The Federal Ministry of Transport, Building and Urban Development supplies with the reworked "Guideline for Sustainable Building" an obligatory practical aid for sustainable planning, building and building of federal real property and buildings.

Dr. Peter Ramsauer
Federal Minister of Transport, Building and Urban Development

"The sustainable development has worldwide an outstanding meaning as model for the future, especially in civil engineering. The Federal Government has a special responsibility, because their buildings are in the public eye. Government recognizes its role model as awarding authority for building. The Federal Ministry of Transport, Building and Urban Development supported significantly the development of zero and plus energy houses with holistic solutions to connect modern architecture and electro mobility within the context of the research initiative Future Building. The buildings of future produce more energy as they need for their own operating, by integrating renewable energy extraction systems. The exhibition shows the high state of the technical development and gives suggestions for the implementation in practice."

The Federal Ministry of Transport, Building and Urban Development has, with the "Assessment System for Sustainable Building", a planning tool available, which implies and assesses sustainable aspects already in the beginning of the planning phase and over the buildings entire life cycle. Sustainability is thereby no topic just for exclusive buildings, but an indispensable social concept.

Besides functionality, safety and efficiency, important political aims of building activities are the quality of architecture as well as sustainable and energy-efficient building design. This applies also the application of building materials, technologies and procedures, monument protection and art in architecture. All this aspects should be implemented with the Federal Buildings.

Welcome to the German Pavilion of the Federal Ministry of Transport, Building and Urban Development

Tervetuloa Saksalaiseen Paviljonkiin Liikenteen Rakentamisen ja Kaupunkikehityksen Liittoministeriöltä

Herzlich Willkommen im Deutschen Pavillon des Bundesministeriums für Verkehr, Bau und Stadtentwicklung

Planning of the New Construction
Umweltbundesamt, Berlin
Reference: Braun, Kerbl, Löffler

Reference: TU Darmstadt, T. Ott
Centre of Competence Sustainable Building
within the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR)

- Scientific consultancy and assistance to the Federal Ministry of Transport, Building and Urban Development (BMVBS), the “Round Table of Sustainable Building” and the task groups and committees
- Development, implementation and further advancement of the „Assessment System for Sustainable Building” for the buildings of the Federal Government (BNB) including office buildings, residential and educational buildings
- Scientific attendance of BNB pilot projects
- Education of „BNB-Coordinators”
- Public Relation
  - Support of the information platform “Sustainable Building” (www.nachhaltigesbauen.de)
  - Preparation and implementation of exhibitions
  - Scheduling and realisation of conferences and events, including documentation and publication
  - Transfer of knowledge through public lectures
- Organisation of the “Round Table of Sustainable Building”

e-mail contact: nachhaltiges-bauen@bbr.bund.de
In 2002 the Federal Government passed the national Sustainability Strategy under the title „Perspectives for Germany“. Targets are the areas „generational equality“, „quality of life“, „social cohesion“ and „international responsibility“. Furthermore the four fields of action energy and climate protection, transport, agriculture as well as global responsibility measures were named.

Already 2001 the Council for Sustainable Development was founded by the Federal Government. The Council’s main tasks are to advise the Federal Government in Sustainability and the dialogue with the different interest groups. The Council gives recommendations to the Federal Government and names concrete fields of action. The Council gives statements about current topics, gives scientific studies in order and helps spreading the model of Sustainability in the public. The public is invited to participate actively in the „civil dialogue sustainable development“ to develop the national Sustainability Strategy further on.

To support the Federal Ministry of Transport, Building and Urban Development in implementing sustainable building activities, the Round Table Sustainable Building was founded in December 2001. It consists of representatives of the building sector, industry, chambers of architects and engineers, relevant building authorities and the sciences.

The „Committee of Governmental Secretaries for Sustainability Development“ implements the national sustainability strategy into concrete action. To its tasks it also belongs to develop the national Sustainability Strategy further on its content and to check the state of implementation. Moreover the committee is the main person of contact for the governmental advisory council for sustainable development, which was constituted in 2010, for the Federal States and the national local-authority organisations.

