

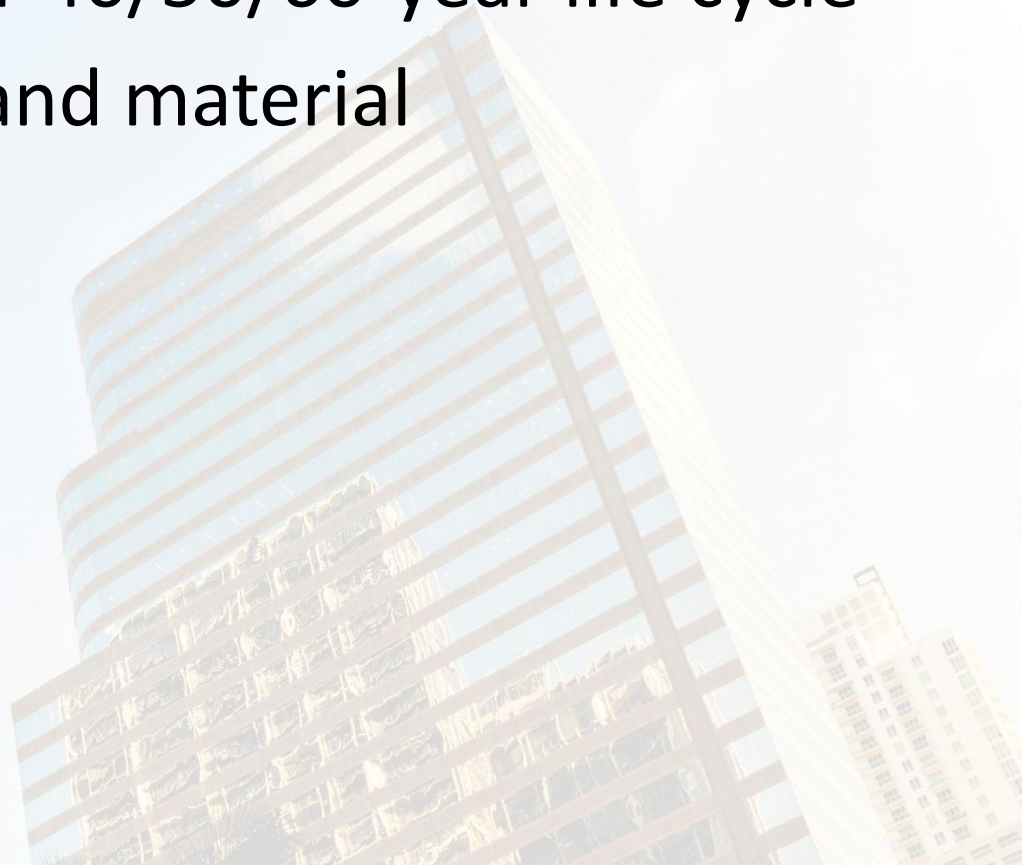
# LCA of Commercial Buildings and its relevance to GHG Accounting



