



RAMBOLL

CO-GENERATION & FUEL EFFICIENCY

Co-generation – also known as Combined Heat and Power generation – is an energy efficient use of fuel. In conventional thermal power generation low value energy is wasted, but in CHP most of it is captured at a modest cost.

With CHP, less fuel is required to produce the same amount of useful energy. CHP also offers the advantage of high-quality and reliable energy supply to the consumers as well as the generation of low-carbon or renewable energy in a cost-effective manner.

Ramboll has for more than 40 years been the leading consultancy in the development of both district heating, CHP conversion and new plant construction projects in Denmark.

Hence, this has given us a unique experience from all phases of implementing both new and retrofit CHP projects.

Retrofitting at a modest cost

CHP is most optimally implemented when designing a new power plant. CHP may also be retrofitted at a modest cost and a short outage time into an existing thermal steam power plant without loss of performance. Even a retrofitted

The Danish CHP conversion

Since the oil crises in the 1970s, the total Danish energy consumption has been almost constant despite a 2-3 % annual economic growth. The main single contributor to this is a strategic conversion of thermal power production into CHP – Combined Heat and Power. This has also resulted in the consumption of fossil fuels for the heating sector being reduced to 40 % in 30 years in the most cost effective way.

CHP solution is with respect to economy, efficiency, environmental impact, operability, and stability a much better solution than separate production of power and heat.

Ramboll's experience

Our vast experience with energy production facilities based on a variety of fuels combined with our experience of district heating transmission systems help us

maximise the benefits for both investors and consumers.

We offer our clients a partnership within all services necessary for establishing optimised CHP plants, heat accumulators and district heating systems – from planning, design and procurement to implementation and O&M support.

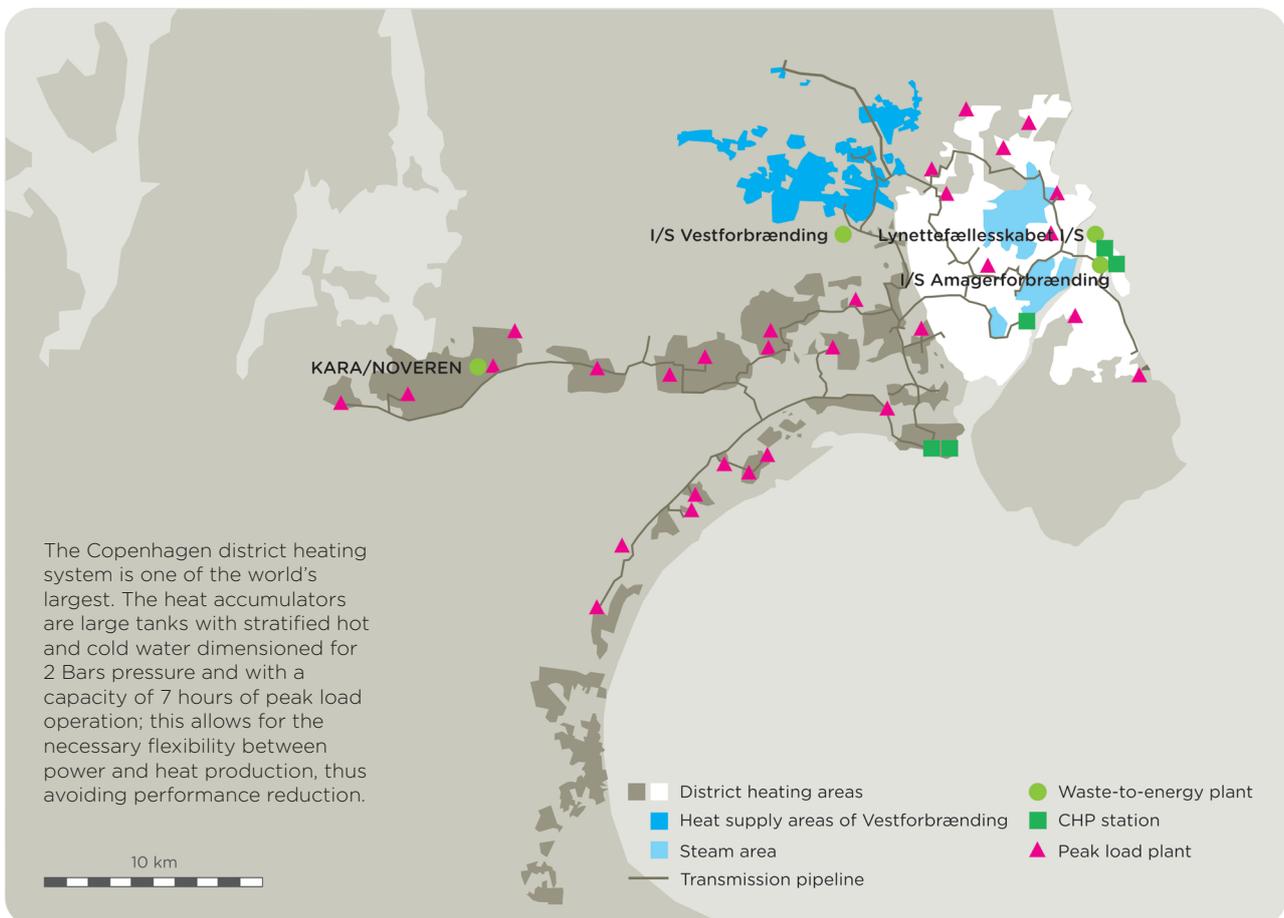
For further information please visit our website www.ramboll.com/power or contact our Service Line Manager directly.

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MAJOR ADVANTAGES OF A CHP SOLUTION

- A heat accumulator causes a decoupling of the production of power and heat resulting in enhanced flexibility: production at non-peak hours, a spinning power reserve in the grid and overload heat capacity.
- Much higher total energy efficiency (up to 80 to 85 % on an annual basis) resulting in a higher income. Viewed as a (virtual) heat pump, a CHP solution has a COP in the order 4 to 10.
- Reduced emissions (CO₂, SO₂, NO_x) per produced (sold) energy unit (heat or power).
- The heat loss from the heat transmission system is relatively modest, hence locating the CHP plant far (30+ km) from densely populated areas is not a major problem.
- Selection of fuel and emission control can be implemented without interruption in the supply.



RAMBOLL'S EXPERIENCE

We have been involved in all phases of both new and retrofit CHP projects: analysis, planning, detailed design, implementation, quality control and operation. Our force is in particular on:

Energy planning: Resources, capacities, load dispatch

Power plants: Fuel handling, boiler design, process and process control, operation, and materials

Turbine process: Process design, valves, heat exchangers, pumps and heat accumulators

District heating: Transmission lines, distribution system, auxiliary equipment, and end user connection.