



Energy Efficiency in Buildings

German Policy and Examples for Best-Practice

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Commissioner for Energy in Federal Buildings

Tasks:

- Minimization of the energy demand/consumption in Federal Buildings
- Optimization of the energy supply concepts in Federal Buildings
- Broad use of renewable energies
- Monitoring of assorted Federal Buildings in the first years of operation
- Certification of the Energy Demand regarding to EnEV 2007 for assorted Federal Buildings
- Consultation of the Ministry in questions of energy-saving in Buildings



Commissioner for Energy in Federal Buildings

Methods:

- Activities in Federal Building Projects
 - Definition of the specific energetic aims
 - Participation in meetings
 - Consultation of the building owner
 - Preparation of assessments to the achieved energetic quality in the different planning steps
- Monitoring of innovative systems (technical and structural)
- Monitoring of the Energy Consumption in assorted Federal Buildings



German Policy Objectives and Measures



Policy - Objectives

- Minimization of the energy demand/consumption
- Increase of the energy efficiency
- Reduction of emissions (especially greenhouse gases)
- Expansion of the use of renewable energies
- Improvement of the security of energy supplies
- Decoupling of economic growth and energy consumption



Meeting of the cabinet, Meseberg, 23./24. August 2007

➤ Integrated Energy and Climate Program



Policy - Objectives

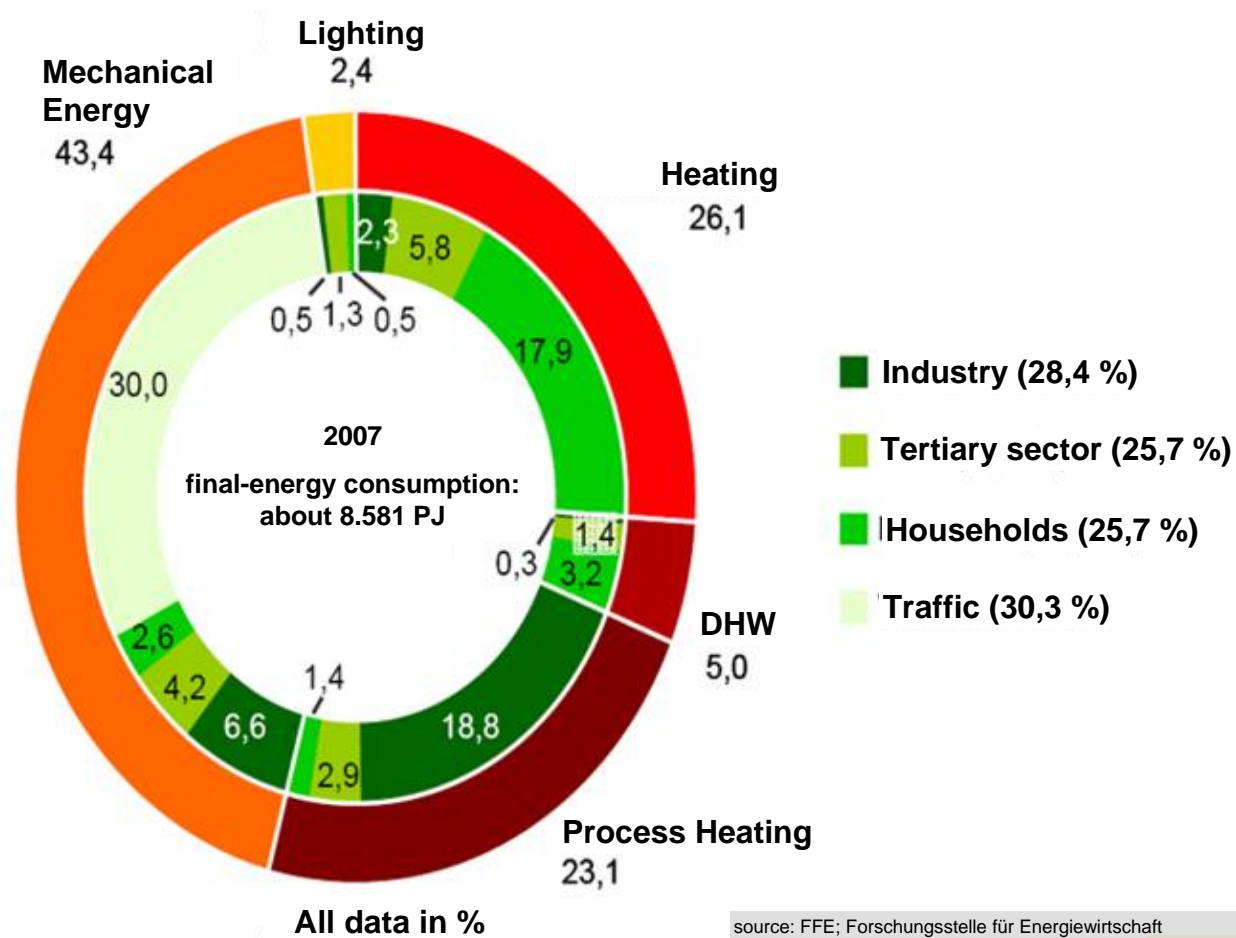
At the end of 2007 Germany has set up an Integrated Energy and Climate Program to meet the adopted goals by 2020:

- ➔ Reduction of energy consumption by 20%
(compared with the trend)
- ➔ Reduction of greenhouse gas emissions by a total of 40%
(compared to 1990)
- ➔ Increase share of renewable energy sources:
 - electricity produced from renewable energy to 25-30%
 - heat produced from renewable energy to 14%
 - useage of biofuels to 17%
- ➔ ...

➔ The German Building Sector plays an important role !



