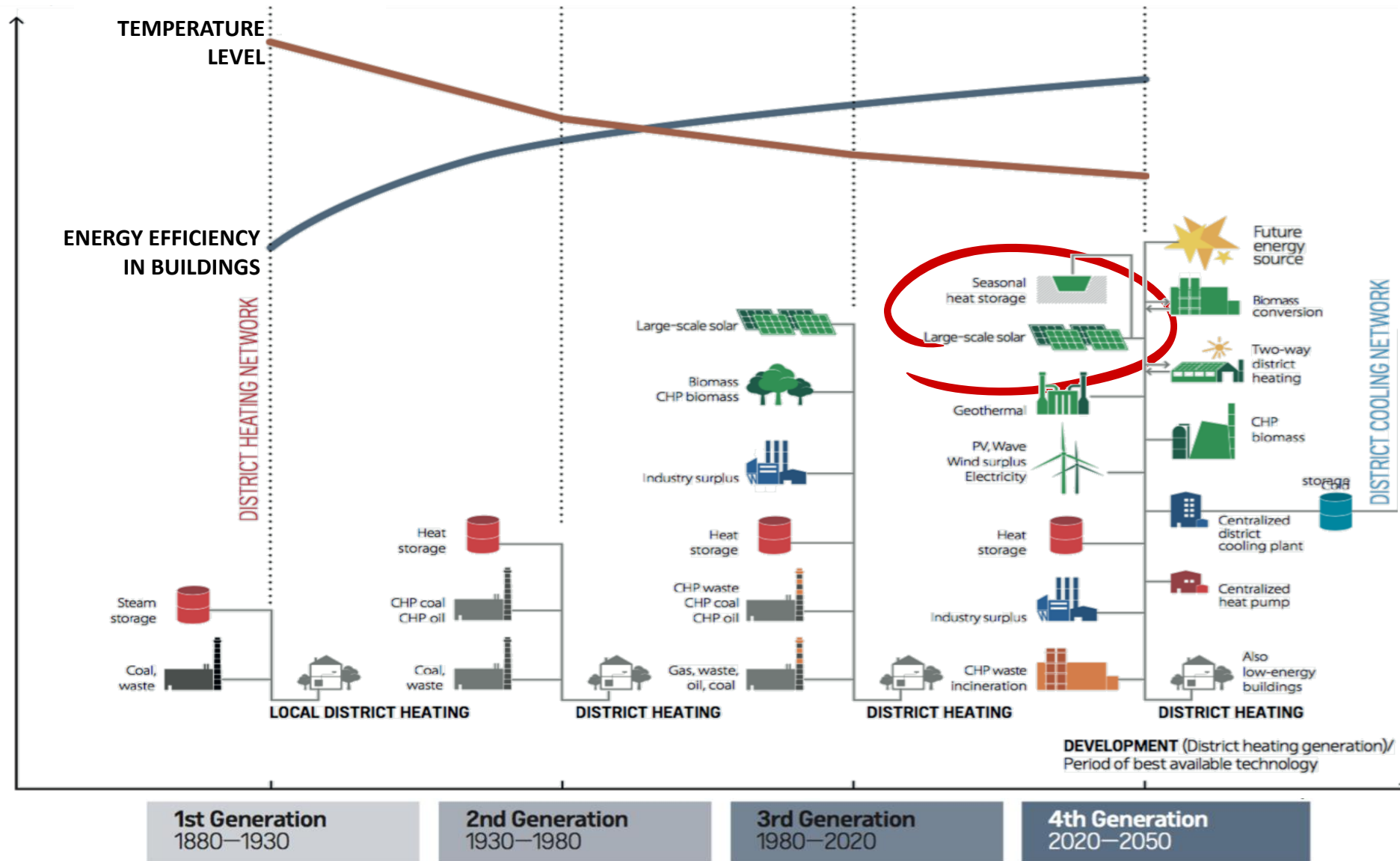


WE HARVEST THE SUN

LARGE SCALE SOLAR THERMAL.
SOLUTIONS FOR URBAN AREAS?

CHRISTIAN STADLER, MD ARCON-SUNMARK GMBH
OCT 2018

Modern district heating grids use various sources!



