

1 **A mixed-method approach for the assessment of local community**
2 **perception towards wind farms**

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24
25 **Abstract**

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27
28 The implementation of wind power projects can have significant impacts on local
29 communities. If on one hand the project can bring important economic benefits, on the
30 other hand it can represent a source of conflicts and discontentment. This paper aims to
31 revisit this topic, addressing impacts and their perceptions from the local community
32 point of view. A mixed method approach was proposed and implemented in a Portuguese
33 region (municipality) used as case study. Semi-structured interviews directed towards
34 local stakeholders were conducted to evaluate the acceptance of these wind power
35 projects and the perceived impacts. The qualitative study was subsequently

36 complemented and validated by a quantitative approach, through a questionnaire
37 targeting local population. In general, the collected opinions seem mainly driven by the
38 perceived socio-economic benefits resulting from wind farm deployment, with generally
39 positive attitude towards wind farms. Identified local positive impacts include
40 “community funds”, “benefits in kind” and “indirect local employment”. The key role of
41 benefit sharing mechanisms on ensuring public acceptance and effective local
42 development is confirmed.

43

44 Keywords: Wind power; interviews; questionnaire; community; impact assessment.

45

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51

52 **1. Introduction**

53

54 Overall energy is a driving force for social wellbeing, and particularly renewable energy
55 sources (RES) projects have brought important changes to national energy systems but
56 also to local communities. Several studies have been addressing the topic of local and
57 community social aspects of RES projects but the topic is still far from being fully
58 explored. A thorough research on the public perception on local development brought by
59 these projects, more specifically of direct and indirect benefits and negative effects to
60 hosting communities is still required, as this represents fundamental information for both
61 investors and energy policy makers.

62 The perception of wind power impacts and social acceptance is highly dependent on the
63 cultural and socio-economic conditions of the local population and the planning of these
64 projects is influenced by multiple conflicting interests and values (Ek and Matti, 2015).
65 As Aitken (2010a) highlighted, there is merit in understanding public attitudes and
66 responses in order to fully understand the social context of wind power and open

67 participation can produce positive outcomes and opportunities to improve planned
68 developments.

69 The importance assigned to employment generation is well demonstrated in the literature
70 with different studies addressing this as a major potential socio-economic benefit of RES
71 development (see for example Sooriyaarachchi et al, 2015 and Ortega et al, 2015) but still
72 suffering from significant uncertainties (Camerona and van der Zwaan, 2015). In
73 addition, benefits such as community funds and project ownership are also discussed
74 given the possible role of RES projects on improving socio-economic welfare in isolated
75 rural areas (del Rio and Burguillo (2010); Munday et al (2011) and Allen et al, 2012).
76 However, several factors contribute also to local resistance and opposition towards such
77 projects such as concerns about health, noise, shadow flicker, aesthetics, loss of place
78 identity or potential loss in property value (Khorsand et al, 2015).

79 Ek and Matti (2015) work on local impacts of large scale wind park planned to the
80 northern Sweden demonstrated concerns on external costs for the local community both
81 related to sustained nature conservation and local economic activities, namely reindeer
82 herding. Also for northern Sweden, Ejdemo and Söderholm (2015) concluded on the
83 existence of significant local impacts on construction jobs for wind power projects but
84 put also in evidence the importance of benefit sharing mechanisms to generate positive
85 impacts on employment rates during operation phase. In fact, benefit sharing can be of
86 major importance for social acceptance, generating additional socio-economic benefits
87 from the re-investment of the revenues. In line with this, several studies pointed to the
88 importance of perceived benefits brought from direct economic gains to local
89 communities (e.g employment opportunities) but highlight also the benefits generated
90 from funds offered to affected communities, aiming for the fair distribution of earning
91 and to the promotion of acceptance of hosting communities (Khorsand et al, 2015).
92 Okkonen and Lehtonen (2015) focused on wind power projects in Northern Scotland and
93 found that strategic re-investments of revenues in local social services can generate
94 several times more employment and income compared with the impact of wind power
95 production. Equally distributed regional benefits is then an important measure to increase
96 local acceptance of wind energy projects (Walter, 2014).

97 Although in developing countries the public seems to give particular attention to the
98 possibility of industrial development yield economic benefits, perception of negative
99 externalities such as noise or visual impact play also an important role on these emerging

100 economies (Guo et al, 2015). Gorayeb and Brannstrom (2016) argued that wind farms
101 can cause large impacts on the environment and traditional livelihoods of local residents
102 in Brazil and underlined the importance of management of benefits generated by wind
103 power on local communities. In line with this, de Sena et al (2016) also concluded that
104 the positive vision towards RES and wind farms in particular is mainly related to the
105 perception of positive local socio-economic impacts in Brazil, but showed that the
106 population is highly sensitive to the environmental impacts. The importance of economic
107 factors was also demonstrated for European countries. Frantál (2015) showed that the
108 significance of visual impact is outweighed by perceived socio-economic benefits for
109 municipalities in the Czech Republic and Ribeiro et al (2014) concluded that at local level
110 the economic revenues flowed to the populations largely contributed to the RES
111 acceptance in Portugal.

