energies

Article

Forest Management Communities' Participation in Bioenergy Production Initiatives: A Case Study for Galicia (Spain)

Raquel Fernández-González [1], Félix Puime Guillén [2], Otilia Manta [3,*,†], Simona Andreea Apostu [4,5] and Valentina Vasile [5]

1 Department of Applied Economics, ECOBAS, University of Vigo, ERENEA, 36310 Vigo, Spain
2 Faculty of Economics and Business, University of A Coruña, 15008 A Coruna, Spain
3 Department of Research, Romanian-American University, 012101 Bucharest, Romania
4 Department of Statistics and Econometrics, Faculty of Statistics, Cybernetics and Economic Informatics, Bucharest University of Economic Studies, 010552 Bucharest, Romania
5 Institute of National Economy, 050771 Bucharest, Romania
* Correspondence: otilia.manta@rgic.ro
† Financial and Monetary Research Center of "Victor Slavescu", Romanian Academy, 050711 Bucharest, Romania.

Abstract: Bioenergy is the form of clean energy with the greatest potential for growth in Spain, especially in those regions with a large forest area and a high potential for the utilization of forest resources for energy purposes. This is the case in Galicia (a region located in northwestern Spain), where the communal management of forest resources is widespread. Within this type of management, there is a pioneering case study in which biomass energy use activities have been initiated through an international project. The possible success of this project is of great importance since it could represent an alternative to the main energy activity in the common management of forests: the production of wind energy. In recent years, and with a special increase in 2022, Galician public opinion has expressed its opposition to the implementation of new wind farms in its forests. The aim of this article is to analyze whether or not it is profitable for forest management communities to participate in bioenergy initiatives, which is a novel analysis of the Galician geographical area. For this purpose, the main economic and financial variables of the Galician forest management communities participating in the bioenergy project, SilvaPlus Project, have been analyzed, before and during their participation in the project. In addition, a financial comparison is also made with a group of Galician forest management communities without the energy use of their resources. The evolution of the relevant variables, analyzed between 2011 and 2020, shows a generally positive trend in the values of the forest communities participating in the bioenergy generation project, resulting in a positive experience, both environmentally and financially, for the forest community.

Keywords: bioenergy; community management; financial and economic performance; Galicia; Spain

check for updates

Citation: Fernández-González, R.; Guillén, F.P.; Manta, O.; Apostu, S.A.; Vasile, V. Forest Management Communities' Participation in Bioenergy Production Initiatives: A Case Study for Galicia (Spain). *Energies* **2022**, *15*, 7428. https://doi.org/10.3390/en15197428

Academic Editors: Mirela Panait, Daniel Balsalobre-Lorente, Magdalena Radulescu, Umer Shahzad and Abdul Rehman

Received: 10 September 2022
Accepted: 8 October 2022
Published: 10 October 2022

1. Introduction

Urgent action on climate change is a global priority [1]. The current environmental governance system has led to the creation of an institutional framework that involves all social agents [2]. Public administrations, the business sector, non-profit organizations, and citizens should be strongly involved in order to successfully address the effective protection of the environment [3,4]. One of the most effective ways to limit environmental degradation is through an energy transition. At the 26th United Nations Climate Change Conference (COP26), held in November 2021, an agreement was reached on the complete eradication of pollutant emissions by 2050 [5]. The aim is to limit the increase in global average temperature to 2 °C while trying not to exceed 1.5 °C above pre-industrial levels. By 2022, human activities have already caused the global temperature to rise by 1.1 °C [6].

One of the most important commitments achieved at COP26 was the one related to halting and reversing deforestation by 2030 [7]. The Sustainable Development Goals are to be achieved within the same time horizon. Among them is the 15th goal, "Life on land", which addresses the protection of ecosystems and biodiversity, along with the fight against deforestation and degradation [8]. Deforestation is both an environmental and a social problem. In terms of the environmental aspects, this practice reduces biodiversity, alters the water cycle, contributes to the advance of desertification, and increases global greenhouse gas emissions, since a large percentage of terrestrial carbon is locked up in the large forest masses of the world [9,10]. On the social side, the use of forest resources reduces the possibility of suffering from malnutrition and diseases derived from air pollution, as well as preventing lower income opportunities. This bio-social interdependence is even greater in the local communities of developing countries, although in high-income countries, this relationship also exists [11–13].

Among the applications of forest masses that have grown the most in importance in recent decades is their use as a source of raw material for biomass energy [14]. Access to biomass is widespread in a large part of both northern and southern hemisphere countries. Its use decreases the import of energy products and reduces the volatility of energy prices by increasing the energy security of the country [15]. However, the overexploitation of biomass can have a negative impact on the environment, such as deforestation, loss of biodiversity, or the degradation of land and water [14]. Therefore, one of the most important challenges for the growth of this type of energy is to implement environmentally management.

The European Union (EU) is one of the most prolific administrations in adopting energy regulations. In 2010, it had already adopted more than 350 legal measures in this area [16]. European energy policy has evolved in recent decades. Whereas until the end of the 20th century, energy regulation focused on technical issues, in the last 20 years, this regulation has shifted its efforts to ensuring energy security and not harming state interests, based on an environmental approach [17]. In 2022, the institutional energy framework is based on the integrated climate and energy strategy approved in October 2014, and revised in December 2018, by the European Council [18].

Following the guidelines set by this reference regulation, more specific strategies have been created. This is the case with biomass energy, for which the EU Biodiversity Strategy for 2030 (COM/2020/380) was approved in May 2020. The need to develop specific regulations for this energy is justified by its share in the market—over 60% in 2019—of renewable energy in Europe. Although its main use (75%) is as a primary energy source for private heating and cooling, it is increasingly being used as a secondary energy source for new biomass-based heat and power plants, or for bioelectricity production [19].

In academia, there are several case studies on biomass production at the international level. The capacity and feasibility analyses of different bioenergy projects have been applied to initiatives in such diverse locations as Brazil, Ghana, Indonesia, Finland, Ethiopia, and China [20–25]. Although each case study has its own characteristics, different legal frameworks, and ecosystems, they all have in common the need to find an alternative to the use of fossil fuels and to increase the energy independence of the communities. In the Spanish context, there are specific analyses, among others, for the Basque Country [26,27], Catalonia [28,29], or Valencia [30,31]. Thus, energy analyses have been implemented for both Atlantic and Mediterranean forests. In all these cases, the decrease in CO_2 emissions and the fulfillment of the climate objectives of the European Union are the central objectives of the analysis. In the case of Galicia, there have also been several examples of the study of forest biomass as an energy source. These studies have been performed with different approaches: measuring the importance of bioenergy in the introduction of renewable energies in the region [32], using the contingent valuation method to measure the effectiveness of the energy use of biomass against fires [33], or analyzing consumer preferences, given a change in the energy paradigm [34,35]. However, an analysis of the implementation of bioenergy projects from a financial perspective, such as the one carried out in this article, is novel. Considering the extant literature, this study fills the gap in the literature, highlighting the forest management communities' impacts on various domains and the profitability in a specific region. The case study used in this article will focus on the profitability of the implementation of an initiative for the transformation of forest resources into bioenergy. This project is financed by the European Regional Development Fund (ERDF) through the Spain-Portugal Cross-border Cooperation Program (POCTEP). Although the project involves different forest management communities in Spain and Portugal, for reasons of data availability, the economic–financial analysis will only include two of the participating Spanish forest communities.

This article aims to increase knowledge about communal practices and to emphasize innovative practices in achieving the energy transition. In this case study, a solution is proposed that takes advantage of forest resources, promotes decarbonization, and fosters the development of local populations [36].

The main objective of this study is to analyze, through the evolution of several significant variables, the economic and financial trends of these forest management communities. However, there is also a secondary objective, which is to compare the profitability of the forest management communities with the rest of the Galician Forest management communities that do not allocate their resources to the generation of any type of energy. In this way, it will be possible to analyze not only whether the project is profitable for the communities that participate in it but also whether this initiative is an example to follow for the other forest management communities that are not involved in any energy initiative. The novelty of this paper consists of considering the financial approach of bioenergy project implementation and highlighting the added value in the case of the profitability of the forest management communities, utilizing a case study for the Galicia region. Although we have focused on one specific region, we can consider the results on forest management to be generally pertinent, especially since, to our knowledge, it represents the first analysis in the literature considering these financial indicators.

