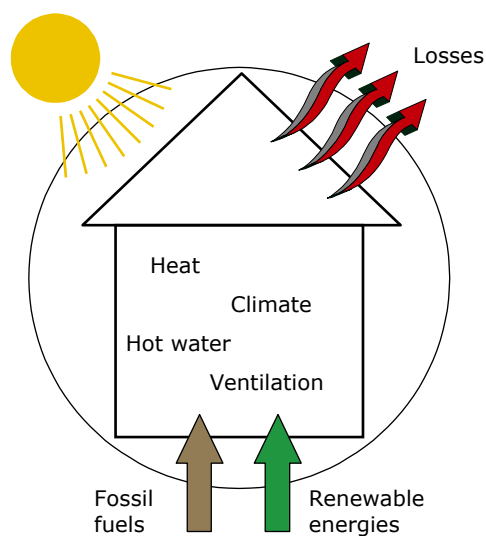


Identification of the basic conditions



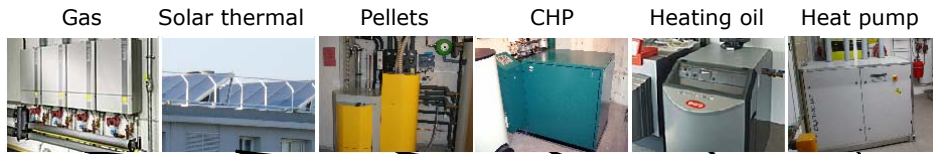
- Estimation/compilation of consumption data
- Are the consumption data confirmed by measurements?
- Have the losses been taken into consideration?
- Are the consumption profiles (year, week, day profile) known?
- Have vacation times been taken into consideration?
- Energy savings at the object (insulation, renovation, economic armatures,...)?
- Is it possible to minimise boiler and circulation losses?
- Is an exchange of the boiler or a refitting planned?
- Are changes in the user structure imminent (modification, enlargement,...)?
- What is the life cycle of the designated roofages?
- Are static expertises necessary?
- Is there enough space for the placement of storages and system technology?
- Is the insertion of storages through existing openings possible?
- Determine ceiling height, tilting degree
- Are shadowless spaces available?
- First clarification of the cable routing

Energetic overall concept



- Registration of the whole energy demand in the building
- Energetic examination of the building stock
- Examination of all energy supply devices
- Saving potentials of building equipment and systems
- User
- Consumption profile
- ...

Available technologies and possibilities of supply



Criterion	Evaluation	Gas (Reference)	Gas and Solar	Pellets and Solar	Gas and CHP	Pellets, Solar, CHP	Heating oil	Heat pump
Ecology	... %							
Investment	... %							
Operational costs	... %							
Maintenance	... %							

++ very good + good o satisfying - bad -- very bad

Photos: Klemast, Lauerer, Paradigms, target GmbH (2), Wibbing

Synergetic effects at renovation and boiler exchange



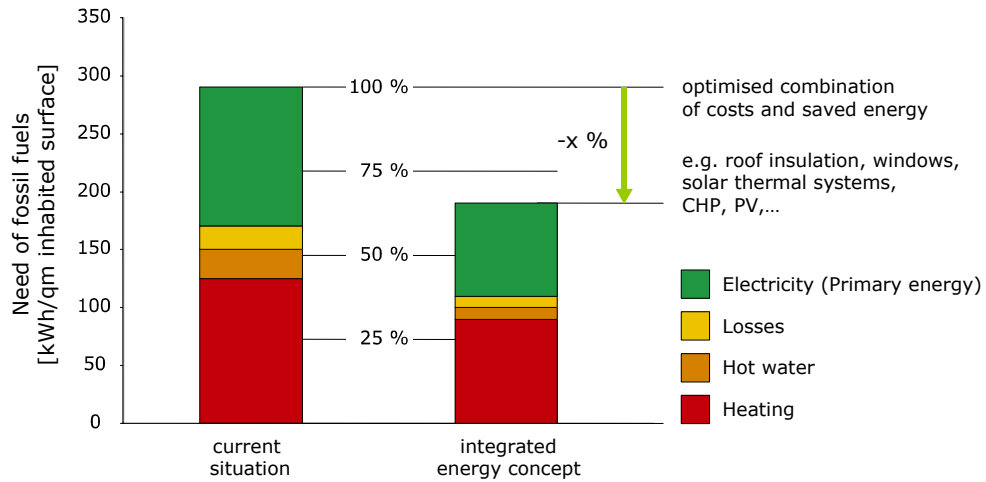
Are renovation works for the building pending?