The German Building Sector - Energy consumption and Emissions

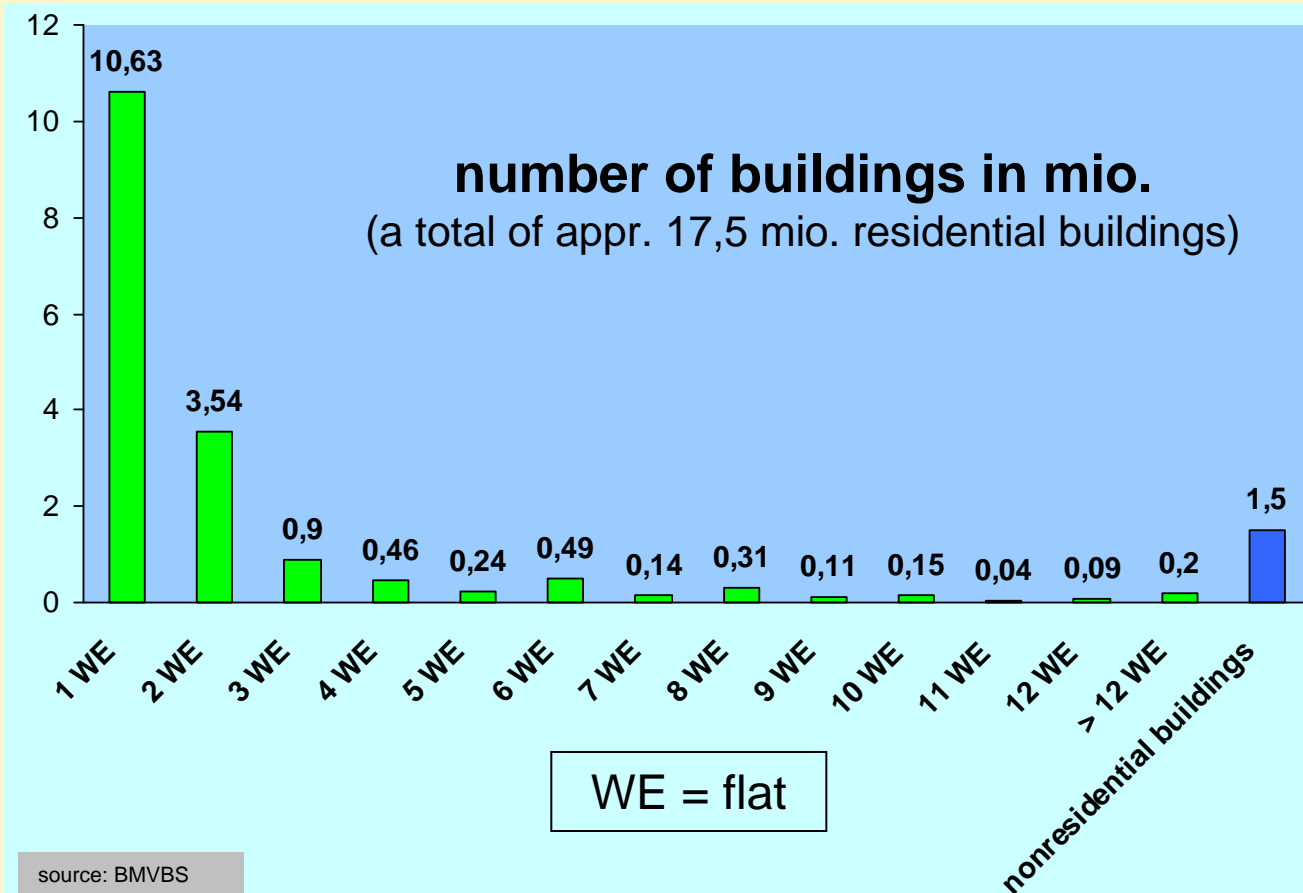


Building sector:

- about 40 % of the total final-energy consumption in Germany
- about 15 % of the total greenhouse gas emissions in Germany



The German Building Sector - Building stock



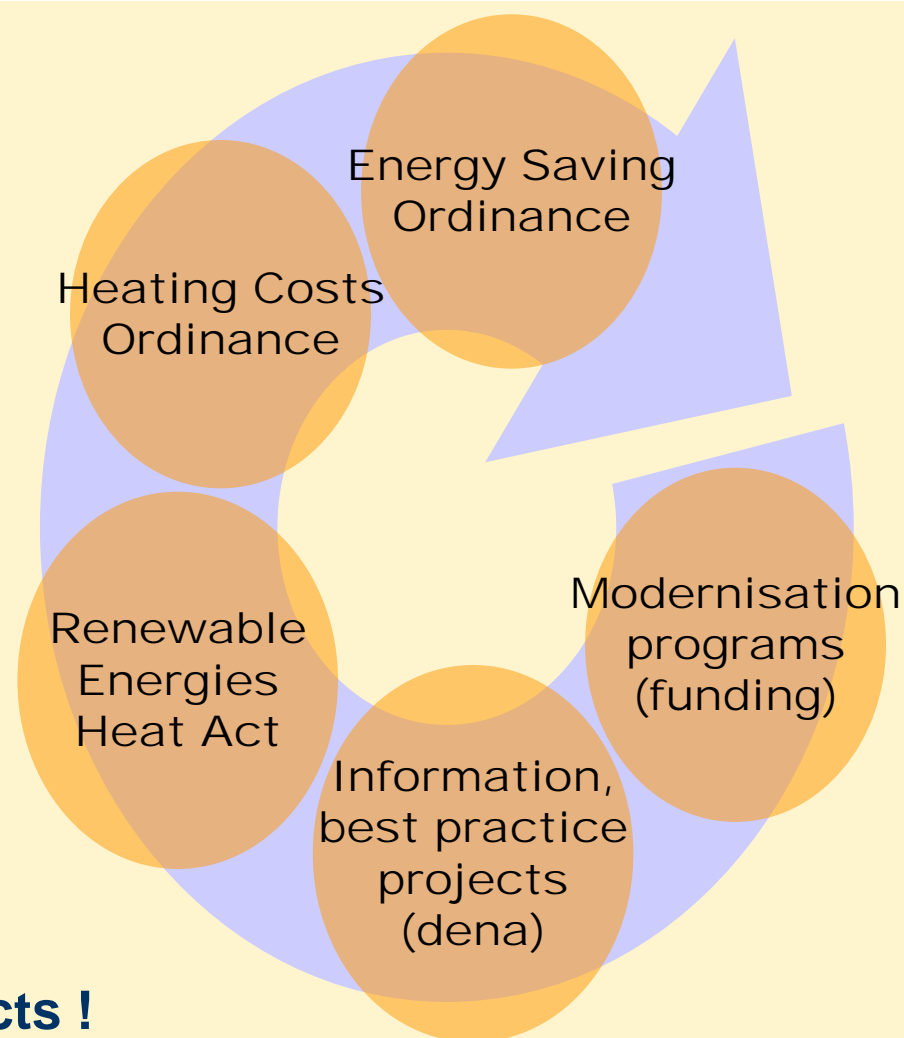
- Residential Buildings
→ about 66 % of the building related total final-energy consumption
- Non-Residential Buildings
→ about 33 % of the building related total final-energy consumption
- about 75 % of the buildings were erected before 1977 (1st Thermal Insulation Ordinance)
- The refurbishment-rate is about 1 %/a.



