

How Passive House helps with delivery of NZEBs

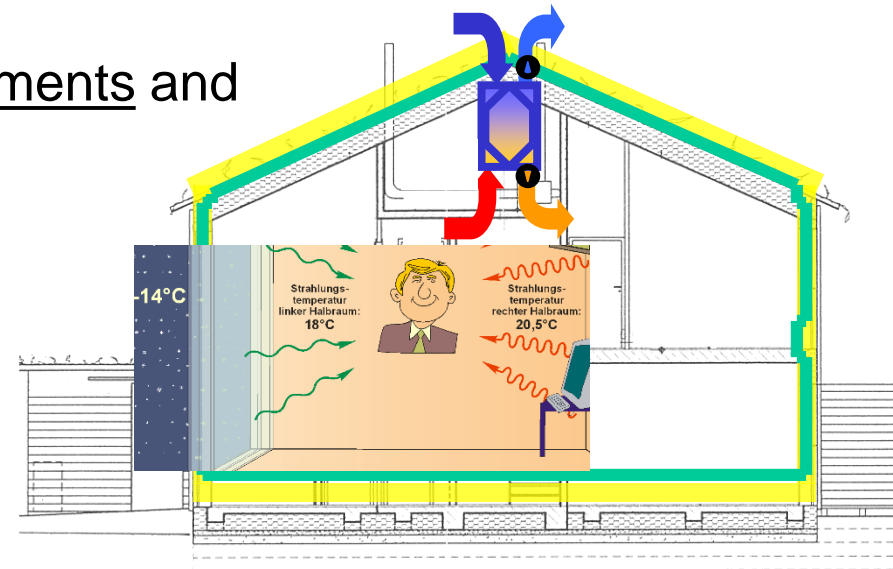
Speaker: Jessica Grove-Smith
Passive House Institute, Darmstadt, Germany

2010/31/EU

According to (article 2, section 1)

“This Directive promotes
the improvement of the energy performance of buildings [...],
taking into account [:]

- outdoor climatic and local conditions, as well as
- indoor climate requirements and
- cost-effectiveness.”



2019: all public buildings
2021: all buildings



“Nearly zero-energy buildings” (NZEB)

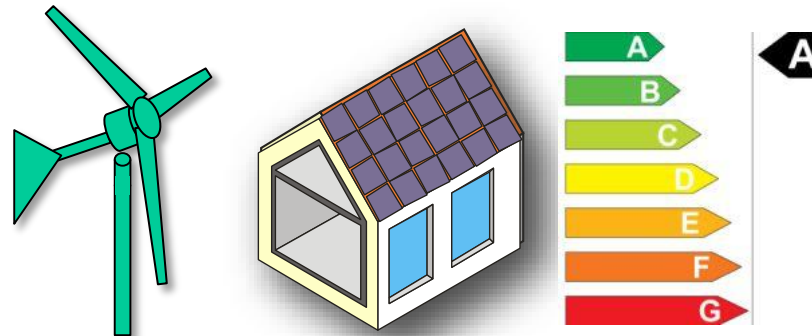
with energy requirements at the
“cost-optimal level”



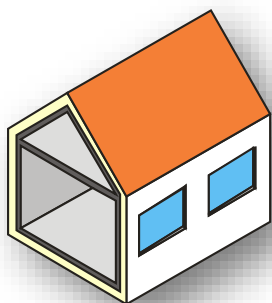
Definition of “nearly zero-energy building”: (article 2, section 2)

“... a building that has **a very high energy performance**, as determined in accordance with Annex I.

The nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources, including energy from **renewable sources produced on-site or nearby**”



Passivhaus = High Energy Performance



Heating demand:

$\leq 15 \text{ kWh}/(\text{m}^2\text{a})$
or heating load $\leq 10 \text{ W}/\text{m}^2$

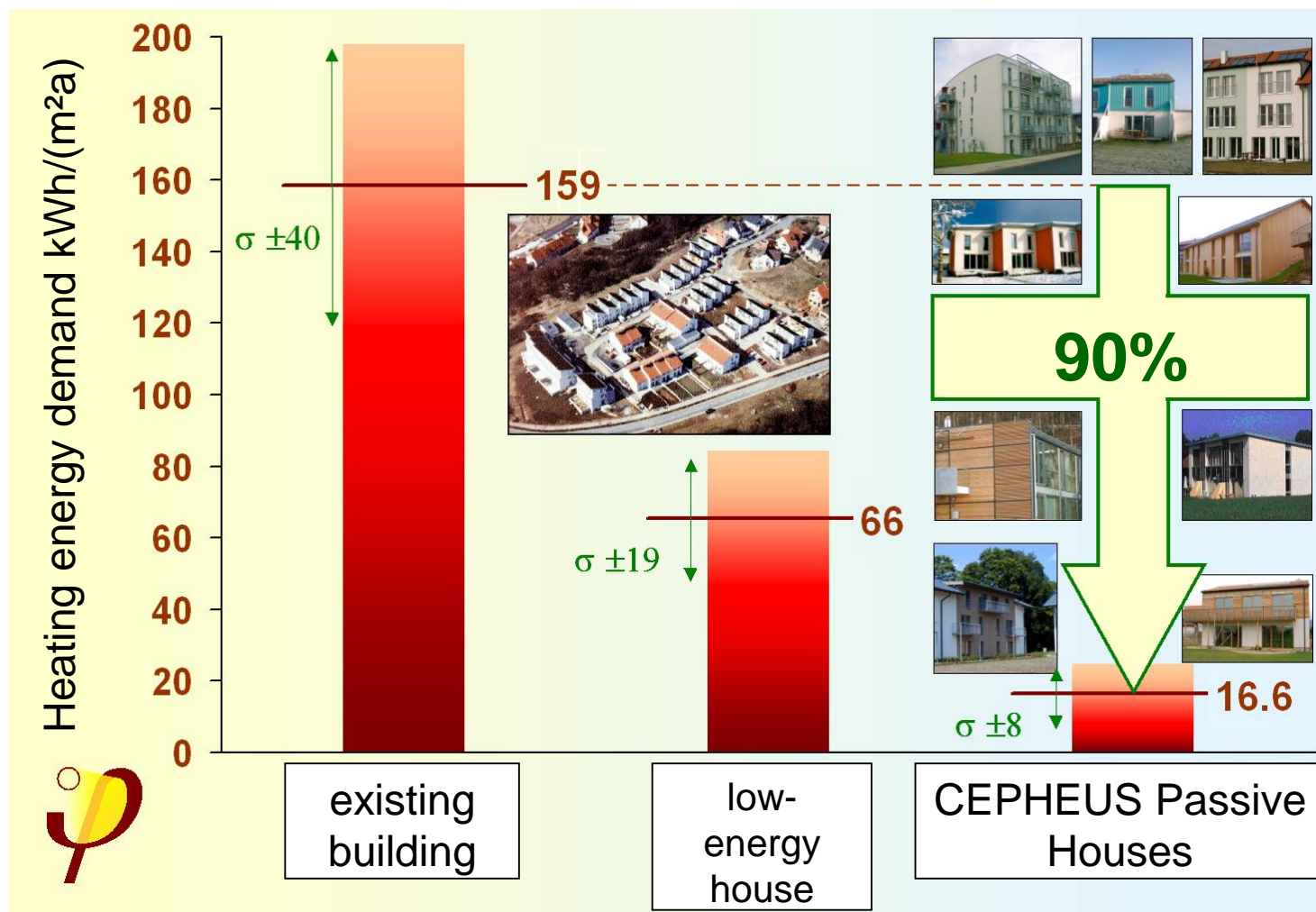
Primary energy demand:

$\leq 120 \text{ kWh}/(\text{m}^2\text{a})$

For further details see www.passivehouse.com

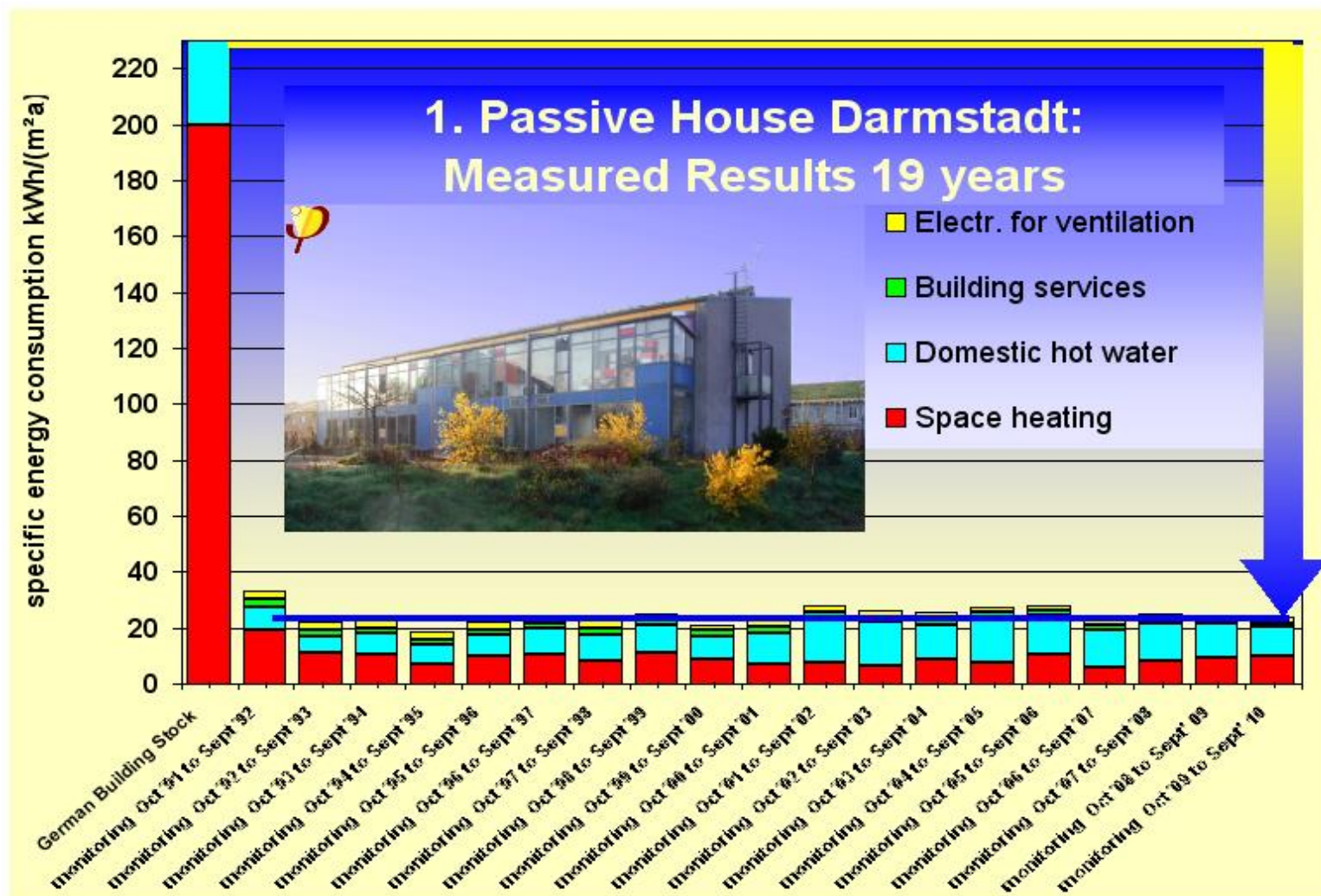
Passivhaus = High Energy Performance

Field projects prove that energy saving are reliably achieved ...



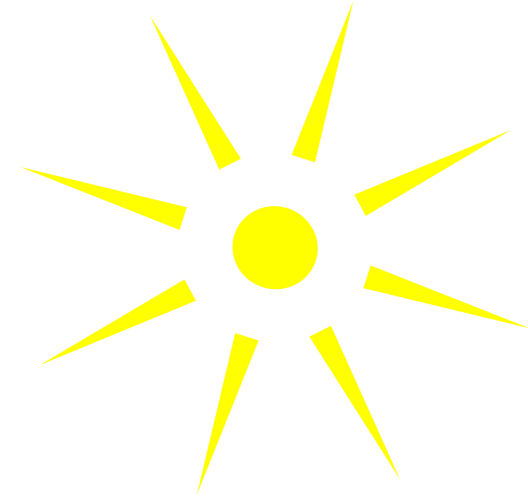
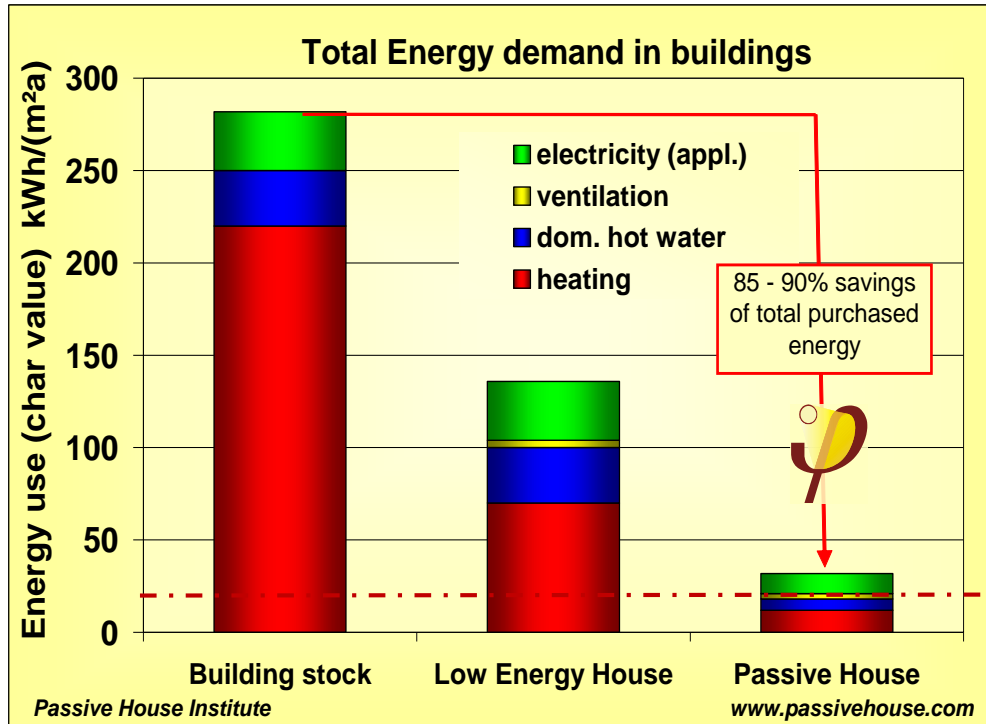
Passivhaus = High Energy Performance

... and that consumption remains low over time!