Source: District heating grids of 4th generation (4th Generation District Heating, 4GDH);
Integration of intelligent DH-grids into sustainable energy systems of the future.

LARGE-SCALE SOLAR HEATING INSTALLATIONS

CHEAPER

Large-scale solar heating installations will generate the lowest possible heating costs.

It will stabilize the price of your heating on a low level

You will know all costs from the start. The price of a MWh is fix over a 25-year period.

CLEANER

The sun is the cleanest of all energy sources and the most powerful source of sustainable energy. It emits no CO₂.

It makes no noise, does not smell and does not spoil the environment.

LEANER

Lean and effective installation of the perfect large-scale solar heating system demands expertise.

We have optimized every single stage. From planning to financing, from construction to installation and to the perfect operations.

UNLIMITED LARGE-SCALE ADVANTAGES



BIGGER IS BETTER

A large-scale solar heating system is 4-6 times more efficient than solar thermal installations in individual homes.



WELL-KNOWN WELL-TESTED

Solar thermal is a known technology, tried and tested for decades.



THE PERFECT MATCH

Solar heating is a perfect match to other sources of energy.

History of large scale solar thermal

The first large system for district heating was opened in Saltum 1988. The system is still in operation without any problems. Today the systems are far in the MW-scale and are already extended to reach higher solar fraction.



Saltum, DK (1988),
0.7 MW, 1,000 m²



Almere, NL (2010), Vattenfall
4.9 MW, 7,000 m²
2,700 households, 10% solar fraction
1 Mio. of “solar shower” per year

OUR REFERENCES



Rank	Town	Country	Type	Collector aperture area (m ²)
1	Silkeborg	Denmark	SDH	156.694 (110 MWp)
2	Vojens	Denmark	SDH	69.991 (49 MWp)
3	Gram	Denmark	SDH	44.836 (31 MWp)
4	Minera Gaby/Codelco	Chile	SHIP	40.260 (27 MWp)
5	Dronninglund	Denmark	SDH	37.500 (26 MWp)
:				
35	Grenaa	Denmark	SDH	12.096 (8,5 MWp)
36	Hvidebæk	Denmark	SDH	12.096 (8,5 MWp)
37	Løkken	Denmark	SDH	12.096 (8,5 MWp)
38	Sydfalster	Denmark	SDH	12.094 (8,5 MWp)
:				
111	Neckarsulm	Germany	SDH	1.100
112	Herlev	Denmark	SDH	1.025
113	Saltum	Denmark	SDH	1.005
114	Ellos	Sweden	SDH	1.000
115	Ingelstad	Sweden	SDH	1.000
116	Shangri-La Hotel, Bangkok	Thailand	SDH	1.000
117	Varese	Italy	SDH	988
118	Berlin	Germany	SDH	983

Sum: > 1.3 Mio m² in large systems
> 880 MW

Innovative „role model“ system for urban areas:
Energie Graz - project „HELIOS“

Speicherprojekt HELIOS

Located at the city border with close-by DH-grid!

- Landfill at Köglerweg (closed in the last century)
- Close connection to DH-grid
- Owned by:
 - Stadt Graz 
 - Holding Graz 
- Available resources:
 - Landfill gas
 - Land for solar thermal

