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Comparative Review of Methodologies for Assessing Wind Farms' Impact on Tourism

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Key Points

- While there are individual examples of scientifically rigorous studies of the potential impacts of wind farms on tourism, most research on this topic to date has been conducted without reference to a shared methodology, leading to a fragmented evidence base.
- Mixed and interdisciplinary methods can offer the most comprehensive understanding of the effects of wind farm developments on tourism because quantitative data, such as number of visits and tourist spend, can be compared with more qualitative data in relation to attitudes and perceptions.
- Research gaps include assessment of the potential impact of wind farms on different kinds of tourists, how impacts might differ according to length of stay, reason for visit and socio-demographic background; and in tourists understanding of any wider benefits from wind farms.
- The recommended approach to future work will deliver a better understanding of the complex, multidimensional nature of public perceptions of physical attributes of wind farms in specific landscape and seascape contexts, the ways in which beliefs shape attitudes and are socially mediated through friends, family and the media, and how attitudes are translated through the tourist experience.

1. Introduction

The Scottish Government asked ClimateXChange to compare approaches used in a wide variety of studies that have considered the impact of onshore and offshore wind farm development on tourism.

Tourism in Scotland provides direct employment for 200,000 people, many in rural areas, and in 2011 attracted visitor spending in excess of £4 billion (Scottish Tourism Alliance, 2012). Renewable energy also plays an important part in Scotland's economic development (Scottish Government, 2011), making an increasingly significant contribution to the reduction of challenging climate change emissions targets. The Scottish Government believes that Scotland can lead the world in the development and deployment of offshore renewable energy technologies. Indeed, the large scale development of offshore wind represents the biggest opportunity for sustainable economic growth in Scotland for a generation (Scottish Government, 2013). Onshore wind also offers opportunities for local community ownership and income generation.

This report compares existing studies of wind farm impacts on tourism in terms of study aims and design, measures used, representativeness, and funding sources. Fifty-one papers were identified through a literature search, including empirical studies (e.g. market-based research and interviews/questionnaires with tourists) and mixed methods research (i.e. using existing literature and both qualitative and quantitative empirical data), as well as so-called 'grey literature' (e.g. impact studies and fact sheets) and academic papers. Twenty-five papers were reviewed and twenty-six were excluded from review on several grounds, including duplication, insufficient information on methodology or lack of availability (see Appendix).

A key starting point was set by the study conducted by Glasgow Caledonian University (GCU, 2008a), which found that wind farms have little or no adverse impact on tourism in Scotland. ClimateXChange reviewed evidence from 2008 to 2012 and concluded that there was no new evidence to contradict findings from the GCU study (Dinnie, 2012). However, concerns persist about the potential effects of wind farms on tourism, as illustrated in the report by the Mountaineering Council of Scotland (MCofS, 2014) which examined perceptions of wind farms and their effects on landscapes, sceneries and wildlife.

2. Findings and discussion

Research aims

The research aims for each of the qualifying studies were examined to determine the underlying purpose that delivered their respective findings. Studies exploring the impacts of wind farms on tourism have a variety of aims, often making it difficult to compare findings across different studies.

Some studies had more than one aim. The GCU study (2008a) for example sought to compare the experiences of countries with similar characteristics to Scotland, analyse and quantify local and national impacts in terms of jobs and income, and inform policy on tourism, renewables and planning.

Of the literature looking at effects of wind farms in general, Breukers and Wolsink (2007) examined the differential acceptance of wind energy across Europe through formal and informal decision making structures, while Devine-Wright (2005) sought to develop a theoretical framework for assessing differences in public perceptions and Cetkovsky and Nova (2009) assessed perceptions of wind turbines in different landscape types. A number of studies aimed to recommend practical solutions to potential or perceived conflict between wind farm development and other economic interests, including tourism (Breukers and Wolsink, 2007; GCU, 2008a; Gordon, 2001).

Discussion of Research Aims

Research investigating the acceptance of wind farms in particular landscapes concluded that perceived 'fit' is stronger when continuity with the past is built into the approach (Devine-Wright, 2005). Enjoyment of the scenery and similar factors may relate to intentions to (re)visit areas with wind farms, alongside other factors such as quality of services and accommodation, which some studies suggest may be more important to tourists than the presence or absence of wind farms (Frantal and Kunc, 2011).

Study design

Good study design is essential if robust results are to be achieved. This review identified studies which employed both primary empirical research (typically using surveys and face-to-face interviews with 'key actors'), and secondary desk-based reviews considering empirical studies as well as tourism and planning strategy documents. Key examples are highlighted throughout the report.

