

# The Danish Model for Organising and Financing of District Heating

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PlanEnergi:  
Consultant Engineers  
33 years years with  
renewable energy

- biomass
- biogas
- solar thermal
- heat storages
- heat pumps
- district heating
- energy planning



Training course

Liutomer and Zagreb 31 05 and 01 06 2017

Per Alex Sørensen

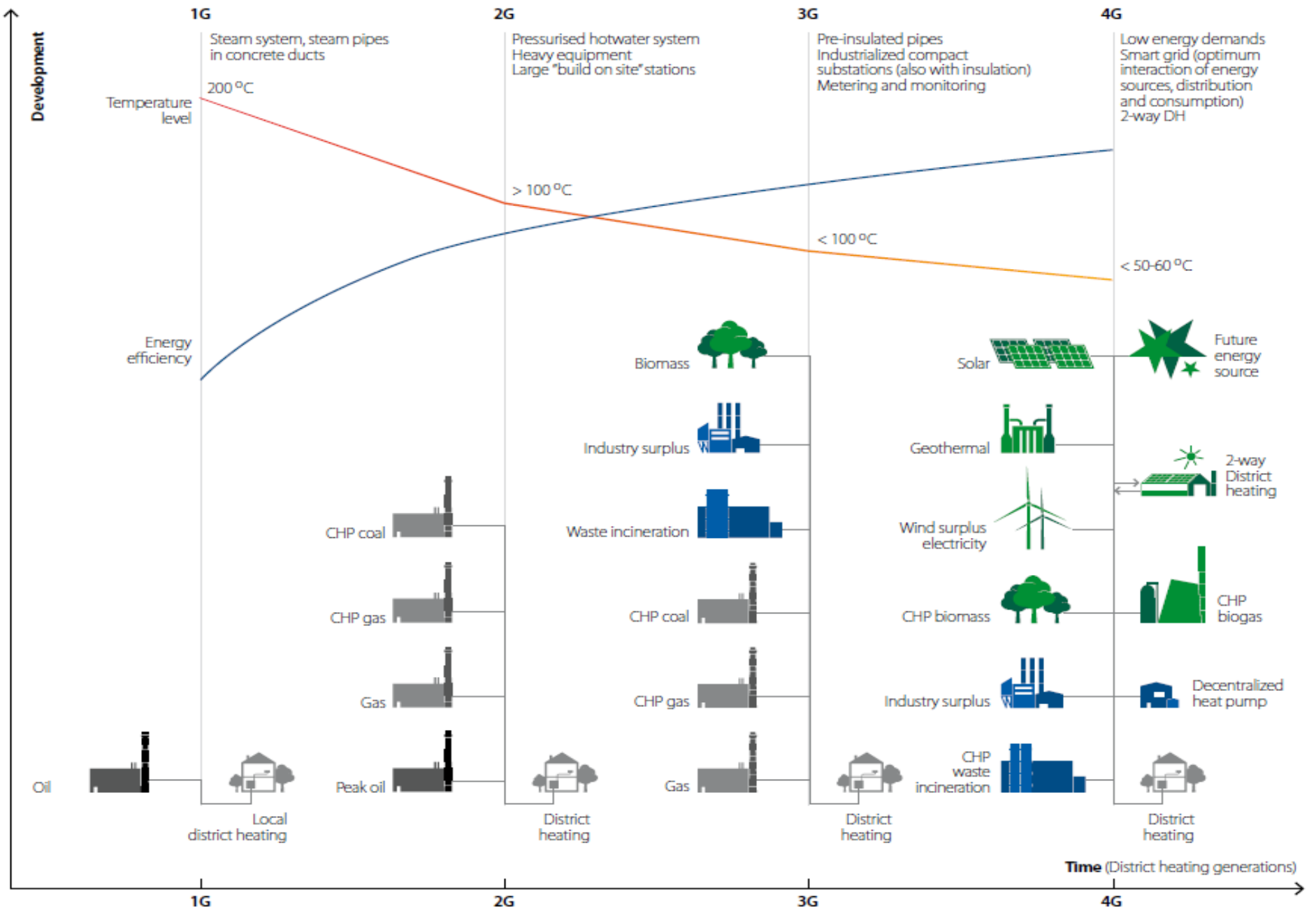
## Agenda

- **The development of district heating in Denmark**
- **The legal framework**
- **Examples of ownership and organisation**
- **Financing of district heating**
- **Development trends**

