

Large Scale Solar District Heating

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25 years with
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20 years with
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- biomass
- biogas
- solar thermal
- heat pumps



Large Scale Solar District Heating



Large Scale Solar District Heating in **Denmark**



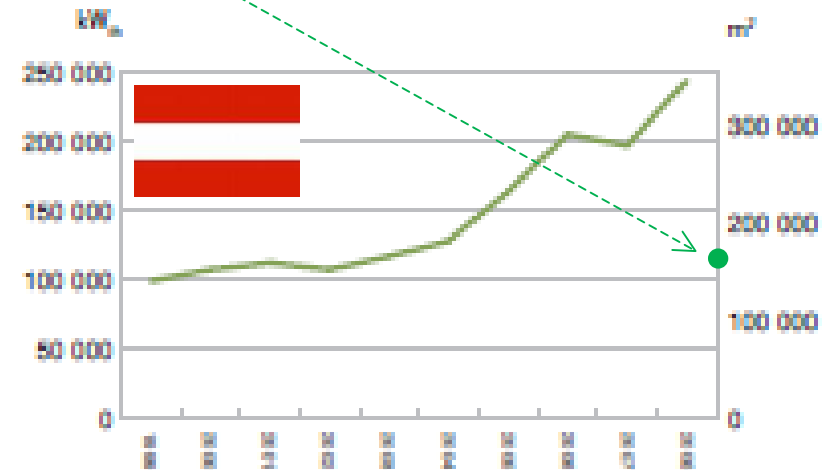
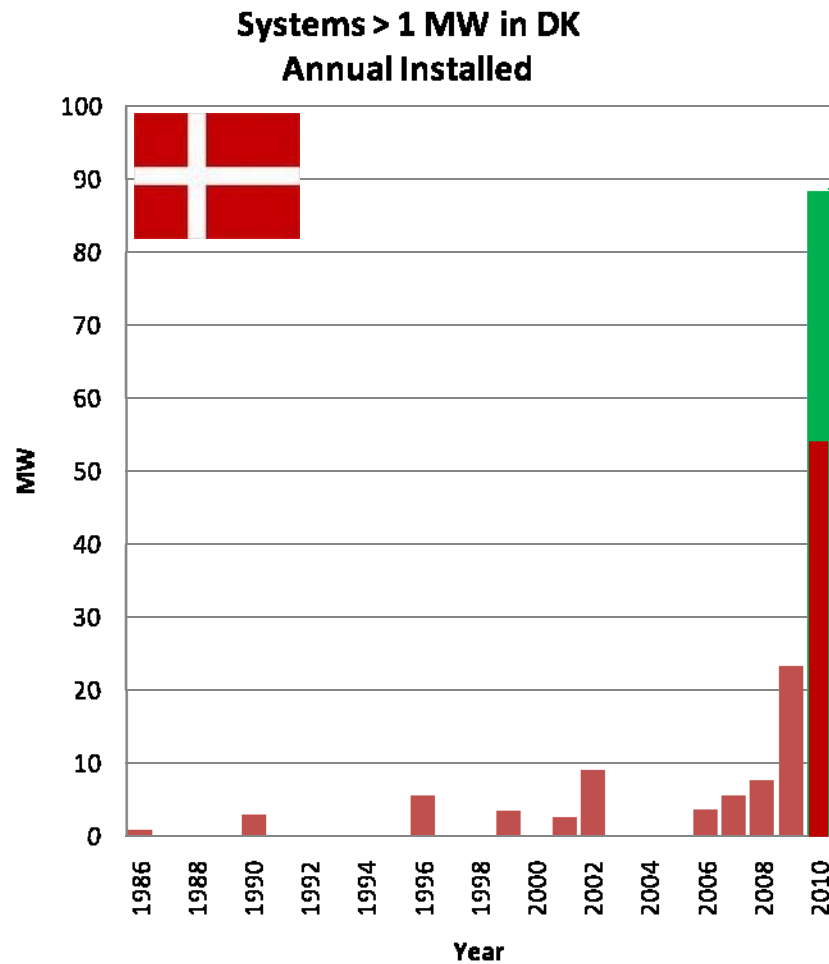
SDHtake-off - Solar District Heating in **Europe**



