

## Capabilities For Modelling Of Conversion Processes In Life Cycle Assessment

**Damgaard, Anders; Zarrin, Bahram; Tonini, Davide; Baumeister, Hubert; Astrup, Thomas Fruergaard**

*Publication date:*  
2015

*Document Version*  
Peer reviewed version

[Link back to DTU Orbit](#)

*Citation (APA):*

Damgaard, A., Zarrin, B., Tonini, D., Baumeister, H., & Astrup, T. F. (2015). Capabilities For Modelling Of Conversion Processes In Life Cycle Assessment. Abstract from Sardinia 2015 - 15th International Waste Management and Landfill Symposium, Cagliari, Italy.

### DTU Library

Technical Information Center of Denmark

---

#### General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

## CAPABILITIES FOR MODELLING OF CONVERSION PROCESSES IN LIFE CYCLE ASSESSMENT

A. DAMGAARD\*, B. ZARRIN\*\*, D. TONINI\*, H. BAUMEISTER\*\*, T. ASTRUP\*

*\*Department of Environmental Engineering, Technical University of Denmark, Miljoevej, B. 113, 2800 Kgs. Lyngby, Denmark*

*\*\*Department of Applied Mathematics and Computer Science, Technical University of Denmark, Miljoevej, B. 113, 2800 Kgs. Lyngby, Denmark*

Life cycle assessment was traditionally used for modelling of product design and optimization. This is also seen in the conventional LCA software which is optimized for the modelling of single materials streams of a homogeneous nature that is assembled into a final product. There has therefore been little focus on the chemical composition of the functional flows, as flows in the models have mainly been tracked on a mass basis, as emphasis was the function of the product and not the chemical composition of said product.

Conversely, in modelling of environmental technologies, such as wastewater treatment and waste management, the material being addressed is of a very heterogeneous nature. This heterogeneity is seen both between treatment facilities receiving materials with different compositions, but also at the individual treatment facility where the temporal composition of a treated material varies considerably. To address this, EASETECH (Clavreul et al., 2014) was developed which integrates a matrix approach for the reference flow which contains the full chemical composition for different material fractions, and also the number of different material fractions present in the overall mass being handled. These chemical substances can then be traced through the different processes similarly to substance flow assessment, but with the added options to address emissions, material and energy usage through each process step.

However, it was found that further capabilities were needed, when considering how the biochemical parameters change through a process chain. A good example of this is bio-refinery processes where different residual biomass products are converted through different steps into the final energy product. Here it is necessary to know the stoichiometry of the different products going in, and being able to set constraints for a possible flow on basis of other flows, and also do return flows for some material streams. We have therefore developed a new editor for the EASETECH software, which allows the user to make specific process modules where the actual chemical conversion processes can be modelled and then integrated into the overall LCA model. This allows for flexible modules which automatically will adjust the material flows and the conversion takes places in processes on basis of its chemical information, which can be set for multiple input materials at the same time. A case example of this was carried out for a bio-refinery process, and the result of this case studied will be used to exemplify the use of the new process editor.

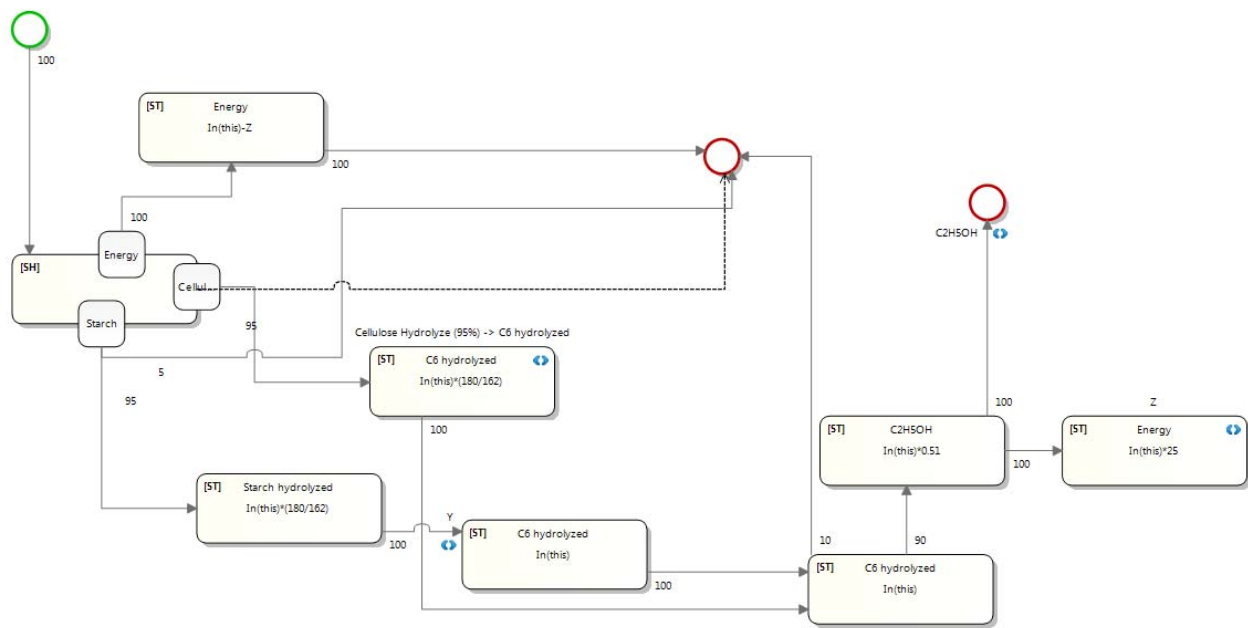


Fig.1 Example of Process modelled in the new editor, as part of the bio-refinery technology

References:

Clavreul, J., Baumeister, H., Christensen, T.H., Damgaard, A. 2014. An environmental assessment system for environmental technologies. *Environmental Modelling & Software* 60: 18–30