

Climate Protection in the Building Sector

- Energy Efficiency Standards and Experiences in Federal Buildings in Germany

Dr.-Ing. Olaf Böttcher

- Commissioner for Energy in Federal Buildings -

Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) within the Federal Office for Building and Regional Planning (BBR)

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Federal Institute for
Research on Building,
Urban Affairs and
Spatial Development

within the Federal Office for
Building and Regional Planning



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 Energy Saving Ordinance for assorted Federal Buildings
- Consultation of the Ministry in questions of energy-saving in Buildings

Energetic Target Specifications for Federal Buildings

Energetic 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).

... until the end of the actual legislative period 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 Federal Government takes the lead: From 2012 all new Federal Buildings are going to fulfill the Nearly-Zero-Energy-Standard. ...

Results for Federal Buildings

- New and Existing Buildings

Edict of the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety from 10.06.2014

... 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:

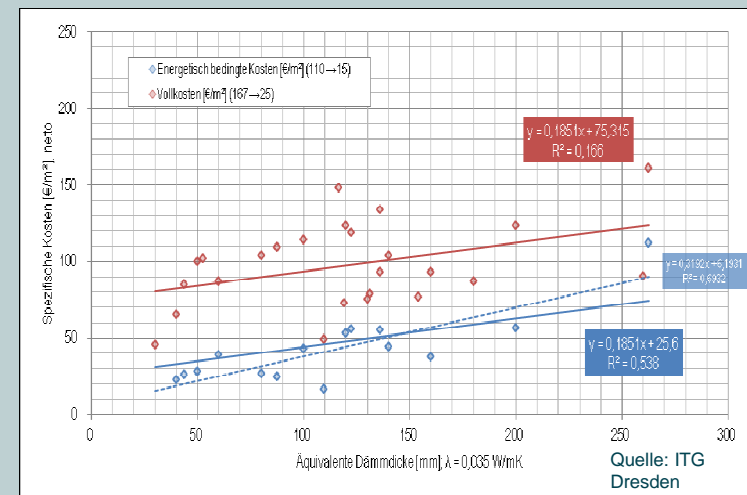
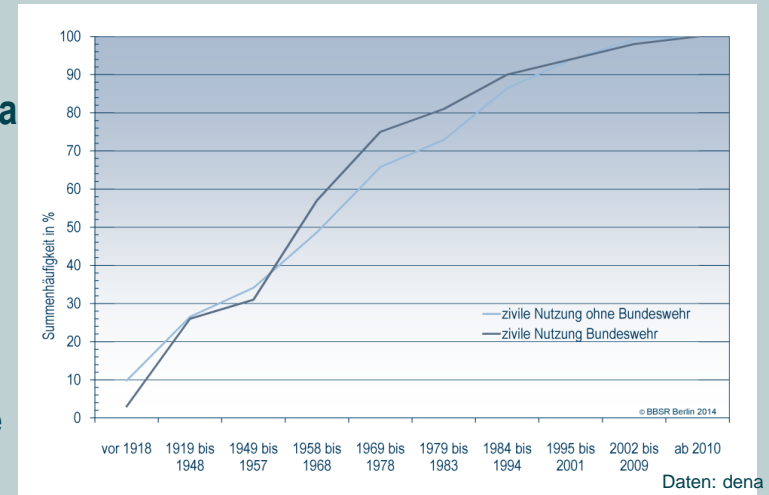
- Annual primary energy demand: - 20 %
(in case of using heat from CHP: - 30 %)
- Mean of the heat transfer coefficient: - 30 %

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 for Federal Buildings - Refurbishment Roadmap

- **Extent of balance:** appr. 2,300 civil used Federal sites
 appr. 24.5 Mio. m² heated net floor area
- **Aim of reduction:** appr. 0.8 TWh final energy
 (heat and electricity)
- **Method of approach:**
 1. Scoringlist of sites
(Base: energetic refurbishment potential of the site)
 2. Detailed roadmap of refurbishment
 3. Energy strategies for the sites on base of the results for the single buildings
 4. Decision to the further steps regarding to the refurbishment potential of the single buildings
 5. Energy strategies for the buildings with refurbishment potential
 6. Decision to the realization of certain refurbishment measures
 7. Realization of certain refurbishment measures

