A COMMUNITY SURVEY OF THE VISUAL IMPACT AND ACCEPTABILITY OF WIND FARMS IN AUSTRALIA

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SCENIC SOLUTIONS

2018, 2020

Lothian, A., 2018. *A community survey of the visual impact and acceptability of wind farms in Australia*. 140 pp
Scenic Solutions

Original version 2018
Revised with data weightings, revised wind farm statistics & analysis by state, 2020

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Cover photo: The old and the new. Apart from using wind, there is little in common between farm windmills which pumped water and wind turbines. Waterloo wind farm, Mid North, South Australia

A COMMUNITY SURVEY OF THE VISUAL IMPACT AND ACCEPTABILITY OF WIND FARMS IN AUSTRALIA
EXECUTIVE SUMMARY

Dr Andrew Lothian, Scenic Solutions

Fifteen years after completing the author's first study of the visual impact of wind farms in South Australia, the current survey covered actual wind farms in NSW, Victoria and SA and drew participants in the survey from across Australia.

Dimensions of wind farms

The report commences by describing the growth of wind farms in Australia, growing from virtually none in 2000 to 106 in 2019 with 3,400 turbines producing 6.8% of Australia's electricity. This is matched globally where wind farms now generate 651 GW of electricity annually (Australia's total electricity generating capacity is 66 GW). As well as their growth in numbers, another factor contributing to their visual impact is their growth in size. In the 1980s wind turbines were 50 m in height with 10 – 15 m blades. Now they are 125 – 150 m in height with blades 50 m+.

Visual impacts

The visual impact of wind farms has led to some European nations placing them in coastal seas and estuaries.

Research on the effect of distance on the perception of wind farms is summarised and their effect on property values examined.

Australian opinion surveys of wind farms are summarised; 21 surveys show 75% support wind farms. Overseas experience regarding community opinion is also summarised.

Opposition in Australia has been led by landscape guardians who contest about half of the proposals. Some lead to litigation but out of 17 cases brought before appeal courts in NSW, Victoria and SA, only two were rejected and one of these was subsequently approved in an amended form thus indicating that litigation is an ineffective instrument for opponents to use.

Social acceptance

Research has shown the social acceptance of wind farms, not their technology is the main limiting factor to wind farm development. Many factors influence the acceptance of wind farms by the community. For nearby wind farms, noise and their effects on property values dominate, but for visitors and more distant residents, the visual appearance of the wind farms is the main factor followed by concerns for wildlife. Ensuring effective two-way communication between the community and the developer, and enhancing local integration of the developer with the community can help to develop the trust which is a pre-requisite for a social licence to operate.

2003 study

The author's 2003 study found that on the coast and in higher quality inland landscapes, wind farm reduced the scenic quality. However, the study also found that where the scenic quality drops below 5.1, the wind farm actually lifts ratings by adding interest and diversity into the landscape.

Threshold of visual acceptability

A key issue is the threshold at which perception of the wind farm shifts from being acceptable to unacceptable. Both its magnitude (size and number) and its visual significance are important factors in determining this. Statistical measures have been used to help determine this threshold but with limited success.

Project purpose & objective

The purpose of the project was to investigate whether it was possible to determine the thresholds at which the visual acceptability of wind farms shifts from being acceptable to unacceptable.

The project had three specific objectives:

1. To derive a model with Australia-wide applicability of their visual impact.
2. To confirm the findings of the 2003 study that wind farms diminish the scenic quality of high-quality landscapes while enhancing the scenic quality of low-quality landscapes;
3. To determine a threshold of acceptability/ unacceptability of the proposed wind farms.

Images

Criteria for photographing wind farms included photographing them from a similar distance,

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using the 50 mm focal length, taking the photographs in winter so the ground cover was green in all images, and taking the photographs in horizontal format. Some 31 wind farms in SA, Victoria and NSW were photographed in August, 2017. Survey participants were asked to both rate the scene with and without the wind farm. For scenes with wind farms, they were also asked to indicate their acceptability or otherwise in the landscape. The scenes were randomised.

Internet survey

The survey comprised 49 scenes with wind farms and 49 without, a total of 98 scenes for the survey. These included ten coastal scenes from the 2003 survey with hypothetical wind farms. Over 800 turbines were shown in the images.

Using the Survey Monkey platform, the survey was launched on the Internet on 2 March and ended 31 days later on 1 April, 2018. During this time, nearly 4000 invitations to participate in the survey were emailed to councils and councilors in SA, Victoria and NSW as well as to 1700 clubs across Australia including outdoor, car, caravanning, gem & mineral clubs. Internet access in Australian households in 2016/17 was 86% with little difference between rural and city locations.

Participation in survey

Nearly 850 people participated in the survey. The data set used for analysis was 779 and excluded the 69 who failed to rate any scene. This provided a confidence interval of 0.035 at the 95% confidence level which is considerably better than the 0.05 benchmark for the social sciences.

Over 30 participants displayed strategic bias in their ratings – if they favoured wind farms they rated the scenic quality of all or most scenes as 10 and rated them all as very acceptable or acceptable. The opposite applied for those who opposed wind farms. However, as the deletion of these ratings was found to have a very minor effect on the mean ratings, they were retained in the data set.

The following table summarises the differences between the survey sample and the Australian population (2016 Census).

Gender	Survey %	Australia %
Females	36.20	50.7
Males	63.67	49.3
Age		
18 - 24	0.90	11.79
25 - 44	15.66	35.80
45 - 64	45.70	32.20
65+	37.74	20.21
Education		
No qualification	9.50	50.35
Dep/Cert	29.78	27.68
Degree	26.32	15.14
Higher Degree	32.35	6.82
Birthplace		
Born in Australia	80.74	74
Not born in Australia	19.26	26

The survey participants were principally males aged 45 and older and many participants had degrees and higher degrees. Those from SA, Victoria, NSW and Queensland were the most familiar with wind farms although 12 participants claimed to have never seen one. The largest number opposed to wind farms was from NSW and Qld. Those with less education opposed wind farms more than those with higher education. A higher proportion of females than males were opposed to wind farms.

Compared with the Australian population, participants' age, gender, birthplace and education were all statistically significantly different – overall, they were better educated, more middle aged and elderly, more males and more Australian-born than the Australian community. Despite these differences, their mean ratings were fairly similar across all demographic characteristics surveyed.

Examining the influence of participant characteristics on their ratings found the following:

- Older people generally rated scenes lower than younger people, a difference of nearly one unit.
- There were significant differences between men and women in rating scenes, with women rating 8% higher than men.
- Scenes without wind farms were rated lower by people with higher education than people with lesser education. Ratings of scenes with wind farms were broadly similar across education levels.
- Being born in Australia or overseas resulted in statistically significant different ratings.

- Multiple regression analysis indicated that age and gender were the most important determinants of participant ratings.

Data set

The overall data set from the survey was as follows.

Data	Wind farm	Participant ratings	Scene ratings
Number	With	779	49
	Without	779	49
Mean	With	5.67	5.69
	Without	6.90	6.88
SD	With	1.18	0.45
	Without	1.36	0.98

Comparing the ratings with those obtained from previous surveys found they were around 0.70 higher than expected. This may be due to the absence of benchmark photos to base the ratings at a State or national level. Given however, that the ratings reflected preferences from across Australia, they were taken as accurate.

Weighting the data

Using a Dutch weighting service (Spinnaker Research), the data was weighted by all four characteristics. The difference between the weighted and unweighted is shown in the table.

Data	Wind farm	Unweighted ratings	Weighted ratings
Mean	With	5.69	6.19
	Without	6.88	7.29
SD	With	0.45	0.40
	Without	0.98	0.85

The difference in the ratings of scenes with and without wind farms was statistically significant in all but two scenes.

Analysed by state showed that Tasmania had the highest ratings followed by NSW and Qld while the remainder were below the national average.

Compared with scenes with wind farms, the ratings of scenes without wind farms was much higher at high ratings but nearly converged at lower ratings. Extrapolating the ratings found they converged at a rating of 5.85, somewhat higher than the 2003 finding of 5.10. Below this rating, the presence of wind farms would enhance scenic quality.

Acceptability of wind farms

The acceptability of wind farms was rated on a 5-point scale:

Very acceptable - Acceptable- Neutral - Unacceptable - Very Unacceptable

The results were as follows.

Acceptability	Scenes	%	SD
Very acceptable	9.34	28.86	14.82
Acceptable	12.25	37.88	14.10
Neutral	3.64	11.26	6.09
Unacceptable	3.88	11.98	6.62
Very unacceptable	3.25	10.03	8.99
Total	**33.05**	**100**	

The acceptable scores were three times as prevalent as the unacceptable. In only one scene were the unacceptable scores higher than the acceptable. The principal finding of the survey was that the community found wind farms acceptable in virtually all landscapes, including most coastal scenes of high scenic quality. This was despite the participant's own ratings showing that scenes with wind farms rated lower than scenes without them. In other words, despite their acknowledgement that wind farms diminished scenic quality, they still found them acceptable.

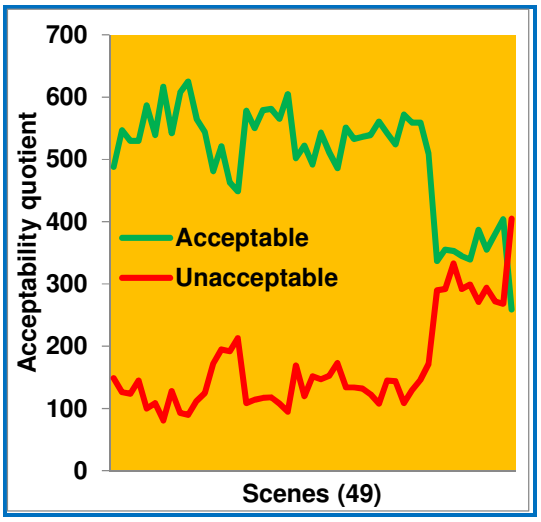
Acceptability was uniform among the states, except for Tasmania which had the highest score for very acceptable (52%) and the second highest score for very unacceptable (13%). NSW, Victoria, and South Australia with large numbers of wind farms all scored high acceptability scores.

Attitudes towards wind farms influenced the ratings. Participants who were in favour of wind farms voted heavily for their acceptability whereas the minority opposed to wind farms voted them unacceptable.

More females than males regard wind farms as acceptable, the 25 – 44 age group (both males and females) had higher levels of acceptance of wind farms than other age groups, there is a slight trend among older persons to be against wind farms, the level of education had little influence on rates of acceptance, and those born outside of Australia had a slightly higher level of acceptance than the Australia-born.

Acceptability quotients were derived by multiplying the very acceptable and very unacceptable scores by 2 and adding them to

the acceptable and unacceptable scores. The unacceptable scores were subtracted from the acceptable scores: Acceptability quotient = (2VA+A) - (UA+ 2UVA).The graph shows the result from deriving an acceptability quotient for each scene.



On the RHS of the figure is shown the one scene in which the unacceptable score was greater than the acceptable score.

What is particularly surprising is that wind farms are considered acceptable in high quality landscapes. That landscapes which rate 8 and above could be considered acceptable is very surprising given that these are among Australia's highest rating landscapes.

Threshold of acceptability

Applying the Standardised Mean Difference formula (i.e. (mean scene without wind farm – mean scene with wind farm)/population SD), produced the following number of scenes in each category for scenes with wind farms.

	Stamps	Scenes
Small	0.2	0
Medium	0.5	2
Large	0.8	47
	Palmer	**Scenes**
Possibly go unnoticed	0 – 0.2	0
Noticeable but not adverse	0.2 – 0.5	0
Adverse	0.5 – 1.1	6
Unreasonably adverse	>1.1	43

The majority of scenes were found to have an adverse or unreasonably adverse visual impact. This puts into question the reliability of these criteria.

This suggests that the community is far more tolerant of the visual impact of wind farms than previously believed. It might also indicate a substantial shift in opinion over the past decade as wind farms proliferated across Australia. Now that most of the community has seen wind farms, their former fears have been allayed and they are much more accepting of them.

Factors influencing ratings

The context and characteristics of wind farms had a small but generally significant effect on ratings.

Environmental factors

- Heavy cloud reduced ratings of scenes without wind farms by 0.50 compared with sunny conditions but had little effect on scenes with wind farms.
- The presence of the sea or freshwater increased ratings of scenes without wind farms by 1.54 and for scenes with wind farms by 0.04.
- For scenes with and without the wind farms, the hillier the land, the higher the ratings, as much as 1.39 for scenes without wind farms comparing flat land with hilly land.
- For the scenes without wind farms, the increase in ratings towards the natural scenes is very apparent but for the scenes with wind farms the semi-natural scenes rated highest. For scenes without wind farms, ratings of natural scenes were 1.34 higher than grazing scenes.
- There was a slight trend for higher ratings with denser vegetation. For scenes without wind farms, the difference in ratings between barren land and dense vegetation was 0.38. However for scenes with farms, the largest difference, 0.39, was between barren land and land with scattered vegetation.

Wind farm factors

- Ratings decreased slightly with an increasing number of turbines, the difference between 1-9 turbines and 40-49 was only 0.20.
- Placing turbines linearly along ridges increased ratings by 0.26 compared with random layouts.
- Increasing the height of turbines from 100 m to 150 m increased ratings by 0.19.

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- Ratings were lowest for the nearby turbines and increased with distance to the turbines.
- Mid-distant turbines rated 0.37 higher than those nearby, while distant turbines rated 0.42 higher.
- Increasing the generating capacity from 1.5 MW to 2 MW reduced ratings by 0.1 but increasing them to 3 MW increased ratings by 0.1 compared with 1.5 MW: the highest ratings were for the largest turbines.

Key factors for developers to consider are the number of turbines and their distribution layout with alignments along ridges preferred over random layouts. Their height and generating capacity had negligible influence on ratings.

Multiple regression analysis showed that environmental factors were more important than the turbine characteristics in determining the acceptability of the wind farm. Taken together the environmental and turbine factors explained 64% of the variance, but the environmental factors alone explained 37% compared with only 18% by the turbine factors.

A visual impact predictive model was created by applying the following algorithms:

Without wind farm: $y = 0.058x + 5.83$
With wind farm: $y = 0.0135x + 5.85$
Where y is the scenic quality, x is scene number.

Over 200 respondents provided comments about the survey and wind farms in general.

Subject	Number of comments
Landscape	120
Location	44
Survey	76
Energy	34
Cost	8
Other	7
Total	331

Conclusions

In conclusion, the implications of this may include the following:

- Wind farm industry - may be commended that in their development of wind farms they have achieved such strong community endorsement of their efforts.

- Wind farm companies should provide some financial compensation to nearby affected landholders, say 10% of the annual rent.

- Government regulation of wind farms - the current good standing of the industry may be partly attributed to the care with which governments have regulated it.

- Community – opponents to wind farm should not rely on public support but rather work with the developer to achieve the best outcomes.

- Wind farm developers should avoid high quality landscapes and concentrate on lower quality landscapes – flat land devoid of tree cover, or low ridges with trees, of which Australia has plenty. Low-lying coastal areas also offer potential.

Further research could be conducted into Australian's perceptions of and attitudes towards wind farms and determine if a threshold between acceptable and unacceptable exists.

Two of the project's three objectives were achieved:

- A model of visual impact of Australia-wide applicability was derived;
- Confirmation that wind farm diminishes scenic quality of high quality landscapes while enhancing that of low quality landscapes.

The third objective, to determine the threshold of acceptability was not achieved because virtually all landscapes in the survey were deemed acceptable for wind farms.

Lessons from the survey include recognition of the usefulness of such surveys to elicit the community's subjective attitude and rating of wind farms, and secondly that such projects require considerable work, in this case, around 400 hours of 3 - 4 months, with close attention to detail and quality control.

Strengths of survey included:

- It was conducted Australia-wide;
- It rated the scenic quality of the landscape with and without the wind farm and also rated the acceptability of the wind farm;
- Through contacting hundreds of clubs, it reached into the lives of ordinary Australians; nearly 40% had either no qualification or only a certificate or diploma.

Weaknesses of the project include the following:

Static turbines While the images were not of rotating turbines, Grimm (2009) found little difference in their rating compared with static turbine;
Length of survey Reflected in 15 participant comments and the drop off rate;
Gap in scenic quality between the coastal scenes and the remainder. However, there were no photographs available of wind farms in high quality landscapes;
Bias It could be alleged that the survey was biased to those who favoured wind farms; however, the survey was sent across Australia and many ordinary people responded. However sending it mainly to councils and clubs biased it towards male participants and it should have been sent to a wider range of clubs.
Failure to rate scenes. There were 69 participants who failed to go past the demographic questions, probably due to their old Internet browsers;
Failure to include other generating sources such as coal-fired power stations. However, the survey was already long enough and their inclusion would detract from the project's purpose.

The feedback included many positive comments from participants. Comments were received by email during the survey, on familiarity with wind farms, on being in favour or against wind farms, and, at the end of the survey, final overall comments.

Nearly 600 comments from participants were received:

- 18 by email during the survey;
- 70 regarding familiarity with wind farms
- 285 regarding attitude towards wind farms
- 216 comments at the end of the survey.

In addition, 265 participants, nearly one third, asked to receive a summary of the survey's findings.

CONTENTS

Chapter	Section	Page
	Executive summary	i - vi
	Contents	vii
	Detailed contents	viii
1	Introduction	1
2	Dimensions of wind energy	2
3	Visual impacts of wind farms	8
4	Project design	23
5	Acquiring the data	27
6	Data analysis	42
7	Conclusions	84
8	References	88
Appendix 1	Australian wind farms	92
Appendix 2	Scenes with weighted ratings and acceptability percentages	96
Appendix 3	Comments by email	106
Appendix 4	Comments on familiarity with wind farms	110
Appendix 5	Comments in favour or opposed to wind farms	112
Appendix 6	Final comments from participants	120

DETAILED CONTENTS

SECTION		Page
Chapter 2 Dimensions of wind energy		
2.1	Growth of wind farms in Australia	2
2.2	Growth of global wind energy	5
2.3	Growth in turbine dimensions	6
Chapter 3 Visual impacts of wind farms		
3.1	Assessing the visual impacts of wind farms	8
3.2	Community attitudes about wind farms	10
3.3	Opposition and litigation	14
3.4	Social acceptance of the visual impact of wind farms	15
3.5	Visual impacts of wind farms study, 2003	17
3.6	Thresholds of visual impact	19
Chapter 4 Project design		
4.1	Purpose, objects & scope	23
4.2	Images	23
4.3	Factors that may influence visual impact	24
4.4	Survey options	24
Chapter 5 Acquiring the data		
5.1	Photographs	27
5.2	Selection of scenes	29
5.3	Preparation of scenes with and without turbines	30
5.4	Survey scenes	31
5.5	Internet survey preparation	31
5.6	Survey implementation	32
5.7	Emailed comments	34
5.8	Timeline of the project	34
5.9	Internet survey – visual impact of wind farms	35
Chapter 6 Data analysis		
6.1	Introduction	42
6.2	Data management	42
6.3	Participant characteristics	49
6.4	Comments on familiarity with wind farms	52
6.5	Comments on being in favour or against wind farms	53
6.6	Comparison with the Australian population	55
6.7	Internet access	56
6.8	Ratings by participant characteristics	56
6.9	Applying weightings to the data	60
6.10	Analysis of ratings	64
6.11	Comparison of scenes	65
6.12	Acceptability of wind farms	65
6.13	Influence of respondent characteristics on acceptability	68
6.14	Acceptability quotients	70
6.15	Factors affecting ratings	72
6.16	Regression analysis	77
6.17	Threshold of acceptability	78
6.18	Visual impact predictive model	79
6.19	Final comments from participants	80
Chapter 7 Conclusions		
7.1	Overview	84
7.2	Survey lessons, strengths and weaknesses	85
7.3	Conclusion	87
8.	**References**	88

CHAPTER 1 INTRODUCTION

Wind farms have become a key renewable energy source of electricity in Australia and show no sign of abating in number and scale. In 2019, wind power contributed nearly 6.8% of the total electricity generation in Australia, or 35% of the contribution of renewable energy (AMEO, 2018).

A significant issue associated with proposals is their likely impact on the landscape – their visual impact. This has been the basis of many of the objections to wind farm proposals.

Predicting the likely visual impact has been based largely on simulations by landscape architects of the proposed placement and distribution of the turbines within a landscape and their professional judgement of the significance of their visual impact. Usually no effort is made to test their judgements against the community although some provide displays of the simulations and ask people to comment.

The author conducted research of the likely visual impact of wind farms in 2003 at a time when there were only a few in operation. The survey used hypothetical sites around the coast of South Australia and also inland sites. This survey found that the community opposed wind farms along the coast and also in high quality landscapes away from the coast. However, for lesser quality inland landscapes, generally flat and treeless, the wind farm gave interest and diversity into an otherwise mediocre landscape. In these situations, the presence of the wind farm actually enhanced the perceived scenic quality of the landscape.

Now, fifteen years after that research, the author launched the current survey to ascertain contemporary opinions of wind farms. Whereas the previous study was confined to hypothetical sites in South Australia, this survey covered operating wind farms in New South Wales and Victoria as well as South Australia. Whereas the previous study used participants only from South Australia, the current study was extended Australia-wide, with participants from all States and Territories. The resulting findings therefore provide a snapshot of Australian's opinions of wind farms as they existed in many States in early 2018.

The study's objective was to assess whether a threshold exists at which the community acceptance of wind farms shifts from being acceptable to unacceptable.

The report commences with a review of the growth of wind farms in Australia, community attitudes about them, opposition and appeals, national codes for wind farms, the social acceptance of the visual impact of wind farms, thresholds of visual impact, and a summary of the author's 2003 survey. It then describes the design and implementation of the survey to assess the visual impact and acceptability of a selection of Australian wind farms. The results from the survey are discussed and their implications examined. Appendices show the scenes and their ratings, and the comments received on various questions posed by the survey

References to *community* mean a body of people with diverse individual characteristics in a common location - Australia.

CHAPTER 2 DIMENSIONS OF WIND ENERGY

2.1 GROWTH OF WIND FARMS IN AUSTRALIA

The development of renewable energy in Australia has been stimulated by the setting of successive and successful targets with buy-in measures to translate the targets into action. In 2001, the Mandatory Renewable Energy Target (MRET) was set by the Federal and State Governments. The target was 9,500 GWh of new renewable energy by 2010 and electricity wholesalers were required to purchase 2% of their electricity from renewable energy sources (Kent & Mercer, 2006; Hindmarsh, 2010).

In 2009, MRET was succeeded by the Renewable Energy Target which aimed for renewable energy to deliver 20% of electricity or 41,000 GWh by 2020. In 2015 this target was reduced to 33,000 GWh and became the annual target to 2030 (www.cleanenergyregulator.gov.au). A short-lived carbon price, initially set at $23/tonne was introduced in 2012 by the Federal Labor Government and repealed by the Liberal Coalition Government in 2014.

By 2019, renewable energy provided 24% of Australia's electricity (Clean Energy Council Report, 2020). Wind farms provided 6.8% of the total electricity or 35% of the renewable energy. Wind farms have grown: in 2000, there was 22 MW of installed wind capacity, by 2019, there was over 9,000 MW capacity generating 17,930 GWh electricity.

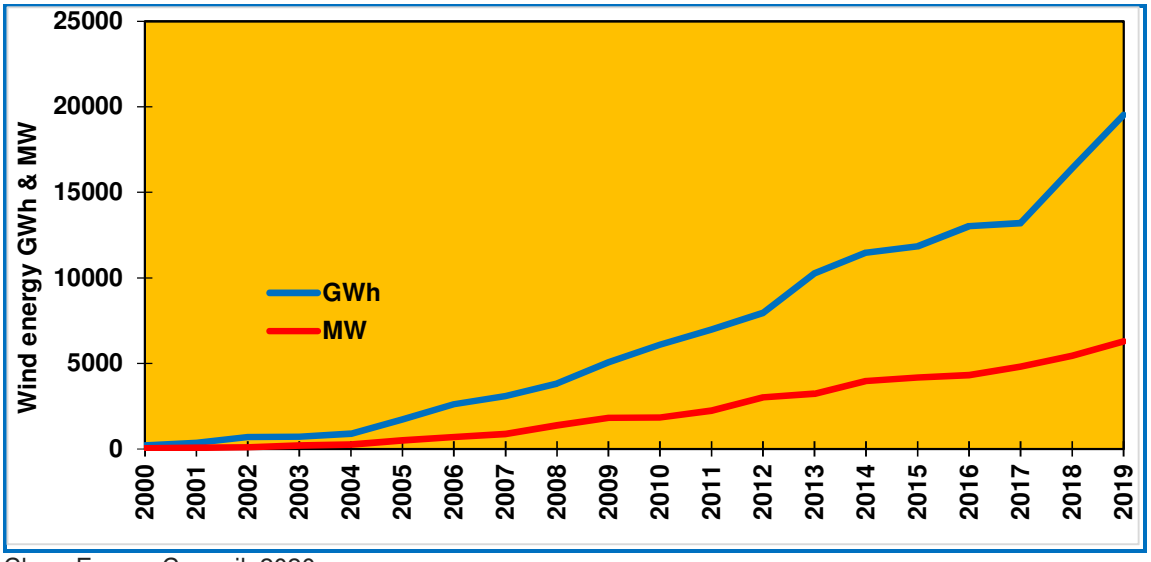
The number of wind farms and turbines in Australia together with their generating capacity in 2018/19 are summarised in Table 2.1. With over 3,400 wind turbines operating, this is a mature industry. In the year 2000 there were scarcely any wind farms in Australia yet only 16 years later there are 106. Appendix 1 contains the list of wind farm by State.

Figure 2.1 displays the growth in wind installed capacity and electricity generation from 2000 to 2019 in Australia. Figure 2.2 shows that the proportion of electricity in Australia that is generated by wind farms has grown rapidly from virtually zero until 2005 to nearly 6.8% in 2019.

