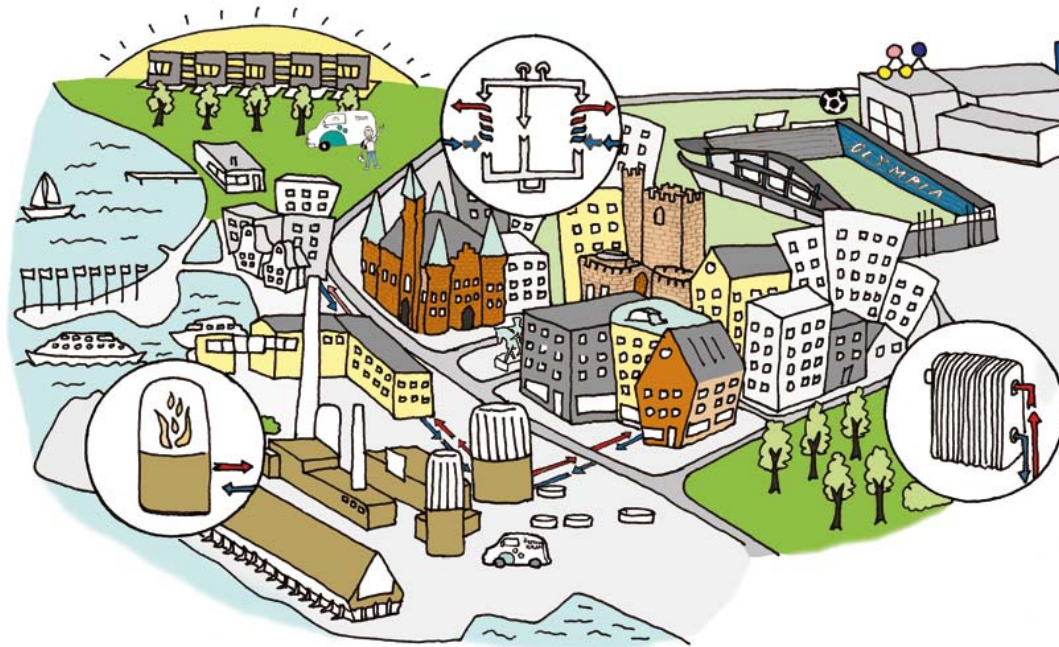


HELSINGBORG



# Summary District Heating System

- **Starting year 1964**
- **Customers**
  - 8435 B2C
  - 1788 B2B
- **Energy Volume**
  - Heat 890 GWh (20% B2C, 80% B2B)
  - Electricity 350 GWh
- **Network**
  - 560 km
  - 18 000 m<sup>3</sup> water
- **Remote metering since 2009**
  - Monthly invoicing based on actual energy consumption





# Production Helsingborg

## Production Units and Power

- Waste heat from local industry (A)
  - 40 MW<sub>H</sub>
- Heat and Power Plant (B)
  - 138 MW<sub>H</sub>, 69 MW<sub>E</sub>
  - 100% Biofuel (Wooden Pellets)
- Heat pumps in sewage purification tank (C)
  - 30 MW<sub>H</sub>
- Combined Heat and Power Gas Turbine (peak load winter time)
  - 53 MW<sub>H</sub>, 56 MW<sub>E</sub>
- Landfill gas fueled boiler (D)
  - 9 MW<sub>H</sub>
  - Cooperation with Waste Disposal Company