Policy – Measures in the Building Sector

Instruments to lower the energy demand/consumption in Buildings:

- Laws and Ordinances
- Financial Benefits
 - KfW – up to 1.35 billion €/a (2010) federal budget
- Information, Transparency in the market and Best Practice
 - German Energy Agency, Energy Certificates, etc.
- Research



Monitoring of the achieved effects !

source: BMVBS

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Policy – Measures in the Building Sector - European Level

- Energy Performance of Buildings Directive (2010/31/EU)
 - since 08.07.2010
 - to execute for residential and non-residential buildings
 - to execute for new buildings and for refurbishments of existing buildings
 - Requirements to:
 - a minimum standard of energy efficiency for certain technical systems in buildings (Heating, Ventilation, ...)
 - the energetical standard of the building envelope of new buildings
→ „Nearly Zero Energy Building“
 - others

There is a special responsibility in public building sector !



Policy – Measures in the Building Sector - National Level (1/2)

- Energy Saving Act
 - Energy Saving Ordinance
 - since 01.10.2009
 - to execute for residential and non-residential buildings
 - to execute for new buildings and for refurbishments of existing buildings
 - Requirements to:
 - Annual demand of primary energy
 - Energetical performance of the building envelope or single parts of the building envelope
 - Certification of the energy demand or the energy consumption
 - others

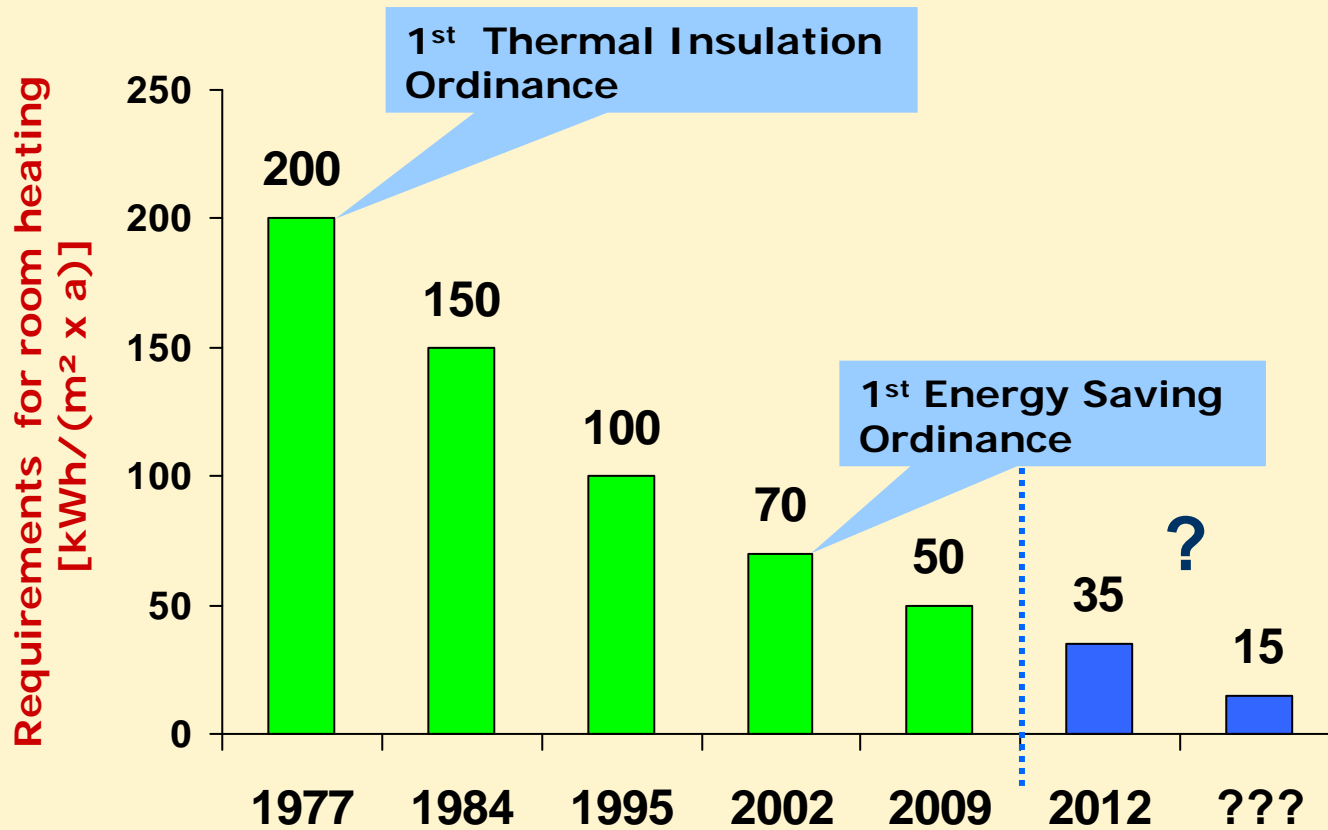
There is a special responsibility in public building sector !



Policy – Measures in the Building Sector

- Energy Saving Ordinance

Tightening of requirements to the energy demand of new buildings



source: BMVBS

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Policy – Measures in the Building Sector - National Level (2/2)

- Renewable Energies Heat Act
 - since 01.01.2009
 - to execute for residential and non-residential buildings
 - to execute only for new buildings
 - Requirements to the coverage of the energy demand for heating by using renewable energies:
 - solar thermal energy → minimum share of 15 %
 - Heat pumps → minimum share of 50 %
 - others
- The requirements of the Renewable Energies Heat Act are fulfilled too, if there is a certain undercut of the requirements of the Energy Saving Ordinance.

