

Viewpoint

# Change in public attitudes towards a Cornish wind farm: Implications for planning

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Received 9 March 2007; accepted 12 September 2007

Available online 18 October 2007

## Abstract

While independently conducted polls suggest significant public support for wind energy, there are often objections to particular wind farm developments from the local population which can result in planning permission being declined and a restriction in the ability to meet renewable energy and greenhouse gas reduction targets. The aim of the study was to determine whether the pre-construction opinions held by communities local to a wind farm change after an extended period following commissioning. Residents of St. Newlyn East, Cornwall, England, were asked to recall their opinions of Carland Cross wind farm in 1991 and 2006. Statistically significant changes in opinion were observed for attitudes regarding the wind farm's visual attractiveness and the importance of the energy security it provides. This study continues by exploring potential reasons for this in the context of recent literature on public attitudes towards renewable energy. The findings of this study support the proposals in the 2007 UK White Paper, *Planning for a Sustainable Future*, for community engagement early in the project process and for the requirement of infrastructure to be debated at the national level.

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*Keywords:* Attitudes; Renewable energy; Planning

## 1. Introduction

In response to the global climate change and national risks to energy security, the UK has proposed that 10% of electricity generated in England and Wales by 2010 will be derived from renewable sources, rising to 20% by 2020 (UK Department for Trade and Industry (DTI), 2007). In the recent past, this has seen the development of onshore wind energy to meet these targets (Strachan and Lal, 2004). This approach has been controversial due to the negative environmental and socio-economic impacts perceived to be created by wind farms (e.g. Booker, 2006; Vidal, 2004).

These concerns extend the time wind farm projects spend progressing through the spatial planning system and can be responsible for development control committees declining planning consent. If the attitudes of local populations to a wind farm improve over time then planning consent for up to three times the total installed wind energy capacity of the

UK (The British Wind Energy Association (BWEA), 2006) may have unnecessarily been declined.

This issue and potential policy solutions are explored by comparing the recalled opinions from 1991 of a population living locally to a wind farm in Cornwall, UK, with their opinions in 2006.

### 1.1. Environmental concerns of wind farms

The public's concern regarding the environmental impacts of wind farms is subjective and sociological factors are important in determining their extent, such as a person's knowledge of the technology (Sustainable Energy Ireland, 2003), exposure to particular media reports (Boyle, 2004) and the opinions of friends and relatives living locally (Devine-Wright, 2003 cited in Devine-Wright, 2005).

The assessment of the visual impact of wind energy is the most important environmental issue (Wolsink, 2007b) that arises from wind turbines and power transmission lines being constructed in the open, upland landscapes required for effective wind generation. The type of landscape

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dominates other factors for objection such as the number of turbines or turbine size. Consistently, however, larger-scale wind farms are perceived more negatively than smaller installations (Devine-Wright, 2005). Two further aspects of visual intrusion from wind turbines are sun glint and sun flicker, which can annoy residents and become a blinding hazard to drivers. Sun glint occurs when the sun's rays are intermittently reflected from the turbine rotors and sun flicker refers to the intermittent shadow cast when the rays of the sun are viewed through a turning turbine.

Visual intrusion from wind farms can be perceived to affect tourism, especially within economies that rely on tourism as a primary income. However, studies in Wales and Scotland found contradictory responses; a proportion of visitors reported that a wind farm would put them off visiting a location while others suggested a wind farm could actually be used as a tourist destination to bring more visitors into an area (NFO System Three, 2002, 2003).

Noise arising from the mechanical components of the wind turbine (e.g., gearbox) and the aerodynamic characteristics of blades and blade–tower interaction is considered to be a significant barrier to the deployment of wind energy (Oerlemans et al., 2007). The magnitude of noise annoyance has been found to be influenced by a person's opinion of the visual impact of wind turbines (Pederson and Persson Waye, 2004) as well as sound characteristics and pressure. Additionally, the degree of annoyance will depend upon noise tone, intermittency and sensitivity of individuals under certain circumstances, such as sleeping (Sørensen, 1995). Careful turbine siting can minimise sound immission at near-by dwellings. This is demonstrated in the findings of a study by Moorhouse et al. (2007), which reports that only 20% of operational wind farms in the UK have been subject to formal noise complaints.

Wind farms are placed across large land areas, a common reason for public objection, but the footprint of the wind turbines is between 1% and 2% of the total site area (BWEA, 2007), leaving the land between the towers available for its previous use. Furthermore, sites can easily be returned to their original state upon decommissioning unlike the infrastructure required for large hydro, nuclear or fossil-fuelled plants.

The Royal Society for the Protection of Birds has reported that the number of breeding pairs of white-tailed eagles on the Smola Islands, Norway, have fallen from 19 to one since a wind farm was constructed (Anon, 2006), suggesting that wind farms can impact bird populations. However, Ross (2006) mentioned that during the first 2 years of operation of the Novar wind farm, Scotland, only two grouse and one kestrel were killed despite the wind farm being located in eagle territory and on a migration route for geese. While bird strikes are frequent, the threat posed to bird life appears to be highly dependent upon site and bird-specific parameters.

Problems can arise with television signal interference (Dabis and Chignell, 1999). The reflection of the signal

from the turbine blades may cause a cyclic ghosting of the picture at the frequency of turbine rotation. This can generally be overcome through various technical fixes such as erecting a local repeater transmitter.

