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Training workshop "Studying international practices in implementation of innovative energy efficiency technologies in the electric power industry. Methodology, goal and objectives of electricity and heat consumers energy survey"

SEIT building, 62 Bayram Khan st, Mary, 13-19 March 2024

Review of certification systems for sustainable buildings

Agris Kamenders,
International Consultant, SECCA

Stantec | intec | ACTED | European University Institute | Robert Schuman Centre for Advanced Studies | FSR ENERGY Florence School of Regulation

Building Sector Impact

- 30% of global final energy consumption
- 26% of global greenhouse gas emissions
- 45% of materials utilized in construction
- 36% of overall waste generation
- Humans spend 80% of time indoors (residential, health, work environments

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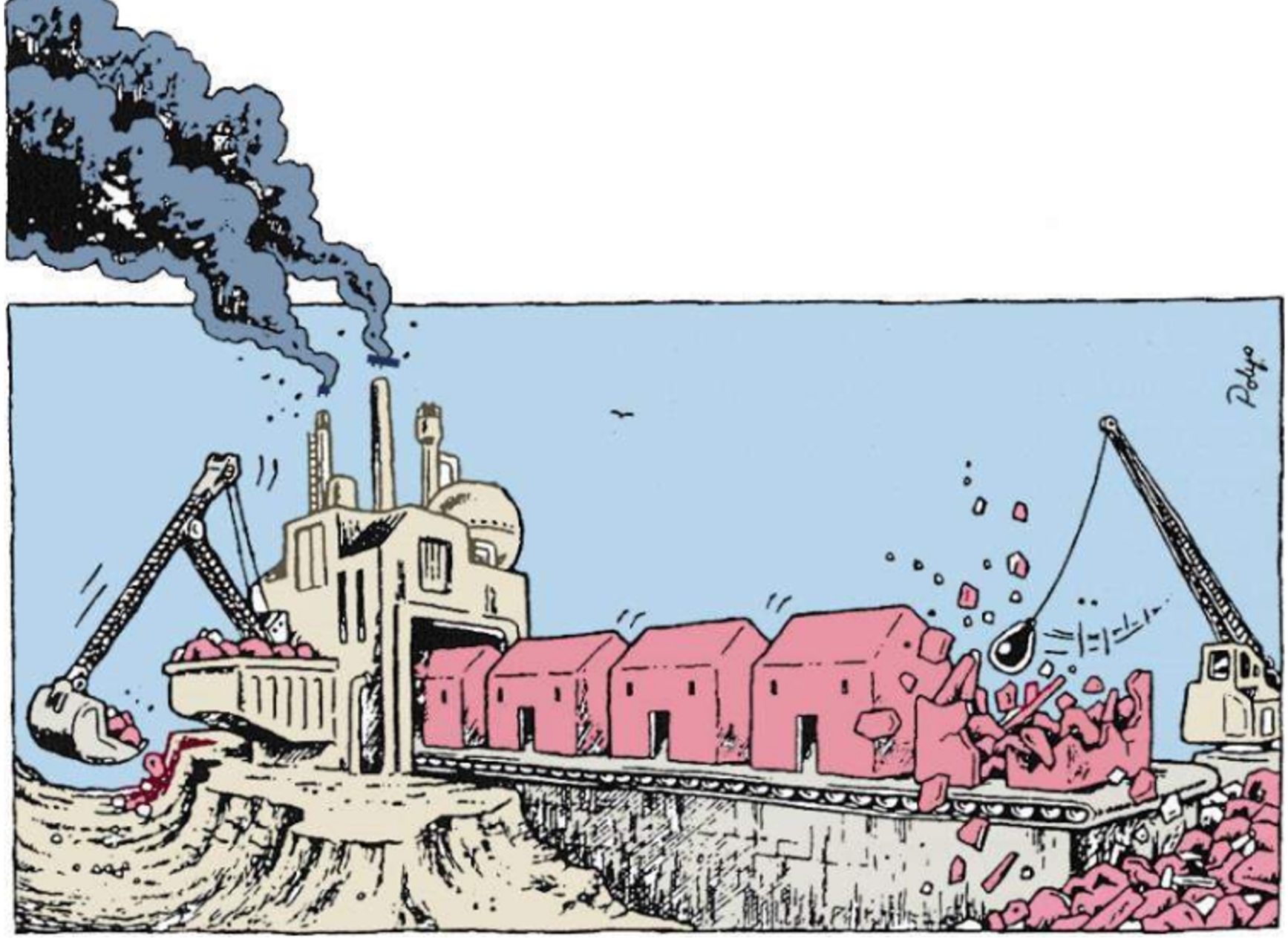
BUILDING LIFE CYCLE



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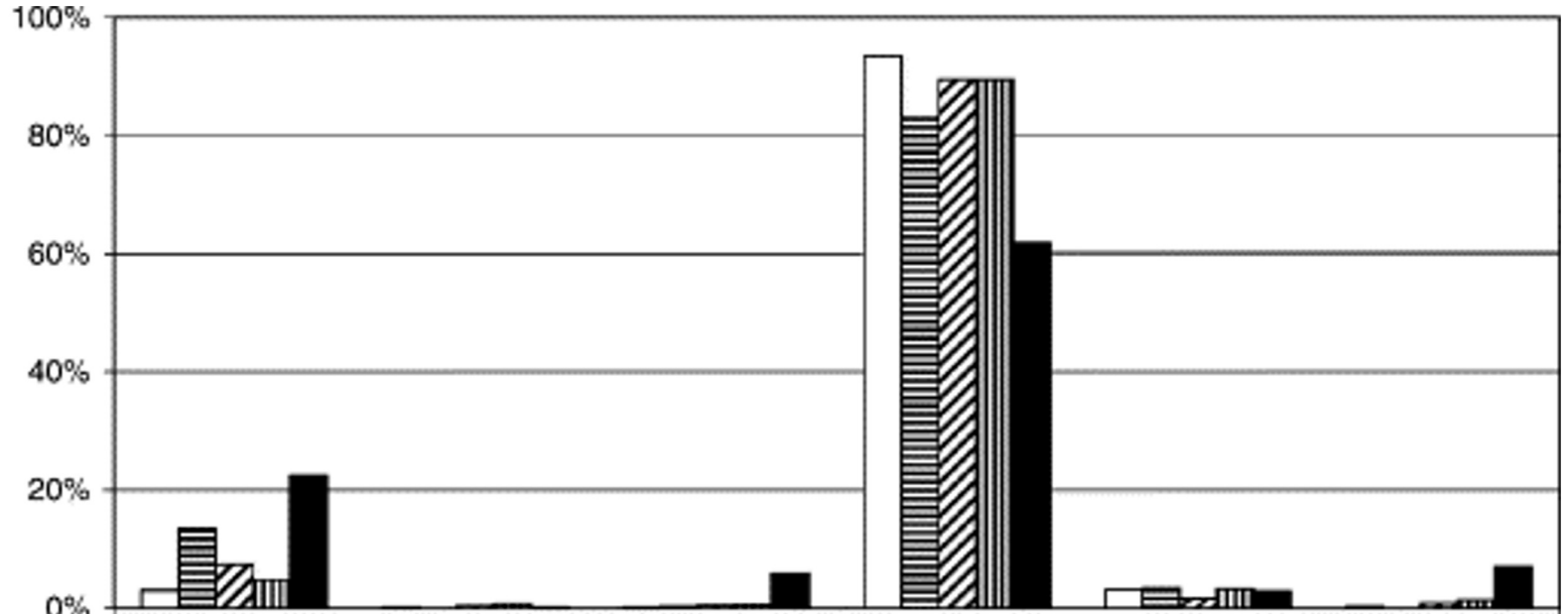
Life cycle energy and environmental performance of a new university building



