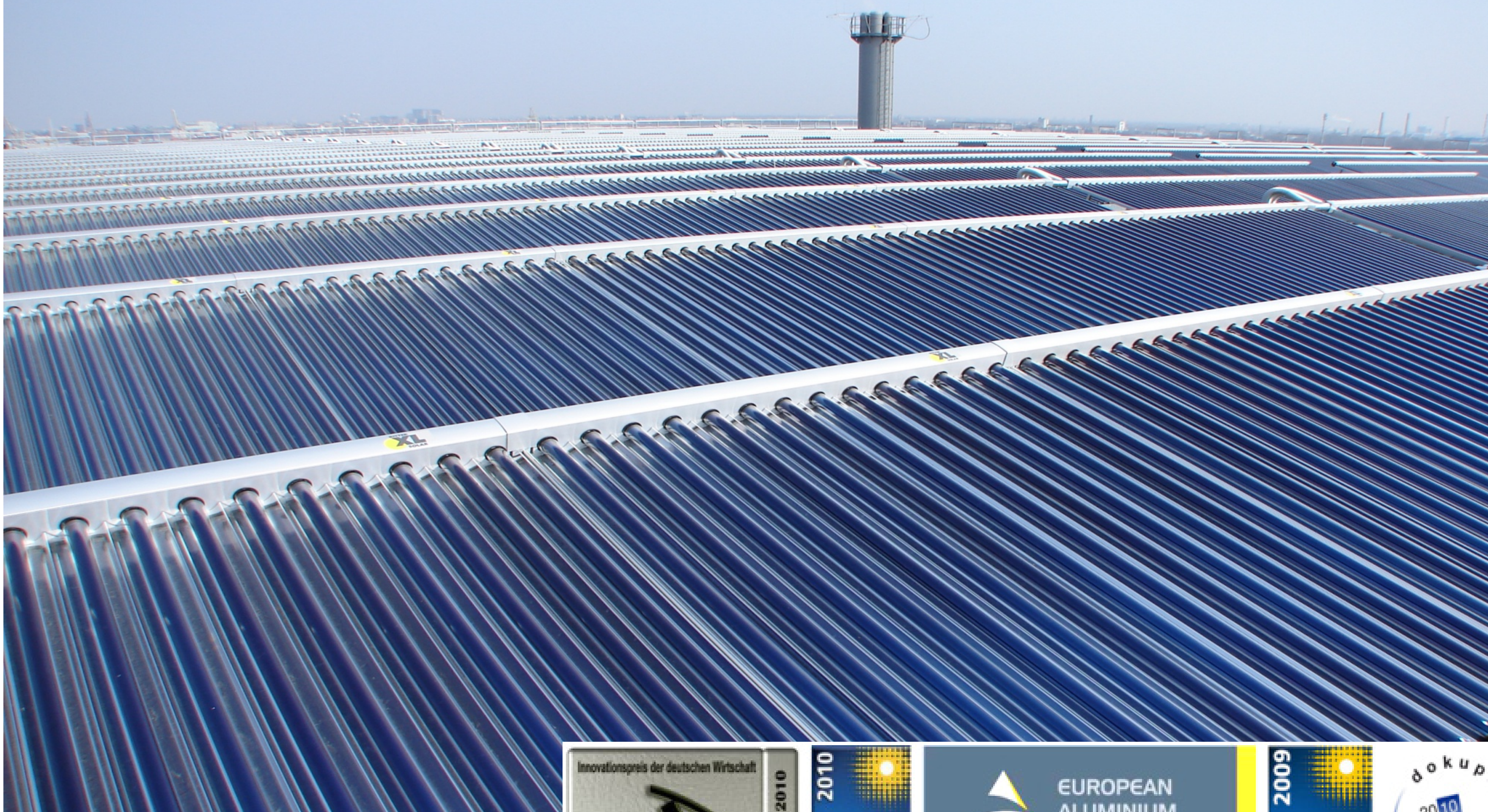
SDH 2014

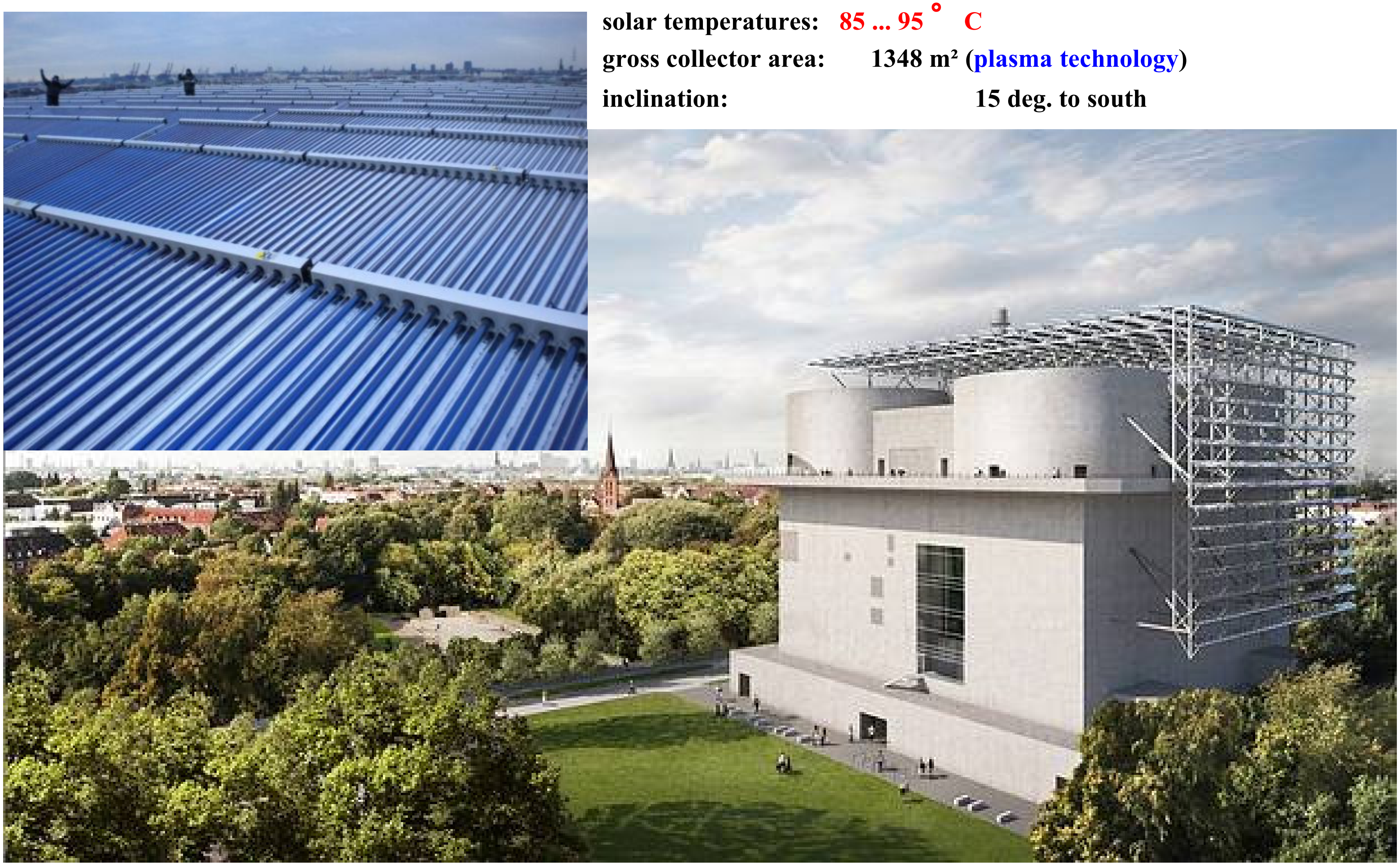
CPC evacuated tube collector systems in practice



