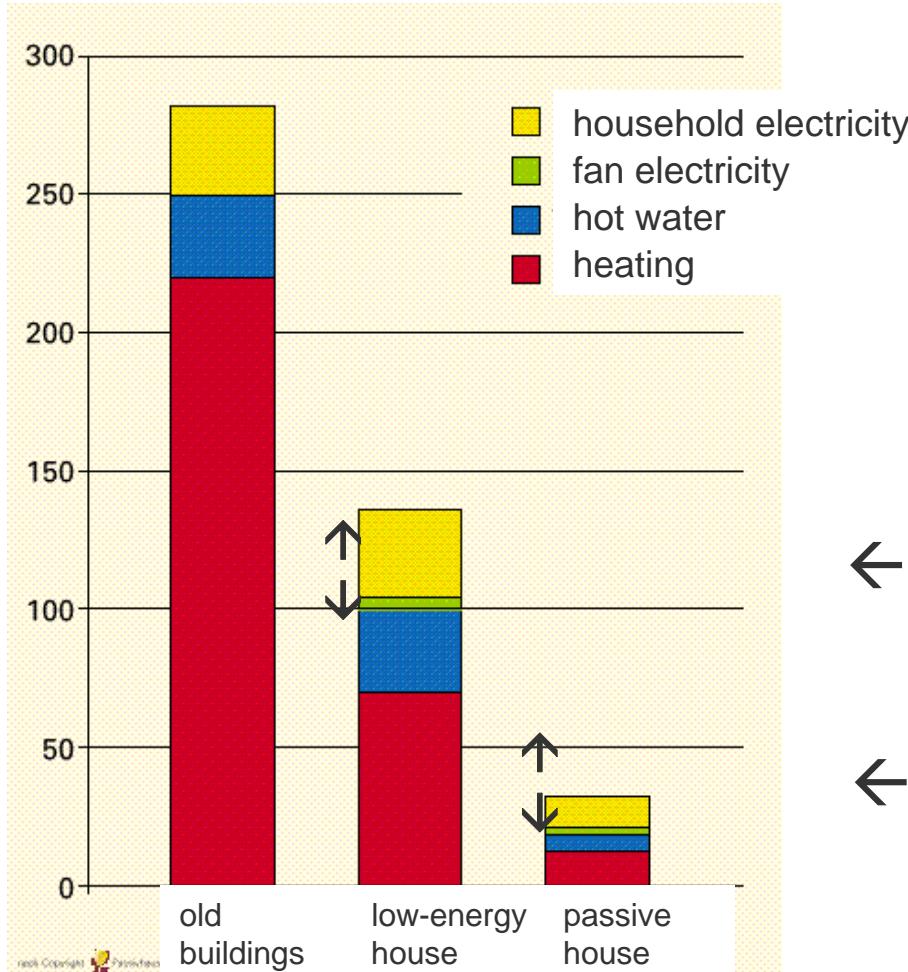


# Free State of Saxony



# Passive House

## Energy consumption kWh/(m<sup>2</sup> a)

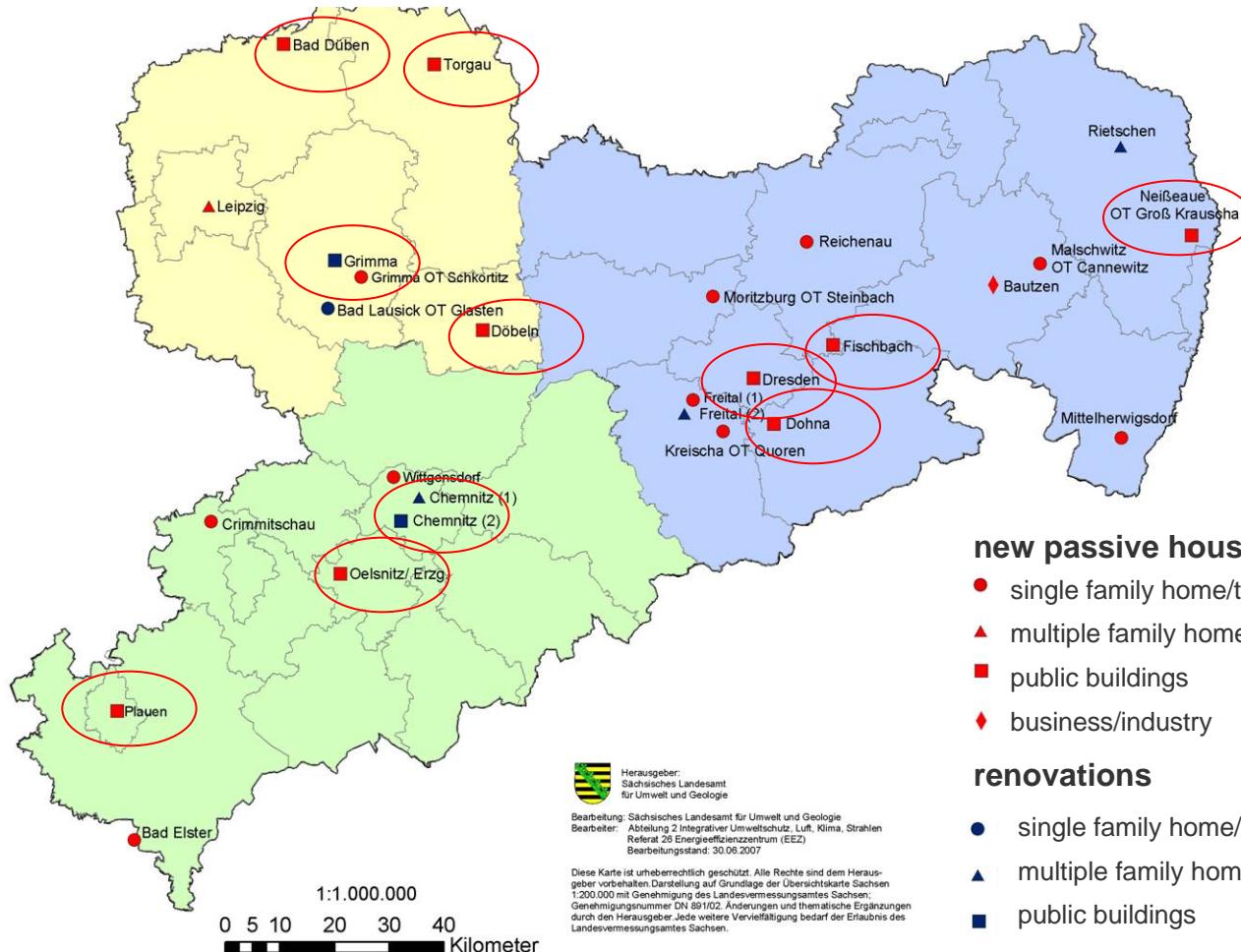


