



QAiST

Quality Assurance in Solar Heating
and Cooling Technology

Solar Assisted District Heating

Boom in the MW Size Solar Heating Systems

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25 years with
solar thermal

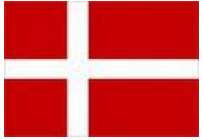
PlanEnergi

Consultant Engineers

20 years with
renewable heating

- biomass
- biogas
- solar thermal
- heat pumps





Large Scale Solar District Heating in **Denmark**

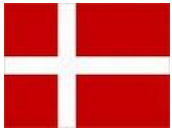


SDHtake-off - Solar District Heating in **Europe**



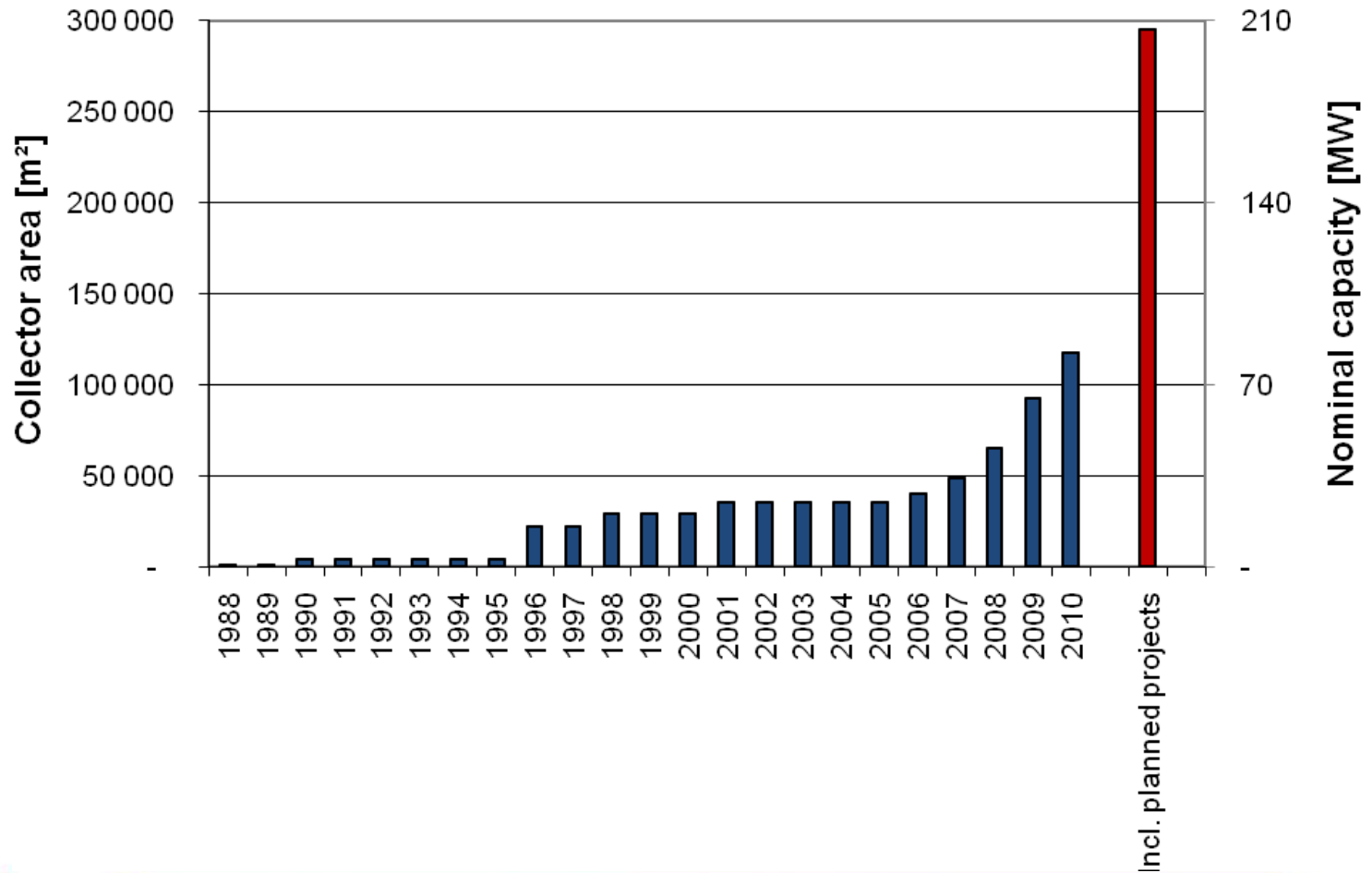
Large scale solar heating and cooling in the **World** - in combination with seasonal storage and heat pump