Energiebunker Hamburg, a project of the International Building Exibition IBA, Hamburg 2013

Rolf Meißner, r.meissner@ritter-xl-solar.com

Energiebunker Hamburg



solar temperatures: 85 ... 95 °C
gross collector area: 1348 m² (plasma technology)
inclination: 15 deg. to south

Energiebunker Hamburg

- 2006: first solar-thermal ideas
- 2011: first bunker saving works
- Feb.-Jul. 2013: tendering procedure
- Aug. 2013: order to RXLS
- Aug.-Dec. 2013: RXLS planning
- Dec.-Feb. 2013: RXLS construction
- 8. April 2013: commisioning

Energiebunker Wilhelmsburg

First results

- Target: 600 MWh/a (445 kWh/m²a)
  with 55 ° C intented medium collector temperature
  Result after 12 months: 517 MWh heat-fed into the buffer
  + ca. 150 MWh unused due to thermal standstill
  with 80 ° C real medium collector temperature

- 8th April ... 8th June 2013
  2000 m³ buffer tank
  heated from
  8 ° C to > 90 ° C by solar-thermal heat exclusively
  or including thermal losses
  about 217 MWh or
  0,16 MWh/m²
  gross collector area

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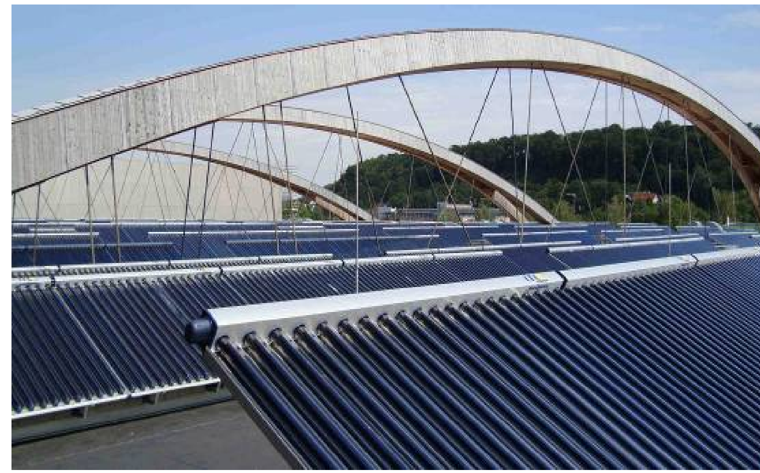
Trading center Wels, Austria, May 2011

First decentralized SDH
First application with DHN-water in the collectors

temperatures 85 ... 100 °C
storage tank 3 m³ (no buffer)
gross collector area 3388 m²
peak power 2,8 MW
max. constant power 1,8 MW
yield guarantee 1.300 MWh/a
first 12 months ≈ 1.350 MWh
active frost protection measured 13 MW (1 %)