# The Danish Model for Organising and Financing of District Heating

- 1898**      **Waste to heat**
- 1903**      **Heat from power plants. Fuel: coal**
- 1960**      **Change from individual peat and coke to individual oil or district heating . Fuel: oil in district heating. From 1972 change to coal.**
- 1979**      **Natural gas introduced. Law of heat supply and division in individual gas and district heating areas. Fuel: coal and straw in district heating.**
- 1990**      **Natural gas fired CHP-plants. Fuel: natural gas (and still coal in power plants)**
- 2010**      **Individual gas conversion to district heating. Fuel: natural gas and renewable energy (and still coal in power plants, but power plants start to convert to biomass)**
- 2017..**    **Conversion to renewable energy and excess heat in hybrid plants**

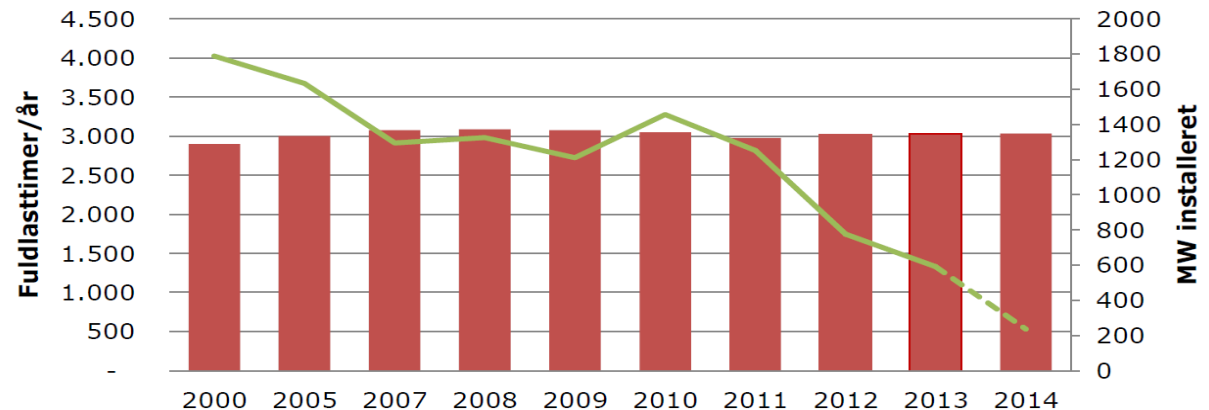
# District heating from 1G to 4G



# The Danish Model for Organising and Financing of District Heating

## District heating status in Denmark today

- 65% of all Danish houses have district heating
- 54% of the heat demand is covered by district heating
- 50 municipal owned district heating companies deliver 70% of the heat
- 340 cooperatives deliver 30% of the heat
- 250 utilities have CHP with gas engines or gas turbines, but full load hours have been reduced from 4,000 in year 2000 to 500 in year 2014.  
No new gas engine capacity installed since 2007



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## Law of Heat supply

**Introduced in 1979.** Every municipality should elaborate a heat plan where heat supply was defined as individual, natural gas, or district heating for consumers in the area to secure a market for natural gas heating in stead of individual oil.

There is a public phase in the planning process.

**After 1990** only few municipalities made new heat plans. Instead new projects with change of heat supply or heat production have to be accepted by the municipality. The project proposal has to show that the actual project is the best socio economic option among possible alternatives. When a project proposal is approved the municipality is allowed to expropriate land for the project.

**Since 2007** the climate agenda has initiated new heat plans in municipalities.

The heat plans are now part of a strategic energy planning process.

District heating is non profit



## Law of Planning

Regulates **area utilization** (where to situate new city parts, industrial areas, new infrastructure etc.)

