



LCM2007

Benchmarks for sustainable construction

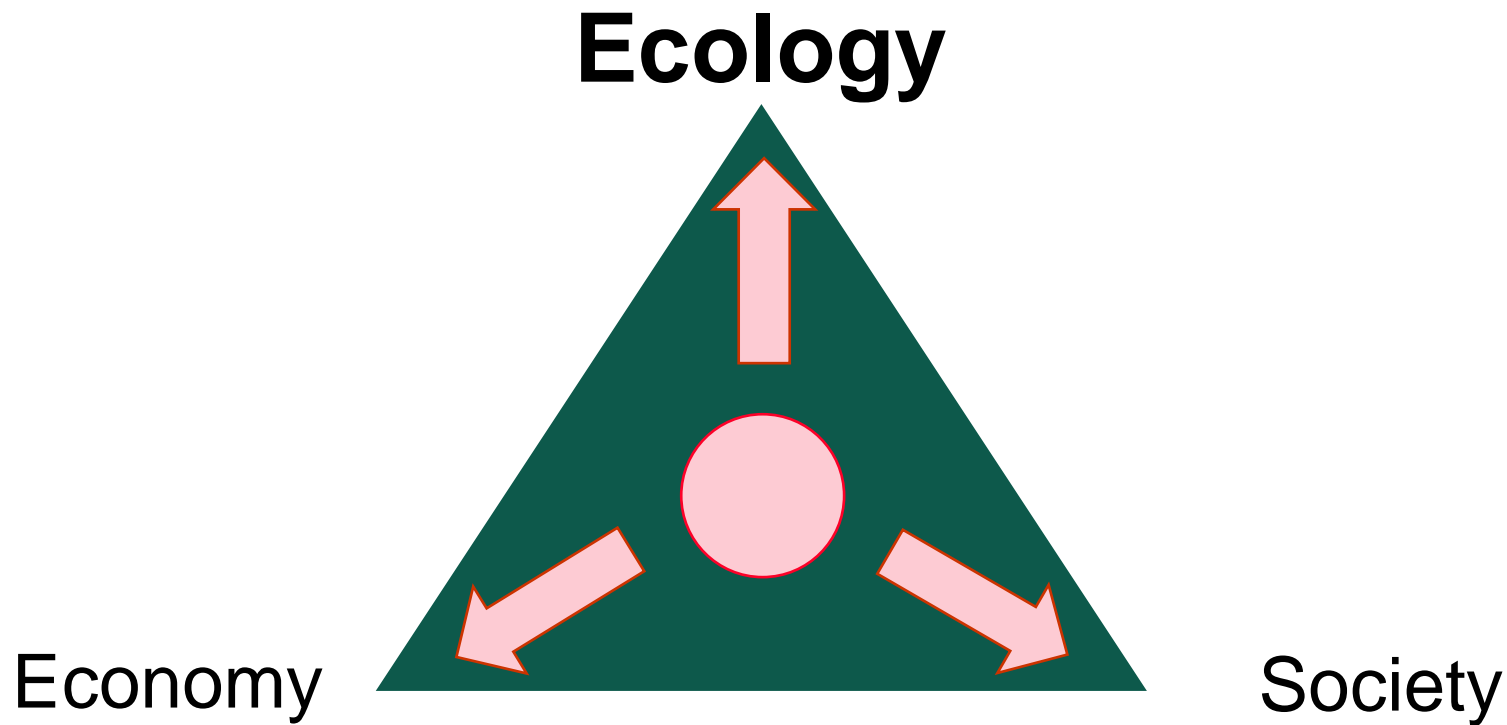
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Sustainability has 3 dimensions





Prerequisites for sustainable development

- **Criteria for sustainable development**
- **Benchmarks for the contribution of sectors to sustainability (e.g. construction)**
- **Measurability / controllability of sustainability**