## Renovation targets:

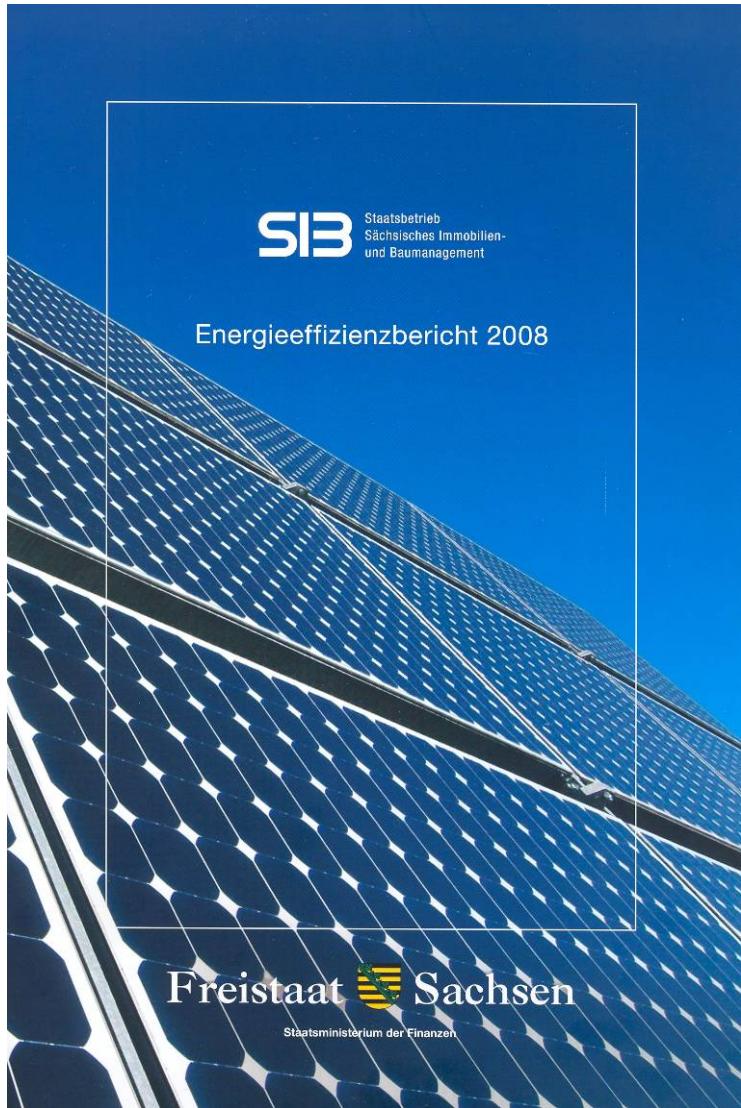
- ← EnEV\*: 140 % of new buildings
- ← high-efficiency renovation

