

# COMMUNITY PERCEPTIONS OF WIND FARM DEVELOPMENT AND THE PROPERTY VALUE IMPACTS OF SITING DECISIONS

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## ABSTRACT

*With the Government-led drive to reduce greenhouse gas emissions under the Kyoto Protocol through the increased generation of electricity from renewable sources, there has been an associated increase in the deployment of wind technology. In Australia, the total operating wind capacity at the end of 2008 was 1125 MW. Possible “Not in My Back Yard” (NIMBY) reactions to proposed or constructed wind farm developments can have detrimental impacts on nearby property values. To estimate any value effects, it is important to establish the nature and level of market reaction.*

*This paper outlines the results of research carried out in Western Australia in 2008 to investigate community attitudes, and help verify the reported level of opposition, towards the proposed development of a wind farm in the south-western town of Denmark.<sup>1</sup> Contrary to media reports, the results indicate that the majority of the respondents generally think of a wind farm in positive terms. Nearly three quarters (74%) of the respondents were either moderately or strongly in favour of the proposed development due to the perceived benefits of producing “clean”, renewable energy. However, there were grave concerns voiced about the specific site selected for the development and the way in which the proponents/developers had managed the development process. These results highlight the need for research into the market reactions towards wind farm developments to fully understand if, and how much, they may impact nearby property values.*

**Keywords:** Wind farms, NIMBY syndrome, community opinion, property values

## BACKGROUND

The Government is committed to Australia’s internationally agreed target of limiting greenhouse gas emissions to 108% of 1990 levels between 2008 and 2012 under the

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<sup>1</sup> See for example, Madden, C. (2008). “Bad blood in battle for who is the greenest”, November 6, [http://www.sciencewa.net.au/index.php?option=com\\_content&view=article&id=2337:bad-blood-in-battle-for-who-is-the-greenest](http://www.sciencewa.net.au/index.php?option=com_content&view=article&id=2337:bad-blood-in-battle-for-who-is-the-greenest) [Accessed 18 August 2009].

Kyoto Protocol. On 30 April 2009, Council of Australian Governments' (COAG) agreed the design of an expanded national Renewable Energy Target (RET) scheme, to implement the Government's commitment that 20 per cent of Australia's electricity supply comes from renewable energy sources by 2020. The RET will accelerate the deployment of renewable energy technologies, such as wind.<sup>2</sup>

In Australia, the total operating wind capacity at the end of 2008 was 1125 MW. According to the Australian Wind Energy Association (AWEA, 2007), 150 wind turbines have been built in Western Australia on 14 wind farms (554 wind turbines on forty-two wind farms Australia-wide).<sup>3</sup>

While wind technology offers many advantages, property owners have voiced opposition to the siting of wind farms. Such opposition can result in planning permission being declined and a restriction in the ability to meet the 2020 climate change target. For example, the Environment Minister, Mr Garrett, is concerned that a number of wind farm proposals in Australia had been refused because of objections by the local community and says that a 'not in my back yard' kind of mentality will not see the rolling out the deployment of wind that we need.<sup>3</sup>

There are a growing number of examples of wind turbine NIMBYism. For example, in Nantucket Sound, Massachusetts, some residents and businesses opposed construction of "Cape Wind", a proposed offshore wind farm in Nantucket Sound. Proponents cite the environmental, economic, and energy security benefits of clean, renewable energy, while opponents are against any obstruction to the views from oceanfront vacation homes and tourist destinations based in the region (Wikipedia, 2009). A number of wind farm opponents have formed more powerful community groups. For example, in Australia, these anti-wind farm groups go by the names Landscape Guardians or Coastal Guardians. They rely heavily for their information and campaign tactics on overseas groups such as Britain's Country Guardians, established by Sir Bernard Ingham, who has links with the nuclear power industry.<sup>4</sup>

In order to examine whether there is any substance to the objections towards wind farm development, research is needed. This study aims to determine residents' attitudes towards a proposed wind farm development in WA. This will not only help inform local government and power companies of any negative attitudes that need to be addressed to help increase the success rate of planning applications, but can aid valuers in understanding how community attitudes may impact on nearby property values.

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<sup>2</sup> Australian Wind Energy Association, *Windfarms in Western Australia*, <http://www.auswea.com.au/auswea/projects/wa.asp> [accessed April 30, 2007].

<sup>3</sup> Franklin, M (2008). Embrace wind farms, Peter Garrett tells NIMBYs. *The Australian*, October 24. [accessed April 30, 2007].

<sup>4</sup> Frew, W. (2006). "It's an ill wind", <http://www.smh.com.au/news/national/its-an-ill-wind-133/2006/05/18/1147545460802.html?page=fullpage#contentSwap1> [Accessed 18 August 2009].

