Solar Concepts and monitoring results of buildings with high solar thermal fraction in Austria

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Content

Boundary conditions to reach high solar thermal fractions
- heat demand
- suitable areas
- storage capacity

system concepts for high solar thermal fractions

Monitoring results

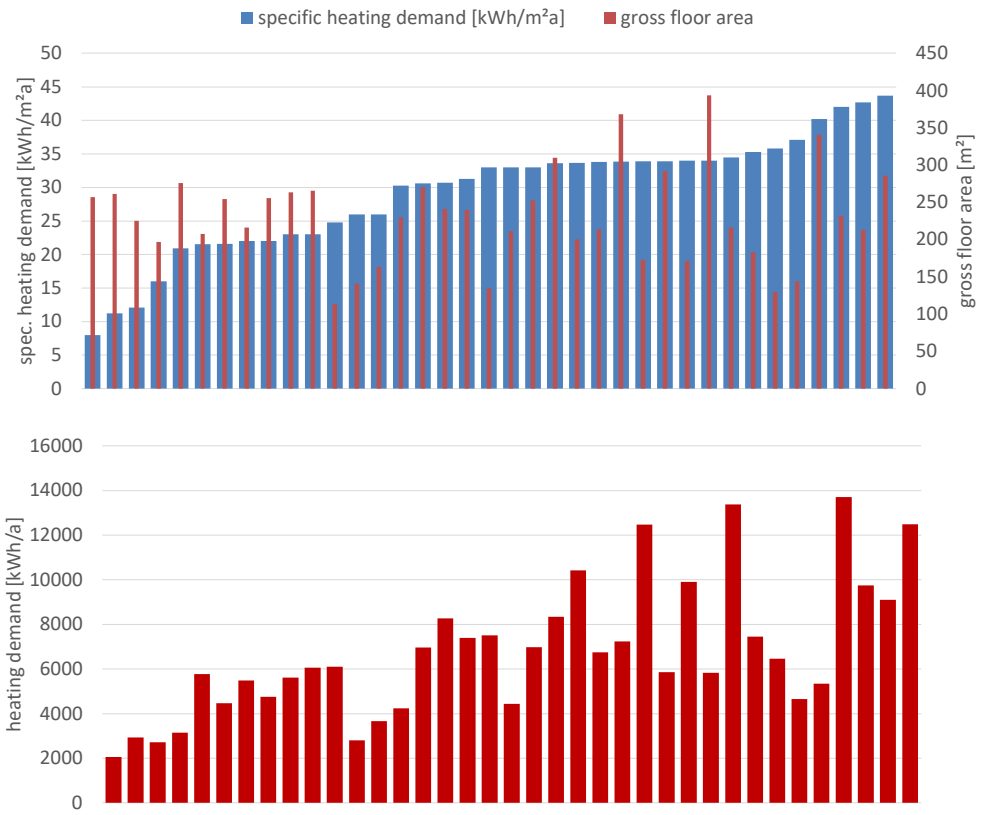
Conclusion

Boundary conditions – heat demand

Optimisation before realisation!

Requirements for subsidy program:
Spec. Heating demand < 45 kWh/m²a

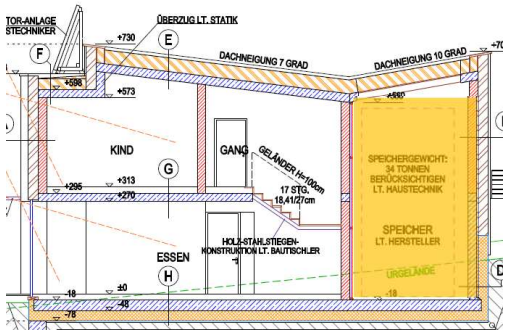
All buildings planned for at least 70% solar fraction of DHW and heating