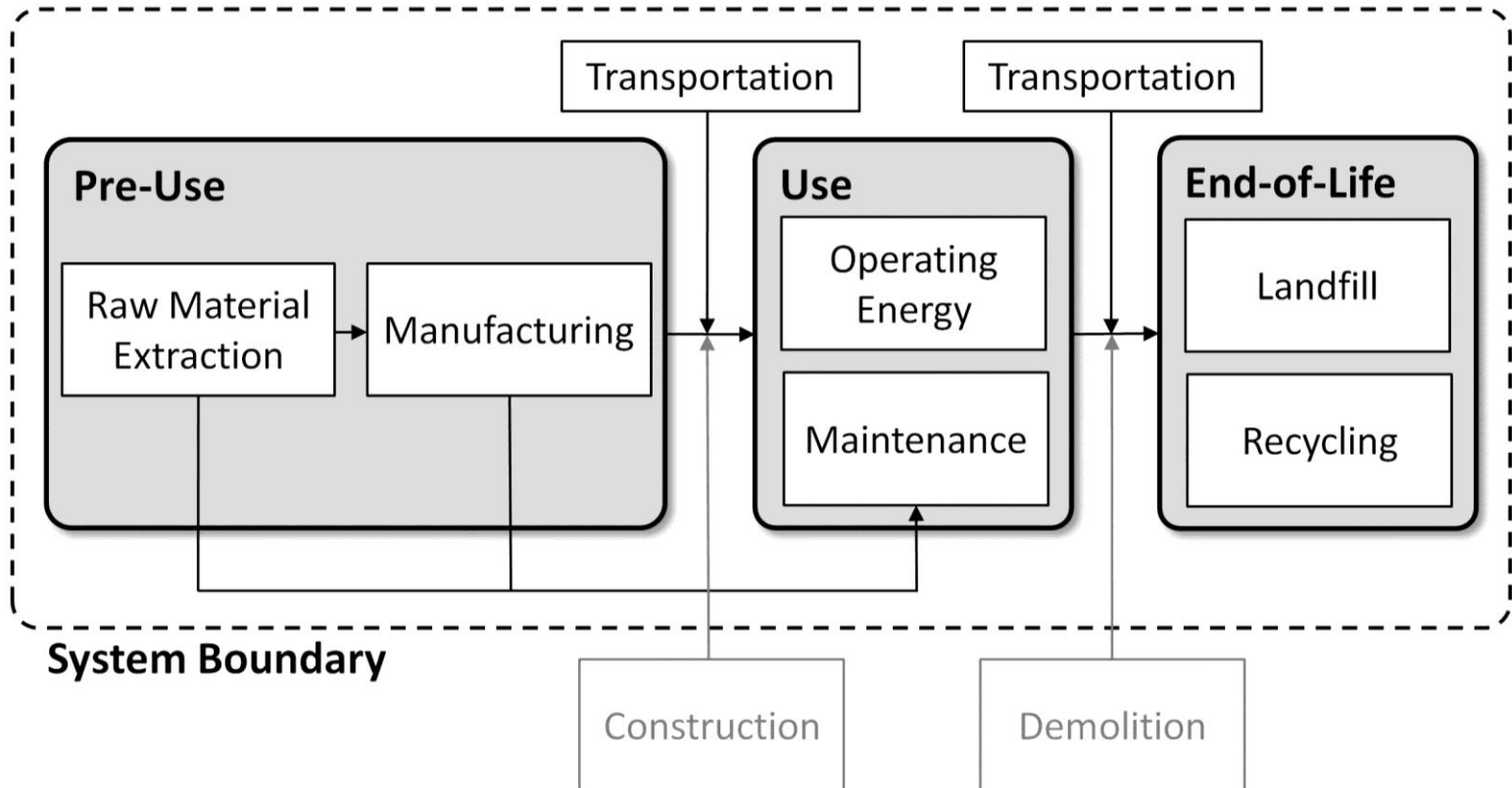
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# LCA Coverage

- Embodied energy
- Operating energy for 40/50/60-year life cycle
- Retrofitting energy and material
- Salvage