## Yearly Energy Production

- Heat 900 GWh
- Electricity 400 GWh



A



A



B



C



D

**KRAFT**

D

D

D

D

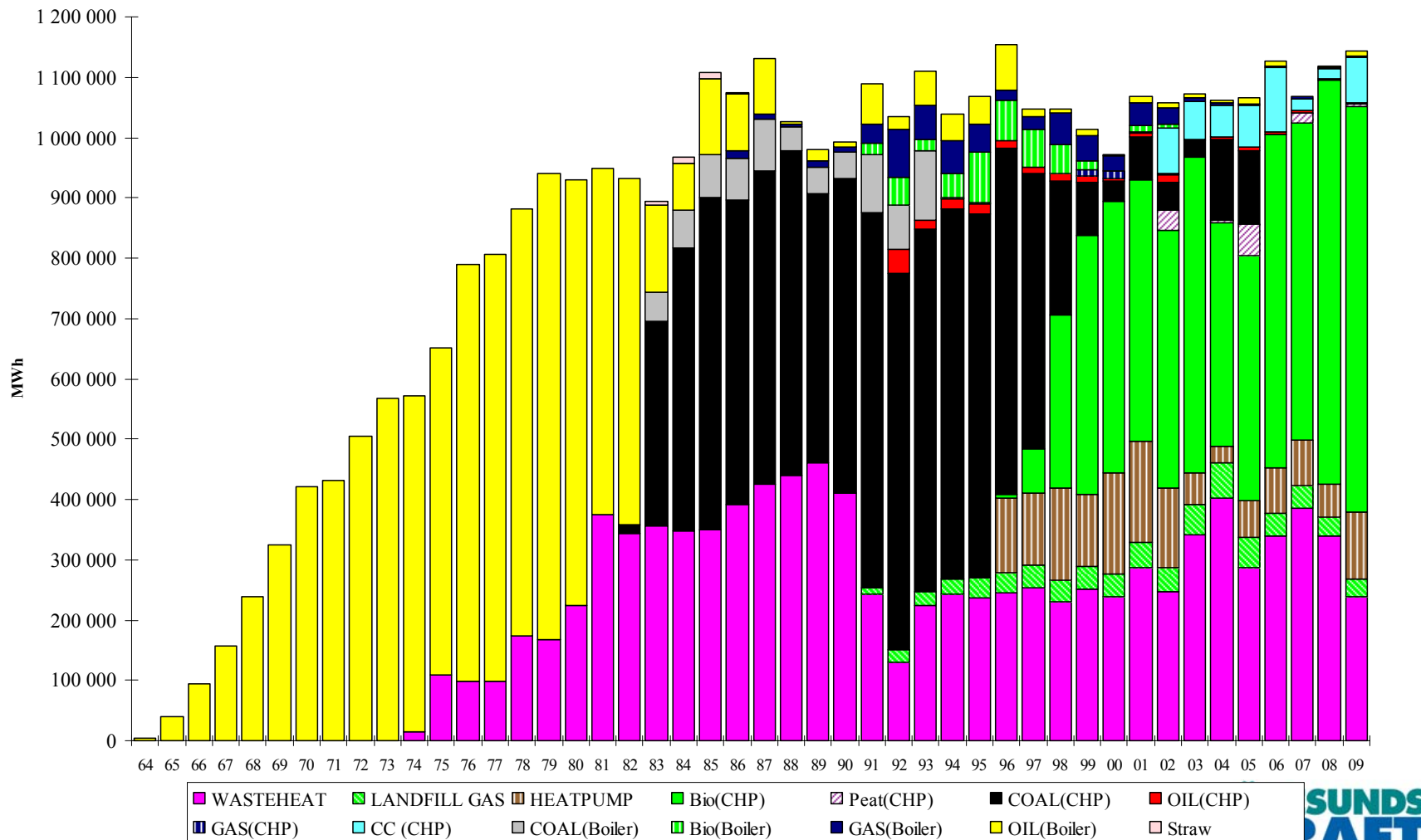
# Main Production Unit

## Cogeneration Power Plant

- Cogeneration Plant
- Built in 1983
  - Originally for oil
  - Rebuild no 1; for coal
  - Rebuilt no 2; 100% biofuel (2006)
- Power Output
  - $138 \text{ MW}_H$ ,  $69 \text{ MW}_E$
- Hours of operation
  - 170 000
- Availability
  - 97,2%
- Fuel
  - 100 % biofuel (wooden pellets)