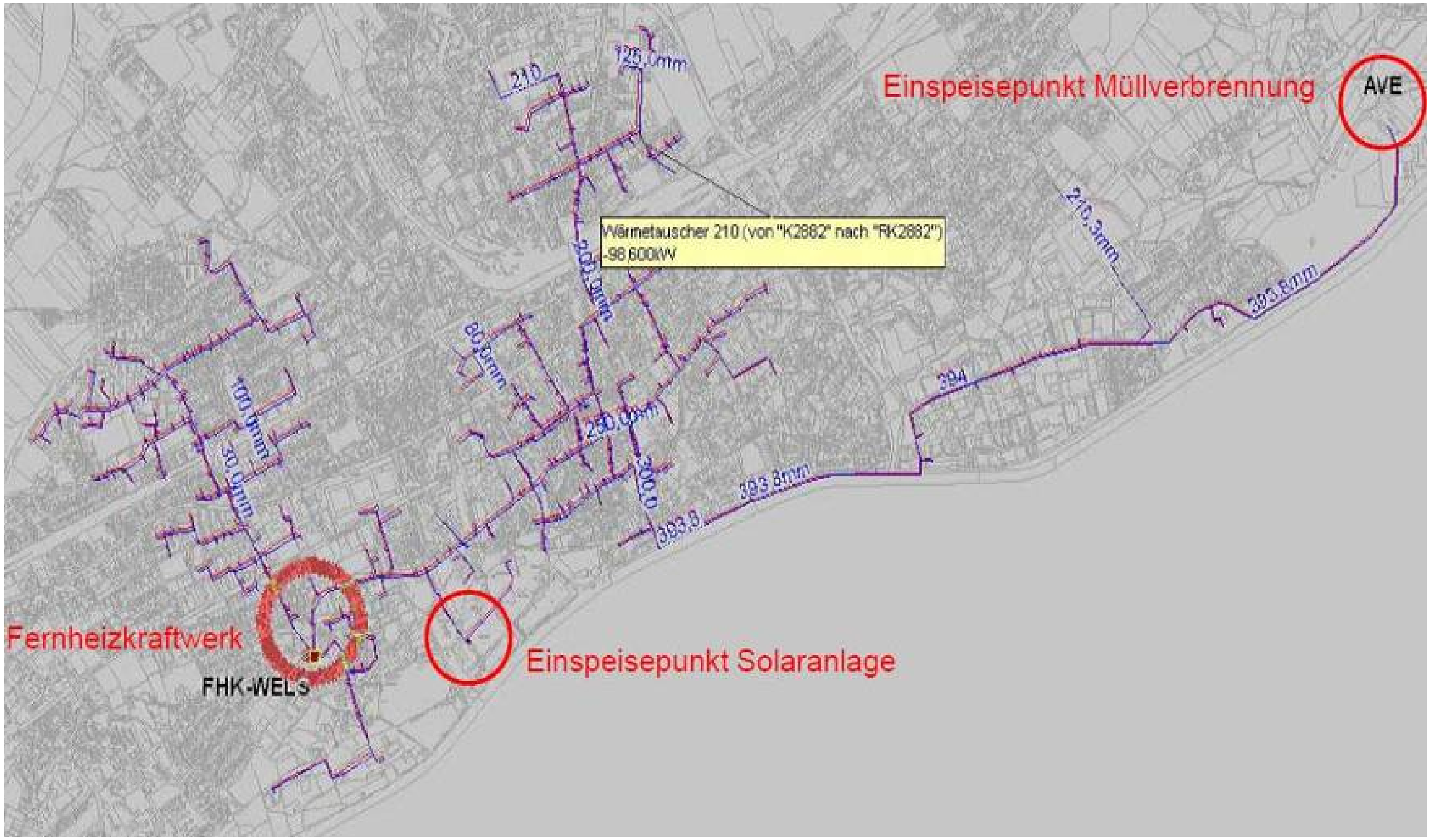
E-Werk Wels

mea solar
Ein Unternehmen der Elektrizitätswerk Wels AG

ASiC

Trading center Wels, Austria, May 2011

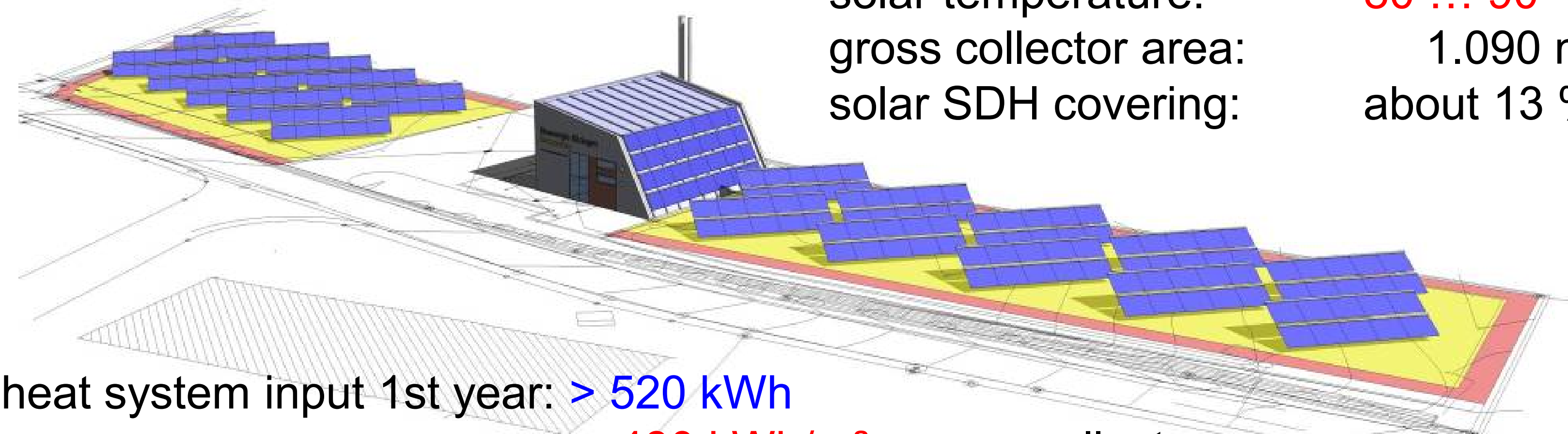
- 1st decentralized solar-thermal district heating feeding-in
- 1st application with district heating water in the collectors
- 1st solar-thermal SDH application without no solar buffer storage



SDH Businger

plasma tube technology

solar temperature: 80 … 90 ° C
gross collector area: 1.090 m²
solar SDH covering: about 13 %

