Alternative Energy Systems

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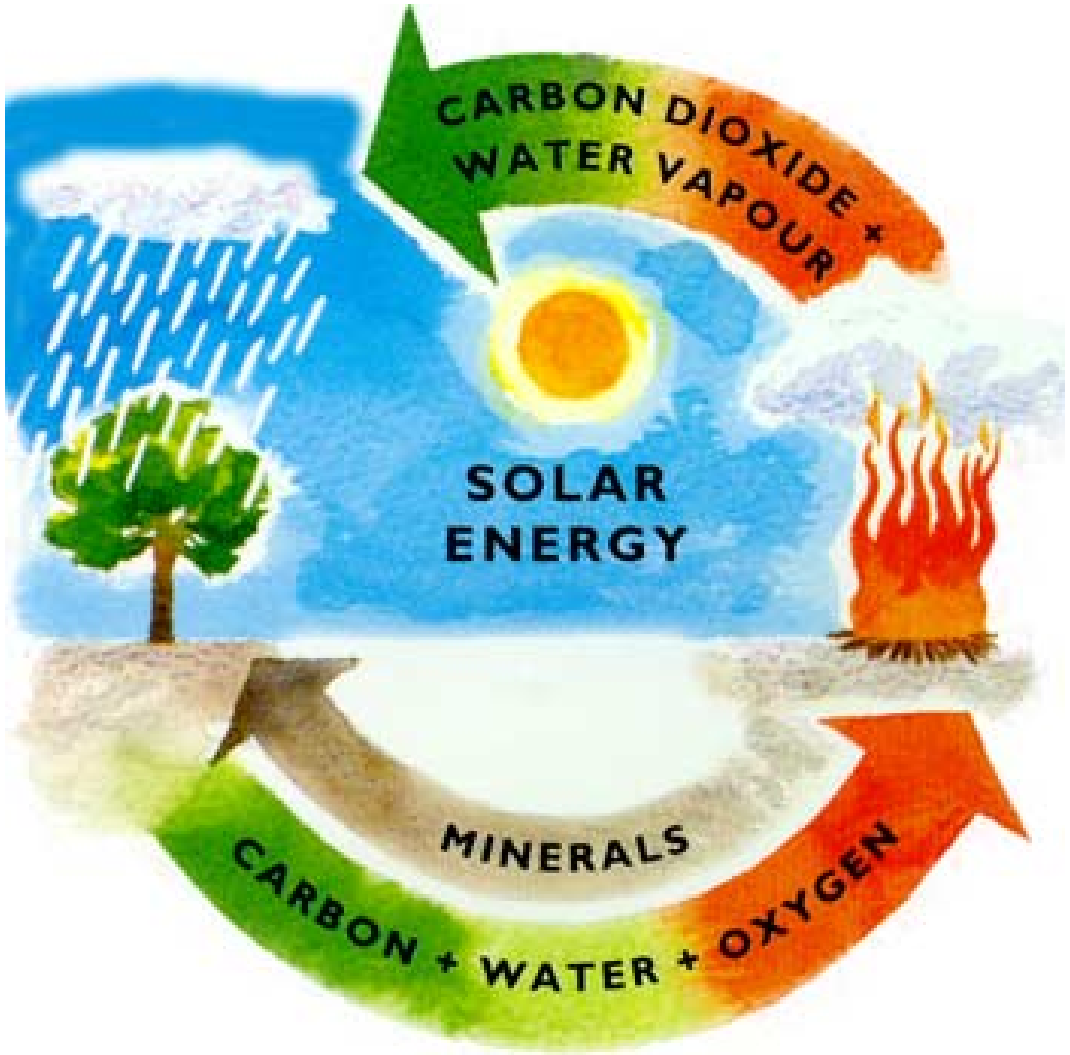
- Biomass
- Thermal panels
- Photovoltaic technology

Biomass energy

Definition

Biomass is all plant and animal matter on the Earth's surface. Harvesting biomass such as crops, trees or dung and using it to generate energy such as heat, electricity or motion, is bioenergy.

Biomass



Source: www.bioenergy.org

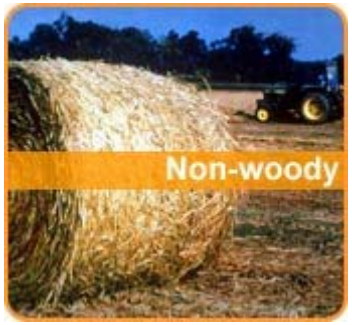
Biomass

In many ways biomass can be considered as a form of stored solar energy. The energy of the sun is 'captured' through the process of photosynthesis in growing plants.'

Biomass Types and Sources:

Woody

Non woody



Other Organic Waste

Woody

Forest residues,
examples include: thinnings, prunings or any other leftover plant material after cutting.

Fuelwood,
examples include: logs or any other form to be used in small stoves.