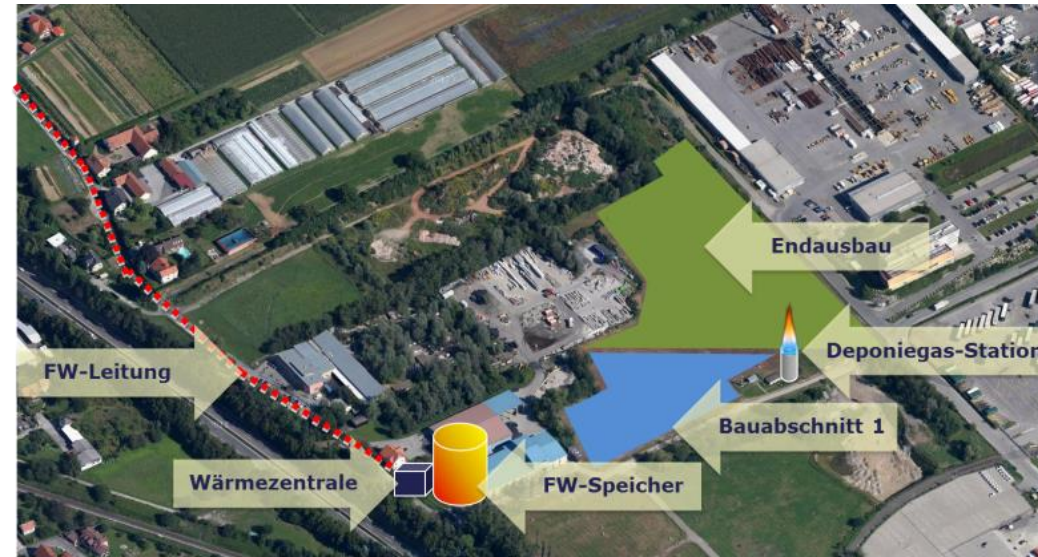
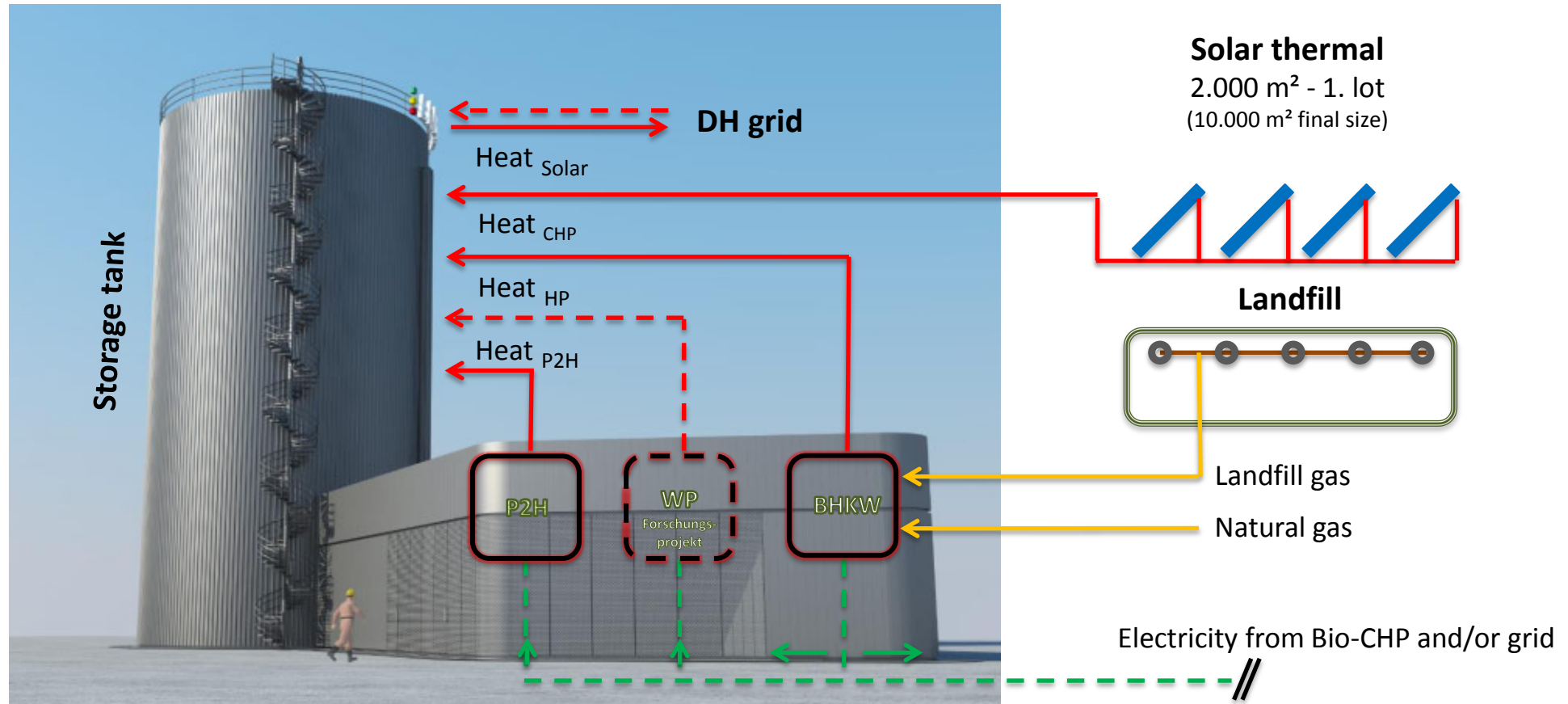


