Thai-German Technology Conference
Energy Efficiency in Buildings 2016

Energy Efficiency and Sustainability of Buildings in Planning Practice

Dr.-Eng. Saad Baradiy
Dipl.-Eng. Architect Thomas Gross

07th March 2016 / Bangkok

full of fresh ideas

iproplan®

EE	Energy Efficiency & Sustainability in Planning Practice
a	iproplan® - Who we are
b	iproplan® - Our services
c	State of technology in Germany

full of fresh ideas

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Company Structure

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... and other regional offices.

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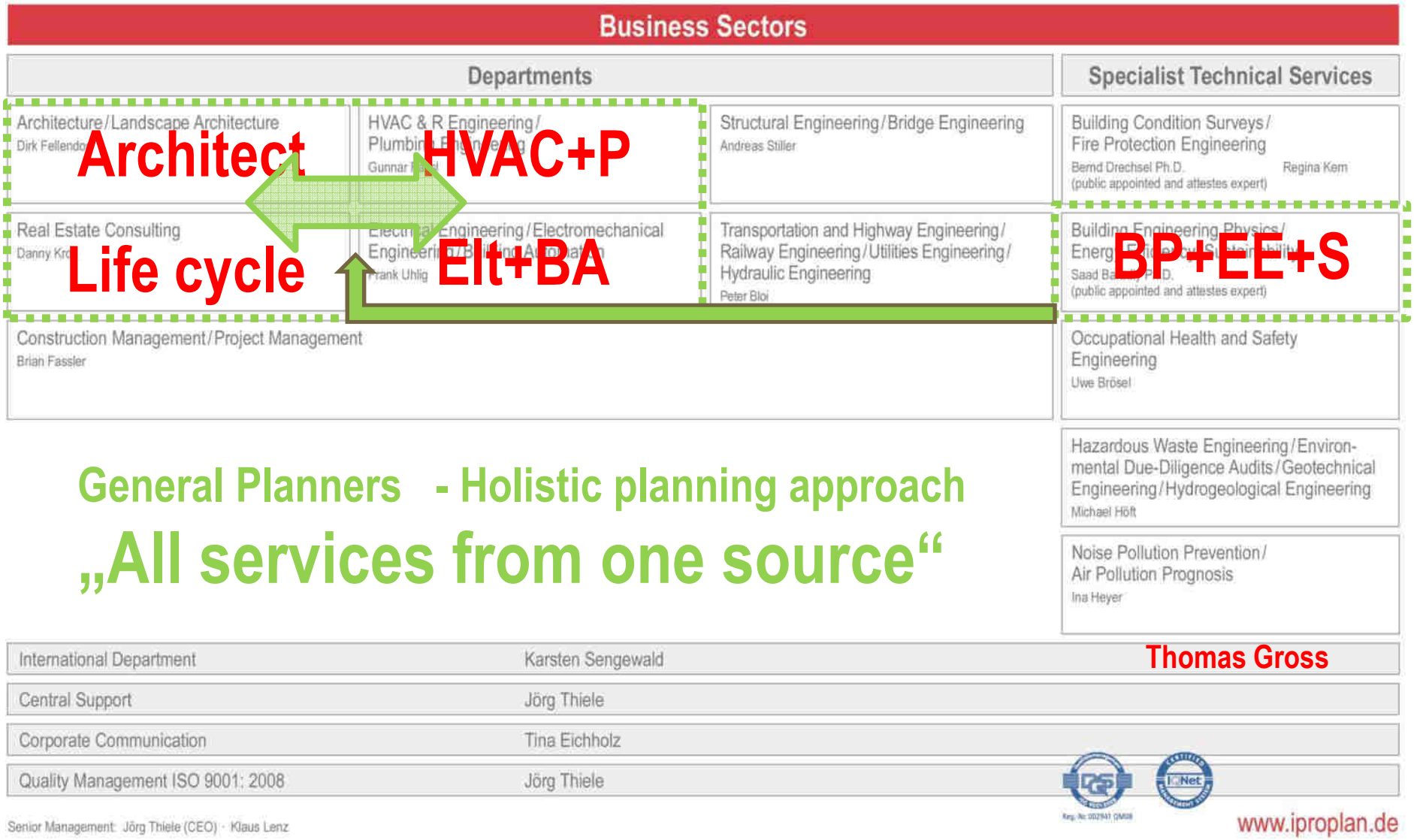
MMR

... and other offices worldwide.

Status: January 2016

www.iproplan.de

Consultancy Services



Team Dr Saad Baradyi

Engineering Services
(for holistic building design)

Training National & International
(BPh, EnEf, Sustainability, e.g. UAE, Vietnam, Egypt, Saudi Arabia, etc.)

Agendas for developing EE strategies and policies
(for building sector, e.g. Maghreb, Syria, Jordan, Qatar, Algeria, etc.)

Development of sustainable rating systems
(e.g. Green Pyramid Rating System for Hotels in Egypt)

- Building Physics
- Energy Efficiency
- Sustainability

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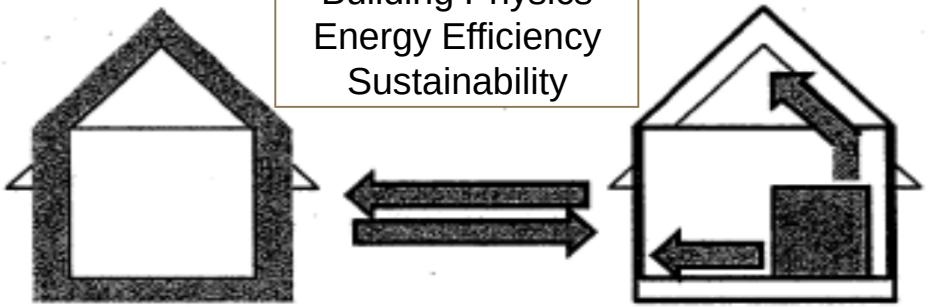
Philosophy & Objective of good EE-design

Optimized interaction

of passive & active components

(EE-Team)

Building Physics
Energy Efficiency
Sustainability



(ARCHITECTS)
Building Envelope

(ENGINEERS)
Building Services

Quelle: Hegger, Energie Atlas

Quelle: Manfred Hegger u. a., FG ee

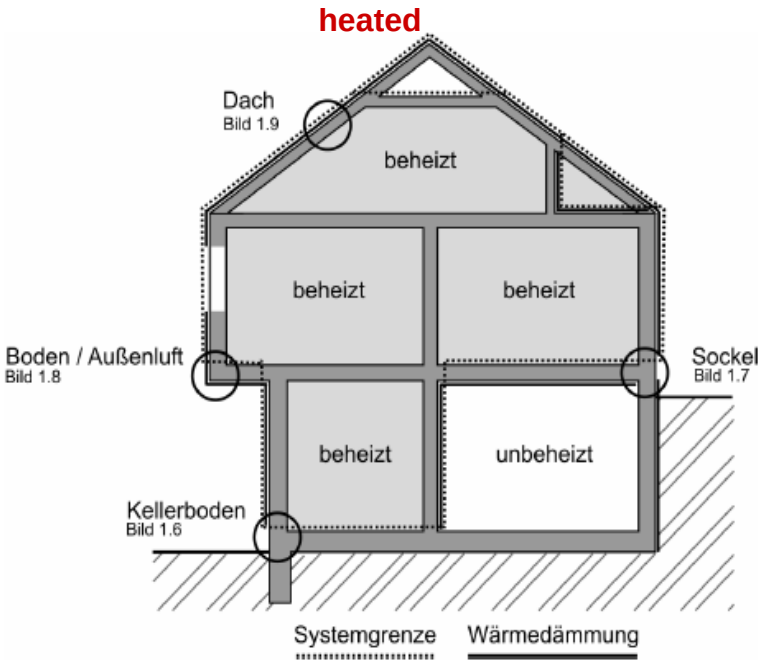
DGNB

© DGNB 2009 | 8

Building envelope

Thermal envelope / Passive components

Building geometry (DIN 18599 DIN EN ISO 13789)

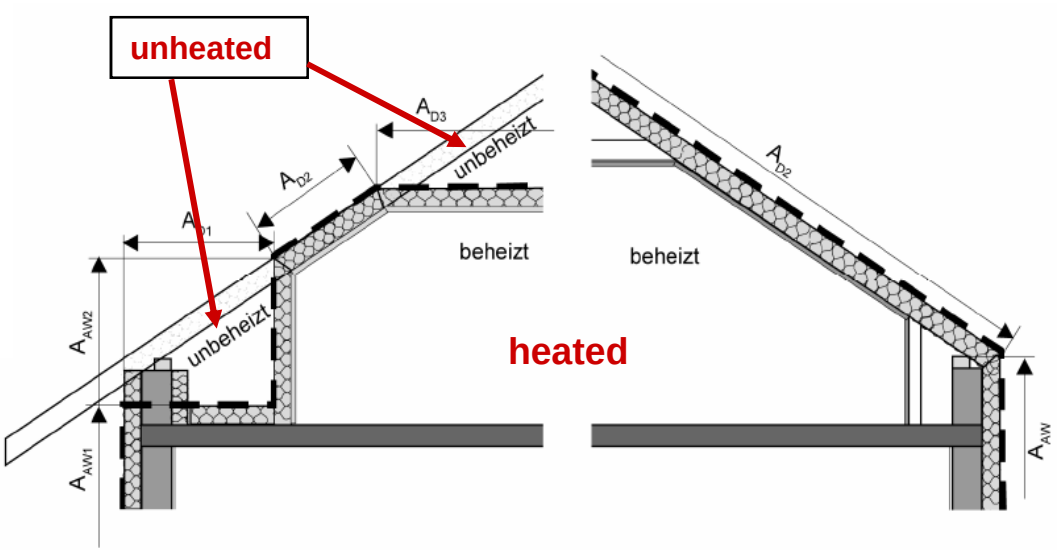


Grey areas "heated zones or heated areas"