Table 2.1 Australian wind farms and turbines, 2018/19

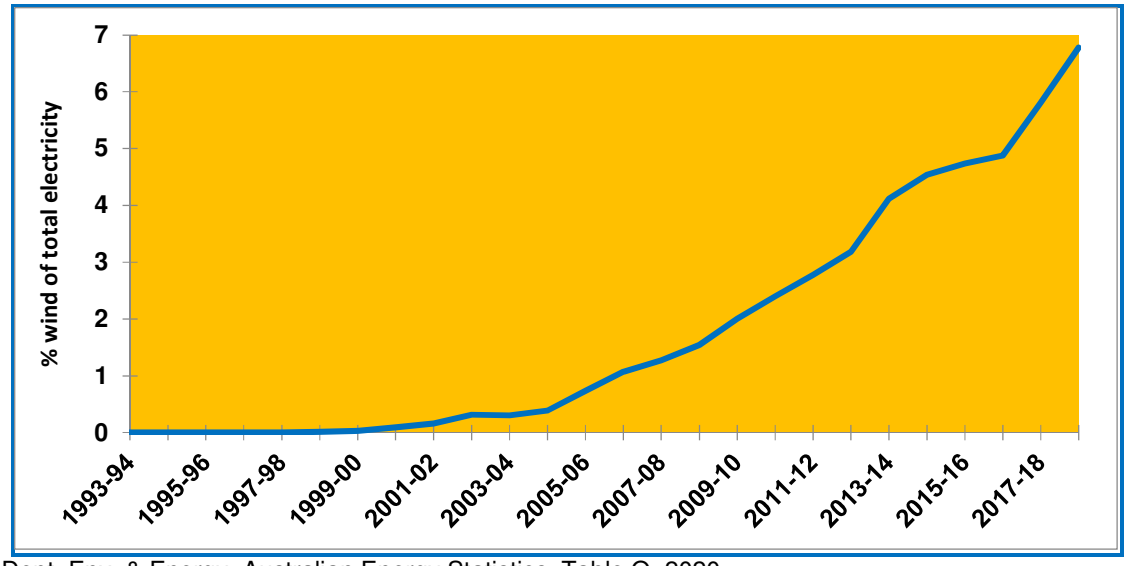
	State wind generation GWh	Wind farms	Wind turbines	Wind farm capacity MW
Queensland	502.5	7	196	644.45
New South Wales	3836.7	16	620	1613.45
Victoria	4884.8	40	1096	3102.05
Tasmania	1119.9	5	197	641.00
South Australia	5722.4	24	845	2161.61
Western Australia	1864.3	8	456	1023.88
Total	**17930.6**	**106**	**3410**	**9186.44**

Note: There are no wind farms in the ACT and NT. WA figures from Wikipedia & www.ramblingsdc.net
Australian Energy Market Operator (AMEO) NEM Registration and Exemption List 2020, Department of the Industry, Science, Energy and Resources, Australian Energy Statistics, Table O, May 2020.
All wind farms except Western Australia are connected to the National Electricity Grid.



Clean Energy Council, 2020

Figure 2.1 Installed wind capacity (MW) and electricity generated by wind (GWh), Australia

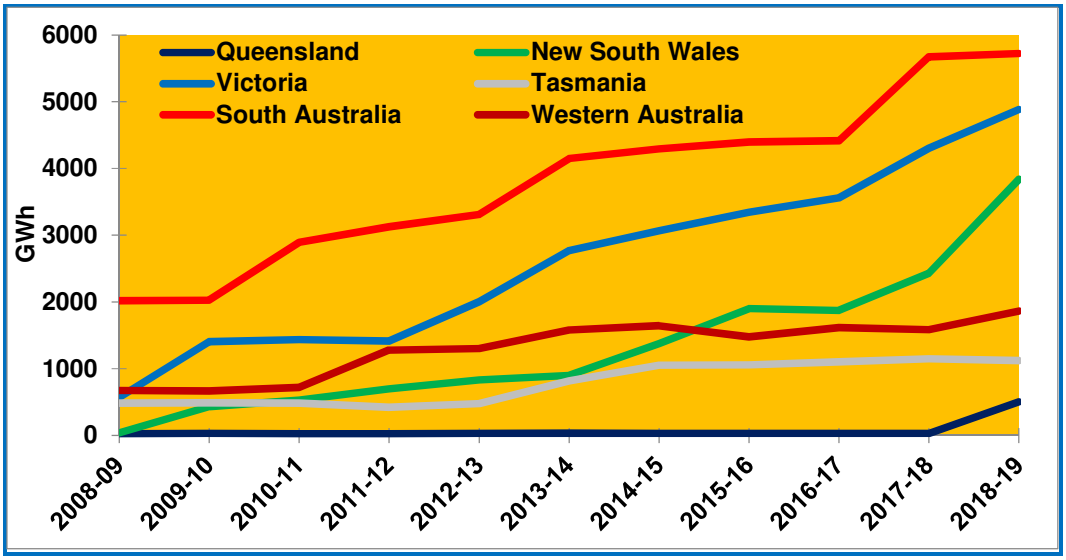


Dept. Env. & Energy, Australian Energy Statistics, Table O, 2020

Figure 2.2 Wind generated electricity as proportion of total electricity in Australia

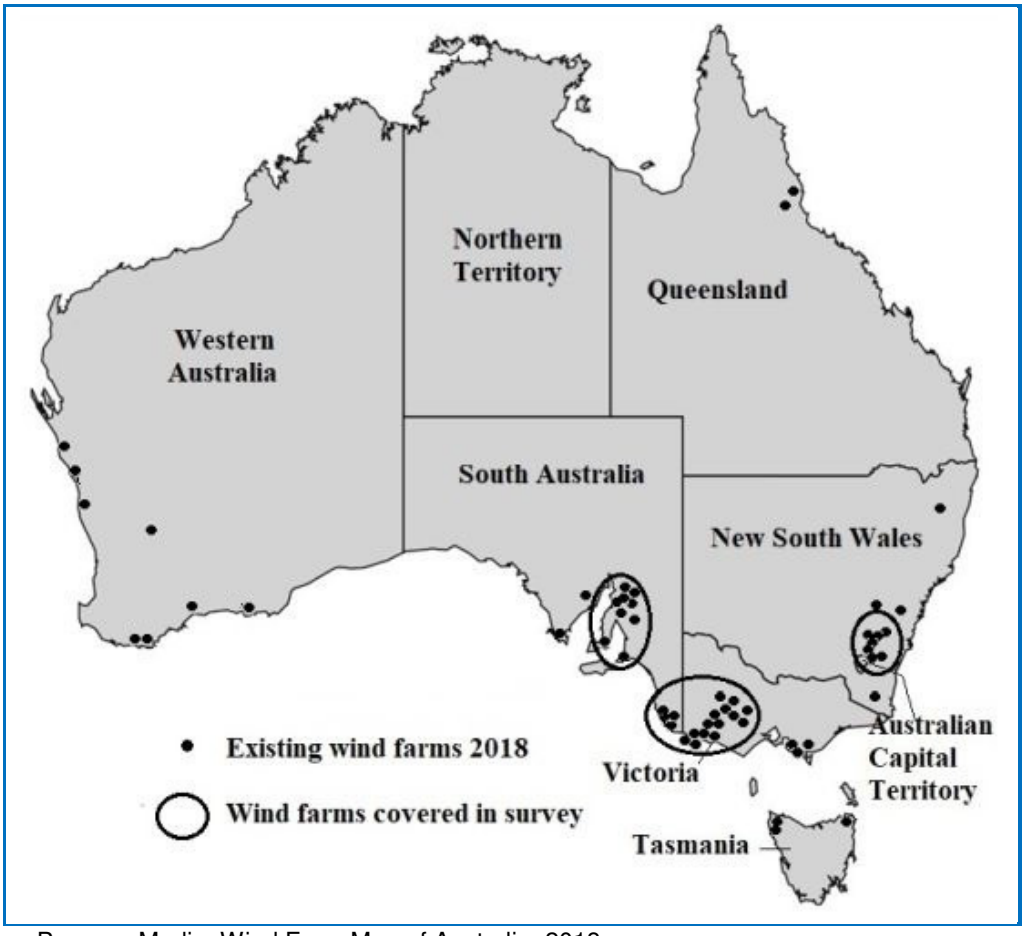
Figure 2.3 shows the rapid growth of wind generated electricity in the Australian States. The growth has been particularly rapid in South Australia and Victoria.

Wind farms in Australia are located mainly in the southern area where the winds are strongest and consistent (Figure 2.4).



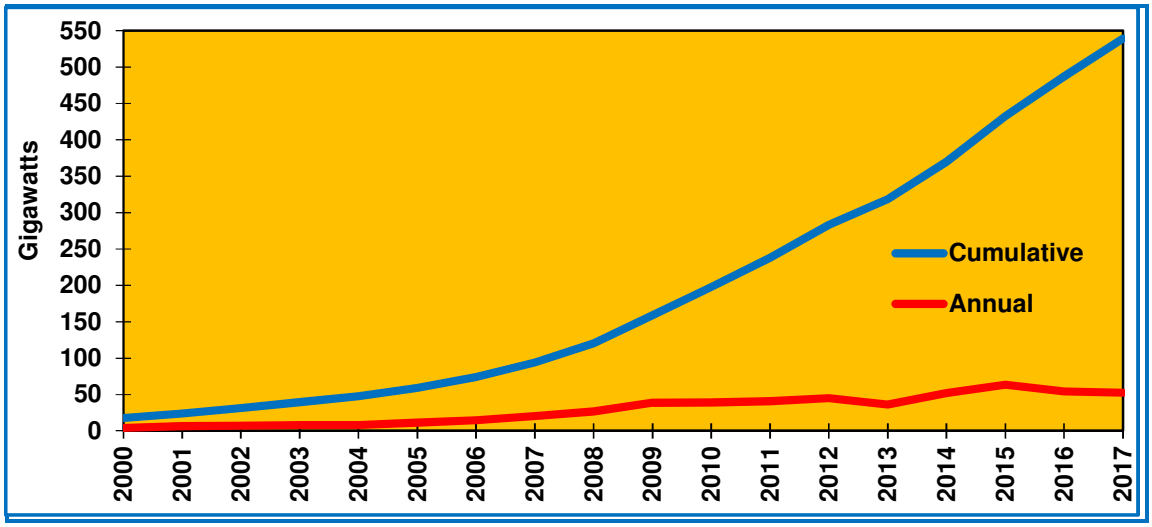
Dept. Env. & Energy, Australian Energy Statistics, Table O, 2020

Figure 2.3 Growth of wind energy generated by State, 2008/09 – 2018/19



Paragon Media, Wind Farm Map of Australia, 2018

Figure 2.4 Wind farms in Australia, 2018



Source: Global Wind Energy Council. http://gwec.net/global-figures/graphs/#

Figure 2.5 Growth of global wind power

2.2 GROWTH OF GLOBAL WIND ENERGY

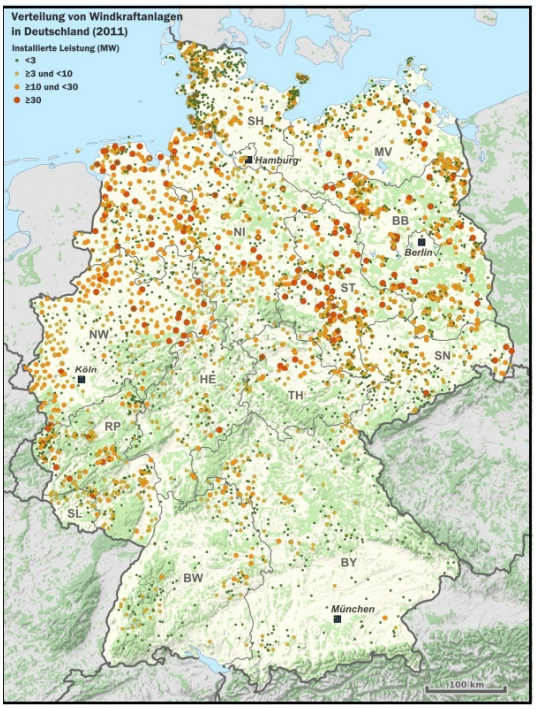
The 2019 global wind turbine market installed 60.4 GW of generating capacity, bringing total global installed capacity to nearly 651 GW (Global Wind Energy Council) (Figure 2.5). By comparison, Australia's total electricity generating capacity is 65.6 GW. The greatest growth in wind farms is in China with nearly half the new global installations occurring. Since 2006, China's Renewable Energy Law has required power grid operators purchase a full amount of wind power generated by registered producers (Saidur, *et al*, 2010).

In Europe, the European Parliament and European Council Renewable Energy Source Directive 2001/77/EC was issued in 2001 for the promotion of electricity produced by renewable energy sources in the internal electricity market. This established indicative targets for member nations for 2010. On 5 June, 2009, this Directive was replaced with the Renewables Directive 2009/28/EC which mandated targets for 2020 which included 18% Germany, 23% France, 15% UK, 17% Italy and 30% Denmark. An overall EU target of 20% was set in 2007. Germany, however, has increased its target to 40 - 45% by 2025, driven by the Renewable Energy Sources Act (Erneuer-bare Energien Gesetz –EEG), increasing to 80% by 2050. In 2019, 46.3% of electricity in Germany was from renewable sources (Wikipedia, accessed 27/8/20).

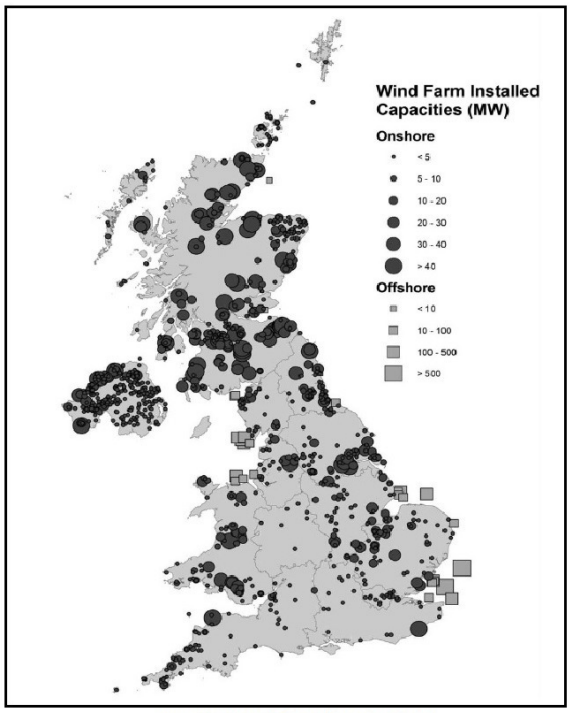
Germany has a goal of 30% electricity from renewables by 2020 and 50% by 2050. Even tourist areas have been targeted for wind farms including the Moselle valley, the Allgäu, Lake Constance and the foothills of the Alps.

Figure 2.5 shows the dense distribution of wind farms in Germany and the United Kingdom. In Germany there were 27,270 wind turbines onshore at 2016. In 2000 in Germany, wind turbines generated 9,500 GWh of electricity but by 2016 the figure had increased to 77,400 GWh, 16% of Germany's total demand. In the UK in 2000 there were 73 wind farms, by 2014 there were 458 wind farms. In 2018 in the UK there were 9,088 wind turbines onshore, generating 41,000 GWh of electricity, 15% of the UK's total demand. The UK now generates more electricity from wind power than from coal. At an all-of-Europe scale, in 2005, wind provided 6% (41 GW) of its installed electricity capacity but by 2016 this had grown to 16.7% (154 GW). On 28 October, 2017, wind power generated nearly 25% of Europe's electricity including 109% of Denmark's need and 61% of Germany's (WindEurope, 1/11/17).

It is the rapidity of the change over a single decade or so by such a significant visual element in the landscape that is a



German Wikipedia



www.lse.ac.uk/GranthamInstitute/

Figure 2.5 Distribution of wind farms in Germany and the United Kingdom, 2017

major reason for the antagonism they have generated in some areas

Many European nations are moving to offshore solutions to avoid the complexity and difficulty of achieving outcomes onshore (Hindmarsh, 2010). The strategy is to "site the turbines out to sea, out of sight and out of mind" (Babbage 2010). As a consequence, offshore wind farms have expanded greatly. Currently, they are mainly located in the seas off Europe – North Sea, Baltic Sea, Irish Sea and the English Channel, but offshore wind farms have also commenced off China, Japan, South Korea, Taiwan and the US. Offshore wind turbines are taller than onshore turbines, in the United States they average 142 m onshore and 180 m offshore. A 12 MW offshore turbine standing 260 m has been proposed in the US with rotors 106 m long (Roberts, 2018).

2.3 GROWTH IN TURBINE DIMENSIONS

An additional factor in the visual impact of wind turbines is the increase in turbine dimensions. During the 1980s, wind turbines were less than 50 m in height to the top of the hub with 10 – 15 m blades. By 2015, turbines had grown to 125 – 150 m hub height with 50 m+ blades. These are very sizeable structures in the landscape, far larger than electricity transmission towers (Figures 2.6 and 2.7). Old 60 m turbines are being replaced by 150 m high turbines in a process called repowering which has also drawn flack.

www.ucsusa.org/clean-energy/renewable-energy/

Figure 2.6 Growth of wind turbine size

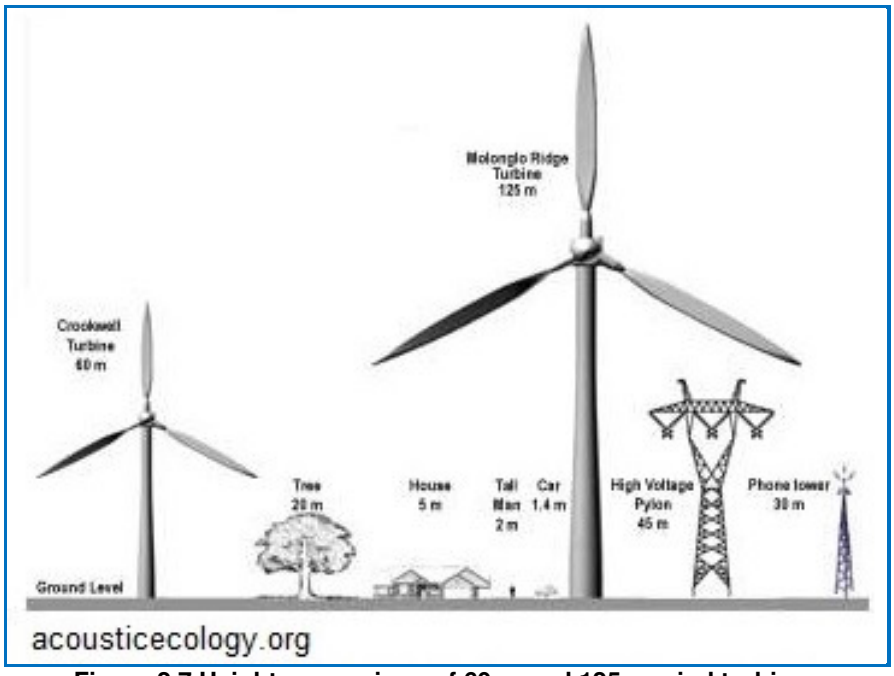


Figure 2.7 Height comparison of 60 m and 125 m wind turbines

CHAPTER 3 VISUAL IMPACTS OF WIND FARMS

3.1 ASSESSING THE VISUAL IMPACTS OF WIND FARMS

Recognizing that renewable energy technologies reduce our reliance on fossil fuels with their substantial adverse environmental and health effects, Bisbee (2004) argued in the context of National Environment Protection Act (NEPA) in the US that these benefits are more important than their visual impact: "*local aesthetic preferences must not be permitted to overshadow broad regional benefits."* She concluded the essentially legal review:

> *Offshore wind power can reduce emissions of air pollutants that are contributing to global warming and causing premature deaths. This is the most important impact of offshore wind, and it deserves immediate, in-depth attention. Used appropriately, NEPA can show decision makers that when they choose to save the view, they also choose to perpetuate the adverse effects of fossil-fuel use on human health and the environment.*

Ian Bishop of the University of Melbourne developed computer simulation software to enable the visual impact of proposed wind farms to be evaluated (Bishop 2002, 2003, 2007, 2010). A number of authors have applied GIS and multi-criteria tools to the wind farm site selection and visual impact assessment including: Simao *et al*, 2009; Torres Sibille *et al*, 2009; Molina-Ruiz *et al*, 2011, and van Haaren & Fthenakis, 2011.

Macintosh & Downie (2006) of the Australia Institute stated:

> *Even with an accepted methodology of measuring landscape issues, the aesthetic impacts of wind turbines are likely to continue to cause problems because of the inherently subjective nature of aesthetic values. Some people loathe the look of wind farms, while others think they enhance the landscape or have no affect* (sic) *on it. In many cases in Australia, it appears that aesthetics has been one of the major drives behind anti-wind campaigns.*

In an attempt to address the visual impacts of wind farms, the industry group, Austwind, partnered with the Australian Council of National Trusts in preparing a framework for landscape values assessment - *Wind Farms and Landscape Values: A National Assessment Frame-work* (Austwind, 2007). The framework provided a comprehensive process for assessing, evaluating and managing the visual impacts of wind farms but left it up to the developers to decide the actual technical methods, tools and techniques they would use.

As part of their investigation of the visual impact of developments on the Dutch landscape, De Vries *et al*, (2012) included wind farms. They examined the mitigating influence of distance to the turbines, their height and their configuration (Table 3.1).

Table 3.1 Percentage reduction in ratings due to mitigating components for wind farms

Distance to turbines	500 m	1500 m	2000 m
% reduction in ratings	36.29%	28.12%	25.21%
Height of turbines	80 m	120 m	
% reduction in ratings	25.15%	33.16%	
Configuration	Cluster	Linear	
% reduction in ratings	30.89%	32.85%	

De Vries *et al*, 2012.
Note: Ratings without these components: distance 5.91, height 5.80, configuration 6.15.

Turbines at 500 m distance reduced ratings from 5.91 to 3.77 (7 - point scale), a reduction of 36%. When the turbines were viewed at 2000 m distance, this fell to 4.42, a 25% reduction. Distance thus had a slight influence. Increasing the height of turbines increased their visual impact, but whether the turbines were in a cluster or in linear configuration did not make much difference.

Bishop (2002) examined the detection and recognition of wind farms with distance for clear and hazy conditions. He found that in clear conditions*, "object detection or recognition will occur for only about 5% of people at a distance of 30 km and for just 10% at 20 km. Most of the drop of in detection rates occurs between 8 km and 12 km in clear conditions and between 7 km and 9 km in light haze."* In clear conditions, recognition will be 20% of people at 10 km distance. He found that visual impact "*may well become minimal beyond 5 km – 7 km, even in clear air."* He concluded that what "*is abundantly clear is that any impact model should not be based purely on line of sight but must also take distance into account."*

A study by the Argonne National Laboratory in the US of five wind farms, hub heights 230 – 260 feet (70 – 80 m), found (Sullivan *et al*, 2012):

> *The facilities were found to be visible to the unaided eye at >58 km (36 miles) under optimal viewing conditions, with turbine blade movement often visible at 39 km (24 miles). Under favourable viewing conditions, the wind facilities were judged to be major foci of visual attention at up to 19 km (12 miles) and likely to be noticed by casual observers at >37 km (23 miles). A conservative interpretation suggests that for such facilities, an appropriate radius for visual impact analysis would be 48 km (30 miles), that the facilities would be unlikely to be missed by casual observers at up to 32 km (20 miles), and that the facilities could be major sources of visual contrast at up to 16 km (10 miles).*

Grimm (2009) asked visitors to wind farms in Australia whether their impressions of the wind farm had changed as a result of their visit. Only 29% said they had changed. Two of the reasons cited were that the scale of the wind farm was larger than expected (45%), and secondly, the dynamic nature of the blades turning (7%), a surprisingly small proportion which suggests that viewing the rotation of the blades is not visually significant. He compared the scenic ratings of scenes with rotating turbines and scenes with static turbines and found that generally there was no difference. The exception was for nearby wind turbines, within 1 km, where there was a significant difference.

As a surrogate of visual impact, several authors have examined the impact of wind farms on property values as this is often a concern regarding proposed wind farms. Gibbons (2014) sought to measure the visual impact of wind farms by examining their effects on house prices in England and Wales. Using a GIS digital elevation model, he defined viewsheds of houses with a view of a wind farm and those without. A total of 148 wind farms were involved and he took land cover into account. He used housing transaction data for the period 2000 – 2012 and examined sales of houses with a view and compared these with sales of houses without a view. wind farm visibility reduces local house prices, and the implied visual environmental costs are substantial. He found the following:

- The price reduction was around 5-6% within 2 km, falling to less than 2% between 2 and 4 km, and less than 1% by 14 km which is at the limit of likely visibility;
- Small wind farms have no impact beyond 4 km, whereas the largest wind farms (20+ turbines) reduced prices by 12% within 2 km, and reduced prices by around 1.5% right out to 14 k.
- A household would be willing to pay around £600 per year to avoid having a wind farm of small-average size visible within 2 km, around £1000 to avoid a large wind farm visible at that distance and around £125 per year to avoid having a large wind farm visible in the 8-14 km range.
- The implied amounts required per wind farm to compensate households for their loss of visual amenities was therefore fairly large: about £14 million on average to compensate households within 4 km. The corresponding values for large wind farms would be much higher than this, as their impact is larger and spreads out over much greater distances.

In contrast, Hoen *et al* (2010), who examined the sales of 7,500 homes within ten miles of 24 existing wind farms in the United States, found that "*neither the view of the wind facilities nor the distance of the home to those facilities was found to have a statistically significant effect on home*

sales prices." They did concede, however, that houses within 1000 feet of turbines may be negatively impacted.