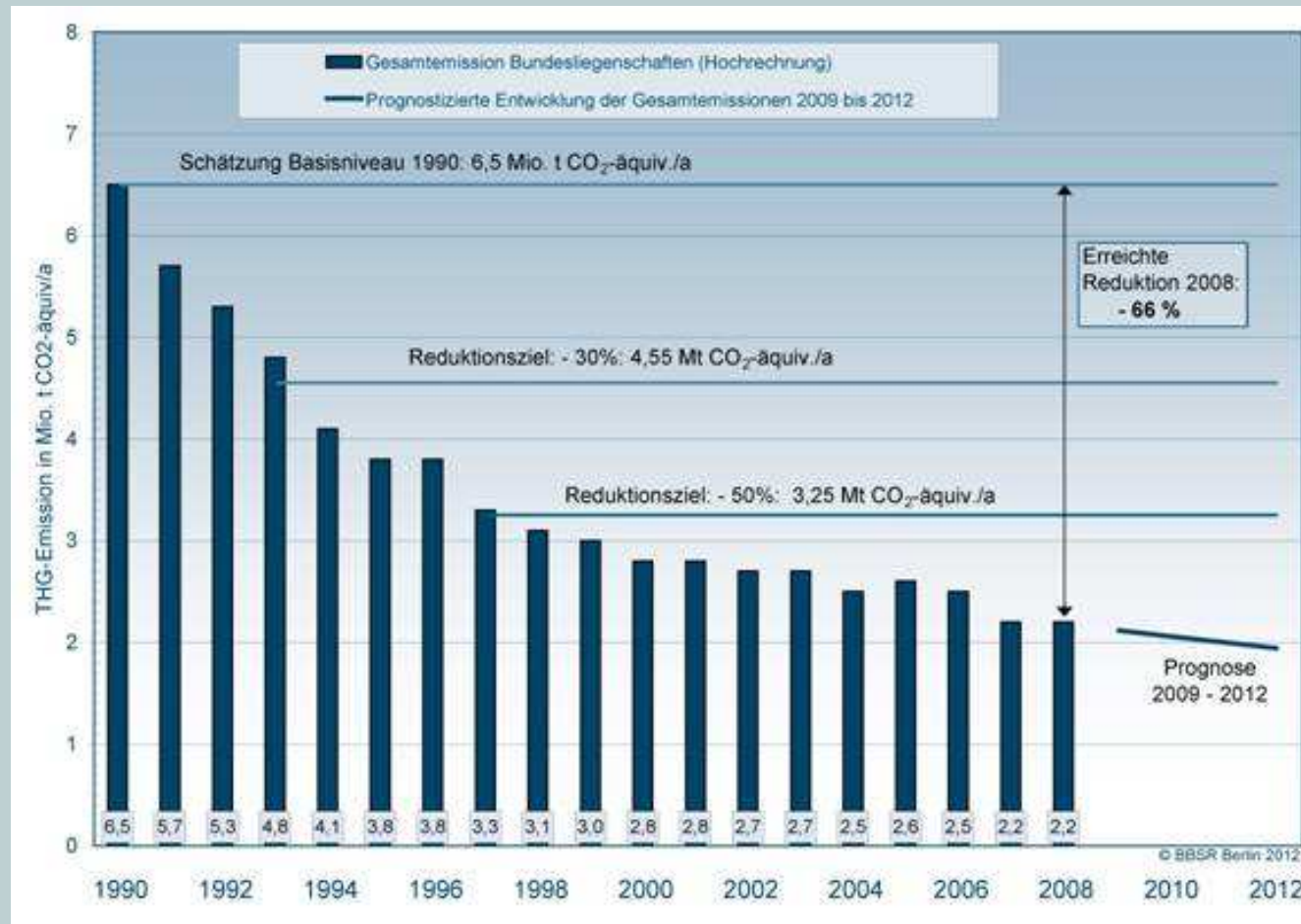


Results and Best Practice Examples

Energy and CO₂-Report

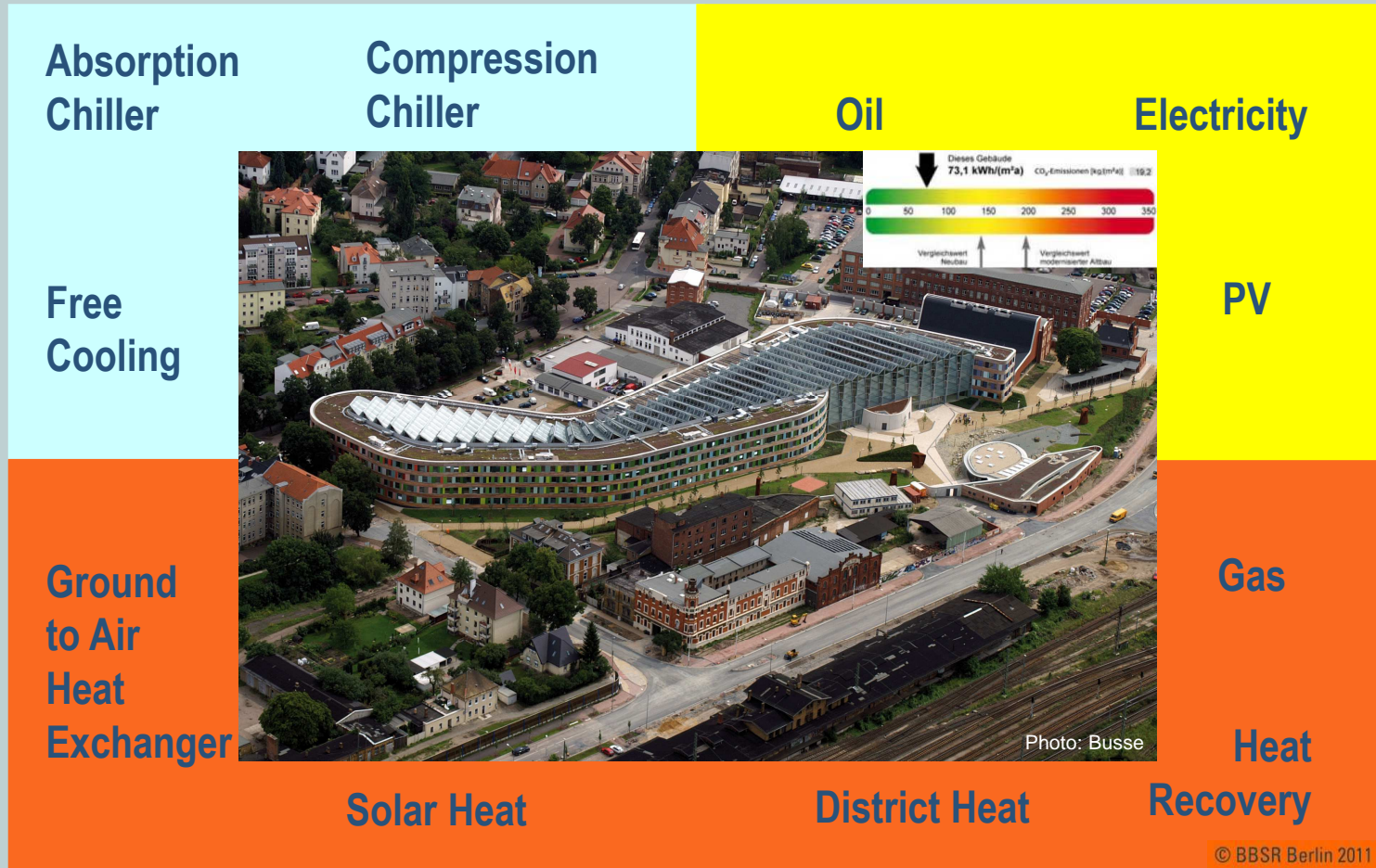
- Results for Federal Buildings

Total CO₂-equivalent GHG-Emissions for Federal Buildings (2008)



UBA Dessau

- Energy Concept



Building envelope (U-Values):