Empirical approaches - Empirical research includes a wide variety of methods for exploring perceptions, including face-to-face interviews or administered questionnaires (Aitchison, 2004; Failte Ireland, 2008; Frantal and Kunc, 2011; GCU, 2008a; MORI Scotland, 2002; NFO System Three 2002, 2003; Visit Scotland, 2012), postal or internet surveys (GCU, 2008a; The Market Specialists, 2012; MCofS, 2014), choice experiments (Westerberg et al 2013), visual preference of actual and/or potential developments (Cetkovsky and Nova, 2009; GCU, 2008a; Lilley et al, 2010), and consultations (NFO System Three, 2002, 2003; Regeneris Consulting Ltd, 2014). The sample population varies between studies and includes tourists/visitors (Aitchison, 2004; GCU, 2008a; Lilley et al, 2010; MORI Scotland, 2002; VisitScotland, 2012; Westerberg et al, 2013), niche tourists (e.g. mountaineers) (MCofS, 2014), tourism providers/businesses (BiGGAR, 2007; The Market Specialists, 2012), residents of areas with and without wind farm developments (Aitchison, 2004; Cetkovsky & Nova, 2009; Frantal & Kunc, 2011); and government agencies (NFO System Three, 2002, 2003). Two studies reviewed here used a case study approach of local people's perceptions of proposed or actual wind farm developments (Cetkovsky & Nova, 2009; Frantal & Kunc, 2011).

Secondary analyses - Desk-based studies of wind farm effects on tourism include reviews of existing published research either as part of or as the main focus of the research (Aitchison, 2004, 2012a, 2012b, 2012c; BiGGAR 2007; British Wind Energy Association (BWEA) 2006, 2010; Devine-Wright, 2005; Dinnie, 2012; GCU, 2008a; Gordon, 2001; NFO System Three, 2002, 2003; Regeneris Consulting Ltd, 2014; The Tourism Company, 2012; Westerberg et al, 2013), of tourism and renewable energy policies (Aitchison, 2012c), visitor numbers before and after the development of wind farms (BWEA, 2010); tourist features that could be affected (Aitchison, 2012a); and GIS analyses of wind farm sight lines (Frantal and Kunc, 2011).

Two studies included in this review looked at the potential impact of offshore wind farms on tourism, including the potential for eco-tourism (Lilley et al, 2010; Westerberg et al 2013). Two further studies included offshore wind farms, although the differential effects of offshore developments on tourism in relation to onshore developments were not examined (MCofS, 2014; Aitchison, 2012c). The growing number of (proposed) offshore wind farm developments suggests there is a need for further empirical research on perceptions of offshore wind developments and potential effects on tourism. The 'seascape' is important in relation to perceptions and acceptance of offshore wind farms (Devine-Wright, 2005).

There are examples of a case study approach being used in areas where wind farm development has taken place (Regeneris Consulting Ltd, 2014) and of a comparative case study approach between developed areas and areas where no development has taken place (Frantal and Kunc, 2011).

Many studies combine empirical and secondary methods (e.g. Aitchison, 2004; BiGGAR 2007; GCU, 2008a; NFO System Three 2002, 2003; Regeneris Consulting Ltd, 2014; Westerberg et. al., 2013). Aitchison (2004) combined an interviewer-administered questionnaire of tourists with a review of tourism strategies in south-west England. Day visitors and tourists were interviewed at three locations to assess the characteristics and attitudes of tourists towards existing (and one proposed) wind farm developments. The GCU (2008a) study combines a desk-based review, face-to-face survey of tourists in four areas of Scotland, internet survey of people likely to visit Scotland in

the near future and GIS analyses to identify the number of tourists likely to see turbines while travelling (by road) or from their accommodation. The survey combined analyses of perception with economic analyses of willingness to pay based on visual preferences with and without wind farms. Analysis of this and other data collected as part of the study was used to estimate the overall economic impact of wind farms on Scottish tourism. The BiGGAR study combined a literature review of perception-based evidence with a review of case studies, and four case studies of its own, in areas where wind farms had been developed, using both desk-based research (e.g. visitor numbers to the area) and consultations with local organisations and businesses. Studies with combined methods, in particular the GCU (2008a) report, are considered to provide a more reliable knowledge base from which to draw conclusions about the impact of wind farms on tourism (Aitchison, 2012a) than studies which use only a single approach, since they combine a number of different factors that help explain the relationships between attitudes and potential impacts. Study designs that use only a single method can imply the existence of a causal relationship between wind farms and tourism; mixed methods are able to more fully convey the complex relationships between attitudes, decision-making and other factors that impact tourism.

Discussion of study design

Each of the study designs adopted to investigate wind farm effects on tourism (literature reviews; self-report questionnaires; interviewer administered questionnaires; and (semi-structured) interviews) are useful means of gathering data needed to draw conclusions as to any wind farm effects (Howitt and Cramer 2007; Howitt 2010). Mixed methods study designs, such as that used in the GCU (2008a) and NFO System Three studies, can be a useful approach to explaining wind farm effects on tourism. Quantitative data on measures such as number of visits and tourist spend can be compared with more qualitative measures of factors such as attitudes and perceptions. However, it is important to remember that the views of tourism providers are not the same as the views of tourists themselves. Care should also be taken when extrapolating findings from one sample or one area to other populations and areas (Aitchison, 2012b, 2012c).

