DTU Management Engineering
Department of Management Engineering
Section for Quantitative Sustainability Assessment

Innovative method to optimize territorial organic waste resources – part I Electricity

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AIM

- To test a multi-level approach (technical, territorial, regional) capable of handling the variability of background systems in time
- To show the effects of different forecasted energy grid scenarios on the overall climate change impact potential of a new technology

METHOD

- Two simplified technology scenarios were modelled in openLCA
  - Biogas: Classic anaerobic digestion (AD)
  - PHA: AD with polyhydroxyalkanoates (PHA) production
  - The Functional Unit (FU): 1 ton of feedstock with a composition of 50% liquid cow manure, 15% solid cow manure, and 35% wine pomace
- Four forecast scenarios for the French government[3] were used to vary the background energy grid
- Impact pressure in terms of climate change potential, from all induced and avoided electricity consumption in the scenarios was then modelled dynamically
- Midpoint ReCiPe Hierarchist was used as LCIA

CONCLUSIONS

- Dynamic results provide a more complete picture of the emerging technology's future impact, and were opposite to static results
- Static results are potentially biased by the status quo and can potentially provide unreliable decision support
- Future research will focus on extending dynamism to other areas of the background and foreground systems and more

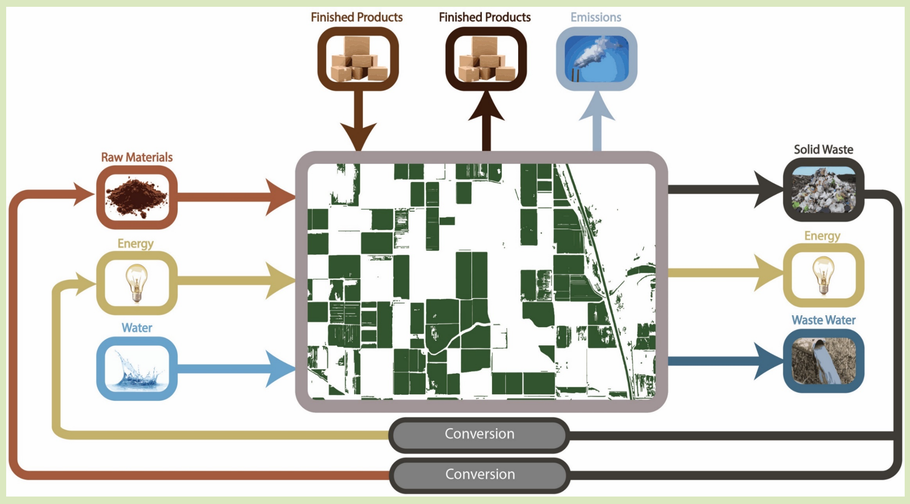
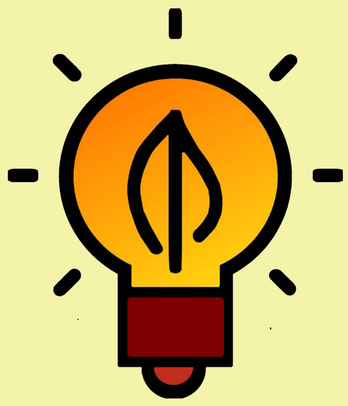


Figure 1. Conceptual image of territorial assessment of producing territories with circular optimization of waste resources

RESULTS

BIOGAS ONLY



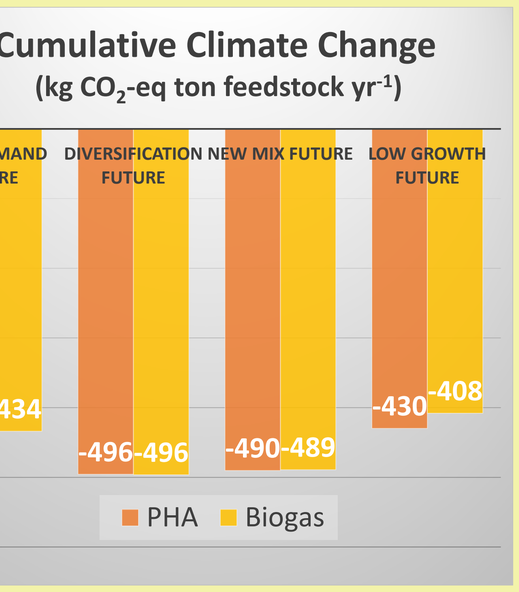


Figure 2. Cumulative climate change savings in kg-CO_2 equivalent FU^{-1} for the 20 year period of the dynamic assessment.