By means of 21 indicators, the sustainability will be constantly observed and assessed by the Federal Agency for Statistics. At regular intervals progress reports and indicator reports are created. In 2009 a peer review was instructed, the report „Sustainability - Made in Germany“ was created by experts of Sustainability, climate and economy from seven countries with organisational support by the Council for Sustainable Development.
The responsibility for the Federal Government’s civil building in Germany and overseas lies with the Federal Ministry of Transport, Building and Urban Development. This includes the initiation of research projects, the supply of funding, the advice of Federal states and communes as well as the development of rules.

An important issue is the development of sustainable buildings, because the main parts of our energy- and resource consumption, of the emissions but also of the consumption of our constructed area are determined by real estate and transport.

At the same time the federal buildings are in public interest, thus lending them a special function as role models.

The "Guidelines for the Realisation of Federal Building Measures" (RBBau) set out the responsibilities and procedure for federal building measures.

The Federal Office for Building and Regional Planning (BBR) is responsible for building matters for the constitutional bodies, the highest federal authorities and civil building matters overseas as well as for buildings in Berlin and Bonn.

All other federal buildings in the german territory are dealt with by the building authorities of the federal States by means of administrative agreements between the Federal Government and the Federal States (based on fiscal administration law).

The performance of the coordination of sustainability in the planning phase, the assessment and the conformity testing is an ongoing task of the Federal Building Authority. Until the end of 2011 the BBSR executes the conformity testing on an interim basis.

Within the framework of the implementation of the Guideline and the Assessment System for Sustainable Building, further training was offered to users in the respective operative building authorities.
In the year 2001 the Federal Ministry of Transport, Building and Urban Development (BMVBS) introduced the first “Guideline for Sustainable Building” which provides a clear statement of requirements for the building sector, influenced by the final report of the committee of inquiry “Protection of People and the Environment” in 1998. The Guideline for Sustainable Building updated in 2011 offers in a first step a concrete practical aid for the planning and the construction of federally owned properties. The structural maintenance, the operation and the utilisation (Part C and D) are still in process and the implementation of these parts is planned for the first half of 2012. Moreover it serves as a working aid for the implementation of the holistic approach in connection with federal building activities for which the application of the guideline is mandatory. It can also be used by other awarding authorities for construction, such as the Federal States, municipalities or the private sector.

The reissue of the Guideline for Sustainable Building integrates a method for a sustainable assessment - the BNB - for the first time and defines the silver-level as a minimum requirement.

The BNB is an “Assessment System for Sustainable Building” especially for federal buildings. The existing assessment profile for new office and administrative buildings will be further developed for application with other types of buildings and kinds of utilisation. Consequently, benchmarks and specific requirements for new built residential buildings, educational buildings and outdoor facilities are being developed, as well as a system for existing buildings. Furthermore, it shall be continuously revised to reflect results of current research and to accommodate changes in the area of statutory regulations, standardisation and the “Round Table Sustainable Building”.
Announcement about using and acceptance of assessment systems for sustainable building

In April 2010 the Federal Ministry of Transport, Building and Urban Development has announced several informations about the using-conditions of the BNB-System for provider of the private sector and rules for acceptance and recommendation of private assessment systems for sustainable buildings by the ministry. The idea of the announcement is the installation of a high standard of sustainability to the building sector in Germany. The review and recommendation of private assessment systems by the Federal Government, is the first effort for a transparent policy and quality control.

The announcement is structured in three main-parts:

- General
- Using-conditions of the Assessment System for Sustainable Building (BNB)
- Acceptance of different assessment systems

Part I: General

- Information about complexity of assessment systems
- Informations about the holistic approach
- Informations about the BNB and using the logo ("N") for private stakeholders
- Conditions of review BBSR / BMVBS
- Acceptance of different building profiles
- Requirements for not acceptance

Part II: Using-conditions of the Assessment System for Sustainable Building (BNB)

- Requirements for the education of auditors
- Requirements for certifying bodies
- Using the logo ("N")
- Quality Control

Part III: Acceptance of different assessment systems

- Requirements for the whole assessment system
- Ecological quality requirements
- Economical quality requirements
- Social-cultural and functional quality requirements
- Technical quality Requirements
- Requirements for the assessment of the process quality
- Requirements for the description of local profiles
- Requirements for the education of auditors
- Requirements for certifying bodies
- Quality control