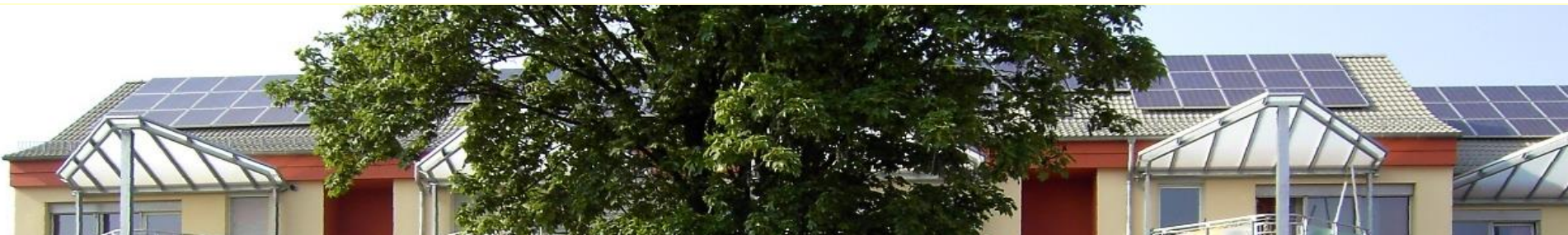


Passivhaus + Renewables = Dream Team

The remaining demand can easily be covered by on-site or nearby renewables

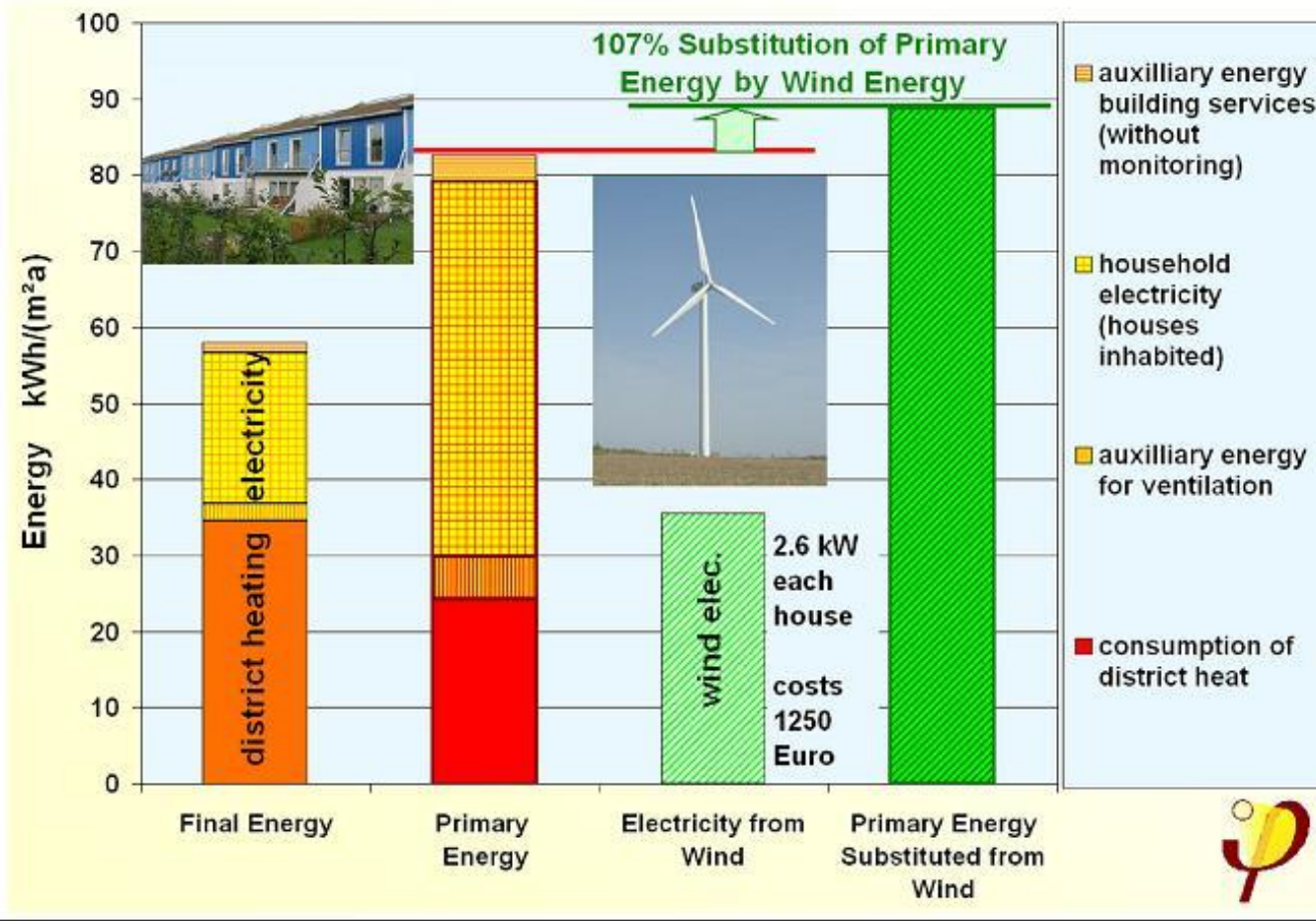


**16 m² PV for each
80m²-apartment**



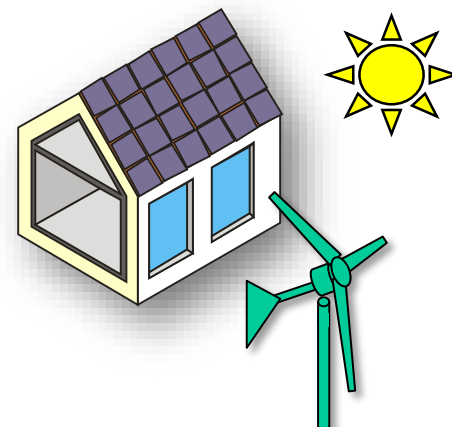
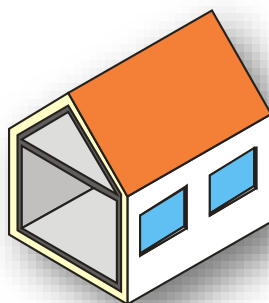
Passivhaus + Renewables = Dream Team

The remaining demand can easily be covered by on-site or nearby renewables



*Passive Houses
Hanover
Kronsberg (2000):
wind electricity*

Energy efficiency and renewable energy generation – The Dream Team





Nearly zero-energy buildings” (NZEB)

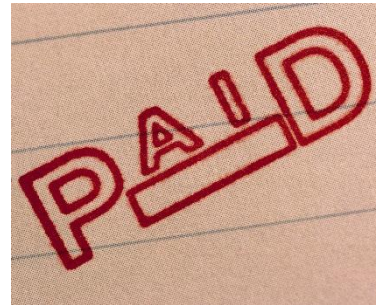
with energy requirements at the
“**cost-optimal level**”