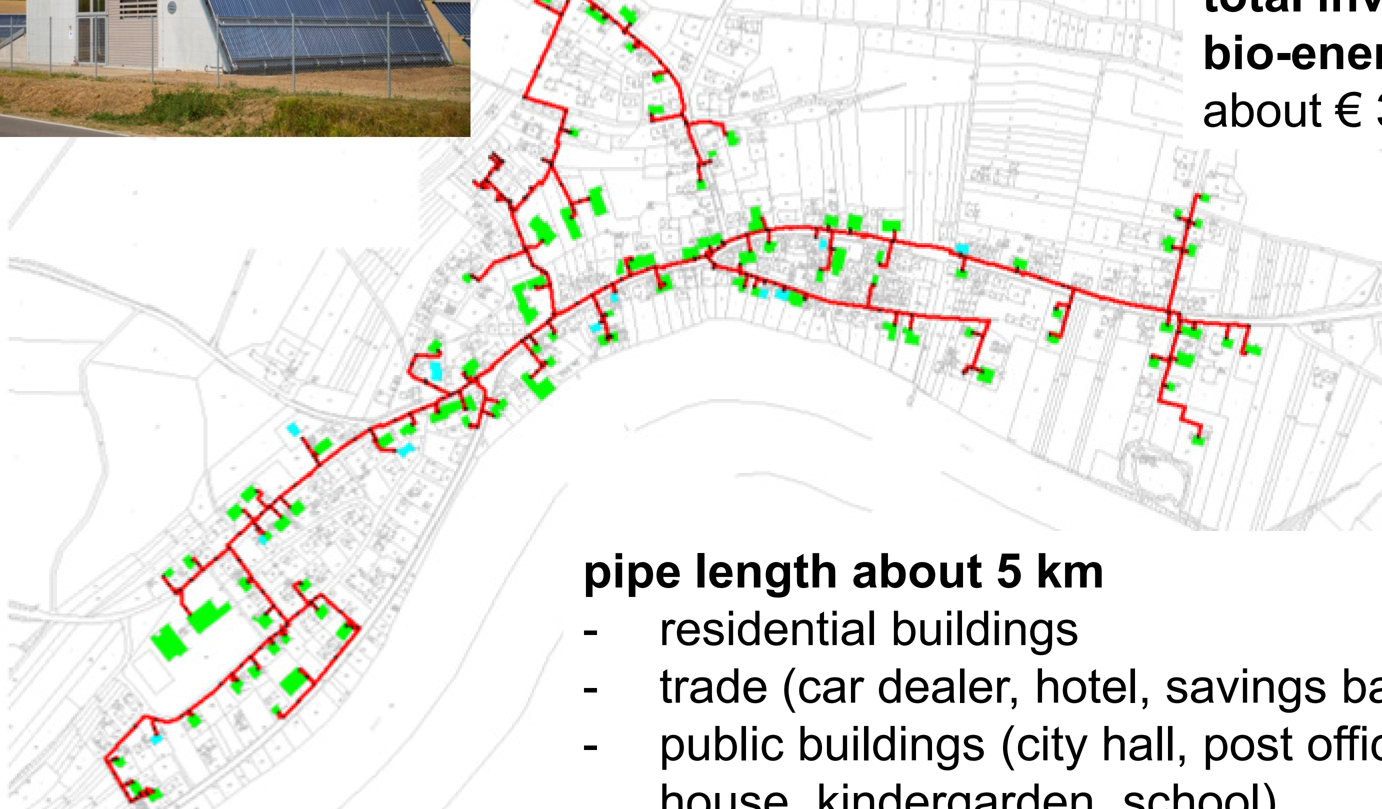


heat system input 1st year: > 520 kWh
or ≈ 480 kWh/m²a gross collector area
+ ≈ 50 kWh/m²a heat losses due to thermal standstill

SDH in Busingen

heat demand
4.200 MWh/a

total invest of the bio-energy-village
about € 3,5 Million



pipe length about 5 km

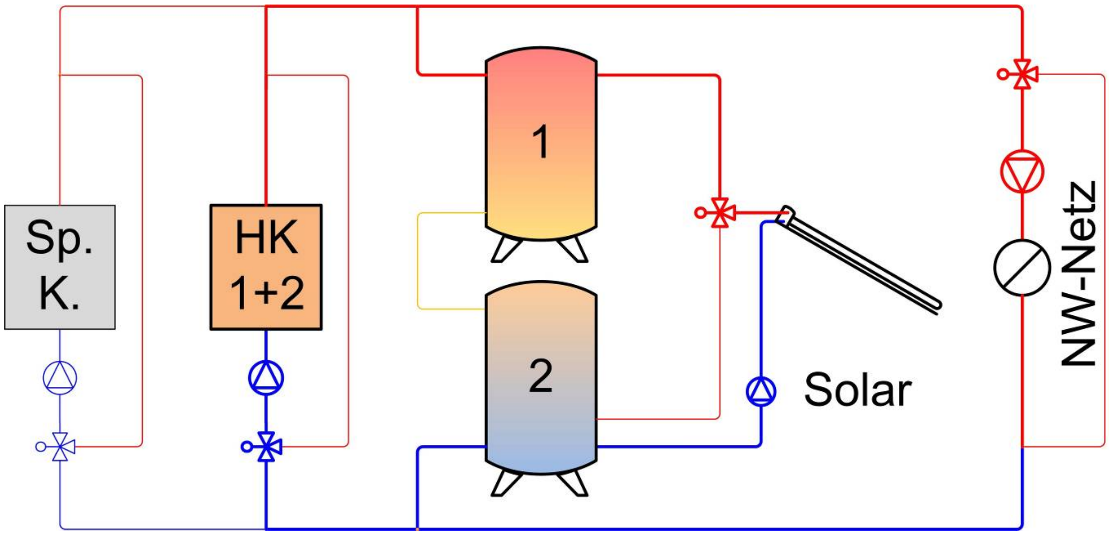
- residential buildings
- trade (car dealer, hotel, savings bank)
- public buildings (city hall, post office, parish house, kindergarden, school)

Quelle: solarcomplex:

SDH in Busingen

Easy is always best!

- water in the collectors, no heat exchanger
- works like an additional boiler
- no additional storage, tanks for biomass energy are sufficient



heating oil peak load 730 kW

wood chip boiler 450 + 900 kW

buffer tank 2 x 50 m³

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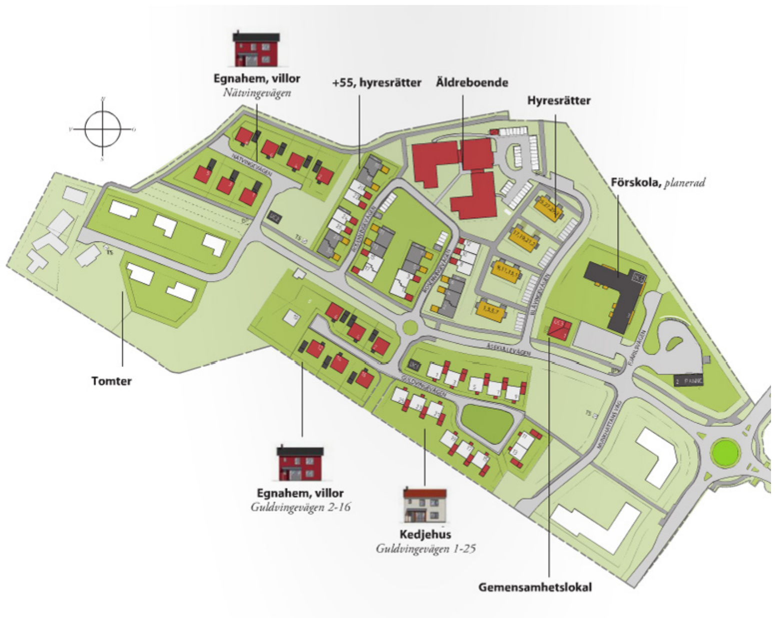
Vallda Heberg (120 m²), Schwden, 5/2013

