

Solar air systems – technology and applications

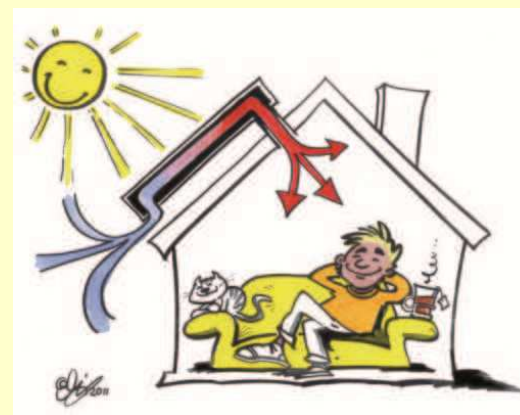
KEE- TU Kosice, Sarpanec / Slovakia 8.11.2012

PRODY SOLAR, Berlin
Ingenieurbüro
(Grammer Solar - business partner)

Dipl. Ing. Corneliu Prodan

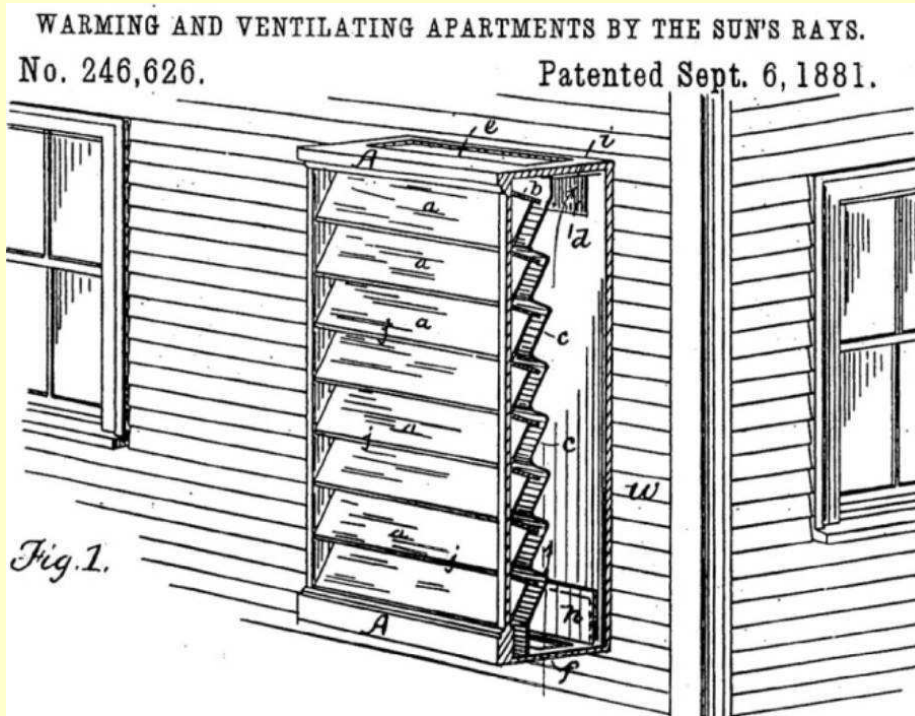
**Planning, projecting and implementation
of solar facilities**