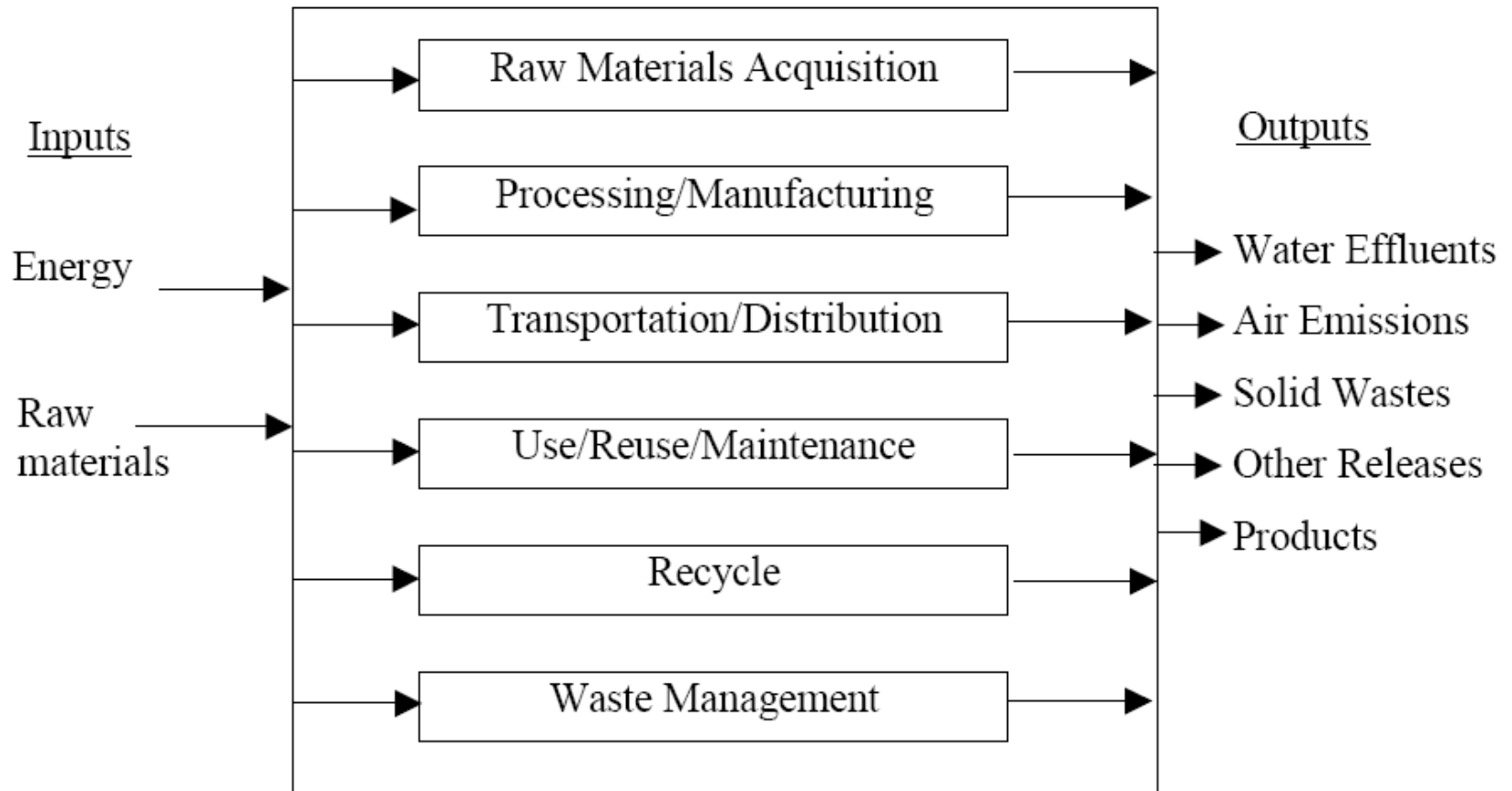


# Defining Boundaries



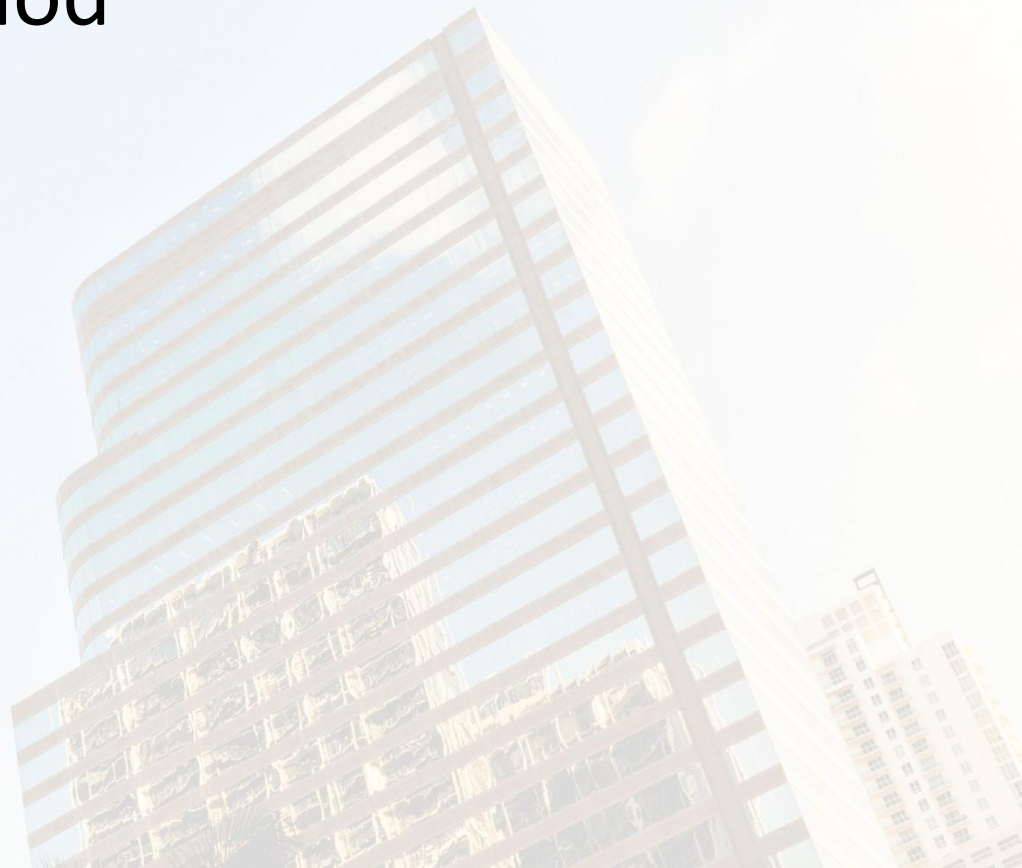
Source: MIT Research, USA

# LCA approach



# Three Major Approaches

- Process chain analysis
- Input-output method
- Material balance



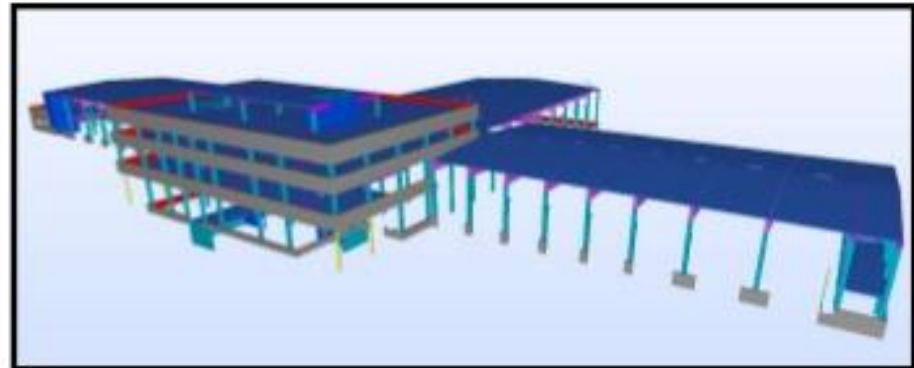


# LCA process

## LCA PROCESS (SIMPLIFIED)

1. Construction material bill of quantities (BIM)
2. Assumptions and best estimates:
  - Transportation distances, maintenance & EOL scenarios...
3. Modelling of product system in LCA software tools
  - **Embodied life cycle impacts**
4. Energy simulations
  - Operational energy use
5. Emission factors
  - **Operational impacts**
  - **Total LCA results**