Voltage fluctuations, due to sudden wind speed variation, propagate electrical flicker on mains electricity (Vilar et al., 2006), which can cause problems for consumers in the form of changes in the illumination intensity of incandescent light bulbs (i.e. 'flicker') (Larsson and Poumarède, 1999). Voltage regulation can mitigate electrical flicker and, with state-of-the-art variable speed wind turbines possessing this intrinsic capability, flicker is no longer a difficulty (Zhe Chen, 2005).

### 1.2. Planning process

The exposed, remote, high ground that provides the greatest opportunity for the exploitation of wind energy is often environmentally sensitive. One of the main reasons for wind farms in the UK encountering difficulties in gaining planning permission is that the approval of these large structures in upland areas is a reversal of land use policy (ETSU, 1994) in areas that have historically been protected from development because of their natural beauty and value (Hedger, 1995). Local authorities currently handle planning applications for wind farms under 50 MW while applications for larger onshore and all offshore wind farms are made directly to the Secretary of State, although local authorities will submit a recommendation. The Development and Control Committee's decision will be influenced by the local plan, the responses from a list of statutory consultees and the public, countryside protection groups, and the planning officer's recommendation. Countryside protection groups, such as the Council for the Protection of Rural England (CPRE), often have a significant influence over planning decisions: Toke (2005) analysed 51 wind farm planning decisions from across England and Wales and discovered that every application that had been objected to by the CPRE was declined planning permission.

Due to a lack of interaction between national energy and spatial planning policies, despite both domains being influenced by environmental policy (Breukers, 2007, cited in Wolsink, 2007a), different local authorities have adopted dissimilar policies on renewable energy development and have interpreted the objectives and intentions of national strategies in disparate ways (Birnie et al., 1999). This has led to inconsistent decision making across England and Wales and has possibly contributed to the perception that the planning process is designed to prevent development rather than to ensure that high-quality development goes ahead (Price, 2004). In an attempt to integrate national energy policy into local planning decisions Planning Policy Statement 22: Renewable Energy was published by the Office of the Deputy Prime Minister in 2004. It aims to allow Development and Control Committees to make more favourable decisions for renewable energy by ensuring that

the national economic and environmental benefits of renewable energy developments are well understood and prepared for in the decision-making process.

### 1.3. Public attitudes

Public concern can be responsible for the refusal of planning permission for renewable energy projects. However, the literature is increasingly identifying the importance of distinguishing between public opinions of wind energy and opinions of wind farms (Bell et al., 2005). There has been much public opposition to wind farm developments in the UK (Devine-Wright, 2005), which is in contrast to the support for wind energy identified by many past studies on an international scale (Wolsink, 2007a; Krohn and Damborg, 1999). This distinction can help explain why, despite public support for wind energy, between 1999 and 2002, only 25% of the capacity of proposed wind energy developments was awarded planning approval (Toke, 2002).

The ‘not in my backyard’ (NIMBY) syndrome, which suggests that people favour renewable energy except when it is sited in their vicinity, has been quoted in the past as a reason for the disparity between the outcomes of public attitude surveys and the granting of planning consent (Wüstenhagen et al., 2007). However, this is contradicted by a Swedish study which found no significant difference between the opinions of the public living locally to a wind farm and the public who have little contact with them (Ek, 2005). The simplicity of this theory has also been criticised by many researchers who have determined a range of additional factors upon which local objection can be based. These include the campaign stance of a community group (Van der Horst, 2007), the beliefs held by the public regarding particular wind farm impacts (Wolsink, 1996), the communication and consultation methods employed from the outset of the planning process (Gross, 2007), the nature of the planning system and suspicion of the developer’s motives (Wolsink, 2000). This suggests that while residents’ pre-construction objections to a wind farm may appear to be entirely based upon environmental or economic concerns, the underlying reasons are likely to be related to the socio-institutional factors listed above. Similarly to real environmental and economic fears, these socio-institutional fears may be unfounded and therefore may not come to fruition after the project is completed. This adds an extra layer of public objection to renewable energy projects, which further reduces the opportunity for schemes to receive planning consent, perhaps unnecessarily.

Few studies have determined how the opinion of the public changes between having a wind farm proposed in their locality and after having lived with the development for a period of time (Devine-Wright, 2005). Those that have occurred have returned similar improvements in acceptance from local people after project completion when compared with their attitudes during the planning

stage. One of the earlier studies in Europe was performed in the Netherlands by Wolsink (1989), in which it was found that acceptance increased after commissioning. In 1990, residents of Delabole, Cornwall, were questioned on their opinions of a proposed wind farm near the village and were questioned again in 1992 around 6 months after commissioning (DTI and Exeter Enterprises, 1994); it found that residents were more accepting of the wind farm after having lived with the development for 6 months. Later, Bishop and Proctor (1994 cited in Damborg, 2003) in a report for BBC Wales performed a ‘before and after’ survey of three wind farms in Wales. It was found that both before and after construction more residents were in support of the development than opposed it, with an average 66% of the population supporting the wind farms after construction, while 41.1% supported them before. There was, however, great variability across the sites. More recently, a study on public attitudes of four operational wind farms in Scotland (Dudleston, 2000) found that 40% of residents expected to be negatively affected by the construction and operation of a local wind farm. In reality only 9% experienced any problems. Similarly, a study of 10 wind farms in Scotland found that 48% of residents living locally to them anticipated being negatively impacted by their presence. After commissioning only 18% of residents believed they were subject to any negative effects (Braunholtz, 2003).