- solar-air systems
- solar-drying systems
- solar-water systems
- PV-systems

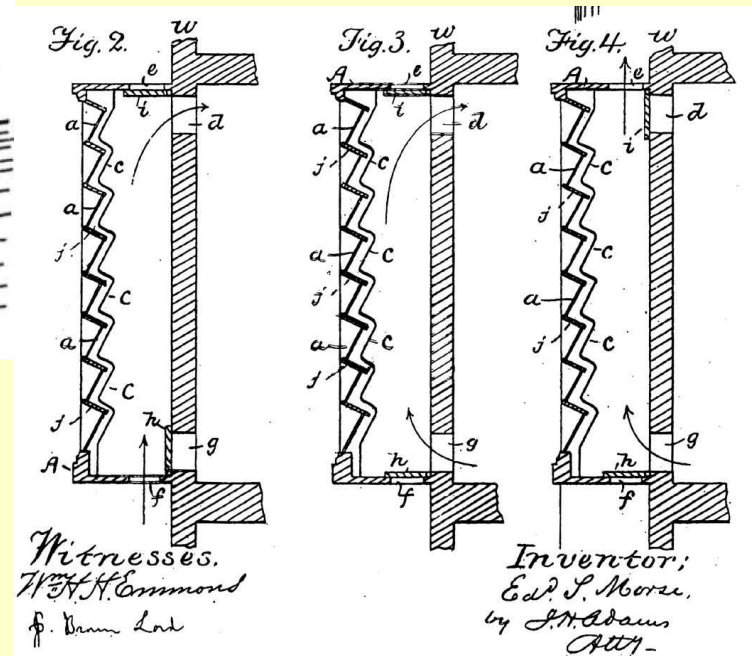


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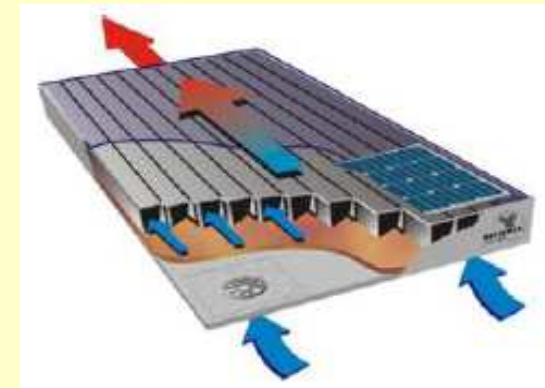
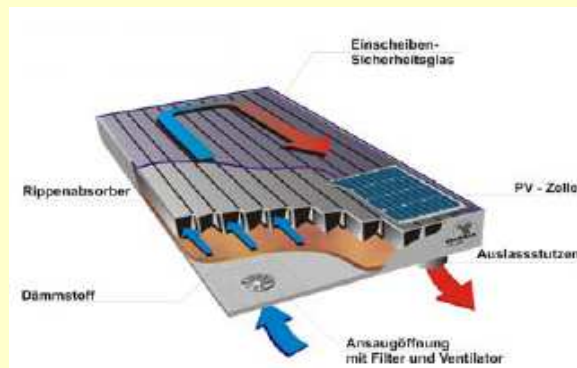
1881 USA



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2012 Grammer Solar - Germany

Collector type TWINSOLAR Compact – Autarc System



as soon as the sun starts shining, solar air collectors produce hot and dry air

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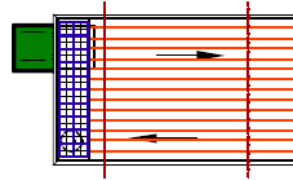
TWINSOLAR 1.3 compact