In order to reach our objective, this study is designed as follows. Section 2 shows the state of the art of bioenergy. Section 3 describes the characteristics of the forest management communities, specifies the data treatment, and describes the economic–financial variables used. Section 4 analyzes and compares the aggregated data, in absolute and relative terms, for the group of bioenergy forest communities and the group of communities that do not exploit their resources. Also interprets the results and compares them with similar results from academia. Finally, Section 5 presents the main conclusions of the analysis.

2. Background

Information on the Galicia Region

Galicia has 1,939,660 hectares of forest, which represents 65.5% of the total area of the region. This makes Galicia the fourth-largest forested area in Spain, behind the Basque Country, Navarra, and Catalonia (Figure 1) [37]. The economic exploitation of Galician woodlands is divided into four major sub-sectors: forestry and logging (0.7% GDP Galicia), the wood and bark industry (0.5% GDP Galicia), the paper industry (0.4% GDP Galicia), and furniture manufacturing (0.3% GDP Galicia). Overall, the forestry wood-chain employs 24,107 workers, contributes EUR 1,144,000 of added value, and represents 1.8% of the GDP of Galicia [38].

In addition to these economic sectors, there is another activity of great importance to the forest management communities in Galicia; although it is not directly related to the exploitation of the forest mass, it is a regular source of income. This sector is that of wind energy generation, which has experienced great growth in the region. In 1998, there were only 8 wind farms in operation in Galicia. In 2020, the number of wind farms reached 186 units, with an accumulated installed capacity of more than 3500 MW [38].

Although the onshore wind energy business continues to show a growing trend in Galicia, there is an increasing level of social opposition. The landscape impact, the lack of direct economic compensation to local communities, the rivalry of land use with the agricultural and livestock sector, and the scarcity of local job creation are among the most widespread reasons for the rejection of the establishment of wind farms on the part of forest community members [39,40]. Since a large part of the wind farms are located on common lands and the rejection of this practice by the community members is increasing, the forest management communities of Galicia are looking for alternatives for the use of their resources [41].

Figure 1. Location of Galicia, the region where the forest communities are situated.

Forest management communities, also known as "*montes vecinales de mano común*", have their own characteristic management that has lasted from the 18th century to the present day. In Spain, this type of organization was legally recognized in Law 13/1989, of 10 October 1989, regarding common land. This law recognized the power of local groups, acting as social groups and not as administrative entities, to use the forests. Therefore, this is a type of management of a private and collective nature, one that does not assign quotas for the exercise of rights over the resource, but instead assigns decision-making power over the resource to those neighbors who have their habitual residence in the municipality where the forest resource is located [42].

In Galicia, more than 700,000 hectares are organized into forest management communities, which are administered by 2992 forest communities [43]. In 2013 two of these forest communities, located in the south of the region, resolved to participate in a European project for the production, transformation, and consumption of primary forest biomass for energy purposes. This project, SilvaPlus, aims to "... stimulate the development of the use, transformation, logistics, storage, distribution and utilization of forest biomass on a local and regional scale, contributing to the fulfillment of national and European objectives to increase the use of renewable energies ... " [44]. Project partners include 15 forest management communities from Portugal and Spain, 13 social organizations, 20 local administrations, 27 companies, and 2 research centers.

The high availability of primary biomass in the region of southern Galicia and northern Portugal has driven this initiative for the creation of a forest production value chain for bioenergy (Figure 2). Through a collaboration between forest managers and forestry companies, products such as wood chips, pellets, and briquettes are created to be used as a source of energy and/or heating at both industrial and domestic levels. The common management forests analyzed in this case study have allocated 20 hectares, divided into 5 plots, for the production of biomass [45].

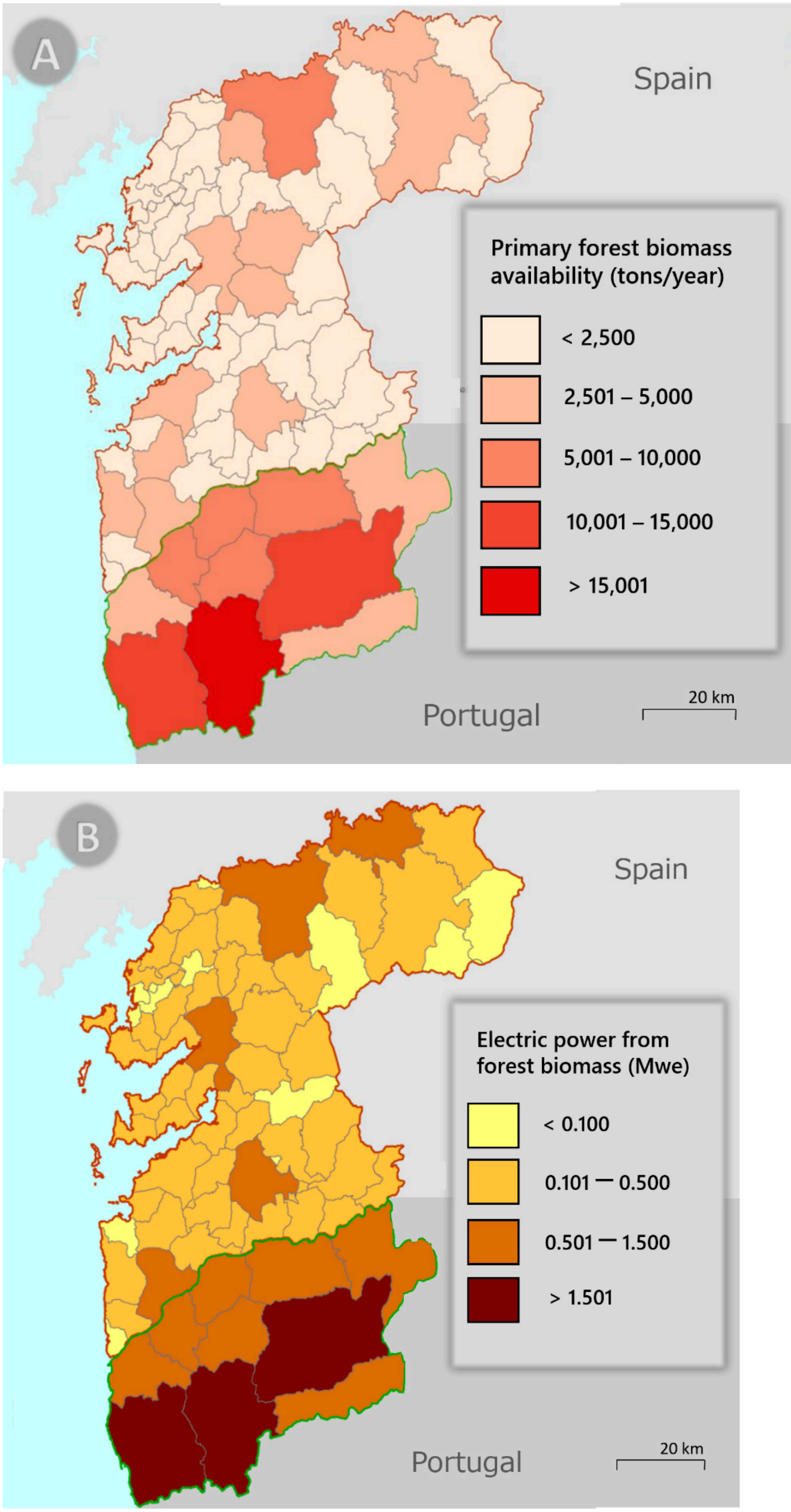

Figure 2. (**A**) The availability of primary forest biomass; (**B**) electric power from forest biomass.

3. Data and Methods

The database used to obtain the financial and economic records of forest management communities is SABI (Sistema de Análisis de Balances Ibéricos), belonging to the Bureau van Dijk group [46,47]. More than 2.9 million Spanish companies and 900,000 Portuguese firms are individually registered on SABI, which provides information on a company's finances, corporate structure, brand names, directors and contacts, or audit reports [48].