The aim of this study was to add to the existing literature on public attitudes towards renewable energy and the implications for planning policy. This was to be achieved by determining whether the opinions of the Carland Cross wind farm, Cornwall, UK, held by the residents of the nearby village of St. Newlyn East are maintained after having lived with the completed wind farm in their environment for 14 years, the longest period of any study of this type.

## 2. Study location

The county of Cornwall currently has eight wind farms, commissioned between 1991 and 2004 (Yes2Wind, 2006) and is home to Delabole, the UK’s first wind farm (Freris, 1992). There has thus been considerable opportunity for residents to form their true opinions of wind farms.

The 6 MW Carland Cross wind farm, constructed in 1992, was chosen as the location for this study (Fig. 1) due to its proximity to a reasonably sized population and its offering of a more rural location over other Cornish wind farms.

The wind farm has 15 turbines (each 30 m high) constructed upon the highest hill in the area at an altitude of 149 m and surrounded by sparsely vegetated moorland and downland. The village of St. Newlyn East, 2¼ km from Carland Cross, with a population of 1230 (Cornwall County Council, 2000) was used for questioning due to the uninterrupted vistas of the wind farm across the Lappa Valley (Fig. 2).

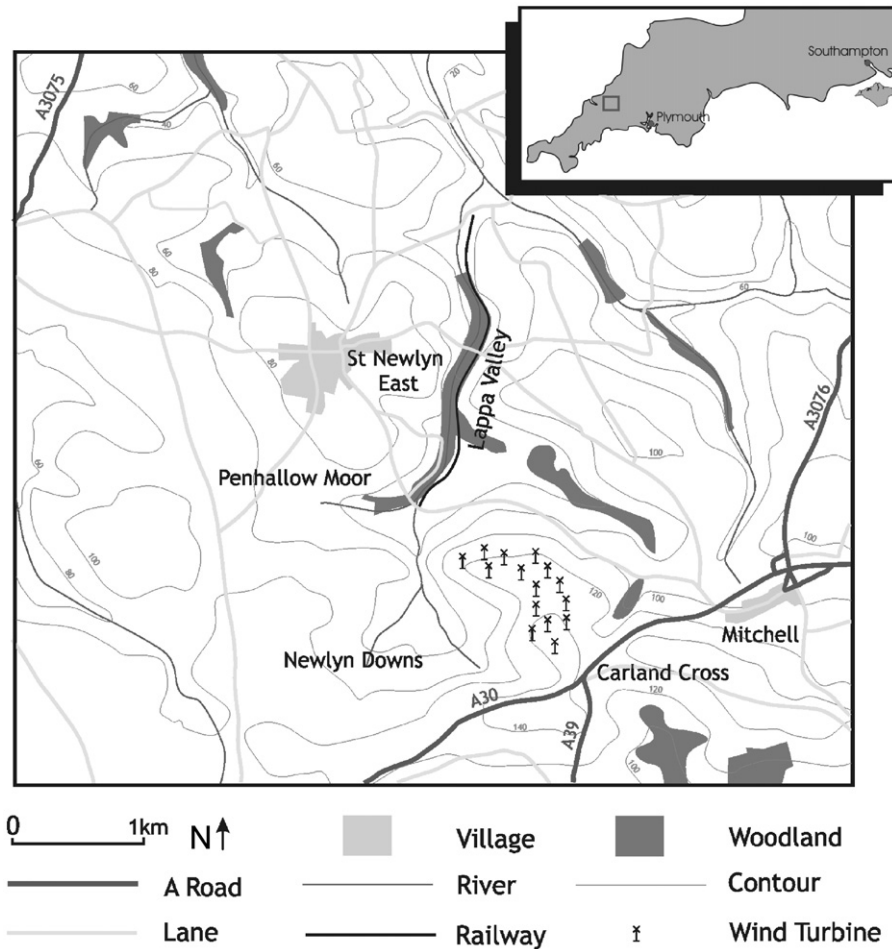


Fig. 1. Location map of St. Newlyn East and the Carland Cross wind farm. The area is both sparsely vegetated and populated. *Source:* Traced from Edina Digimap (2006).



Fig. 2. Carland Cross wind farm viewed from St. Newlyn East. Many residents can see the turbines from their property.

### 3. Methodology

The methodology was required to meet two main objectives. The first was to determine the opinions of residents of St. Newlyn East on the then planned Carland Cross wind farm before it was constructed. The second was to determine the opinions of residents today after having lived with the development for 14 years.

To obtain residents' opinions of the wind farm from the time the development was proposed, a retrospective door-

to-door interview was prepared. This was used to ask residents who had lived in St. Newlyn East since before the construction of the Carland Cross wind farm to recall their opinion in 1991. To overcome the possible reluctance of residents to admit that their attitudes towards the wind farm had changed and to address the time period over which respondents were asked to recall their opinions, it was proposed that the interview results would be compared with local media reports of the Carland Cross wind farm project from the early 1990s. However, while opinions of community action groups and councillors were prominent in the local press, very few opinions of residents were found in the historical press for this purpose. The face-to-face nature of the interview, non-hostile and affable communication style and the assurance that the respondents were aware of the purpose of the study will have assisted in ensuring that the resulting comments are truthful and reliable.