Definition of “cost-optimal level”: (article 2, section 14)

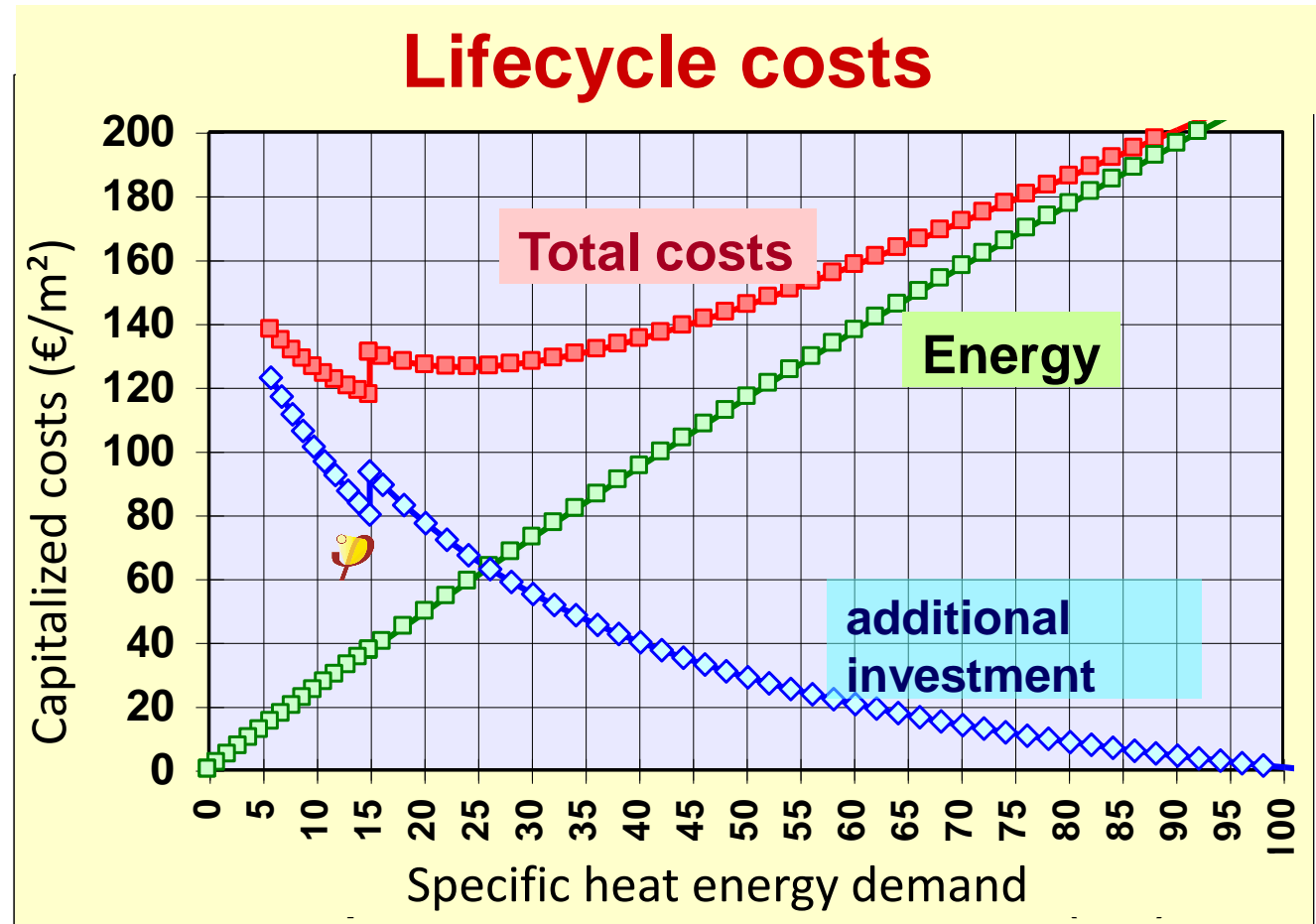
“... the energy performance level which leads to the lowest cost during the estimated **economic lifecycle**, where: (a) the lowest cost is determined taking into account

- energy-related investment costs,
- maintenance and operating costs (incl. energy costs and savings, [...])
- [...] and disposal costs, where applicable ”



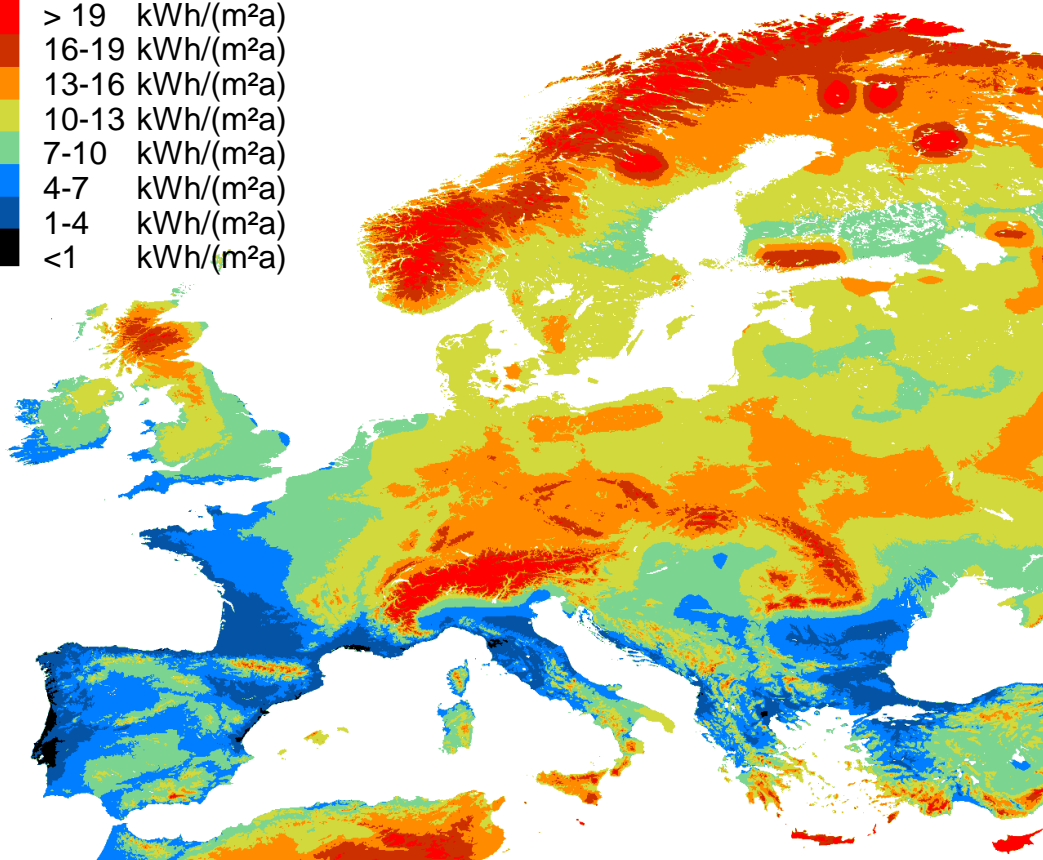
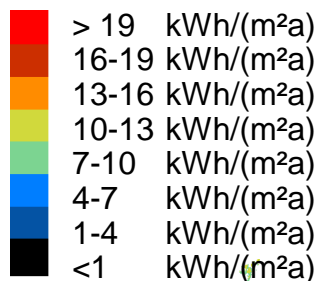
Passivhaus = Cost-optimum