In this case study, two groups of companies have been analyzed (Figure 3). The first group corresponds to the forest community management companies involved in the bioenergy production project. In this case, the identification of the two companies in the SABI database was performed via their corporate name, once they were located on the list of entities associated with the SilvaPlus project. The search for the second group of companies, that of forest communities without the energy use of their resources, was more complex. To define the second group for comparison in this article, a Boolean search was carried out, based on the following criteria:

1. Region: Galicia
2. Availability of financial accounts for the years: 2020, 2019, 2018, 2017, 2016, 2015, 2014, 2013, 2012, and 2011.
3. Company name or VAT (value-added tax) number: "*comunidad de montes*"; "*comunidade de montes*".
4. Activity description using any of these words (in English, Spanish, or Portuguese): "forestry"; "local forests"; "*man común*".
5. Legal form: co-ownership or other legal form.
6. Clasificación de la actividad: NAICS (North American Industry Classification System) 2017 (primary and secondary codes): 221115, wind electric power generation.
7. Activity description using any of these words (in English, Spanish or Portuguese): "energy"; "wind"; "electric".

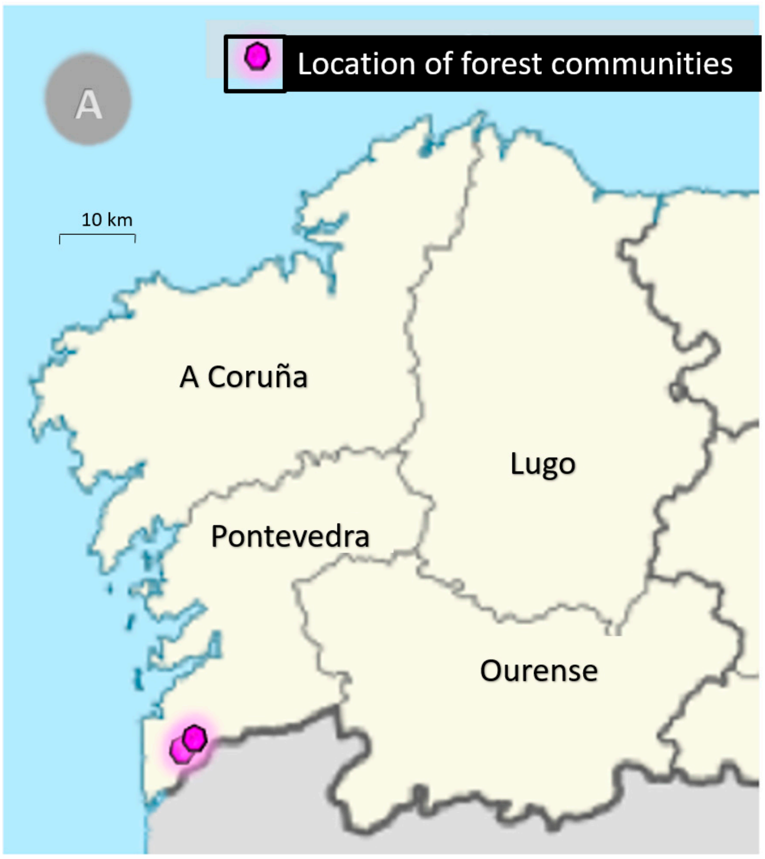

Figure 3. *Cont.*

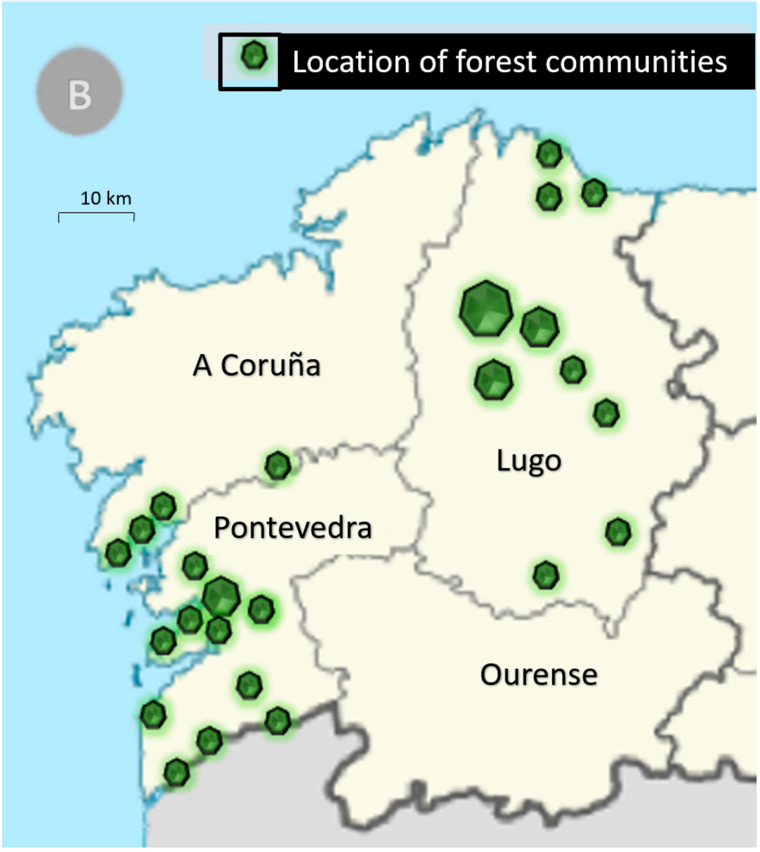

Figure 3. (**A**) Location of forest communities participating in the bioenergy project; (**B**) forest communities with no energy use of their resources.

In order to define the sample of the second group of companies, the following Boolean expressions were used: (1 and 2 and 3 and 4 and 5) and NO (6 and 7). After carrying out this composite search strategy, the group of forest communities without the energy use of their resources is composed of 37 companies.

Once the analysis groups were defined, an aggregation analysis of the two groups was performed. Since the number of elements in the group of forest communities without energetic use of their resources varied over the period studied (2011–2020), median values, rather than mean values, were calculated for the following variables: operating income/turnover, P/L before tax, total assets, the number of employees, ROA, ROE, debt ratio, and EBIT margin. These variables were used due to their data availability regarding the results of forest communities participating in the bioenergy projects.

These variables can be defined as follows:

- Operating income/turnover:

$$\text{Operating income} = \text{Revenue} - \text{Cost of Goods Sold} - \text{Operating expenses} \quad (1)$$

- P/L before tax:

$$\frac{\text{P}}{\text{L}}\text{before tax} = \text{Revenue} - (\text{Cost of Goods Sold} - \text{Depreciation Expense} - \text{Operating Expense} - \text{nterest Expense}) \quad (2)$$

- Total assets:

$$\text{Total Assets} = \text{Liabilities} + \text{Owner's Equity} \quad (3)$$

- Number of employees
- ROA (return on assets):

$$\text{ROA} = \frac{\text{EBIT}}{\text{Total assets}} \tag{4}$$

- ROE (return on equity):

$$\text{ROE} = \frac{\text{Net profit}}{\text{Equity}} \tag{5}$$

- Debt ratio:

$$\text{Debt ratio} = \frac{\text{Total debts}}{\text{Value of assets}} \tag{6}$$

- EBIT margin:

$$\text{EBIT margin} = \frac{\text{EBIT}}{\text{Turnover}}. \tag{7}$$

4. Results

As a result of the application of the methodology described in the previous section, two sample populations for the study have been identified (Table 1). The forest communities involved in bioenergy production are located in the Vigo-Baixo Miño district, which has the highest average number of community members in the entire region (140 people per forest management community). The group of forest communities without energy use, as they are located in different parts of Galicia and include more unpopulated areas in the interior of the territory, only has an average value of 79 community members [49].

Table 1. Descriptive data obtained from two groups of forest management communities.

	Province	Region	Date of Establishment	Status	Legal Form	CNAE 2009 Primary Code	Company Size
Forest management communities (bioenergy project)	Pontevedra (2)	Galicia (2)	1980 (2)	Active (2)	Co-ownership (2)	0210 (Silviculture and other forestry activities) (2)	Micro (2)
Forest management communities (no energy use of their resources)	A Coruña (3) Lugo (20) Ourense (0) Pontevedra (14)	Galicia (37)	1975 (4) 1977 (1) 1978 (2) 1980 (2) 1981 (1) 1982 (2) 1983 (3) 1985 (4) 1986 (4) 1987 (5) 1989 (1) 1990 (3) 1991 (1) 1997 (1) 1998 (1) 2012 (2)	Active (37)	Co-ownership (29) Other legal form (8)	0210 (Silviculture and other forestry activities) (11) 0220 (Logging) (15) 0240 (Support services to forestry) (7) 9499 (Activities of other membership organizations (n.e.c.)) (4)	Micro (37)

Forest management communities present a widespread problem, with over 40% of them not complying with their administrative obligations, including the filing of their financial accounts with the corresponding agency [50]. For this reason, although there are more communities that meet the requirements to be part of the study groups of this analysis, only 2 and 37 communities have been sampled.

