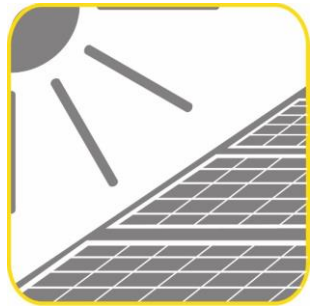
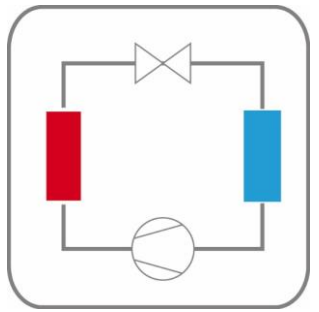
siz energieplus
steinbeis innovations zentrum





Examples of multi-family houses with high solar fractions in Germany

Dipl.-Ing. Franziska Bockelmann

IEA SHC Task 66 - Industry Workshop No. 3

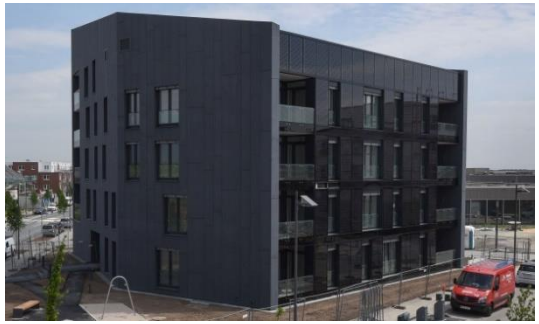
online, 07.02.2023

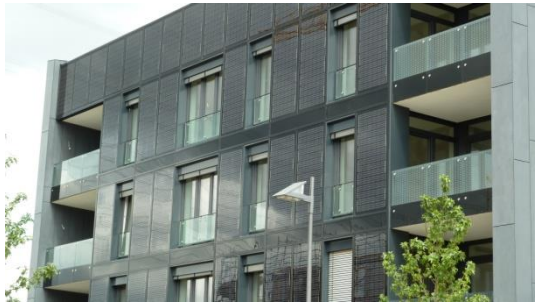
Motivation - Rethinking

Quelle:
de.goipadwallpapers.com

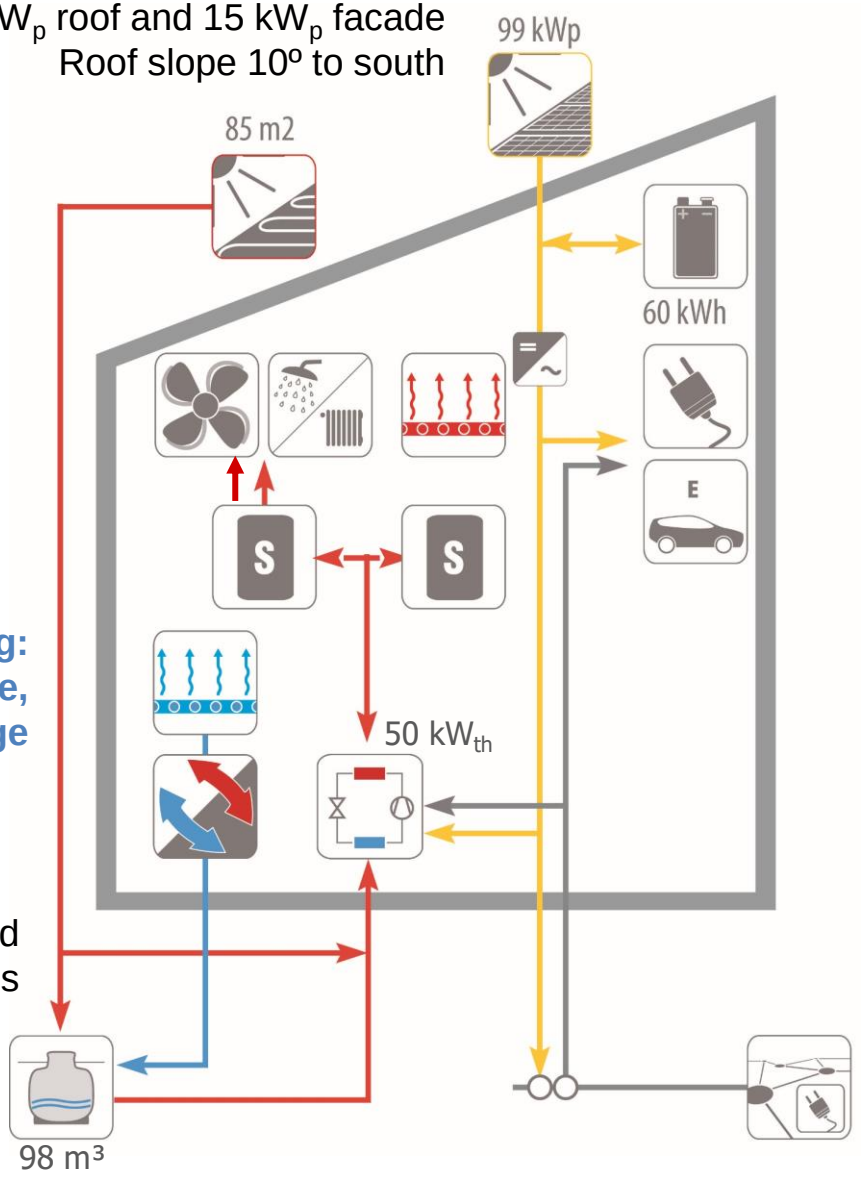
- EU policy and federal target: from 2019 or 2021 only "nearly zero energy buildings" (new construction)
- efficient supply concepts become mandatory
- high solar fractions = answers to the challenges of our future energy supply?!