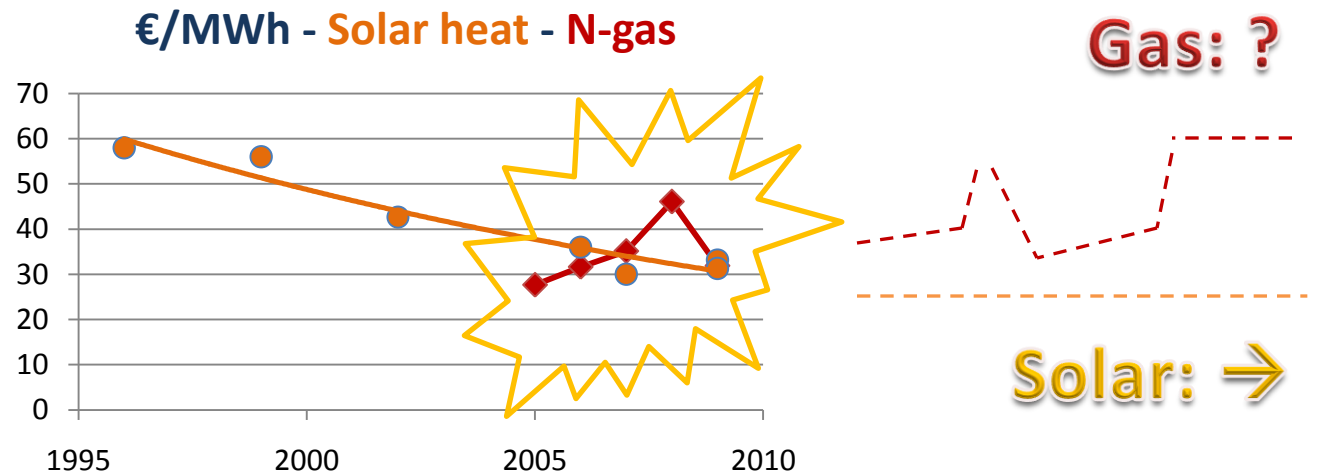


Denmark

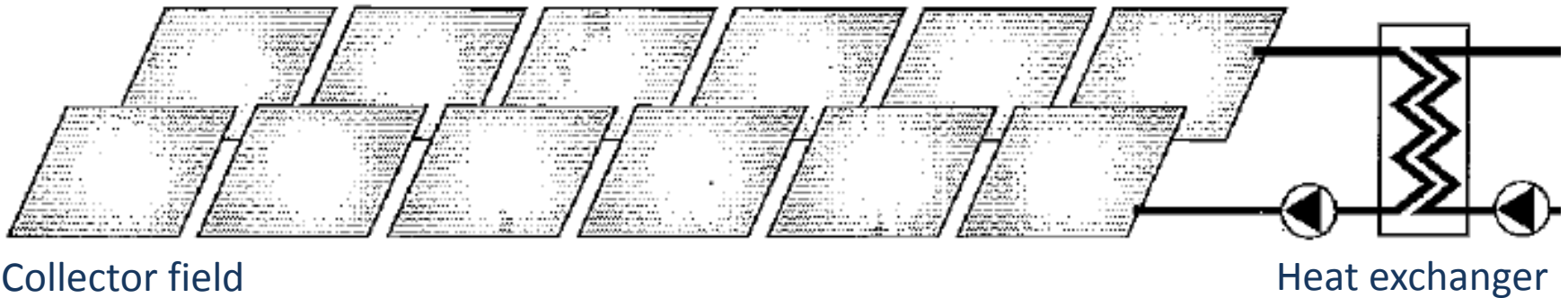
Large Solar Systems in Denmark



Price Development

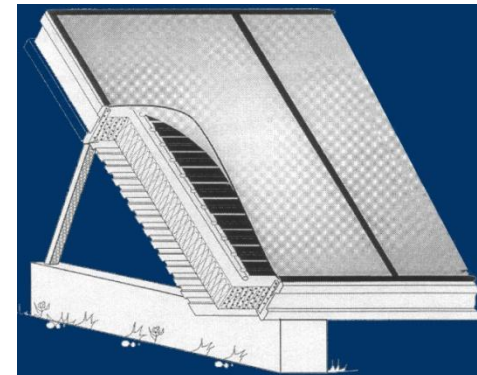


Simple technology / easy set-up



Collector improvements:

- **Price/performance: 100% improvement in 15 years:**
 - Optimized collector design
 - Anti reflex glazing
 - Price reduction





Ulsted 5 000 m² / 3,5 MW



Nordby 2 500 m² / 1,8 MW



Brædstrup 8 000 m² / 5,6 MW



Rise 4 000 m² / 2,8 MW



Ærøskøbing 4 900 m² / 3,4 MW
(to be enlarged soon)



Marstal 18 300 m² / 13 MW
(to be doubled soon)



Hillerød 3 000 m² / 2,1 MW



Sønderborg 6 000 m² / 4.2 MW



Broager 10 000 m² / 7.0 MW



Tørring 7 300 m² / 5.1 MW

Store solvarmeanlæg i fjernvarmesystemer



HER-OG-NU MÅLINGER

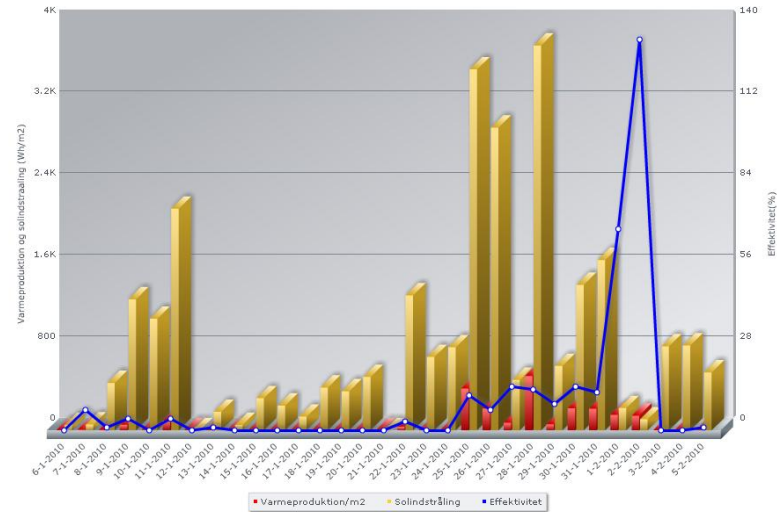
Før museen hen over bynavret for at se den aktuelle solvarme-production.

Klik på byen for at få flere oplysninger.

- > FORSIDE
- > GENERELT
- > ALT OM SOLVARME
- > SOLVARME PLATFORM
- > ENERGISTYRELSEN



SUSTAINABLE SOLAR SOLUTIONS



Forventet andel solproduktion af total årsproduktion på værk (%)	12%
Forventet CO2-reduktion pr. år p.g.a. solproduktion (tons/år)	1.000
Alternativt brændsel på værk (naturgas, flis, halm eller lign.)	Naturgas
Investering ekskl. tilskud (mio. kr.)	12
Tilskud (mio. kr.)	-
Forventet økonomisk resultat netto over 25 år (mio. kr.)	15
Simple tilbagebetalingstid (år)	9,3

Aktuel solvarme-produktion	0 kW
Aktuel solvarme-produktion pr. m2	0 W/m2
Aktuel solindstråling	0 W/m2

Målingen er foretaget 05-02-2010 16:51:04

Historiske data

Fra dato:
 Til dato:
 Visning:

Samlet solvarme-produktion i perioden: 605,14 MWh
Samlet solindstråling i perioden: 355.089,47 Wh/m2

[DOWNLOAD DATA SOM .CSV](#) [VIS GRAFER](#)

Målinger	Varmeprod. (MWh)	Varmeprod./m2 (Wh/m2)	Solindstråling (Wh/m2)
august 2009	182,34	25.033	108.998
september 2009	258,52	35.491	110.884
oktober 2009	135,63	18.620	82.747

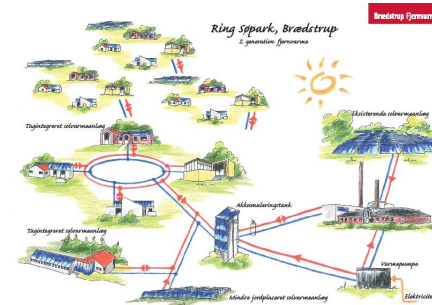
Quick links

[Aktuelle data](#)



