# Solar District Heating in Hamburg-Bramfeld – Experiences with Pre-insulated Bonded Pipes and Solar Feed-in

Presentation at SDH Conference in Malmö, 9.4.2013

Dipl.-Ing. Dirk Mangold,
Dipl.-Ing. Thomas Schmidt, Solites

Coauthor: Dipl.-Ing. Martin Ebel, HGC –
Hamburg Gas Consult GmbH,
Heidenkampsweg 99, 20097 Hamburg, Germany

Steinbeis
Research Institute
for Solar and
Sustainable
Thermal
Energy Systems
www.solites.de

Meitnerstr. 8
70563 Stuttgart, Germany
www.solites.de

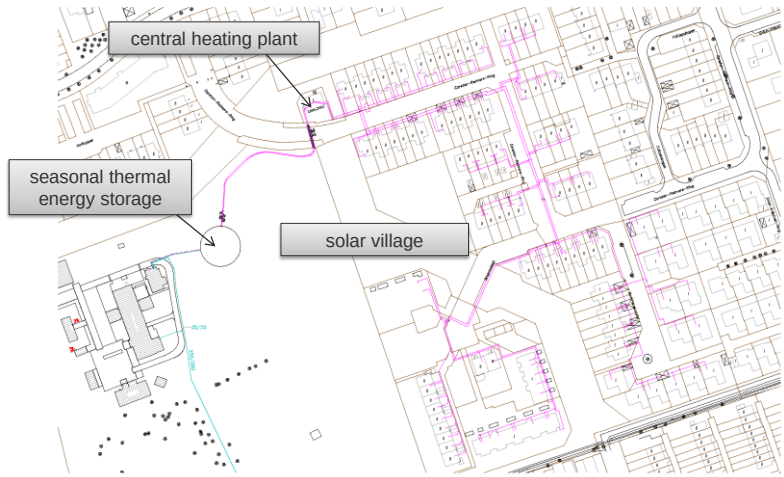
## Solar District Heating in Hamburg-Bramfeld – Experiences with Pre-insulated Bonded Pipes and Solar Feed-in

- Germanies oldest SDH system with seasonal heat storage in Hamburg
- Damage in the solar network
- The multifunctional heat storage
- Solar feed-in model in Hamburg

Steinbeis Research Institute
for Solar and Sustainable
Thermal Energy Systems
www.solites.de

solites

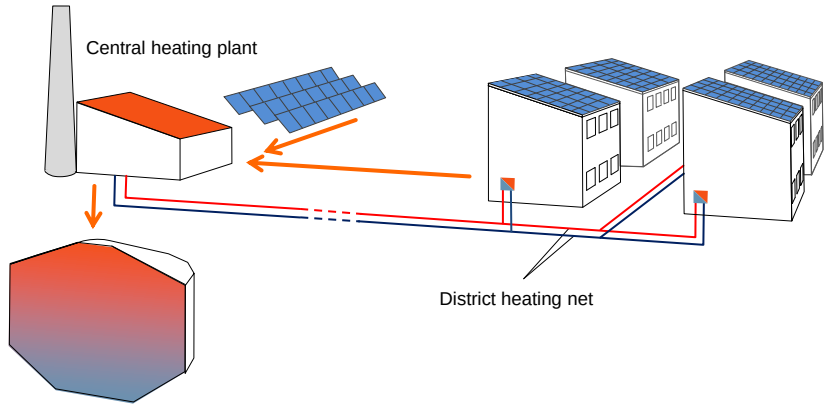
## Solar district heating in Hamburg-Bramfeld, 1996




Steinbeis Research Institute
for Solar and Sustainable
Thermal Energy Systems
www.solites.de