Wood waste,
from wood-processing industry, examples include: bark, sawdust, shaving, offcuts, black liquor, etc.

Short rotation forestry,
examples include: willow (Salix) or eucalyptus.

Woodlands/Urban biomass,
examples include tree trimmings and gardening waste, both domestic and municipal, as well as the green and woody portion of municipal solid waste.

Non-woody

Agricultural crops,
examples include various annual and perennial crops like Miscanthus, Swithgrass, but also many traditional agricultural crops like maize, rapeseed, sunflowers, both for direct utilization or liquid biofuels production.

Crop residues,
examples include: rice or coconuts husks, maize cobs, cereal straw.

Processing residues,
examples include: bagasse from sugar cane processing, olive marc from olive oil extraction, etc.

Other organic waste

Animal waste,
includes manure from pigs, chickens and cattle (in feed lots) because these animals are reared in confined areas.

Sewage sludge,
domestic and municipal sewage from mainly human waste.

Woody Biomass

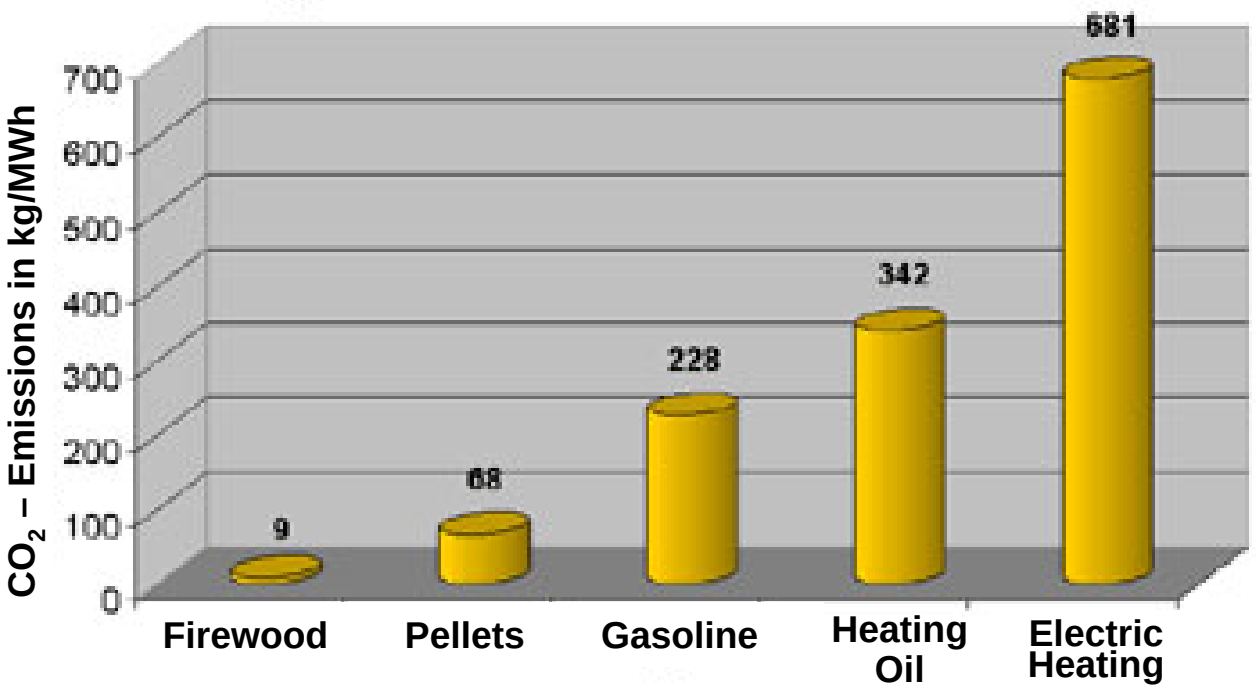
Woody

firewood

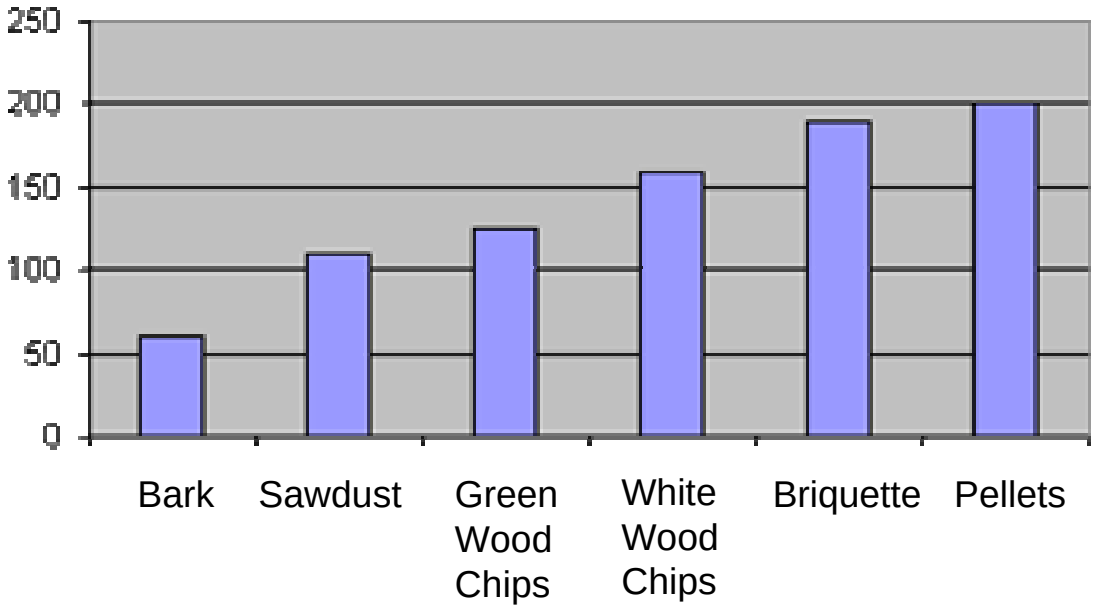
wood chips

pellets

CO_2 – Emissions



Costs pro GJ


250
200
150
100
50
0
Bark
Sawdust
Green Wood Chips
White Wood Chips
Briquette
Pellets

Heating Technologies

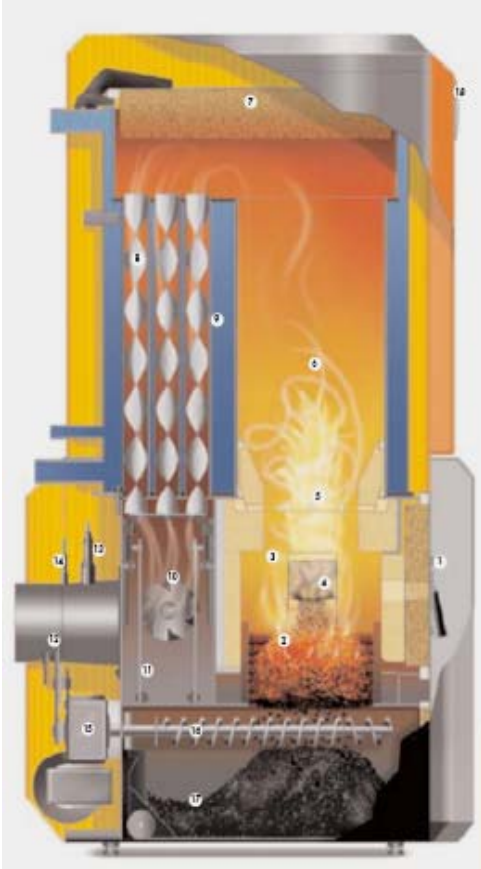
- **Steps of Wood Combustion**
  - drying and warming
  - degassing and thermic decomposition
  - gas combustion
  - solid combustion
- **Requirements for good Wood Combustion**
  - Time
  - Temperature
  - Turbulence

Firewood kettle

Source: Guntamatic. (Internet, 09.11.2006)

- **Technical Data**
  - 520 kg/rm storage density
  - 4,1 kWh/kg heating value
  - 1.700 kWh/rm energy density
- Firewood kettle always combined with buffer storage
- Costs for one unit with 30kW and 1.400l buffer storage ca. EUR 10.000,- to 12.000,- without vat.

Woodchips Kettle

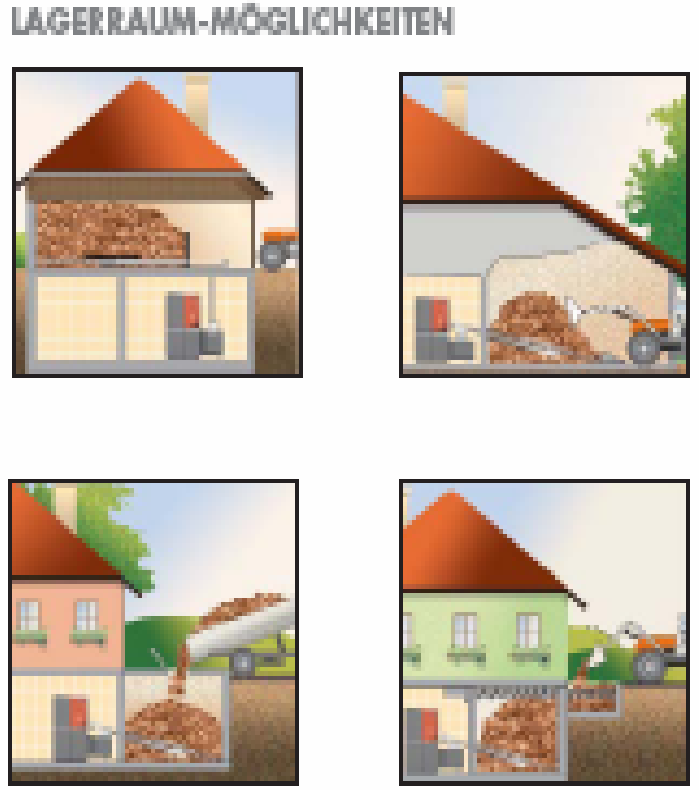


Source: Guntamatic. (Internet, 09.11.2006)

