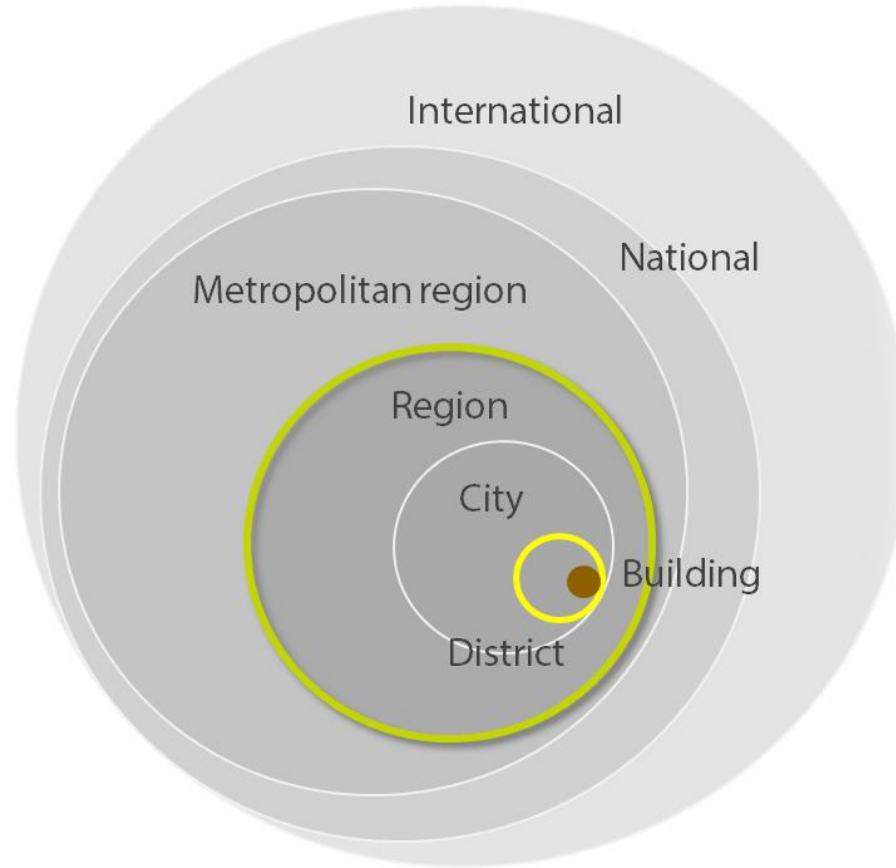


THE GREEN LEAP FORWARD – DGNB, LEED AND BREEAM
WORLD GREEN INFRASTRUCTURE CONGRESS
THOMAS KRAUBITZ | BUROHAPPOLD CITIES



SWEET SPOTS AND SWEET AREAS



WHAT IS THE LIFE WE ARE LOOKING FOR?



© <https://greenmotion.com/perch/resources/green-living.jpg>

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ENGINEERING

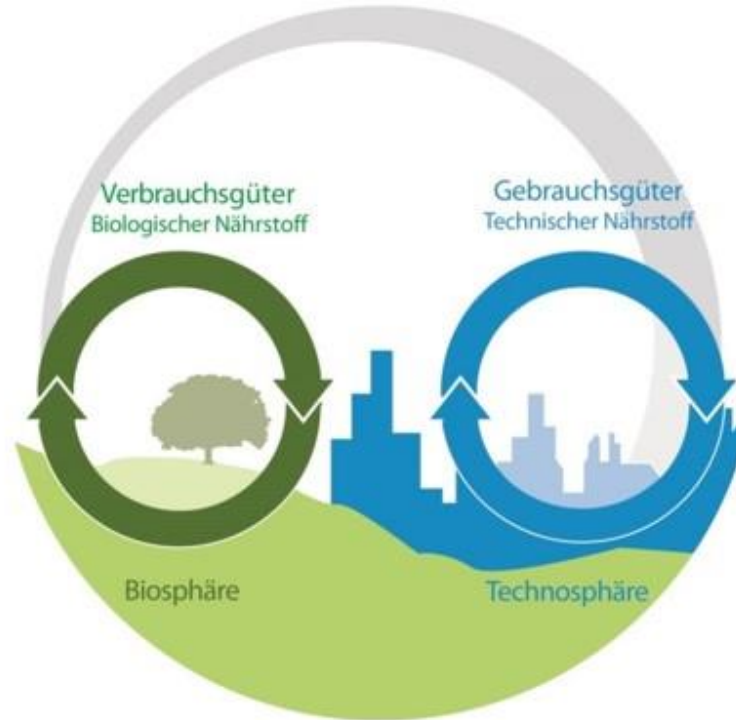
HOW DO WE CREATE BUILDINGS?



HOW CAN WE BRING NATURE TO OUR BUILDINGS AND CITIES?