# Fuel Mix Helsingborg 1964-2009



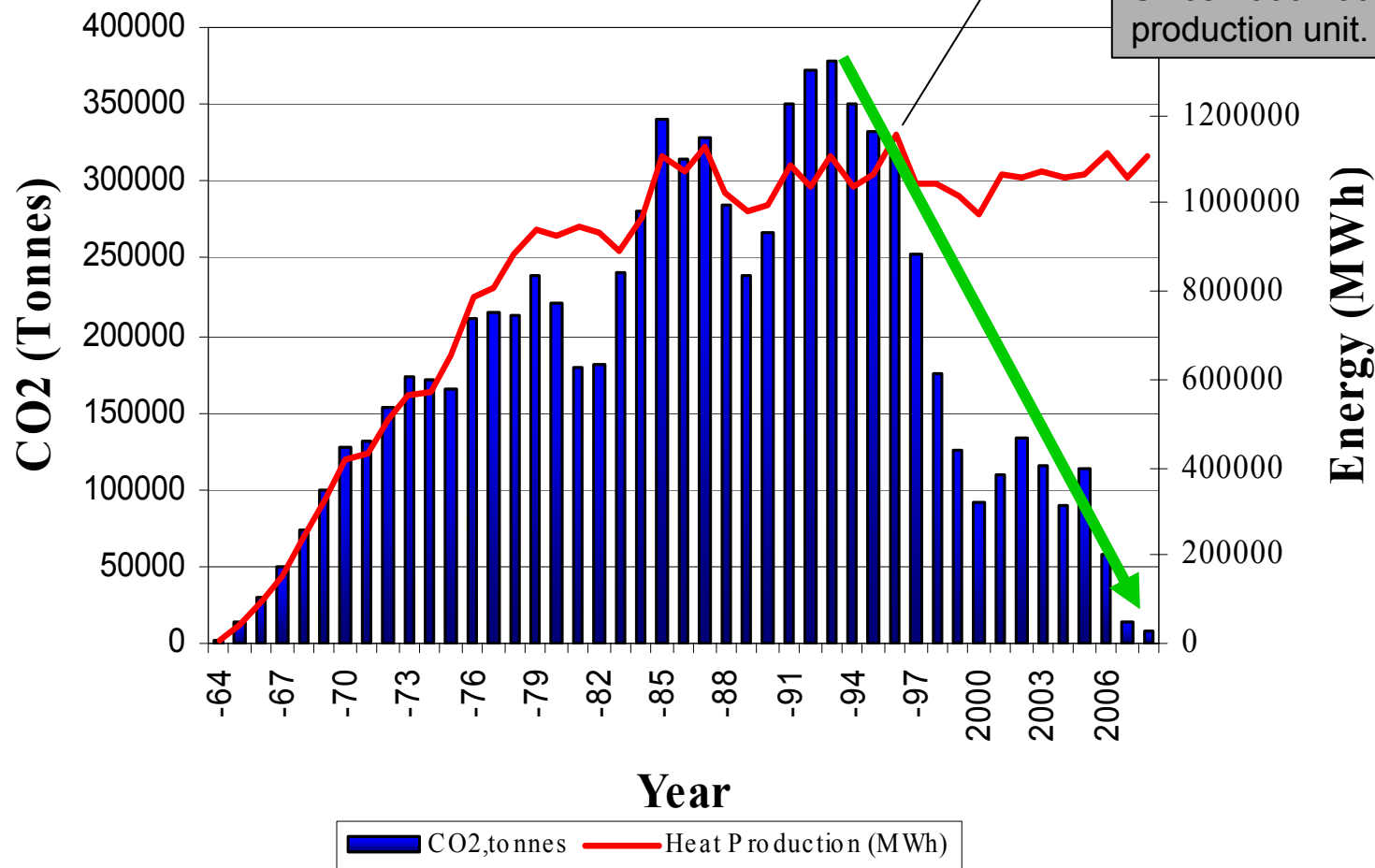
# CO<sub>2</sub>-emissions Helsingborg

## Reduced 340 000 tonnes 1994-2009

### Comment CO2 