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EXPERTS IN SUSTAINABILITY

# PROBOS LEZING:

## Life Cycle Assessment of Wooden Products in context of EPD and Building Certification

**PROBOS**
**Wagening, 4 april 2012**

Adolf Merl

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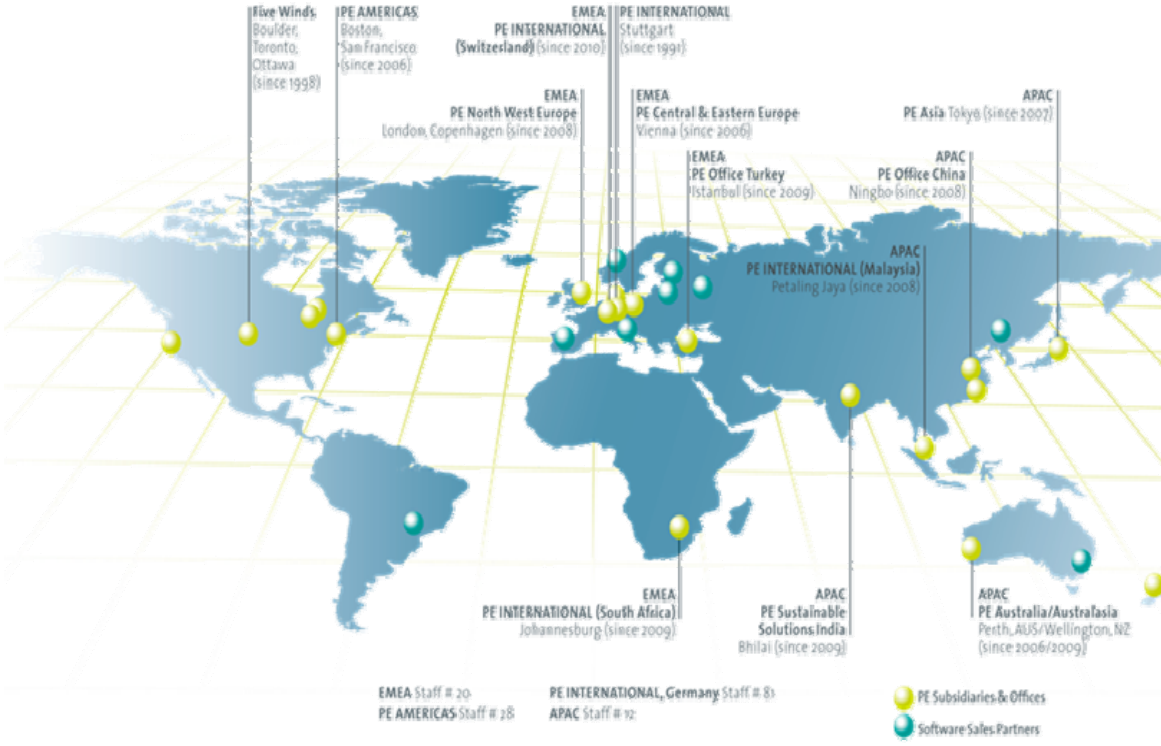
- **Introduction PE**
- **LCA of Wooden Products**
- **EPD**
- **Building Certification**

# Headquarters and global office locations




**PE Offices in:**

Berlin
Bihlai
Boston
Bolder
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Copenhagen
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Guelph
Hamburg
Istanbul
Johannesburg
Kapstadt
Kuala Lumpur
London
Lyon
Mumbai
Ottawa
Perth
Ravenna
San Francisco
Seattle
Sheffield
Tokyo
Wellington
Wien
Winterthur



# 2,000+ man years of sustainability expertise…

**Dr. Adolf Daniel Merl**

PhD, Vienna University of Technology

Carbon footprint
EPD
Green Building

16+ years of experience

**Anna Braune**

Masters degree in Environmental Engineering, TU Berlin

Building & Construction
EPD
Green Building

12+ years of experience

**Alexander Stoffregen**

Masters degree in Environmental Engineering, TU Berlin

LCA, Energy & Utilities
Water Footprint
Waste Incineration

9+ years of experience

**Dr. Barbara Nebel**

PhD, TU Munich

Building & Construction
Life Cycle Assessment
Carbon Footprint

12+ years of experience

**Dr. Christoph Koffler**

PhD in Engineering on Automotive LCA, TU Darmstadt

Automotive
Carbon Footprint
Product Sustainability

11+ years of experience

**Dr. Constantin Herrmann**

PhD and Masters degree in Mechanical Engineering

Electronics
EuP Directive & Ecodesign
Green IT

16+ years of experience

**Franz Knecht**

Masters degree in Law, University of Basel

Banking & Financial Services
CSR & Sustainability Strategy
Water Footprint

22+ years of experience

**Henrik Frijs**

Master of Science in Int'l Environmental Science and B. Sc. in Innovation Engineering

CSR & Sustainability Strategy
Environmental Management
Sustainability Reporting

15+ years of experience

**Jan Poulsen**

Masters in Environmental Engineering and graduate Diploma in Business

Carbon Management
CSR & Sustainability Strategy
Life Cycle Assessment

10+ years of experience

**Jane Anderson**

Postgraduate in Life Cycle Management, Masters Degree in Environmental Architecture

Building & Construction
Green Building
Environmental Product Declaration

14+ years of experience

**Dr. Jim Fava**

PhD in Environmental Toxicology, University of Maryland

Corporate Social Responsibility & Sustainability Strategy

32+ years of experience

**Jeff Yorzyk**

MBA from U of Boulder, Masters in Environmental Science & Engineering

Life Cycle Assessment
Consumer Goods
Electronics , Metals & Mining

20+ years of experience

**Jennifer Clipsham**

Honours B.E.S. in Environment and Resource Studies from U of Waterloo, Canada

Corporate Social Responsibility
Sustainability Strategy

12+ years of experience

**Dr. Johannes Gediga**

Masters in aeronautical engineering, PhD in Chemical Engineering (U of Stuttgart)

Metals & Mining
CDM
Resource & Energy Efficiency

22+ years of experience

**Johannes Kreißig**

Masters degree in Mechanical Engineering from University of Stuttgart

Building & Construction
EPD
Data on demand & Databases

17+ years of experience

**Johannes Partl**

Masters degree from University of Natural Resources and Applied Life Sciences, Vienna

Carbon Management
Corporate Sustainability
LCA

22+ years of experience

**Dr. John Heckman**

PhD in Systems Ecology and a graduate of Virginia Polytechnic Institute

Corporate Sustainability
LCA
Retail

20+ years of experience

**Julia Pflieger**

Master of Environmental Engineering, University of Stuttgart

Metals & Mining
Data on demand & Databases

8+ years of experience

Note: the list above includes employees and contractors of PE International

# PE INTERNATIONAL - SOLUTIONS

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## Integrated solutions for product and corporate sustainability management


### Sustainability Consulting

- Sustainability Strategy
- Management Systems
- Stakeholder Engagement
- Carbon & Water Footprints/Offset/CDM
- Life Cycle Assessment
- Energy efficiency studies

### Corporate Sustainability

- Sustainability Management Solution
- GRI, CDP, UN Global Compact, ISO 14001, OHSAS 18000, etc.
- Corporate Footprint (Carbon and Water)

### Product Sustainability

- Product Life Cycle Assessment solution
- Design for Environment
- Product Footprint (Carbon and Water)
- Scenario analysis / decision support

**Databases & Content**



## PE helps Customers Improve Sustainability Performance

**Succeed!** Enhanced corporate & environmental performance

**Improve** Product and Corporate Sustainability Performance

**Strategise** the best actions on basis of facts to maximise Sustainibility Performance

**Understand** the Impact of Sustainability on their Business

## PE Approach “From EPD to Ecodesign”

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**Succeed!** Enhanced corporate & environmental performance

**Understand** the Impact of Sustainability on your Business



## Key Sustainability Drivers

**…Drives Innovation**

…Reduces Risks

…Builds Brand Equity

**…Creates Shareholder Value**

…Attracts Talent / Investment / Partners

…Enhances Company Reputation

…Creates Awareness by General Public / Media / Business Partners

**…Helps the Planet**

…Saves Money

**…Optimizes Supply Chain Performance**

…Reduces Resource Costs

…Delivers Efficiencies

***PE International helps deliver a comprehensive end-to-end approach to Sustainability Performance Management***

# Customers are actively integrating sustainability principles into their businesses

### Top reasons for addressing sustainability in 2011 vs. 2010

% of respondents, n = 1,946

- **Improving operational efficiency and lowering costs** was cited by **33% of survey respondents** as a reason for addressing sustainability – **14% more** than in 2010.
- **New growth opportunities** was cited by **27% of survey respondents** – an **increase of 10%** compared to 2010.
- **Corporate reputation** is no longer the most frequently chosen reason; it has been replaced by **improving operational efficiency and lowering costs**

### Areas in which companies are currently taking action

% of respondents, n = 2,956


Source: McKinsey global survey "The business of sustainability, 2011"



## Business goals of product life cycle management




## Business goals of product life cycle management 1/2

**Resources and emissions management**

- Identify new market **opportunities**
- React on **regulation**
- Identify your **products'** physical, economical and regulatory **risks** throughout life cycle
- Assess your **company's** potential **risks** from fluctuant energy costs and resource and material availability

**Performance tracking**

- **Focus** your effort on efficiency improvements and cost saving opportunities
- Set **meaningful** environmental **targets** and develop strategies to achieve those
- Measure and report emissions and resource consumptions **over time**

## Business goals of product life cycle management 2/2

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**Supplier and customer stewardship**

- Partner with your **suppliers** and achieve improvements
- Assess your suppliers' performance for your **green procurement** efforts
- Reduce emissions, resource consumption, costs and risks and **avoid future costs**
- **Educate** your **customers** to encourage environmental actions

**Differentiation**

- Strengthen your **brand image**
- Achieve **competitive advantage** of your products by creating low impact products
- Respond to **changing customer preferences** by redesigning your products
- Enhance your **employee retention** and **recruitment**



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- Introduction PE
- **LCA of Wooden Products**
- EPD
- Building Certification

## Life Cycle Perspective

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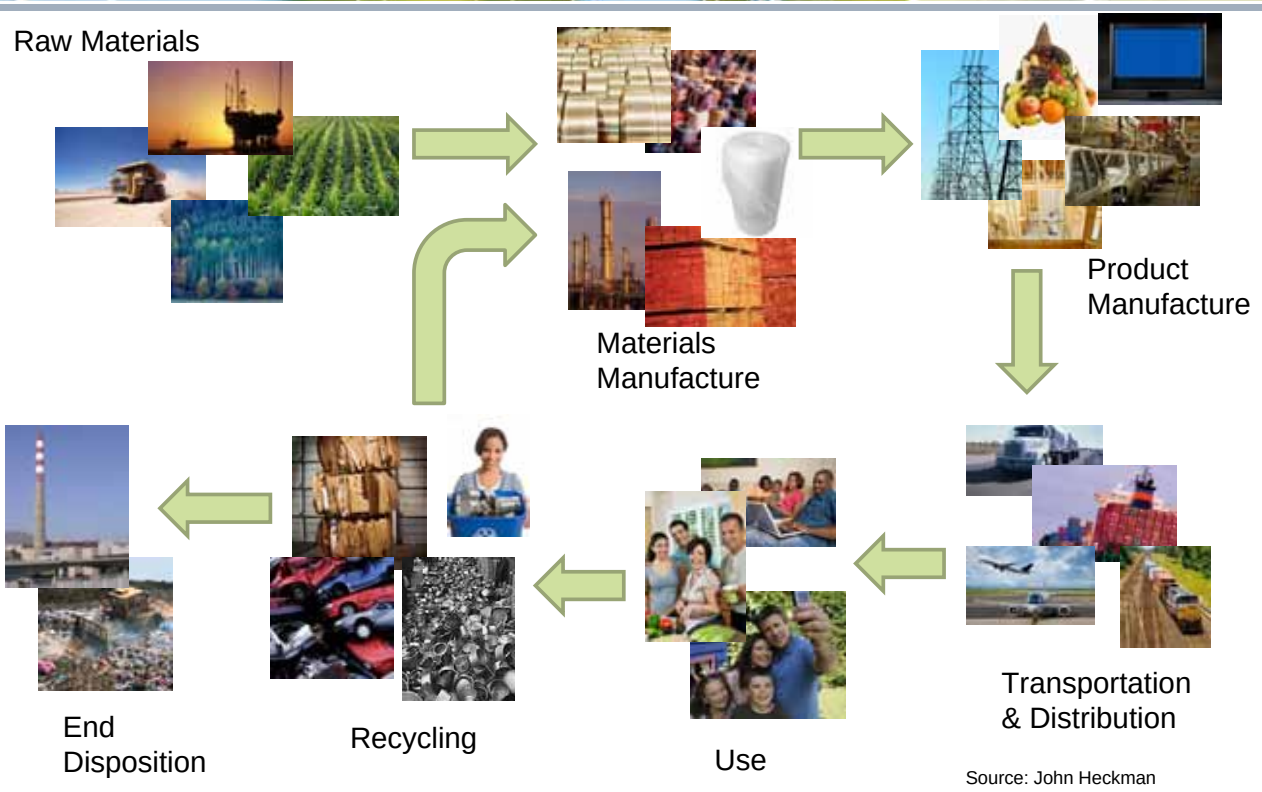