White areas "unheated zones or unheated areas"

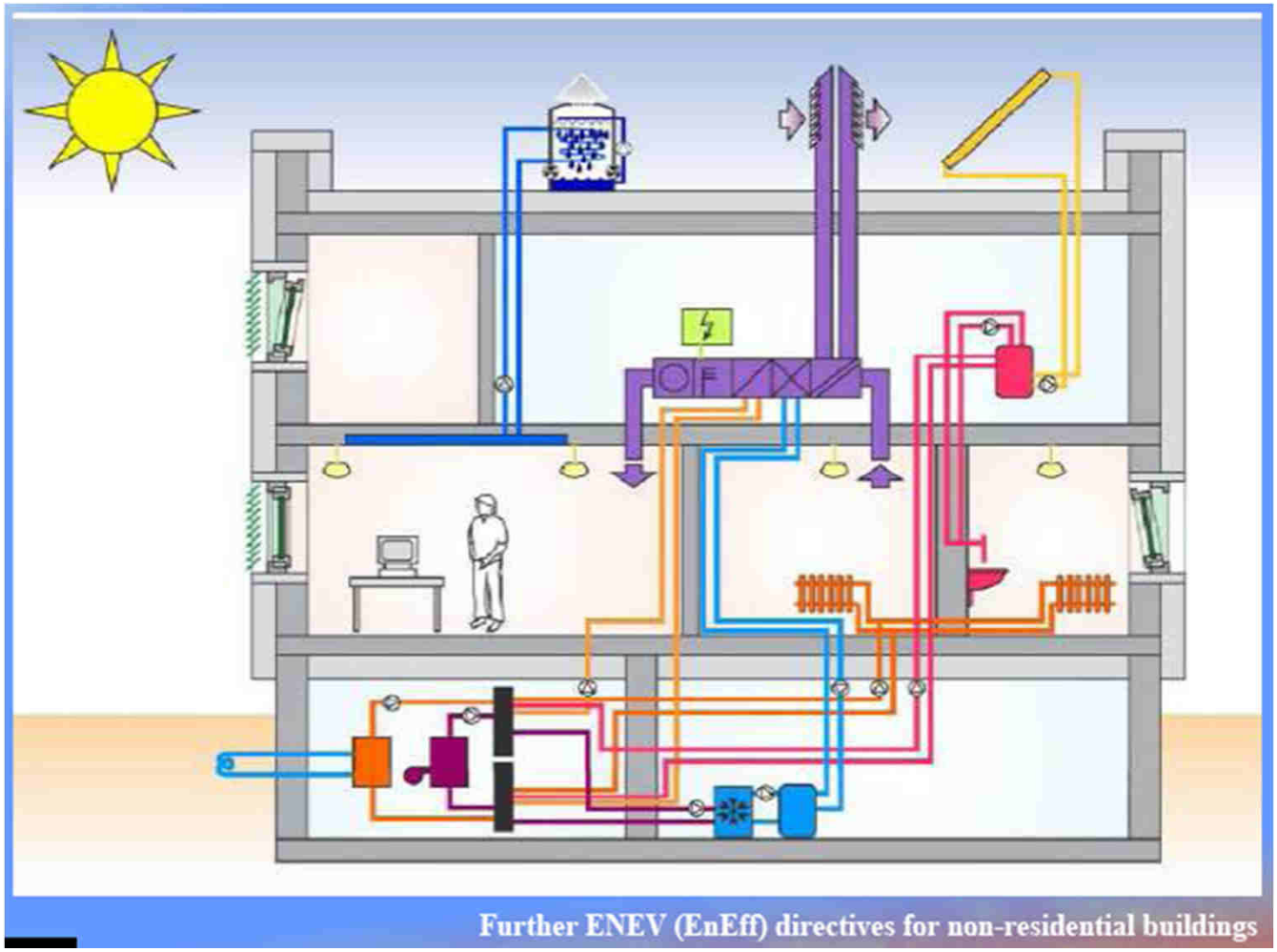
Normally heated rooms / zones ($\theta_i \geq 19$ C°)

Low temperatures heated rooms / zones (12 C° ≥ θ_i < 19 °C)



Building services

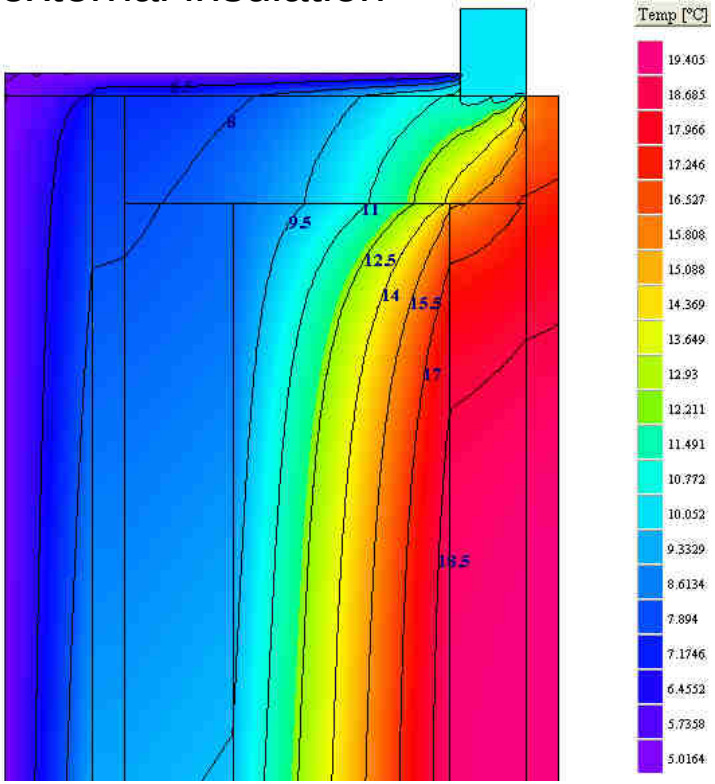
Thermal building services / active components



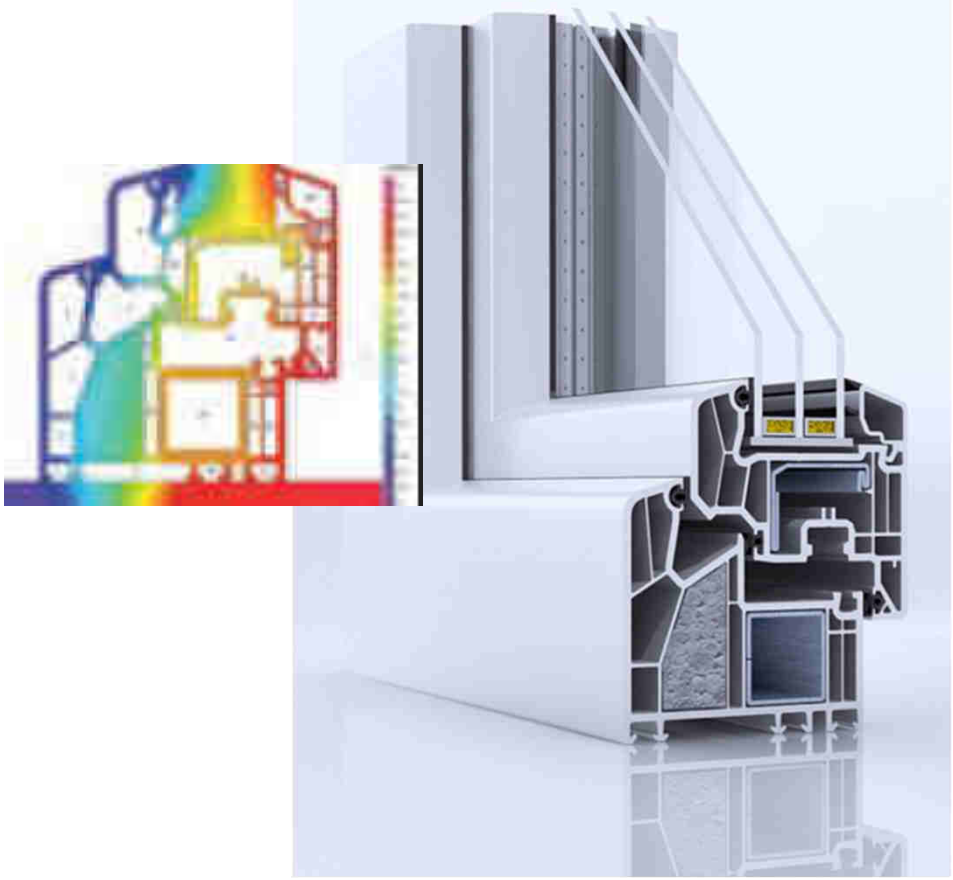
Thermal bridge simulation - building envelope

Exemplary thermal engineering improvements

Thermal improvement / renovation of the envelope: Wall core insulation plus external insulation