	Mat Plcmt. Material Prod.	Mat. Plcmt. Transportation	Mat. Plcmt. Construction	Operations HVAC/Electrical	Operations Water Services	De-commissioning
GWP	3.0%	0.1%	0.1%	93.4%	3.1%	0.2%
ODP	13.5%	0.0%	0.2%	82.9%	3.4%	0.0%
AP	7.4%	0.4%	0.4%	89.5%	1.5%	0.8%
NP	4.7%	0.7%	0.5%	89.5%	3.3%	1.3%
Waste	22.4%	0.1%	5.8%	61.9%	2.8%	6.9%

Research: Life cycle energy and environmental performance of a new university building: modeling challenges and design implication, Chris Scheuer, Gregory A. Keoleian, and Peter Reppe

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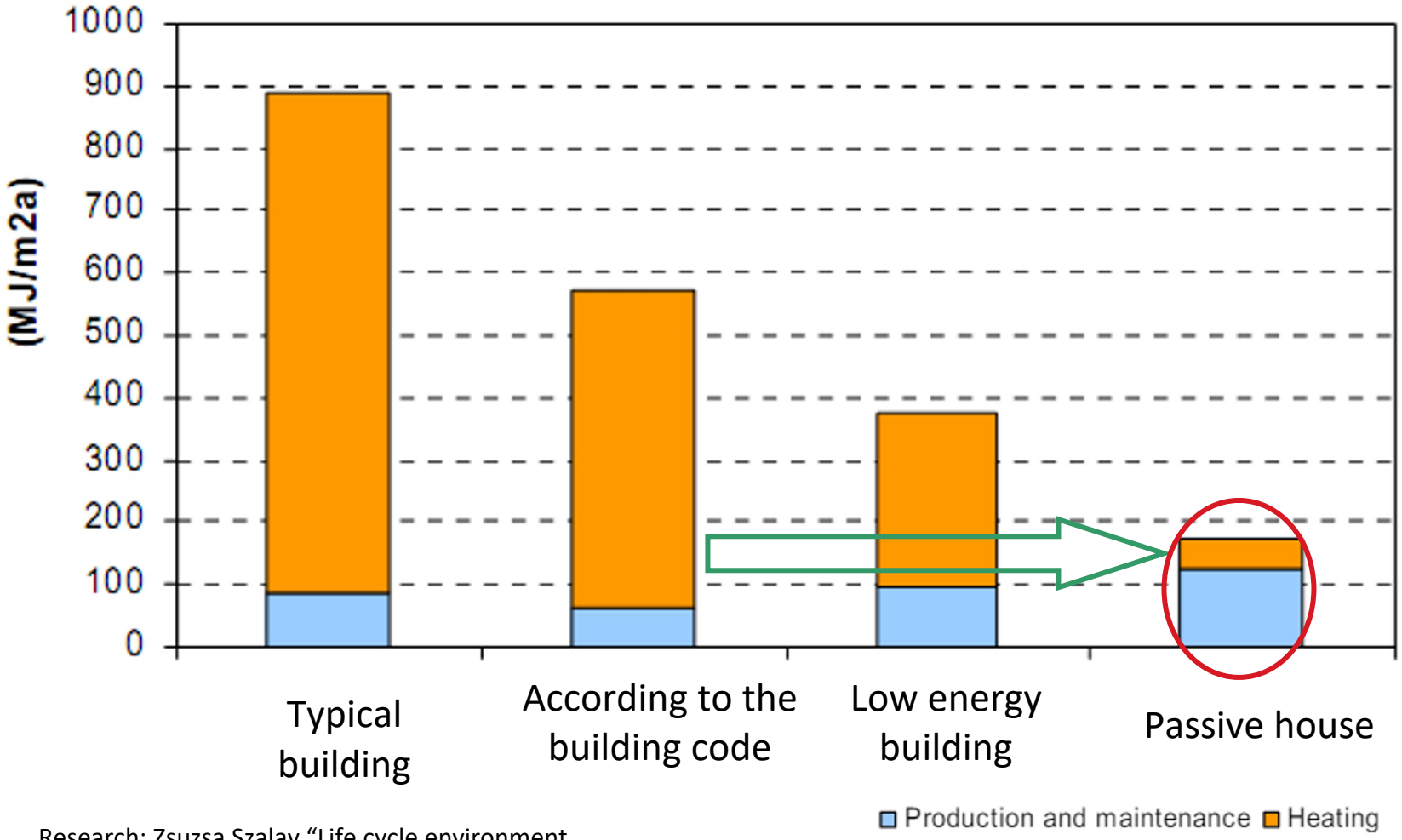
Non-renewable cumulative energy demand



Research: Zsuzsa Szalay “Life cycle environment impact of residential buildings”, 2007