Source: John Heckman



## Principle of LCA

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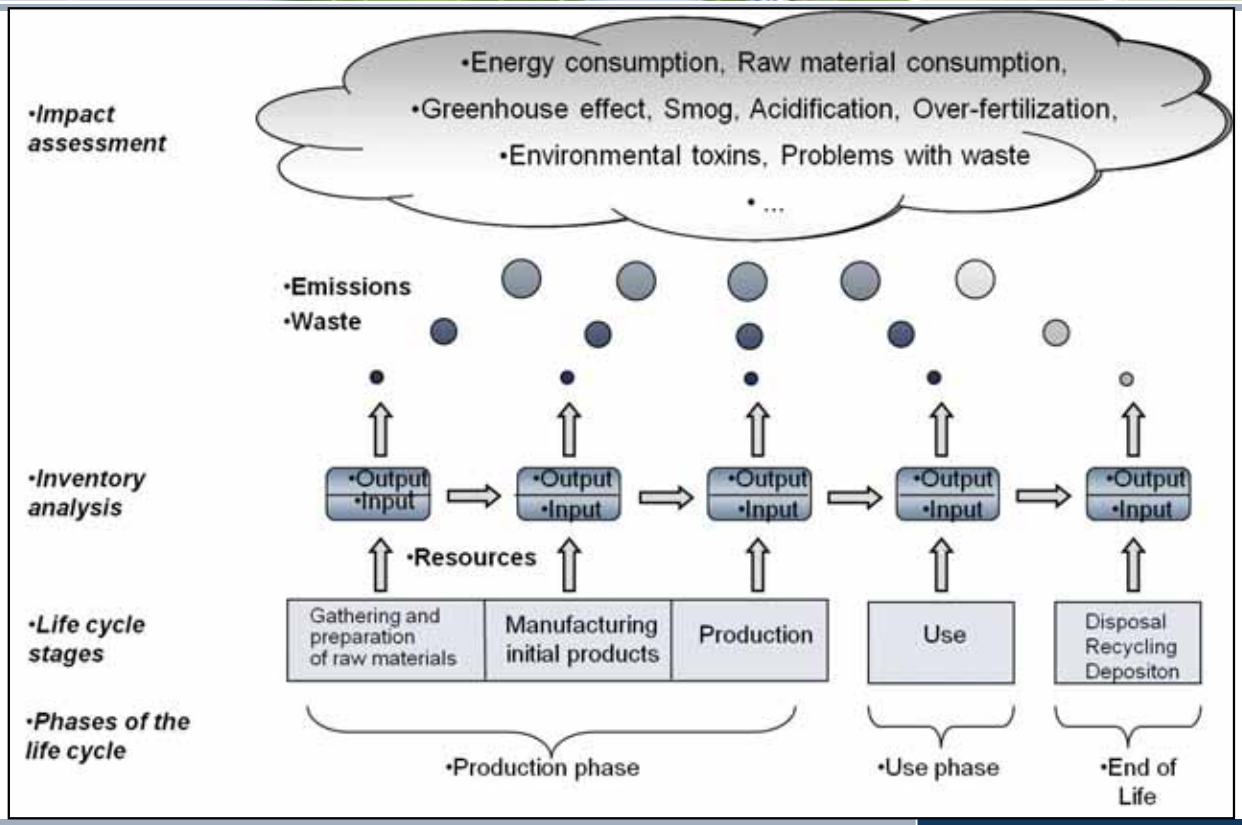

# LCA Results

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| Umweltthema | Indikator | Einheit |
|---|---|---|
| Emissionen in Boden, Luft und Wasser | Acidification Potential (AP) | kg SO2-Äq. |
| | Eutrofication Potential (EP) | kg Phosphat-Äq. |
| | Photochemical Ozone Creation Potential (POCP) | kg Ethen-Äq. |
| | Ozone depletion Potential (ODP) | kg R11-Äq. |
| Klimawandel | Global Warming Potential (GWP) | kg CO2-Äq. |
| Primärenergie-Ressourcen | Primärenergiebedarf total | MJ |
| | Primärenergie erneuerbar | MJ |
| | Primärenergie nicht erneuerbar | MJ |
| | Anteil erneuerbarer Primärenergie | % |

**Environmental Topics:**

➔ Emissions

➔ Climate Change

➔ Energy Ressources

- **Acidification potential** — describes potential for acidification of land („acid rain")
- **Eutrophication potential** — describes potential for eutrophication of rivers, lakes and land („population turnover")
- **Photochemical Ozone creation potential** — describes potential of creation of „summer smog"
- **Ozone depletion potential** — describes potential of ozone depletion („ozone hole")
- **Global warming potential** — describes potential of global warming („greenhouse effect", "Carbon Footprint")
- **Primary Energy demand renewable** — describes sum of renewable primary energy input
- **Primary Energy demand non renewable** — describes sum of non renewable primary energy input
- **Abiotic depletion potential** — describes consumption of abiotic resources



# Case study: PCF Calculation according to ISO and PAS

## Scope

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Wooden table


Plastic table

## The biogenic carbon cycle ~ 100 years

Biogenic $CO_2$ from atmosphere
1.8 kg / kg biomass dry
**Renewable Energy is stored**

Biogenic $CO_2$ to atmosphere
1.8 kg / kg biomass dry
**Renewable Energy is produced**

C in biomass

**Production phase**

C in product

**Use phase**

**End of Life**

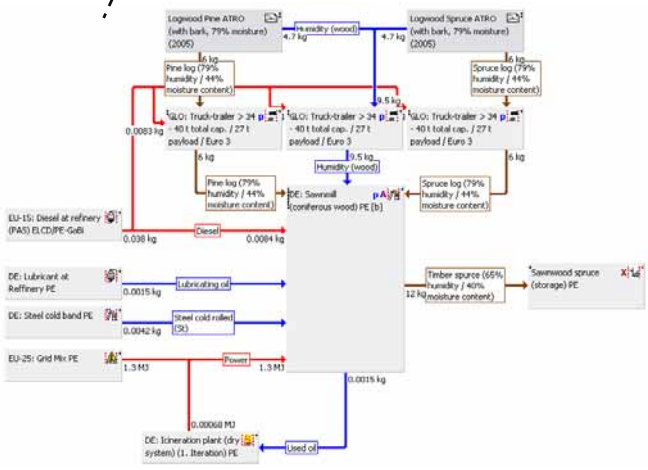
combustion






Master plan level


1st layer

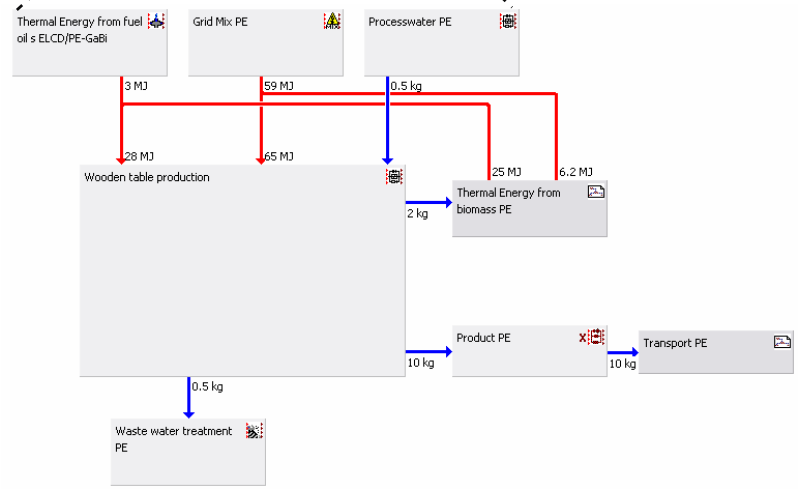



# Case study: PCF Calculation according to ISO and PAS

## Wooden Table – Timber supply

Master plan level


1st layer



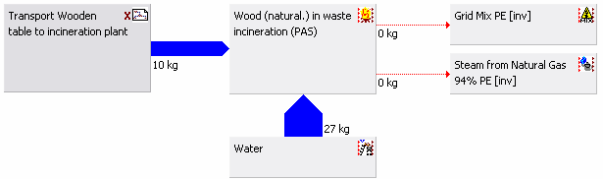



# Case study: PCF Calculation according to ISO and PAS

## Wooden Table – End of Life

Master plan level


1st layer



## Case study: PCF Calculation according to ISO and PAS

Wooden Table – Results according to ISO: $CO_2$ emissions along the life cycle

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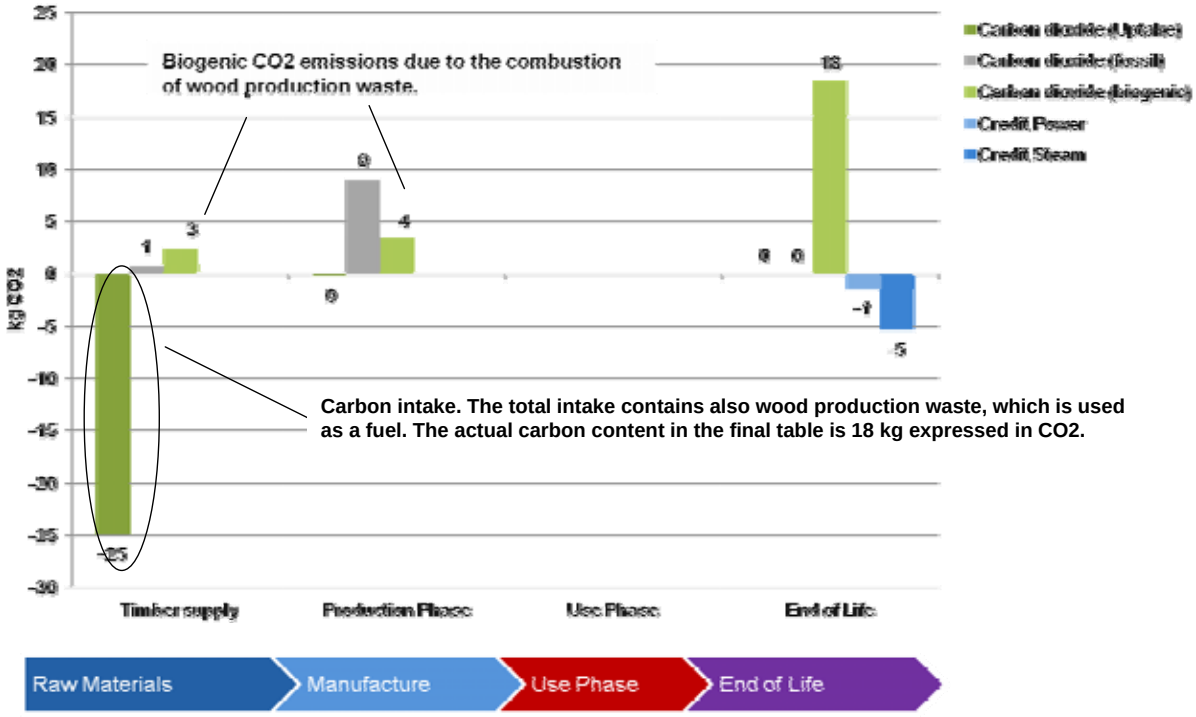




## Case study: PCF Calculation according to ISO and PAS

Wooden Table - $CO_2$ emissions according to PAS and Comparison with ISO

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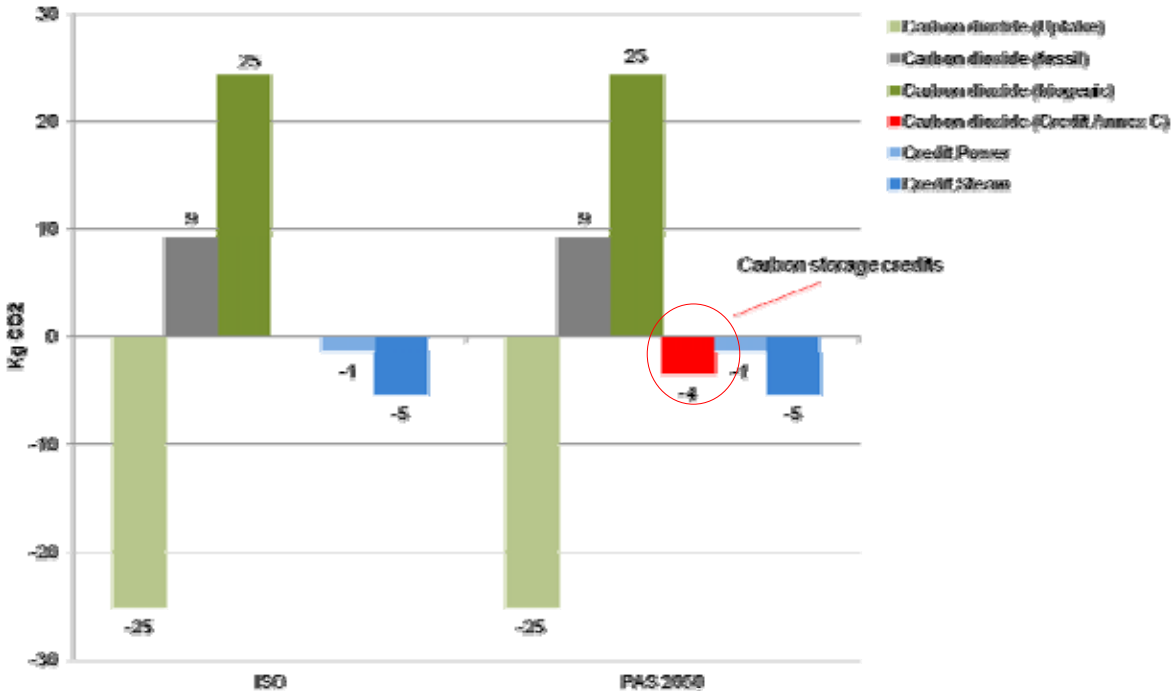

## Case study: PCF Calculation according to ISO and PAS

The plastic table – Carbon Cycle

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**The carbon cycle (carbon uptake 200 – 500 Million Years ago)**

Oil refining

**Production phase**

Fossil $CO_2$ to atmosphere
Energy from fossil source is produced

Steam cracking

**Use phase**

C in product

Combustion

**End of Life**

## Case study: PCF Calculation according to ISO and PAS

Plastic table – Construction part production

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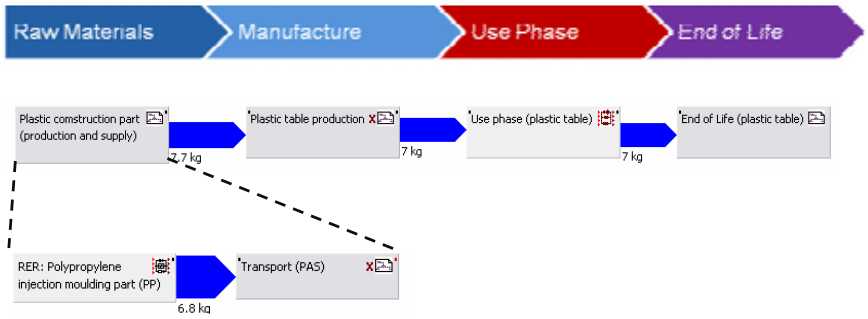

# Case study: PCF Calculation according to ISO and PAS

## Plastic table – Table production

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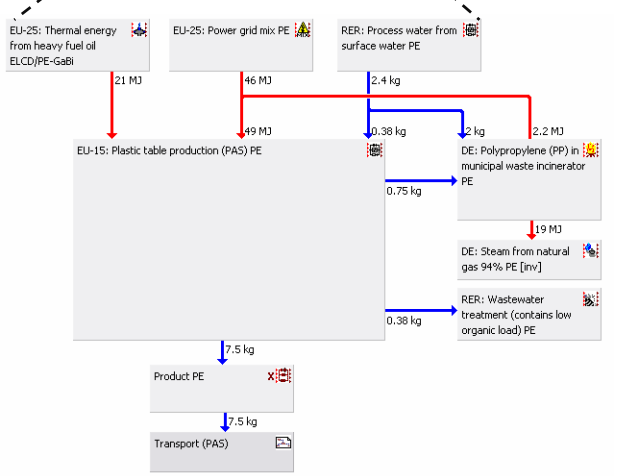
Master plan level