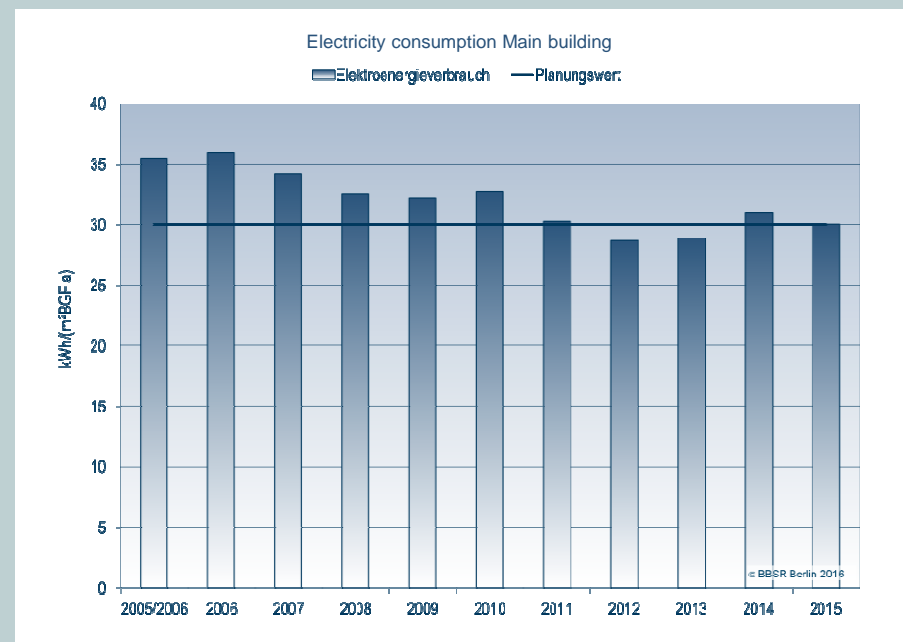
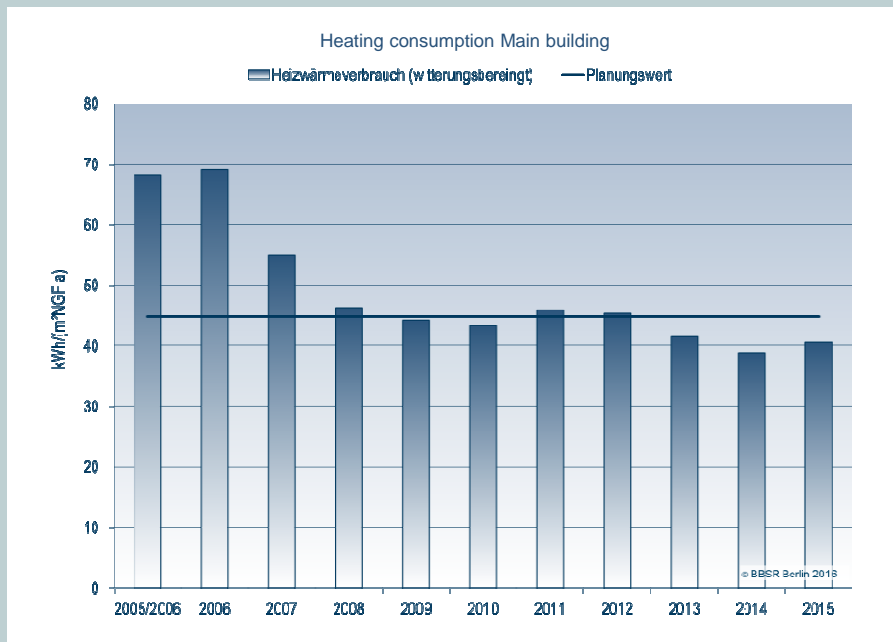
- External Wall: 0,15 W/(m²K)
- Roof: 0,12 W/(m²K)
- Bottom Slab: 0,29 W/(m²K)
- Windows: 1,2-1,4 W/(m²K)

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

UBA Dessau

- Results of Monitoring



The building of the Federal Office for Environment in Dessau is the first Federal Office Building with an annual primary energy demand of less than 100 kWh/(m²_{NGF}·a). This demand was evaluated also in the practical use of the building – for the first time in 2008.