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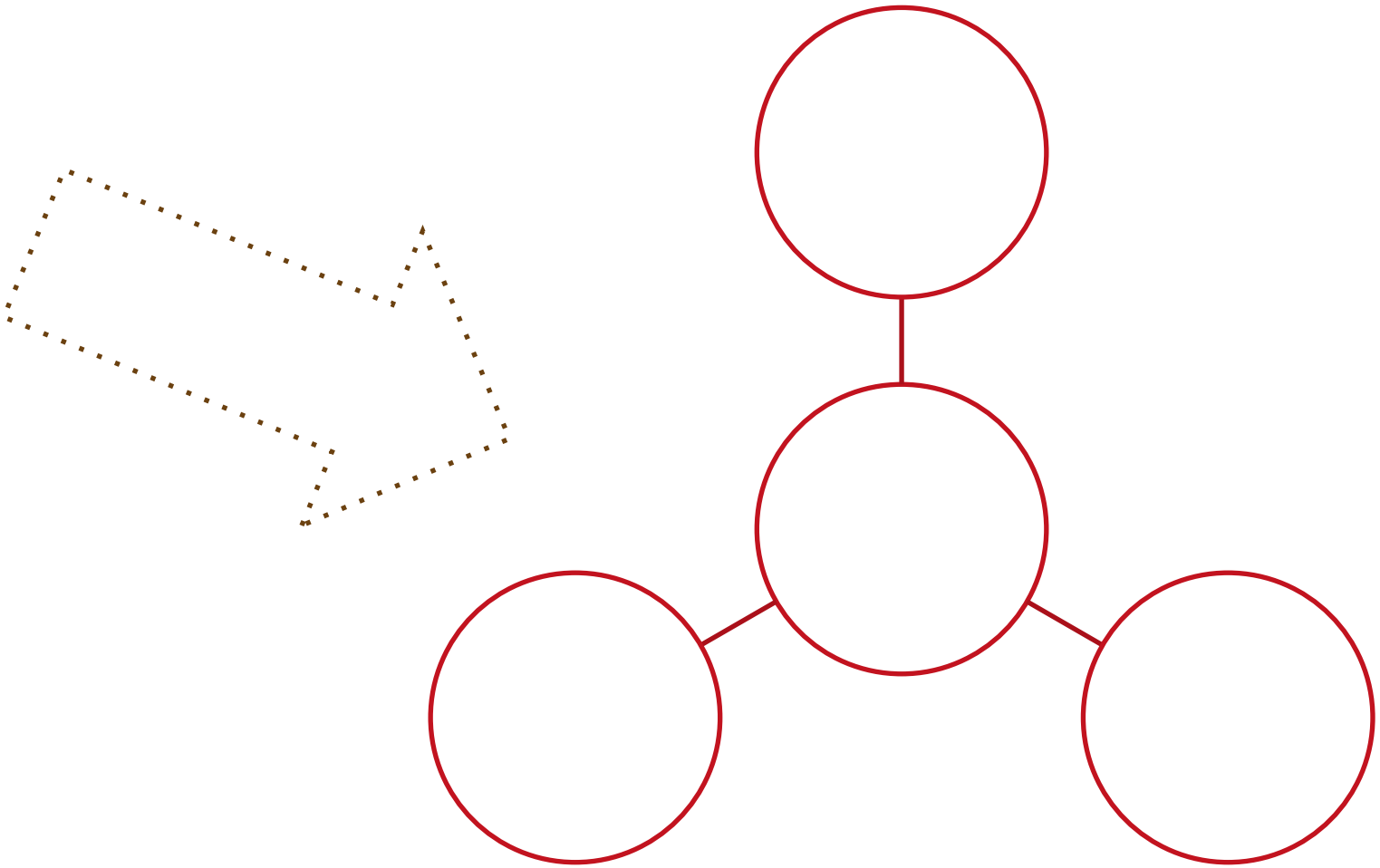
What is sustainable building?

Sustainability



Sustainable building

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Sustainable building certification systems

- Sustainable building certifications, also known as green building rating tools, evaluate and acknowledge buildings meeting specific sustainability criteria.
- These certifications serve to reward companies and organizations for constructing and operating environmentally friendly buildings.
- By establishing standards, certifications stimulate the market and influence government regulations, workforce training, and corporate strategies.
- Certifications vary in scope, covering planning, design, construction, operation, maintenance, renovation, and demolition phases of buildings.
- They also cater to different building types, including homes, commercial buildings, and entire neighborhoods, with specific tools designed for each.

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WHO AND WHY USE BUILDING CERTIFICATION SYSTEMS

- **Building developers and financiers**, to be assured of the building's quality and sustainability
- **Tenants and owners**, to be confident in a healthy, comfortable work/living environment and rational resource consumption
- **Real estate brokers**, to provide clear information about the building's quality and environmental impact, comparing it with other buildings
- **Building managers**, to reduce building maintenance costs
- **State and municipal institutions**, to demonstrate best practices in construction and achieve the best possible socio-economic and environmental performance

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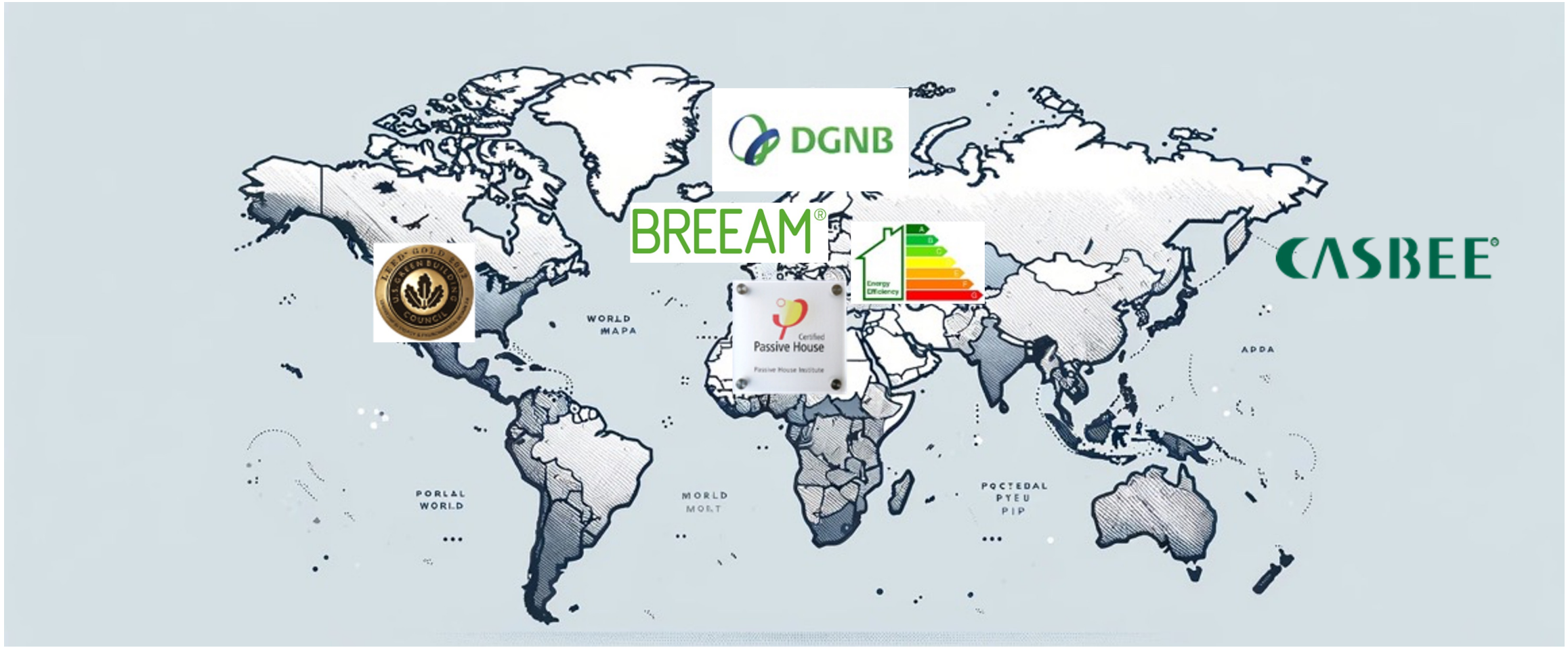
Most popular sustainable building certification systems



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Most popular sustainable building certification systems

Voluntary sustainable building certification shames:

- BREEAM - Building Research Establishment's Environmental Assessment Method
- LEED - Leadership in Energy and Environmental Design
- DGNB - German Sustainable Building Council
- PH – passive house
- CASBEE - Comprehensive Assessment System for Built Environment Efficiency
- ..