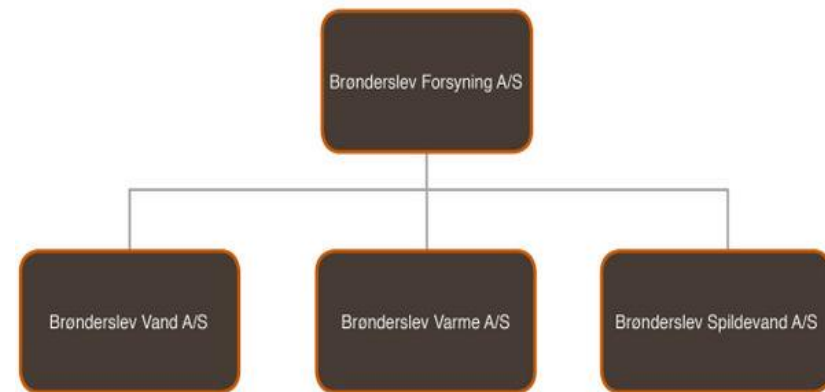
Every municipality makes a **Municipal plan** and revise it every 4 years. A public phase of 8 weeks is part of the process.

To the municipal plan can be added **Thema plans** for instance for situation of wind power plants.

When an energy plant is built, a planning permission is needed. Normally a **Local plan** is elaborated. In the local plan the new energy plant is visualized and all consequences for landscape and environment are described. A public phase of 8 weeks is part of the process. When a local plan is accepted, the municipality is allowed to expropriate land for the project

## Municipal owned utility. Example Brønderslev

Overall a holding company (Ltd). The board consists of members elected by the city council and the employees. All employees are employed by the holding company. Below the 3 supply utilities (Ltds) for water, heat and sewage water. The board for the heat supply utility consist of the chairman and the vice chairman for the holding company, the manager and two representatives from consumer side. The heat utility supplies 4,500 buildings.





## Energy Service Company. Example Nordby-Mårup, Samsø

Owner: the energy supplier *NRGi*  
(*electricity company*)

Energy Service Companies (ESCO's) act as third-party financiers by assuming the financing responsibility in energy projects. NRGi runs 11 small district heating plants. There is a fuel supply agreement for all district heating plants. It ensures the supply of biomass, and manages the risk of fuel interruption. Suppliers must pay for backup oil, if they cannot deliver straw / wood chips. 185 buildings connected



## Private ownership. Example Onsbjerg, Samsø

Owner: a privately owned limited liability company *Kremmer Jensen Aps*

An example of third party financing

Management board: members of the family + two representatives for the 80 consumers + 1 representative from the municipality

The owner constructed the plant and runs it himself. He also takes care of the Ballen-Brundby plant.

The consumers pay a one-time connection fee, an annual subscription fee, and a price per consumed MWh



## Consumer owned company. Example Ballen-Brundby, Samsø

Owner: the consumers in a co-operative (Coop) with limited liability

The members both own and manage the coop. The coop must be of the greatest possible use to the members, rather than give the highest profit.

In a coop every member has one vote, independently of the magnitude of his investment

The municipality issued a municipal guarantee for a loan.

Before construction members paid a fee of 80 DKK (11 EUR) to get connected.

After construction new members pay 45000 DKK (6000 EUR) for the connection labour and materials. 232 buildings connected.



## Why local ownership? Reasons for Samsø

- **it created collective wealth**
- **local community developed**
- **local acceptance improved**
- **it was an education**

## Financing Example EKF [www.ekf.dk](http://www.ekf.dk)

### About EKF

- Denmark's official export credit company
- 94 years of experience
- Owned and guaranteed by the Danish state
- Works on commercial terms
- Operates under international rules and regulations, including standards for CSR-evaluations



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## Financing - EKF

### A note on rules & regulation

A management agreement between EKF and bank secures that each individual utilisation of the line of credit is acceptable to EKF & in compliance with OECD-rules.

