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Protecting the Local Landscape or Reducing Greenhouse Gas Emissions? A Study on Social Acceptance and Preferences towards the Installation of a Wind Farm

Maria De Salvo [1,2,*], Sandra Notaro [3], Giuseppe Cucuzza [1,2], Laura Giuffrida [1] and Giovanni Signorello [1,2]

[1] Department of Agriculture, Food and Environment, University of Catania, 95131 Catania, Italy; giuseppe.cucuzza@unict.it (G.C.); laura.giuffrida@phd.unict.it (L.G.); g.signorello@unict.it (G.S.)
[2] Centre for the Conservation and Management of Nature and Agroecosystems, University of Catania, 95131 Catania, Italy
[3] Department of Economics and Management, University of Trento, 38122 Trento, Italy; sandra.notaro@unitn.it
* Correspondence: maria.desalvo@unict.it

Abstract: We conducted a contingent valuation survey to estimate the social acceptance and preferences of a local community towards the installation of a wind farm in a countryside area presenting significant aesthetic, cultural, and identity place attributes. We focused on two opposite potential externalities caused by wind turbines. The first relates to the contribution to the reduction of greenhouse gas emission through the production of green energy. The second concerns the degradation of rural landscape assets. In the sample, we identified factors for or against the installation of the wind farm. People in favor of the wind farm were asked to state their willingness to pay for reducing the effect of global warming by purchasing electricity produced by wind turbines. People against it were solicited to declare their willingness to pay to avoid landscape loss. Welfare measures were elicited using a payment card elicitation format and quantified through different estimation models. An analysis of data revealed high heterogeneity in attitudes, beliefs, and preferences of citizens towards the two potentially competing environmental goods. The willingness to pay for reducing the effect of global warming was much higher than the willingness to pay for avoiding the loss of the rural landscape.

Keywords: wind farms; rural landscape; global warming; willingness to pay; contingent valuation method; payment card elicitation format

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1. Introduction

In the recent years, the rapid spread of wind farms worldwide as an answer to national commitments has entered into international agreements to tackle global warming, which have focused the attention of the public and academia on issues related to local negative impacts, such as landscape alterations; the production of noise; electromagnetic interferences; the subtraction of agricultural and natural space; and the risk of possible damages to flora and fauna, especially to migratory birds [1–6]. Although numerous sector studies and monitoring activities demonstrated the marginality of the majority of such impacts [7], the landscape degradation of wind farms is still considered a limiting factor, especially when wind farms take place in areas with distinctive landscape characteristics and identity place beliefs [8,9]. However, in such situations it is useful to investigate the social acceptance of wind farms [10,11], taking into account not only environmental attitudes but also how place identity perceptions can influence preferences and support the achievement of two competing green objectives: the reduction of green gas emission and the conservation of local landscapes. The literature suggests the existence of numerous key influencers of wind farms' social acceptance, and warns about difficulties in the analysis of this phenomenon due to complex interactions, at a variety of geographical scales, concerning attitudes, beliefs, and behaviors of individuals, communities, wind energy operators, regulatory regimes, and technology [12]. Many studies point out that the decision making process should be accompanied by early political and economic participation [13], communication with residents after the planning phase [14], possibilities for discretion at the local level [15–21], ecological compensations [22], the exclusion of decide–announce–defend practices [23], and distributional and procedural fairness in the siting process [24–30], and based on preliminary assessment of social economic losses and benefits [31–33].

In this study, we verify whether or not a community accepts the installation of a hypothetical wind farm in a rural area with a distinctive landscape and place identity value, and explore the main factors that motivate such choices. We also estimate the monetary values of two (opposite) environmental externalities. The first concerns the "Green-House Gas (GHG) emissions reduction", and the second is related to "landscape protection". Benefits associated with the former spring from a "global" environmental good. Oppositely, benefits related to the latter concern a "local" environmental good.

To investigate attitudes and monetary preferences towards these two very different environmental goods, we use the contingent valuation method (CVM) [34–36]. In the survey, respondents in favor of wind farms were asked to state their willingness to pay for reducing the effect of global warming by purchasing electricity produced by wind turbines, while respondents against it were solicited to declare their willingness to pay to avoid landscape loss. This "double" valuation exercise approach represents the main novelty of this study. To elicit welfare measures, we use the payment card format [37]. An analysis of attitudes and beliefs and an valuation of economic preferences for each environmental good are conducted through different econometric models. Our analysis reveals high heterogeneity in the attitudes, beliefs, and preferences of citizens towards two potentially competing environmental goods, and that willingness to pay for reducing the effect of global warming is much higher than the willingness to pay for avoiding the loss of the rural landscape.

2. Background

There is an extensive literature on the social acceptance of wind energy and on the assessment of economic impacts caused by the planting of wind farms. Ellis and Ferraro [12] identified numerous factors affecting the social approval of a wind farm. A list of these factors and their key influences is summarized in Table 1.

Devine-Wright [38] and Devine-Wright and Howes [39] identified the importance of the strength of place attachment and place identity among host communities in the acceptance of specific wind energy developments [38]. Other scholars [40–43] explored the role played by the "Not In My BackYard" (NIMBY) syndrome [44]. Smith and Klick [45], in particular, demonstrated that when people think about the advantages and disadvantages of wind farms, as they would if a wind farm were proposed for their community, their support for such technology diminishes. In this regard, Bell et al. [46] distinguished a ''social gap" from an ''individual gap". Social gap arises between high public support for wind energy expressed in opinion surveys and the low success rate achieved in planning applications for wind power developments; oppositely, ''individual gap" exists when an individual person has a positive attitude to wind power in general but actively opposes a particular wind power development. Guo et al. [47] proved the existence of a more extreme syndrome, named "not in my backyard, but not far away from me". Some authors [48–54] revealed non-existence of NIMBY. Others [32,55,56] judged that the NIMBY syndrome is inadequate in capturing the complexity of the phenomenon under investigation and neglected its validity.

Table 1. Summary of factors and influences on social acceptance of wind energy projects.