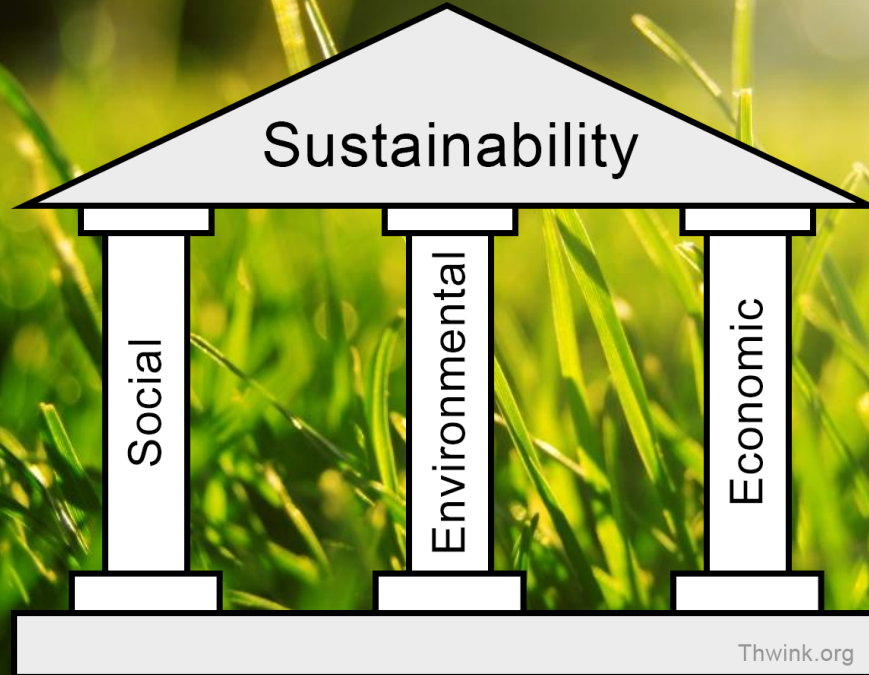
GREENWALL AS INTERFACE



COMPETITION IN CHINA 2011 – ACTIVE WALLS



GREEN IN 2D AND 3D



NATIONAL CERTIFICATION SCHEMES IN GERMANY

BREEAM® DE



TÜV SÜD Industrie Service GmbH –
Deutsches Privates Institut für Nachhaltige
Immobilienwirtschaft



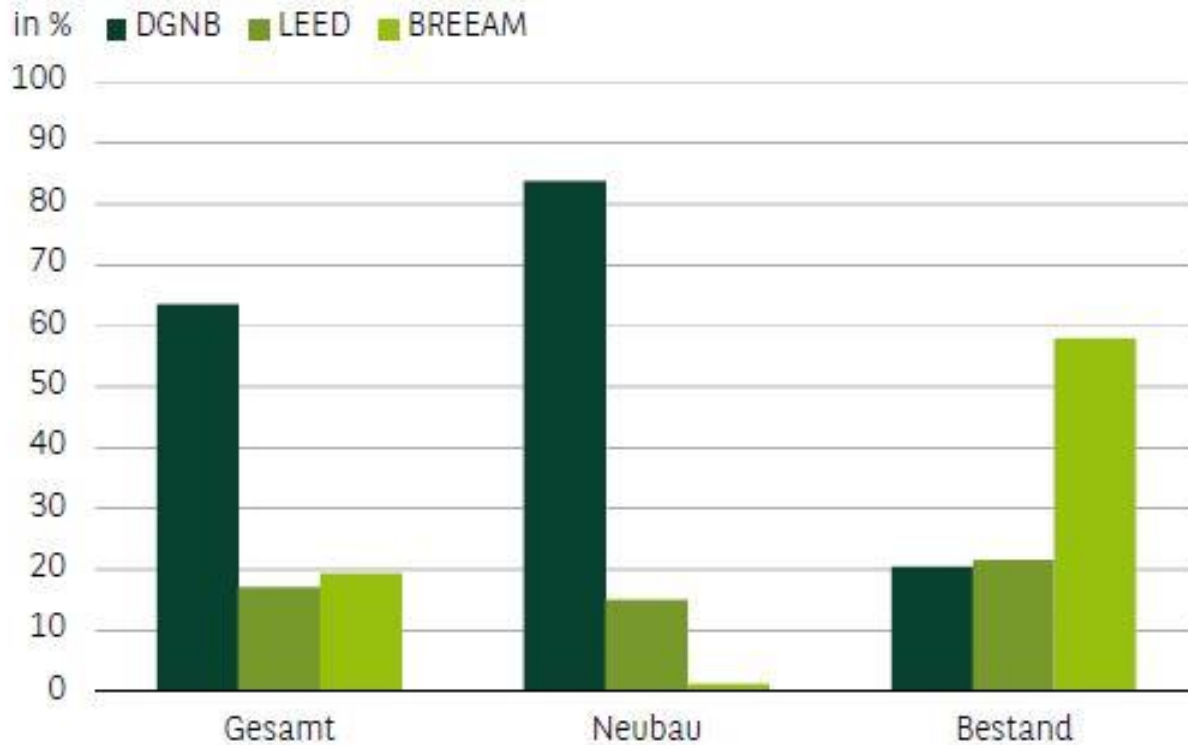
DGNB

Deutsche Gesellschaft für Nachhaltiges Bauen e.V.
German Sustainable Building Council