EU legislative requirements:

- Energy Performance certificates and minimum energy efficiency requirements
- CO_2 life cycle perspective
- SRI – Smart Readiness Indicators

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BREEAM: The pioneer from Great Britain

The Building Research Establishment Environmental Assessment Method has been in use since 1990, making it the oldest certification system for sustainable construction. Originally developed in the UK, BREEAM has long since become the most widely used certificate. It is awarded in more than 70 countries.

DESCRIPTION OF THE PROCESS

- **BRE group established the criteria for buildings**

The BREEAM certificate can be applied to renovations and new buildings. It applies to offices, public buildings, residential buildings, housing estates and industrial buildings and thus covers a wide range of different building types.

- **The Certified BREEAM assessors will asses the building**

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BREEAM

What is evaluated?

In total, the certificate includes **9+1 assessment categories**:

- Management
- Health and well-being
- Energy
- Transport
- Water
- Material
- Waste
- Land Use and Ecology
- Pollution
- Innovation

How is it evaluated?

Percentage points (on a scale of 0 to 100) are awarded for each category as part of the certification process. These are then added together, resulting in the overall ranking.

It decides on the degree of excellence to be awarded to the building in question. There are a total of five of these grades for new buildings and six for existing buildings:

- Unclassified
- Pass
- Good
- Very good
- Excellent
- Outstanding

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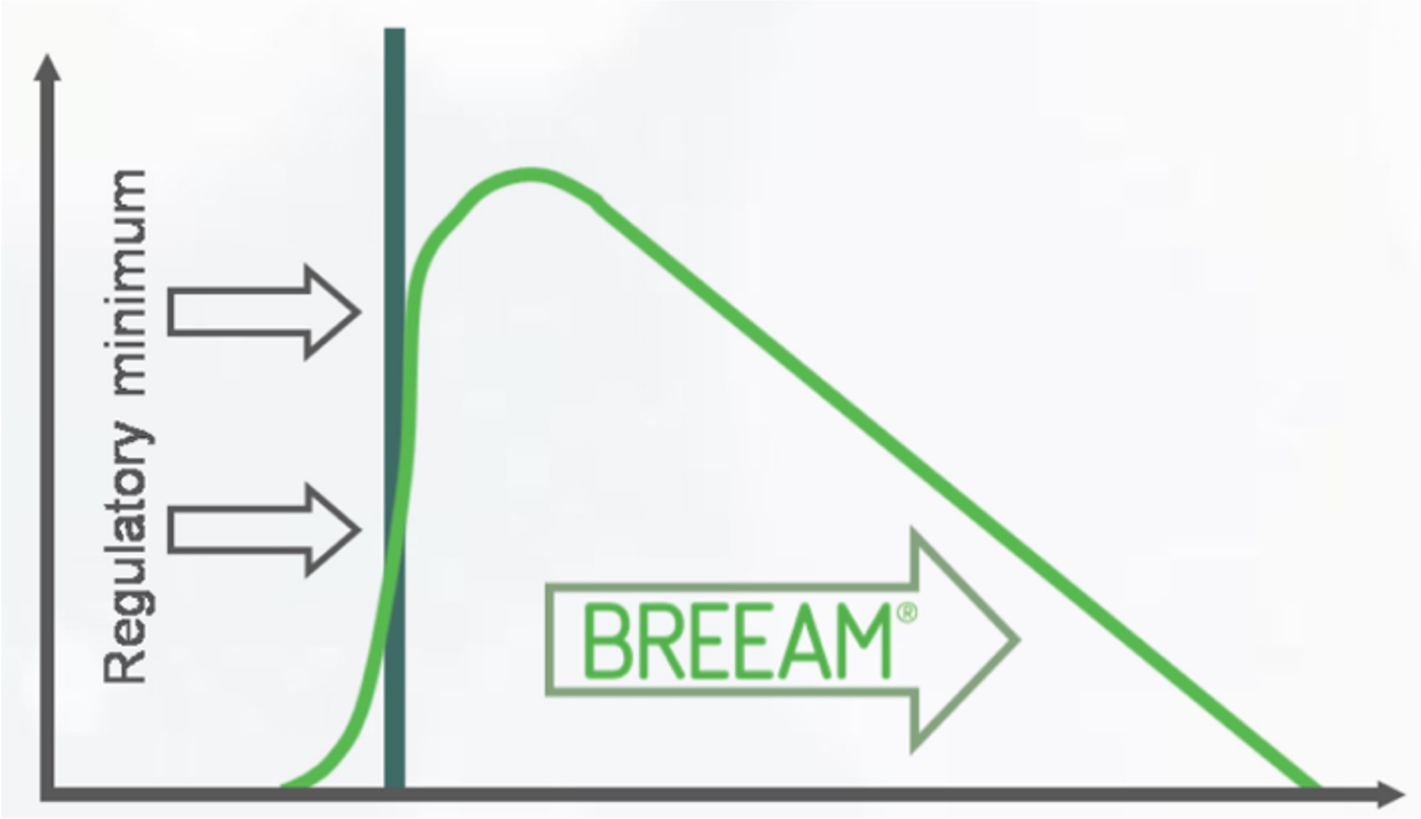
A rating approach

