

1C1

Design of sustainable construction

Petr Hájek



List of lessons



- 1) Sustainable construction
- 2) Integrated design process
- 3) Life Cycle Assessment
- 4) Assessment criteria
- 5) Methods of complex assessment of construction sustainability
- 6) Material efficient design principles I
- 7) Material efficient design principles II
- 8) Energy efficient design principles
- 9) Recycling and use of recycled materials
- 10) Prefabricated and demountable structures
- 11) Sustainable reconstruction and refurbishment
- 12) Examples of sustainable constructions
- 13) Reserve

Objectives

Background and
basic principles

Complex approach

Criteria of
sustainability

Regional aspects

International
context

Standardisation

Objectives of the lecture

- Background and basic principles of sustainable construction
- Complex approach – criteria of sustainability: environmental, social and economic aspects
- Regional aspects
- International context – research and standardisation – CEN350, ISO TC59



**background
and basic principles**

Objectives

**Background and
basic
principles**

Complex approach

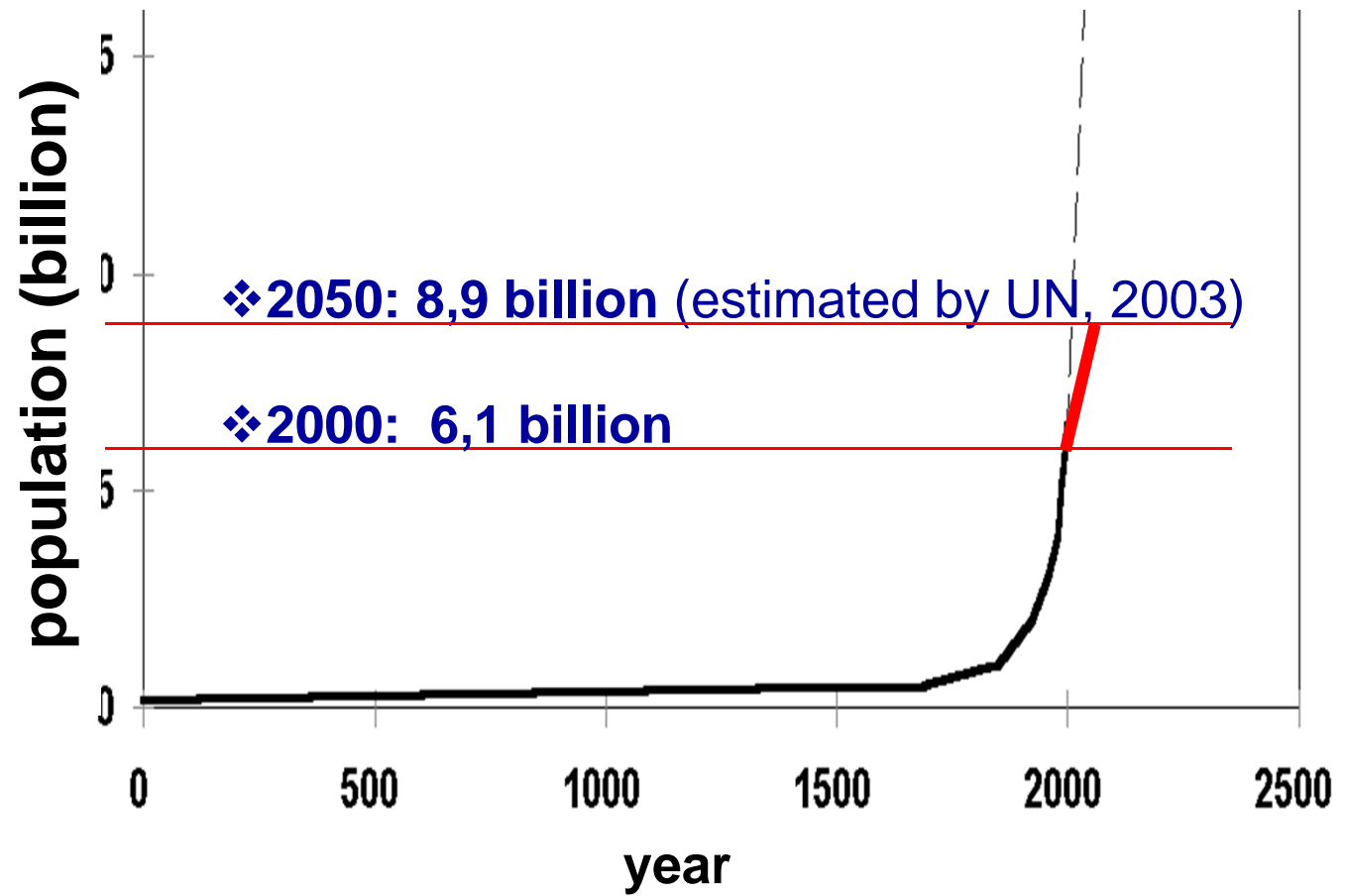
Criteria of
sustainability

Regional aspects

International
context

Standardisation

Population growth



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Objectives

Background and basic principles

Complex approach

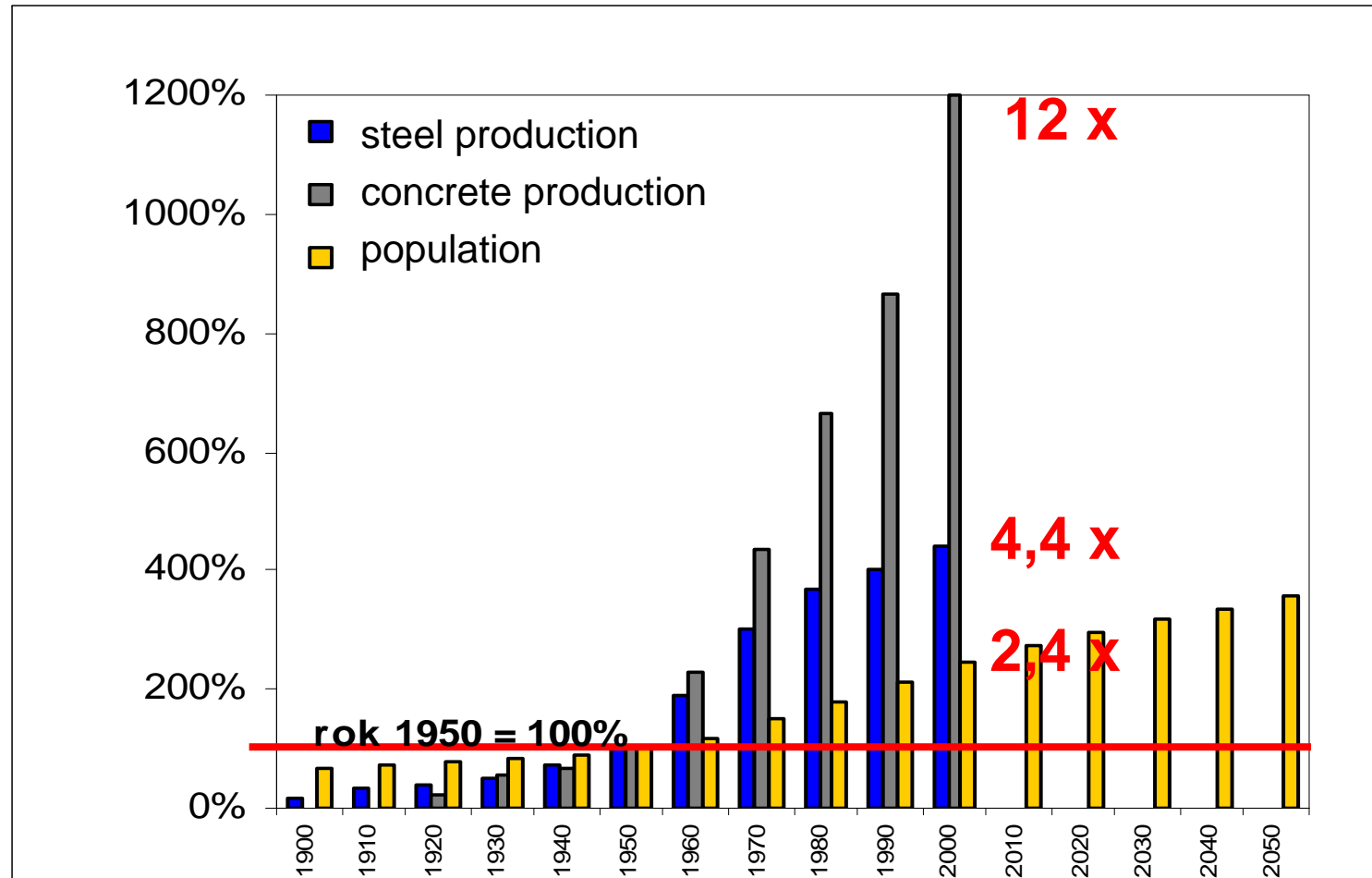
Criteria of sustainability

Regional aspects

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World production of steel and concrete