As for the forest communities involved in bioenergy production, during the period of 2011–2019, the trend of their economic parameters, ROA, ROE, debt ratio, and EBIT margin, is positive (Tables 2 and 3), indicating profitability in terms of financial indicators due to bioenergy production. Despite this, there have been significant year-to-year variations. It is important to note that the crop yields for biomass are subject to the biophysical conditions of the ecosystem in which they are grown. The speed of soil regeneration, the risks of installation, the adaptation of the species to each season, the characterization and regeneration of the biomass, and the results of seeding are variables with an intrinsic uncertainty that affects the economic results of the project.

Table 2. Structure indicators of the two groups of forest management communities at the aggregate level.

Forest Management Communities (Bioenergy Project)	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Operating income/turnover (th EUR)—Median	43	22	170	162	165	193	188	97	126	230
P/L before tax (th EUR)—Median	65	−452	27	21	−15	110	91	−10	52	77
Total assets (th EUR)—Median	9224	8588	4491	4523	4411	4504	4537	4483	4561	8364
Number of employees—Sum	7	6	6	6	6	4	4	7	3	3
Forest Management Communities (no energy use of their resources)										
Operating income/turnover (th EUR)—Median	42	35	35	40	68	39	46	36	46	35
P/L before tax (th EUR)—Median	10	12	5	10	23	18	21	6	8	1
Total assets (th EUR)—Median	133	137	135	195	186	147	157	200	173	146
Number of employees—Sum	106	104	110	125	121	122	130	133	127	87

Table 3. Economic performance indicators of the two groups of forest management communities at the aggregate level.

Forest Management Communities (Bioenergy Project)	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
ROA (%)—Median	0.7	−5.26	0.99	13.17	5.85	9.39	14.38	0.45	14.15	0.91
ROE (%)—Median	0.7	−5.27	1	13.2	6.45	10.54	15.02	0.5	15.4	0.91
Debt ratio (%)—Median	0.29	0.21	0.47	0.51	4.67	6.17	2.31	4.07	4.07	0.39
EBIT margin (%)—Median	7.45	10.85	28.69	21.92	15.31	56.79	49.72	17.77	32.22	16.83
Forest Management Communities (no energy use of their resources)										
ROA (%)—Median	7.58	6.84	2.1	−0.12	6.71	0.15	11.73	2.1	9.02	0.75
ROE (%)—Median	9.5	7.37	3.75	0.78	11.56	0.31	15.42	3.83	16.14	2.1
Debt ratio (%)—Median	18.03	2.73	1.84	3.88	4.27	5.33	4.31	3.52	4.6	2.66
EBIT margin (%)—Median	−7.05	88.07	3.13	−5.08	23.52	−14.01	22.22	−21.87	6.38	−36.6

During the process of finding the optimal form of cultivation to maximize the benefits for the communities, there have been different modifications to forest energy crops. This strategy was established to find the optimal and balanced characteristics for the use of mixed wood–biomass forestry production. In the specific case of the bioenergy project communities, given the physical characteristics of their plantation areas (southwest orientation, altitude of 25–50 m, soil of alluvial deposits, and more than 50 cm soil depth), mixed wood and biomass production based on *Pinus pinaster* species were chosen [51].

The organization of marketing logistics has also been important to boost and consolidate the share of the producer communities in the market, to produce bioenergy from sustainable sources. The margin generated by sales, as well as the return on assets, has improved from 2013, when the involvement of the communities in the project began, to the present. This positive evolution is explained through the establishment of organizational alliances between forest owners, local and regional institutions, and biomass production and consumption companies. The increase in production, except in 2018 for environmental reasons, has generated economies of scale.

As can be observed in Table 2, in the case of forest management communities (bioenergy project), the median value of the operating income increased more than 5 times over the period 2011–2020; in 2013, the values registered a large jump, from EUR 22,000 to EUR 180,000. The median value of total assets oscillated over the time period, decreasing between 2011 and 2013, followed by slightly greater increases and decreases until 2018, and a significant increase in 2020, almost 100% more than in 2019. The number of employees decreased by half over the time period, and the median value of p/L before tax oscillated a great deal over time; however, overall, the values registered a small increase, from EUR 65,000 to EUR 77,000.

In the case of forest management communities (with no energy use of their resources), the median value of operating income oscillated over the period 2011–2020, but, overall, it registered a descending trend. Regarding total assets, a small increase could be observed over the time period, and, in the case of employees, it registered an increase until 2014, followed by decreases and increases. The median value of P/L before tax oscillated substantially, but at the beginning of the period, it was registered as EUR 10,000 and, by the end of the period, it was registered as EUR 1000. These results indicate an increase in the structure indicators regarding forest management communities, both in the case of bioenergy projects and with no energy use of their resources, the greater increase in those communities with bioenergy projects highlighting its impact on economic added value.

A core indicator in the case of the forest is represented by wood production. As can be observed in Figure 4, wood production increased until 2018, along with the average price of wood, while after this period, it decreased. Thus, we can affirm that the results of forest management increased over time, highlighting its good performance.

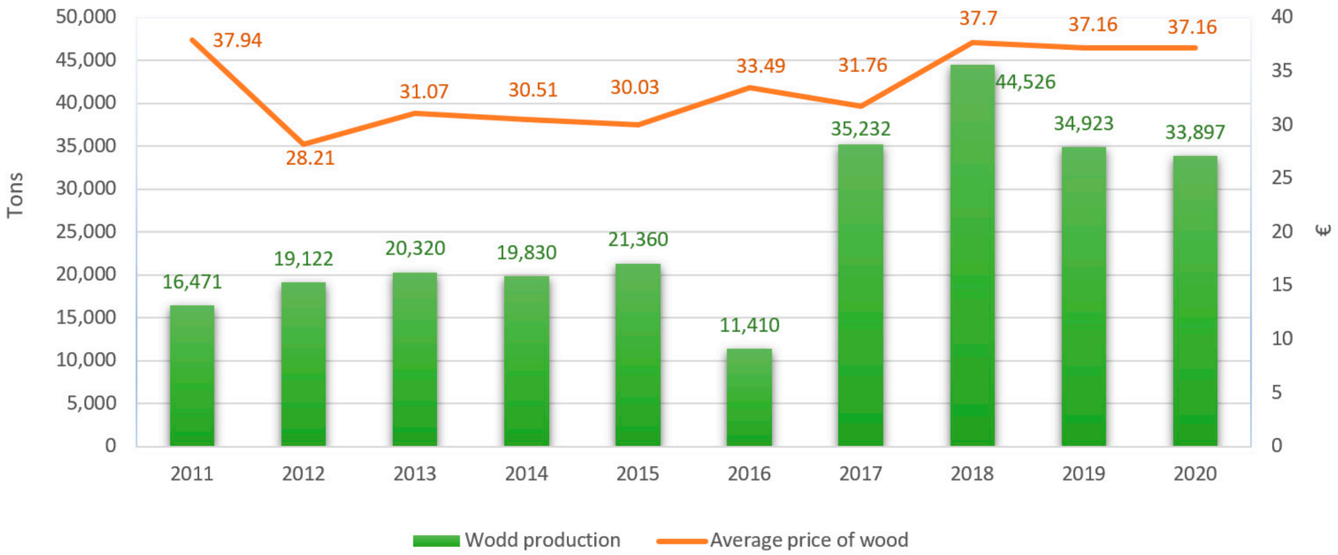

Figure 4. Wood production and average price per ton of wood marketed in Galicia (2011–2020).