- Renovation of the roofage
- Exchange / renovation of the boiler plant
- Renewal of the heat / hot water distribution network
- Change-over of the heating system to another energy source

In these cases synergy effects can be used:

- Economisation of the roofing
- Installation of fixing elements without harming the roof panel later on
- Use of the scaffolds and the elevators
- Entitlement to adequate support programmes
- Reduction of energy need and losses
- Application of shared control and measurement technique

Possible saving effects




Factors of success

Which factors are necessary for the evaluation of a solar system's success?

- always hot water
- high water temperature
- visibly installed collector surface
- minor losses
- fuel economy

- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____
- _____

Definition of the terms 

Efficiency

Utilisation level

Fraction

Fuel economy


Coefficient of performance

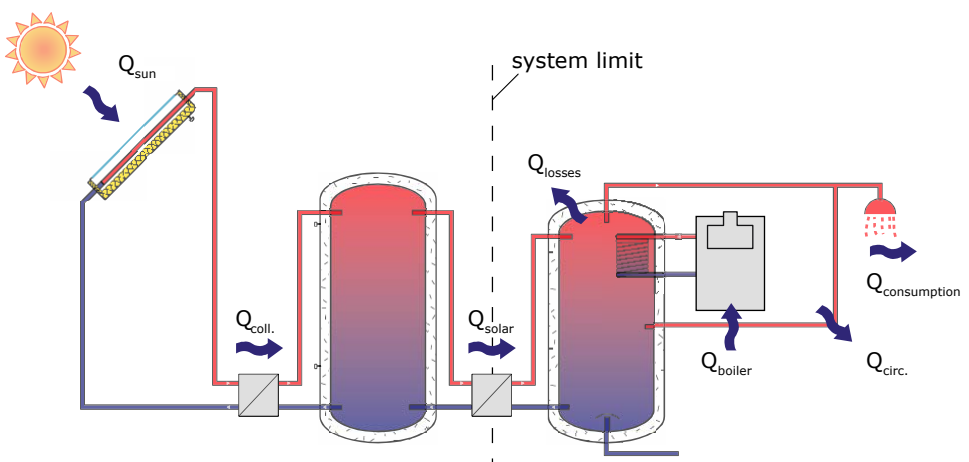
Capacity utilisation

}

consider connection!