- **Technical Data of Woodchips**
  - 200 kg/srm bulk density
  - 3,8 kWh/kg heating value (at 25% humidity ratio)
  - 760 kWh/srm energy density
- Woodchips transported via worm gear but exceptional also via pumps and blowers.
- Costs for one unit with 30kW and 1.400l buffer storage ca. EUR 15.000,- to 17.000,- without vat.

Woodchips Kettle

Source: Guntamatic. (Internet, 09.11.2006)



Source: Guntamatic. (Internet, 09.11.2006)

Pellets

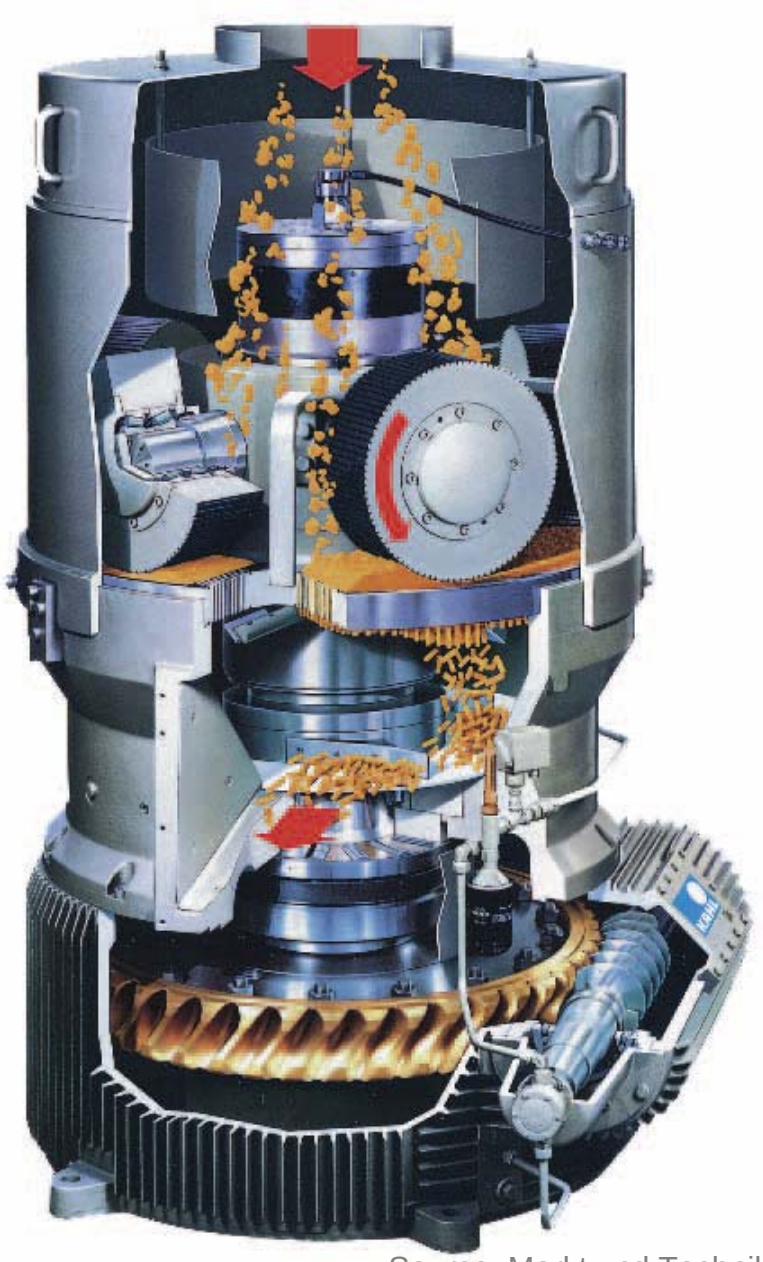
Pellet fuel is a renewable, clean-burning and cost stable home heating alternative. It is a biomass product made of renewable substances – generally recycled wood waste.

Pellet fuel for heating can also be found in such large-scale environments as schools and prisons.

In short, pellet fuel is a way to divert millions of tons of waste from landfills and turn it into energy.