Abbildung: Standortübersicht © Google Maps

„... Preserving resources in the urban area...“

Speicherprojekt HELIOS

Energy sources



Schematic diagram

© Markus Pernthaler Architekt ZT GmbH

Speicherprojekt HELIOS

Layoutplan collector field

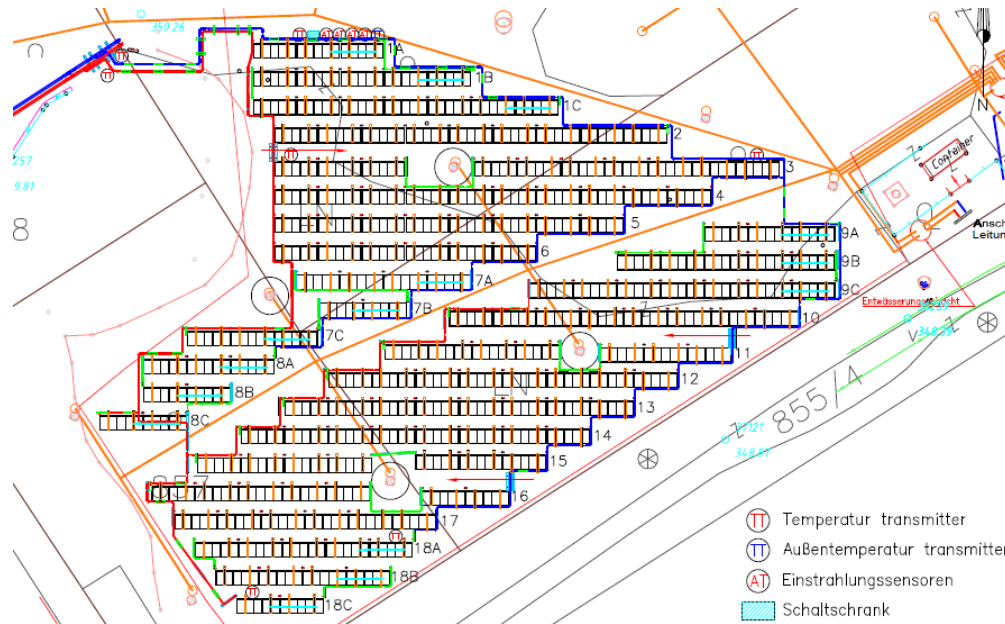


Abbildung: Planung Kollektorfeld

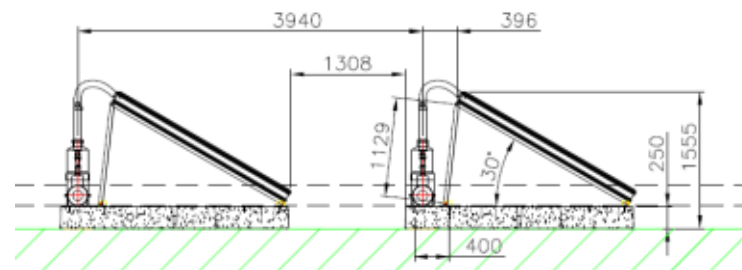


Abbildung: Schnitt Kollektorfeldreihen

To be taken into account:

- Settlement of the ground
- Landfill gas transport system
- No intrusion into the landfill
- Everything flexible
- Piping on ground
- Guaranteed solar yield

Speicherprojekt HELIOS



Start of tank building



Tank building



Distance between technique building and tank



Finished tank while insulation and sheet metal cladding

Speicherprojekt HELIOS



Landfill area for solar thermal field



Solar mounting system



*Finished solar system with
access to gas maintenance wells*

159 collectors with an
Aperture area: $\sim 2.000 \text{ m}^2$

Speicherprojekt HELIOS



Solar unit



Landfill CHP unit



Charge-/Discharge unit tank ↔ DH grid



Connection to DH-grid

Innovative „role model“ system for urban areas:
Silkeborg: Think big & use land at the city limits!