The paper commences with a brief review of the literature relating to property value effects from wind farms. The following section describes the methodology and case study used. The results are then discussed. The final section provides a summary and conclusion.

## **LITERATURE REVIEW**

### **Property value effects from wind turbines**

Since the global focus on the need to address climate change through the uptake of renewable energy alternatives such as wind power, a growing body of literature has emerged dealing with the impact that proximity to wind turbines has on property values. For example, authors of the Renewable Energy Policy Project (REPP, 2003), Sterzinger et al., analysed some 25,000 transactions of properties in the US that were within eight kilometres of wind turbines at 10 wind energy projects, over a six year period (1999-2001). The results indicate that there was no evidence that wind turbines sited within an eight kilometre radius of property had a negative impact on value. More recently, results from a comprehensive study by Hoen and Wiser (2007) confirmed those of the REPP. They investigated the prices of properties within 11.25 kilometres of wind turbines at four wind energy projects between 2006 and 2010. The results indicate that there was no statistical evidence that homes within 6.4-11.25 kilometres of a wind farm are affected adversely.

Dent and Sims (2007), in the UK, investigated two areas in North Cornwall: St Bereock and St Eval that had 27 turbines constructed (11 and 16 in each respectively). They analysed 919 transactions that had taken place within eight kilometres of the wind farms since April 2000. Despite initial evidence that there was an effect, when they investigated more closely, there were generally other factors which were more significant than the presence of a wind farm.

More pertinent to this study, are studies in the UK that suggest that when wind farm developments are first announced, property prices may decline, but prices are likely to recover after the wind farms start operating as communities learn more about the actual impacts of wind developments (see for example Khatri 2004, and Warren et al. 2005).

Other studies have been reported in Bond (2008) and highlight the ongoing controversy about public attitudes towards wind farms, with no one study providing conclusive evidence either for or against.

## **Public attitudes towards wind turbines: opinion surveys**

### **Australian opinion surveys**

There has been very little authoritative research on public opinion to the proposed development of wind farms in Australia. However, various polls have been conducted in several states to determine public perception towards wind farm development. In 2001, a poll in Victoria showed that 94% of respondents described wind generators as ‘interesting’ and 74% as ‘graceful’ (Auspoll, 2001). A subsequent survey showed that 95% of respondents supported the construction of more wind farms (Auspoll, 2002). This result was again backed up in a national poll by AusWEA in 2003 which found that 95% support (27% support and 68% strongly support) building wind farms to meet Australia’s rapidly increasing demand for electricity (Australian Research Group, 2003).

Conversely, other evidence exists of public opposition to wind farms. For example, as reported by Hannan and Warren (2007), the Spa Country Landscape Guardians, a non-profit organisation formed to protect local residents from the ‘turbinsation’ of their landscapes, claims that local residents were opposed to a proposed wind farm near the Victorian town of Smeaton that is being developed by Wind Power Ltd. for a raft of reasons, including noise and the fear of declining property values.

### **New Zealand opinion surveys**

Two studies have explored the public opinion of New Zealanders to wind energy and the existing Tararua wind farm (Berg, 2003; Energy Efficiency Conservation Association, 2004). The Omnibus Wind Survey conducted in 2004 found that wind power is the public’s preferred generation option to meet NZ’s future electricity needs, with 60% of respondents expressing some level of support for building a wind farm in their local area (Energy Efficiency Conservation Association, 2004). The main reason cited for opposing such development was the perceived visual and auditory impact. Similar arguments were used to oppose the Tararua Wind Farm: noise, electro-magnetic interference (EMI), visual intrusion and land devaluation (Berg, 2003).

## **Health effects of turbines**

The NZ Parliamentary Commissioner for the Environment (2006) has identified noise as one of the most frequently raised concerns, both in NZ and overseas, about wind farms. Recent research suggests that this noise may be impacting negatively on human health and safety. MD Nina Pierpont (2006, 2008) has been investigating a cluster of stress-related physiological effects of low frequency turbine noise that she terms “wind turbine syndrome”. Symptoms suffered include: sleep disturbance, headache, tinnitus, ear pressure, dizziness, nausea, visual blurring, irritability, etc. Pierpont claims that disturbing symptoms of Wind Turbine Syndrome occur up to 1.9km from the closest turbine and in more mountainous terrain, they can occur up to 3km away.

She recommends a 2km buffer between turbines and homes, but a greater buffer for larger turbines and in more varied topography.

## **Property value effects from cellular phone towers and high voltage overhead transmission lines**

Wind turbines are similar structures to both pylons that support high voltage overhead transmission lines (HVOTL) and cellular phone towers (towers). Public concerns about these structures are also similar. The siting of pylons (and associated HVOTL) and towers is a concern due to fears of potential health hazards from the electromagnetic fields (EMFs) that these structures emit. It can be seen from the forgoing that health concerns from living near turbines also exist. The unsightliness of pylons and towers and fear of lowered property values are other regularly voiced concerns about the siting of these structures. Therefore, it is worth reviewing the studies that have investigated the property value effects of pylons and towers.