© target GmbH III General aspects of the planning Source: M. Schnauss 9

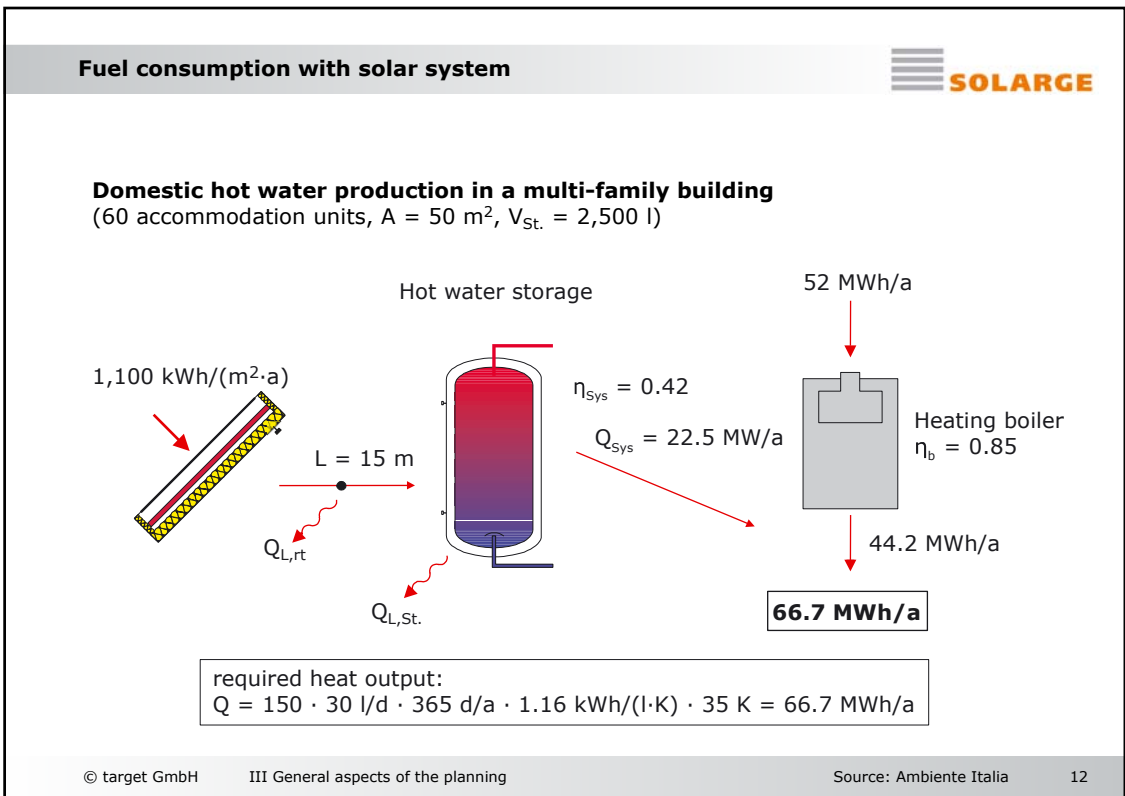
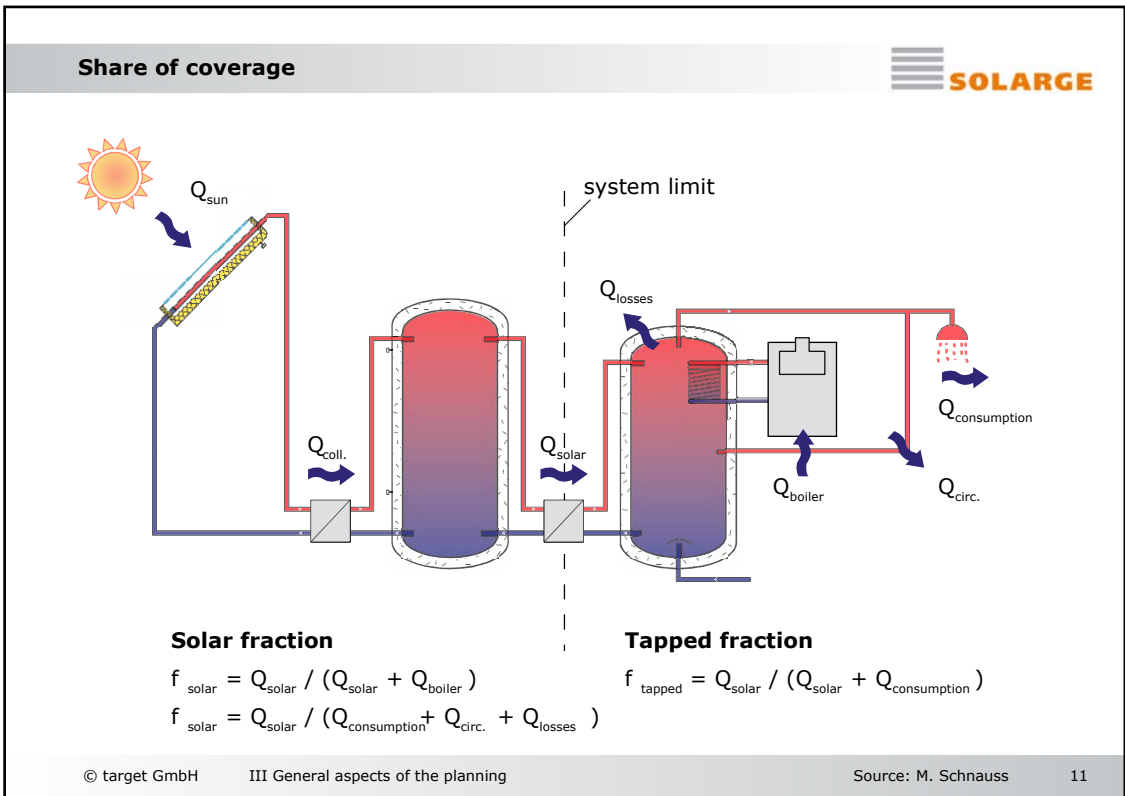
Utilisation level 