Analysis by simulation: Window frame & wall connection zone

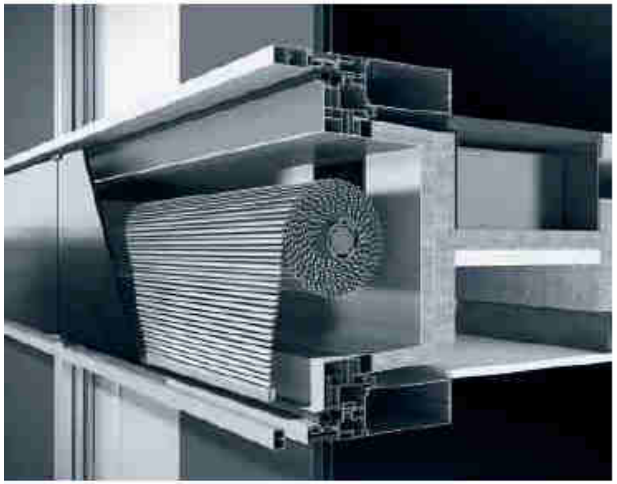


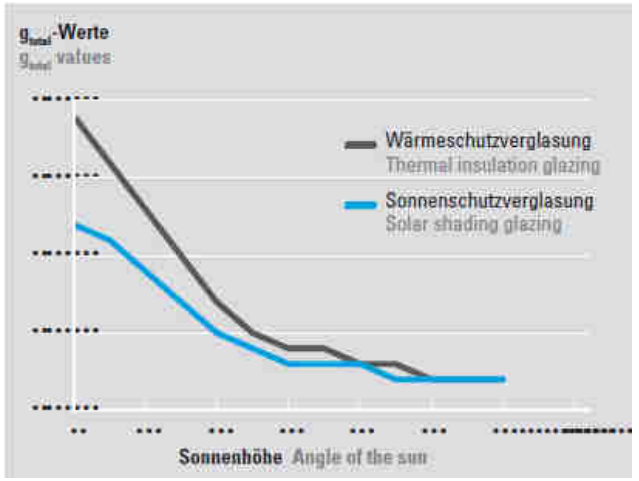
Sun protection external - building envelope

Exemplary thermal engineering improvements

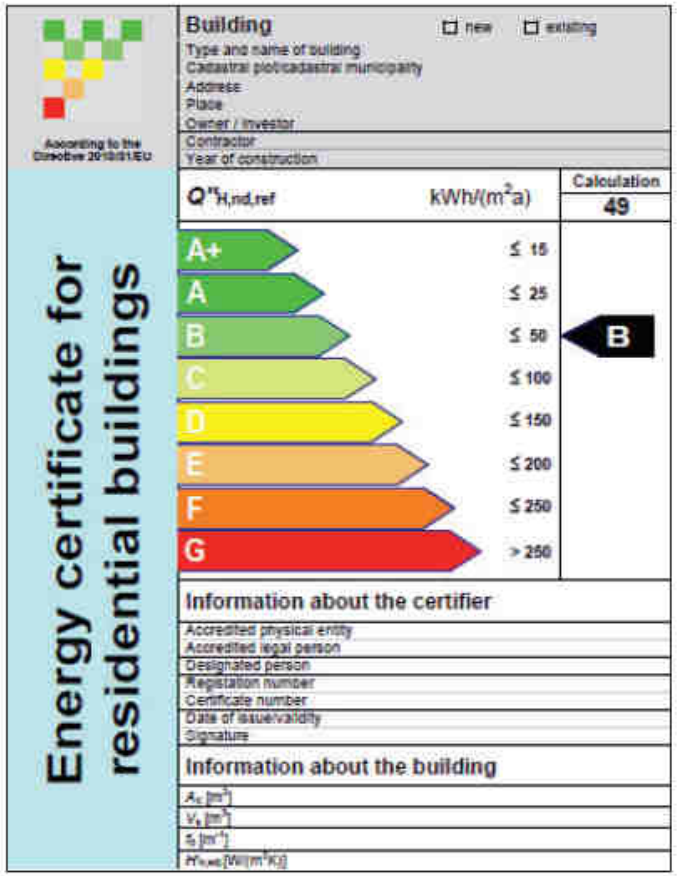
Thermal improvement and renovation of the envelope:
Sun protection with external reference

Winter:	high solar win inactive (active solar protection)
Summer:	reducing solar load (active solar protection)





Energy Performance Certificates



Energy performance certificates

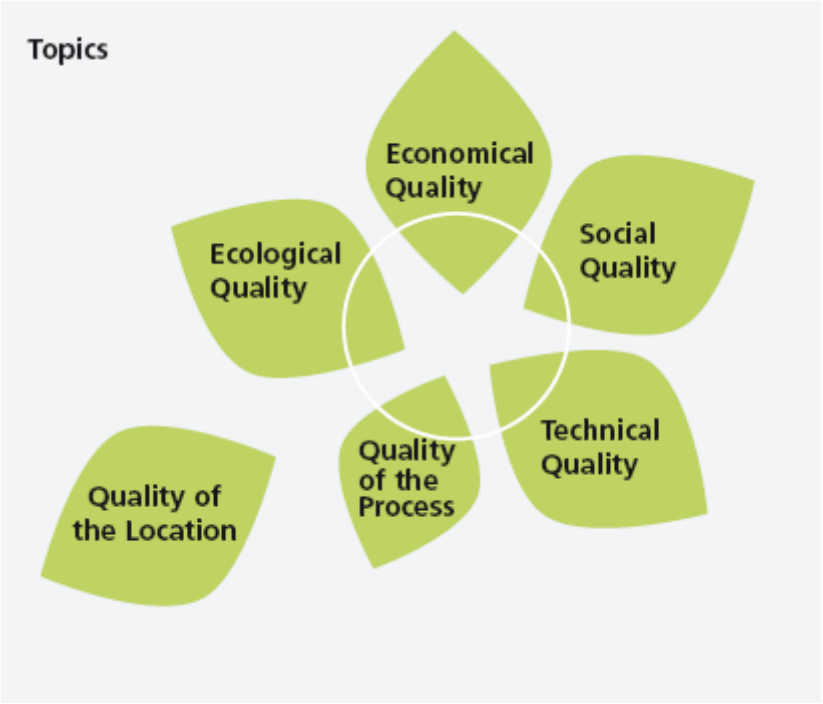
Table 2: Energy Classes in EPCs.

Energy class	Residential buildings $Q_{H,nd,ref}$–specific annual energy need for heating in kWh/(m².year)	Non-residential buildings $Q_{H,nd,rel}$–relative value of annual energy needs for heating in %
A+	≤ 15	≤ 15
A	≤ 25	≤ 25
B	≤ 50	≤ 50
C	≤ 100	≤ 100
D	≤ 150	≤ 150
E	≤ 200	≤ 200
F	≤ 250	≤ 250
G	> 250	> 250

The German Sustainable Building Certificate (DGNB)

DGNB - Clear Topics

– Ecological Quality
– Economical Quality
– Socio-cultural and Functional Quality
– Technical Quality
– Quality of the Process
– Quality of the Location

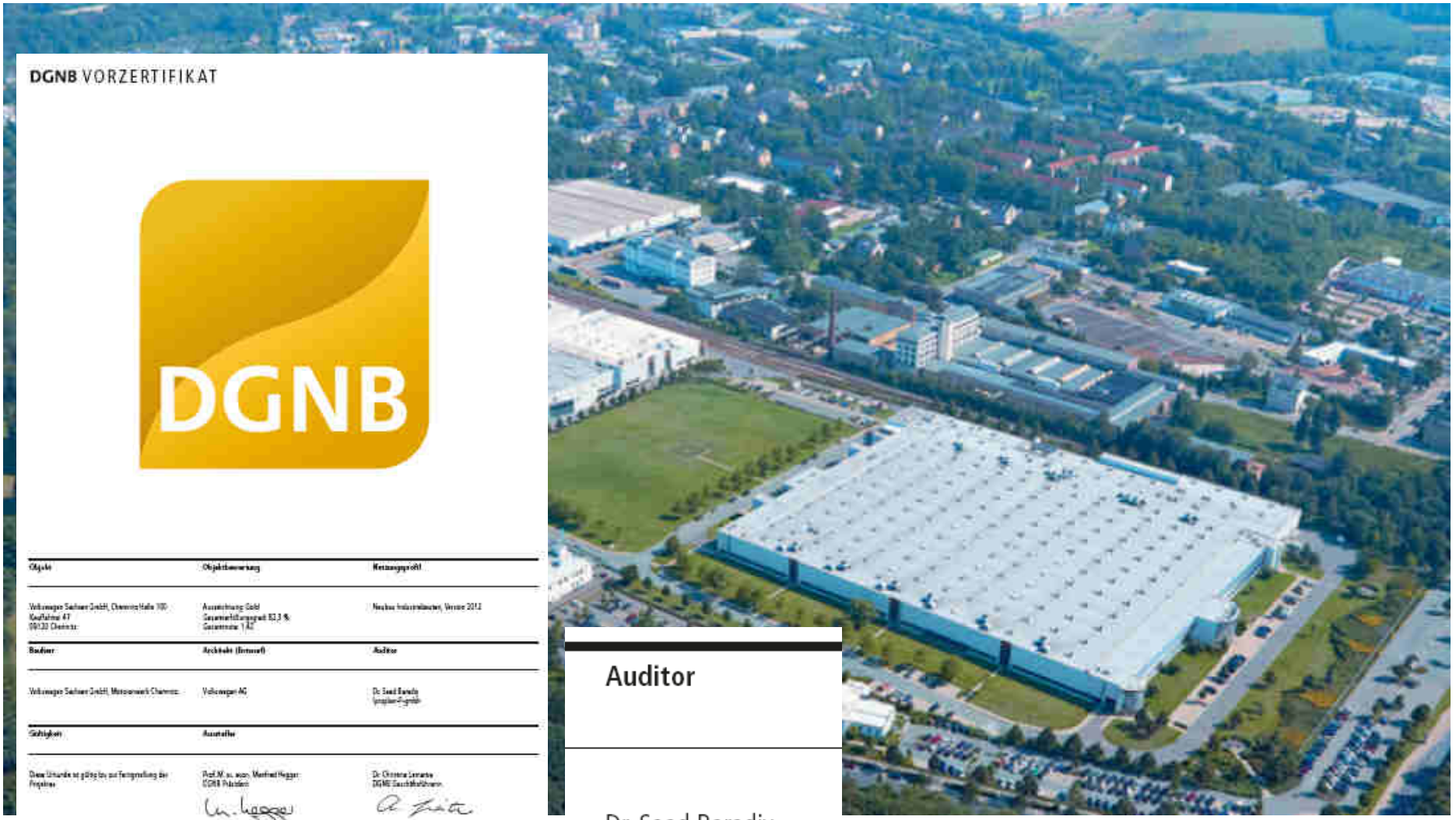


The benchmarks for awarding the certificate are orientated

- on the current state-of-the-art
- on an integral planning statement
- including the aims of sustainable construction