The decreasing trend in the forest management communities (no energy use of their resources) is related to a crisis in wood production, in which both the production and the price per ton of wood decreased until 2017. Galician wood production is concentrated in three species: *Pinus pinaster, Eucalyptus nitens,* and *Eucalyptus globulus.* Eucalyptus wood is mainly destined for the pulp and paper industry. Since 2012, the price paid by this sector to private producers has dropped by up to 10% (Figure 4) [52]. Faced with this reduction in income, the forestry communities sought a solution by the export of wood to Portugal, where large paper companies operate. However, the data show that while 1,526,129 tons of Galician wood were exported to Portugal in 2013, only 744,479 tons were exported in 2015. The Galician forestry producers' associations blamed this situation on a tacit agreement between the companies of Ence (Galicia), Portucel (Portugal), and Celvi (Portugal); therefore, they pushed for an investigation by the Galician Competition Council, which was not accomplished [53]. In 2016, this scenario was compounded by the proliferation of the eucalyptus pest *Gonipterus scutellatus*, which reduced production to its minimum quotas [54].

Table 3 presents the median value of the economic performance indicators over the time period of 2011–2020. In the case of forest management communities (bioenergy project), the median value of ROA increased from 0.7% in 2011 to 0.91% in 2020. The highest values were registered in 2014, 2017, and 2019 (13.17%, 14.38%, and 14.15%) and in 2012, they registered the minimum value, which was, furthermore, a negative value (−5.26%). The trend is similar in the case of ROE. In the case of a debt ratio, the values increased from 0.29% in 2011, up to 0.39% in 2020, the maximum values being registered in 2015, 2016, 2018, and 2019 (4.67%, 6.17%, and 4.07% for 2018 and 2019). The median value for the EBIT margin increased by more than twice over time, from 7.45% in 2011 to 16.83% in 2020. The maximum values were registered in 2016 and 2017 (56.79% and 49.72%) and the minimum value was registered in 2011 (7.45%).

In the case of forest management communities (with no energy use of their resources), the median value of ROA decreased from 7.58% to 0.75% over the time period, these being registered increases and decreases. The maximum value was reached in 2017 (11.73%) and the minimum value was reached in 2014 (−0.12%). The trend in the case of ROE is similar to that of ROA, decreasing from 9.5% in 2011 to 2.1% in 2020. Regarding the debt ratio, an oscillating trend was observed, decreasing overall from 18.03% (maximum value) in 2011 to 2.66% in 2020, with the minimum value being registered in 2013 (1.84%). EBIT margin values decreased over time, from −7.05% in 2011 to −36.6% (minimum value) in 2020, the 2012 value being registered as the maximum value (88.07%).

These results indicate a decrease in economic performance indicators regarding forest management communities, both in the case of bioenergy projects and with no energy use of their resources, with the greater decrease in bioenergy projects highlighting its impact on economic performance.

The group of forest management communities focuses its production on three different types of activities: timber harvesting, pasture harvesting, and mycological cultivation. The communities located in the east of the region are the ones that practice the highest percentage of timber harvesting, while pasture and mycological activities are mostly located in the forests of western Galicia. Except for the mycological activity, timber and grazing activities have a long tradition in the communally managed forests of Galicia.

In Table 4, we present the median values for the rate of change of the structure in the case of financial indicators for forest management communities, both for bioenergy projects and with no energy use of their resources. In the case of operating income, the rate of change for the period 2011–2020 was 4.35%, in the case of bioenergy projects, and −0.17% in the case of no energy use of their resources. In terms of total assets, the rate of change for the period 2011–2020 was −0.09% in the case of bioenergy projects and 0.10% in the case of no energy use of their resources. The median P/L before the tax rate of change for the period 2011–2020 was 0.18% in the case of bioenergy projects and −0.9% in the case of no energy use of their resources. Regarding the number of employees, the rate of change for the period 2011–2020 was −0.57% in the case of bioenergy projects and −0.18% in the case of no energy use of their resources.

According to Table 5, it can be seen that in the case of forest management communities, the rate of change for ROA for the time period 2011–2020 was 0.30% in the case of bioenergy projects and −0.9% in the case of there being no energy use of their resources. In the case of ROE, it registered a rate of change of 0.30% regarding bioenergy projects and 0.78% in the case of there being no energy use of their resources. The debt ratio rate of change was 0.34% in the case of the bioenergy projects and −0.85% % in the case of there being no energy use of their resources. Regarding EBIT, the rate of change was 1.26% in the case of bioenergy projects and −4.19% in the case of there being no energy use of their resources.

Table 4. Rates of change of the structural indicators of the two forest management communities' groups at the aggregate level.

Forest Management Communities (Bioenergy Project)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2011–2020
	% Var.	% Var.	% Var.	% Var.	% Var.	% Var.	% Var.	% Var.	% Var.	% Var.	% Var
Operating income/turnover (th EUR)—Median	43	22	170	162	165	193	188	97	126	230	4.35
P/L before tax (th EUR)—Median	65	−452	27	21	−15	110	91	−10	52	77	0.18
Total assets (th EUR)—Median	9224	8588	4491	4523	4411	4504	4537	4483	4561	8364	−0.09
Number of employees—Sum	7	6	6	6	6	4	4	7	3	3	−0.57
Forest Management Communities (no energy use of their resources)											
Operating income/turnover (th EUR)—Median	42	35	35	40	68	39	46	36	46	35	−0.17
P/L before tax (th EUR)—Median	10	12	5	10	23	18	21	6	8	1	−0.90
Total assets (th EUR)—Median	133	137	135	195	186	147	157	200	173	146	0.10
Number of employees—Sum	106	104	110	125	121	122	130	133	127	87	−0.18

Table 5. Rates of change of the economic performance indicators of the two groups of forest management communities at the aggregate level.

Forest Management Communities (Bioenergy Project)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2011–2020
	% Var.	% Var.	% Var.	% Var.	% Var.	% Var.	% Var.	% Var.	% Var.	% Var.	% Var
ROA (%)—Median	0.27	−8.51	−1.19	12.30	−0.56	0.61	0.53	−0.97	30.44	−0.94	0.30
ROE (%)—Median	0.27	−8.53	−1.19	12.20	−0.51	0.63	0.43	−0.97	29.80	−0.94	0.30
Debt ratio (%)—Median	0.21	−0.28	1.24	0.09	8.16	0.32	−0.63	0.76	0.00	−0.90	0.34
EBIT margin (%)—Median	−0.10	0.46	1.64	−0.24	−0.30	2.71	−0.12	−0.64	0.81	−0.48	1.26
Forest Management Communities (no energy use of their resources)											
ROA (%)—Median	−0.17	−0.10	−0.69	−1.06	−56.92	−0.98	77.20	−0.82	3.30	−0.92	−0.90
ROE (%)—Median	0.04	−0.22	−0.49	−0.79	13.82	−0.97	48.74	−0.75	3.21	−0.87	−0.78
Debt ratio (%)—Median	1.93	−0.85	−0.33	1.11	0.10	0.25	−0.19	−0.18	0.31	−0.42	−0.85
EBIT margin (%)—Median	−1.82	−13.49	−0.96	−2.62	−5.63	−1.60	−2.59	−1.98	−1.29	−28.68	−4.19

5. Discussion and Conclusions

Global energy needs have increased considerably since the end of the 20th century. The increasing industrialization of developing countries and their growing populations has led to escalating global demand for fuels, mostly fossil fuels, which has led to an elevation in the emission of greenhouse gases [55]. The developed countries have also contributed to climate change through the types of industrial models widespread in high-income countries, which are traditionally energy intensive. Moreover, given the relatively higher institutional quality, the investment climate in developed countries is more attractive to investors. The development of the financial system, in turn, increases economic activities, positively influences real income, and contributes to the growth of energy demand and consumption [56,57].

Therefore, the growth in energy demand is a globally widespread phenomenon. The problem lies in the fact that large quantities of fossil fuels are used to meet this great need, which is one of the main causes of climate change [58]. Faced with such an important challenge, a political and social consensus has evolved over the years. The current political agenda against climate change is based on the Conference of the Parties (COP) for the United Nations Framework Convention on Climate Change (COP26) and the Convention on Biological Diversity (COP15), which present the foundations for addressing climate challenges using an integrated approach [59]. In turn, within the lines of action proposed by the previous agreements, supranational and national governments have designed and approved their own energy policies. However, there are historical deficiencies in terms of regional and local governance against climate change [60].