Utilisation level of collector loop
 $\eta_{coll.} = Q_{coll.} / Q_{sun}$

System's utilisation level
 $\eta_{sys.} = Q_{solar} / Q_{sun}$

© target GmbH III General aspects of the planning Source: M. Schnauss 10



Coefficient of performance (COP)



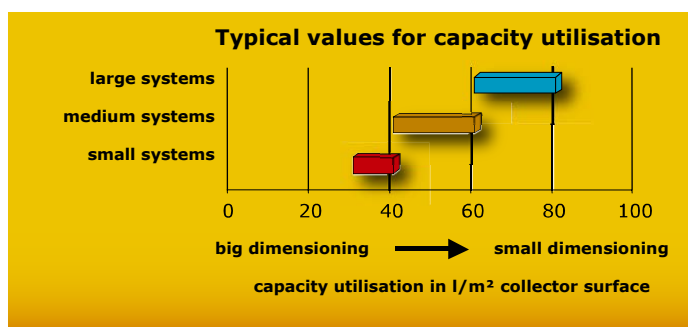
The **coefficient of performance (COP)** describes the ratio of the utility heat provided by the solar system to the electrical energy needed for pumps, control and actuator.



$$\text{COP} = \frac{\text{Solar system output}}{\text{Sum of auxiliary electrical energy}}$$

Foto: Stadtwerke Karlsruhe

Capacity utilisation

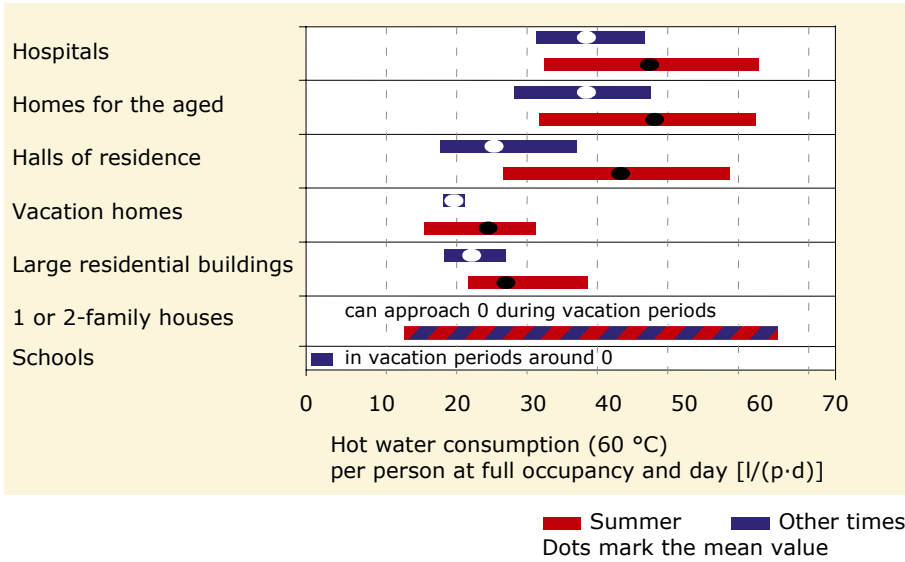


The **capacity utilisation** of a solar hot water system describes the ratio of the daily need of hot water to the collector surface:

$$\text{capacity utilisation} = \text{need of hot water} / \text{collector surface [l/(d·m}^2\text{)]}$$

- only useful for systems for pure domestic hot water heating
- it is important to indicate the temperature level (normally 60 °C)