> 50 Criteria ; influence of Energy and Energy Efficiency > 25 Criteria

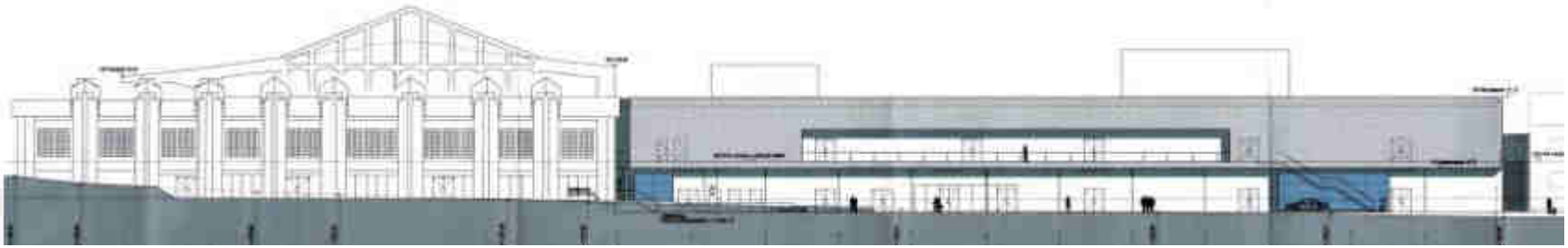
The First Engine Factory in the world with “DGNB Certificate”



Sustainability in the practice - certified objects

Industry:
Airport Leipzig-Halle





Shopping Mall: **Fachmarktzentrum Fulda**

Health Care:
Rehabilitation Clinic, Medical Centre in Schleswig


Services of iproplan® of our EE - Experts

Engineering Services from EE team - Dr Saad Baradyi

- Thermal Building Simulation
- Computational Fluid Dynamics
- Daylight Simulation
- Thermal Bridge Simulation
- Acoustic Simulation
- Other consultancy to Building Physics and Energy Efficiency
- Energy performance certificates
- Consulting to and Certification of sustainable projects/objects according to German DGNB, or to LEED

Services of iproplan® as General Planner

“All services from one source” – the holistic approach

- Architecture
- Infrastructure
- Civil and Structural Engineering
- Building Services
- Landscaping, Urban and Regional Planning
- Building Physics – Energy Efficiency – Sustainability
- Construction Management – Project Management
- Real Estate Consulting
- Evaluations and special Services

Services of iproplan® to whom ?!?

- Ministries, Universities, Local Governments (Building sector)
  - EE relevant trainings, conferences, workshops
  - Developing EE strategies and policies
  - Development of sustainable rating systems
- Local Governments (Building sector)
  - Energie efficient rehabilitation of public buildungs (schools, hospitals, offices, etc.)
  - Certification of buildings and Quarters (LEED and DGNB)
- Private investors, operators (health care, hotels, commercial & industrial)
  - EE-holistic Architectural Design & Engineering
  - Project & Construction Management
  - Energy Audits, Monitoring, special EE services
  - Energie efficient rehabilitations

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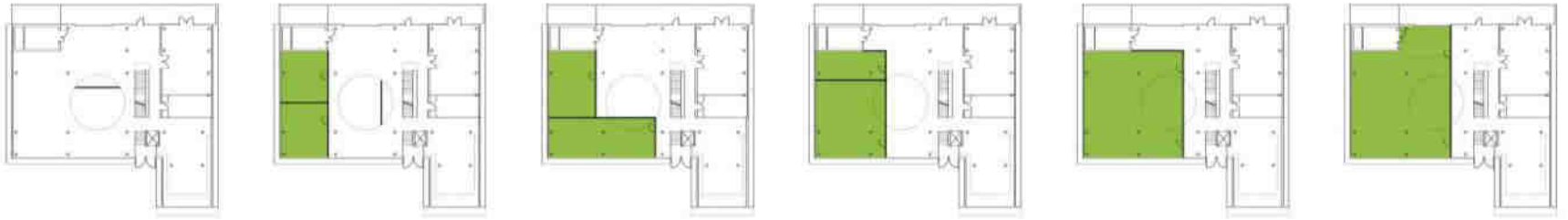
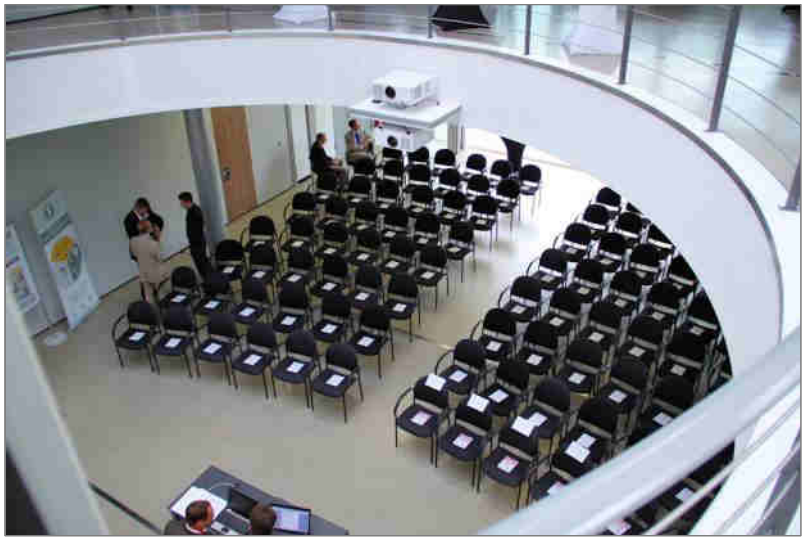
Energy Efficiency in Practice