Variables	Main Determinants
Individual attitudes	Age, gender, educational level, ownership Strength of place attachment Political beliefs and voting preferences Emotional response Prior experience of wind turbines Attitudes to environmental issues Psychological factors including perception of social norms Individual roles (consumer, landowner, etc.) Familiarity with wind energy
Relationships	Type and level of social capital Trust in government other public agencies and developers Proximity to, and visibility of, turbines Technology-society relationships Time, reflecting the dynamic nature of social acceptance National–local policy Regulator–developer links Discourses within and between communities
Contextual issues	Policy regimes Project design—turbine height, color number and massing Place attachment Range and mix of actors Ownership of proposed project Specific siting issues Cumulative impacts
Perceived impacts	Noise Landscape Shadow flicker Property values Level of economic benefit Bio-diversity: bats, birds Infrasound Navigation lights Health concerns Levels of economic benefits Disruption of 'place' Efficiency of turbines and wind energy Distributive justice
Process-related issues	Trust in institutions involved Transparency and openness Procedural justice Expectations and aspirations of public participation Availability and quality of information Power in the participation process Value places on lay and expert knowledge Timing Discourses of community, developer, and regulatory bodies Fait accompli

Source: adapted from Ellis and Ferraro [12].

Devine-Wright [38] and Strazzera et al. [55], in particular, demonstrated the incapability of the NIMBY to explain social acceptance of wind firms, due to the complexity of both territorial and personal attitudes affecting social acceptance of wind farms. Recently, Brinkman and Hirsh [56] proved the existence of an opposite syndrome, "Please in My Backyard" (PIMBY), which represents the most recent expression of identity in rural communities, in opposition to the NIMBY syndrome of city residents.

As it concerns the assessment of economic impacts caused by the planting of a wind farms, the majority of existing literature focuses on welfare effects caused by the visual alterations of landscape. These welfare effects have been quantified by using different valuation methods, such as hedonic pricing [57–62], CVM [50,63–67], and choice experiments [55,68,69]. This primary valuation literature has been reviewed and summarized in several meta-analysis studies [7,66,70–75]. Recently, Goh et al. [76] provided a useful summary of existing literature on valuation of carbon tax and demonstrated through a Contingent Valuation study conducted in Malaysia that citizens have a high level of positive attitude towards and a significant willing to pay for a carbon tax to reduce greenhouse gas emission.

3. Materials and Method

The CVM survey was conducted in Ragusa, a town located in the Ibleo plateau in Southern part of Sicily (Italy). Using face-to-face interviews, we collected useful data from a random sample composed by 555 adult citizens. The survey was designed and administered following standard protocols and best-practice recommendations [77–79]. The design of the questionnaire benefitted from focus groups and pilot interviews. Focus groups highlighted a clear split in the public opinion between those who did not accept the construction of the wind farm due to its visual-landscape impact and those who recognized its utility for the reduction of greenhouse gas emissions. The final questionnaire was therefore structured to capture these two different types of attitudes and preferences and to provide two distinct monetary assessments: (1) the willingness to pay (WTP) for green electricity produced by the installation of the wind farm, thus reducing GHG emissions; (2) the WTP to protect the landscape of the Ibleo plateau, avoiding the construction of the wind farm. The first scenario was presented to respondents in favor of the installation of wind turbines near the town of Ragusa. The second one was presented to those who declared themselves opposed to the installation of wind turbines in the area of investigation.

In the case of the WTP for reducing greenhouse gas emissions, we used as payment an increase in the average bimonthly family bill to purchase green electricity produced by the simulated wind farm. For the elicitation of the WTP per household, we used a payment card format [37]. Respondents were asked to identify the percentage of average increase in their average bimonthly family bill (the amount of which was previously asked during the interview) that they were willing to pay to purchase electricity coming from the wind source. Prices ranged from a minimum of one euro to a maximum of € 150. We included the options to declare another value in addition to the payment card bids.

In the assessment of the WTP for the protection of the Ibleo landscape, we simulated the possibility to donate a lump sum to a hypothetical "fund" to acquire and preserve all land interested by the wind farm, thus avoiding the installation of the turbines. In the payment card, bids ranged from a minimum of one euro to a maximum of € 1000, and we allowed also for the possibility of identifying other amounts.

The final questionnaire was structured in three sections. Section A contained questions aimed at identifying environmental perception of the respondent, knowledge, identification and evaluation of the Ibleo agricultural landscape; presence of any disfiguring elements of this landscape; and potential interventions for its conservations. Other questions concerned the knowledge and visual perception of wind farms. To support these questions, the interviewer showed a photographic portfolio consisting of numerous images relating to some wind farms already installed in Sicily and in province of Ragusa; a photographic portfolio realized with Photoshop with images of the hypothetical wind farms that should have installed in an rural area near the town of Ragusa; an information sheet of political instruments to reduce GHG emissions; a list of advantages and disadvantages procured by the installation of a wind farms; statistical data on current consistency of wind power plants in Italy, in Sicily, and in the province of Ragusa; and a short technical data sheet on the hypothetical wind farm. Section B contained the two economic valuation scenarios previously illustrated. Section C was devoted to collect socio-economic characteristics of respondents.

Table 2 reports summary statistics for many variables used in the successive analysis.

Table 2. Summary statistics of the sample (*N* = 555).