reduction:

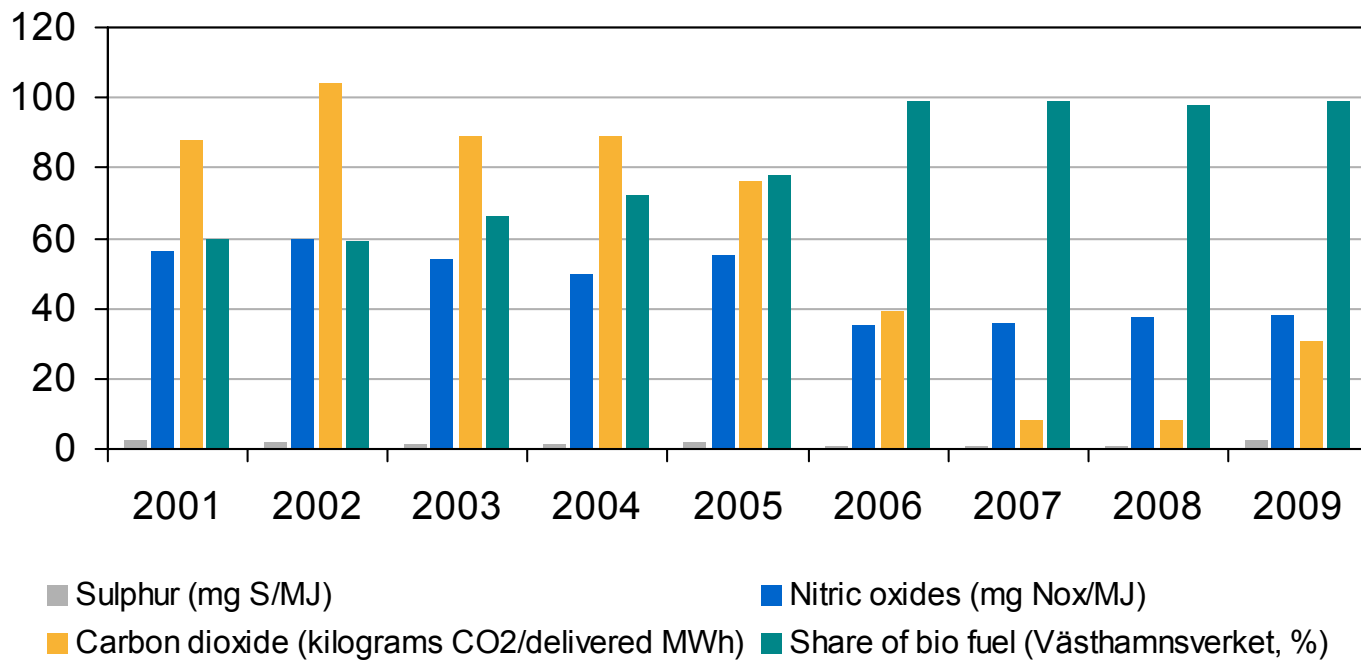
Starting mid nineties introducing biofuels in main production unit.

Since 2006 100% biofuel in main production unit.