BMUB Berlin

- Energy Concept

Free Cooling

Electricity (power supplier)

District Cooling

District Heating

Heat Recovery

Fuel Cell (FC) (natural gas)

Heat Pump (waste water)

PV

Dieses Gebäude 62 kWh/(m²·a)

Dieses Gebäude 82 kWh/(m²·a)

ENEV-Anforderungswert Neubau

ENEV-Anforderungswert modernisierter Altbau

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Building envelope Refurbishment (U-Values):

- External Wall: 0,15 – 1,06 W/(m²K)
- Roof: 0,12 – 0,17 W/(m²K)
- Bottom Slab: 0,18 – 0,28 W/(m²K)
- Windows: 1,4-1,7 W/(m²K)

Building envelope New Building (U-Values):

- External Wall: 0,11 – 0,17 W/(m²K)
- Roof: 0,11 W/(m²K)
- Bottom Slab: 0,11 W/(m²K)
- Windows: 0,76 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

BMUB Berlin

- Results of Monitoring



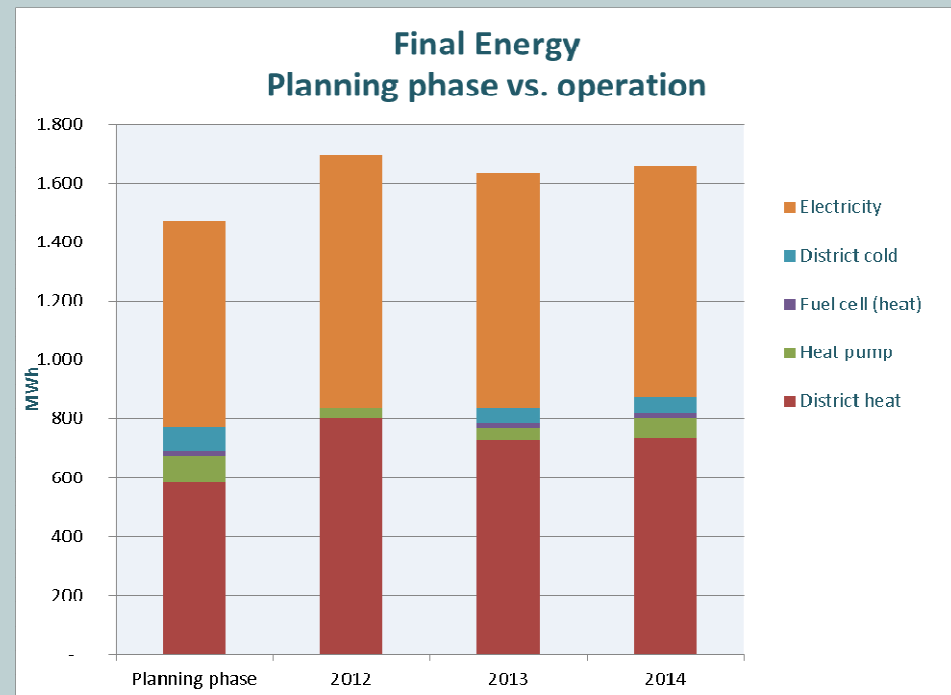
Waste-Water Heatpump (2 x 22 kW)



Fuel cell:

- SOFC
- 2 kW thermal power
- 1 kW electrical power

The expected/calculated benchmarks from the planning phase are still not achieved. A further optimization of the operation of the building and the technical equipment is going on.



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

- Energy Concept

Free Cooling

Electricity
(Public Supplier, Battery)

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)

