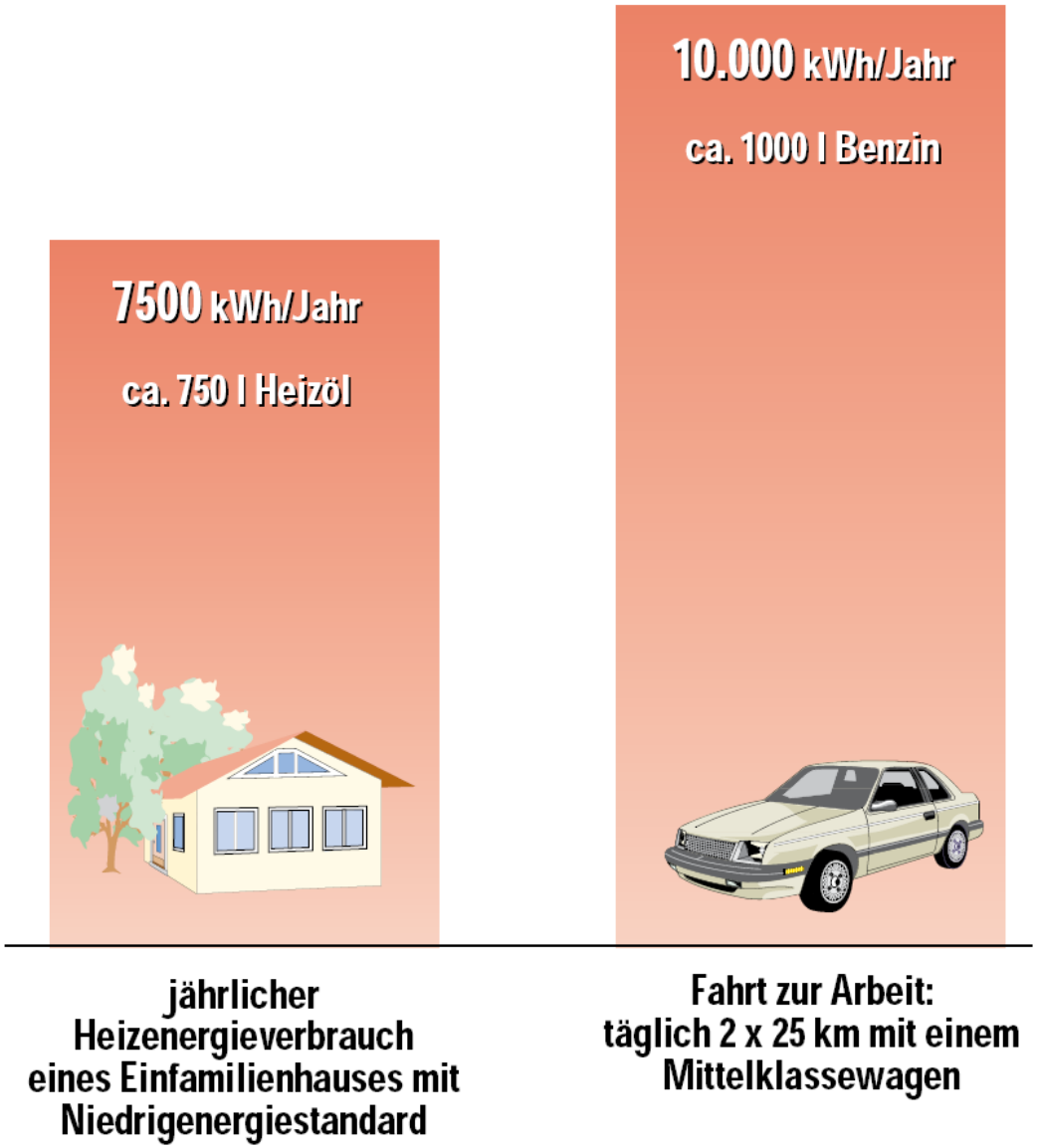
Energy Saving in Private Households

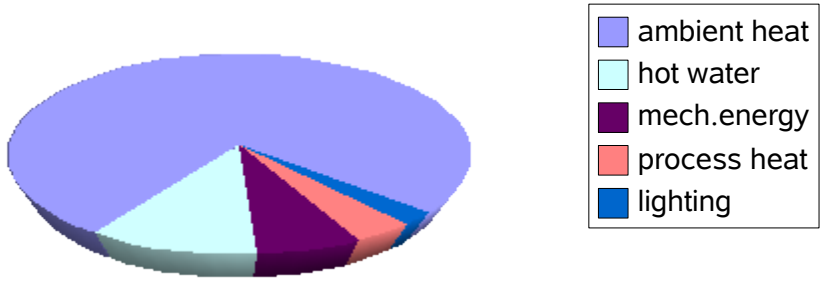
Christoph Wendel
09.11.2005



Initial Situation

- 64% of primary energy can be used - private households use 30% of final energy

77%	ambient heat
11%	hot water
7%	mech. energy
4%	process heat
2%	lighting



possibilities:

- raise of efficiency or decrease of consumption