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

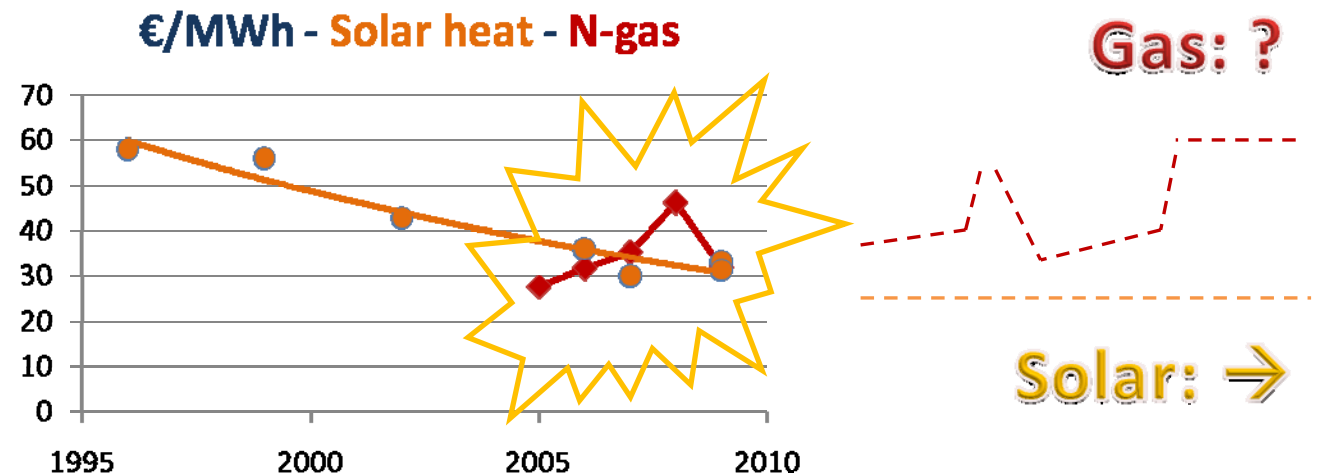
World

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Price Development



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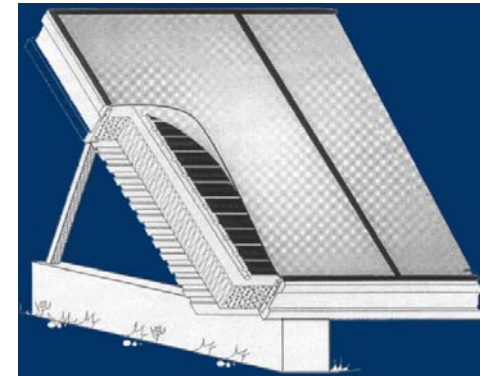
Simple technology / easy set-up



Collector improvements:

•Price/performance: 100% improvement in 15 years:

- Optimized collector design
- Anti reflex glazing
- Price reduction



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Ulsted 5 000 m² / 3,5 MW



Nordby 2 500 m² / 1,8 MW



Brædstrup 8 000 m² / 5,6 MW

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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)

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Hillerød 3 000 m² / 2,1 MW



Broager 10 000 m² / 7.0 MW



Sønderborg 6 000 m² / 4.2 MW



Tørring 7 300 m² / 5.1 MW

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Installed systems, DK

Saltum	1986	1 030 m ²
Ry	1990	3 025 m ²
Tupperupvænge	1990	1 030 m ²
Marstal I+II	1996 - 1999	8 000 m ²
Ærøskøbing	1999	4 900 m ²
Rise	2001	3 575 m ²
Nordby-Mårup	2002	2 500 m ²
Marstal III	2002	10 365 m ²
Ulsted	2006	5 000 m ²
Brædstrup	2007	8 000 m ²
Hillerød	2008	3 000 m ²
Strandby	2008	8 000 m ²
Sønderborg	2009	5 960 m ²
Gram	2009	10 000 m ²
Broager	2009	10 000 m ²
Tørring	2009	7 284 m ²
<i>In the pipe line ...</i>	<i>2010</i>	<i>60 000 – 120 000 m²</i>
<i>(Dronninglund</i>	<i>2010</i>	<i>35 000 m²)</i>

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Store solvarmeanlæg i fjernvarmesystemer