Variables	Mean	Standard Deviation
Wind farms social acceptance:		
Agreement to the installation of wind farms in the province of Ragusa (1 if yes)	0.62	0.49
Agreement to the installation of wind farms in Ibleo plateau (1 if yes)	0.48	0.50
WTPs:		
Willing to buy electricity produced with the wind farm (1 if yes)	0.43	0.50
Willing to make a one-off monetary contribution aimed at creating a fund intended exclusively to purchase the rustic plots of that area, avoiding the installation of the wind farm and thus protecting the landscape of the Ibleo plateau (1 if yes)	0.36	0.48
Household WTP for reducing greenhouse emissions (in term of increments of the average amount of bimonthly bill for the supply of electricity) (in euro)	7.34	14.90
Household WTP for landscape protection (in euro)	43.85	119.94
Motivations for refusing wind farms installation:		
Negative impact on the landscape (1 if yes)	0.33	0.47
Noise (1 if yes)	0.08	0.27
Damage to birdlife (1 if yes)	0.11	0.32
Taking away space from agriculture (1 if yes)	0.08	0.27
Disturbing to grazing animals (1 if yes)	0.11	0.31
NIMBY (1 if yes)	0.14	0.35
Indifference to the problem (1 if yes)	0.01	0.07
The judgment depends on the type and cost of the system (1 if yes)	0.06	0.24
Opinions about landscape relevance:		
High importance to landscape in tourism destination choice (1 if yes)	0.06	0.24
High importance to landscape in daily trip (1 if yes)	0.04	0.19
The viewing of the rural local landscape generates a pleasant sensation (1 if yes)	0.86	0.47
The care and protection of the rural local landscape is extremely important (1 if yes)	0.97	0.18
The rural local landscape is generally positively judged (1 if yes)	0.06	0.24
Collectivity should protect the rural local landscape even if this involves significant costs (1 if yes)	0.86	0.35
The rural local landscape is disfigured by elements that should be removed (1 if yes)	0.76	0.43
Motives for rural landscape protection:		
The local rural landscape should be protected because its aesthetic qualities make outdoor sports and recreational activities pleasant (1 if yes)	0.46	0.50
The local rural landscape should be protected for its historical and cultural value (1 if yes)	0.77	0.42
The local rural landscape should be protected because it is right to leave it intact for future generations (1 if yes)	0.69	0.46
The local rural landscape should be protected because it can offer opportunities for sustainable economic development (agritourism, rural tourism) (1 if yes)	0.71	0.46
Actions for rural landscape maintenance:		
The local rural landscape should be maintained giving high priority to the maintenance and conservation of the traditional elements of the Ragusa landscape (dry stone walls, rural buildings, and carob trees) (1 if yes)	0.88	0.32
The local rural landscape should be maintained giving high priority to forestation (1 if yes)	0.60	0.49
The local rural landscape should be maintained giving high priority to the increasing in grazing area (1 if yes)	1.00	0.00
The local rural landscape should be maintained giving high priority to the increasing of the surface destined for spontaneous flora (1 if yes)	0.67	0.47
The local rural landscape should be maintained giving high priority to the removing of disfiguring elements (1 if yes)	0.92	0.27

Table 2. *Cont.*

Variables	Mean	Standard Deviation
Wind farms knowledge:		
The respondent has seen a wind farm in attendance	0.90	0.30
The respondent has seen a wind farm in photos or on TV before this interview	0.16	0.73
Respondent's attitudes, habits, and opinions about the environment:		
High level of information on environmental issues arising from the mass media (1 if yes)	0.44	0.50
The defense of the natural environment is extremely important (1 if yes)	0.02	0.13
Outdoor recreationist (1 if yes)	0.56	0.50
Agri-food tourist (tourism activities in rural areas, meal and/or stay on farms, food, and wine tours) (1 if yes)	0.86	0.35
Natural tourist (naturalistic hiking, guided visits to oases, natural parks, reserves, and zoos) (1 if yes)	0.60	0.49
Social volunteer (1 if yes)	0.28	0.45
Environmental volunteer (1 if yes)	0.15	0.36
Donations in the past, to non-profit associations that deal with solidarity, the environment, health (1 if yes)	64.00	665.30
Respondent's profile:		
Age (in years)	49.17	14.02
Male (1 if yes)	0.49	0.50
Educational level (in years)	13.93	3.76
Employed (1 if yes)	0.70	0.46
Family size	3.23	1.26
Number of minors in the family	0.33	0.67
Other employed in the family (1 if yes)	0.62	0.49
Ownership (1 if yes)	0.08	0.26
Income (in euro)	36,171.96	17,063.11
Average amount of bimonthly bill for the supply of electricity (in euro)	105.32	42.13

To identify variables influencing the decision to support or not the plant of the wind farm near the town of Ragusa, we estimated a Probit model [80]:

$$Y = X^T\beta + \varepsilon \tag{1}$$

where X^T represents the matrix of covariates able to explain the value of the dichotomous dependent variable, represented by Y, and ε is the idiosyncratic error, assuming that $\varepsilon \sim N(0, \sigma^2)$.

The dependent variable (Y) is an indicator variable and depends on a latent variable, Y^*:

$$Y = \begin{cases} 1 & Y^* > 0 \\ 0 & otherwise \end{cases} \tag{2}$$

Therefore, Y equals 1 if the respondent accepts the installation of the wind farm, 0 otherwise. The variable Y^* formally represents the differences between the WTP to reduce gas emissions and the WTP to protect the Ibleo landscape. Thus, this variable is able to express in monetary terms the trade-off between the preferences for the two environmental goods, named the reduction of gas emissions (the global good) and the protection of the Ibleo landscape (the local good). Consequently, at the question: "do you agree with the installation of the wind farm near to you?", the respondent assigning a higher value to the reduction of gas emissions answered "yes". In this case, $Y = 1$ and $Y^* > 0$. Otherwise, if the respondent judged the protection of the rural landscape to be more important, his/her response was "no". In this case, $Y = 0$ and $Y^* < 0$. For "I don't know" answers, $Y = 0$ and $Y^* = 0$.

The Probit model takes the form:

$$\Pr(Y|X) = \Phi\left(X^T\beta\right) \tag{3}$$

where *Pr* denotes probability and $\Phi(\cdot)$ is the cumulative distribution function (CDF) of the standard normal distribution. The parameters β and σ were estimated by maximum the likelihood function:

$$\mathcal{L}(\beta,\sigma|Y,\ X) = \prod_{i=1}^{n}\left(\Phi({x_i}'\beta)^{y_i}\left[1-\Phi({x_i}'\beta)^{(1-y_i)}\right]\right) \tag{4}$$

where the set $\{y_i, x\}_{i=1}^{n}$ represents data related to n individuals.

The Probit model was also used to identify in the two subsamples, defined according their approval or disapproval of the installation of the wind farm near Ragusa, variables influencing the willingness to pay (y_{i^*} = 1 and $z_i > 0$; y_{i^*} = 0 and $z_i \leq 0$) or to buy green energy or to protect landscape assets. Figure 1 illustrates the subsample segmentation and names assigned to all Probit models.