Within the multilevel institutional framework, the adoption of an environmental policy infrastructure is not as widespread as at other geographic levels. However, this fact increases the level of failure of climate strategies. The specific characteristics of each region must be taken into account in order to create regulatory instruments that influence local internal factors [61,62]. Policy frameworks should promote integrated solutions that create positive synergies and identify the needs and challenges of local entities, as they have an important role to play in the success of policies as a major agent in ecosystem governance [63]. The analysis of specific additional indicators is necessary for the substantiation of investment decisions in view of the configuration of economic policy measures [63].

De Jong et al. [64] analyzed greenhouse gas mitigation potential, in order to combine forest management and bioenergy substitution in the Central Highlands of Michoacan, Mexico, comparing the outcomes of the three scenarios in a managed community forest. The results highlighted that carbon mitigation potential after 20 years is smaller in the case of a conservation scenario than in the case of an oak conservation–bioenergy scenario. Therefore, the bioenergy scenario registers a carbon benefit yearly, while the oak conservation scenario will stop accumulating carbon after 40 years.

Kraxner et al. [65] showed that globally, nature-oriented forestry measures in the case of typical temperate forests and bioenergy systems lead to the continuous and permanent removal of CO_2 from the atmosphere, respecting the ecological integrity of the ecosystem.

In the southern United States, using forest resources in order to create bioenergy and bio-based products is a viable option, increasing the value to the forest landowners, providing a renewable natural energy source, and providing much-needed economic development for many southern communities [66].

Studies in North America indicate that growth reduction is conducive to nutrient removal in the harvested residue [67,68]. In Europe, residue extraction affects the subsequent growth rates of forests and, hence, the C sequestration rate [37].

In Australia, forest bioenergy has only developed to a very limited extent, although significant opportunities are known. The major cause for this limitation can be attributed to the lack of public acceptance and support, especially in the case of using native forest residues, which are the main available biomass source [69].

Carvalho-Ribeiro et al. [70] analyzed multifunctional forest management in Portugal in order to achieve sustainable development. Their results indicated that there were neither robust planning mechanisms nor adaptive governance systems regarding forest management in order to achieve a sustainable landscape scale, highlighting the difficulties encountered when implementing sustainable development concepts in practice.

Elsewhere in the world, Pagdee et al. [71] studied the factors leading to the success of community forest management, including both the biophysical and socioeconomic domains. These results illustrate the importance of community–forest relationships, the community's ability to organize and continue the collective activities, and the protection of the benefits, rights, and responsibilities in common resource management.

Although Galicia produces more than 8 million cubic meters of timber, the forestry sector provides only 12% of industrial employment in the region; thus, the potential to produce remains underdeveloped [41].

In this context, this article responds to the need to create a collection comprising research on local case studies. It addresses an innovative solution in the practice of communal forest management in Spain that values the role of local communities in the fight against climate change. The results presented in this study help policymakers in the preparation and design of environmental policies. Moreover, the study serves as a possible example to the other forest communities on whose management the use of biomass in Spain depends.

The results show that participation in the biomass project has been profitable, both from an economic and a social perspective. The trend in the financial variables of all the forest management communities participating in the Silvaplus project shows that their financial statements have improved since their incorporation into the project. The robustness of their financial accounts and their degree of consolidation has meant that, in the face of a large-scale crisis, such as that resulting from the COVID-19 crisis, not only has the financial and economic situation of the companies remained stable, but their operating income has also increased. This situation is the opposite seen in the group of communities that do not allocate their resources to energy use, which have seen their profitability reduced during the pandemic.

In the context of efficient energy transitions, the innovative solution offered by our study is given by the application element, based on the economic–financial indicators at the local level, namely, the region of Galicia, which gives the study a multiplicative effect, both in other regions at the European level, and also in other similar regions around the world. At the same time, another innovative element is based on the concept of a collaborative economy, which determines the encouragement of sustainable development at the local level and the maintenance of the ecosystem in the parameters of economic efficiency and cross-border collaboration between Galicia and the north of Portugal, with direct implications and benefits of an ecological nature.

On the other hand, there have also been social benefits that not only resonated with the community members but also in those populations where the bioenergy generation project has been developed. In addition to encouraging local development and cross-border collaboration between Galicia and northern Portugal, there have been benefits of an environmental nature. The most obvious is the reduction in greenhouse gas emissions by substituting fossil fuel energy with renewable energy. The risk of fires and pests has also been decreased, due to the design of biomass disposal.

Although our study is a case study focused on the Galicia region, we can consider the results on forest management to be generally pertinent, especially since, to our knowledge, it represents the first analysis in the literature considering these financial indicators.

These results can encourage the creation of new sustainable initiatives, in local settings and that are of local benefit, as well as achieve an effective energytransition. It would be of particular interest to compare the wider value added of forest communities dedicated to bioenergy and that of communities with installed wind farms. Furthermore, we can also consider other regions in future analyses.

This study has its limitations, including the reliance on data regarding management communities' results, and also due to the lack of relevant working papers. In terms of the existing literature, there are not that many significant papers related to our theme since we considered the management communities that participate in bioenergy projects. The limitations related to data consist of partial data availability, making it necessary to consider only some variables and the specific case study of the Galicia region.

Author Contributions: Conceptualization, R.F.-G., F.P.G., O.M., S.A.A. and V.V.; methodology, R.F.-G., F.P.G., O.M., S.A.A. and V.V.; validation, R.F.-G., F.P.G., O.M., S.A.A. and V.V.; formal analysis, R.F.-G., F.P.G., O.M., S.A.A. and V.V.; investigation, R.F.-G., F.P.G., O.M., S.A.A. and V.V.; resources, R.F.-G., F.P.G., O.M., S.A.A. and V.V.; data curation, R.F.-G., F.P.G., O.M., S.A.A. and V.V.; writing—original draft preparation, R.F.-G., F.P.G., O.M., S.A.A. and V.V.; writing—review and editing, R.F.-G., F.P.G., O.M., S.A.A. and V.V.; visualization, R.F.-G., F.P.G., O.M., S.A.A. and V.V. All authors have read and agreed to the published version of the manuscript.

Funding: This research has been funded by the Consellería de Cultura, Educación e Ordenación Universitaria of the Xunta de Galicia in Spain, through the predoctoral grant, ED481A-2018/341, the postdoctoral grant ED481B2018/095, and the following grants: ED431C2018/48 and ED431E2018/07. In addition, this publication is part of the Spanish R&D and I project, RTI2018-099225-B-100, funded by MCIN/AEI/10.13039/501100011033/and FEDER: "A way of doing Europe".

Data Availability Statement: Publicly available datasets were analyzed in this study. This data can be found here: https://sabi.bvdinfo.com/version-2020226/List.FormatEdition.serv?_CID=110&BackServiceid=List&context=HM2OED7UO1AWU08 (accessed on 12 July 2022).