There is a special responsibility in public building sector !



Results and Experiences

- Federal Buildings -



Certification of the Energy Demand

- Balance Method

ENERGIEAUSWEIS

für Nichtwohngebäude
gemäß den §§ 16 ff. Energieeinsparverordnung (EnEV)

Gültig bis: 06.06.2017
Aushang

Gebäude

| | |
|-----------------------------------|---------------------------------|
| Hauptnutzung/ Gebäudekategorie | Verwaltungsgebäude, Ministerium |
| Sonderzone(n) | |
| Adresse | Invalidenstr. 44, 10115 Berlin |
| Gebäudeteil | Bestandsgebäude |
| Baujahr Gebäude | 1875 |
| Baujahr Wärmeerzeuger | 1999 |
| Baujahr Klimaanlage | 1999 |
| Nettogrundfläche | 12.568 m ² |

Primärenergiebedarf „Gesamtenergieeffizienz“

↓ Dieses Gebäude
127,3 kWh/(m²·a)

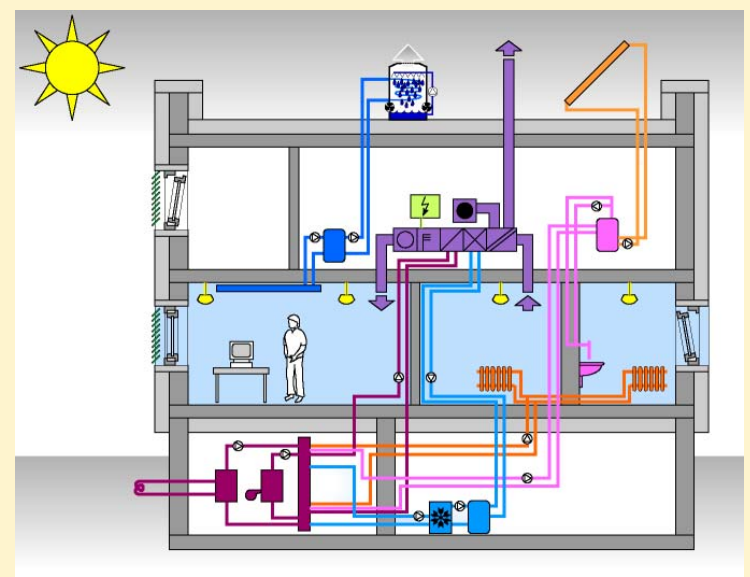
↑ EnEV-Anforderungswert
Neubau
↑ EnEV-Anforderungswert
modernisierter Altbau

Aufteilung Energiebedarf

Aussteller

07.06.2007
Datum

Böttcher
Unterschrift des Ausstellers



Balance Method: DIN V 18599

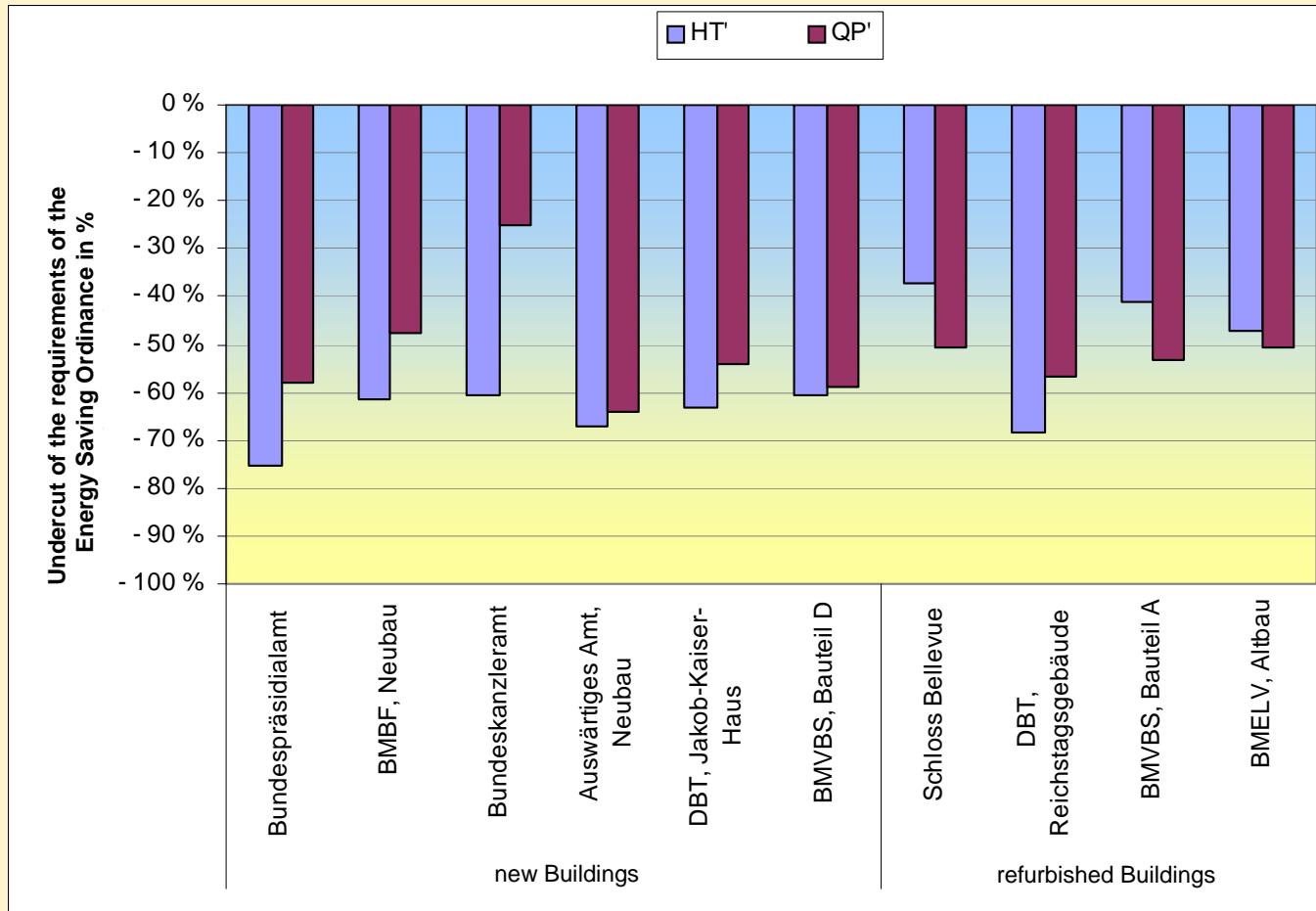
- Processes:**
- Heating
 - DHW
 - mechanical Ventilation
 - Cooling
 - Lighting

only non-residential buildings



Certification of the Energy Demand - assorted Federal Buildings in Berlin

Certification of the energy demand in assorted Federal Buildings



Mean undercut of the requirements of the Energy Saving Ordinance (2007):