A separate section of the interview was designed to decipher the current opinion of the wind farm held by the same sample of residents. The same sample of residents for both the 'before' and 'after' questioning was used to avoid the likely occurrence of demographic disparities had two

separate samples been used. The interviews were performed over 2 and 3 June 2006.

The interview used a questionnaire to ensure consistency in the range of information received from each respondent, which the interviewer used to record the respondents' comments and answers. The interview was designed to make the comparison of residents' opinions between the pre-construction stage and today as simple as possible. This involved using a combination of closed and open questions to allow a quantitative analysis. However, an important aspect of the questionnaire design was the inclusion of open questions that ensured respondents were not prompted with specific impacts that the wind farm may have had on their lives, but were simply asked to disclose, without the provision of examples, the negative and positive impacts they recalled anticipating before the wind farm was constructed and the impacts they experience today. The respondents were then asked to rank their concern about the self-identified negative impacts through closed questioning, using a point scale of 1 to 5 where 1 was 'very slightly concerned' and 5 was 'very greatly concerned', and to rank the importance of self-identified positive impacts where 1 was 'very slightly important' and 5 was 'very greatly important'. Data significance was analysed using Wilcoxon's signed rank test. The study only questioned residents who had lived in St. Newlyn East since before the wind farm was proposed. After 2 full days of questioning a sample size of 100 was achieved.

## 4. Results

### 4.1. Sample characteristics

The gender distribution of the sample was consistent with that of the village with 43% of the sample being male, leaving 57% as female. The gender distribution of the population of the Newlyn and Goonhavern Ward, in which St. Newlyn East appears, is 51% female and 49% male (National Statistics, 2001a). The age group distribution of the sample varied by a maximum of 9% from that of the ward population (Fig. 3).

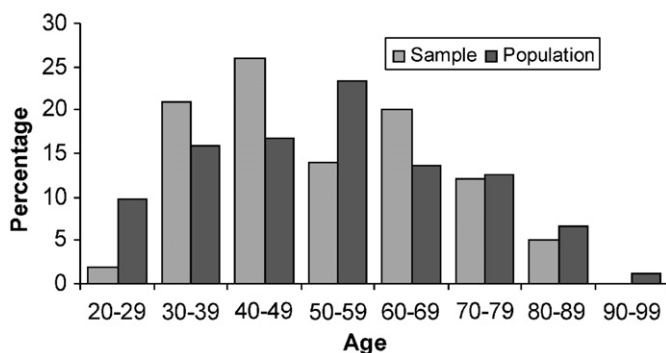


Fig. 3. Frequency distribution of the age of respondents in the survey sample compared with that of the Newlyn and Goonhavern Ward. Source: National Statistics (2001b).

### 4.2. Attitudes towards wind energy

The vast majority,  $84 \pm 7.2\%$  ( $p = 0.05$ , used throughout this study), of the residents suggested that wind energy should be included in the UK's energy portfolio while the remaining 16% were either undecided or believed that wind energy should not be advocated further as an energy source for the UK. The overwhelming reason given for this was that wind energy does not "produce enough electricity" to make a significant contribution to UK electricity demand and so "too many wind farms would be required".

### 4.3. Changes in general opinion

Due to sampling error, no statistically reliable change in the residents' general opinion of Carland Cross wind farm occurred. However, both during planning and after having lived with the wind farm, the residents showed support for the development. In all,  $74 \pm 8.6\%$  recalled approving of the wind farm proposal in 1991, before construction, while  $14 \pm 6.8\%$  were in objection. The remaining  $12 \pm 6.3\%$  were undecided. In 2006, after having lived with the wind farm for 14 years,  $82 \pm 7.5\%$  were in support for the wind farm,  $6 \pm 4.7\%$  objected and the undecided proportion remained at 12%.

### 4.4. Changes in opinion of the negative impacts

Fig. 4 shows how the concerns of the population of St. Newlyn East changed between 1991 and 2006. No statistically reliable change in the overall opinion of the population was identified between 1991 and 2006 for the negative impacts. However, small reliable changes were identified in the proportion of the population that individually changed their opinion regarding the negative impacts caused by visual and noise intrusion.

A total of  $10 \pm 5.9\%$  of the population thought that the visual intrusion of the wind turbines was greater after the wind farm was constructed than they had expected while  $8 \pm 5.3\%$  thought that the visual impact was less intrusive. Similarly,  $75 \pm 8.5\%$  of the population did not change their opinion about the noise generated by Carland Cross;  $11 \pm 6.1\%$  believed that the noise factor was more intrusive than they had expected, with four respondents changing their opinion by more than three scale points, while  $14 \pm 6.8\%$  thought noise was less of a problem than they had previously anticipated, with eight respondents changing their opinion by more than three scale points.

No statistically significant changes were identified at the 95% confidence level between the residents' recalled opinions of the potential negative impacts in 1991 and their opinions in 2006.

