

A Participatory Multi-Criteria Decision Approach to assess biofuel management strategies implications in Fuerteventura

Summary

This paper discusses different alternatives of biofuels implementation from an integrated point of view, carrying out a Multi-Criteria Assessment as well as a Participatory Process providing not only feedback, but also facilitating the development of the assessment together with the local population in order to develop a better land-use management strategy together with a possible sustainable economic activity for the local population. The main findings of this analysis are based on an interdisciplinary research project carried out by the University of La Laguna assessing the agricultural and chemical feasibility, as well as the socio-economic implications of the implementation of the jatropha crop as a source of biofuel in the Island of Fuerteventura,

Extended Abstract

This paper aims at evaluating different alternatives of implementation of biofuels at an island level to contribute to its sustainable development, exploring the consequences - both positive and negative- derived of moving the energetic system of an island in that direction.

The geographical position and fragmentation of the Canary Islands implies a complete energy dependence from external petroleum inputs [1]. Although there is huge potential for implementation of various alternative energies, there has been only a marginal support to renewable sources by regional and national government. Due to the ratification of a new national legislation on renewable energy production [2], the construction of new green energy fields have been stopped or cancelled in the Canaries, with the exception of the island of El Hierro [3] and the implementation of some wind turbines and photovoltaic fields on the rest of the islands. In fact, the

national government has recently supported deep sea oil drill activity near the coast from the islands of Lanzarote and Fuerteventura. This decision has been taken with a relevant opposition of the regional population (more than 75% of the population) while 71% of those surveyed expressed a preference for changing the present regional energy production model [4]. In this context, it is not surprising that the transport sector is also heavily reliant on fossil fuels.

Together, the European Commission Renewable Energy Directive [5] has set the “20-20” goal for the transport sector that stipulates that 10% of total fuel consumption be comprised of biofuels, considering that 21% of the Green House Gases produced in the European Union is caused by this sector, currently the proportion of biofuels is less than 5%, in the Canary Islands, which implies that reaching a 10% of biofuel consumption by 2020 is not a realistic objective nowadays.

Thus, any modification of the fuel-based model implies remarkable changes of both the landscape and the economic activities of the area. Hence an assessment of the possible natural resources management strategies and their implications in environmental, societal and economical terms is needed.

In this context, an interdisciplinary group of researchers of the University of La Laguna has started a three-years research project funded by the DISA foundation¹, aimed at evaluating the feasibility of producing biodiesel based on the jatropha crop and by means of non-conventional hydric resources.

The island of Fuerteventura and the jatropha (*Jatropha curcas* L. – JCL) were selected to carry out the analysis. Fuerteventura is one of the driest islands in the Archipelago; more than 90% of its agricultural lands have been abandoned and it has experienced a severe desertification process. Together, the jatropha was selected as the source for obtaining oil from its seeds to produce biodiesel due to its well-known adaptation to drought conditions and marginal lands, and the fact that it is not an edible crop [6].

¹ DISA foundation is part of a Spanish oil company aimed at funding research and social activities.

This research project consisted of three phases; an initial phase of crop growth, experimenting with two varieties of seeds and several combinations of irrigation techniques and soil qualities. After harvesting the different possible combinations of crop varieties and applied techniques a second and third phase of analysis were committed to produce and measure the quality of the oil and biofuel respectively obtained from the seeds.

Once these experimental phases were undertaken an assessment of the viability of the different alternatives of biofuel production was carried out. Insights from the methodology applied as well as the most relevant findings are the scope of this paper.

In order to carry out the above-mentioned assessment, an integrated approach was selected, consisting of the combination of the following tools, a participatory multi-criteria assessment and a geographical information system to assess the different available resource management strategies . This approach targets at validating socially the outcomes of an initial assessment of the technical and economical feasibility of the different alternatives of crops production and biofuel production carried out by the researchers. This social assessment is fulfilled throughout a participatory process that involves the stakeholders. This approach follows recent works from Corral Quintana [7], De Marchi [8] and Paneque [9] among others and focusing on the relevance of extended participatory assessments [10-13].

