Land Use Policy 72 (2018) 110–115

Contents lists available at ScienceDirect

Land Use Policy

journal homepage: www.elsevier.com/locate/landusepol

Renewable energies, business models and local growth

Filippo Sgroi[a,*], Enrica Donia[b], Domenico Russo Alesi[c]

[a] Department of Agricultural, Food and Forestry Sciences, University of Palermo Viale delle Scienze, Edificio 4 (Ingresso H), 90128, Palermo, Italy
[b] Department of Economics, Business and Statistics, University of Palermo, Viale delle Scienze, Edificio 13, 90128, Palermo, Italy
[c] Department of Economics, Business and Statistics, University of Palermo, Viale delle Scienze, Edificio 13, 90128, Palermo, Italy

ARTICLE INFO

Keywords:
Agriculture
Growth
Territory
Renewable resources

ABSTRACT

Energy is one of the driving factors of the world economy: energy consumption is closely linked to quality of life and environmental impact. Reducing the use of fossil fuels, curtailing greenhouse gas emissions, and cutting energy dependence from traditional energy producing countries are the cornerstones of European policies for safe, competitive, sustainable, and renewable energy. In addition, the pressing need to provide new and diversified opportunities for supplementary income for the agricultural sector has fueled the desire to engage rural areas in this process. Biogas, derived from the anaerobic digestion of biomass, is one of the renewable energy sources that has been very successful in these areas recently.

This paper describes a practical example of the implementation of a biogas plant at a farm in the Madonie Mountain area of Sicily, Italy; by estimating the costs and revenues that will result from its management, we demonstrate how the bioenergy sector presents a great opportunity for farm supplementary income. Through cost-benefit analysis, we show that the investment is cost-effective both in terms of Net Present Value (NPV) and Internal Rate of Return (IRR).

1. Introduction

Problemsrelating to the decreasing availability of fossil fuel energy sources, their geographic distribution in politically unstable areas, along with major global environmental issues have brought increasing attention to the search for renewable energy sources. Renewable energy production has found its main push in the commitments undertaken in the Kyoto Protocol (1997), which provide for the promotion of long-term energy planning by introducing appropriate incentives for the use of technological innovation and multidisciplinary research aimed at saving energy and improving efficiency (Alabrese et al., 2013).

Widely utilized in the bioenergy sector, biomass consists of all organic materials that can be used directly as fuels, or which can be transformed into solid, liquid, or gaseous fuels (Santi, 2010; Bavazzano and Maltagliati, 2013). The various substances which, through an anaerobic digestion process, lead to the production of this latter type of fuel—biogas—include the animal waste produced by agricultural operations, which is the subject of our work (Fiorese et al., 2006).

According to the European Biomass Association (AEBIOM), bioenergy growth over the last five years, in absolute terms, is as large as the growth of all other renewable sources put together (6.2 Mtoe per year). Despite the doubling of energy production from renewable sources, its consumption is relatively low (11.8%) compared with oil (33.4%), gas (23.2%), solid fossil fuels (17.2%), and nuclear energy (13.6%). This shows a strong European dependence on energy imports, which has been leading to a reconsideration of the energy system as a whole. Unlike other energy sources, whose imports amount to 4% of GDP per year in European countries, biomass represents only 3.84% of imports used for domestic consumption.

Many European countries have been relying on bioenergy to reach their 2020 objectives, and the current percentage of bioenergy in total renewable energy consumption has reached 91.4% in Estonia, 89.2% in Poland, and 86.9% in Hungary and Lithuania. In 2013, the highest percentages of biomass final energy consumption at the national level were found in Latvia (31.9%), Finland (31.8%), and Sweden (31.6%). Of the biomass consumed today for energy purposes, 74.6% is used to produce heat (78.4 Mtoe), followed by bioelectricity, with 13.5 Mtoe, and biofuel for vehicles, with 13.1 Mtoe (AEBIOM, 2015).

It is in the context of an integrated and coherent policy that the European Commission has presented an action plan for biomass, from which about fifty percent of the renewable energy used in the EU is currently obtained. In Italy, since 2009, the average size of biomass-fueled plants has progressively decreased, mainly due to the entry into operation of small-scale biogas plants (installed power less than 1 MW), generally designed to benefit from the incentive system of the all-inclusive feed-in tariffs defined by the Ministerial Decree of 18 December

* Corresponding author.
E-mail addresses: filippo.sgroi@unipa.it (F. Sgroi), enrica.donia@unipa.it (E. Donia), domenico.russoalesi@gmail.com (D.R. Alesi).

https://doi.org/10.1016/j.landusepol.2017.12.028
Received 28 September 2017; Received in revised form 5 December 2017; Accepted 9 December 2017

2008 (GSE, 2015).

Between 2001 and 2014, the installed power of biomass plants increased at an average annual rate of 13.9%. Following a period of continuous and sustained growth after 2008, however, there was a sharp slowdown in 2014, with relatively small increases compared to the previous year, both in the number and power of the plants.

Opportunities offered by national legislation on this issue, on the one hand, help to strengthen the environmental role that agriculture is called upon to play and, on the other, make it is possible for farmers to earn supplementary income through the sale of electric and/or thermal energy. This latter aspect, which is the cornerstone of the work done, is favored by the advantages of using biomass rather than conventional energy sources and other renewable sources, especially relatively low costs and less short-term dependence on climate change. In addition, agricultural and livestock wastes, in particular, are a renewable energy source whose main quality is being intrinsically linked to the local area; they are widely available in varying qualities and quantities.

