



# Sustainable building materials in Europe

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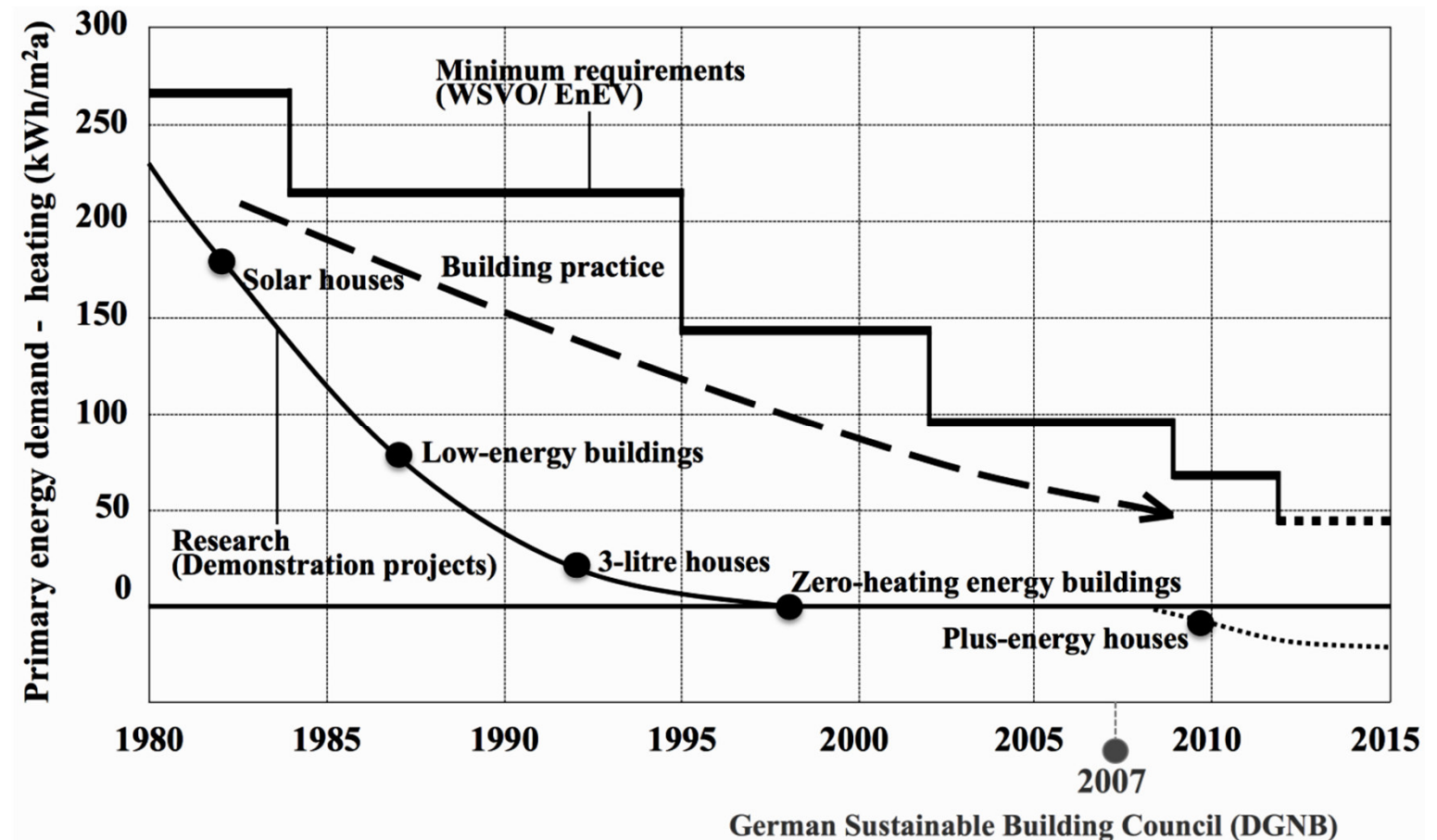
*05. September 2016*

- **Green building evolution in Europe**
- **Importance of sustainable building materials**
- **Policies supporting sustainable building materials**
- **Material production**

# Short history of green building evolution in Europe

## Building energy efficiency

- Early developers of highly efficient technologies
- Early establishment of mandatory energy codes and standards with stepwise stringency