Collector area : 1,3 m²

Thermal output: 600 Wp

Residential surface: 10 – 20 m²

3



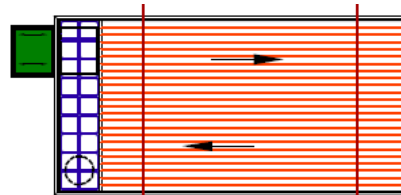
TWINSOLAR 2.0 compact

Collector area: 2 m²

Thermal output: 1.200 Wp

Residential surface: 20– 30 m²

.0

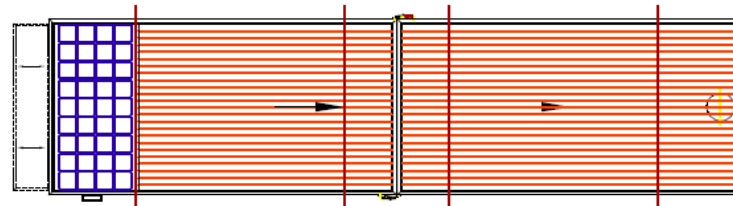


TWINSOLAR 4.0 compact

Collector area: 4 m²

Thermal output: 2.400 Wp

Residential surface: 30– 50 m²

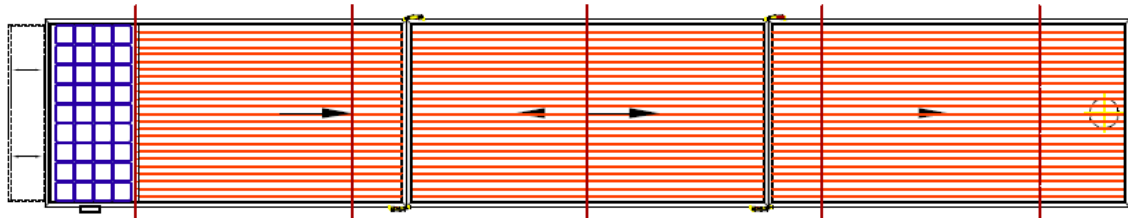


TWINSOLAR 6.0 compact

Collector area: 6 m²

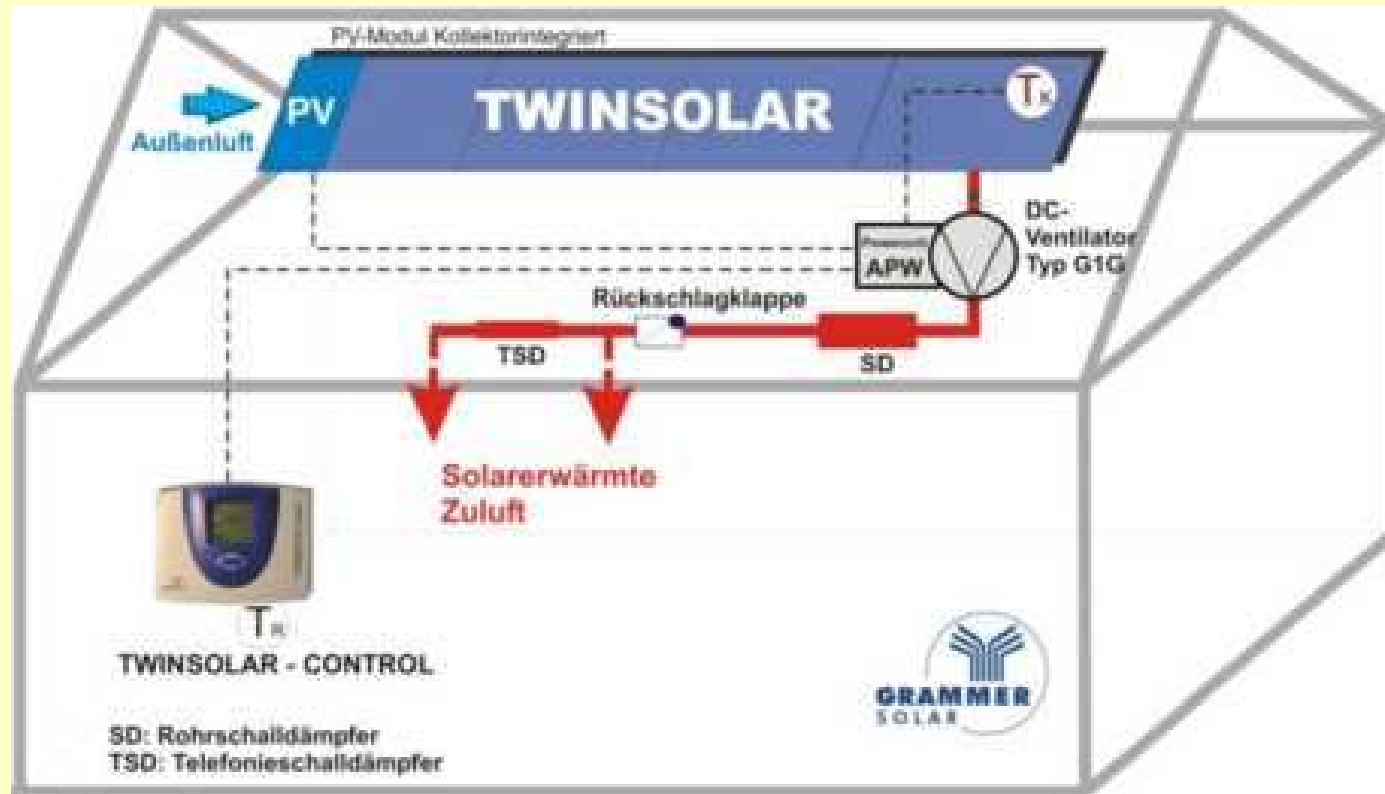
Thermal output: 3.600 Wp

Residential surface: 50-80 m²



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Solar air systems – technology and applications

facade



Inclined roof



flat roof

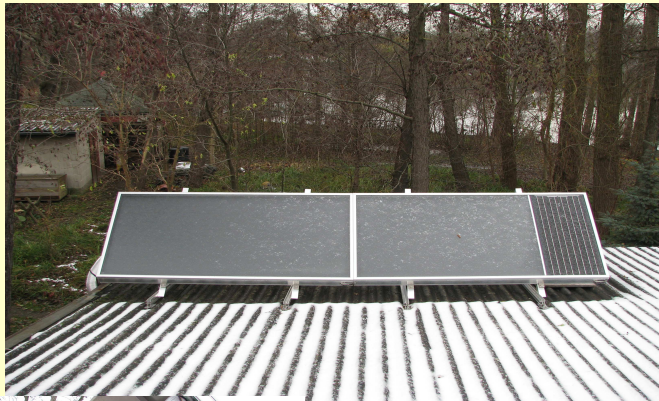


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Application examples for weekend houses in Berlin

local solar radiation: 1.050 kWh/m²/a



**TwinSolar 4.0 - 4m² - 200m³/h
flat roof**



**TwinSolar 2.0 - 2 m² - 120 m³/h
Façade**



Flatroof

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Summer residence – Blumenthal/Prötzel – Brandenburg - 2010



solar-air-collector area:
thermal nominal output:
air-volume-flow:

TOPOSOLAR 10.0

10 m²
6 kW_{peak}
350 m³/h

air electrical heating – 1 kW
heating firewood oven
self montage

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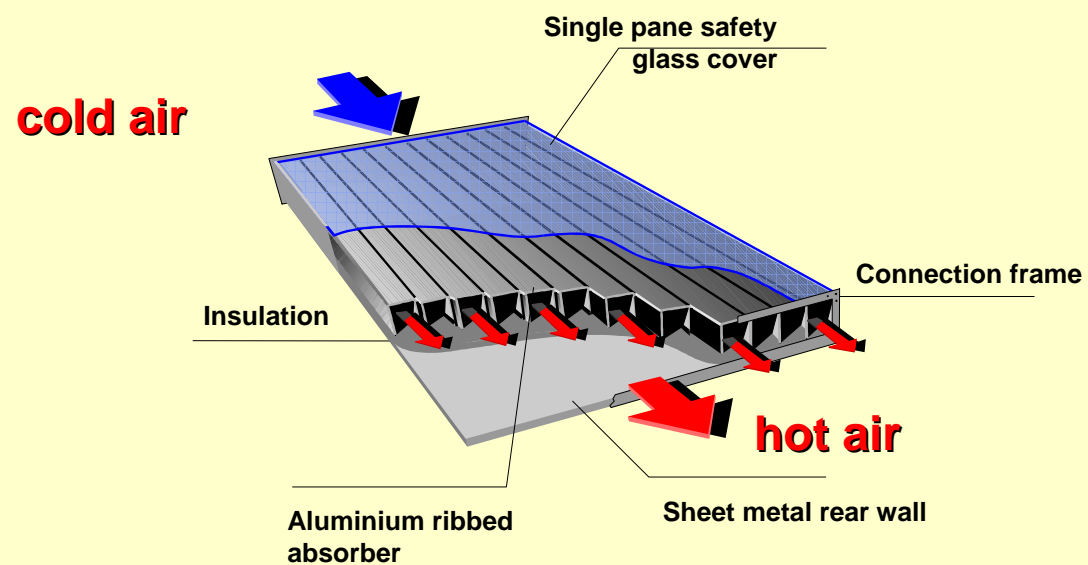
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Collector type TOPSOLAR

collector area: 2.0 m²
thermal nominal output: 600 W/m²

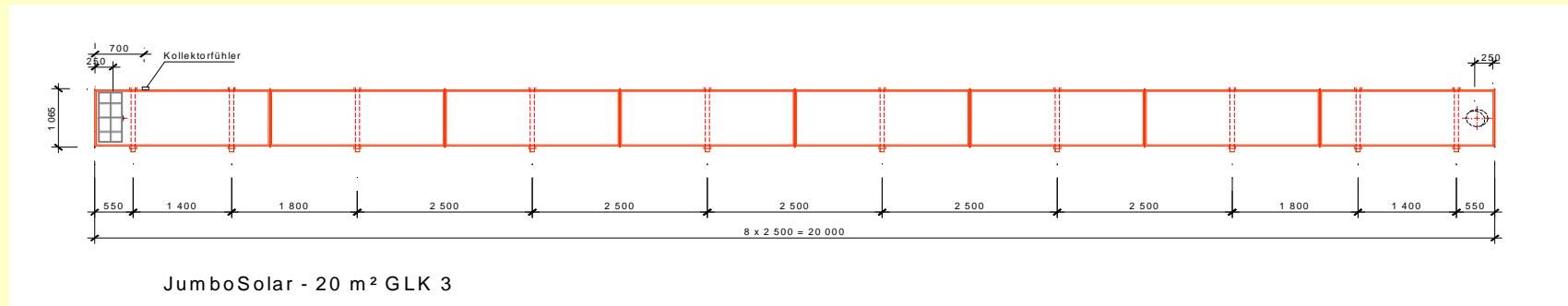
Collector type GLK (JUMBOSOLAR)

