

# KEEPING THE CITY WARM EFFICIENTLY

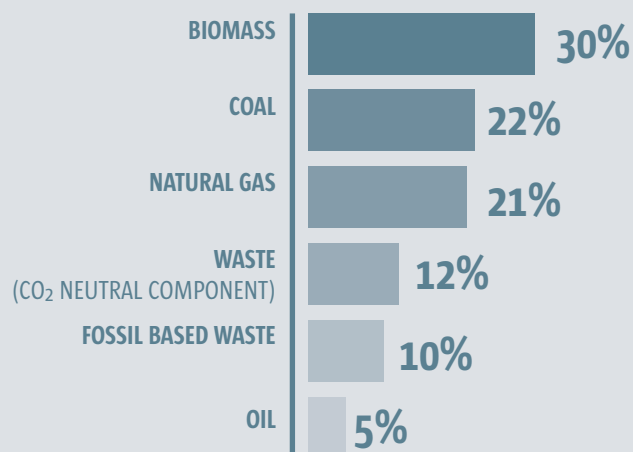
DISTRICT HEATING IS ONE OF THE MOST CARBON EFFICIENT AND FLEXIBLE WAYS TO PRODUCE AND SUPPLY ENERGY LOCALLY, CUTTING OUT MUCH OF THE WASTE ASSOCIATED WITH CENTRALISED POWER GENERATION. BY INTEGRATING RENEWABLE ENERGY SUCH AS BIOMASS, SURPLUS WIND ENERGY, GEOTHERMAL ENERGY AND BIOMASS TO REPLACE FOSSIL FUELS IN THE SYSTEM, FURTHER REDUCTIONS OF EMISSIONS HAVE BEEN ACHIEVED.

98%

98% of heating provided in Copenhagen comes from the district heating grid.

The district heating system was first established in the mid 1920s and was more intensively developed in the 1970s as a way to protect citizens and the economy from the dramatic rise in fossil fuel prices. This was a time when the city faced overdependency on increasingly scarce and expensive fossil fuels, air quality concerns caused by coal and oil burning within a city environment, and low efficiency in energy distribution in the existing district heating network. The solution was to reduce reliance on fossil fuels by maximising energy generated from waste, biomass and other fuel sources.

## COMPOSITION OF THE DIFFERENT TYPES OF FUEL SOURCES USED FOR DISTRICT HEATING SYSTEM.



## SOLUTION

### – DECARBONISING THE DISTRICT HEATING

- Technologies such as Combined Heat and Power (CHP) to capture and re-use heat energy that is otherwise lost in the electricity generation process.
- The district heating network distributes heat energy efficiently around the city. The integration of renewable fuels such as biomass further reduces the carbon intensity of the network.

## BENEFITS

- Creation of new jobs.
- Reduced CO<sub>2</sub> emissions.
- District heating costs around 45% less than oil by individual oil boiler.
- The most cost-effective way to heat buildings, taking into account environmental costs.
- Almost no negative impact on air quality.

## SOLUTION IN DETAIL

Development of a district heating system that uses heat generated from waste-to-energy plants; along with CHP technology, initially fuelled by coal, natural gas and oil.

### STEP BY STEP EXPANSION OF THE NETWORK

District heating does not necessarily require an overhaul of existing energy systems. It can be implemented over a suitable period of time. A steam network was originally established to supply hospitals and industry, and once a steam pipe was established, offices, daycare centres and private homes nearby were also connected.

This network is now replaced by water-based district heating which is more energy efficient and can be stored in thermal storages.

Regional co-operation in Greater Copenhagen:

The entire integrated district heating system spanning more than 20 municipalities in the region is developed and operated through regional co-operation and partnerships.

### DECARBONISING THE HEATING SYSTEM

#### Strategy

The short-term goal of the city is to convert all remaining coal-fired CHP to biomass.

As a long-term strategy the City of Copenhagen is now using geothermal energy in the district heating network.