A German study (Sunak & Madlener, 2012) found some evidence for negative local pricing effects of proximity to the site and shadowing caused by wind turbines, but the results were not sufficiently determinant.

Maehr *et al*, (2015) found that people's psychophysiological response to the appearance of wind farms was stronger than that of churches but similar to powerlines and powerplants. However, they were rated less aversive and more calming compared with powerlines and powerplants and equivalent to churches.

Wikipedia stated rather optimistically (25/11/17):

> *…when appropriate planning procedures are followed, the heritage and landscape risks should be minimal. Some people may still object to wind farms, perhaps on the grounds of aesthetics, but their concerns should be weighed against the need to address the threats posed by climate change and the opinions of the broader community.*

3.2 COMMUNITY ATTITUDES ABOUT WIND FARMS

Australians appear to have a polarized love-hate relationship with wind farms. In July 2006, the Federal Treasurer Peter Costello stated, "Well if you are asking me my view on wind farms, I think they are ugly,…I wouldn't want one in my own back yard." (Hudson, 2017). A later Federal Treasurer, Joe Hockey, similarly described the wind farm on Lake George near Canberra as "utterly offensive, I think they're just a blight on the landscape." (ABC.net.au, 2 May, 2014).

Surveys of the Australian population however have consistently shown that renewable energy, and wind farms in particular, have overwhelming support. Table 3.2 summarizes 21 surveys of the community taken while wind farms were being established across Australia. In total, the surveys covered 20,500 of the Australian population. The average overall support for wind farms was 75% and for renewable energy, 81%. Opposition to wind farms averaged 11% and against renewable energy, 6.5%.

Table 3.2 Community attitude surveys of wind farms, Australia, 2006 – 2018

Date	Location	N	% support	% against	Source
2003	Australia	1027	Support wf 95% Need wf for electricity 91% Increase RE a lot 67% Increase RE a bit 21% Strongly support wf 67%	Decrease RE a lot 1% Decrease RE a bit 1% Oppose wf 3%	AWE, 2003
2006	Australia	900	Support growth of wf in Australia 63%		Ashworth, *et al,* 2006
2006	Tourist centres, Qld, & SA	280	Tourist accommodation should have RE 86%		Dalton, *et al*, 2008
2007	Australia	1007	Governments should boost wind power 78% 89% want electricity to be min. 25% RE	Govts should boost nuclear 25%	Global Market Insite
2008	Western Australia		Majority think of a wind farm in positive terms. 89% not concerned about visual intrusion.	2% oppose wf	Bond, 2008
2008	Upper Lachlan CC, NSW	4822	58% support more wf. (Crookwell wf in area)	24% against more wf	By Electoral Comm. of NSW.
2010	Australia	1085	80% support for wind 11% neither wind or solar	4.6% against wind	Bird, *et al*, 2014

2010	NSW	2022	85% support wf in NSW 79% support wf within 10 km 60% support wf within 1-2 km	13% against wf in NSW or within 1-2 km.	NSW Office Env Climate Change & Water, 2010
2011	NSW, Victoria, SA	1000	National 83% support NSW 77% support Victoria 84% SA 90%	National 14% opposed	Qdos for Pacific Hydro. 100 people in 10 electorates
2011	Waterloo, SA	358	77% support wf 69% for local wf		TRUEnergy Waterloo wf.
2012	Bungendore, NSW	234	Benefits env. 75%	No benefit 10%	QDos Research
2012	Australia	1907	Support: wind 38%, solar PV 37%, solar thermal 33%		Hobman, *et al,* 2012
2012	Australia	1101	78% support for wind 10% neither wind or solar	8.6% against wind	Bird, *et al*, 2014
2014	NSW	2000	RE support 91% 83% want more RE 81% support wf.	3% less RE 11% current levels of RE	NSW Office Env & Heritage, 2015
2014	Australia		88% in favor wind & solar 95% RE a 'good idea'	8% against wind & solar 2% RE not a good idea	Newspoll 20/8/14
2014	Australia		>80% support wind & solar	35% prefer coal	Australia Institute
2016	Australia		Support State RE targets 76%	Against State RE targets 7%	Australia Institute
2017	Hunter Valley NSW		Govt. should invest in RE 59%	Govt. should invest in coal 34%	Coal mining area Australia Inst.
2017	Australia	1420	Support State RE targets 77% Keep current Federal RE target 26% Increase Federal RE target 52% Higher 2030 target 73%	Against State RE targets 10% Reduce Federal RE target 9% Not higher 2030 target 12%	Australia Institute
2017	Australia	1421	Support Clean Energy Target for more RE 77% Want wind and solar 81%	Don't support CET 11% Want coal-fired power 16%	Australia Institute
2018	SA		Australia should switch to solar & wind 62%		ReachTEL survey

Note: wf = wind farms, RE = renewable energy. Some surveys provided no data on the population number surveyed.

In Australia, Hindmarsh (2010) surveyed eleven "landscape guardian" groups and their primary concerns, in order (by the number of groups) were: noise, spoilt sense of place, property values, and visual amenity. Spoiling the sense of place referred *to "outsiders", "environmental identity"* and "*destruction of our way of life."* "*Outsiders"* were regarded as profit driven and therefore they failed *to "objectively assess wind farm impacts on the landscape and community."* They objected to sacrificing their local landscape for external electricity users. Hindmarsh (2010) found the extent of community engagement in wind farm planning to be inadequate in Australia. He suggested:

> A more promising approach is the collaborative approach, which can also facilitate social mapping of local community qualifications and boundaries about wind farm location alongside technical mapping of wind resources. This is needed to identify the most socially, economically and technically viable locations to locate wind farms to ensure effective renewable energy transitions.

Community support for wind farms is often stronger than might be assumed from media coverage which focuses on

disputes. Reviewing 49 articles from 19 newspapers in Australia, Hall found they reported more reasons for wind farm opposition than reasons for support. Reasons for rejecting wind farms were:

- landscape change/visual amenity impacts
- noise
- poor consultation

Reasons for supporting rural wind farms were:

- action against human-induced climate change,
- reduce greenhouse gas emissions
- support job creation.

Chapman, *et al* (2013) reviewed complaints about Australian wind farms between 1993 and 2013, a total of 51 wind farms; there were no complaints from 33 while 18 had been subject to at least one complaint.

A study in Greece (Kaldellis, 2005) found that while there was strong support for wind farms on the islands, the opposite applied on the mainland: islands, 80 – 90% supported existing wind farms, mainland 15 – 40% support. The study pointed to a minority of around 15% who were strongly opposed to new wind farms regardless of their benefits.

German wind farm near Wurzburg

The German Association for Landscape Protection generally oppose wind farms. Over 700 citizens' initiatives have been founded in Germany to campaign against what they describe as "*forests of masts", "visual emissions"* and the "*widespread devastation of our highland summits"* (Schulz, 2013). Landscape publications in Germany described the destruction of scenic beauty as a "*catastrophe"* and "*the beauty of our landscape is in danger"* (Hoppe-Kilpper & Steinhäuser, 2002).

Wind farm in England's south downs

In the United Kingdom, perhaps no development has raised more concerns regarding their visual impact as wind farms. Their construction across the countryside has galvanised criticism and opposition. The English experience is particularly interesting given their love of their countryside:

> *More than their poets, their art, or their architecture, the English love their landscape and woe betide any who would threaten it. This protectionist attitude has brought wind development in England nearly to a standstill* (Short, 2002).

The Economist (1994) described wind farms as a "*new way to rape the countryside"* and Sir Bernard Ingham described a wind farm in Yorkshire as "*lavatory brushes in the air"* (Pasqualetti, 2001). Ann West, vice Chair of Country Guardian, described them as "*industrial-size blots on the landscape"* (West, 2004). At the same time, there are many in the community who appreciate the significant contribution wind farms make to renewable energy. Jones & Eiser (2010) found that in the UK, people were happy about offshore wind farms but not keen on onshore sites. However, as long as the proposal was "out of sight" they were happy, a typical "not in my backyard" response.

Wind turbines along Liverpool docks in England. Wind farms can be located in industrial areas.

Early lattice wind turbines at Tehachapi Pass near Los Angeles, California

Lilley *et al* (2010) assessed the impact of offshore wind farms on tourist use of Delaware beaches in the US and found around 25% of visitors would switch beaches if an offshore wind project was located 6.2 miles (10 km) from the coast, but this decreased with greater distance from shore.

In 2011, Ian Bishop of the University of Melbourne presented to the World Renewable Energy Congress in Sweden an analysis of 31 studies of the public response to wind farms across the world. He found:

> *… a large gap between the knowledge required for effective planning and the agreed understanding of visual and other impact levels, and the influence of planning and communication processes. There is only limited agreement on some basic impact variables: numbers of turbines, amelioration with distance, role of design and so forth. There is no consensus on what methods should be used to assess acceptability or to design for acceptable outcomes. This means that, in many countries, there is no societal consensus about the acceptability of widespread deployment of wind energy systems.*

Table 3.3 summarises Bishop's key findings relating to the aesthetic aspects of wind farms.

Table 3.3 Key findings of aesthetic response to wind farms (results of various studies)

Variable increasing	On-shore impact	Off-shore impact
Distance	Linear decline to at least 7.5 miles (12 km)	Linear decline to ~ 7.5 miles (12 km)
Number of turbines	• Increase with number, size & proximity until they occupy 15% of view, then constant. • Impact proportional to number of turbines • Between 2 and 8 turbines best accepted	No known studies
Color/contrast	Increase with contrast	Increase with contrast
Size of turbines	One 5 MW turbine has more impact than many smaller units comprising 5 MW.	No known studies
Movement	No known studies	Less when blades moving
Visual complexity	Fractality (i.e. fractals) introduced, simpler structures preferred.	No known studies
Host landscape	Effect is negative on high scenic quality but positive in low scenic quality	Greater distance offshore preferred

Bishop, 2011

There are considerable uncertainties regarding the planning of wind farms but Bishop concluded the following:

- Aesthetic impacts are less the further the viewer is from the turbines (although we have no clear idea of the shape of the distance-impact curve);
- Contrast with the surroundings and background should be low;
- Wind farms should not be located in highly valued landscapes;
- The distribution and design of the turbines should have regard for aesthetic factors such as complexity and continuity;
- Protected sites should be avoided;
- Less dissent arises through involvement of the local population in the siting procedure, transparent planning processes, and a high information level;
- Familiarity with existing small-scale projects is likely to increase later acceptance of further projects.

Molnarova *et al*, (2012) summarized 18 studies of the visual impact of wind farms. They found:

> "…that the physical attributes of the landscape and wind turbines influenced the respondents' reactions far more than socio-demographic and attitudinal factors. One of the most important results of our study is the sensitivity of respondents to the placement of wind turbines in landscapes of high aesthetic quality, and, on the other hand, a relatively high level of acceptance of these structures in unattractive landscapes. Wind turbines also receive better acceptance if the number of turbines in a landscape is limited, and if the structures are kept away from observation points, such as settlements, transportation infrastructure and viewpoints. The most important characteristic of the respondents that influenced their evaluation was their attitude to wind power."

Meyerhoff *et al* (2010) used choice modeling to assess the social acceptability of various wind farm options in Westsachsen and Nordhessen, Germany. The options were the size of wind farms, maximum height of turbine, effect on the red kite (i.e. bird) population, and the minimum distance to settlements. Less than 2% of respondents were very disturbed and 5% were rather disturbed by the wind turbines. They found a high degree of preference heterogeneity among the 154 residents living within 3 km of wind farms with the residents falling into three groups: advocates (32.5%), opponents (39.5%), and moderates (28%).

3.3 OPPOSITION AND LITIGATION

The intensity of feeling in parts of the community regarding wind farms is illustrated by the opposition and litigation they have engendered. In Australia, Landscape Guardians contest half of all wind farm proposals (Hall *et al*, 2012), engaging with disgruntled residents early and mobilising them into action. Some 21 organized landscape and coastal guardian groups exist in Australia (Hindmarsh & Matthews, 2008).

The state of Victoria has witnessed strong opposition to new wind farms. In 1997, 95 wind turbines were proposed at Cape Bridgewater on the coast near Portland, an area identified by the Victorian Coastal Council as of "*outstanding scenic quality requiring special landscape protection"* (VCC, 1998). On appeal, the proposal was rejected on grounds that the wind farm would have a "disturbing visual impact on the significant landscape values of the Cape" (VCAT, 1999). Subsequently, the proponent proposed a four cluster, 120 turbine wind farm. The Planning Panel appointed to report on the project recommended qualified approval of the proposal with amendments (PPV, 2002), and the Planning Minister approved it with modifications.

Opposition resulting in litigation has occurred in many instances. Table 3.4 summarizes the 17 wind farm cases that have been considered by the courts and only two of these were rejected, one to be later approved in an amended form. Litigation as a weapon of opposition therefore does not appear effective.

Table 3.4 Wind farm proposals reviewed by courts

Year	Location	State	Turbines	Court	Outcome
1995	Cape Bridgewater	Vic	95	Civil & Admin. Tribunal	Rejected*
2001	Toora, South Gippsland	Vic	12	Civil & Admin. Tribunal	Approved
2007	Taralga	NSW	69	Land & Env Court	Approved
2007	Hepburn	Vic	2	Civil & Admin. Tribunal	Approved
2007	Sale, South Gippsland	Vic	7	Civil & Admin. Tribunal	Approved
2008	Cooramook	Vic	13	Civil & Admin. Tribunal	Approved
2008	Port Campbell	Vic	15	Civil & Admin. Tribunal	Approved
2010	The Sisters, Mortlake	Vic	12	Civil & Admin. Tribunal	Approved
2010	Gullen Range	NSW	73	Land & Env Court	Approved
2010	Bald Hills, Sth Gippsland	Vic	52	Civil & Admin. Tribunal	Approved
2010	Hallett	SA	33	Env Resources & Dev Court	Approved
2011	Allendale	SA	46	Env Resources & Dev Court	Rejected
2012	Woolsthorpe	Vic	20	Civil & Admin. Tribunal	Approved
2013	Seymour	Vic	16	Civil & Admin. Tribunal	Approved
2014	Tothill	SA	35	Env Resources & Dev Court	Approved
2018	Palmer	SA	114	Env Resources & Dev Court	Approved
2020	Rokewood	Vic	228	Supreme Court	Approved

*Note: A larger proposal at Cape Bridgewater was approved by the Minister in 2002 after a thorough review.

3.4 SOCIAL ACCEPTANCE OF THE VISUAL IMPACT OF WIND FARMS

The major constraining factor is no longer the technology but the social acceptance of wind farms (Wüstenhagen, *et al*, 2007). Sullivan & Consideine (2010) stated: "Whether we fully exploit wind's potential in Australia will depend on the limit of what's acceptable to local people, rather than what's technically possible."

Visual impact is considered the most significant issue that communities are concerned about. Factors such as noise, shadow flicker, impact on birds and bats provide a measure of annoyance but these are overshadowed by the visual effects.

The Netherlands researcher, Maarten Wolsink, has extensively researched wind energy and wrote (2007):

> Regarding community acceptance of wind power schemes, the visual evaluation of the impact of wind power on the values of the landscape is by far the most dominant factor in explaining opposition or support. Type of landscape fully overshadows other attitudinal attributes, as well as other visual and scenic factors such as the design of wind turbines and wind farms, and the number and size of turbines.

Mimicking President Clinton's motto, "*It's the economy, stupid!",* Wolsink coined: "*It's the landscape, stupid!"*

Wolsink (1989) found that perceptions about wind farms comprised four distinct attitudes:

- A general attitude expressing support or opposition to wind energy;
- An attitude towards energy policy stimulating wind energy development and regulation of turbine siting;
- An attitude to wind energy specifically concerned with its proximity to the built environment;
- An attitude towards the size of turbine development, contrasting scattered single turbines versus concentrated wind farms.

He argued for the "*multidimensionality of wind farm perception".* Attitudes towards wind farms are clearly a significant factor.

In England, Jones & Eiser (2010) found concern that the development would spoil the landscape was "a particularly strong predictor of attitudes" followed by lowering of house prices and construction impacts.

In an analysis of 682 wind farm articles in the Australian national and local press, Hindmarsh (2013) found that while the benefits of wind farms were heavily promulgated by the State Governments and by the industry, local citizens and the community focused on the problems they associated with wind farms. The top issues identified were: visual amenity impact, bird and bat strike, noise, and inappropriate siting. Over time, he found the visual impact and noise remained high while other issues dropped off in significance. For those living near wind farms, however, health issues were likely to dominate (Botterill & Cockfield, 2016).

Williams (2011) asked 2167 rural residents in Western Australia and Tasmania about their attitudes to conventional and non-conventional land uses, the latter including wind farms and 50% found wind farms very acceptable.

Surveying over 200 rural residents in the vicinity of 15 wind farms across five Australian States, D'Souza & Yiridoe (2014) found visual intrusion, impacts on wildlife, aesthetic impact and making a region less attractive were the top four issues. Hall (2014) found rural communities often had "underlying cultural or ideological concerns" including being politically neglected by urban centres and opposition to a 'green' political agenda.

Examining French and German wind farms, Jobert *et al* (2007) found the local integration of the developer with the community to be a crucial factor to minimise statements such as "they profit and we have to look at it", or of foreign developers "stealing the landscape." Local integration provides proximity, knowledge of context, contacts with authorities and local media, and the ability to create a network of local actors. Similarly, in Australia, Hindmarsh (2010) surveyed eleven landscape guardian groups and their primary concerns were: noise, spoilt sense of place, property values, and visual amenity. Spoiling the sense of place referred to "outsiders", "environmental identity" and "destruction of our way of life."

Devine-Wright (2005) examined NIMBY-ism (not in my back yard) opposition to wind farms and based on an extensive review of the literature identified six strands:

1. Public support for switching from conventional energy sources to wind energy;
2. Aspects of turbines associated with negative perceptions;
3. Impact of physical proximity to turbines;
4. Acceptance over time of wind farms;
5. NIMBYism as an explanation for negative perceptions;
6. Impact of local involvement on perceptions.

Table 3.5 Summary of factors affecting public perceptions of wind farms

Category	Aspect
Physical	Turbine size, colour, acoustics
	Wind farm size & shape
	Cumulative effects of neighbouring projects
Contextual	Proximity to turbines
	Landscape context
	Proximity to important features
Political & Institutional	Energy policy support
	Political self-efficacy
	Institutional capacity
	Public participation & consultation
	Attitude toward wind power in general
	National good / security of supply
Socio-economic	Shareholding
	Economic effect – property values
	Social impact
Social & communicative	Social influence process (media, social networks, trust)
Symbolic & ideological	Representations of wind turbines
Local	Place & identity processes
	Local & community benefit & control
	NIMBYism
	Local construction impacts
Personal	Previous experience & knowledge
Environmental	Local environment

Devine-Wright, 2005; Graham *et al*, 2009

He found the research was fragmented and "*failed to adequately explain, rather than merely describe, perceptual processes."* Graham *et al* (2009) added further factors which stemmed from their research in New Zealand. Table 3.5 summarises *the "physical, contextual, political, socio-economic, social, local and personal aspects and reflect the complex, multi-dimensional nature of forces shaping public perception"* of wind farms.

Wüstenhagen *et al* (2007) identified three factors in social acceptance: socio-political, community and market acceptance with community acceptance being the key issue. Factors which affect the social acceptance of renewable energy: plants are of a smaller scale than conventional energy plants resulting in more siting decisions; their lower energy densities mean greater visual impact per MWh; plants are above ground, not underground so are more visible, and they are located closer to the consumer thus increasing their visibility.

Forunis & Fortin (2016) reviewed 100 papers on social acceptance in the context of wind farms and found that local "acceptance of wind energy is influenced by a multitude of factors including scale of analysis, psychological factors, the makeup of local communities, governance structures and processes, participation processes and the nature of the market and industrial structure of the wind energy sector."

A review by the European Union identified factors affecting social acceptance included individual attitudes, relationships with the developer, project details and ownership, impacts, and process related (Ellis & Ferraro, 2016). They noted that acceptance "cannot be addressed through simple fixes such as community benefit funds or just more consultation, but … fundamental reform of how energy systems engage with communities and citizens." The link between visual/landscape impacts and "acceptability" is perhaps one of the most complex to understand (Wolsink, 2007).

In Australia, the means of involving the local community are basically to inform and consult but go no further (Hindmarsh, 2010). Limited advertising of proposals, inadequate periods for comment on proposals with the periods for comment being frequently at inconvenient times, and little to compel the developer to take comments seriously are among the frustrations felt by the community. Gross (2007) identified the importance of procedural justice - appropriate participation, the ability to be heard, adequate information, being treated with respect, & unbiased decision-making. Hall (2014) argued for the wind farm industry to seek a "social licence to operate" (SLO) under which they "engage local communities in ways that could enhance transparency and local support, and complement formal regulatory processes."

Recently issued *Community engagement guidelines for the Australian wind industry* by the Clean Energy Council (2018) are based on the Social Licence to Operate which it defines as: *The general level of acceptance or approval continually granted to a wind developer's proposed or actual project by local communities and other stakeholders.*

In summary, it is generally agreed that social acceptance, not technology is not the limiting factor to wind farm development. Many factors influence the acceptance of wind farms by the community. For nearby wind farms, noise and their effects on property values dominate, but for visitors and more distant residents, the visual appearance of the wind farms is the main factor followed by concerns for wildlife. Ensuring effective two-way communication between the community and the developer, and enhancing local integration of the developer with the community can help to develop the trust which is a pre-requisite for a social licence to operate.

3.5 VISUAL IMPACTS OF WIND FARMS STUDY, 2003

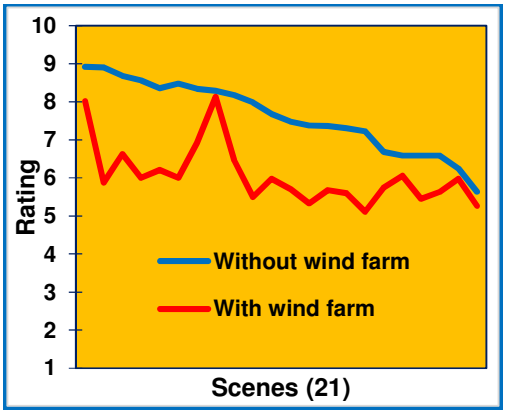
In 2003, the author conducted a survey of the visual impact of wind farms in coastal

and agricultural settings in South Australia (Lothian, 2008). As there were few wind farms extant at the time, images of turbines were inserted digitally into photographs of the landscapes. Scenes were selected to represent both proposed and potential wind farm sites on the coast (21 scenes) and on inland agricultural land (47 sites). The sites were photographed and the images scanned and standardized digitally to show blue skies so that the presence of clouds would not influence ratings. Photomontages were prepared, inserting standard wind turbines into the original photographs. The ratings of 311 participants who completed the 150 scenes were selected for analysis.

The survey comprised the scenes with and without the wind farm (Figure 3.1), arranged in random order. Because viewing wind farms may have been novel for participants, the first ten scenes were replicated at the end of the 150 scenes and the first ten ratings discarded. Participants viewed the survey and rated the images on a 1 – 10 scale in viewing sessions from a CD or an Internet survey.

Figure 3.1 Example of a coastal scene with and without a wind farm

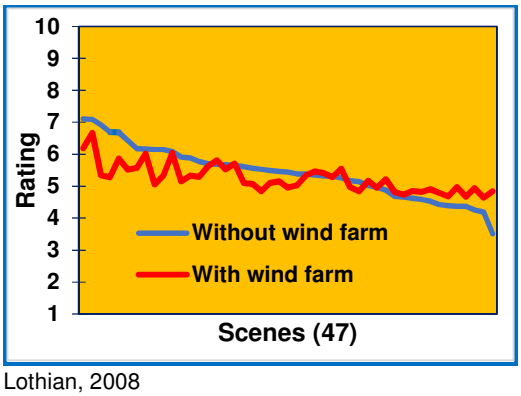
The results were analyzed separately for the coastal and inland scenes. Figure 3.2 shows for coastal scenes the differences in descending order of rating without the wind farm. This indicates the rating of each scene with and without the wind farm. With few exceptions, the difference was largest where the scenic quality was high and narrowed as the rating decreased. In all coastal locations, however, the presence of the wind farm diminished scenic quality.



Lothian, 2008

Figure 3.2 Coastal scenes – visual impact of wind farms on scenic quality

In agricultural landscapes, the presence of wind farms affected areas of high scenic quality but in areas of lower scenic quality the presence of the wind farm actually enhanced scenic quality (Figures 3.3 & 3.4). This implied that in landscapes of low quality, below 5.1 rating, the presence of the wind farm added interest to an otherwise mediocre landscape and thus enhanced its perceived scenic quality.



Lothian, 2008

Figure 3.3 Agricultural scenes – visual impact of wind farms on scenic quality

Rating with wf 4.84, without wf 3.51

Figure 3.4 Example of a wind farm enhancing landscape quality

From trend lines derived from the data, Table 3.7 indicates the expected impact of a wind farm on coastal and agricultural landscapes. For example, the rating of a coastal landscape which rated 8 without a wind farm could be expected to decrease to a rating of 6.2 with the presence of a wind farm.

Table 3.7 Effect of wind farms on scenic quality rating (1 - 10 scale)

Scenes without wf	Coastal scenes with wf	Inland scenes with wf
9	6.8	
8	6.2	
7	5.7	5.9
6	5.2	5.5
5	4.6	5.1
4		4.7

Lothian, 2008, N=377

An analysis of the influence of distance on the ratings of the wind farm indicated that the negative effect actually increased with distance, which appears counter intuitive (Hull & Bishop, 1988) and contrary to Bishop's (2002) findings (Figure 3.5). Up to 7 km, the wind farms had both a positive and negative influence but beyond this distance, the influence was wholly negative. The scenes with positive influence were those where the landscape rated 4 or in the low 5's whereas the negative ratings were for higher quality landscapes. The findings thus reflect that regardless of distance away, the presence of wind farms in higher quality landscapes had a negative influence.