There are two known NZ studies investigating the impact of cellular phone towers on property prices. A study by Bond and Wang (2005) analysed 4283 property sales transactions in four case study areas in Christchurch that occurred between 1986 and 2002. The sales data that occurred before a tower was built were compared to sales data after a tower was built to determine any variance in price, after accounting for all the relevant independent variables. Interestingly, the effect of a tower on price (a decrease of between 20.7% and 21%) was very similar in the two suburbs where the towers were built in the year 2000, after negative media publicity given to the health effects of living near towers. The other two suburbs that indicated a tower was either insignificant or increased prices by around 12%, had towers built in them in 1994, prior to the media publicity. The main limitation affecting this study was that there was no accurate proximity (distance to tower) measure included in the model.

Bond (2007) refined the previous 2005 study by including a more accurate variable to account for distance to a tower. A further six suburbs were added to the database to give a total of ten suburbs: five suburbs with towers located in them and five control suburbs without towers. In addition, the geographical {x, y} coordinates that relate to each property's absolute location were included. A total of 9,514 geo-coded property sales were used (approximately 1000 sales per suburb). In terms of the effect that proximity to a tower has on price the overall results indicate that this is statistically significant and negative. Generally, the closer to the tower a property is the greater the decrease in price. The effect of proximity to a tower reduces price by 15%, on average. This effect reduces with distance from the tower and is negligible after 300 metres.

The body of literature on the property values effects from HVOTLs and pylons was reviewed by Bond and Wang (2005) and previously, Kroll and Priestley (1992). These reviews show that proximity and views of pylons are more of a concern and affect

price to a greater extent than do HVOTLs. The price effect of the pylon does seem to be consistent between the studies that show an impact (i.e. negative and significant) ranging from between 12-27% depending on the distance to these. The closer the home is to a pylon, the greater the diminution in price. The effect diminishes to a negligible amount after 250 meters, on average. The impact of HVOTL-proximity on price is less certain, with this ranging from having no impact on price (Bond and Hopkins, 2000) to having a negative impact of up to 18% (Sims and Dent, 2005).

It is interesting to note that none of the wind turbine studies have found a value impact to the degree indicated by the tower and pylon studies. Despite the varying results reported in the literature on property value effects from these structures, each study adds to the growing body of evidence and knowledge on this (and similar) valuation issue(s). The study reported here is one such study.

## **METHODOLOGY**

### **Introduction**

From a property valuation perspective, one hypothesis is that where there is a wind turbine constructed, it will be possible to observe that discounts are made to the selling price of homes located near these structures. Such a discount will only be observed where buyers of proximate homes perceive the wind farms in negative terms due aesthetic, auditory, property value and other effects. However, where the wind farm has not yet been constructed, it is not possible to observe price effects. Instead, a survey of community attitudes towards the proposed wind farm can provide a gauge of the likely opposition, and hence likely price implications should the wind turbines be built.

A case study approach was used to examine community opinions of a proposed wind farm. This involved selecting of an appropriate case study area where a wind farm was proposed for development and administering a postal survey to a random sample of 500 residents living in the case study area to determine their attitudes towards the wind farm proposal.

### **Study area**

The area selected for the case study was Denmark, a southern coastal regional centre located 421 km (262 miles) south of Perth, the capital of Western Australia (see map in Appendix I). The median house price for Denmark as at December 2008 was \$367,500AU. This is considered quite high for a regional town compared to Perth Metropolitan Area of \$415,000AU. Denmark has a population of around 5,000 in the

Denmark Urban Area. The median age is 45 years of age (compared to 36 years for the whole of WA).<sup>5</sup>

The proposed Denmark wind farm is to be located at Wilson Head, 10km south of the Denmark town-site and more than 3km from the nearest permanent residence, reducing visibility issues and eliminating noise disturbance (see map in Appendix I).

According to the Denmark Community Windfarm Inc., two 800kW wind-turbine generators costing \$3million AU will be erected at Wilson Head, south of an existing lime sand quarry, on an area within A-class Reserve. The wind farm and associated infrastructure will take up about one hectare, less than 1% of the reserve. The WA state government approved rezoning in November 2005. The project has environmental approval from the WA Environmental Protection Authority. A walk trail and interpretive shelter are proposed for visitors on foot to enjoy the site's spectacular 360-degree views and learn about the wind farm.<sup>6</sup>

### **The sample and survey**

A random sample of 500 residents was drawn from an Excel database of ratepayers names obtained from the Shire of Denmark. Any company or trust names were deleted from the database as were all files where the ratepayer's mailing address was a P.O. Box number or different to the rateable property address. Next, 500 hundred random numbers were generated and these were used to select the rows in the Excel spreadsheet that held each property file.