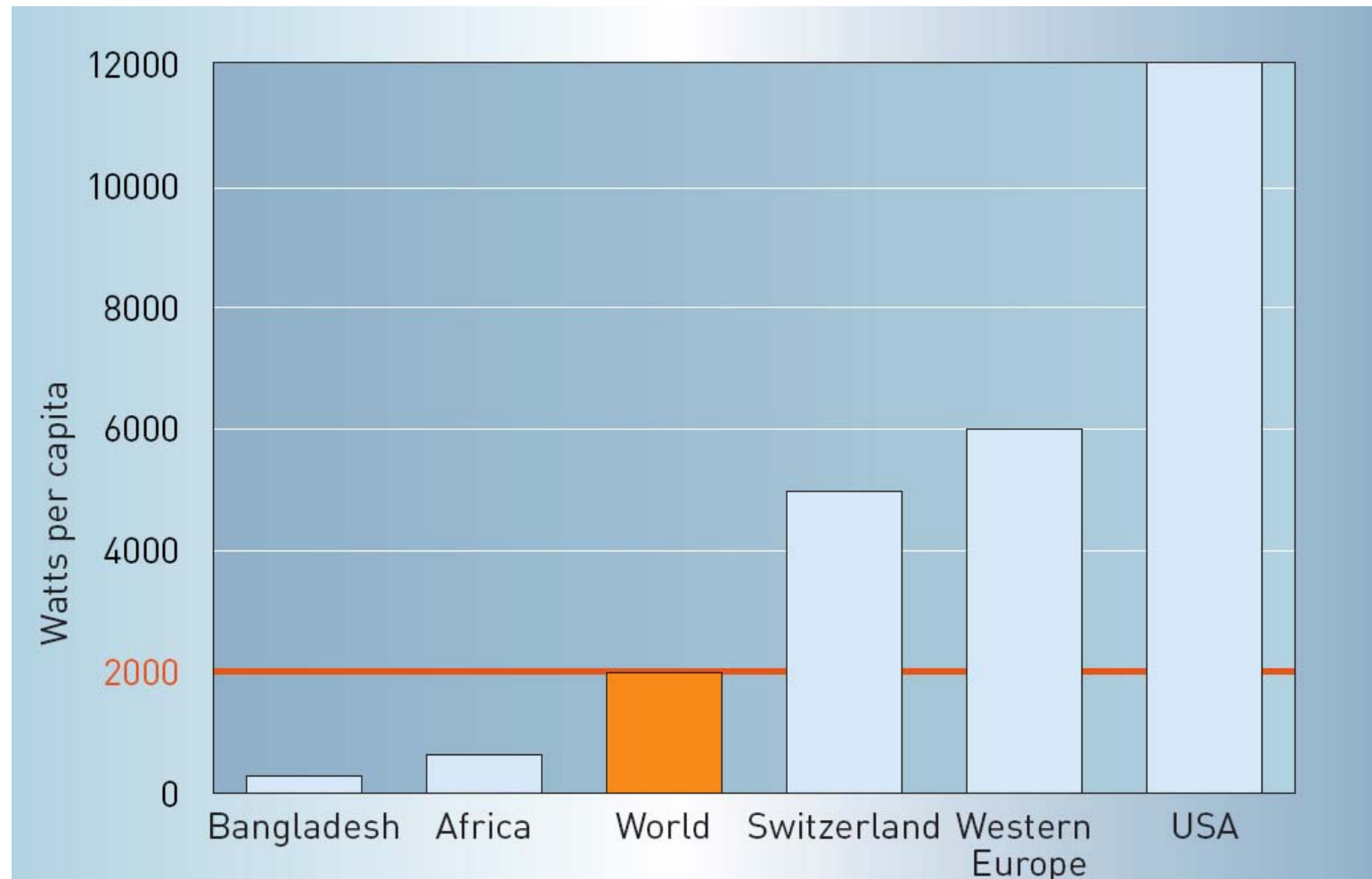


Energy related criteria for sustainability – 2'000 Watt

- **About 2'000 Watt per capita (17'500 kWh/year) are needed to enable a healthy economy and a secure society**