#### Renewable energy supply

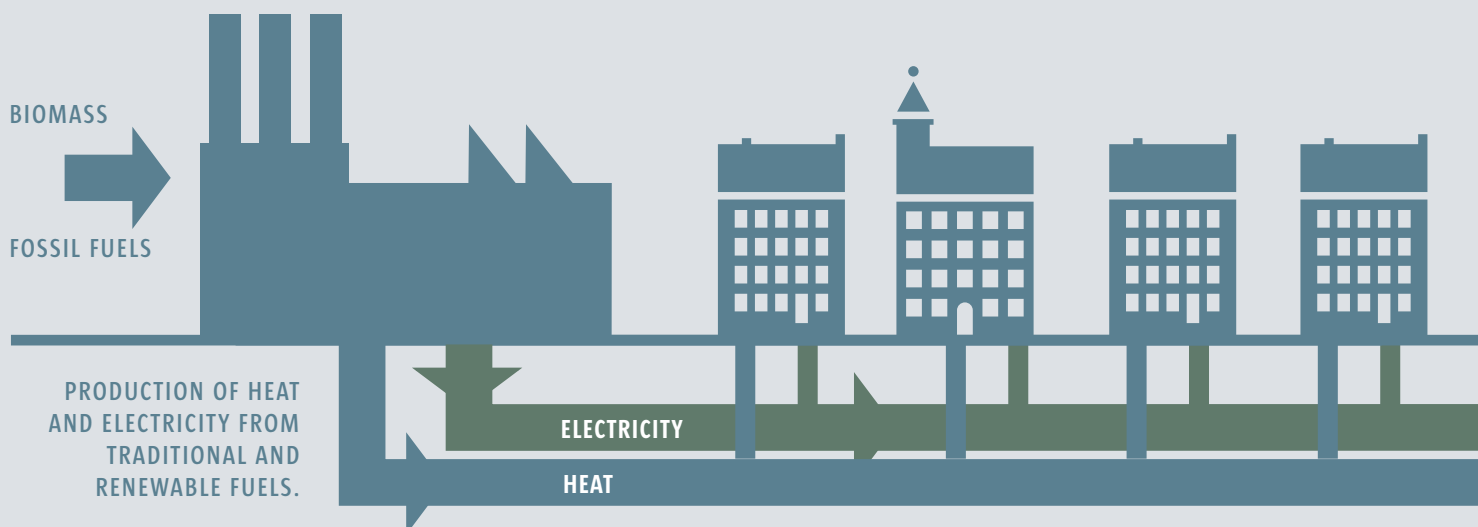
The use of CHP units allows highly efficient use of the energy in the fuels (up to 94%), and results in lower carbon dioxide emissions.

Biogas is being made an operational part of the town gas grid by extracting gas from sludge produced in wastewater treatment processes.

Biomass is planned to replace coal and provide 100% renewable energy from the CHP plant-one plant has already been converted to 100% biomass.

## FUEL SOURCES FOR THE DISTRICT HEATING NETWORK

STEP-BY-STEP EXPANSION OF THE NETWORK. A DISTRICT APPROACH ALLOWS FOR FLEXIBLE, SCALED AND PHASED INTRODUCTION OF FUEL SOURCES AND TECHNOLOGIES.



## THE SUSTAINABLE BENEFITS



### ECONOMIC

- With high fuel efficiencies of up to 94% by simultaneously generating heat and power, the power plants need much less fuel per kWh generated. In comparison, conventional power plants have an efficiency of around 40%.
- For society in general, district heating is the most cost-effective heat supply taking into account environmental costs of CO<sub>2</sub> and other emissions.



### ENVIRONMENTAL

- The District Heating system achieves lower carbon dioxide emissions than the individual gas boilers (40% lower) and oil boilers (50% lower) it replaces.
- District heating can utilise and store the available heat from CHP plants and thereby reduce the primary energy consumption by 70% compared to individual boilers.
- Conversion to biomass-fuelled district heating is further decarbonising the energy supply.



### SOCIAL

- Jobs were created in developing the grid infrastructure required for the district heating system.
- Municipal and consumer ownership of the district heating grid infrastructure and the Danish Heat Supply Act ensure that all economic benefits of district heating are returned to the consumers.
- Joining the district heating system and sharing the fixed infrastructure costs reduces the heat price to the benefit of all consumers.