The questionnaire adopted was based on previous surveys by Bond (2008) and Watts et al. (2005). It contained eighteen questions: two questions helped identify if residents rented or owned the home, and how long they had lived there for; ten questions asked about respondents' attitudes towards renewable energy and more specifically to wind farms and the proposed development; four demographic questions were included at the end.

Specific questions relating to the proximity of the proposed wind farm were asked: whether the proximity was a concern; if they knew about the proposal at the time they purchased their home whether they would have still gone ahead with their purchase decision; how the wind farm proximity would affect the price/rent they were prepared to pay for their property. They were asked from a range of options what the perceived main advantages and disadvantages of the wind farm were.

A covering letter describing the survey, the questionnaire, and a self-addressed prepaid envelope were mailed to the 500 selected residents in November 2008. The

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<sup>5</sup> Source: Australian Bureau of Statistics, "Population by Age and Sex, Regions of Australia, 2007" <http://www.abs.gov.au/> [Accessed 6 March 2009].

<sup>6</sup> <http://www.dcw.org.au/dcwmaps.html>, [accessed 6 March 2009].

responses were individually coded, entered into a computerised database, and analysed.

## **Limitations**

It must be kept in mind that these results are the product of a single case study carried out in a specific geographic location at a specific point in time and that great caution must be used in making generalisations from them or applying them to other locations. Residents of Albany, a town which is only 53 km from Denmark, appear more accepting of the wind farm that has been developed there according to a study by Bond (2008) perhaps due to a more transparent process, better community consultation, and careful site selection away from residential areas. These studies show how location-specific community opinions can be.

## **RESULTS**

Of the 500 questionnaires mailed to homeowners and tenants in the study area, 225 (45%) were completed and returned without any follow-up reminders indicating the high level of interest in the topic by residents. The majority (99.5%) of respondents were homeowners. Nearly two thirds (68.6%) had lived at the same address for five years or more.

Interestingly, during the survey collection period, the author received phone calls from residents in Denmark about their fears that the proponents of the wind farm were going to try to bias the survey results by copying the survey instrument and returning them. They were concerned they may even go to the extent of copying the pre-paid return envelopes so it would not be apparent that the surveys had been returned by residents not surveyed. However, while eight returned surveys were in non-Curtin University envelopes and may confirm the residents' fears, only those responses received in the official pre-pay envelope were included in this analysis in an attempt to avoid the potential bias identified.

Evaluation of the responses to the questionnaire's background questions revealed that 51.4% of the respondents were female. Over half of the respondents (57.5%) were 60 years of age or older; 16.3% were between 50 and 59 years, and 18.1% were between 40 and 49 years. Half of the respondents were retired; 20.4% work full-time, and 20.4% work part-time.

## **Preferences for generation options to meet Australia's future electricity needs**

To determine respondents' preferences for power generation options, respondents were asked to rank various options in terms of their preferences from 1 (most preferred) to 8 (least preferred). Table 1 shows the order that respondents ranked the

various options, with wind being most favoured, followed by solar and wave/tidal. Coal and nuclear were ranked as least preferred options, mostly due to the polluting nature of these options or that they are costly to decommission. Other options suggested by respondents were: geothermal, bio-fuel, bio-mass, and hot rocks.

**Table 1: Preferences for generation options**

Option	Frequency % (number responding to the option, e.g. 57% ranked Solar as most preferred (1 <sup>st</sup> ); 51% ranked Wind as 2 <sup>nd</sup> )
1. Solar	57
2. Wind	51
3. Wave/Tidal	47
4. Hydro	40
5. Gas	44
6. Coal	39 *
7. Nuclear	30 #
8. Other	36

\* 38% ranked this as 7<sup>th</sup>; # 28% ranked this as 8<sup>th</sup>

The majority (88%) of the respondents had visited a wind farm with more than one turbine. This question was posed as it has been found that residents are often more accepting of wind farms if they have visited one previously (Wolsink, 1994; Krohn and Damborg, 1999).

When asked if they knew about the proposal to develop a wind farm near Denmark all respondents said that they did. They were then asked about their feelings about the proposal for the development of a wind farm near Denmark. Over three quarters (74%) of the respondents were either moderately or strongly in favour of the development, 5.5% were not concerned, and 20.5% were either moderately or strongly opposed to the proposal. Table 2 outlines these results.