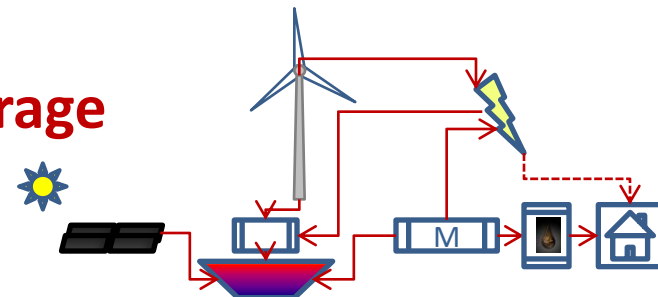
Interesting concepts:

Central & distributed production



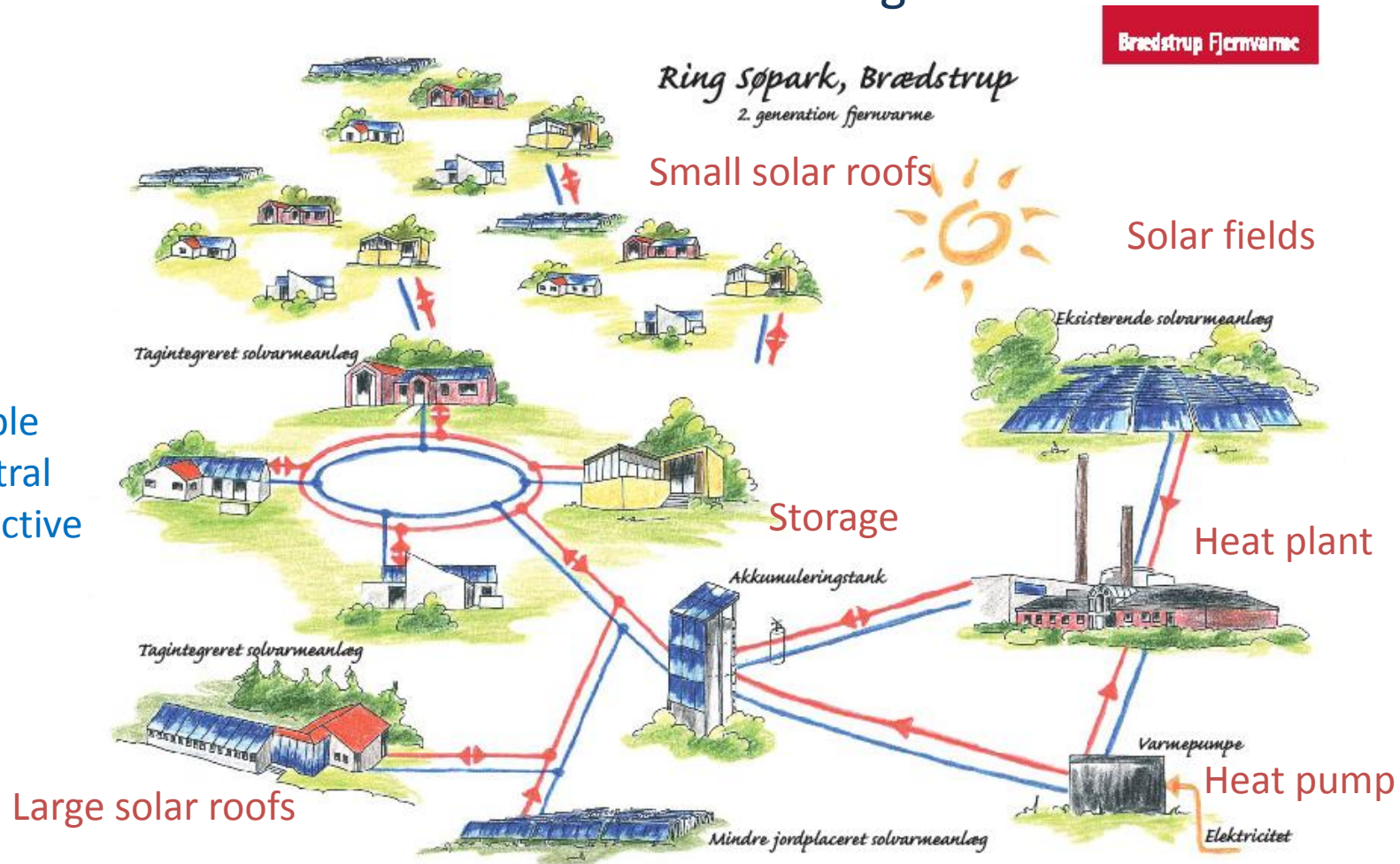