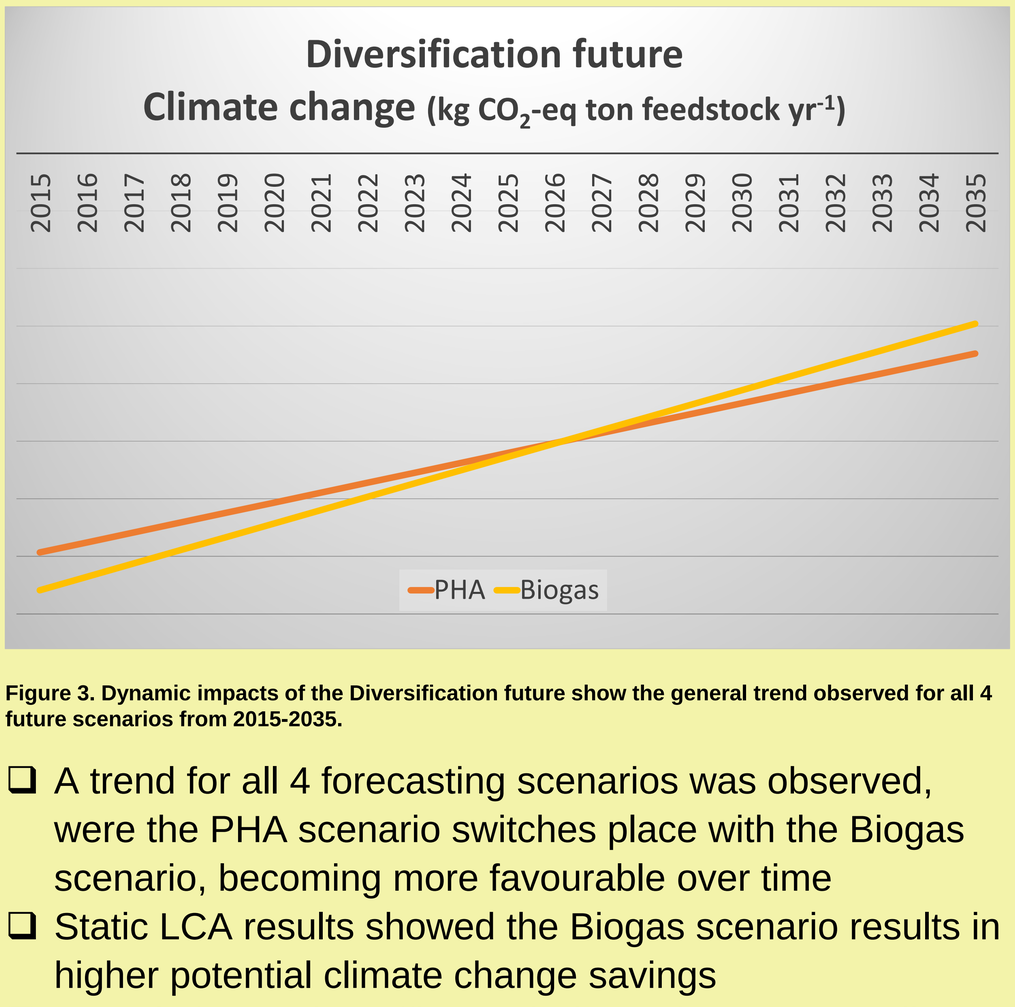


Figure 3. Dynamic impacts of the Diversification future show the general trend observed for all 4 future scenarios from 2015-2035.

- A trend for all 4 forecasting scenarios was observed, were the PHA scenario switches place with the Biogas scenario, becoming more favourable over time
- Static LCA results showed the Biogas scenario results in higher potential climate change savings
- Cumulative savings (figure 2) showed PHA generally results in higher savings over the long run, with the exception of the New Mix Future

INTEGRATED BIOGAS AND PHA PRODUCTION

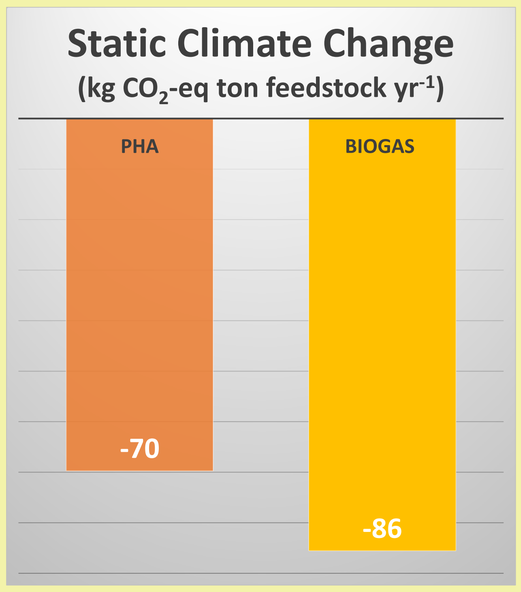


Figure 4. Climate change results for today's energy-grid show Biogas performs best in this impact category.

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3 Reference: *2014 EDITION GENERATION ADEQUACY REPORT on the electricity supply-demand balance in France.* https://www.rte-france.com/sites/default/files/2014_generation_adequacy_report.pdf

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