**Table 2: Feelings about proposal for the development of a wind farm**

Feelings	Frequency %
Strongly opposed	14.5
Moderately opposed	6
Does not bother me	5.5
Moderately in favour	10.5
Strongly in favour	63.5

The reasons for their favouring the proposal were that they saw the benefits in producing “clean”, renewable energy that was cost effective, and that allowed the town to be more independent of the power grid electricity supply (reporting occasional power cuts to support this view). However, some respondents, while agreeing with the concept of a wind farm, had grave concerns over the proposed location: that it would

destroy the A-class reserve, the pristine coastal scenery, and would create an “eyesore”. Suggestions were made to join efforts with Mt Barker and share the site costs of building a wind farm inland or to add to the current Albany wind farm as “it all goes into the grid anyway”.

There were many concerns voiced by respondents about the management of the proposed wind farm. One respondent commented that the management of the Denmark Community Wind Farm Inc. (DCW)<sup>7</sup> were contemptuous of the organisation’s membership and were not representative of the community, that “it is a fraud”, and that the organisation is run by developers not community representatives, as the title suggests. Another respondent described the practices of the DCW as “bullying”. Other respondents felt the location was chosen solely for the benefit of the developer, who apparently obtained the land for free, to the detriment of the rest of the community, and were concerned other locations with less impact had not been investigated. One respondent summarised these feelings by saying that the process did not appear to be either transparent or consultative and that it has deeply divided the community.

Over three-quarters (76%) of the respondents knew of details about the proposed wind farm development. They were then asked about various listed details known to them and the source of this information. Nearly three quarters (72%) knew about the location of the proposed wind farm, over half (55%) knew the number and size of the turbines; around a third knew what percentage of Denmark’s energy needs the turbines would produce (39%) and who is to own the project (31%). The cost of the project and expected completion date were not widely known (25% and 10%, respectively). The source of the information came from: the community newspaper; community meetings with the DCW; Denmark Shire offices; television; and other residents.

Further comments were made about the vagueness of some of the information. There were also variations in responses from respondents to each of the above information types:

Location:	Wilson Head; Ocean Beach.
Number of turbines:	1-3.
Percentage of energy needs:	Small - 100%.
Cost of the project:	\$1m -\$3.2m.
Who is to own the project:	Shareholders; Community; Denmark based company.

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<sup>7</sup> A not-for-profit “community group”, set up to progress legal and financial structures for an organisation to own and operate the wind farm.

As the above responses suggest, and as reported by one respondent, a lot of the information is conflicting.

Despite concerns raised earlier by some respondents about the proposed site, for the majority of them (80%), the proximity of the proposed wind farm was not a concern to them. Similarly, when asked if they had known at the time of purchase/rental that a wind farm was to be developed, 92% would have still gone ahead with the purchase/rental. The main reason put forward for this was because the wind farm is not close to where they live (2-5km away) and they cannot see it, so it was not a concern. As noted by one resident, “the 2km buffer area seems adequate”.

For those that were concerned about the proximity, their concerns related to the destruction of the A-class reserve, the use of Crown land for private purposes, the negative visual impact on the coastline, the noise that would be created by the turbines and the increased traffic.

### **Wind farm impacts**

Table 3 summarises the ways in which the presence of a wind farm nearby would affect respondents’ purchase/rental decisions. The question was asked twice based on two distance criteria: if the wind farm was within 3 kilometres of their home, and if it was between 3km to 5km of their home, to determine if distance to the wind farm influenced their decision.

For over two-thirds (66%) of respondents, the presence a wind farm within 3km of their home would not influence the price they would be prepared to pay, while 28% reported they would be prepared to pay less. When asked to specify this effect as a percentage of total property price, 37% said they would pay 1%-9% less for their property, 25% would be prepared to pay 10%-19% less, 12% would pay 20% or greater less. However, 17% would be prepared to pay 1%-9% more for their property if a wind farm was nearby.

For 89% of the respondents, their answer would not be any different if the wind farm was between 3km and 5km from their home (compared to being within 3km). Of the 11% of respondents who said their response would be different if the wind farm was between 3-5km from their home, nearly two-thirds (65%) said it would not influence the price they would be prepared to pay.

**Table 3: Affect on property price/rent**

Price affects	Wind Farm <3km	Wind Farm:3-5km
	Frequency %	Frequency %
Substantially more for this property	0.5	
A little more for this property	5.7	
A little less for this property	16.3 (n=34)	
Substantially less for this property	11.5 (n=24)	
It would not influence the price	66 (n=138)	65 (n=15)
<i>As % of price/rental:</i>	(n = 75)	(n = 6)
20% higher or more	1.3	17
10% to 19% more	6.7	0
1% to 9% more	17.3 (n=13)	17
1% to 9% less	37.3 (n=28)	50
10% to 19% less	25.3 (n=19)	17
20% or a greater reduction	12 (n=9)	0

From the results shown in Table 3, it appears that being further away from a wind farm would have a positive influence on the price/rent respondents would be prepared to pay for their home. Of the 65% (n=15) of respondents that said it would not influence the price they would be prepared to pay if the wind farm was further away (between 3-5km), 53% of them would have paid 1-9% less and 27% of them would have paid 10-19% less for a property that was closer to a wind farm. Half of those respondents that would pay 1-9% less for a property if the wind farm was further away, would have paid 10-19% less if the property was closer to a wind farm.