### 4.5. Changes in opinion of the positive impacts

A total of 59% of the population recalled anticipating that, in 1991, the wind farm would bring no positive

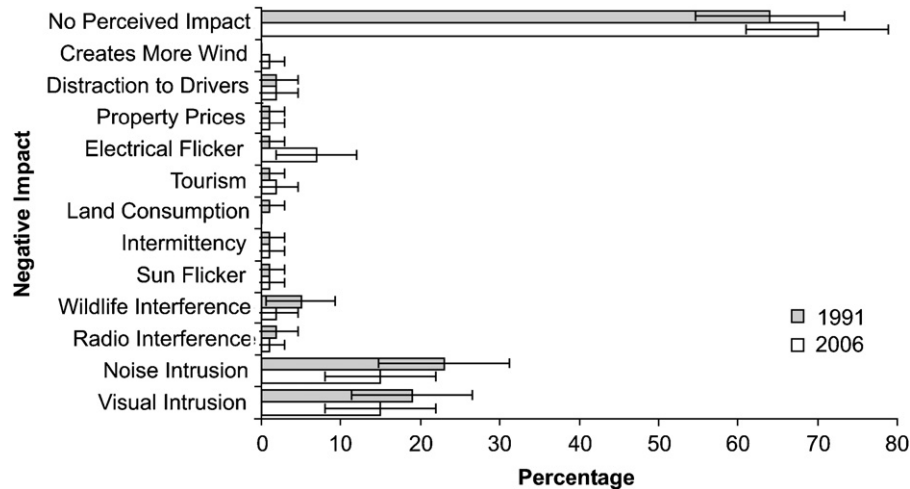


Fig. 4. Change in residents' concerns over the negative impacts of the wind farm between 1991 and 2006. No statistically reliable overall changes in opinion were identified.

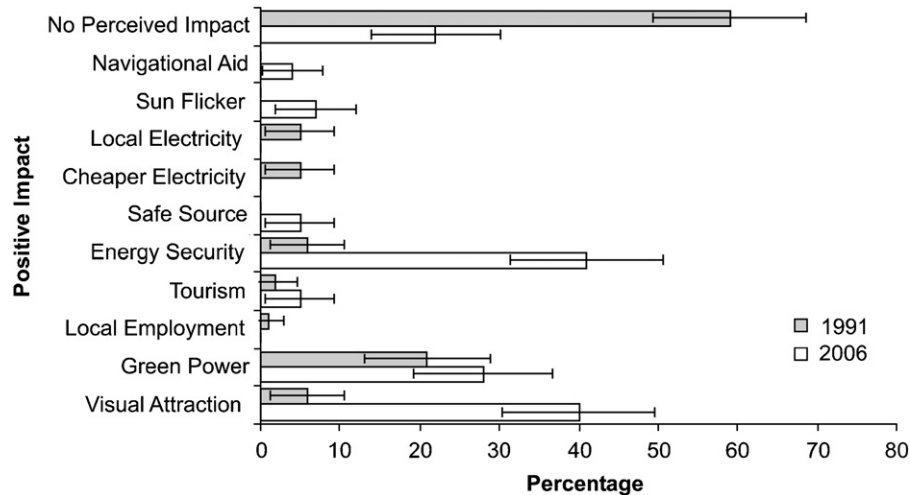


Fig. 5. Change in the perceived positive impacts of the wind farm in 1991 compared with the actual positive impacts over the past 14 years.

environmental, social or economic impact to St. Newlyn East. By 2006 this proportion reduced by  $37 \pm 16\%$  to 22% (Fig. 5). Between the residents' recalled opinions of 1991 and their opinions in 2006, the overall proportion of the population of St. Newlyn East finding the wind farm visually attractive changed by  $34 \pm 11.5\%$  from 6% to 40% with a modal change in opinion of two scale points. By 2006 certain positive impacts of the wind farm emerged that none of the respondents had considered occurring whilst Carland Cross was in the planning process. These were the usefulness of the wind farm as a navigational aid, which one respondent ranked as 'very greatly important', and the pleasure gained in watching the phenomenon of sun flicker and sun glint. The fact that wind farms provide a secure form of energy for the UK had risen in popularity in the population by  $35 \pm 11.6\%$  from 6% in 1991 to 41% in 2006.

Of the population,  $58 \pm 9.7\%$  did not change their opinion regarding the visual attractiveness of wind turbines;  $38 \pm 9.5\%$  found the Carland Cross wind farm more attractive after living with the development than they recalled thinking they would before it was constructed. A statistically unreliable proportion found the structures less visually attractive;  $41 \pm 9.6\%$  of the residents believed that the energy security and independence that the deployment of wind energy provides to the UK had become more important since 1991, despite living with a wind farm on their immediate doorstep;  $9 \pm 5.6\%$  did not remember believing energy security was important in 1991 but responded with 'very greatly important' in 2006.

No statistically reliable change was identified for the opinion of residents of the positive impact that Carland Cross may have had on tourism over the past 14 years;  $93 \pm 5\%$  of the population left their opinion unchanged.

In all,  $21 \pm 8\%$  of the population recalled identifying in 1991 that the ‘green’, renewable source of energy that Carland Cross wind farm provides as a positive impact. While there was no statistically reliable change in the overall opinion of the population over the succeeding period to 2006,  $16 \pm 7.2\%$  of the population did enhance their opinion of this factor to ‘very greatly important’ by a modal scale point change of 3;  $81 \pm 7.7\%$  did not change their opinion.

