Integration of Detailed Electricity Grid and Sector-Coupled Energy System Models: Nexus-e Engages with SecMOD

Work package 1: Pathways on a national and international scale
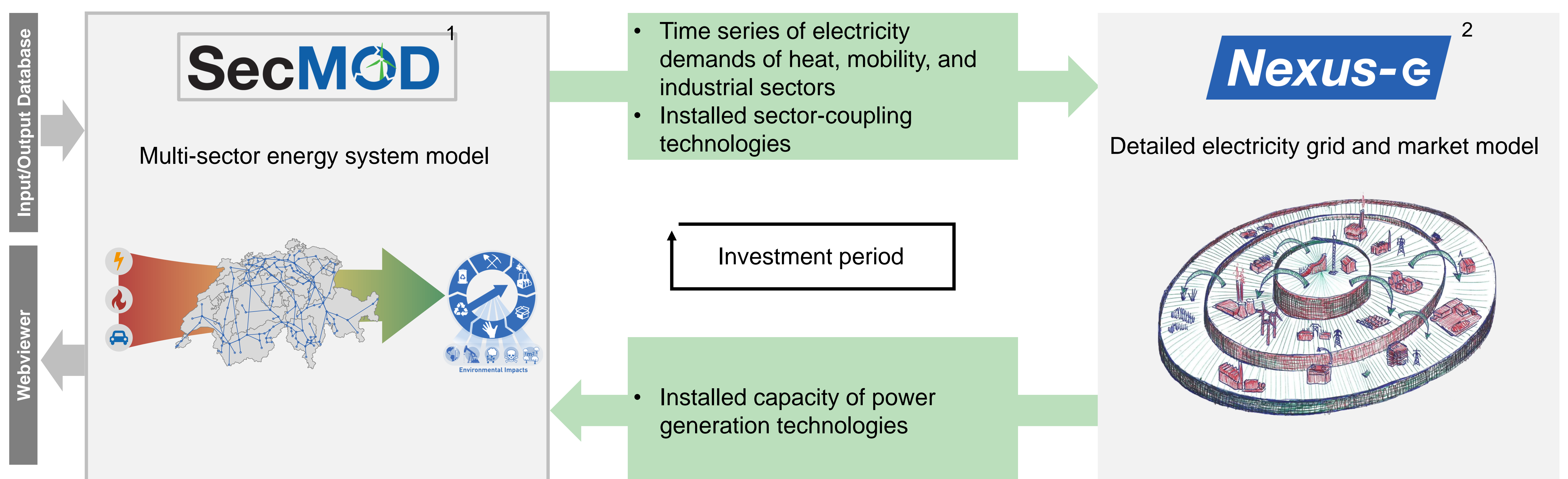
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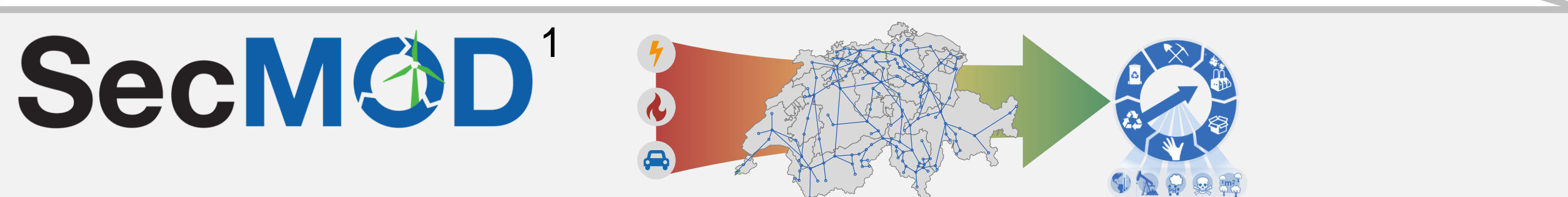[2]Research Center for Energy Networks, ETH Zurich
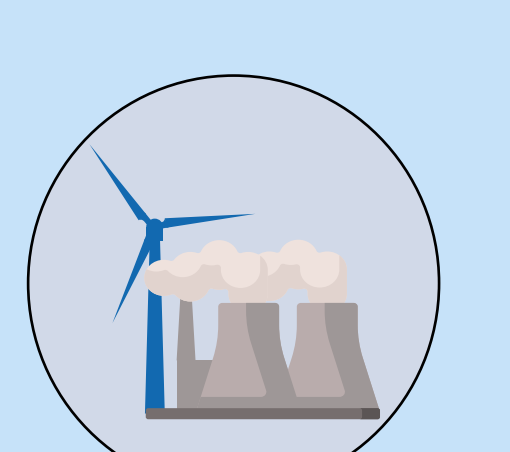[3]Energy Science Center, ETH Zurich

Energy and Process System Engineering, Research Center for Energy Networks and Energy Science Center proudly announce the engagement of

SecMOD[1] — Multi-sector energy system model

- Time series of electricity demands of heat, mobility, and industrial sectors
- Installed sector-coupling technologies

Nexus-e[2] — Detailed electricity grid and market model

Investment period

- Installed capacity of power generation technologies

Input/Output Database

Webviewer

SecMOD[1]

Multi-energy systems optimization

Life cycle assessment

- Framework for optimization & life cycle assessment of sector-coupled energy systems
- Multi-sector energy demands: electricity, residential, transport, industry
- Investment decisions & operation
- Holistic assessment of environmental impacts
- Open-source available
- Case study for Germany, Switzerland, EU, steel plant, etc.

Progress of the integration

Done	Busy	To Do
Align SecMOD to grid of Nexus-e	Add neighboring countries in SecMOD as in Nexus-e	Connect SecMOD and Nexus-e technically
Model Swiss heating, transport, and industry demands in SecMOD	Implement temporal disaggregation of SecMOD's optimization results	Calculate sector-coupled transition pathways for CROSS scenarios
Implement spatial aggregation and disaggregation in SecMOD	Align data	Evaluate pathways holistically

Questions to be answered by the connection

- How can supply and demand be balanced? What flexibility options are needed?
- How does an increased sector coupling affect the electricity system in future energy systems in detail?
- Is sector-coupling a challenge or a chance for the electricity system?
- How do the results of a detailed electricity system model differ from the results of a less detailed but sector-coupled energy system model?
- Are there environmental co-benefits or environmental burden shifting in a transition to net-zero?

REFERENCES

1 Reinert C., Schellhas L., Mannhardt J., Shu D. Y., Kämper A, Baumgärtner N., Deutz S., Bardow A. (2022). SecMOD: An Open-Source Modular Framework Combining Multi-Sector System Optimization and Life-Cycle Assessment. Frontiers in Energy Research, 10, 884525.

2 Gjorgiev B., Garrison J. B., Han X., Landis F., van Nieuwkoop R., Raycheva E., Schwarz M., Yan X., Demiray T., Hug G., Sansavini G., Schaffner C. (2022). Nexus-e: A platform of interfaced high-resolution models for energy-economic assessments of future electricity systems. Applied Energy, 307, 118193.