Source: www.pelletheat.org

Pellets



Source: Markt und Technik 01-04

Pellet Kettle

Technical Data

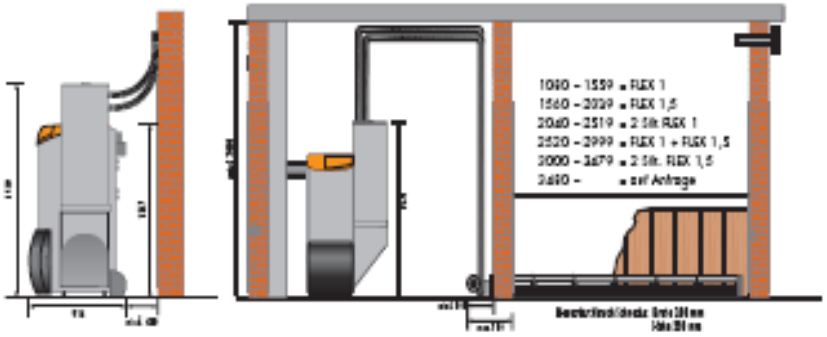
- 650 kg/srm bulk density
- 5,0 kWh/kg heating value (at 35% humidity ratio)
  - 3.250 kWh/srm energy density

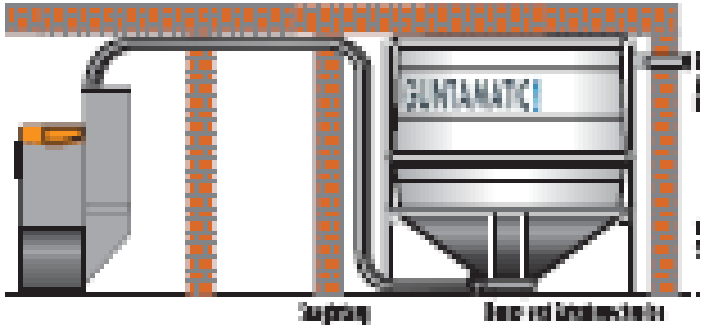
- Pellets transported via worm gear anpumps and blowers.

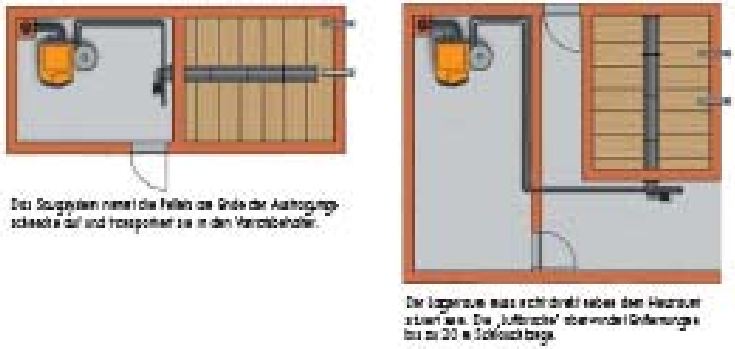
- Costs for one unit with 30kW and instalation ca. EUR 13.000,- to 15.000,- without vat.

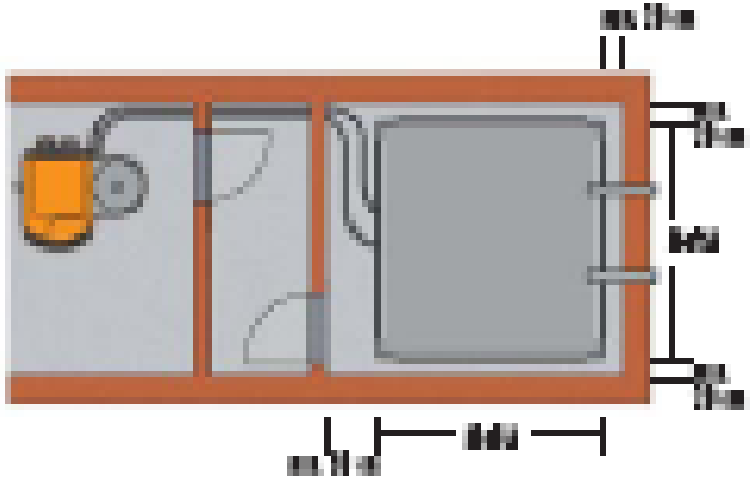
Source: Guntamatic. (Internet, 09.11.2006)

Pellet Kettle









Source: Guntamatic. (Internet, 09.11.2006)

Source : Guntamatic. (Internet, 09.11.2006)

Biomass

Biomass fuel comes from a renewable, sustainable resource base.

Fossil fuels will eventually run out, but with proper forestry practices, the biomass resource base can be sustained indefi nitely.

Biomass fuel euros stay in the local and state economy.

Biomass comes from in-state businesses that use local labor for cutting, hauling, chipping, and delivering fuel. The raw material - growing trees – is purchased from local landowners. Increasing the use of biomass helps the local tax base and builds tax revenues.