20% solar coverage of 400 GWh demand in Silkeborg

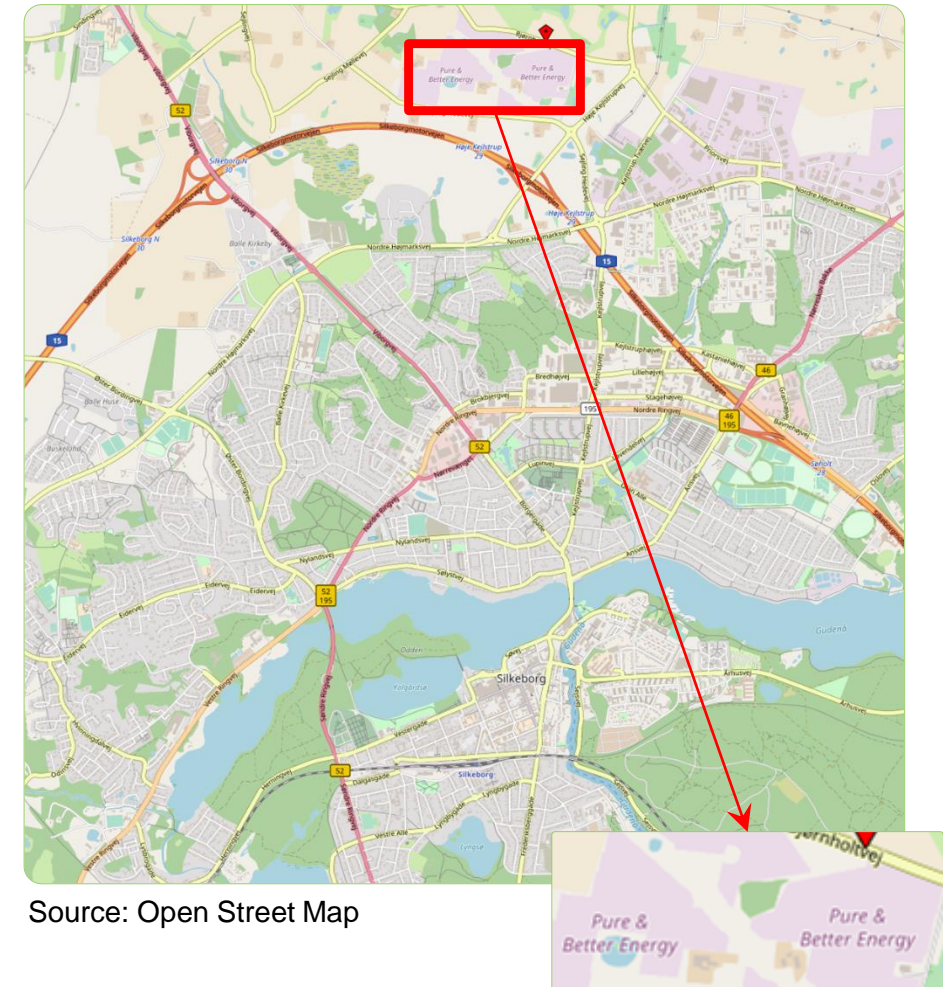
The current world's biggest plant: 110 MW peak power.



Planned street

Silkeborg, DK:

Solar system:	110 MW, 156,694 m ² aperture area
Yearly yield:	80,000 MWh (20% solar fraction)
CO ₂ -saving:	15.750 ton/year
Households in grid:	11.000
Inhabitants:	40.000
Grid-demand:	400 GWh/a