BREEAM	% vērtējums
OUTSTANDING	≥ 85
EXCELLENT	≥ 70
VERY GOOD	≥ 55
GOOD	≥ 45
PASS	≥ 30
UNCLASSIFIED	< 30



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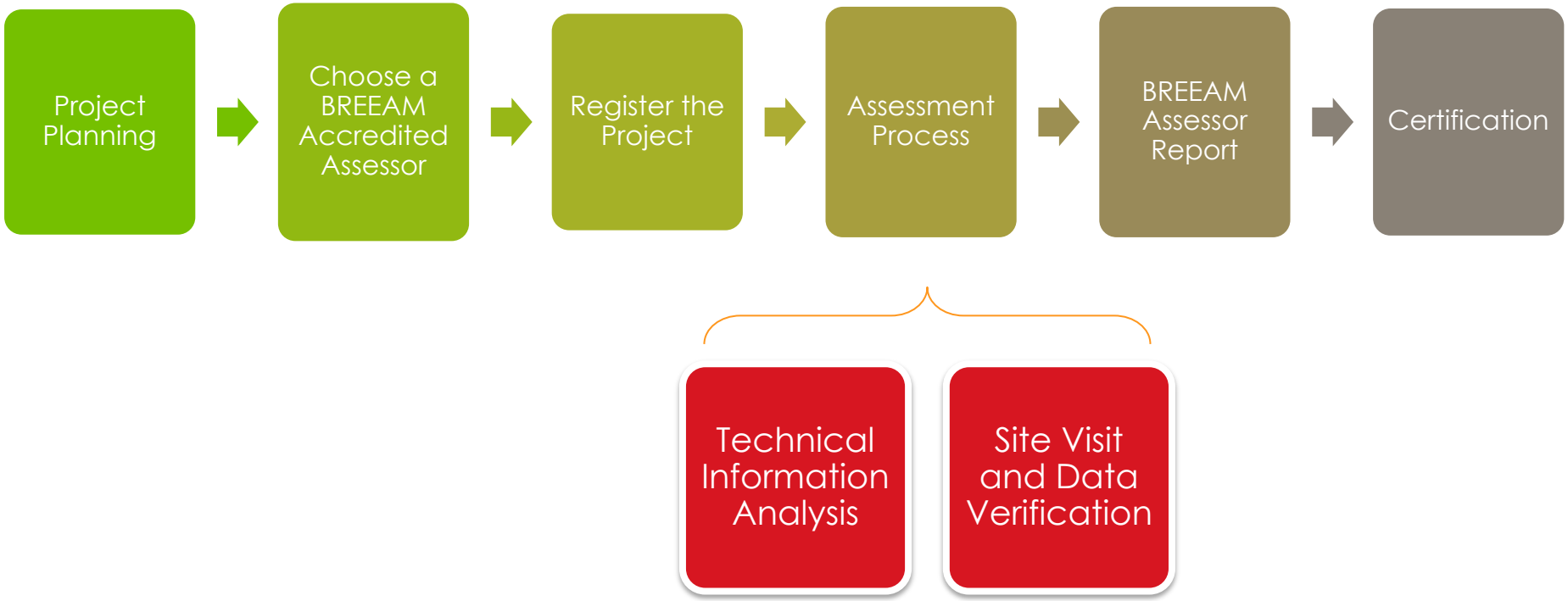
BREEAM Certification Process



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BREEAM - Example of a category assessment

Provides technical guidelines and assessment criteria for 6 different types of Building. The sustainability assessment of buildings is carried out in 9 main categories + 1 innovation:

1. Management
2. Health and well-being
3. Energy
4. Transport
5. Water
6. Material
7. Waste
8. Land Use and Ecology
9. Pollution
10. Innovation

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2. Health and wellbeing

This category encourages the increased comfort, health and safety of building occupants, visitors and others within the vicinity. Issues in this section aim to enhance the quality of life in buildings by recognizing those that encourage a healthy and safe internal and external environment for occupants.

Consists of 9 criteria:

- Visual Comfort up to 6 credits
- Indoor Air Quality up to 5 credits
- Safe Facilities, Spaces up to 2 credits
- Thermal Comfort up to 3 credits
- Acoustics up to 4 credits
- Accessibility up to 2 credits
- Hazard Analysis up to 1 credits
- Private Spaces up to 1 credits
- Water Quality up to 1 credits

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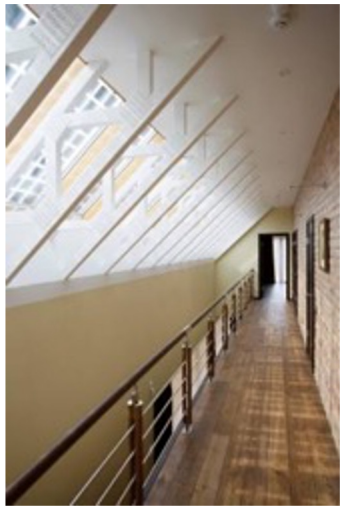
Hea 01 Visual comfort (up to 6 credits)

To ensure daylighting, artificial lighting and occupant controls are considered at the design stage to ensure best practice in visual performance and comfort for building occupants.

- Glare control (1 credit)
- Daylighting (up to 4 credits - building type dependent)
- View out (1 credit)
- Internal and external lighting (1 credit)



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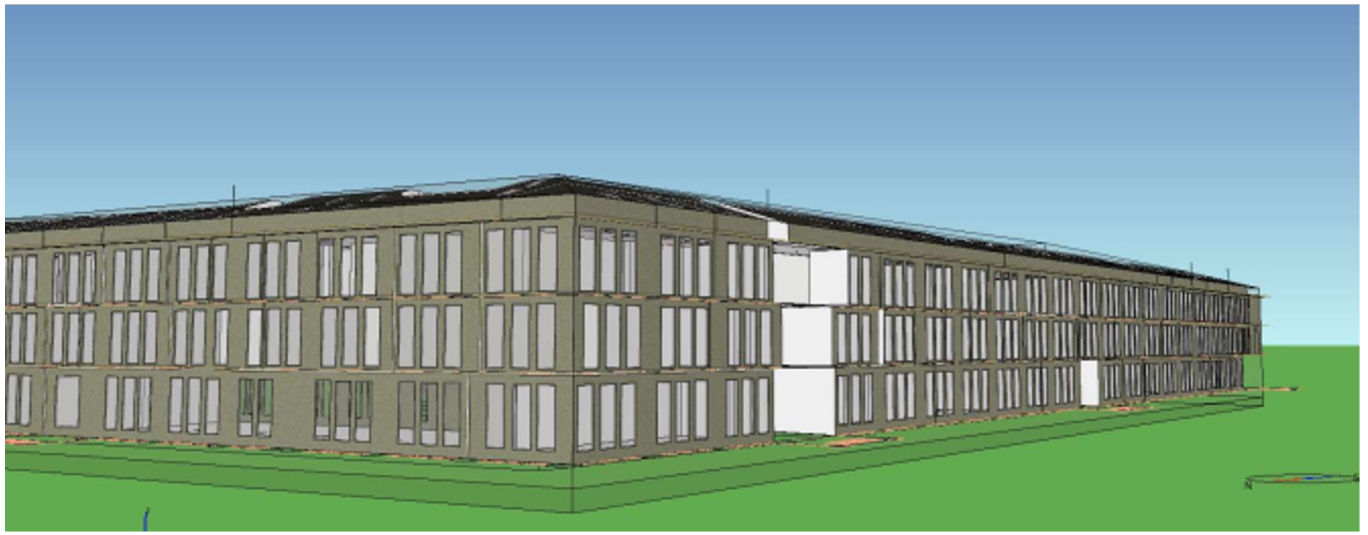
Daylighting (up to 4 credits - building type dependent)

Average daylight factor required by latitude 55 - 60 (degrees)		
	1 credit	2 credits
Universities, colleges and higher education - occupied spaces	60%	80%