Riedberg





84 kW_p roof and 15 kW_p facade
Roof slope 10º to south



Cooling:
more or less 100 % renewable,
cooling from ice storage

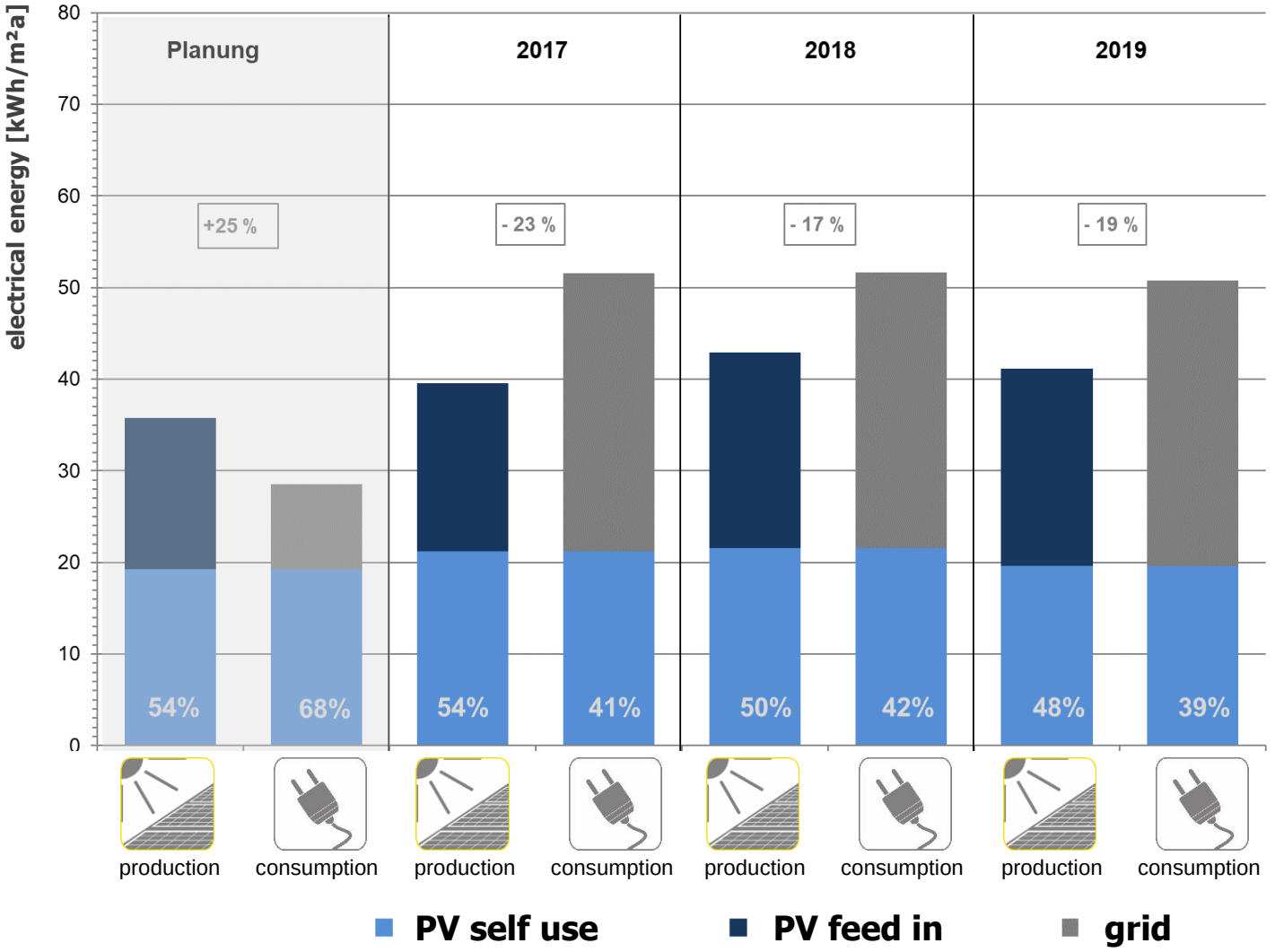
Ice storage and
air absorber under PV modules

1 buildings (2016)
17 apartments
5 floors
NFA 2.417 m²

Riedberg

No surplus available in practice because

- the user electricity demand has increased compared to the planning assumptions.
- the hot water demand has doubled compared to the planning assumptions.