Accepted Stakeholders

- for part II: Steinbeis-Transfer-Institut, BNB
- for part III: German Sustainable Building Council (DGNB), building profile for new office buildings

In verification

- for part III: German Sustainable Building Council (DGNB), building profiles for new hotels, office building refurbishment, new industrial and retail buildings
Implementation and application of the Assessment System for Sustainable Building

In 2008, the Federal Ministry of Transport, Building and Urban Development (BMVBS), in co-operation with the German Sustainable Building Council e. V. (DGNB), and with the scientific support of the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR), developed a national assessment system for the new construction of office and administration buildings. With the introduction of the revised Guideline for Sustainable Building 2011, the federal government undertakes to apply the Assessment System for Sustainable Building (BNB) for the new construction of non-military federal building projects.

BNB_New Buildings
Office and Administration Buildings
The assessment system was evaluated in two pilot phases with a total of eight government buildings. With the introduction of the Guideline, the BNB is currently being applied in nine new building projects, starting with the early planning phase.

BNB_Outdoor Facilities on Federal Properties
Five projects are included in the evaluation of the newly developed assessment system for outdoor facilities on federal property. The results are expected to be presented at the beginning of 2012.

BNB_Module_Operation and Maintenance
The evaluation of the system is taking place at three projects which had already been assessed in 2008 in the first pilot phase. Intriguing findings are anticipated from the assessment, e.g. of actual consumption under real-life conditions, which is expected to be published at the beginning of 2012.

BNB_Building Stock
Office and Administration Buildings
The pilot phase for the assessment of comprehensive measures involving existing buildings with a total of three projects is expected to be completed at the beginning of 2012. Two buildings currently undergoing renovation will be monitored by the system.

BNB_New Buildings_Education Facilities
The BNB was adjusted for the assessment of education facilities. The pilot phase involving a total of seven buildings is expected to be completed in the first quarter of 2012.

A degree of fulfilment of 65%, corresponding to Category Silver, is targeted. Starting from the basis of the present system, sustainability assessment will be further developed for additional utilisation categories, building stock, outdoor facilities and for the utilisation and operation of buildings and properties. These systems are evaluated in pilot applications. The existing assessment system for the new construction of office and administration buildings is individually adjusted to the special prerequisites, requirements and objectives of the various categories. The results will be published on the information portal www.nachhaltigesbauen.de.
A wide variety of information on the subject of sustainable building is available at the Internet portal www.nachhaltigesbauen.de of the Federal Ministry of Transport, Building and Urban Development (BMVBS).

Here, general explanations and statements regarding sustainable building can be found as well as information about federal guidelines and working aids. Furthermore, the Assessment System for Sustainable Building is explained alongside extensive data for use as a basis for sustainability assessment. This offering is supplemented by information regarding research topics, current events and an array of good examples for sustainable building.

The information is as a rule available public. For the members of the Round Table of Sustainable Building there is a separate login access available for additional information.
Guideline for Sustainable Building 2011

Design Principles
Ecological Assessment
Efficiency
Health, Comfort and Socio-Cultural Issues
Tender/Building Construction
Operation, Use, Maintenance
Quality Management
Implementation of the Guideline
WECOBIS - Web-based Building Material Information System

A substantiated assessment and choice of construction products during the planning and construction phases is one of the main challenges for sustainable planning, construction and management of buildings.

WECOBIS has provided users with a comprehensive update since 2009. The system offers online links with further sources of information and data. WECOBIS offers structured and neutral information to health and ecological aspects of construction products. The system supports the observation of life cycle phases providing information for building product categories regarding the relevant raw material, production and manufacturing process, use and re-use of the products.

The webpage of wecobis, which has its origins already in 2000, is operated by the BMVBS in co-operation with the Bavarian Chamber of Architects (BayAK), and is organised by the office of BBSR.

Data content

WECOBIS provides comprehensive information on health, environmental and technical parameters as well possible applications with 165 data sheets for the following building product categories and basic construction materials. This allows a building material classification of most components of a building.