Acknowledgments: The authors would like to thank Juan Carlos López Rodríguez for his contributions to this article.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Afshan, S.; Ozturk, I.; Yaqoob, T. Facilitating Renewable Energy Transition, Ecological Innovations and Stringent Environmental Policies to Improve Ecological Sustainability: Evidence from MM-QR Method. *Renew. Energy* **2022**, *196*, 151–160. [CrossRef]
2. Sovacool, B.K.; Hess, D.J.; Cantoni, R.; Lee, D.; Claire Brisbois, M.; Jakob Walnum, H.; Freng Dale, R.; Johnsen Rygg, B.; Korsnes, M.; Goswami, A.; et al. Conflicted transitions: Exploring the actors, tactics, and outcomes of social opposition against energy infrastructure. *Glob. Environ. Chang.* **2022**, *73*, 102473. [CrossRef]
3. Durdovic, M. Emergent consequences of narrating futures in energy transitions. *Futures* **2022**, *138*, 102930. [CrossRef]
4. Li, F.G.N. Actors behaving badly: Exploring the modelling of non-optimal behaviour in energy transitions. *Energy Strategy Rev.* **2017**, *15*, 57–71. [CrossRef]
5. Shahbaz, M.; Wang, J.; Dong, K.; Zhao, J. The impact of digital economy on energy transition across the globe: The mediating role of government governance. *Renew. Sustain. Energy Rev.* **2022**, *166*, 112620. [CrossRef]
6. United Nations Decision-/CP.26. Glasgow Climate Pact. Available online: https://unfccc.int/sites/default/files/resource/cop26_auv_2f_cover_decision.pdf (accessed on 12 July 2022).
7. World Leaders, Corporations at COP26, Take Major Step to Restore and Protect Forests. Available online: https://news.un.org/en/story/2021/11/1104642 (accessed on 9 July 2022).
8. U. N. Sustainable Development. Sustainably Manage Forests, Combat Desertification, Halt and Reverse Land Degradation, Halt Biodiversity Loss. Available online: https://www.un.org/sustainabledevelopment/biodiversity/ (accessed on 6 July 2022).
9. Oldekop, J.A.; Sims, K.R.E.; Karna, B.K.; Whittingham, M.J.; Agrawal, A. Reductions in deforestation and poverty from decentralized forest management in Nepal. *Nat. Sustain.* **2019**, *2*, 421–428. [CrossRef]
10. Lawrence, D.; Vandecar, K. Effects of tropical deforestation on climate and agriculture. *Nat. Clim. Chang.* **2015**, *5*, 27–36. [CrossRef]
11. Klooster, D.; Masera, O. Community forest management in Mexico: Carbon mitigation and biodiversity conservation through rural development. *Glob. Environ. Chang.* **2000**, *10*, 259–272. [CrossRef]
12. Samii, C.; Lisiecki, M.; Kulkarni, P.; Paler, L.; Chavis, L. Effects of decentralized forest management (DFM) on deforestation and poverty in low- and middle-income countries: A systematic review. *Campbell Syst. Rev.* **2014**, *10*, 1–88. [CrossRef]
13. Zulu, L.C. The forbidden fuel: Charcoal, urban woodfuel demand and supply dynamics, community forest management and woodfuel policy in Malawi. *Energy Policy* **2010**, *38*, 3717–3730. [CrossRef]
14. Irfan, M.; Elavarasan, R.M.; Ahmad, M.; Mohsin, M.; Dagar, V.; Hao, Y. Prioritizing and overcoming biomass energy barriers: Application of AHP and G-TOPSIS approaches. *Technol. Forecast. Soc. Chang.* **2022**, *177*, 121524. [CrossRef]
15. Majeed, M.T.; Luni, T.; Tahir, T. Growing green through biomass energy consumption: The role of natural resource and globalization in a world economy. *Environ. Sci. Pollut. Res.* **2022**, *29*, 33657–33673. [CrossRef] [PubMed]
16. Vavrek, R.; Chovancová, J. Energy Performance of the European Union Countries in Terms of Reaching the European Energy Union Objectives. *Energies* **2020**, *13*, 5317. [CrossRef]
17. Wilson, J.D. A securitisation approach to international energy politics. *Energy Res. Soc. Sci.* **2019**, *49*, 114–125. [CrossRef]
18. European Parliament La Política Energética: Principios Generales | Fichas Temáticas Sobre la Unión Europea | Parlamento Europeo. Available online: https://www.europarl.europa.eu/factsheets/es/sheet/68/la-politica-energetica-principios-generales (accessed on 11 July 2022).
19. European Commission. Joint Research Centre. In *The Use of Woody Biomass for Energy Production in the EU*; Publications Office: Luxembourg, 2021.
20. Brandão, P.C.; de Souza, A.L.; Rousset, P.; Simas, F.N.B.; de Mendonça, B.A.F. Forest biomass as a viable pathway for sustainable energy supply in isolated villages of Amazonia. *Environ. Dev.* **2021**, *37*, 100609. [CrossRef]
21. Präger, F.; Paczkowski, S.; Sailer, G.; Derkyi, N.S.A.; Pelz, S. Biomass sources for a sustainable energy supply in Ghana—A case study for Sunyani. *Renew. Sustain. Energy Rev.* **2019**, *107*, 413–424. [CrossRef]
22. Suntana, A.S.; Vogt, K.A.; Turnblom, E.C.; Upadhye, R. Bio-methanol potential in Indonesia: Forest biomass as a source of bio-energy that reduces carbon emissions. *Appl. Energy* **2009**, *86*, S215–S221. [CrossRef]

23. Lehtinen, U.; Juntunen, J.; Juga, J. Evaluating the feasibility of bio-energy based heat and power production in rural community. *Biomass Bioenergy* **2020**, *139*, 105578. [CrossRef]
24. Gabisa, E.W.; Gheewala, S.H. Potential of bio-energy production in Ethiopia based on available biomass residues. *Biomass Bioenergy* **2018**, *111*, 77–87. [CrossRef]
25. Qu, M.; Ahponen, P.; Tahvanainen, L.; Pelkonen, P. Chinese academic experts' assessment for forest bio-energy development in China. *Energy Policy* **2010**, *38*, 6767–6775. [CrossRef]
26. Mateos, E.; Ormaetxea, L. Sustainable Renewable Energy by Means of Using Residual Forest Biomass. *Energies* **2018**, *12*, 13. [CrossRef]
27. Mateos, E.; Garrido, F.; Ormaetxea, L. Assessment of Biomass Energy Potential and Forest Carbon Stocks in Biscay (Spain). *Forests* **2016**, *7*, 75. [CrossRef]
28. Puy, N.; Tabara, D.; Bartrolimolins, J.; Bartrolialmera, J.; Rieradevall, J. Integrated Assessment of forest bioenergy systems in Mediterranean basin areas: The case of Catalonia and the use of participatory IA-focus groups. *Renew. Sustain. Energy Rev.* **2008**, *12*, 1451–1464. [CrossRef]
29. Regos, A.; Aquilué, N.; López, I.; Codina, M.; Retana, J.; Brotons, L. Synergies Between Forest Biomass Extraction for Bioenergy and Fire Suppression in Mediterranean Ecosystems: Insights from a Storyline-and-Simulation Approach. *Ecosystems* **2016**, *19*, 786–802. [CrossRef]
30. Madrigal, J.; Fernández-Migueláñez, I.; Hernando, C.; Guijarro, M.; Vega-Nieva, D.J.; Tolosana, E. Does forest biomass harvesting for energy reduce fire hazard in the Mediterranean basin? A case study in the Caroig Massif (Eastern Spain). *Eur. J. For. Res.* **2017**, *136*, 13–26. [CrossRef]
31. Lorenzo-Sáez, E.; Oliver-Villanueva, J.-V.; Lerma-Arce, V.; Yagüe-Hurtado, C.; Lemus-Zúñiga, L.G. Potential Analysis of Mediterranean Forestry for Offsetting GHG Emissions at Regional Level: Evidence from Valencia, Spain. *Sustainability* **2021**, *13*, 4168. [CrossRef]
32. Miguez, J.; Lopezgonzalez, L.; Sala, J.; Porteiro, J.; Granada, E.; Moran, J.; Juarez, M. Review of compliance with EU-2010 targets on renewable energy in Galicia (Spain). *Renew. Sustain. Energy Rev.* **2006**, *10*, 225–247. [CrossRef]
33. Soliño, M.; Prada, A.; Vázquez, M.X. Green electricity externalities: Forest biomass in an Atlantic European Region. *Biomass Bioenergy* **2009**, *33*, 407–414. [CrossRef]
34. Soliño, M.; Vázquez, M.X.; Prada, A. Social demand for electricity from forest biomass in Spain: Does payment periodicity affect the willingness to pay? *Energy Policy* **2009**, *37*, 531–540. [CrossRef]
35. Soliño, M.; Farizo, B.A.; Campos, P. The influence of home-site factors on residents' willingness to pay: An application for power generation from scrubland in Galicia, Spain. *Energy Policy* **2009**, *37*, 4055–4065. [CrossRef]
36. Vanegas Cantarero, M.M. Of renewable energy, energy democracy, and sustainable development: A roadmap to accelerate the energy transition in developing countries. *Energy Res. Soc. Sci.* **2020**, *70*, 101716. [CrossRef]
37. Instituto Galego de Estadística Análise da Cadea Forestal-Madeira. Available online: https://www.ige.gal/Shiny/Analise_Cadea_Forestal_Madeira/ (accessed on 11 July 2022).
38. Red Eléctrica de Español. *Informe del Sistema Eléctrico Español 2020*; Red Eléctrica de España: Madrid, Spain, 2021.
39. Copena, D.; Pérez-Neira, D.; Simón, X. Local Economic Impact of Wind Energy Development: Analysis of the Regulatory Framework, Taxation, and Income for Galician Municipalities. *Sustainability* **2019**, *11*, 2403. [CrossRef]
40. Simón, X.; Copena, D.; Montero, M. Strong wind development with no community participation. The case of Galicia (1995–2009). *Energy Policy* **2019**, *133*, 110930. [CrossRef]
41. Copena, D.; Simón, X. Wind farms and payments to landowners: Opportunities for rural development for the case of Galicia. *Renew. Sustain. Energy Rev.* **2018**, *95*, 38–47. [CrossRef]
42. Comunidad Autónoma de Galicia. Ley 13/1989, de 10 de Octubre, de Montes Vecinales En Mano Común. BOE-A-1990-3358. 1990, pp. 3996–3999. Available online: https://noticias.juridicas.com/base_datos/CCAA/ga-l13-1989.html (accessed on 15 July 2022).
43. Xunta de Galicia Montes Vecinales en Man Común. Available online: https://ovmediorural.xunta.gal/es/consultas-publicas/montes-vecinales-en-man-comun (accessed on 11 July 2022).
44. Proyecto Silvaplus Objetivos y Socios. Available online: http://silvaplus.com/es/ (accessed on 12 July 2022).
45. Silvaplus Promoción del uso Sostenible de Biomasa Forestal para Fines Energéticos en el Norte de Portugal y sur de Galicia. Available online: http://silvaplus.com/fotos/editor2/Produtos/silvaplus_es.pdf (accessed on 10 July 2022).
46. SABI. *Análisis de Balances de Empresas 2020*; SABI: Madrid, Spain, 2020.
47. Fernández-González, R.; Pérez-Pérez, M.I.; Pérez-Vas, R. Real options for a small company in a context of market concentration: A case study of investment in a turbot farming plant in Spain. *Mar. Policy* **2021**, *134*, 104828. [CrossRef]
48. Fernández-González, R.; Pérez-Pérez, M.; Hervés-Estévez, J.; Garza-Gil, M.D. Socio-economic impact of COVID-19 on the fishing sector: A case study of a region highly dependent on fishing in Spain. *Ocean Coast. Manag.* **2022**, *221*, 106131. [CrossRef]
49. Xunta de Galicia. *Anuario de Estadística Forestal de Galicia 2019*; Xunta de Galicia, Consellería do Medio Rural: Santiago de Compostela, Spain, 2020; p. 120.
50. Xunta de Galicia Sistema de Indicadores da Administración Dixital. Available online: https://indicadores-forestal.xunta.gal/portal-bi-internet/dashboard/Dashboard.action (accessed on 13 July 2022).
51. Silvaplus Parcelas de Ensayo y Demostración Para la Producción de Biomasa. Available online: http://silvaplus.com/fotos/editor2/Produtos/parcelas_silvaplus_web_es.pdf (accessed on 9 July 2022).