Biomass fuels can be expected to increase in price more slowly than competing fuels.

Over the last 15-20 years biomass prices have stayed level or decreased, regardless of the dramatic fluctuations in the prices of oil and gas.

Biomass systems are often capable of giving higher levels of comfort at a lower energy cost.

Because biomass fuels are very inexpensive.

Using wood wastes from sustainable forestry as fuel increases the health of the forest resource.

Thermal panels

The principle of solar thermal captors :

- A plain surface, the captor itself, to recover solar heat;

- A circulation system to carry that heat to a storage place or to its end use;

- A system of control, to maintain the desired temperature.

Captors are of 3 types, according to the temperature required:

•**Non-vitreous captors:** they are long black tubes (the colour which best absorbs heat) made of plastic or metal, in which water circulates. They are not insulated, which means that the temperature increase obtained is low: +20°C compared to the temperature of the air. These captors are very suitable for heating swimming pools.

•**Plain captors:** they consist of an insulated box with a glass or plastic window fixed on top. Inside, a black metallic sheet absorbs the heat of the sun, which is retained in the box. This heat is transmitted to air, water, or another thermal carrying fluid that does not freeze in winter. The thermal carrying fluid circulates freely, or in pipes, to the point where the heat is used. The temperature increase compared with the ambient air temperature can reach +70°C. It is ideal for producing household hot water or for heating all types of buildings.

•**Vacuum captors**: they take the form of a panel on which a series of transparent glass tubes are aligned. Inside these tubes, there is a vacuum, which is one of the best thermal insulations that exist. In each tube, an absorber captures the solar heat that is transmitted to a thermal carrying fluid by means of a heat exchanger system. In the same way as for the other types of captor, the thermal carrying fluid then circulates to the point where the heat is used. In this system, heat losses are very low. The temperature can rise to 100/140°C. Such captors are suitable for industrial applications where high temperatures are required. The circulation system is driven by a circulation pump or a thermo-siphon. The latter device depends for its operation on the fact that hot water is lighter than cold. In a circuit of vertical pipes, the hot water rises by itself and the cold water goes downwards. A thermo-siphon can only work if the point where the hot water is used is located above the captor. A system of temperature probes and a thermostat controls the starting and stopping of the circulation pump.

Collector Types

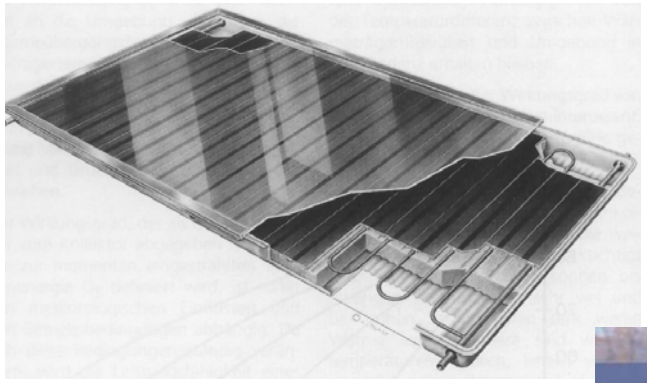
Swimming pool absorber

Non-vitreous captors, EPDM (Ethylen-Propylen-Dien-Monomer)

Flat-plate collector

Plain captors

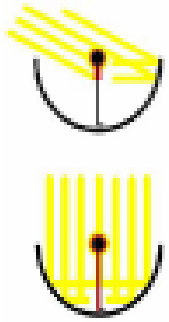
– inclination min. 20°
lifespan ca. 25 years



