

# Target values regarding environmental impacts of buildings

Discussion forum on LCA, Zürich, 2. December 2014

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- Introduction
- Goals and objectives
- Methodology and procedure
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- Summary and outlook

# Present situation

- The construction sector causes a major share of the present environmental impacts
- Swiss SIA efficiency path energy: target values for
  - Primary energy demand, non renewable
  - Greenhouse gas emissions
  - Caused by construction, operation and induced mobility
- Differentiation between 3 types of usage: residential buildings, office buildings and school buildings
- Differentiation between new and refurbished buildings
- Target values: according to 2050-milestone of 2000-Watt-society

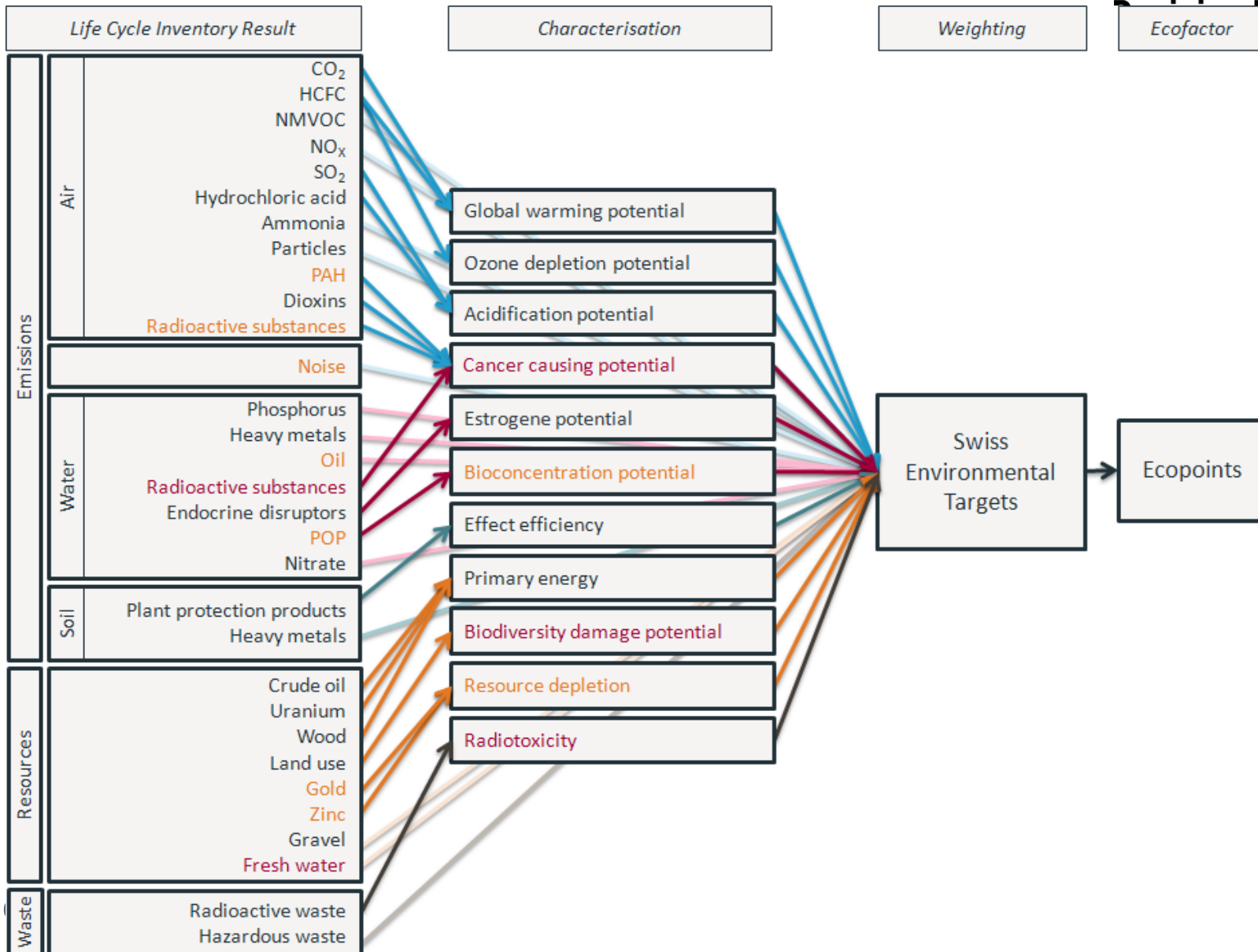
# Goals and objectives

- A fully aggregated environmental indicator should complement existing target values and provide a more comprehensive picture about the environmental impacts of buildings.
- Defining guidance values for the total environmental impacts of buildings
- Reference values need to be defined related to construction, operation and induced mobility

# Ecological scarcity method

- Goal
  - Aggregation of pollutants (and resources) according to politically defined scarcity
- Characteristics
  - Fully aggregating
  - Large variety of environmental impacts (and wastes) included in assessment
  - Based on national or regional environmental targets (or international agreements with national participation)

# Basic scheme Swiss ecofactors '13



# Methods and procedure

- Case study: 33 Swiss buildings analyzed using LCA
  - Construction
  - Operation
  - Mobility induced by the building
- Schools, offices, retirement homes and residential buildings
- 60 years life time
- Environmental impacts expressed relative to the energy reference area

# Methods and procedure (II)

- Methodology and system boundaries according to SIA efficiency path energy (SIA 2040)
- Database ecoinvent data v2.2 and KBOB recommendation 2009/1:2012 are used
- Life cycle stages construction, operation and induced mobility have each an orientational reference value
- -> sum of reference values is binding target value