  more efficient generation of final energy (condensing boiler)
  use of other sources (photo-thermic, geothermic, district heating)

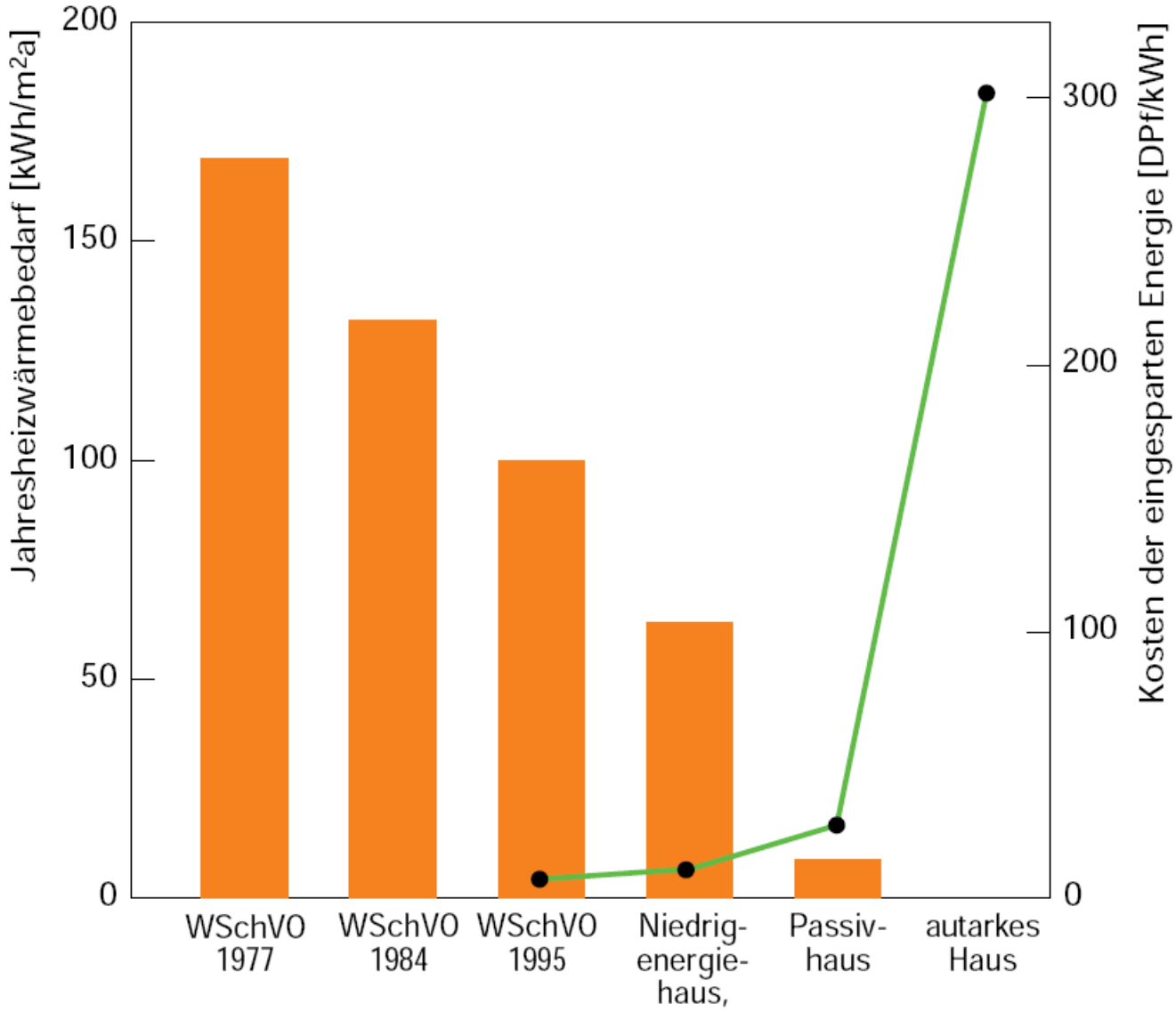
  buffering
  insulation

- primary source for energy saving is ambient heat and hot water

  ambient heat: 34% Gas (p)
  26% Oil (p)
  5% district heating (f)
  3% electrical power (f) (electrical needs 3x more primary energy)