The collectors are mounted at the front of the biomass boiler building.



temperatures: 80 ... 90 ° C
storage tank: 8 m³
gross collector area: 120 m² (**plasma tube technology**)
first 12 months: 45 MWh
375 kWh/m² gross collector area
+ about 7 % wasted in thermal stagnation

Further local heating network applications

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FESTO near Stuttgart, Germany

Solar cooling in summer, room heating in winter, finished in 2007

solar temperatures 80 ... 95 °C

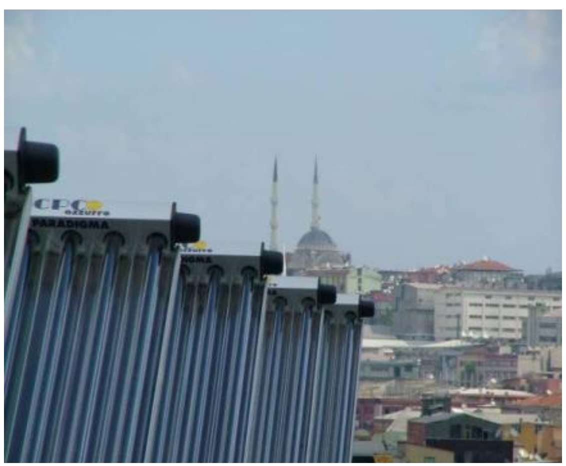
gross collector area	1330	m²
storage tank	17	m³
peak power	1.2	MW
max. continual power	0.65	MW
guaranteed yield p. a.	500	MWh
2011(+ 35 %!)	676	MWh

METRO shopping center Istanbul

Solar cooling in summer, heating in winter, finished in 2009

solar temperatures 80 ... 95 °C

gross collector area	1030	m²
storage tank	15	m³
peak power	1.1	MW
max. continual power	0.6	MW
guaranteed yield p. a.	650	MWh



Galvanization Blum, Austria, 2011

Factory heating network support for process heat galvanization)

(5 working days per week, 2 days thermal standstill)

solar temperatures:	75 ... 90 ° C
gross collector area:	459 m²
buffer tank volume:	8 m³
max. continuous power:	230 kW
yield/year:	150 MWh
or	≈ 330 kWh/m²a gross collector area

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Galvanization Zehnder, Switzerland, 2012

Factory heating network support for process heat (galvanization)

(5 working days per week, 2 days thermal standstill)

temperatures 70/95 ° C

gross collector area 400 m² **(plasma tube technology)**

buffer 5 m³

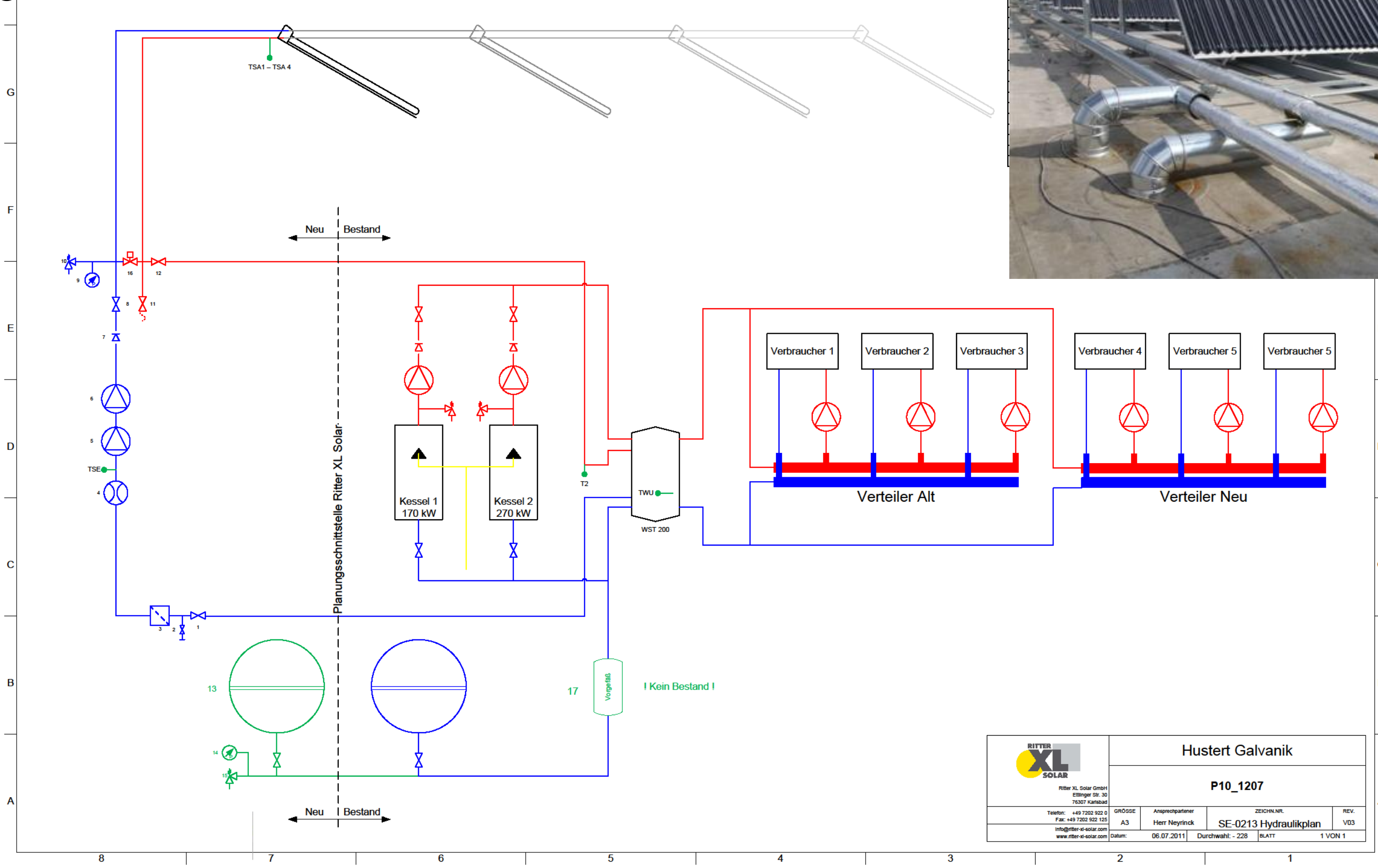
Galvanization Hustert, Germany, 2011

Factory heating network support for process heat (galvanization)

