Plus Energy
refurbishment of a office building in Vienna

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worldwide first
Plus Energy office building

**Basic Data:**
Technical University of Vienna

350 work places, up to 1,500 students

Type of the building: office building
Net floor area: 13,500 m²
Height: 55 m
Project start: 2011
Construction period: 2012-2014

(Source: Technical University of Vienna, edited by Schöberl & Pöll GmbH)
Energy efficient Buildings performance comparison

- Low energy
- Nearly Zero Energy
- Passive House
- Zero Energy
- Plus Energy
- Energy self-sufficient
Definition of Plus-Energie-Standard

1. The primary energy

2. Annual balance

3. Entire building

4. Incl. Usage (office equipment, servers, kitchens, telephone systems, standby consumption, etc.)
Technical challenges of the first Plus Energy office building worldwide

Amount of energy in kWh/m²a

Energy demand for buildings (ventilation, heating, etc.) and devices consumption

Production (Photovoltaic)

(Source: DI Markus Leeb)
Roof:
618 m²
97,8 kWp

Facade:
1.581 m²
230,6 kWp
The biggest area of building-integrated photovoltaics in Austria

(Source: TU Wien, Forschungsbereich für Bauphysik und Schallschutz)
From Passive House to Plus-energy Building

- **Passive House components** (highly insulated and airtight building envelope, ventilation system with heat and moisture recovery ...)

- **Plus energy technology** (photovoltaics, utilization of server and elevator heat), Austria's largest building integrated photovoltaic system

- **Extreme optimization** of energy consumption (energy-saving equipment, lighting optimization ...) more than 9,300 components
Social rooms and kitchen: 458 kWh/m²a
Other devices (photocopier, projectors..): 907 kWh/m²a
Computer equipment workstations: 680 kWh/m²a
Communication (telephones, switches): 454 kWh/m²a
Server + UPS: 227 kWh/m²a
Building control technology: 0 kWh/m²a
Other electrical components: 0 kWh/m²a
Elevators: 0 kWh/m²a
Lighting: 0 kWh/m²a
Ventilation: 0 kWh/m²a
Warm water + drinking water: 0 kWh/m²a
Cooling + server cooling: 0 kWh/m²a
Heating: 0 kWh/m²a

(Source: TU Wien, Forschungsbereich für Bauphysik und Schallschutz)
The graph shows the primary energy demand in kWh/m²a for a new office building and a Plus Energy office building. The new office building has a total energy demand of 458 kWh/m²a, while the Plus Energy office building has a demand of 56 kWh/m²a. The energy demand is categorized into various components:

- **Social rooms and kitchen**
- **Other devices (photocopier, projectors..)**
- **Computer equipment workstations**
- **Communication (telephones, switches)**
- **Server + UPS**
- **Building control technology**
- **Other electrical components**
- **Elevators**
- **Lighting**
- **Ventilation**
- **Warm water + drinking water**
- **Cooling + server cooling**
- **Heating**

Source: TU Wien, Forschungsbereich für Bauphysik und Schallschutz
primary energy demand in kWh/m²a

- New office building: 458 kWh/m²a
  - Use: 200 kWh/m²a
  - Building: 258 kWh/m²a

- Plus Energy office building: 56 kWh/m²a
  - Use: 20 kWh/m²a
  - Building: 36 kWh/m²a

Source: TU Wien, Forschungsbereich für Bauphysik und Schallschutz)
Plus-Energy-Building

Source: TU Wien, Forschungsbereich für Bauphysik und Schallschutz
Ineffiziente Geräte

Source: TU Wien, Forschungsbereich für Bauphysik und Schallschutz

Primary energy demand in kWh/m²a

- Before refurbishment: 803 kWh/m²a
- New office building: 458 kWh/m²a
  - Use: 228 kWh/m²a
  - Building: 230 kWh/m²a
  - Elevators: 10 kWh/m²a
  - Server heat: 10 kWh/m²a
- Plus Energy office building: 56 kWh/m²a
- Energy production: 61 kWh/m²a

Source: TU Wien, Forschungsbereich für Bauphysik und Schallschutz
Highly efficient motion sensor

Reduction up to 97 %

(Source: Schöberl & Pöll GmbH)

(Source: TU)
Effect of optimized motion sensors:

(Source: Schöberl & Pöll GmbH)
Plus Energy Buildings

- Highest indoor comfort in every climatezone (cooling, heating, dehumidification)

- Maximum of energy saving

- Plus Energy Extra Costs amortized in 3 to 7 years