For example:

- Each utilisation of the credit must be linked to a corresponding export contract.
- The buyer pays min. 15 per cent cash up front to get up to 85 per cent funded at the bank for each individual contract.
- The credit amount does not exceed the amount fundable according to OECD-rules (import value/local works limitation).
- During the utilisation period each utilisation accumulates under the credit line until SPOC (F.x. utilisation over 12 mths./SPOC in 12th month. ).
- Maximum tenor of 8½ years - however longer tenor can be justified for renewable energy investments.

### How to get started

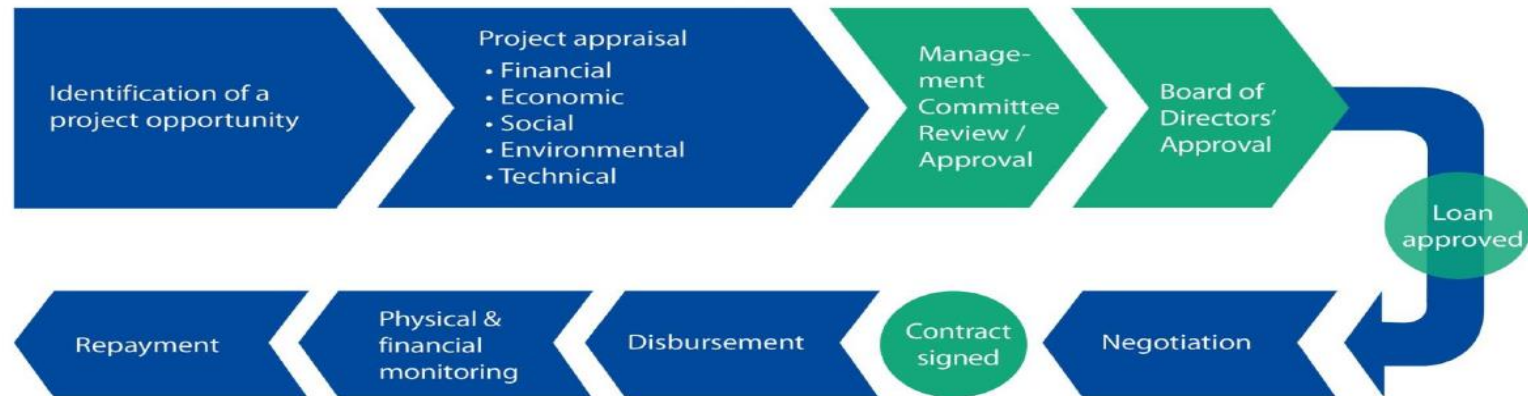
- The buyer identifies a group of Danish technology & equipment providers, an investment budget and financing need over a certain time-frame.
- EKF conduct a CSR-compliance test of the buyer' activities, if connected with larger projects a project-specific CSR-test will apply.
- EKF check with each of identified Danish exporter whether the required Danish Economic Interest will be met.
- EKF, bank and buyer agree on terms of the credit line, how it's managed.

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**ELENA** <http://www.eib.org/products/advising/elena/>

## General operational considerations

- ❖ Projects financed by the Bank must be:
  - ❖ economically justified
  - ❖ technically viable
  - ❖ financially self-supporting and
  - ❖ environmentally and socially sound
- ❖ All projects financed by the Bank are appraised by a multi-disciplinary team; confidentiality is always respected.





## European Local Energy Assistance - ELENA

### *ELENA* *Technical Assistance*

Support for  
local or regional entities for :

- **Additional personnel**
- **Technical studies**
- **Preparation of calls for tender**
- **Financial structuring**

### **INVESTMENT PROGRAMME**

#### **EE and RE**

in public and private buildings,  
public lighting and traffic light network  
photovoltaics,  
heating/cooling systems ;

#### **Efficient and sustainable urban transport**

high-efficiency buses,  
electrically powered cars,  
logistical improvements;

#### **Local energy facilities that support EE/RE**

smart grids,  
infrastructure for recharging electrically  
powered cars,  
information and communications technologies,

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European Energy Efficiency Fund - <http://www.eeef.eu/objective-of-the-fund.html>