Building products category
- Building Boards
- Flooring
- Insulation
- Seals
- Timber and derived timber products
- Adhesives
- Solid Construction
- Mortar and Screeds
- Surface treatments
- Glazing

Basic Construction materials
- Binders
- Aggregates
- Plastics
- Metals

User Friendliness

The user friendliness of WECOBIS has a high priority. In future, more practical information for architects and planners will be offered:
- Tendering assistance
- Risk tables regarding environmental hazards
- Comparisons of sets of building product

The online presentation will allow for continuous updating. Technically this is achieved through a network of editors.

Online links

WECOBIS is linked to the Hazardous Materials Information System of the BG Bau (WINGIS) and other environmental information services.

Office

The WECOBIS administrative offices has been set up in the BBSR, Division II 6 – Civil Engineering – Construction and Environment.
Life Cycle Analysis – Information and Tools

The German assessment methodology BNB uses a holistic assessment procedure which considers the life cycle of a building and a comprehensive quantification. This evaluation of sustainable construction requires the most diverse basis data. BMVBS therefore provides essential data, guidelines and practical tools for life cycle analysis, which ensure that sustainability criteria are included in planning and construction processes, and are comprehensively documented.

Ökobau.dat

Ökobau.dat was the first German database developed for construction products and processes providing information on their environmental impacts. At present 650 so-called stylesheets developed with support of the German construction materials industry offer information on the global and ecological effects and provide a simplified basis for data for the ecological evaluation of buildings. If IBU/ECO EPDs are available, these data are integrated in the Ökobau.dat. These data are usually used for further lifecycle assessment of building systems or the entire building.

Ökobau.dat is continuously updated, e.g. further stylesheets are implemented, background information (energy mix etc.) is adapted, and provided data will be adjusted to upcoming European Standard EN 15804.

Ökobau.dat is provided as free download on the German webpage of Sustainable Construction of BMVBS (www.nachhaltigesbauen.de).

Environmental Product Declarations

Environmental Product Declarations (EPD) offer the relevant basic data of environmental features of a product and hence, for assessing buildings on an ecological level. These manufacturer-orientated data are examined by an independent advisory board. Thus, a reliable and secure source of data is given for environmental and health related issues for construction products. The declaration testifies to what extent a product contributes to

- greenhouse effect,
- acidification,
- overfertilization,
- destruction of the ozone layer,
- smog,
- use of energy and resources.

In Germany the examinations conducted by the Institute Construction and Environment e.V. (IBU), ensure that EPD are based on ISO standards and the currently established ECO EPD comply with the European Standard EN 15804.

Service Life of Construction Elements (Table)

For the sustainable buildings assessment the service life of construction elements predicted is decisive, as this determines the frequency calculated for the replacement of construction elements within a specified period.

Information regarding the service life of construction elements is given in the Guideline for Sustainable Building 2001. This information is continuously updated and provided as free download on the German webpage of Sustainable Construction of BMVBS (www.nachhaltigesbauen.de).

At the moment, the information given in the Guideline for Sustainable Building 2001 or the updated information given by BMVBS via their webpage has to be used within the BNB system for the evaluation of federal buildings, if no exact details are available from the planners or the product manufacturers.
The Federal Ministry of Transport, Building and Urban Development (BMVBS) has developed, as part of a two-year collaboration with the German Sustainable Building Council (DGNB), an initial criteria checklist for the comprehensive assessment of sustainability aspects for building.

The “Assessment System for Sustainable Building” of the BMVBS for the building stock of the Federal Government is an overall assessment procedure for newly built office and public administration buildings. The assessment system is published and updated on the website “Sustainable Building” of the BMVBS (www.nachhaltigesbauen.de).

The planning-based assessment system is distinguished for its comprehensive consideration of the entire life cycle of buildings. Not only ecological, economical, social and cultural qualities are evaluated, but also technical and procedural aspects.

For the main grading (mark) the building is considered as the system boundary. The assessment of building qualities is accomplished in accordance with transparent rules and objective, essentially quantitative methods.