Data basis: 37 single family houses with accompanying research

Boundary conditions – suitable solar active areas

Boundary conditions – storage capacity

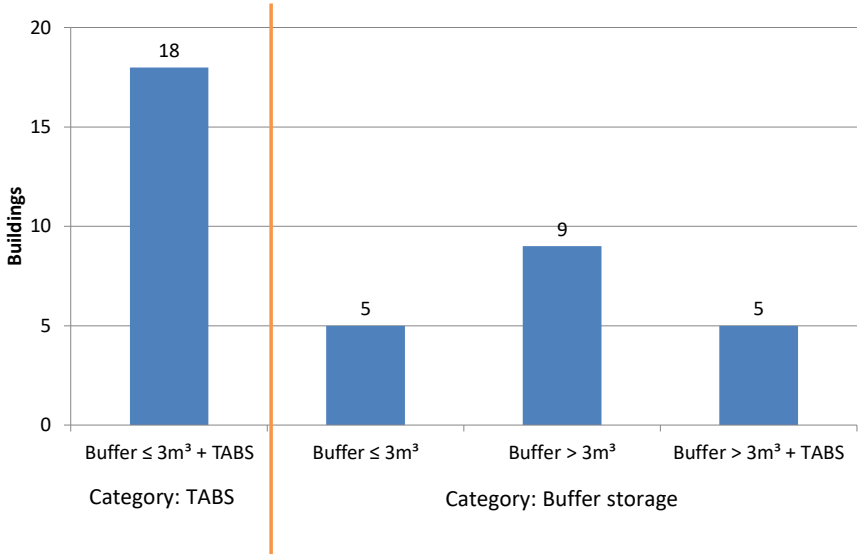


Source: building owner

Key component: thermal storage

readily available:

buffer storage (water) & TABS



Data basis: 37 single family houses with accompanying research

Two main system/storage concepts for buildings with high solar fraction

System concept „A“

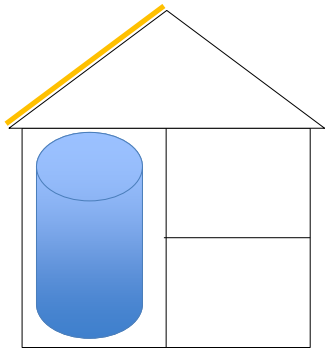
Traditional large water storages

- 57 plants
- 19 plants with accompanying research
- Water Storage Volume
  - 3 to 90 m³
  - specific: 60 to 2600l/m_{coll}^2

System concept „B“

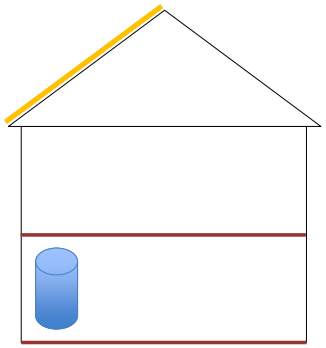
Thermal activation of building mass (ceilings, foundation)

- 48 plants
- 21 with accompanying research
- Storage Volume (specific: 60 to 510 l/m_{coll}^2)
  - -Water storage Volume
    0.8 to 2 m³
  - -Concrete Storage Volume
    20 to 148m³ (1.2 to 9 m³ water equ.)



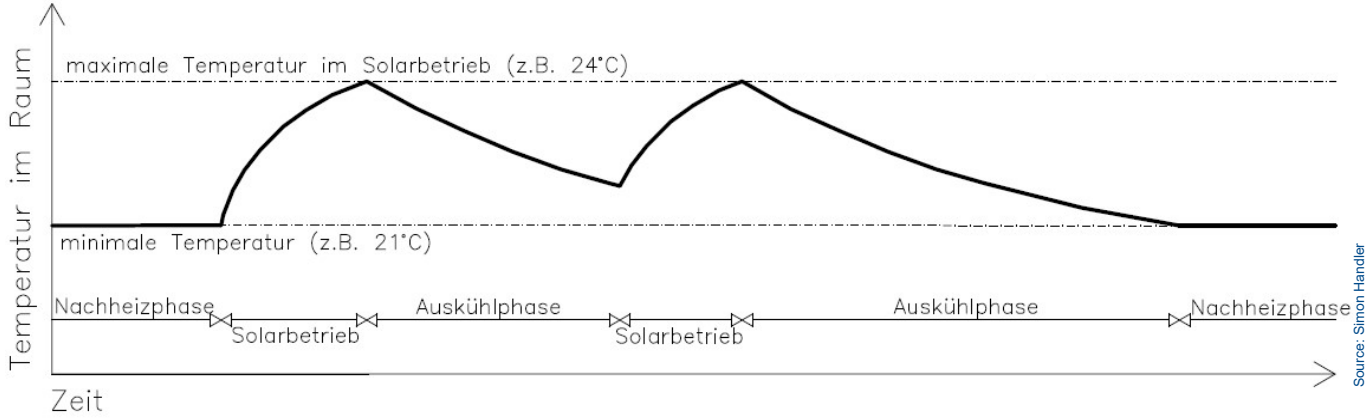
8 m³ water tank (95/30°C)

Reduced water tank volume by utilising thermal activation of building mass



120 m³ thermal activation of building mass (27/20°C), 1m³ water tank (95/30°C)