## UK

- €4.2m senior debt to project entity **Cardenden Heat and Power**  
(EE: boiler replacement and RE: onshore wind)

## FRANCE

- €5.1m junior funds to project vehicle to supply heat to **City of Orléans**  
(EE: CHP/biomass)
- €7.3m junior funds to project vehicle to supply heat to **City of Rennes**  
(EE: CHP/biomass)
- €30m senior funding to **Bolloré**  
(Clean Urban Transport: electric cars)
- €5m senior construction facility to project vehicle of **Région Rhône-Alpes**  
(EE: schools retrofit)

## SPAIN

- €2.5m forfeiting loan to **Universidad Politécnica de Madrid** via Enertika (EE: building retrofit)

## NETHERLANDS

- €8.5m senior debt to City of Venlo  
(EE: public lighting)

## GERMANY

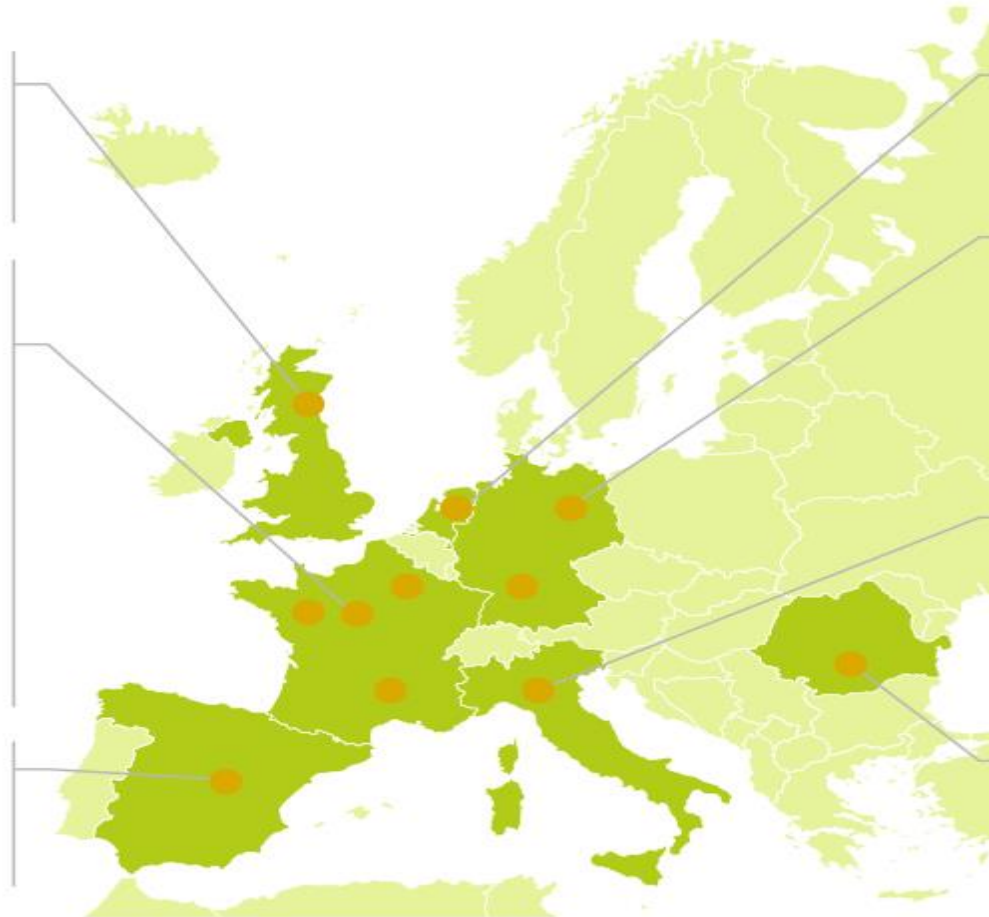
- €0.9m forfeiting loan to **Jewish Museum Berlin** via Johnson Controls' ESCO  
(EE: building retrofit)
- €0.6m forfeiting loan to **University of Applied Sciences Munich** via Johnson Controls' ESCO  
(EE: building retrofit + CHP)

