Integration of LCA in a thermo-economic model for synthetic natural gas production from woody biomass

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1. Context
Conventional LCAs (Life Cycle Assessment) for emerging technologies, such as biofuels, are based on average technology at development stage and at pilot-scale. Therefore, the effects on the LCA of changes in process design, technology evolution and scaling are not considered. Moreover, conventional LCA cannot be used by engineers as a design tool.

2. Objectives
For the production of SNG (synthetic natural gas) from residual wood:
- Adapt life cycle inventory (LCI) to process design and scale, by writing a LCA model linked to the parameters of an existing thermo-economic model.
- Use the model for multi-objective optimization, to study the effects of economic optimization and scaling on environmental impacts.

3. Methodology

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4. Results
Following graphs show an example of environmental impact variation for an optimization having costs as objective, at multiple scale. Environomic trade-offs existing at fixed scale have yet to be investigated.

5. Conclusions and perspectives
The present work demonstrated that changes in process design and scale affect the environmental impacts, and can influence the decisions taken with the use of the LCA. Moreover, it opens the possibility for engineers to use thermo-environomic models at the conception stage to take into account environmental aspects in addition to economic and thermo-dynamic aspects when searching for optimal process configurations. The developed method to link LCA with design may be applied to other technologies in the field of energy production.