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A multi-level approach to analyze the effects of renewable energy in the wine sector

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Abstract

The objective of this paper is to design a map of the positive effects caused by the implementation, in a winery, of a series of prototypes for substituting non-renewable energies for clean energies. For this aim, we propose the use of a multi-level approach including three analyses: a multi-stakeholder analysis to determine all the interest groups affected by this intervention; a multi-dimensional analysis in order to identify the effects from the triple bottom line of sustainability; and a multi-term analysis to classify the effects depending on when they take place: immediate, intermediate and long-term.

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Keywords: Multi-dimensional analysis; multi-stakeholder analysis; multi-term analysis; Renewable energy; wine sector

1. Introduction

The European Union has promoted the use of renewable energy sources by several directives, establishing a common framework for the production and promotion of renewable energy sources in order to limit greenhouse gas emissions. In this sense, the European Union aims to reach a 20% increase in the use of renewable energy by the year 2020 and shifts this task to its member states. Renewable energy sources differ from non-renewable in their environmental and economic impacts. Common features to all renewable energy sources are that they are more

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expensive than the current energy-mix, and none of them is solely beneficial for the environment (Kosenius and Ollikainen, 2013).

Agribusiness is one of the sectors with the highest energy consumption; in fact, its consumption accounted for 26% of the European Union total in 2013 and 28% of this consumption comes directly from the industrial process. This means that 7.3% of all the energy consumed in the EU goes to the production of food and beverages. In addition, Spain is among the five European countries with a larger food and beverage industry (the others are Germany, France, Italy and the United Kingdom). Therefore, Spain is among the countries whose energy consumption is higher. Data in Spain shows how agribusiness has consolidated its position as the country's leading industrial sector, with almost half a million direct jobs, accounting for 21% of the country's manufacturing industry and consolidating itself as the 4th largest economy in the European Union in Production (with a value of € 95 billion). So what is valid for the European Union itself will also be for the Spanish case, in which the introduction of renewable energies would be associated with cost reduction and environmental improvement.

The starting hypothesis is that the agribusiness has a high receptivity for the implementation of renewable energies, since it favours not only the protection of the environment, but also the essence of its business. Within the agribusiness, the wineries and their vineyards, due to their peculiar characteristics, they are more innovative than the rest of the sector and can serve as a model of how the use of renewable energy on a small scale can be profitable.

In this sense, a series of prototypes have been installed in the vineyard of *Viñas del Vero*, which produce renewable energy by photovoltaic generation. The photovoltaic panels are on three different types of support, including a floating set on the surface of an irrigation pond. The system is stand-alone (not connected to the grid) and is managed by an advanced hardware and software system. The energy produced feeds the water treatment plant of the cellar and drip irrigation in the vineyard. The wastewater of the cellar is purified and used for irrigation. The surplus energy produces hydrogen by water electrolysis, which is used on the farm itself, in an agricultural off-road vehicle with a fuel cell.

This intervention is framed within a broader REWIND LIFE project that addresses climate change in the rural environment, both for mitigation and adaptation. As mitigation, it reduces CO_2 emissions related to energy consumption in agricultural activities and industries. As adaptation to climate variations, it allows the production of clean energy for irrigation in remote or isolated locations. Furthermore, noise, spills and other environmental impacts of diesel are avoided, as well as the visual impact of the electricity grid in natural areas. The partners are the University of Zaragoza, CSIC–LIFTEC, *Viñas del Vero* and *Intergia Energía Sostenible*.

The objective of this paper is to determine all positive effects from this REWIND LIFE project by means of a multi-level approach and taking into account all the stakeholder affected by the project (firm, partnership and community), the three dimensions considered on any sustainability problem (social, economic and environmental) and the length of the term in which the effect happens (immediate, intermediate and long-term).

The rest of the paper is organized as follows. Section 2 presents the multi-level approach used in the paper. Section 3 applies the methodology to our case study. Finally, Section 4 includes the most relevant conclusion of the paper and the future lines of research.

2. Methodology

In this section, the methodology used in the paper is presented. It is based on a multi-level approach following the ideas of Qayum et al. (2012). First, a multi-stakeholder analysis is carried out in order to determine all the interest groups affected by this intervention. After that, we perform a multi-dimensional analysis to identify the effects from the triple bottom line of sustainability: economic, social and environmental. And finally, a multi-term analysis in order to classify the effects, depending on the length of the term in which they take place: immediate, intermediate and long-term. Fig. 1 shows a Rubik cube in which each small cube represents the results of the project for the combination of the three levels: dimension, stakeholder and length of the term.