# Results

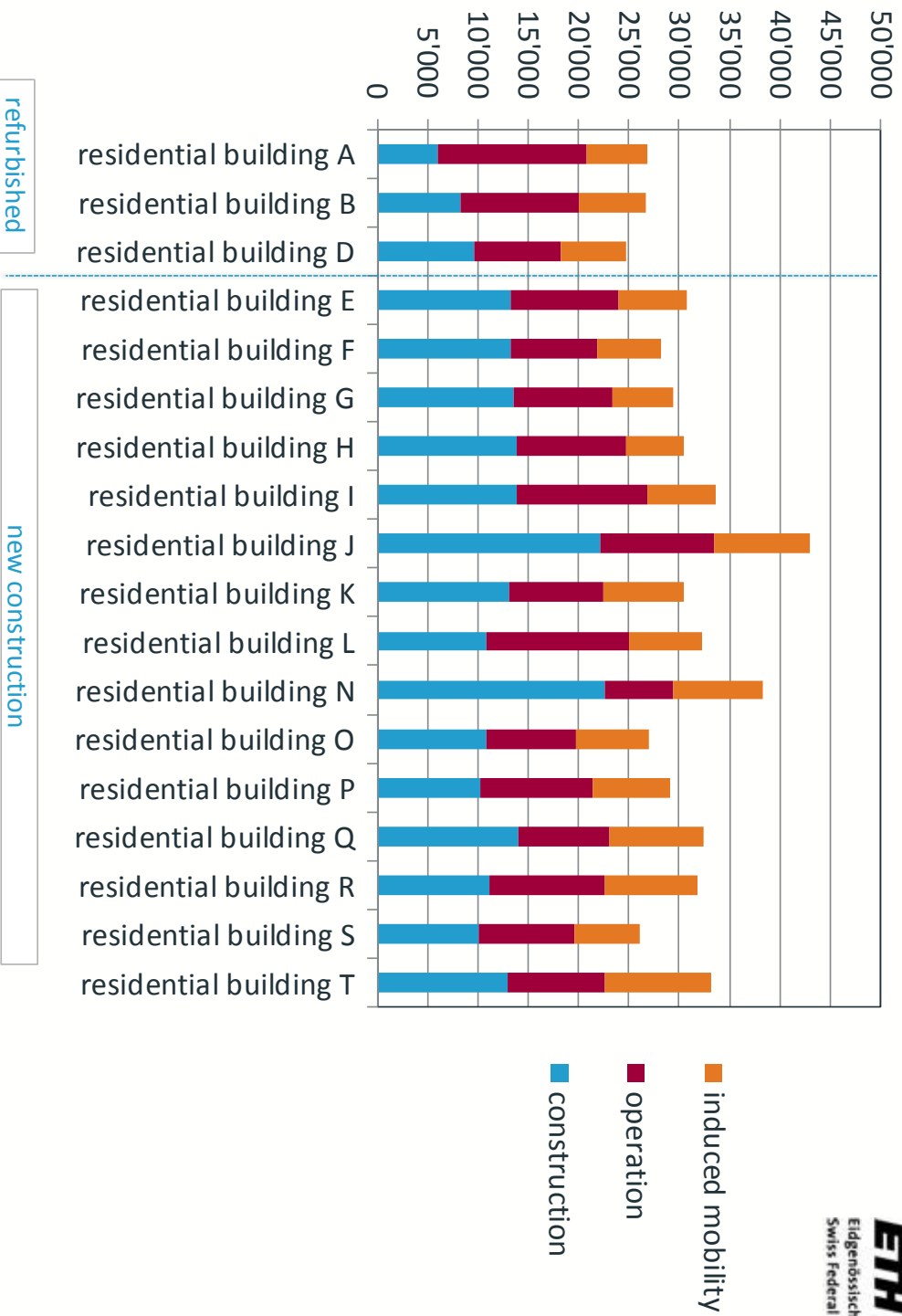


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