Large Solar Thermal Systems

SOLID solarinstallation+design

A successful technology

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SOLID Group - What we do

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Large solar thermal plants:

- District heating nets
- Resorts and hotels, hospitals, dorms, prisons,...
- Swimming pools & sporting facilities
- Process heat & process cooling
- Solar cooling /air conditioning

Existing References:

- > 200 large plants
- 13 commercial solar cooling systems

SOLID's scope of supply:

- Project Development
- Engineering
- Construction
- Supervision
- Operating & Maintenance

R&D activities for Solar Thermal

Financing:

- Third Party Financing models
- Guarantee contracts
- ESCo arrangements

Orust Sweden, 768 m² , 540 kW , 1997

The context

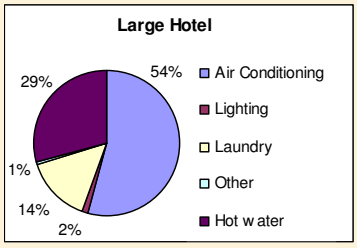
- Price increase of fossil energy will continue on an exponential scale for the next decades.
- Possible solutions lay in the combination of:
  - ✓ Efficiency increase of all consumers
  - ✓ Increasing use of all renewable sources

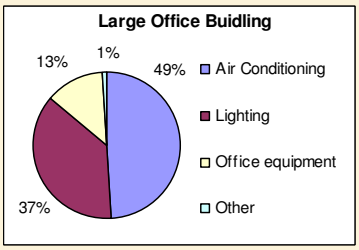
The context

- Solar Thermal is well known for:
  - Solar Heating like: Domestic hot water, heating, …
    Installed capacity worldwide: 118.000 MW/168.000.000 m²
    (Source : IEA SHC Task 33 Task 33 report, valid for 2005)
- Solar Thermal is barely known for:
  - Heating of process fluids, washing detergents, heating processes, drying processes, …
    Installed capacity worldwide Process Heat: 25MW/35.000 m²
    (Source : IEA SHC Task 33 Task 33 report)
  - Solar Cooling like air conditioning, cold storage, cooling of technical processes, …
    Installed capacity worldwide Solar Cooling: 5-6 MW

Market potential Solar Cooling

- The buildings sector accounts for 42% of global electricity consumption (IEA 2007)
- Air-Conditioning (AC) represents the biggest single energy/power consumer in public and commercial sectors
- AC key driver of electric peak power demand growth → negative impact on grid load factor, electricity price and environment





Market potential Process Heat

3 - 4 % of all industrial heat demand can be covered by solar process heat

(Source : IEA SHC Task 33 Task 33 report)

Higher potential than the whole domestic hot water market !

International projects

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EAR Tower Pristina (2002/2003), 6th operating season

2 thermal driven absorption cooling machines with a total load of 70 kW

226 m² solar collectors

4 m³ storage tank

back up for peak load: electric chiller 30 kW.

International projects

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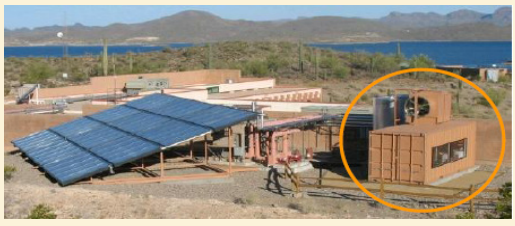


Desert Outdoor Center Phoenix, AZ, (2006)

Solar Panels:
124 m²

Cooling Power:
70 kW

Project Partner :
Arizona Public Service

International projects

Lanta Self Storage, Phoenix , AZ, (2008)

Solar Panels: 500 m² Cooling Power: 105 kW

International projects

Olympic Sailing Village China (2008)

Solar Hot Water for Sports Center and Olympic Village

Solar Air Conditioning for Logistic Building

Solar Panels: 1296 m²

Backup Energy Source: District heat

In operation

Asian Power award:
Best renewable plant of Asia 2006

International projects

Gatorade (Pepsi Cola) Phoenix , AZ, (2008)

Solar Hot Water for process heat in the soft drink industry.

Biggest process heat installation on the American continent.