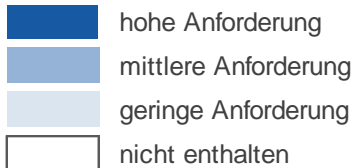
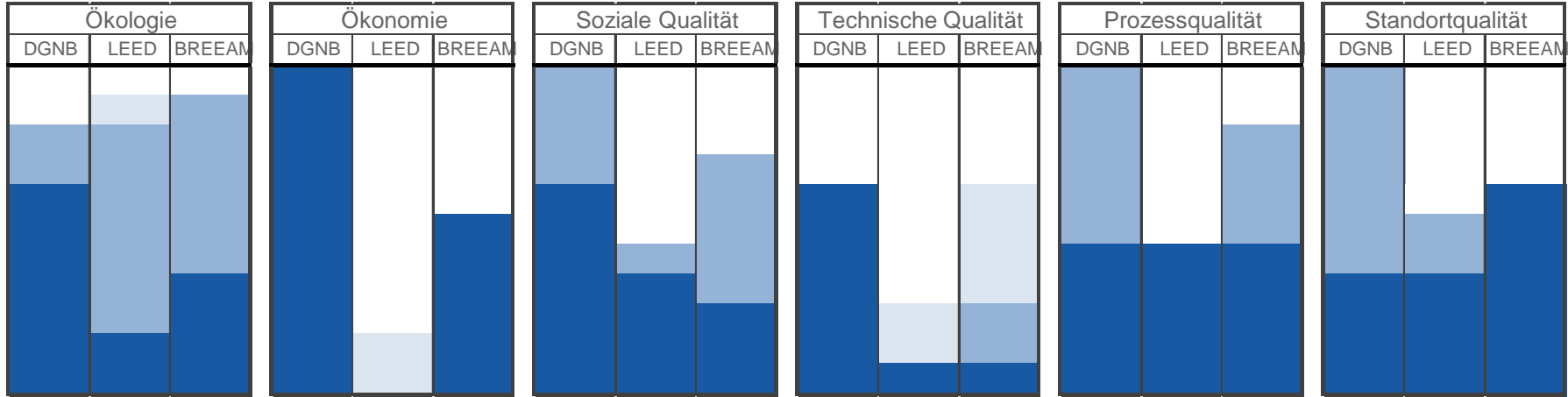
MARKET SHARE CERTIFICATION

Marktanteile der Zertifizierungssysteme Ende 2016



© BNP Paribas Real Estate GmbH, 31. Dezember 2016

COMPARISON OF THE THREE MAJOR CERTIFICATION SCHEMES



© Drees & Sommer Advanced Building Technologies, Dr. Peter Möhle

GREEN AND GREEN CERTIFICATIONS



ONE ANGEL SQUARE – HIGHEST BREEAM AT 95.16%



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HUMBOLDTHAFEN EINS – HIGHEST DGNB AT 90.4%

BUROHAPPOLD
ENGINEERING



HOW DOES A GREENWALL SUPPORT A BUILDING CERTIFICATION?