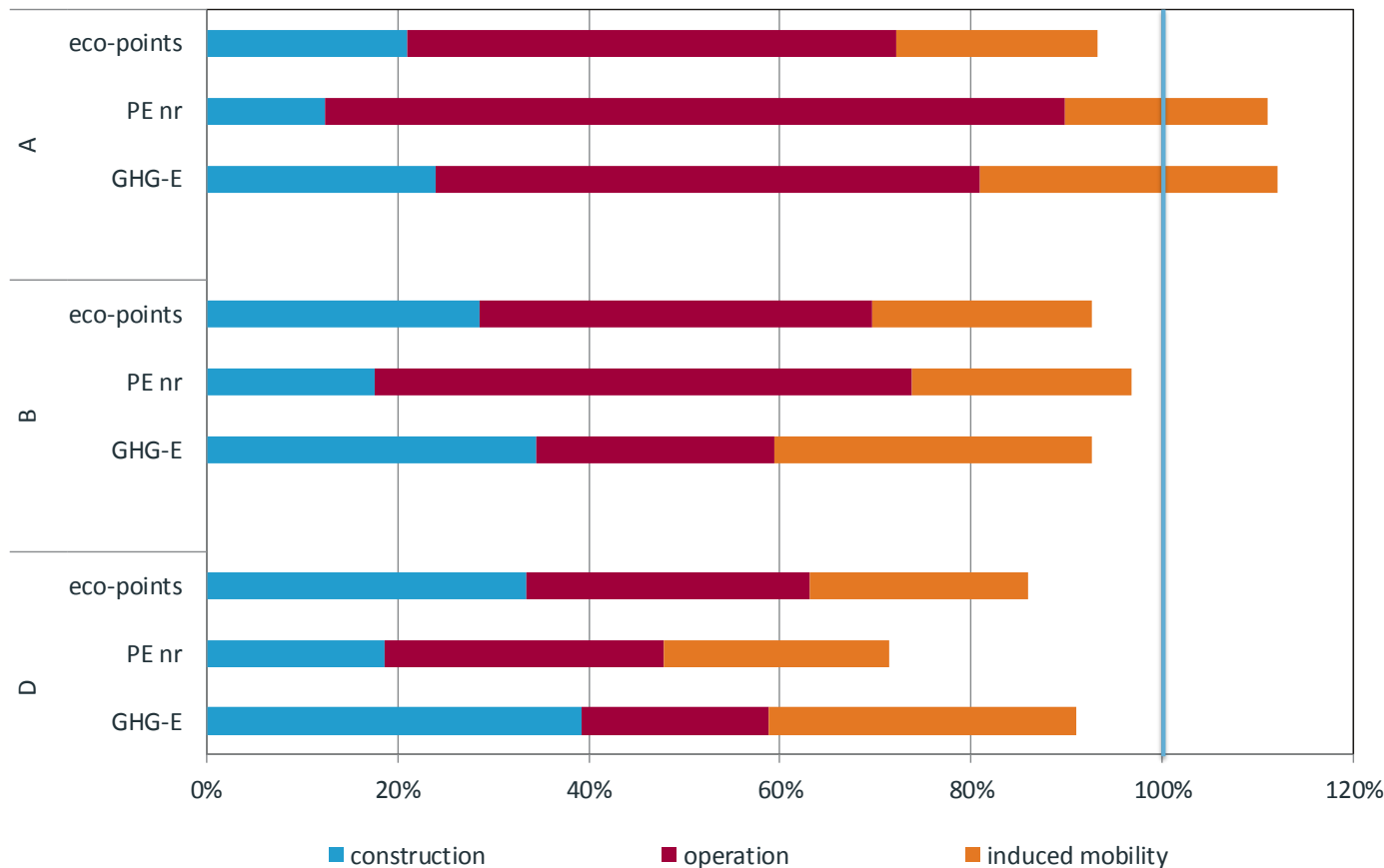
Total env. impact  
eco-points/m<sup>2</sup>/a