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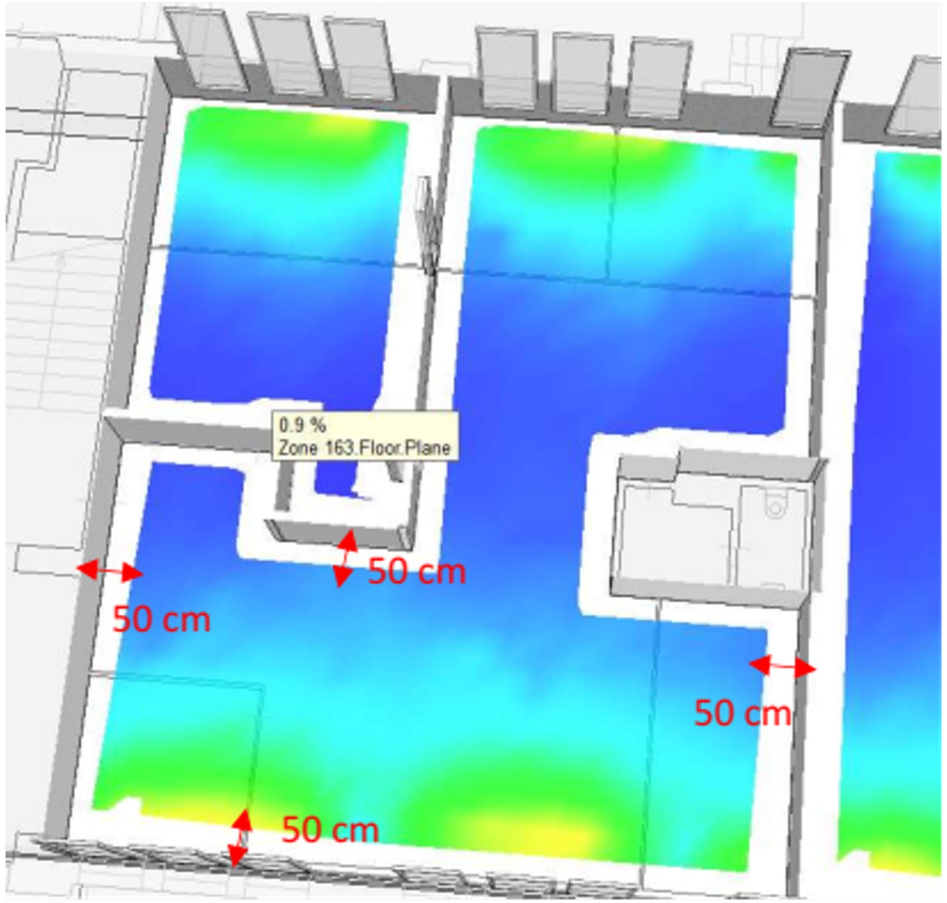
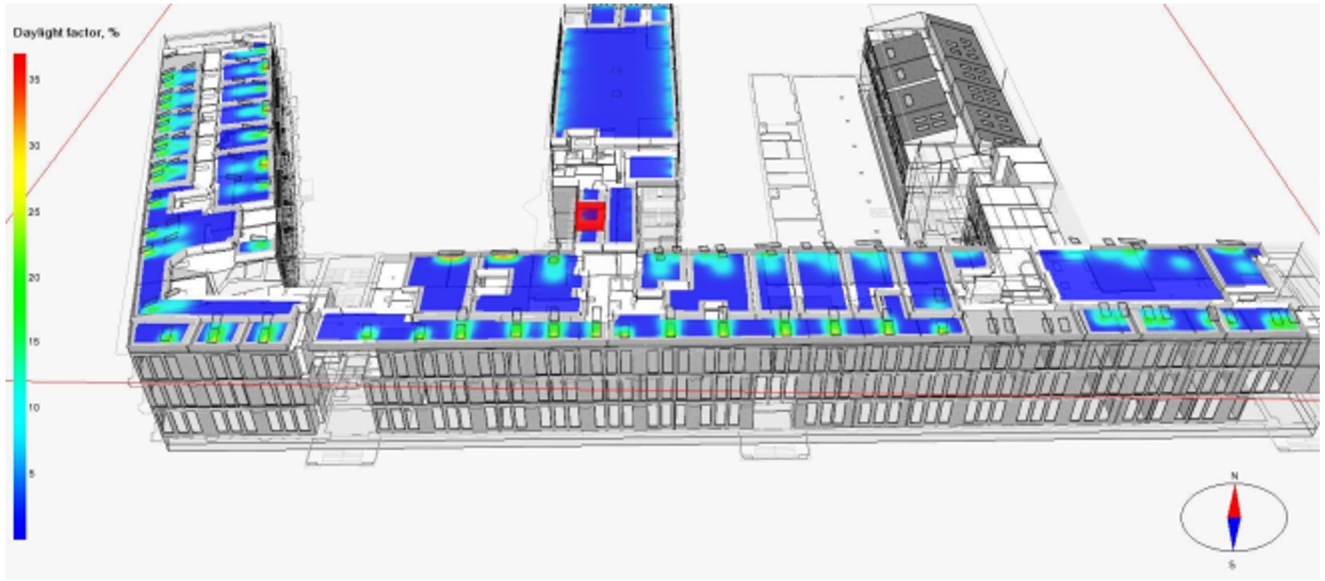
Use of daylight



The uniformity ratio calculation, minimum point daylight factor and minimum daylight illuminance can exclude areas within 0.5m of walls. Areas within 0.5m are not regarded as part of the working plane for this purpose, although they are included in the average daylight factor and average daylight illuminance calculations.



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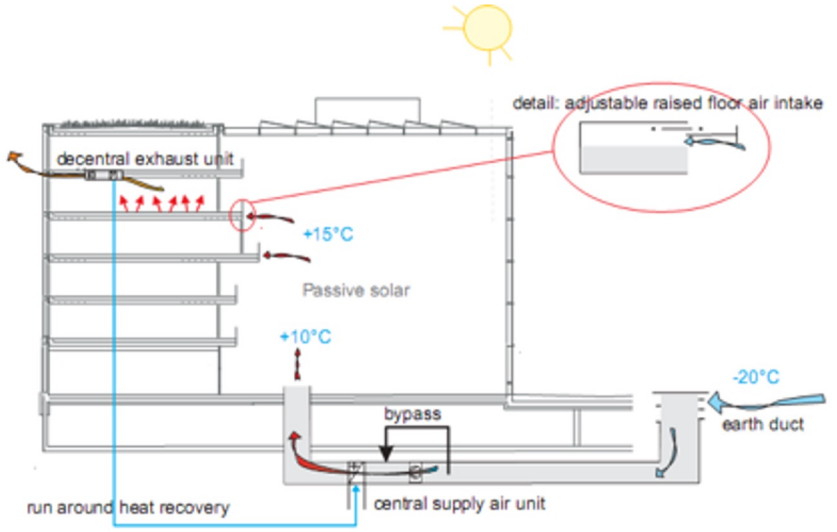
Examples of section Energy

Assessment issues

Ene1: Reduction of energy use and carbon emissions
Ene2: Energy monitoring
Ene3: External lighting
Ene4: Low carbon design
Ene5: Energy efficient cold storage
Ene6: Energy efficient transport systems
Ene7: Energy efficient laboratory systems
Ene8: Energy efficient equipment
Ene9: Drying space
Ene10: Flexible demand side response



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BREEAM CERTIFIED BUILDINGS

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LEED: Building Certification from America

The LEED (Leadership in Energy and Environmental Design) certification system was initially developed in 1998 for the United States. Since 2002, LEED Canada has been a version tailored to Canada, which takes into account the climatic conditions, construction methods and national laws there.