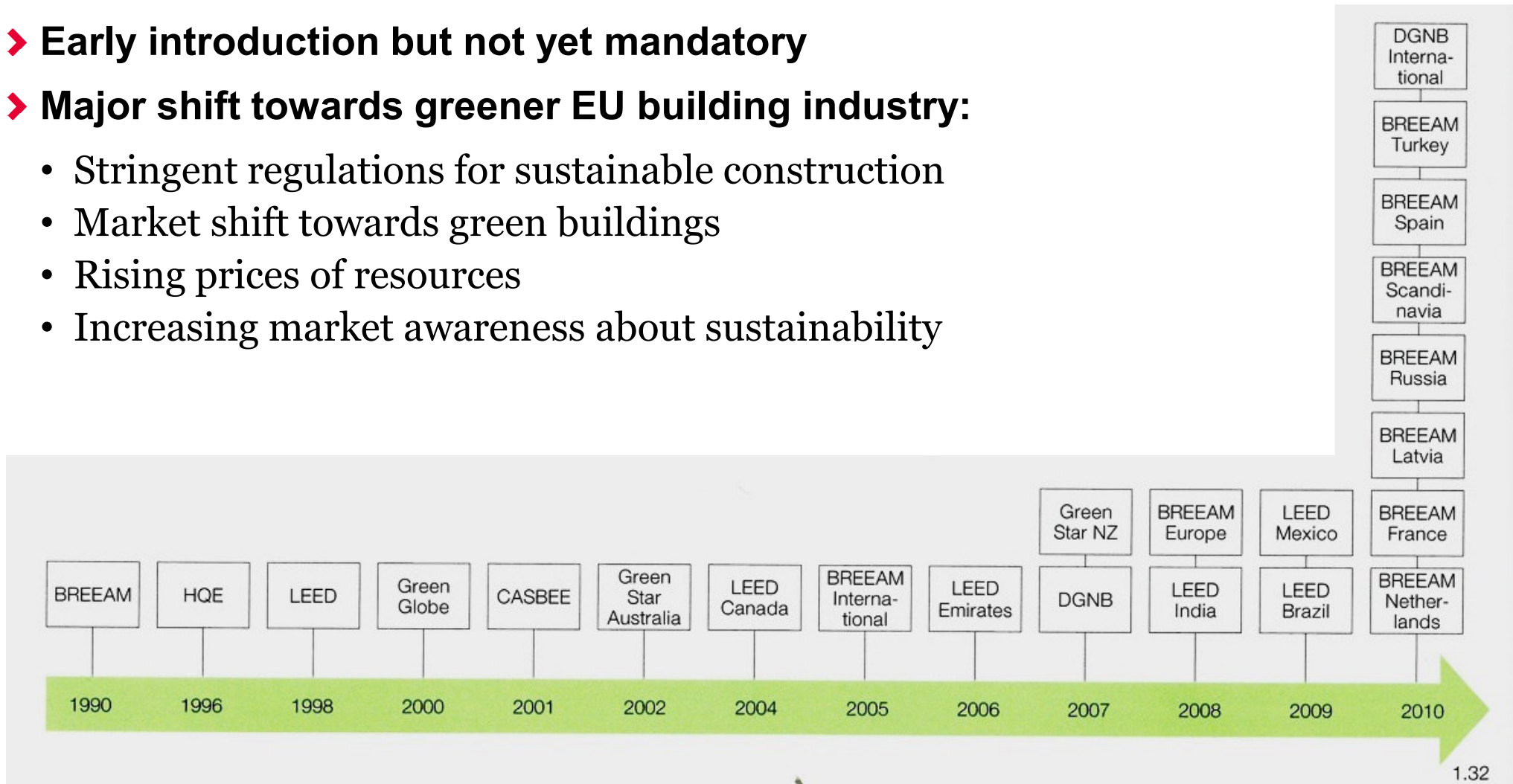
Development of MEPS for new buildings in Germany

Source: Erhorn and Erhorn Kluttig, 2009

# Short history of green building evolution in Europe

## Green buildings and Green building certifications

- **Early introduction but not yet mandatory**
- **Major shift towards greener EU building industry:**
  - Stringent regulations for sustainable construction
  - Market shift towards green buildings
  - Rising prices of resources
  - Increasing market awareness about sustainability