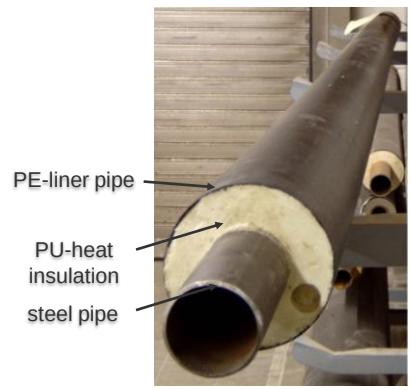
solites

## Centralized feed-in of solar thermal energy in district heating






## Pre-insulated bonded pipes for solar network



## Damage in the solar network, 2008

In 2008: damage in the solar network with multiple leakages

- Statically overstressing of the pre-insulated bonded pipes caused by high number of load cycles in the solar net (more than 500 per year)
- Overstressing of the pipe compound by overheating of collector fluid (above 130°C) and occasionally steam pressure shocks
- Decomposition of pipe bonding (steel pipe, heat insulation, liner pipe) with a loss of static stability of the pipe construction.
- Damaged pipe fittings (due to poor workmanship) led to a wetting of heat insulation and corrosion of steel pipes.



## Additional findings

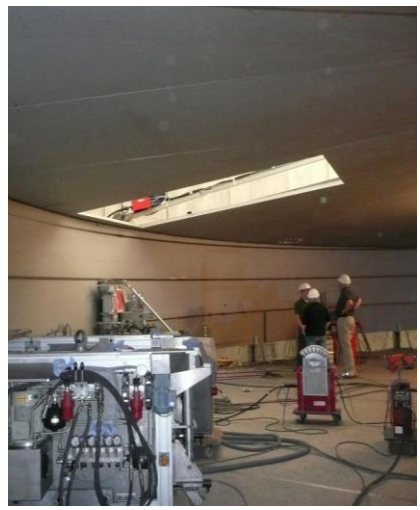
Expert team of consultancies, producers and scientists:

- Recalculation of static stability according to up-to-date standards with 500 load-cycles per year shows that the solar network lasted longer than it should.
- Temperatures of the pipe compound above about 130°C have to be avoided definitely.
- Pre-insulated bonded pipes seems to be usable for solar networks if dimensioning of static system considers special “solar conditions”
- As an alternative pre-insulated bonded pipes without active static compound might be used (e.g. with double layered mineral wool as heat insulation)

## Renewal of the solar network, 2011



## Realisation of multifunctional heat storage in Hamburg, 2010



## Multifunctional heat storage in Hamburg

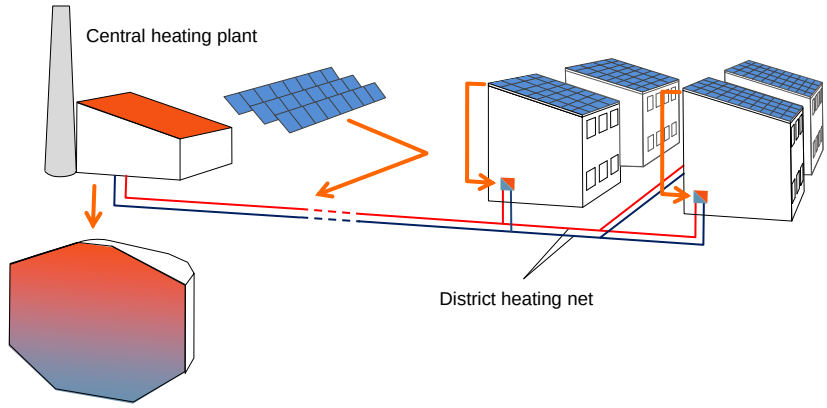
- Germany's first seasonal thermal energy storage was reconstructed to a multi-functional thermal energy storage (4.100 m³)
- A separate steel tank installed inside the former building turned out to be the most economic solution
- Advantages for the owner E.ON Hanse Wärme GmbH :
  - Higher efficiency of the storage
  - Peak load storage of CHP waste heat in winter
    - Increase of CHP fraction
    - No inefficient peak load boilers necessary in the heating season
  - Possibility for the integration of large scale solar thermal systems into the district heating network
- Advantages for housing companies in the service area:
  - Cost-effective solar thermal systems
  - Favourable primary energy factors for the buildings



## Solar feed-in model in Hamburg, 2011

- E.ON opened the wide-spread district heating network in eastern Hamburg for feeding-in solar heat.
- Operators of solar thermal collector plants larger than 100 m² have the possibility to feed their heat into the network for transportation and storage.
- The heat can be stored in the network for a time period up to 8 months (heat losses are not taken into account). This means that solar heat produced in summer can be used in winter.
- Surplus solar heat in the network can be stored in a 4,100 m³ underground tank.
- For the storage service E.ON charges a service fee to the customer.
  The price announced in 2010 was 2.1 – 2.5 Ct/kWh.