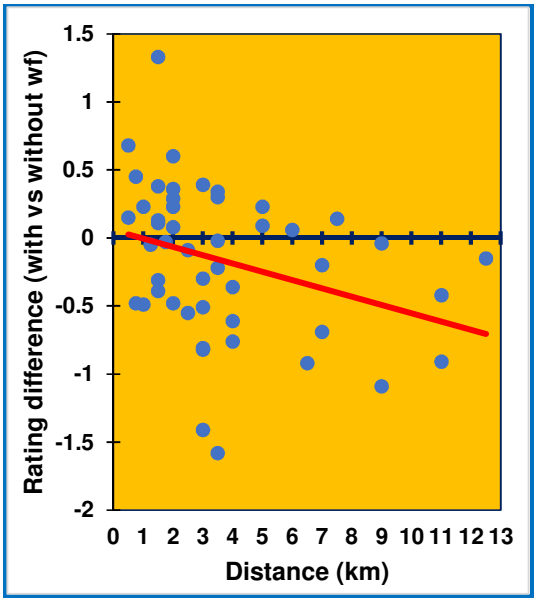


Figure 3.5 Influence of distance on wind farm ratings

3.6 THRESHOLDS OF VISUAL IMPACT

The crucial issue for wind farm location is their acceptability to the community. What is the threshold level when a wind farm shifts from being acceptable to unacceptable? In a hand book on visual impacts, Buchan (2002) noted:

> Ultimately, significant is whatever individuals, people, organisations, institute-ions, society and/or policy say is significant – it is a human evaluative and subjective judgement on which there may or may not be consensus. It is therefore important that two separate but critical characteristics of all effects – **magnitude and significance** – are clearly distinguished.

Buchan proposed the use of matrices to determine significance, these were however, "indicative suggestions only" and "a case by-case approach is required in assessing significance for individual windfarm proposals…"

Palmer (2015) reviewed statistical methods of determining significance of the scenic impact, referred to a study by Arthur Stamps (1997) who reviewed "*thousands of ratings for paired landscape scenes"* and adopted Cohen's (1988) effect size thresholds.

Cohen used the standardized mean difference – i.e. the difference between population means (μx) that is divided by the population standard deviation (σ) (i.e. $(\mu x_1 - \mu x_2)/\sigma$).

Stamps proposed:

Difference = 0.2 is trivial or too small to be noticed.

Difference = 0.5 is a medium size effect, large enough to be visible to the naked eye.

Difference = 0.8 is grossly perceptible, sufficient to draw one's gaze.

Stamps further suggested a threshold of difference = 1.1 of a very large impact that authorities should anticipate public opposition. However, Palmer suggested:

0 – 0.2 Possibly go unnoticed
0.2 – 0.5 Noticeable but not adverse
0.5 – 1.1 Adverse
> 1.1 Unreasonably adverse

Applying these figures to the South Australian study yielded the following number of scenes (Table 3.8).

Table 3.8 Application of Palmer (2015) thresholds to South Australian scenes

Inland scenes σ = 1.85

Difference	Significance	Scenes
0 – 0.2	Possibly go unnoticed	33
0.2 -0.5	Noticeable but not adverse	22
0.5 – 1.1	Adverse	5
>1.1	Unreasonably adverse	0
	Total	60

Coastal scenes σ = 1.90

Difference	Significance	Scenes
0 – 0.2	Possibly go unnoticed	3
0.2 -0.5	Noticeable but not adverse	3
0.5 – 1.1	Adverse	10
>1.1	Unreasonably adverse	6
	Total	22

The following four coastal scenes exceeded 1.1 from the author's 2003 study.

Pennington Bay 1.59

Troubridge Point 1.31

Whalers Way 1.34

Parsons Beach 1.30

However, the following two significant sites are below the 1.1 threshold. Both of these scenes are from South Australia's premier coastal resort area of Victor Harbor. Wind farms in these locations are likely to be strongly opposed by the community.

The Bluff & Encounter Bay 0.90

Kings Head 0.90

Based on these examples, the top threshold may need to be below 1.0, possibly 0.9 or even 0.8. It is quite arbitrary where to set the thres-hold. Stamps suggested 0.8 is grossly perceptible, sufficient to draw one's gaze.

An alternative approach is to calculate the difference in ratings with and without the wind farm. Only the negative differences need to be used – the positive differences indicate that the wind farm enhances the landscape quality. Using the South Australian study again, Table 3.9 shows the results.

On the basis of this, it suggested that a difference of 0 - 1 is acceptable, a difference of 1 – 1.5 is marginal, a difference of 1.5 - 2 is unacceptable, and a difference of 2+ is definitely unacceptable.

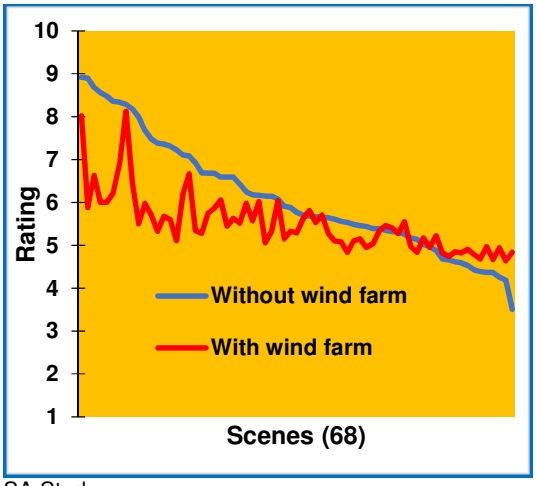
Table 3.9 Difference in ratings, with and without wind farm, SA study

Range	Frequency
0 to - 0.49	19
0.50 - 0.99	13
1 - 1.49	3
1.5 - 1.99	6
2 - 2.49	6
2.5 - 2.99	1
3 +	1
Total	49

The foregoing analysis, however, considers only the reduction in landscape quality caused by the development, it does not consider the level of landscape quality prior to the development. The visual impact of a development in a landscape of 4 or 5 rating will be far less objectionable than a development in a land-scape of 6, 7 or especially 8 rating. This corresponds with the finding from the author's 2003 study that while ratings increased where the wind farm was located in low quality landscapes, they decreased for higher value landscapes. For coastal wind farms, all sites reduced the landscape quality.

The thresholds in landscapes of high quality will be considerably less than the thresholds for landscapes of low quality. A reduction from 8 to 7 will be far more objectionable than a reduction from 5 to 4. Two factors need to be considered in establishing visual thresholds, firstly the rating of the subject landscape, and secondly, the reduction in landscape quality that results from the development. This is similar to Buchan's suggestion that **magnitude** and **significance** are the important issues. It is then necessary to determine at what point the reduction in scenic quality becomes unacceptable.

A possible clue to how these thresholds may change with the landscape quality may be derived from the results of the 2003 study. Figure 3.6 combines the data from the coastal and inland sites. Figure 3.7 shows the trend lines for the two lines, with and without the wind farms.



SA Study

Figure 3.6 Coastal and inland wind farm sites combined

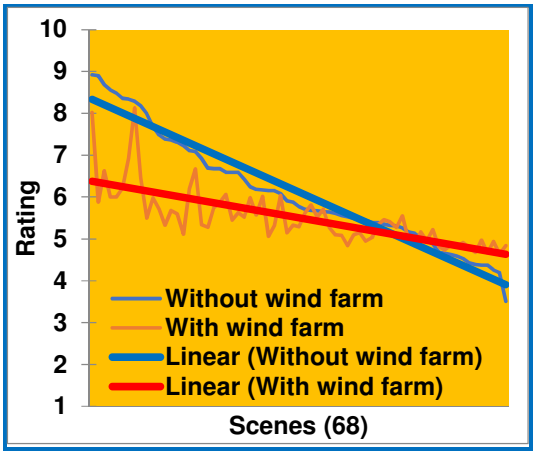


Figure 3.7 Trend lines for wind farm sites

Table 3.10 indicates the average gap for each level of landscape quality.

Table 3.10 Influence of landscape quality on the visual impact of wind farms

Landscape quality	Wind farm present	Gap
9	6.64	-2.36
8	6.25	-1.75
7	5.86	-1.14
6	5.46	-0.54
5	5.00	0.00
4	4.60	+0.60

The question arises from Table 2.8 of whether these gaps represent the threshold for a given level of landscape quality at which the wind farm becomes unacceptable. Thus for a landscape quality 8, a reduction of 1.75 to 6.25 represents a significant diminution in landscape quality which would be considered unacceptable.

CHAPTER 4 PROJECT DESIGN

4.1 PURPOSE, OBJECTS & SCOPE

The purpose of the project was to investigate whether it was possible to determine the thresholds at which the visual acceptability of wind farms shifts from being acceptable to unacceptable.

Objectives

The study had the following three objectives:

1. To derive a model with Australia-wide applicability of the visual impact of windfarms;
2. To confirm the findings of the 2003 study that wind farms diminish the scenic quality of high-quality landscapes while enhancing the scenic quality of low-quality landscapes;
3. To determine a threshold of acceptability/unacceptability of the proposed wind farms.

Geographic scope options

The 2003 study examined potential sites in South Australia. For the model to have wider applicability across Australia, wind farms in other States should be included, in particular New South Wales and Victoria where the majority of wind farms outside of South Australia are located. These three States account for nearly 80% of the turbines in Australia in 2017.

There are three wind farms in Tasmania (plus one on King Island), comprising two in north-west (Woolnorth) and one on north-east (Musselroe). The author has photos of the Woolnorth wind farm, but because it was a stormy day (typical for the area!), they are unsuitable for the study. The landscape is similar to those in the other states.

The study will therefore use existing wind farms in NSW, Victoria and South Australia.

4.2 IMAGES

While the 2003 study inserted wind farms into the photos, there being few wind farms extant at the time, in this study, the photos of wind farms will be utilised and modified to provide images of the landscape with and without the wind farm. Thus the study will be based largely on actual wind farm locations which will enhance the credibility of the results.

A total of 966 images of 30 wind farms were taken in NSW, Victoria and South Australia, over half the wind farms in those States.

Image consistency

A key principle in the study design is consistency among the images. To achieve consistency, the following criteria were followed:

- All images were taken in winter showing green ground cover. Previous studies found that summer straw colour reduced preferences by around 0.5 which could render analysis difficult.
- The images should be from a similar distance, say 1 km. Distance is likely to be a factor affecting their visual impact. Images taken from a variety of distances will make it difficult to identify the contribution of various components. There would be value, how-ever in measuring the effect of distance on visual impact.
- All images should be of 50 mm focal length. A telephoto of wind farm differs from normal eye-sight and if used, the results may not be regarded as applicable as guidance.
- All images were in horizontal landscape format. Although turbines are vertical elements, the mixture of horizontal and vertical images can be confusing for participants and affect ratings.
- As far as possible, all images were taken in bright sunny conditions with minimal cloud cover. Where clouds are present, the turbines were in sun.

4.3 FACTORS THAT MAY INFLUENCE VISUAL IMPACT

Based on previous research (Wolsink, 1989, 2007, Devine-Wright, 2005; Lothian, 2008, Graham *et al*, 2009, Bishop, 2011, De Vries *et al*, 2012), the visual impact of wind farms may be a function of the following factors:

1. Height of turbines
2. Number of turbines
3. MW capacity of turbines
4. Distribution of turbines – rows (linear or circular) vs random
5. Distance to turbines
6. Colour of turbines
7. Quality of the landscape
8. Naturalness and diversity of the landscape
9. Attitude to wind farms
10. Respondent characteristics

The relative significance of each of these factors will vary greatly. Key factors are likely to be the landscape quality, the number of turbines in a scene, attitudes to wind farms and possibly their distribution - whether linear or circular.

Some factors may be difficult to measure effectively. A 1.5 MW turbine vs a 3 MW turbine is not sufficiently different in size to discriminate between them (Figure 4.1). Similarly, the difference in height cannot be easily judged as the distance to the turbines varies.

Challicum Hills, Vic. 1.5 MW turbines, 100 m height

Hornsdale, SA. 3.2 MW turbines, 150 m height

Figure 4.1 Comparison of 100 m and 150 m high wind turbines

4.4 SURVEY OPTIONS

There are three alternative survey methods:

1. Bi-polar Like- Dislike scale

- Scenes with and without wind farms.
- Will quantify degree of like/dislike between with and without wind farm
- Acceptability/unacceptability
- on gap and degree of dislike.
- Cannot correlate with landscape quality.
  Will not assess enhanced ls quality.

2. Landscape survey 1 – 10 scale

- Relationship between visual impact & landscape quality.
- Assesses enhanced landscape quality.
  Cannot determine acceptability/ unacceptability of wind farm.

3. Both landscape survey and bi-polar survey.

- Shows relationship between visual impact and landscape quality.
- Assesses enhanced landscape quality.
- Quantifies degree of like/dislike between with and wind farm.
- Scale of gap/degree of dislike enable judgement on acceptability/ unacceptability of wind farm.
- Correlate bi-polar ratings with landscape quality.
- May determine at what level of landscape quality the unacceptable

wind farm appears.

Clearly it would be preferable to use both the bi-polar survey to quantify the like/dislike, and the landscape survey to link this to the landscape rating.

If two surveys are used, can these be incorporated into the single survey instrument through Survey Monkey?

Survey Monkey allows an extra question - see instructions below.

1. Type the question text into the provided text box.
2. A drop-down menu appears if you'd like to use one of our certified Question Bank questions.
3. Add your answer choices (one per row) and select the question type.
4. Click Save when you are finished; of if you have **an additional question** you'd like to appear directly after the first, click Save and Add Next Question (my emphasis).

On this basis, it was assumed that the two questions in succession can be used.

The 50 scenes will be shown with wind farms and without wind farms (in random order). For the scenes with a wind farm, respondents will firstly rate the landscape quality on a 1 – 10 scale and it will then open to a further question related to that scene and ask the respondent to rate it on an acceptable -unacceptable scale of 1 – 5. The acceptability question thus follows immediately after the rating and is linked to the particular scene.

Rating range

Rating scenes without benchmark scenes means that their ratings cannot be compared with other studies which is essential if the survey results are to provide generic ratings for future wind farms. Benchmark scenes are images of other landscapes in the State or region which cover a wider range of ratings than may be found in the survey itself.

The landscape quality does not vary greatly across the scenes as all are located on agricultural land sometimes amidst scattered trees. The landscape quality of the scenes taken in NSW, Victoria and South Australia were judged to be in the range 4 – 6 which is a narrow range and does not provide much discrimination (Figure 3.2). Including benchmark scenes would widen this range and enable the survey results to be applied Australia-wide which is an objective of the project.

Yambuk rating 4

Starfish Hill rating 6

Figure 3.2 Examples of the likely rating of scenes

An alternative to benchmark scenes is to include some of the coastal scenes from the 2003 survey, with and without wind farms. The ratings of the scenes without wind farms in that survey ranged from 4 to nearly 9, more than double the range of the scenes taken for this survey. Figure 3.3 shows an example of one of the coastal scenes, rating 8.68 without the wind farm and 6.63 with it. An advantage of this option is that it would enable a comparison of the results with those of the earlier survey. Ten coastal scenes have potential for use in the survey.

With wind farm 6.63 (without wf 8.68)

Figure 3.3 Scenes from 2003 survey with high rating of landscape quality

Number of scenes

The survey should aim for up to 100 scenes for assessment. Therefore, this will require 50 scenes. The 2003 survey had 47 inland sites plus 22 coastal sites.

Respondents

Ideally have a minimum of 380 respondents to reduce sample error to ≤ 5% (i.e. 0.05).

CHAPTER 5 ACQUIRING THE DATA

5.1 PHOTOGRAPHS

During 11 – 16 August, 2017, the author traveled into New South Wales and Victoria with the purpose of photographing wind farms in those States. Figure 5.1 shows the location of wind farms photographed in NSW and Figure 5.2 shows the location of those in Victoria.

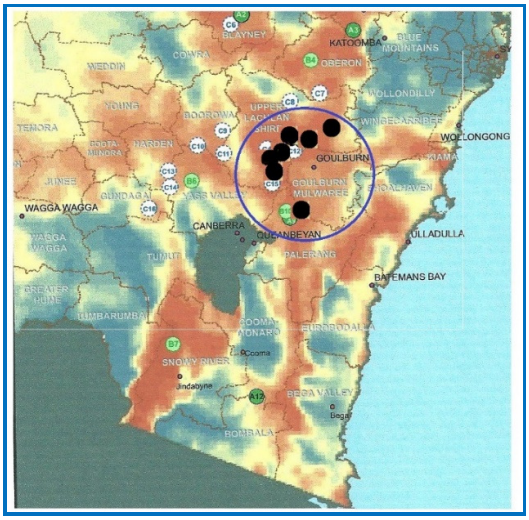


Figure 5.1 New South Wales wind farms surveyed (black circles) and wind resource

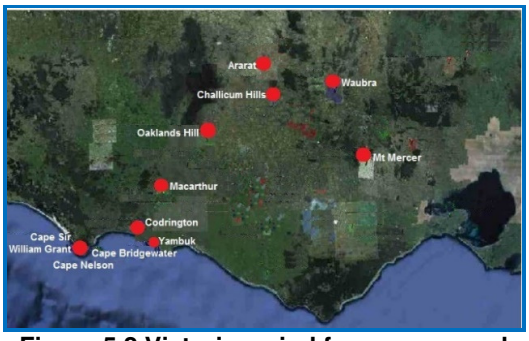


Figure 5.2 Victorian wind farms surveyed

Wind farms at Lake Bonney and Canunda in the south east of South Australia were also photographed. On 19 August, photographs were taken in the mid north of South Australia of the many wind farms there (Figure 5.3).

Photographs from previous trips of the Starfish Hill and Wattle Point wind farms were also used. A total of 30 wind farms were included, seven in NSW, 11 in Victoria and 12 in South Australia.

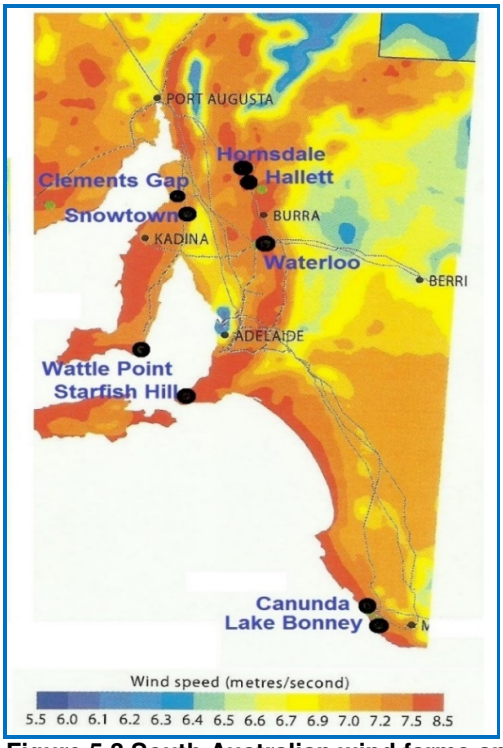


Figure 5.3 South Australian wind farms and wind resource

Tables 5.1, 5.2 and 5.3 summarise the wind farms in NSW, Victoria and South Australia respectively photographed for the survey.

A total of 966 photos of wind farms were available, 232 in NSW, 311 in Victoria, and 423 in South Australia.

Nearly 80% of the scenes photographed were in sunny weather or with scattered clouds. Heavy cloud cover occurred for the large Macarthur wind farm and for those near Portland in Victoria. The land forms on which the wind farms were located varied from flat (31% of locations), undulating (17%), hilly (14%) or along ridges (37%). In 62% of the sites there was no significant vegetation, 27% had scattered vegetation, and 11% had clumps or dense vegetation. A judgement was made of the landscape quality of the site without the wind farm: 40% were assessed as rating 4, 51% were assessed as rating 5 and 9% were assessed as rating 6. There were none that rated 7 or 8.

Table 5.1 Wind farms in South Australia photographed for the survey

Name	Turbines	Hub/ blade	Total height	Turbine	Farm total	Year
		m	m	MW	MW	
Canunda	23	67/39	107	2	46	2005
Clements Gap	27	80/44	124	2.1	56.7	2010
Hallett #1 Brown Hill Range	45	80/44	124	2.1	94.5	2008
Hallett #2 Hallett Hill	34	80/44	124	2.1	71.4	2009
Hallett #4 North Brown Hill	25	80/44	124	2.1	52	2012
Hallett #5 Bluff Range	25	80/44	124	2.1	52.5	2011
Hornsdale #1	32	95/55	150	3.2	100	2017
Hornsdale #2	32	95/55	150	3.2	100	2017
Hornsdale #3	35	95/55	150	3.2	109	2017
Lake Bonney, SA Stage 1	46	67/32	99	1.75	80.5	2005
Lake Bonney, SA Stage 2	53	78/45	123	3	159	2008
Lake Bonney, SA Stage3	13	78/45	123	3	39	2010
Snowtown #1	47	80/44	124	2.1	100.8	2008
Snowtown #2	10	75/49	124	3	30	
Snowtown #2	80	70/54	124	3	240	
Starfish Hill (Cape Jervis)	23	68/32	100	1.5	34.5	2003
Waterloo #1	37	80/44	124	3	111	2010
Waterloo #2	6	80/44	124	3	18	2016
Wattle Point, Yorke Pen	55	67/40	110	1.65	90.8	2005

Table 5.2 Wind farms in Victoria photographed for the survey

Name	Turbines	Hub/ blade	Total height	Turbine	Farm total	Year
		m	m	MW	MW	
Ararat	75	83.5/51.5	135	3.2	240	2017
Cape Bridgewater	29	80/40	120	2	59	2009
Cape Nelson south	22	80/40	120	2	44	2009
Cape Sir William Grant/ Cape Nelson north	23	80/40	120	2.3	54	2015
Challicum Hills	35	68/32	100	1.5	52.5	2003
Codrington	14	50/32	82	1.3	18.2	2001
Macarthur	140	84/56	140	3	420	2013
Mt Mercer	64	85/41	126	2	131	2014
Oaklands Hill	32	80/44	124	2.1	67.2	2012
Waubra	128	70-82/	115	1.5	192	2009
Yambuk	20	64-80?/36	116	1.5	30	2007

Table 5.3 Wind farms in New South Wales photographed for the survey

Name	Turbines	Hub/ blade	Total height	Turbine	Farm total	Year
		m	m	MW	MW	
Capital, Lake George	67	80/44	124	2.1	140.7	2009
Crookwell	8	45/22	67	0.6	4.8	1998
Cullerin Range	15	80/46	126	2	30	2009
Gullen Range	56	80/50	130	2.5	165.5	2014
Gullen Range	17	85/41	126	1.5		2014
Gunning	31	70-82/	115	1.5	46.5	2011
Taralga	21	80/50	130	2	42	2015
Taralga	21	80/45	125	1.8	37.8	2015
Taralga	9	80/45	125	3	27	2015
Woodlawn, Lake George	23	80/44	124	2.1	48.3	2011

5.2 SELECTION OF SCENES

A preliminary selection of scenes was made, deleting photographs in the wind farms were too distant, the scene complicated by other features such as animals, or poor visibility due to heavy cloud cover or fog. In addition, some scenes were spliced – two scenes were combined into one which provided a wider view of the wind farm.

In addition, to ensure that the results could be applied in future assessments, only photographs which had a focal length similar to the human eye, i.e. 50 mm, were used. This better ensures consistency as otherwise comparisons would be made of scenes taken with telephoto lens with those taken with a normal 50 mm lens.

A number of panorama photos were taken and were spliced using a PhotoStich program (Canon Utilities PhotoStich Version 3.1.1). These spliced images provide a wider view of extensive wind farms than is possible with single photos. The selection resulted in a total of 128 scenes, comprising 94 single scenes and 34 spliced scenes.

A second selection was then made, reducing it to 39 scenes. To these were added ten scenes of coastal wind farms from the 2003 study. There was a total of 49 scenes. These comprised 15 spliced images and 34 single images. Most were in the range 48 – 52.5 mm focal length. Two scenes were well outside this range. Scene 48 had a focal length of 27 mm but provided a close-up view of turbines, while scene 240 had a focal length of 105 mm and provided an extended view of a line of turbines (Figure 5.4).

Scene 7. Focal length 27 mm

Scene 45 Focal length 105 mm

Figure 5.4 Scene with non-standard focal lengths

5.3 PREPARATION OF SCENES WITH AND WITHOUT TURBINES

Apart from the ten scenes from the 2003 study which were scenes with and without turbines, each of the scenes contained wind turbines. Each image was copied and Photoshop Elements 15 was used with Auto SmartFix and Auto Haze Removal. This was also applied to the 2003 photos. These changes strengthened the colour and contrast in the image and made the white turbines stand out more clearly in the image (Figure 5.5). In some instances, the lighting was adjusted to alter the brightness and contrast, shadows and highlights. Following these adjustments, the copied image was opened in MS Paint and the turbines were painstakingly removed. In addition, for a few scenes such as those of the Macarthur wind farm in Victoria, the heavy cloud cover was replaced with blue sky, imported from another scene (Figure 5.6).

Figure 5.5 Scene before and after Photoshop adjustments

Original spliced scene 509 - 10 with heavy cloud cover, Macarthur wind farm, Victoria

Scene 509 - 10 with turbines and blue sky, Macarthur wind farm, Victoria

Scene 509 - 10 with blue sky and without turbines

Figure 5.6 Scene showing adjustments

5.4 SURVEY SCENES

Table 5.4 summarises the scenes by State and indicates the number of turbines, either full or part, in each scene. A total of 4 wind farms in NSW, 7 in Victoria and 6 in South Australia plus 10 hypothetical scenes making a total of 27 wind farms were used in the survey. A total of 833 turbines are contained in the scenes, 760 being full turbines and the remaining 69 being glimpses of turbines.