## ITALY

- €32m project and VAT bond facility to project entity upgrading **University Hospital S.Orsola Malpighi in Bologna**  
(EE: reduction on energy in entire fluid production and distribution system)

## ROMANIA

- €25m subdebt to **Banca Transilvania**  
(Financial Intermediary investment: EE, RE, Clean Urban Transport)



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## Financing 1 mio. €

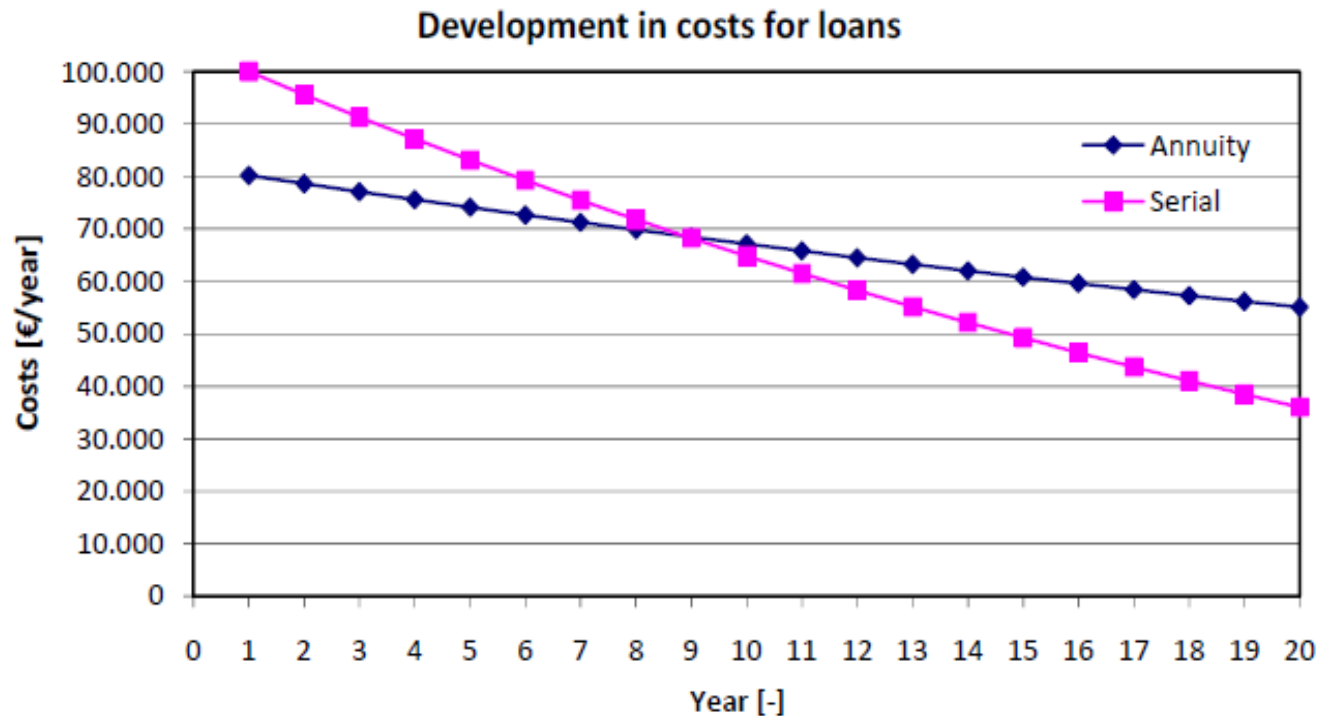


Fig. 2.4.1. Development in costs for annuity loans and serial loans, interest rate 5%, inflation 2%.