Solar & Heat Pump & Seasonal Storage

→ High VE Fraction

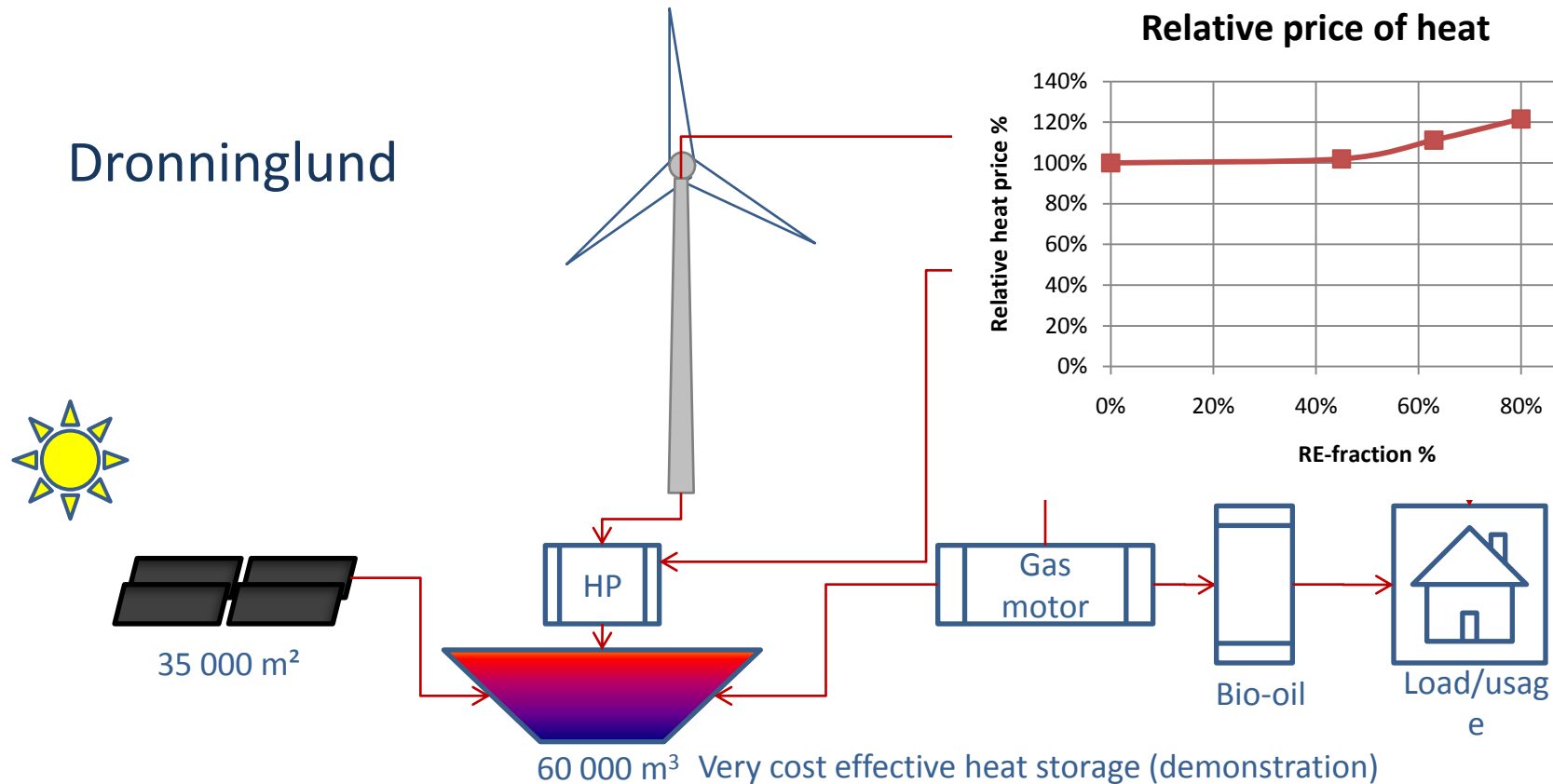


“Central-distributed” renewable district heating !?