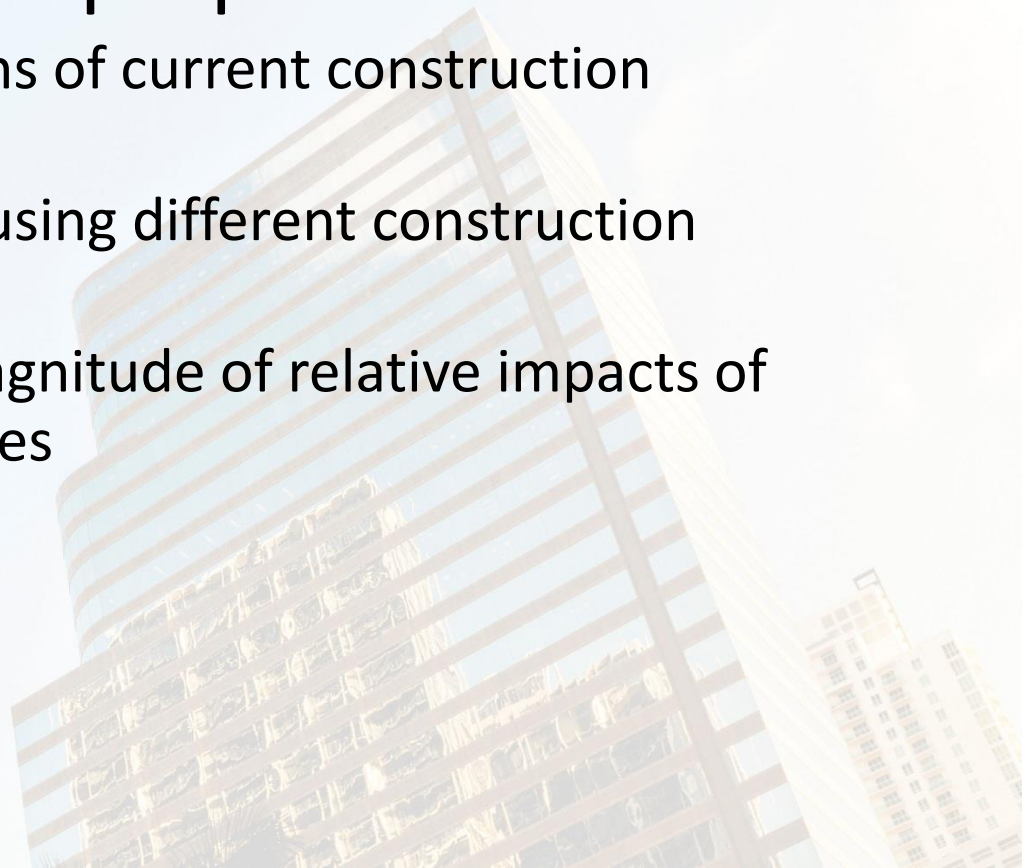
RAMBOLL



# Importance of GHG Accounting

Global warming potential (CO<sub>2</sub> equivalent) quantified for several purposes

- Benchmarking emissions of current construction practices
- Comparing impacts of using different construction materials
- Understand relative magnitude of relative impacts of different life cycle phases