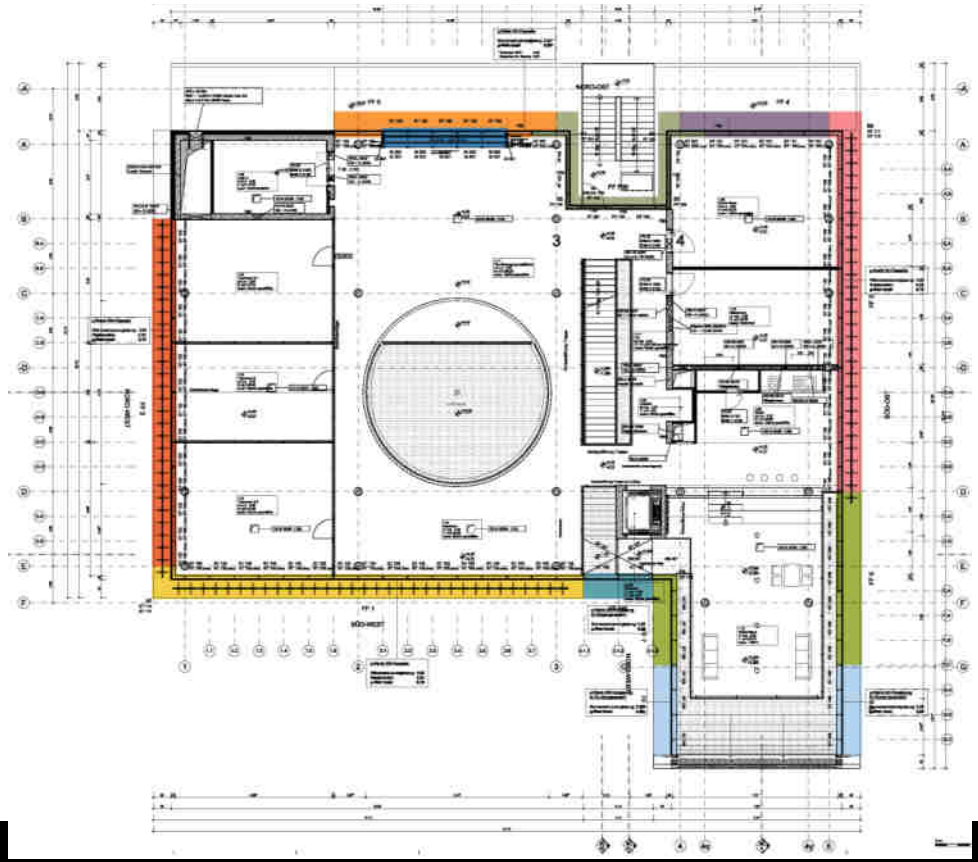
Projekthaus MeTeOr, TU Chemnitz

Energy Efficiency in Practice

Projekthaus MeTeOr, TU Chemnitz







Energy Efficiency in Practice

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Energy Efficiency

Thermal Comfort

Daylight

Air Tightness

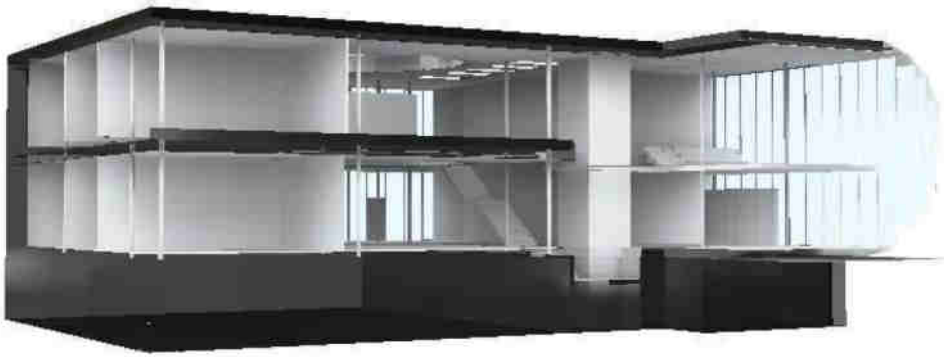
Room Acoustics

Noise Protection

Energy Efficiency in Practice

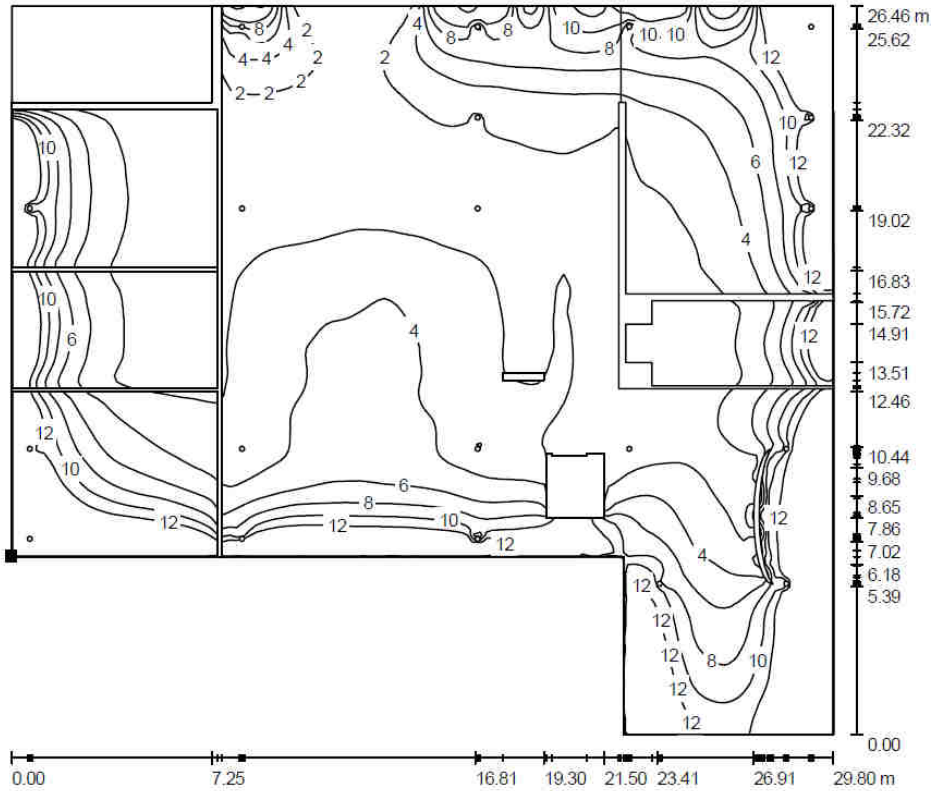
Projekthaus MeTeOr, TU Chemnitz

Daylight



Projekthaus MeTeOr, TU Chemnitz

Daylight



Results:
avarage Daylight Factor
> 5

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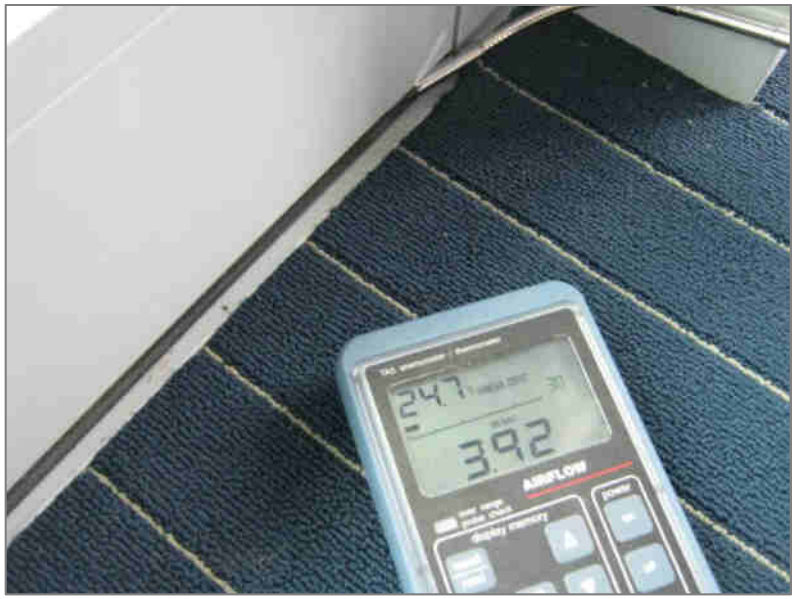
Air Tightness



Energy Efficiency in Practice

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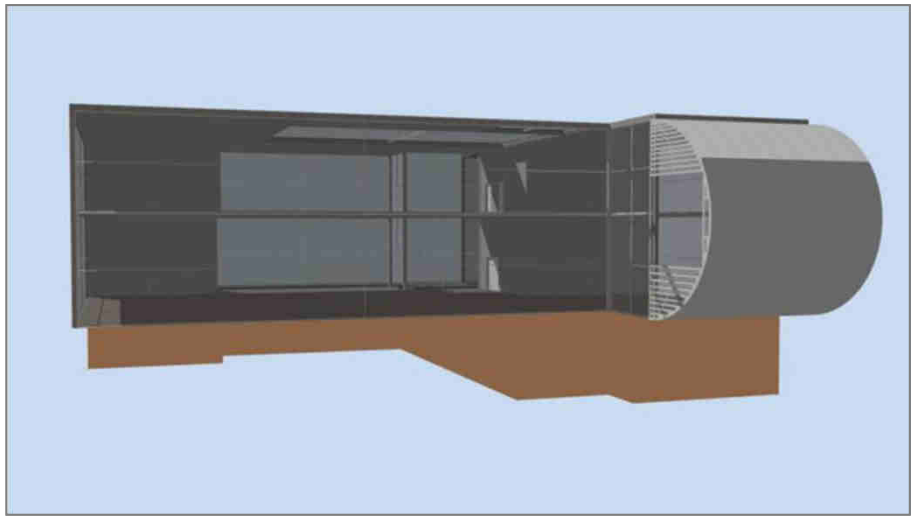
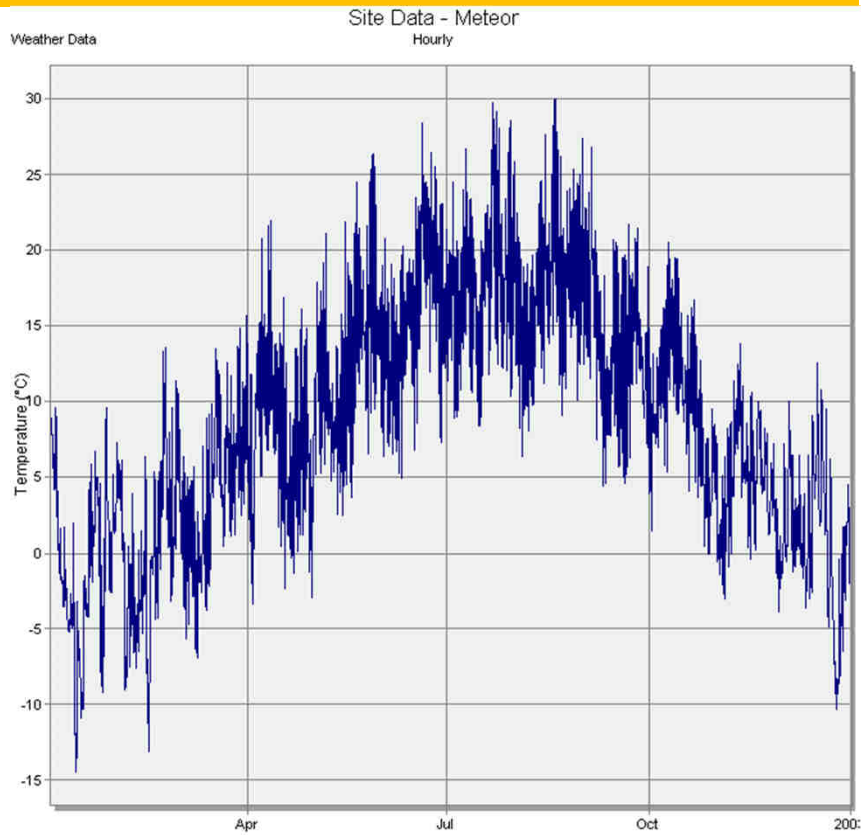
Air Tightness