112 A previous study from Ribeiro et al (2014), on the social acceptance and for renewable
113 energy sources in Portugal indicated a general positive attitude towards wind power. The
114 authors even concluded that residents in municipalities where wind power plants are
115 already operating can be more supportive than residents living in municipalities with no
116 installed wind farms. This positive attitude can be to some extent explained by the
117 perception of contribution for development of local population. The case of Portugal was
118 also analyzed by Delicado et al (2016) focusing on case studies of communities living in
119 the vicinities of three wind farms with the authors concluding on the heterogeneity of the
120 community perceptions and also on the significant levels of indifference towards these
121 facilities even for residents living nearby. Nevertheless, concerns about environment
122 including animal welfare and noise complaints were also reported and opinions on
123 landscape change were ambivalent. However, national positive attitudes should not be
124 seen as a guarantee of high local acceptance (Walter, 2014; Khorsand et al, 2015) and the
125 success of wind power requires a better understanding of the so called “social gap” (Bell
126 et al, 2005). Further studies on local impacts, perception and willingness to accept new
127 wind farms are then required under a sustainable energy planning perspective.

128 The proposed work aims to contribute to this debate on the perceived local and regional
129 impacts of wind power projects as fundamental drivers’ for local acceptance. A mixed
130 methodology is proposed to assess these impacts from a stakeholder’s perspective and
131 overall public opinion. The proposed methodology is then tested and applied to a
132 Municipality case study with the objective of both demonstrating its potential

133 implementation process and to draw conclusions on the local and regional perceived
134 impacts of these projects in Portugal.

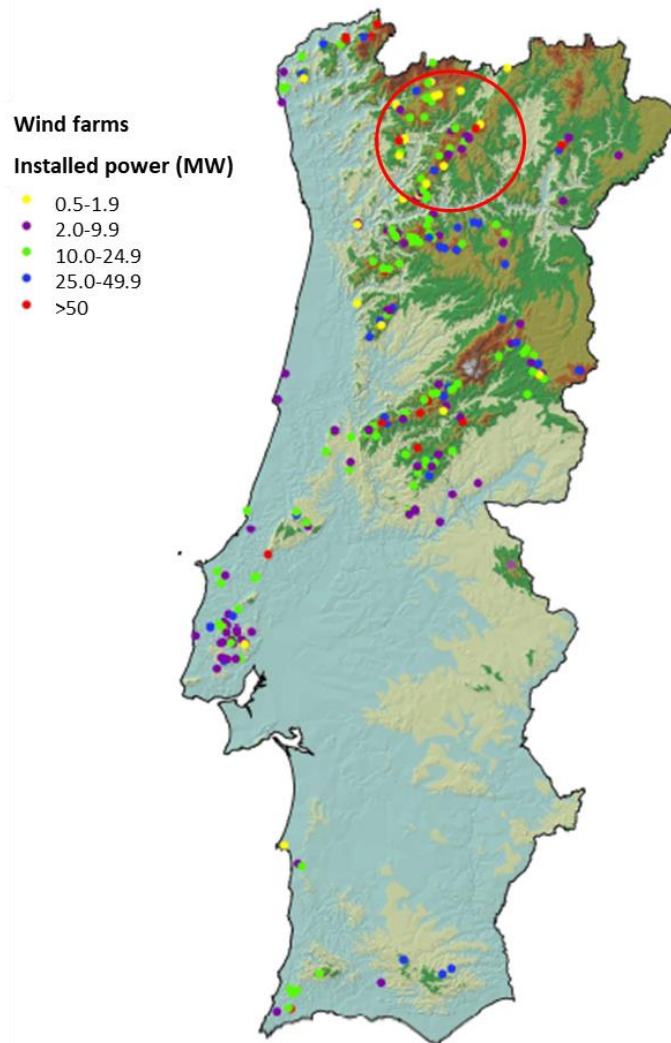
135 The case of Portugal is particularly interesting to be analyzed given the high level of RES
136 contribution in the electricity system and also given the particular characteristics of these
137 projects, frequently located in less developed regions of the country with a declining and
138 ageing populations. The proposed approach is focused on a particular municipality with
139 the above mentioned characteristics and although the results may not be generalized to
140 all municipalities, are expected to give an important contribution to understand some of
141 the social aspects of wind power under the Iberian context.

142 **2. Case Study**

143

144 Portugal has been considerably dependent on external energy resources, mainly due to
145 energy system's reliance on fossil fuel (oil, natural gas and coal) (DGEG, 2015). In order
146 to reduce the country's external energy dependence, while increasing energy efficiency
147 and reducing CO₂ emissions, the national government has developed strategic guidelines
148 for the energy sector promoting energy efficiency and stimulating the contribution of
149 RES, focusing on wind energy, among others (National Plan for Renewable Energies and
150 National Plan for Energy Efficiency, last version available on Presidência do Conselho
151 de Ministros, 2013). Wind power currently represents a key technology in the national
152 energy context. By the end of 2015, installed wind power represented 26% of the total
153 installed power of the Portuguese electricity system and its power output contributed to
154 meet 23% of the total electricity demand of the country (REN, 2015).

155 Both qualitative and the quantitative studies described in the paper were developed in the
156 same rural municipality (for confidentiality reasons the municipality will not be
157 identified) located in the north region of Portugal in the district of Vila Real, a region
158 characterized by the high density of wind turbines, as shown in Figure 1.



159

160

Figure 1 - Case Study location area. (Source: adapted from INEGI (2015))

161

162 Vila Real district has more than 20 wind power farms connected to the grid and is the
 163 second district with the highest installed wind power in the country reaching a total of
 164 658 MW (INEGI, 2015). The population of the municipality is about 13200 residents
 165 although in the quantitative study only close to 9600 habitants were considered as those
 166 were the ones living in parishes (in Portuguese *freguesias*) where wind farms are already
 167 operating. This region could be described as having “disperse population” distribution,
 168 with a pronounced declining pattern due to above mentioned reason, as well as an
 169 increasing growth of elderly population. The cited characteristics, along with other factors
 170 such as the reliance on agricultural activities, the high unemployment rate, the land
 171 availability and the favorable wind characteristics make these areas particularly well
 172 suited new project’s development.

