MODELLING THE IMPACTS OF POLICIES ON MICROALGAE BIOFUEL FEEDSTOCKS DIFFUSION

Lauro André Ribeiro

MIT Portugal Program - Sustainable Energy Systems, INESCC, Faculty of Sciences and Technology, University of Coimbra, Sílvio Lima Street, Pólo II, 3030-790 Coimbra, Portugal
Phone: + 351 23 985 1040/9; Fax.: + 351 23 982 4692, e-mail: lribeiro@inescc.pt

Patrícia Pereira da Silva

Faculty of Economics, University of Coimbra, INESCC, Initiative energy for Sustainability
e-mail: patsilva@fe.uc.pt

Leila Ribeiro

Institute of Informatics, Federal University of Rio Grande do Sul, Brazil
e-mail: leila@inf.ufrgs.br

Fernando Luís Dotti

Computer Science Department, Catholic University of Rio Grande do Sul ,Brazil
e-mail: leila@inf.ufrgs.br

Overview

The proposed study aims to analyze the market share penetration of cultivating microalgae with biofuel production and assess the economical, political and technological factors critical to the diffusion of this emerging biofuel feedstock.

Methods

In order to reach feasible future market share data on transportation fuels, this study is divided in three categories. The first one handles economic policies, the second focuses on processes of technological diffusion of emerging technologies, and finally the third category models possible scenarios of transportation fuels within this market. For the first category, a research is be presented to point out the main European policies concerning advanced biofuels that could replace the use of fossil fuels.
Strictly linked with the first, the second category of this study aims to provide information regarding the technology diffusion of recently found energetic pathways, in particular how they are developing and which are, or were, the main barriers found along their diffusion. The methods used in this paper include data compilation of previous and present energetic technologies that can be somehow be related to algae biofuels.
It is, therefore possible to develop a model and draw conclusions related to the most effective public policies and, moreover, build feasible scenarios that could in the future enhance the dissemination of this new technology.
Stochastic Automata Networks (SAN) is used to model these future scenarios. SAN is a structured formalism originally proposed by Plateau (1985) and it provides a high-level abstraction to represent continuous and discrete-time Markovian models. Thus, this study uses a software tool named SAN LITE-SOLVER, that computes the steady-state probability of a model described by the SAN formalism, using a Multi-valued Decision Diagram structure to store and to manipulate the model's reachable state space.

Results

The results of the energy used in transportation were modelled and analyzed in two separate markets: Europe and United States, including overall expected evolution of each fuel until 2050. In order to boost development of advanced biofuels, public investment in R&D is the most important policy to be adopted by countries. Developing strategies aimed to renewable resources; applying tax incentives and subsidies; and issuing mandatory country objectives are also encouraged.

Conclusions

Modelling using SAN formalism proved to be a successful research method and provided useful future scenarios regarding the microalgae biofuels' market. It revealed some potential diffusion pathways regarding this emerging market and allows to draw some recommendations concerning public policies. To the best of the authors knowledge, this is the first study using SAN Modelling to assess the future of microalgae as a biofuel feedstock.

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