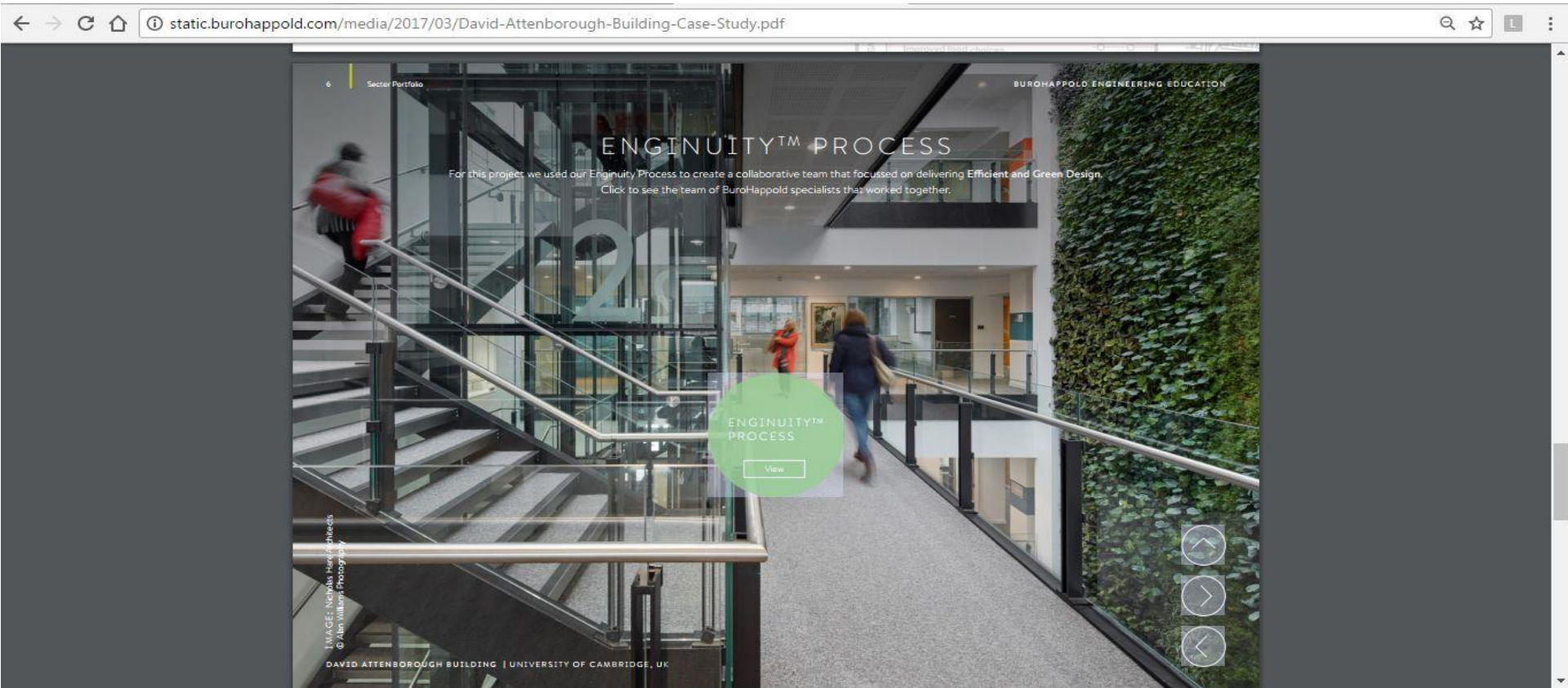
GREEN WALLS IN BREEAM

BREEAM®

ALEA 101 BERLIN



BREEAM – DAVID ATTENBOROUGH BUILDING



BREEAM – DAVID ATTENBOROUGH BUILDING



BREEAM – DAVID ATTENBOROUGH BUILDING

BESPOKE SUSTAINABILITY FRAMEWORK

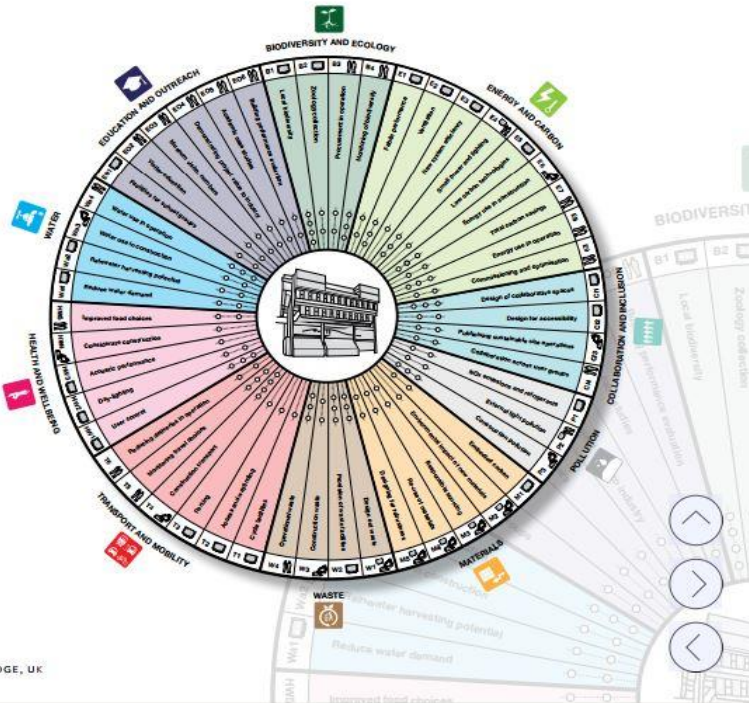
BuroHappold pioneered a bespoke Sustainability Framework which aimed to reach beyond BREEAM by setting ambitious project specific targets across 10 headline themes and 50 sub-themes.

Headline targets included a 40% reduction in operational carbon emissions, 30% reduction in water use per person and 60% total roof coverage for biodiverse green roofs.

A comprehensive evidence handbook was produced setting design, construction and post occupancy targets, developed through fully facilitated stakeholder engagement workshops with all building users, the University Estates Energy, Environment and Facilities Management teams. The framework was presented to the Cambridge City Council Planning Authority who fully supported its unique and robust approach to sustainability.



DAVID ATTENBOROUGH BUILDING | UNIVERSITY OF CAMBRIDGE, UK



BREEAM – GREEN WALLS



Policies, standards & incentives

Increasingly councils and planning authorities are looking at encouraging the inclusion of green infrastructure in new developments and many Local Development Framework (LDF) policies are being modified to reflect these changes. Though no standards or certification processes are currently in place for green wall installations, there is a movement amongst industry experts to address this gap through the development of a trade association for green wall providers.

In the meantime the most common specifications adopted in the UK for sustainable buildings is the BREEAM environmental assessment method and rating system for buildings (www.breeam.org). Though no green wall specific measures or ratings are currently in effect, the ratings system can be applied to green walls in two main areas:

1. The materials used in construction of green wall system.
2. Improvements in biodiversity offered by the new/addition of plant species in the area.

BREEAM – ADDING TO THE OVERALL CONCEPT

KEY FACTS

- BREEAM rating: Outstanding
- Score: 96.31%
- Size: 39936 m²
- Stage: Post-Construction
- BREEAM version: BREEAM 2008 Offices

OVERVIEW OF ENVIRONMENTAL FEATURES

- Biofuel trigeneration CCHP with and absorption chillers
- Biofuel is sourced from locally collected and refined waste vegetable oil
- Green walls and landscaped garden planting
- Waterless urinals and low flush toilets
- Comprehensive metering strategy and BMS
- Interactive screen in reception confirming building energy usage
- An innovation credit was achieved for the responsible sourcing of materials. >95% of materials used within the construction were responsibly sourced with an ISO 14001 certificate as a minimum.
- Staircase installed within the atria to promote vertical movement without the use of lifts.