collector area: 2.5 m²
thermal nominal output: 670 W/m²



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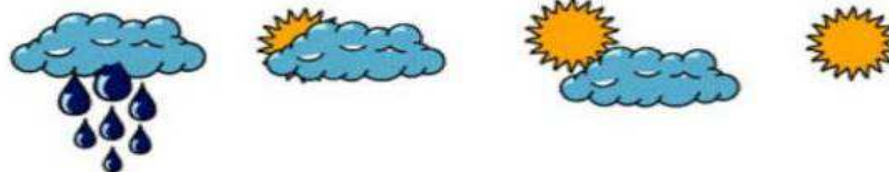
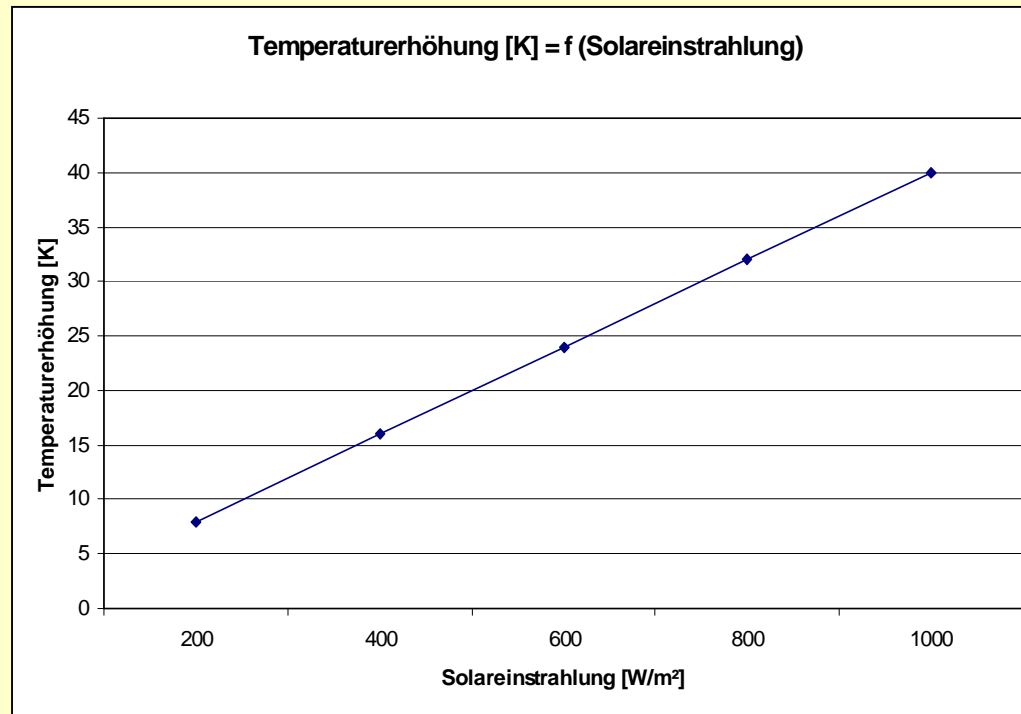
JUMBOSOLAR 20.0 - technical data + performance:



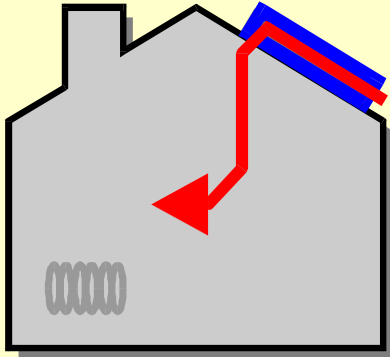
- **Gross collector area:** 20.00 m² (2.50 m² for each GLK module)
- **Thermal rating:** 13.4 kWp
- **Control system:** differential temperature control
- **Expected solar gain:** ~ 525 kWh/a/m², central Europe
- **Air volume flow:** 660 to 2300 m³/h
- **Temperature rise:** up to 40 K above outside air temperature

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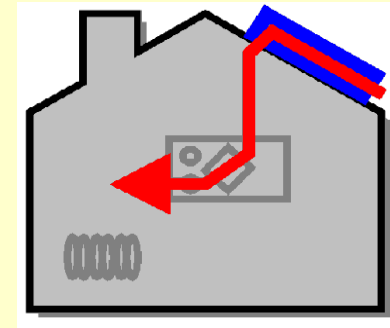
temperature rise air volume flow: 1000 m³/h



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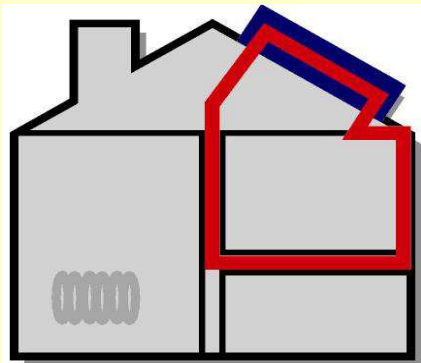


solar powered heating and ventilation
with a simple ventilation system

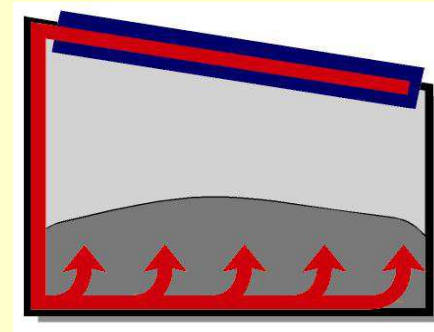


solar powered heating and ventilation
combined with (heat-recovery)
ventilation systems