Riedberg

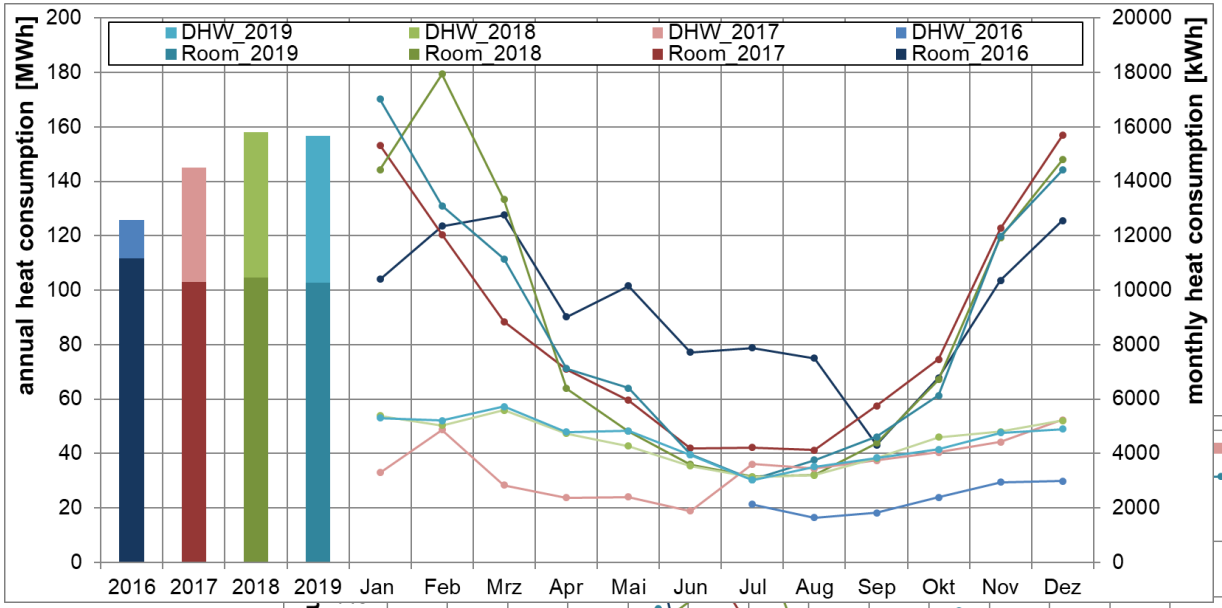
Heat consumption

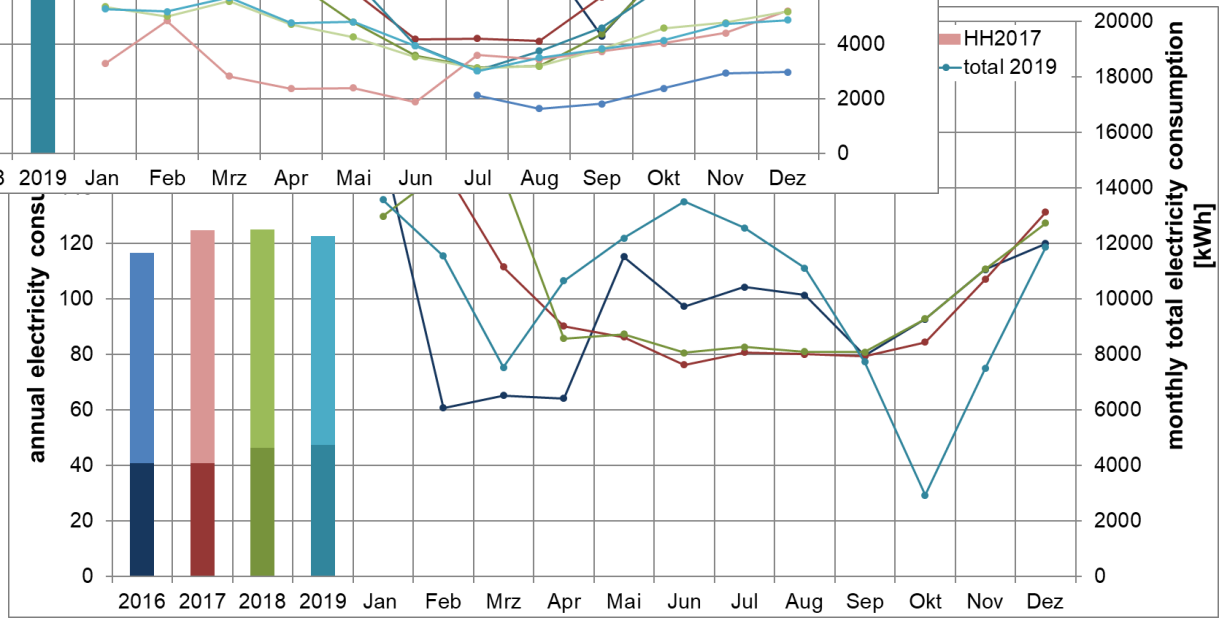
SH	43,7 kWh/(m²a) 68 %
DHW	21,0 kWh/(m²a) 32 % (design 12,5 kWh/m²a)

Electricity consumption

HP	18 kWh/(m²a) 36 %
HH + other technicals	32 kWh/(m²a) 64 % (design HH 13,3 kWh/m²a)

Heating (space heating and domestic hot water) and electricity (heat pump and houshold plus technical part) – annual and monthly consumption