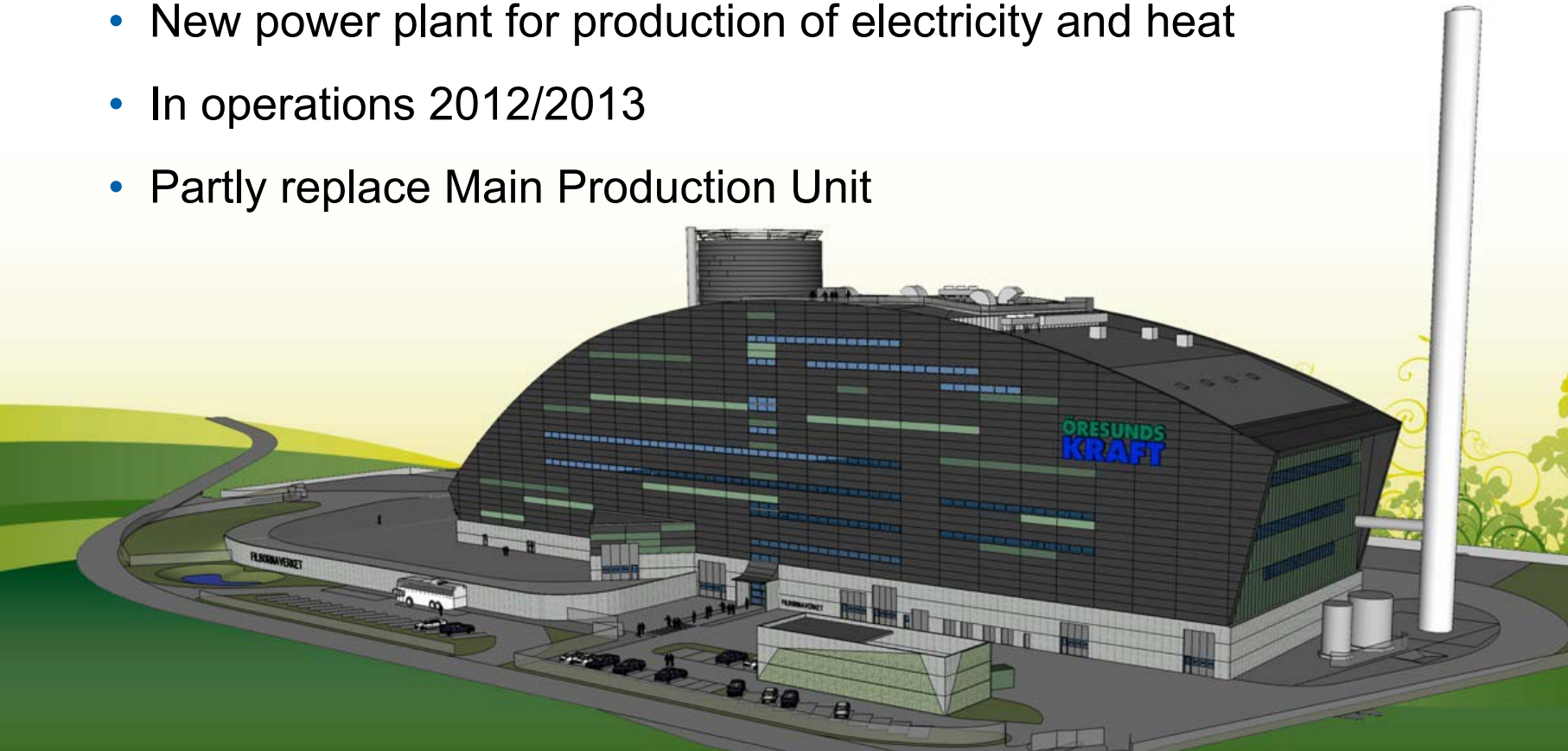


# Discharge values Helsingborg



# New power plant converts waste to energy

- New power plant for production of electricity and heat
- In operations 2012/2013
- Partly replace Main Production Unit