HER-OG-NU MÅLINGER

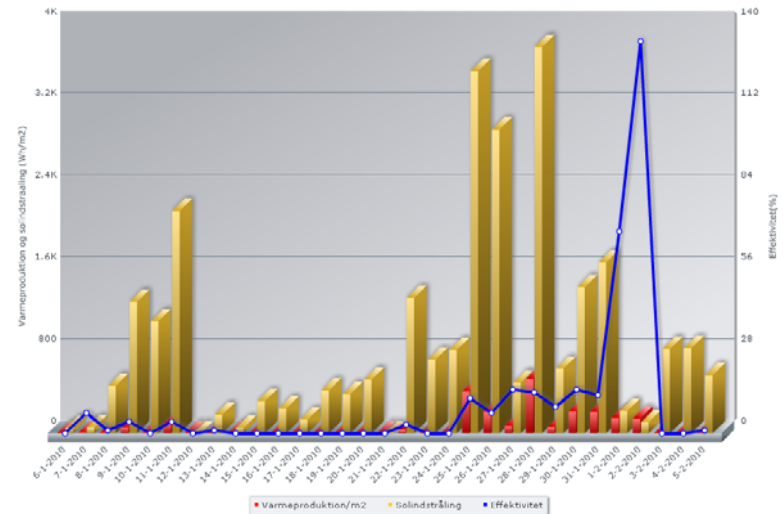
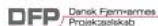
Før museen hen over bynavnet for at se den aktuelle solvarme-produktion.

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, holm 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: 01-01-2009

Til dato: 05-02-2010

Visning: Måneder

VIS DATA

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	10.620	62.747

Quick links

Aktuelle data

<http://www.solvarmedata.dk/>

Jan Erik Nielsen
PlanEnergi

World Sustainable Energy Days 2010

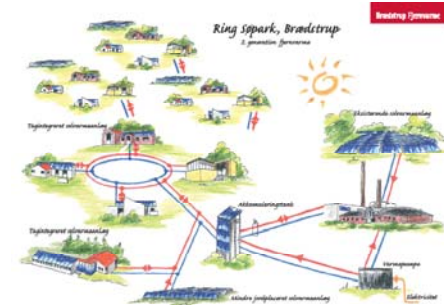
SDH solar district heating
Intelligent Energy Europe

SHC SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

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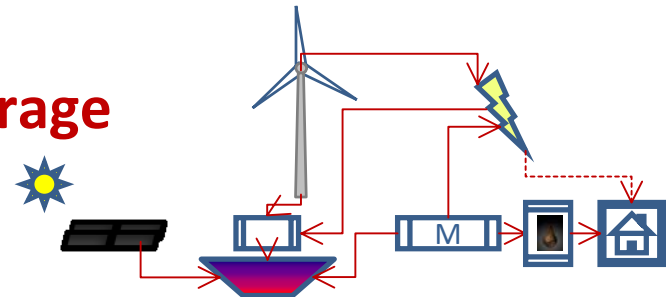
Interesting concepts:

Central & distributed production



Solar & Heat Pump & Seasonal Storage

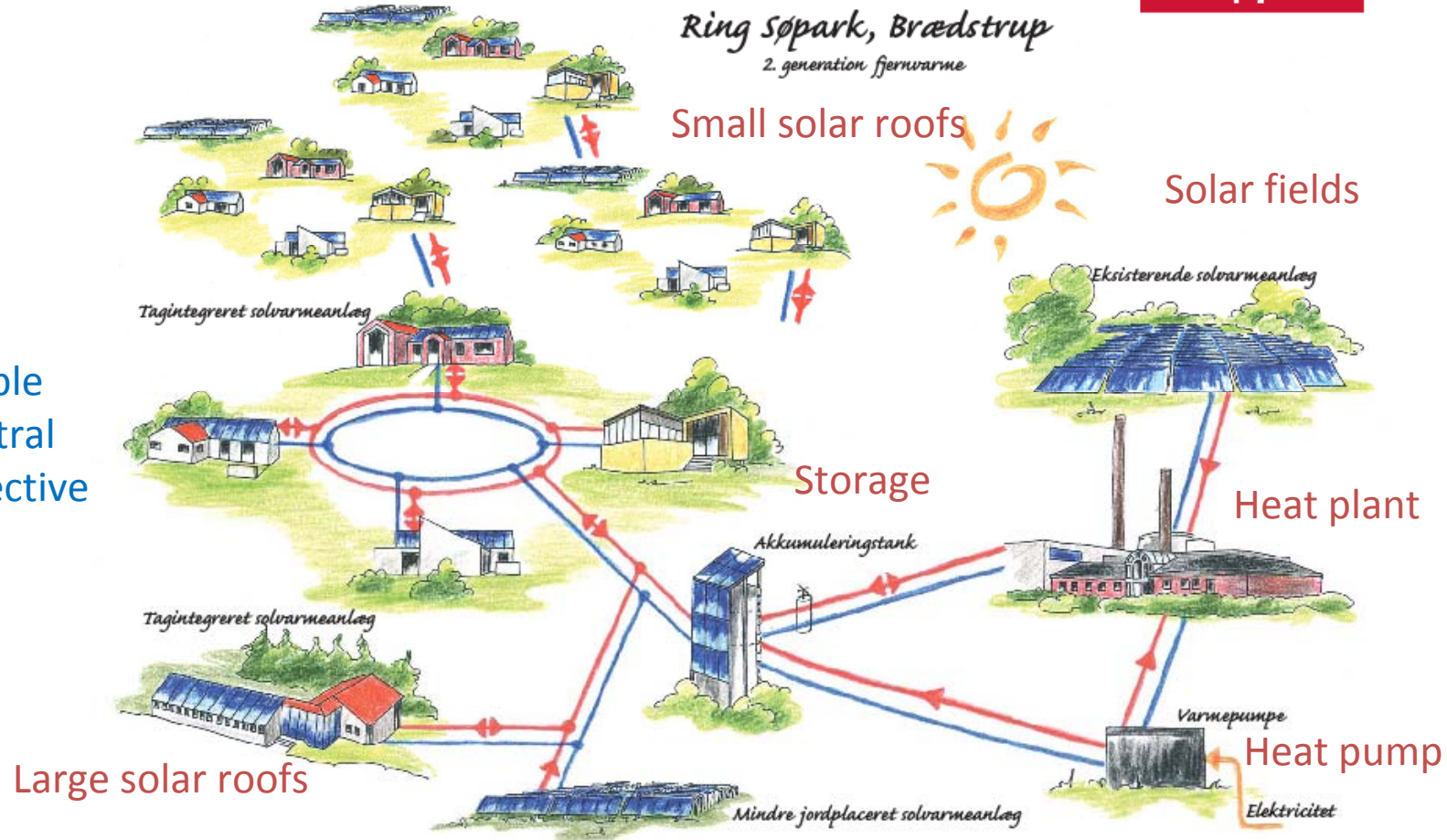
→ High VE Fraction