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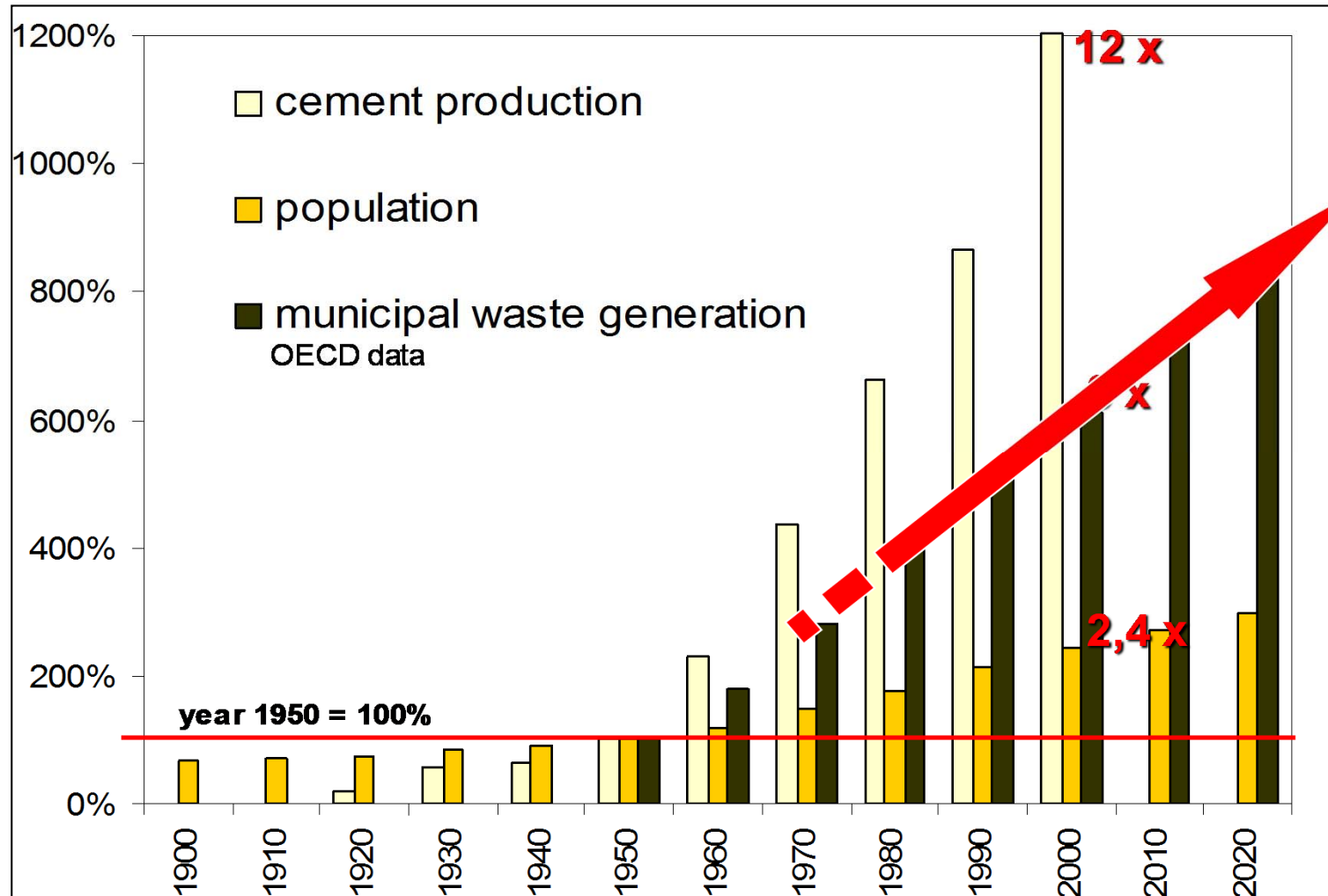
Criteria of
sustainability

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Waste generation



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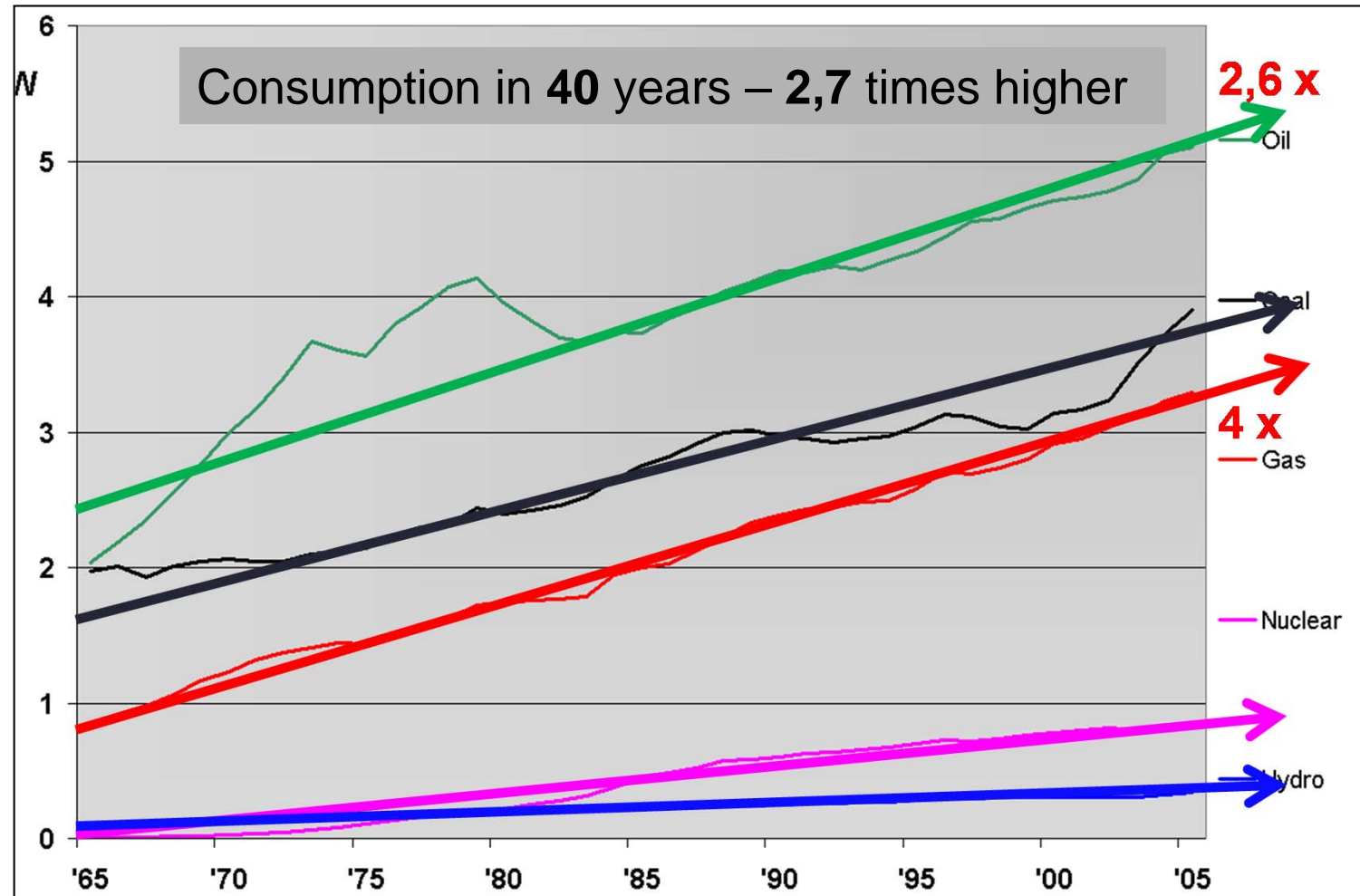
Criteria of
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Energy consumption