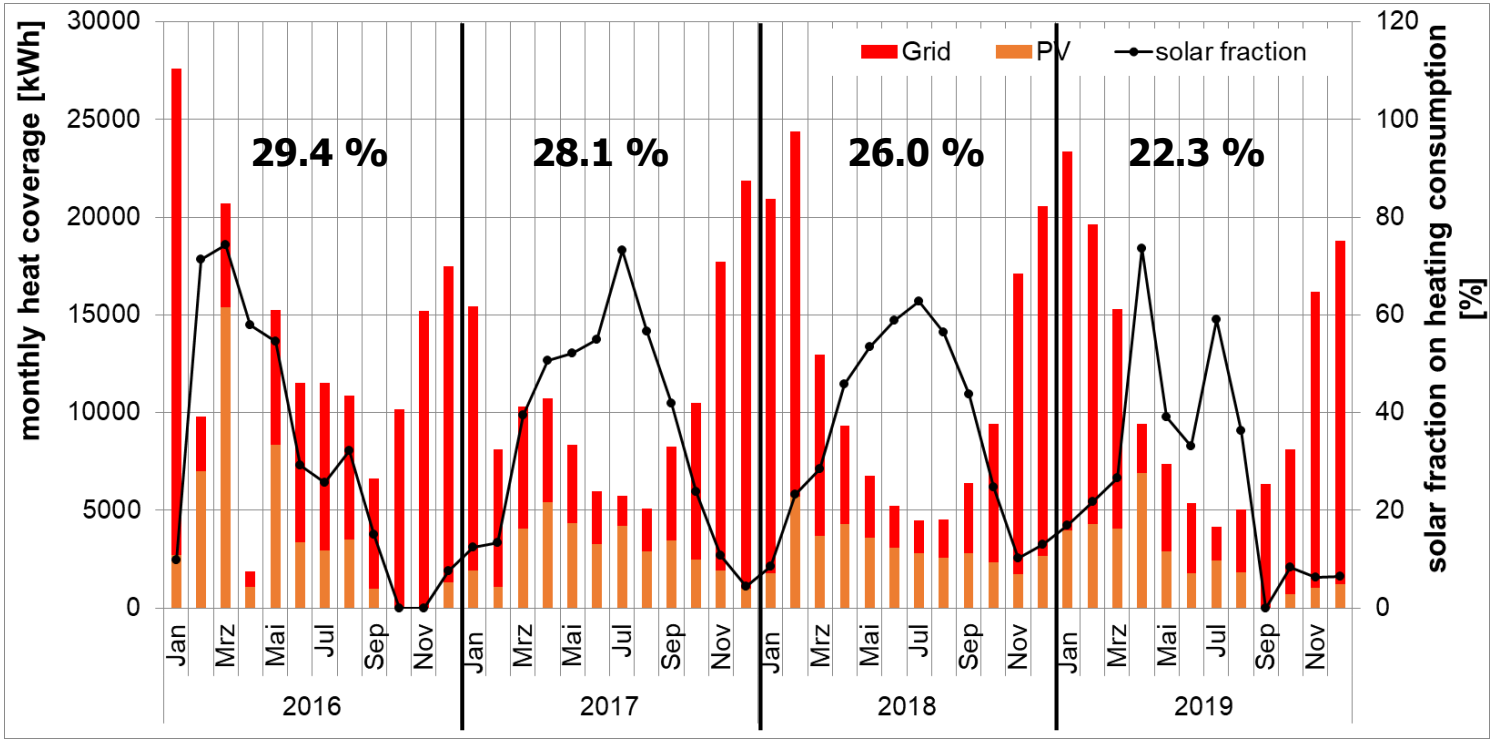


Solar fraction

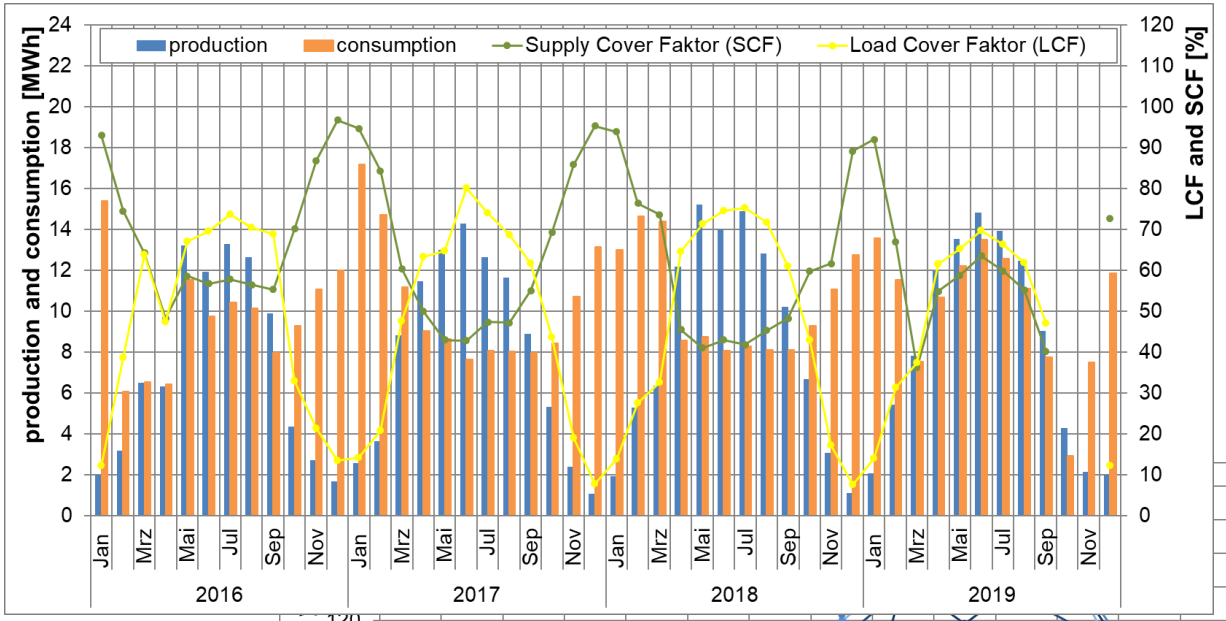
f_{sol} 0 – 74 %
(monthly values)

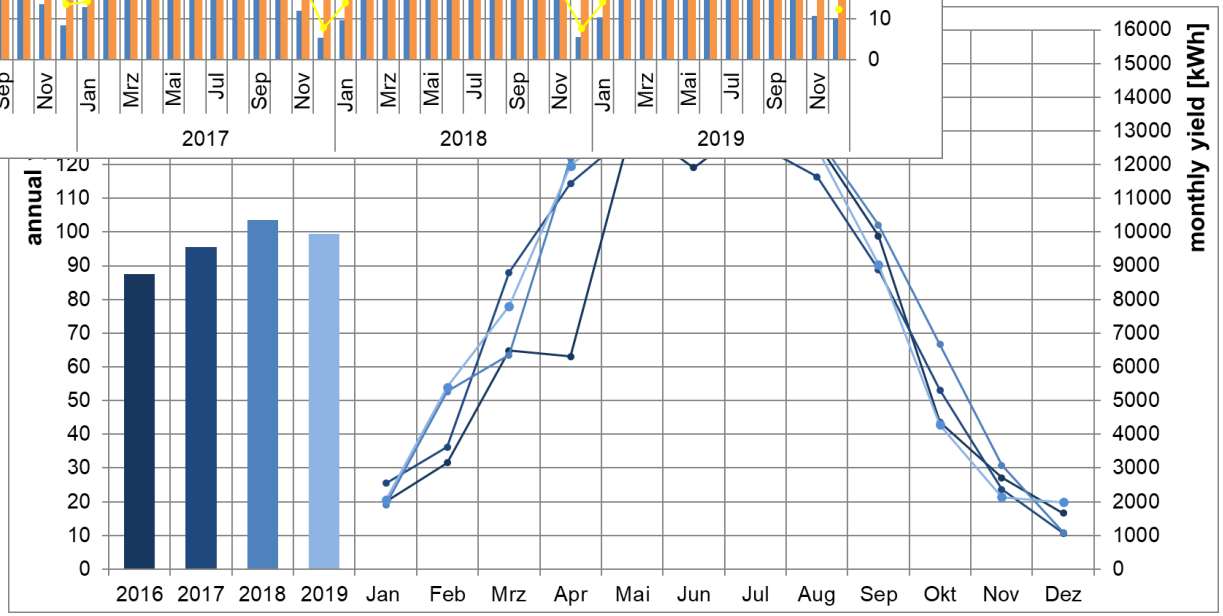
f_{sol} 27 %
(annual mean value)