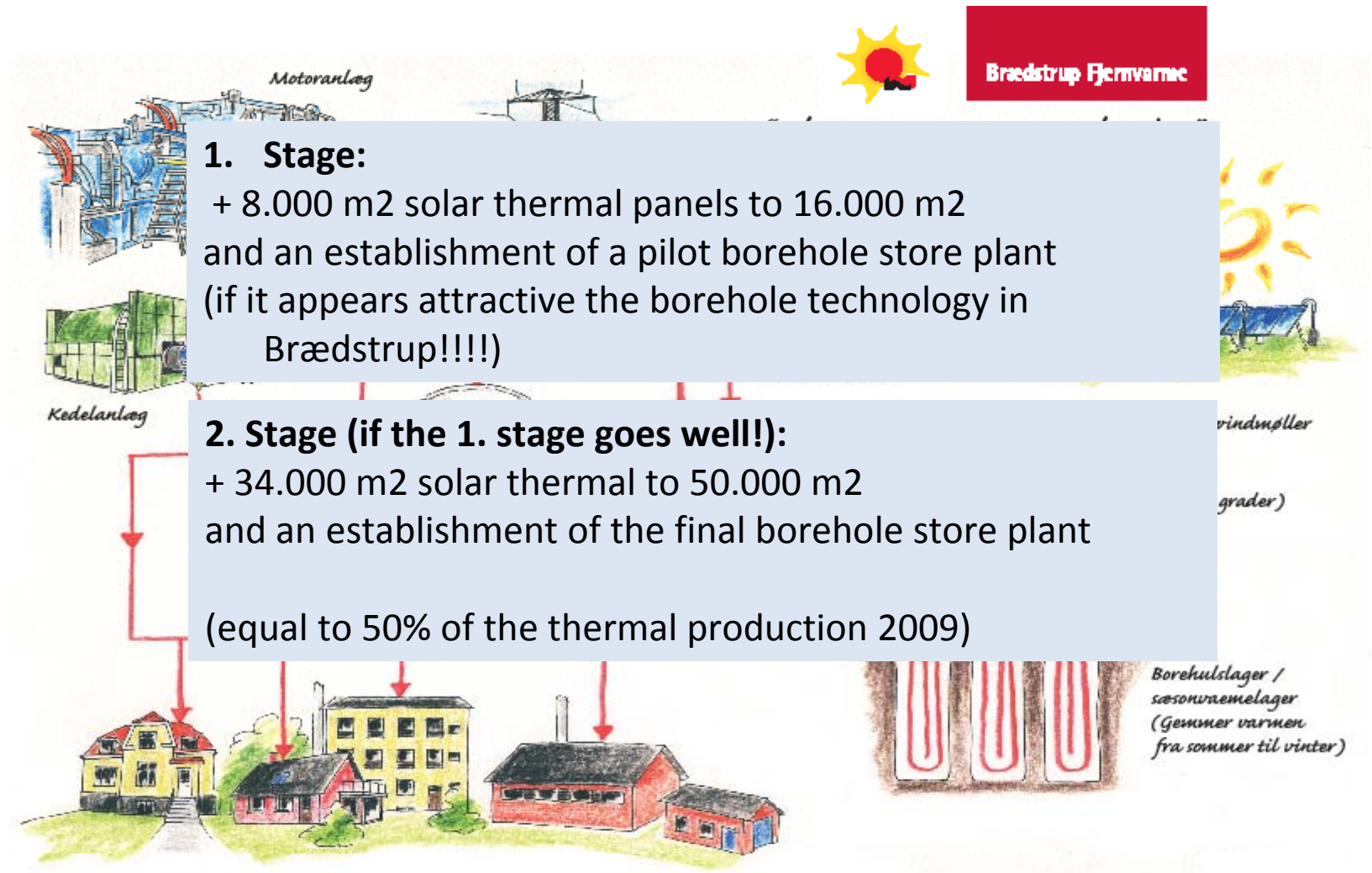
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“Central-distributed” renewable district heating !?