Of the sample,  $7 \pm 5\%$  found that they had a more positive attitude towards sun flicker and glint once they had lived with the wind farm;  $6 \pm 4.7\%$  improved their opinion by more than three scale points.

A statistically significant change was identified between the proportion of the population that did not anticipate a positive impact transpiring from the wind farm in 1991 and those unable to identify a positive impact in 2006 ( $p = 0.000$ ). Further significant changes were identified in how the residents’ opinion of the visual attractiveness of the wind farm changed between 1991 and 2006 (median change in opinion of  $+0.5$  scale point;  $p = 0.000$ ) and in their opinion regarding the secure source of energy that wind energy provides to the UK (median change in opinion of  $+1.0$  scale point;  $p = 0.000$ ).

## 5. Discussion

### 5.1. Attitudes towards wind energy

The presence of Carland Cross wind farm has not given the majority of the residents of St. Newlyn East a negative opinion of further wind energy exploitation in the UK. This corroborates various past opinion studies. For example, a study prepared for the UK DTI (2003) found that 82% of residents living within 5 km of a wind farm were in favour of further wind energy exploitation. Similarly, the BWEA (2005) found consistently that over the past 15 years, between 70% and 80% of residents living near wind farms are in favour of further wind energy development both in principle and in practice. Those respondents who disagreed with the further exploitation of wind energy were concerned about the number of wind farms that would be required to make a significant contribution to the UK’s electricity supply. This concern is most likely centred on the degradation of the landscapes that would be lost to the presence of wind farms across the UK; this is a commonly reported public objection to wind energy but is probably based upon the loss of familiar, local landscapes (Pasqualetti, 2000).

### 5.2. Changes in general opinion

Despite the negative press and opposition new wind farm developments in Cornwall received at the time of the Carland Cross proposal (e.g. Anon, 1991; Drake, 1991; Hall, 1991; Jobson, 1991), many residents remember approving of the wind farm when it was being planned.

Subsequently, due to the already high levels of support identified at the planning stage of Carland Cross, no significant change in the overall levels of support for the Carland Cross wind farm was identified between 2006 and 1991. While studies of public opinion towards wind energy frequently discover high levels of support, there is frequent opposition to the construction of an initial wind farm in a particular locality (Devine-Wright, 2005). After project completion, acceptance levels have then been shown to improve (Wolsink, 1989; Bishop and Proctor, 1994 cited in Damborg, 2003; DTI and Exeter Enterprises, 1994) and, in the case of wind farms constructed by Dutch developer *Energy Connection*, return to pre-project levels (Gipe, 1996).

The response in this study contradicts this pattern. Perhaps because many respondents admitted that their approval of the scheme was largely based on the fact that they were unsure of what to expect but were excited to be at the heart of the development of a new technology; the first wind farm in the UK, at Delabole, Cornwall, had opened only months earlier. Additionally, respondents recalled feeling very remotely involved in the planning process, even unaware of its existence, and therefore had little opportunity to fully consider the likely impacts. This is akin to many of the residents of Taralga, Australia, who were unaware of any consultation process related to the proposal of a local wind farm (Gross, 2007).

### 5.3. Changes in opinion of the wind farm impacts

As previously stated, the assessment of the visual impact of wind energy is consistently reported to be the most important environmental issue (Wolsink, 2007b) of wind farms. This is supported by a study performed by Warren et al. (2005) in southwest Ireland in which 89% of respondents were concerned about the visual intrusion from a planned wind farm. The second most reported concern in Warren’s study, by 59% of the respondents, was noise intrusion. This study, however, reveals that the greatest concern held by the residents of St. Newlyn East before the wind farm was constructed was noise intrusion; visual intrusion was the second greatest concern but at a very much lower level than in Warren’s study, at 19%. This reversal of concerns and the significantly lower response is perhaps because the wind farms used in Warren’s study were commissioned much later and are therefore comprised of much larger turbines than at Carland Cross. Studies frequently find that larger-scale wind farms are perceived more negatively than smaller installations (Devine-Wright, 2005). Additionally, unlike the residents of St. Newlyn East, the respondents in Warren’s study will have had the opportunity to gather opinion first hand from existing wind farms in their country and through the media. Their opinions may have consequently been of a more empirical nature than the opinions of the residents of St. Newlyn East.

The proportion of local residents who anticipate noise as a negative impact from a proposed wind farm varies between studies, e.g. 12% (Dudleston, 2000), 59% (Warren et al., 2005) and 86% (DTI and Exeter Enterprises, 1994). The relatively small proportion of the population in this study that recalled being concerned about the potential noise that would be created by Carland Cross is again possibly due to the residents' self-professed lack of previous experience with wind farms and their excitement of the new technology. In contradiction to the majority of the sample, it was disclosed by a few respondents that the village had been given the opportunity to visit the recently commissioned Delabole wind farm to hear for themselves the noise generated by wind turbines. This emphasises the occurrence within wind farm attitude studies of the majority of the public not being aware of the consultation process or the opportunity for participation (e.g. Gross, 2007; Warren et al., 2005). This ineffectual communication with the public often slows the planning process and impacts upon the development of further wind farms in the region (Jobert et al., 2007).