Table 5.4 Turbines in scenes

State & wind farm	Scenes	Full turbines	Part turbines	Total
NSW				
Cullerin Range	1-2	38	3	41
Cullerin Range	3-4	4	2	6
Cullerin Range	5-6	6	1	7
Gullen	7-8	4	2	6
Gullen	9-10	16	1	17
Lake George	11-12	15	1	16
Lake George	13-14	36	4	40
Taralga	15-16	36	6	42
	Total	**155**	**20**	**175**
Victoria				
Ararat	17-18	7	1	8
Ararat	19-20	3	0	3
Cape Nelson	21-22	8	0	8
Challicum Hills	23-24	13	2	15
Macarthur	25-26	14	1	15
Macarthur	27-28	36	2	38
Mt Mercer	29-30	28	0	28
Mt Mercer	31-32	31	5	36
Waubra	33-34	16	4	20
Waubra	35-36	13	5	18
Waubra	37-38	10	4	14
Waubra	39-40	12	2	14
Yambuk	41-42	12	0	12
Yambuk	43-44	12	0	12
	Total	**215**	**26**	**241**
SA				
Bluff Range	45-46	15	0	15
Hornsdale	47-48	7	5	12
Hornsdale	49-50	17	2	19
Hornsdale	51-52	25	5	30
Hornsdale	53-54	15	1	16
Hornsdale	55-56	28	1	29
Hornsdale	57-58	14	0	14
Lake Bonney	59-60	14	3	17
Lake Bonney	61-62	33	3	36
Lake Bonney	63-64	24	3	27
Starfish Hill	65-66	11	0	11
Waterloo	67-68	15	0	15
Waterloo	69-70	11	0	11
Waterloo	71-72	18	0	18
Wattle Point	73-74	11	0	11
Wattle Point	75-76	18	0	18
Wattle Point	77-78	21	0	21
	Total	**297**	**23**	**320**
Hypothetical				
Encounter Bay	79-80	5		5
Kings Head	81-82	11		13
Parsons Beach	83-84	7		9
Troubridge Pt	85-86	9		9
Daly Head	87-88	13		13
Nth Balgowan	89-90	11		11
Mt Westall	91-92	8		8
Whalers Way	93-94	9		9
Cape Torrens	95-96	10		10
Pennington Bay	97-98	10		10
	Total	**93**		**97**
Grand total		**760**	**69**	**833**

Final scenes

5.5 INTERNET SURVEY PREPARATION

To prepare the scenes for the Internet survey, they were compressed to 700 pixels width using Irfanview. This also reduced their file sizes considerably, generally less than 100 kb which makes for faster loading during the survey.

Survey Monkey has a limit of 150 kb for photos.

The 98 photos were placed into the Survey Monkey file preceded by pages covering:

- Introduction
- Instructions
- Demographic data of participant
- Questions covering familiarity with wind farms and attitudes towards them
- Four example photos with and without wind farms.

The file was set to randomise the photos so that each participant saw a different order of scenes. This overcomes the issue of one scene influencing the next. A progress indicator was included in each scene showing the number of scenes already rated and the number to come, and the number rated as a percentage of the total (Figure 5.7).

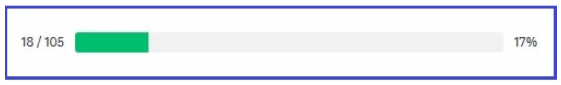


Figure 5.7 Progress indicator used in the survey

The survey progress indicators may reduce the drop off rate as respondents can see where they are in the survey and how many photos are to go; without this information they are at a loss to know how long the survey will take to complete.

Following the 98 photos, the final page thanked the participant, provided them with the opportunity to comment on wind farms or the survey, and also enabled them to include their email address if they wanted to receive a summary of the survey.

The complete survey is shown at the end of this chapter.

5.6 SURVEY IMPLEMENTATION

Survey invitations

The survey commenced on 2 March, 2018. Invitations to participate in the survey were sent out by email, Figure 4.8 shows the invitation letter. An addition was made soon after the start of the survey because several participants had asked whether the project was being undertaken for a client or for other purposes. The following words were therefore added: "This is a personal project being done out of interest in the subject. There is no client involved."

The invitation was emailed to Councils in South Australia, Victoria and New South Wales. Table 5.5 shows the distribution of over 1700 emails sent. The emails were sent in batches of four addresses to avoid being consigned to the SPAM basket at the Council. The response rate from councils was relatively poor.

Table 5.5 Councils by State sent survey invitations

	NSW	Vic	SA	Total	%
Council	186		143	329	19.1
Shire/District Council	478	301	209	988	57.2
City Council	119	59	67	245	14.2
Rural City Council		42	22	64	3.7
Regional Council	77		23	100	5.8
Total	860	402	464	1726	100
%	49.83	23.29	26.88	100	

In addition to councils, invitations were emailed to clubs throughout Australia (Table 5.6). A website which contained the details of over 36,500 clubs listed by State and Territory was used as the basic resource - www.clubsofaustralia.com.au, supplemented by some specialist websites of interest groups. The clubs sought were those with an interest in the outdoors, particularly rural areas or who would be likely to drive through such areas.

For the clubs, the letter was usually preceded by a brief invitation tailored to the particular group – an example is shown below.

Dear …. enthusiasts,
As people who get out and about, I am writing to ask your club members to

participate in a survey on wind farms that I am conducting. I would appreciate it very much if you would participate in it and email it to your members. Details follow.
Cheers
Andrew Lothian

Initially the invitations were sent only to clubs in South Australia, Victoria, New South Wales and the Australian Capital Territory as these were the locations in which the wind farm scenes were photographed. As wind farms are located in other States however, invitations were also sent to clubs in Tasmania, Western Australia, Queensland, and the Northern Territory.

Around 1,700 clubs were canvassed with the invitation. What was notable was the large number of car and 4WD clubs accounting for over 44% of the total.

Survey responses. Note: Cycling included BMX & mountain bikes; Flying included gliding and hang-gliding; Bush-walking included walking, camping, climbing; Caravans included campervans & motorhomes; Fishing excluded sea fishing.

Invitations continued to be sent until 20 March. About 20% of emails were rejected by the server as being out-of-date or no longer functioning for some reason. A few clubs responded with positive advice that they would distribute the survey, or alternatively that they would not do so.

In addition to the councils and clubs, a further 375 invitations were emailed to various personal contacts including a church group, former TAFE students and former work colleagues.

The survey was terminated on 1 April. Table 5.7 summarises the invitations sent, totalling around 3,800.

Table 5.7 Summary of groups invited to participate in the survey

Group	Invitations
Councils	1726
Clubs	1703
Personal	375
Total	3804

Table 5.6 Clubs emailed invitations to participate in the surveyed

Clubs	Qld	NSW	ACT	Vic	Tas	SA	WA	NT	Total	%
Bushwalking	14	42	1	48	4	48	6	3	166	9.76
Caving	1	10	2	1	5	2	1	0	22	1.29
Canoe	18	21	2	16	3	7	8	1	76	4.47
Cycling	22	30	9	23	11	17	13	2	127	7.47
Car	80	159	34	148	21	17	52	3	514	30.22
4WD	27	61	9	55	6	63	17	3	241	14.17
Caravan	27	12	8	8	1	10	2	0	68	4.00
Fishing	7	12	3	25	3	10	3	1	64	3.76
Flying	29	43	6	27	5	14	20	1	145	8.52
Gem / mineral	8	15	1	10	6	11	1	0	52	3.06
Photography	22	34	2	26	8	28	13	0	133	7.82
Running	24	32	1	18	1	10	5	2	93	5.47
Total	279	471	78	405	74	237	141	16	1701	100.00
%	16.4	27.7	4.59	23.8	4.35	13.9	8.29	0.94	100.00	

SURVEY OF THE VISUAL IMPACTS OF WIND FARMS

Wind farms have become a feature of some areas of the Australian rural landscape and their numbers are likely to increase in future.

A key issue of wind farms is their likely impact on the landscape – their visual impact. This has been the basis of many of the objections to wind farm proposals.

This project aims to identify factors which affect the perception of the visual impact of wind farms and see if it is possible to predict their likely visual impact. This is a personal project being done out of interest in the subject. There is no client involved.

The success of the survey depends on having as many people as possible participate.

I invite you to participate by rating the scenic quality of the scenes. I believe you will find it very interesting.

No qualifications or experience are required and the responses will be anonymous.

You can indicate at the end of the survey if you would like to see the results.

To participate simply click of the following link: https://www.surveymonkey.com/r/9ZSLCLQ

Please forward this to anyone you think might be interested.

If you have any questions about the project you can contact me by email:
lothian.andrew@gmail.com

Thank you for your assistance in this important project.

Dr Andrew Lothian
Scenic Solutions
www.scenicsolutions.world

Figure 5.8 Invitation letter to participate in the survey

5.7 EMAILED COMMENTS

During the survey, 18 participants emailed the author with comments and suggestions. These are included at Appendix 3. They covered:

- Questions about the purpose of the survey
- Criticism of its length
- Wishing the author well with the survey
- Suggestion that coal fired power stations should be included to show the alternative.
- General comments, for and against wind farms including some general polemic.

5.8 TIMELINE OF THE PROJECT

Table 5.8 summarises the steps and timeline involved in developing and implementing the Visual Impact of Wind Farms Project.

Table 5.8 Timeline of the project

Segment	Date
Photography of wind farms	August, 2017
Preparation of background material in report	January 2018
Selection & preparation of images for survey	14 - 25 Feb
Preparation of Internet survey on Survey Monkey	26 Feb – 1 March
Launch of Internet survey	2 March
Invitations sent out to participate in the survey	2 – 20 March
Termination of the survey	1 April
Data analysis	2 – 28 April
Finalised project	8 May

5.9 INTERNET SURVEY – VISUAL IMPACT OF WIND FARMS

The appearance of the survey as it appeared on the Internet is shown over the following pages.

VISUAL IMPACT OF WIND FARMS PROJECT

Introduction

Wind farms have become a feature of the Australian rural landscape and their numbers are likely to increase in future.

A key issue of wind farms is their likely impact on the landscape – their visual impact. This has been the basis of many of the objections to wind farm proposals.

This project aims to identify factors which affect the perception of the visual impact of wind farms and see if it is possible to predict their likely visual impact.

The survey contains a total of 98 scenes, 49 without a wind farm, and 49 with a wind farm. The order of scenes is randomised. Most of the wind farms shown are located in New South Wales, Victoria and South Australia. Ten coastal scenes contain hypothetical wind farms from an earlier survey conducted some years ago.

No qualifications or experience are required but participants should be at least 18 years old.

At the end you are given the opportunity to comment and request a summary of the survey's results.

Please queries please contact Dr Andrew Lothian: lothian.andrew@gmail.com.

Page 1 Introduction to the survey

Instructions

How it works

- You will shown a photograph of a scene and asked to rate its scenic attractiveness - i.e how much you like the landscape.
- The rating is on a scale of 1 (low) to 10 (high).
- Just click on the appropriate number to register your rating.
- You will then be asked how acceptable or unacceptable you find the wind farm in the scene.
- Click on the next button to move on to the next scene.

How long will it take?

- The survey contains 98 scenes. Depending on how long you take on each scene it can be done in 15 - 20 minutes.
- There is no time limit to rate each scene.
- Please rate each scene

Hints

- Use the entire rating scale, don't just sit in the middle.
- Judge each scene on its merits
- Trust your initial instinct. Don't think too much about your response.
- Try to ensure you have no distractions (phone, callers etc) before you start.
- If you feel tired or are interrupted, take a break - the survey will wait till you return.

IMPORTANT NOTE: If your survey stops after you have filled out your demographic information, it probably means your Internet browser (e.g. Internet Explorer, Chrome, Mozilla Firefox) needs to be updated to a later edition. The following browsers are required to operate the survey: Chrome 18 and later, Mozilla Firefox 24 and later, Safari 7 or later, Microsoft Edge, Internet Explorer 9 – 11

Page 2 Instructions to participants

Age

- ○ 18-24
- ○ 25 – 44
- ○ 45 – 64
- ○ 65+

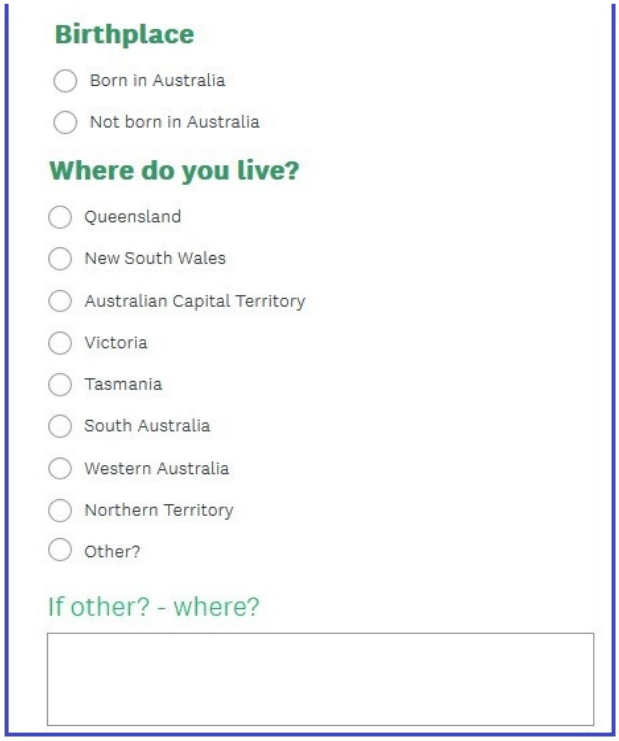
Gender

- ○ Female
- ○ Male

Highest qualification

- ○ No qualification
- ○ Certificate or Diploma
- ○ Degree
- ○ Higher Degree (Grad.Dip., Masters, PhD)
- ○ Other

If other? - please specify



Page 3 Demographic information

Page 5 Familiarity and attitude regarding wind farms

Example scenes

The survey shows images of landscapes with wind farms and the same landscape without the wind farm.

Scene with wind farm

Same scene without wind farm

Page 6 Example scenes

Panorama with wind farm

Same panorama without wind farm

Page 6 (continued) Example scenes

Rate the scenic quality of the scene from 1 (low) to 10 (high).

1 2 3 4 5 6 7 8 9 10

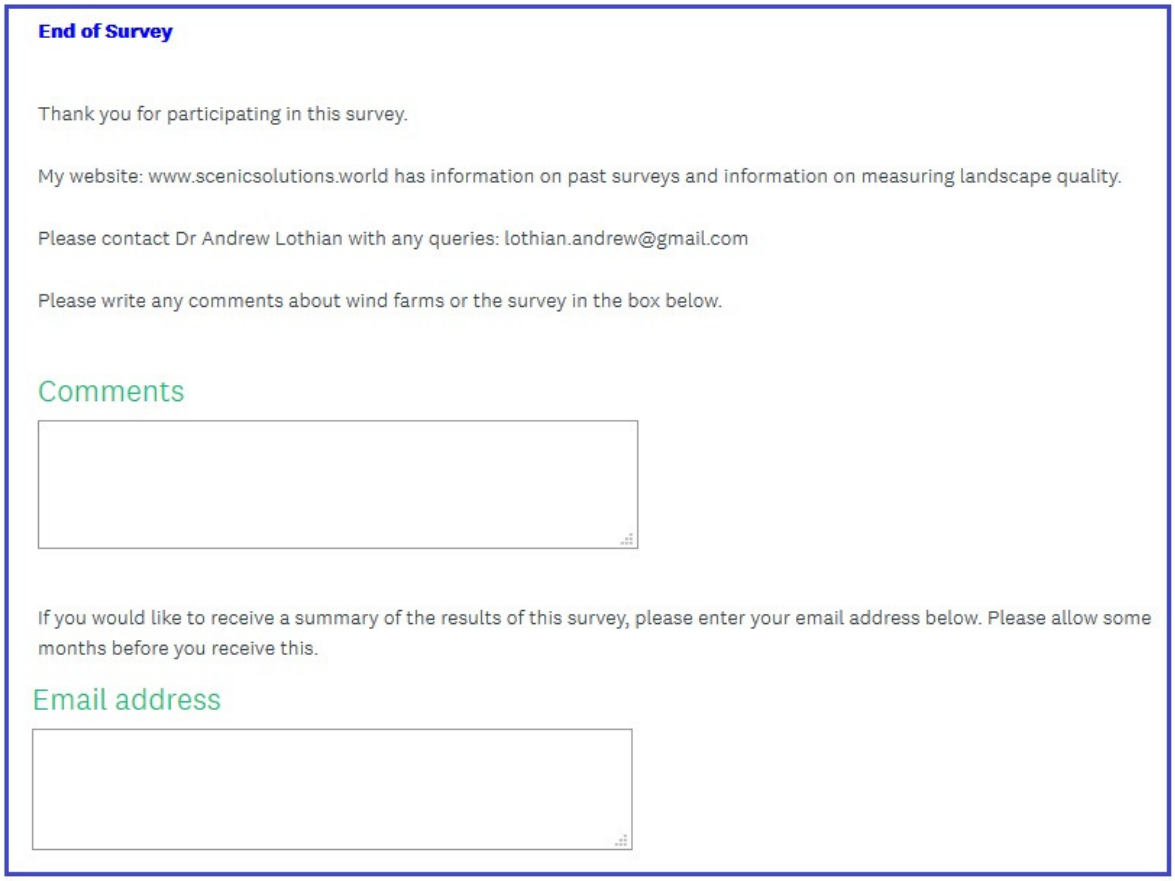
Rate the scenic quality of the scene from 1 (low) to 10 (high).

1 2 3 4 5 6 7 8 9 10

How unacceptable or acceptable do you find this wind farm?

- Very Acceptable
- Acceptable
- Neutral
- Unacceptable
- Very Unacceptable

Typical rating scene without and with the wind farm plus the question on acceptability



Final page – end of the survey

CHAPTER 6 DATA ANALYSIS

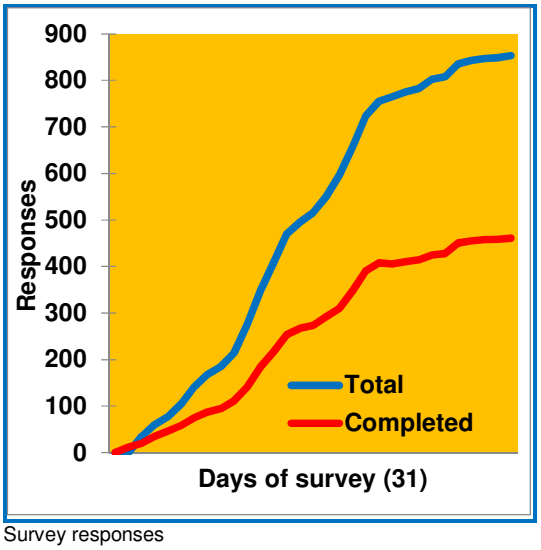
6.1 INTRODUCTION

The analysis of the data proceeds from the derivation of the data set, the analysis of participants and their influence on ratings, then the analysis of the ratings themselves and the derivation of a predictive model.

6.2 DATA MANAGEMENT

Survey responses

The survey was launched on 2 March, 2018 and terminated 32 days later on 1 April. Over this period, 848 persons participated in the survey, with 444 completing it. The figure of 848 was 22% of those emailed an invitation which is quite a high return rate. Figure 6.1 indicates the daily responses to the survey.

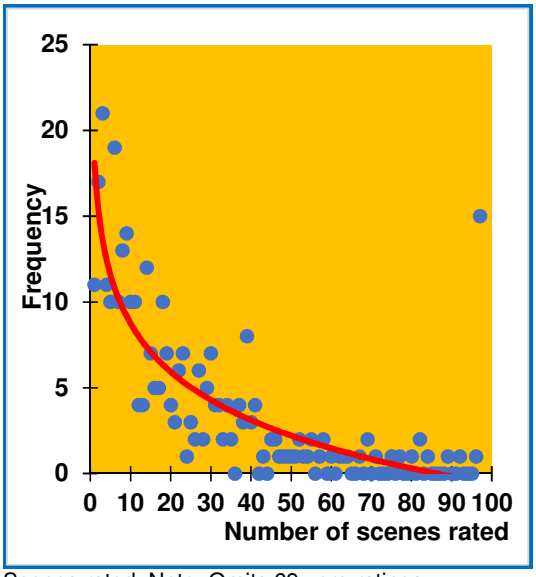


Survey responses

Figure 6.1 Daily responses to the Internet survey

Number of scenes rated

The survey comprised 98 scenes and while a few complained about its length, 444 participants completed all 98 scenes (Table 6.1 and Figure 6.2). A sample of 444 provides a confidence interval of 4.65. A further 15 respondents rated 97 scenes but failed to complete the survey of 98 scenes.



Scenes rated. Note: Omits 69 zero ratings.
Trend line: $y = -4.25 \ln(x) + 18.61$, $R^2 = 0.77$

Figure 6.2 Frequency distribution of scenes rated by participants

Table 6.1 Number of scenes completed by participants

No of scenes	Participants
0	69
1 - 10	136
11 - 20	68
21 - 30	42
31 - 40	34
42 - 50	13
51 - 60	11
61 - 70	6
71 - 80	4
81 - 90	5
91 - 96	2
97	15
98	444

As indicated in Table 6.1, 69 participants failed to commence the survey after having completed the first few questions including their demographic information. This left 779 surveys. The probable reason for this failure, according to Survey Monkey, is that their Internet browser was out of date. For this reason, the following note had been included in the Survey Instructions:

IMPORTANT NOTE: If your survey stops after you have filled out your demographic information, it probably means your Internet browser (e.g. Internet Explorer, Chrome, Mozilla Firefox) needs to be upgraded to a later edition.

Because the survey scenes were randomised, the number of participants for each scene was actually higher than the 444 who completed the survey. Others rated some scenes but not all. Figure 6.3 indicates the number of participants who rated the 48 sets of scenes. The distribution ranged from 510 to 545 for each scene with a mean of 527. This provides a confidence interval of 4.27 at 95% confidence level.

Results

Figure 6.3 Number of participants per scene

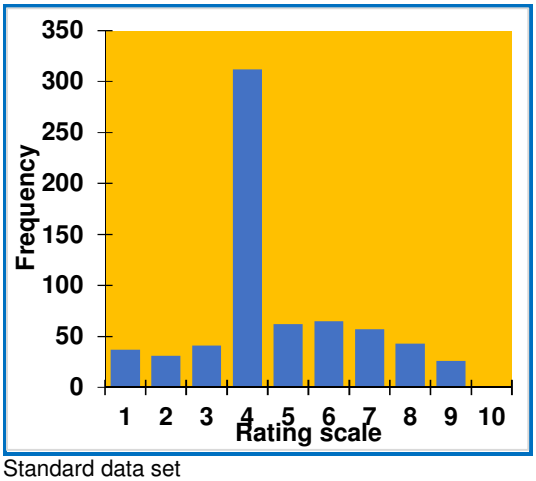
Confidence Interval & Confidence Level (www.surveysystem.com/sscalc.htm)

The **confidence interval** (also called margin of error) is the plus-or-minus figure usually reported in newspaper or television opinion poll results. For example, if you use a confidence interval of 4 and 47% percent of your sample picks an answer you can be "sure" that if you had asked the question of the entire relevant population between 43% (47-4) and 51% (47+4) would have picked that answer.

The **confidence level** tells you how sure you can be. It is expressed as a percentage and represents how often the true percentage of the population who would pick an answer lies within the confidence interval. The 95% confidence level means you can be 95% certain; the 99% confidence level means you can be 99% certain. Most researchers use the 95% confidence level.

When you put the confidence level and the confidence interval together, you can say that you are 95% sure that the true percentage of the population is between 43% and 51%. The wider the confidence interval you are willing to accept, the more certain you can be that the whole population answers would be within that range.

Omitting the 69 participants who rated zero scenes from the 848 total participants 779 participants. This provides the data set for analysis. It has a confidence interval of 3.51, i.e. 0.035 which is considerably better than the 0.05 confidence interval at the 95% confidence level which is the benchmark for the social sciences. Figures 6.4 – 6.11 show the histograms and QQ plots for the data set.