THE BREEAM ASSESSMENT

- Management 100.00%
- Transport 100.00%
- Materials 100.00%
- Energy 95.65%
- Waste 85.71%
- Water 83.33%
- Land Use 80.00%
- Innovation 80.00%

GREEN WALLS IN DGNB



DGNB[®]

Deutsche Gesellschaft für Nachhaltiges Bauen e.V.
German Sustainable Building Council

GRAND CENTRAL BERLIN

DGNB



IN COLLABORATION WITH THE DGNB



ENV1.1
Ökobilanz-
emissionsbedingte
Umweltwirkungen

ENV1.2
Risiken für die lokale Umwelt

ENV1.3 Umweltverträgliche
Materialgewinnung

ENV2.1
Ökobilanz –
Ressourcenverbrauch

ENV2.2
**Trinkwasserbedarf
und Abwasserauf-
kommen**

ENV2.3
Flächeninanspruchnahme



ECO1.1
Gebäudebezogene Kosten
im Lebenszyklus

ECO2.1
Flexibilität und
Umnutzungsfähigkeit

ECO2.2
Marktfähigkeit



SOC1.1
Thermischer Komfort

SOC1.2
**Innenraumluft-
qualität**

SOC1.3
Akustischer Komfort

SOC1.4
Visueller Komfort

SOC1.5
Einflussnahme des Nutzers

SOC1.6
**Aufenthaltsqualität
en Innen / Außen**

SOC1.7
Sicherheit

SOC2.1
Barrierefreiheit

SOC2.2
Nutzungsangebote an die
Öffentlichkeit



TEC1.2
Schallschutz

TEC1.3
Tauwasserschutz der
Gebäudehülle

TEC1.4
Anpassungsfähigkeit der
technischen Systeme

TEC1.5
**Reinigungs- und
Instandhaltungs-
freundlichkeit des
Baukörpers**

TEC1.6
Rückbau- und
Recyclingfreundlichkeit

TEC3.1
Mobilitätsinfrastruktur



PRO1.1
Projektvorbereitung und
Planung

PRO1.3
Konzeptionierung und
Optimierung in der
Planung

PRO1.4
Sicherung der
Nachhaltigkeitsaspekte in
Ausschreibung und
Vergabe

PRO1.5
Voraussetzungen für eine
optimale Nutzung und
Bewirtschaftung

PRO1.6
Verfahren zur
städtebaulichen und
gestalterischen Konzeption

PRO2.1
Baustelle/Bauprozess

PRO2.2
Qualitätssicherung der
Bauausführung

PRO2.3
Geordnete Inbetriebnahme



SITE1.1
Mikrostandort

SITE1.2
**Image und Zustand
von Standort und
Quartier**

SITE1.3
Verkehrsanbindung

SITE1.4
Nähe zu nutzungs-
relevanten Einrichtungen

SOC 1.2 – INDOOR AIR QUALITY



© DGNB

Impact of less than 0.1%

SOC 1.6 – SPACE QUALITY INDOORS

Soziokulturelle und funktionale Qualität SOC1.6 AUFENTHALTSQUALITÄTEN INNEN / AUSSEN

TABELLE 11

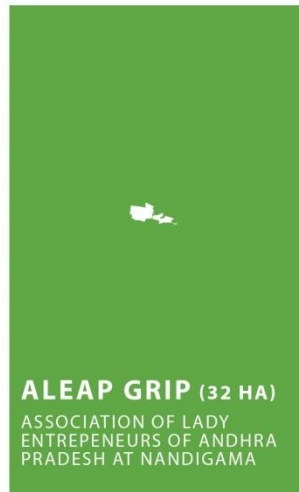
BESCHREIBUNG

CLP

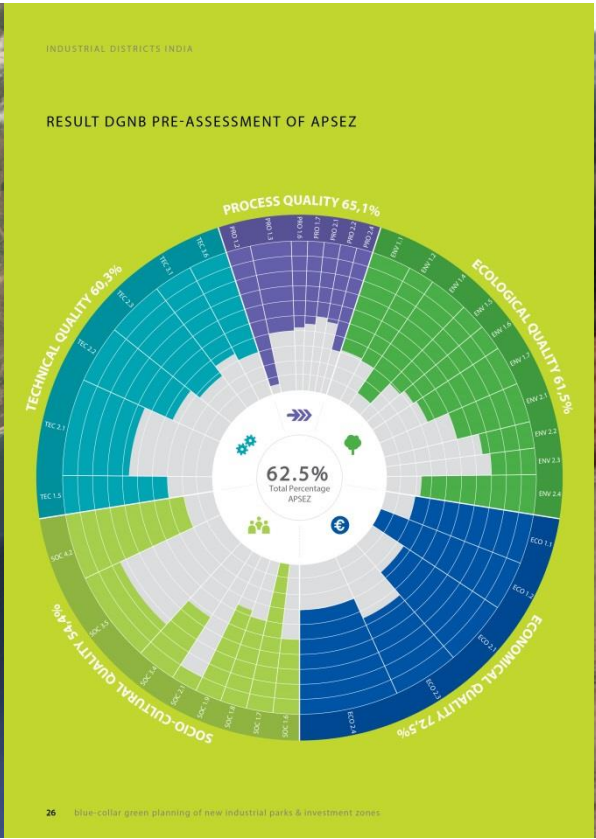
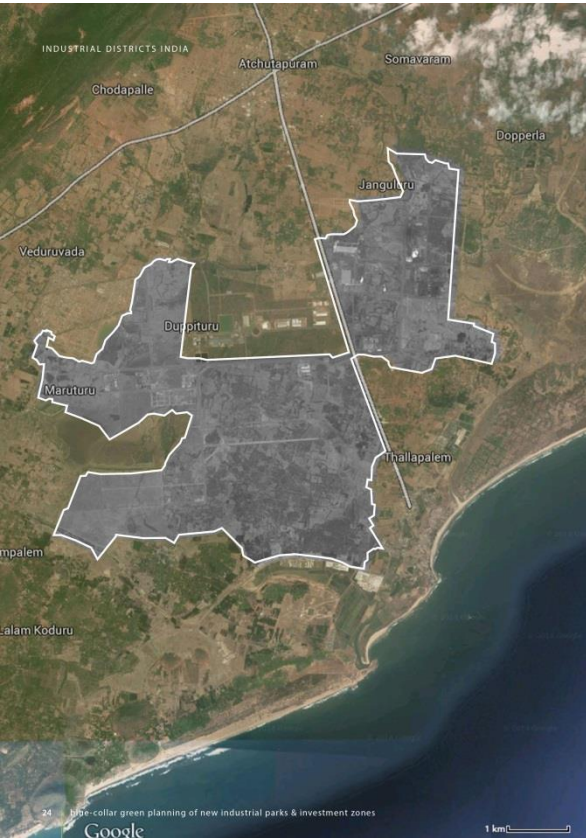
| Folgende Ausstattungsmerkmale sind vorhanden: | Anzahl der Merkmale | |
|--|---------------------|----|
| - Sitz- und/oder Liegemöglichkeiten fest installiert | 3 | 6 |
| - Sitz- und/oder Liegemöglichkeiten nicht fest installiert | 4 | 8 |
| - Schutz gegen Niederschlag - wetterfeste Außenmöblierung für Essenspausen mit Tisch- und Stuhlelementen - Stromversorgung für Außenarbeitsplätze - fest installierte Fitness- und Bewegungsgeräte - Wasserelemente - Windschutzmaßnahmen - sommerlicher Sonnenschutz über Bäume, festinstallierte starre oder bewegliche Verschattungssysteme | ≥ 5 | 10 |
| Liste auf Nachweis erweiterbar | | |