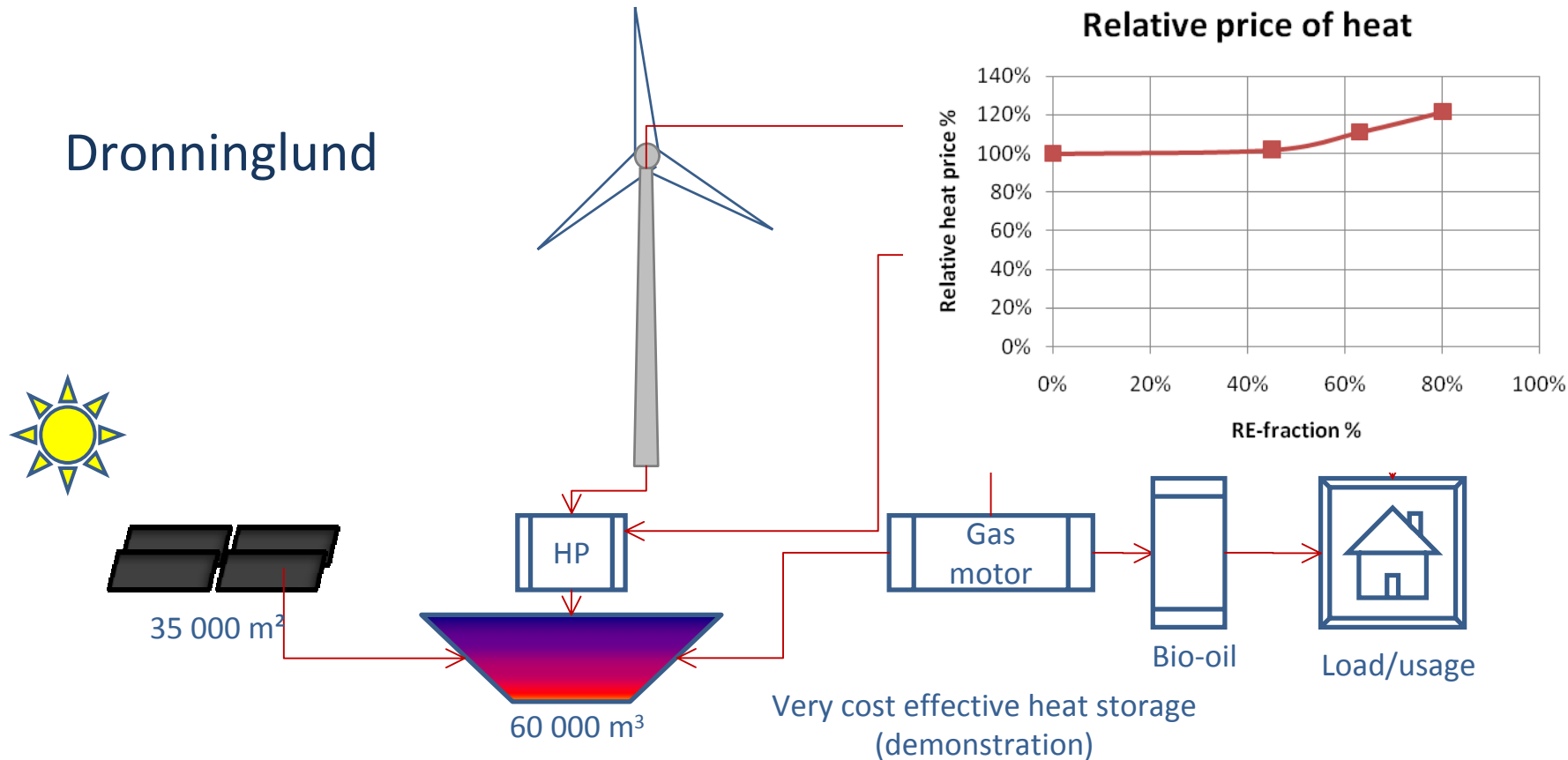
- ✓ Flexible
- ✓ Renewable
- ✓ CO₂-neutral
- ✓ Cost effective



Large Scale Solar District Heating



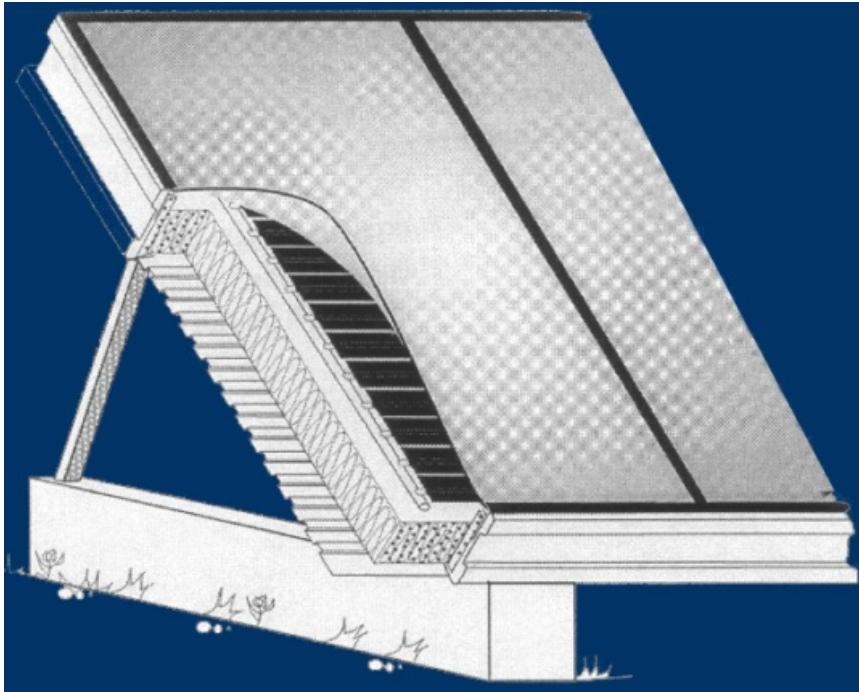
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- ☐ Solar fraction 30 % (or higher) at same heat price as now
- ☐ RE-fraction 50 % (or higher) at same heat price as now
- ☐ Very flexible and fitted for the free electricity market