52. Ministerio de Agricultura Pesca y Alimentación Estadísticas agrarias: Economía. Available online: https://www.mapa.gob.es/es/estadistica/temas/estadisticas-agrarias/economia/default.aspx (accessed on 7 August 2022).
53. La Voz de Galicia Parálisis en la Venta de Madera a Portugal. Available online: https://www.lavozdegalicia.es/noticia/ferrol/ferrol/2017/06/29/paralisis-venta-madera-portugal/0003_201706F29C1995.htm (accessed on 7 August 2022).
54. Mansila, P.; Pérez-Otero, R.; Salinero, C. *Lucha Biológica Contra Plagas Forestales en Galicia*; MOL (Sociedad de Ciencias de Galicia): Pontevedra, Spain, 2020.
55. Sequeira, T.N.; Santos, M.S.; Magalhães, M. Climate change and economic growth: A heterogeneous panel data approach. *Environ. Sci. Pollut. Res.* **2018**, *25*, 22725–22735. [CrossRef]
56. Katircioğlu, S.T.; Taşpinar, N. Testing the moderating role of financial development in an environmental Kuznets curve: Empirical evidence from Turkey. *Renew. Sustain. Energy Rev.* **2017**, *68*, 572–586. [CrossRef]
57. Imamoglu, H. The role of financial sector in energy demand and climate changes: Evidence from the developed and developing countries. *Environ. Sci. Pollut. Res.* **2019**, *26*, 22794–22811. [CrossRef]
58. Tan, X.; Zhu, K.; Meng, X.; Gu, B.; Wang, Y.; Meng, F.; Liu, G.; Tu, T.; Li, H. Research on the status and priority needs of developing countries to address climate change. *J. Clean. Prod.* **2021**, *289*, 125669. [CrossRef]
59. Pettorelli, N.; Graham, N.A.J.; Seddon, N.; Maria da Cunha Bustamante, M.; Lowton, M.J.; Sutherland, W.J.; Koldewey, H.J.; Prentice, H.C.; Barlow, J. Time to integrate global climate change and biodiversity science-policy agendas. *J. Appl. Ecol.* **2021**, *58*, 2384–2393. [CrossRef]
60. Wu, S.; Han, H. Energy transition, intensity growth, and policy evolution: Evidence from rural China. *Energy Econ.* **2022**, *105*, 105746. [CrossRef]
61. Fernández-González, R.; Arce, E.; Garza-Gil, D. How political decisions affect the economy of a sector: The example of photovoltaic energy in Spain. *Energy Rep.* **2021**, *7*, 2940–2949. [CrossRef]
62. Miguez, G.C.; Ballesteros, M.A.; Fernández-González, R. La economía política de Elinor Ostrom: Análisis institucional, comunes y gobernanza policéntrica. *Rev. Española Cienc. Política* **2015**, *28*, 13–40.
63. Fernández-González, R.; Suárez-García, A.; Álvarez Feijoo, M.Á.; Arce, E.; Díez-Mediavilla, M. Spanish Photovoltaic Solar Energy: Institutional Change, Financial Effects, and the Business Sector. *Sustainability* **2020**, *12*, 1892. [CrossRef]
64. de Jong, B.H.; Masera, O.; Olguín, M.; Martínez, R. Greenhouse gas mitigation potential of combining forest management and bioenergy substitution: A case study from Central Highlands of Michoacan, Mexico. *For. Ecol. Manag.* **2007**, *242*, 398–411. [CrossRef]
65. Kraxner, F.; Nilsson, S.; Obersteiner, M. Negative emissions from BioEnergy use, carbon capture and sequestration (BECS)—The case of biomass production by sustainable forest management from semi-natural temperate forests. *Biomass Bioenergy* **2003**, *24*, 285–296. [CrossRef]
66. Mayfield, C.A.; Foster, C.D.; Smith, C.T.; Gan, J.; Fox, S. Opportunities, barriers, and strategies for forest bioenergy and bio-based product development in the Southern United States. *Biomass Bioenergy* **2007**, *31*, 631–637. [CrossRef]
67. Ponder, F.; Fleming, R.L.; Berch, S.; Busse, M.D.; Elioff, J.D.; Hazlett, P.W.; Kabzems, R.D.; Marty Kranabetter, J.; Morris, D.M.; Page-Dumroese, D.; et al. Effects of organic matter removal, soil compaction and vegetation control on 10th year biomass and foliar nutrition: LTSP continent-wide comparisons. *For. Ecol. Manag.* **2012**, *278*, 35–54. [CrossRef]
68. Thiffault, E.; Hannam, K.D.; Paré, D.; Titus, B.D.; Hazlett, P.W.; Maynard, D.G.; Brais, S. Effects of forest biomass harvesting on soil productivity in boreal and temperate forests—A review. *Environ. Rev.* **2011**, *19*, 278–309. [CrossRef]
69. Smyth, C.; Kurz, W.A.; Rampley, G.; Lemprière, T.C.; Schwab, O. Climate change mitigation potential of local use of harvest residues for bioenergy in Canada. *GCB Bioenergy* **2017**, *9*, 817–832. [CrossRef]
70. Carvalho-Ribeiro, S.M.; Lovett, A.; O'Riordan, T. Multifunctional forest management in Northern Portugal: Moving from scenarios to governance for sustainable development. *Land Use Policy* **2010**, *27*, 1111–1122. [CrossRef]
71. Pagdee, A.; Kim, Y.S.; Daugherty, P.J. What makes community forest management successful: A meta-study from community forests throughout the world. *Soc. Nat. Resour.* **2006**, *19*, 33–52. [CrossRef]