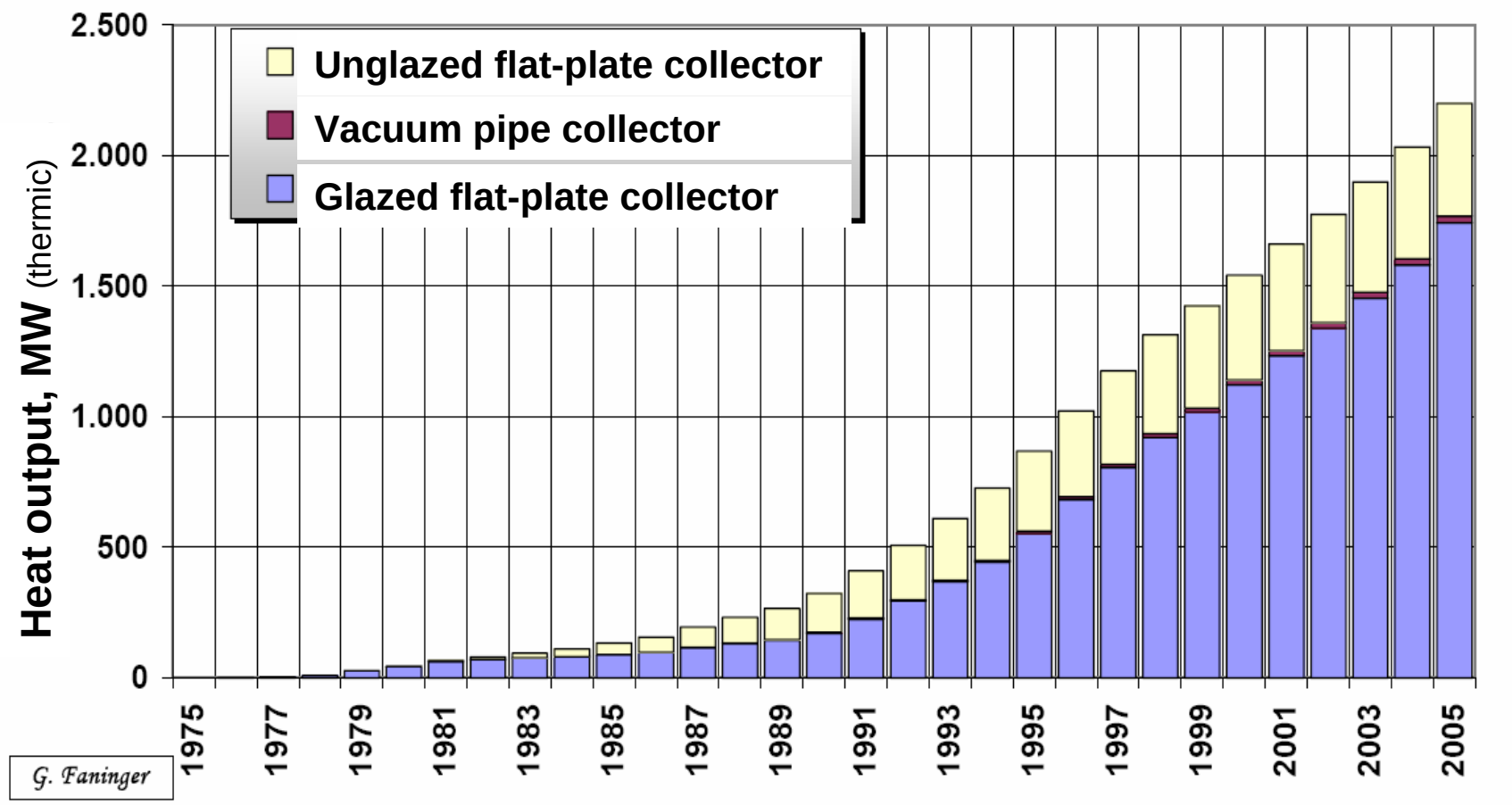
Vacuum pipe collector

- costs: 2x flat-plate
- inclination min. 25°
- lifespan? „aging“?

Focusing Collectors



Heat output



Faninger, 2006

Building Integration

On the Roof

(+) Orientation, Accessibility

(-) Assembly, Costs, Wind-resistance

In the Roof (Integrated)