Finding the balance between investment & energy saving costs



Passivhaus = Cost-optimum

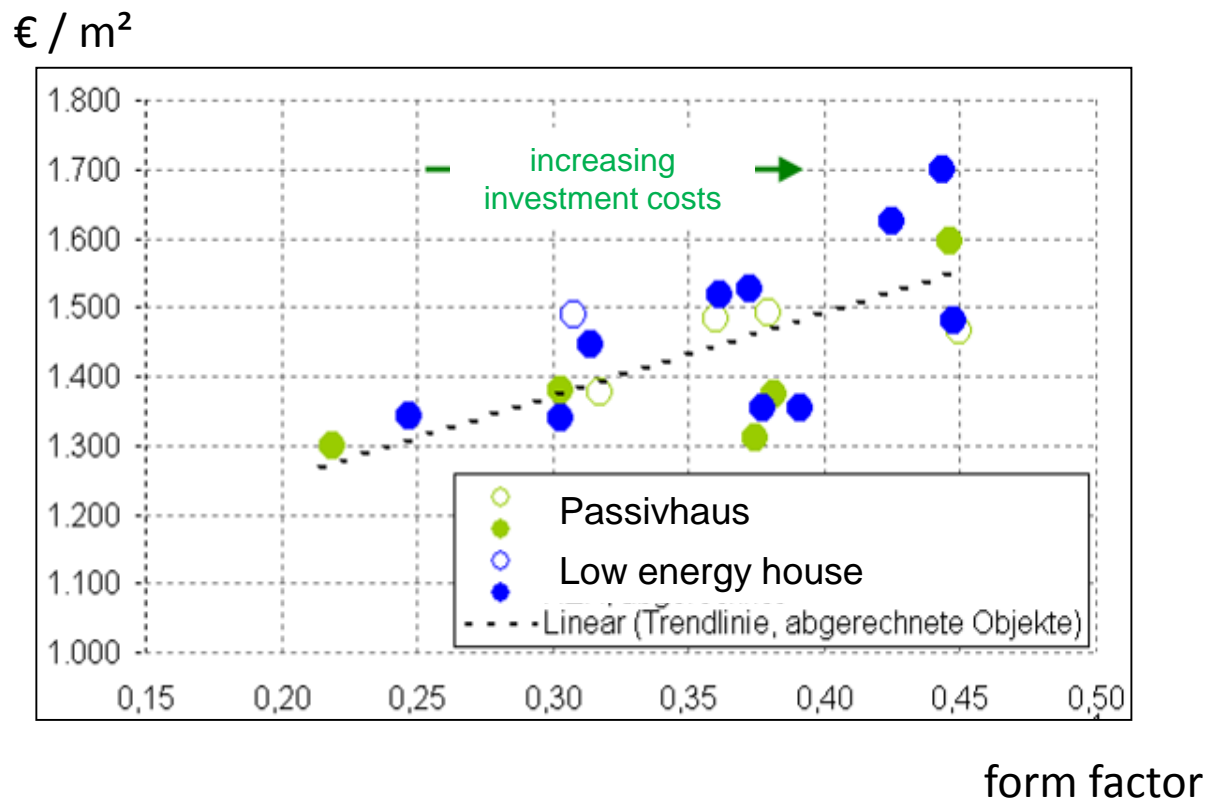
Finding the balance between investment & energy saving costs



Annual energy demand (heating, cooling) of a cost-optimised building
Source: „PH in different climate zones“ Feist et. al. 2011,
research project supported by Deutsche Bundesstiftung Umwelt and Saint-Gobain

Passivhaus = Higher investment?

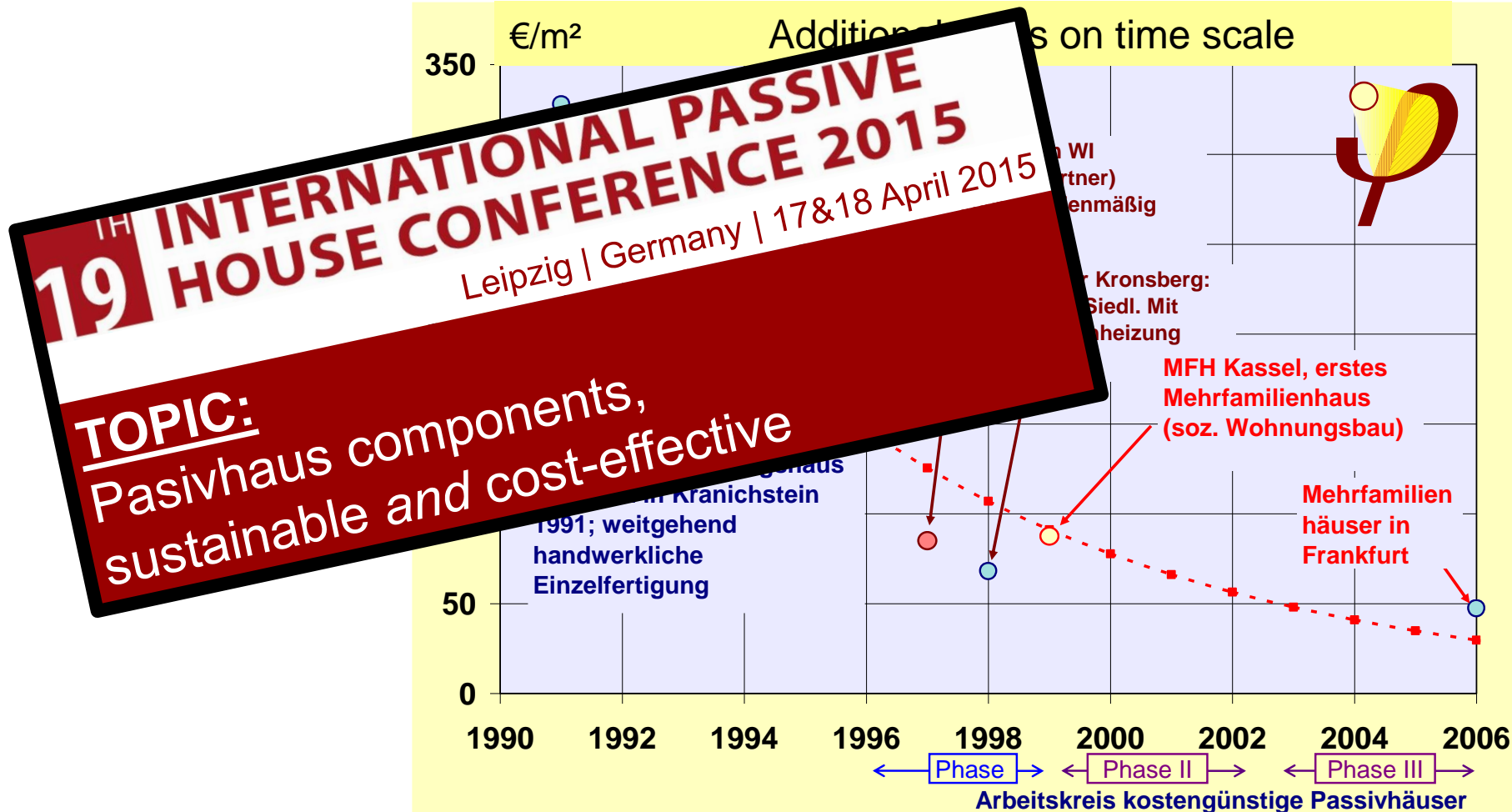
Cost difference between PH and low energy building near zero