Impact of less than 0.1%

GREEN INDUSTRIAL PARKS – SHADES OF GREEN



APSEZ (2300 HA)



GIP (386 HA)



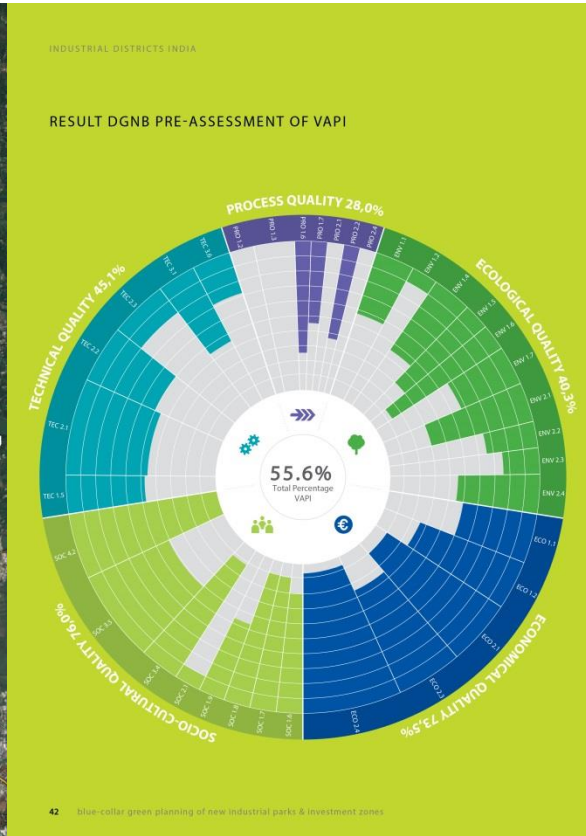
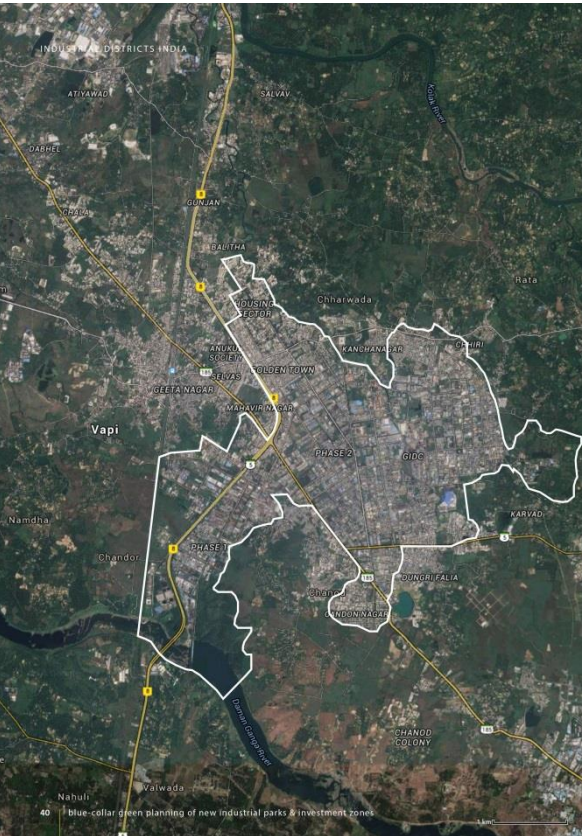
MPSEZ (1114 HA)



ALEAP (32 HA)



VAPI (902 HA)



GREEN WALLS IN LEED



TUN RAZAK EXCHANGE KUALA LUMPUR



TUN RAZAK EXCHANGE KUALA LUMPUR



TUN RAZAK EXCHANGE KUALA LUMPUR



B.BRAUN PHARMA SUNRISE PROJECT BERLIN



GREEN WALL – LEED

LEED® Credits

Most people's reaction when seeing a Green over Grey™ living wall is 'wow this is a green building!' but other than simply looking green it can be used to earn additional LEED® credits. LEED®, which stands for the Leadership in Energy and Environmental Design, is an internationally recognized green building certification system. Categories cover issues of sustainability, energy savings, indoor air quality, health & wellness, and acoustics, among others.