Typical Consumption

typical household consumes 90-150 kWh/(m² a) / 120 Mwh/a (Stat. Bundesamt) -- (70kWh/(m²a))



passive house: 10-15 kWh/m² a

Losses

losses:

structure design / location (wind / sun ...)

heat cunduction (U-value): x W/(m²K)

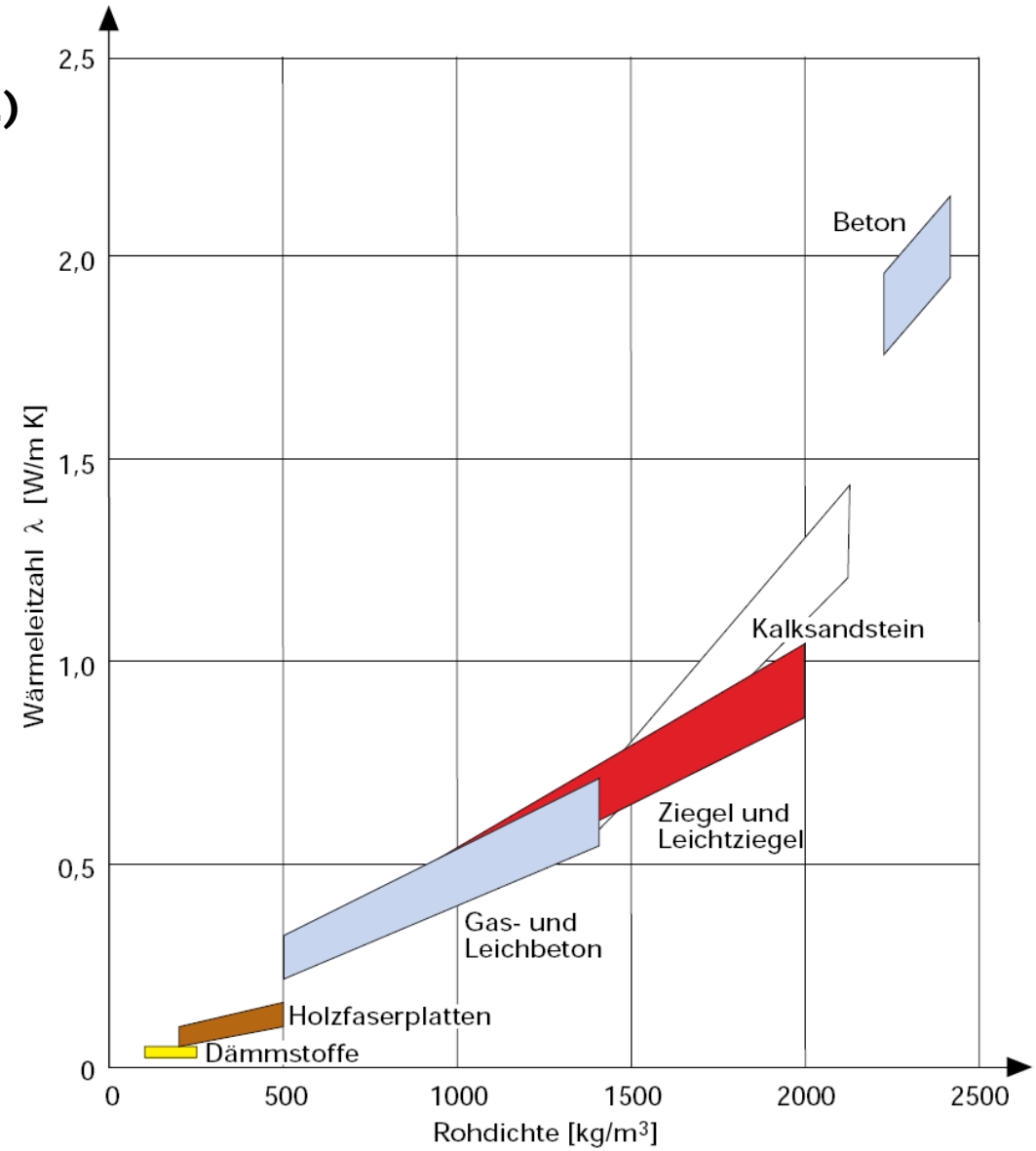
- **walls:**

30 cm concrete wall	3
normal wall (cavity bricks)	0,42
wall w. external insulation	0,28
leightweight construction	0,19