### **Advantages and concerns associated with wind farms**

Respondents were asked about their feelings on a number of advantages commonly associated with wind-farms, and their turbines. The majority agreed with most of the items listed: renewable resource (94% agreed, 5% unsure); environmental friendliness/non-polluting (87% agreed); low cost energy source (63% agreed, 26% unsure); boost to tourism/local economy (52% agreed, 29% unsure). There was only some uncertainty about employment opportunities, with 32% agreeing with this advantage and 45% unsure. Other respondents commented that they felt the wind farm was only a boost to tourism in the early days and that they will become commonplace in time and lose their appeal as a result.

Next, respondents were asked about their feelings towards a number of concerns commonly associated with wind farms, and their turbines. The items respondents were mostly concerned about were the potential harmful impact on wildlife (47% were worried somewhat to a lot), visual intrusion (33% were worried somewhat to a lot do not worry), and the noise intrusion (31% were worried somewhat to a lot). The majority reported that they do not worry about sun/light flicker (80.6%) or the effect on their property's value (80.6%). Table 4 summarises these responses.

**Table 4: Concerns about wind farms & their turbines**

Percentage of Respondents by Category of Concern			
Concern	Don't worry very much	Worry somewhat	Worry a lot
Visual intrusion/aesthetic impact	67.3%	14.7%	18%
Potential harmful impact on wildlife	52.8%	36.3%	10.8%
Noise intrusion	68.8%	25.7%	5.5%
Effect on property's value	80.6%	14.4%	5.1%
Sun/light flicker	80.6%	14.3%	5.1%

Other concerns respondents had about the wind farm/turbines were: the possible increase in road traffic visitors to the wind farm; potential vandalism; and the risk in storms that a blade could come loose.

Lastly, respondents were asked if they would favour the construction of a wind farm nearby if it were: within 1km (48.1% in favour); between 1-3km (60.7%); more than 3km (85.8%); or a self nominated distance from their home (34.2% would favour if > 1km; 25% would favour if >3km; 13% would favour if >5km). Only 8% would not favour a wind farm nearby under any circumstances. The results to this question are shown in Table 5:

**Table 5: Would favour the construction of a wind farm nearby**

Percentage of Respondents: Albany	
Response:	Frequency %
I would not favour it	8
I would favour if: within 1km	48.1
I would favour if: Between 1 - 3km away	60.7
I would favour if: More than 3km away	85.8
I would favour if :more than (self nominated distance in km) away	1km (34%); 2km (9%); 3km (25%); 5km (13%); 10km (9%); 50km (2.5%)

The main reasons given for the responses include: visual and noise pollution; the access routes to them, etc. Many voiced concerns that it will create more traffic and about the proposed location, on a scenic, A-reserve coastline. From a positive perspective, some respondents felt that the environmental concerns outweigh any other concerns residents might have about the wind farm proposal.

Finally, respondents were invited to make additional comments. The comments indicate that residents felt that the information provided to the community was inaccurate, dishonest, misleading, and lacked transparency and that there was insufficient information provided. Another respondent stated that the whole

development has been “an appalling shambles”, that the developer had adopted “an abusive, intimidating manner to those that oppose him”. Further, they reported the process had not been inclusive and that a minister had overruled a council decision which seems to be as a result of political bargaining rather than acknowledgement of community attitude towards those currently in charge of the process.

Other concerns related to the use of wind as an energy source, with one respondent claiming it is unreliable and provides a small fraction of the power available from tidal power. There are concerns about the efficiency of wind farms and the amount of energy needed to build them versus how much power will be produced. A number of respondents suggested solar panels (government sponsored) on every roof and use of rain water as alternatives to wind.

## **SUMMARY AND CONCLUSIONS**

The wide media coverage globally on climate change and the focus of many governments to reduce green house gas emissions through the use of renewable energy sources such as wind has, no doubt, had a positive influence on public perceptions towards wind farms. From the above results, this appears to be the case: the majority of residents surveyed in Denmark are generally supportive of wind farms and think of them in positive terms: provision of environmentally friendly, low cost renewable energy source. However, there are some respondents who are not supportive of the proposed wind farm due to potential harmful affect on wildlife, noise and aesthetic impacts, and more particularly concerns about the way the proponents have dealt with the community, the lack of transparency about the process and in particular, the site selection, and the accuracy of the information provided, or lack thereof.