\* German energy-saving act

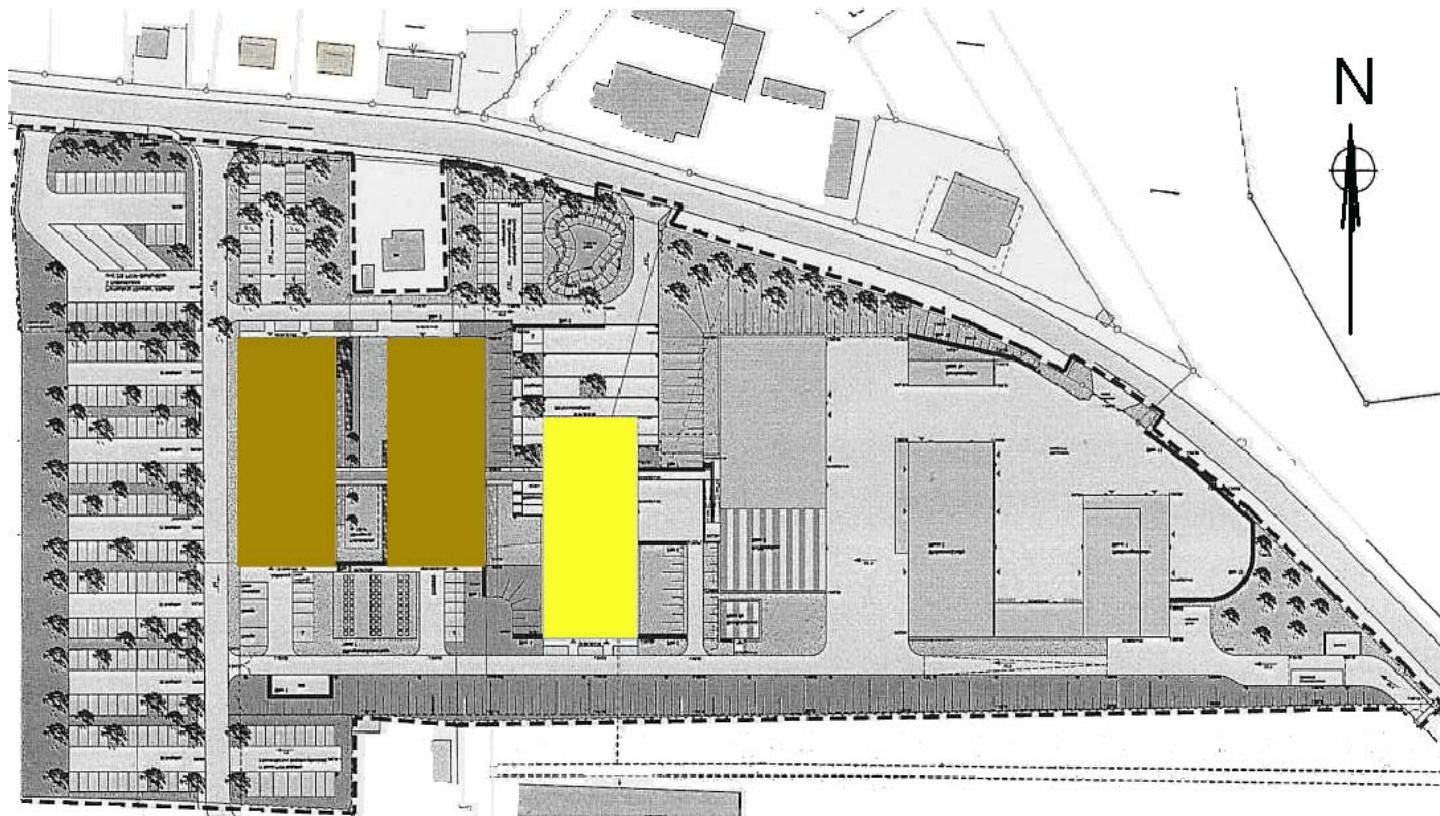
## Passive house locations in Saxony (state support programme)