The aim of sustainable building is the protection of common property such as environment, natural resources, health, culture and capital. The classical three dimensions of sustainability – ecology, economy and the socio-cultural aspects - which also influence the quality evaluation of buildings - deduce from these subjects of protection.

Furthermore, the technical qualities and process qualities have to be considered, which influence the entire scope of sustainability.

This six qualities are exactly defined by criteria profiles and organized in main criteria groups. The weighing of the criteria against one another is accomplished with the aid of a factor of relevance. According to the achieved degree of performance, a certificate can be obtained in bronze, silver and gold.

The site characteristics are identified in a separate note.
The specific quality requirement of Sustainable Building are described and assessed by 46 individual criteria embedded within the 6 Main Criteria Groups:

- Ecological Quality
- Economical Quality
- Socio-Cultural and Functional Quality
- Technical Quality
- Process Quality
- Location Profile

Structural Setup of Criteria

- Relevance and Objectives
- Description, Comments
- Positive Total Effects
- Assessment
- Method of Assessment
- Documents, Standards, Guidelines
- Information on Datasets, Calculation Aids
- Mandatory Documents
- Scale of Assessment
- Appendices
6 Main Criteria Groups

- Ecological Quality
- Economical Quality
- Socio-Cultural and Functional Quality
- Technical Quality
- Process Quality
- Location Profile

11 Criteria Groups

- Effects on Global and Local Environment
- Demand of Resources and Amount of Waste
- Life Cycle Costs
- Health, Comfort and User Satisfaction
- Functionality
- Ensuring Design Quality
- Management and Design Process
- Building Construction Process
- Location Profile

46 Criteria New Buildings: Office and Administration Buildings (Version 2011_1)
System variants for the building stock and additional utilisation categories are being developed on the basis of the fundamentals of BNB_new Buildings_Office and Administration Buildings.

The system is being adjusted thereby to the prerequisites and special features of the different utilisation categories. New criteria were developed for the assessment of additional modules such as the sustainable operation and maintenance of real estate property and the planning of outdoor facilities. The system variants presented are being tested on measures which have already been implemented.

The assessment of further utilisation categories and the expansion of the assessment to include existing buildings are planned.
Federal Environment Agency Dessau

Client: Federal Republic of Germany
Architect: Sauerbruch Hutton, Berlin
Auditor: Holger König, Dr. Günter Löhnert, Prof. Thomas Lützkendorf, Prof. Alexander Rudolphi
Completion: 2005
Gross Floor Area: 36,623 m²

Cost:
- Building Cost Total: 68,3 Mio. €
- Life Cycle Cost: 1.311 €/m² GFA
- Cash Value of Occupancy Cost: 1.097 €/m² GFA

Energy / Ecology:
- Primary Energy Demand / DIN V 18599: 73,1 kWh/(m²a)
- Energetic Quality of the Building Closure HT: 0,57 W/(m²K)

Life Cycle Analysis:
- Total Primary Energy Demand PEges: 157 kWh/(m² NFAa)
- Primary Energy Demand not Renewable PEne: 136 kWh/(m² NFAa)
- Amount of Renewable Energy Demand PEe: 13,3%
- Global Warming Potential: 27,6 kg CO₂-Äqu/(m² NFAa)

Degree of Performance: 86,4%
Paul-Wunderlich-Haus Eberswalde

Client
District administration Barnim

Architect
GAP Gesellschaft für Architektur & Projektmanagement mbH, Berlin

Auditors
Holger König,
Dr. Günter Löhnert,
Prof. Thomas Lützkendorf

Completion
2007

Gross Floor Area
22,218 m²

Cost
Building Cost Total
24,9 Mio. €

Life Cycle Cost
Production Cost
945 €/m² GFA
Cash Value of Occupancy Cost
893 €/m² GFA

Energy / Ecology
Primary Energy Demand / DIN V 18599
100,8 kWh/(m² a)
Energetic Quality of the Building Closure HT
0,35 W/(m² K)

Life Cycle Analysis
Total Primary Energy Demand PĒges
157 kWh/(m² NFAa)
Primary Energy Demand not Renewable PĒne
130 kWh/(m² NFAa)
Amount of Renewable Energy Demand PĒe
17 %
Global Warming Potential
25,6 kg CO₂-Aqu/(m² NFAa)
Main Customs Office Rosenheim