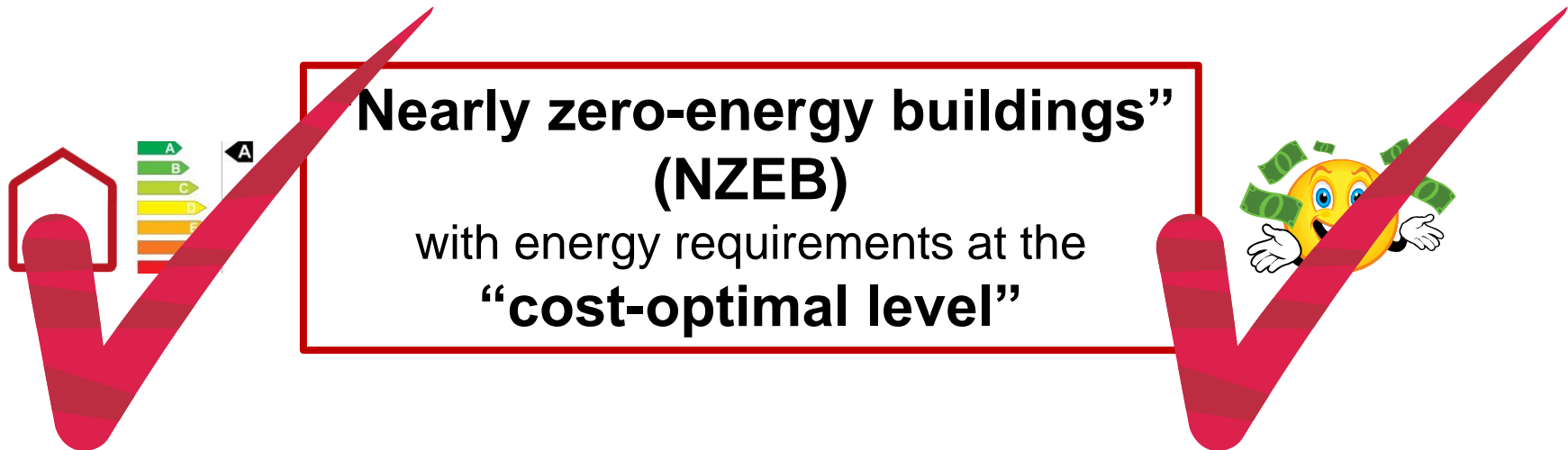


Source: Prof. Martin Treberspurg, DI Roman Smutny, DI Roman Grüner, (BOKU)

Passivhaus = Higher investment?

Effects of the learning curve & component availability







Passivhaus = NZEB !!

All the requirements are met. It's tried and tested.



NZEB = Passivhaus ??

Not necessarily ...

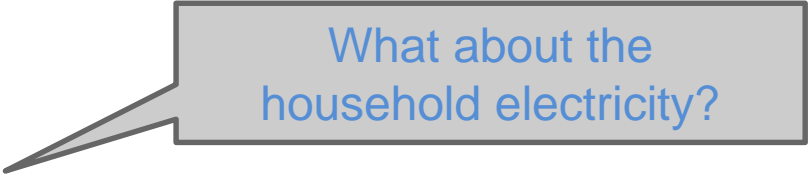


Definition of “nearly zero-energy building”: (article 2, section 2)

“... a building that has **a very high energy performance**, as determined in accordance with Annex I. [...] ”

(Annex 1)

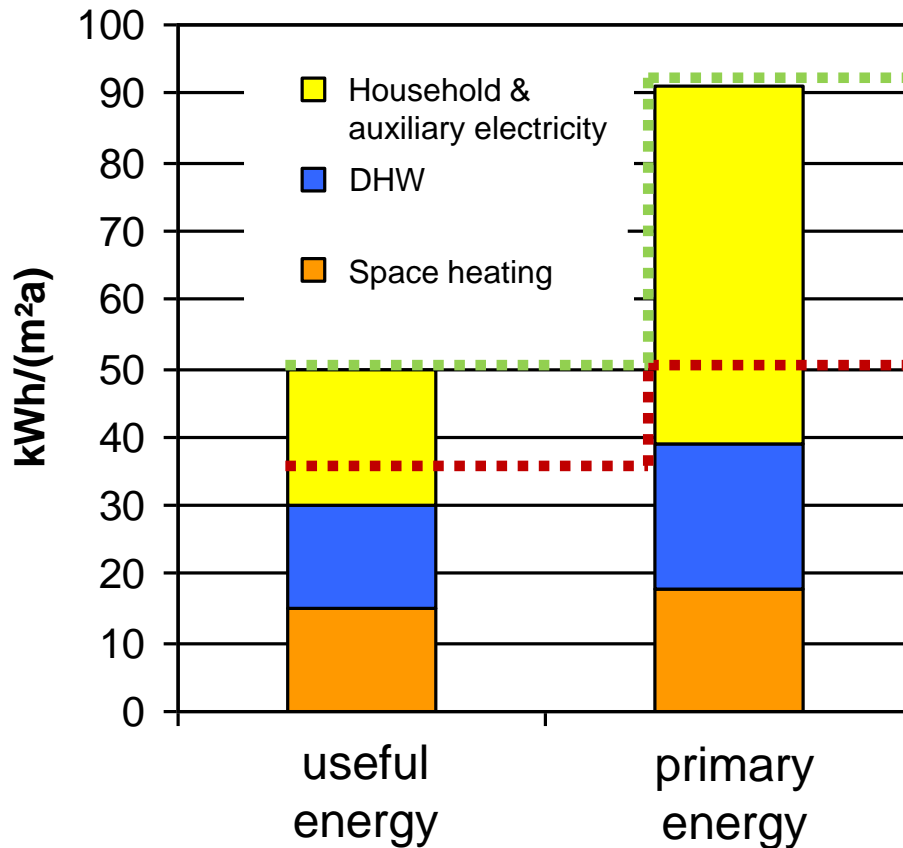
“The energy performance [...] ”



What about the
household electricity?

- [...] shall reflect the heating energy needs and cooling energy needs [...] and domestic hot water needs.”

What is part of the energy performance?



Passivhaus:

- Household electricity included
- Important, as it is dominant

Nearly Zero Energy Building:

- Household electricity not necessarily included

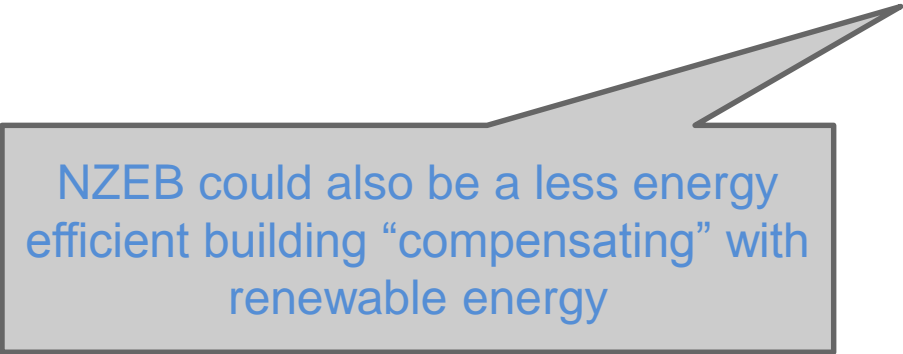
Definition of “nearly zero-energy building”: (article 2, section 2)

“... a building that has **a very high energy performance**, as determined in accordance with Annex I. [...] ”

(Annex 1)

“The energy performance [...] ”

- [...] shall include an energy performance indicator and a numeric indicator of primary energy use [...]”

