

IEooc_Methods2_Exercise3: Energy and buildings - a global perspective

Goal: Get to know the orders of magnitude of scope 1+2 GHG, energy use, and services in the residential building sector in different countries; practice systems thinking and quantitative systems analysis; work with system definitions and scope 1-2 emissions; stock-flow-service nexus.

Background: Buildings are a major source of greenhouse gas (GHG) emissions, responsible for about 40% of global energy-related emissions, driven by energy used for heating, cooling, and power, as well as construction and demolition. To mitigate this, efforts focus on improving energy efficiency and reducing energy consumption through measures like better insulation, updated HVAC systems, and promoting energy-saving habits.

Per capita building area and energy consumption varies substantially across countries, and in the accompanying workbook, we show datasets on the residential building stock-flow services nexus profiles for 6 countries:

- m²/cap residential floorspace
- residential final energy per m² (for all building energy services)
- % of final energy in residential buildings by end-use type (heating, cooling, appliances, cooking, lighting)
- % of final energy in residential buildings by energy carrier
- GHG intensity by carrier and by country-specific electricity mix

Tasks:

- 1) Develop a MEFA system definition for building energy services, energy supply, and scope 1+2 GHG! GHG can be treated as extension (GHG layer of energy flows), no mass-balanced approach with carbon as indicator element is needed here.
- 2) Quantify the system variables in that system definition: energy flows and scope 1+2 GHG emission flows for the given per capita profiles for 6 countries and a hypothetical population of 1 million (or any other number that you want to scale up to).
- 3) Think about and discuss which countries the six anonymous datasets may apply to and why!
- 4) Develop a simple but plausible decoupling scenario for the residential building stock-flow-service nexus for each of the six countries! Include changes for at least two parameters in the nexus. (Optional: Calculate the resulting changes in GHG emissions.)