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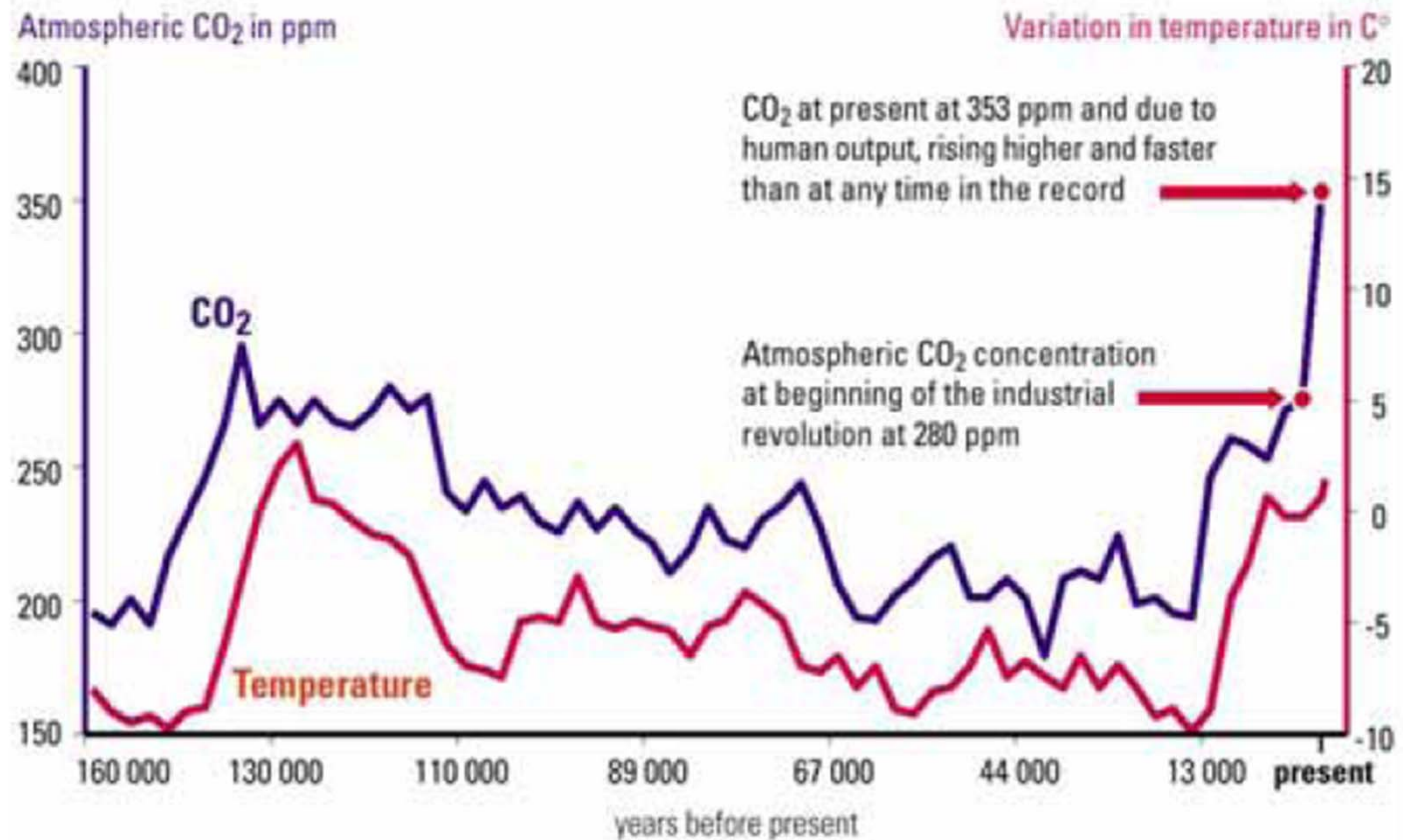
Standardisation