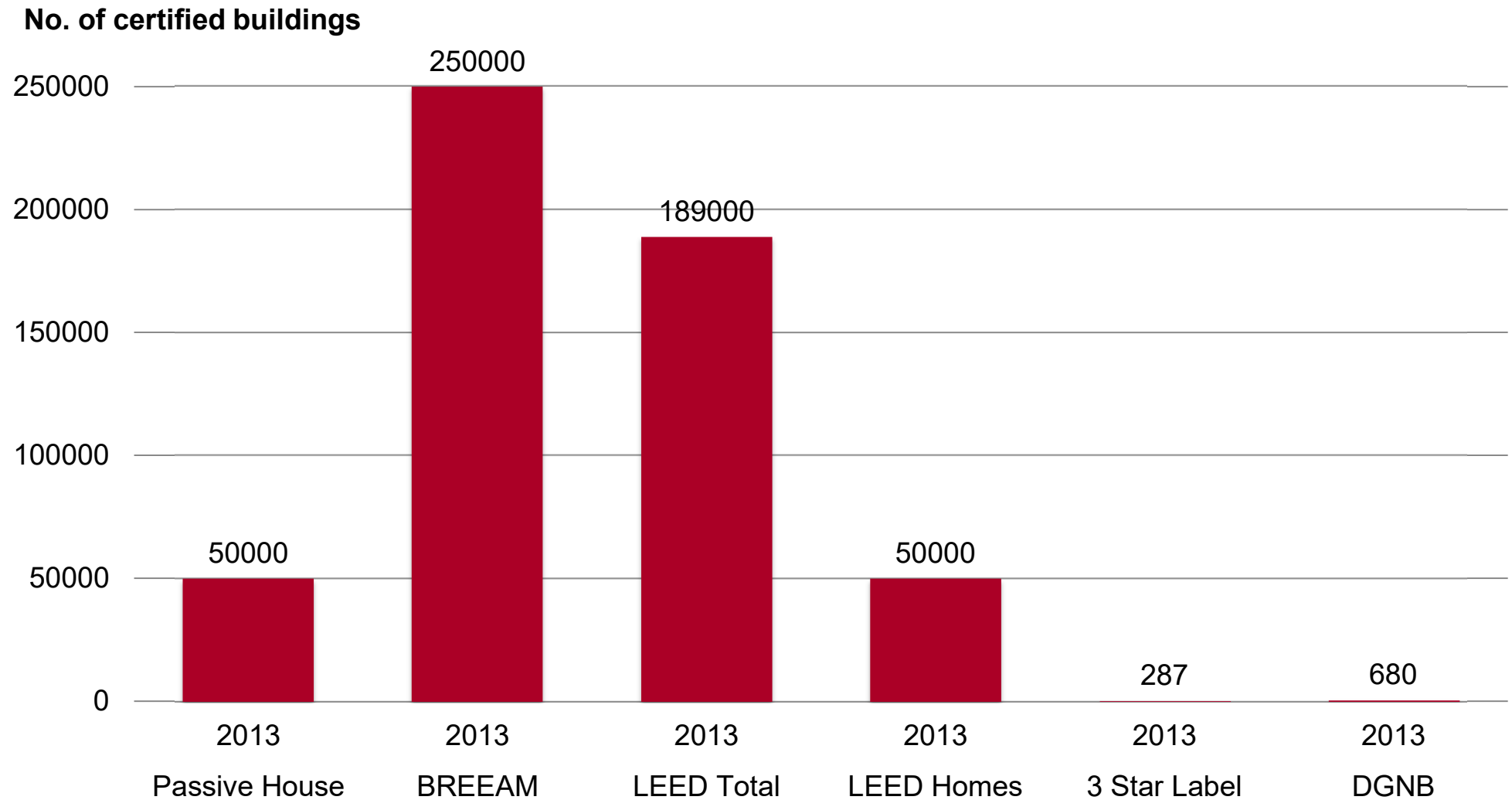


Evolution of Green building certifications

Source: Ebert, Essig and Hauser, 2011

# Short history of green building evolution in Europe

## Green buildings and Green building certifications

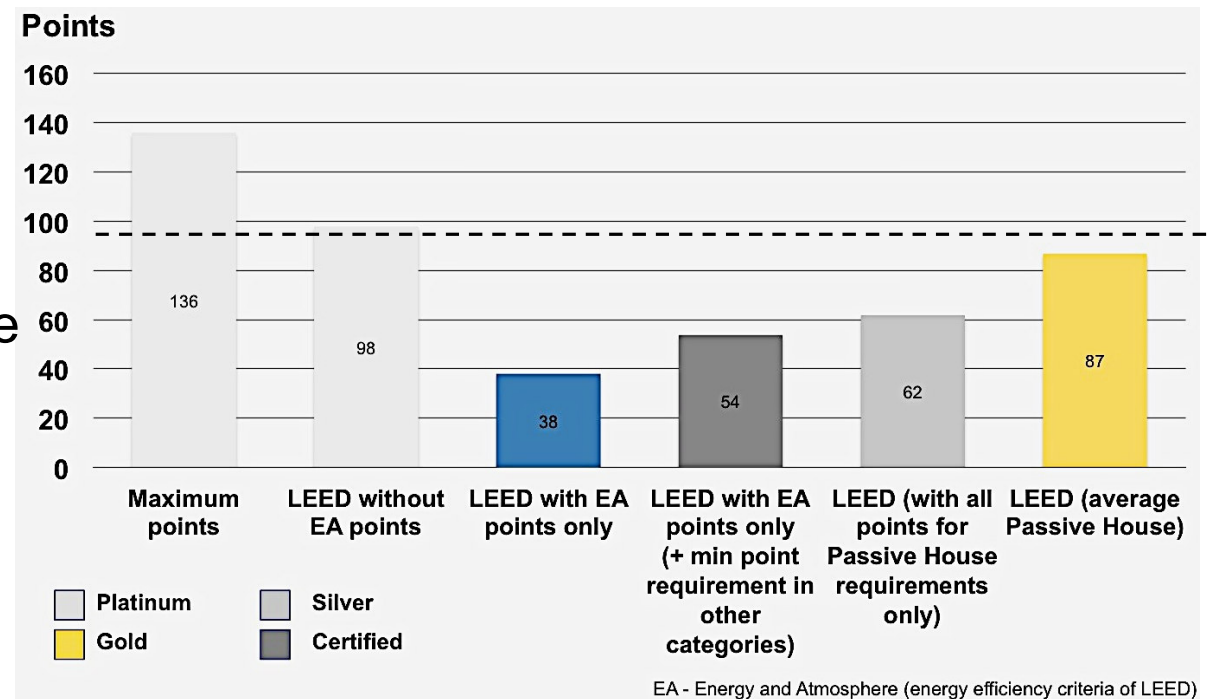


Source: Passive House Institute, BREEAM, LEED, 3 Star, DGNB

# Building life cycle and green building certifications

## Green buildings with higher energy efficiency

- Green building certification systems – performance based and ratings – awarded on overall scores
- 28-35% LEED buildings use more energy than comparable non-LEED buildings (Newsham et al., 2009)
- Effectiveness of green building certification increases when
  - The stringency of energy standard is higher
  - The whole life cycle assessment is considered (e.g. 2013/2014 version of LEED and BREEAM have incorporated LCA)