173 In order to assess the perception of socio-economic benefits and costs at a regional and
174 local scale, a case study for the described region was developed. Because wind turbines
175 have been or will be installed in communal ground, which management is delineated by
176 the Portuguese Legal Resolution n° 68/93 through the institution of Communal Land
177 Commission Councils, the selected research participants for the qualitative approach were
178 representatives from these same Commissions. This focal group was considered ideal for
179 exploring local impact from RES projects because they have been present throughout the
180 entire negotiation process and established the links with other key players, namely RES
181 promoters and local population. This exploratory approach was supported by semi-
182 structured interviews and was expected to bring considerable information about the
183 perception of the population, the acceptance and the social impacts.

184 Although current legal framework established that 2.5% over total energy generation
185 income from a wind farm should be assigned to the local municipalities (Decree-Law
186 339-C/2001), other benefits obtained from wind farm projects were also discussed with
187 the interviewed from the Communal Land Commission Council. Discussing with
188 stakeholders this negotiation process directly contributes to the outlined objectives of the
189 research, regarding what are the main impacts and how they are being perceived. Overall
190 within stakeholders group, the focused participants had a good knowledge of local reality
191 given their positions and due to their responsibilities, despite having different professional
192 backgrounds. Most backgrounds ranged from three of the most preeminent local
193 activities, such as construction workers, farmers or shepherds to engineers, accountants,
194 bank account managers, contributing to diversified perceptions of wind energy
195 deployment.

196

197 **3. Methodology**

198

199 Mixed methods approaches can combine different methods targeting the evaluation of
200 impacts of projects, technologies or programs and allowing to integrate social quantitative
201 and qualitative approaches to theory, data collection, data analysis and interpretation
202 (Bamberger, 2012). Bamberger (2012) pointed out that mixed methods approach can
203 result in an enhancement of validity or credibility of evaluation findings and allows to
204 strength the representativeness of in depth qualitative studies by linking a case study to
205 quantitative sampling.

206 Even though quantitative approaches, and particularly questionnaires, seem to prevail
207 when assessing public perception regarding RES projects (Ribeiro et al, 2011), their
208 disadvantage lies precisely on its inability to fully assess the social dimension with
209 incomplete data collection and difficulties on results interpretation (Bamberger, 2012).
210 Conversely qualitative approaches have been perceived as being appropriate to assess
211 public perception taking into consideration the complexities of public opinion (Aitken,
212 2010a). However, as Bamberger (2012) pointed out qualitative approaches also present
213 weaknesses such as the lack of generalizability, difficulties on reaching consensus and
214 apparent subjectivity. Combining both qualitative and quantitative approaches can then
215 bring new insight to the impact evaluation directed towards the case of RES technology
216 in a particular region.

217 In previous works, this mixed-method proved to be useful to gain a thorough insight of
218 social aspects influencing wind power deployment (Del Rio and Burguillo, 2009; Munday
219 et al, 2011 and Rogers et al., 2008). However, this issue has not been comprehensively
220 addressed in the Portuguese case before for the case of assessment of local perception of
221 impacts of wind farms. A few recent examples for Portugal include Delicado et al. (2016)
222 using interviews with residents to assess community perceptions of the impact, both
223 positive and negative of wind and solar farms, Botelho et al (2016) using questionnaires
224 directed towards residents to provide some insights on the compensation for damage
225 sustained for wind, forest, solar and hydro power plants and Ribeiro et al (2014) using
226 large scale surveys on public acceptance of renewable power (wind, solar, biomass,
227 hydro) and underlying motivations for the Portuguese population.

228 To the best of the authors' knowledge the use of a mixed method approach for the analysis
229 of the impacts perception of RES projects on a particular municipality is not yet attempted
230 in Portugal. The present case study was then developed in order to assess the potential
231 socio-economic benefits or disadvantages at a regional and local scale. Both interviews
232 with local stakeholders directly involved in the negotiation phase for the wind farm
233 implementation and in the management of communal benefits (qualitative approach) and
234 questionnaires to local population (quantitative approach) were conducted followed by
235 the statistical analysis.

236 The use of interviews with open-ended questions is justified with the objective of bringing
237 out rich and meaningful answers and allowing greater spontaneity and adaptation of the
238 interaction between the researcher and the interviewed (Mack et al, 2015). This study

239 included 7 interviews and counted with the support of a local resident as a facilitator for
 240 the contacts. This local facilitator acted as an interface between the researcher and the
 241 local community, by referring potential participants to be included in the interview
 242 process and allowing to gain access to groups that would otherwise be inaccessible,
 243 through any other means (see Rubin and Babbie, 1997; Hale and Astolfi, 2007). The main
 244 selection criteria underlying this specific case, lay on four premises:

- 245 • All participants of the stakeholder’s group (hereafter called interviewees) are members
 246 of the local community;
- 247 • All interviewees are members of the Council Commission, who are elected by the
 248 community for representation, management and inspection purposes;
- 249 • These interviewees closely followed the wind power project to safeguard that local
 250 communities’ interests were well understood and considered by the promoters;
- 251 • As members of the community, the interviewees may have themselves both direct and
 252 indirect benefits or complaints related to the wind power project.