Over a quarter (28%) of respondents would be prepared to pay less for their home if it were within 3km of a wind farm. Of this group of respondents, 37% (n=28) said they would pay 1-9% less for their property, 25% (n=19) would be prepared to pay 10-19% less, 12% (n=9) would pay 20% or greater less. However, 17% (n=13) would be prepared to pay 1-9% more for their property if a wind farm was nearby.

Being further away from a wind farm has a positive influence on the price/rent respondents would be prepared to pay for their home. Further, respondents would favour the construction of a wind farm nearby if it were: more than 3kms (85.8% in favour); between 1-3kms (60.7% in favour); or within 1km (48.1% in favour).

Further research is needed to determine if the residents’ reported willingness to pay for potentially affected property, as indicated in this survey, are reflected in the price they would actually pay for such property. To this end, a study that involves an econometric analysis of the sales transaction data is required. However, this would

require a case study wind farm located within 3km of homes to have any observable price effect. Fortunately, to date, wind farms in Australia have been located far enough away from homes for this not to be a cause concern. But the results from this study do highlight the need for planning authorities and power companies to take distance to residences into account in their wind farm siting decisions. If they do not, they are likely to have compensation claims to deal with. The results from this study can aid valuers in understanding the issues involved with wind farm siting decisions, market reactions to these, and potential value impacts on property in close proximity.

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## REFERENCES

Auspoll 2001. *Report To Pacific Hydro Limited Portland Wind Energy Project - Quantitative Research*,

July, [http://pacifichydro.com.au/docs/Auspoll\\_Survey\\_Portland\\_0701.pdf](http://pacifichydro.com.au/docs/Auspoll_Survey_Portland_0701.pdf) [Accessed April 30 2007].

Auspoll 2002. *Report To Pacific Hydro Limited Portland Wind Energy Project - Quantitative Research*,

February, [http://pacifichydro.com.au/docs/Auspoll\\_Survey\\_Portland\\_0701.pdf](http://pacifichydro.com.au/docs/Auspoll_Survey_Portland_0701.pdf) [Accessed April 30 2007].

Australian Research Group 2003. *National Renewable Energy – Quantitative Research*, Unpublished report to the Australian Wind Energy Association, September.

Australian Wind Energy Industry Association (Auswind), *Windfarms in Western Australia*, <http://www.auswea.com.au/auswea/projects/wa.asp> [Accessed April 30, 2007].<sup>8</sup>

Bond, S.G. 2007. “Cell Phone Tower Proximity Impacts on House Prices: a New Zealand Case Study”, *Pacific Rim Property Research Journal*, Vol. 13, No. 1, pp. 63-91.

Bond, S.G. 2008. “Attitudes Towards the Development of Wind Farms in Australia”, *Journal of Environmental Health Australia*, Vol. 8, No.3, pp. 19-32.

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<sup>8</sup> Auswind is now *The Clean Energy Council*: an amalgamation of Auswind and the Australian Business Council for Sustainable Energy (BCSE).

Bond, S.G. & Hopkins, J. 2000. "The Impact of Transmission Lines on Residential Property Values: Results of a Case Study in a Suburb of Wellington, New Zealand", *Pacific Rim Property Research Journal*, Vol.6, No. 2, pp.52-60.

Bond, S.G. and Wang, K. 2005. "The Impact of Cell Phone Towers on House Prices in Residential Neighborhoods", *The Appraisal Journal*, Volume LXXIII, No.3, pp.256-277.

Dent, P. & Sims, S. 2007, *What is the impact of wind farms on house prices?* A research report commissioned by the RICS Education Trust, <http://www.rics.org/NR/rdonlyres/63D1BF3E-A608-45CD-8086-A6E7924D7F14/0/WindfarmsFiBREversionthreelowres.pdf> [Accessed April 22 2008].

Eltham, D. C., Harrison, G. P. and Allena, S. J. 2008, "Change in Public Attitudes Towards a Cornish Wind Farm: Implications for Planning", *Energy Policy*, Vol 36, pp23–33.

Frew, W. (2006). "It's an ill wind" <http://www.smh.com.au/news/national/its-an-ill-wind-133/2006/05/18/1147545460802.html?page=fullpage#contentSwap1> [Accessed 18 August 2009].

Global Wind Energy Council 2007, *Global Wind 2007 Report*, [http://www.gwec.net/uploads/media/Global\\_Wind\\_2007\\_Report\\_final.pdf](http://www.gwec.net/uploads/media/Global_Wind_2007_Report_final.pdf) [Accessed April 23 2008].

Government of Western Australia 2007, *Making Decisions for the Future: Climate Change*, The Premier's Climate Change Action Statement, <http://www.5starplus.wa.gov.au/uploads/2007006ClimateChangeV3h.pdf> [Accessed June 4 2007].