U.S. Green Building Council → **CLIENT** → **CERTIFIED DESIGNER**

DESCRIPTION OF THE PROCESS

- **The U.S. Green Building Council established the criteria for buildings**

The LEED applies to:
- **Commercial**
- **Neighborhood Development**
- **Residential**
- **Volume Supplement**
- **Cities and Communities**

Covers a wide range of different building types.

- **LEED Certified™: a verified score of 40-49**
- **LEED Silver®: a verified score of 50-59**
- **LEED Gold®: a verified score of 60-79**
- **LEED Platinum®: a verified score of 80+**

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LEED

What is evaluated?

The spectrum of LEED certification ranges from new buildings and renovations to investor models and from existing buildings to entire communities.
8 topics are considered:

- Infrastructural integration of the site
- Property Qualities
- Water efficiency
- Energy and Global Environmental Impacts
- Material cycles and resource conservation
- Indoor air quality
- Innovations
- Bonuses for criteria that are of particular importance due to the location

How is it evaluated?

The LEED certificate is based on a point system that is awarded in the categories mentioned. Based on the score, the evaluated buildings are divided into four different levels:

- Certified (40 to 49 points)
- Silver (50 to 59 points)
- Gold (60 to 79 points)
- Platinum (80 to a maximum of 110 points)

Certification procedures and conformity testing can also be transferred to projects in other countries. Green Business Certification Inc. Europe (GBCI) carries this out on behalf of the USGBC for the European region.

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DGNB: German Certificate for Sustainable Building

The German award for sustainable buildings has been presented since 2009. The DGNB certificate was launched as a joint project of today's Federal Ministry of Transport and Digital Infrastructure and the eponymous German Sustainable Building Council (DGNB).

With its own certification system, the requirements of German standards and regulations, among other things, should be incorporated more strongly into the quality criteria. As with BREEAM and LEED, the overall performance of a building is evaluated over its entire life cycle.

German Sustainable Building Council → **CLIENT** → **CERTIFIED DESIGNER**

DESCRIPTION OF THE PROCESS

- **The German Sustainable Building Council established the criteria for buildings**

The certificate can be applied to renovations and new buildings. It applies to offices, public buildings, residential buildings, housing estates and industrial buildings and thus covers a wide range of different building types.

- **The DGNB auditor will act to apply the credits**

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DGNB: German Certificate for Sustainable Building

What is evaluated?

The DGNB certification system offers variants for different building types and uses. For new construction, refurbishment, existing buildings and demolition, there are therefore adapted certifications as well as for residential, office, commercial or logistics buildings.

The system is based on 6 criteria:

- Ecological quality
- Economic quality
- Socio-cultural-functional quality
- Technical quality
- Process quality
- Locational quality

How is it evaluated?

Similar to other leading certification systems, the DGNB procedure also awards points for the individual criteria, which are added together to form a percentage.
Four different levels can be reached:

- Bronze
- Silver
- Gold
- Platinum

In addition, there are additional awards such as DGNB Diamond for exceptionally high architectural quality, DGNB "Climate Positive" and the DGNB special award "Ecolabel".

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Passive House: German based

PASSIVE HOUSE	CLIENT	DESIGNER	ACCREDITED BODY

DESCRIPTION OF THE PROCESS

- **The Passive House Institute established the criteria and Passive House Planning Package for buildings to ascribe to, to be considered Passive Houses**


Certificate

- **The client contacts a non-accredited designer to build a who**
- **The building will be designed according to Passive House standards using the PHPP program**
- **Once the design has been completed, the documentation is sent to the Passive House Institute accredited certifying body**
- **The documentation required must be provided to the certifier which will be reviewed at least once**
- **The client is then given the calculation results corrected with the proposed improvements, if applicable**
- **Supervision during the construction phase is not subject to certification**
- **After construction, any changes in the planning will be updated**
- **If the technical accuracy of the documentation required is confirmed and the criteria established are met, the certificate will be issued.**

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Sustainability classification ranking granted by LEED, BREEAM and DGNB

RATING SCALES	LEED	BREEAM	DGNB
Highest level	Platinum >80 points	outstanding >85% (innovator)	Platinum >80%
Second highest level	Gold 60–79 points	Excellent>70% (best practice)	Gold>65%
Third highest level	silver 50–59 points	Very good>55%	silver>50%
Fourth highest level	certified 40–49 points	Good>45%	Bronze>35%
Fifth highest level		Pass >30%	

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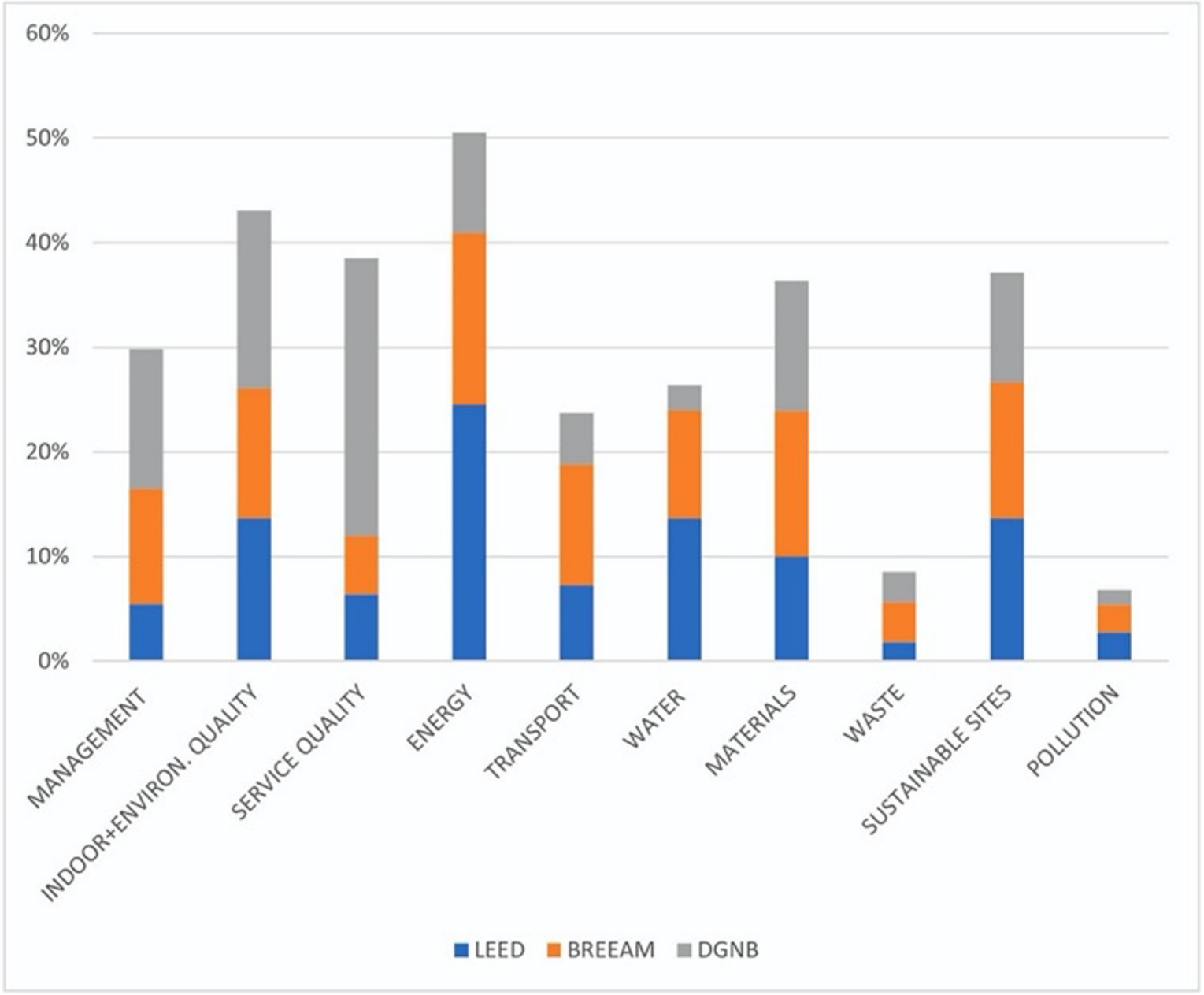
WEIGHT OF EACH SUSTAINABILITY CATEGORY IN THE OVERALL CERTIFICATION RATING ACHIEVED BY LEED, BREEAM AND DGNB