Client
Federal Republic of Germany

Architect
Staatliches Bauamt Rosenheim

Auditor
Dipl.-Ing. Nicolas Kerz,
Federal Institute for Research on Building, Urban Affairs and Spatial Development

Completion
2007

Gross Floor Area
5,181 m²

Cost
Building Cost Total
7,8 Mio. €
Life Cycle Cost
1,084 €/m²_GFA
Production Cost
918 €/m²_GFA
Cash Value of Occupancy Cost

Energy / Ecology
Primary Energy Demand / DIN V 18599
69,7 kWh/(m² a)
Energetic Quality of the Building Closure HT
0,71 W/(m² K)

Life Cycle Analysis
Total Primary Energy Demand PEges
236,3 kWh/(m²_NFA)²
Primary Energy Demand not Renewable PEne
115,4 kWh/(m²_NFA)²
Amount of Renewable Energy Demand PEe
51,2 %
Global Warming Potential
21,3 kgCO₂-Äqu/(m²_NFA)²

Assessment of Main Criteria Groups

Object Grade 1,90 (Silver)
Federal Office for Radiation Protection Berlin

<table>
<thead>
<tr>
<th>Client</th>
<th>Federal Republic of Germany</th>
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<tbody>
<tr>
<td>Architect</td>
<td>Cosa Nova Architekten, BDA, Berlin</td>
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<td>Auditor</td>
<td>Prof. Ing. Alexander Rudolphi, GFÖB Berlin mbH</td>
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<td>Completion</td>
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<td>Primary Energy Demand / DIN V 18599</td>
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<td>Total Primary Energy Demand PEges</td>
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<td>Primary Energy Demand not Renewable PEne</td>
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<td>Amount of Renewable Energy Demand PEe</td>
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<td>Global Warming Potential</td>
<td>47,2 kgCO2-Äqu/(m² NFAa)</td>
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Federal Ministry of Health Bonn

Client Federal Republic of Germany
Architect Petzinka Pink Architekten, Düsseldorf
Auditor Dipl.-Ing. Natalie Eßig, Technische Universität München
Completion 2007
Gross Floor Area 17,202 m²

Cost
Building Cost Total 28 Mio. €
Life Cycle Cost 1,093 €/m² GFA
Production Cost 1,109 €/m² GFA
Cash Value of Occupancy Cost

Energy / Ecology
Primary Energy Demand / DIN V 18599 195,5 kWh/(m² a)
Energetic Quality of the Building Closure HT 0,78 W/(m² K)

Life Cycle Analysis
Total Primary Energy Demand PEges 316,7 kWh/(m² NFAa)
Primary Energy Demand not Renewable PEne 304,3 kWh/(m² NFAa)
Amount of Renewable Energy Demand PEe 3,9 %
Global Warming Potential 73,9 kgCO₂-Äqu/(m² NFAa)
1st prize in the international „Solar Decathlon 2007“ competition to find the most attractive and energy-efficient solar home in 2007 went to Germany. The competition rules require a fully energy-independent building with a floor area limited to 75 m². The design is based on three basic ideas. Firstly, the principle of layering: The ground plan is sub-divided into various zones which are set like layers of an onion around an inner core. The differently temperature-controlled layers of the building envelope allow a differentiated display of the ground plan depending on the time of year (summer and winter house). Secondly, there is the platform concept for furniture and technology, similar to automotive construction: A false floor houses the building service components which can be added to the overall system according to the plug-in procedure. An equipment room for the building is no longer necessary. The false floor also serves as storage space for furniture which is crucial for the third topic of design: A quiet room should be created which can be perceived in its pure, actual form. The room can be used flexibly and is, in that sense, also sustainable. Afterwards this high-tech building was erected as a project office on the „Lichtwiese“ campus at TU Darmstadt, serving as an EnBau model project for detailed testing and optimisation in everyday use.

Key aspects: Heat insulation, facade systems, glazing + windows, daylight planning, ventilation + heat recovery, active cooling, regenerative + passive cooling, thermo-active building element systems, heat pump, heat / cold storage, control technology, operational management, building automation, solar thermal energy, photovoltaic, biomass utilisation, ecology of building materials.