1st layer






# Case study: PCF Calculation according to ISO and PAS

## Plastic table – End of Life

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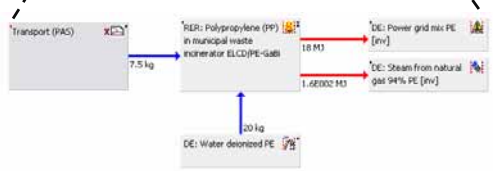
Master plan level


1st layer



## Case study: PCF Calculation according to ISO and PAS

Plastic table – GWP 100 (years)

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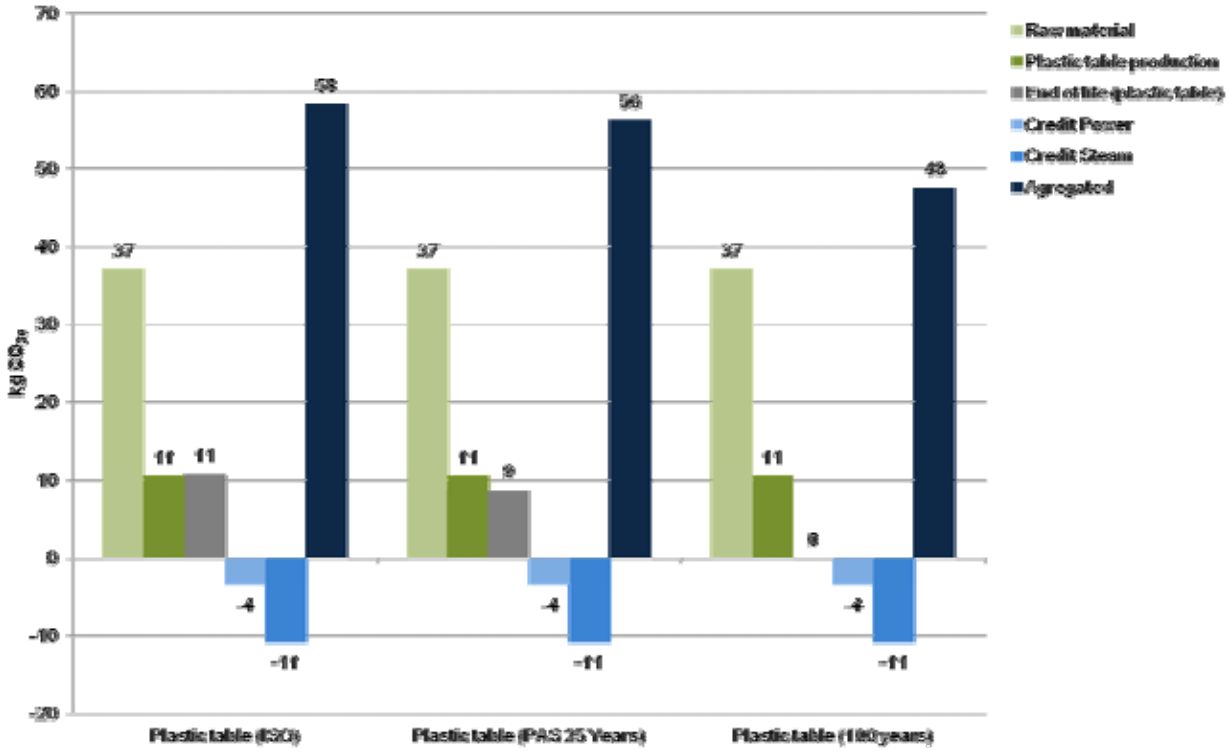




## Case study: PCF Calculation according to ISO and PAS

Comparison: GHG Emissions per Life Cycle Stage

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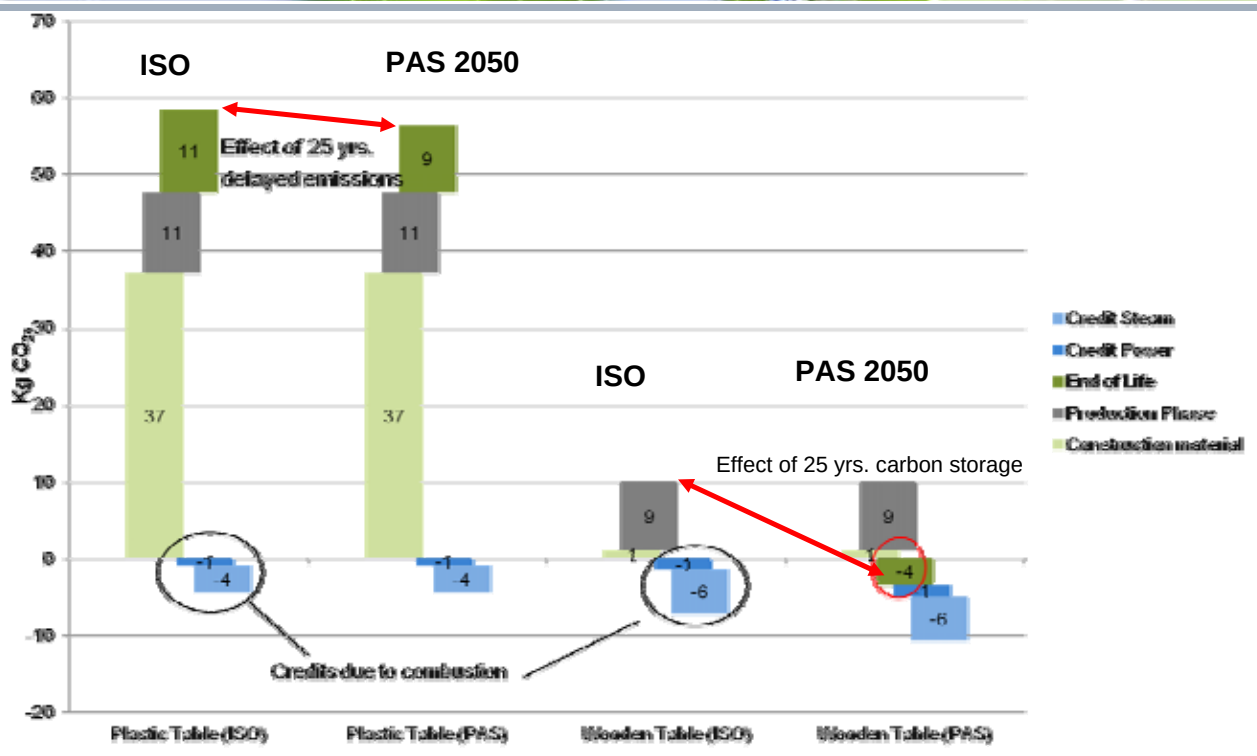
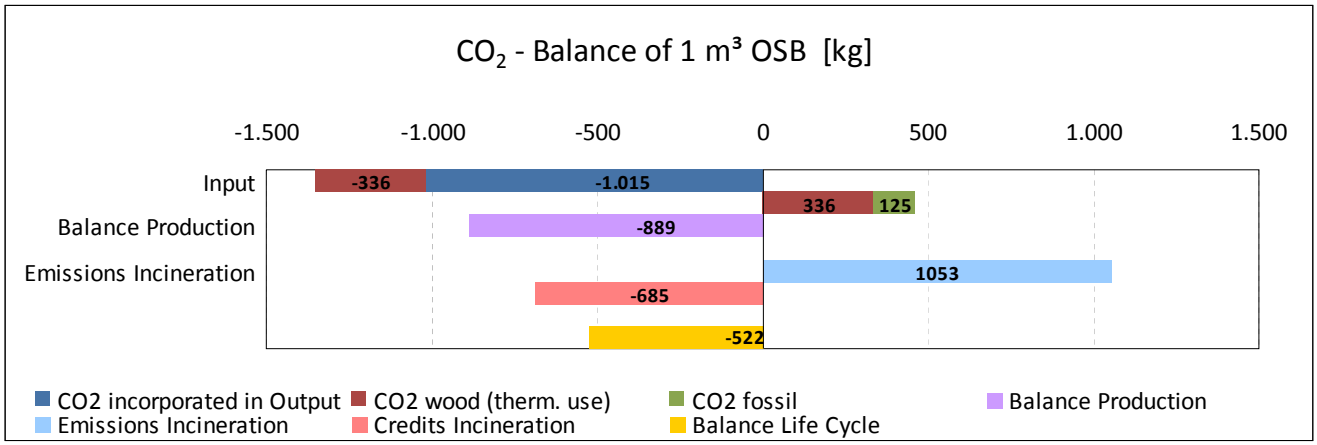


## Results and Data from an EPD

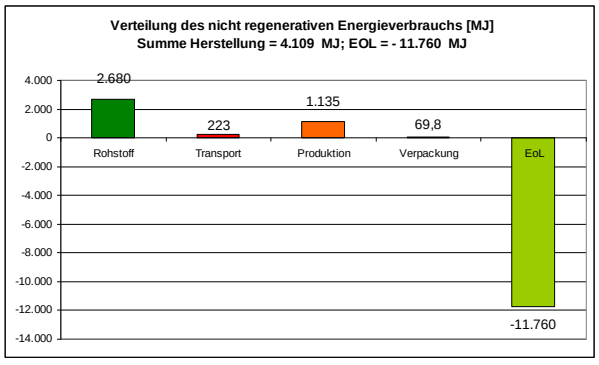



- Life Cycle Inventory data like CO2 Cycle is part of an EPD (all relevant information according ISO 14040 ff
- Data are related to a specific product for a specific company at a specific production place
- Every 3 years the data are reviewed: the system keeps data always updated
- The background LCA report owned by the producer includes additional product related information (e.g. each single product of a product mix) – confidential data.

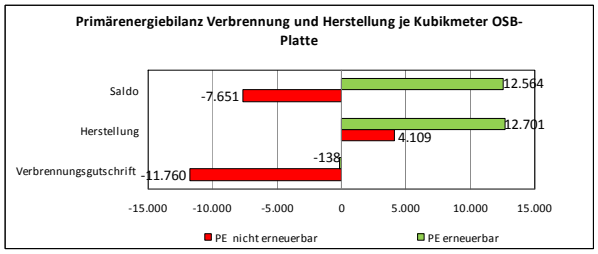


## Other LCI data from EPD – Examples OSB

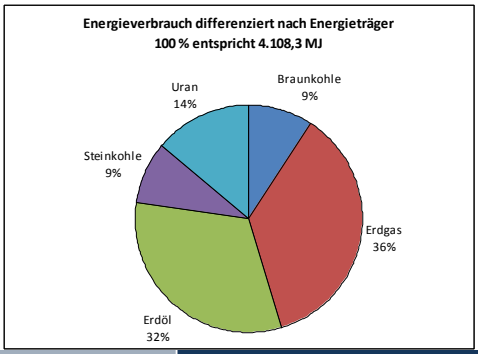
### Primary Energy Demand not Renewable




### Primary Energy Balance over the Life Cycle



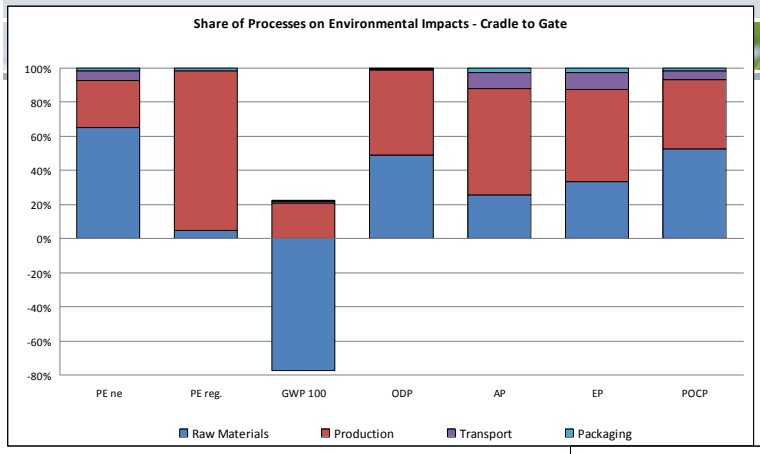

### Sources of Primary Energy non Renewable - Mix

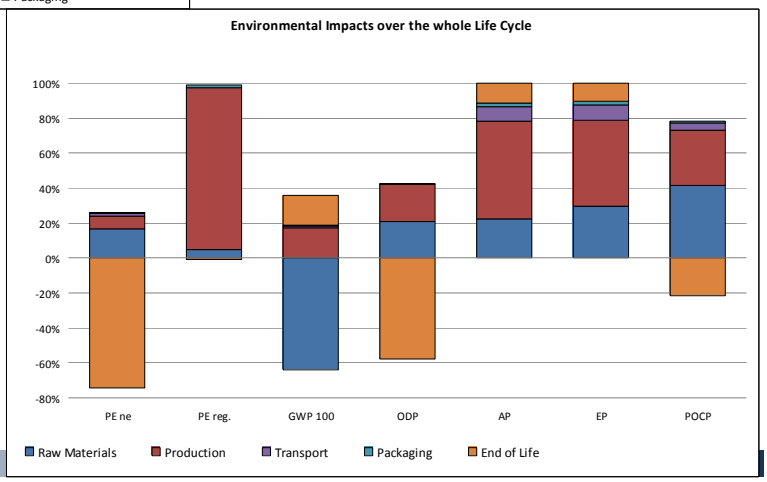



### Waste over the Live Cycle - Categories

| Auswertegröße | Herstellung [kg / m3] | EoL [kg / m3] | Summe [kg / m3] |
|---|---|---|---|
| Ablagerung / Haldengüter | 512,87 | -989,86 | -476,99 |
| Siedlungsabfälle | 0,28 | 0,00 | 0,28 |
| Sonderabfälle | 0,81 | -0,39 | 0,42 |
| davon Radioaktive Abfälle | 0,20 | -0,39 | -0,19 |

# LCIA data from EPD – Examples OSB






# Specific references

## Product-related ecological potential analysis

BMBF-Förderschwerpunkt
Nachhaltige Waldwirtschaft

Erschließung von Wertschöpfungspotenzialen entlang der Forst- und Holzkette

Verbundprojekt: ÖkoPot

ÖKOLOGISCHE POTENZIALE
DURCH HOLZNUTZUNG GEZIELT FÖRDERN

ENDBERICHT

Kritische Prüfung (Critical Review) gemäß DIN ISO 14040 / 14044

Erstellt durch:

Universität Hamburg

Universität Stuttgart

Gefördert durch:

STUTTGART / HAMBURG 2008

- The “product-related ecological potential analysis”, which was developed within the German Federal Ministry of Education and Research (BMBF) funded OekoPot project, focuses on the identification of ecological potentials and environmental effects of shifts in the market.
- The method represents a new approach scientifically combining LCA with market analysis.
- The procedure identifies the most relevant products and their principle competitors in combination with market shares and the product group’s market volume.
- This new approach is applied exemplarily for wood products within the OekoPot-Project, aiming to promote the environmentally friendly use of timber products through an analysis of the ecological potentials of the timber and wood value chain.