- **windows:**

single glazing	6
double glazing	3
dg with heat insulation	2
tripple h. i. with Krypton	0,8

U=1 equals 10 l oil per year and m²



- **ventilation:**

window ventilation T in = T outside , T out = T amb
central ventilation with heat recovery (T out = T in +2°C)

Energy Production / Buffering

production:

normal boiler	75-90 %	of primary energy used for heating/hot water
condensing boiler	105 %	(uses condensation heat after the combustion)

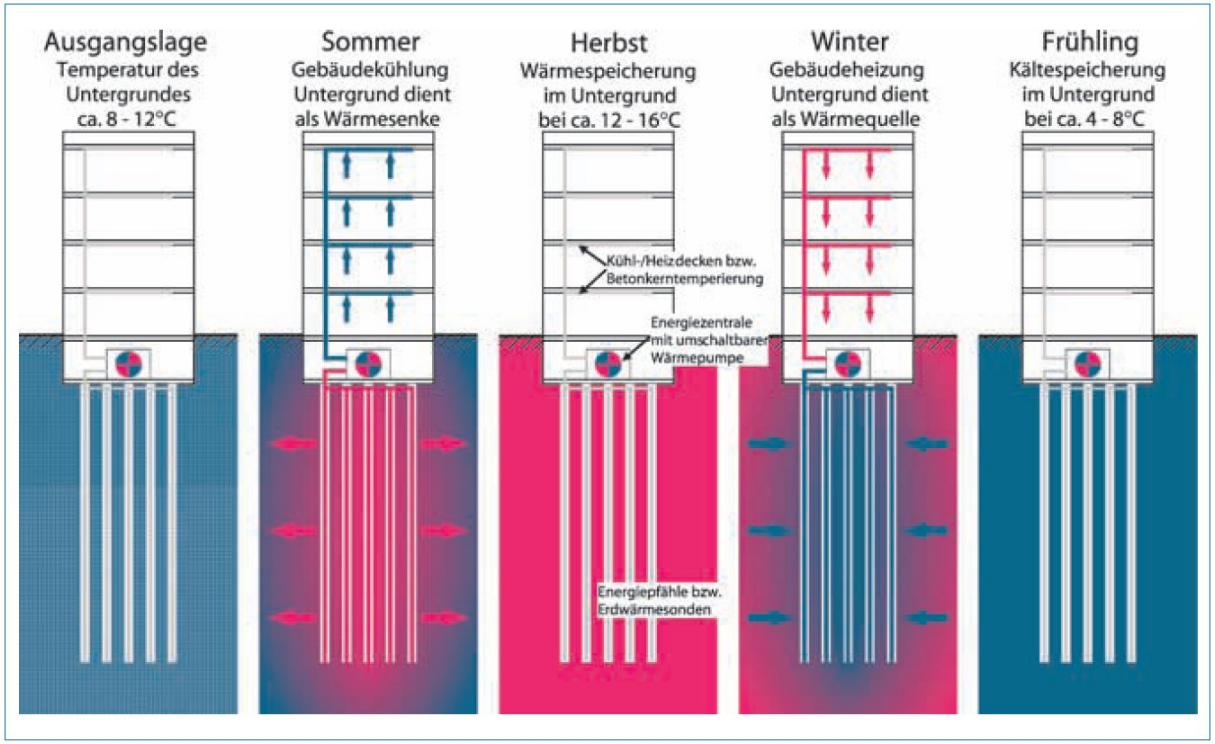
distribution:

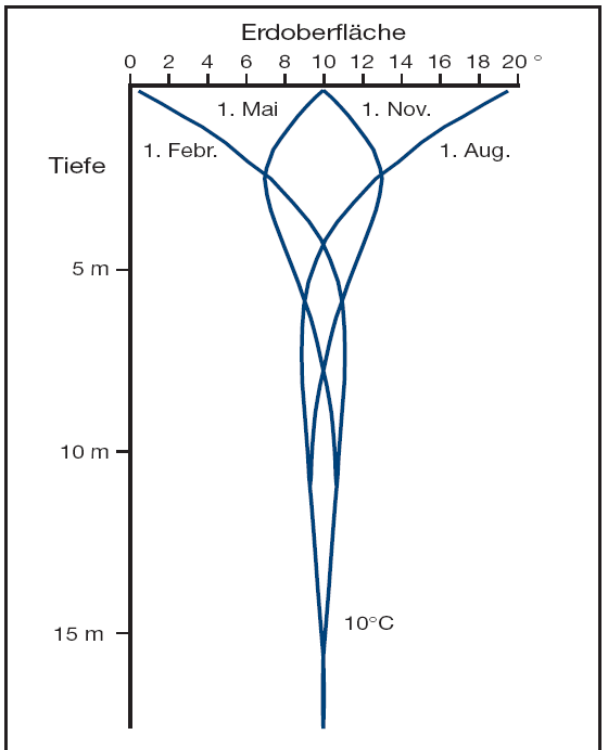
radiator heating:	55°C/45°C (VL/RL)
heat mat:	35°C/32°C
concrete core heating:	25°C/23°C

energy buffer / energie source:

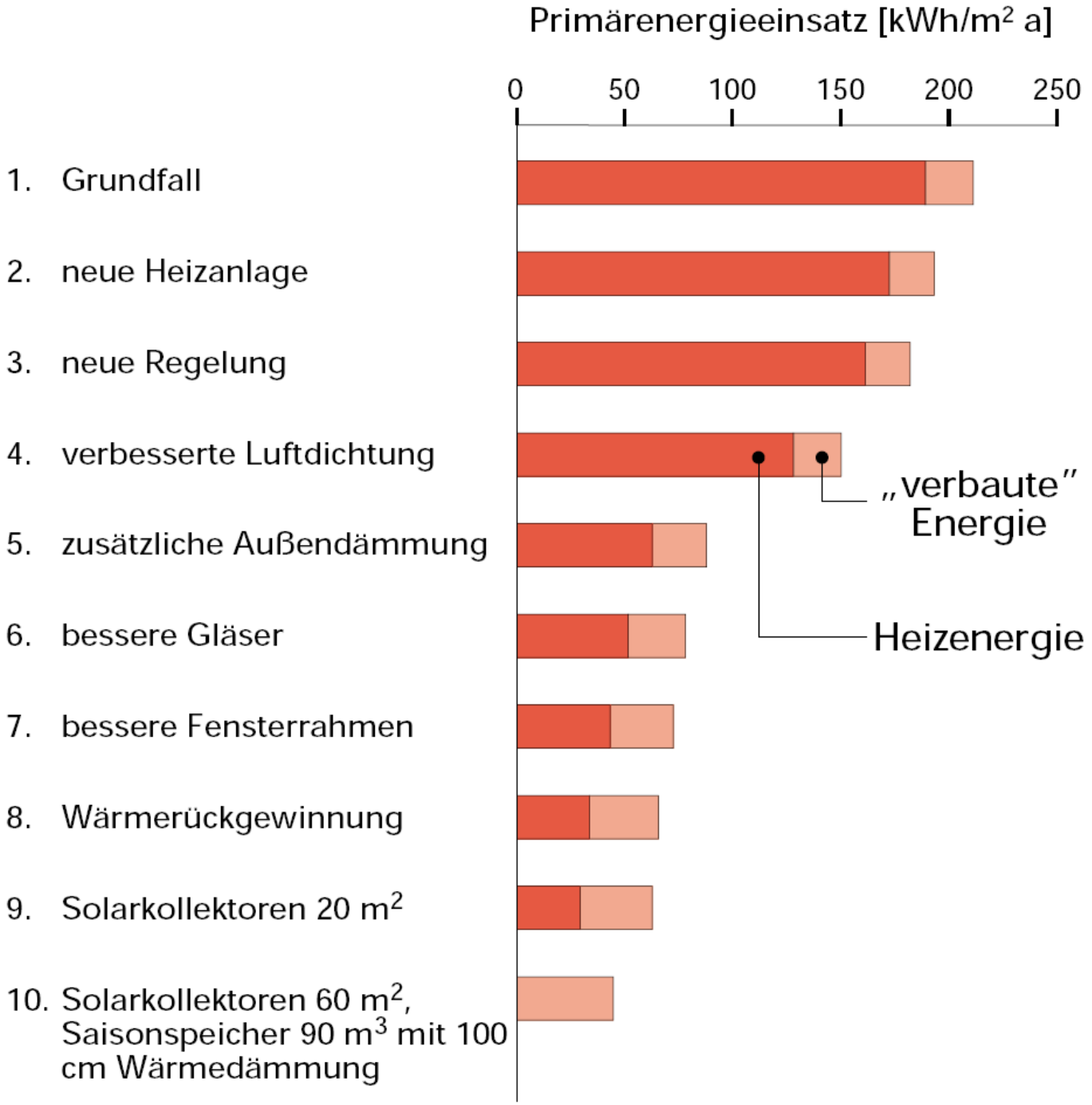
photo-thermic hot water

geo-thermic energy buffer/source

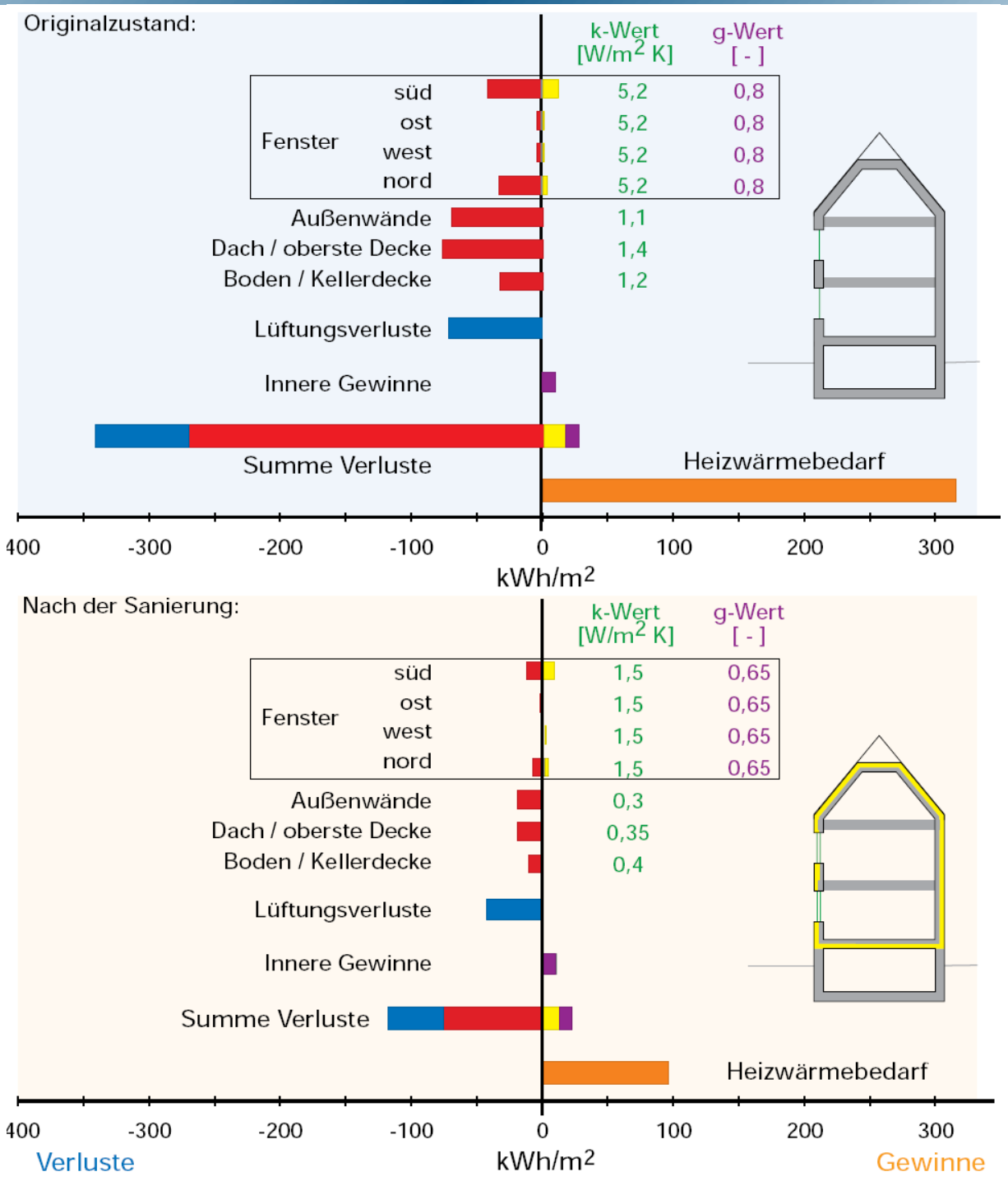