A Green over Grey™ living wall qualifies directly for two LEED® credits and helps gain an additional thirty points. The following chart lists potential credits that can be earned by the installation of a green wall either on the interior or exterior of a building.



Quelle: <http://www.greenovergrey.com/green-wall-benefits/leed-credits.php>

GREEN WALL – LEED

| LEED® Category | Credits and associated point(s) that a green wall helps to earn | |
|---------------------------------------|---|---|
| Sustainable Sites ▶ | Credit 3: Integrated Pest Management, Erosion Control and Landscape Management Plan (1 point) | ~ |
| | Credit 5: Site Development: Protect or Restore Open Habitat (1 point) | + |
| | Credit 6: Stormwater Quantity Control (1 point) | ○ |
| | Credit 7.1: Heat Island Reduction: Non-Roof (1 point) | ○ |
| | Credit 8: Light Pollution Reduction (1 point) | ~ |
| Water Efficiency ▶ | Credit 3: Water Efficient Landscaping (1-5 points) | + |
| Energy & Atmosphere ▶ | Credit 1: Optimize Energy Efficiency Performance (1-18 points) | + |
| Materials & Resources ▶ | Credit 3: Sustainable Purchasing: Facility Alterations and Additions (1 point) | ~ |
| Indoor Environmental Quality ▶ | Credit 1.4: IAQ Best Management Practices: Reduce Particulates in Air Distribution (1 point) | + |
| | Credit 2.1: Occupant Comfort: Occupant Survey (1 point) | + |
| | Credit 3.6: Green Cleaning: Indoor Integrated Pest Management (1 point) | ~ |
| Innovation in Operations ▶ | Credit 1: Innovation in Operations (1-4 points) | + |

○ Qualifies for LEED® credit
 + Positively effects LEED® qualification
 ~ No negative effect on LEED® credit

Quelle: <http://www.greenovergrey.com/green-wall-benefits/leed-credits.php>

GREEN WALL – LEED

Sustainable Sites (SS):

Credit 5: Site Development: Protect or Restore Open Habitat (1 point)

- The natural site that is damaged by a building can be restored with a green wall which is an area that provides habitat and promotes biodiversity.
- Only native and locally adapted plants are used and placed vertically thus increasing the percentage of the total site area covered by vegetation.
- An exterior green wall positively impacts this LEED® credit.

Water Efficiency (WE):

Credit 3: Water Efficient Landscaping (1-5 points)

- Captured rainwater can be used to irrigate a green wall thus reducing or completely cutting out potable water use or other natural surface or subsurface resource consumption.
- Special water-efficient, climate-tolerant native or adapted plant species are selected.
- Moisture sensors or weather data-based controllers can be installed which automatically shut off the irrigation system when not required.
- A green wall positively impacts this LEED® credit.

Go back to the LEED® categories chart. ▶

Quelle: <http://www.greenovergrey.com/green-wall-benefits/leed-credits.php>

GREEN WALL – LEED

Energy & Atmosphere (EA):

Credit 1: Optimize Energy Efficiency Performance (1 – 18 points)

- An interior or exterior green wall can help a building achieve an increased level of operating energy efficiency performance through the following two ways:
 - Having a large number of plants can reduce indoor air temperatures by up to 7°C. Electricity savings of up to 20% can be obtained through reductions of air conditioning requirements.
 - The Green over Grey™ system has a layer of air between it and the wall; this acts as additional insulation thus reducing heating and cooling requirements of a building.
- An interior or exterior living wall positively impacts this LEED® credit.

Go back to the LEED® categories chart. ▶

Quelle: <http://www.greenovergrey.com/green-wall-benefits/leed-credits.php>

GREEN WALL – LEED

Indoor Environmental Quality (EQ):

Credit 1.4: IAQ Best Management Practices: Reduce Particulates in Air Distribution (1 point)

- Plants can be thought of as natural, non-mechanical air filtration media.
- A Green over Grey™ living wall incorporates hundreds of plants, many of which have been proven by NASA scientists to substantially reduce particulates.
- Certain tropical plants have demonstrated that they capture and remove airborne toxins such as formaldehyde, particulate matter, VOCs, trichloroethylene, carbon monoxide, benzene, toluene, xylene, plus countless others. This leads to significant air quality improvements during the recirculation of indoor air within a building.
- An indoor green wall has a positive effect on this LEED® credit.

Credit 2.1: Occupant Comfort: Occupant Survey (1 point)

- A green wall can improve a buildings score on an occupant survey in the following ways:
 - Thermal comfort; natural cooling of plants and insulation provided by the Green over Grey™ living wall system.
 - Acoustics; the leaves of plants attenuate sound by reflecting, refracting and absorbing acoustic energy which leads to fewer echoes.
 - Indoor air quality; plants have been proven to filter and substantially remove airborne particulates and toxins.
 - Other comfort issues; having greenery in and around buildings has shown to alleviate stress and increase overall wellness of its occupants.