The findings in this study add further support to the concept that objections to a specific wind farm are not due to the traditional definition of NIMBYism but are instigated by social and institutional factors causing distrust and angst during the planning and siting stages of the project. For example, improvements in the opinion of noise intrusion were of a larger magnitude than those that worsened. Intriguingly, one respondent who accepted the wind farm explained how the noise meant that it was unpleasant sitting outside on a summer's evening, while their immediate neighbour questioned whether the turbines were audible at all. Additionally, a statistically significant change in opinion was observed between 1991 and 2006 in the proportion of residents who found the wind farm visually attractive. In fact, in 2006, more residents in St. Newlyn East found wind turbines visually attractive than the respondents not living in proximity to a wind farm in an opinion survey conducted in the adjacent county of Devon (MORI, 2004). This, and the significant decrease in the proportion of residents not being able to identify a positive impact from Carland Cross, suggests that residents focused on the negative impacts of the wind farm as a proxy for their protest against socio-institutional factors and had not considered the positive impacts that subsequently transpired.

An extension of this theme could be used to explain the disparities between the experiences of St. Newlyn East's residents. One respondent was adamant that their poor television reception was caused by the wind farm despite their immediate neighbours not reporting any problems. Additionally, a 'snowy' picture was described rather than the cyclic ghosting of a television picture that the rotation of a wind turbine can cause. A similar situation arose with the issue of electrical flicker: In 2006,  $7 \pm 5\%$  of the residents suggested that they had experienced electrical flicker but the remaining majority had no recollection of its

occurrence in their homes since Carland Cross was constructed, suggesting that the village does not suffer from this problem. Finally, one elderly respondent believed the wind speed in the area had increased since the wind farm had been constructed. Whilst these negative attitudes could have materialised through the misinterpretation of wind farm impacts communicated via third parties, it is likely that their origins are sourced in the desire to protest against more significant underlying issues.

If socio-institutional factors instigated the lower levels of acceptance seen in 1991 compared with 2006, it is interesting that the number of residents remembering being concerned about the impact of Carland Cross on local tourism is negligible. This is despite the prominence of tourism within the Cornish economy (Lang, 2004) and the importance of the promotion of the "unique and beautiful natural environment" (South West Tourism, 2007) as a pull factor for potential visitors. St. Newlyn East, however, has no significant tourist accommodation or facilities, which Toke (2005) found to be an important requirement in a settlement for significant concern to arise about impacts on tourism from local wind farms.

Varley et al. (1989) found that 85% of the respondents they questioned from Devon, Cornwall and Orkney believed that the 'clean energy' provided by wind turbines was of a 'great advantage'. This is over four times greater than the proportion of respondents believing that 'green energy' provision is important in this study. This disparity highlights the need to ensure that the consultation and engagement methods used are individual to each wind farm development to ensure their effectiveness.

The growing concern regarding national energy security produced a statistically significant change in opinion between 1991 and 2006, with a modal change of three scale points, of the energy independence that wind farms provide. The requirement for secure forms of energy is likely to gain precedence in the future as fossil fuel resources dwindle and consumer awareness of environmental protection issues rises. These are factors that will be debated by an independent commission and integrated into the National Policy Statements proposed within the UK White Paper, *Planning for a Sustainable Future (Communities and Local Government, 2007)*, from here on referred to as the White Paper.

#### 5.4. Implications for planning

Recent literature on the understanding of the NIMBY theory suggests that the true public attitudes and opinions that exist in relation to the siting of the physical infrastructure of a wind farm are often masked by objections that are based upon social and institutional factors, such as a distrust of the planning system or a suspicion of the developer's intent. Therefore, the significant decrease in the percentage of residents unable to identify a positive impact from the wind farm and the statistically significant increase in the proportion of



residents finding the wind farm visually attractive is an indication that the planning system requires reform to ensure that these attitudes are captured during the planning stages of future wind energy projects.

It is reported widely in the literature that publicly available project information and an accessible planning system are imperative for the acceptance of a wind farm (e.g. Gross, 2007; Jobert et al., 2007). Engaging the public early and by inviting key stakeholders to input their valuable local understanding during the preparation of a project will enhance the design quality of the scheme (Breukers and Wolsink, 2007), reduce the perceived threat posed to a community and increase the anticipation of benefiting from the wind farm (Mclaren Loring, 2007). Historically, inclusivity has been absent from renewable energy planning in the UK due to the Non Fossil Fuel Obligation (1990–1998) which provided funding to the lowest cost projects (Breukers and Wolsink, 2007). Whilst early engagement is unlikely to change the opinion of those who object to wind power, it may serve to reduce opposition and enhance acceptance levels from those whom Breukers and Wolsink (2007, p. 2738) call ‘conditional supporters’, such as local residents’ groups. The findings of this study therefore support the need for the reforms detailed in the White Paper, which aims to improve planning transparency and enhance the opportunities for public consultation. This will serve to reduce the magnitude of objections based upon social and institutional factors that have been shown to be confused with feelings of NIMBYism. Ultimately, this will serve to increase the number of wind farm applications that are granted planning consent and contribute to government targets for the proportion of electricity generated from renewable sources and reduction in greenhouse gas emissions.