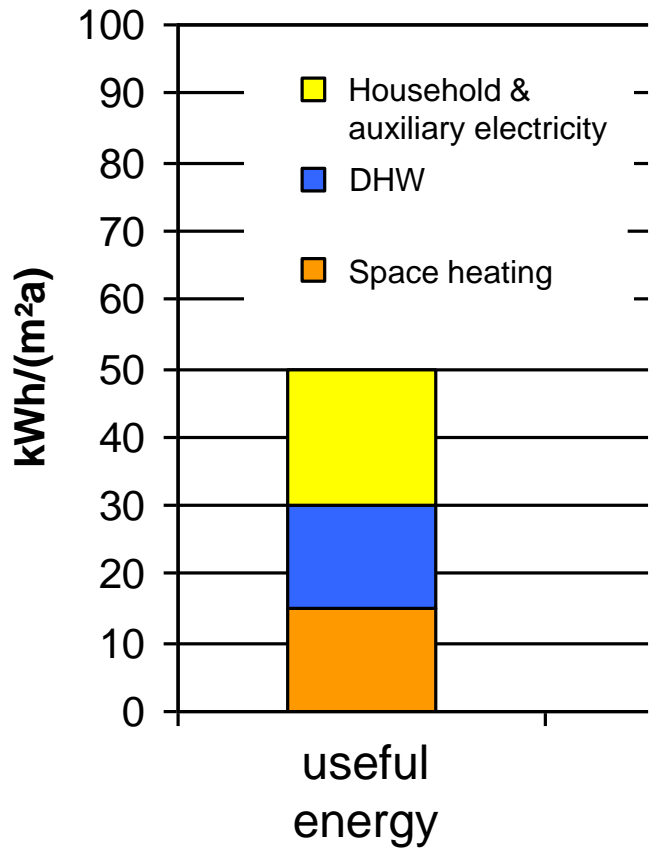


NZEB could also be a less energy efficient building “compensating” with renewable energy



Is primary energy a suitable indicator?

Primary energy as sustainability criteria?



- **Useful energy**

Only reliable indicator for the long-term performance of the building itself
PH = 15 kWh/(m²a) heating
NZEB = ?

- **System efficiency / overall performance**

- **Environmental impact**

- **Seasonal energy storage**

} **Limited resources**

An additional overall sustainability indicator is required
NZEB = PE, primary energy

Energy supply over the course of a year

(In this example: 41 m² PV + Wind)

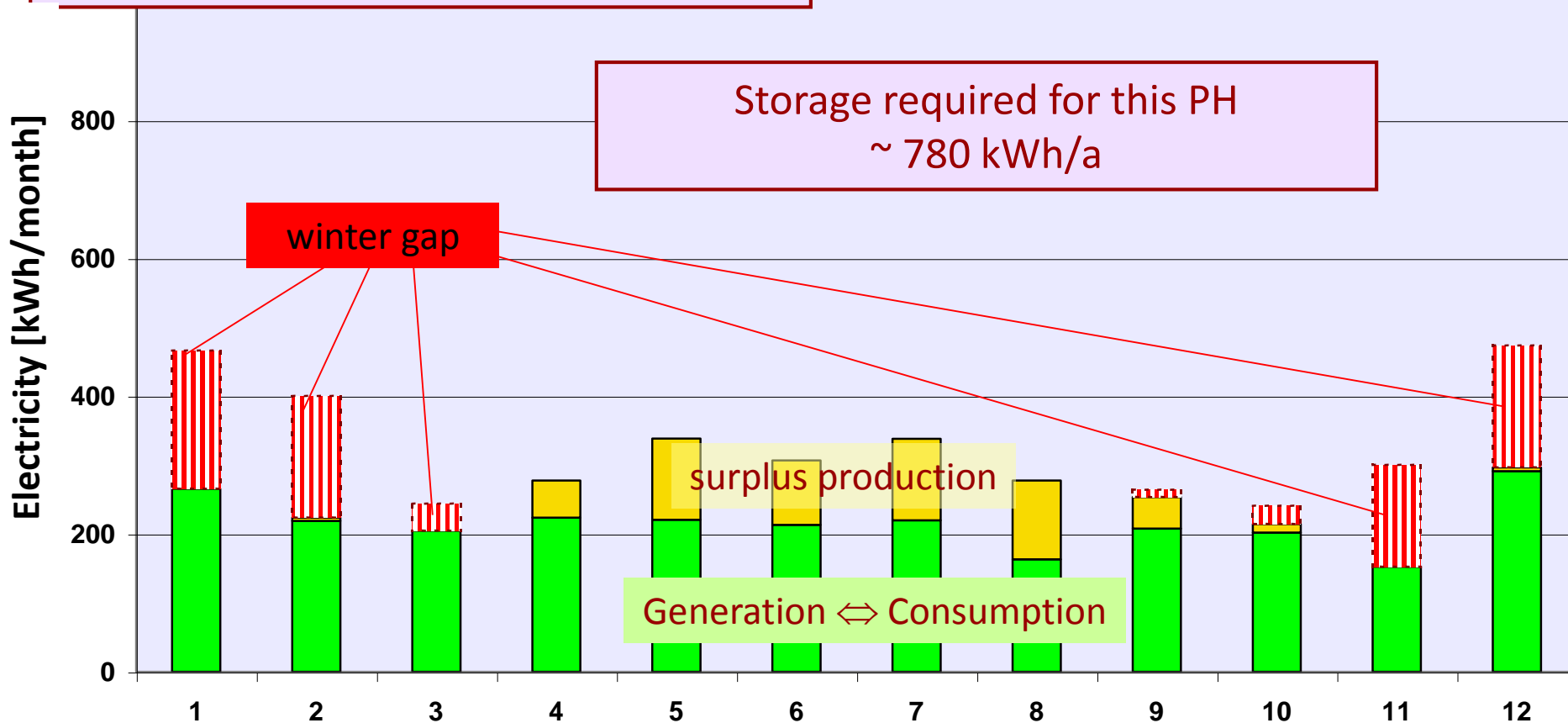
Seasonal energy storage required,
which will always imply energy losses