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CO₂ emissions - GWP

Correlation of CO₂ and temperature variation during the last 160 000 years

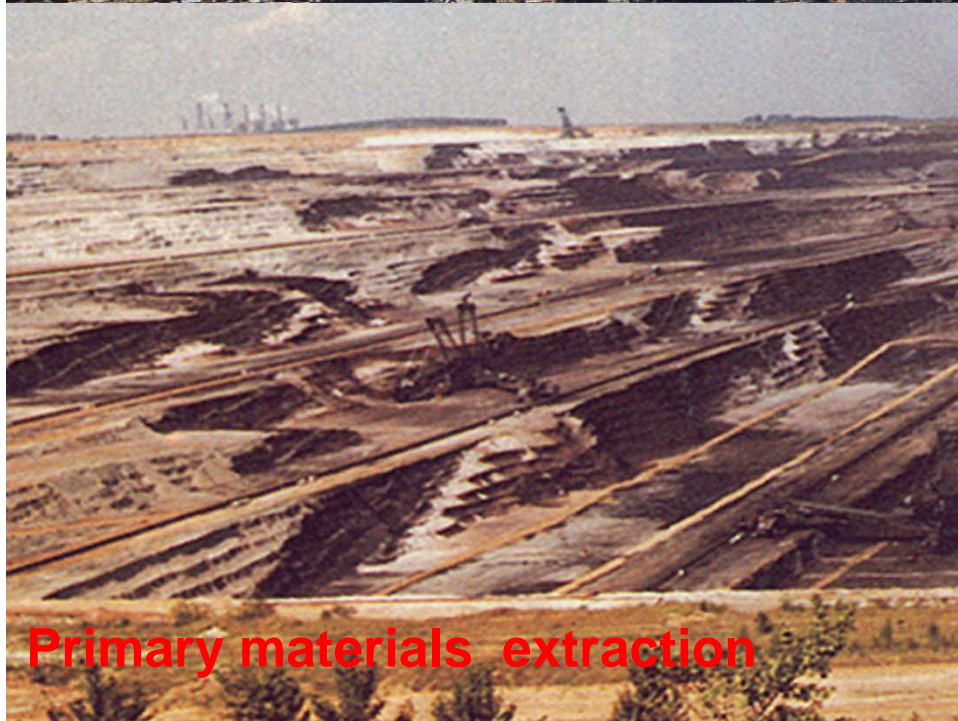
and the fast rising CO₂ output since the industrial revolution



**Population growth ...
... growth of demands**



Pollution



Primary materials extraction



Waste

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Resource use efficiency growth factor