Energy consumption per capita



Energy
needed for
appropriate
level of
prosperity



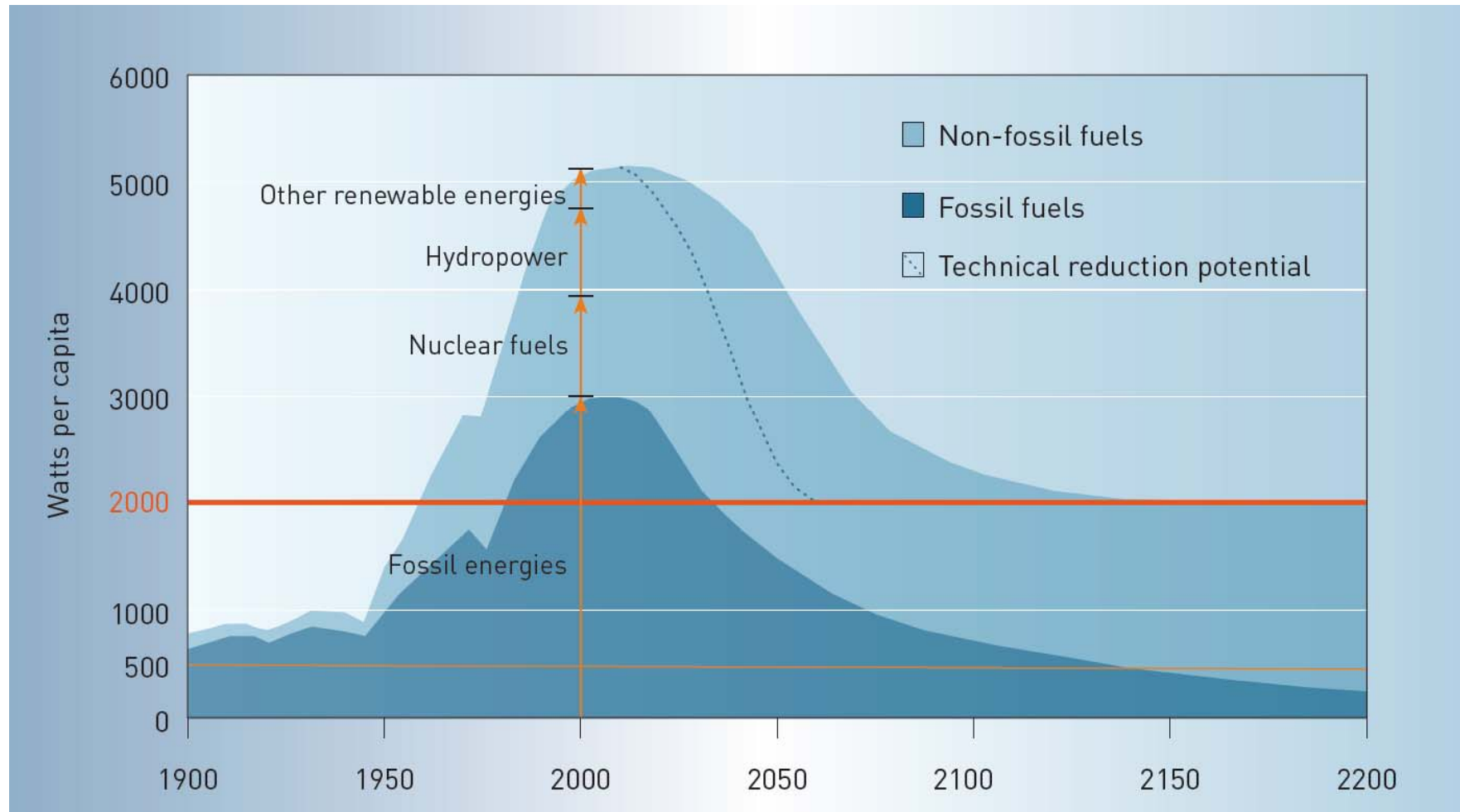


Energy + environmental related criteria for sustainability

- About 2'000 Watt per capita (17'500 kWh/year) are needed to enable a healthy economy and secure society
- **For environmental reasons, green house gas emissions should not exceed 1 to CO₂-Eq per capita and year (IPCC 2001). This equals a consumption of 500 Watts of fossil energy. 1'500 Watts have to come from renewable or CO₂-neutral energy sources.**