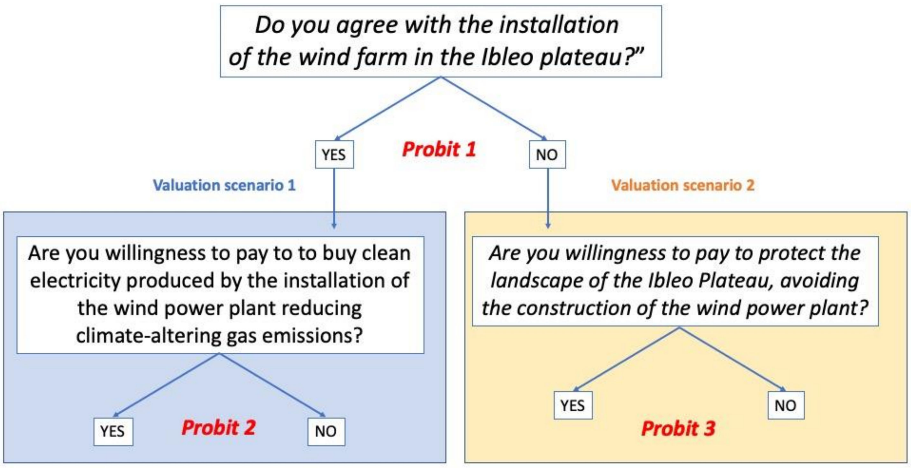

Figure 1. Questions articulation and Probit models.

The WTP was estimated using non-parametric and parametric econometric approaches. Non-parametric approach follows the minimum legal interpretation proposed by Harrison and Kristrom (1995) [81] and assumes that the WTP of the respondent has to be considered equal to the selected bid in the payment card. Instead, parametric approaches rely on the assumption that the WTP of respondent lies between the picked bid or price and the subsequent bid or price reported in the payment card if it is arranged, as in our case, in ascending order [37]. Consequently, parametric approaches follow a probabilistic interpretation. In the study, we used several models that implicitly adopt different assumptions on interval distribution of WTP. They are: i) the Tobit model [82]; ii) the Cameron and James [83] model; and iii) the dichotomous choice multiple bound model [84,85]. In all these models, we specified s multivariate function for estimating summary statistics for WTP.

The Tobit specification is a censored regression model, where the dependent variable is left-censored, right-censored, or either [82]. It is based on a latent variable (Y^*), which is obtained by an observed variable truncated to specific values. In this case of study, the observed variable was represented by the elicited WTP, which is truncated to zero. We assumed that:

$$\mathrm{WTP} = \begin{cases} = 0 & Y^* \leq 0 \\ = Y^* & Y^* > 0 \end{cases} \tag{5}$$

Moreover, we assumed a linear relation between the WTP and the covariates (X) and $\varepsilon_i \sim N(0,\sigma^2)$. The parameters β and σ were estimated by maximum the likelihood function:

$$\mathcal{L}(\beta,\sigma|Y,\ X) = \prod_{i=1}^{n}\left(\frac{1}{\sigma}\varphi\left(\frac{y_i - x_i{}'\beta}{\sigma}\right)^{\mathrm{WTP}_i}\left(1 - \Phi\left(\left(\frac{x_i{}'\beta}{\sigma}\right)\right)^{(1-\mathrm{WTP}_i)}\right)\right) \tag{6}$$

where φ(.) represents the standard normal probability density function, Φ(.) is the CDF, and n is the number of observations.

The Cameron and James model [86] assumes that the bid selected in the payment card (t_j) is an underestimate of the true individual WTP, which falls in the interval [$t_j \leq \mathrm{WTP}_i < t_{j+1}$] where the t_{j+1} is the bid following t_j. This model can be interpreted as a variant of the Tobit model, given that it assumes that the true WTP_i shows a truncate distribution and is both inferiorly and superiorly limited. This approach was used to analyze payment card data by Majumdar et al. [87], Chen and Qi [88], Chen et al., [89] and Chen et al. [90].

Tables 3 and 4 report, for each bid value included in the payment cards, the frequency and the interval of ranging according to the Cameron and James [83] model.

Table 3. Frequencies and WTP interval range of prices to purchase green energy produced by wind turbines.

j	t_j	WTP Range	Frequency	%
1		$-\infty \leq$ WTP < 0.0		
2	0.0	0.0 $\leq$ WTP < 0.5	31	11.5
3	0.5	0.5 $\leq$ WTP < 1.0	15	5.6
4	1.0	1.0 $\leq$ WTP < 2.5	19	7.1
5	2.5	2.5 $\leq$ WTP < 5.0	49	18.2
6	5.0	5.0 $\leq$ WTP < 7.5	52	19.3
7	7.5	7.5 $\leq$ WTP < 12.5	21	7.8
8	10.0	10.0 $\leq$ WTP < 12.5	35	13.0
9	15.0	15.0 $\leq$ WTP < 20.0	23	8.6
10	20.0	20.0 $\leq$ WTP < 25.0	5	1.9
11	25.0	25.0 $\leq$ WTP < +∞	19	7.1
	Total		269	100.0

Table 4. Frequencies and WTP interval range of bids to protect the Ibleo plateau landscape.

j	t_j	WTP Range	Frequency	%
1		$-\infty \leq$ WTP < 0.0		
2	0.0	0.0 $\leq$ WTP < 5.0	92	32.2
3	5.0	5.0 $\leq$ WTP < 10.0	2	0.7
4	10.0	10.0 $\leq$ WTP < 15.0	15	5.2
5	15.0	15.0 $\leq$ WTP < 20.0	14	4.9
6	20.0	20.0 $\leq$ WTP < 30.0	32	11.2
7	30.0	30.0 $\leq$ WTP < 50.0	15	5.2
8	50.0	50.0 $\leq$ WTP < 100.0	37	12.9
9	100.0	100.0 $\leq$ WTP < 200.0	39	13.6
10	200.0	200.0 $\leq$ WTP < 500.0	23	8.0
11	500.0	500.0 $\leq$ WTP < +∞	17	5.9
	Total		286	100.0

Bids sorted from the lower to the higher value represents the vector $t = (t_1, t_2, \ldots, t_J)$, where t_j is the generic bid selected by the i-th respondent. The WTP_i function was modelled as follows:

$$\mathrm{WTP}_i = X_i^{'}\beta + \varepsilon_i \tag{7}$$

where X_i represents covariates and ε_i is the error term that, in this model, is assumed to be $\varepsilon_i \sim N(0,\sigma^2)$. The probability that the generic t_j is selected by the i-th individual becomes:

$$\Pr(t_j) = \Phi\left(\frac{t_{j+1} - X_i'\beta}{\sigma}\right) - \Phi\left(\frac{t_j - X_i'\beta}{\sigma}\right) \tag{8}$$

where $\Phi(\cdot)$ is the cumulated density function for the standardized normal and $t_{J+1} = +\infty$.