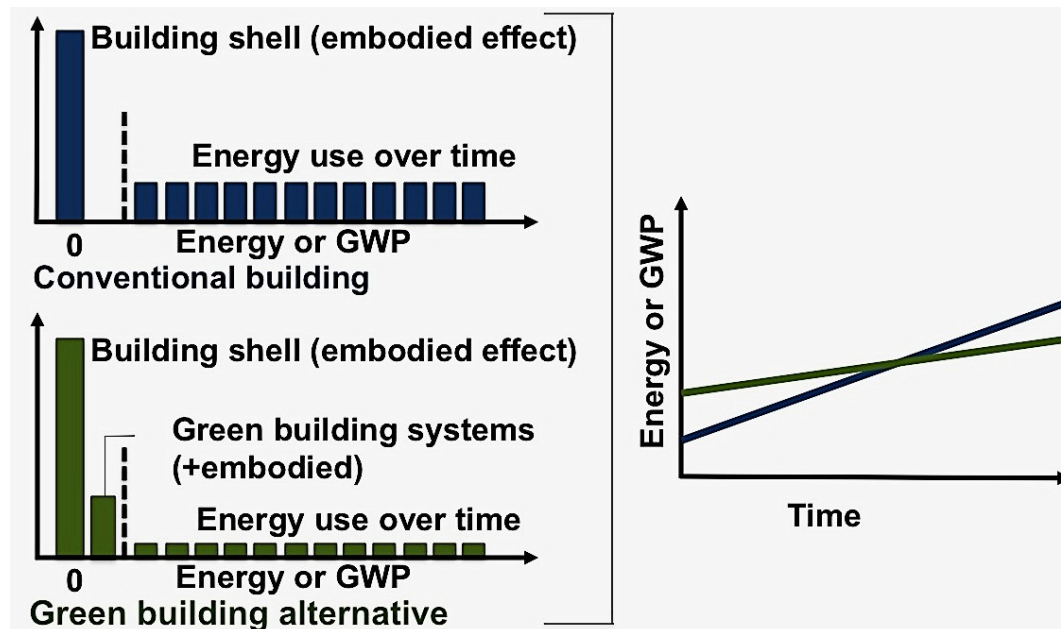


**LEED Points for different energy scenarios**

# Building life cycle and building energy standards

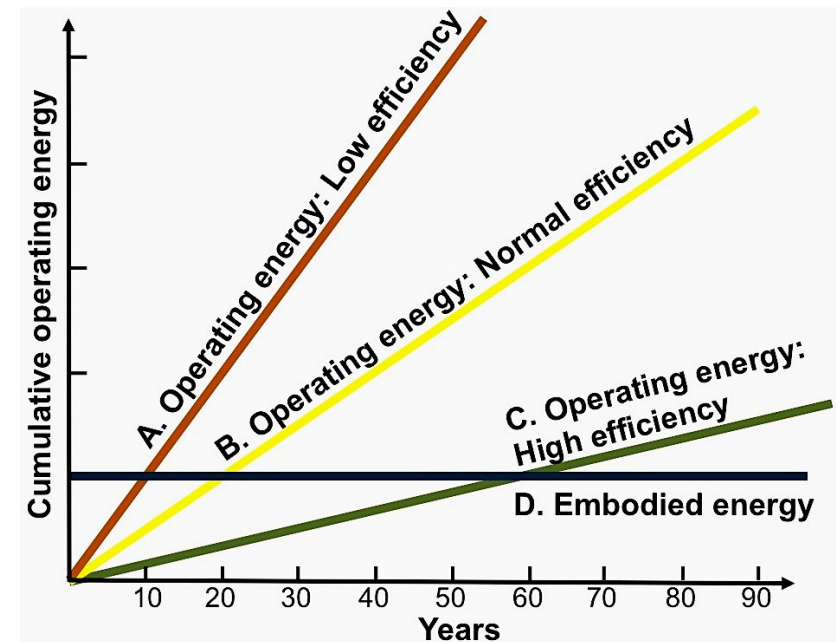
## Green requirements in higher energy efficient buildings

- Environmental impact of building materials
- Higher energy efficient buildings – low operational energy but LCEA shows high embodied energy
- Material selection to reduce embodied energy and environmental impact



Embodied energy effect in conventional and green buildings

Source: AIA, 2010



The changing relationship between embodied and operational energy consumption over time in buildings

Source: Stauffer, 2009

### ➤ **Resource efficient Europe**

- Provides the overall strategy for improving resource efficiency in Europe.

### ➤ **Sustainable Use of Natural Resources**

- Provide background framework conditions for more sustainable buildings by influencing the extraction and utilisation of natural resources and the processes involved in building development in the urban environment

### ➤ **Raw materials strategy**

- Addresses sustainable access to raw materials both within and outside the EU, as well as resource efficiency and recycling