Solar Panels:
893 m² / 9,600 ft²

International projects

CGD Bank Headquarter, Lisbon (2008)

100,000 m² Offices

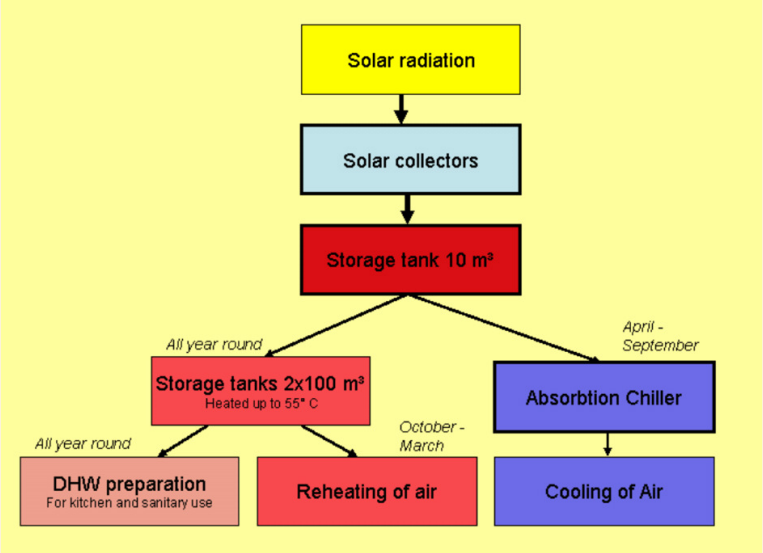
Power 545 kW
Cooling, Reheating, Heating, DHW

Solar Panels:
1,579 m²

In operation since February 2008

Project Partner: EDP

Sample energy flow



Experiences in Solar Cooling

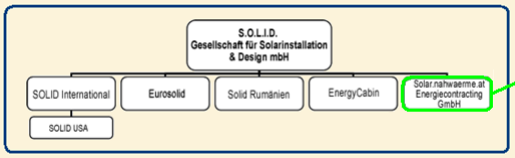
SOLID's cooling installations of the last 7 years

Location/Project	Cooling Machine	Constr.	Cooling Power	Collector Area
Pristina – EAR Tower	2 Pcs. LiBr-Chiller	2002/3	70 kW	226 m²
Leutschach – Wine Cooling	Ammonia, Custom-made (Podesser)	2003	15 kW	100 m²
Graz – Büro, Test Plant	Ammonia, Custom-made (Kunze)	2003	2 kW	8 m²
Stadtwerke, Crailsheim	1 Pcs.. LiBr-Chiller	2004	15 kW	Boiler
Bruxelles – Renewable Energy House	1 Pcs.. LiBr-Chiller	2005/7	35 kW	60 m²
Phönix – Desert Outdoor Center	1 Pcs.. LiBr-Chiller	2006	70 kW	168 m²
Qingdao – Olympic Village	2 Pcs.. LiBr-Chiller	2006	512 kW	631 m²
Tampa – Estellas Restaurant	1 Pcs. LiBr-Chiller	2007	70 kW	210 m²
Lisbon- CGD	1 Pcs. LiBr-Chiller	2008	585 kW	1592 m²
Phoenix-Lanta	1 Pcs. LiBr-Chiller	2008	130 kW	504 m²
Gleisdorf- Service Center Municipality	1 Pcs. LiBr Chiller, and DEC	2008	35 kW 6000 m³/h	260 m²
Graz, office	1 Pcs. Li Br Chiller	2008	17.5 kW	58 m²

Experiences in Solar Cooling

Long lifetime of absorption chillers.
This one is > 70 years old !

ESCo Experience



nahwaerme.at

Nahwaerme-Group
Biomass + Solar

Annual investments:

2004/05	3 Mio €
2005/06	7 Mio €
2006/07	12 Mio €
2007/08	12 Mio €

Total sum since 1995:
50 Mio € Investment

ESCo Experience

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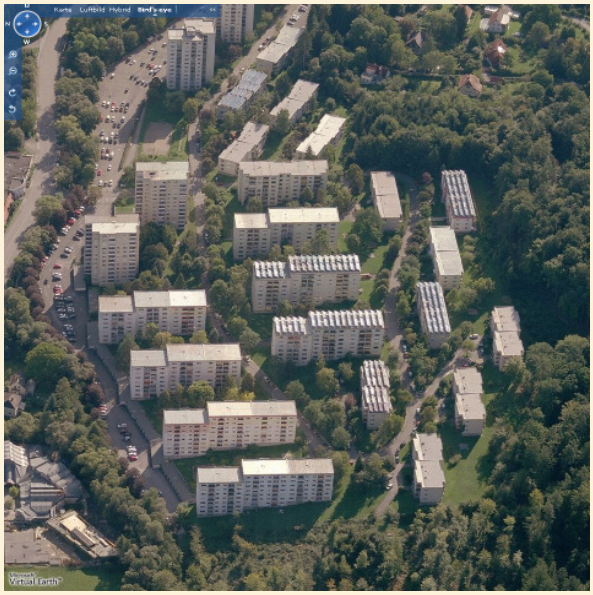