Large Scale Solar District Heating

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)

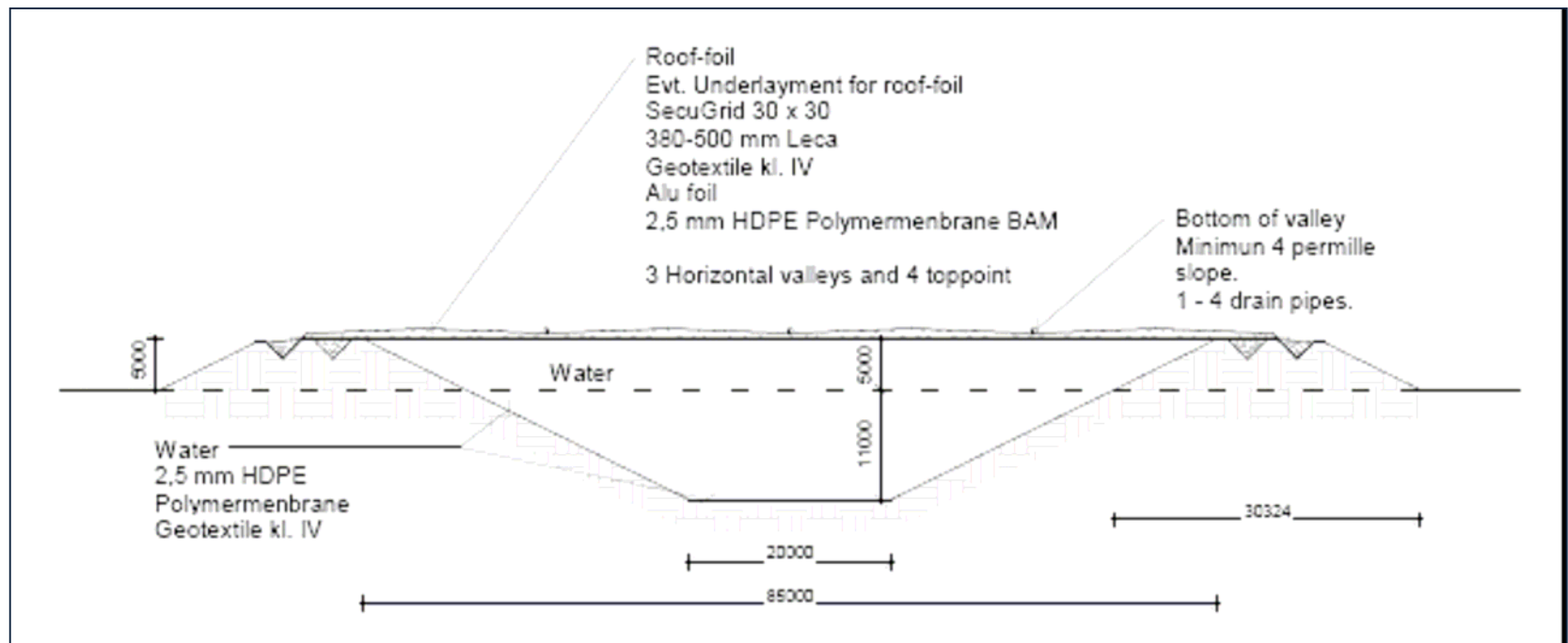
❑ Row distance: 4.5 m (collector front to collector front)

❑ Price: Ca. 150 €/m²

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Store parameters

- ❑ Geo-tests show that the heat conduction of the earth around and beneath the store is $1 - 2 \text{ W/(m}^2\text{K)}$ – 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 $0.08 \text{ W/(m}^2\text{K)}$ – if dry !



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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

Large Scale Solar District Heating

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



Large Scale Solar District Heating

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 market 18 EU countries.