# Example Floors (Ökopot, 2008)

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- PE has information analyzed which cover impacts (shown below only Pne, and GWP) along life cycle of the following floor materials: Carpet Laminate, Parquet, ceramic Linoleum etc.

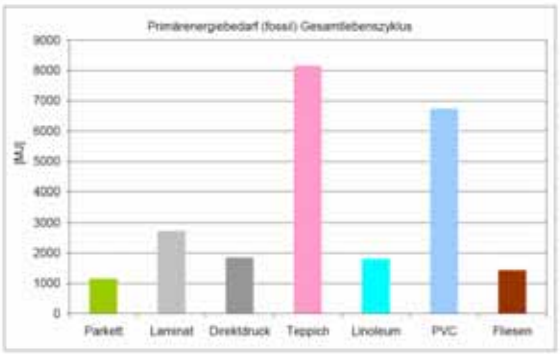


Abbildung 5-38: Primärenergiebedarf (fossil) Gesamtlebenszyklus Fußböden pro 20 m²

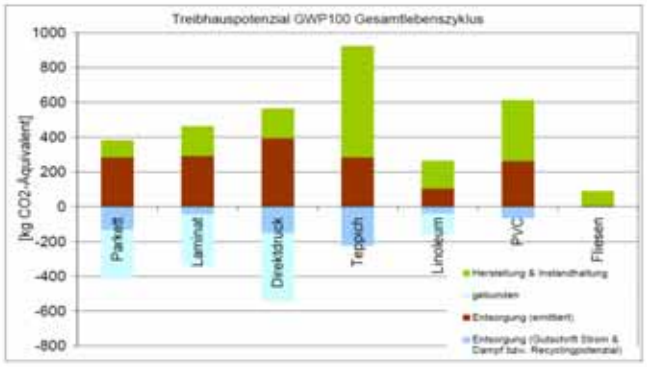


Abbildung 5-40: Treibhauspotenzial Gesamtlebenszyklus Fußböden pro 20 m²

- FU: (living area of 20 m$^2$), not necessary following functional equivalence for comparison but from the perspective that the alternatives in the market exists as such (market shares for floors in Europe for example).
- Other criteria considered: costs of installation, cleaning, hygiene and health, fire safety, demolition, recyclability disposal, costs etc.
- Production, use phase and EoL considered and modeled.
- Data for the different models arise from GaBi 4 and different literature sources.
- Communication: decision to buy solid parquet instead of an average non wood floor, contributes to the reduction of GWP of 3 months driving a car.



# LCA of Buildings – Project 8+

GaBi Software
PRODUCT SUSTAINABILITY

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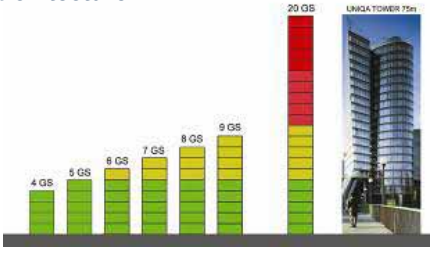
**Design, Rendering: schluderarchitecture**

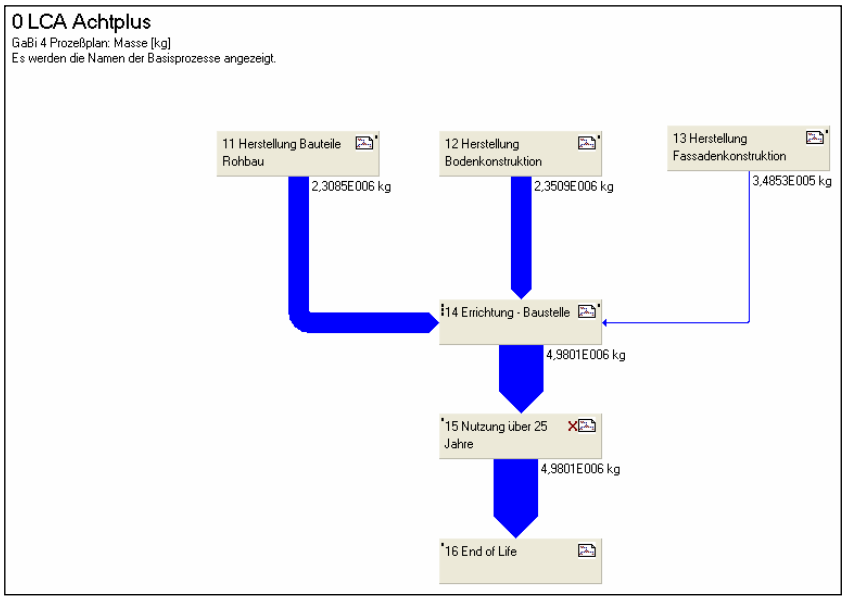

Office Building, 20 Storeys

Useful Area: ~14.000 m²

Timber Structure: 4.970 m³

Ecological Impact Assessment using LCA methodology

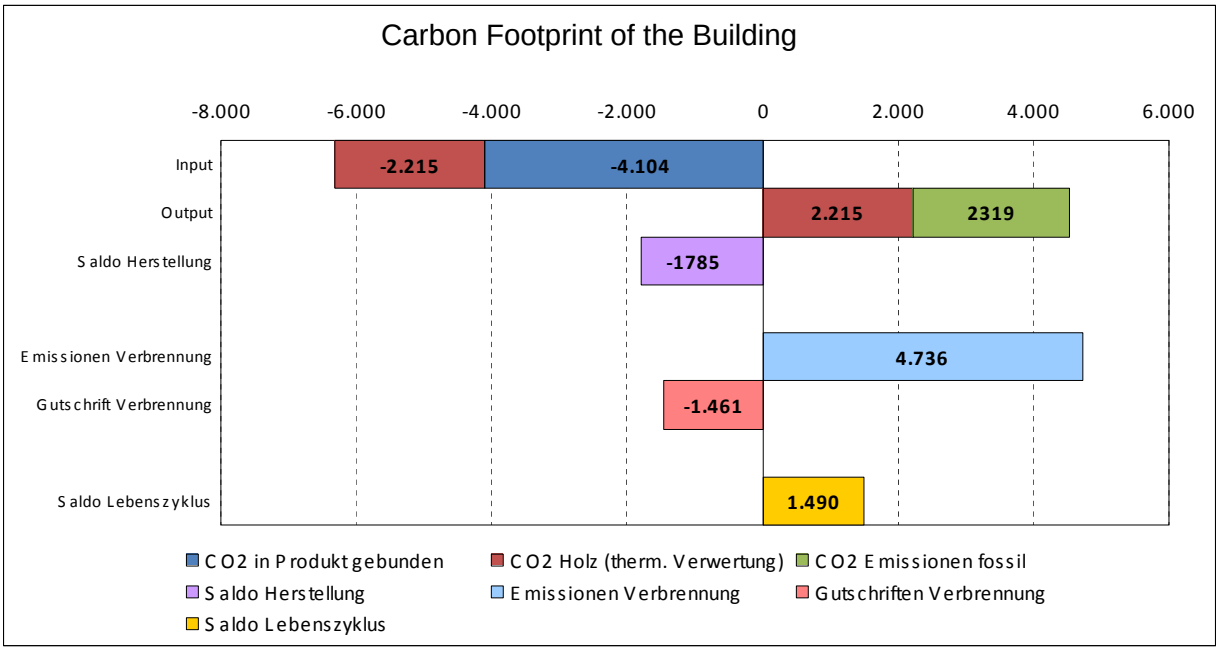
# LCA of Buildings – Project 8+ System

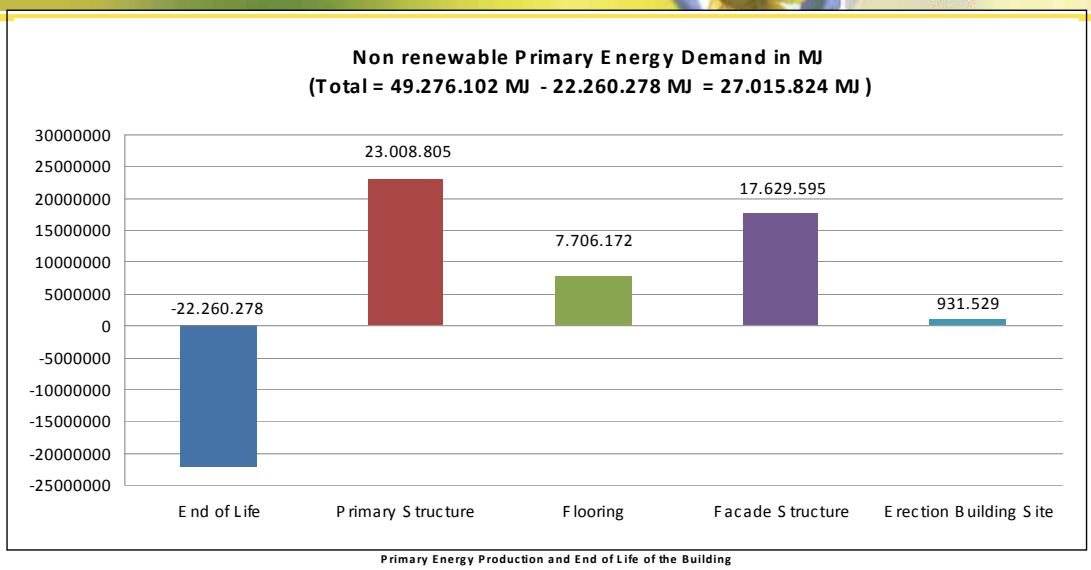


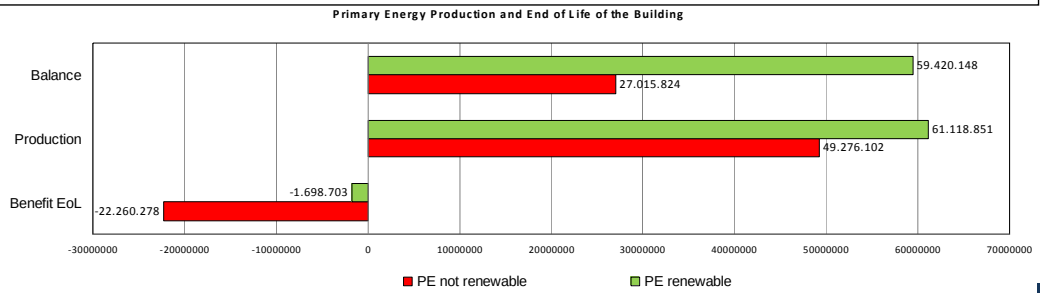

- System Analysis:
- Raw Material Extraction in the region around Vienna
- Prefabrication of the Construction
- Erection of the Building
- Service Life – Use (25 Years)
- Dismantling
- End of Life – Waste Management System Vienna (thermal Use and Recycling)



# LCA of Buildings – Project 8+ Carbon Footprint

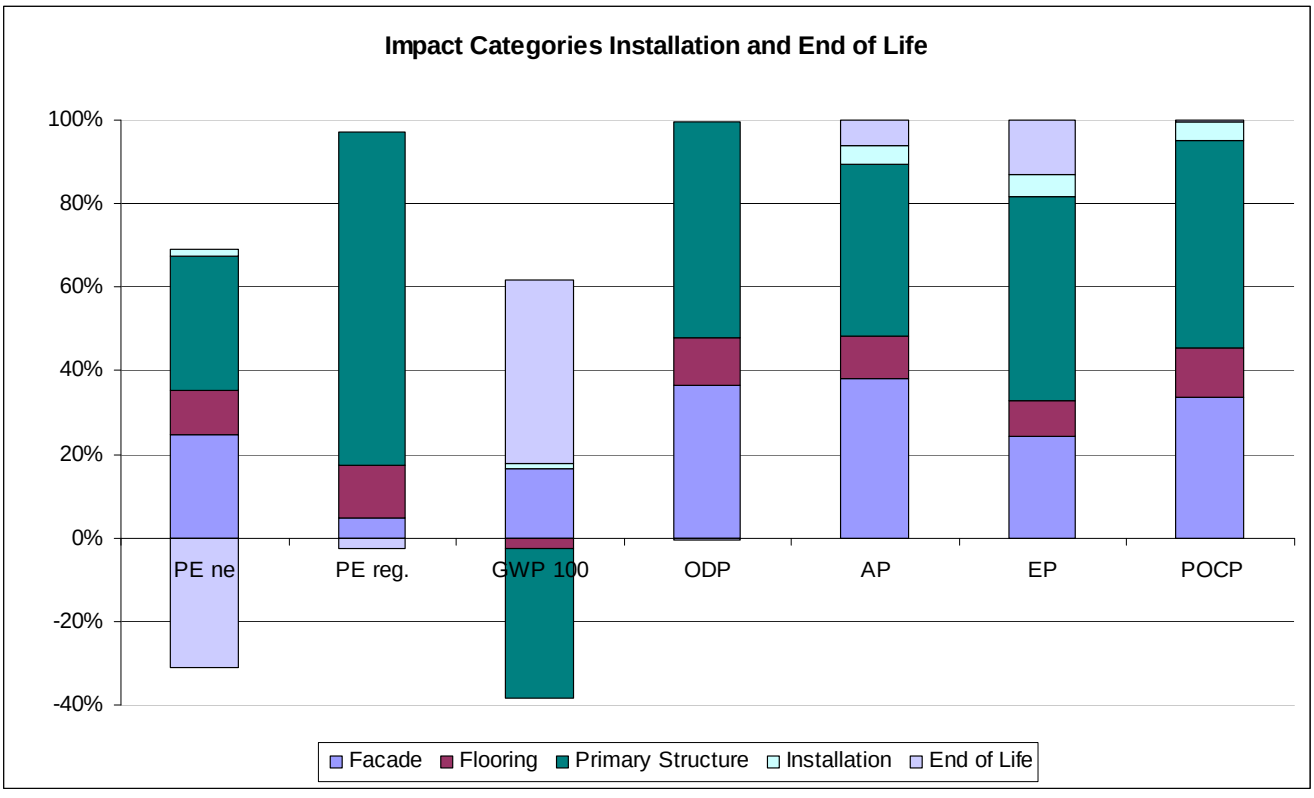



Non renewable Primary Energy Demand in MJ
(Total = 49.276.102 MJ - 22.260.278 MJ = 27.015.824 MJ )
30000000
25000000
20000000
15000000
10000000
5000000
0
-5000000
-10000000
-15000000
-20000000
-25000000
-22.260.278
23.008.805
7.706.172
17.629.595
931.529
End of Life
Primary Structure
Flooring
Facade Structure
Erection Building Site