Berliner Ring

Solar Panels:
2500 m²

27 Buildings/
Techn.Centrals

750 Flats
Panels on 6 roofs

ESCo Experience

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Nahwaerme Gleinstaetten Biomass + Solar

Solar Panels:
1300 m²

90m³ buffer tank

District heat and process heat for drying

Covering most of the summer load of the District heating grid

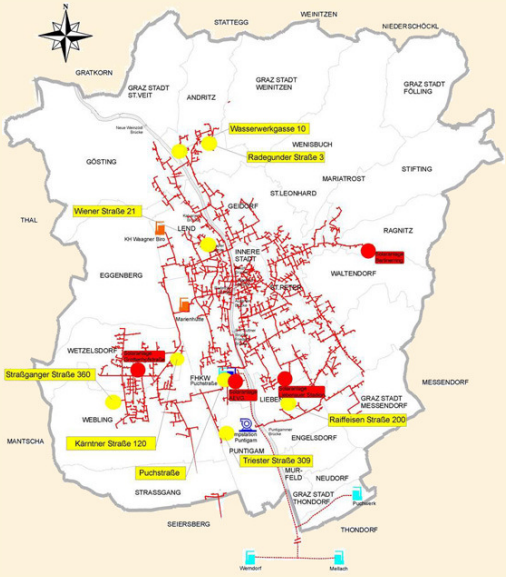
ESCo Experience

AEVG Graz
District Heating

Solar Panels erected:
3,556 m²

Solar Panels additionally planned:
3,347 m²

District Heating Graz, Austria



4 plants connected with the district heating grid of the city

Solar Panels installed:
> 10,000 m²

Further projects planned to double the actual size

Solar Panels

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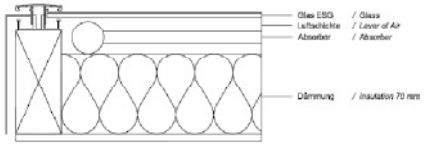
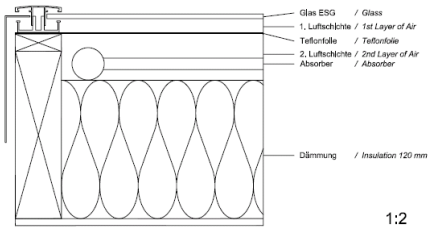
Comparision of gluatmugl Solar Collectors

gluatmugl Standard-Kollektor
gluatmugl Standard-Collector



gluatmugl HT-Kollektor
gluatmugl HT-Collector



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Comparison Solar Panels

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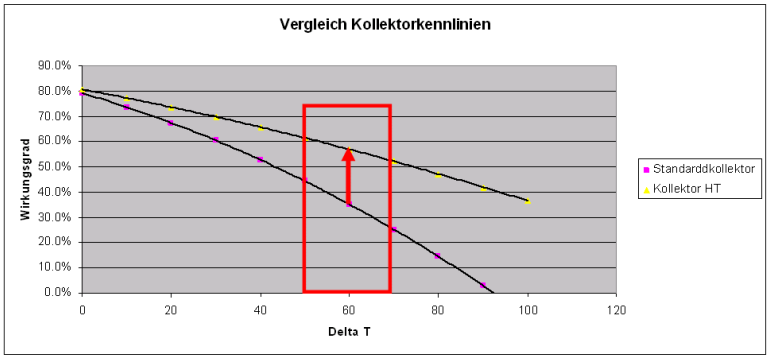


Eta 0	80,6 %
a1	2.580 W/K*m²
a2	0.009 W/K²*m²

(Arsenal test: 2.04.00518.10, March 2008)

Advantages:

