



**HILLERØD  
KOMMUNE**



Conference: Klimatilpasning i byerne

## Low energy buildings and low energy District Heating

A presentation about District Heating



**Speaker/ Jens Lunding**

**Engineer and Project manager, Utility Hillerød**

# Agenda

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- **Introduction to the presentation:**
- **District Heating and the environment:**
  - Reduction of the CO2 emission
  - Barriers mentioned by the media
- **District Heating in the future:**
  - “Low temperature” District Heating
  - A new District Heating cost structure
- **Agenda for the workshop tomorrow:**
- **End of presentation and Questions:**

# Introduction

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- **My golden goals in this presentation**
  - I want to describe how we can use district heating in the future and show the barriers we have to pass in order to achieve this.
  - I want to use a general approach with simple examples, and link this to experiences learned in Hillerød and other Danish cities.
  - I want to show that “the normal way of thinking” may be the largest barrier for not achieving CO2 reductions.
- **Through this presentation I hope to:**
  - Increase your knowledge about District Heating
  - Give you an idea of how things are done in Hillerød.
  - Give inspiration that can be used, to make your work with district heating as interesting and fun, as it is in Hillerød.
- **Presentation**
  - 20 minutes

# Introduction

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- This presentation, including examples, has been designed by Hillerød Varme A/S with support from COWI.



- One of the examples has been designed with support from the EFP2007 project "Development and demonstration of low-energy district heating for low energy buildings."



- This presentation has been financed with support from the EU-Concerto.



# District Heating and the Environment: What is it and how can it reduce CO2

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- **Production**
  - Earth temperature (Geotermik-heatpumps)
  - Wind (Wind turbines)
  - Sun (Solar cells)
  - Gasification
  - Combustion (Bio-fuel, wood chips, activated sludge)
  - Water (waterfall-turbines)
  - Combustion cells
  - Other – Carbonfuels
- **Distribution – Low temperature**
  - Pipes and cables, electricity, Water, Heat.
  - Super batteries, Hydrogen pellets.
  - Move the production to the consumer
- **Consumption – Low energy buildings**
  - Low-energy technology, light, insulation, electricity cars, etc..
  - Normal practice – knowledge, motivation and economy

# How much heat do we have



Abonnement | Annonceinfo | Advertising | KrakTeknik | Ingeniør-job - Jobfinder.dk | Mes:

**Ingeniøren** NYHEDER BLOGS DEBAT AVISARKIV KURSUSGUIDE

Forsiden / Nyheder / Energi & miljø / Energien fosser ud af kraftvarmeværkerne i sommervarmen

## JOBFINDER

Rambøll  
Erfaren ingeniør til  
broprojektering og  
projektledelse  
Rambøll

## Energien fosser ud af kraftvarmeværkerne i sommervarmen

De centrale kraft  
på 90 procent, m  
fordi varmen ikke

borsen.dk  
**Børsen**

Nyheder fra borsen.dk



Foto: Colourbox

## Stort uudnyttet potentiale i solvarme

31-08-2009 10:20 af Jimmy Hansen

## Krematorier skal lave fjernvarme

Nye krav om røgrensning tvinger krematorierne til at få kølet røgen ned fra 800 til 130 grader. Det får flere til at forvandle røgen til fjernvarme

16:27 - 26. okt. 2009 | Mathilde Miller

D. 1. januar 2011 skal alle krematorier til at rense den røggas, som ledes ud ved selve ligafbrændingen. Det har fået flere af dem til at indgå aftaler...

## TIDENS ENERGIFORM

I dag får br

19. juni 2008 | Debatindlæg

## Fjernvarme er fremtidens energiform

Indlæg i Energi-tillæg til JyllandsPosten

Af Jørgen G. Jørgensen, direktør, Dansk Fjernvarme

Verden har som aldrig før fokus på miljø, energieffektivitet og forbruget af fossile brændstoffer. Onnaven er klar: Kloden har fået feber, og vi skal mindske den globale opvarmning ved...



## Forretningsaktiviteter

Exploration & Production | **Generation** | Energy Markets | Sales & Distribution | Forskning & Udvikling

## Elproduktion

- Termisk Elproduktion
- Centrale kraftværker
- Decentrale kraftværker
- Affaldsfyrede kraftværker
- Vindkraft

## Elproduktion

87% af DONG Energys elproduktion i 2007 kom fra termiske kraftværker som overvejende er kulfyrede. Den resterende produktion kommer fra Vandkraft i Sverige og on- og offshore vindmøller i:

Udskriv | Forster skrift

# Why District Heating

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- **Renewable energy sources can be used directly or in combination with large scale heat storages. It is flexible system suitable for all kind of energy sources**
- **Waste heat from CHP plants, refuse incineration and industrial processes can be utilized**
- **Reliable and easy operation for the heat consumers**
- **The system (pipes) can last for many years (probably more than 100 years)**