### ➤ **Construction Products Regulations**

- Aim to ensure reliable performance information on construction products by providing a common technical language and offering uniform assessment methods of the performance of construction products.

#### ➤ Criteria for low embodied energy in:

LEED (2013)	BREEAM (2014)	DGNB (2014)
<b>Materials and Resources</b> MR Building Life Cycle Impact Reduction MR Building Product Disclosure and Optimisation – Environmental Product Declaration, Sourcing of Raw materials	<b>Materials</b> Mat 01 Life cycle impacts Mat 03 Responsible Sourcing of Materials Mat 04 Insulation Mat 06 Material efficiency	<b>Environmental quality</b> ENV 1.2 Local environmental impact

#### ➤ Efficient material database

- Greenbuildingproducts.eu (for DGNB and LEED)
- Greenbooklive.com (for BREEAM)
- Greenspec
- Ökobaudat
- WECOBIS
- Ecoinvent

#### ➤ Sustainable building material certificates

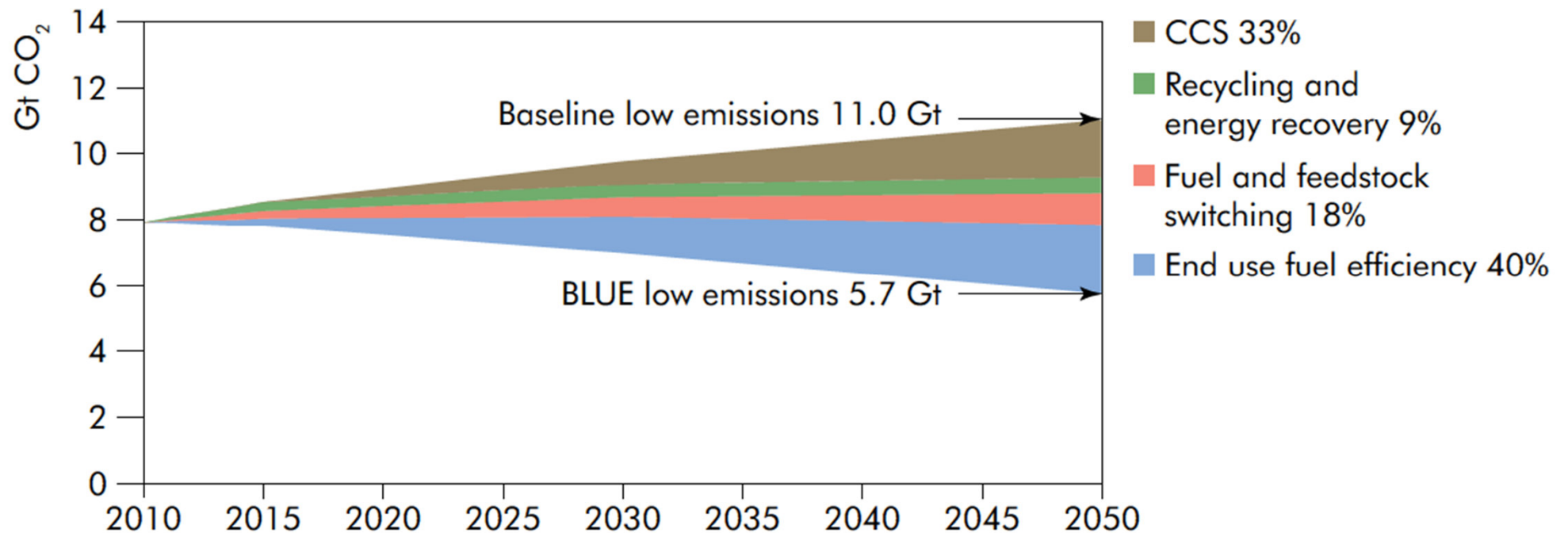
- The Blue Angel (around 12,00 environmentally-friendly products and services)
- Forest Stewardship Council (products originating from responsible forestry management)
- Natureplus (identifies the best products for sustainable building)
- Cradle to Cradle (products through five quality categories – material health, material reutilization, renewable energy and carbon management, water stewardship, and social fairness)