- Annual primary energy demand:

- 50 % (new buildings)
- 45 % (refurbishment)

- Specific heat transfer coefficient (transmission):

- 55 % (new building)
- 40 % (refurbishment)



Results and Experiences

- Refurbishment Programs and Best Practice -

Results and Experiences

- Refurbishment Programs (Examples)

Low Energy Standard in Existing Buildings:



- Residential Buildings
 - EfficiencyHouse100 (equal to a New Building)
 - EfficiencyHouse70 (better than a New Building)

 - Non-Residential Buildings
 - Schools
 - Kindergarden
 - ...
- Promotion of the organisatoric and functional part by dena
- Promotion of the financial part by the KfW Banking Group



Results and Experiences

- Best Practice (Example)

„Low energy standards in existing buildings“

An example of the modernization program:

Leipzig before refurbishment





Results and Experiences

- Best Practice (Example)

Measures how to reach the low-energy standard

| Component | before refurbishment | measures taken | after refurbishment |
|------------------|---|---|---|
| exterior walls | 1.27 W/(m ² K) | 15 cm insulation | 0.20 W/(m ² K) |
| roof | 0.97 W/(m ² K) | 20 cm insulation | 0.17 W/(m ² K) |
| basement ceiling | 1.19 W/(m ² K) | 10 cm insulation | 0.28 W/(m ² K) |
| thermal bridges | 0.10 W/(m ² _{surface area} K) | standard measures | 0.05 W/(m ² _{surface area} K) |
| windows | 3.20 W/(m ² K) | two-pane heat-insulating glazing, conventional windows | 1.1 W/(m ² K) |
| ventilation | natural ventilation | ventilation with heat recovery | system efficiency > 80 % |
| heating systems | steady-temperature boiler | new boiler, regulated pumps | condensing boiler |

Results and Experiences

- Best Practice (Example)



Leipzig after refurbishment: Better than a new building !

- **Primary energy demand:**

| | |
|-----------------------------|--------------------------|
| before refurbishment | 184 kWh/m ² a |
| after refurbishment | 44 kWh/m ² a |
| energy savings | 76 % |

- Requirements for new building (EnEV 2007) max. 72 kWh/m²a

- **Rent** before 3.12 €/m²
afterwards 4.70 €/m²

- **Vacancy** before 40 %
afterwards **waiting list**



Results and Experiences

- Best Practice

Results of research program EnSan:

- Part of the research program



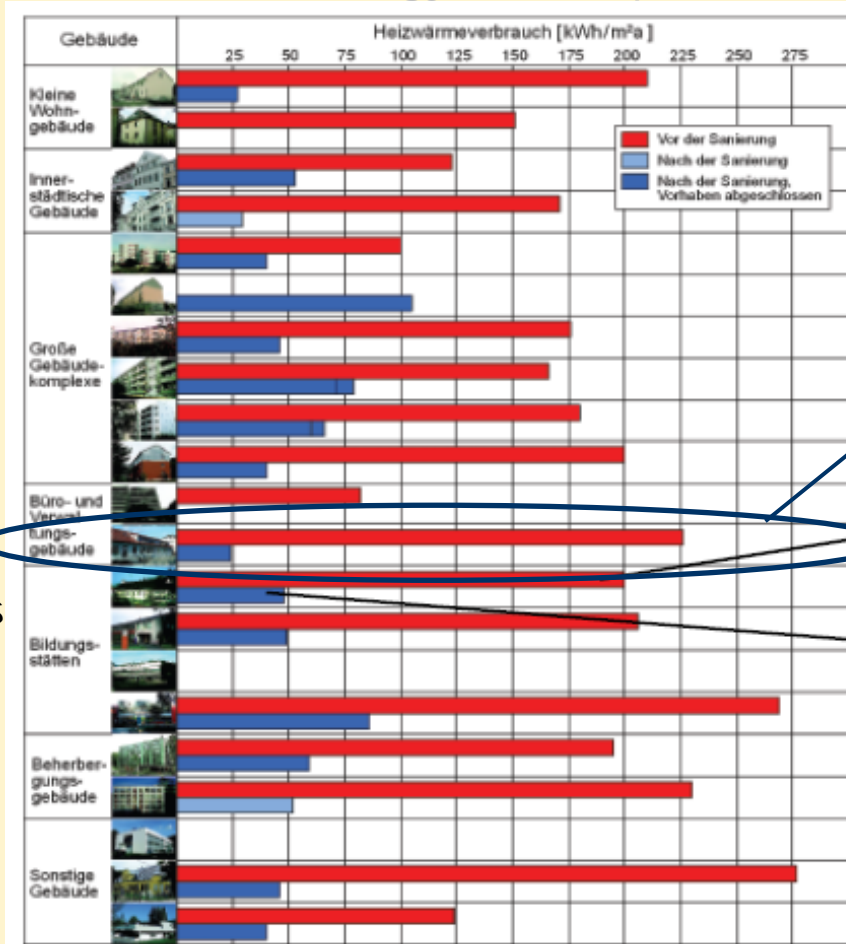
for residential and non-residential buildings