# Establishing a target value for residential buildings

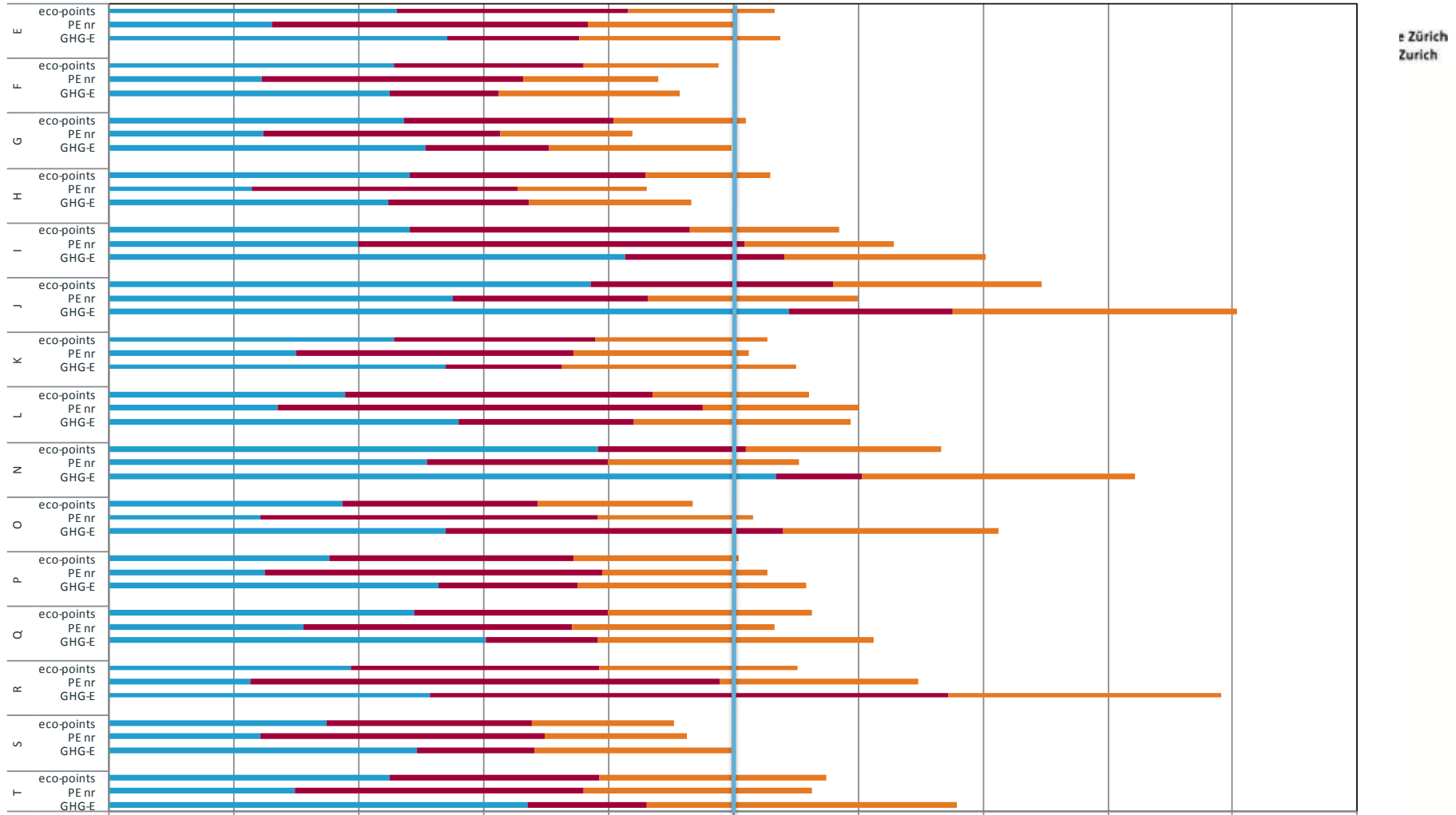
- Actual env. impact of the building sector
  - Construction 18'000 eco-points/m<sup>2</sup>/a
  - Operation 31'000 eco-points/m<sup>2</sup>/a
  - Ind. mobility 16'000 eco-points/m<sup>2</sup>/a
  - **Total 65'000 eco-points/m<sup>2</sup>/a**
- National environmental impacts should be reduced by 38-63 % (Jungbluth et al. 2011)
- 56 % reduction for a sustainable building sector  
-> **25'000 eco-points/m<sup>2</sup>/a for residential buildings**