253 Due to the exploratory nature of qualitative research, accurate and detailed insights
 254 resulting from interviews with the stakeholders were subsequently complemented and
 255 validated by quantitative methodology, through application of telephonic questionnaires.
 256 These questionnaires were applied considering the geographical division parish, which is
 257 a subdivision of Municipality in Portugal. Wind farms are located in nine parishes of the
 258 selected Municipality, totaling 9583 inhabitants according to the last Portuguese census
 259 (censos.ine.pt, consulted on March 2013). The CATI (computer-assisted telephone
 260 interviewing) allowed to collect 353 valid responses resulting reaching a 95% of
 261 confidence interval and 5.1% of margin of error. Details of the questionnaire are present
 262 in Table 1.

263
 264

Table 1 – Questionnaire outline

Survey period	May 2013
Population	9583 inhabitants
Respondents	436, among which 353 were considered valid
Method	CATI (computer-assisted telephone interviewing)
Questions and response codes	1. Have you heard of wind farms or electricity produced from the wind? (Filter question; only those who respond positively may proceed). Yes No

	2. Do you believe that wind power brings benefits to the community? Yes No
	2.a (Only if response to question 2 was positive): Please specify the most important benefit. Rent from communal land New roads New social infrastructures Job creation Others
	3. Do you believe that wind power brings disadvantages to the community?
	3.a (Only if response to question 3 was positive): Please specify the most important disadvantage. Visual impact Noise impact Impact on agriculture, shepherding or other economic activities Others
	4. What was your position towards the construction of the wind farm, before its implementation? Favorable Against
	5. Did your position towards the wind farm change after its implementation? Yes No

265

266

4. Results of the quantitative analysis

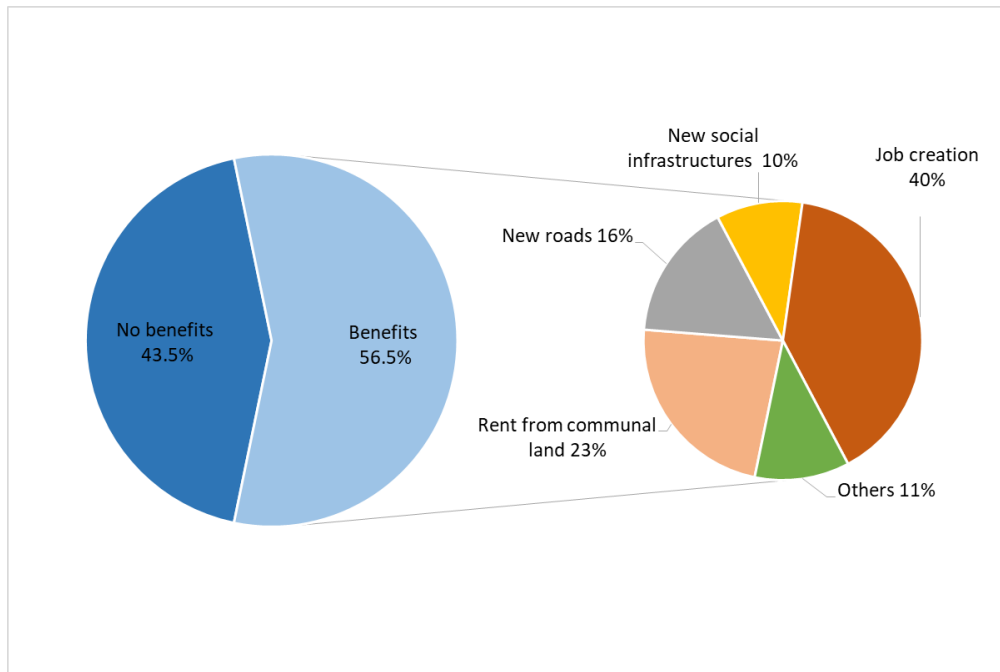
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268 The first question acted as a filter, with the objective of allowing only respondents that
269 were aware of the technology to proceed until the end of the questionnaire. This question
270 had to be very clear even for respondents with low educational degree, so respondents
271 were asked “have you heard of wind farms or electricity produced from the wind?” A
272 proportion of 81%, or three hundred and fifty-four (354) respondents passed the filter
273 question.

274 The second question, “did the wind farm bring benefits to the community”, received
275 56.5% of positive answers, against 43.5% negative ones. Taking into account the sample
276 size, it can be said that the number of respondents who believe there are benefits is
277 statistically significantly higher than those who believe there are no benefits. It was found
278 that respondents with a positive view towards the wind farms are younger (t-test,
279 $p=0.002$) and have higher education (Wilcoxon-Mann-Whitney U test, $p<0.01$).

280 The respondents who answered positively on the benefits were asked to specify the most
281 important benefit. The most mentioned one was job creation, while the least mentioned

282 was investment in social infrastructure (such as daycare centre, cemetery or other
283 facilities). Results are presented in Figure 2.



284

285 Figure 2- Distribution of most relevant benefits by public opinion.

286 It was found that the number of times that males refer to job creation is statistically
287 significantly higher than females' references (Fisher's exact test, $p=0.005$), along with
288 respondents with higher education (Wilcoxon-Mann-Whitney U test, $p=0.001$).

289 The question "did the wind farm bring disadvantages to the community" received a much
290 more negative proportion of answers (70%) than positive ones (30%), therefore also a
291 statistically significantly higher number of respondents believe there are no disadvantages
292 to the community. Age, gender or educational degree do not have statistical significance
293 on these results. Among those who perceive the existence of negative impacts, 66%
294 responded that noise was the most important issue. Results are presented in Figure 3 with
295 more detail. The respondents who chose "noise" have no clear tendency of age, gender
296 or educational level.