solar air systems examples



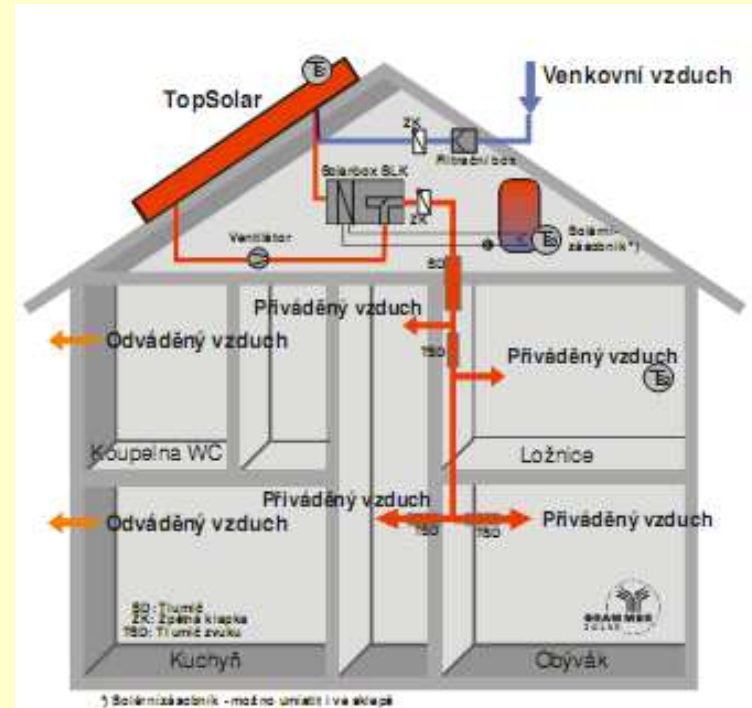
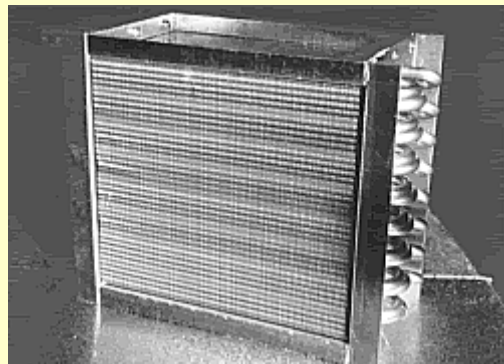
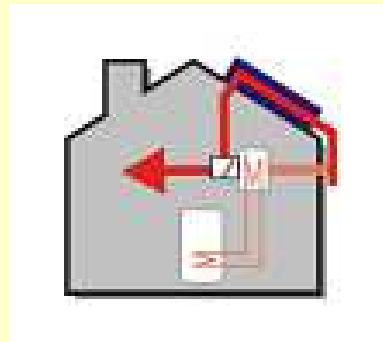
solar hypocaustum/murocaustum system



