

"CLEANER PRODUCTION INITIATIVES AND CHALLENGES FOR A SUSTAINABLE WORLD"

Organic waste, residues and by-products from agricultural, industrial and urban systems as biorefinery substrates: Viable Option or Fairie Tale? An application of SUMMA (SUstainability Multi-method Multi-scale Assessment)

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Our societies are day by day overwhelmed by increasing amounts of organic waste materials, from agricultural, industrial and urban systems. Solutions to safely dispose of these waste materials are most often not easy, not cheap, not environmentally friendly. New strategies for prevention, recycling, and conversion of waste to useful products are urgently needed and call for the ability to evaluate the feasibility and profitability of proposed solutions, from several points of view, in order to take into proper account the economic, energetic, environmental and social sustainability.

SUMMA (SUstainability Multi-method Multi-scale Assessment), a performance evaluation tool, capable to provide an integrated assessment of technological, energy and environmental processes across time and spatial scale, is applied to a biorefinery system design aimed at usefully converting organic residues into bioenergy and biochemicals, in order to test the feasibility of the model as well as identify bottlenecks and improvement opportunities. The approach is based on the joint and consistent application of material, energy, exergy, economic and emergy methods, at local, regional and global scales, and provides a set of efficiency, feasibility and environmental sustainability indicators in support to sound policy making.

Results indicate first of all the importance of preventing waste generation. Integrated clusters of production and consumption processes must be properly designed in order to make the biorefinery feasible and viable. Short distances, transfer infrastructures, and proper exchange of still usable resources according to their information content and chemical characteristics are all crucial to a successful strategy.

The emergy synthesis method, integrated in SUMMA, projects the assessment to the global scale of the biosphere, providing a sustainability check that complements economic and LCA evaluations.