Large Scale Solar District Heating



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

Task proposal

- ☐ 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 District Heating



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

Sub Tasks (proposal)

- ☐ Collectors and collector loop
- ☐ Stores – short and long term
- ☐ Combined systems & Strategies for operation

Time schedule

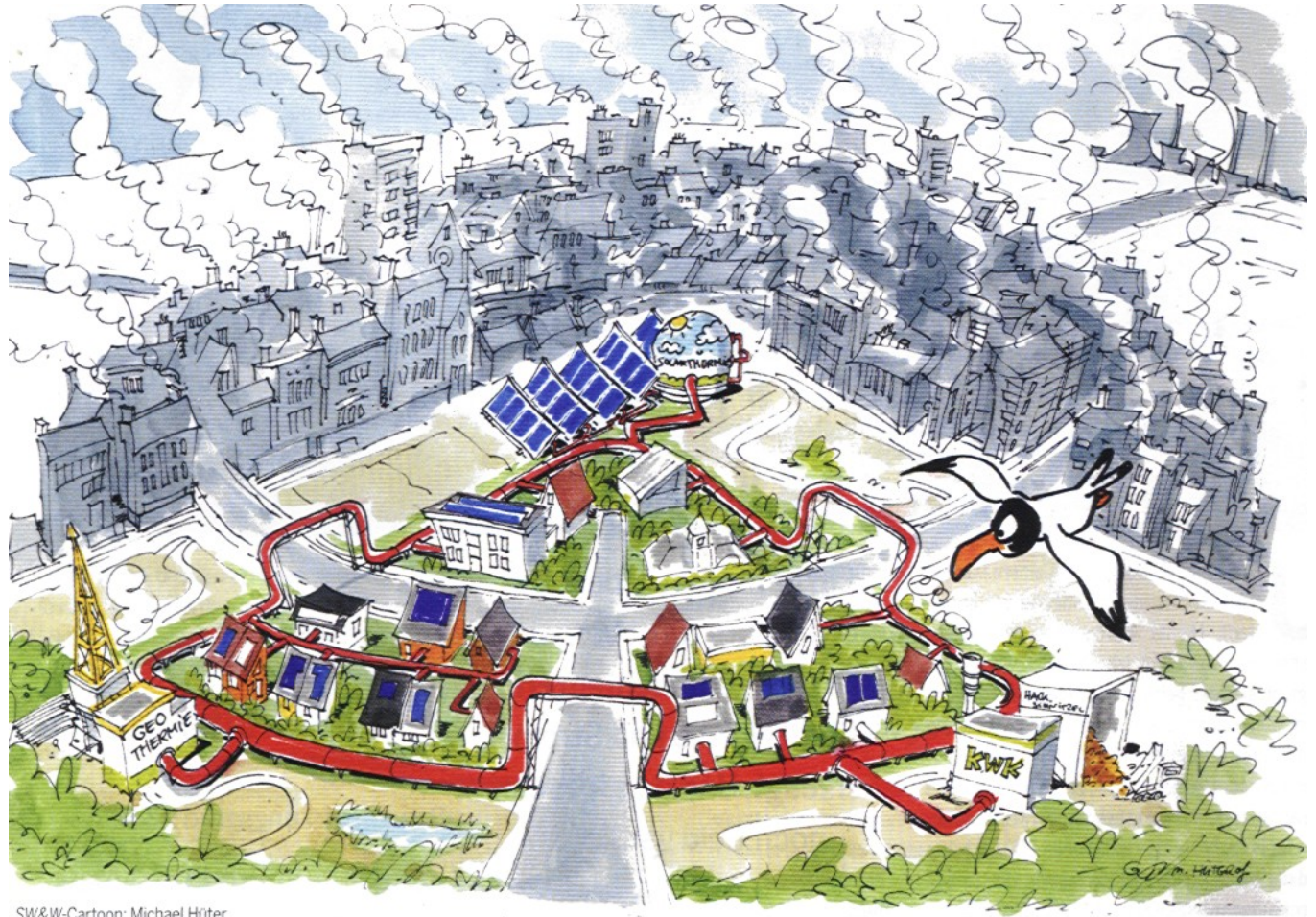
- ☐ 2010: Task initiation
- ☐ 2011: Start 1/1?
- ☐ 2013: End 31/12?



Large Scale Solar District Heating

The future ?! Renewable district heating !?

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



SW&W-Cartoon: Michael Hüter

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Thank you for your attention !

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