Credit 3.6: Green Cleaning: Indoor Integrated Pest Management (1 point)

- Routine inspection and monitoring for pests is part of our ongoing maintenance package.
- If required, only organic methods of control are used and then just for targeted species.

Quelle: <http://www.greenovergrey.com/green-wall-benefits/leed-credits.php>

GREEN WALL – LEED

Innovation in Operations (IO):

Credit 1: Innovation in Operations (1-4 points)

- Installing a green wall does not only help in gaining LEED® points but does it in an innovative way. This is accomplished by simply incorporating the technology that nature has provided instead of relying on man made solutions, which usually require much more energy.
- A green wall is unique in that it meets a broad range of LEED® credits and does so with a single system.

Quelle: <http://www.greenovergrey.com/green-wall-benefits/leed-credits.php>

ENABLING PLANNERS



SWITCHING TO GREEN

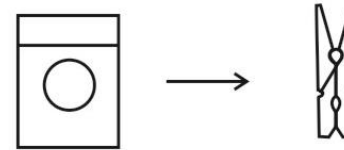
Effizienz

besser



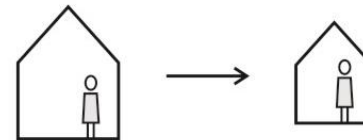
Konsistenz

anders

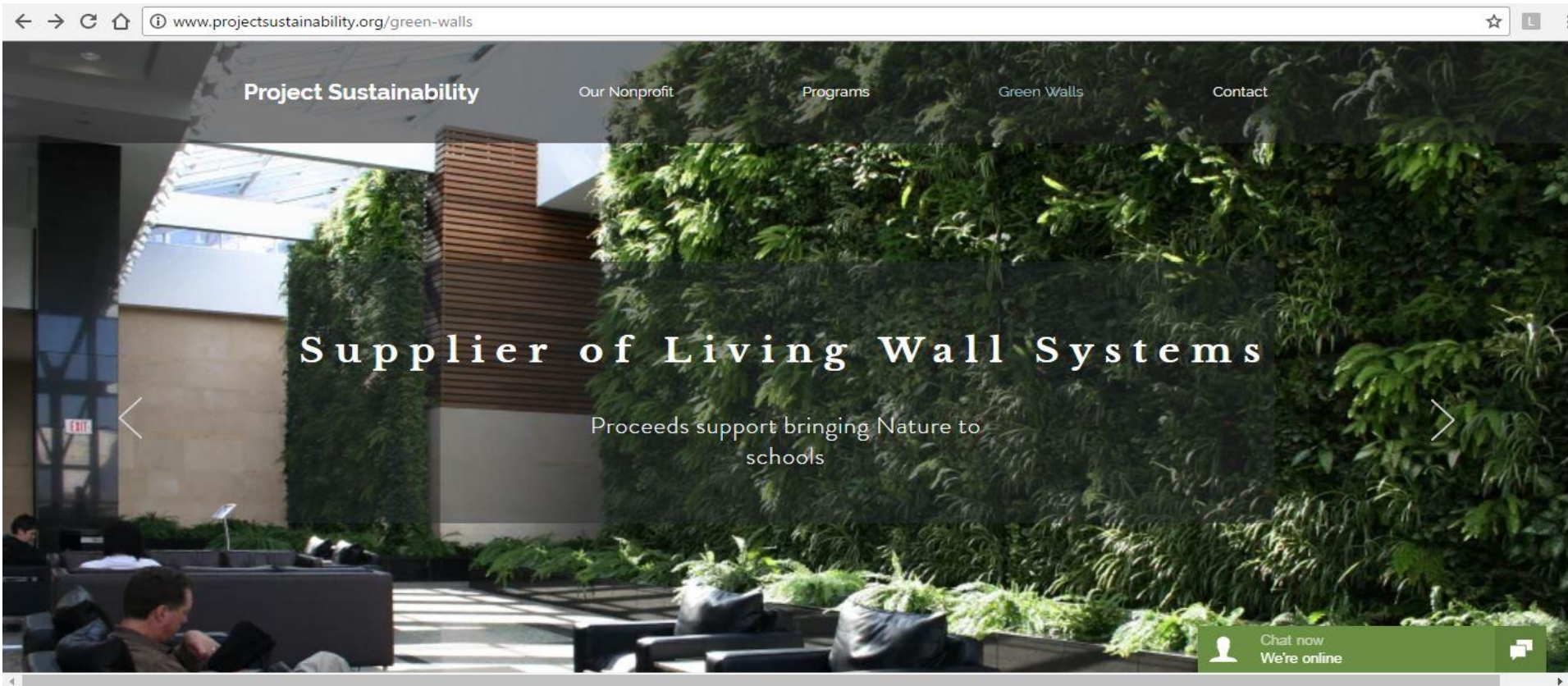


Suffizienz

weniger



LIVING WALL – INNOVATION ON DGNB, LEED AND BREEAM



LIVING WALL – INNOVATION ON DGNB, LEED AND BREEAM

Active Green Wall Programs

Please note: this page is currently under development. To learn about specific programs, please email Michael McCullough at michael@projectsustainability.org



Elementary STEAM Green Wall Program

A Green Wall STEAM program for Elementary School students



High School Green Wall Workshop

A Green Wall technical workshop for high school students



Green Wall Design Build Workshop for College-Students

A comprehensive design/build studio for college-level students



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