Dynamic Life Cycle Assessment of Electricity Demand in Swiss Buildings

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WHY
- The environmental assessment of the Swiss consumed electricity is based currently on average annual statistics of energy flows
- This modelling simplification raises concerns because:
  - The environmental impacts of the Swiss electricity mix varies substantially throughout the year
  - The buildings’ energy consumption also fluctuates but rarely with similar trends
  - It is therefore necessary to investigate how this mismatch between production and consumption can influence the impacts of building uses (or charging of electric vehicles)

WHAT
- To consider the dynamics of energy flows when assessing the life cycle environmental impacts of buildings
- To evaluate how the environmental impacts of the Swiss electricity mix evolve on a hourly basis
- To analyse how different time resolutions might affect the environmental assessments of energy demands in buildings

WHO
- School of Management and Engineering Vaud (HES-SO / HEIG-VD – project leader)
- Swiss Federal Laboratories for Materials Science and Technology (Empa)
- Scuola Universitaria Professionale della Svizzera Italiana (SUPSI)
- Advisory board: ecoinvent, PSI, ETHZ, EWZ, Stadt Zürich - Amt für Hochbauten

KEY RESULTS
- Carbon footprint of the Swiss consumed electricity:
  - Winter peaks are mainly explained by high imports from neighbouring countries
  - High impact of the imported electricity
  - Lower values for Spring & Summer are linked to indigenous electricity production
  - Swiss national production has a low impact (but can not supply alone the winter demand), the impacts are driven by imports
  - Performing hourly assessments every year would be necessary to identify the influence of the energy turnaround

HOW
Three-step approach:
1. Collect data on hourly electricity production mixes for Switzerland & neighbouring countries (Big data approach)
2. Model the hourly Swiss electricity supply mix with imports & characterise its environmental impacts
3. Collect data regarding buildings’ electricity demand per usage & decentralised electricity production (monitoring approach)

Environmental impacts of the building electricity demand per usage and for various time step known
Variability of the electricity impact characterized and proposal to reduce the building energy demand environmental footprints

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