The 2'000 Watt Society scenario



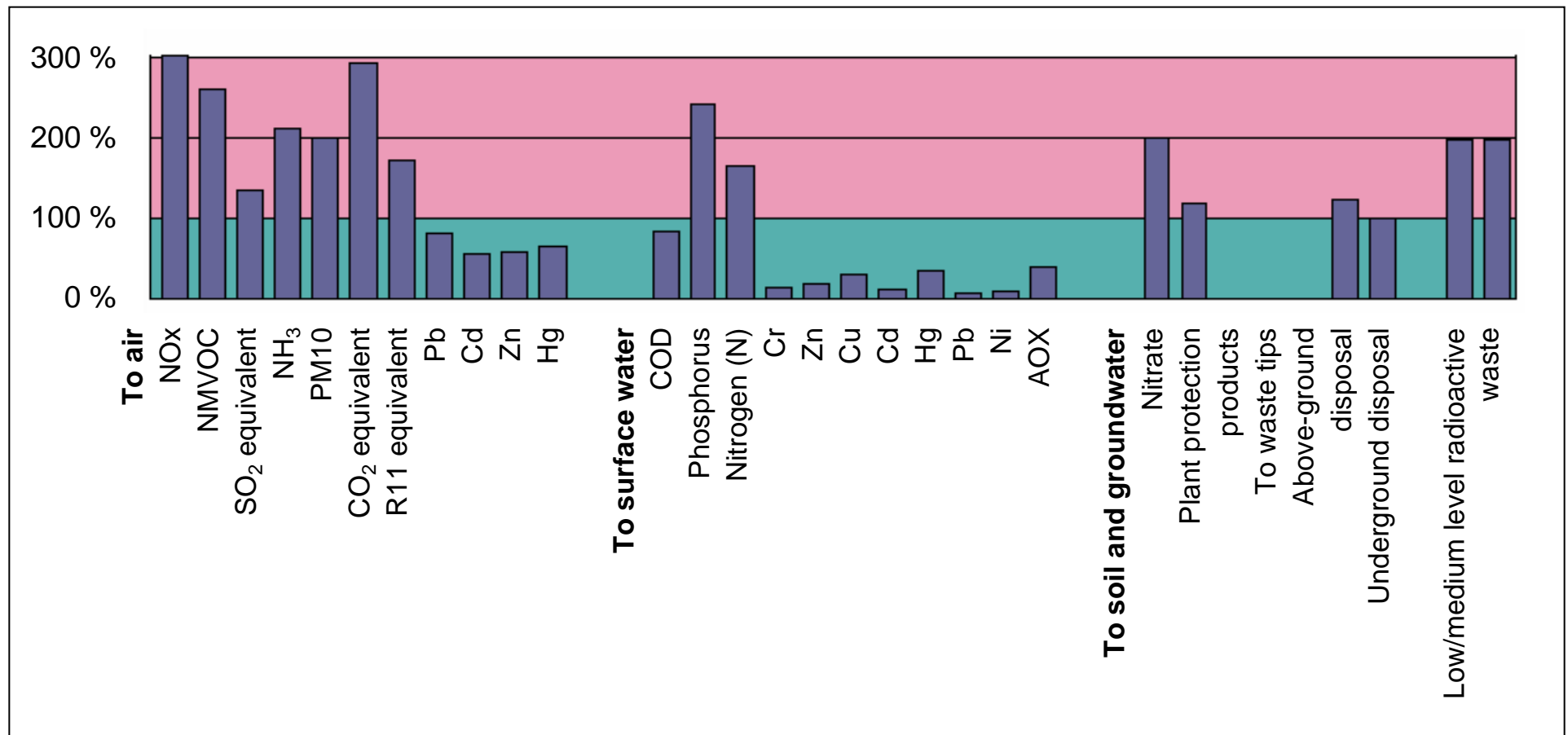


Energy + environmental related criteria for sustainability

- About 2'000 Watt per capita (17'500 kWh/year) are needed to enable a healthy economy and secure society.
- For environmental reasons, green house gas emissions should not exceed 1 to CO_{2-Eq} per capita and year (IPCC 2001). This equals a consumption of 500 Watts of fossil energy. 1'500 Watts have to come from renewable or CO₂-neutral energy sources.
- **The Swiss „ecological scarcity method“ [UBP 1997] allows to define acceptable environmental impacts.**