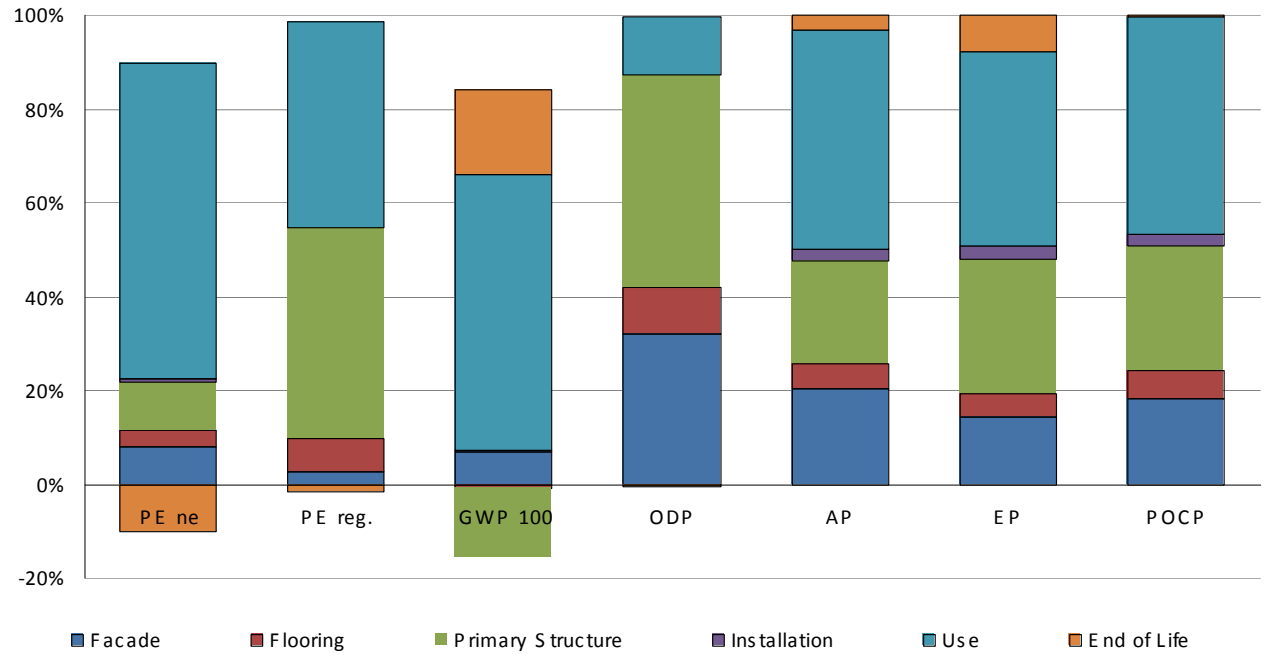

Primary Energy Production and End of Life of the Building
Balance
Production
Benefit EoL
59.420.148
27.015.824
61.118.851
49.276.102
-1.698.703
-22.260.278
-30000000
-20000000
-10000000
0
10000000
20000000
30000000
40000000
50000000
60000000
70000000
PE not renewable
PE renewable





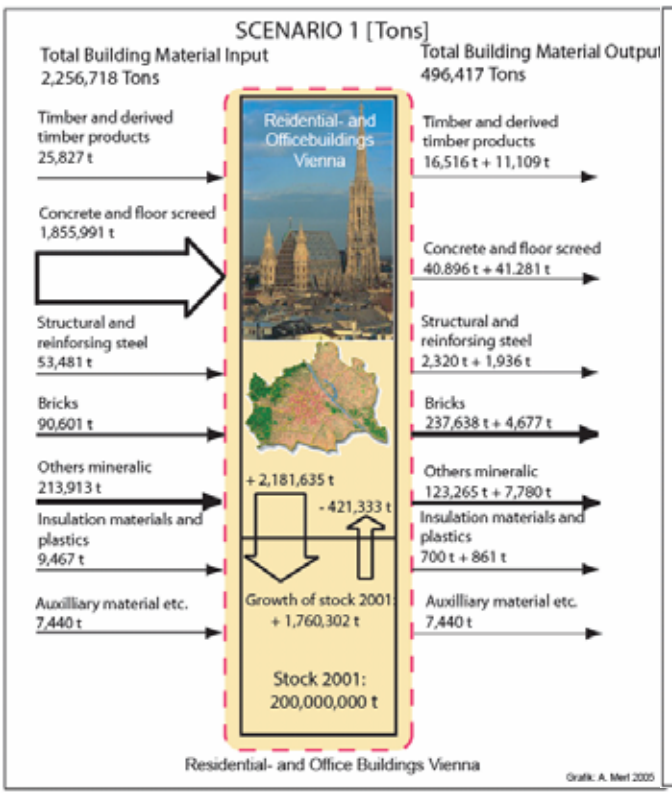

Impact Categories Installation and End of Life
100%
80%
60%
40%
20%
0%
-20%
-40%
PE ne
PE reg.
GWP 100
ODP
AP
EP
POCP
Facade
Flooring
Primary Structure
Installation
End of Life

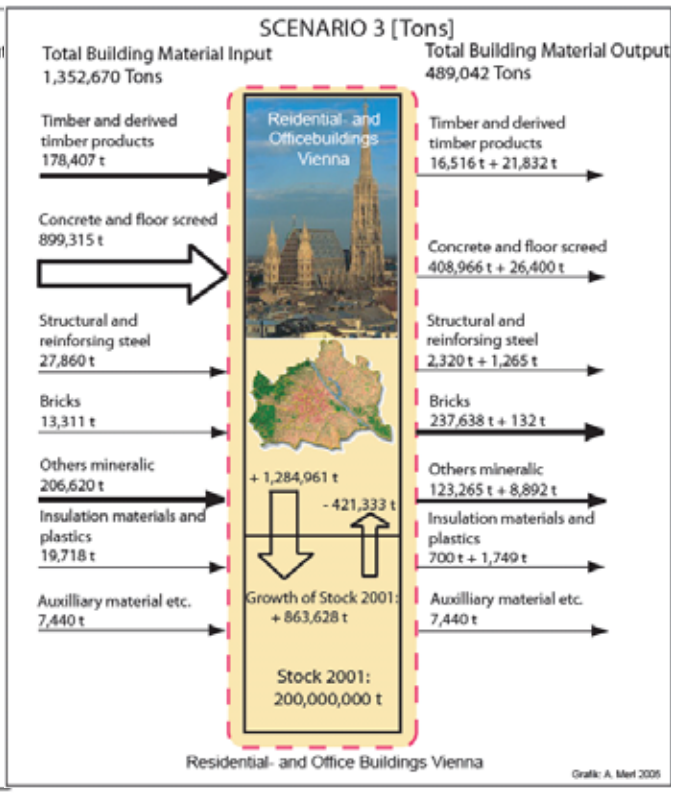
## Impact Categories Life Cycle







# GWP: Case Study Vienna

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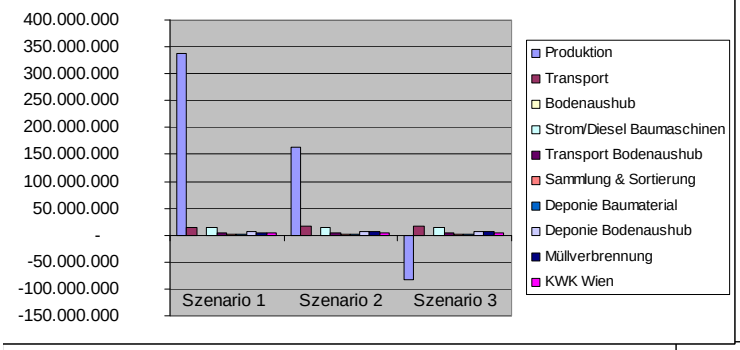
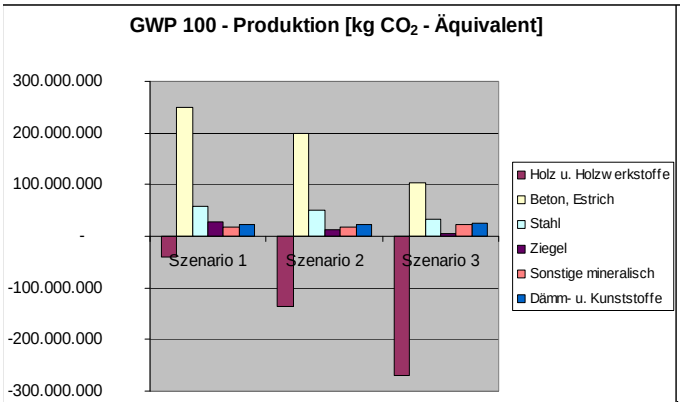
EXPERTS IN SUSTAINABILITY

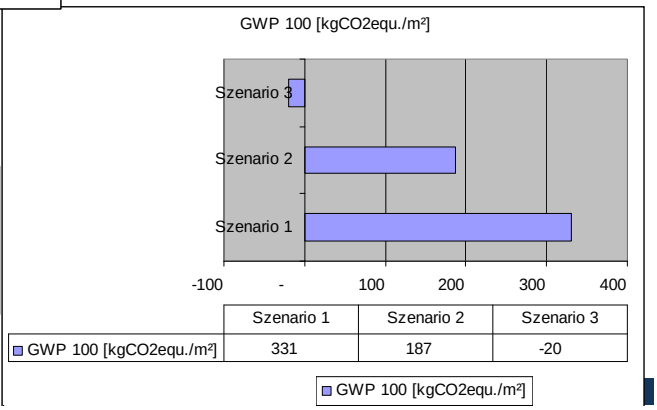



Scenario 1: 391.360 t $CO_2$ – Äquiv.

Scenario 2: 221.450 t $CO_2$ – Äquiv.

Scenario 3 -23.800 t $CO_2$ – Äquiv.




PE INTERNATIONAL
EXPERTS IN SUSTAINABILITY

- Introduction PE
- LCA of Wooden Products
- **EPD**
- Building Certification

EPDs are declarations providing the **environmental performance** of a product or service:

- **Business to business**
- **Business to consumer**
- **Information for DGNB System**

**Content** of an EPD:

- **Comprehensive Product Information**
- **Life Cycle Documentation**
- **Results of LCA**
- **Certificates for measured data**

**Way of presentation** of an EPD:

- **Summary (2 pager)**
- **Extended version**





**Typ I: Environmental labels**
**(ISO 14024)**

**Typ II: Self-declaration**
**(ISO 14021)**

GESUND BAUEN
NATÜRLICH MINERALISCH

made in Green by AITEX


**Typ III: Verified Environmental Product Declaration**
**(ISO 14025)**
(EPD, Environmental Product Declaration)

## Legal Basis
### from CPD to CPR

PE INTERNATIONAL
EXPERTS IN SUSTAINABILITY

**Construction Product Regulation (Bauproduktenverordnung)**

**CPR = CPD+**

- CPR ** replaces Construction Products Directive (CPD)
- Jan. 2011: European Parliament votes for Construction Products Regulation (CPR)
- Transition period until July 1, 2013
- CPR is valid in all member countries
- Contains requirements for providing information on environmental performance of products (BWR BWR 3 and 7)
- CPR contains explicit reference to EPD:

**“(56) For the assessment of the sustainable use of resources and of the impact of construction works on the environment Environmental Product Declarations should be used when available.”**


KOMMISSION DER EUROPÄISCHEN GEMEINSCHAFTEN

VERORDNUNG DES EUROPÄISCHEN PARLAMENTS UND DES RATES

DE DE

## Environmental product declarations for construction products

PE INTERNATIONAL
EXPERTS IN SUSTAINABILITY

Institut Bauen und Umwelt e.V.

BRE Certification Limited
Environmental Profiles Scheme

THE GREEN STANDARD

ECO LEAF
製品環境情報
http://www.jemai.or.jp
EcoLeaf is a type III label.

MRPI
milieu relevante product informatie

BY OG BYG

EPD

ENVIRONMENTAL DECLARATION

epd-norge.no

# About IBU

Institut Bauen und Umwelt e.V.

## Who is IBU?

- **IBU** is an international initiative of construction product manufacturers

## Was does IBU do?

- **IBU** is programme operator of an Environmental Product Declaration (EPD) system
- **IBU** assigns “type III declarations” according EN 15804

## Goals of IBU

- Development of **credible** and **consistent information** on the environmental performance of construction products
- **Communication** to members, expert groups and customers
- Providing all information for LCA based sustainability assessment of buildings acc. EN 15978 and for the CPR in one document

# IBU in figures

Institut Bauen und Umwelt e.V.

## Structure of IBU

| | |
|---|---|
| **Full members:** | **88** |
| - maunufaturing and sales companies: | 68 |
| - associations: | 20 |
| **Associated members:** | **13** |
| **Declaration holders:** | **101** |

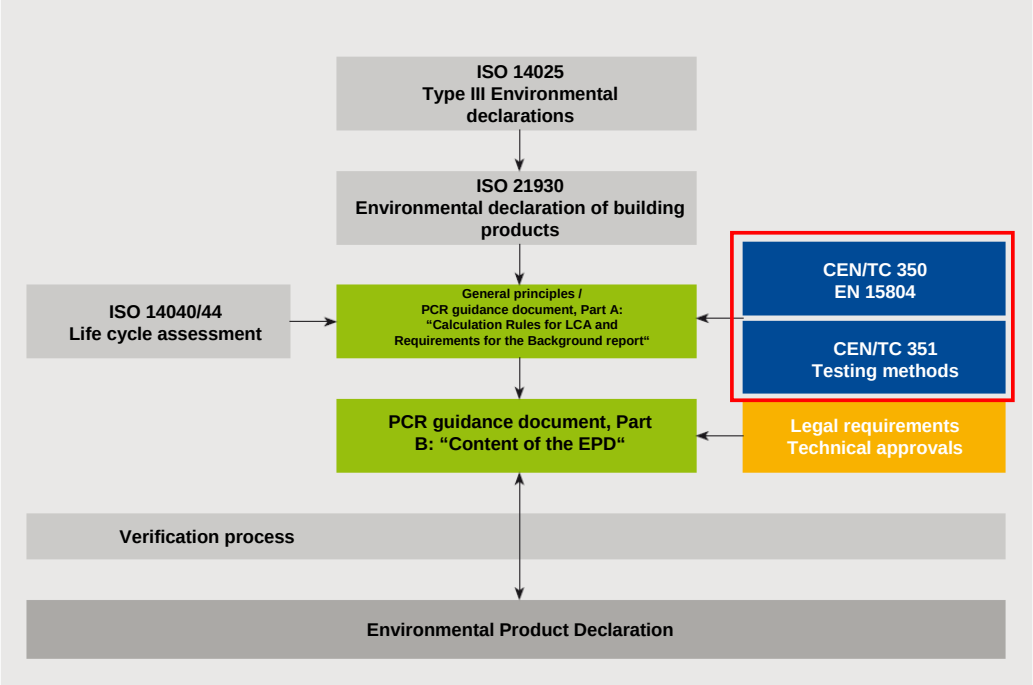
- **Declaration holders´origin:**
  Germany, Finland, Italy, Netherlands, Belgium, Austria, Spain
  Denmark, Slowenia, Switzerland, Turkey, Malaysia

## EPDs

- **230 verified EPDs are published by IBU (end 2011):**
  ⇨ representing > 800 products

# Basic principles and normative background

Institut Bauen und Umwelt e.V.