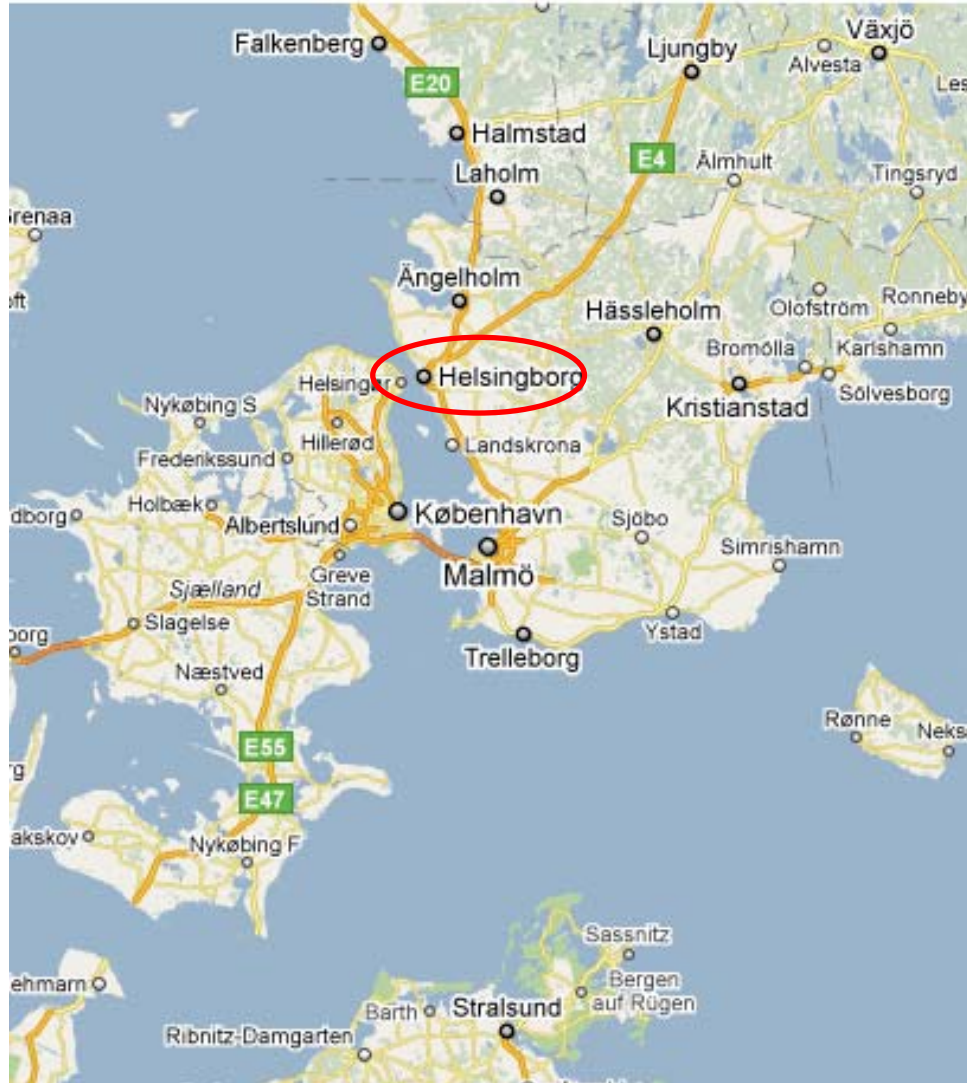
# Appendix B – Presentation Energy Company and City of Helsingborg



**ÖRESUNDS  
KRAFT**



# City of Helsingborg



- 129 177 residents
- 11 500 companies
- Apartments in Apartment Buildings
  - 41 000
- Apartments in Houses
  - 22 000



HELSINGBORG

# City Environmental Strategy

- Environment Goal year 2035
  - Energy from Wind Power and Wave Power 60 GWh
  - Solar Energy 15 GWh
  - Zero fossile fueled heating in City of Helsingborg
  - Energy use reduced 30% (since 2005)
- Environment Goal year 2020
  - Energy from Wind Power and Wave Power 60 GWh
  - Solar Energy 3 GWh
  - Energy use per resident reduced 15% (since 2005)





# House Hold Heating Helsingborg

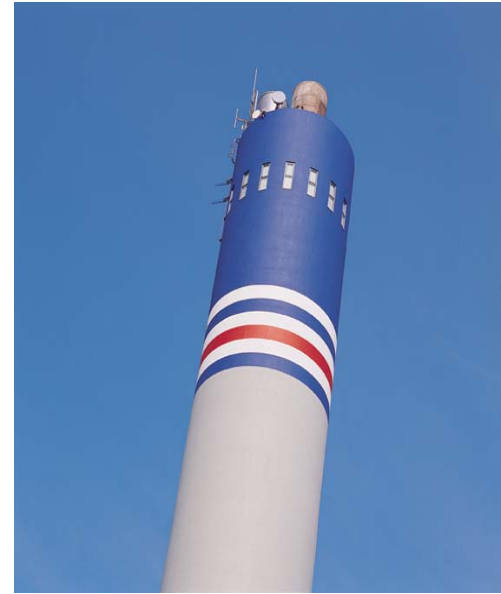
(data from 2004)

- District Heating 730 GWh (78%)
- Electrical Heating 80 GWh
- Gas heaters 40 GWh
- Biofuelled heaters 20 GWh
- Oil heater 60 GWh
- **Total 930 GWh**