(5 working days per week, 2 days standstill)

temperatures 70/85 ° C

gross collector area 221 m², no buffer



The history…

In 1986 as answer to the nuclear reactor catastrophe of Tchernobyl Alfred Ritter from the chocolate dynasty **Ritter Sport** founded Paradigma which is spezialized in solar-thermal heating systems. 25 years later the Ritter Group is one of the most innovative market players in solar-thermal vacuum tube technology.

„I can only encourage all entrepreneurs to pursue a sustainable company policy concerning raw materials and energy. You will not only succeed in economic terms but also enjoy your commitment to the environment very much.“

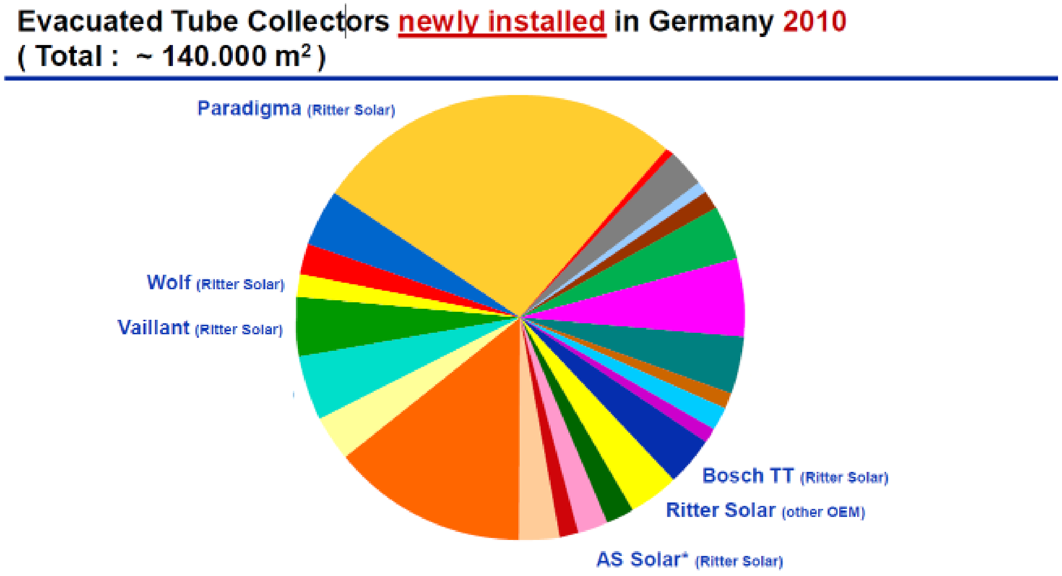
Alfred T. Ritter

Rolf Meißner, r.meissner@ritter-xl-solar.com

The vacuum tube collector market

Ritter is market leader in Europe:

Market share in Germany	~ 50 %
Market share in Europe	~ 35 %



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Ritter XL Solar

1988
Gründung der **Ritter Energie- und Umwelttechnik GmbH & Co. KG** durch Alfred T. Ritter und Klaus Taafel.

1990
Start der Marke **Paradigma**

1997
Markteinführung der **CPC-Vakuumröhren-technologie** in Deutschland

1994
Erste **solarthermische Großanlagen** von Paradigma

2000
Gründung der **Ritter Solar GmbH & Co. KG** als Produktionsfirma für Vakuumröhrenkollektoren

2004
Markteinführung **AquaSystem**

2001
Joint-Venture mit der Linuo Gruppe in Jinan/China, unter dem Namen **Linuo Paradigma**

2007
Bau der bis dato **weltweit größten Vakuumröhren-Kollektoranlage mit 1.330 m² Kollektorfläche** bei der Firma Festo in Esslingen, Süddeutschland

2008
Erste direkte solare Einspeisungen in vorhandene Wärmenetze ohne zusätzliche Speicher und ohne Wärmetauscher

2009
Eigene Marke **„XL Solar"** für Solare Großanlagen

Bau der bis dato **zweitgrößten Vakuumröhren-Kollektoranlage** in Istanbul, Türkei, **Kollektorfläche 1.030 m²**

2010
Bau der bisher **weltweit größten Vakuumröhren-Kollektoranlage mit 3.373 m² Kollektorfläche** zur Einspeisung in das Fernwärmenetz der Stadt Wels, Österreich

Gründung der **Ritter XL Solar GmbH**

Erweiterung des XL-Portfolios um das mehrfach ausgezeichnete **CPC-Vakuumröhren-Fassadenkollektorsystem**

Nominierung zum **„Innovationspreis der deutschen Wirtschaft 2010"**

> 20 years large-scale solar-thermal installations

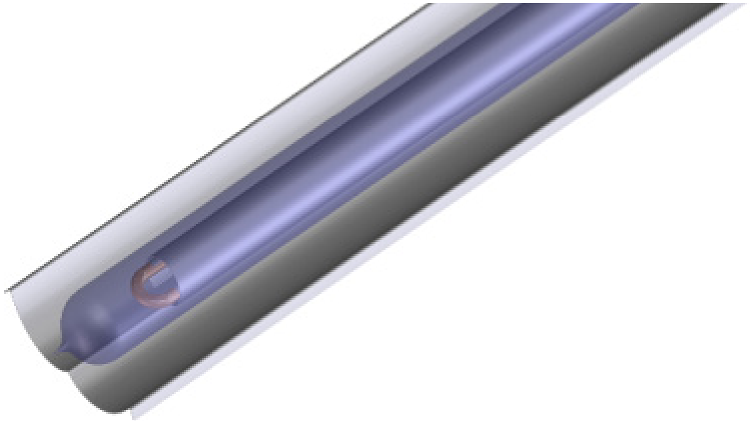
> 10 years successful application of the **AquaSystem**

> 350 installations **in 20 countries** with about **50,000 m² collector area, 8 of them are the world's largest** pressurized CPC-ETC installations.