This review included one study that measured visitor numbers before and after wind farm development (BWEA, 2010). A number of case studies attempted to assess impacts by comparing areas with wind farm developments with similar areas without developments (Aitchison, 2004; Cetkovsky & Nova, 2009; Frantal & Kunc, 2011). Chronological and comparative studies may offer a robust method for determining the effects of wind farms on tourist behaviour by measuring changes between pre and post development, although design should explicitly account for other factors that might affect tourist decisions about why and where to visit. Empirical studies of visitor behaviour can be useful in assessing changes but it should be noted that such changes can be subject to wider social and cultural influences and thus do not necessarily represent a direct cause-and-effect relationship (Devine-Wright, 2005).

The approach to evaluating wind farm effects as adopted by many wind energy researchers has been criticised for taking a deterministic view of human behaviour, which has shaped the sorts of questions posed in empirical studies (Devine-Wright, 2005). This is typified by the idea that physical proximity (through residency or visiting) is the most important factor influencing reactions to wind farms. Similarly, it has been assumed that opposition to wind turbines is largely motivated by negative perceptions of physical attributes of the turbines (Devine-Wright, 2005). This rationale has been criticised by arguing for greater recognition of the way in which beliefs (e.g. about renewable energy) shape attitudes (to visual features), and are simultaneously mediated through social networks of friends, family and the media (Krohn & Damborg, 1999; Devine-Wright, 2003).

While some studies of wind farm effects on tourism can be considered exemplary because of their rigour, objectivity and study design (e.g. GCU, 2008a; Aitchison, 2004; BiGGAR 2007) it is difficult to directly compare findings about the effects of wind farms on tourism across the evidence base because of the many different study designs and methods employed. Aitchson (2012a) notes that criticisms of studies include selection and extrapolation of data from secondary research, resulting in conclusions reached in one study at one time and in one location being applied to much larger areas - with exaggerated effect, inappropriate and biased sampling methods (Aitchison, 2012b), and a focus on visitor perceptions and intentions rather than actual behaviour (BiGGAR, 2007). One recommendation from this review is that a reliable methodology for assessing the impacts of wind farms on tourism must ensure robust and unbiased sampling methods which follow good practice, and be explicit in the reasoning for any comparisons that are drawn.

Much empirical work on wind farms and tourism and on public perceptions of wind farms in general, is 'barrier oriented' in seeking to identify specific reasons for negative reactions to local development. This body of research has largely been conducted without reference to a conceptual base, with rather disjointed results. (Devine-Wright, 2005).

Computer-generated composite photos used in recent visual assessment offer a new way for social researchers to study public (including tourist) perceptions of turbines. Few examples of studies using this design exist (Devine-Wright, 2005) but this may be changing as this review identified three (Cetkovsky and Nova, 2009; Lilley et al, 2010; GCU, 2008a). Composite photo methods allow comparison of perceptions of visual impact of different forms of development and differently sized wind farms in different landscape contexts. In the GCU study composite photos were used to estimate willingness to pay for hotel rooms with and without wind farms and other infrastructure in view (e.g. pylons), which in turn were a key component of the overall economic analysis. Lilley et al (2010) used photo-simulations of offshore wind turbine projects at several distances and used a self-report questionnaire to evaluate effects on visits. Cetkovsky and Nova (2009) used visual preference research to compare residents' attitudes in areas with and without views of turbines. The inclusion of some form of visual methods potentially allows for a more detailed understanding of how several variables might interact to influence perceptions of visual impact. Few studies have combined symbolic evaluation of visual impacts (such as the extent to which wind farms symbolise 'higher' concepts such as environmentalism or clean energy) with more rational aspects such as size, colour and shape (Devine-Wright 2005). Thus the extent to which evaluation of visual impact is determined by the relative strength of physical and symbolic aspects is not known.

Research suggests that social norms and social networks (e.g. the opinions of significant others) are important in determining perceptions of wind farms (Devine-Wright 2005). This means that research into wind farm perceptions among tourists and tourism providers should go beyond physical properties and proximity to include 'social' aspects that are likely to shape attitudes amongst tourists. There is evidence to suggest that those opposed to wind energy locally are opposed in principle, and that local involvement (such as shared community ownership) or early and open engagement on development and planning with local people having influence and some level of control over the process) can have a strong positive effect on attitudes (Devine-Wright, 2005).