## Financing costs for different interest rates

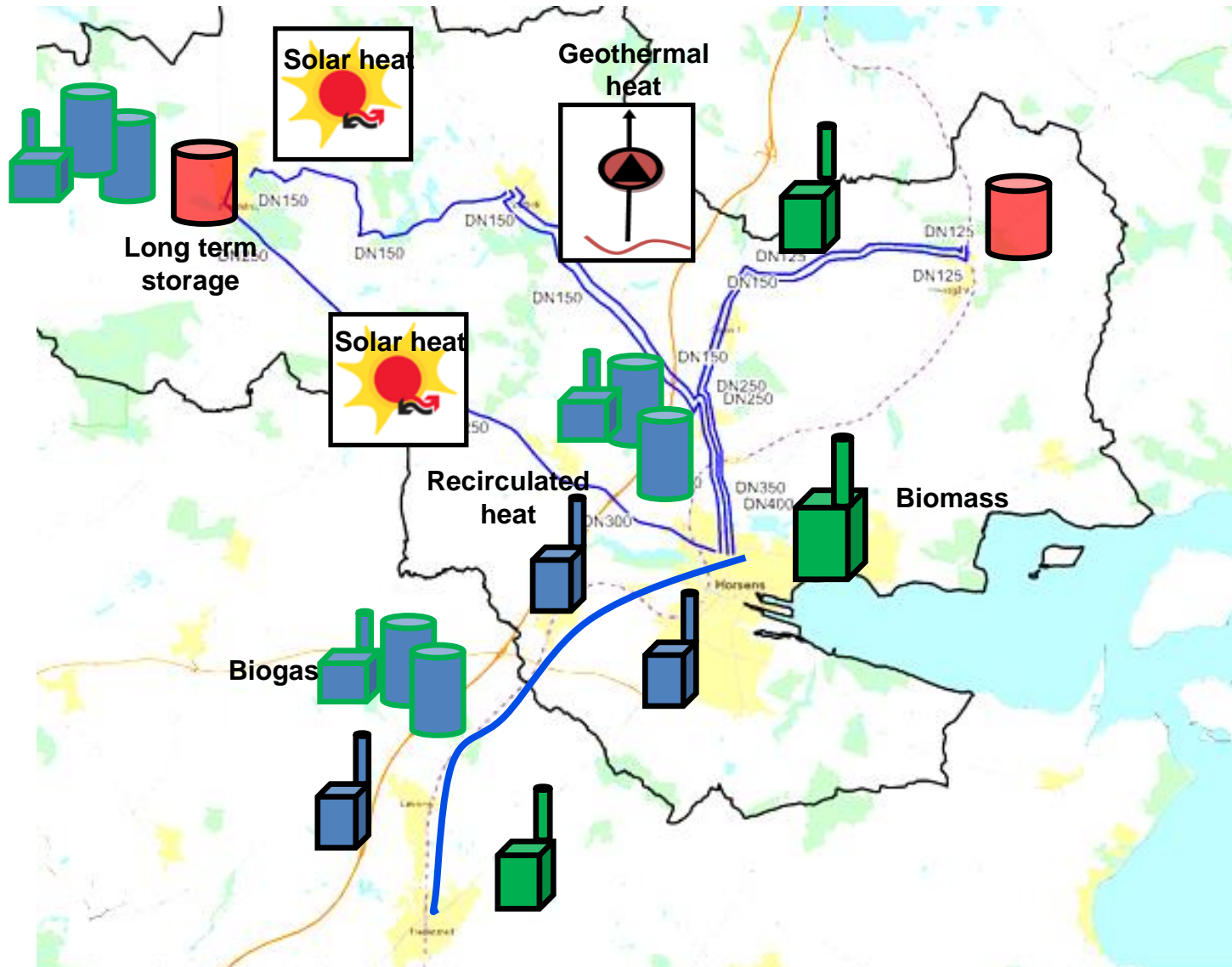
Loan 20 years, inflation 2%

Serial loan, 5%, 1.st year	10%
Serial loan, 3%, 1.st year	8%
Annuity loan, 5%, 1.st year	8%
Annuity loan, 4%, 1.st year	7.4%
Annuity loan, 5%, average	6.7%
Annuity loan, 4%, average	6.1%
Annuity loan, 3%, average	5.5%