solar drying systems

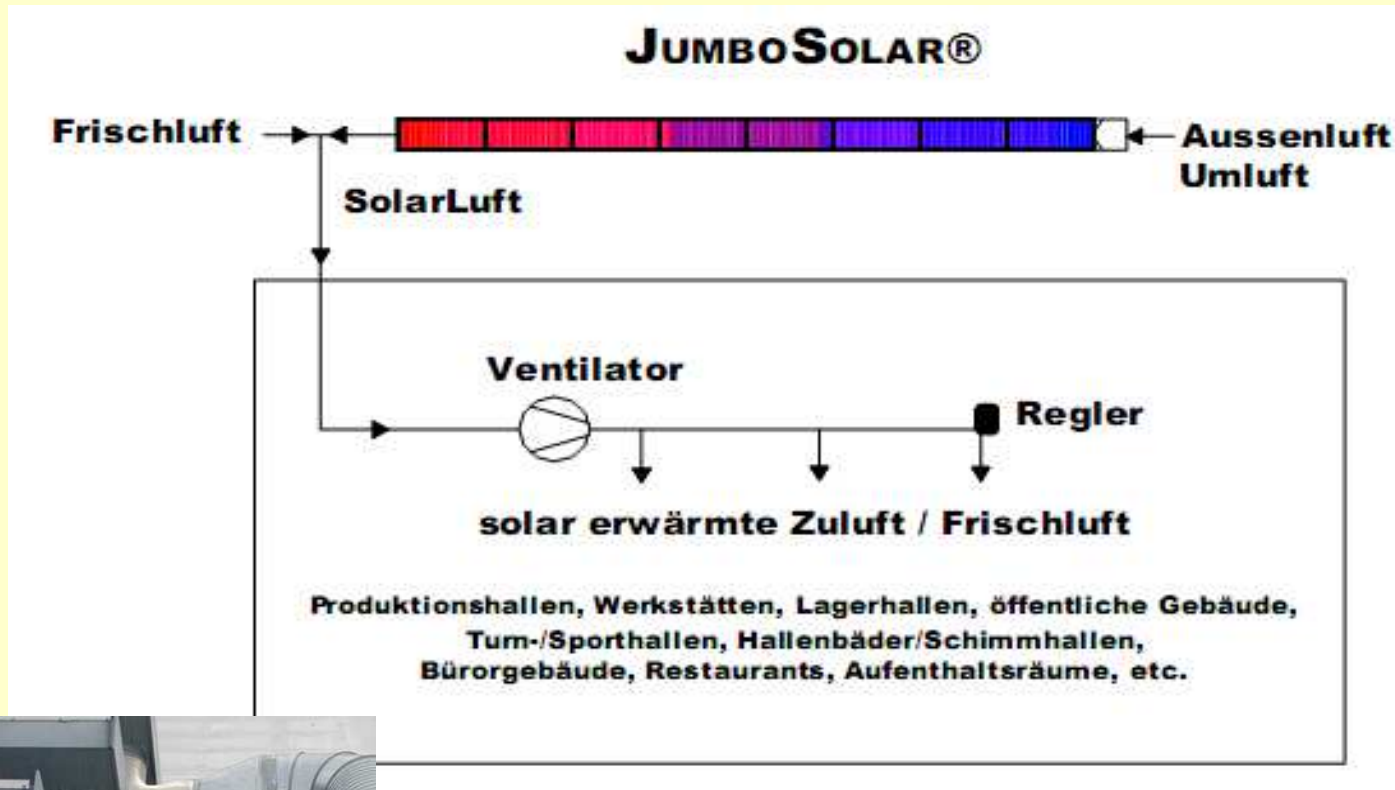
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solar powered heating, ventilation and preparing of warm water



SolarBox: air /water exchange

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installation possibilities



< flat roof

inclined roof >



< outside

facade >



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Solar air systems JumboSolar

Application Examples

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**GRAMMER SOLAR GmbH based in:
Amberg, Bavaria/Oberpfalz, Germany**
35 employees of it 10 engineers



- 250 m² solar-air collector
- 25 m² vacuum-tube collector
- 12 + 42 kWp photovoltaic
- murocaustum system
- heat recovery ventilation system
- 8 kWel/16 kWth biofuel CHP unit



GRAMMER Solar GmbH = zero-emission factory

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Renovation prefabricated apartment block- Potsdam, Germany – 2000



Senior Citizens` Center Dietmannsried, Germany - 2002



solar-air-collector area: 150 m²
thermal nominal output: 100 kW_{peak}
air-volume-flow: 6.000 m³/h
heating solar coverage: ca. 35%

solar-air-collector area: 155 m²
thermal nominal output: 104 kW_{peak}
air-volume-flow: 6.400 m³/h

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Sports hall - Bad Grönenbach, Germany



solar-air-collector area: 190 m²
thermal nominal output: 114 kW_{peak}
air-volume-flow: 11.400 m³/h
heating solar coverage: 38%
natural gas savings: 17.000 m³/a

Market hall - Fürth, Germany - 2004



solar-air-collector area: 100 m²
thermal nominal output: 67 kW_{peak}
air-volume-flow: 9.200 m³/h

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Process heating: active solar drying of biomass

- protection of the primary energy resources (oil and gas)
- short implementation time, easy to install
- minimal operating and maintenance costs: low energy costs

the product is protected against:

- insect attack
- dust and dirt
- rain

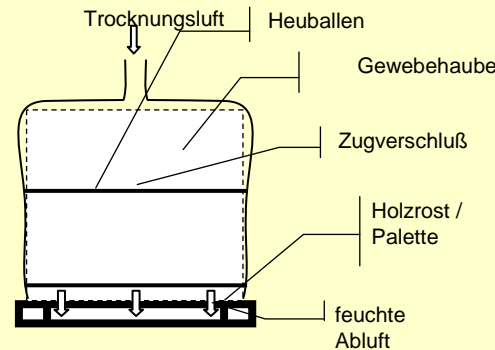
high quality of the product in terms of:

- nutrients
- hygiene
- colour
- flavour

use of solar radiation as a free, renewable and unlimited available energy source

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solar assisted drying of hay - SALSOMAGGIORE, Italy - 2006



solar-air-collector area: 40 m²
thermal nominal output: 26.8 kW_{peak}
air-volume-flow: 1,400 - 4,600 m³/h