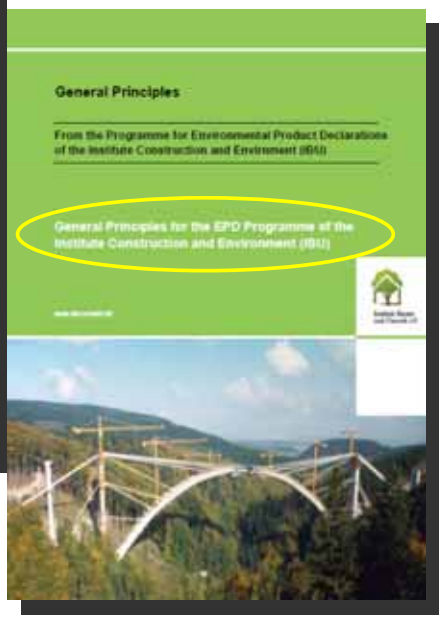



# Adaption of the EN 15804 in the IBU EPD progamme

Institut Bauen und Umwelt e.V.


**PCR Guidance document, Part A, common requirements on LCA and project report**

**General principles and program rules**





**PCR Guidance document, Part B, specific for each product group**

# The IBU procedure

Institut Bauen und Umwelt e.V.

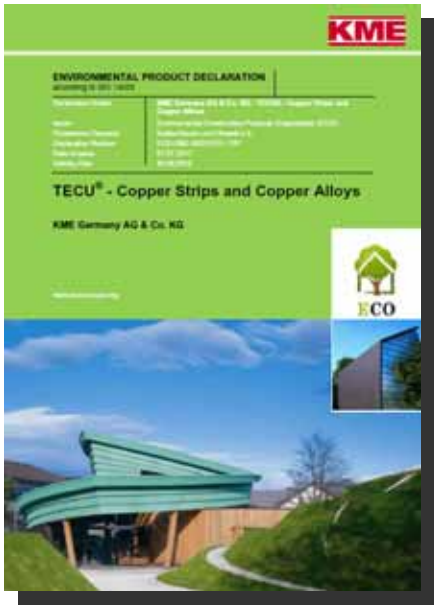

- PCR part A gives further guidance for aspects not fixed in EN 15804
  - e.g. use of ELCD and GaBi data as reference for background data
- PCR part B gives further guidance on product group related aspects
  - "interpretation of EN 15804", e.g. application of allocation rules

# The EU Situation: Two main applications of EPD

Institut Bauen und Umwelt e.V.

**CPR**

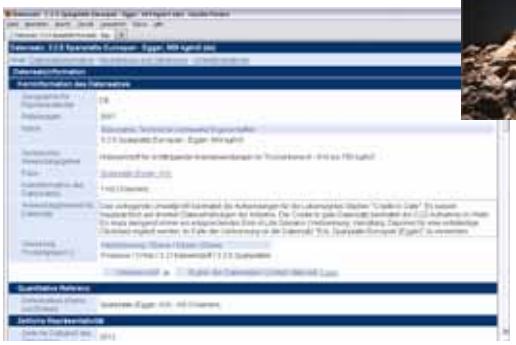
**EPD acc. EN 15804**




**database for Building Assessment**

DGNB

- **EPD-Document (6 – 8 pages)**
- **Publication of EPD** (for example on the homepage of IBU)
- **Detailed background report**
- **xml-Dataset,** which will be available in LCA databases for architects etc**.**
- **GaBi LCA Modell** (at PE)





ECO
A European umbrella for
national EPD program operators …

Institut Bauen und Umwelt e.V.

**ECO** **ccording EN 15804**

**nvolvement of national EPD system operators**



## EPD Example: OSB (download area IBU, English)

***Summary of the EPD***

PE INTERNATIONAL
EXPERTS IN SUSTAINABILITY

Summary
Umwelt-Produktdeklaration
*Environmental Product-Declaration*

| | |
|---|---|
| Institut Bauen und Umwelt e.V.<br>www.bau-umwelt.com | Program holder |
| Fritz EGGER GmbH & Co.<br>Company Head Office<br>Weiberndorf 20<br>A – 6380 St. Johann in Tyrol | Declaration holder |
| EPD-EHW-2008112-E | Declaration number |
| EGGER EUROSTRAND® OSB boards for construction<br>This declaration is an environmental product declaration according to ISO 14025 and describes the environmental rating of the building products listed herein. It is intended to further the development of environmentally compatible and sustainable construction methods.<br>All relevant environmental data is disclosed in this validated declaration.<br>The declaration is based on the PCR document "Wood-based materials", year 2009-01. | Declared building products |
| This validated declaration authorises the holder to bear the official stamp of the Institut Bauen und Umwelt. It only applies to the listed products for one year from the date of issue.<br>The declaration holder is liable for the information and evidence on which the declaration is based. | Validity |
| The declaration is complete and contains in its full form:<br>- Product definition and physical building-related data<br>- details of raw materials and material origin<br>- description of how the product is manufactured<br>- instructions on how to process the product<br>- data on usage condition, unusual effects and end of life phase<br>- life cycle analysis results<br>- evidence and tests | Content of the declaration |
| 25. February 2009 | Date of issue |
| Prof. Dr.-Ing. Horst J. Bossenmayer (President of the Institut Bauen und Umwelt) | Signatures |
| This declaration and the rules on which it is based have been examined by an independent expert committee (SVA) in accordance with ISO 14025. | Verification of the declaration |
| Prof. Dr.-Ing. Hans-Wolf Reinhardt (chairman of the expert committee) / Dr. Frank Werner (leader appointed by the expert committee) | Signatures |

Summary
Umwelt-Produktdeklaration
*Environmental Product-Declaration*

| | |
|---|---|
| OSB boards (Oriented Strand Board) is a synthetic-resin bonded, wood-based material board product with a three-layer structure made out of micro-veneer oriented long wood chips called strands according to EN 300 "OSB". "Strands" with a defined thickness and shape which are primarily produced using logwood which is glued in several layers. The middle layer is oriented at a 90° angle relative to the outer layers. The OSB boards are glued with a MUF resin in the outer layers and a polyurethane resin in the middle layer, or only with polyurethane resin. The boards are manufactured in thicknesses of 6-40 mm (different depending on the board type), the raw density of the boards is approx. 600 kg/m³. | Product description |
| OSB board can be used in all load-bearing and reinforcing components (ceilings, wall cladding, roof shell, subfloor, sill plates) for which the national technical approvals of the respective product or the CE mark according to DIN EN 13986 is a prerequisite for use. Furthermore, OSB boards can be used for non-load-bearing applications in interior design or as wood packing and concrete forms. | Application |
| The Life Cycle Assessment (LCA) was performed according to DIN ISO 14040 following the requirements of the IBU guideline for type III declarations. Both specific data from the reviewed products and data from the "GaBi 4" database were used. The life cycle assessment encompasses the raw material and energy production, raw material transport, the actual manufacturing phase and the end of life in a biomass generating plant with energy recovery. The OSB board product mix was declared. | Scope of the LCA |
| **EUROSTRAND® OSB boards** | Results of the LCA |

| Evaluation variable | Unit per m³ | Total | Manufacturing | End of Life |
|---|---|---|---|---|
| Primary energy, non renewable | [MJ] | -7651 | 4109 | -11 760 |
| Primary energy, renewable | [MJ] | 12 584 | 12 701 | -137.8 |
| Global warming potential (GWP 100) | [kg $CO_2$ eqv.] | -537.9 | -864.1 | 326.2 |
| Ozone depletion potential (ODP) | [kg R11 eqv.] | -7.59E-06 | 2.13E-05 | -2.89E-05 |
| Acidification potential (AP) | [kg $SO_2$ eqv.] | 1.10E+00 | 9.82E-01 | 1.23E-01 |
| Eutrophication potential (EP) | [kg Phosphate eqv.] | 1.80E-01 | 1.62E-01 | 1.83E-02 |
| Photochemical oxidant formation potential (POFP) | [kg ethylene eqv.] | 9.59E-02 | 1.32E-01 | -3.62E-02 |

| | |
|---|---|
| Prepared by: PE INTERNATIONAL, Leinfelden-Echterdingen<br>in cooperation with EGGER Holzwerkstoffe Wismar GmbH & Co. | |
| In addition, the results of the following tests are shown in the environmental product declaration:<br>• Formaldehyde according to EN 120<br>Testing institute: WKI Fraunhofer Wilhelm-Klauditz-Institute, Braunschweig<br>• MDI (diphenylmethane-4,4'-diisocyanate) according to procurement regulation RAL ZU-78 and NIOSH (P&CAM 142)<br>Testing institute: Wessling Beratende Ingenieure GmbH<br>• Eluate analysis according to DIN 38406-4 and EN 71-3<br>Testing institute: ECO – Institute, Cologne<br>• EOX (extractable organic halogen compounds) according to DIN 38414-S17<br>Testing institute: ECO – Institute, Cologne<br>• Toxicity of the fire gases according to DIN 53 436<br>Testing institute: University Osnabrück, Chemical laboratory<br>• Lindane/PCP according to PA-C-12:2006-02<br>Testing institute: WKI Fraunhofer Wilhelm-Klauditz-Institute, Braunschweig | Evidence and verifications |

# EPD program of IBU used in DGNB
## *Content*

PE INTERNATIONAL
EXPERTS IN SUSTAINABILITY

**CO2 balance sheet**

The $CO_2$ balance sheet in figure 4 shows that the manufacturing of one $m^3$ of OSB board causes 461 kg of $CO_2$ emissions, of which 336 kg of $CO_2$ come from the direct thermal utilisation of wood during the production phase and an additional 125 kg $CO_2$ are fossil emissions. On the other hand, through manufacturing a total of 1351 kg of $CO_2$ per $m^3$ of OSB board is removed from the air and

EUROSTRAND® OSB - Oriented Strand Board — Page 15

| | | |
|---|---|---|
| Product group | Wood-based materials OSB - Oriented Strand Boards | Version |
| Declaration holder: | Fritz EGGER GmbH & Co. | 09-12-2008 |
| Declaration number: | EPD-EHW-2008112-E | |

stored in the wood through photosynthesis as the trees grow, of which 1015 kg of $CO_2$ per $m^3$ remains bound throughout the usage phase. The $CO_2$ component bound in the wood of the OSB board is only released again at the end of the lifecycle, that is, during the thermal utilisation of the board. If one allocates the manufacturing $CO_2$ intake (intake bar) and $CO_2$ emissions (output bar), one obtains, on balance, a $CO_2$ storage of -869 kg per $m^3$ of OSB board through binding in the product and substitution of non-renewable energy sources for the manufacturing phase. This storage effect is effective throughout the utilisation phase. During combustion at end of life in the modelled waste incineration, the carbon stored in the board is released back into the atmosphere, primarily in the form of $CO_2$. At the same time, however, a substitution of fossil fuels and therefore of $CO_2$ from the combustion of these fossil energy sources of -685 kg of $CO_2$ takes place. This energy substitution effect results in a total balance of -522 kg $CO_2$ over the entire life cycle.

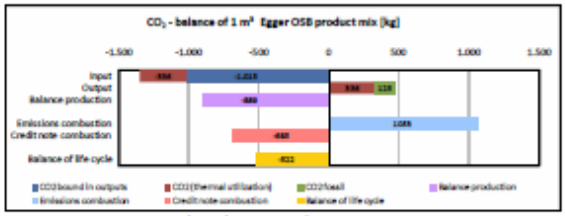



**Figure 4: CO2 balance sheets for the manufacturing of 1 m³ of OSB board.**

### *Life Cycle Documentation*

1. Description of the product
2. Raw materials
3. Production
4. Construction Phase
5. Use stage
6. Special issues
7. End of life

***Results from LCA**:*

8. LCA according ISO 14040

***Additional remarks:***

9. Certificates for measured data
9. Verification
10. Literature



## EPD Results

PE INTERNATIONAL
EXPERTS IN SUSTAINABILITY


# Interpret LCA Results

PE INTERNATIONAL
EXPERTS IN SUSTAINABILITY

1 m² KLH (57mm [27kg])

| Information für den Lebensweg des Gebaudes | | | | | |
|---|---|---|---|---|---|
| Wirkung Kategorie | Einheit | Product Stadium | Gutschriften und Lasten über den Lebensweg des Gebaudes hinaus | Example | |
| | | A1-A3 | D | | |
| CML2001 - Nov. 09, Abiotischer Ressourcenverbrauch (ADP elemer | [kg Sb-Äqv.] | 4,03E-06 | -4,86E-06 | | |
| CML2001 - Nov. 09, Abiotischer Ressourcenverbrauch (ADP fossil) | [MJ] | 76,92 | -216,08 | | |
| CML2001 - Nov. 09, Eutrophierungspotential (EP) | [kg Phosphat-Äqv.] | 0,004 | 6,33E-03 | Winter Wheat (kg) | 3,7 |
| CML2001 - Nov. 09, Ozonabbaupotential (ODP, katalytisches) | [kg R11-Äqv.] | 4,17E-07 | -5,38E-08 | | |
| CML2001 - Nov. 09, Photochem. Oxidantienbildungspot. (POCP) | [kg Ethen-Äqv.] | 2,94E-03 | 1,89E-03 | Gasoline driven car (EURO 3) [km] | 84 |
| CML2001 - Nov. 09, Treibhauspotential (GWP 100 Jahre) | [kg CO2-Äqv.] | -46,42 | 24,93 | Gasoline driven car (EURO 3) [km] | -249 |
| CML2001 - Nov. 09, Versauerungspotential (AP) | [kg SO2-Äqv.] | 0,02 | 0,02 | Gasoline driven car (EURO 3) [km] | 243 |
| | | | | | |
| Primärenergiebedarf aus reg. Ressourcen (unterer Heizwert) | [MJ] | 630,30 | -8,33E+01 | | |
| Primärenergiebedarf aus Ressourcen (unterer Heizwert) | [MJ] | 96,70 | -268,91 | Raw oil mix (Austria) net calorific value [kg] | 2 |
| Total Primärenergiebedarf | [MJ] | 727,00 | -352,20 | | |