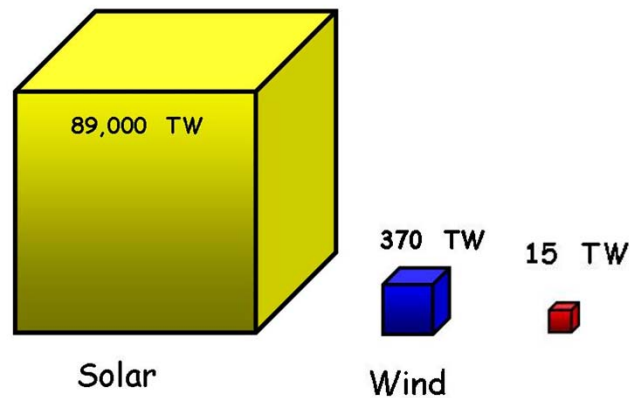
1995 - E. Weizsäcker, A. a H. Lovins

Factor Four - Doubling Wealth, Halving Resource Use

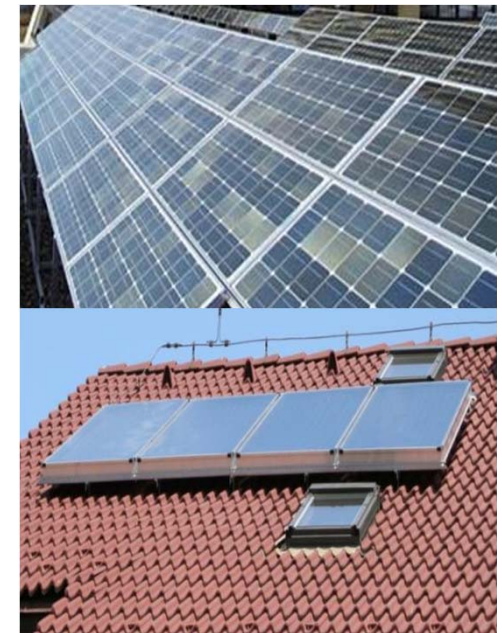
1999 - Schmidt-Bleek

4 – 10 x

Factor 10 - MIPS concept – material input per unit service



= Total annual world energy consumption



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Source: Frank van Mierlo

Environmental impacts of buildings in CR and EU

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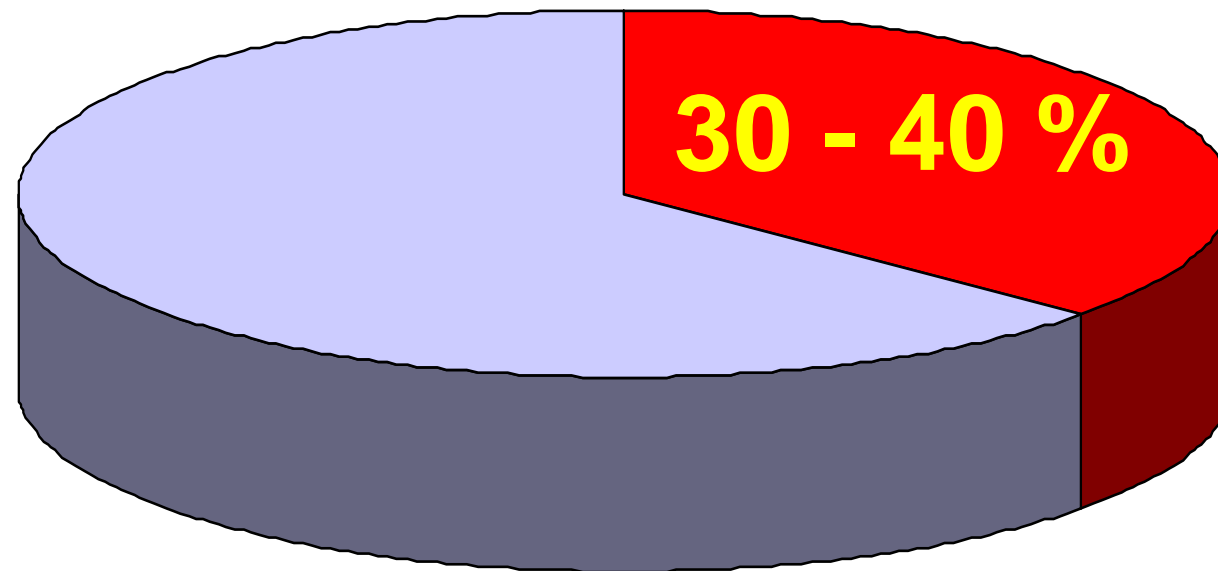
International context

Standardisation

energy consumption

CO₂ emission production

waste production



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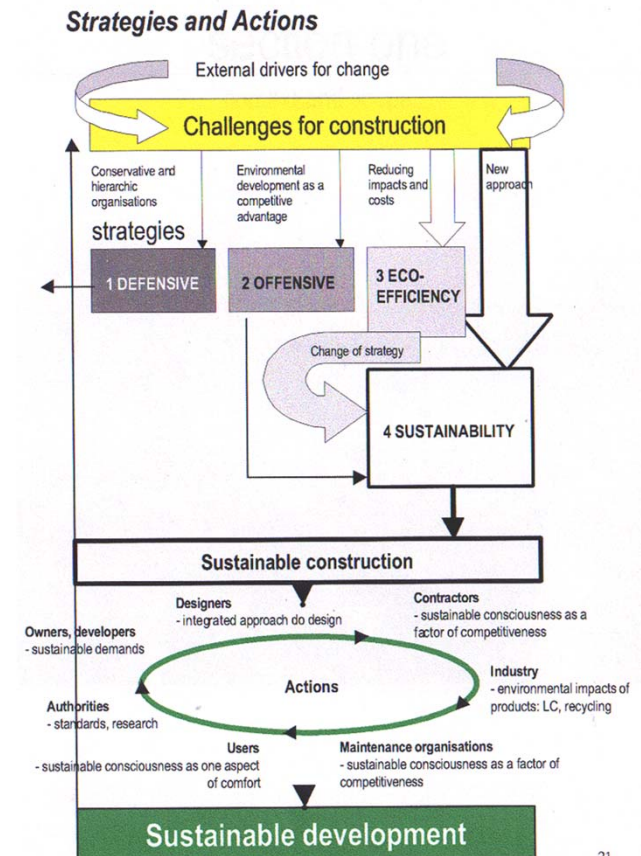
Regional aspects

International context

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AGENDA 21 on Sustainable Construction

CIB Report No. 237 1999



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Traditional and sustainable construction approach