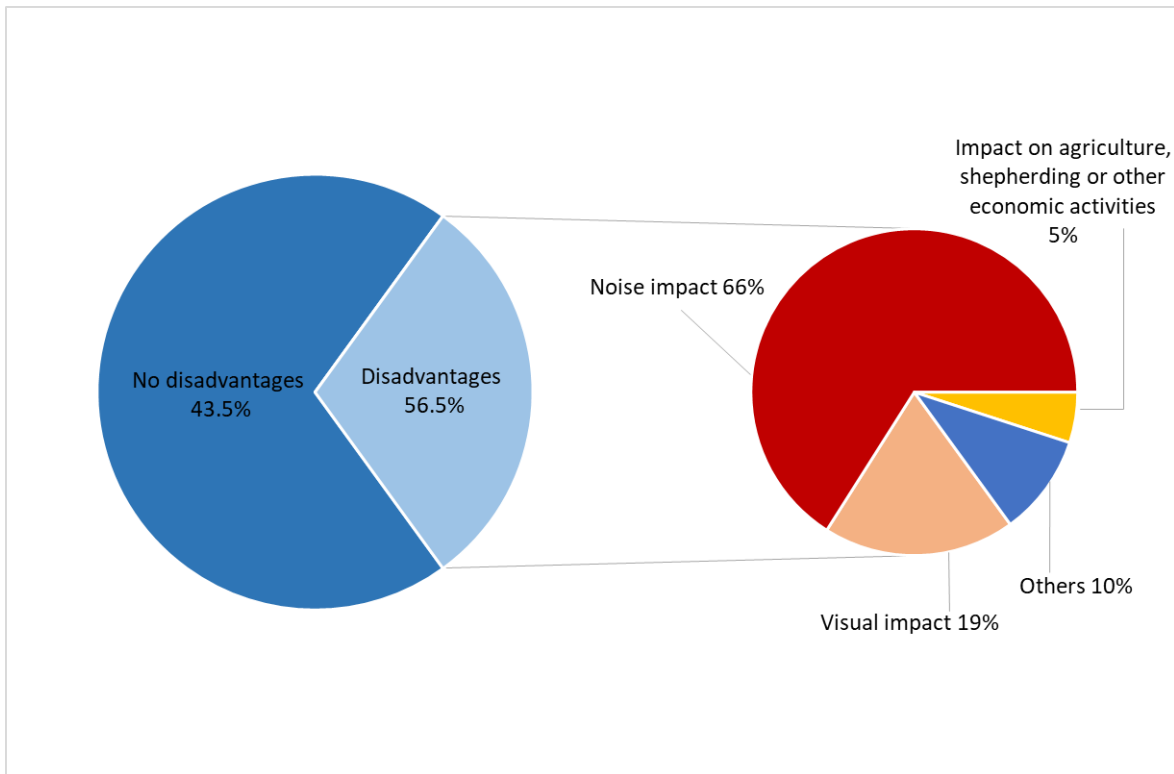


Figure 3- Distribution of most relevant adverse effects by public opinion.

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298

299

300 The majority of respondents corresponding to 169 or 51% was favorable to the
 301 construction of the wind farm before its construction, 127 or 39% were neither for or
 302 against the farm, and 33 (10%) were against. Ignoring those who were neither for or
 303 against the construction, statistically significance tests (Wilcoxon-Mann-Whitney U test,
 304 $p=0.015$) suggest that respondents inclined to agree with the construction of the farm
 305 possess a higher educational degree.

306 After the farm was built, only 23 of those who were favorable (roughly 14% of the 169)
 307 changed their opinion. Among these 23, only 12 of them believe the wind farm brought
 308 disadvantages (10 mentioned noise, 1 visual impact and 1 “other”). These 23 who
 309 changed to a negative opinion have a statistically higher education (Wilcoxon-Mann-
 310 Whitney U test, $p=0.035$) than the rest of the respondents. On the other hand, 5
 311 respondents, roughly 15% of the 33 who were against the wind farm and changed their
 312 opinion to a positive one. Three of them believe the farm has brought benefits: two of
 313 them mentioned job creation and one mentioned land rent.

314 We can conclude that the public opinion in the area where the survey was collected is
 315 characterized by a generally positive attitude towards wind farms. As seen, although in
 316 absolute numbers, more respondents gained a negative opinion towards the wind farm

317 after it was built, in relative terms it is roughly the same percentage of respondents (15%
318 vs. 14%) changing their opinion towards a positive one.

319

320 **5. Results of the qualitative analysis**

321 The importance of preliminary impact analysis and planning for determining an ideal
322 location for wind farms, therefore promoting its integration in the surrounding
323 environment is highlighted in studies such as Mendes et al, (2002) or Watson and Hudson
324 (2015). As such, this section is based on a previous revision of the literature to summarize
325 positive and negative impacts on wind farms (Lima et al, 2013) which were then discussed
326 with the interviewees for the specific case under analysis. This review, especially in what
327 concerns social issues, showed that despite the increasing relevance of the theme, social
328 dimension is far from being fully explored. Yet, the main social aspects which were
329 considered to be particularly relevant for the region under analysis have been analyzed,
330 generally focusing on employment generation; community funds and benefits in kind.

331 For the sake of simplicity, the analysis of the qualitative study (interviews with
332 stakeholders) will be divided in two main aspects namely, the perception of positive and
333 negative impacts.

334

335 **5.1 Stakeholder's perceptions of positive impacts**

336

337 Regarding positive impacts overall most interviewees viewed this investment as positive
338 for local communities, with a wide assortment of benefits being distributed according to
339 different categories of community benefit schemes, encompassing “community funds”,
340 “benefits in kind”, or “local employment” (see Table 2).