## Decentralized feed-in of solar thermal energy in district heating



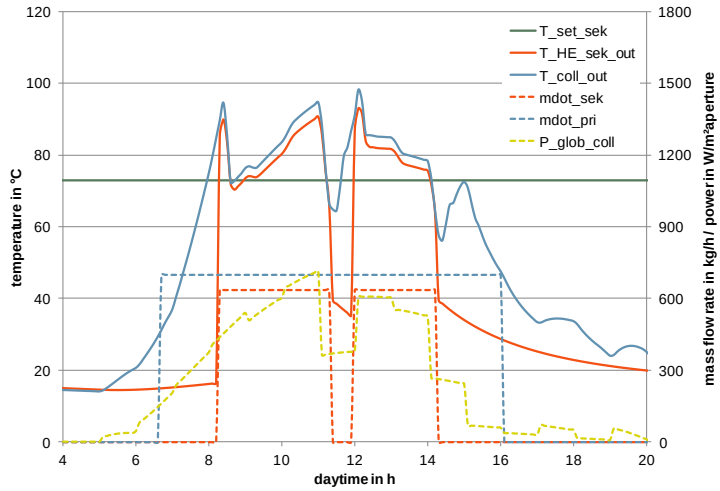



## Example of solar feed-in by TRNSYS-simulation

Boundary conditions of the simulation:

| | |
|---|---|
| place | Frankfurt am Main (Germany) |
| set temperature sekundary circle | 73 °C |
| set temperature primary circle | 40 °C |
| collectortype | high temperature flat plate collector |
| collector azimuth | 0° |
| collector slope | 30° |
| collector aperture | 100 m² |

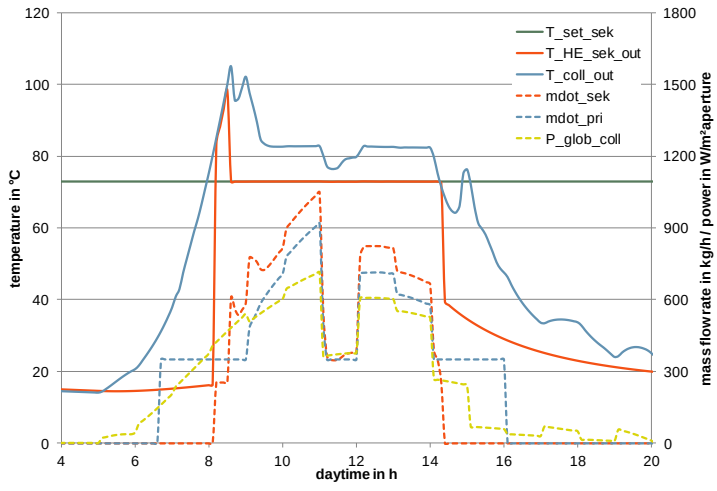
## Decentralized feed-in of solar heat in DH with constant mass flow




Steinbeis Research Institute
for Solar and Sustainable
Thermal Energy Systems
www.solites.de

solites

## Decentralized feed-in of solar heat in DH with controlled mass flow




Steinbeis Research Institute
for Solar and Sustainable
Thermal Energy Systems
www.solites.de

solites

# Solar District Heating in Hamburg-Bramfeld – Experiences with Pre-insulated Bonded Pipes and Solar Feed-in

Presentation at SDH Conference in Malmö, 9.4.2013

Dipl.-Ing. Dirk Mangold,
Dipl.-Ing. Thomas Schmidt, Solites

Coauthor: Dipl.-Ing. Martin Ebel, HGC –
Hamburg Gas Consult GmbH,
Heidenkampsweg 99, 20097 Hamburg, Germany

Steinbeis
Research Institute
for Solar and
Sustainable
Thermal
Energy Systems
www.solites.de

Meitnerstr. 8
70563 Stuttgart, Germany
www.solites.de

solites