

Re-thinking sustainable systems architectures: the role of rebound effects prevention

A hands-on workshop with simulation-based insights – 2 hours and 45 minutes

Systems engineers are masters of balancing trade-offs, yet sustainability often remains an afterthought, faced as a reporting requirement rather than engineered into the core. As we integrate technologies into increasingly complex socio-technical systems, how do we prevent localised efficiency gains from triggering rebound effects that erode our sustainability goals?

This interactive workshop explores rebound effects as emergent phenomena in complex socio-technical systems, using simulation as a central learning tool. Building on the REBOUNDLESS framework, participants engage with a reusable packaging case to identify potential rebound mechanisms and examine the effectiveness of mitigation strategies. Each analytical step is paired with live simulation, allowing participants to compare their assumptions with dynamic system behaviour and uncover rebound effects over time. By combining hands-on group work with simulation-based insights, the workshop demonstrates how system dynamics can support rebound-aware sustainability design and research.

Who should join

Systems engineers, architects, and technical leads tasked with embedding sustainability as a core design requirement, as well as those seeking rigorous, model-based approaches to validate systemic sustainability outcomes against evolving requirements throughout the entire project lifecycle.

What you'll do

- Analyse a reusable packaging case study using the structural lenses of the REBOUNDLESS framework.
- Identify the latent feedback mechanisms and causal loops that cause rebound effects.
- Examine the effect of different intervention configurations using a System Dynamics simulation model.
- Discuss the use of simulation models to investigate complex system dynamics.

Agenda (2 hours and 45 minutes*):

- Framing the problem: rebound effects and the packaging case study
- Active session 1: Analysing the intervention using the REBOUNDLESS framework and simulation model
- Active session 2: Uncovering rebound mechanisms and their effects
- Active session 3: Preventing rebound effects: strategies and effectiveness
- Wrap-up, next steps: Discussing the use of simulation models to investigate complex systems dynamics

* A 10 min Networking Break is planned for the activity

What you'll leave with

Familiarity with the REBOUNDLESS framework for rebound effects identification, simulation and prevention. Understanding of the mechanisms eroding sustainability benefits. Potential collaboration within rebound effects, system dynamics and beyond.

Format: Alternating sequences of collaborative causal mapping (using physical cards or digital boards) and live model execution. **Duration:** 2 hours and 45 minutes. **Bring:** both your passion and systemic thinking.

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