- Demonstration projects as „Best practice“

- www.enob.info

source: Fraunhofer IBP

Reduction of energy consumption for Heating and DHW



Refurbishment by Factor 10

before retrofit

after retrofit





Building the Future

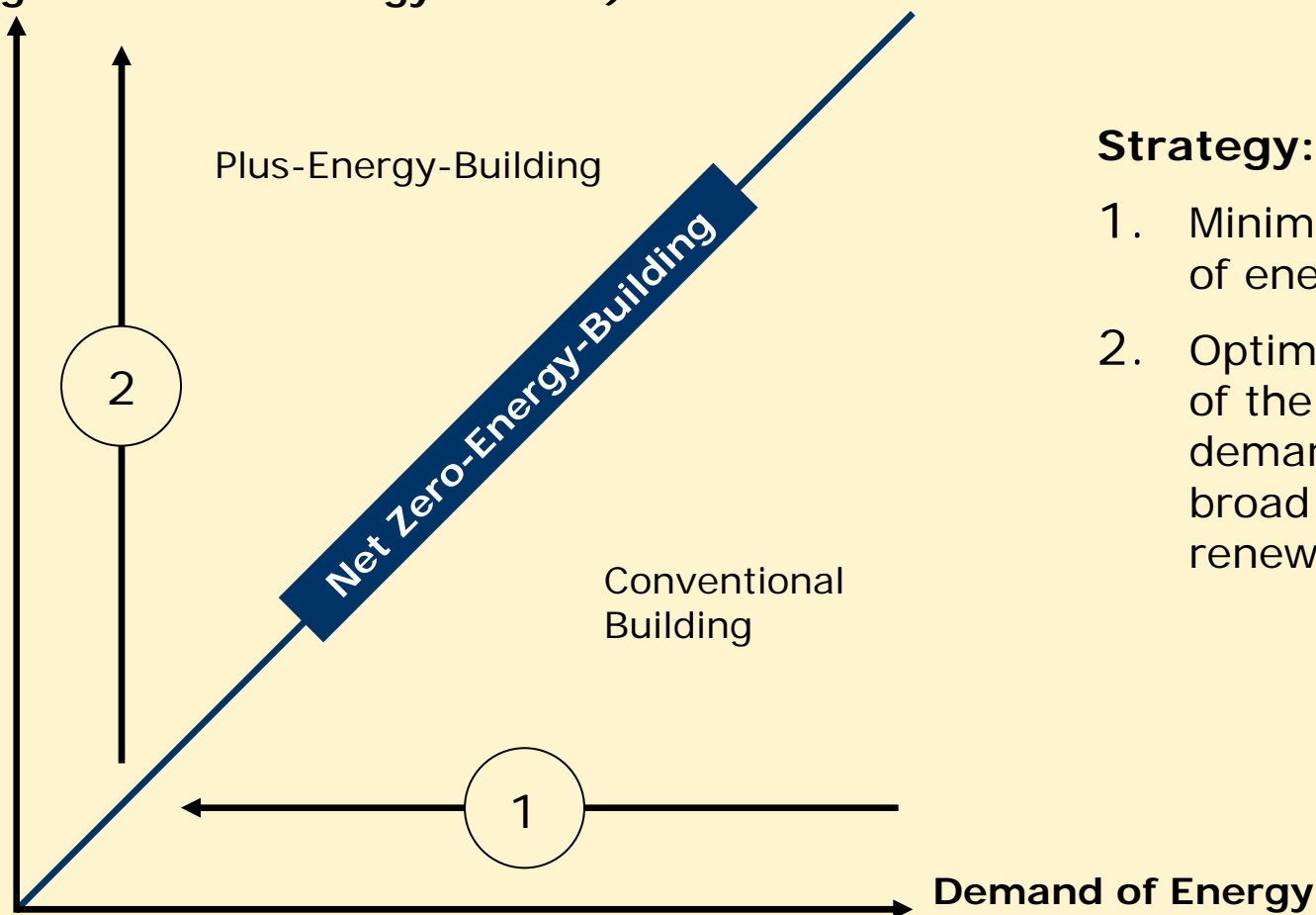
Pilot Project „Zero-Energy-Building“ for Federal Purposes



Pilot Project „Zero-Energy-Building“ - Strategy

Production of Energy

(using renewables energy sources)



Strategy:

1. Minimize the demand of energy
2. Optimize the coverage of the minimized demand of energy by a broad use of renewable energies



Pilot Project „Zero-Energy-Building“ - Facts

Objective:

Erection of a Zero-Energy-Building for purposes of a Federal Institution

- Location: Berlin
- Use: Office Building
- Occupancy: about 30 Persons
- Area: about 1.000 m² net floor area

Costs:

about 3 Mio. € in total

Funding:

The funding is intended by financial resources of the „Konjunkturprogramm II“ (about 2 Mio. €) and by financial resources from the budget of the Federal Institution (about 1 Mio. €).

Pilot Project „Zero-Energy-Building“

- Examples for measures

Building Envelope (U-Values):