# The barriers we need to overcome: The news, media and more



The screenshot shows a news article on the website jpaarhus.dk. The main headline is "Barmarksværker ude i hampen" (Barren fields are in the hamper), with a sub-headline "Da man aldrig er kommet godt fra at sætte markedsmekanismen ud af kraft gennem tilskudsmuligheder, bør barmarksværkerne lukkes." (Since one has never managed to get the market mechanism out of force through subsidy opportunities, the barren fields should be closed). The article is by Leo Lund, Arildsvej 53, Viborg, published on 25.08.08 at 03:00. A sidebar on the left lists various news categories: Forsiden, Politik, Kriminalitet, Erhverv, Studie, Kultur, Meninger, Blogs, Sport, and AGE. Below the main article, there is a section titled "Skatteregler sender varme for en milliard ud til fuglene" (Tax rules send heat for a billion to the birds) with a sub-headline "Danmarks årlige CO2-udslip kunne sænkes med godt en halv" (Denmark's annual CO2 emissions could be reduced by about half). A "SENESTE NYT" (Latest News) section lists recent updates: 16:17 Japanerne sat, 15:36 Vestas udvikle, and 14:55 Dansk robot r.

- **District heating in a financial context**
  - How shall a distributionsystem be payed off...
  - How long dos a new district heating system live...
  - Why can` t we use the fuels we want to...

# District Heating in the future:

## News in the distribution net

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### District Heating pipes

#### Parameters to lower the heat losses

- Smaller pipe dimensions (because of 10 bar system etc.)
- Larger insulation thickness
- Highly-efficient PUR insulation
- Cell gas diffusion barrier
- Diffusion-tight flexible carrier pipe
- Twin pipes (double pipes)
- Reduced pipe lengths, if possible

#### Used types

- AluFlex twin pipes in dimensions Ø14 to 32 mm
- Steel twin pipes in dimensions DN32 to DN 80

**New smaller  
dimension flexible  
twin pipe Ø14/14  
Aluflex**

**(by Logstor)**

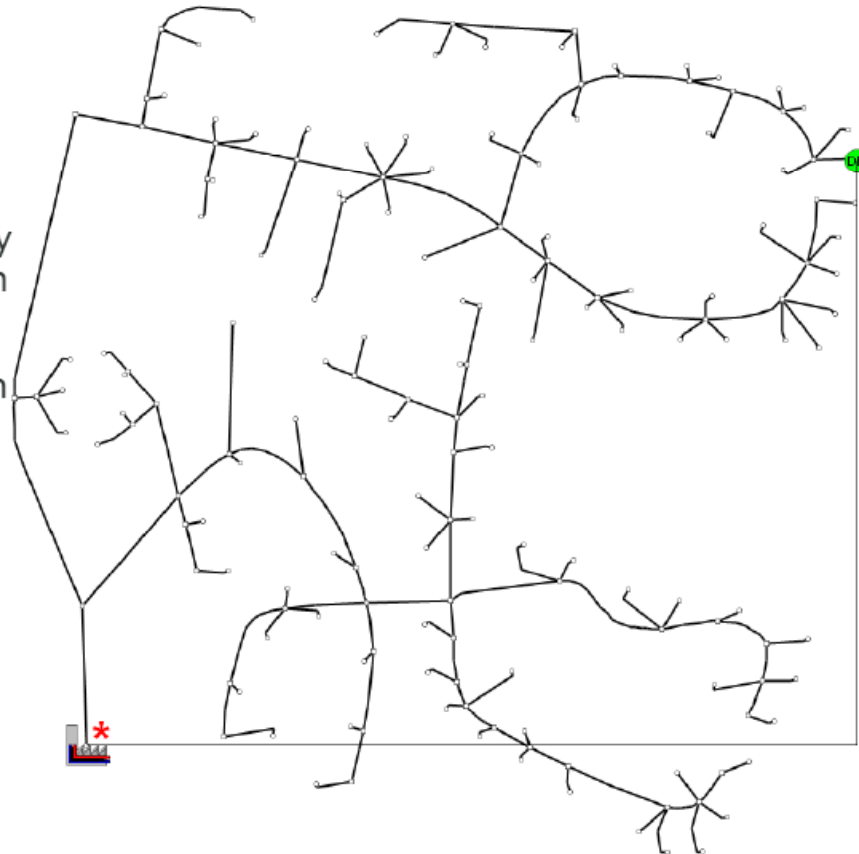


# District Heating in the future:

## Hillerød – Ullerødbyen North - a case study

### Simulated district heating network

- Reference house: 145 m<sup>2</sup> low-energy class 1 house (Danish Building Regulation)
- Reference house: Peak heat demand of 3.7 kW and a yearly heat consumption of 6750 kWh (incl. domestic hot water)
- 92 houses and 1 DH substation / plant in Ullerød, Municipality of Hillerød
- Peak heat density: 5.7 kWh/year/m<sup>2</sup> and 193 kWh/year/meter DH pipe
- Not optimised with focus on reduction of total pipe length and location of the DH substation / plant