Solar fraction on heating consumption – annual and monthly values



Electricity: PV-System – annual and monthly yield





PV-yield ~ 975 kWh/kWp

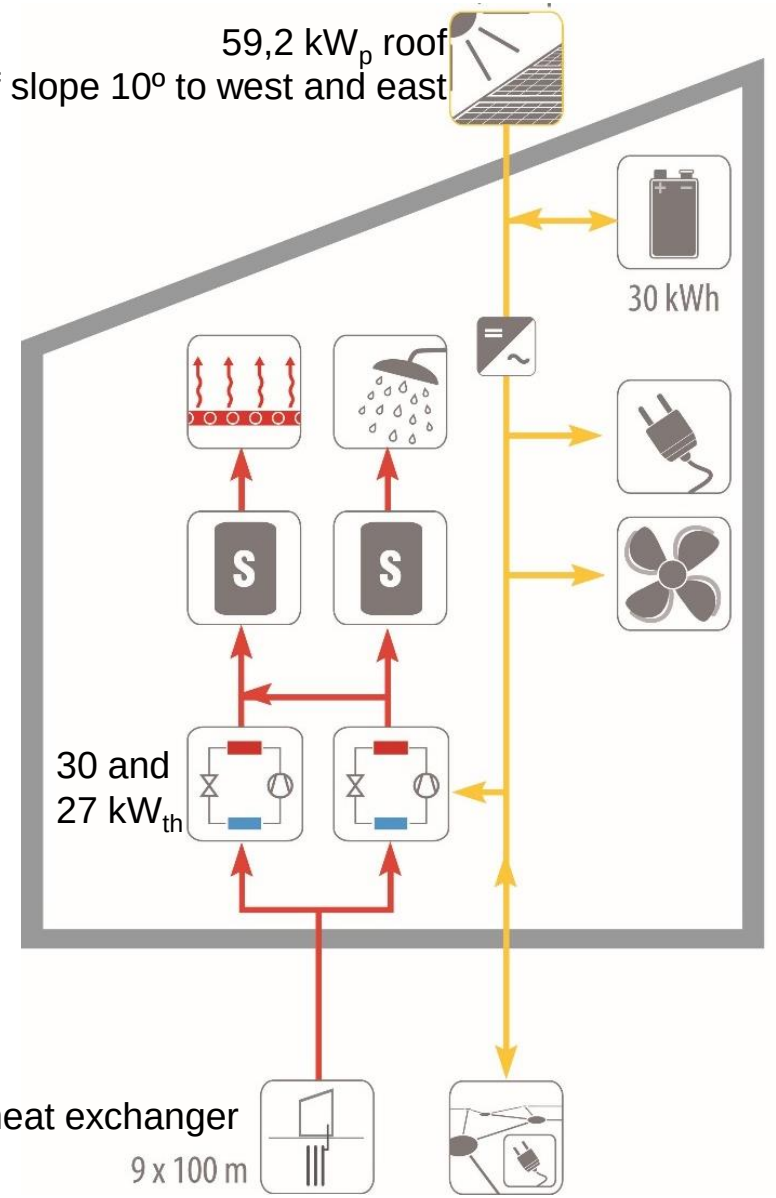
monthly values
Load Cover Factor (LCF)
8 - 80 %

Supply Cover Factor (SCF)
36 - 97 %

yearly average
LCF 40 %
SCF 50 %

Konstanz

2 buildings (2016)
12 apartments (total)
3 floors (each)
NFA 1.140 m² (total)