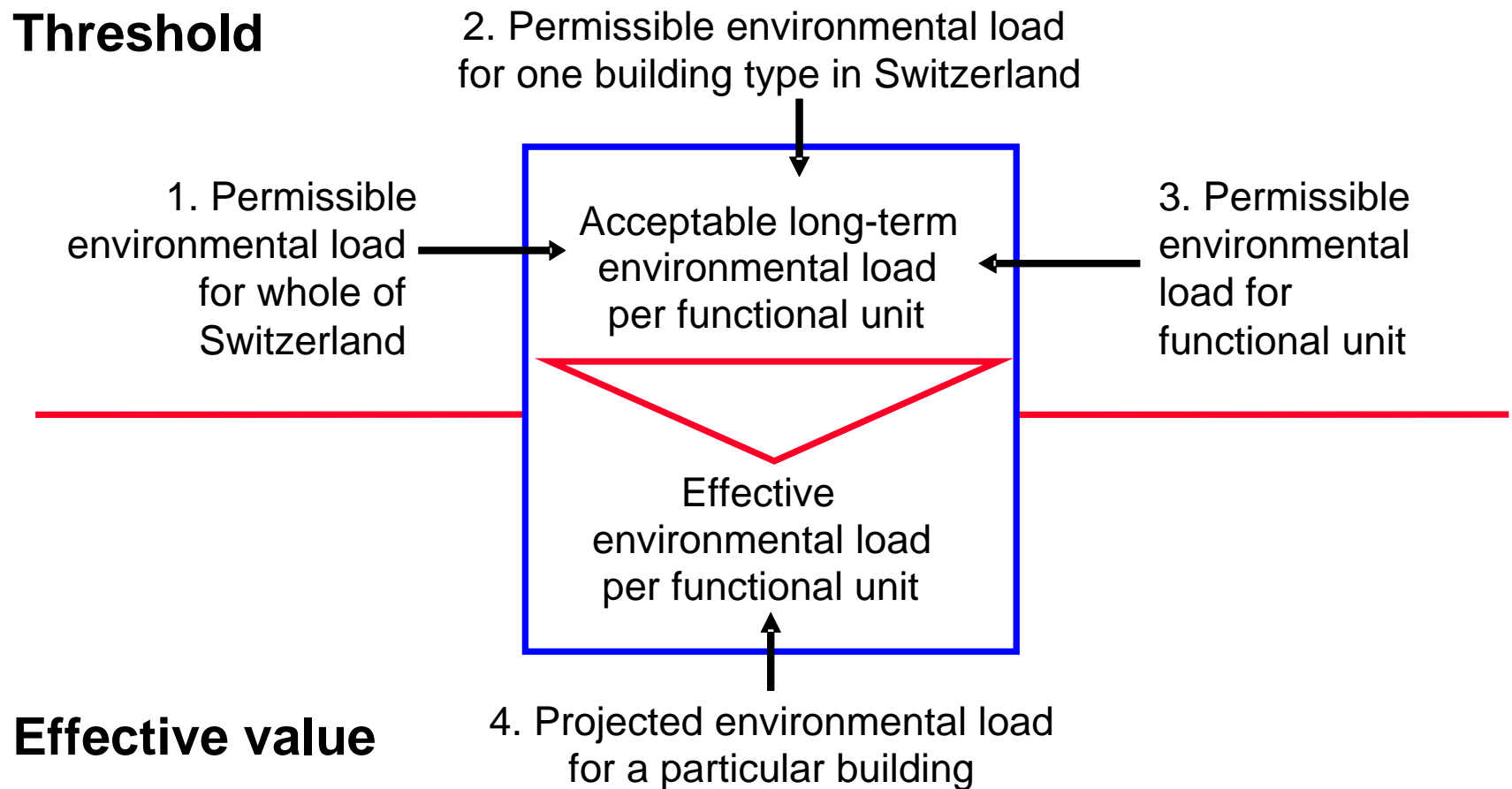
Ecological scarcity method





Benchmark development