# LCA Results for KLH

PE INTERNATIONAL
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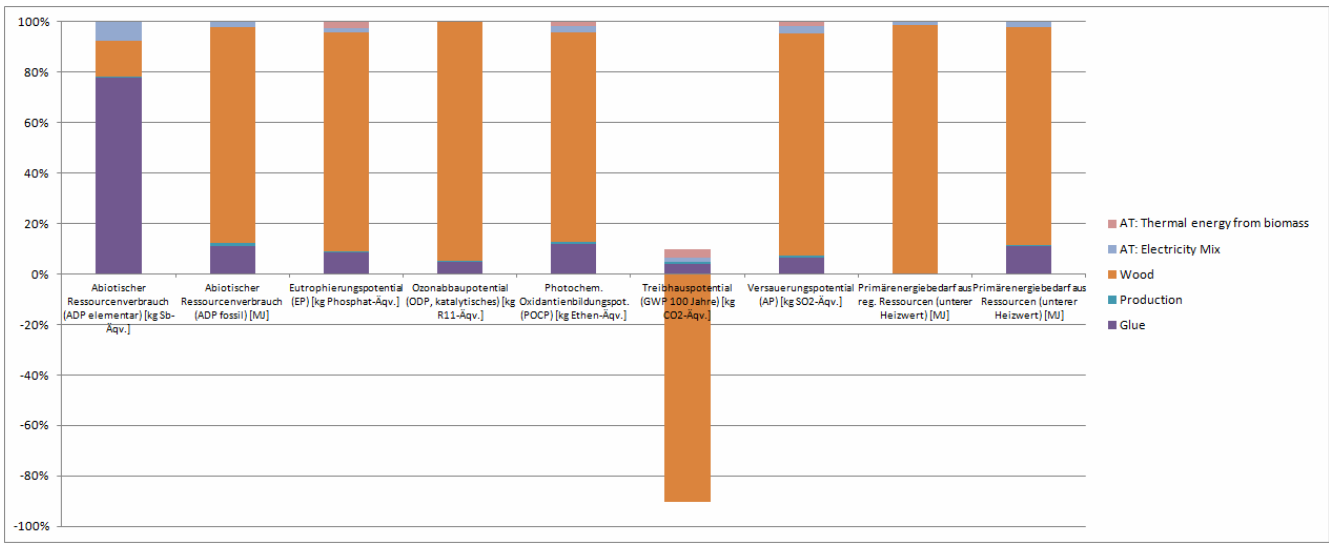
1 m² KLH (57mm [27kg] - Production



# EPD´s Summary & Conclusions

- EPD´s are based on data provided by the producer – the producer is responsible for provided data
- EPD´s are based on PCR – documents developed by the industry and experts – open product forum
- EPD´s are “living documents” – additional aspects are integrated continuously
- EPD´s undergo an independent external review which additionally ensures high quality and acceptance
- EPD´s are actualised every 3 years which ensures reflecting state of current technology
- EPD´s are already the data base for building certification
- EPD´s are providing information regarding production of the product, the stored amount of CO2 of a wooden product during use phase, and End of Life including substitution for Energy production
- EPD´s provide also data of all other materials – basis for calculation of substitution effects regarding CO2 emissions.

For a Carbon Credit system the following aspects have to be considered:

- How is the product embedded into the whole system? (useful life of products, new formation of wood in forests and connected total stock of wood in Technosphere and in forests, development of stock over time, etc.)
- Situation of the carbon balance in soil?
- Substitution effects by material substitution?
- Economic competition and political discussion.
- How to verify saved CO2 emissions – additionality?
- Which Baseline?



# Ökobau.dat - The LCA Data Base in DGNB

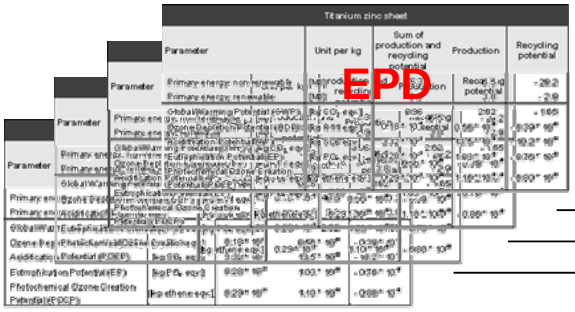
1 **Planning: average data**

2 **Certification: Possibility of use of specific data**

**Specific product information from manufacturers**

2

1




**typical and/or average data**

**National LCA - Indicators – ökobau.dat**

# Interaction between DGNB-Certificate and IBU Declaration

PE INTERNATIONAL
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- **Description of construction material – Life Cycle**
  - Characterization of construction products
  - Inserted substances and precursors
  - Description of manufacturing process
  - Processing
  - Use phase
  - Re-use options
- **LCA**
  - Documentation of Boundary conditions und data base
  - Result of LCA (Indicators)
- **Verification**



PE INTERNATIONAL
EXPERTS IN SUSTAINABILITY

- Introduction PE
- LCA of Wooden Products
- EPD
- **Building Certification**

# DGNB in CEE, examples in Austria, Tschech Republik and Romania – Blue Buildings 2010

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# Trend 1 – Europe
## Growing network of Green Building Council

PE INTERNATIONAL
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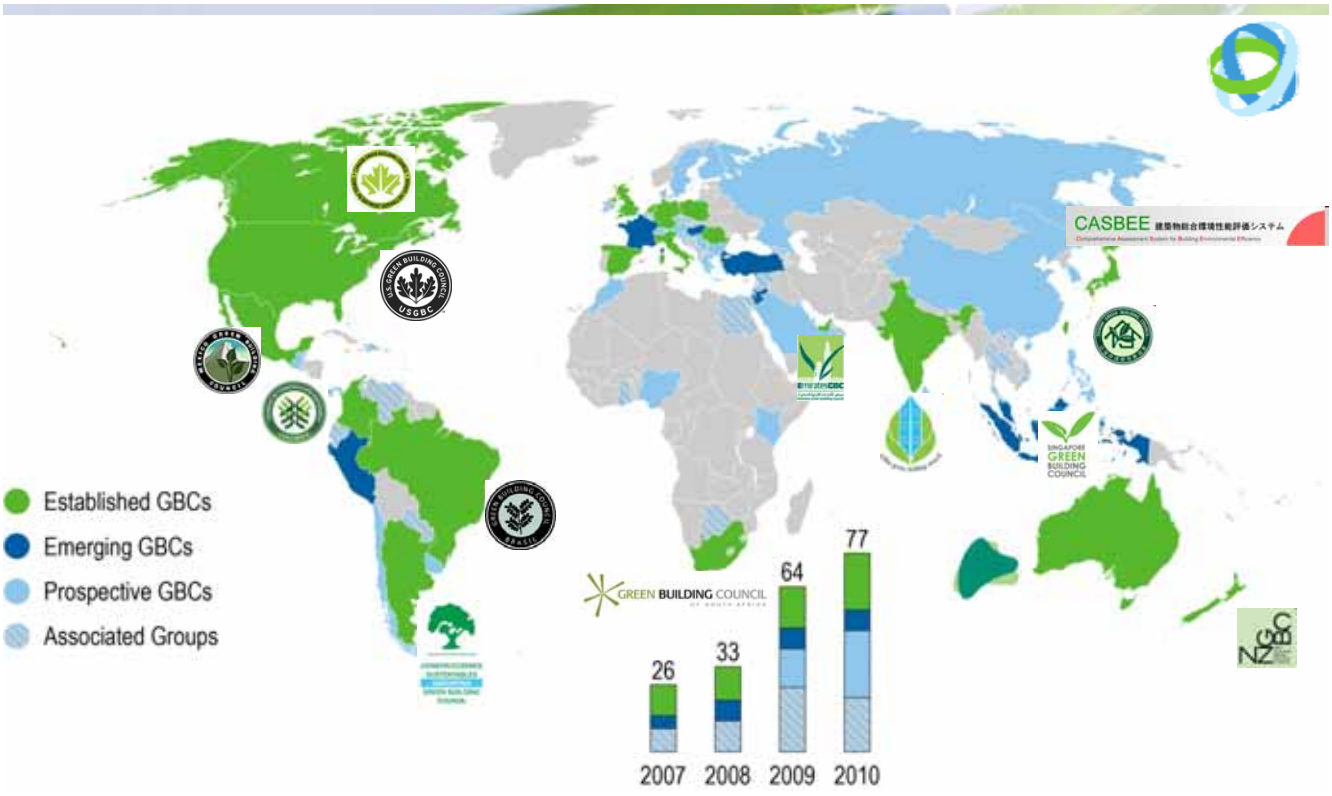
## Trend 1 – Europe
## Growing network of Green Building Council






## Interaction between EPD and building certification

epd-norge.no
EPD
ENVIRONMENTAL DECLARATION
BY OG BYG

- **Harmonized according to EN 15804**
- **25 Organisations from 17 countries**

MRPI
ies
dapc
LCA or EPD
Pilot
breeam nl
breeam
DGNB
GBCe

| System | Importance in the EU | Used in |
|---|---|---|
| LEED (US) | Focus on office buildings in EU | Amerikas, VAE, IT, ES, TR, SE… |
| BREEAM (UK) | All building types | UK, NL, DE, US, LUX, IT, ES, … |
| DGNB (DE) | All building types, new approach | DE, AT, BG, CN, HUN, CAN, … |
| HQE (FR) | Residential and office buildings | FR |



# LEED 2009 Rating Systems

- New Construction rating system
- Core and Shell rating system
- Schools rating system
- Existing Buildings: Operations and Maintenance rating system
- Commercial Interiors rating system


# LEED

PE INTERNATIONAL
EXPERTS IN SUSTAINABILITY

## LEED® for New Construction

| Total Possible Points** | 110* |
|---|---|
| Sustainable Sites | 26 |
| Water Efficiency | 10 |
| Energy & Atmosphere | 35 |
| Materials & Resources | 14 |
| Indoor Environmental Quality | 15 |

*Out of a possible 100 points + 10 bonus points

**Certified 40+ points, Silver 50+ points, Gold 60+ points, Platinum 80+ points

| | |
|---|---|
| Innovation in Design | 6 |
| Regional Priority | 4 |


- Over 7,500 certified buildings since introduction in 2001

# Example LEED 2009 NC credits

PE INTERNATIONAL
EXPERTS IN SUSTAINABILITY

| Energy and Atmosphere | | 35 Possible Points |
|---|---|---|
| ☑ Prerequisite 1 | Fundamental Commissioning of Building Energy Systems | Required |
| ☑ Prerequisite 2 | Minimum Energy Performance | Required |
| ☑ Prerequisite 3 | Fundamental Refrigerant Management | Required |
| ☐ Credit 1 | Optimize Energy Performance | 1–19 |
| ☐ Credit 2 | On-site Renewable Energy | 1–7 |
| ☐ Credit 3 | Enhanced Commissioning | 2 |
| ☐ Credit 4 | Enhanced Refrigerant Management | 2 |
| ☐ Credit 5 | Measurement and Verification | 3 |
| ☐ Credit 6 | Green Power | 2 |

| Materials and Resources | | 14 Possible Points |
|---|---|---|
| ☑ Prerequisite 1 | Storage and Collection of Recyclables | Required |
| ☐ Credit 1.1 | Building Reuse—Maintain Existing Walls, Floors and Roof | 1-3 |
| ☐ Credit 1.2 | Building Reuse—Maintain Existing Interior Nonstructural Elements | 1 |
| ☐ Credit 2 | Construction Waste Management | 1-2 |
| ☐ Credit 3 | Materials Reuse | 1-2 |
| ☐ Credit 4 | Recycled Content | 1-2 |
| ☐ Credit 5 | Regional Materials | 1-2 |
| ☐ Credit 6 | Rapidly Renewable Materials | 1 |
| ☐ Credit 7 | Certified Wood | 1 |

# Sustainability in Building and Construction Definitions

PE INTERNATIONAL
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# Dimension Life Cycle – Life Cycle Perspective

PE INTERNATIONAL
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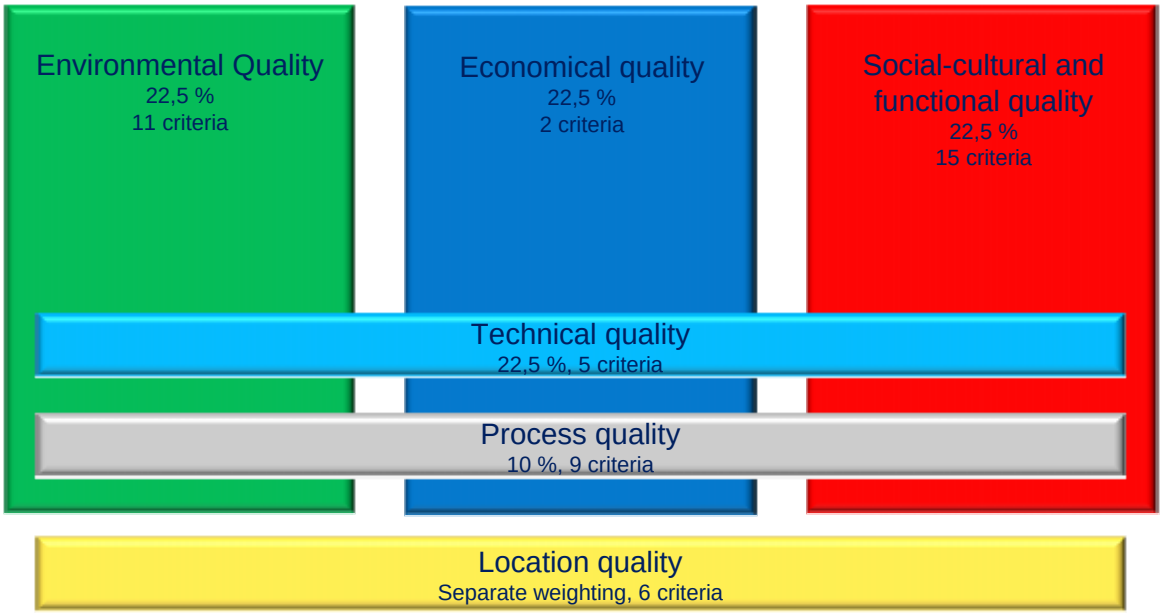
Planning | Raw materials | Production | Construction | Operation | Waste | Recycling