Source: Open Street Map

Silkeborg

Some impressions from building the world biggest plant



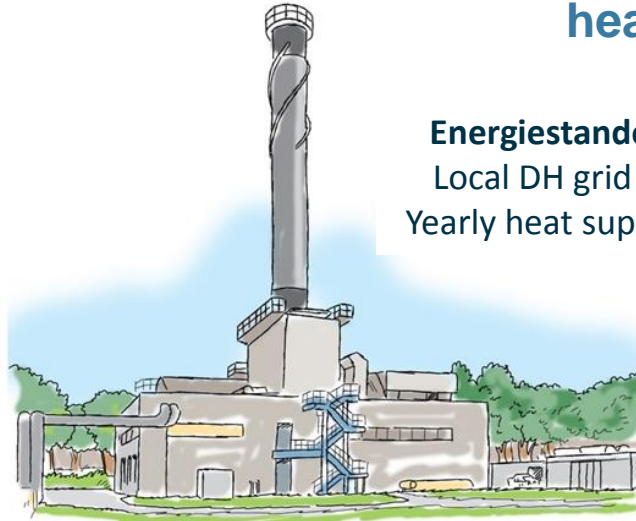
Innovative „role model“ system for urban areas :
Vattenfall Heat – Berlin-Köpenick

Berlin-Köpenick

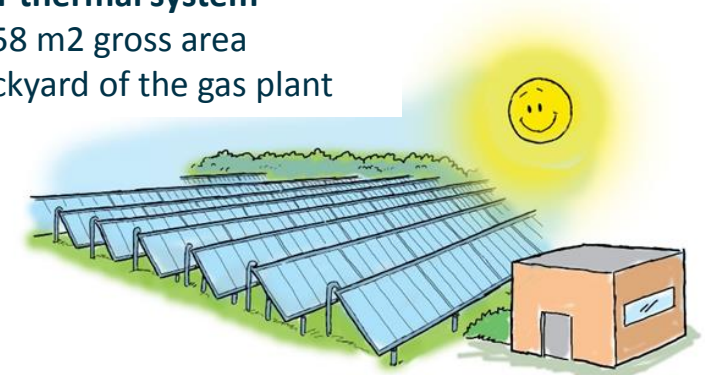
Project description

Solar heat transferred into district heating for Berlin-Köpenick

Energiestandort Köpenick
Local DH grid of Vattenfall
Yearly heat supply of 75 GWh



Solar thermal system
1.058 m² gross area
In the backyard of the gas plant

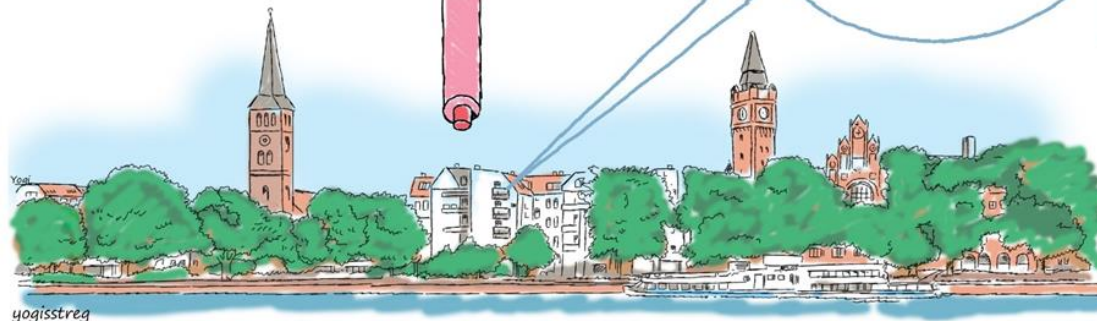


Berlin - Köpenick
District heating for
~ 10.000 households



Equals to:

- 140.000 CO₂-free showers a year
- ~100 ton of CO₂ reduction
- 440 MWh saving of fossile fuels / year