Rolf Meißner, r.meissner@ritter-xl-solar.com

James Dewar (1874): thermos flask principle

double-walled glass tubes
+ cylindrical evacuated
absorbers



copper, steel or stainless steel collector tubes + CPC reflector

Vacuum

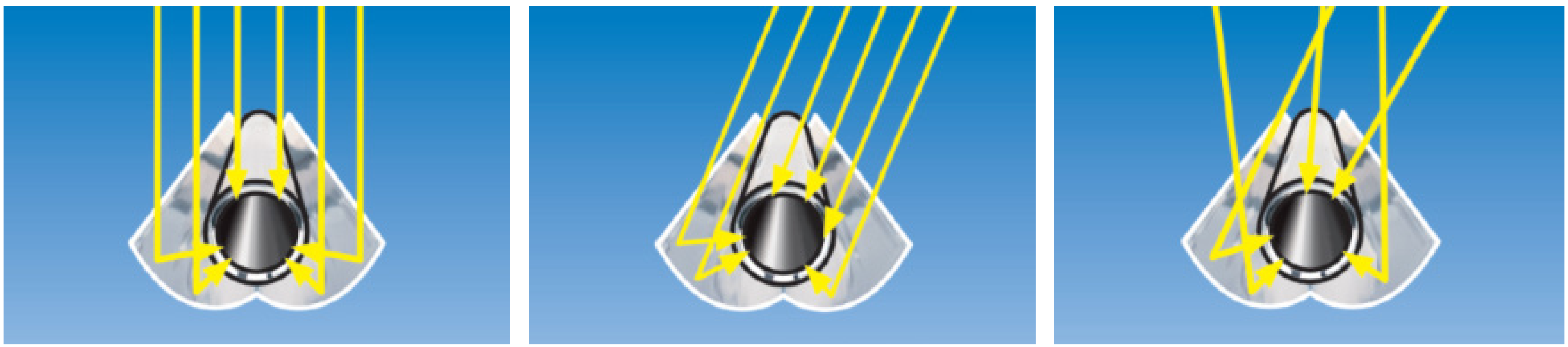
is the best physical insulator!

- Like in a thermos flask the heat can be stored for a long time.
- This allows to operate the collector with high efficiency even in times with low solar irradiation or at high temperatures.
- the design is very durable
due to the material (pure glass tube).

Rolf Meißner, r.meissner@ritter-xl-solar.com

Main components of the CPC ETC collector

CPC = Compound Parabolic Concentrator



direct irradiation **sidewise irradiation** **diffuse irradiation**

Best possible solar yields at all weather conditions.
Especially useful with cloudy sky and low ambient temperatures.

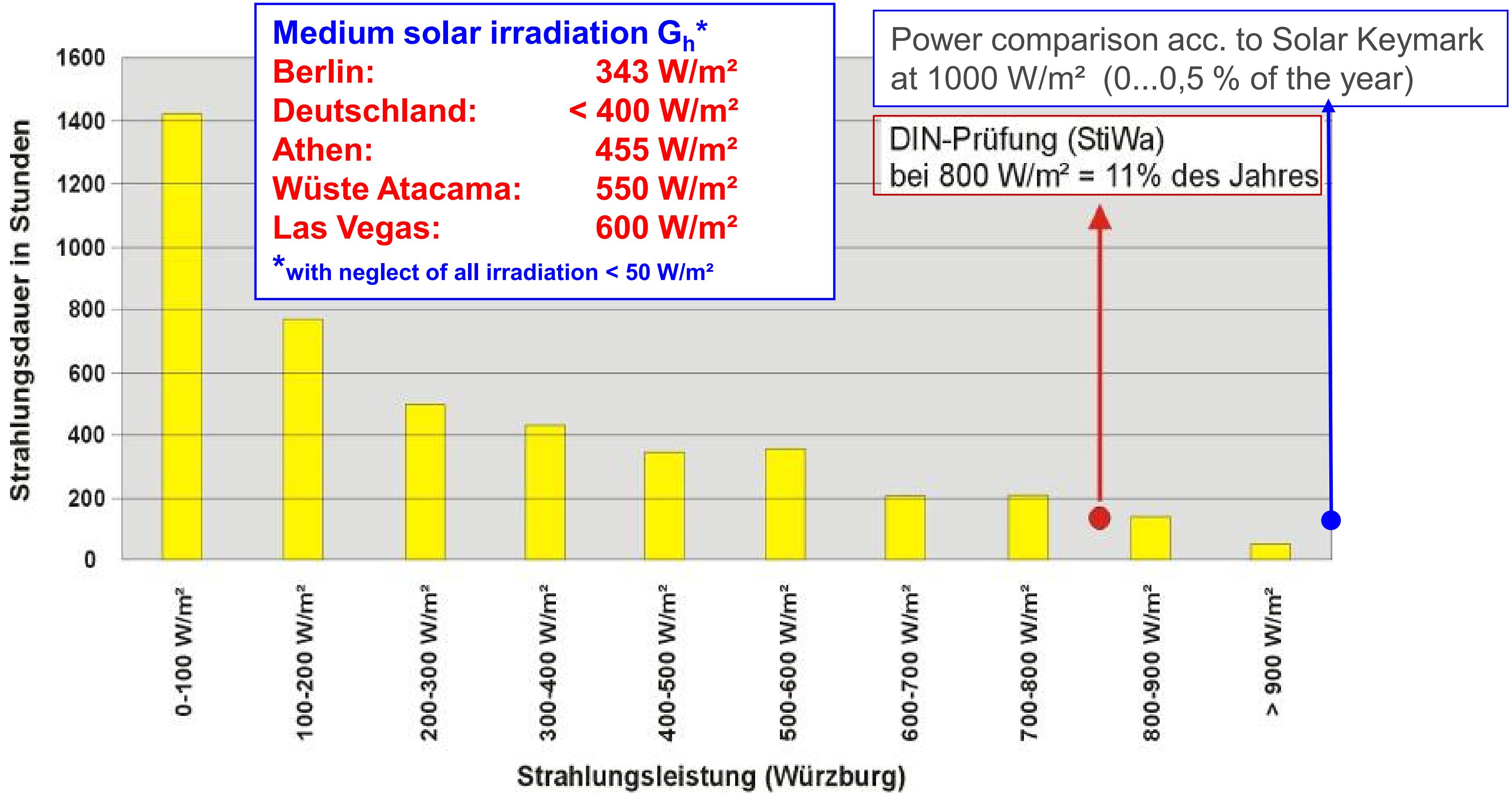
Rolf Meißner, r.meissner@ritter-xl-solar.com