Hannan, E. and Warren, M. 2007, Energy plan hits turbulence, *The Australian*, September 25, <http://www.theaustralian.news.com.au/story/0,25197,22476921-601.00.html> [Accessed May 14 2009].

Hoen, B. & Wiser, R. 2007, Do wind facilities affect local property values? Results from a multi-site analysis, Paper presented at *WINDPOWER Conference & Exhibition*, Los Angeles, California, June 4-6.

Khatri, M. 2004, *RICS Wind farm research: impact of wind farms on the value of residential property and agricultural land*, Royal Institution of Chartered Surveyors, November 3, 2004. <http://www.rics.org/NR/rdonlyres/66225A93-840F-49F2-8820->

[0EBCCC29E8A4/0/Windfarmsfinalreport.pdf](#) [Accessed April 22 2008].

Krohn, S. and Damborg, S. 1999, “On Public Attitudes Towards Wind Power”, *Renewable Energy*, Vol 16, pp954–960.

Kroll, C. and Priestley, T. 1992, “The Effects of Overhead Transmission Lines on Property Values: A Review and Analysis of the Literature”, Edison Electric Institute, July.

Madden, C. 20088. “Bad blood in battle for who is the greenest”, November 6, [http://www.sciencewa.net.au/index.php?option=com\\_content&view=article&id=2337:bad-blood-in-battle-for-who-is-the-greenest](http://www.sciencewa.net.au/index.php?option=com_content&view=article&id=2337:bad-blood-in-battle-for-who-is-the-greenest) [Accessed 18 August 2009].

Pierpont, N. MD. 2008, “*Wind Farm Syndrome: Nina Pierpont’s Research*”, pending publication, <http://www.windturbinesyndrome.com/>, accessed 27 November 2008.

Sims, S. and Dent, P. 2005, “High-voltage Overhead Power Lines And Property Values: A Residential Study in the UK”, *Urban Studies*, Vol.42, No.4, pp. 665-694.

Sterzinger, G., Beck, F. & Kostiuk, D. 2003, *The effect of wind development on local property values*, Renewable Energy Policy Project, Washington D.C., United States.

Warren, C., Lumsden, C., O’Dowd, S. & Birnie, R. 2005, ““Green On Green”: Public Perceptions of Wind Power in Scotland and Ireland”, *Journal of Environmental Planning and Management*, Vol. 48, No.6, pp. 853 – 875.

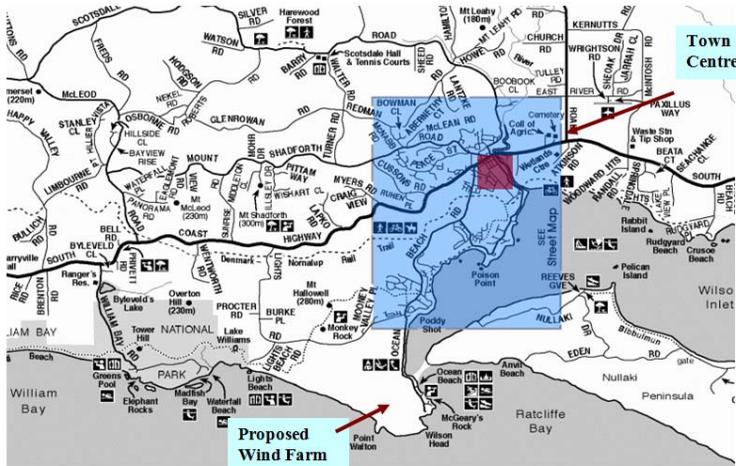
Watts, C.W., Schluter, P.J., & Whiting, R. 2005, ‘Public Opinion of a Proposed Wind Farm Situated Close to a Populated Area in New Zealand: Results from a Cross-sectional Study’, *Environmental Health*, Vol. 5, No. 3, pp. 73-83.

Webb, H. and Inglis, J. 2006, “Minister gives reasons for Denmark windfarm”, May 5, <http://www.abc.net.au/wa/stories/s1632060.htm> [Accessed 18 August 2009].

Wikipedia 2009, “NIMBY” <http://en.wikipedia.org/wiki/NIMBY> [Accessed 18 August 2009].

Wolsink, M. 1994, ‘Entanglement of Interests and Motives: Assumptions Behind the NIMBY-Theory on Facility Siting’, *Urban Studies*, Vol 31, No 6, pp851–866.

## Appendix 1: Denmark location map



Source: [http://www.denmarkwa.asn.au/map\\_denmarkwa\\_east.htm](http://www.denmarkwa.asn.au/map_denmarkwa_east.htm) [Accessed March 6 2009]



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