341 Interviewees have mentioned unanimously as main advantages several aspects within the
342 main available categories, which were, as interviewee statements attest, highly
343 interconnected. For instance, additional revenues resulting from annual rent within
344 “community funds” were closely connected to accessibility provision and improvement
345 and social infrastructure within “benefits in kind” which is interlinked to “local
346 employment” category, as Interviewee's 1 and 5 emphasized.

347 Nonetheless, a full overview of the most mentioned benefits checklist has also highlighted
 348 less consensual aspects such as reforestation or tourism within “benefits in kind”,
 349 reflecting different perspectives within stakeholder’s perception regarding re-investment
 350 and diversification of attained revenues as expressed by Interviewees 1 and 2 quotes, as
 351 well as the non-applicability of “project ownership” category to wind farms located in the
 352 communal land regimen.

353

354 **Table 2– Most mentioned impacts within categories of community benefits schemes.**

Category	Most mentioned impacts	Interviewees							Relevant Quotes
		1	2	3	4	5	6	7	
Community Funds	- Regular payment (annual rent)	*	*	*	*	*	*	*	<p>“...income resulting from leasing location site, is being channeled towards social infrastructures.” (Interviewee 1)</p> <p>“(…) our biggest benefit was on a financial level, because it allowed to invest in new infrastructures and to improve others already existing. Before this would not be possible because we lacked income. These are remote areas, that do not have that sort of funds.” (Interviewee 5);</p> <p>“(…)People haven’t seen yet the forest as an asset, or maybe as one of the biggest sources to generate profit and richness. Nowadays people view investment as applying revenues in local improvements (social infrastructure or accessibilities), that in my opinion will not have a return profit as interesting as the forest. I really think the secret here is to re-invest in the forest and people have not got that sensibility yet, so they do not see it as an objective, they do not make the proposal and do not vote for it.(…). “(Interviewee 1);</p> <p>“(…) the routes opened on the mountain, brought benefits to firefighting (...) because fire fighters can now reach forest areas, which otherwise would be inaccessible.” (Interviewee 3)</p>
Benefits in kind	-Accessibilities provision or improvement	*	*	*	*	*	*	*	
	- Social infrastructure	*	*	*	*	*	*	*	
	-Facility enhancements (repair local buildings)			*	*				
	-Environmental improvements (reforestation)		*	*		*	*	*	
	-Wood supply to Commission members							*	
	- Rental of local buildings	*							
	-Invest in other commercial activities (tourism)			*	*	*			
- Donations			*		*		*		
Local Employment Direct	-Local labor supply for construction phase						*		
	- Local labor supply for operational phase	*		*					
Local Employment Indirect	- Local labor supply for investment in social infrastructure	*	*	*	*	*	*	*	
	-Local labor supply for investments in environmental improvement			*					

355 *Acknowledged impact

356

357 Therefore, all identified categories have been acknowledged by local stakeholders, with
 358 some benefits clearly having a more significant expression such as regular payment;
 359 provision and improvement of local infrastructure and social infrastructure; and indirect
 360 employment in contrast to reforestation; tourism; donations or direct employment
 361 generation.

362 Nevertheless, these less mentioned benefits within each category, have also contributed
 363 to make a distinction from previous studies and existing literature, showing that impacts
 364 and population concerns are strongly related to the local specificities and needs.

365

366 **5.2 Stakeholder’s perceptions of negative impacts**

367 Regarding negative impacts, and as patent in Table 3, most mentioned impacts with
 368 potential adverse effect were either nonexistent or, if they were acknowledged by the
 369 interviewees, they were mostly not perceived as a negative repercussion, as stated by
 370 Interviewee 1 and Interviewee 3 concerning visual impact.

371 The interviewees also showed interest and concern over some aspects, namely impact on
 372 local economic activities and noise emissions, as stated by Interviewee 7. However, none
 373 of the represented commissions ever received complaints regarding negative impacts
 374 from wind energy parks.

375

376 **Table 3**– Main referenced concerns with adverse impacts perceived by interviewees.

Category	Interviewees							Relevant Quotes
	1	2	3	4	5	6	7	
Landscape and visual impact	*	*	*	*	*	*	*	<p>“(…) in our case, I do not think we will have visual impact because wind parks are located very far away from the village (about 3km). From residential areas it will not be even possible to see it. We (village) are located in the lower part of the mountain, and the wind park at a very long distance on top, therefore it will not be visible (…)”.</p> <p>(Interviewee 1);</p> <p>“(…) people get easily used to visual impact, as long as there is interest and benefit involved. People recognize that benefits largely surpass disadvantages, at least that is what I’ve heard people say.”</p> <p>(Interviewee 3);</p> <p>“I used to be a shepherd and I used to take my cattle grazing to the area where now the wind park is located, and initially it was a big shock to see all the people that now could access what used to be a difficult access area, and walking on grazing areas</p>
Noise emission impact	*	*	*	*	*	*	**	
Wildlife impact	*	*	*	*	*	*	*	
Land occupation and usage impact	**	*	*	*	*	*	*	
Shadow flicker effect	*	*	*	*	*	*	*	
Electromagnetic interferences	*	*	*	*	*	*	*	
Socio-economic impacts:								
- Property value	*	*	*	*	*	*	*	
- Cattle grazing	*	*	*	*	*	*	**	
- Farming	*	*	*	*	*	*	*	
- Tourism	*	*	*	*	*	*	*	
Water resources impact	*	*	*	*	*	*	*	

									<i>jeopardizing them.” (Interviewee 7).</i>
Air quality	*	*	*	*	*	*	*	*	

377
378
379

*No impact
*Impact not negatively perceived
**Impact negatively perceived

380 Similarly, to positive impacts portrayed in Table 2, most of the discussed negative impacts
381 associated to the environmental and socio-economic categories have been acknowledged
382 by the interviewees. The negative aspects frequently reported in the literature such as
383 landscape and visual impact; noise; wild life; land occupation and air quality have been
384 discussed as possible concerns but those aspects were not necessarily negatively
385 perceived by the majority of the interviewees. Aspects related to concerning socio-
386 economic activities with local expression in the region, such as cattle grazing or farming
387 were also mentioned as an initial source of concern which ended up not being as
388 significant as expected.