- ✓ Flexible
- ✓ Renewable
- ✓ CO₂-neutral
- ✓ Cost effective

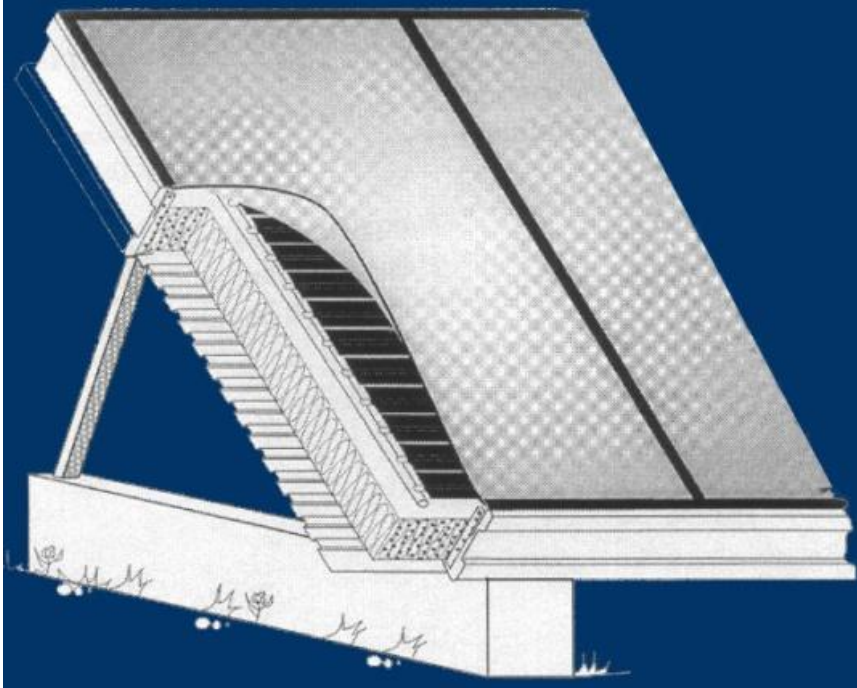


Dronninglund



- Solar fraction 30 % (or higher) at same heat price as now
- RE-fraction 50 % (or higher) at same heat price as now
- Very flexible and fitted for the free electricity market

Collector parameters



❑ The collector applied in the bases cases has the efficiency parameters:

- ❑ n_0 : 0.815 (AR glass)
- ❑ a_1 : 2.43 (Teflon convection barrier)
- ❑ a_2 : 0.012

❑ The collectors are place with:

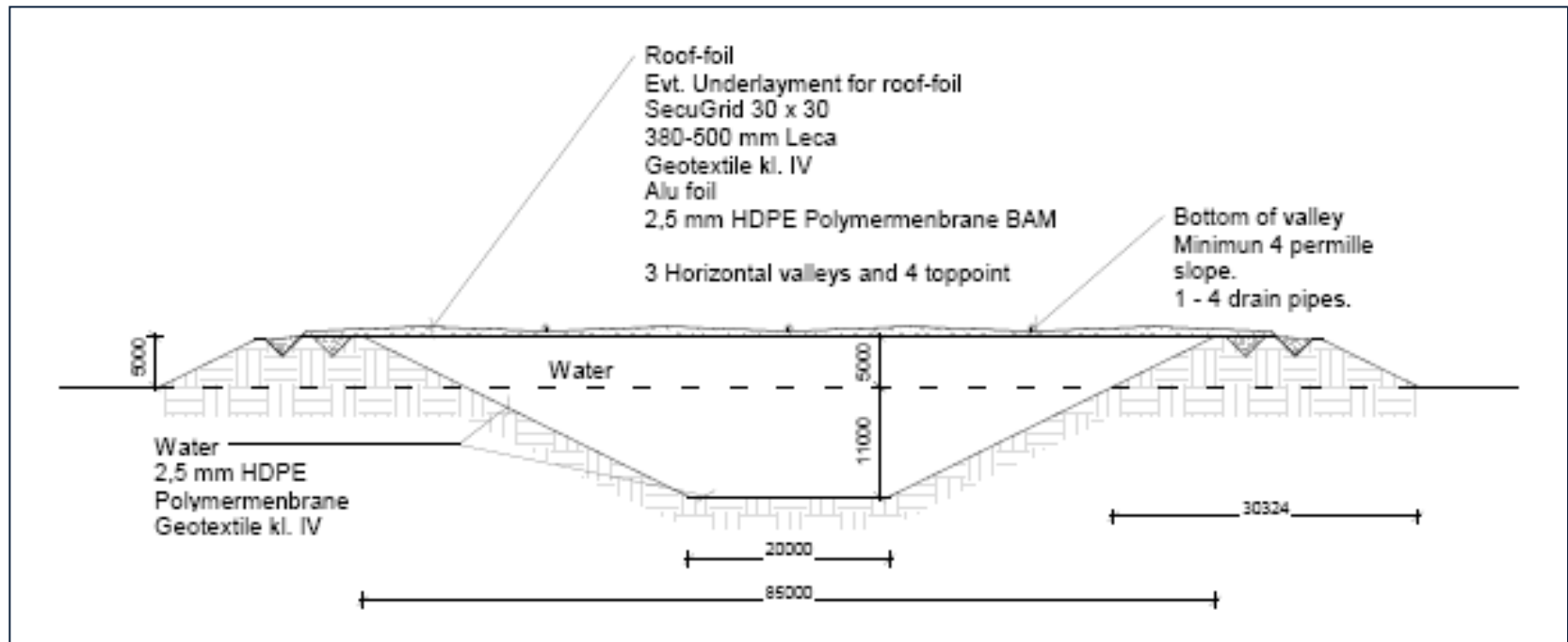
- ❑ slope: 30° (low angle is optimum due to shadows from row in front)
- ❑ azimuth: 0° (South)