# Saxon public record office (archive) passive house standard



# Office building and laboratories in Nossen



# What is a passive house?

- a technical building standard better than EnEV (German energy-saving act)
- realisable with all building- and insulation-materials
- max. heating load 10 W pro m<sup>2</sup> (*EnEV only 80 – 100 W per m<sup>2</sup>*) respectively annual heat demand max. 15 kWh per m<sup>2</sup> (*EnEV only 60 – 100 kWh / m<sup>2</sup>*)
- good air quality

# Main principles of a passive house

- excellent heat insulation
  - without thermal bridges and joints permeable to air
- high-efficiency windows
  - solar heat gains higher than heat losses (also in winter)
- ventilation with fresh air and high-efficiency heat recovery

## Main passive house criteria (1):

- max. heating load  $\leq 10 \text{ W/ m}^2$
- annual heat demand  $\leq 15 \text{ kWh/ (m}^2\text{a)}$
- primary energy demand  $\leq 120 \text{ kWh/ (m}^2\text{a)}$
- wall, roof and floor:  
heat transfer coefficient  
free of thermal bridges  $U < 0,15 \text{ W / (m}^2 \text{ K),}$
- windows:  $U_w \leq 0,8 \text{ W / (m}^2 \text{ K); } g \leq 50...60\%$

## Main passive house criteria (2):

- airtightness:  $n_{50} \leq 0,6 \text{ h}^{-1}$   
(max. 0,6-fold air exchange by 50 Pa pressure difference – verification with blower door test)
- additional / discharged air with heat recovery:  
heat delivery efficiency:  $\eta_{\text{eff}} \leq 75\%$   
electricity efficiency:  $p_{\text{el}} < 45 \text{ Wh/ m}^3$
- calculation with the passive house planning tool (PHPP)

# Kindergarten in Döbeln



source fotos: Reiter & Rentzsch, Dresden

wood, insulation with cellulose, wood-clay construction (inside walls)

554 qm floor area, wall heating, 10 qm solar-thermal area, rotating heat exchanger

# Renovation, Chemnitz

- year of construction: 1911
- floor area:  $A_{EB} = 445,6 \text{ m}^2$

before – ca. 320 kWh / m<sup>2</sup>a



source fotos: Taube, Chemnitz



after - 29 kWh / m<sup>2</sup>a

## renovation measures:

- roof insulation: 16 cm WLG 040 + 8 cm on top
- wall : 20 cm WLG 035
- cellar-ceiling: 14 cm WLG 040
- ventilation with 83 % heat recovery
- glycol-water heat pump and floor heating
- solar-thermal system for hot water

## Renovation of a school, Grimma

- year of construction: 1988
- floor area:  $A_{EB} = 2208 \text{ m}^2$

before – ca. 100 kWh / m<sup>2</sup>a



after - 14 kWh/ m<sup>2</sup>a

### renovation measures:

- roof insulation: 28 cm WLG 035
- wall: 24 cm WLG 040
- cellar: 14 cm WLG 040
- ventilation with 80% heat recovery
- 20,4 m<sup>2</sup> solar-thermal collector, existing district heating

## Renovation, Freital



source fotos: Arch.büro Herklotz

## Renovation, Rietschen



source fotos: Arch.büro Herklotz

# Montessori-school and kindergarten, Torgau

## „bale-of-straw construction“



source fotos: Mrs. Frankenstein-Krug / SAENA