Objectives

Background and basic principles

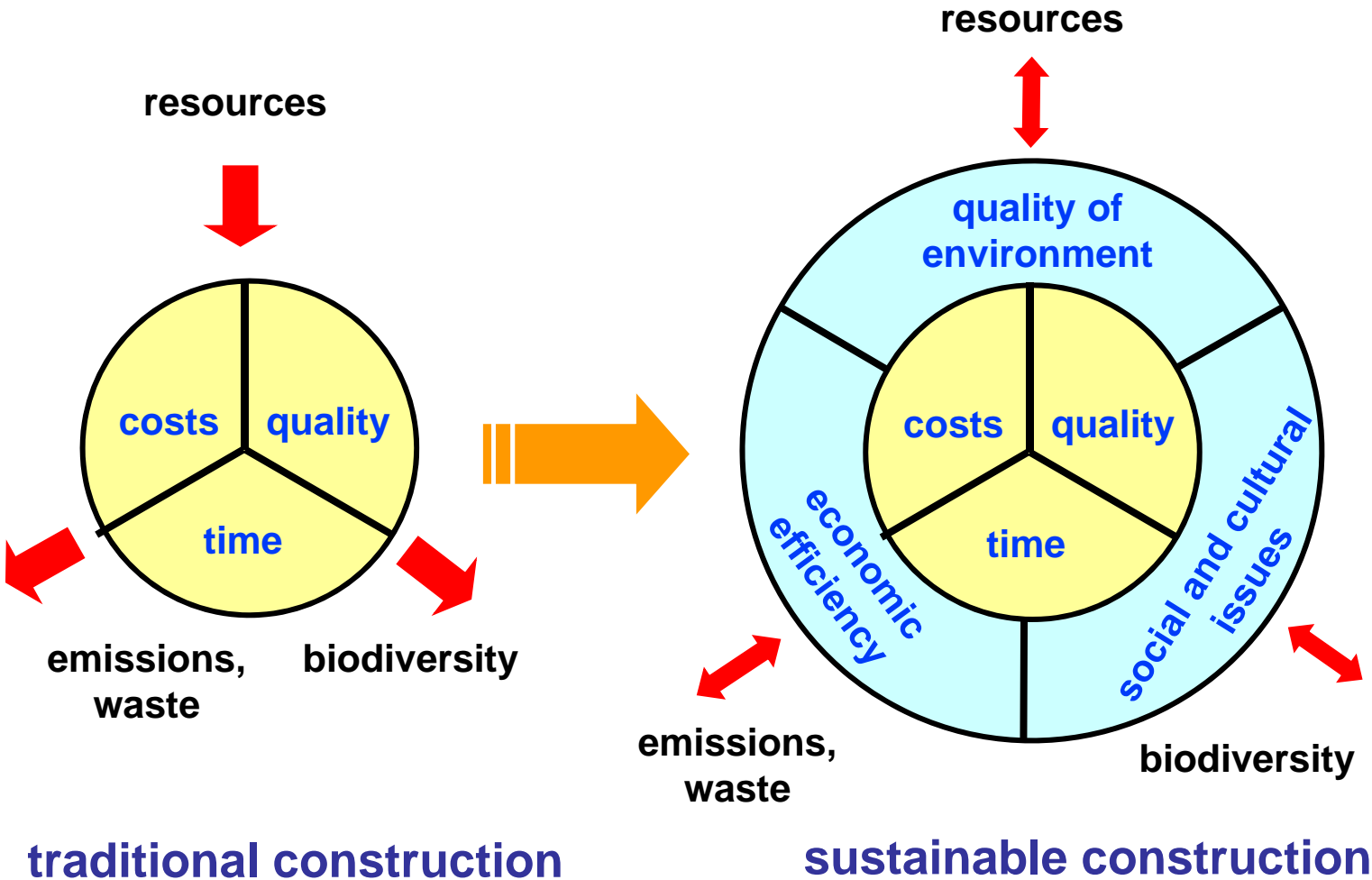
Complex approach

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**Complex
approach**

Three basic groups of sustainable criteria

Objectives

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**Complex
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Environmental criteria



Social criteria



Economic criteria



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Environmental aspects and criteria

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Climate changes

CO2 emission equivalent

Air quality

SOx emission

NOx emission

Biodiversity

Use of green

Ecological quality

Source depletion and waste generation

Primary energy consumption

Water use

Use of renewable and recycled materials

Waste generation

Climatic and geophysical risks

Retention land potential



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Social aspects and criteria

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Indoor quality

Thermal

Acoustic, Lighting

Air quality

Use of green in interior

Accessibility

Accessibility of services

Accessibility of public transport

Cycling support

Non-barrier access

Safety and security

Safety in building and in surroundings

Security

Social and cultural value

Cultural heritage preservation

Satisfaction of inhabitants and users

Functionality

Adaptability



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Economic aspects and criteria

Life cycle cost - LCC

- Investment construction cost
- Operational cost
- Demolition cost

Local economy support

- Use of local products
- Use of local services

Externalities

- Associated investments and their impacts
- Innovations

Economical risks

- Minimization of regional climatic and geophysical risks
- Operational autonomy

Směřující rovnice

Totální ekonomický náklad: 12 780 000 Kč

Kategorie	Investice	Operace	Demolice
Investice	10 000 000	0	0
Operace	0	10 000 000	0
Demolice	0	0	2 780 000
CELKEM	10 000 000	10 000 000	2 780 000



Regional aspects



Regional specifics

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Climatic condition

Geomorphological conditions

Material and technology basis

Economical conditions

Population density

Tradition

Culture



Different construction approaches



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An aerial photograph of a coastal development, possibly a resort or residential complex, featuring a large, curved shoreline and a central body of water. The land is densely packed with buildings, greenery, and swimming pools. The surrounding ocean is deep blue with visible reef formations. The text "International context" is overlaid in large, bold, yellow letters across the lower right portion of the image.