- Suppliers at the beginning of the value chain
- Sectors: metals, chemicals , glass, ceramics , paper and stones and earth
- 830,000 direct jobs and many more additional jobs through indirect effects
- 123 TWh of electricity demand in 2008 = almost  $\frac{1}{4}$  of the electricity demand in Germany
- Since 1990 : increase in production of 46 % ; Reduction in specific energy consumption by 11.5%
- Innovation and investment in industries and the development of appropriate policies, technologies and business environment
- E.g. 30% energy saving in German industries by the replacement of machines

# Material production

## Options to reduce CO<sub>2</sub> emissions in industry



Source: IEA, Energy Technology Perspectives 2010

- **Cleaner production:** the reduction in production costs that results from improved process efficiencies
- **Given the energy consumption levels and capital of energy intensive industries care must be taken:**
  - “Final” energy price
  - Encourage investment in energy efficiency and emission reductions
  - Avoid “carbon leakage” firms wandering to other regions
- **National Action Plan on Energy Efficiency (2014)**
  - Several measures addressing industry:
    - 500 Energy Efficiency Networks
    - Implementation of Article 8 (Energy Audits and Energy Management Systems) of Energy Efficiency Directive
    - Support of waste heat utilization
    - Funding schemes for energy efficiency measures
    - Funding schemes for energy audits

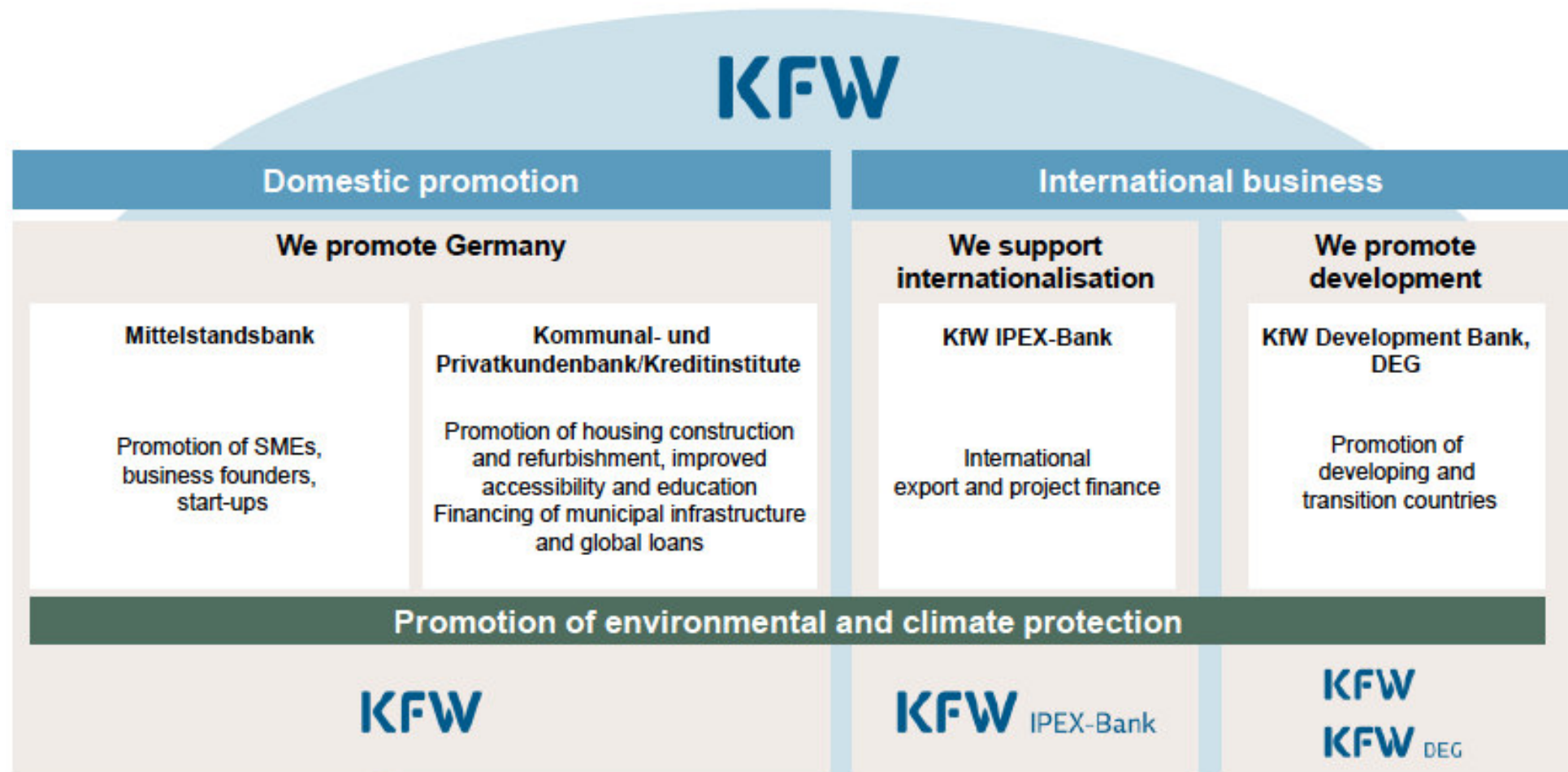
Quelle: IEA, Energy Technology Perspectives 2010