Energy Efficiency in Practice

Projekthaus MeTeOr, TU Chemnitz

Thermal Comfort





Energy Efficiency in Practice

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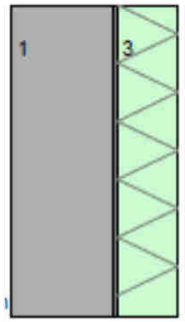
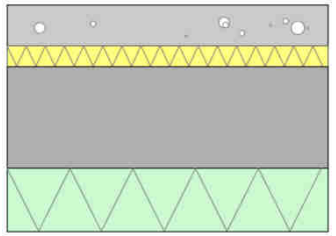
Energy Efficiency - Envelope

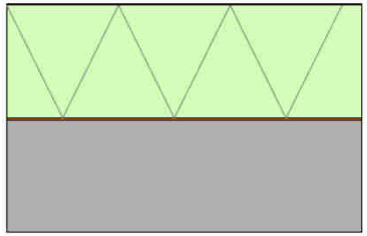


- External Walls:
  Concrete with 15 cm thermal insulation (λ = 0,035W/mK)
- External walls against soil:
  Concrete with 12 cm thermal insulation (λ = 0,035W/mK)



- Baseplate:
  Screed with impact sound insulation on concrete with insulation

- Roof:
  Concrete with vapor barrier, 20 cm insulation



- Windows:
  Double glazing, U_w 1,3 W/m²K

Energy Efficiency in Practice

Projekthaus MeTeOr, TU Chemnitz

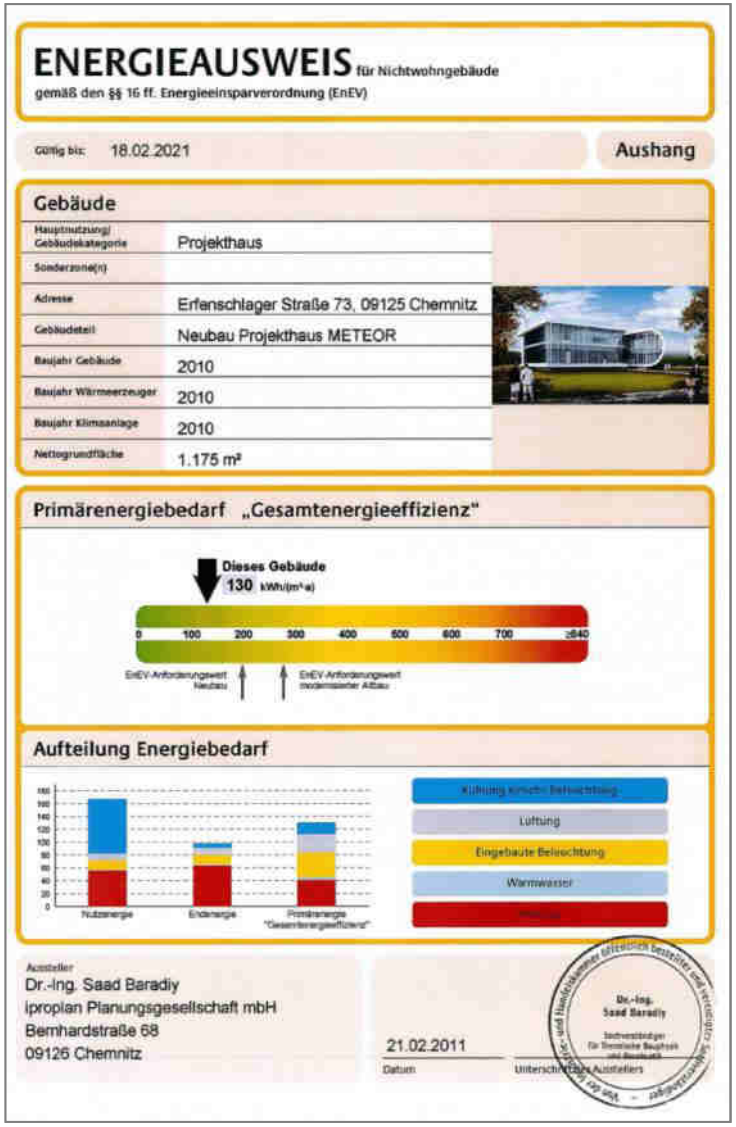
Energy Efficiency – HVAC systems

- Floor heating system
- District heating system
- Mechanical Ventilation System
  - Heat Recovery ≥ 75 %
  - adiabatic cooling
  - air exchange rat ≈ 1 / h,
  - Cooling of the supply air to 22,5 °C

Energy Efficiency in Practice

Energy Efficiency –

Energy Certificate



ENERGIEAUSWEIS für Nichtwohngebäude

gemäß den §§ 16 ff. Energieeinsparverordnung (EnEV)

Gültig bis: 18.02.2021 — Aushang

Gebäude

Hauptnutzung/ Gebäudekategorie	Projekthaus
Sonderzone(n)	
Adresse	Erfenschlager Straße 73, 09125 Chemnitz
Gebäudeteil	Neubau Projekthaus METEOR
Baujahr Gebäude	2010
Baujahr Wärmeerzeuger	2010
Baujahr Klimaanlage	2010
Nettogrundfläche	1.175 m²

Primärenergiebedarf „Gesamtenergieeffizienz"

Dieses Gebäude
130 kWh/(m²·a)

0 100 200 300 400 500 600 700 ≥840

EnEV-Anforderungswert Neubau

EnEV-Anforderungswert modernisierter Altbau

Aufteilung Energiebedarf

Lüftung

Eingebaute Beleuchtung

Warmwasser

Nutzenergie Endenergie Primärenergie "Gesamtenergieeffizienz"

Aussteller
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Bernhardstraße 68
09126 Chemnitz

21.02.2011
Datum

Unterschrift des Ausstellers

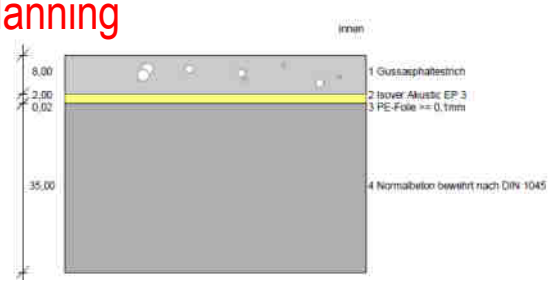
Dr.-Ing. Saad Baradiy

Energy Efficiency in Practice

Projekthaus MeTeOr, TU Chemnitz

Noise Protection

Planning



Einfluss flankierender Bauteile

flankierende Bauteile	$m'_{L,i}$ [kg/m²]
1 Glasfassade	412
2 Glasfassade	412
3 massive Wand	664
4 GK-Montagewand	biegeweich

$m'_{L,Mittel}$ = 1/n Σ $m'_{L,i}$ = 496 kg/m²

2 dB Zuschlag bei $m'_{L,Mittel}$ ca. 400 kg/m² oder mehr (Tab.13)
1 dB Korrektur $K_{L,2}$ für ein flankierendes, biegeweiches Bauteil (Tab.15)

vorh $R'_{w,R}$ = 59 + 2 + 1 = 62 dB.

Ermittlung des bewerteten Norm-Trittschallpegels $L'_{n,w,R}$ (DIN 4109)

vorh $L'_{n,w,R}$ = 69 - 20 = **49 dB** (DIN 4109, Bbl.1, Tab.16/17/18)

20 dB $\Delta L_{w,R}$ durch Gussasphaltestrich nach Tab.17-1, Dämmschicht 50 MN/m³

Anforderungen an die Luft- und Trittschalldämmung

DIN 4109 Bbl.2, Empfehlungen für normalen (erhöhten) Schallschutz im eigenen Arbeitsbereich DIN 4109 Bbl.2
Decken, Treppen, Decken über Fluren in Büro- und Verwaltungsgebäuden

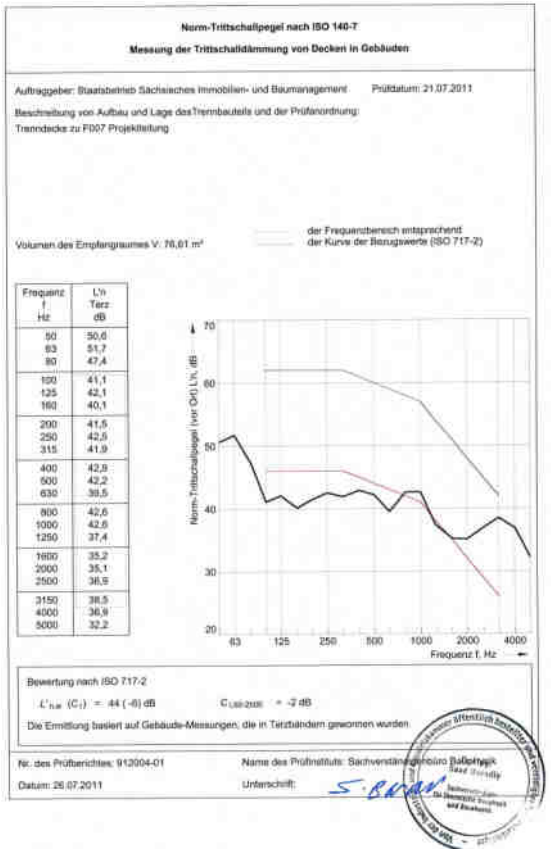
erf R'_w ≥ 52 (55) dB erf $L'_{n,w}$ ≤ 53 (46) dB

