

The Performance Measures of Agro-Energy Production Chains: The Grape Pomace Case

Topic: Environmental IO models 1

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The design and implementation of agro-energy production chains (APCs) raise some important questions about their economic, environmental, and social sustainability, related to spatial (e.g. land dispersion), environmental (e.g. the exploitation of land and natural resources), economic (e.g. competition in energy markets) and ethical (e.g. increased food prices) aspects. Therefore, suitable key performance indicators need to be provided in order to evaluate the effectiveness and efficiency of agro-energy production, from the economic, environmental, and social points of view.

With this regard, in this paper, an Enterprise Input-Output (EIO) approach is adopted to trace both the material/energy/waste and monetary flows of an APC which is represented as a network of processes. In particular, we measure some performance indicators such as total chain profit, CO₂ emissions, reduced waste, net energy balance, and creation of green jobs.

Considering that (local) government incentives are widely seen as stimulating factors to promote the implementation of such APCs, the proposed model will be applied to the case study of bioenergy production from grape pomace, which can be an important second generation biomass source in the Apulia region, Italy.

In particular, three types of APC are considered in the case study: (1) food/beverage-oriented chain (e.g. the grape pomace is addressed to beverage production, such as liquors), (2) biogas-oriented chain (e.g. the grape pomace is addressed to biogas production), and (3) electricity-oriented chain (e.g. the grape pomace is addressed to electricity production via biogas and/or solid biomass).

In the case study, a particular attention is given to transportation issues (e.g. maximum feasible distance between cultivation areas and bioethanol production units) due to the fact that highly dispersed cultivation areas reduce the environmental and economic performance of APCs.

Results of the study can be stimulating for local governments to sustain APCs by suitable policies and incentives to the different actors and stakeholders of the chain.

Keywords: agro-energy production chain, economic and environmental performance, enterprise input-output, energy policy, biogas, grape pomace