Konstanz

No surplus available in practice because

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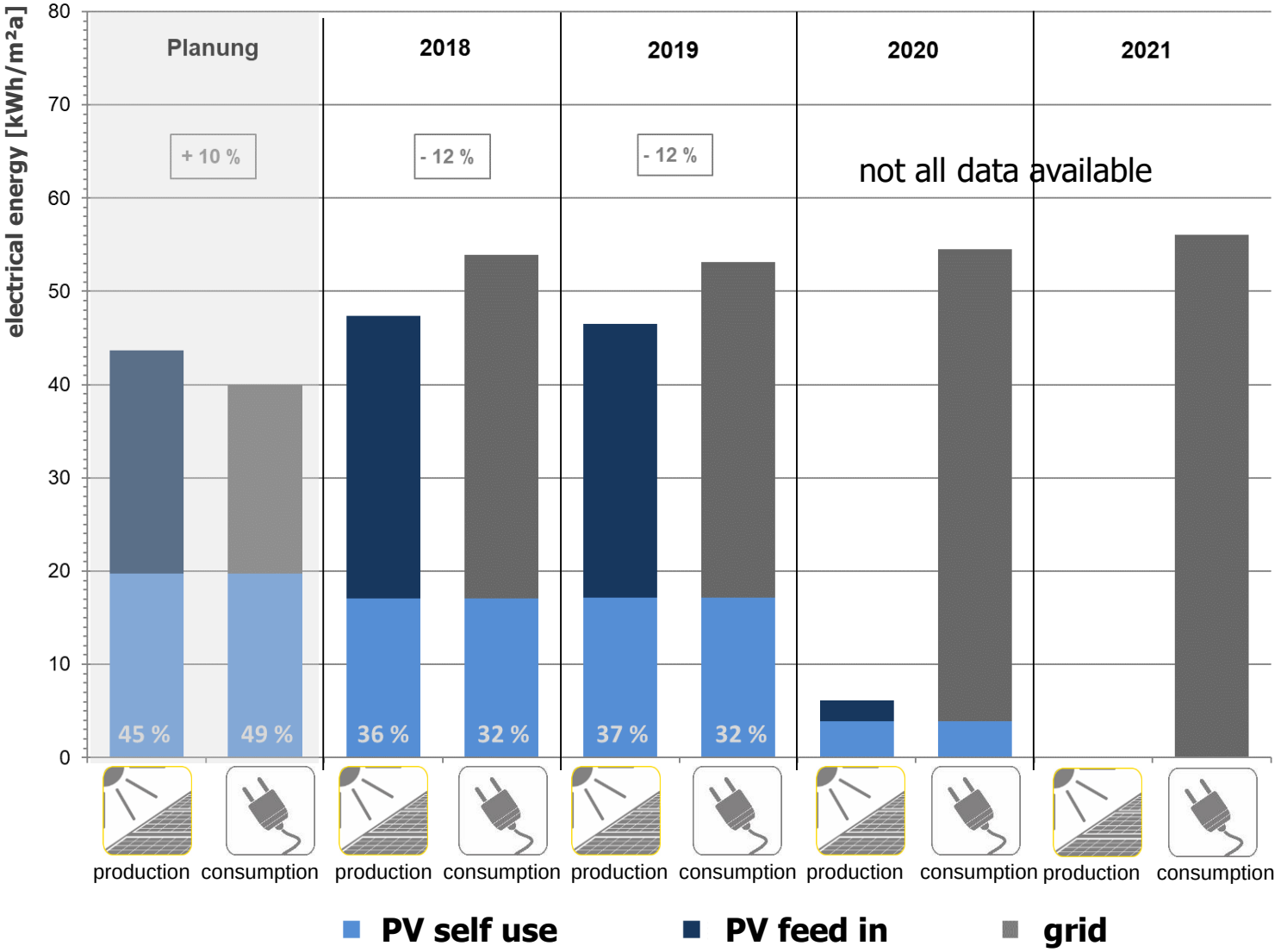