- **Mandatory energy audits in the Directive for Energy Efficiency (EED) 2012/27/ EU from 2012 (Article. 8)**
  - For **SMEs, households and all smaller final customers**, EU Member States (MS) must promote the availability of high quality, cost-effective energy audits.
  - For **large enterprises**, MS **must ensure** that they carry out energy audits of their buildings and installations at regular intervals not exceeding four years, starting 5 December 2015 at the latest.
  - **Penalties for non-compliance** with the obligations on large enterprises to carry out energy audits
  - **Certification and quality assurance:** Article 16 of the EED requires MSs to ensure the availability of certification, accreditation and/or qualification schemes by 31 December 2014 for providers of energy audits and for energy managers and, if necessary, to establish suitable training programmes for them.
  - Annex VI sets out a number of **quality criteria for the energy audits**.

# Material Production

Promotion of energy efficiency

Financial support by KfW (Kreditanstalt für Wiederaufbau/Reconstruction Credit Institute) bank



## Material Production

Promotion of energy efficiency

Financial support by KfW SME bank

### › Banking for small and medium-sized businesses

It supports SMEs by providing long term loans as well as innovative programmes aiming to strengthen the companies' equity base.

<b>Target group</b>	Commercial enterprises, start-ups, self-employed professionals
<b>Total volume of promotion 2015</b>	EUR 20.4 billion
<b>Financing products</b>	Medium and long-term financing for <ul style="list-style-type: none"><li>› General corporate finance</li><li>› Start-ups</li><li>› Innovation</li><li>› Climate and environmental protection</li></ul>

Source: KfW presents itself, May 2016, KfW

### ➤ **KfW for energy efficient production**

- KfW-Program 291 Energy and Environment Credits for Syndicated
  - For energy efficiency improvement in large commercial enterprises, loan amount 15-100 millions euros
- KfW-Program 292/293 Energy Efficient Production and Processes
  - supports energy efficiency measures in the field Production / processes of industrial companies with low-interest loans.
- KfW-Program 294 Energy efficient Program Waste Heat
  - aid and finance projects for the reduction and avoidance of waste heat and/or the use of industrial waste heat of firms under the framework of “Campaign for waste heat utilization” of the National Energy Efficiency Action Plan ( NAPE )

- **Tax exemptions on manufacturing firms and energy-intensive industries if**
- SMEs operate an energy or environmental management system
- Industry sector reduce energy intensity in keeping with required targets
- **Tax break under**
- Energy Tax act (EnergieStG)
- Electricity Tax Act (StromStG)
- Peak compensation payments (Spitzenausgleich (SpaEfV))
  - in special cases and if applicants operate energy management systems in accordance with DIN EN ISO 50001 or the company is a registered organisation with the Community eco-management and audit scheme (EMAS) pursuant to Article 13 Regulation EC 1221/2009

➤ **A premium management instrument for companies and other organisations to evaluate, report, and improve their environmental performance**

➤ **EMAS provides**

- Enhanced credibility, transparency and reputation
- Enhanced environmental risks and opportunities management
- Enhanced environmental and financial performance
- Enhanced employee empowerment and motivation