Innovations: Vacuum insulation panels (VIP), thermo-active building systems using phase change materials (PCM), solar power generation (PV) integrated into the facade and roof and many other features ensure energy autonomy.

The German Federal Ministry of Transport, Building and Urban Development (BMVBS) promoted project-related work and studies. The performance of this high-tech building will now be measured and optimised in detail during normal building usage over several years within the scope of the research programme “EnOB – Research for Energy-Optimised Construction” sponsored by the German Federal Ministry of Economics and Technology (BMWi).

Further Details at www.enob.info
The building's design concept developed by the Rosenheim university team is based on a modular structure. This produces a flexible and open floor plan. The building, which is designed as a home for two people, also provides enough space for two overnight guests and enables up to eight people to eat in the dining area. With its "serrated" facade, an entirely new facade and solar shading concept, the building's architecture is given an individual and expressive character. In addition, the solar shading can be adapted to meet the requirements and needs of the building and occupants during the course of the day and year. This creates a play of light and shade, and the facade continually shows a different face. The energy concept relies on excellent thermal insulation, a maximum of air tightness and efficient solar shading. At midday when the solar loads are greatest, the solar shading – which retracts into the ground – can be extended upwards from the ground as far as the eaves. The building is predominantly cooled using passive measures, whereby a film of water is directed across the sloping solar modules on the roof during the cool hours of the night. By means of thermal radiation and evaporative cooling, the water is cooled by up to 10 kelvin, is collected in a storage tank, and is then used during the day to provide ceiling cooling. In order to provide a buffer for peak loads, a newly developed channel is used with latent heat storage material (PCM). In air recirculation mode, a cooling output of 2 kW is achieved with a temperature difference of around 10 kelvin. And there is one more special feature: with this building, hot water is not provided from solar thermal collectors but using the process heat from a water-to-water heat pump.

Innovations: Modular wooden frame construction system with rigid and specially developed wood-to-steel adhesive bonds, Variable, retractable "serrated façade", Radiation and evaporative cooling across the roof surfaces in combination with a cooling ceiling, PCM latent heat storage system operated in recirculation mode, Flexible LED lamps (Plugit) that can be slotted into a ceiling grid, Multifunctional interior furnishings (kitchenette, room divider)

The Federal Ministry of Economics and Technology (BMWi) is the patron of the German entrants to the Solar Decathlon Europe competition, and has supported these university projects under the auspices of government energy research (the EnOB research initiative).
Open, interdisciplinary competition
for institutes of higher education in collaboration with planning offices

Central requirements:

- Energy supply for a 4-person household solely from environmental energies
- Energy networking of buildings and vehicles (approximately 29,000 km/year)
- Electrical storage capacity in connection with an intelligent network control
- Complete recyclability of the house

The design project submitted by the first prize winner has been under construction in Berlin since Spring 2011 and will undergo a two-year monitoring period under real-life conditions.

2nd PRIZE: The form of the building is compact and optimised for solar energy absorption. The PV modules are utilised for the design of the plus energy house in order to achieve a succinct autonomy. The well-dimensioned energy yield of the PV systems, in combination with a 30 kWh buffer storage unit, enables a self-use share of electricity generation of 53%. The integration of the user by means of touch screens, adaptive regulation options, etc. establishes a good coupling of building engineering with electric mobility.*

3rd PRIZE: The architectural and construction conception as city block is a convincing approach for the development of buildings and connections between buildings at the level of urban quarters. At this site, however, it leads to an almost completely closed south facade. The street facade shares a space-saving but nonetheless visible E-mobility concept with the cantilevered upper storey. The use of wood as construction material lends the building an air of being connected with nature. The overall energy management concept is good but, because of low storage capacities, only a 34% self-use share of the electricity generated is achieved.*

SHORT-LISTED: The architectural concept relies on the integration of the „classical form“ of the house and new technologies. The southern roof and facade surfaces of the house with monocrystalline PV modules convey the energy mandate of the building. The supply air for the heat recovery system is pre-warmed by underflow of the PV modules. These are cooled thereby at the same time, thus enhancing their efficiency. The inclusion of the subsoil enables component cooling in the summer. The capacity of the buffer storage unit should be designed to be greater; a positive feature is the approach of an inductive loading station.*

*Excerpt from the assessment of the prize jury
The Efficient House Plus represents a convincing combination of energy-efficient living and electric mobility.