Measurement

Tourists have been asked about wind farm effects on: experiences (VisitScotland 2012; Frantal and Kunc, 2011; Lilley at al, 2010; MCofS, 2014); sightseeing (Failte Ireland 2008); likelihood of making a return visit to the area (Aitchison, 2012c; BiGGAR 2007; MORI Scotland 2002; NFO System Three 2002; NFO System Three 2003; Failte Ireland 2008; Lilley, et al. 2010; GCU, 2008a); decisions about where to visit/stay, including willingness to pay

(GCU, 2008a; VisitScotland 2012); impressions of the area as a place to visit (MORI Scotland 2002; NFO System Three 2002; NFO System Three 2003); the environment, including noise and wildlife (Lilley et al. 2010; Failte Ireland, 2008); and the appearance of the landscape (Lilley et al. 2010; VisitScotland 2012; Cetkovsky and Nova, 2009; MCofS, 2014). Tourists have been asked how they feel about the use of renewable energy (Aitchison, 2004); their interest in going to a wind farm visitor centre (Aitchison, 2012c; BiGGAR, 2007; Frantal and Kunc, 2011, MORI Scotland, 2002); their recall of wind farm locations (MORI Scotland, 2002); and their feelings about various landscapes with and without wind farms (NFO System Three 2002; NFO System Three 2003; Frantal and Kunc, 2011). Tourists have also been asked about the following: the likelihood of visiting an area specifically to see a wind farm (MORI Scotland 2002; Lilley et al., 2010; VisitScotland 2012); views on wind farm development (NFO System Three 2002; NFO System Three 2003; GCU, 2008a; Westerberg et al 2013); preferred wind farm location types (NFO System Three 2002; NFO System Three 2003; Cetkovsky and Nova, 2009; Frantal and Kunc, 2011; Westerberg et al, 2013); and attitudes towards wind farms (NFO System Three 2002; NFO System Three 2003; VisitScotland 2012). Studies do not usually differentiate between different kinds of tourists; exceptions to this include the MCofS (2014) study, which asked members about their views and experiences of wind farms in mountainous areas, thus sampling tourists with a particular interest, and Westerberg et al (2013) who tried to evaluate the impact of offshore wind on economically desirable tourists, namely repeat visitors with high purchasing power, and GCU (2008a) which asked about tourists' opinion of wind farms by main tourist activity and by trip type.There is thus a gap in identifying how attitudes (and hence impact of wind farms) may differ between different kinds of tourists.

Tourism providers and agencies have been asked about planning and development of wind farms (Regeneris Consulting Ltd, 2014), characteristics of the local visitor economy (Aitchison, 2012c; BiGGAR, 2007; Frantal and Kunc, 2011; GCU, 2008a; Regeneris Consulting ltd, 2014, NFO System Three, 2002, 2003) and application of local impact assessment framework (Regeneris Consulting Ltd, 2014). A number of studies have attempted to assess the influence of wind farm developments on tourism by mapping visitor attractions and tourist routes relative to wind farms (Aitchison, 2012a, 2012c; GCU, 2008a; Regeneris Consulting Ltd, 2014).

Evaluations of the impact of wind farms on tourism have tended to focus on qualitative factors such as landscape perceptions and attitudes to wind farms, rather than using quantitative metrics, such as visitor numbers. One notable exception is the GCU, 2008a study, which included both qualitative aspects and economic evaluation through measures such as willingness to pay for accommodation with and without a view of a wind farm. This approach, combining attitude statements with economic data, enables greater exploration and potentially understanding of tourists' decision-making processes.

Discussion of measurement

Although wind farm visual impacts have consistently emerged as an issue of objection, few studies have examined visual perceptions by systematically comparing how turbines of different colour, shape or size are perceived (Devine-Wright, 2005). That wind farms are perceived to have a *negative* effect upon (enjoyment of) the landscape is reflected in the language of visual impact assessments through, for example, asking about visual intrusion, visual burden and visual impact. It is recommended that research starts from an impartial position, examining the potential for both positive and negative impacts on tourism, as was reported in many of the cases reviewed here, including through becoming visitor attractions in their own right (e.g. Aitchison 2004, 2012a; BWEA 2010). Thus whilst the research agenda has rightly focused on establishing how much truth lies behind claims and anecdotal evidence of negative impacts, there is a case for widening the scope of impact studies to consider potentially positive impacts.

Measures of visitor numbers at sites before and after development of a wind farm may indicate impact on tourism. However, there are many factors influencing decisions to visit such as quality of services, exchange rate and scenery (Frantal & Kunc, 2011). Key drivers of tourism, such as major economic and geopolitical events or local/regional impacts (BiGGAR, 2007), therefore need to be considered alongside wind farm developments when looking at visitor trends. With a few notable exceptions (Breukers and Wolsink, 2007; Cetkovsky and Nova, 2009; GCU, 2008a), there is little evidence from this review of studies incorporating this level of nuanced analysis of multiple factors and how they combine to influence tourist decision-making.

Measures of wind farm effects on tourism used in the studies reviewed here include the likelihood of return visits, decisions about where to visit/stay, and impressions of the area as a place to visit. Such measures are likely to be influenced by factors other than the presence of wind farms and should therefore be treated alongside other influences affecting tourism. Other measurements used in the studies reviewed here, such as attitudes towards wind farms, offer clues about general attitudes and how these may change when viewed from a different perspective, i.e. that of a tourist rather than a resident. Studies tend to favour one measurement over another with very few, if any, combining tourism decision-making with more general attitudinal surveys. Evidence suggests that acceptance of wind farms in the landscape is influenced by whether the observer considers them useful, their level of knowledge about the project, public participation in planning (Cetkovsky and Nova, 2009) and whether or not they have a stake in the project (such as share ownership) (Devine-Wright, 2005). However the latter can also be considered an explanatory variable since people in favour of wind power generation are more likely to invest in share ownership or schemes with community benefit than those who are opposed to it.

