Climate Protection in the Building Sector

- The German strategy to improve energy efficiency in the building sector and the leading role of public buildings

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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 Energy Saving Ordinance for assorted Federal Buildings
- Consultation of the Ministry in questions of energy-saving in Buildings
Background information - building sector in Germany

- approx. 40% of the total final energy use in Germany
- approx. 20% of the total CO₂-Emissions in Germany
- Residential buildings → approx. 66% of the building related final energy use
- Non-residential buildings → approx. 33% of the building related final energy use
- More than 66% of all buildings were erected before the 1st Thermal Insulation Ordinance came into effect in 1977.
- Refurbishment rate is approx. 1%/a
Improving the Energy Performance - boundary conditions

Political objectives:
- Satisfaction of people
- Economic growth
- Climate protection
- Energy efficiency
- …

International and European requirements:
- COP 21
- EPBD (2010/31/EU)
- EED (2012/27/EU)
- …

National boundary conditions:
- Climate
- Economy
- Prices
- Building culture
- Users
- …
German Policy  
- measures in the building sector

Stipulation
Setting a minimum standard of energy efficiency by laws and ordinances with respect to:

• specific economic conditions
• specific climatic conditions
• specific cultural conditions
• ...

Promotion
Promoting energy efficiency standards which are more ambitious than the minimum standard by financial and fiscal measures:

• subsidies
• loans
• payback bonuses
• ...

Information I
Gathering practical experiences and publishing information about nZEB by research programmes, best-practice-projects and information campaigns.

Information II
Training of planners and craftsmen to explain the new challenges and to show possible solutions by specific campaigns.
German Political Parameters  
- national level (1/2)

- **Energy Saving Act** → Energy Saving Ordinance (EnEV)
  - since 01.05.2014
  - 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
    - Energetic 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!
Certification of the Energy Demand - balance method

Balance Method: DIN V 18599

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

only non-residential buildings
German Policy
- tightening of requirements to the energy demand
German Political Parameters
- national level (2/2)

• Renewable Energies Heat Act (EEWärmeG)
  - since 01.01.2009
  - to execute for residential and non-residential buildings
  - to execute for new buildings in general, but also for refurbishments of existing buildings in public building sector
  - Requirements to the coverage of the energy demand for heating and/or cooling by using renewable energies:
    - solar thermal energy \(\rightarrow\) minimum share of 15 %
    - Heat pumps \(\rightarrow\) minimum share of 50 %
    - others (\(\rightarrow\) 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!
Improving the Energy Performance - strategy

Generation 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
Energetic Target Specifications for Federal Buildings
Target Specifications for Federal Buildings
- status quo

Sustainability Strategy, Board of State Secretaries (06.12.2010 and 30.03.2015)
„Program - Measures for Sustainability in Administration“

... following up to the negotiated agreement of the Federal Government from 18.10.2000 the agreed reduction of CO₂ until 2020 will be tightened from 30 % to 50 % (regarding to the emissions of 1990).

... a roadmap for the energetic refurbishment of Federal Buildings has to be developed. The scope of that roadmap is a climate neutral portfolio (in a range of - 80% regarding to the annual primary energy demand of 2010) until 2050 and a reduction of the demand of final energy for room heating by 20 % until 2020 (basis: 2010).

About the results of the practical implementation of the roadmap has to be reported in an annual „Energy and CO₂ Report“. ...

Energy Concept of the Federal Government, 06.06.2011
„Eckpunkte – Der Weg zur Energie der Zukunft“

... The German Federal Government takes the lead:
   From 2012 all new Federal Buildings are going to fulfill the Nearly-Zero-Energy-Standard. ...
Results for Federal Buildings
- existing buildings


… The Federal Government takes the lead. In all Federal Building Projects has to be achieved a certain minimal undercut of the general energetic requirements regarding to the Energy Saving Ordinance 2013. In the cases of the erection of new buildings or broad refurbishments of existing buildings:

- Annual primary energy demand: - 20 %
  (in case of using heat from CHP: - 30 %)

- Mean of the heat transfer coefficient: - 30 %

In cases of the refurbishment of single building parts in existing buildings the energetic quality of the new building parts shall be better than the corresponding general requirements of the Energy Saving Ordinance 2013. The specific degree of the undercut has to be cost effective. …

Due to the tightening of the requirements of the Energy Saving Ordinance for new buildings from 01.01.2016 a new standard for the new buildings of the Federal Government has to be developed. This process is still going on.
Results and Best Practice Examples for Federal Buildings
Federal Buildings
- best-practice-examples