(+) Assembly time, Optics, Costs, U-Value

(-) Accessibility, Tightness

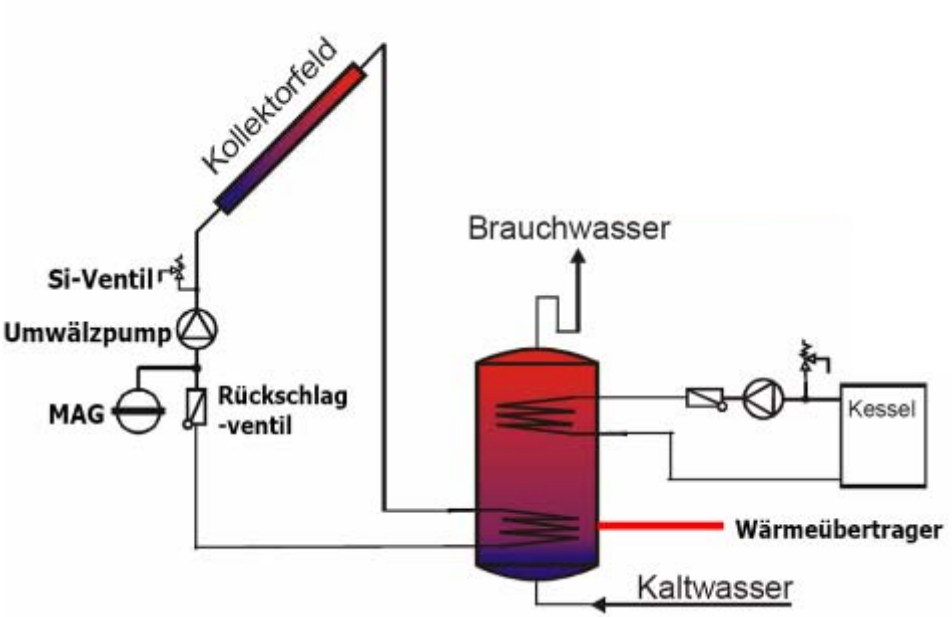
Facade Integration

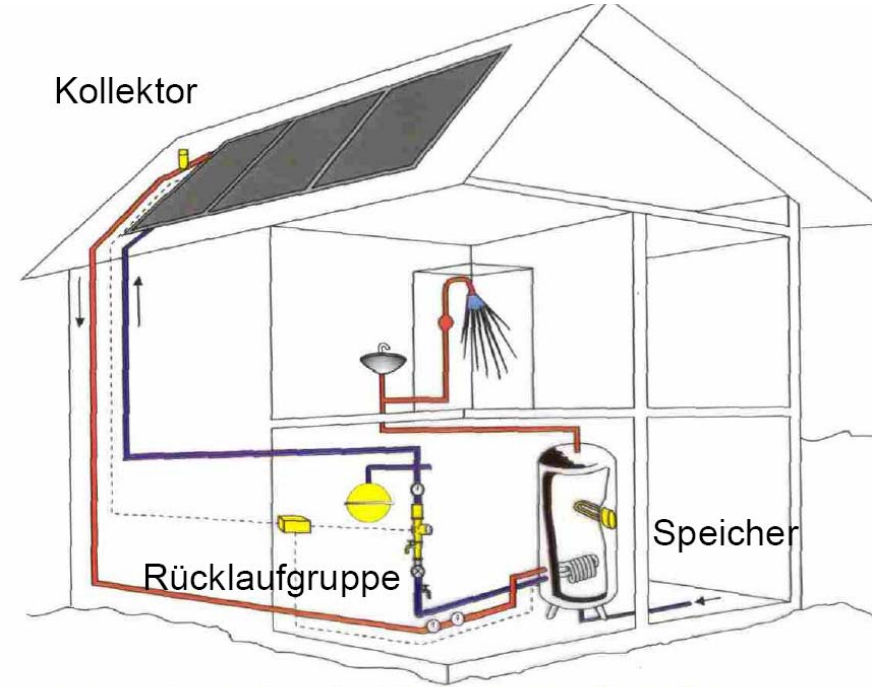
(+) Assembly time, Costs, U-Value, No Stagnation

(-) Shading, Accessibility, Earnings

Klima:aktiv, solarwärmeberater, 2005

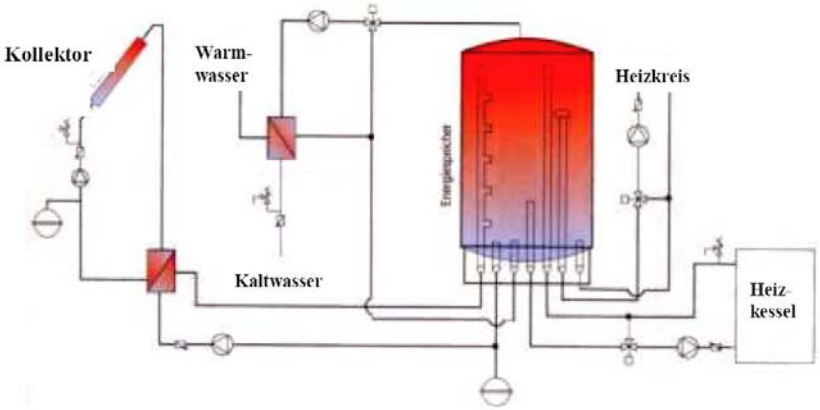
Warm Water Preparation



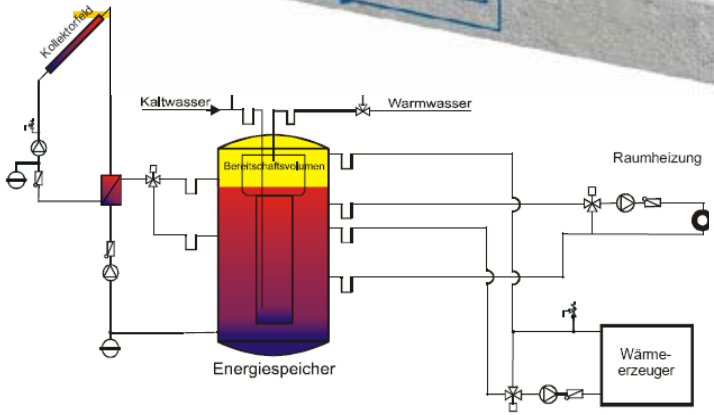


Klima:aktiv, solarwärmeberater, 2005

Heating



2-Speicher-Konzept: Boiler + Schichtladespeicher



Kombispeicher-Konzept

Klima:aktiv, solarwärmeberater, 2005

Thank you for your attention

Source: www.thesietch.org/projects/solarthermalpanel2/index.htm