Research suggests that negative perceptions decline over time (Cetkovsky & Nova, 2009). However, this generalisation hides variability across different sites (Devine-Wright, 2005), and it is recommended that studies should be designed to address this point. It is unlikely that there will be a linear relationship between experience and perception because of the many other influences that shape judgements and opinions and lead to change over time. Monitoring of perception change may need to be sensitive to whether the focus is primarily on ratings of approval or disapproval as they may represent qualitatively different dimensions of evaluation. The variability in perception change between sites may show that contextual influences specific to a location have a more significant role in shaping perceptions than has generally been acknowledged in the literature (Devine-Wright, 2005). The range of different measures, considerations when using particular measures, and good practice are summarised in Table 1.

Table 1: Summary of measures, considerations and good practice

Measure	Issues for consideration	Good practice
Visitor numbers	Likely to be influenced by many factors not just wind farms	Include analysis of multiple factors when assessing impact
Likelihood of return visits		
Decisions about where to stay		
Impression of area as a place to visit		
Experience of area		
General attitudes towards and perceptions of wind farms	Attitudes/perceptions may change over time, or if viewed from a different perspective	Assess how attitudes and perceptions may impact upon tourism decision-making in different scenarios
	Difficult to assess site-specific variability	Assess contextual influences
Visual perception	Tendency to assess negative effects	Systematically compare size, colour, shape
		Start from an impartial position (i.e. +ve & -ve impacts possible)
		Assess perceived 'fit' with landscape history as well as features

Representativeness/sampling

Geographic samples have been used in studies looking at the impacts of wind farms on tourism in Argyll & Bute (The Market Specialists 2005); Scotland (NFO System Three 2002; MCofS, 2014; MORI Scotland, 2002; GCU, 2008a); Wales (NFO System Three 2003, Aitchison 2012a, 2012c; Regeneris Consulting Ltd, 2014); Ireland (Failte Ireland 2008); the UK (VisitScotland 2012; Aitchison 2004, BiGGAR, 2007; BWEA 2006, 2010; MCofS, 2014); the Czech Republic (Cetkovsky, & Nova,2009; Frantal & Kunc, 2011); France (Westerberg et al, 2013), Europe (Breukers and Wolsink, 2007) and the USA (Lilley et al. 2010). In addition, samples have comprised tourists (MORI Scotland 2002; NFO System Three 2002; NFO System Three 2003; Failte Ireland 2008; Lilley et al. 2010; VisitScotland 2012); tourism key players [e.g. tourist boards; local authorities] (NFO System Three 2002; NFO System Three 2003); and tourist business representatives (NFO System Three 2002; NFO System Three 2003; The Market Specialists 2005). Tourist samples ranged from 180 participants (NFO System Three 2002) to 3,000 participants (VisitScotland 2012) whilst tourism business representative samples ranged from 19 participants (NFO System Three 2003) to 139 participants (VisitScotland 2012). Studies evaluating the effects of wind farms on tourism have thus predominantly focussed on tourists, tourism providers and those promoting tourism.

Discussion of representativeness

Tourists and/or potential tourists have been seen as the most relevant sample to consult in efforts to develop understanding of wind farm effects on tourism. It appears that tourism providers' opinions about wind farm effects on tourism are viewed as less useful (The Tourism Company 2012). However, it should be noted that tourists have identities elsewhere (as residents) and that attitudes to wind farms are shaped by beliefs and values

as well as visual perception. In other words, those who oppose wind farms locally, including tourists, are likely to oppose wind farms anywhere (Devine-Wright, 2005).

There is little in the studies reviewed to differentiate the attitudes and behaviour of different kinds of tourists with respect to wind farms. This is beginning to be addressed, through for example, the MCofS (2014) study, which looked specifically at the attitudes of a group of niche tourists - mountaineers - in remote areas of Scotland. In general the studies reviewed here do not allow understanding of whether day visitors have different attitudes to those who stay for several days; or how those visiting to enjoy scenery through walking or wildlife watching differ from those looking at historic monuments, or doing an activity holiday. With the exception of GCU (2008), studies do not unpick how attitudes to wind farms differ according to socio-economic background, gender, nationality, religion, ethnicity, age and other socio-demographic factors. Frantal and Kunc (2011) looked at population divergence in attitudes within their sample but other studies do not differentiate between different kinds of tourists, the purpose and length of stay, and socio-economic background.