Konstanz

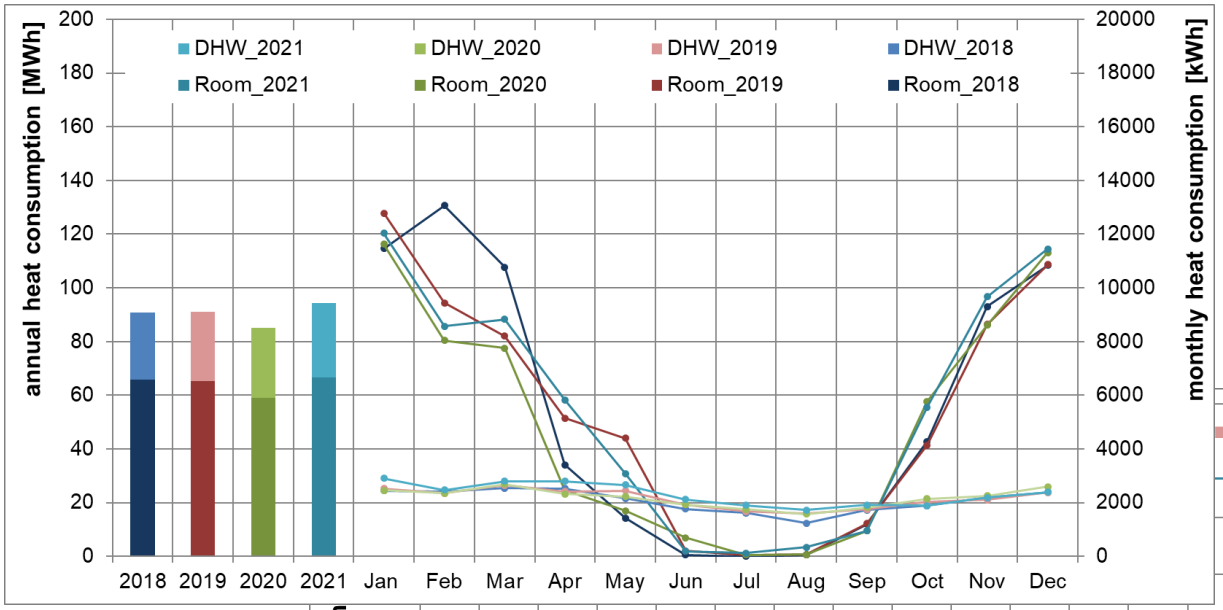
Heat consumption

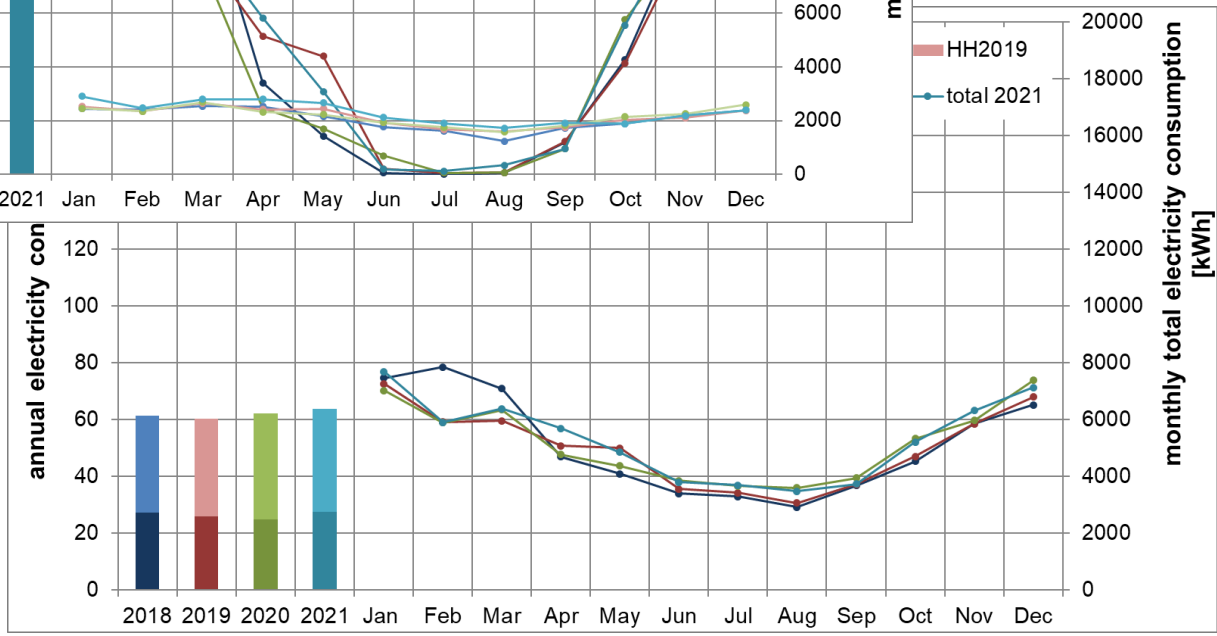
SH	56,3 kWh/(m²a) 71 %
DHW	23,0 kWh/(m²a) 29 % (design 12,5 kWh/m²a)

Electricity consumption

HP	23 kWh/(m²a) 43 %
HH+ other technicals	31 kWh/(m²a) 57 % (design 15,4 kWh/m²a)

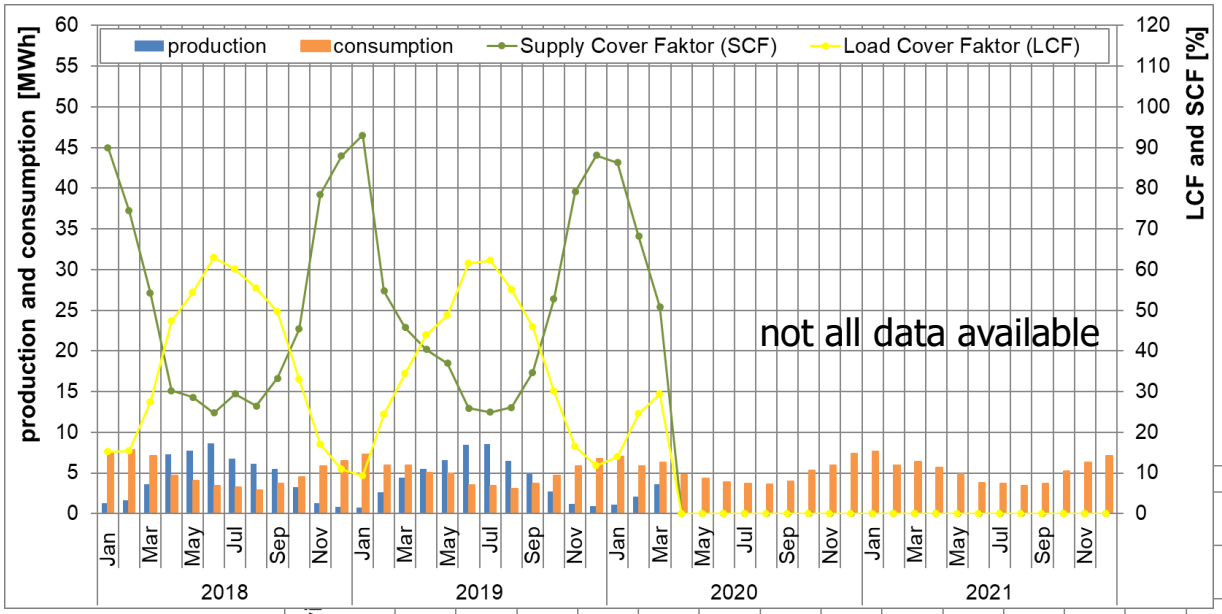
Heating (space heating and domestic hot water) and electricity (heat pump and houshold plus technical part) – annual and monthly consumption