Nachweis

vorh $R'_{w,R}$ = 62 dB ≥ 52 dB = erf R'_w **Konstruktion erfüllt DIN 4109.**

vorh $L'_{n,w,R}$ = 49 +2 = 51 dB ≤ 53 = erf $L'_{n,w}$ **erfüllt DIN 4109.**
2 dB Korrektur / Vorhaltemaß nach Abschnitt 4.1.1, DIN 4109 Bbl.1

Verification



Norm-Trittschallpegel nach ISO 140-7

Messung der Trittschalldämmung von Decken in Gebäuden

Auftraggeber: Staatsbetrieb Sächsisches Immobilien- und Baumanagement Prüfdatum: 21.07.2011

Beschreibung von Aufbau und Lage des Trennbauteils und der Prüfanordnung:
Trenndecke zu F007 Projektleitung

Volumen des Empfangraumes V: 76,61 m³

der Frequenzbereich entsprechent der Kurve der Bezugswerte (ISO 717-2)

Frequenz f Hz	L'n Terz dB
50	50,6
63	51,7
80	47,4
100	41,1
125	42,1
160	40,1
200	41,5
250	42,5
315	41,9
400	42,9
500	42,2
630	39,5
800	42,6
1000	42,5
1250	37,4
1600	35,2
2000	35,1
2500	36,9
3150	38,5
4000	36,9
5000	32,2

Bewertung nach ISO 717-2

$L'_{n,w}$ (C_I) = 44 (-6) dB $C_{I,50-2500}$ = -7 dB

Die Ermittlung basiert auf Gebäude-Messungen, die in Terzbändern gewonnen wurden.

Nr. des Prüfberichtes: 912004-01 Name des Prüfinstituts: Sachverständigenbüro Tulovsky

Datum: 26.07.2011 Unterschrift:

Energy Efficiency in Practice - Implementation

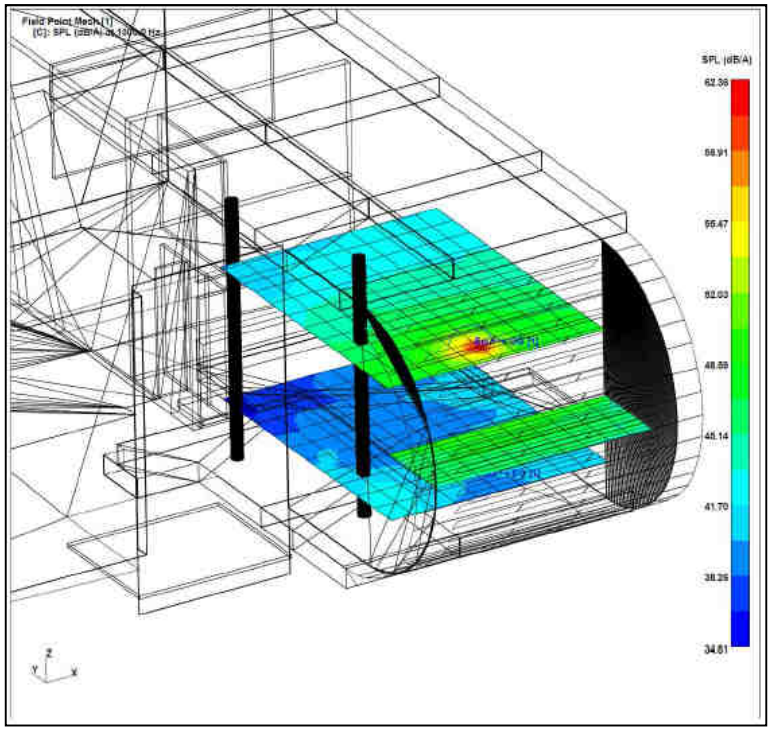
Projekthaus MeTeOr, TU Chemnitz

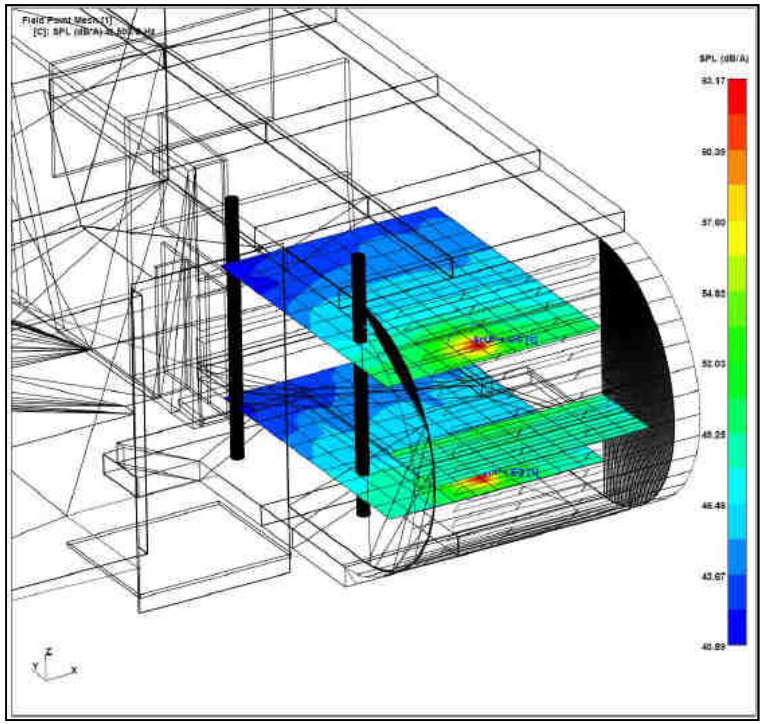
Noise Protection

Energy Efficiency in Practice - Simulation

Projekthaus MeTeOr, TU Chemnitz

Architectural Acoustic - Room Acoustics

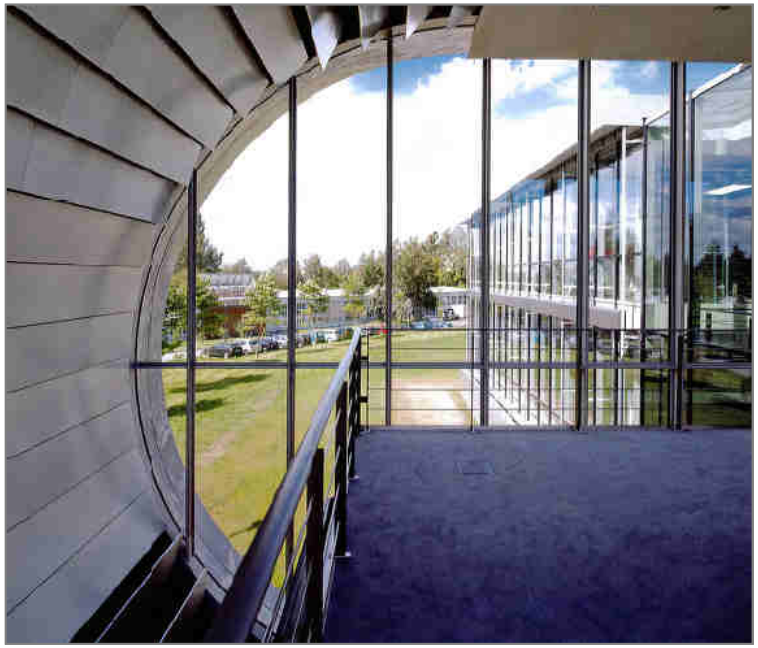




Energy Efficiency in Practice - Implementation

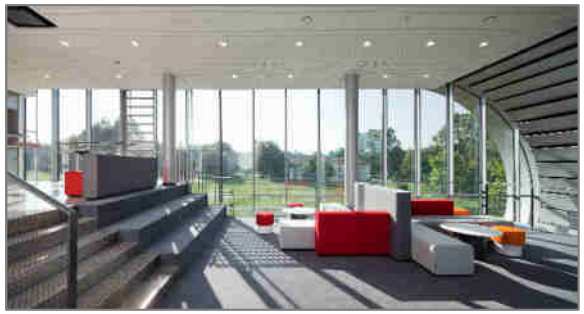
Projekthaus MeTeOr, TU Chemnitz

Architectural Acoustic - Room Acoustics



Energy Efficiency in Practice - Implementation

Projekthaus MeTeOr, TU Chemnitz



EE	Energy Efficiency & Sustainability in Planning Practice
a	iproplan® - Who we are
b	iproplan® - Our services
c	**State of technology in Germany**

Evolution of Energy Efficiency for buildings

Sustainability as further task of building physics

Energy Crisis 1973

EnEG 1976

heating system- / thermal Insulation regulation

EnEV since 2002

EU-Guideline GEEG 2002

Energy balance / DIN V 18599

DGNB (LEED et. al.)