Hot water consumption of different institutions



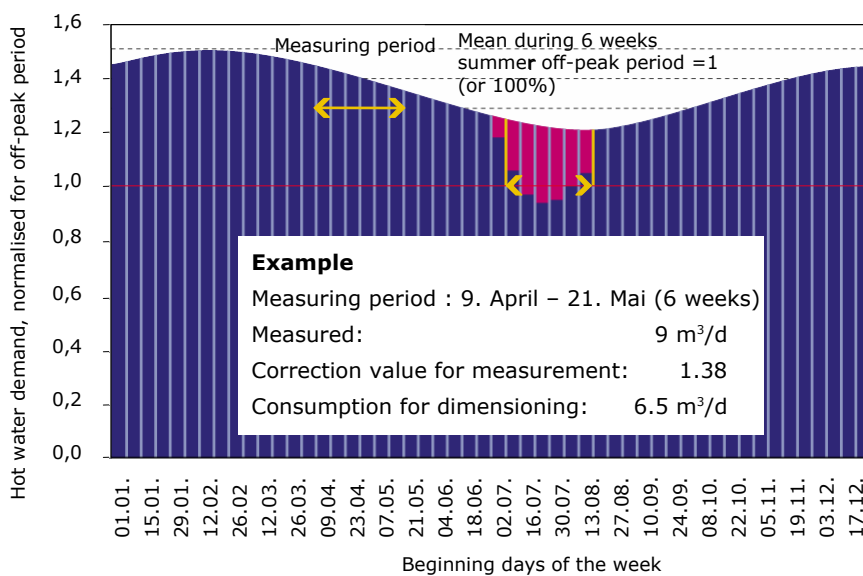
© target GmbH

III General aspects of the planning

Source: BINE/Solarpraxis

15

Normalisation of consumption for the off-peak period



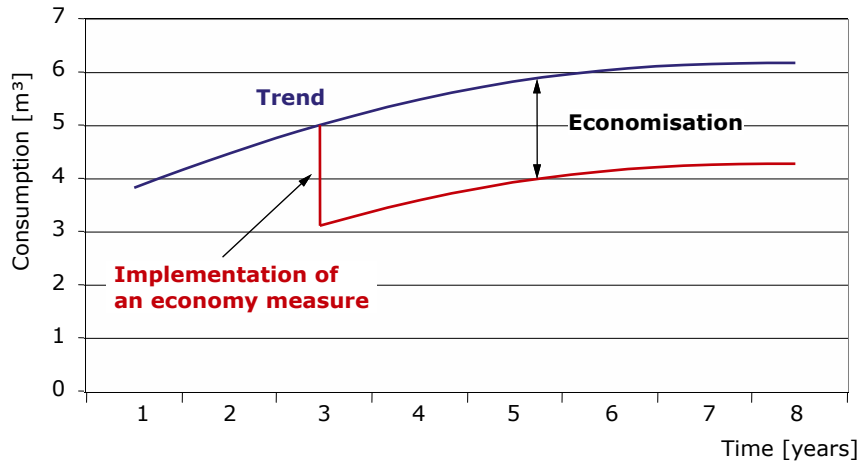
© target GmbH

III General aspects of the planning

Source: BINE/Solarpraxis

16

Development of the hot water demand in a building



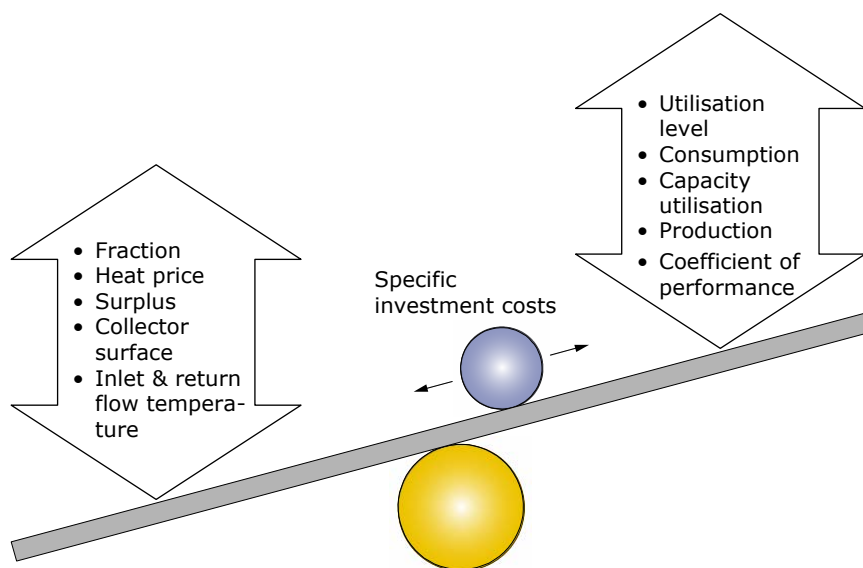
© target GmbH

III General aspects of the planning

Source: M. Schnauss

17

Connections: fraction, capacity utilisation, utilisation level



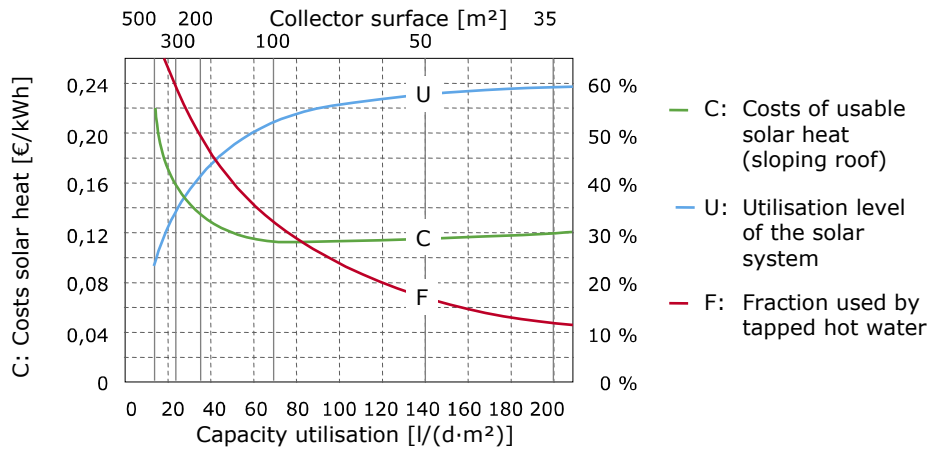