Fundamentally, this and other ‘before and after’ studies have highlighted a majority acceptance of a wind farm by local communities at the pre-construction stage (e.g. Brauholtz, 2003; Dudleston, 2000; Bishop and Proctor, 1994 cited in Damborg, 2003). However, organised opposition groups often have an effective voice in the decision-making process (Haggett and Toke, 2006). The White Paper highlights the fact that the current planning process is more accessible to these organisations, resulting in an unrepresentative and unproductive collection of opinion from the consultation. The proposed reforms aim to separate the arguments over the need and acceptability of a particular technology from the suitability of a specific location in an attempt to ensure that individuals can enter the consultation arena with confidence and equal prominence to larger organisations so that a greater cross section of a community’s voices are heard. This would suggest that it would be in the developers’ interest to facilitate the creation of a community wind farm supporters group to provide balance to the comments from the anti-wind farm organisations. However, Mclaren Loring (2007) states that a more successful strategy would be to attempt to address

the concerns of those opposed to the development to mitigate the formation of an opponents network.

While a proportion of the change in opinions identified in this study can be attributed to the social and institutional factors that are evident during the planning of a new development discussed above, the public’s belief (Wolsink, 1996) and knowledge (Sustainable Energy Ireland, 2003) of certain wind farm impacts can influence their opinion of a project, as can the opinions held within their social networks (Devine-Wright, 2005). While knowledge of wind farm impacts is used by both supporters and objectors of wind energy to support their opinions (Devine-Wright and Devine-Wright, 2006), it is important that a person’s or campaign group’s knowledge and beliefs are based upon empirical observations. Therefore easily accessible and widely publicised education material and events for councillors and residents should be organised, such as visiting a similar installation or arranging a networking event with people who already live adjacent to a wind farm. This would allow informed decision making regarding the possible impacts of a proposed wind farm installation and may address the formation of opponents networks, mentioned above.

The White Paper recognises that a local approach to planning does not promote the most advantageous decisions for the wider society or environment. It proposes reforms to the UK planning system, which would introduce a new streamlined system for dealing with major infrastructure projects, including renewable energy. This will require ministers to demonstrate the national need for infrastructure, such as climate change mitigation and ensuring the secure supply of the UK’s energy, in National Policy Statements prepared by an independent commission and after public consultation on the associated economic, social and environmental factors. This will remove the need to debate the merit of infrastructure projects at each planning application. Having interviewed planning officers in England and Wales, Toke (2005) suggests that planning officers are responsive to the political environment in which their decisions are made. The reforms proposed to the planning system should therefore encourage planning officers to make more favourable recommendations, which are often pivotal in the decision-making process of development control committees (Haggett and Toke, 2006).

##### 5.5. Considerations for future studies

A limitation of this study is the age of the wind farm. The 400 kW turbines that are installed at Carland Cross have rotor diameters of 39 m. In comparison to current technology, this is very small as a modern 5 MW turbine will have a rotor diameter of 135 m, over three times as large, which could have much greater real and perceived impacts. Studies have assessed the differences in public acceptability of wind farms composed of different sized turbines and varying turbine spacing but with mixed results (Devine-Wright, 2005).

## 6. Conclusion

No statistically reliable change in opinion was identified for the residents' general acceptance of the wind farm between 1991 and 2006. However, the majority of the population was in support of the development both 'before and after'. While no reliable change was identified in the proportion of residents that were concerned about negative impacts, a statistically significant decrease was observed in the number of residents who were unable to identify a positive impact from Carland Cross. Statistically significant changes in opinion were also identified between the recalled opinions of 1991 and those of 2006 for the increase in residents finding the wind turbines visually attractive and the increase in residents considering the secure form of energy that wind energy provides to be a valuable asset.

Between 1999 and 2002, planning applications for 75% of UK contracted wind energy capacity were declined (Toke, 2002). Due to the prominence of landscape intrusion in wind farm objectors' reasoning identified in past studies (Wolsink, 2007b), the statistically significant change in opinion of the visual attractiveness of wind turbines found in this study may imply that up to three times the total installed wind capacity (5170 MW; BWEA, 2006) was unnecessarily declined planning consent. However, underpinning such objections is often a selection of social and institutional factors, such as a disbelief in the planning system, distrust of the developer or the persuasive opinion of a local opposition group.

To reduce the magnitude of opposition and capture a more representative summary of public opinion, the planning system requires reform to become more transparent and participatory. This will encourage a wider spectrum of communities to engage in the consultation and reduce the power of local and national opposition groups.

Additionally, developers and planning authorities need to engage local populations early so that concerns and objections can be addressed through effective dialogue between stakeholders. Combined with this is the need for trusted information and the provision of empirical evidence for councillors and residents in the form of visits to similar wind farms and an opportunity to discuss the experiences with communities in similar situations. This will help mitigate the proportion of residents responding negatively.

The findings of this study therefore support recent literature on public perceptions to wind farms and the intentions of the White Paper, which has the potential to mitigate the magnitude of objections to wind farm projects, increase the success rate of planning applications and therefore bring renewable energy generation and greenhouse gas reduction targets closer.

## Acknowledgement

The authors are very grateful for the contribution of the two anonymous reviewers whose extensive critique and suggested changes have greatly improved the paper.

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