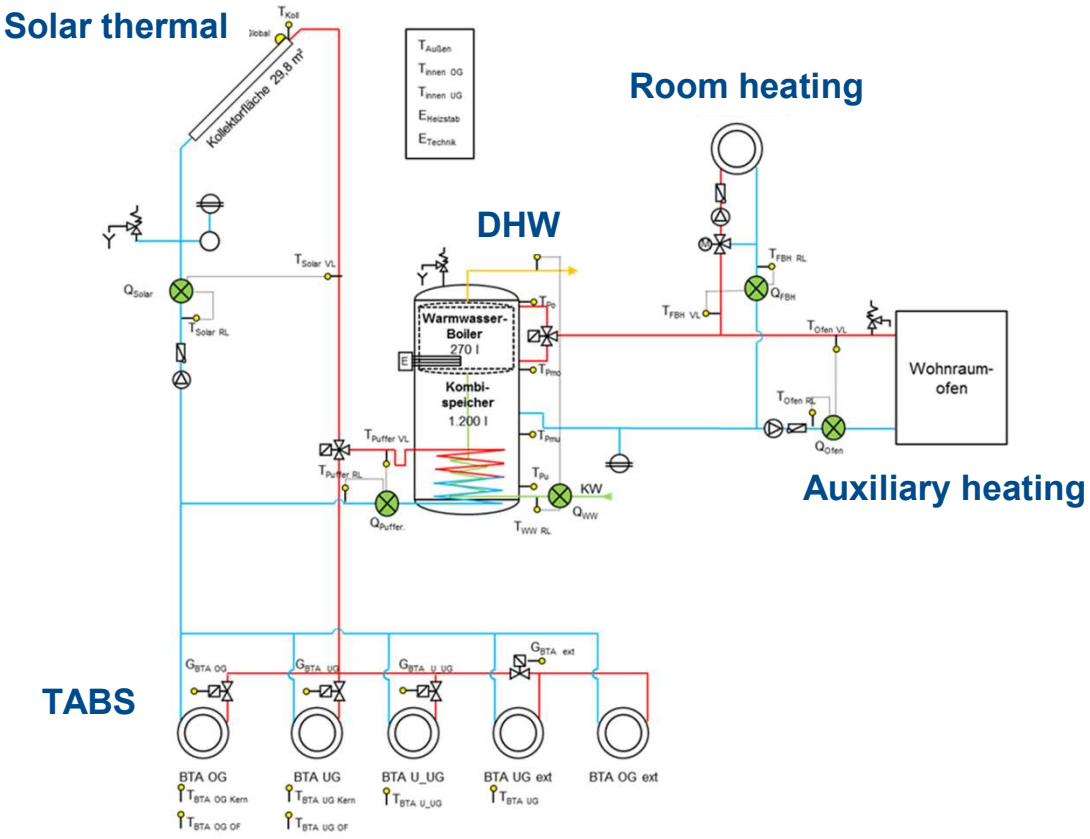
Principle of using building mass as storage



Advantages of TAB´s:

- Consequent reduction of the water storage volume
- Cost reduction (storage, enclosed space)
- Increased solar yields due to low temperatures (<40°C)
- Reduction of storage losses
- Use as heat delivery system
- Load management between building mass and auxiliary heating system reduces peak load
- Solar coverage ratios of between 50 and 90%.