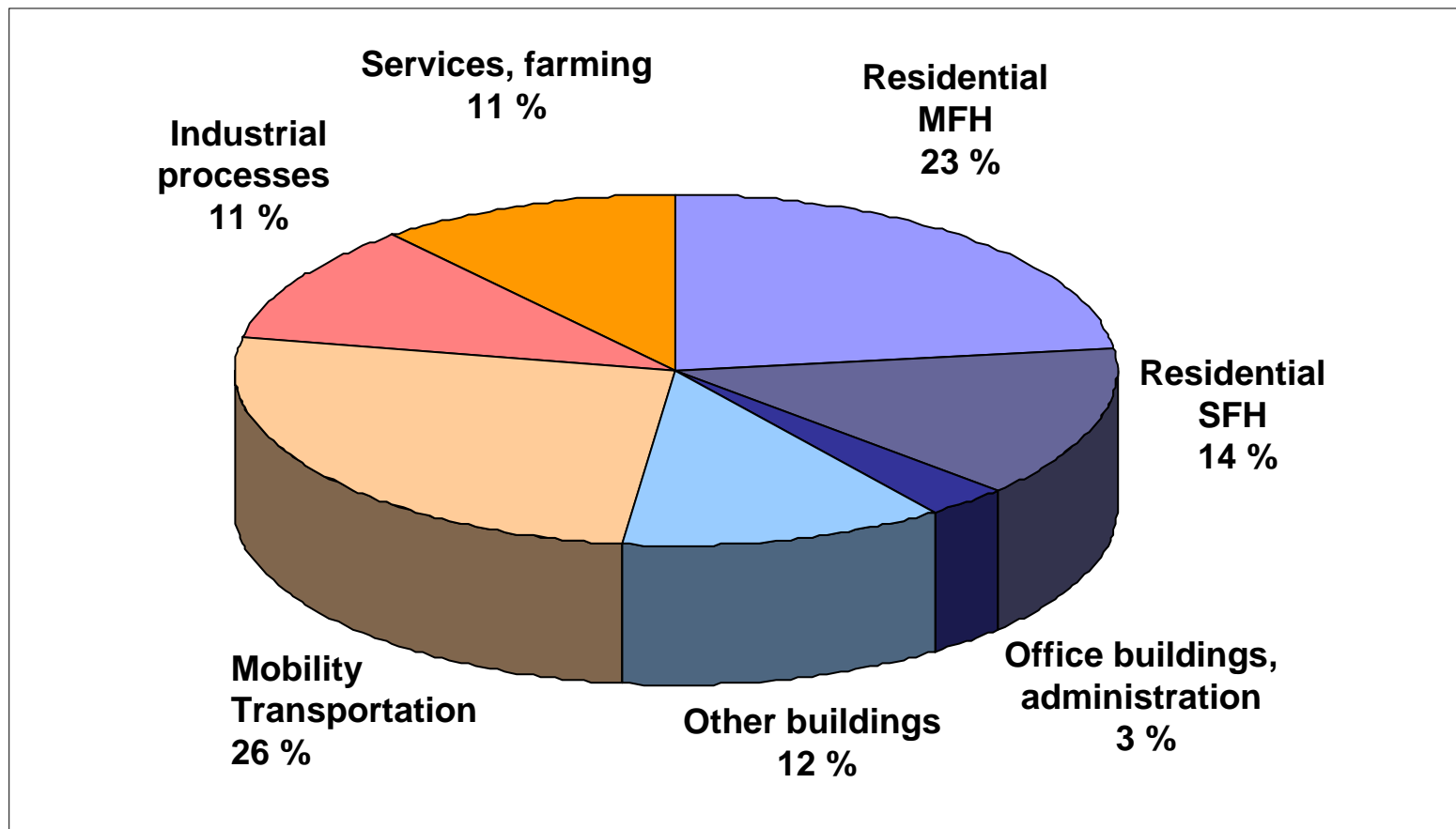
Threshold



Effective value