Parameters β and σ were identified by the following log-likelihood function:

$$\log L = \sum_{i=1}^{n} \log\left[\Phi\left(\frac{t_{i+1} - X_i'\beta}{\sigma}\right) - \Phi\left(\frac{t_i - X_i'\beta}{\sigma}\right)\right] \tag{9}$$

The dichotomous choice multiple bound model is quite similar to Cameron and James model. The direct information on the WTP provided by the payment card format is analyzed as discrete response to a closed bounded elicitation format. Consequently, the model assumes that the WTP_i will fall into the interval with the following probability:

$$\Pr(t_{iL} < \text{WTP}_i < t_{iU}) = F(t_{iU};\beta) - F(t_{iL} - \beta) \tag{10}$$

Its log-likelihood is the following:

$$\ln(L) = \sum_{i=1}^{n} \ln[F(t_{iU};\beta) - F(t_{iL} - \beta)] \tag{11}$$

where the cumulated density function $F(.)$ follows a specified distribution. In this study, for practical reasons, we assumed for $F(.)$ a logistic distribution.

Inside the parametric approaches, welfare measures were estimated using the means of all independent variables included in the multivariate functions.

4. Results and Discussion

Overall, 61.62% of respondents are in favor of the installation of a wind farm in the province of Ragusa. However, this percentage dropped to 48.47% when presented with the hypothesis that the plant be installed near the town of Ragusa. Disapproval of the proposal was motivated by the negative impact on the landscape (85.45%), people not wanting wind farms near their home (e.g., NIMBY syndrome) (36.62%), the disturbance caused by shovels to grazing animals (28.64%), the damage to birds (27.27%), the subtraction of space for agriculture (21.13%), and the noise produced by the blades (20.66%). 16.43% of the interviewees stated that their judgment depended on the type of plant designed, while only 1.41% of the interviewees declared themselves indifferent to the issue. Results suggested the existence of different groups of respondents with different preferences. In particular, we identified the presence of a segment of locals appreciating the conservation of rural landscape. Even if this group does not refuse in general the installation of wind farms, it regrets them when they should take place in the rural area of the Ibleo plateau. Moreover, results indicated only partially that the opposition at the plant of turbines could be motivated by the NIMBY syndrome. Respondents' opinions about the protection of the Ibleo plateau rural landscape are reported in Figure 2, which highlights motivations related to both use and non-use values.

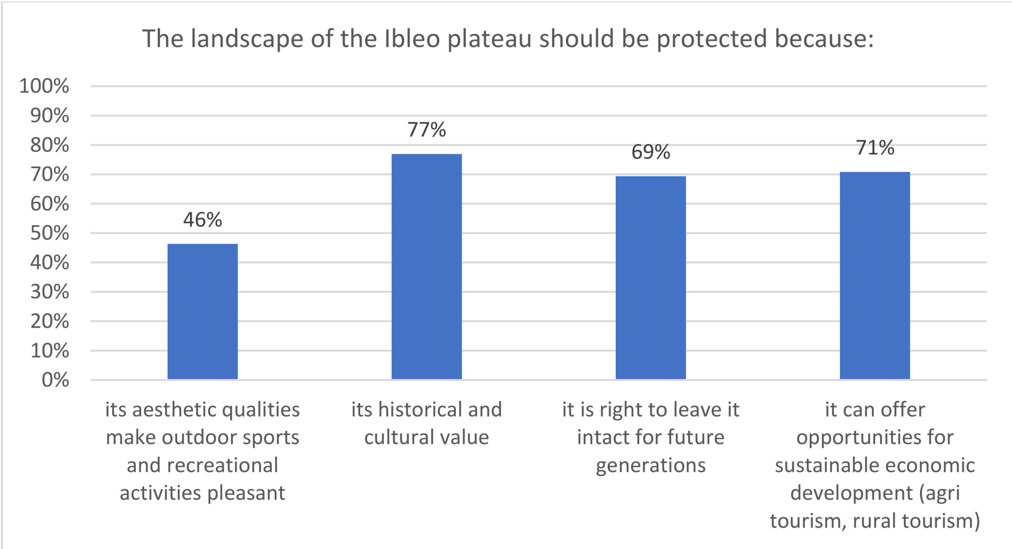

Figure 2. Stated reasons to protect the rural landscape of the Ibleo plateau.

Answers to the specific question about the proposal regarding the installation of a wind farm in the Ibleo plateau near the town of Ragusa allowed us to discriminate between the sample in two sets. The first one was composed of respondents who show more preferences for the protection of the Ibleo landscape (52%). The second one included those who, instead, consider more it important to reduce GHG emissions (48%).

Table 5 reports the coefficient' estimates related to the Probit 1 model (see Figure 1), which was implemented to identify explanatory variables segmenting the whole sample into the two already-mentioned sub-samples. Some variables are highly significant (with $p < 0.001$) and relate to knowledge of wind farm before the survey, even if it was seen by a photo or on TV, and the age of respondents. Both these variables show a positive effect on the acceptance of the installation of the wind farm in the Ibleo plateau near the town of Ragusa. Other significant ($p < 0.01$) aspects that positively affect the acceptance of the wind farm are being a natural tourist, the number of minors in the family, and income; the educational level instead negatively affects the respondent's opinion about the installation of the wind farm. Moreover, the opinion that the collectivity should protect the rural landscape even if this involves significant cost positively affects the acceptance of the plant of the wind farm.