## Future development

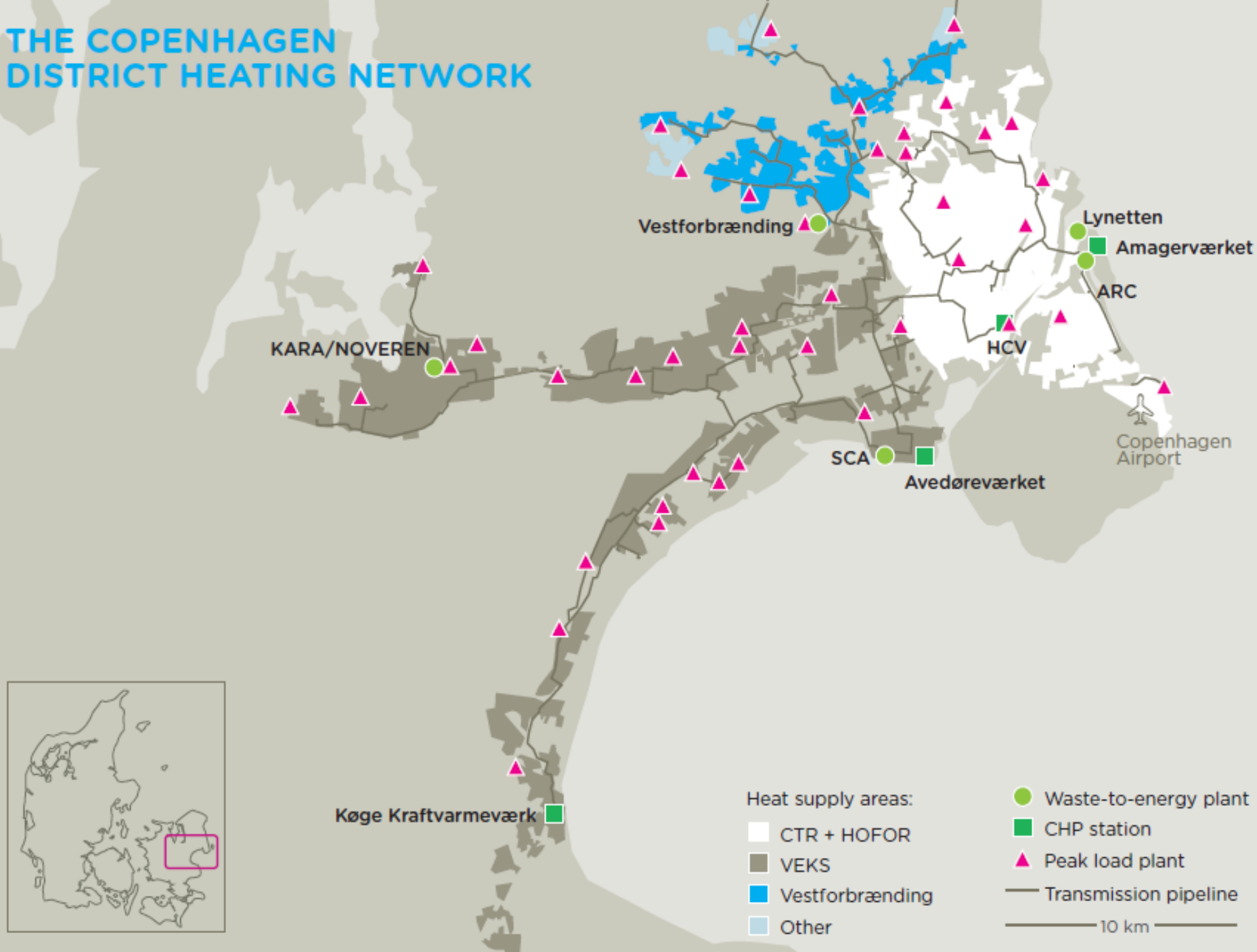
- **Small DH utilities will be administrated by the larger ones**
- **Monitoring of consumption flow and return temperatures from buildings will be online (this is already realised for several utilities)**
- **Bench marking will be obligatory for the larger plants**
- **More transmission lines connecting utilities**

# The Flex Cities project





# THE COPENHAGEN DISTRICT HEATING NETWORK





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## Thank you for your attention



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