Source: Ana Ferreira, Manuel Duarte Pinheiro, Jorge de Brito, Ricardo Mateus, A critical analysis of LEED, BREEAM and DGNB as sustainability assessment methods for retail buildings

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Passive house standard

What is evaluated?

Main focus on indoor quality, energy efficiency and primary energy consumption

- Building energy consummation (insulation levels, airtightness
- Primary energy consummation (Renewable energy sources, Integration of renewable energy systems such as solar panels or geothermal heating to further reduce energy demand)
- Indoor quality

How is it evaluated?

Verification through rigorous testing:

- Blower door tests
- PHPP and external certification processes to ensure compliance with Passive House standards.

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Passive house certificates

Building certificates

Certification for Individuals

Certification of Building Elements

Certified window frames, glazing, window installation details, glazed walls, exterior doors, wall and structural systems, ventilation systems, compact heating equipment, thermal bridge-free structures, etc.

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Passive House requirements

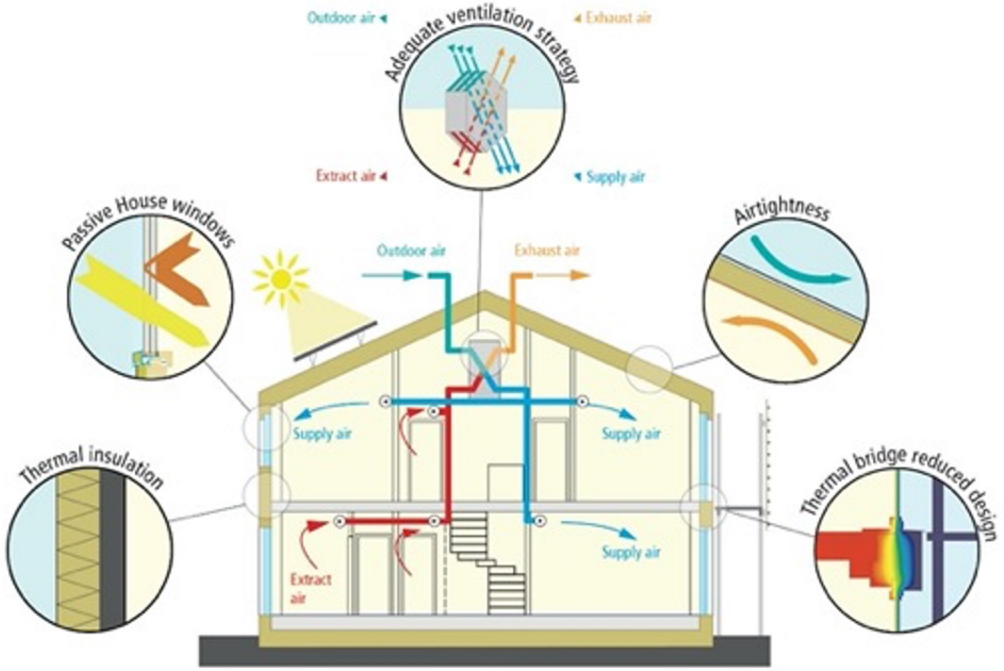
1. The **Space Heating Energy Demand** is not to exceed 15 kWh per square meter of net living space (treated floor area) per year or 10 W per square meter peak demand.

In climates where active cooling is needed, the **Space Cooling Energy Demand** requirement roughly matches the heat demand requirements above, with an additional allowance for dehumidification.

2. The Renewable **Renewable Primary Energy Demand (PER, according to PHI method),** the total energy to be used for all domestic applications (heating, hot water and domestic electricity) must not exceed 60 kWh per square meter of treated floor area per year for Passive House Classic.

3. In terms of **Airtightness**, a maximum of 0.6 air changes per hour at 50 Pascals pressure (ACH50), as verified with an onsite pressure test (in both pressurized and unpressurized states).

4. Thermal **comfort** must be met for all living areas during winter as well as in summer, with not more than 10 % of the hours in a given year over 25 °C. For a complete overview of general quality requirements (soft criteria)



Source: passiv.de

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Passive House requirements

Thermal insulation
All opaque building components of the exterior envelope of the house must be very well-insulated. For most cool-temperate climates, this means a heat transfer coefficient **(U-value) of 0.15 W/(m²K)** at the most, i.e. a maximum of 0.15 watts per degree of temperature difference and per square metre of exterior surface are lost.

Passive House windows
The window frames must be well insulated and fitted with low-e glazings filled with argon or krypton to prevent heat transfer. For most cool-temperate climates, this means a U-value of 0.80 W/(m²K) or less, with g-values around 50% (g-value= total solar transmittance, proportion of the solar energy available for the room).

Ventilation heat recovery
Efficient heat recovery ventilation is key, allowing for a good indoor air quality and saving energy. In Passive House, at least 75% of the heat from the exhaust air is transferred to the fresh air again by means of a heat exchanger.

Airtightness of the building
Uncontrolled leakage through gaps must be smaller than **0.6** of the total house volume per hour during a pressure test **at 50 Pascal (both pressurised and unpressurised).**

Absence of thermal bridges
All edges, corners, connections and penetrations must be planned and executed with great care, so that thermal bridges can be avoided. Thermal bridges which cannot be avoided must be minimised as far as possible.

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