Ground
water



PV

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

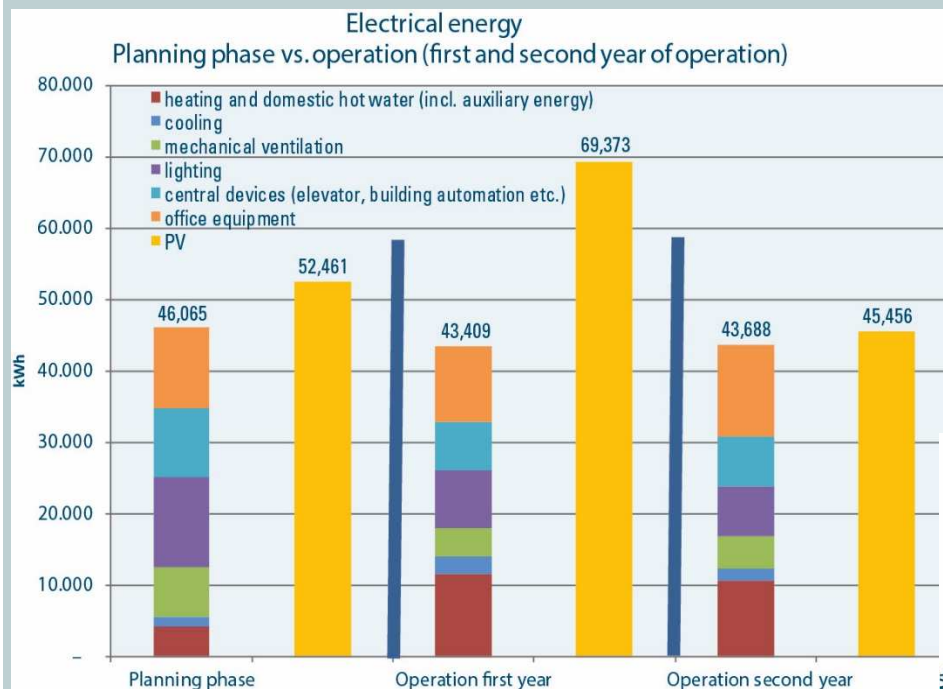
Heat Pump

Heat Recovery

Solar Heat

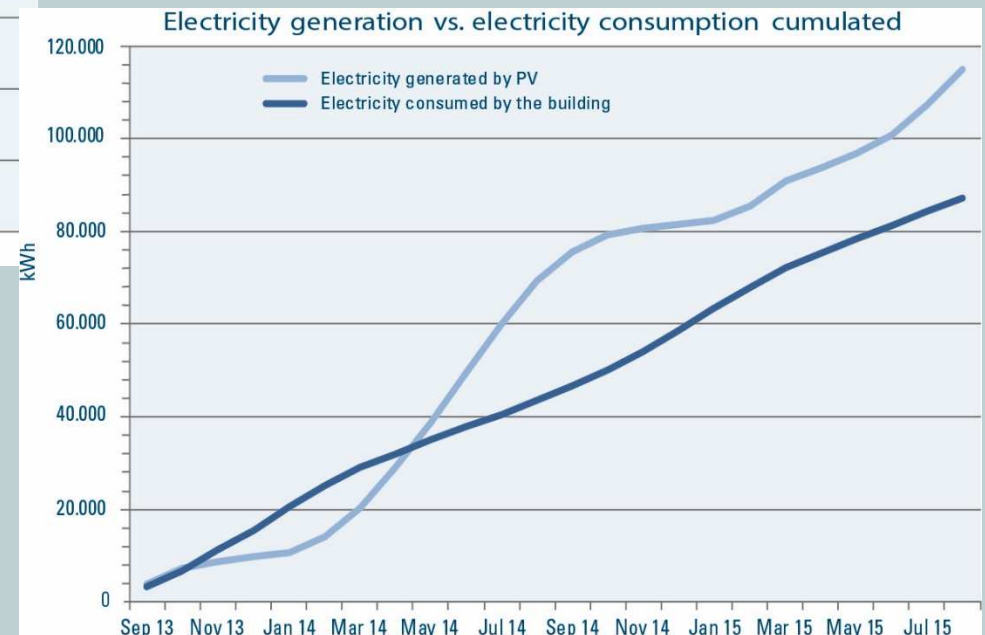
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UBA „2019“ Berlin - 1st Federal Net-Zero-Energy-Building - Results of Monitoring



The calculated total energy demand (electricity) was approximately equal to the measured one. But there are differences between the calculated and the measured data for the certain technical processes. An optimization of the operation of the technical equipment is still in process.

The extraordinary solar irradiation in 2014 and the reduced use of the building were causing an energy+ already in the first year of operation.



UBA Dessau – 2nd Federal Net-Zero-Energy-Building - Energy Concept

**Compression
Chiller (?)**

Water to Ground

PV

Electricity

**Free
Cooling**



Photo: Anderhalten Architekten Berlin

Heat Pump (Ground to Water)

Heat Recovery

**Building envelope
(U-Values):**

- Is going to meet the Passivehouse-standard.

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

Challenges for the Future

- An integral view on building, technical equipment and site located options is required.
- The improving 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

- 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 and has started a lot of activities to reduce the energy demand in their buildings at an early stage.
- 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.
- There are continuative regulations for Federal Buildings:
 - Commissioner for Energy in Federal Buildings
 - Guideline for Sustainable Building
 - Assessment System Sustainable Building „BNB“
 - ...
- We develop a roadmap for the energetic refurbishment of Federal Buildings to achieve a climate neutral stock of Federal Buildings until 2050. New buildings have to fulfill the nearly zero energy standard.



Thanks for your attention !