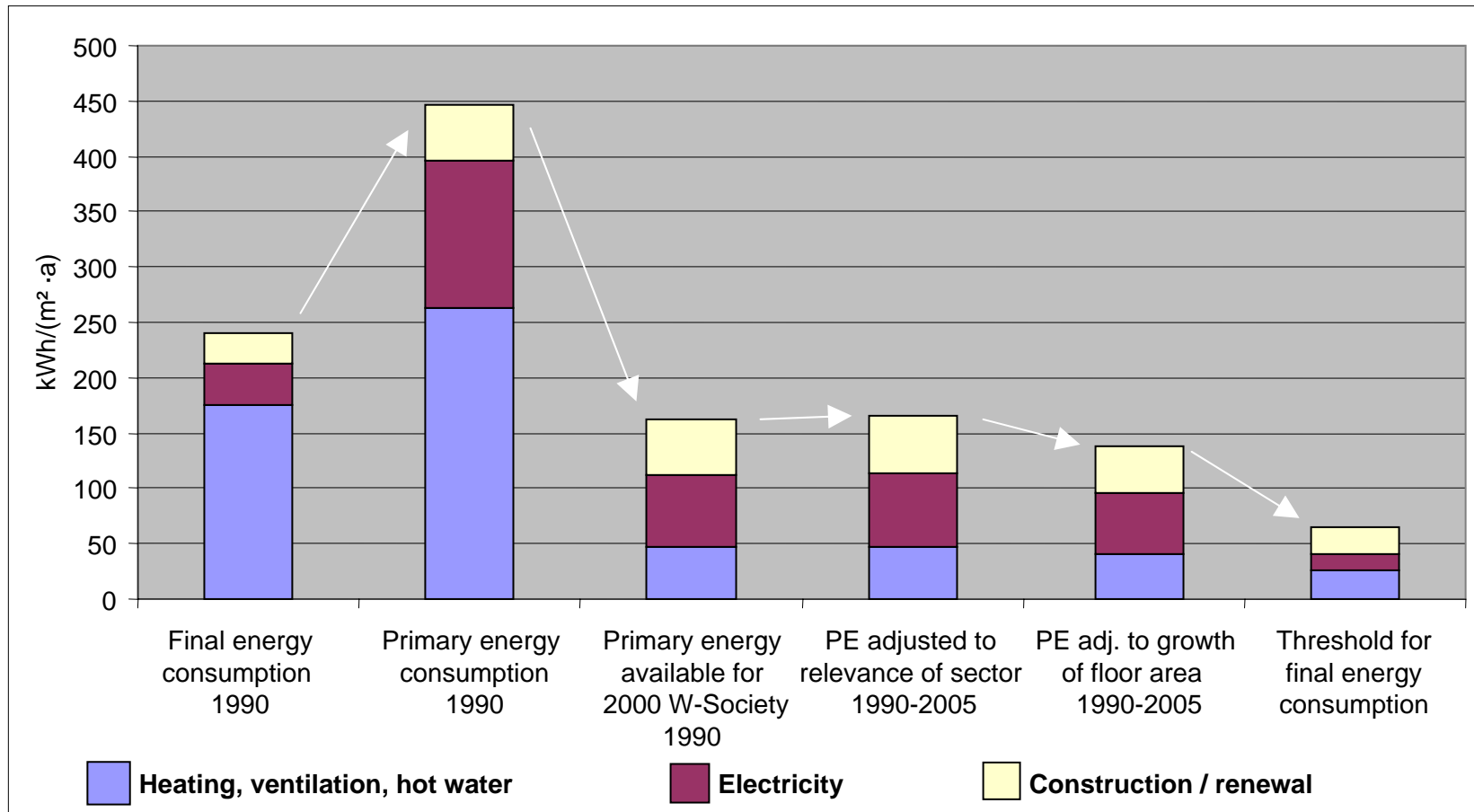


Distribution of Swiss energy consumption (PE)





