

FIPSE-6 Short Presentation 1a

Assessing sustainability in energy and industry transition to net-zero: the role of critical raw materials

Fabrizio Bezzo,
CAPE-Lab, Department of Industrial Engineering,
University of Padova, Italy

ABSTRACT

The transition of the chemical and process industry towards decarbonisation and sustainable production represents quite an unprecedented technological revolution. The PSE community has a pivotal role in this paradigm change as it is primarily up to this community to deliver modeling and computational methods to quantify the impact of the forthcoming change and to guide investors and policymakers toward the most effective routes. However, the path to a low-carbon economy challenges several traditional PSE tools and approaches. One key issue is concerned with the sustainability of new unit operations and new technologies for sustainable energy generation and storage, with reference to their “hunger” for critical materials. Building solar photovoltaic plants, wind farms, and electric vehicles requires more minerals than their fossil fuel-based counterparts.

Assessing the environmental and social impact of critical materials processing and usage is far from trivial:

- Many raw critical materials are extracted and processed in regions where data are often scarce and/or of questionable reliability.
- Recycling processes are sorely needed to increase security and reduce external supply; however, technology is far from mature and based on non-standard unit operations, for which validated models do not exist.
- Knowledge of solid-based processes and particle technology is essential to represent the recycling, transport, and manufacturing of goods, where critical materials are involved.
- Many critical materials are processed in very small quantities, and this makes the quantification of sustainability metrics even more uncertain and easy to “stretch” towards these set a-priori.

The consequence is a dramatic increase in uncertainty jeopardising the current reliability of model forecasts. There is a double challenge for the PSE community. On the one side, there is the need to start from fundamentals and build libraries to bridge the gap between customised models based on the developer’s expertise and standard simulation models. On the other side, we advocate for effective methods capable of incorporating uncertainty and yet providing meaningful results to decision-makers.

To go back to the FIPSE-6 Scientific Program, click [HERE](#).