# Important is

- Transparency of data
- Define scope
- Identify system boundaries
- Define functional unit



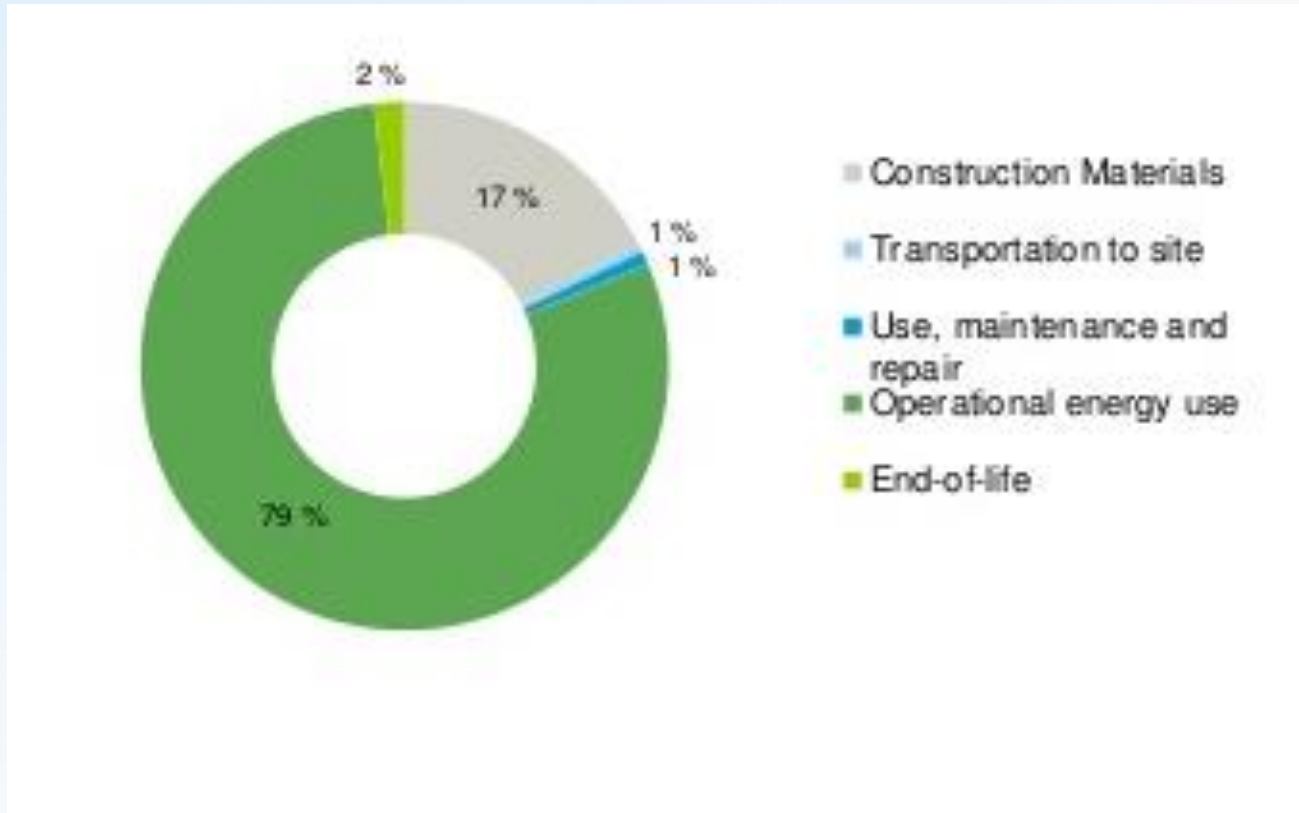


# Example of Glass

- Usually talked about
- Lot of variations
- Can save significant operational energy
- What is baseline for comparison