Since a diverse range of influences affect tourists' decisions on where and when to visit it is impossible to draw any conclusions about causal effects of wind farms on tourism from national tourism statistics (BWEA, 2006). Future studies could examine this on a case study basis to provide an insight into the effects of wind farms relative to other factors in specific locations.

A number of studies reported a difference between tourism organisers and actual tourists in opinions of wind farms in their locality (BWEA, 2006; Frantal & Kunc, 2011) with tourism businesses/entrepreneurs (as residents in the locality) more likely to have negative opinions/feelings towards wind farm development locally than (non-resident) tourists

Surveys have been criticised for using an exclusive sample (i.e. not typical of all tourists or even tourists in that area) and for using an exclusive approach that excluded certain kinds of visitors and tourist activities (BWEA, 2006). Including different categories of tourists would enable any potential differing impact of the economic contribution of different kinds of tourists to be assessed. With a couple of exceptions (Westerberg et al 2013; MCofS, 2014) there is little evidence of studies looking at the impact of wind farms on different kinds of tourists.

Sampling errors in primary research include sampling tourism providers rather than, or as well as, tourists, (and then extrapolating from this data to include tourists) or the sampling frame has been fundamentally flawed so that it is not representative (Aitchison, 2012a). Research from one area has been extrapolated to another area for which it may not be relevant, or from part of a country to the whole country (NFO System Three, 2002, 2003).

The process of wind energy development has emerged as an important factor, alongside physical characteristics, shaping perceptions and acceptability of wind farms (Devine-Wright, 2005). Some studies look at this in the context of tourism (e.g. community involvement, availability of shares, whether a visitor centre is planned or not) but it is clear from the research that the way in which a wind farm is planned and developed influences perceptions and acceptability. Given that (tourist) perceptions are shaped by social networks the attitudes of local tourism representatives could influence the views of tourists but this aspect has not been explored thus far.

Findings should be seen within the context of tourism as a growth area, and a dynamic business in which one 'type' of tourist may be replaced by another (Aitchison, 2012a).

Research funders and providers

Studies into perceptions of wind farms, including tourist perceptions, have been funded from a number of different sources including those who may have an interest in the outcome of any research conducted. This review includes studies funded by government (Aitchison, 2012b; BWEA, 2006; Dinnie, 2012; GCU, 2008a; Lilley et al, 2010; Regeneris Consulting Ltd 2014), local authorities (Aitchison, 2004, 2012a; The Tourism Company 2012), renewable energy companies (Aitchison, 2012c; BiGGAR, 2007; BWEA, 2010; MORI Scotland, 2002; NFO System Three, 2002), scientific bodies (Breukers and Wolsink, 2007; Devine-Wright, 2005; Frantal and Kunc, 2011), tourism/development agencies (Failte Ireland, 2008; NFO System Three, 2003; The Market Specialists 2012; Visit Scotland, 2012), interest groups (MCofS, 2014) and jointly by scientific organisations and development companies (Westerberg et al, 2013). Because of potential conflicts of interest the funding body of any particular study should be open and transparent, along with the aims for which the research was undertaken.

3. Conclusions and Recommendations

While there are some well-regarded studies that explore the impact of wind farm developments on tourism, much of the literature on this topic does not give an explicit account of the method(s) used (particularly in relation to sampling) and does not share a common framework, making it difficult to systematically compare methodologies across different studies. Studies evaluating the impacts of wind farms on tourism often rely on assessing the intentions and behaviour of actual and potential tourists towards wind farms. Two related approaches can be distinguished:

i) direct, measurable consequences of the presence of the wind farm development in the area, including socio-economic and technical factors, such as effects on (re)visiting, willingness to pay and visual impact on the landscape

ii) perceptions of impacts on tourism due to wind farms, and attitudes towards wind farms, sometimes extrapolated from secondary data and/or public opinion surveys

Table 2 provides a review of the different methods employed to date, and includes references to good practice examples. However, it must be emphasised that the application of the methods will be determined by a robust study design which will meet clearly defined research objectives.

Table 2: A Summary of the Different Methods Identified

Methods	Strengths	Limitations	Good Practice Examples
Primary data collection e.g. interviews, surveys, questionnaires	Provides tailored quantitative and qualitative data Can survey different samples/populations/areas Can explore how wider influences combine to inform perceptions, attitudes and decision-making	Difficult to extrapolate data from one sample/area to another Can imply the existence of relationships for which direct causal links may not be supported by the evidence Sample population may not be representative Tends to be 'barrier-orientated'	GCU, 2008a Aitchison, 2004 Frantal & Kunc, 2011