The use of water ...

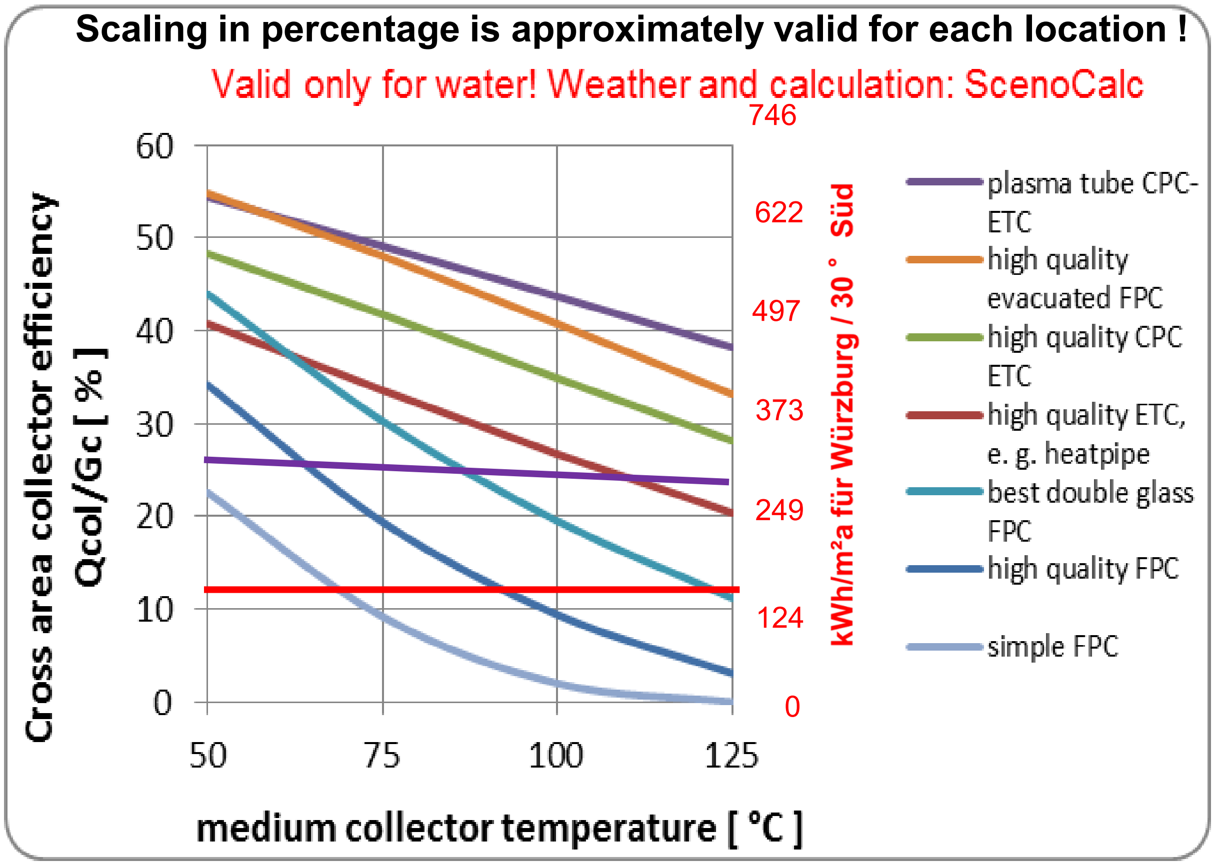
- ... allows direct integration in existing hydraulic
- ... reduces the number of components needed
- ... eliminates all risks of thermal stagnation
- ... ensures long period of operation
- ... ensures best thermal properties (capacity, transfer, conduction)
- ... guarantees long-term high efficiency in the long term
- ... reduces costs for spare parts
- ... avoids costs for antifreezing agent
- ... allows fast and easy commissioning

- **Water is the most applicable, cheapest, efficient and environmentally friendly fluid for solar-thermal collectors and persistent for billions of years!**

What about collector tests?



CAOs of different collector types



Wurzburg, collector yield (CAO) without thermal standstill

CAO:
Collector Annual Output acc. to the Solar-Keymark-Tool „ScenoCalc“

completion:

photovoltaics delivers independent from the temperature
ca. 11,5 %

concentrating solar collectors (CSP) like parabolic troughs or Fresnel reflectors deliver also almost temperature-independent
24 … 28 %
valid only for Wurzburg!

Caution without CAOs! Don’t trust other numbers.

- Different countries and markets use different tests.

- Tests often use irrelevant and misleading references:
  → power values at 800 W/m² or even more
  → power and yield refer to the aperture area but
  calculations concerning costs and subsidies use the gross collector area,
  usually without any explanation,
  → Tests are made with water, this whitewashes the practice with glycol by 5 ... 10 %.

- system yield ≠ collector yield reduced by:
  - piping heat losses
  - storage heat losses
  - stop-and-go-losses
    (positive as well as negative heat flow has to be measured)
  - AquaSystem: heat demand for frost protection

- The collectors are the “engine” of the solar-thermal system. Compare carefully the CAOs before you think about a whole system because:

A lame horse cannot drag any coach in a satisfactory manner.

Ask for an energy yield guarantee!

Many thanks


Nothing is more powerful than an idea whose time has come.
Victor Hugo