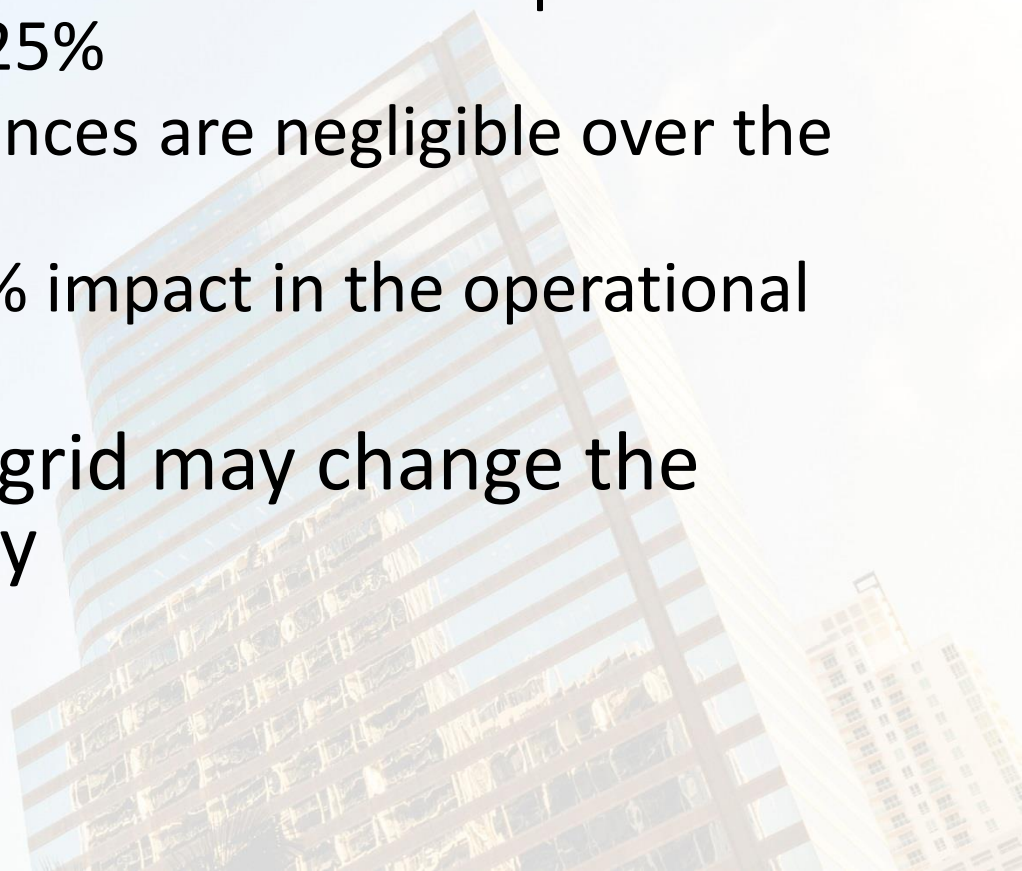
# Indicative LCA results



Source: Johanna Mero, WBC16

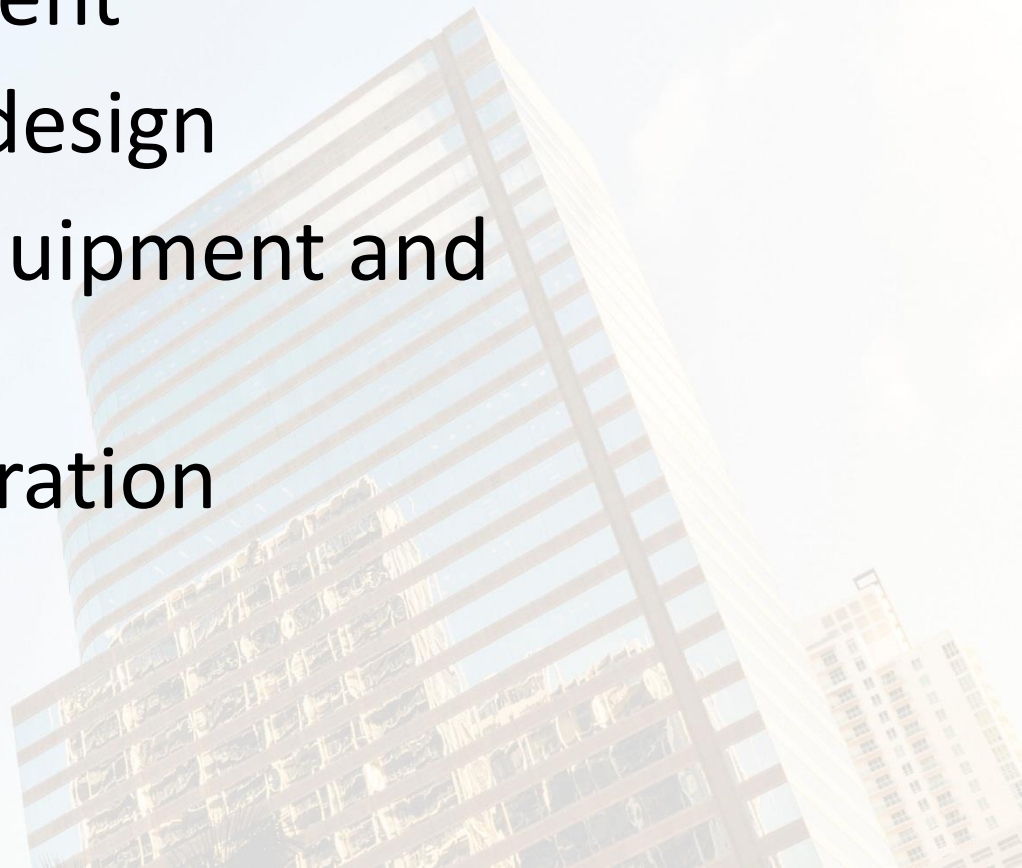
# Locational variations

- Has significant impact on the life cycle
- Assuming 40-year lifetime
  - Difference in GWP between different parts of India can be about 25%
  - Transportation distances are negligible over the total life cycle
  - HVAC has about 50% impact in the operational energy use
- Renewable share in grid may change the numbers significantly