389

390 6. Discussion of the results

391 Regarding positive impacts, there was a predominance of community benefits in both
392 quantitative and qualitative analyses over potential disadvantages, with a statistically
393 significantly higher number of respondents (56.5%) supporting that wind farm
394 implementation brings benefits to local communities, against 43.5% who believe there
395 are no benefits. According to the conducted interviews, the most mentioned benefits are
396 consistent with some of the categories previously identified in the literature including
397 “community funds”, “benefits in kind”, or “local employment” (see Table 2).

398 Stakeholder’s perceptions and distribution of the most mentioned impacts within the
399 categories of community benefit schemes were corroborated by collected questionnaire
400 results. For instance, when asked to specify most important benefits, respondent’s
401 answers coincided with those mentioned by a large majority of interviewees, reporting
402 job creation (40%) and community benefit funds (23%), along with some benefits in kind,
403 mainly providing or improving access roads (16%) as the most the most relevant benefits.
404 This is supported by Interviewee 2 quote: *“The main advantage for us is the financial
405 benefit that is a compensation they give us resulting from the usage of land (“baldios”).
406 Then we also have infrastructure improvement, since to access wind farm location,
407 developers have to provide accessibilities, which is also reflected as a positive outcome*

408 *for local community*". The extent of the potential impact of these projects in both social
409 and economic dimension is also adequately described by Interviewee 5: "(...) *here the*
410 *little income we had was from the forest, there was no other source of income. We were*
411 *talking about a yearly sum around 2 to 3 thousand euros, and now we are talking about*
412 *40 to 50 thousand. It is a very big difference*". (Interviewee 5).

413 Notwithstanding, despite that the investment in social infrastructure had a statistically
414 lower response from the local residents (10%), a more detailed analysis based on open-
415 ended interviews has revealed an interlinkage to employment generation category. For
416 the most part of the focal stakeholders, employment generation has been associated to the
417 way generated income is managed and redirected towards other investments, i.e. it has an
418 indirect nature. These results reflected that indirectly generated employment should be
419 emphasized, demonstrating a wide level of implementation contributing to local welfare,
420 which is line with Okkonen and Lehtonen (2015) and shows a rather positive vision
421 comparatively to findings in other cases as described for example in Munday et al (2011).
422 Interviewee 2 gave an example of a nearby village that was very much undeveloped, and
423 due to wind park implementation has now a retirement home that employed a total of
424 about 18 people, making a substantial difference in an isolated rural area with social
425 issues, namely aging and emigration of population as well as limited employment
426 prospects. Nonetheless, despite the exposed connection, a large majority of the
427 respondents still addressed employment generation as their main concern for the region.

428 Similarly, this conjoint analysis has allowed to focus other specific aspects from this case
429 study, included in "other" benefits (11%) such as reforestation that far from being
430 considered one of the most relevant benefits is according to most interviewees a recurrent
431 and controversial theme. Respondents had conflicting views regarding potential
432 application of wind energy funds to forest resources, either willingly and consciously
433 accepting this proposal or opposing it, preventing its application. Such resistance is a
434 consequence of a combination of socio-economic and cultural background allied to
435 misinformation and miscommunication issues that shape not only the perception about
436 the project but also decision making towards application of funds. This is not unexpected
437 outcome as other studies also concluded that consensus over how a community fund
438 should be managed may never be fully possible (Aitken, 2010b).

439 Regarding negative impacts, quantitative and qualitative data are generally on agreement.
440 Qualitative data reflect to some extent a problem with incomplete knowledge and also the

441 recognition by research participants that socio-economic benefits tend to be overvalued
442 comparatively to negative impacts, which inevitably conditions their perceptions. Most
443 of the negative impacts are not mentioned and if acknowledged are perceived as irrelevant
444 case study.

445 Quantitative data shows that a minority of respondents (30%) recognize the existence of
446 negative impacts. Noise is regarded as the most important negative impact, although only
447 mentioned by 20% of overall respondents. Likewise, most interviewees claimed not
448 having suffered of noise pollution. These results were consubstantiated by Tsouchlarakia
449 et al. (2009), with most negative perceptions being linked to aesthetic and noise impacts
450 despite a wide acceptance by local inhabitants. Interviewee 7 stated that although no
451 complaints by local community have ever been reported concerning this issue, he in
452 particular thinks that his village is somewhat affected by noise emissions, being
453 influenced by the prevalent wind direction. Nonetheless measures were taken to reduce
454 its negative effects. For instance, Interviewee 3 claimed that special care has been taken
455 to control noise emissions during certain periods of the day during the construction phase,
456 to avoid interference with highly ecologically sensitive areas.

457 Visual impact was also emphasized by less than 6 % of the responses, while according to
458 some interviewees it was not an important issue due to wind farm location and substantial
459 distance to residential areas or verified but not negatively perceived. This is in line with
460 Aitken (2010b) and Katsaprakakis (2012) findings, who concluded that the nearest
461 communities to the wind farm were not necessarily the ones facing the greatest impact,
462 because rocky areas tend to confine direct impact opposing flat areas tending to have
463 more extensive impact areas, nearby residential areas. However, this case study was
464 confined to one region and as such no generalization on this aspect can be attempted on
465 this matter as the respondents' opinion may be influenced by the landscape attributes and
466 siting of the turbines (Molnarova et al., 2012).