Estimating the residual biomass is an important operation underlying the energy planning for using the resource (Klass, 1998). Indeed, it is important to understand the potentialities of biomass for energy and whether these can significantly affect the energy balance of an area, making it more economically viable and renewable over time (Donati and Molinari, 2015; Cioffi et al., 2009). Estimating the availability of agricultural wastes is a complex operation, mainly due to the differences in yield according to the different types of matrices. In order to have the most reliable and relevant data and parameters for a particular geographic area, data collection needs to be performed on the amount of wastes from crops and the area under examination. To access national data that can facilitate the estimation of the impact of the matrix supply in terms of land occupied or in use, the Italian National Agency for New Technologies, Energy, and Sustainable Economic Development (ENEA) has created a database which is available to the public (Fontana, 2012). Information regarding the potential for obtaining woody biomass, agricultural waste, and energy crops, for producing biogas from bovine and swine waste, slaughterhouse waste products, and even the percentage of organic waste from urban solid waste is presented on a national level, scalable to the provincial level. Through this tool, ENEA can support biomass-based companies in planning their choice of location and operations in a given national area, assessing the potential availability of raw material and identifying available logistical networks.

According to the Ministerial Decree of 6 July 2012, the energy obtained from the use of biomass can benefit from an incentive rate related to the size of the plant or its power (Bioenergy Executive Report, 2012; Dell'Olio, 2013). To estimate the economic potential of crop wastes, three differentiated incentive scenarios were designed: 257 €/MWh, in the case of plants from 1 to 300 kW, 209 €/MWh for plants from 300 to 1000 kW, and 145 €/MWh for plants with power greater than 5 MW; no additional premiums, such as those resulting from high performance cogeneration, were considered.

The theme of energy self-sufficiency in agriculture is linked, on the one hand, to the need to optimize costs related to the use of production factors and, on the other, to the environmental sustainability of production in the countryside. These two issues are obviously compatible and can be perfectly integrated both in principle and in practice. Farms have a unique opportunity to equip themselves for the future with plants that will be fundamental for their survival. In a world in which having energy available steadily and reliably, and at a lower cost, will play a decisive role in the near future, self-production becomes a highly competitive advantage.

Reducing costs is of vital importance for small producers, whereas it becomes a determining factor for the development of profitability for large companies and even a deciding factor for those considering making investments in agriculture. However, less waste, lower CO_2 emissions, and a sustainable approach to production are not the only benefits. The bioenergy business is a global one characterized by the prospect of imposing a new approach to supplying energy. Self-production will lead to supplying energy first on a local scale (local heating, supplying the electricity grid and the methane network) and then beyond (Gatto et al., 2010). Technologies capable of optimizing production cycles will be able to produce more and more energy at competitive costs, to a point that they can eventually move outside the incentive policy of almost all advanced countries.

The income guaranteed today by energy sales and state incentives is an essential cornerstone of energy production from organic materials, sun, and water. Beyond incentivization, with increased reliability and productivity, the scenario will also be the harbinger of the development and improvement of access to energy resources. There is no doubt that investment for commercial production will be equally advantageous. It is reasonable to say that a new energy paradigm, without incentives, can be fully operational in the next twenty years or so (Fontana, 2012).

The evolution of the bioenergy sector has offered, and will continue to offer, an interesting opportunity for the agricultural world, keeping in mind that the main objective should be to provide supplementary agricultural income and not become the primary business activity so as to avoid the risk of losing sight of the strategic role that agriculture has traditionally occupied.

Renewable energy sources present an important opportunity in the agricultural sector. Indeed, they can help reduce production costs or increase the entrepreneur's income through energy sales. In the first case, there are advantages in that the company internally furnishes its own energy needs directly and no longer has to pay for electricity costs. In the second case, the sale of energy helps increase ancillary revenues. The EU legislature has directed its policies in this direction for a number of years, giving incentives to farmers to make investments in the renewable energy sector. Many investments have been made with contributions from the Common Agricultural Policy with the aim of supplementing the income of agricultural entrepreneurs, fostering growth and development processes and producing clean energy (Motola et al., 2009; Vieri, 2012a; Prestamburgo and Prestamburgo, 2016; Valenti et al., 2017). However, in many cases, renewable energy incentives have been used improperly in agriculture for the sole purpose of simply banking the incentives. It must be remembered that the incentives provided to the agricultural entrepreneur are governmental assistance intended to be used for investments to improve productive, without which the entrepreneur would not able to realize the investment (Vieri, 2012b).

In light of the foregoing, we can state that, in the future, the agricultural sector will become even more of a standard-bearer for renewable energy since it is based on the concept of energy, drawing nourishment and its very reason for existing from it. Agriculture is, structurally, on the front lines of the world of renewable energy sources and, in this sector, it can benefit from continued economic integration and steady profitability even though it has to undertake a new and ongoing process of technological learning.

The mission of this work, derived from these considerations, aims at demonstrating how biomass can contribute to increasing income for agricultural enterprises, keeping in mind that the main objective of investing in biomass-fueled plants should be to supplement agricultural income and not become the main business activity to avoid the risk of losing sight of the strategic role of farms which is to produce agricultural products for the market.

2. Material and methods

Decision-making regarding the feasibility of a renewable energy investment by agricultural entrepreneurs needs to take into consideration the income obtainable, the productive orientation of the company and the area, and the ability to make good use of available resources. In terms of management, each consideration counts as far as it can be implemented at the moment of making an investment in products, land, machinery, and work.