Calculation of threshold value





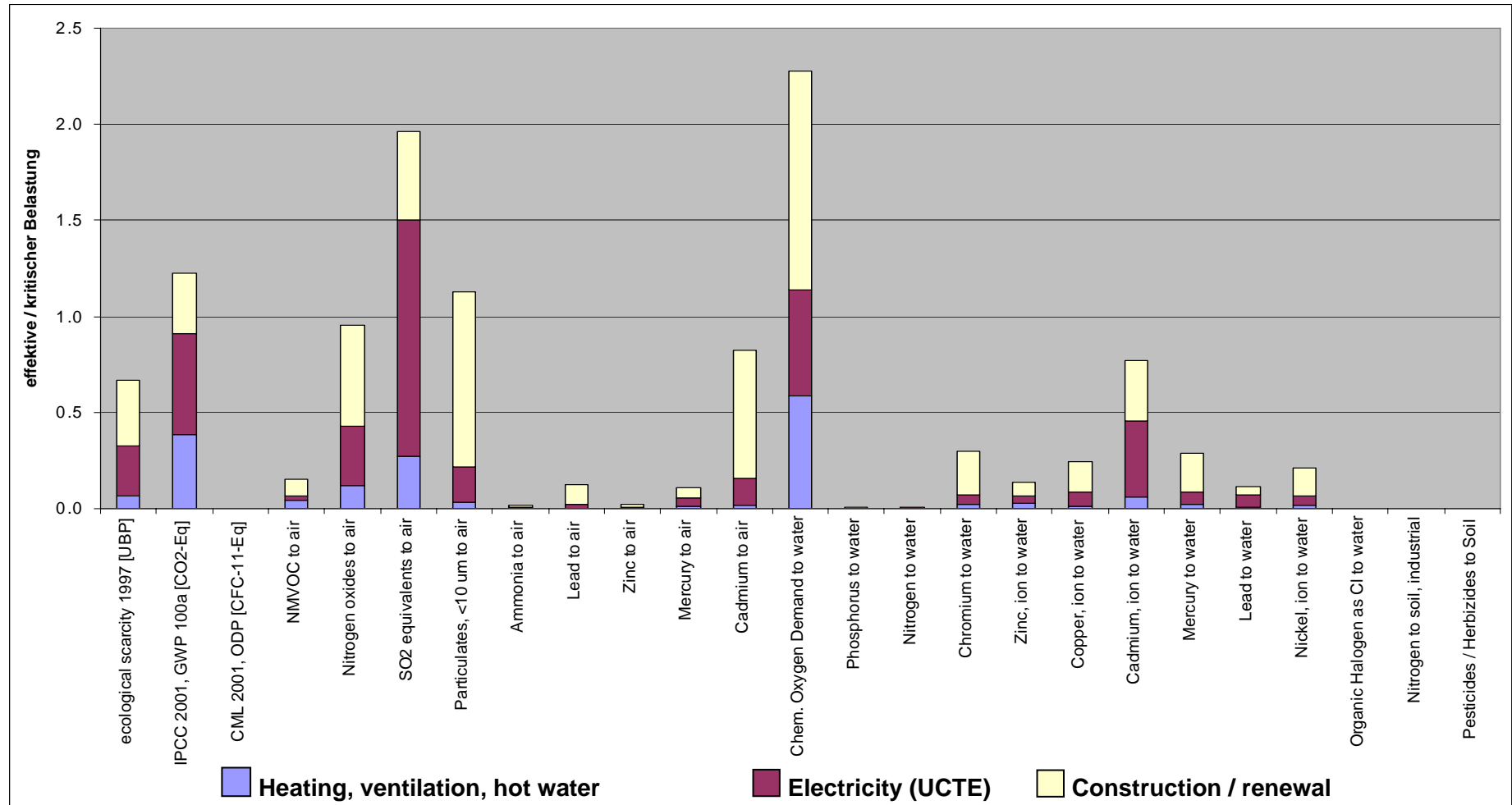
Specific energy consumption of residential buildings

	CH 1990 existing buildings kWh/(m ² ·a)	CH 1990 new buildings kWh/(m ² ·a)	2000 W primary energy kWh/(m ² ·a)	2000 W final energy kWh/(m ² ·a)
Heating, ventilation, hot water	175	123	40	26
Electricity	38	32	56	15
Construction, maintenance	27	27	43	23
Total for residential buildings	240	182	139	64

Residential buildings according to the international “Passive House” standard are close to fulfil the requirements of 2’000-W-Society buildings



Environmental impact of 2'000-W-Society houses





Results

- **The primary energy consumption for the operation of residential buildings should not exceed 100 kWh/(m²-a).**
- **The final energy consumption for heating cooling, ventilation and hot water has to be reduced by a factor 5 to about 25 kWh/(m²-a).**
- **The electricity consumption be reduced by 50 % compared to the present needs.**
- **The Passive-House-Standard can be considered as sustainable if the generation of electricity is largely based on renewable or low-carbon energy.**

For details see: Mark Zimmermann: Benchmarks for sustainable construction – A contribution to develop a standard, Energy and Buildings, 37 (2005) 1147-1157



Conclusions

- **Without quantified targets it will be impossible to move systematically towards a sustainable society.**
- **The method shown is suitable to quantify how much each sector - e.g. the building sector or a specific building type - should contribute to a sustainable society.**
- **However, the method is difficult to apply if detailed data is missing and/or if it is difficult for the consumer to estimate the environmental impact. This is the normal situation on a micro-economic scale.**
- **The method is not appropriate for specific technologies and markets. Here, qualitative benchmarking should be applied.**