Standard data set

Figure 6.4 With wind farm - Histogram of participant means

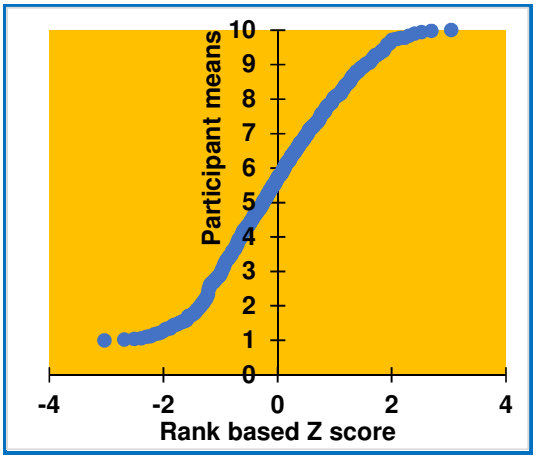


Figure 6.5 With wind farm - QQ plot of participant means

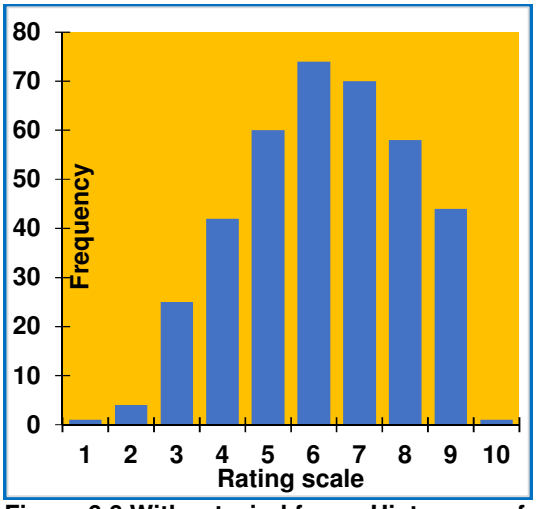


Figure 6.6 Without wind farm - Histogram of participant means

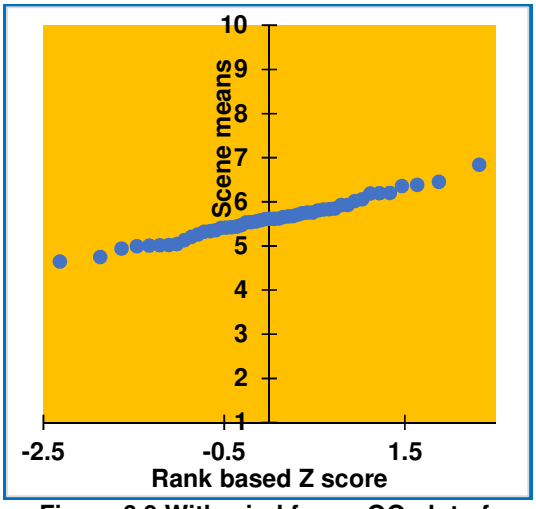


Figure 6.9 With wind farm - QQ plot of scene means

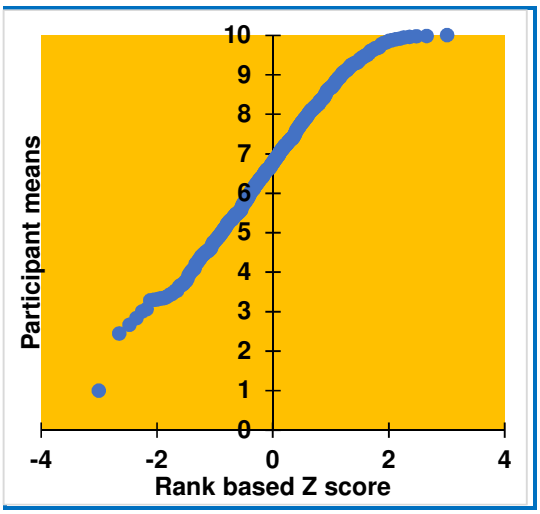


Figure 6.7 Without wind farm - QQ plot of participant means

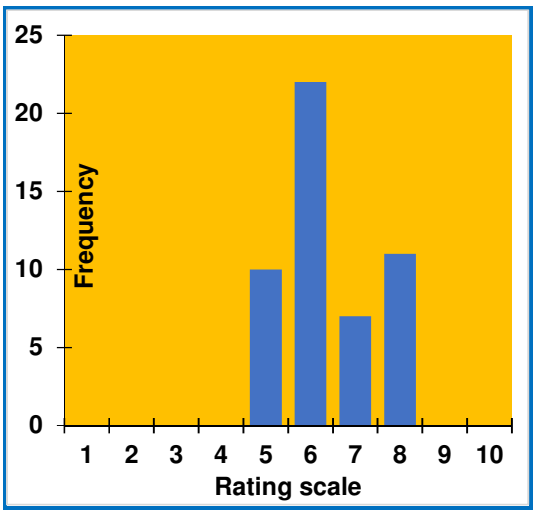


Figure 6.10 Without wind farm - Histogram of scene means

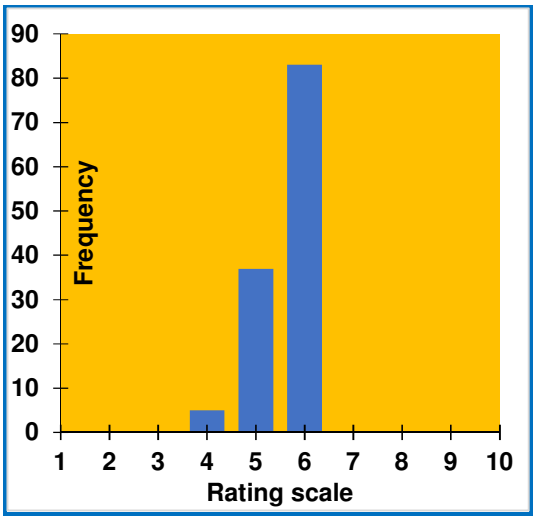


Figure 6.8 With wind farm – Histogram of scene means

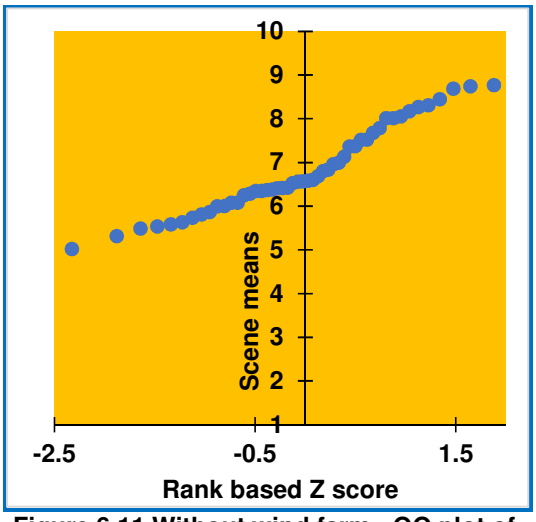
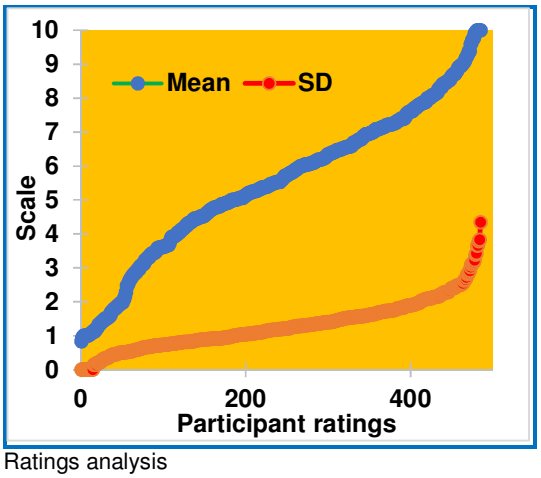


Figure 6.11 Without wind farm - QQ plot of scene means

For the QQ plots, ratings that are close to the diagonal line indicates a normal distribution. The histograms also show whether the distribution is normal which is a bell-shaped distribution.

For the graphs of the scenes without the wind farms, the distributions approaches the normal distribution (i.e. Figures 6.6 - 6.7 & 6.10 - 6.11). However for the scenes with wind farms, the histograms were concentrated around the 4, 5 and 6 ratings but the QQ plots display normality (Figures 6.4 – 6.5 & 6.8 - 6.9).

Figure 6.12 shows the distribution of the means and standard deviations of respondent ratings arranged in descending order. The distribution displays an 'S' curve, which curves down at the lower ratings and arches upwards at the top ratings. This suggests a tendency to place slightly more extreme values on scenes of very low or very high scenic quality, a phenomenon which is common in surveys of this nature[1].

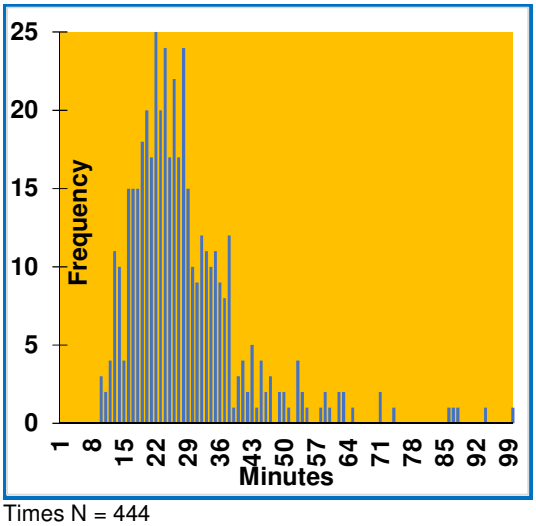


Ratings analysis

Figure 6.12 Distribution of respondent means and standard deviations

Time taken to complete survey

The spreadsheet that recorded the ratings of participants also included the time they commenced and completed the survey. The times of those who completed all 98 scenes, plus the 15 who completed 97 scenes, a total of 444 participants, were analysed.



Times N = 444

Figure 6.13 Histogram of elapsed periods for rating scenes

The mean time period was 28 minutes with a fairly large standard deviation of nearly 13 minutes, the spread of which is reflected in Figure 6.13. The fastest time was 10 minutes which three accomplished, and a further 31 completed it within 11 – 15 minutes. Thirteen took more than an hour to complete it.

Strategic bias

Strategic bias occurs where the participant seeks to use the survey to promote his or her own objectives, instead of that of the survey. In a study involving only the rating of scenic quality, ratings which are 1 or 10 on a 1 - 10 scale may indicate strategic bias, where the participant is attempting to use the survey to either diminish or promote the perceived scenic quality of the area according to their interests.

The survey ratings were therefore examined to identify participants showing possible strategic bias. In this survey where participants were also asked to rate the acceptability of the wind farm in the scene in addition to rating the scenic quality of the scene, there is an additional source of possible strategic bias. This might occur where participants rated all the scenes very acceptable or very unacceptable, depending on their attitude to wind farms. A person who likes wind

1. *Pers. comm.* Prof. Terry Daniel, Department of Psychology, University of Arizona.

farms may rate most if not all scenes with wind farms as acceptable or very acceptable and may also rate highly the landscapes in which they are located. Conversely a person who dislikes wind farms may rate most scenes with wind farms as unacceptable or very unacceptable and rate the scenes with wind farms very low on the 1-10 scale.

Three types of ratings may be differentiated:
Type A: Scenes with a wind farm were rated either Very Acceptable or Very Unacceptable and the scenic quality was rated as 10 or 1 respectively on the 1-10 scale.
Type B: Scenes with a wind farm were rated either Very Acceptable/Acceptable or Very Unacceptable/Unacceptable and the scenic quality was rated 8 - 10 or 1 - 2 respectively on the 1 - 10 scale.
Type C: Most scenes were Very Acceptable/Acceptable or Very Unacceptable/Unacceptable but the ratings of the landscape quality varied across the 1 – 10 scale.

The following lists the ratings by type. The caption, #200, refers to the line in the spreadsheet.

Type A

Very Acceptable

#200 49 scenes with wind farms rated very acceptable and all 98 scenes rated 10.
#298 49 scenes with wind farms rated very acceptable and all 98 scenes rated 10.
#333 49 scenes with wind farms rated very acceptable and all 98 scenes rated 10.
#446 45 scenes with wind farms rated very acceptable and 89 scenes rated 10.
#505 45 scenes with wind farms rated very acceptable and 92 scenes rated 10.
#566 49 scenes with wind farms rated very acceptable and 97 scenes rated 10.
#572 49 scenes with wind farms rated very acceptable and 98 scenes rated 10.
#576 49 scenes with wind farms rated very acceptable and 49 scenes rated 10.
#628 49 scenes with wind farms rated very acceptable and 79 scenes rated 10.
#805 45 scenes with wind farms rated very acceptable and 47 scenes rated 10.

These ten participants rated virtually all scenes as Very Acceptable and most rated the scenic quality of all scenes as 10 regardless of whether they included wind farms or not. They simply chose the same rating number for all scenes. These ratings provided no discrimination of the landscape on the basis of the presence of the wind farm.

Very Unacceptable

#130 48 scenes with wind farms rated very unacceptable and rated 1. 48 scenes without wind farms rated 10.
#208 49 scenes with wind farms rated very unacceptable and rated 1.
#221 48 scenes with wind farms rated very unacceptable and rated 1.
#279 47 scenes with wind farms rated very unacceptable and rated 1.
#300 46 scenes with wind farms rated very unacceptable and 45 scenes rated 1.
#305 48 scenes with wind farms rated very unacceptable and rated 1.
#440 47 scenes with wind farms rated very unacceptable and rated 1.
#553 46 scenes with wind farms rated very unacceptable and 48 scenes rated 1.
#619 49 scenes with wind farms rated very unacceptable and 38 scenes rated 1, 44 scenes rated 10.
#631 41 scenes with wind farms rated very unacceptable and rated 1.
#732 41 scenes with wind farms rated very unacceptable and rated 1, 39 scenes rated 10.
#752 46 scenes with wind farms rated very unacceptable and 38 scenes rated 1.
#787 48 scenes with wind farms rated very unacceptable and 59 scenes rated 1 & 32 scenes rated 10.

These 13 participants rated most scenes with wind farms as Very Unacceptable and rated them as 1. Several participants also rated most scenes without wind farms as 10. Unlike the previous group that rated all scenes the same, this group showed greater discrimination and did not apply the same rating to scenes with and without wind farms.

Type B

Very Acceptable/Acceptable

#124 49 scenes with wind farms rated acceptable. 93 scenes rated 9.
#140 44 scenes with wind farms rated very acceptable. 47 scenes with wind farms rated 9.
#571 49 scenes with wind farms rated very acceptable and 98 scenes rated 8.
#606 46 scenes with wind farms rated very acceptable and 87 scenes rated 9.
#633 49 scenes with wind farms rated acceptable and rated 10.

#643 49 scenes with wind farms rated acceptable and 94 scenes rated 8.
#672 48 scenes with wind farms rated very acceptable and 49 scenes rated 8 & 49 scenes rated 9.
#689 49 scenes with wind farms rated acceptable and 97 scenes rated 8.
#812 47 scenes with wind farms rated very acceptable and 90 scenes rated 9.

These nine participants rated the scenes with wind farms as acceptable or very acceptable and 7 of the 8 rated all scenes the same regardless of whether or not they contained a wind farm.

Very Unacceptable/Unacceptable
No participants.

Type C
Very Acceptable/Acceptable with varied ratings 32 participants.
Very Unacceptable/Unacceptable with varied ratings 1 participant.

A considerable number of participants rated the scenes with wind farms as Acceptable or Very Acceptable but provided a range of scenic quality ratings for the scenes. They thus provided greater discrimination of scenes on the basis of whether or not they contained a wind farm.

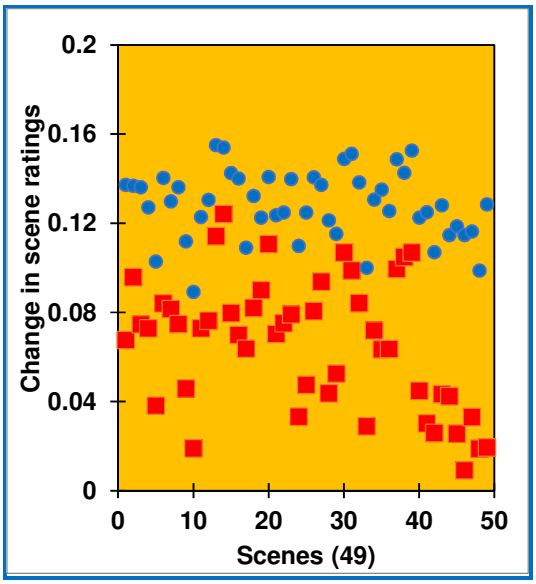
Evaluation

The paired two sample T test was used to assess the significance of the differences between the original data set and that with the multiple Acceptable and Unacceptable ratings removed.
Very Acceptable & Acceptable
With wind farm: $t = 58.64$, $df = 48$, $p < 0.000$
Without wind farm: $t = 15.86$, $df = 48$, $p < 0.000$
Very Unacceptable
With wind farm: $t = 67.51$, $df = 48$, $p < 0.000$
Without wind farm: $t = 18.48$, $df = 48$, $p < 0.000$

The T test indicated that all four options were statistically significantly different. However, they were also highly correlated - Pearson Correlation = 0.999959 which suggests close similarity between the options.

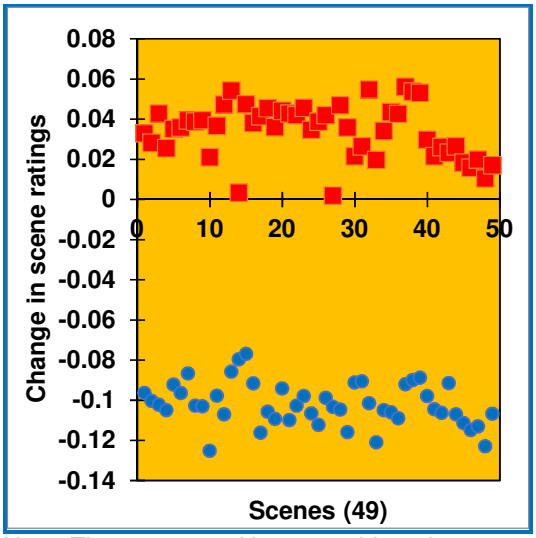
Before deciding whether or not to omit some or all of these ratings, an analysis was conducted of the effect of their removal on the overall ratings. If their removal resulted in the mean rating shifting say 1 unit on the 1 – 10 scale, then this would be regarded as a major change. In other words, the strategic bias apparent in these ratings would have had the participant's desired effect of changing the overall results.

Each of the scenes was analysed to assess the effect on their means of deleting the Very Acceptable/Very Unacceptable and Acceptable/Unacceptable ratings. Figures 6.14 and 6.15 display the change in ratings of each of the 49 scenes with the wind farm following the deletion of the potentially strategic bias Very Acceptable/ Acceptable and Very Unacceptable ratings.



Strategic bias.
Note: Blue - with wind farm, Red - without wind farm

Figure 6.14 Change of rating of scenes by deleting Types A & B Very Acceptable & Acceptable from scene ratings



Note: There were no Unacceptable ratings
Blue - with wind farm, Red - without wind farm

Figure 6.15 Change of rating of scenes by deleting Type A Very Unacceptable from scene ratings

These changes are summarised by Table 6.2 which shows the means for each of the changes. The largest change, that of deleting both the Very Acceptable and Acceptable from scenes with wind farms changed the rating by 0.128, a change of only 2.3%. This is considered a relatively minor change.

Table 6.2 Effect of deleting Type A & B Very Acceptable & Acceptable from scene ratings

	Delete VA/A	Delete VA
With wf	0.128	0.081
% change	2.32	1.47
Without wf	0.066	0.03
% change	1.06	0.62
	Delete VUA	Delete UA
With wf	-0.101	-
% change	-1.81	-
Without wf	0.034	-
% change	0.53	-

Strategic bias
Note: There were no Type B Unacceptable

Given that these respondents have taken the time to participate in the survey and that the effect of their strategic bias is minor, albeit statistically significant, their ratings were included in the survey analysis.

Scene format

The scenes used in the survey were in two formats, 34 with standard format and 16 of spliced photos which used a rectangular format. The mean of the standard format was 5.684 and that for the rectangular format was 5.671, a difference of only 0.0126. Comparing the two sets of data using the paired two sample t test found no significant difference in the ratings between the two formats: t = 0.40, df = 705, p = 0.34.

Summary: Data set

Assembly of the data set involved the following steps:

- The survey resulted in 848 participants with 444 completing it and 69 not rating any scenes.
- Because the survey was randomised, the actual number of participants who rated scenes was higher than 444, ranging from 510 to 545 participants for each scene with a mean of 527. This provided a confidence interval of 0.043 at 95% confidence level.
- The data set used for analysis, however, was the full set of 848 minus the 69 participants who rated no scenes, a net of 779 participants. This provided a confidence interval of 3.51, i.e. 0.035 at the 95% confidence level.
- Histograms and QQ plots of the ratings for scenes and participants indicated reasonably normal distributions.
- There were over 30 participants who displayed strategic bias in their ratings. If in favour of wind farms, they rated the scenic quality of all or most scenes as 10 and rated them all as very acceptable or very acceptable. If opposed to wind farms, they rated all or most scenes 1 and rated them all as unacceptable or very unacceptable. The effect of deleting these ratings was found to be statistically significant. However, their deletion changed the mean ratings by between 0.03 and

0.13 which is considered minor Therefore these ratings were retained in the data set.

- There was no significant difference in the ratings of scenes with the standard format and a rectangular format.

6.3 PARTICIPANT CHARACTERISTICS

The demographic characteristics of participants were examined using the data set of 779 participants.

Table 6.3 summarise the characteristics of the survey participants. Many more males than females participated, 83% of participants were in the 45+ age groups, 81% were born in Australia, and 59% had either a degree or higher degree.

Table 6.3 Demographic characteristics of participants

Categories	Number	%
Gender		
Female	282	36.20
Male	496	63.67
Age		
18 – 24	7	0.90
25 – 44	122	15.66
45 – 64	356	45.70
65+	294	37.74
Birthplace		
Born in Australia	629	80.74
Not born in Aust.	150	19.26
Education		
No qualification	74	9.50
Diploma or Cert.	232	29.78
Degree	205	26.32
Higher degree	252	32.35

Demography. N = 779

Tables 6.4 – 6.10 provide cross-tabulations between age, gender, education, and birthplace. These are discussed below.

Table 6.4 Age vs gender

	18 – 24	25 – 44	45 – 64	65+
Female	2	48	136	96
Male	5	73	220	198
Total	**7**	121	356	294

Table 6.5 Age vs education

	18-24	25-44	45-64	65+
No qualification	1	3	29	41
Diploma/Certificate	1	25	123	83
Degree	5	46	86	68
Higher Degree		48	113	91
Total	**7**	**122**	**353**	292

Table 6.6 Qualifications vs gender

	Female	Male
No qualification	22	52
Certificate or Diploma	79	152
Degree	80	125
Higher Degree	97	155
Total	**280**	**491**

Table 6.7 Age vs birthplace

	18-24	25-44	45-64	65+
Born in Australia	7	95	300	227
Not born in Aust.		27	56	67
Total	**7**	**122**	**353**	**292**

Table 6.8 Gender vs birthplace

	Female	Male
Born in Australia	237	391
Not born in Aust.	45	105
Total	**282**	**496**

Table 6.9 Age vs residence

	18-24	25-44	45-64	65+	Total
Qld		8	50	49	107
NSW	3	46	129	56	234
ACT		3	6	29	38
Vic		31	70	52	153
Tas	1	3	7	5	16
SA	3	24	77	95	199
WA		4	14	7	25
NT		1	2		3
Total	**7**	**122**	**356**	**294**	**779**

Table 6.10 Gender vs residence

	Female	Male
Qld	38	69
NSW	96	137
ACT	14	24
Vic	55	98
Tas	3	13
SA	71	128
WA	3	22
NT	1	2
Total	**282**	**496**

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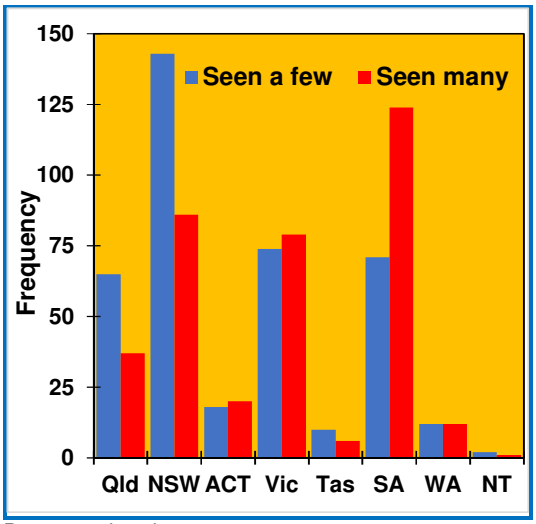
Familiarity with wind farms

Table 6.11 and Figure 6.16 indicate the familiarity of respondents with wind farms. The majority had seen a few or many wind farms while a few stated they had seen none.

Table 6.11 Familiarity with wind farms

	Never seen one	Seen a few	Seen many	Total
Qld	4	65	37	107
NSW	5	143	86	234
ACT		18	20	38
Vic		74	79	153
Tas		10	6	16
SA	3	71	124	199
WA		12	12	25
NT		2	1	3
Total	**12**	**396**	**368**	**779**

Plus 3 not stated



Demography-pivot

Figure 6.16 Familiarity with wind farms

Table 6.12 Attitude towards wind farms vs familiarity

	Never seen one	Seen a few	Seen many
Against (59)	16.67	6.28	9.35
In favour (508)	41.67	65.97	70.82
It depends (182)	41.67	27.75	19.83
Total	**100.00**	**100.00**	**100.00**

Table 6.12 and Figure 6.17 compare with familiarity with their attitude towards wind farms. They indicate that over two-thirds of participants were in favour of wind farms and less than 8% were opposed to them. Of those against wind farms, 41% had seen a few and 56% had seen many. Of those in favour, half had seen a few and half had seen many wind farms.