467 Although Interviewees 3 and 6 share the opinion that construction of wind farms
468 indirectly benefited local shepherds by facilitating access to grazing pastures, another
469 Interviewee 7, disagrees and views this new accessibility to pastures as quite shocking
470 and as potentially compromising these habitat's management. This restricted concern
471 over impacts on local economic activities, namely interference with agricultural and
472 shepherding is consubstantiated by an equally limited percentage (1.5%) of all
473 respondents.

474 Both a majority of respondents to the questionnaire and interviewees were favorable to
475 wind power deployment. Anyway, there was a somewhat considerable percentage of
476 indecisive respondents, which highlighted the importance of timely access to accurate
477 information directed towards specific local communities' interests. This aspect is also
478 connected to changes in attitude towards project acceptability, since although a large
479 percentage of respondents were favorable to this kind of project a few changes to initial
480 stance were registered. These results reinforce the importance an open and inclusive
481 participatory process. In addition, an important claim brought to the debate by the
482 interviewees was related to the lack of negotiation skills and knowledge of the
483 communities representatives when working with the promoters. This issue is also debated
484 in the literature calling attention to the benefits of residents' involvement in RES projects
485 facilitated by professionals in order to accompany negotiation process, ensuring
486 advisement and support for local communities (see for example Rogers et al. 2008).

487 According to the interviewees, resorting to an independent entity would also contribute
488 to establish a missing connection between national and local authorities ensuring a more
489 successful outcome to revenues, The mention by interviewees of the need to establish a
490 link between national and local authorities has been considered focal and very accurate,
491 as other authors (see Allen et al, 2012) have mentioned it as being vital to implement
492 RES projects at a local scale.

493

494 **7. Conclusions**

495

496 The presented case study resorted to a mixed methodology and has allowed to perceive a
497 positive attitude of local residents' opinion and stakeholders towards wind farms. This
498 community support seems mainly driven by the perceived benefits resulting from wind
499 farm deployment. This is in line with the previous study from Ribeiro et al (2014) also
500 for Portugal, who showed that local social benefits can play a major role on the acceptance
501 of these plants.

502 Therefore, there was a predominance of community benefits in both inquires over
503 potential disadvantages, with stakeholder's perceptions and distribution of most
504 mentioned impacts within identified categories of community benefit schemes,
505 encompassing "community funds", "benefits in kind" and "local employment" being

506 corroborated by collected questionnaire results. Regarding the most important benefits,
507 respondent's answers from the quantitative analysis coincided with those mentioned by a
508 large majority of interviewees, reporting job creation and community benefit funds, along
509 with some benefits in kind, mainly providing or improving access roads. Emphasis to
510 employment generation and community funds reflect the relevance of present local socio-
511 economic and cultural context play when addressing benefits or social costs ascribed to
512 RES projects and the results show how historical cultural practices can shape perceptions
513 of wind energy development.

514 Although a few negative effects were also reported both during interviews and
515 questionnaires, as in Frantál (2015) the amount of socio-economic benefits seems to play
516 a determinate role on the locals' attitudes towards wind farms.

517 The results of both questionnaires and interviews have illustrated how management of
518 community benefit schemes is connected to local specificities such as traditions and
519 socio-cultural background denoting the need to adopt a widespread integrative solution
520 involving various stakeholders within negotiation process, in order to achieve a more
521 consensual, future length appropriate outcome, reinforcing the importance of local
522 community perception's to achieve local sustainability. Based on the results some policy
523 implications can be drawn from the study.

524 Firstly, and by far most the highest importance assigned to job creation either from direct
525 wind power projects or from socio-economic activities derived from the benefits assigned
526 to the local community. As Guo et al (2015) supported this should be seen as a sign of
527 the importance of prioritizing hiring local residents to increase the acceptance of these
528 wind farms.

529 Secondly, the sense of benefit sharing is evident for both local residents and stakeholders
530 although the relative importance assigned to the resulting investments or facilities is not
531 fully consensual reflecting the heterogeneous characteristics of the population. The socio-
532 economics impacts of re-investment of financial returns directly assigned to local
533 community demonstrate the relevance of the implementation of fair benefit sharing
534 mechanisms to ensure public acceptance and effective local development.

535 Thirdly, negatives aspects are related to several factors but the noise issue remains as the
536 most important one closely followed by landscape concerns. Even if for the moment these
537 negative factors do not seem to be enough to overweight the perceived socio-economic

538 benefits, decisions makers should not overlook them as possible drivers of conflicts and
539 negative reactions with important effects across the population and affecting future
540 projects acceptance.

541 Fourthly, communication issues and lack information still remain as major drawbacks for
542 the involvement of local population on energy decision making. Local population
543 frequently lacks the technical background, time and negotiation skills to engage in these
544 processes demonstrating the importance of creating mechanisms to obtain external
545 professional support.

546 As for the proposed research approach, this study showed that combining both qualitative
547 and quantitative methods brings additional information for the impact evaluation allowing
548 to access the general views of the population but also to match the results with the socio-
549 economic and cultural background of local population.

550 Finally, it is worth pointing out that being the results derived from a single case study
551 they suffer from potential limitations on any attempt of generalization. Nevertheless, the
552 selected case presents population characteristics similar to most locals where wind farms
553 are installed in Portugal and even in the Iberian region. These common characteristics,
554 provide then some confidence on the general conclusions and on the possibility of sharing
555 valuable foundations to future studies on social impact assessment of RES projects at
556 local scale.

557

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