# District Heating in the future:

## Hillerød – Ullerødbyen North - a case study



Scenario	Consumer unit type	Design load	Design temperatures	
			T <sub>supply</sub>	T <sub>return</sub>
3	<b>Domestic hot water storage</b>	8 kW	60° C	30° C

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# District Heating in the future:

## Hillerød – Ullerødbyen North - a case study



### Calculation results

Energy in DH network		Scenarie 0 Reference*	Scenario 3 D. hot water unit
Electricity to pumping, total network	MWh <sub>p</sub> /year	1.1	4.8
Heat delivered, total network	MWh/year	966.0	743.5
Heat consumption, 92 houses	MWh/year	621.0	621.0
Heat loss, total network	MWh/year	345.0	122.5
<b>Heat loss, total network</b>	<b>%</b>	<b>36</b>	<b>16</b>

\* Domestic hot water units and "traditional" DH network with single pipes

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# District Heating in the future: Hillerød – Ullerødbyen South



- Larger insulation thickness and aluflex twin pipes.
- Smaller pipe dimensions and possible larger water velocities.
- Low temperature (60/30) due to “mixing point”
- 3000 m<sup>2</sup> solar heating plant.
- **Estimated heat loss in connection to eco class 2 houses ~ 11-12 %**
  - But this is not enough in order to deliver heat to eco class one houses

# District Heating in the future:

## How expensive is District Heating

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- **Heat (costs in Hillerød)**
  - Variable costs : 462,50 kr./MWh.
- **Distribution net (construction of a new city area – 100 % dwellings)**
  - Cost : Approx. 80.000,00 kr./house
  - Fixed costs: 3.750,00 kr./year
- **Consumption (Heating and water unit – in the houses)**
  - Cost : Approx. 20.000,00 kr./house

# District Heating in the future:

## How cheap can it be

### Yearly costs for District Heating fore eco class one houses (6 MWh/year)

Payback time on the pibes (years)	20 years	50 years	80 years	100 years
Incl. all - as it is now	kr 11.525,00	kr 9.125,00	kr 8.275,00	kr 8.125,00
All (Fixed costs is 1/3)	kr 9.025,00	kr 6.625,00	kr 5.775,00	kr 5.625,00
All (Fixed costs is 1/3+heat 200 kr/MWh)	kr 7.450,00	kr 5.050,00	kr 4.200,00	<b>kr 4.050,00</b>

- The larger companys do not have differentierede fixedcosts strategys for new lowenergy areas.
- Today the national average heatcost is arround 600 kr/MWh. A new heat boiler with woodchips can produce heat to 200 MWh

# District Heating in the future:

## What are the costs of other "Heat Products"



Yearly cost for heating fore eco class one houses (6 MW/year)				
	20 years	50 years	80 years	100 years
<b>Air heatpumps (changed every 20 year), COP 2,5</b>	kr 7.800,00	kr 7.800,00	kr 7.800,00	kr 7.800,00
<b>Ground Heating (Unit changed every 20 year) COP 3,5</b>	kr 7.428,57	kr 5.428,57	kr 4.928,57	kr 4.828,57
<b>Natural Gas (boiler changed every 20 year + instalations - construction work), eff. 80%</b>	kr 7.404,32	kr 6.654,32	kr 6.154,32	kr 6.154,32

### Ground heating is nearly as cheap as district heating but:

- Heat pumps do use electricity....
- Ground heating do use glücole...

# District Heating in the future:

What shall we choose

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**District heating** is the **cheapest** and most  
**sustainable heating**, if we want it to be...

- also for lowenergy houses that only consumes 40 watt/m<sup>2</sup> ´ year

# The Workshop – on Friday

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- **Participants**

- Hillerød Kommune, Hillerød Fjernvarme – Jens Lunding
- Cowi - Peter Kaarup Olsen
- Rambøll - Jørgen Hvid



COWI

RAMBØLL

- **Workshop agenda**

- How can we optimize a product.
- 3. case studies on; Production, distribution, economy.
- District Heating in the future – Workshop discussion

- **Goal**

- Everyone shall be “Out of the box thinking”
- Everyone will be a part of the discussion
- Everyone shall learn something new
  
- There will only be 14 chairs... So don't be late if you don't want to stand up...

# End of the presentation

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- Thank you for your attention.
- I hope you have got some inspiration for your own projects.
- I hope that I have met your expectations.
- I will gladly answer questions now, in the break or by e-mail.

Jens Lunding  
JeLu@Hillerod.dk



## Vision og Mission

**Vision:**  
**Vi vil skabe Danmarks  
bedste arbejdsplads,  
hvor mennesker vokser.**

**Mission:**  
**Vi er til for borgernes skyld.  
Vi leverer serviceydelser  
til rette tid, kvalitet og pris  
med hensynstagen til miljøet.**

**Vores eksistensberettigelse er:**  
**Vi er konkurrencedygtige  
og kan bidrage med noget  
ekstra, både til borgerne  
og til kommunen.**