Almost all of the items proposed to identify high priority factors that should be considered to maintain the local rural landscape (e.g., maintenance and conservation of the traditional elements of the landscape such as dry stone walls, rural buildings, carob trees, forestation, and an increase in grazing area) significantly ($p < 0.05$) and positively affect the accordance to the installation of the wind farm, suggesting that this installation is not considered particularly harmful for the typical elements of the Ibleo plateau. The only exception concerns the removal of disfiguring elements that oppositely have a negative sign, probably because people who consider this kind of action as a priority also judged the turbines a disfiguring element of the rural landscape. Employed respondents disagree with the plant of the turbines, as do male individuals, environmental or social volunteers, agrifood tourists, respondents who are proponents of landscape protection due to its aesthetic qualities and for sport activities, and respondents that want to protect this rural landscape to leave it to future generations.

Table 5. Estimates of Probit model 1—the whole sample.

Variable	Coefficient		Standard Error
Opinions about landscape relevance:			
High importance to landscape in tourism destination choice	−0.4293		0.3192
High importance to landscape in daily trip	−0.3706		0.3734
The viewing of the rural local landscape generates a pleasant sensation	0.2050		0.1449
The care and protection of the rural local landscape is extremely important	0.9805	*	0.5885
The rural local landscape is generally positively judged	−0.5181		0.3288
The rural local landscape protection is necessary	0.1399		0.4360
Collectivity should protect the rural local landscape even if this involves significant costs	0.6200	***	0.2064
The rural local landscape is disfigured by elements that should be removed	0.2608		0.1660
Motives for rural landscape protection:			
The rural local landscape should be protected because its aesthetic qualities make sports activities pleasant	−0.2417	*	0.1507
The rural local landscape should be protected because its historical and cultural value	−0.2622		0.1769
The rural local landscape should be protected because it is right to leave it intact for future generations	−0.3004	*	0.1638
The rural local landscape should be protected because it can offer opportunities for local sustainable economic development	−0.1046		0.1616
Actions for rural landscape maintenance:			
The local rural landscape should be maintained giving high priority to the maintenance and conservation of the traditional elements of the landscape (dry stone walls, rural buildings, and carob trees)	0.5246	**	0.2388
The local rural landscape should be maintained giving high priority to forestation	0.2879	**	0.1444
The local rural landscape should be maintained giving high priority to increase of grazing area	1.5061	**	0.6736
The local rural landscape should be maintained giving high priority to increase of the surface destined for spontaneous flora	−0.1242		0.2873
The local rural landscape should be maintained giving high priority to removal of disfiguring elements	−1.3825	**	0.6796
Wind farms knowledge:			
The respondent has seen a wind farm in attendance	−0.1993		0.2195
The respondent has seen a wind farm in photos or on TV	1.0199	****	0.1045
Respondent's attitudes, habits and opinions regarding the environment:			
High level of information on environmental issues arising from the mass media	−0.1075		0.1398
Outdoor recreationist	0.0007		0.1435
Agrifood tourist	0.3316	*	0.2018
Natural tourist	0.3812	***	0.1487
Social volunteer	−0.2926	*	0.1547
Environmental volunteer	−0.3487	*	0.2012
Donations	−0.00004		0.0001
Respondent's profile:			
Age	0.0235	****	0.0060
Male	−0.2643	*	0.1428
Educational level	−0.0600	***	0.0218
Employed	−0.3607	**	0.1702
Family size	−0.1009		0.0705
Number of minors in the family	0.3800	***	0.1173
Other employed in the family	0.0486		0.1887
Ownership	−0.2069		0.2642
Income	0.000013	***	0.00005
Constant	−1.3691	*	0.7654

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$; **** $p < 0.001$.

Table 6 reports estimates of the Probit model 2. These estimates are based on data coming from the sub-sample in favor of the installation of the wind turbine plant in the Ibleo plateau ($N = 269$). Eighty-eight percent of this sub-sample is, in general, willing to buy green electricity at a higher price. The rest of respondents, composed of those who are not willing pay, motivated their choice mainly (41.94%) by affirming that the problem of CO_2 emissions does not concern them to the point of justifying a personal payment. According the Probit model 2, the variables that significantly explain the probability to pay to reduce greenhouse gas emissions are the high level of information on environmental issues arising from mass media, the knowledge of wind farms given that the respondent has seen an installation before the interview, the years dedicated by the interviewee to his education, and the family size. Estimates suggests that, generally, the propensity to pay to reduce greenhouse gas emissions increases with the knowledge of wind farms ($p < 0.05$) and with the years of education ($p<0.10$), while it decreases with the increase in family size ($p < 0.05$) and the consequent reduction in family disposable income. Finally, the willingness to pay decreases also with the increase of information gathered from mass media ($p < 0.10$), probably because the planetary perception of the climate change issues makes the personal monetary contribution irrelevant.

Table 6. Estimates of Probit model 2—sub-sample in favor of the installation of the wind farm.

Variable	Coefficient		Standard Error
Wind farms knowledge:			
The respondent has seen a wind farm in attendance	0.6366	**	0.3100
The respondent has seen a wind farm in photos or on tv	0.0799		0.2048
Respondent's attitudes, habits, and opinions regarding the environment:			
High level of information on environmental issues arising from the mass media	−0.4356	*	0.2383
The respondents consider the defense of the natural environment to be highly important	−0.5649		0.6990
Outdoor recreationist	−0.1377		0.2430
Agrifood tourist	0.0516		0.3306
Natural tourist	0.3442		0.2528
Social volunteer	−0.0322		0.2882
Environmental volunteer	0.3229		0.4673
Donations	0.0001		0.0003
Respondent's profile:			
Age	0.0107		0.0110
Male	0.3558		0.2633
Educational level	0.0603	*	0.0349
Employed	−0.0406		0.3150
Family size	−0.3194	**	0.1298
Number of minors in the family	0.2770		0.1820
Other employed in the family	0.3054		0.3433
Ownership	−0.0155		0.5546
Income	−0.00001		0.00001
Average amount of your bimonthly bill for the supply of electricity	−0.0007		0.0023
Constant	0.3386		0.9702