System concepts to achieve high solar fraction
Thermal activated building masses



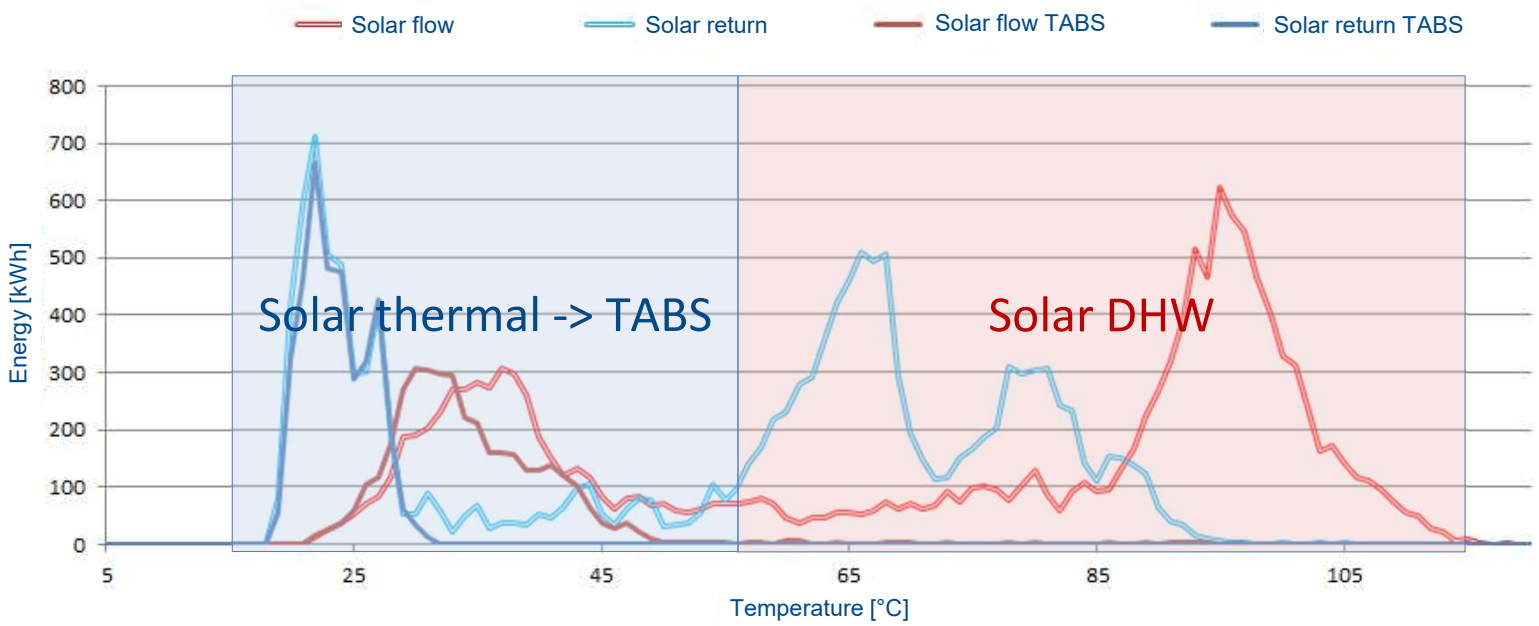
Single family house
84% solar fraction

Source: AEE INTEC

Direct connection with solar circuit
➔ No extra heat exchanger
➔ (very) low usable solar temperatures

At the expense of
– no auxiliary heating of the TABS
– Copper tubes recommended

Monitoring results operation temperatures



System concepts to achieve high solar fraction
Thermal activated building masses

Indirect connection with solar circuit
- ➔ System integration similar to floor heating
- ➔ Plastic tubes possible
- ➔ Heating and cooling

At the expense of
- Lower solar yield due to higher temperature differences (heat exchanger)