❑ Row distance: 4.5 m (collector front to collector front)

❑ Price: Ca. 150 €/m²

Store parameters

- ❑ Geo-tests show that the heat conduction of the earth around and beneath the store is $1 - 2 \text{ W/(m}^*\text{K)}$ – the value 1.5 is used in the base case calculations.
- ❑ The top of the store is assumed insulated with “LECA”; average insulation thickness 450 mm; heat conductivity $0.08 \text{ W/(m}^*\text{K)}$ – if dry !



Potential for solar district heating in DK

❑ Realistic short term goal – 5 years:

❑ 2015: 1 - 2 mill. m², ½ - 1 TWh, 1½ - 3 % of the district heating demand

DK Engineer Association, 2006: *Energiplan 2030*

❑ 2030: 5.4 mio m², 2.7 TWh / 10 % of the district heating demand

Danish Energy Authorities, 2007: *Solar thermal strategy*

❑ 2050: 14 mio. m², 7 TWh / 40 % of the district heating demand

Project partners:

- Steinbeis Research Institute for Solar and Sustainable Thermal Energy Systems Solites (Coordinator)
- AGFW - The German Heat and Power Association, Germany
- Euroheat & Power, Belgium
- CIT Energy Management AB, Sweden
- Associazione Italiana Riscaldamento Urbano (AIRU), Italy
- Ambiente Italia srl, Italy
- Association for District Heating of the Czech Republic (ADHCR), Czech Republic
- Cityplan spol s.r.o., Czech Republic
- Planenergi, Denmark**
- Marstal Fjernvarme A.m.b.a., Denmark
- SOLID Solar Installation and Design GmbH, Austria
- Energie Graz GmbH & CoKG, Austria

**Title**

SDHtake-off - Solar District Heating in Europe

Project duration

7/09 to 6/12 (3 years)

Total budget

1,17 Mio EUR

Supported by

EC-Programme IEE Intelligent Energy Europe



Expected results

- ❑ Reliable knowledge about the market conditions and barriers for SDH, translated into **recommendations** for regulations, support schemes, policy. These recommendations are communicated to decision makers.
- ❑ Standard state-of-the-art industry **standards and guidelines** are available for commercial SDH activities. They are recognized by the European market actors of the DH and solar thermal sector.
- ❑ Capacity on the supply side is built-up by **training and support** structures.
- ❑ Targeted **dissemination activities** reaching more than 18 EU countries.