- Better space usage
- Price / output ratio

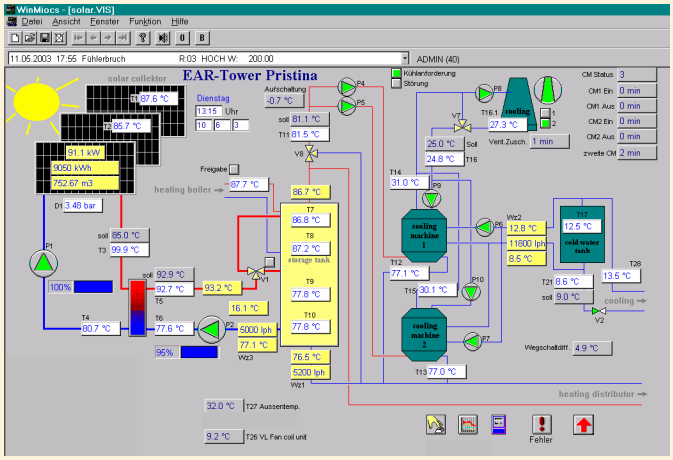
Collector types

- SOLID's collectors gluatmugl + gluatmugl HT perform excellently for the targeted temperature range
- Flat collectors
  - benefit from diffuse radiation
  - excellent performance per m²
  - no movable parts
  - no maintenance
  - lower system cost / m² or kW

Mallorca:

Diffuse radiation:	21%
Direct radiation:	79%
100%	79 %

Telemonitoring



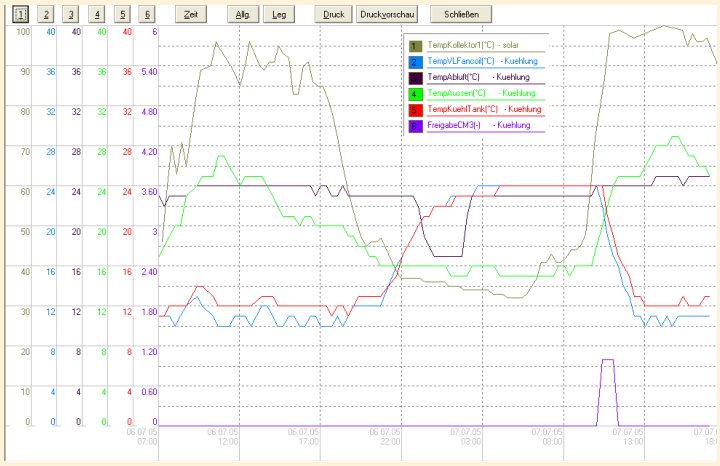
Date: 10.06.2003
Time: 13:15

- Output solar plant: 91.1 kW
- Input cooling machines: 77,8 kW
- Output cooling machines: 59,5 kW
- Collector supplies 99.9 °C/212 F

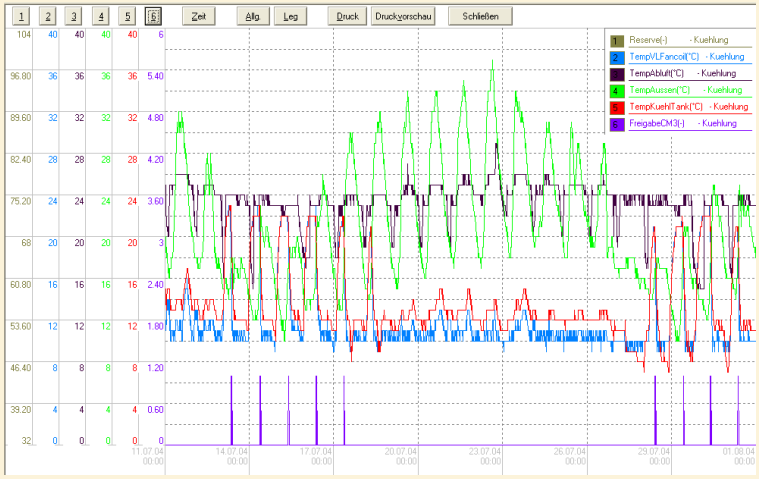
Internet Links:

- Lisbon
- Grottenhof
- Krottendorfer

Telemonitoring 6.+7. July 2005



Telemonitoring July 2004



Conventional Chiller just in early morning on days with cloudy weather !

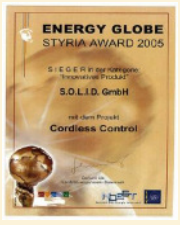
PEAK SAVING TECHNOLOGY !

SOLID Advantages

Technological arguments:

- Modularity as a principle.
  Successfully working all over the world.
- Control unit: Energy Cabin. Plug & play on a grand scale
- Industrial large-area collectors
- Proven success in large-area systems
- Experience in large scale Solar Cooling
- Tele-monitoring, commissioning and „fine-tuning“
- Experience in integrated systems
  Biomass and Solar Thermal as a base for renewable district heat
- Result guarantees
- „Sale of Energy“ contracts – ESCo-Model

Awards



Large scale Solar Thermal

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