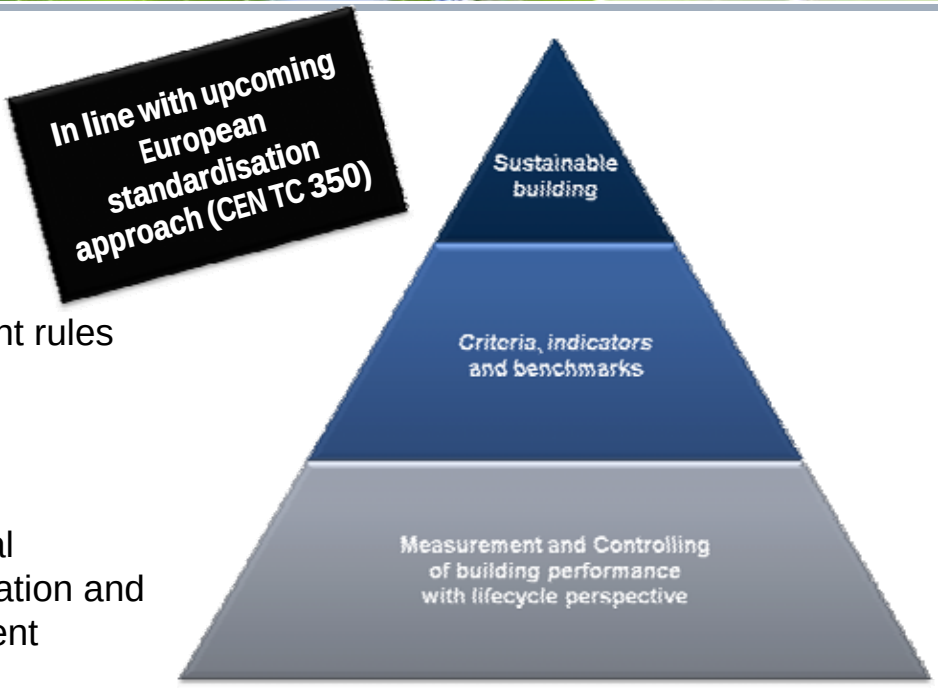
**Sustainability concerns all life cycle stages**

# DGNB Rating Tool – The new approach




# DGNB: Performance-oriented assessment

- Goal
- Assessment rules
- Operational implementation and management



# Ecological Criteria in DGNB Rating Scheme

## EPD´s are the most important data source for environment

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| | | | |
|---|---|---|---|
| Environmental quality | Global and local environment | 1 | Global Warming Potential (GWP) |
| | | 2 | Ozone Depletion Potential (ODP) |
| | | 3 | Photochemical Ozone Creation Potential (POCP) |
| | | 4 | Acidification Potential (AP) |
| | | 5 | Eutrophication Potential (EP) |
| | | 6 | Risks for the local environment (toxic aspects, groundwater, surface water, soil, air) |
| | | 7 | Other impact on the local environment (light-pollution) |
| | | 8 | Other impact on the global environment (materials from renewable resources – PEFC, FSC) |
| | | 9 | Microclimate |
| | Ressources and waste | 10 | Primary energy (non renewable) ($PE_{ne}$) |
| | | 11 | Primary energy (renewable) ($PE_{e}$) |
| | | 12 | Other consumption of non renewable resources |
| | | 13 | Waste (deposited in categories) |
| | | 14 | Water consumption in the use phase |
| | | 15 | Landuse |



## Building LCA´s – materials share
## Primärenergie, GWP, AP und POCP

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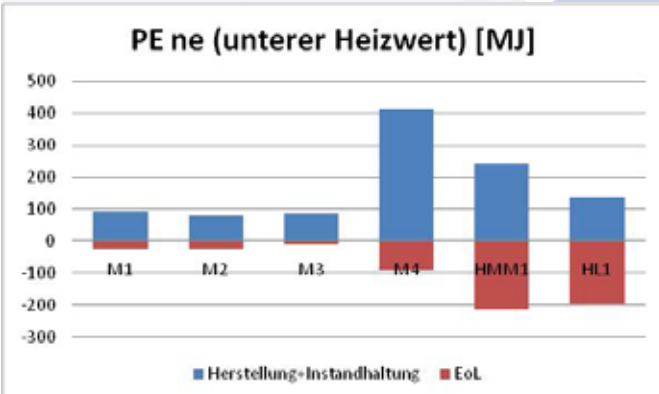
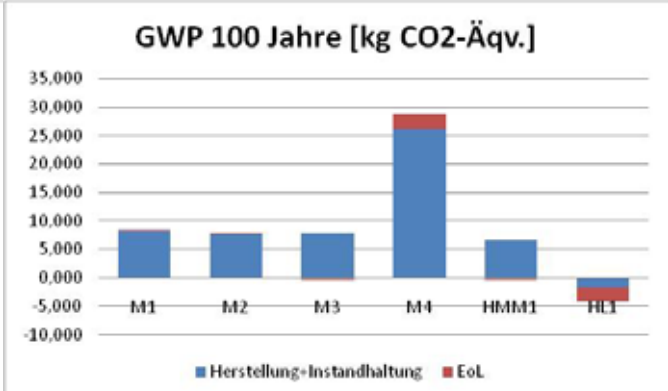
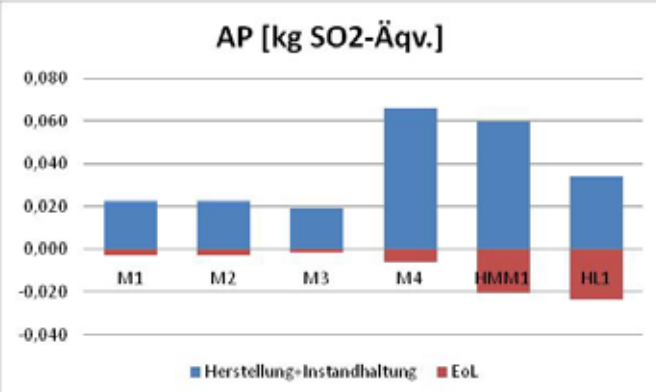
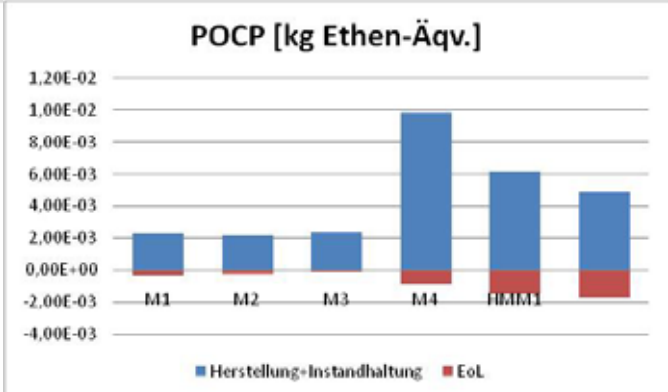


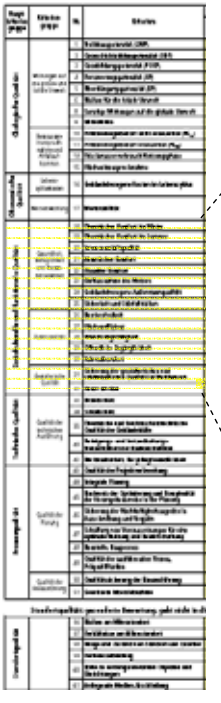



# DGNB Rating Scheme Economic Quality

| | | | |
|---|---|---|---|
| Economic quality | Life cycle cost | 16 | Simulation of life cycle cost (LCC) for the specific building |
| | Economic growth | 17 | Economic stability of the value of the building |



# DGNB Rating Scheme
# Socio-Culural and Functional Quality



| | | | |
|---|---|---|---|
| Socio-cultural and functional quality | Health, comfort and user satisfaction | 18 | Thermal comfort in wintertime |
| | | 19 | Thermal comfort in summertime |
| | | 20 | Indoor air quality (TVOC, Formaldehyde) |
| | | 21 | Acoustic comfort |
| | | 22 | Visual comfort |
| | | 23 | Control options of the user |
| | | 24 | Surroundings of the building |
| | | 25 | Safety and accidents |
| | Functionality | 26 | Accessibility |
| | | 27 | Space efficiency |
| | | 28 | Conversion options |
| | | 29 | Public accessibility |
| | | 30 | Comfort for bike users |
| | Quality of design | 31 | Design and urban development (during the competition) |
| | | 32 | Art in the context of the building |

# DGNB Rating Scheme
# Technical Quality

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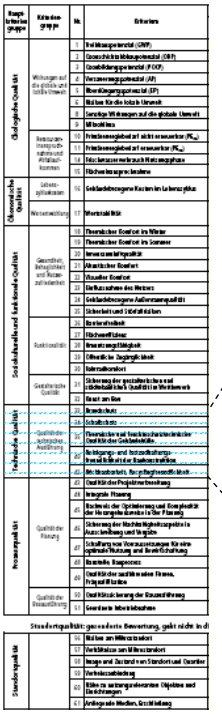

| | | | |
|---|---|---|---|
| Technical quality | Quality of the construction | 33 | Fire protection |
| | | 34 | Sound insulation |
| | | 35 | Thermal and hygro-technical standard of the core and shell |
| | | 36 | Backup ability of Heating, Ventilating, and Air Conditioning |
| | | 37 | Usability of Heating, Ventilating, and Air Conditioning |
| | | 38 | Technical quality of Heating, Ventilating, and Air Conditioning |
| | | 39 | Durability / service life planning |
| | | 40 | Easy cleaning and repair |
| | | 41 | Resistance against hale, storms and floods |
| | | 42 | Deconstruction and recyclability |



# DGNB Rating Scheme
# Quality of the Processes

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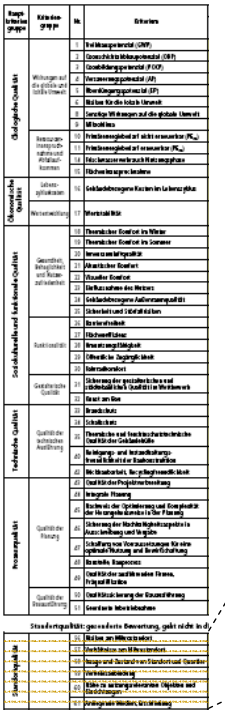
| | | | |
|---|---|---|---|
| Quality of the processes | Planning | 43 | Quality of the pre-planning |
| | | 44 | Participation |
| | | 45 | Concepts and supporting documents |
| | | 46 | Assessment of variants |
| | | 47 | Integral Planning |
| | | 48 | Tendering and awarding |
| | | 49 | Documentation |
| | Construction | 50 | Building site and process |
| | | 51 | Documentation of the construction process |
| | | 52 | Measurements / quality control |
| | | 53 | Structured beginning of operation |
| | Operation | 54 | Controlling |
| | | 55 | Management |
| | | 56 | Systematic inspection, maintenance and repair |
| | | 57 | Qualification of the staff |

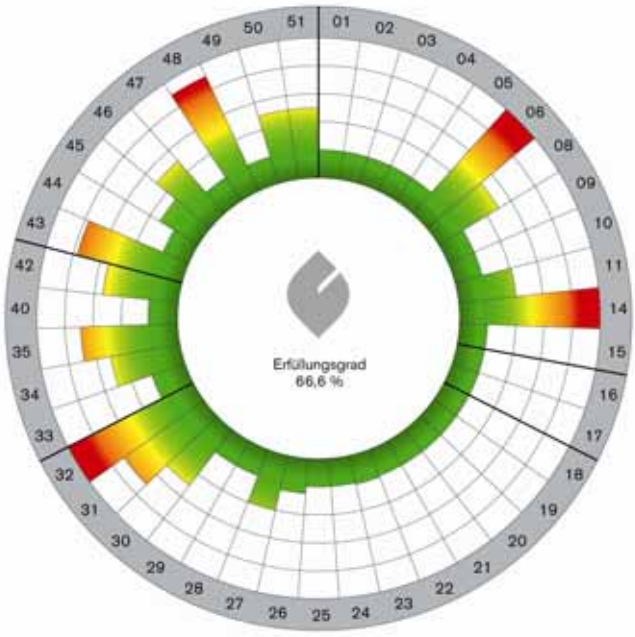
# DGNB Rating Scheme
# Quality of the Site



| | | | |
|---|---|---|---|
| Quality of the site | | 58 | Risks at the site |
| | | 59 | Conditions on the site |
| | | 60 | Image and present situation of site and surroundings |
| | | 61 | Access to public transport |
| | | 62 | Access to public buildings |
| | | 63 | Development of the site |
| | | 64 | planning law regulations |
| | | 65 | Expandability / Reserves |



# EPD in DGNB System – Possibilities of Certification




➔ **7 Criterias with direct reference to EPD**

➔ **10 Criteria's with indirect reference to EPD and possibilities for product manufacturers to declare within EPD respectively**

# Office building EGGER, Raudauti

- Architectural competition resulted in innovative building-concept.
  - Structured in modules
  - Prefabrication of modules at general contractor


- In fure this architecture shall reflect the culture of the company
- Flexible for each building site - flexibility adaptability



# Why building certification?

- Environment and sustainability are high valued at EGGER.
- EGGER has environmental product declarations (EPD´s) for all of their main products.
- Certification process strengthens EGGER´s competence.
  - Own products with EPD´s applied – best practice example for clients


## The track to gold certification
### Avantages from Eggers point of view

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- Product specific EPD´s for Calculation of building LCA/ important information for planning team
- Wood as renewable $CO_2$- and energy storing material with high performance in loadbearing and insulation.
- Low emission wall and ceiling panels high performing in acustics.
- Surfaces with attractive design, long service live and comfort.
- economic modular design (LCC).




## Office Egger Holzwerkstoffe:
## DGNB/ÖGNI Gold mit 84 % certification result

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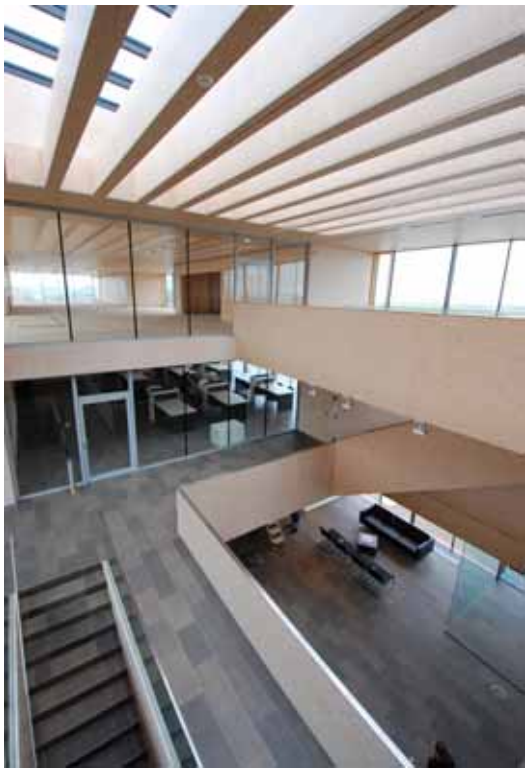
Verwaltungsgebäude EGGER Holzwerkstoffe
Architekt Bruno Moser architektur***WERKSTATT***



Klimaschutzmarkt Murau ÖGNI/DGNB GOLD Crrtification result: 92%


# Wood combined with natural stones

# LED Lightning

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# Innovativ cooling system

PE INTERNATIONAL
EXPERTS IN SUSTAINABILITY

# Murau als internationales Vorbild

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SPAR

**80 t $CO_{2e}$ savings annually!**

**= 40 000 000m³ $CO_2$**

**Or:**

**615 000 PKW km = 15 times round the globe!**