The house has around 130 m² of living area, a terrace and a garden. A large combination living room and kitchen is to be found on the ground floor, while the upper floor has three bedrooms, a bathroom and a storage room. The floor plan structure with east-west orientation and a supply and inter-relative link in the middle is convincing. The project combines in the sense of sustainable construction high quality of design and modern user comfort with energy-efficient construction technologies and renewable energy yield systems.

The form of the building is compact, the thermal insulation and the solar protection highly effective. The building has an efficient heating and cooling system in conjunction with a cistern. Energy is provided by means of photovoltaics, solar heat and a reversible heat pump, which optionally uses the air or the cistern as its energy source. With a buffer storage unit of 40 kWh, a good self-use of the electronic energy generated is possible (50%). The rapid-charging and storage concepts are coherently integrated. The interaction between user, house and vehicles is intelligently planned by means of smart-phone concepts, thus opening up the opportunity for trendsetting applications.

The project is being built as a model house for the Federal Ministry of Transport, Building and Urban Development with the scientific support of the Fraunhofer Society and the Berlin Institute for Social Research (BIS). Following a test phase, a four-member family is scheduled to live in the building for one year, beginning in 2012. The results are intended to be available for the broad-impact economic construction of this kind of building and for the further development of technical systems.
Significant savings potential in refurbishment of existing buildings: dena’s “ Efficient Homes” pilot project

Existing buildings currently require an average of three times more energy for heating than new buildings. However, despite rising energy prices, the enormous potential for energy savings during refurbishment projects is often not sufficiently exploited.

The dena "Efficient Homes" pilot project shows that high-efficiency refurbishments for sustainable buildings are not only technically feasible, but also economically worthwhile.

The goals

- To test and establish high-efficiency refurbishment standards, significantly lower than legal requirements
- To initiate lighthouse projects, which prepare the market and stimulate emulation
- To support the launch of innovative technologies onto the market
- To accelerate know-how transfer

The Concept

- Since 2003, high-efficiency refurbishments of more than 450 residential and non-residential buildings (to date)
- Scientific evaluation research
- Nationwide press and public relations

Results

- Energy requirements of non-refurbished existing buildings can be reduced by up to 85 percent
- Energy-efficient refurbishments are not only technically feasible but also economically worthwhile. Apartment buildings in need of refurbishment up to the standard of "Effizienzhaus 70" ("Efficient Home 70") can be refurbished without any impact on the heating-inclusive rent.

The energy saving in dena’s „Efficient Homes“ pilot project 2008 amounted to up to 90 percent on average.

The EU Buildings Directive requires that new buildings from 2019 to 2021 are constructed as low energy houses. In addition, according to the Federal Government’s Energy Concept, the building stock in Germany should be almost climate-neutral by 2050.

Goals:
To lay the foundations for future climate-neutral standards for new construction and refurbishment, in order to determine how an almost climate-neutral standard in residential buildings can be achieved. The goal for refurbishment or new construction is: climate-neutral.

The Efficiency Standards:
- In new construction: better than a KfW Efficient House 40
- In refurbishment: better than a KfW Efficient House 55

Examples of Current Construction Projects:

The Hamburg Kaffeemühle ("Coffee Mill")
- Increase of living space through an extension
- Refurbishment according to passive house criteria
- Use of renewable energies (wood pellet stove, solar thermal energy, PV)
- Sustainable building materials
- Preservation of architectural quality

ZEROPlus Buildings
Goal: energy and CO₂-neutral residential household
- Energy lifecycle assessment considers mobility, embedded energy of products, users’ CO₂-emissions etc.
- Building envelope: passive house standard
- Heat pump, photovoltaic plant with digital power management

By 2050, buildings in Germany should emit hardly any harmful greenhouse gases