* $p < 0.10$; ** $p < 0.05$

In the sub-sample ($N = 286$) that includes those who declared their opposition to the installation of wind turbines in the Ibleo plateau, the possibility of donating a monetary contribution to a fund for the conservation of the Ibleo plateau landscape was positively expressed by the 69.93% of respondents. People unwilling to donate money mainly motivated their choice by affirming that were not willing to support the landscape protection if this implied a monetary contribution. Table 7 reports estimates for the Probit model 3 implemented to explain these choices. Key variables related to the exercise of both agri-food and natural tourism negatively affect the propensity to donate (both showing a level of significance equals to $p < 0.01$), such as age ($p < 0.001$) and the number of minors in the family ($p < 0.10$). Oppositely, being a male ($p < 0.001$), employed ($p < 0.05$), and with a higher educational level ($p < 0.05$) positively affect the propensity to donate as well as the ownership in the territory interested by the turbines plant ($p < 0.10$), given that the hypothetical scenario assumes the buying of all the lands interested by the project. Other key factors relate to the opinions about the landscape's relevance. Attributing high importance to landscape in tourism destination choice implies a higher propensity to donate to avoid the wind farm installation ($p < 0.05$), as well as a positive judgment on the rural local landscape ($p < 0.10$). Oppositely, the opinion that the collectivity should protect the rural local landscape even if this involves significant costs negatively affects the propensity to contribute with a personal payment ($p < 0.10$). Finally, when motivations to justify the rural local landscape protection relate to its aesthetic qualities that make sports activities pleasant ($p < 0.05$) and to leave it intact for future generations ($p < 0.001$), the propensity to volunteer contribute to avoid the wind farm installation increases.

Table 7. Estimates of Probit model 3—subsample opposing the installation of the wind farm.

Variable	Coefficient		Standard Error
Opinions about landscape relevance:			
High importance to landscape in tourism destination choice	0.5739	**	0.2896
High importance to landscape in daily trip	0.3076		0.3360
The viewing of the rural local landscape generates a pleasant sensation	−0.1890		0.1474
The care and protection of the rural local landscape is extremely important	−0.3115		0.5241
The rural local landscape is generally positively judged	0.4691	*	0.2661
The rural local landscape protection is necessary	0.3124		0.3988
Collectivity should protect the rural local landscape, even if this involves significant costs	−0.2979	*	0.1849
The rural local landscape is disfigured by elements that should be removed	0.1196		0.1514
Motives for rural landscape protection:			
The rural local landscape should be protected because its aesthetic qualities make sports activities pleasant	0.3108	**	0.1381
The rural local landscape should be protected because of its historical and cultural value	0.0972		0.1693
The rural local landscape should be protected because it is right to leave it intact for future generations	0.6172	****	0.1600
The rural local landscape should be protected because it can offer opportunities for the local sustainable economic development	0.0248		0.1545
Respondent's attitudes, habits, and opinions regarding the environment:			
Outdoor recreationist	−0.0502		0.1348
Agrifood tourist	−0.5637	***	0.1863
Natural tourist	−0.5067	***	0.1365
Social volunteer	0.2099		0.1403
Environmental volunteer	0.2653		0.1787
Donations	−0.0001		0.0002
Respondent's profile:			
Age	−0.0274	****	0.0057
Male	0.5351	****	0.1318
Educational level	0.0411	**	0.0208
Employed	0.3876	**	0.1626
Family size	0.0697		0.0657
Number of minors in the family	−0.1929	*	0.1000
Other employed in the family	0.1408		0.1725
Ownership	0.4010	*	0.2353
Income	0.0000		0.0000
Constant	−0.7587		0.6620

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$; **** $p < 0.001$.

The results of the parametric models for computing the WTP for reducing the GHG emissions are shown in Table 8. According to the Tobit model, the WTP increases with the years of education ($p < 0.05$) and is higher for those interviewed whose family members have a working occupation ($p < 0.10$). The significance of the education level is also confirmed by the other two parametric models.

Table 9 shows estimates of the parametric models used for explaining and calculating the WTP for the conservation of the rural landscape. According to the Tobit model, the main determinant of WTP is statistically ($p < 0.05$) and positively explained only by the average annual family income; in Cameron and James' specification, the WTP depends on the membership of social voluntary association ($p < 0.01$), the presence in the family unit of children under 14, and annual income average family (both significant with $p < 0.05$). Finally, with respect to the multiple bound model, both the bid ($p < 0.001$) and the average annual family income ($p < 0.05$) are statistically explanatory variables of the WTP.

Tables 10 and 11 show the WTP estimates for reducing GHG emissions and for protecting the landscape of the Ibleo plateau. In both cases, the nonparametric approach, as expected, yields lower (and more dispersed) estimates than parametric approaches. Among these, in both cases the multiple bound model produces mean estimates closer to non-parametric one. The Cameron and James model estimates a more dispersed measure of the WTP.

Table 8. Estimates of Tobit, Cameron, and James, and multiple bound models related to the WTP for reducing GHG emissions.

Variable	Tobit Model			Cameron and James Model			Multiple Bound Model		
	Coefficient		Standard Error	Coefficient		Standard Error	Coefficient		Standard Error
Respondent's attitudes, habits, and opinions regarding the environment									
Social volunteer	1.2120		1.4839	1.2639		1.1128	0.4024		0.2625
Environmental volunteer	2.5517		1.9545	1.6202		1.4720	0.4686		0.3467
Donations	0.0002		0.0010	0.00001		0.0007	0.0000		0.0001
Respondent's profile:									
Age	0.0672		0.0583	0.0190		0.0432	0.0024		0.0104
Male	−0.7382		1.2795	−1.1270		0.9534	−0.1696		0.2220
Educational level	0.3896	**	0.1926	0.2972	**	0.1418	0.0815	**	0.0344
Employed	1.4776		1.6248	1.0114		1.2151	0.1392		0.2851
Family size	−0.8232		0.6601	−0.1341		0.4923	−0.0664		0.1145
Number of minors in the family	0.0982		0.9317	0.0345		0.6974	0.0815		0.1649
Other employed in the family	2.9209	*	1.7470	0.8722		1.2989	0.1639		0.2978
Ownership	−0.1436		2.6598	0.7991		2.0034	0.2606		0.4589
Income	0.00002		0.00004	0.00003		0.00003	0.00001		0.00001
Bid							−0.2362	****	0.0138
Constant	−3.0660		4.8363	1.4742		3.5676	0.1128		0.8707
Sigma	9.7294	****	0.4540	7.2907	***	0.3379			

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$; **** $p < 0.001$.