So, at first, NAIADE (Munda [14]) a multi-criteria assessment method (MCA) was applied to evaluate the selected alternatives explored during the experimental phases of the biofuel production. During the assessment, several technical, environmental, social and economic criteria were taken into account creating a impact matrix that combines alternatives and criteria. As a result, a ranking of alternatives was produced.

The second step was mapping, using ArcGIS, the environmental and technical peculiarities of the more suitable alternatives for a possible implementation at an Island level.

Finally, and following Gibbons' concept of creating socially robust knowledge [15, 16] a participatory process was set up in order to discuss the validity of the previous results. That process involved those actors revealing high stakes but also those affected by the introduction of the biofuel activity, and those simply interested. During the involvement the previous results were presented using both the impact matrix results and the geo-referenced maps. These sources of knowledge allowed the different stakeholders to have the same level of information, which may contribute to the validation of the results and moreover, the decision making process regarding the implementation of the jatropha in Fuerteventura.

Bibliography

- [1] PECAN. Plan Energético de Canarias. Gobierno de Canarias; 2007.
- [2] BOE. Regulación de la actividad de producción de energía eléctrica a partir de fuentes de energía renovables, cogeneración y residuos. 413/2014, 6 de junio; 2014.
- [3] Gorona_del_Viento. Gorona del Viento El Hierro S.A.; 2010.
- [4] Chirino JB, Quintana SC, Pérez GG, Martín LJL, Ceballos JLR. Estudio sobre el estado de opinión de la población Canaria sobre la calidad de vida, el modelo turístico medioambiental y energético. Gobierno de Canarias, ULL y ULPGC; 2014.
- [5] European_Union. Promotion of the use of energy from renewable sources. 2009/208/EC: Official Journal of the European Union; 2009.
- [6] Dorta-Santos M, Tejedor M, Jiménez C, Hernández-Moreno J, Palacios-Díaz M, Díaz F. Recycled Urban Wastewater for Irrigation of *Jatropha curcas* L. in Abandoned Agricultural Arid Land. *Sustainability* 2014;6:6902.
- [7] Corral Quintana S. Una Metodología integrada de exploración y compensación de los procesos de elaboración de políticas públicas. European Commission, Ispra, EUR 2000;19724.
- [8] B. De Marchi, S.O. Funtowicz, S. Lo Cascio, Munda G. Combining participative and institutional approaches with multicriteria evaluation. An empirical study for water issues in Troina, Sicily. *Ecological Economics* 2000;34:15.
- [9] Paneque Salgado P, Corral Quintana S, Guimarães Pereira Â, del Moral Ituarte L, Pedregal Mateos B. Participative multi-criteria analysis for the evaluation of water governance alternatives. A case in the Costa del Sol (Málaga). *Ecological Economics* 2009;68:990.
- [10] Pereira ÂG, Quintana SC. From Technocratic to Participatory Decision Support Systems: Responding to the New Governance Initiatives. *Journal of Geographic Information and Decision Analysis* 2002;6.
- [11] Munda G. Social multi-criteria evaluation: Methodological foundations and operational consequences. *European Journal of Operational Research* 2004;158:662.
- [12] Funtowicz SO, Ravetz JR. Science for the post-normal age. *Futures* 1993;25:739.

- [13] Gallopin G, Funtowicz S, O'Connor M, Ravetz J. Science for the twenty-first century: from social contract to the scientific core. *International Social Science Journal* 2001;53:219.
- [14] Munda G. NAIADE Method: a short description. Barcelona: UAB; 1995.
- [15] Gibbons M. Science's new social contract with society *Nature -Supplement Impacts* 1999;402:C81.
- [16] Nowotny H, Scott P, Gibbons M. *Re-Thinking Science: knowledge and the public in an age of uncertainty*. Maden, USA: Blackwell Publishers; 2001.