yogisstreg

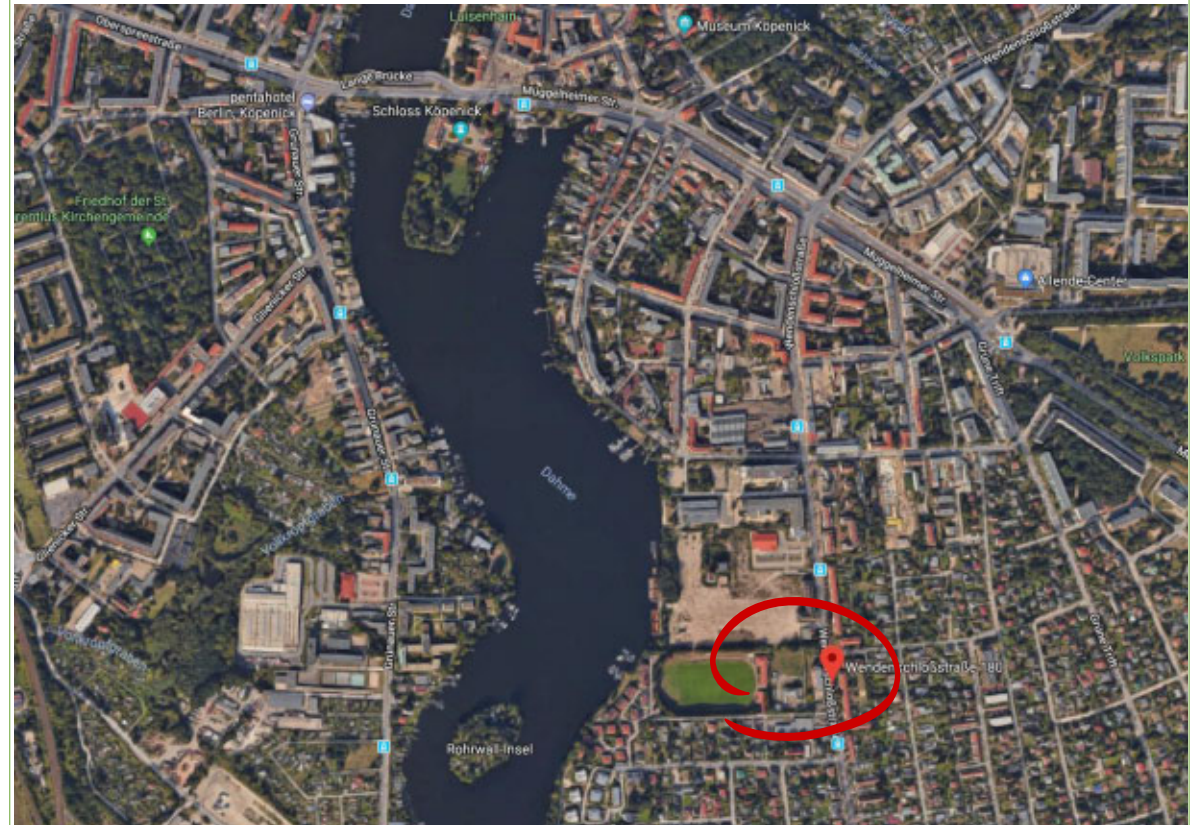
Berlin-Köpenick

Technical data of the solar plant

Solarsystem:

- Size of the solar system: 1.058 m² (gross coll. area)
 - Storage tank: *not needed*
 - Peak power: 700 kW
 - Expected yield: 440 MWh/a
 - CO₂ saving: 98 ton/a (base: natural gas)
 - Life time of the solar system: min. 25 years
-
- Turn-key delivery by Arcon-Sunmark
 - Prefabricated hydraulic unit in sound absorbing building
 - Control on Siemens S7-base for direct connection to main SCADA
 - Incl. KKS-labelling

Areas inside the city are expensive and highly demanded...



Berlin-Köpenick

Before / After

2.200m² unused land in the backyard of the heating plant Köpenick transferred into another small puzzle stone towards the heat transition



Berlin-Köpenick

Simple integration saves costs

Solarsystem:

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Optimized operation by full-year return-line integration:

- Full-year Solar flow-/return-line temp: 65°C / 55°C

To exclude a negative influence of the CHP a full analysis was done before.

Conventional systems at that location:

Gas-CHP and gas boiler

Biomethan-CHP



Berlin-Köpenick

Success factors

3 success factors to make a small systems fly:

- Short transmission line
- No storage tank (Grid demand > Solar supply in summer time)
- Low temperatures



Wrap-up

SOLAR PROVIDES SAFETY

- **25 years** low and fixed heat cost
- **Double use** Put eco-concept on top (compensation area)
- **No** emissions & primary energy use
- **20..45 €/MWh** are typical (depending on local subsidy)
- **30 years** of experience with 100 large systems (in sum >800 MW)

THANKS FOR YOUR ATTENTION!

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Speicherprojekt HELIOS



Finished storage tank with logo



Technique center & storage tank

Building finalization: Dec 2017