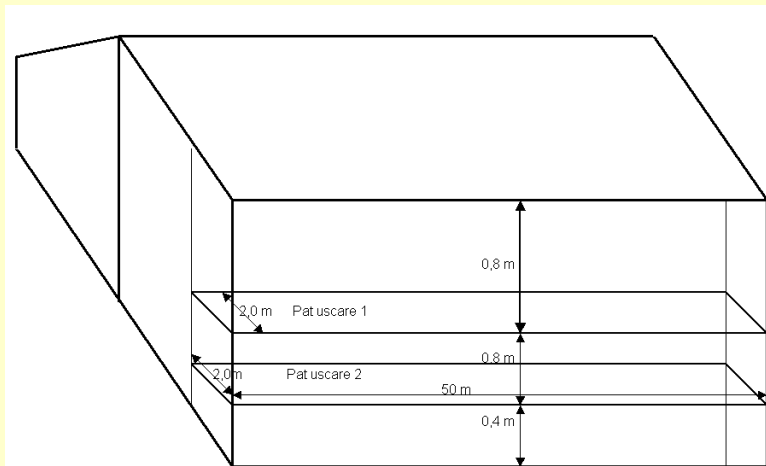
In summer, which is the hay-drying time, it can be dried by using only solar energy. This way, 100% of the necessary heating energy is saved.



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solar drying of herbs and vegetables Bucharest, Romania – 2006



HOFIGAL SA – Bucharest

chamber dryer

area

750 m²

volume

2.100 m³

Dryer capacity

ca. 5.000 kg fresh herbs (moisture until 90%)

Drying temperature

35 - 40°C

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solar drying of herbs and vegetables – Bucharest, Romania



solar-air-collector area: 60 m²
thermal nominal output: 40,2kWpeak
air-volume-flow: 6x 540 m³/h
energy profit ca. 37 MWh/a
drying-time ca. 6 months/a

local solar radiation: ca. 1.400 kWh/m² /a



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solar drying of herbs and vegetables – Bucharest, Romania



drying goods: basil (Basilikum) , balm (Melisse), elderberry (Holunder), camomile (Kamille), rosmary (Rosmarin), hardhay (Johanniskraut), achillea (Scharfgarbe) echinacea (Sonnenhüte) artischock (Artischoke)) etc.

drying time: 2 till 4 days, dependent from the product

the use of drying chamber : all the year (drying, preservation, storehaus)

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solar drying of herbs and vegetables Furculesti , Romania - 2012



solar-air-collector area:
thermal nominal output:
air-volume-flow:
local solar radiation:

120 m² (6 x 20 m²)
81 kWpeak
max. 7.200 m³/h
1.370 kWh/m² /a

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solar drying of herbs and vegetables Furculesti, Romania - 2012



Mulberry leaves – Maulbeerebaum Blätter



chicory – Gemeine Wegwarte



amaranth - Amarant



artichoke - Artischoke

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active solar drying – Freising -Germany, 2010



solar-collector area: 300 m²

thermal nominal output: 200kW

air-volum-flow: 24.000 m³/h

local solar radiation: 1.150 kWh/m² /a

process heat savings: ca. 30% (ca. 30.000 Euro/a) - CO₂ –savings: ca. 60 ton/a

drying goods: cereals (Getreide)

maize (Mais) , rap (Raps)

grass (Gräser)

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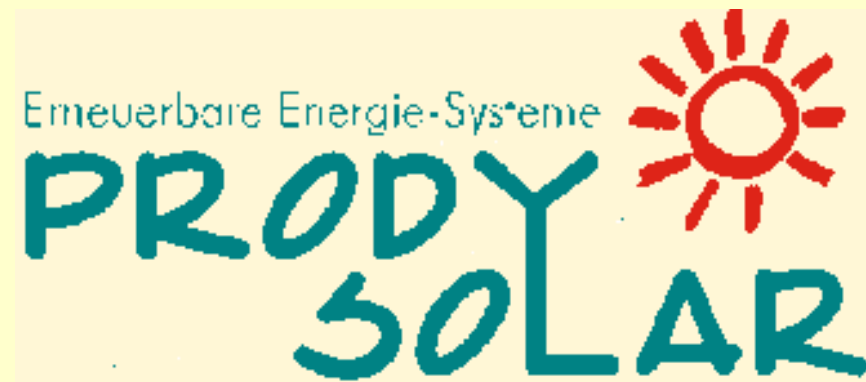
Process heating: Poultry Farming – Zargosa, Spain - 2008



Building volume: 1.700 m³
Operating temperature: 32°C
colector surface: 22,5 m²
nominal output: 15 kW_{peak}
air-volume-flow: 1.200 m³/h
local solar radiation: 1.579 kWh/m²/a

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always on the sunny side !