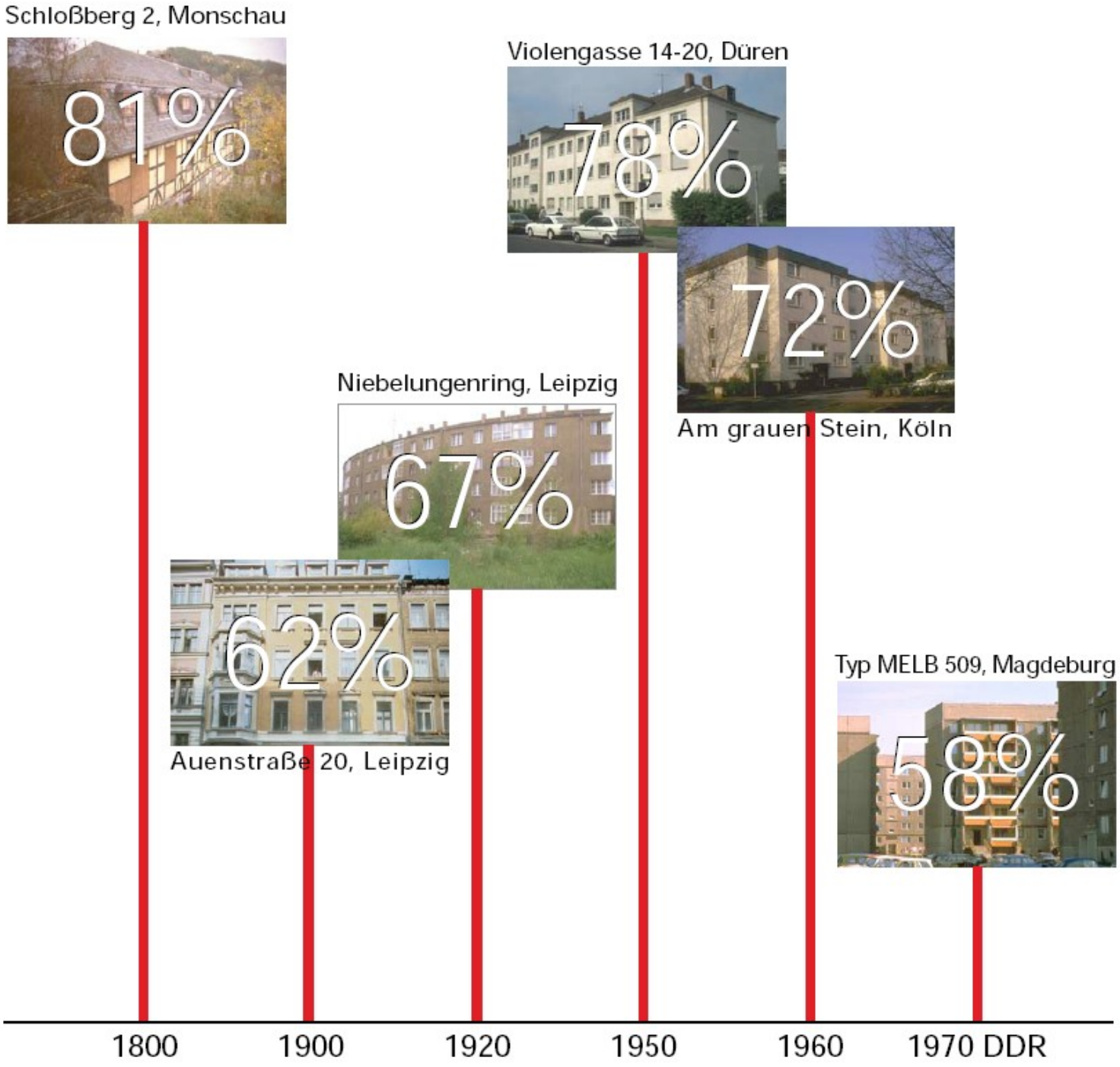
Example 1: From Normal to Passive House



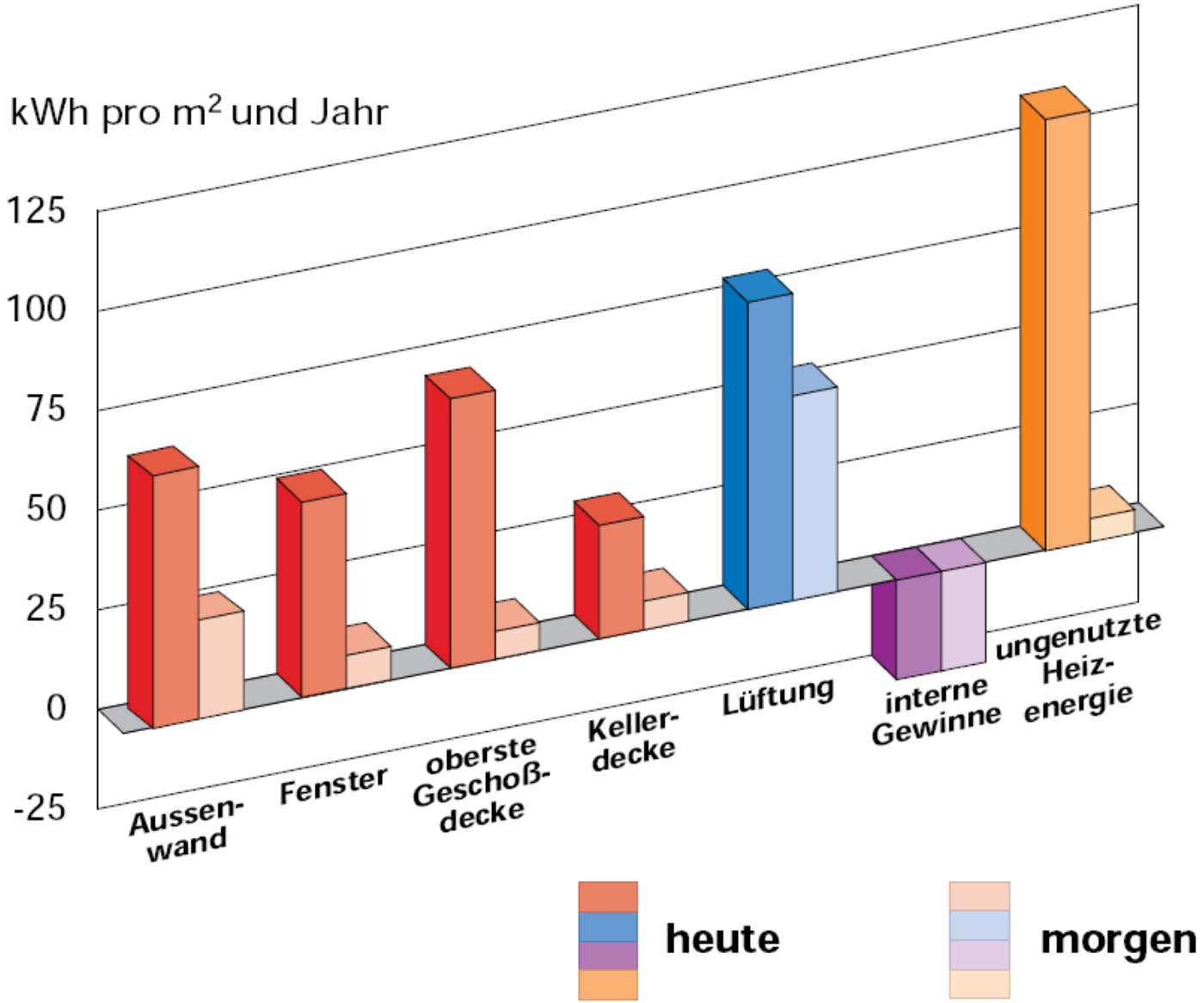
Example 2: Renovation (1995!!)



Example(s) 3: Different Houses



Renovation: Detailed View

Energiebilanzen heute und morgen

Beispiel: Mehrfamilienhaus „Violengasse 14-20" in Düren