# Refurbished buildings in relation to target value



100% = target value PE nr, GHG-emissions and tot. env. impact

# New constructions in relation to target value



e Zürich  
Zurich

100% = target value PE nr, GHG-emissions and tot. env. impact

# Sensitivity analysis

- Update from ecoinvent data v2.2 to ecoinvent data v2.2+ and the indicators from MoeK06 to MoeK13 and from GWP07 to GWP13
- Assessment of the influence of materials and building components on the env. impact
- Variation of energy carriers for space heating and hot water demand in the use stage

# Conclusion database and impact indicators

- Reduced environmental impact with the updated database and the updated indicators
- Update leads to a reduction of the target value
- -> no change of the relation of the building's environmental impacts to the target value

# Conclusions Materialization

- Constructional measures are preferable over enhanced technical installations
- Glazing and brickwork as construction materials are unproblematic
- Constructions in wood: reduced share on the overall environmental impacts with the updated database and indicators

# Conclusions energy carriers

- Only little differences in the overall environmental impacts of the different options assessed
- Results of total environmental impact differs clearly from those of primary energy demand, non renewable and greenhouse gas emissions



# Overall conclusions

- Definition and quantification of target values of buildings possible
- For further discussion a national reduction target is needed
- Indicator settles within the range of the indicators primary energy and greenhouse gas emissions. Most often greenhouse gas emissions are limiting in SIA 2040 assessments.
- Hot spots identified with environmental indicator
  - electrical installations (copper)
  - ventilation equipment (steel)

# Is a new indicator needed in SIA 2040 or the SNBS?

- Currently no need to add environmental impact indicator to SIA 2040 and SNBS
  - Target value total environmental impact is rarely the limiting factor
  - Environmental impacts mostly between primary energy and greenhouse gas emissions
- However, valuable control-parameter
  - Extensive electrical installation (copper cabling)
  - Extensive ventilation systems (steel tubes)
  - High energy demand in the use phase combined with a wood

# Outlook

- Target value:
  - Elaboration of official national reduction targets
  - Reach level of acceptance similar to the goals of 2000-Watt-Society
- Case studies:
  - Assessment of more buildings, especially office buildings
  - Broader validation of target values
  - Further identification of crucial parameters for env. impacts
- Embedding environmental indicator in planning tools

Thank you for your attention!

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