**International
context**

Sustainable Building Alliance

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SBA



Sustainable Building Alliance
common metrics for key issues

**WORK ON
COMMON METRICS**

Key indicators

CO2 emissions

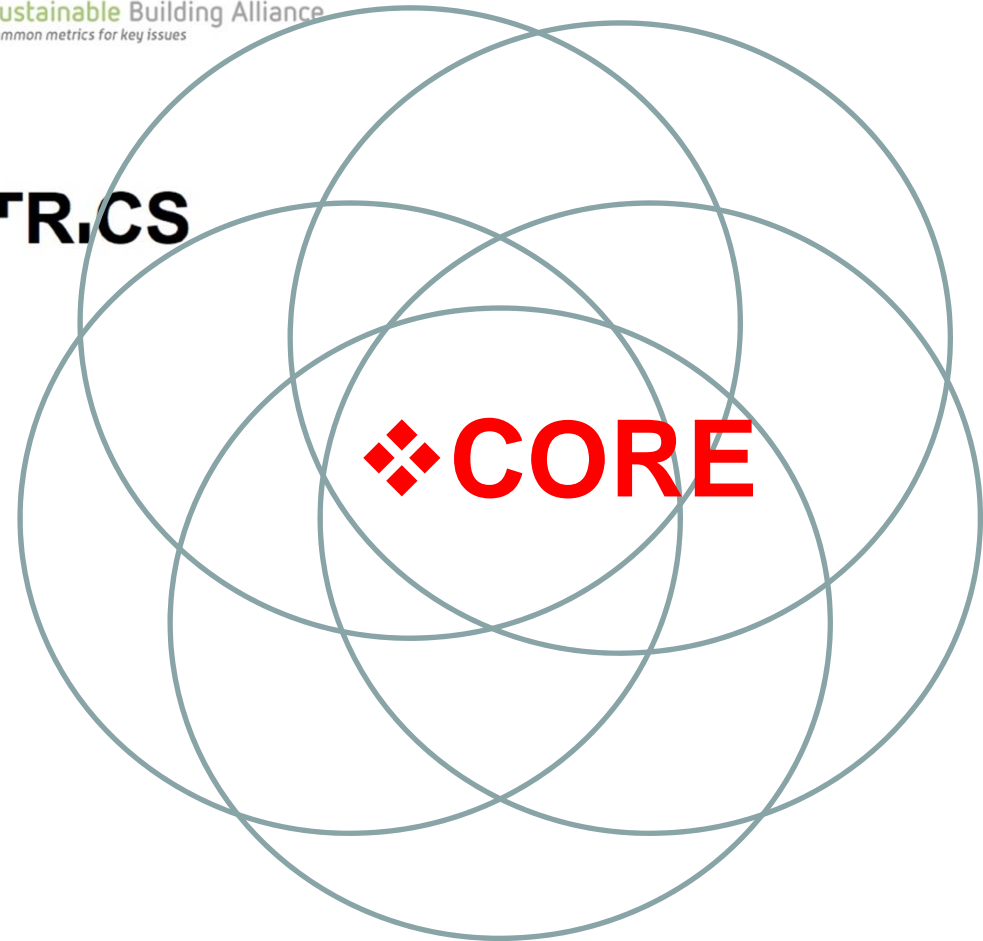
Energy

Waste

Water

Air quality

Economy efficiency



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Tools for evaluation of complex building quality

SBTool

iiSBE – international methodology

BREEAM

UK

LEED

USA

CASBEE

Japan

HQE

France

PROMISE

Finland

DGNB

Germany

Protocollo SBC

Italy

SB Tool Verde

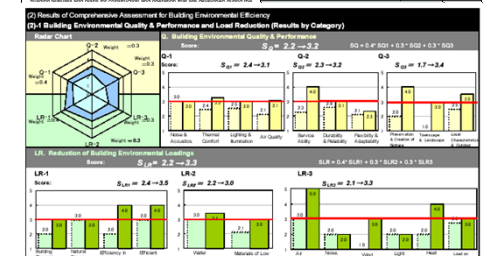
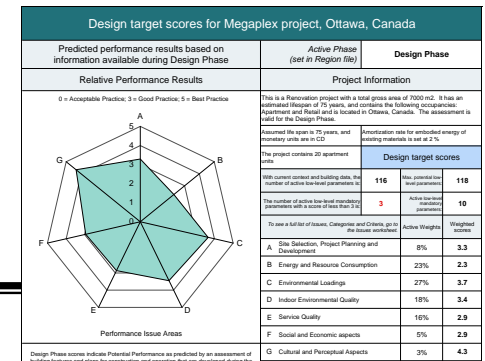
Spain

SB Tool PT

Portugal

SB Tool CZ

Czech Republic



CERTIFIKÁT KVALITY BUDOVY

X-LOFT
U Libeňského pivovaru
Praha 8

Zadavatel: X-LOFT s.r.o.

Hodnocení lokality: 7,0

Hodnocení budovy: 6,3

CELKOVÉ SKÓRE: 6,3

SBTool CZ
stavby certifikace

BYTOVÝ DŮM
HODNOCENÍ VE FÁZI PROJEKTU

Certifikát číslo: BD-PRJ-001
Datum: 5. 11. 2010
Vystavil: Ing. Jana Čurdová

Rekuperace u vybraných bytů
Solární kolektory
Využití dešťové vody na zalévání
Výborná dostupnost veřejné dopravy

BREEAM
Gold

LEED
LEED Project # 0417
LEED Version 2 Certification Level: Platinum
December 11, 2003

SBTool CZ

SB Tool Verde

SB Tool PT

SB Tool CZ

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Research in EU

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LEnSE (FP6) – methodology



PERFECTION (FP7) – indoor indicators



SuPer Buildings (FP7) – assessment and
benchmark settings



OpenHouse (FP7) – implementation of
assessment into construction practice

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Standardisation

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Standardisation: CEN/TC 350 a ISO TC 59



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**Thank you for your attention
and see you next week 😊**

Petr Hájek