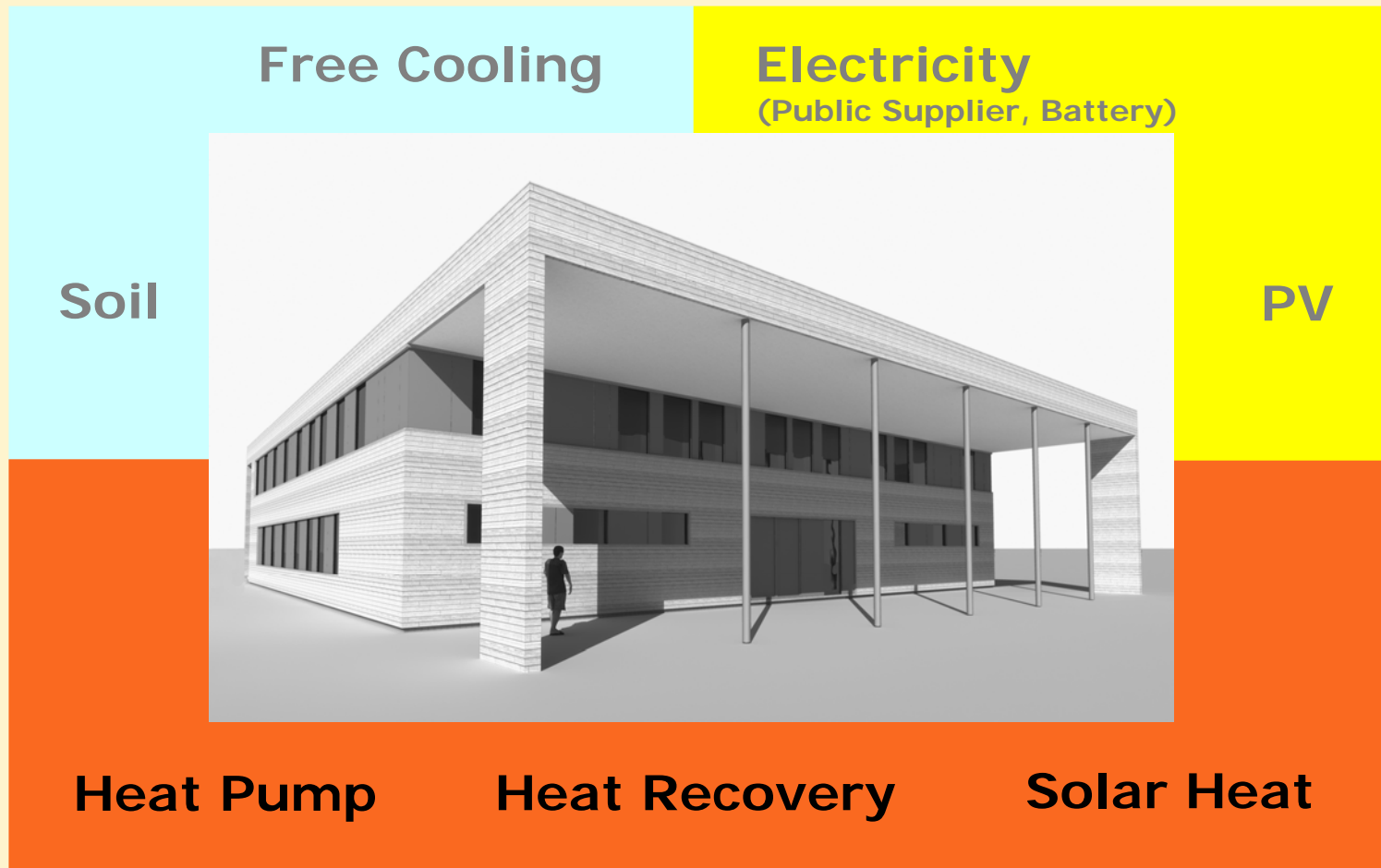
- External Wall: 0,09 W/(m²K)
- Roof: 0,08 W/(m²K)
- Bottom Slab: 0,11 W/(m²K)
- Windows: Glass – 0,51 W/(m²K)
Frame – 0,72 W/(m²K)

Technical Systems:

- Lighting: electronic ballast
control depending on presence and daylight
- Ventilation: high efficient fans
minimal pressure losses in the air-system
- Auxiliary Energy: controlled, high efficient pumps
- Equipment: high level of energy efficiency