Large Scale Solar Heating and Cooling - in Combination with Seasonal Storage and Heat Pump

Task 45

- Exchange experience on large scale solar thermal systems amongst participant
- Give state of the art for large scale solar thermal systems
- Present good existing examples
- Make guidelines for best practise
- Component and system optimization
- Demonstrate combination of solar thermal with other renewable technologies
- Demonstrate new ideas
- Define most important future R/D topics and R/D bottlenecks
- Define most barriers for large solar systems - propose how to overcome these barriers
- Promote large scale solar thermal systems
- Disseminate results to a wide range of (potential) interested parties



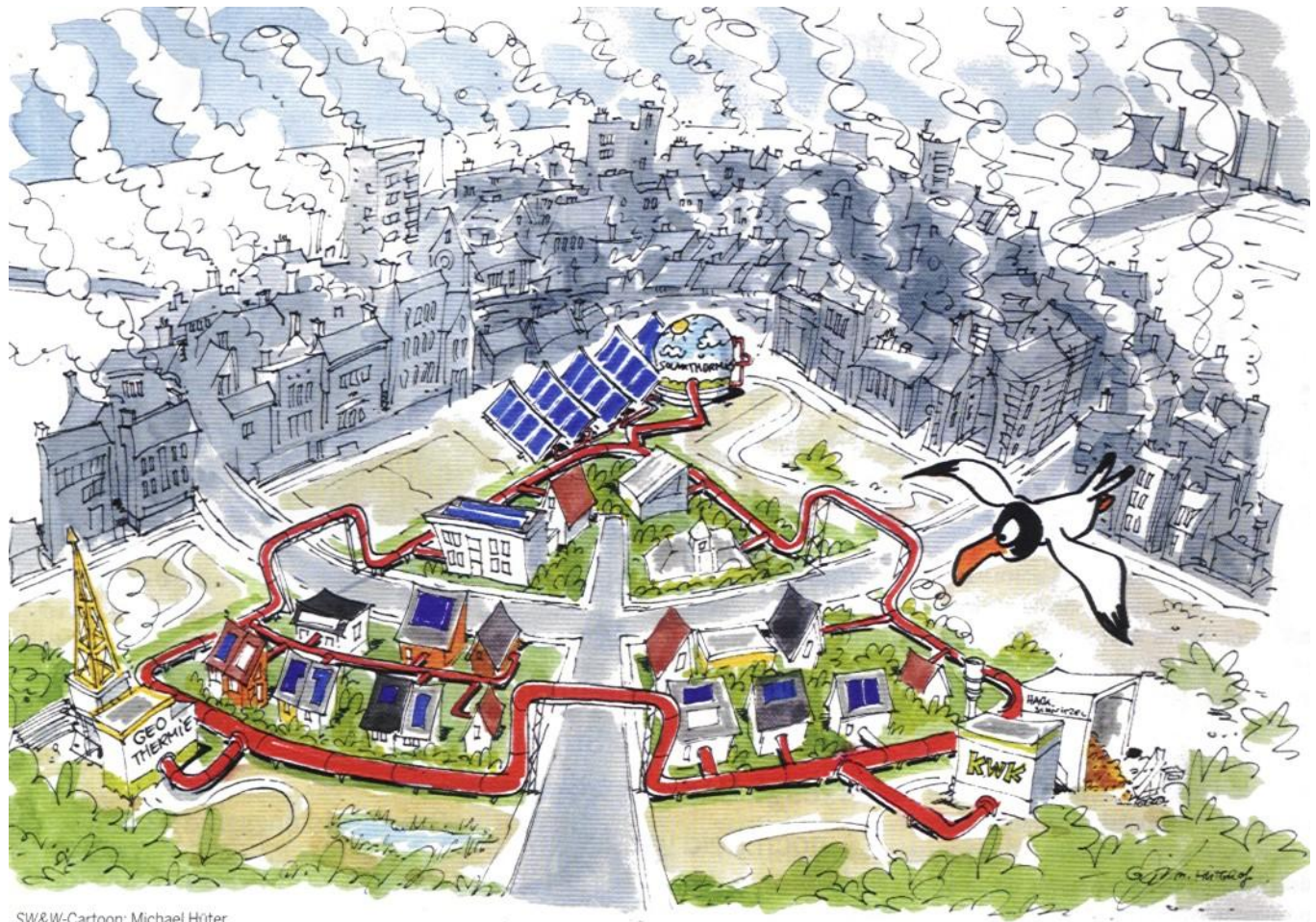
Large Scale Solar Heating and Cooling - in Combination with Seasonal Storage and Heat Pump

Time schedule

- ❑ 2011: Start 1/1
- ❑ 2013: End 31/12

The future ?! Renewable district heating !?

- ✓ Flexible
- ✓ Renewable
- ✓ CO₂-neutral
- ✓ Cost effective



SW&W-Cartoon: Michael Hüter



Thank you for your attention !

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