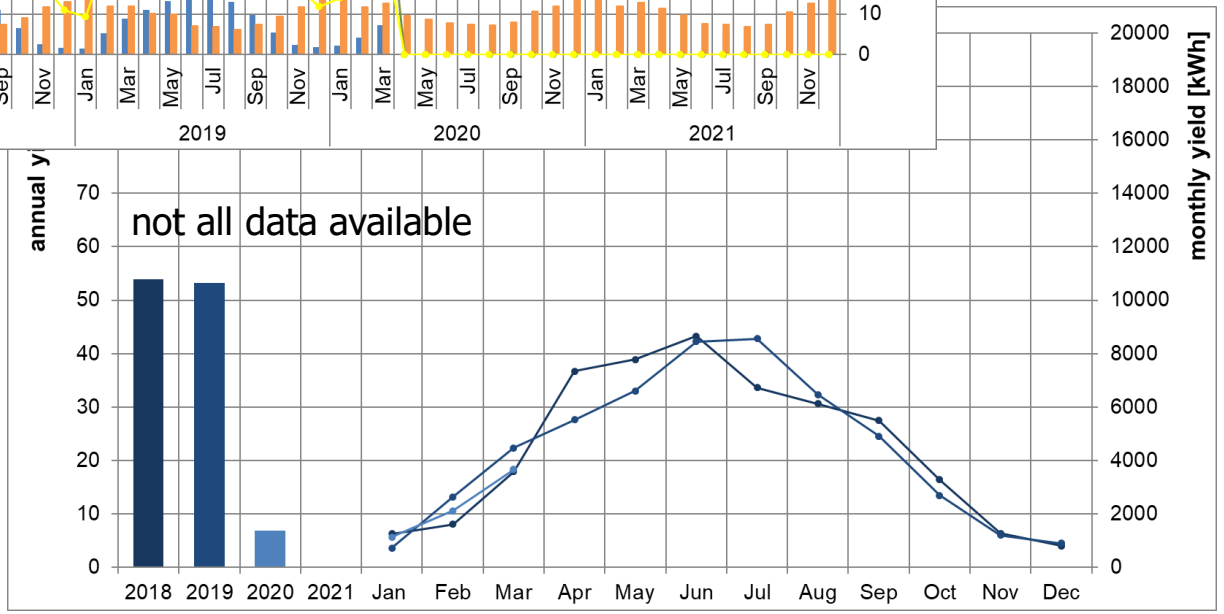




Konstanz

Electricity: PV-System – annual and monthly yield





PV-yield ~ 904 kWh/kWp

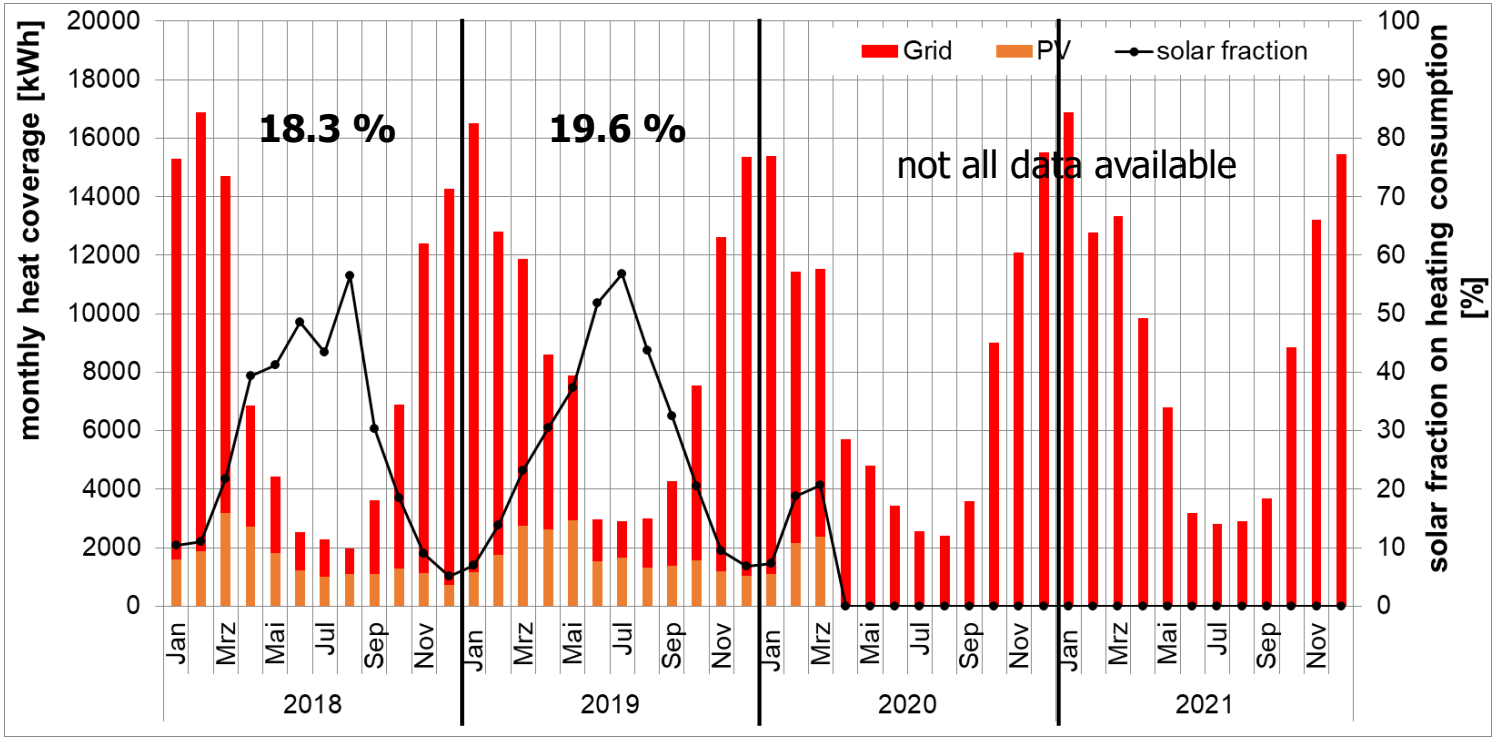
monthly values
Load Cover Factor (LCF)
9 - 63 %

Supply Cover Factor (SCF)
25 - 93 %

yearly average
LCF 32 %
SCF 37 %

Konstanz

Solar fraction on heating consumption – annual and monthly values



Solar fraction

f_{sol} 5 – 57 %
(monthly values)

f_{sol} 19 %
(annual mean value)

Hight solar fraction buildings

Quelle: https://de.dreamstime.com/

- Goal IEA SHC Task 66 (moderate climate)
  - Heating 85 %
  - Cooling 100 % (no cooling in MFH)
  - Electricity 60 %
- Goals not reached!
  - But up to 40 % renewable share for total electricity (with HP) and up to 30 % renewable share for heating in multi-family houses possible!
- Crucial: scheduled implementation and regular operation of the system!

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Thanks for your interest!