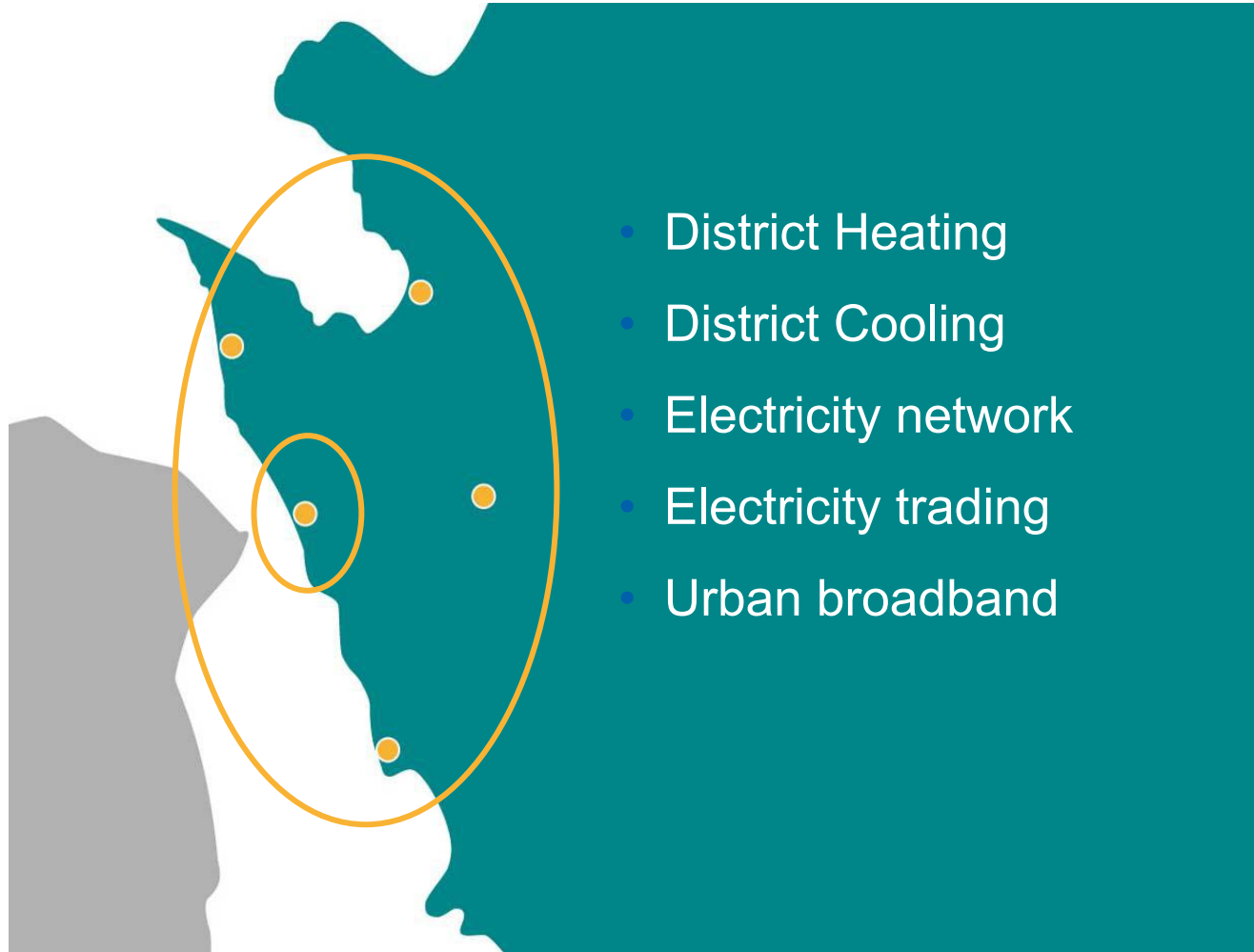


# Energy Company Öresundskraft in figures

- Company started year 1859
- Total customers 270 000
- Total energy sales (2009) 6.5 TWh
- 435 employees
- Head office in Helsingborg
- 100% owned by the City of Helsingborg
- Turn Over 4 300 MSEK



# Business Portfolio





# Öresundskraft

## Ongoing Sustainable investments

- Electrical Cars
  - Charging infrastructure
- Wind Power
- Waste Incineration Plant
- Solar Power
- Energy Efficiency Services

