Buildings Guide

Upgrade to ultra-low-energy buildings

bigEE

Strategic Approach

The Strategic Approach to improving energy efficiency in buildings

New residential buildings – Low-Energy Buildings

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The term Low-Energy Building (LEB) has different definitions in varying contexts. Different stakeholders use it in different and sometimes misleading ways. In the context of the bigEE project, new residential buildings are labelled as LEB if their primary energy consumption for heating, cooling, ventilation and domestic hot water does not exceed a range of between:

- 40 to 80 kilowatt-hours per square metre of treated floor area per year (kWh/m^2_{TFA}/year) for cold climate zones.
- 40 to 80 kWh/ m^2_{TFA}/year for temperate climate zones.
- 50 to 100 kWh/m^2_{TFA}/year for hot and arid climate zones and
- 100 to 150 kWh/m^2_{TFA}/year for hot and humid climate zones (where additional dehumidification is required)[1].

The corresponding final energy consumption for fuel (gas, oil or biomass) and electricity must fall significantly below these limits.

Due to the scope of the bigEE project, as well as the vast areas of the climatic regions covered, the absolute values set for the primary energy consumption are to be seen as the maximum recommended level. These consumption levels are considered representative for regions with the greatest potential for energy saving according to future population and building growth. However these maximum energy consumption levels might have to be adjusted according to actual climatic conditions. In some climatic regions for example, such as in temperate and hot climates, there are so called “lucky climates”, where with little or no effort all buildings are (nearly) Zero-Energy Buildings (nZEB). Here “credits” by using the maximum levels of energy consumption should not be given. Instead the absolute values used to define the LEB and Ultra-Low-Energy Building (ULEB) standards should be based on the Strategic Approach. This is defined as savings in energy consumption against a comparable conventional building whereby for LEB a reduction in consumption of 40% to 60% and for ULEB a reduction in consumption of 60% to 90% are recommended.

Compared to conventional new buildings, LEBs have:

- Energy saving potential of 40 to 60%
- Low or no extra capital costs if well designed
- Lower lifetime costs if well designed
- Improved thermal comfort during summer and winter
- Higher indoor air quality

[1] In the hot and humid climate zone the levels set for primary energy consumption are higher than those of hot and arid climates due to the significant role that dehumidification plays in energy consumption.

The Easy Effciency Approach towards Low-Energy Buildings

A holistic approach is necessary to meet these criteria, involving all stakeholders including the building owner, consultants and contractors. “Passive Options” play a key role in planning and building these highly-efficient buildings. Detailed design recommendations for Low-Energy Buildings can be found in the Buildings Guide of the bigEE.net platform when selecting a type of building and climatic zone in the Recommendations section. In general, the following **principles** apply to LEB for all building types in a climate zone:

A) Hot and humid climate zones

In hot and humid climates, electricity savings constitute the largest potential, where the majority of energy-related costs and emissions in the buildings sector are associated with cooling and dehumidification and appliances.

The following **measures** of an Easy Efficiency Approach (which are described in detail under “Options” in the Buildings Guide of the bigEE.net platform) will lead to the desired LEB standard:

- Adequate (i.e. for conditioned buildings, compact slightly elogatedforms along an east-west axis and for open buildings, shallow open forms orientated along an east-west axis) building form and orientation
- Effective external shading elements (to avoid overheating) against passive solar gains
- Minimisation of thermal bridges
- Highly energy-efficient building envelope including high performance windows, insulation and air tightness (except for open designs or zones).
- Highly energy-efficient cooling and dehumidification technologies
- Highly energy-efficient units for ventilation and domestic hot water production
- Highly energy-efficient lighting and appliances to minimise internal heat gains
- In addition to energy efficiency actions: Use of local renewable sources (solar radiation, ambient and geothermal energy, sustainable biomass) as far as possible
- Quality assurance of construction work
- Occupant’s briefing and building energy management

B) Hot and arid climate zones

In hot and arid climates, electricity savings constitute the largest potential, where the majority of energy-related costs and emissions in the buildings sector are associated with electrical cooling and appliances.

The following **measures** of an Easy Efficiency Approach ((which are described in detail under “Options” in the Buildings Guide of the bigEE.net platform)) will lead to the desired LEB standard:

- Adequate (i.e. compact buildings with slightly elogated forms along an east-west axis) building form and orientation
- Effective external shading elements (to avoid overheating) against passive solar gains
- Minimisation of thermal bridges
- Highly energy-efficient building envelope including high performance windows, insulation and air tightness depending on climate zone (except for open designs or zones)
- Highly energy-efficient cooling technologies
- Highly energy-efficient units for ventilation and domestic hot water production
- Highly energy-efficient lighting and appliances to minimise internal heat gains
- In addition to energy efficiency actions: Use of local renewable sources (solar radiation, ambient and geothermal energy, sustainable biomass) as far as possible

• Quality assurance of construction work
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C) Temperate climate zones

In temperate climates with cold winters, fuel use for heating presents the largest potential for savings. The following **measures** of an Easy Efficiency Approach (which are described in detail under "Options" in the Buildings Guide of the bigEE.net platform) will lead to the desired standard:

• Adequate (i.e. compact buildings with slightly elogated forms along an east-west axis) building form and orientation
• Use of passive solar gains
• Minimisation of thermal bridges
• Effective external shading elements (to avoid overheating in summer)
• Highly energy-efficient building envelope including high performance windows, insulation and air tightness
• Highly energy-efficient heating and/or cooling technologies
• Highly energy-efficient units for ventilation and domestic hot water production
• Highly energy-efficient lighting and appliances
• In addition to energy efficiency actions: Use of local renewable heat sources (solar radiation, ambient and geothermal energy, sustainable biomass) as far as possible
• Quality assurance of construction work
• Occupant's briefing and building energy management

D) Cool climate zones

In cool climates with cold winters, fuel use for heating presents the largest potential for savings. The following **measures** of an Easy Efficiency Approach (which are described in detail under "Options" in the Buildings Guide of the bigEE.net platform)) will lead to the desired standard:

• Adequate (i.e. in most cases compact) building form and orientation
• Use of passive solar gains
• No thermal bridges
• Effective external shading elements (to avoid overheating in summer)
• Highly energy-efficient building envelope including high performance windows, insulation and air tightness
• Highly energy-efficient heating technologies
• Highly energy-efficient units for ventilation and domestic hot water production
• Highly energy-efficient lighting and appliances
• In addition to energy efficiency actions: Use of local renewable heat sources (solar radiation, ambient and geothermal energy, sustainable biomass) as far as possible
• Quality assurance of construction work
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Your guide to energy efficiency in buildings.

bigee.net

bigEE is an international initiative of research institutes for technical and policy advice and public agencies in the field of energy and climate, co-ordinated by the Wuppertal Institute (Germany). Its aim is to develop the international web-based knowledge platform bigee.net for energy efficiency in buildings, building-related technologies, and appliances in the world's main climatic zones.

The bigee.net platform informs users about energy efficiency options and savings potentials, net benefits and how policy can support achieving those savings. Targeted information is paired with recommendations and examples of good practice.

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