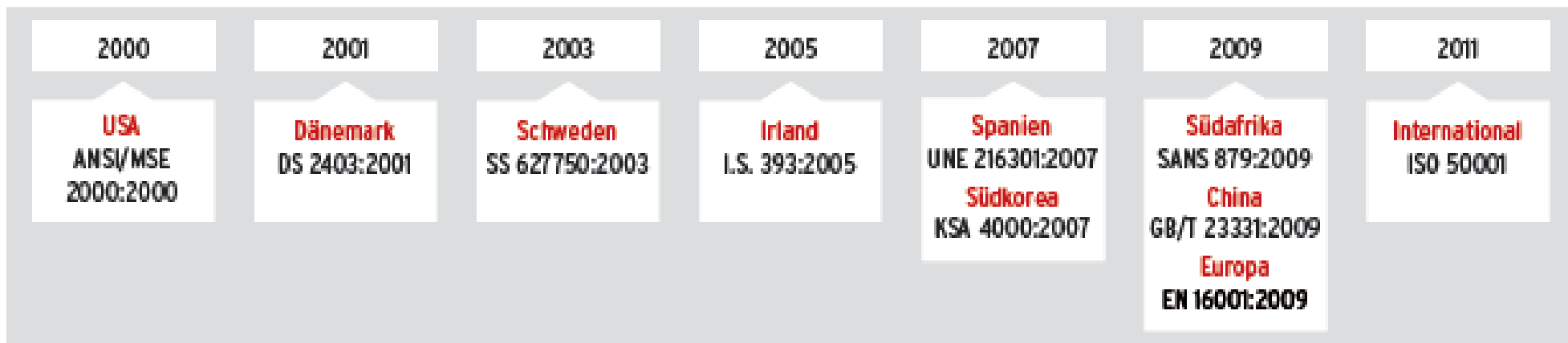
➤ **Complement to ISO 14001**



Performance,  
Credibility,  
Transparency

- **Optimal tool to reduce energy consumption in firms and at the same time sustain or increase the production level**
- **Provides a framework of requirements for organizations to:**
  - Develop a policy for more efficient use of energy
  - Fix targets and objectives to meet the policy
  - Use data to better understand and make decisions about energy use
  - Measure the results
  - Review how well the policy works, and
  - Continually improve energy management
- **Not obligatory**
- **Does not perform certification**

- DIN EN 16001 adopted in August 2009 Europe
- Based on the PDCA cycle
- Same structure as ISO 14001
- Relates to VDI 4602
- DIN EN ISO 50001 replaced DIN EN 16001 in April 2012



## Acceptance of the ISO 50001 standard in Germany

- ISO carries out every year a survey on the penetration of the different standards:
- ISO 50001 has increasingly large acceptance in German companies, especially also due to
  - the legal requirements but still much less in other economies.
- In 2012 1,115 companies were certified in Germany (35 in France, 15 in Japan, 120 in Spain, 85 in Denmark, 3 in the US, 1 in Mexico).

Standard	Number of certificates in 2012	Number of certificates in 2011	Evolution	Evolution in %
ISO 9001	1 101 272	1 079 647	21 625	2 %
ISO 14001	285 844	261 957	23 887	9 %
ISO 50001	1 981	459	1 522	332 %
ISO 27001	19 577	17 355	2 222	13 %
ISO 22000	23 231	19 351	3 880	20 %
ISO/TS 16949	50 071	47 512	2 559	5 %
ISO 13485	22 237	19 849	2 388	12 %
<b>TOTAL</b>	<b>1 504 213</b>	<b>1 446 130</b>	<b>58 083</b>	<b>4 %</b>

Sources: <http://www.iso.org/iso/home/standards/certification/iso-survey.htm?certificate=ISO%2050001&countrycode=DE>  
and [http://www.iso.org/iso/iso\\_survey\\_executive-summary.pdf](http://www.iso.org/iso/iso_survey_executive-summary.pdf)

- German Strategic initiative for ‚smart factory‘
- Connects embedded system production technologies and smart production processes to pave the way to a new technological age.
- Allows the comprehensive networking of firms including the optimization of value added processes and chains
- Four design principles
  - Interoperability
  - Information transparency
  - Technical assistance
  - Decentralized decisions
- IT-Security - utmost importance!

#### From Industry 1.0 to INDUSTRIE 4.0

##### First Industrial Revolution

Introduction of mechanical production facilities with the help of water and steam power

##### Second Industrial Revolution

Introduction of division of labor and mass production with the help of electrical energy

##### Third Industrial Revolution

Use of electronic and IT systems that further automate production

##### Fourth Industrial Revolution

Use of cyber-physical systems

Source: DFKI 2011

**Thank you**  
for your attention