Storage required for this PH
~ 780 kWh/a

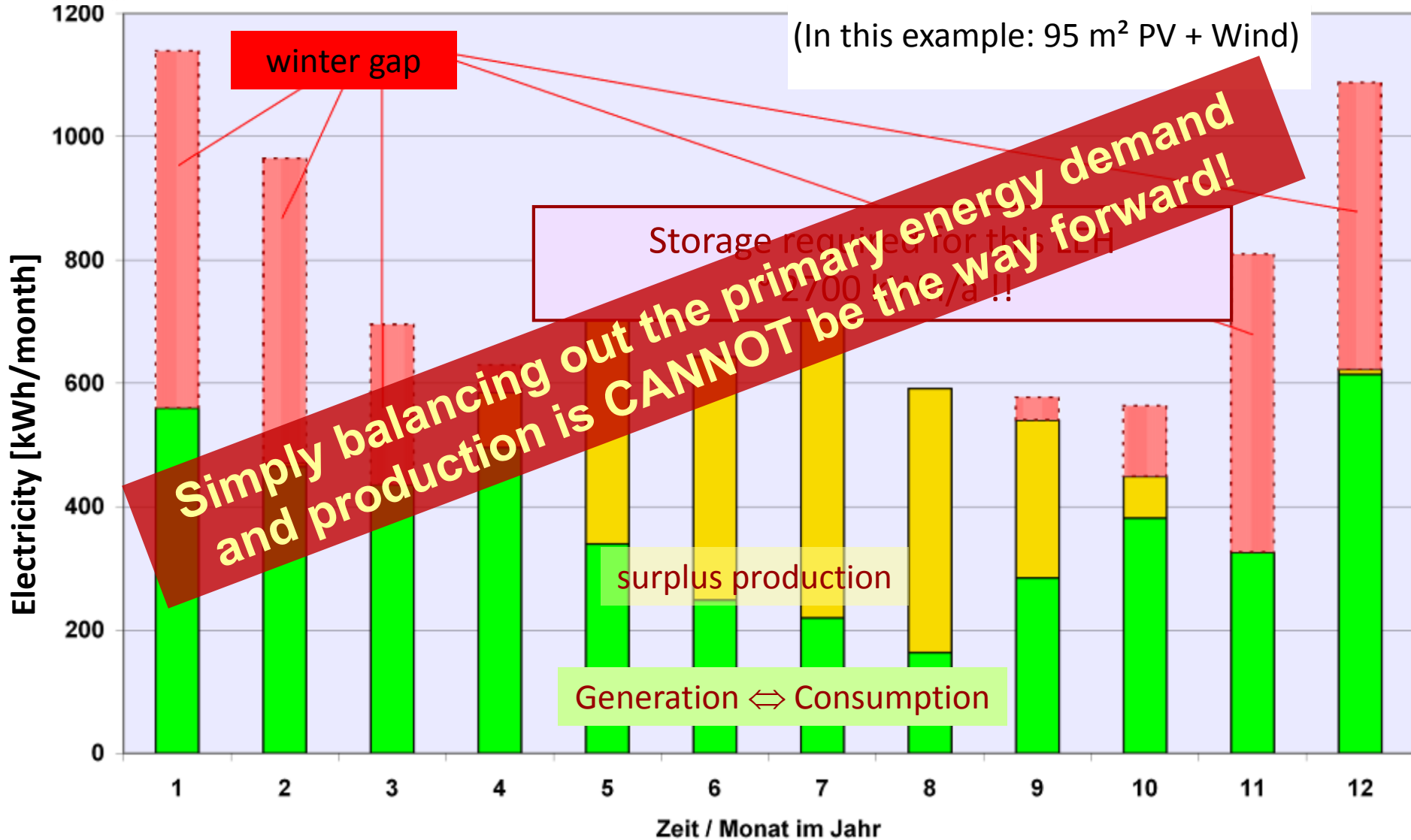
winter gap

surplus production

Generation \leftrightarrow Consumption



Energy supply over the course of a year



PE: Environmental impact / resources

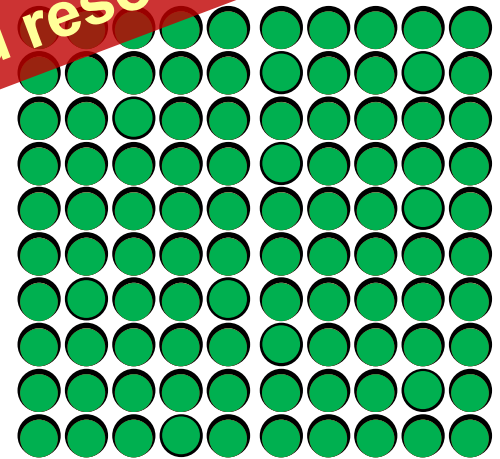
A typical existing detached home
needs 20 m³ fire-wood for its heating demand

- This house as such is carbon free
& has a low primary energy demand

A village of 100 houses aims for sustainable energy
supply; max 200 m³ fire-wood can be used annually.

- The resources only cover 1% typical buildings,
- The remaining 99 houses will have to resort to
other non-sustainable energy sources

**non-renewable primary energy alone is NOT
a suitable indicator for the
environmental impact & use of limited resources**

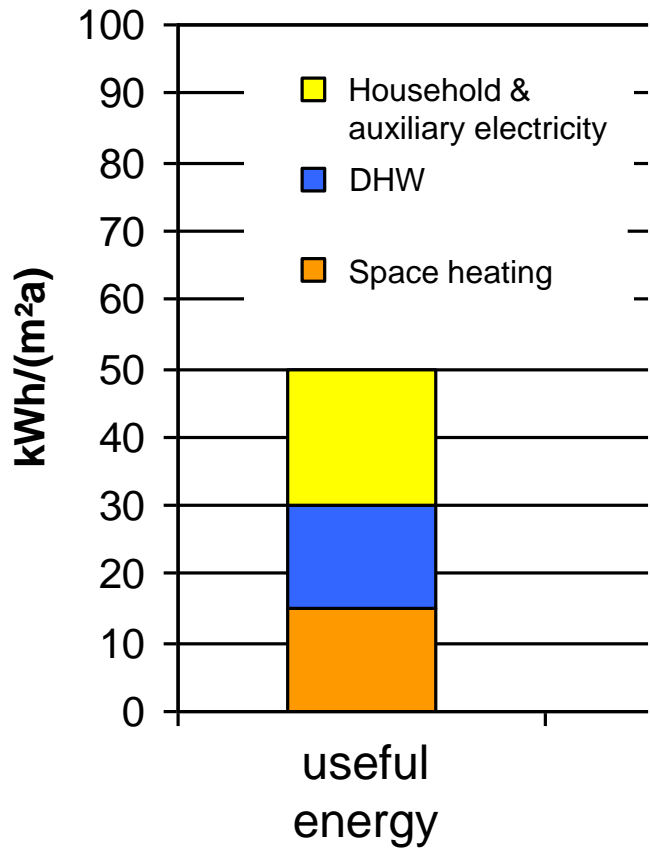


**The only way to achieve sustainable solutions is
to use the available resources responsibly.**

Efficiency is the key!



Primary energy as sustainability criteria?

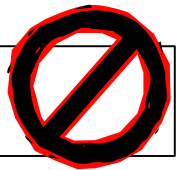


PH sustainability criteria = **NEW!**
PER, primary energy renewable

Details in afternoon
presentation:
Session 4
„standards & performance“

- **System efficiency / overall performance**
- **Environmental impact**
- **Seasonal energy storage**

Overall sustainability criteria
NZEB = PE, primary energy





Passivhaus = NZEB !!

All the requirements are met. It's tried and tested.



NZEB = Passivhaus ??

Not necessarily ...

... but it **CAN** and it **SHOULD** be !!

Efficiency must come first



PH is the very foundation of NZEB!

Speaker: Jessica Grove-Smith
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