© target GmbH

III General aspects of the planning

Source: M. Schnauss

18

Influence of capacity utilisation on important characteristic values

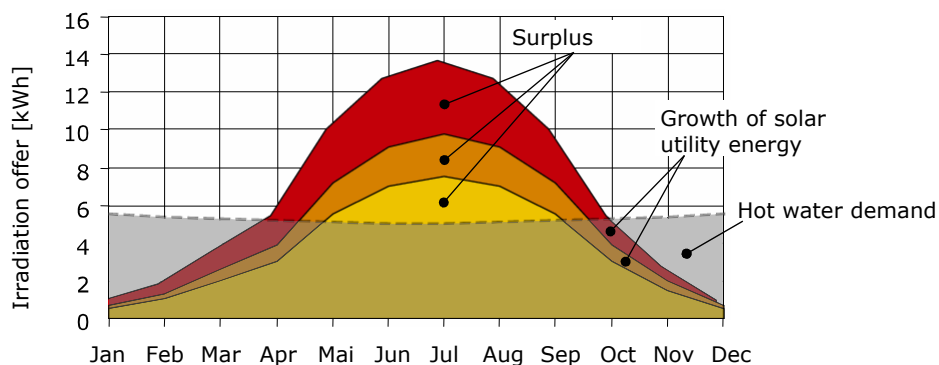


Consumption and connection to consumer fixed; system size variable; optimised system with very good flat plate collectors; place with medium irradiation

Influence of over dimensioning, surplus



Hot water demand and irradiation offer for different collector surfaces



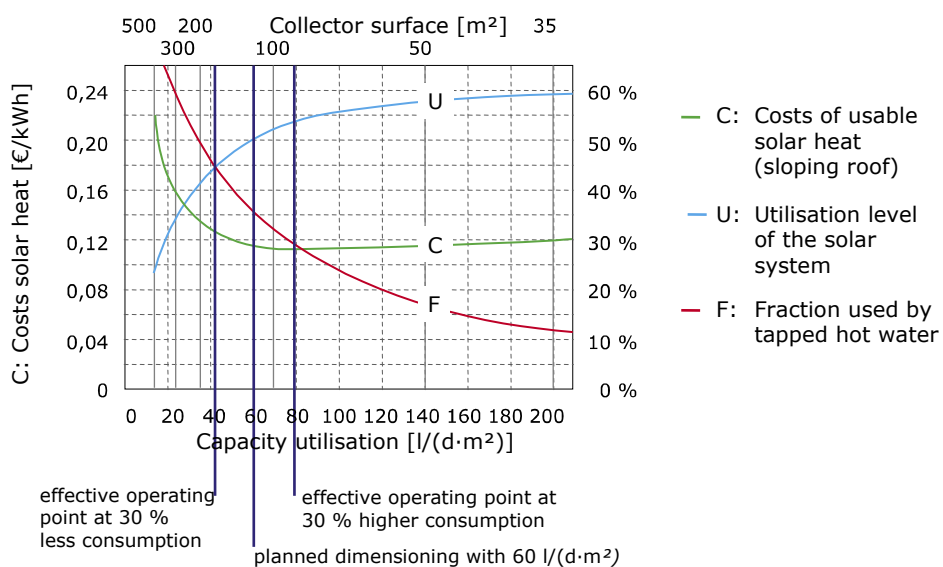
In case of enlargement of the collector surface the surplus is growing faster than the utility energy