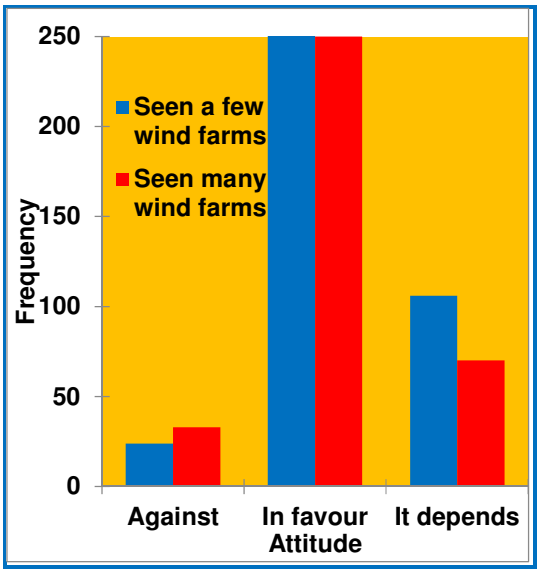


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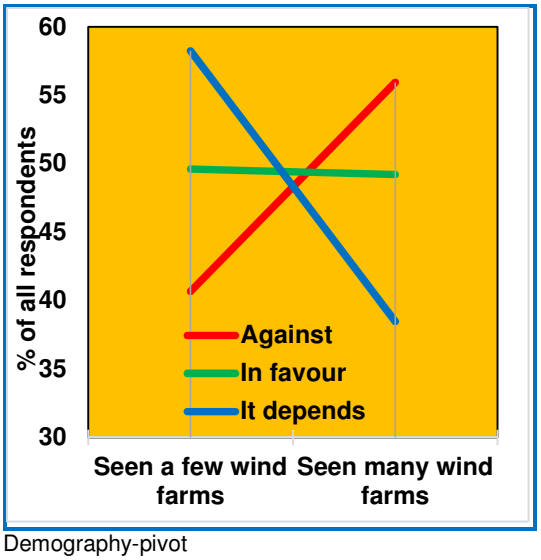
Figure 6.17 Attitude towards wind farms



Demography-pivot

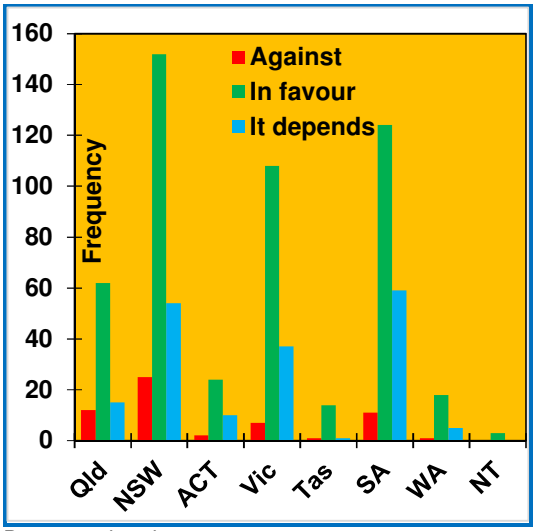
Figure 6.18 Change in attitude with familiarity of wind farms

Table 6.13 and Figure 6.19 compare attitudes by State and Territory and indicates strong support in NSW, Victoria and South Australia, the states with the most wind farms.

Table 6.13 Wind farm attitude State & Territory

	Against	In favour	It depends	Total
Qld	12	62	15	89
NSW	25	152	54	231
ACT	2	24	10	36
Vic	7	108	37	152
Tas	1	14	1	16
SA	11	124	59	194
WA	1	18	5	24
NT		3		3
Total	59	508	182	749

Plus 4 not stated



Demography-pivot

Figure 6.19 Attitude towards wind farms by State & Territory

In summary, most respondents had seen a few or many wind farms, with the few (12) who had never seen one being the most opposed to them. Over two-thirds of respondents were in favour of wind farms and less than 8% were opposed to them. The proportion in favour increased with the number seen – of those who had seen a few, 66% were in favour but for those who had seen many, 71% were in favour. The strongest support for wind farms was in NSW, Victoria and South Australia, the states with the most wind farms.

Respondent characteristics vs attitude

Tables 6.14 – 16 and Figures 6.20 and 6.21 examine the influence of respondent characteristics on attitudes towards wind farms. These indicate that twice as many males as females were against wind farms, that the 18-24 age group were the most equivocal about wind farms with a large proportion saying 'it depends', and those with no qualifications had the highest proportion against wind farms.

Table 6.14 Influence of gender on attitudes towards wind farms (%)

	Female	Male
Against	4.01	10.13
In favour	71.90	65.61
It depends	24.09	24.26
Total	100	100

Table 6.15 Influence of age on attitudes towards wind farms (%)

	18-24	25-44	45-64	65+
Against		2.52	6.61	12.00
In favour	42.86	77.31	62.93	70.55
It depends	57.14	20.17	30.46	17.45
Total	100	100	100	100

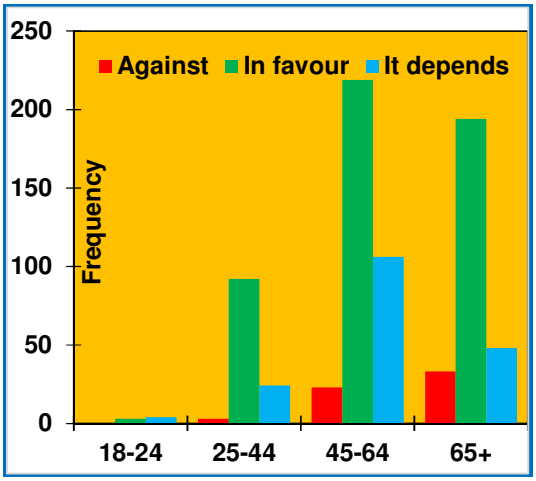


Figure 6.20 Influence of age on attitudes towards wind farms

Table 6.16 Influence of education on attitudes towards wind farms (%)

Education	Against	In favour	It depends	Total
No qualification	20.00	67.14	12.86	100
Certificate or Diploma	8.48	62.95	28.57	100
Degree	5.56	67.68	26.77	100
Higher Degree	6.22	71.78	21.99	100

Plus 16 not stated

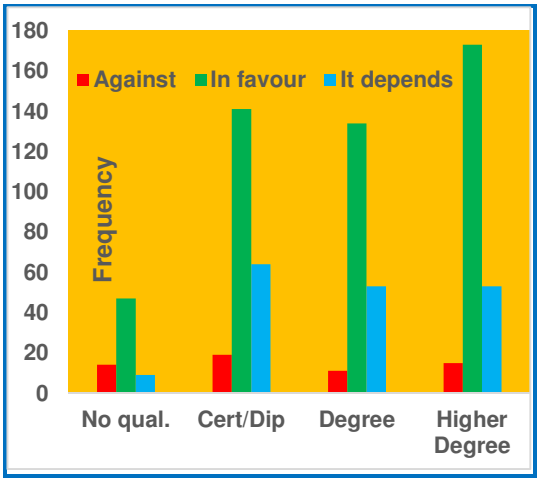


Figure 6.21 Influence of education on attitudes towards wind farms

From these data the following can be drawn:

- The majority of participants were males aged 45 and above. Many participants had degrees and higher degrees
- The largest cohort of under 45 participants were from NSW (46), Victoria (31) and South Australia (24).
- A small number of participants (12) claimed to have never seen a wind farm.
- Familiarity with wind farms was highest in those States with many of them – NSW, Victoria and SA, though surprisingly quite high in Queensland. However, opposition to wind farms increased with the number seen while those in favour remained constant regardless of the number seen. Those who say 'it depends' decreased with familiarity.
- The largest number opposed to wind farm were in NSW and Queensland.
- Twice as many males as females were against wind farms.
- Age played a role with the main opposition coming from the 45 years and older cohort. The 18-24 age group were the most equivocal about wind farms with a large proportion saying 'it depends'.
- Education plays a role in opposing wind farms as 20% of those without qualification were against them compared with between 5.6% and 8.5% for those with more education.

6.4 COMMENTS ON FAMILIARITY WITH WIND FARMS

These comments followed the question on whether the participant had seen some or many wind farms or none at all. Seventy participants provided comments (Appendix 4).

Many of the comments were where they had seen the wind farms – various Australian States, and in Germany, Spain, Denmark, eastern Europe, UK, and China.

Some criticised their visual impact:

- They are a blight on the vista of the land
- Consider them a blot on the landscape
- I was so angry how they have visually damaged the landscape
- Successfully fought the Jupiter wind farm for four years. Recommended rejection primarily on VI grounds, although develop(er) withdrew the DA this week
- They are ugly and horrible

Others provided positive comments:

- Personally I am an environmentalist so I think they are great
- Initially I found their presence intrusive but I now like their presence.
- Love them. They are mesmerising
- I am environmentally in favour of them
- I think they look quite attractive, especially in certain light and weather conditions.
- They are very elegant
- Wind farms look far better than smoking fossil fuel power stations and huge holes left after coal mining!

A few had worked on getting wind farms established:

- Carried out wind monitoring in the early 90's on the Monaro for the purpose of understanding the availability of usable wind in the region.

- I am a town planner and have sought planning permission for wind farms on behalf of developers

6.5 COMMENTS ON BEING IN FAVOUR OR AGAINST WIND FARMS

The question on whether the participant was in favour or against wind farms also provided a let-out option – "It depends". These comments resulted. There were 285 comments indicating the popularity of being provided the opportunity of commenting further. The comments are in Appendix 5.

The comments covered the following areas with the number of comments on each. Many participant's comments covered several areas (Table 6.17).

Table 6.17 Comments on the favourability of wind farms

Subject area	Comments
Energy related / clean green energy/ Coal alternative/ Sustainability/CO2	147
Landscape/visual impact/bird impacts/noise/health	87
Cost, subsidy, efficiency & effectiveness, cost-benefit	14
Location	62
Other	19
Total	349

Energy related / clean green energy/ coal alternative/sustainability/CO2

For the majority, this was the main issue and covered strong support for renewable energy, ending coal fired generation with its CO_2 emissions and the need to address climate change and sustainability. A minority were happy with conventional power sources. Comments included the following:

- "Free" energy such as wind, thermal, solar, tidal, hydro, coal fired/gas etc., are part of our available solution to our insatiable hunger for energy.
- I live beside a coal fired power station and associated coal mine and you want to whinge about a wind farm.
- We should be increasing clean, non-fossil fuel energy production because of global warming
- I prefer coal-based electricity.
- Wind farms provide renewable energy that, when coupled with storage ability can provide clean, sustainable power production. Obviously, they need to be integrated well with the overall power supply system.
- Need to phase out fossil fuels.
- We can't do without them if there is to be any hope coping with climate change.
- Ugly and we need to save power go to bed earlier, no night footy or cricket, no street light plenty of savings.

Landscape/visual impact/bird impacts/ noise/ health

Landscape related issues were the second most prominent and while most were concerned about their visual impact, others raised issues of bird impacts and noise. There were 50 comments against their visual appearance compared with 25 who had positive comment about their appearance.

- Mostly in favour as in opinion that development in renewables are far more important than an aesthetic pleasure of visual impacts. Also bearing in mind similar visual impact of Open Cast Coal mine, hydrology or even electricity grid system impact on general landscapes / environment /air qualities etc.
- Wind farms provide an environmentally friendly source of energy. If we keep burning coal for energy we won't have any nice scenery to look at in future anyway! I don't think they detract too much from the landscape but they are necessary for future energy supplies.
- Highly environmentally-friendly.
- I reckon they are an eye sore on the land.
- Look better and have less air pollution than coal.
- Environmentally destructive and visually ugly.
- Visual and sound pollution. Drives cattle mad. (they don't)

- They are very ugly and I have serious concerns about the impact low frequency has on animals and humans.
- Good for the planet and i think they are beautiful. Health concerns are a beat up if you ask me!
- Generally in favour but if they ruin or transform the landscape I would be not in favour.
- Detrimental impact on high scenic quality areas should be avoided.
- Visually they are imposing and intimidating; while fascinating and eye catching they are ugly and menacing at the same time. Like speed skaters in their tight suits: very athletic, but reptilian to look at watch with their ungainly arm movements. The world can do better than destroy the visual environment in this way.

Cost, subsidy, efficiency, cost-benefit

Apart from questioning their cost and the amount of resources needed to establish them, there was some recognition of the need to balance costs and benefits, that their clean energy benefits may outweigh their economic and environmental costs. Concern was expressed about subsidising them, forgetting that conventional energy sources are also heavily subsidised.

- I am not convinced of any long-term benefits, economically, of unsubsid-ised wind farms. Depends on total cost /benefit analysis - not sure of ALL costs etc involved.
- I'm generally in favour, if the business case stacks up.
- They are inefficient money pits.
- They are usually located in rural areas in localities where there is a high probability of low to mid-range air movement. Hence they generally do not have a highly negative impact on the majority of the population. The value they provide, in my opinion, outweighs the possible negative impacts.
- Heavily subsidised. Power bills go up more.
- Cheap form of energy.
- Erratic top up of supply.
- I am in favour but not if govt subsidised.
- Ugly, costly, not economical, unreliable, etc.

Location

While a number of participants merely wrote “location” without further explanation, some went on to explain the issues that should be considered in locating wind farms. These included the following comments.

- A lot of wind farms aren't out of place, but then a lot are.
- Located away from people's view & living space seems best.
- Location in relation to people, towns, houses, farms.
- Depend on location and proximity to other amenities and environmental assets.
- Some that are very close to roads, I find distracting - they draw attention away from the road – e.g. just southwest of Goulburn on the Hume Hwy.
- Appropriate location without visual impact.
- Okay in remote rural areas not near farmers or communities.
- As long as the farm is far away from the community it will be fine.

Other

In addition to the above comments, some participants did not have an opinion one way or another, other were concerned about dividing communities, some landowners wanted the income from wind farms, and some were concerned that it took more energy to produce them than what they would generate (in fact they pay their energy back in 6 months).

- Divides communities. How many do you want?
- Where they are manufactured and the manufacturing process.
- Not particularly for or against them.
- I would like to have wind farms on our property they look graceful and the income would be great.

- Global Warming and its latest manifestation "Climate Change" is the biggest hoax ever. Wind farms, supposedly produce "green energy" and only exist because of massive subsidies, …
- I think they are good.

6.6 COMPARISON WITH THE AUSTRALIAN POPULATION

One of the purposes of gathering respondent data was to ascertain the representativeness of the survey's participants by comparison with the Australian community. This was examined with respect of age, gender, birthplace and education. Data from the 2016 Census was used for comparison. Chi tests (χ^2) were used to assess the significance of the differences between the survey participants and the Australian population.

Age

Compared with the Australian community, the age distribution of survey participants had fewer young people and young adults and a higher proportion of middle aged and older people (Table 6.18). The differences between the participants and the Australian community were statistically significant: χ^2= 329.17, df 3, p < 0.000.

Table 6.18 Age distribution of participants

Age	Survey %	Australia %
18 - 24	0.90	11.79
25 - 44	15.66	35.80
45 - 64	45.70	32.20
65+	37.74	20.21

Demography

Gender

The survey's gender balance was heavily skewed toward males – the opposite of the community (Table 6.19). The difference between the participants and the Australian community was significant: χ^2 = 65.02, df =1, p < 0.000.

Table 6.19 Gender of participants

	Survey %	Australia %
Females	36.20	50.7
Males	63.67	49.3

Birthplace

The majority of survey participants were born in Australia and this was a higher proportion than in the Australian community (Table 6.20). The differences in birthplace were significant: χ^2 = 18.44, df = 1, p < 0.000.

Table 6.20 Birthplace of participants

	Survey %	Australia %
Born in Australia	80.74	74
Not born in Australia	19.26	26

Education

A much higher proportion of the participants, 58.67%, had tertiary education compared with 22% in the general community, (Table 6.21). The differences in education between the participants and the Australian community were significant: χ^2 = 163.04, df =3, p < 0.000.

Table 6.21 Educational attainment

Education	Survey %	Australia %
No qualification	9.50	50.35
Dep/Cert	29.78	27.68
Degree	26.32	15.14
Higher Degree	32.35	6.82

Summary – Participant characteristics

The age, gender, birthplace and education of participants were all statistically significantly different from the Australian community.

Overall the survey participants were better educated, with more middle aged and elderly, more males and more Australian-born than the Australian community.

Given that the survey respondents differed significantly from the community, do these differences matter? Is it critical

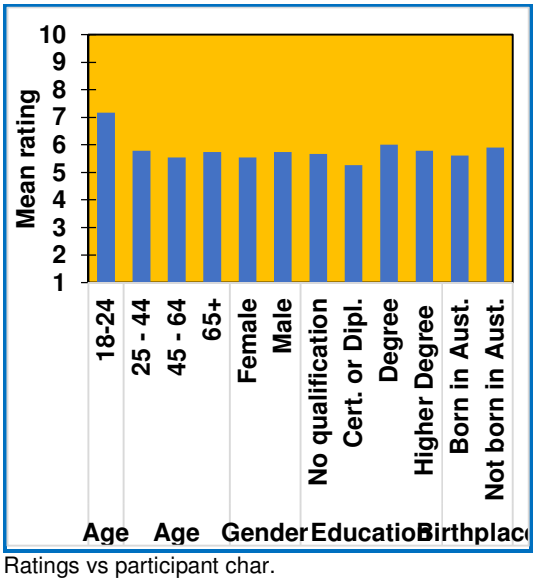
that the sample reflect the characteristics of the wider community?

If these differences affected results it would be expected that the means across the range of respondent characteristics would show this, e.g. different ratings for different age groups. Table 6.22 displays the means across participant characteristics and demonstrates their close similarity.

Table 6.22 Mean ratings by participant characteristics

Category	Categories	Mean rating
Age	18-24	7.17
	25 - 44	5.79
	45 - 64	5.55
	65+	5.74
Gender	Female	5.55
	Male	5.74
Education	No qualification	5.67
	Cert. or Dipl.	5.26
	Degree	6.00
	Higher Degree	5.78
Birthplace	Born in Aust.	5.61
	Not born in Aust.	5.91

Ratings vs participant char.
Note:18-24 age group was only 7 persons.

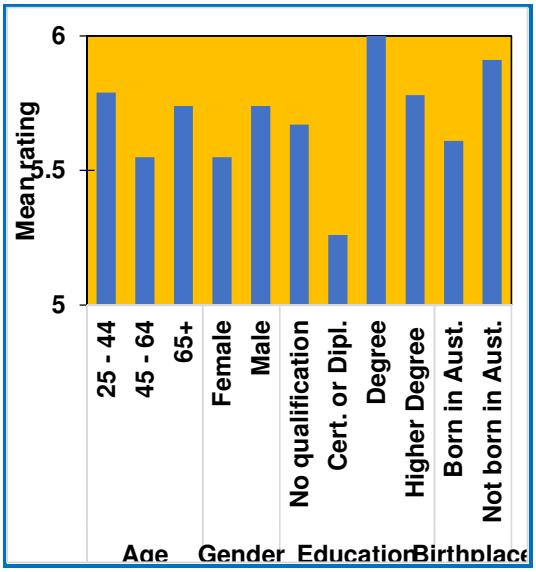


Ratings vs participant char.
Note:18-24 age group was only 7 persons.

Figure 6.22 Mean average ratings by participant characteristics

Because the 18 – 24 age group had only seven persons, their mean is not comparable with those of other groups. Leaving out that age group, the span is a reasonable 0.74 (5.26 to 6), a difference of 7.4% over the 1 – 10 scale. Figure 6.22 indicates the similarity of average ratings across the different respondent characteristics. The similarities are far greater than the differences.

Figure 6.23 exaggerates the scale to highlight the differences. Although these means are for the entire data set, if there were major differences between the participants, then this would be evident in the ratings.



Note:18-24 age group omitted

Figure 6.23 Ratings – exaggerated scale

6.7 INTERNET ACCESS

Internet access for Australia in 2016/17 was 86% of households[2]. Access in urban areas was 86.3% and only slightly less, 84.1%, in rural areas indicating that rural residence was not a handicap for participating in the survey.

6.8 RATINGS BY PARTICIPANT CHARACTERISTICS

In this section, the influence, if any, of participant characteristics on their ratings

2. ABS, 2018. *Household Use of Information Technology, Australia, 2016/17*, 8146.0.

is examined. It covers gender, age, education and birthplace. (Spreadsheet: Ratings vs participant char.)

Gender

Table 6.23 compares the mean ratings by gender and indicates that females rate scenes on average 8% higher than males.

Table 6.23 Mean ratings by gender

Gender	With wf	Without wf
Female	6.02	7.14
Male	5.47	6.75
% difference	10.04	5.67

Ratings vs participant char.

The assessment of the ratings with and without the wind farm found significant differences between males and females:

With wind farm. Males & females
t =3.42, df = 279, p < 0.000.
Without wind farm. Males & females
t =1.65, df = 278, p = 0.049

Comparing the ratings by gender of scenes with and without wind farms also found significant differences:

Females with and without wind farm
t = 8.03, df = 276, p < 0.000
Male with and without wind farm
t = 10.94, df = 478, p < 0.000

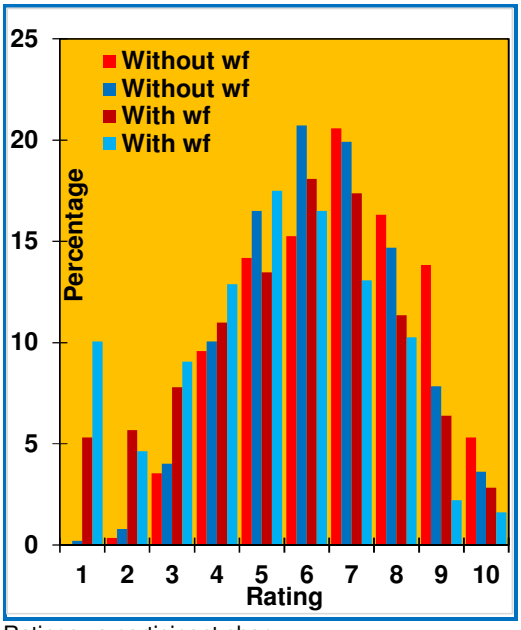
Table 6.24 Number of mean ratings by gender

Rating	With wf	Without wf	With wf	Without wf
	Female	Female	Male	Male
1	15	0	50	1
2	16	1	23	4
3	22	10	45	20
4	31	27	64	50
5	38	40	87	82
6	51	43	82	103
7	49	58	65	99
8	32	46	51	73
9	18	39	11	39
10	8	15	8	18
na	2	3	11	8
Total	282	282	497	497

Ratings vs participant char

This means that the ratings by men and women of scenes with wind farms were significantly different.

Figure 6.24 and Table 6.24 summarise the ratings by gender.



Ratings vs participant char

Figure 6.24 Mean ratings by gender

Age

Table 6.25 and Figure 6.25 summarise the ratings by age group for males and females..

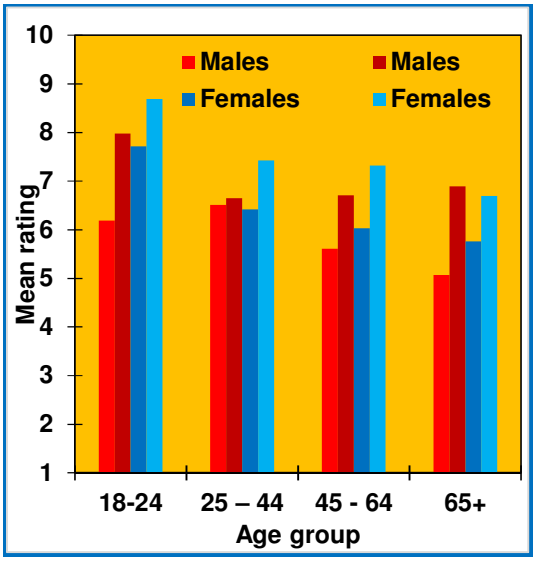
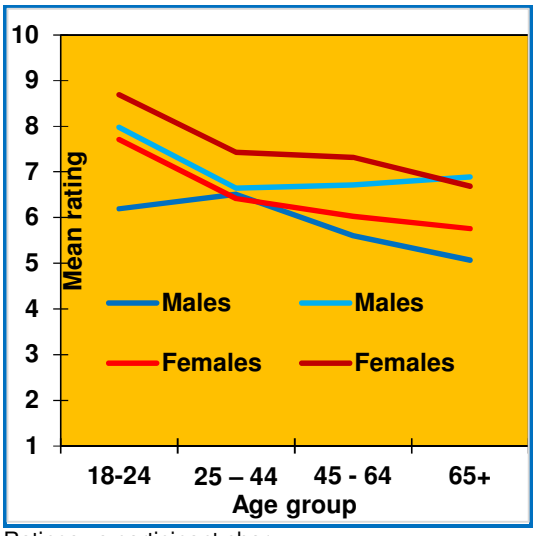


Figure 6.25 Ratings by age group

Table 6.25 Ratings by age group

Gender	Age	With WF	Without wf
Females	18 - 24	7.71	8.69
	25 – 44	6.42	7.44
	45 - 64	6.03	7.32
	65+	5.77	6.69
Males	18 - 24	6.19	7.98
	25 – 44	6.51	6.65
	45 - 64	5.61	6.71
	65+	5.07	6.90

The 18 – 24 group had only 7 participants Hinted at in Table 6.26 but made clear in Figure 6.26 is that ratings decrease with age, in other words, the ratings of scenes are actually lower for older people than for those younger. Even if the 18 – 24 age group is ignored because its numbers are small (7), there is still an apparent decline from the 25-44 age group onwards with the exception of males rating the scene without wind farms.



Ratings vs participant char

Figure 6.26 Decrease in ratings with age

From the age group 25 – 44 to 65+, and omitting the males without wind farms group, the average decline in ratings of the three other groups was 0.95, i.e. nearly one unit. The difference in rating between the 25-44 group and the 65+ group for males and females combined was statistically significant: F = 23.32, df = 1,139, p <0.000.

The data on age was separated by gender and the t test used to determine the significance of any differences in each age group.

Females compared with males
With wind farm
18 – 24 age – too few data
25 – 44 age F = 0.08, df = 1, 116, p = 0.76
45 – 64 age F = 6.10, df = 1, 246, p = 0.01
65+ age F = 6.28, df = 1, 232, p = 0.01
Without wind farm
18 – 24 age – too few data
25 – 44 age F = 7.91, df = 1, 114, p = 0.005
45 – 64 age F = 11.12, df = 1, 246, p < 0.000
65+ age F = 0.74, df = 1, 232, p = 0.39

These results indicate that the difference in ratings between females and males was statistically different (i.e. p < 0.05) for four of the six age groups.

Education

Table 6.26 compares the ratings by education level and indicate that while the ratings of scenes with wind farms were broadly similar, the rating of scenes without wind farms decrease with higher education. In other words, for scenes without wind farms, people with higher education tended to rate them lower than people with lesser education.

Table 6.26 Ratings by education

Education	With wf	Without wf
No qualification	5.66	7.35
Cert. or Diploma	5.87	7.26
Degree	5.77	6.79
Higher Degree	5.34	6.48

People with higher education also had the lowest rating of scenes with wind farms.

The paired two sample t test comparing the ratings with and without wind farms for each qualification indicated that the difference in ratings was statistically significant at all education levels.