Table 9. Estimates of Tobit, Cameron, and James, and multiple bound models related to the WTP for protecting the Ibleo plateau landscape.

Variable	Tobit Model			Cameron and James Model			Multiple Bound Model		
	Coefficient		Standard Error	Coefficient		Standard Error	Coefficient		Standard Error
Respondent's attitudes, habits, and opinions regarding the environment:									
Social volunteer	−21.7081		26.5813	−30.3637	*	17.6346	−0.1695		0.2196
Environmental volunteer	−1.7465		33.0519	3.3407		21.9430	0.0491		0.2775
Donations	−0.0263		0.0318	−0.0011		0.0115	−0.0002		0.0002
Respondent's profile:									
Age	−1.1704		1.0363	0.1212		0.6818	−0.0014		0.0087
Male	−0.1221		25.2965	−20.6496		16.6734	0.0319		0.2128
Educational level	−3.7359		4.0985	−2.1701		2.6719	−0.0056		0.0353
Employed	4.9915		34.2773	6.5816		22.0896	0.3393		0.2914
Family size	−1.2643		13.4722	1.3598		8.8954	−0.0424		0.1119
Number of minors in the family	33.0415		21.8607	33.3420	**	14.9191	0.3157		0.2002
Other employed in the family	21.0797		35.5195	10.7786		23.4025	0.2556		0.3007
Ownership	9.4784		43.4565	−11.4988		29.0126	−0.1376		0.3546
Income	0.0025	**	0.0011	0.0019	***	0.0007	0.0000	**	0.0000
Bid							−0.0103	****	0.0007
Constant	46.3453		89.0327	48.6083		59.2397	−0.4343		0.8016
Sigma	194.8889	****	10.1693	133.9452	****	6.2168			

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$; **** $p < 0.001$.

Table 10. WTP estimates for reducing GHG emissions in terms of increasing of the bimonthly family energy bill (values in Euro).

	Mean	Standard Deviation
Non-parametric approach	7.56	9.22
Parametric approaches		
Tobit model	8.24	2.18
Cameron and James model	8.22	7.56
Multiple bound model	7.66	0.45

Table 11. WTP estimates for protecting the Ibleo plateau (values in Euro).

	Mean	**Standard Deviation**
Non-parametric approach	85.10	156.33
Parametric approaches		
Tobit model	102.20	29.94
Cameron and James model	91.71	138.53
Multiple bound model	90.42	10.01

Finally, Table 12 compares welfare measures for the two competing environmental goods. To allow such comparison, the lump sum values of the WTP for the protection of landscape were converted in annuity values through appropriated financial formula based on a discount rate equals to 2.5%. This value is in the range of discount rates commonly used in social cot benefit analysis. Annual estimates indicate that WTP for reducing GHG emission is over six times higher than WTP for protecting landscape.

Table 12. Annual value per household of losses and benefits caused by the planting of a wind farm in the Ibleo plateau (values in Euro).

	WTP to Protect the Ibleo Plateau Landscape	**WTP to Reduce GHG Emissions**
Non-parametric approach	2.13	15.12
Parametric approaches		
Tobit model	2.56	16.48
Cameron and James model	2.29	16.44
Multiple bound multivariate model	2.25	15.32

5. Conclusions

In this study, we used the CVM to analyze and estimate attitudes and preferences of a local community towards a wind farm installation in a context characterized by a countryside landscape asset with strong aesthetic, cultural, and identity place dimensions. We addressed two environmental goods that could came into play due to the installation of turbines: the preservation of a local landscape and the contribution to the reduction of the effect of global warming.

Even though we were not able to include spatial issues and visual effects in this analysis due to lack of information on the geographical distance of respondents from the wind farm location, our findings led us to exclude the NIMBY syndrome as the main determinant of the social acceptance of the wind farm installation. However, more in-depth research would be necessary to address how distance and direct vision influence the social acceptance and valuation of the externalities of wind farms.

Nevertheless, we have demonstrated that residents exhibit heterogenous preferences. In particular, we found two opposite groups of locals with extreme preferences: one group that judged the GHG emission reduction to be more relevant and favored paying an additional price for buying green energy, and another group who judged it more important to preserve the landscape and were willing to contribute to its conservation. Between these extreme segments, we also found a significant portion of residents that, despite their preferences for one of the two environmental goods, excluded the possibility of contributing monetarily to achieve them. The lower propensity in the willingness to pay was recorded in the group that attributed more importance to the landscape protection. This behavior strongly affected the size of benefits assigned to the protection of the landscape, which were, on average, considerably lower (approximately € 2 vs. € 16) than benefits assigned to the reduction of GHG emissions.

In closing, we believe that our exercise provides useful insights to assess social acceptance of wind farms, and to judge their social profitability. Our study suggests that a comprehensive social cost–benefit analysis of wind fam projects should take into account not only the negative effects on the integrity of local landscape assets but also the positive effects on global environmental issues such as the contribution to the reduction of global warming. Our valuation exercise shows that the value of such global good could be large enough to pass of the potential Pareto compensation test and support the spread of a wind energy system worldwide as a valid solution towards carbon neutrality.

Author Contributions: M.D.S. conducted the sampling design; coordinated the collection of data; performed the econometric analysis of data; wrote the paper; revised the manuscript. S.N. suggested analytical tools; revised the manuscript. G.C. administered the focus groups and pilot surveys; designed the questionnaire layout; conducted debriefing exercises; collaborated in writing survey questions. L.G. conducted bibliography search; analyzed follow up questions; conducted the data cleaning; arranged the final layout of the paper. G.S. conceived and designed the CV experiment; constructed the valuation scenarios and designed the final structure of the questionnaire; identified econometric models for estimating the WTP; wrote the paper; revised the manuscript; obtained funding. All authors have read and agreed to the published version of the manuscript.

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