Methods	Strengths	Limitations	Good Practice Examples
Secondary analysis – previous studies, tourism strategy, planning documents, visitor numbers	Provides qualitative and quantitative data on visits, developments and strategy Provides data on different approaches	May not be directly applicable to other areas or situations Ignores wider influences on tourism and tourist decision-making	Devine-Wright, 2005 GCU, 2008a
Economic data on visits & willingness-to-pay	Provides robust, reliable data based on behaviour	Does not include wider influences on tourist decision making Should account for tourism as a growth area	GCU, 2008a BiGGAR 2007
Photo composite/visual preference	Assesses perceptions in different landscapes Can combine different features such as design and landscape, or willingness-to-pay	Cannot account for wider influences Opinions may differ from reality	GCU, 2008a Cetkovsky & Nova 2009 Lilley et al, 2010
Case study approach	Provides direct and comparative data Includes multiple factors such as visitor attitudes, planning, local area characterisation and so on	May ignore wider influences May not be representative or generalizable to other places/populations	Aitchison 2012a Regeneris Consulting Ltd, 2014
GIS mapping of wind farm areas	Identifies roads and accommodation affected, or potentially affected, by development	Does not assess attitudes or perceptions of visitors	GCU 2008a
Choice experiment	Includes 'bundles' of factors in future scenarios	Difficult to extrapolate to real-life situations Forces abstract decision-making rather than examining influences on attitudes	Westerberg et. al. 2013

In addition, by combining different methods in a design that suits the desired research objectives (e.g. GCU, 2008a), it is possible to account for multiple influences on tourist decision making and deliver results that may be more widely applicable.

It is of concern that some studies make an explicit assumption from the outset that there is a causal relationship between wind farm developments and tourism, which has in turn impacted upon effective study design. Although some studies are good examples of scientific rigour and robustness (e.g. GCU, 2008a), a conceptual framework for systematically assessing both quantitative and qualitative aspects has yet to be developed. Such a framework also needs to take into account relational factors within and beyond the immediate situation that affect decision-making which may impact on tourism. Furthermore, attitudes are not fixed and may change over time in relation to other factors such as media coverage or education. Alongside the development of a conceptual base there would be benefit in developing valid and reliable quantitative tools that measure attitudes and behaviour.

There is little in the studies reviewed to differentiate the attitudes and behaviour of different kinds of tourists with respect to wind farms. The focus on tourists might be misleading since those opposed to wind energy locally are likely opposed to it anywhere (Devine-Wright, 2005). Overemphasis on the market research-orientated case study design, using a quantitative survey tool, neglects the more relational aspects of tourist behaviour and decision-making, such as wider cultural experiences and beliefs, reasons for visiting and general perceptions, giving the impression of causality rather than exploring more complex and nuanced relationships.

This review has highlighted the need for a consistent framework and methodological approach to assess wind farm impacts on tourism, particularly when studies are undertaken as part of a development planning process. It is recommended that research on the impact of wind farms on tourism should apply the following approach:

1. In order to understand the relationship between wind farms and tourism, studies should aim to include visitor numbers and intentions to visit/revisit alongside other factors such as quality of services and accommodation, which are also important to tourists and should be considered alongside the presence or absence of wind farms (Frantal & Kunc, 2011).

2. Mixed methods study designs, such as that used in the GCU, 2008a study, should be more widely used to compare multiple factors influencing tourist decision-making. A mixed methods approach enables quantitative data on measures such as number of visits, tourist spend and so on to be compared with more qualitative factors such as attitudes and perceptions.

3. Any sampling strategy should be appropriate to the study aims and be fully described; the views of one population (e.g. tourism providers) may not be the same as the views of tourists themselves. Care should be taken when extrapolating findings from one sample or one area to other populations and areas (Aitchison, 2012b, 2012c) and the sample should be representative of the population being sampled.

4. There has been insufficient consideration of off-shore wind farms, and these should be explicitly considered at the research design phase and only excluded where the question is entirely land based.

5. Case study examples are useful in examining the processes and influences which actively shape perceptions of wind farms in tourist areas to provide insights into the complex, multi-dimensional relationships between public perceptions of wind farms and physical attributes in specific landscapes in order to understand their effects on tourism. However such approaches would greatly benefit from a standardized conceptual and methodological framework that locates perceptions of and attitudes towards wind farm development alongside a multitude of other factors that influence tourist attitudes and behaviour.

6. Where secondary research is incorporated, care should be taken to avoid extrapolation from studies whose research design is not comparable with the circumstances in question.

7. Computer-generated composite photos should be considered as an approach where the research is exploring public (including tourist) perceptions of turbines. For example, the GCU study (2008a) used composite photos to estimate willingness-to-pay for hotel rooms with and without wind farms and other infrastructure in view (e.g. pylons), which in turn were a key component of the overall economic analysis. This in turn aids a more detailed understanding of how several variables interact to influence perceptions of visual impact.

8. When evaluating visual impact, the research design should incorporate methods that explore both 'physical' (such as size, colour & shape) and 'symbolic' factors (such as environmental awareness and commitment to individual action in the face of climate change). This will enable an analysis of the relative strength of physical and symbolic aspects.

9. A study design that takes explicit account of language, avoiding inbuilt assumptions which can create bias – for example the use of visual intrusion, visual burden and visual impact have a *negative* tone, and prevent the possibility of *positive* impacts being detected in research findings.