Influence of tap water temperature and return flow temperature

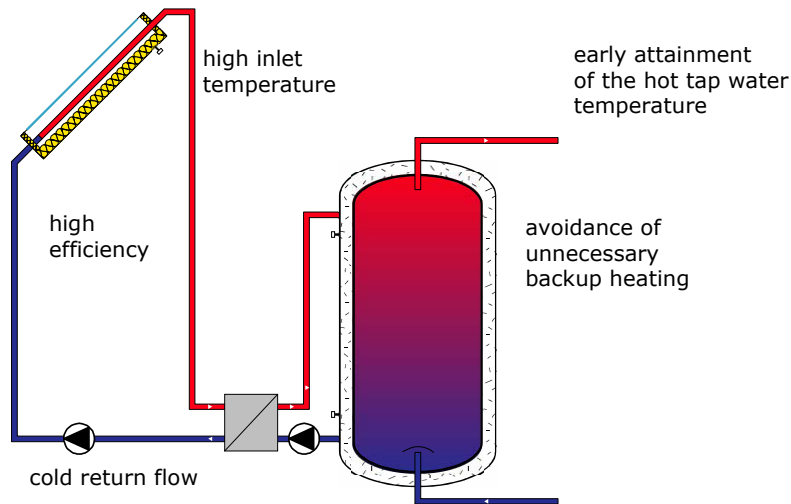


- For a bath a maximum temperature of about 36 °C is needed, for a shower about 40 °C.
As the storage temperature is normally higher, the consumer adds cold water at the extraction point.
- A large part of the tap volume uses the cold water pipe.
- The increase of the temperature in the standby storage reduces the storage output, as more cold water is added because of the higher outlet temperature.
- The storage output is decisive for the heat output of the solar system.
- Low return flow temperatures increase the efficiency of the collector. Production and fraction increase, the heat price sinks.

Result of deviation of the presumed consumption



Advantages of a layered storage tank



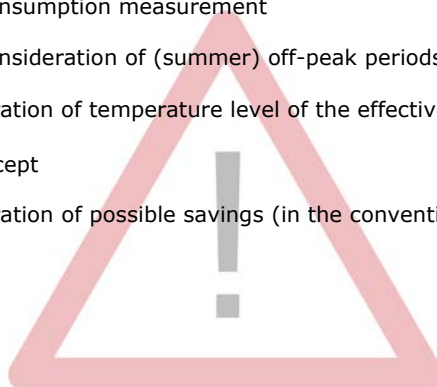
Frequent errors concerning system dimensioning



- wrong estimation of consumption
- no or insufficient consumption measurement
- no or insufficient consideration of (summer) off-peak periods
- insufficient consideration of temperature level of the effective storage output
- missing overall concept
- insufficient consideration of possible savings (in the conventional system)

RESULT:

- over dimensioning
- minor output
- high heat price
- bad amortisation



Reasons for an output and performance control and for guaranteed solar output

- breakdown of collector system is detected very late, as the conventional backup heating is assuring the supply
- badly working systems
- create safety and trust in the technique in the eyes of the investor
- promotional measure
- market stimulation
- demand of the subsidy donor

Procedure

- use of control devices
- acceptance control with mobile data acquisition
- contractual arrangement

Devices for the output and performance control

- Calorific meter
- Registration of the pump run time by time meter
- Input-Output-Controller
- Control unit with integrated functional and solar heat gain test
- Mobile acceptance data acquisition

Approach towards Guaranteed solar gain

- contractual arrangement in sales contract
- stipulation of guaranteed gain on the basis of simulation calculations
- in case of less gain detected:
 - installer/planner can retouch
 - installer/planner refunds output deficit