Event hall
97% solar thermal fraction, PV plant

Source: www.hallwang.salzburg.at

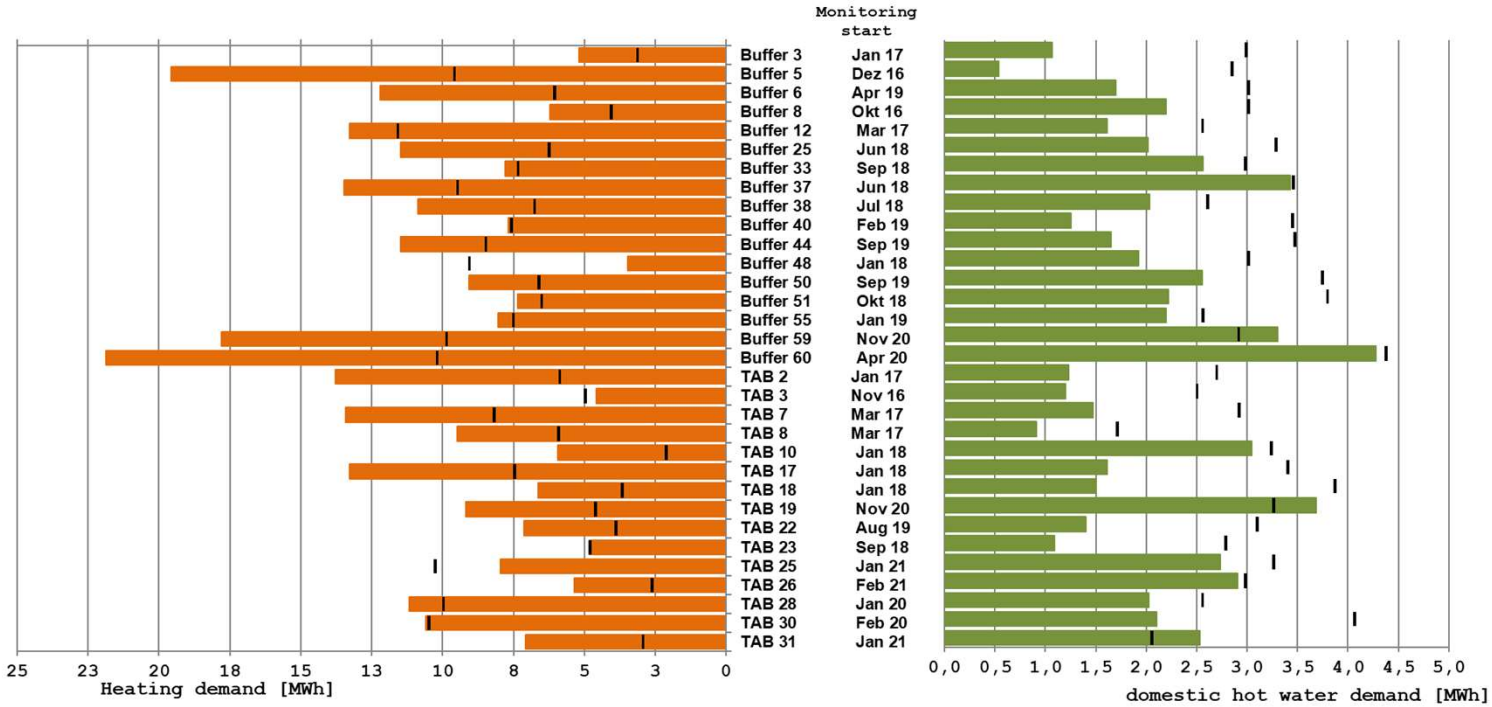
Source: AEE INTEC

Carpentry
79% solar thermal fraction, 50 kWp PV

Source: AEE INTEC

Sports hall
55% solar thermal fraction
100 kWp

Monitoring results – single family houses heat demand



DHW demand **below** expected value in 90% of cases
(Average DHW demand **-32%)**

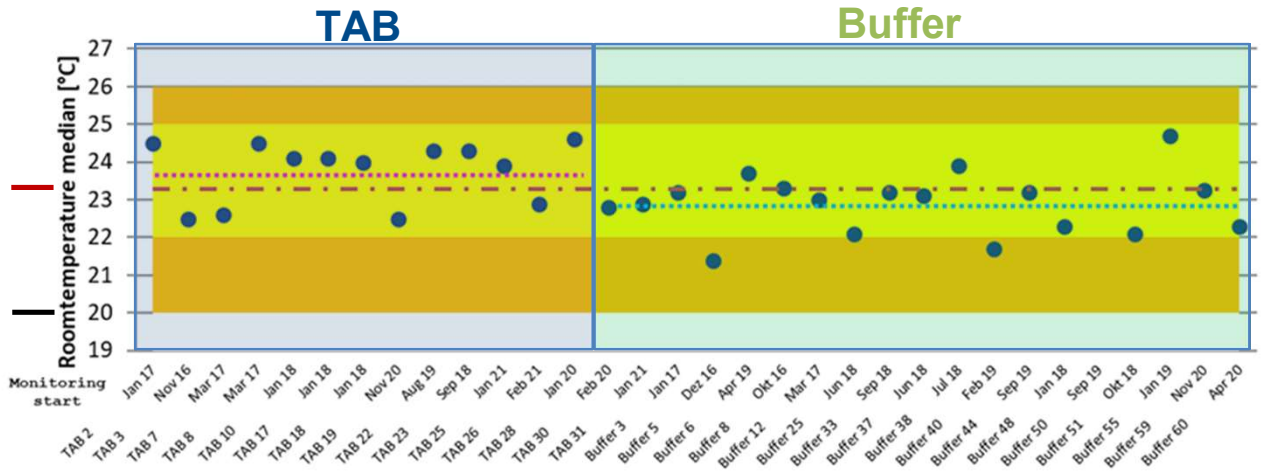
While at the same time heating demand **above** expected value

Monitoring results
Room temperatures

Single family houses

Average measured
room temperatures **23,3°C**

Simulation Temperature **20°C**



Conclusion

- A variety of hydraulic concepts are possible to achieve solar thermal fractions above 80%
- Big buffer storages are a known and reliable technology (disadvantage: space requirement)
- Through the use of TABS
  - the collector can be operated more efficiently
  - the buffer storage volume can be significantly reduced
  - Passive/free cooling becomes possible
- The storage capacity of TABS depends on the permitted temperature range
- The actual heat consumption is usually higher than the forecast
  increased consumption for space heating, reduced consumption for hot water
- Good understanding and knowledge of boundary conditions leads to successful projects

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