This review indicates that a range of methods (qualitative, multivariate statistical tools, composite photos) could be used to develop a more sophisticated conceptual understanding of wind farm perceptions, and hence their impact on tourism. Such a conceptual framework could account for the potential (differential) impact of wind farms in various locations, their effects on different kinds of tourists (recreationist, golfer and so on) and the relative importance of wind farms compared with other influences on tourist decision-making about where and what to visit.

4. Acknowledgements

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5. References

The following material was referred to in the preparation of this paper. All other referenced texts are detailed in the lists of Reviewed and Excluded Papers in the Appendix below.

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6. Appendix

Methodology

A literature search was conducted in March 2013 using the keywords 'tourism', 'wind farms' and 'onshore wind farms' on Web of Science and Google; this was supplemented by a list of 39 publications provided by an academic expert, some of which were also identified in the literature search. This search was updated in July 2014 to include offshore wind farms, and to update the literature on onshore wind farms published since the search in 2013. Fifty-one papers were identified and included peer reviewed academic articles, grey literature and reports undertaken as part of planning enquiries. The literature included studies that directly address the impact of onshore and offshore wind farms on tourism as well as literature that looked at effects of wind farms in general, and public perceptions of wind farms, rather than specific impacts on tourism.

Twenty-six papers from the literature search were excluded from review for the following reasons;

- Fourteen were considered not relevant as they contained no reference to wind farms (DCLG 2004, 2006; Tourism Partnership Mid Wales, 2011) or no/anecdotal-only reference to tourism (Devine-Wright and Howes, 2010; Eltham et al, 2008; Frantal and Kucera, 2009; Klick and Smith, 2009; Pasqualetti, 2000; RES Ltd, 2012; The Planning Inspectorate, 2008; Toke et al, 2008; Van der Horst, 2007; Wolsink, 2000, 2007).
- Two made no reference to methodology (GP WIND Thematic Case Studies, 2012; Australian Wind Energy Association, no date)

- Five duplicated studies reported elsewhere and included in the review (GCU 2008b; Riddington et al; North Devon Marketing Bureau, 2006; The Planning Inspectorate, 2007, The Market Specialists (2005))
- Five were unavailable (Aitchison, 2011; Bosley and Bosley, 1988; Thayer and Hansen, 1988; Young, 1993) or unpublished (Starling, 2006).

Reviewed and excluded papers are listed below.

Papers included in the review ranged from 2001-2014, and included peer reviewed academic articles, grey literature and reports undertaken as part of planning enquiries. The literature included studies that directly address the impact of wind farms on tourism as well as literature that looked at the effects of wind farms in general rather than on tourism in particular. Wind farm impact is considered on national and regional levels. This includes case studies and analysis of regional/community impact vs. overall/national scale impacts. The review includes empirical studies, survey data and secondary data; case studies; desk-based literature reviews and analysis of the previous findings; international and comparative studies; as well as discursive studies, studies identifying negative impacts on tourism and grey literature.

Reviewed papers

1. Aitchison, C. (2004) *The Potential Impact of Fullabrook Wind Farm Proposal, North Devon: Evidence Gathering of the Impact of Wind Farms on Visitor Numbers and Tourist Experience*, Bristol: University of the West of England/Devon Wind Power, 80pp.
2. Aitchison, C.C. (2012a) *Tourism Impact Analysis of Llanbrynmair Wind Farm*, Powis, Wales, University of Edinburgh/RES UK & Ireland Ltd., 48pp.
3. Aitchison, C. C (2012b) *Tourism Impact of Wind Farms*, University of Edinburgh.
4. Aitchison, C.C. (2012c) *Tourism Impact Analysis of Garreg Lwyd Hill Wind Farm Proposal, Powis, Wales*, University of Edinburgh/RES UK & Ireland Ltd., 51pp
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21. Regeneris Consulting Ltd. (2014) *Study into the Potential Economic Impact of Wind Farms and Associated Grid Infrastructure on the Welsh Tourism Sector*, London: Regeneris Consulting Ltd.
22. The Market Specialists (2012) *Wind Farm Research*, Hamilton: Western Isles Tourist Board.
23. The Tourism Company (2012). *The impact of wind turbines on tourism - a literature review*.
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25. Westerberg, V., Jacobsen, J.B. and Lifran, R. (2013). The case for offshore wind farms, artificial reefs and sustainable tourism in the French Mediterranean, *Tourism Management* 34: 172-183.

Excluded Papers

1. Aitchison, C.C. (2011) *Tourism Impact Analysis of Bryn Llywelyn Wind Farm, Carmarthenshire, Wales*, University of Edinburgh/RES UK & Ireland Ltd., 42pp.
2. Australian Wind Energy Association (no date) *Wind Farming and Tourism*, Fact Sheet 4.
3. Bosley, P., and Bosley, K. (1988) Public acceptability of California's wind energy developments: three studies, *Wind Engineering*, 12:5, 311–318.
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