IMPROVING PROCESS INTEGRATION POSSIBILITIES
IN ESOM:s - TOWARDS SITE BASED MODELLING

Erik Sandberg
Luleå University of Technology
erik.sandberg@ltu.se

WHY?

The industry has historically been treated in a **simplified manner** in energy system models, but this is about to change, as more and more studies show the importance of decarbonizing the industry in order to meet tough climate targets. One of the primary strengths with bottom-up energy system models in general, and the TIMES/MARKAL modelling framework specific, is the possibility to have a detailed technology representation of energy sectors. Not applying this detailed representation consequently **undermines the strengths** of the model. Oversimplifying industrial process chains could eventually distort the specific energy use of each included process. **This work proposes a new representation** that includes a wider applied feedstock of industrial products and utilizes multiple process chain configurations, which allows for better implementation of new technologies.

HOW?

1. Industrial Production

The identification of different intermediate and end-use products is what forms the basic structure upon which all process chains are built. Identification of this wider applied feedstock was determined and categorized using official statistics following the CN-nomenclature.

2. Components / Processes

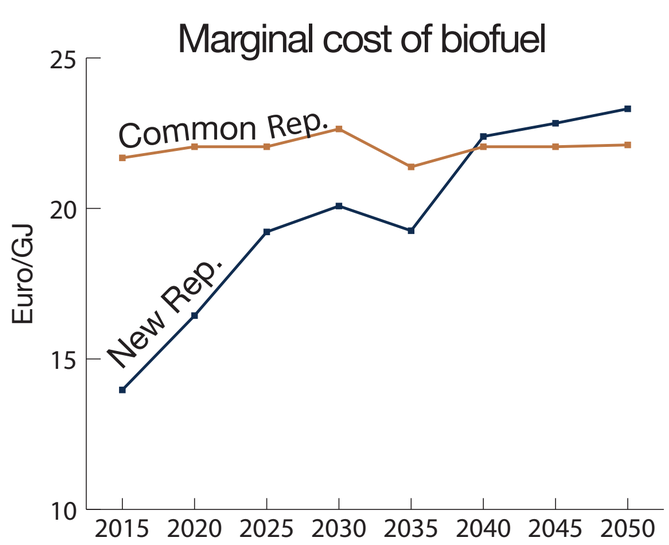
Each process is treated as componentof different process chains rather than a generic option for all production. This allows for improved matching of processes with products making the modelled processes to better align with technology benchmarks from the literature.

3. Building process chains

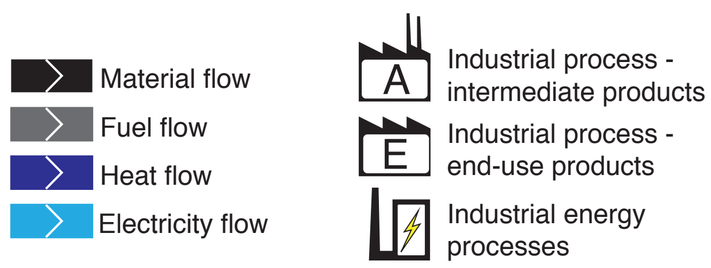
By matching produced materials with the required corresponding processes, a representative process chain is built. These could either be built using site specific data from e.g. environmental reports (the preferred way) or by assuming a common composition as identified from the previous step.

4. Apply to model

The proposed representation has been introduced to and tested in TIMES-Sweden. The studied case compares the production of biofuel using black liquor gasification in paper & pulp mills. The graph below shows the differences in marginal cost of the produced biofuel.



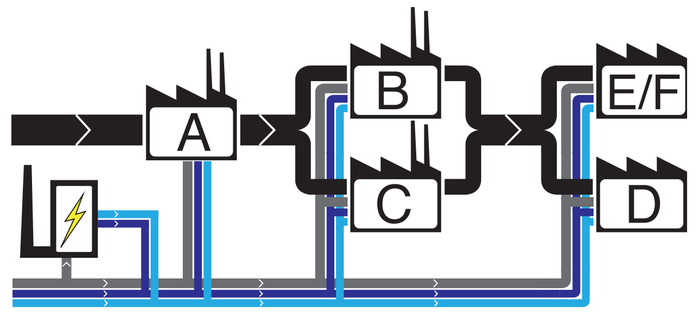
LULEÅ UNIVERSITY OF TECHNOLOGY



COMMON REPRESENTATION
(as often represented in current models)

Characteristics:

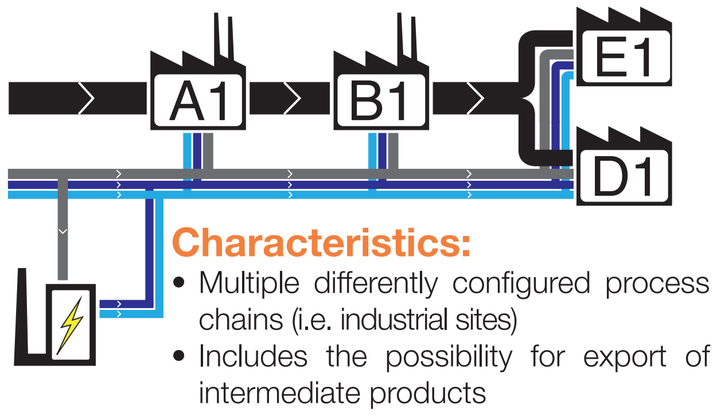
- Industries represented as one homogenous process chain
- Often assuming that all material becomes the end use product
- Assuming an aggregated pool of end use products



When calibrating the model with statistics, the modeller is left out with the following options to get convergence.

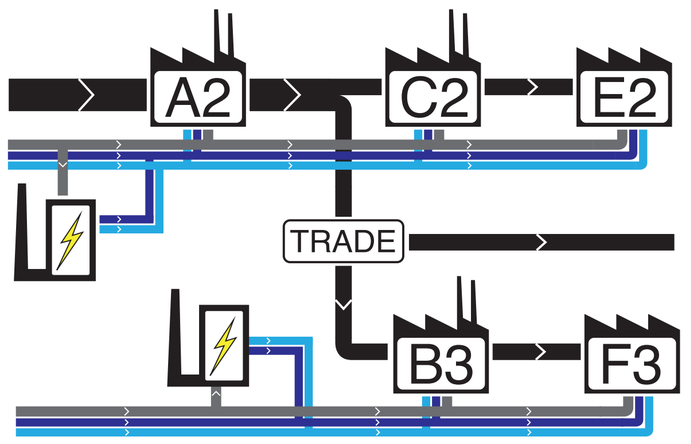
- **Over- or underestimate** the flow of **materials** and intermediate products required for producing end-use products
- **Under- or overestimate** the flow of **energy** for producing a given material

PROPOSED REPRESENTATION



Characteristics:

- Multiple differently configured process chains (i.e. industrial sites)
- Includes the possibility for export of intermediate products
- A wider variety of intermediate and end-use products



The new representation gives the modeller more freedom when trying to make the model converge with statistics and allows for:

- **Better matching** with **technology benchmark** values, which allows for easier traceability of assumptions.
- **Better scaling** of **energy** flows and costs for new technologies (i.e. improved process integration possibilities).