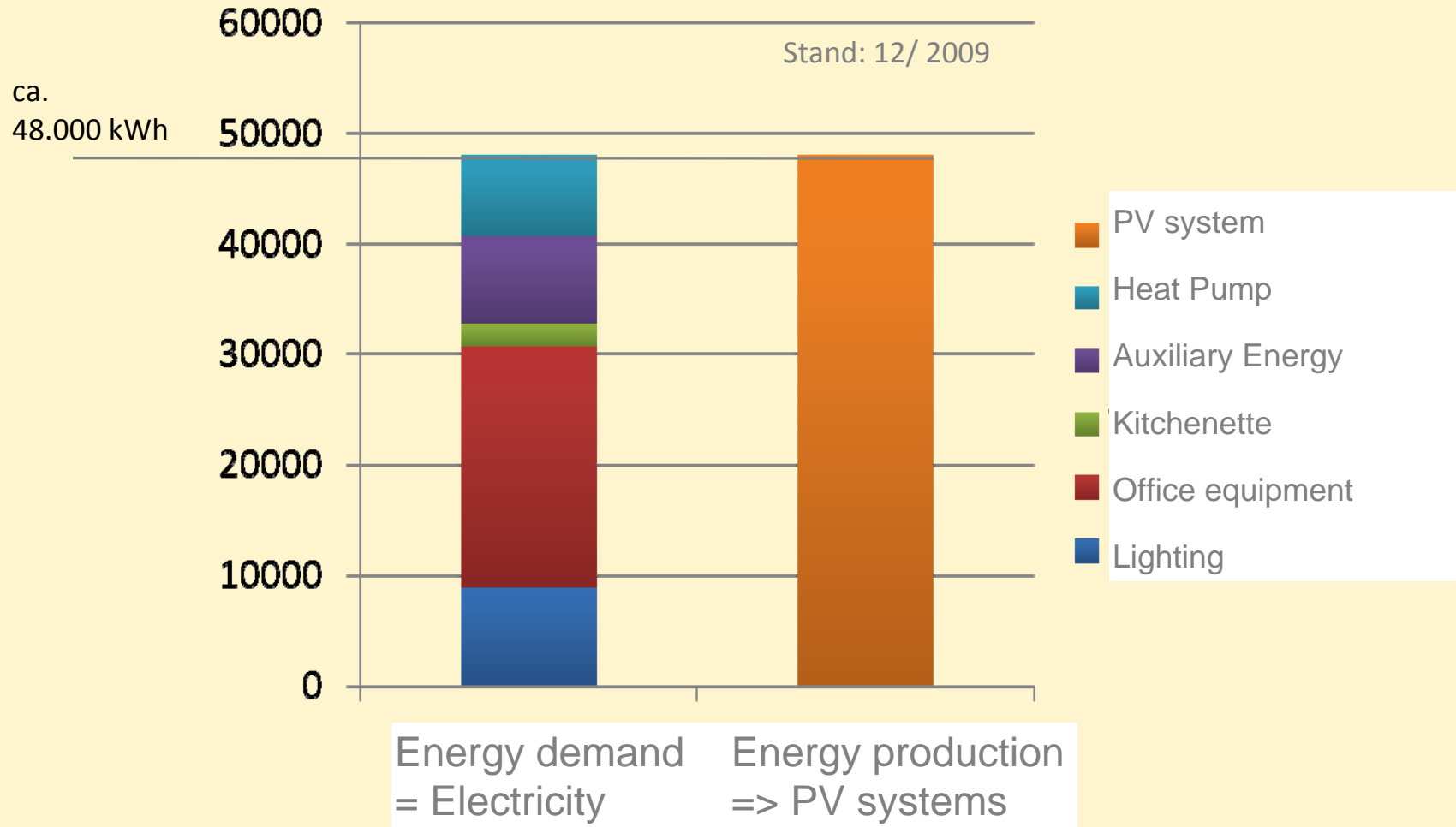


Pilot Project „Zero-Energy-Building“ - Energy Supply Concept



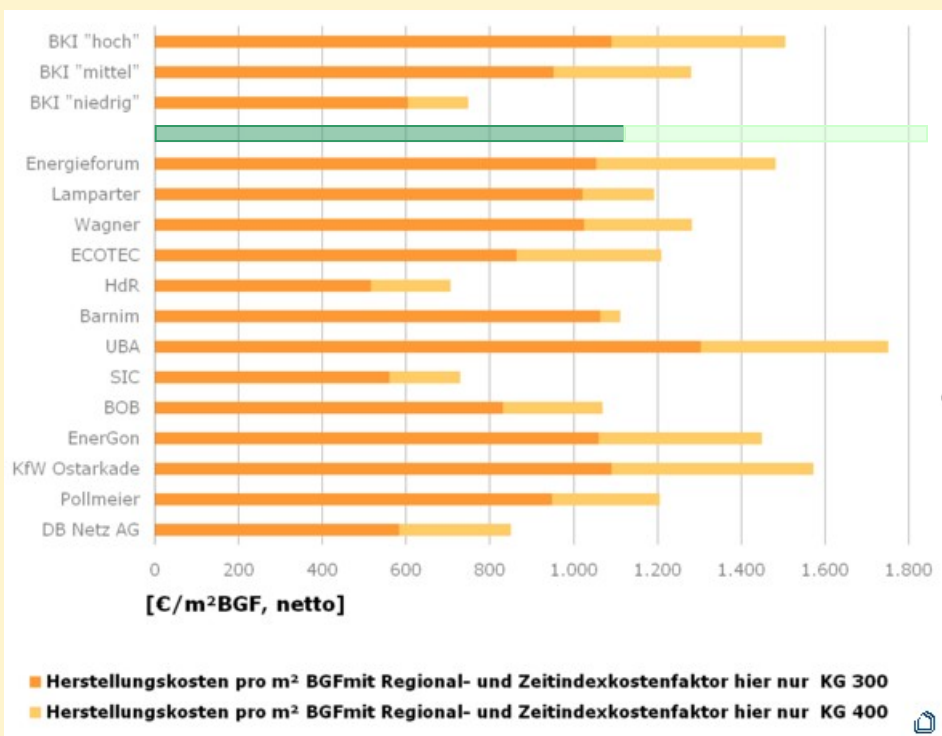


Pilot Project „Zero-Energy-Building“ - Energy Balance

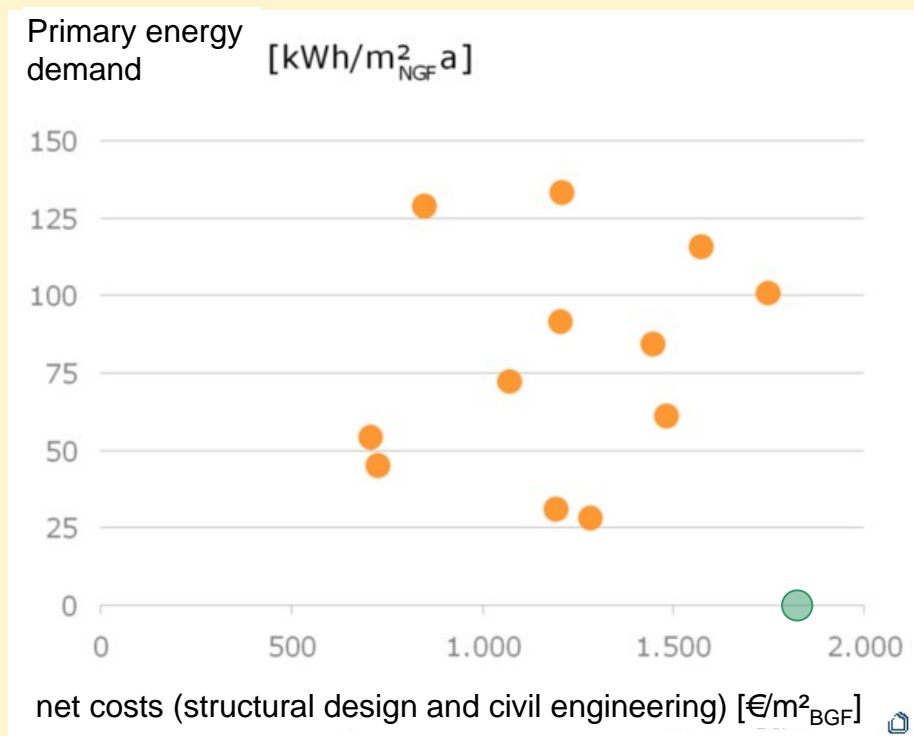




Pilot Project „Zero-Energy-Building“ - cost assessment comparison with other projects (EnOB)



Quelle: EnOB



Quelle: EnOB

Result:

The improvement of the energy efficiency of buildings does not cause obligatorily higher costs.

The decisions in the planning process are most important for cost reductions.



Summary

- The public building sector has a special responsibility in the field of energy efficiency and the protection of the climate. The Federal Government does accept these special responsibility.
- The German Government has started a lot of activities to reduce the energy demand in buildings at an early stage.
- There are National Regulations for the energy demand in residential and non-residential buildings. The National Regulations are adjusted in time regarding to the European Regulations.
- There are Refurbishment Programs and Best Practice Projects with focus on the improvement of the energetic standard of buildings.
- There are continuative regulations for Federal Buildings:
 - Commissioner for energy in Federal Buildings
 - Guideline for Sustainable Building
 - ...
- A pilot project „Zero-Energy-Building“ was started. In the project the annual final-energy demand of a federal building is totally covered by renewable energies.



Thanks for your attention !