UBA, Dessau

UBA „Haus 2019“, Berlin

2005  2007  2009  2011  2013  2018

UBA Erweiterung, Dessau

BMU, Berlin

Facilitator

Quelle: Anderhalten Architekten

Foto: BBSR

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Building envelope (U-Values):
- External Wall: 0.15 W/(m²K)
- Roof: 0.12 W/(m²K)
- Bottom Slab: 0.29 W/(m²K)
- Windows: 1.2-1.4 W/(m²K)

Technical Systems:
- Lighting: electronic ballast; control depending on presence and daylight
- Ventilation: controlled high efficient fans; minimal pressure losses in the air system
- Auxiliary Energy: controlled, high efficient pumps
**BMU Berlin - Energy Concept**

**Building envelope refurbishment (U-Values):**
- External Wall: 0.15 – 1.06 W/(m² K)
- Roof: 0.12 – 0.17 W/(m² K)
- Bottom Slab: 0.18 – 0.28 W/(m² K)
- Windows: 1.4–1.7 W/(m² K)

**Technical Systems:**
- External Wall: 0.11 – 0.17 W/(m² K)
- Roof: 0.11 W/(m² K)
- Bottom Slab: 0.11 W/(m² K)
- Windows: 0.76 W/(m² K)

**Building envelope new building (U-Values):**
- External Wall: 0.11 – 0.17 W/(m² K)
- Roof: 0.11 W/(m² K)
- Bottom Slab: 0.11 W/(m² K)
- Windows: 0.76 W/(m² K)

**District Cooling**
- Free Cooling

**District Heating**
- Heat Recovery

**Electricity (power supplier)**

**Heat Pump (waste water)**

**Fuel Cell (FC) (natural gas)**

- **FC**
- **PV**

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UBA – 1st Federal Net-Zero-Energy-Building - Energy Concept

Building envelope (U-Values):
- External Wall: 0.10 W/(m²K)
- Roof: 0.08 W/(m²K)
- Bottom Slab: 0.11 W/(m²K)
- Windows: 0.80 W/(m²K)

Technical Systems:
- Lighting: electronic ballast; control depending on presence and daylight
- Ventilation: controlled high efficient fans; minimal pressure losses in the air system
- Auxiliary Energy: controlled, high efficient pumps
- Office equipment: high energy efficiency

Electricity demand: approx. 46,000 kWh/a
Calculated PV-generation: approx. 53,000 kWh/a
UBA – 2nd Federal Net-Zero-Energy-Building - Energy Concept

**Building envelope (U-values):**
- External wall: 0.14 W/(m²·K)
- Roof: 0.10 W/(m²·K)
- Bottom slab: 0.17 W/(m²·K)
- Windows: 0.80 W/(m²·K)

**Technical systems:**
- **Lighting:** electronic ballast; control depending on presence and daylight
- **Ventilation:** controlled high efficient fans; minimal pressure losses in the air system
- **Auxiliary Energy:** controlled, high efficient pumps
- **Office equipment:** high energy efficiency

**Electricity demand:**
approx. 78.000 kWh/a

**calculated PV-generation:**
approx. 83.000 kWh/a

*Quelle: BBSR Berlin*
Improving the Energy Performance - strategy to achieve nZEB-standard

Building related Energy Demand:
- Building Envelope
- Thermal Bridges
- Air Tightness
- Compactness
- Share of Windows
- Shading Devices
- …
- Photovoltaics
- Solar Thermal Collectors
- Ground Water / Heat
- Air
- Other Environmental Potential

User related Energy Demand:
- Number of Technical Equipment
- Quality of Technical Equipment
- Operating Time of Building
- Operating Time of Equipment
- …
## Improving the Energy Performance - strategy to achieve nZEB-standard

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Challenges for the future

• An integral view on building, technical equipment and site located options is required.

• The implementation of the use of renewable energies will cause a greater number of energy supply solutions. This requires more effort:
  • to find optimal combinations of the different measures to improve the energy efficiency of a building.
  • to accompany the operation of a building.
  • to tap the full potential of the measures to improve the energy efficiency of a building.

• We have to find an optimal mix between security of energy supply, protection of the climate and economic aspects.
Summary

- In Germany 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.

- 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 this special responsibility.

- There are continuative regulations for Federal Buildings:
  - Commissioner for Energy in Federal Buildings
  - Roadmap for the energetic refurbishment of Federal Buildings to achieve a climate neutral stock until 2050
  - New buildings have to fulfill the nearly zero energy standard
  - Guideline for Sustainable Building
  - Assessment System Sustainable Building „BNB“
  - …
Thanks for your attention!

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