2007 ~

Heat Insulation

Energetic Building Assessment - EBA *(Energy Efficiency Assessment - EEA)*

Green Buildings + „*$*“
Sustainable Buildings

Building isolation

Measuring methods, survey

Selection of components

Formulation of user profiles

Input/output consideration of heating and cooling systems (Primary and final energy)

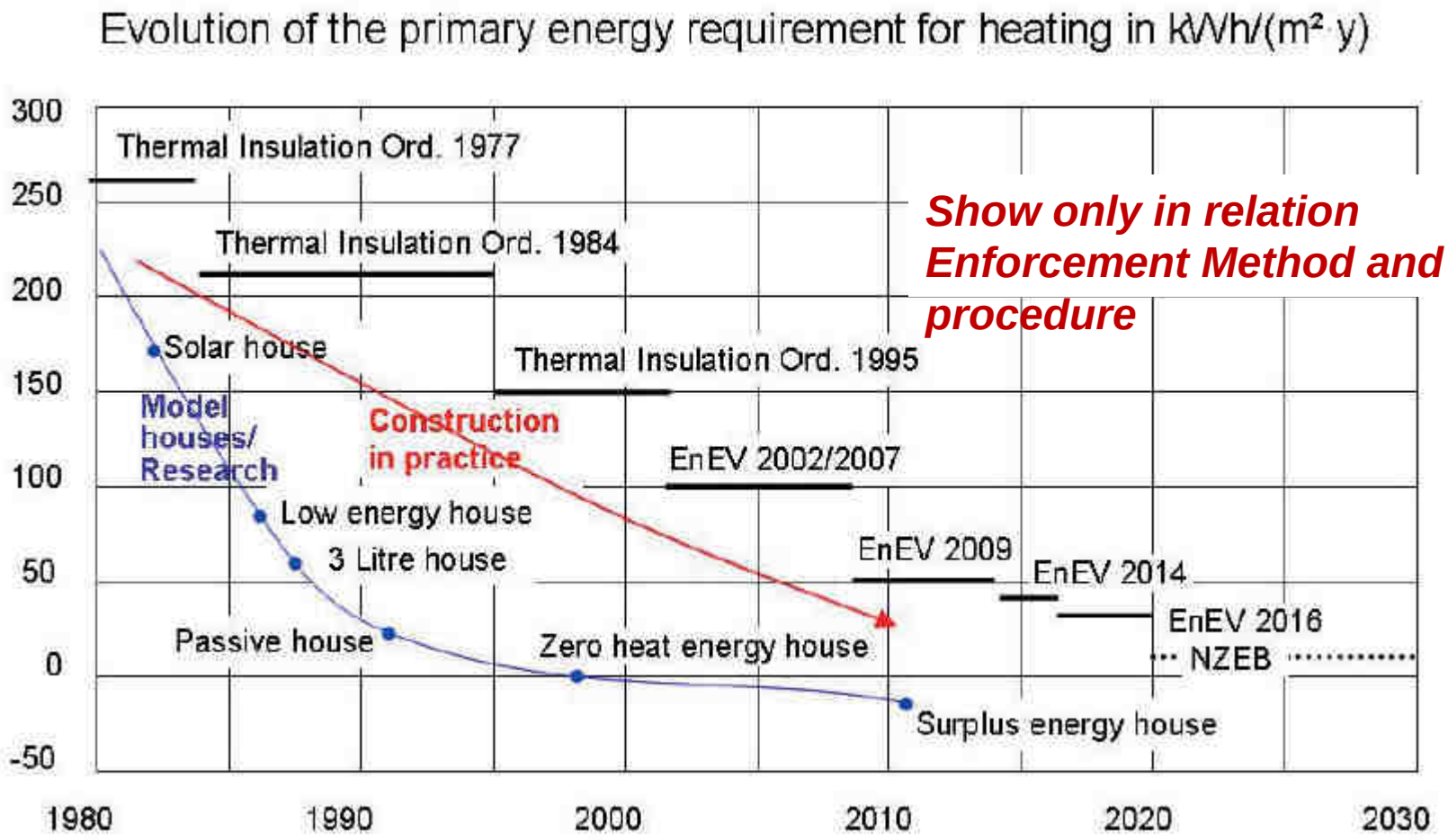
Life Cycle Assessment LCA

Life Cycle Cost LCC

Use of renewable forms of energy

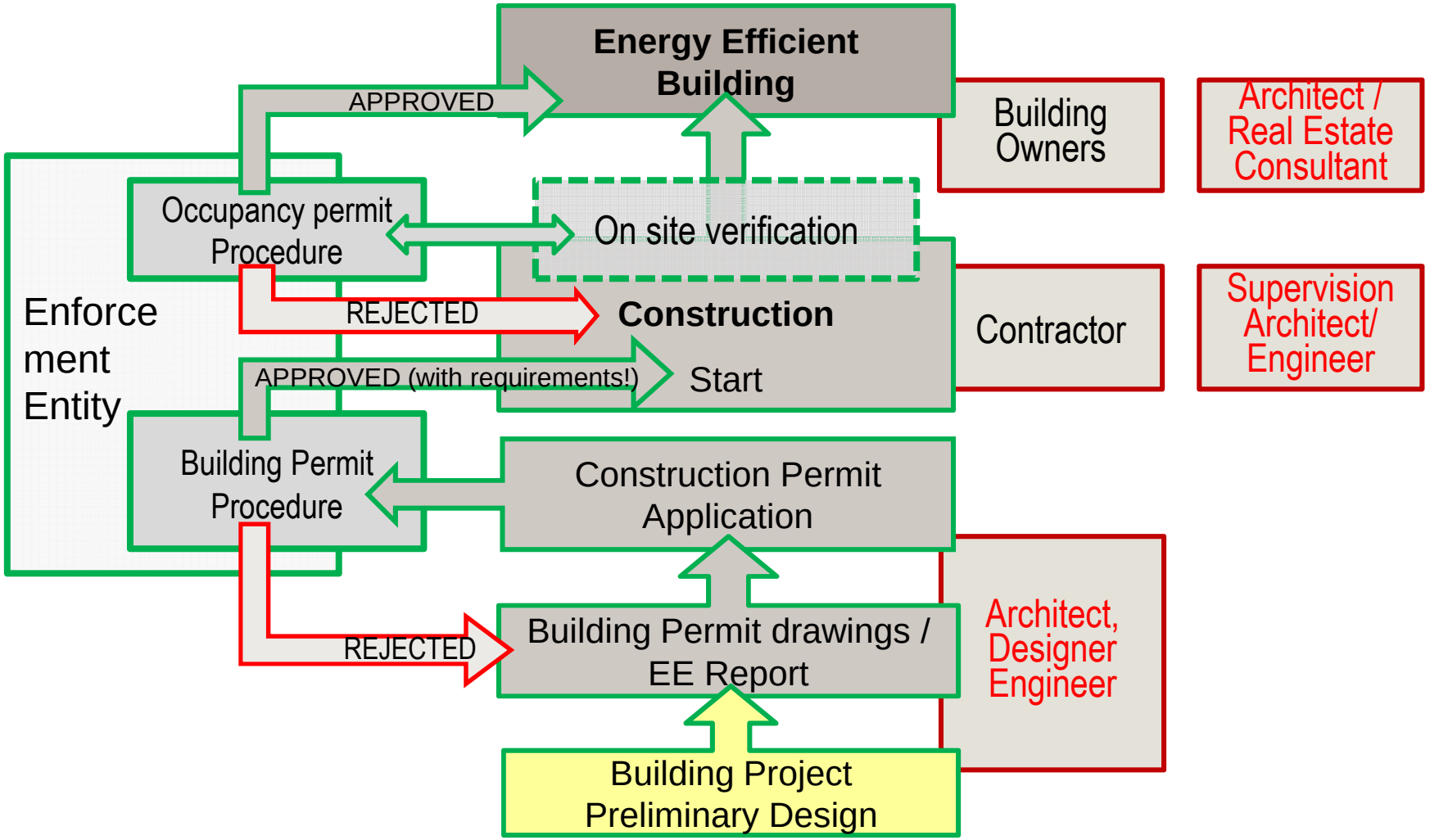
Evolution of Energy Efficiency for buildings

Evolution of Primary energy requirement



Show only in relation Enforcement Method and procedure

EE Enforcement Process



Technical Requirements in South East Asia (tropical climate)

Some Differences in design direction: Europe vs South-East Asia

	Architecture (Holistic design)	**HVAC**	**Thermal Insulation**	**Glasing**
Tropical climate *(South-East Asia)*	Open structure, Natural Ventilation, Shadowing	Cooling, Ventilation, (Aircon)	To minimize Cooling	Solar protective glass
Moderate Climate *(Europe)*	Compact structure, Air tightness (blower door)	Heating, Comfort, (Aircon)	To minimize Heating	Thermo insulated glass

Solutions of Architecture to protect from overheating (saving Energy for cooling):

- Shadowing / appropriate Orientation
- Ventilation Natural / Mechanical
- Thermal insulation to reduce Heat Impact
  (to reduce Energy for Cooling)
- Non-insulated heavy construction materials
  („Speichermassen“ - in shadow areas, for Day/Night balance)
- Greening / water bodies etc

Technical Requirements in South East Asia (tropical climate)

Thermo insulation

- in moderate climate:

  to protect from „cooling down“

  > **Saving Energy for Heating**

  inside: warm, humid – outside: cold

- in tropical climate:

  to protect from „overheating“

  > **Saving Energy for Cooling**

  inside: moderate – outside: warm, humid

Technical Requirements in South East Asia (tropical climate)

Thus, in **tropical climate** the

- Function of **thermo insulation**
- Process of **humidity transmission**
- Arrangement of **vapour barriers**
- Construction issues of **cold bridges**
- Occurance of **bacteria, mould**

are ***reverse*** compared to moderate climate

Thank you for your attention

Dipl.-Eng. Architect
Thomas Gross

full of fresh ideas

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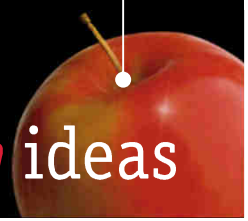

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