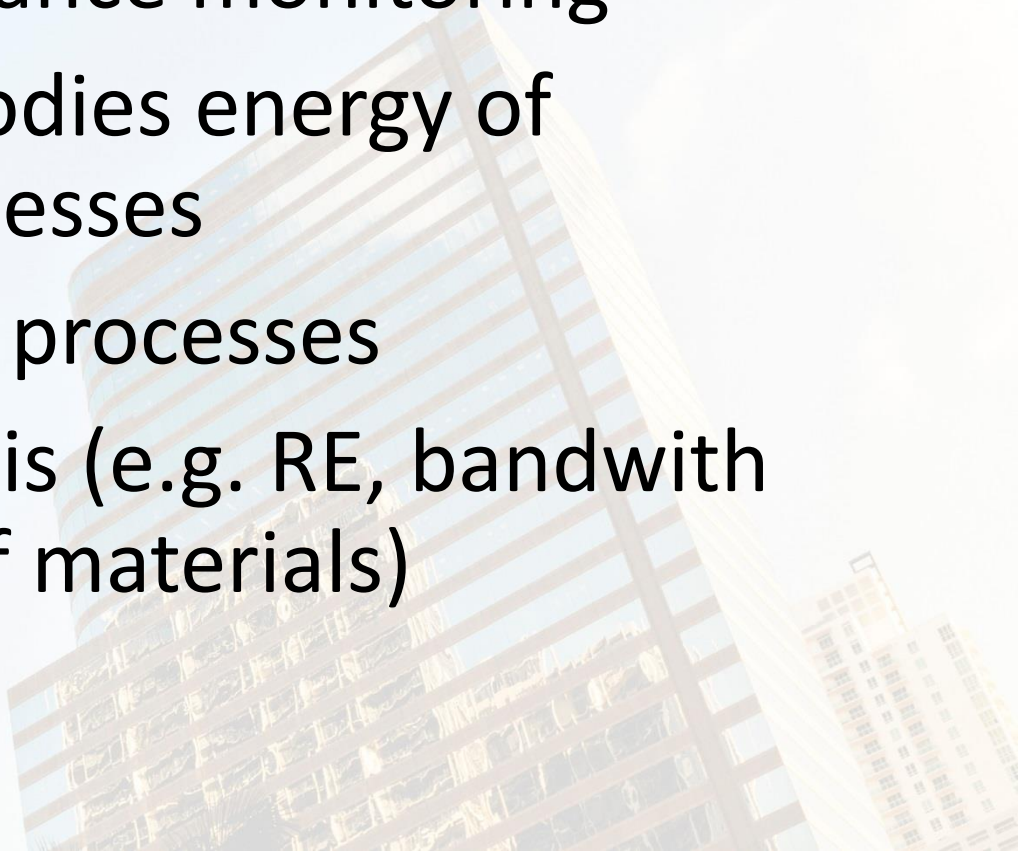


# Life Cycle Impact Reduction Approaches

- Use less energy intensive materials
- High recycled content
- Material efficient design
- Energy efficient equipment and appliances
- Monitoring of operation



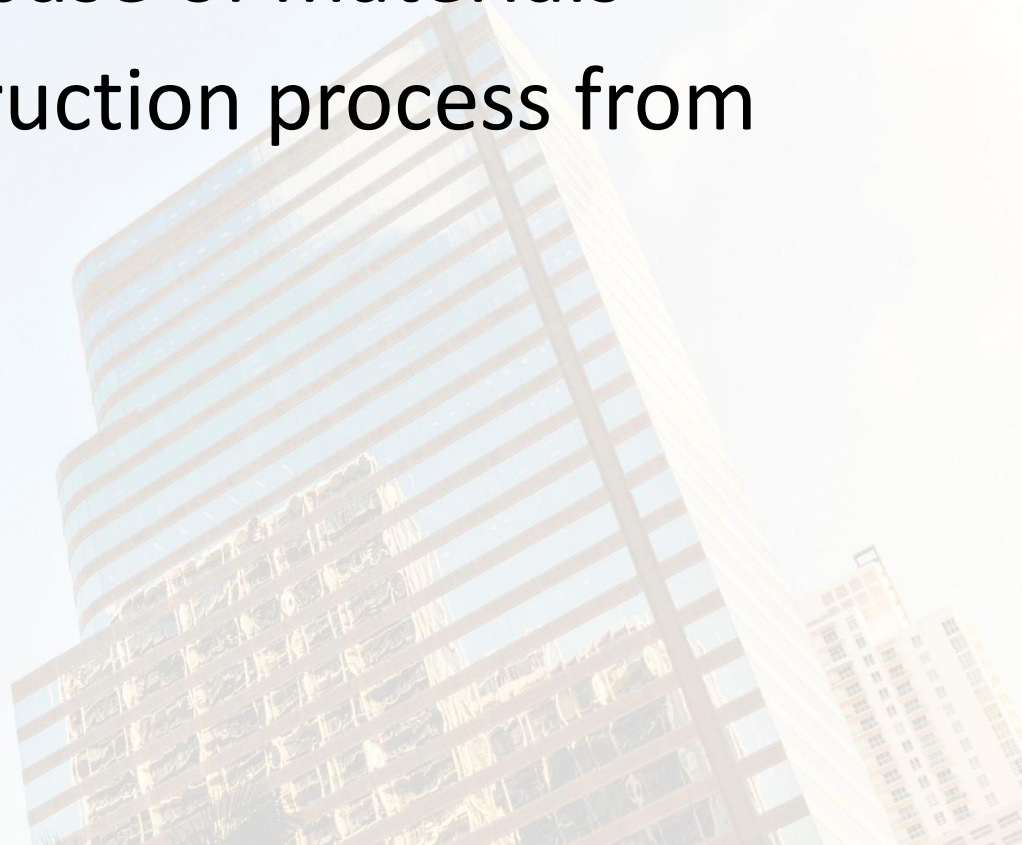
# Requirements for accounting

- Benchmarking
  - Verifiable performance monitoring
  - Database for embodied energy of materials and processes
  - Standardisation of processes
  - Uncertainty analysis (e.g. RE, bandwidth emission factors of materials)
- 



# Way forward

- Define standard LCA methodology
- Enhance LCA database of materials
- Standardise construction process from LCA point of view



**Thanks!!**