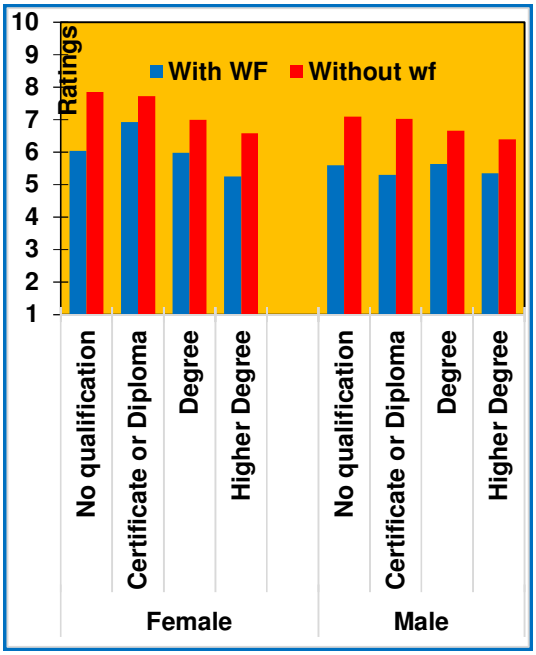
No qualification t = 5.20, df = 71, p <0.000
Cert. or Diploma t = 7.73, df = 224, p <0.000
Degree t = 6.36, df = 198, p <0.000
Higher degree t = 7.69, df = 247, p<0.000

Table 6.27 and Figure 6.27 breaks down the ratings by gender and indicates that for scenes without wind farms the decrease in

ratings with higher education occurs for both males and females but is greater for females. The decrease for females is 1.27 over the range of qualifications and 0.70 for males.

Table 6.27 Ratings by education & gender

Gender	Qualification	With wf	Without wf
Female	No qualification	6.03	7.85
	Cert. or Diploma	6.92	7.72
	Degree	5.98	6.99
	Higher Degree	5.25	6.58
Male	No qualification	5.59	7.09
	Cert. or Diploma	5.31	7.03
	Degree	5.64	6.66
	Higher Degree	5.35	6.39



Ratings vs participant char

Figure 6.27 Ratings by education & gender

Birthplace

Table 6.28 compares the ratings for participants who were born in Australia with those born overseas.

Table 6.28 Ratings by birthplace

Birthplace	With wf	Without wf
Born in Australia	5.70	6.93
Not born in Australia	5.58	6.74

The difference in birthplace was statistically significant in the ratings:

With wind farm: F = 3051.7, df = 1, 1526, p < 0.000
Without wind farm: F = 7857, df = 1, 1526, p < 0.000

Table 6.29 and Figure 6.28 show the ratings by gender for each birthplace. The differences were statistically significant.

Table 6.29 Ratings by birthplace & gender

Birthplace	Gender	With wf	Without wf
Born in Aust.	Female	6.03	7.14
Not born in Australia	Female	5.97	7.11
Born in Aust.	Male	5.49	6.80
Not born in Australia	Male	5.41	6.59

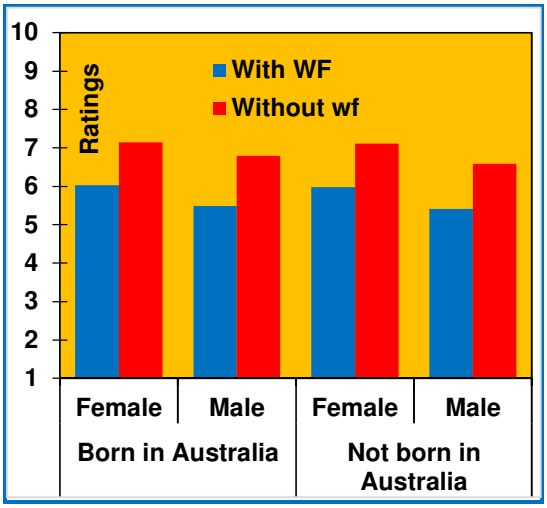


Figure 6.28 Ratings by birthplace & gender

ANOVA indicated the following:

Female, Aust born vs not Aust born, with wf: F = 1316.6, df = 1, 556, p <0.000
Female, Aust born vs not Aust born, without wf: F = 4980.8, df = 1, 555, p < 0.000
Male Aust born vs not Aust born, with wf: F= 4460.2, df = 1, 981, p < 0.000
Male Aust born vs not Aust born, without wf: F = 4886.9, df = 1, 983, p < 0.000

The differences between being born in Australia and overseas were thus

statistically significant for both genders and with and without wind farms.

Multiple regression analysis

Multiple regression was used to assess the contribution of each of the participant components to the ratings that were derived from the survey.

Regression equations:

With wind farm: Y (rating) = 4.398 + 0.53 Age + 0.51 Gender – 0.14 Qualification + 0.14 Birthplace. ANOVA: F = 4.40, df = 4, 750, $p < 0.000$. $R^2 = 0.045$

Without wind farm Y (rating) = 7.10 + 0.156 Age + 0.36 Gender – 0.30 Qualification – 0.07 Birthplace. ANOVA: F = 8.92, df = 4, 750, $p < 0.000$. $R^2 = 0.045$

The algorithms indicate that age and gender were the most important determinants of participant ratings. However, with the very low correlation coefficients of 0.045 indicates that the participant characteristics were not all that important in determining the ratings.

Each of the participant characteristics in turn was examined using multiple regression and again the results were not encouraging (Table 6.30). None of the correlation coefficients was higher than 0.03.

Table 6.30 Regression equations for participant components

	With wind farm	Without wind farm
Age	Y = 4.73 + 0.52 Age	Y = 6.68 + 0.13 Age
Gender	Y = 4.94 + 0.53 Gender	Y = 6.43 +0.36 Gender
Education	Y = 5.98 – 0.10 Education	Y = 7.76 – 0.29 Education
Birthplace	Y = 5.78 – 0.08 Birthplace	Y = 7.17 – 0.22 Birthplace

Ratings vs participant char.

Summary

Age: Older people generally rated scenes lower than younger people, a difference of nearly one unit. There was also a difference between males and females across most of the age groups. The difference between the 25-44 group and the 65+ group for males and females combined was statistically significant.

Gender: There were significant differences between men and women in rating scenes, with women rating scenes 8% higher than men. For each gender there were also significant differences in their rating of scenes with wind farms compared with scenes without them.

Education: While the ratings of scenes with wind farms were broadly similar across education levels, for scenes without wind farms people with higher education tended to rate lower than people with lesser education. The difference in rating of scenes with and without wind farms was statistically significant for all education levels. Older females in particular rated scenes without wind farms slightly lower than males.

Birthplace: Being born in Australia resulted in statistically significant different ratings from those born overseas.

Multiple regression analysis yielded few worthwhile insights of the contribution of the participant characteristics to the ratings.

6.9 APPLYING WEIGHTS TO THE DATA

As identified in section 6.6, the survey sample differed considerably from the Australian population as summarised in Table 6.31.

Table 6.31 Comparison of survey sample and Australian population

Gender	Survey %	Australia %
Females	36.20	50.7
Males	63.67	49.3
Age		
18 - 24	0.90	11.79
25 - 44	15.66	35.80
45 - 64	45.70	32.20
65+	37.74	20.21

Education		
No qualification	9.50	50.35
Dep/Cert	29.78	27.68
Degree	26.32	15.14
Higher Degree	32.35	6.82
Birthplace		
Born in Australia	80.74	74
Not born in Australia	19.26	26

Weighting the data provides a means of addressing this deficiency in the survey results, making statistics computed from the data more representative of the population.

Weighting gender involved the following steps showing for one component[3]:

1) Calculate the weight by gender. The weight is calculated by dividing the national population per gender by the number in the survey.

	2016 Popln	Survey no	Weight
Female	11862432	282	42065.36
Male	11534870	497	23208.99

2) Separate the data into male and female.
3) Insert the weights in a column against each gender
4) Using the Excel count function, code the ratings 1 and where no ratings were made, code them zero.
5) For each scene, calculate the scenic quality rating by the weight; e.g. female rating 42065.36 X 5 rating = 210326. The same calculation is performed for each scene which is quite time consuming on Excel. SPSS has capacity to calculate and apply weights. Do this for both the scenes with wind farms and scenes without.

Resp't	Scenic quality rating	Did respondent provide response?	Rating multiplied by weight	Weight
1	4	1	168261	42065
2	0	0	0	42065
3	7	1	294457	42065

33. The author appreciates the instruction provided by Dr Brian Robertson, Market Decisions Research, Maine, of the weighting process.

6) Sum the totals for each scene as shown below.

	Sum ratings	Sum code 1	Sum rating weight	Sum weights
Sum female	1139	197	47912447	8286876
Sum male	1701	328	39478499	7612550
Sum total	2840	525	87390946	15899426

7) Calculate ratings by dividing sum ratings by sum code 1. Divide the sum rating weight by the sum of weights.

Rating	Unweighted	Weighted
Female	5.78	5.78
Male	5.19	5.19
Total	5.41	5.50

The mean ratings for females and males are the same for the unweighted and weighted but differ in the total; 5.41 unweighted and 5.50 weighted. When only one variable such as gender is weighted, the weighted and unweighted values for male and female will stay the same since each male and female record is merely multiplied by a constant. But the weighting changes the male/female distribution – in this case weighted females count to a greater extent than unweighted females.

8) Derive the ratings for each scene. The table shows the overall results for the survey. The total weighted mean is 0.06 without wind farm and 0.08 with wind farm.

		Unweigh-ted	Weigh-ted	Differ-ence
Without wf	Female	7.08	7.08	0.00
	Male	6.67	6.67	0.00
	Total	6.82	6.88	**0.06**
With wf	Female	5.97	5.97	0.00
	Male	5.39	5.39	0.00
	Total	5.61	5.69	**0.08**

The foregoing example covers only on respondent characteristic, gender. Multiple characteristics - gender, age, education and birthplace. - are difficult to analyse using Excel as it is not possible to do them sequentially as each changes the data set.

As the author does not possess a statistical program such as SPSS which performs weights, the service provided by Spinnaker Research, a Dutch company,

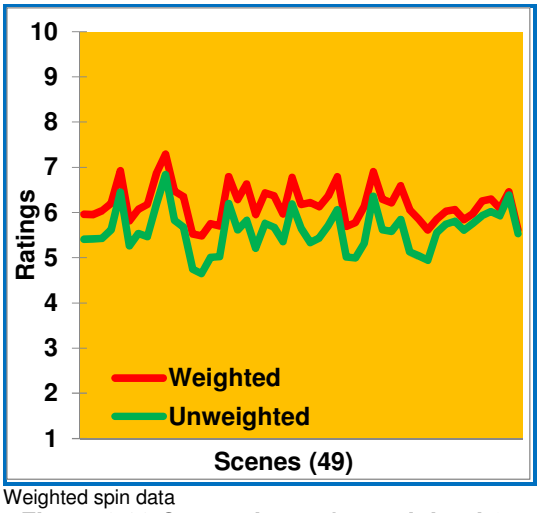
was engaged to carry out multiple weightings on line. They derived the weights per respondent which were then inserted into the Excel file and the weighted data set derived.

Table 6.32 provides a comparison of the unweighted and weighted data for scenes with and without wind farms.

Table 6.32 Comparison of the unweighted and weighted data

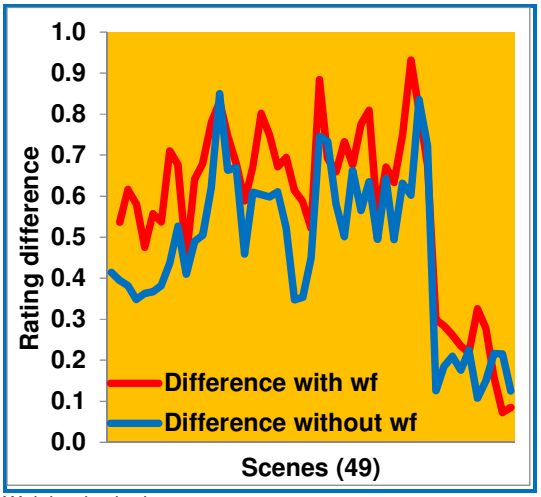
	With wind farm		Without wind farm	
Scenes	Unweighted	Weighted	Unweighted	Weighted
1.2	5.41	5.96	6.56	6.98
3,4	5.41	5.95	5.81	6.21
5.6	5.43	6.04	6.37	6.75
7,8	5.62	6.20	6.61	6.95
9,10	6.45	6.93	7.52	7.89
11,12	5.26	5.82	6.08	6.44
13,14	5.54	6.08	6.00	6.38
15,16	5.47	6.18	6.41	6.84
17,18	6.19	6.87	6.99	7.52
19,20	6.84	7.29	8.02	8.42
21,22	5.83	6.47	6.80	7.29
23,24	5.67	6.35	6.53	7.03
25,26	4.75	5.53	5.54	6.16
27,28	4.65	5.48	5.02	5.87
29,30	5.01	5.75	6.35	7.01
31,32	5.02	5.70	6.42	7.09
33,34	6.20	6.79	6.96	7.42
35,36	5.61	6.28	6.38	6.99
37,38	5.83	6.63	6.29	6.89
39,40	5.21	5.96	5.49	6.08
41,42	5.76	6.43	6.58	7.19
43,44	5.68	6.37	6.25	6.77
45,46	5.35	5.97	6.42	6.76
47,48	6.19	6.78	7.79	8.14
49,50	5.66	6.18	7.13	7.58
51,52	5.33	6.22	6.35	7.09
53,54	5.44	6.13	6.00	6.73
55,56	5.71	6.37	7.37	7.95
57,58	6.06	6.79	7.37	7.87
59,60	5.02	5.69	5.32	5.98
61,62	5.00	5.77	5.73	6.30
63,64	5.32	6.13	6.08	6.72
65,66	6.36	6.91	7.68	8.17
67,68	5.62	6.29	6.57	7.21
69,70	5.58	6.21	6.83	7.33
71,72	5.85	6.60	6.69	7.32
73,74	5.13	6.06	5.87	6.47
75,76	5.05	5.86	5.63	6.46
77,78	4.94	5.62	5.58	6.30
79,80	5.55	5.85	7.52	7.65
81,82	5.74	6.03	8.17	8.36
83,84	5.81	6.07	8.44	8.65
85,86	5.61	5.84	8.01	8.19
87,88	5.76	5.98	8.05	8.28
89,90	5.93	6.26	8.27	8.38
91,92	6.02	6.30	8.68	8.83
93,94	5.93	6.09	8.31	8.52
95,96	6.39	6.46	8.74	8.96
97,98	5.54	5.62	8.77	8.90

Weighted spin data



Weighted spin data

Figure 6.29 Comparison of unweighted & weighted data (with wf)



Weighted spin data

Figure 6.30 Difference between unweighted and weighted data

Figure 6.29 compared the unweighted and weighted data and Figure 6.30 shows the difference between the two datasets. The differences were greater for the scenes with wind farms than those without. Interestingly the differences for the ten coastal scenes were minimal.

Table 6.33 summarises the means for the unweighted and weighted data.

Table 6.33 Means of unweighted and weighted data

Data	Wind farm	Unweighted ratings	Weighted ratings
Mean	With	5.69	6.19
	Without	6.88	7.29
SD	With	0.45	0.40
	Without	0.98	0.85

Weighted spin data

The figures to substitute in the analysis therefore are:

- With wind farm 6.19
- Without wind farm 7.29

Weighted figures for each scene were also used.

Ratings by State

The national rating figures mask differences at the state level. The data was analysed by state and resulted in the following ratings (Table 6.34, Figure 6.31).

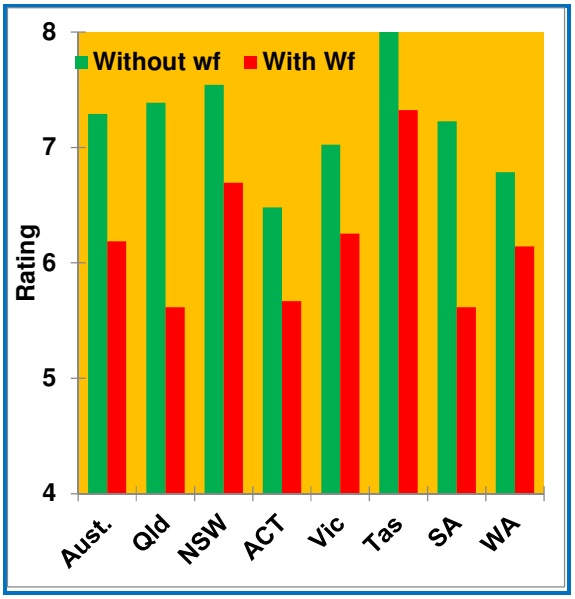


Figure 6.31 Ratings by State

For scenes without the wind farms, Tasmania had the highest ratings followed by NSW and Queensland. These were above the national average while the ACT, Victoria, South Australia and Western Australia were below the national average.

Table 6.34 Ratings by State

		Without wf		With wf	
	N	Mean	SD	Mean	SD
Aust.	779	7.29	0.46	6.19	0.87
Qld	107	7.39	0.36	5.61	0.69
NSW	234	7.54	0.65	6.69	1.23
ACT	37	6.48	2.12	5.67	1.1
Vic	153	7.02	1.09	6.26	0.53
Tas	16	8.07	0.43	7.32	0.87
SA	200	7.23	0.65	5.61	1.31
WA	25	6.79	0.46	6.14	0.87

Note: Excludes NT (3) and Other (4)

For scenes with wind farms, Tasmania again had the highest ratings followed by NSW and Victoria. Victoria, NSW and Tasmania were above the national average while South Australia, Queensland, ACT and Western Australia were below the national average (Figure 6.32).

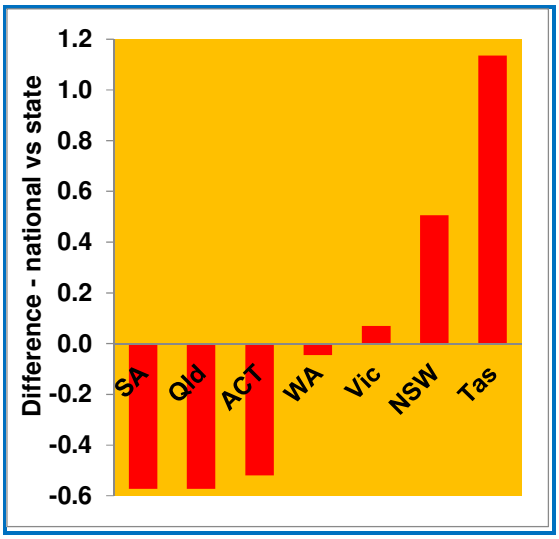


Figure 6.32 Difference in ratings between national mean and state means

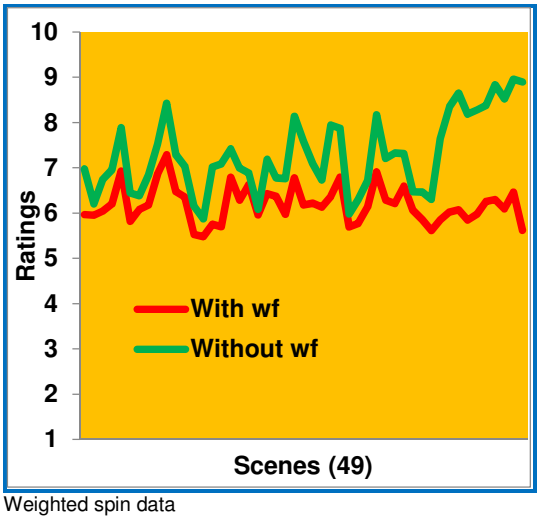
In all cases, both with wind farms and without them, the differences between the national average and the state average were statistically significant (Table 6.35).

Table 6.35 T tests comparing national and state means

	Without wf	With wf
Qld	t = -4.60, df 48, p = 3.08E-05	t= 15.33, df 48, p = 4.01E-20
NSW	t = -6.59, df 48, p = 3.05E-08	t = -23.32, df 48, p = 7.85E-28
ACT	t = 10.55, df 48, p = 4.27E-14	t = 8.16, df 48, p = 1.25E-10
Vic	t = 5.82, df 48, p = 4.67E-07	t = -2.00, df 48, p = 0.051
Tas	t = -5.98, df 48, p = 2.73E-07	t = -10.15, df 48, p = 1.55E-13
SA	t = 2.68, df 48, p = 0.0099	t = 20.88, df 48, p = 9.89E-26
WA	t = 6.28, df 48, p = 9.24E-08	t = 0.76, df 48, p = 0.45

6.10 ANALYSIS OF RATINGS

The following analysis uses the weighted data set. Figure 6.33 compares the mean ratings of scenes with and without the wind farms showing the nearly parallel lines. The rise on the right-hand side of the line - without wind farm - is due to higher ratings of the coastal scenes with the ocean included.

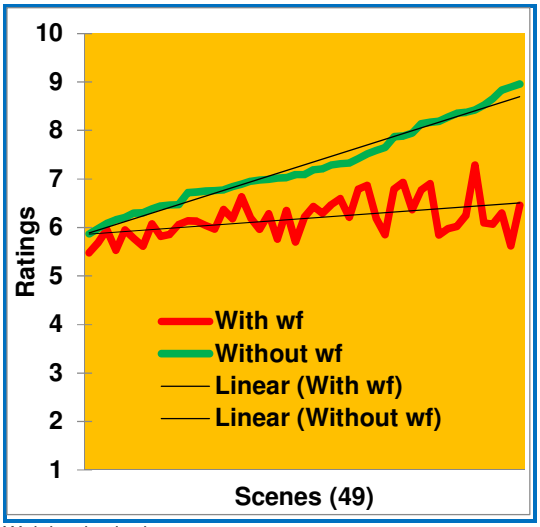


Weighted spin data

Figure 6.33 Ratings of scenes with and without wind farms

As would be expected the difference in scene ratings between the scenes with wind farms and without them was statistically significant: t = -10.15, df 48, p < 0.000.

Arranging the rating of scenes without wind farms in ascending order yields the graph shown by Figure 6.34. The gap in the ratings between the scenes with wind farms and those without them widens in the higher ratings. This is consistent with the finding from the author's 2003 study (see Figure 3.7).



Weighted spin data

Figure 6.34 Scenes without wind farms arranged in ascending order

Trend lines:
Without wf: $y = 0.058x + 5.83$, $R^2 = 0.98$
With wf: $y = 0.0135x + 5.85$. $R^2 = 0.23$

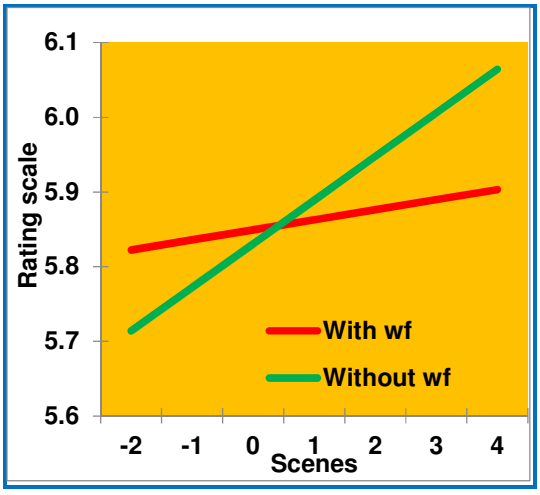


Figure 6.35 Extrapolation of trend lines

Applying the trend lines of Figure 6.34 produces the graph of Figure 6.35. The lines converge at a rating of 5.85.

The author's 2003 study found the cross-over point was 5.10 whereas in this study

the cross-over was 5.85 which is somewhat higher, due to the weighting of ratings. Below this rating, the presence of the wind farm actually enhances the scenic quality of the landscape.

Table 6.36 shows the cross-over point where the two algorithms meet.

Table 6.36 Application of algorithms

Scenes	Without wf	With wf
-3	5.81	5.66
-2	5.82	5.71
-1	5.84	5.77
0	5.85	5.83
0.4	**5.85**	**5.85**
1	5.86	5.89
2	5.88	5.95
3	5.89	6.01

Algorithms:
Without wf: $y = 0.058x + 5.83$, $R^2 = 0.98$
With wf: $y = 0.0135x + 5.85$. $R^2 = 0.23$

6.11 COMPARISON OF SCENES

A comparison was made of the ratings of the coastal scenes in the 2003 study and those used in the current 2018 survey. The scenes from the 2003 survey are not entirely identical with those used in the 2018 survey as additional wind turbines were added and Photoshop used to remove haze and enhance the contrast in the photos which may explain the slightly higher ratings in this survey.

The difference in ratings of the scenes with the wind farms was not statistically significant but it was significant for the scenes without the wind farms. The t tests results were:

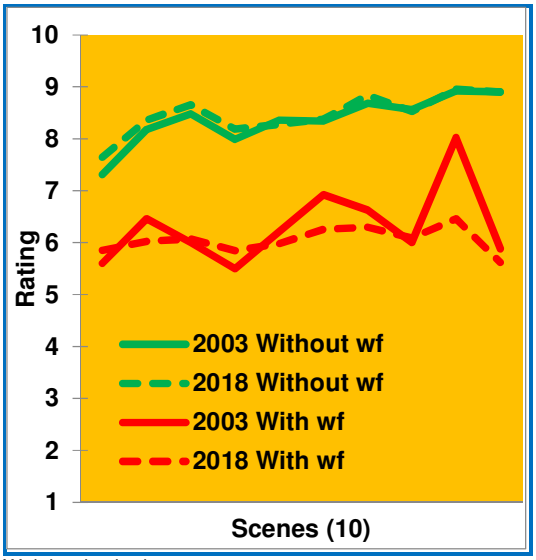
Without wind farm
t = -2.43, df = 9, p = 0.03
With wind farm
t = 1.56, df = 9, p = 0.15

The ratings are summarised in Table 6.37 and Figure 6.36. The ratings of the scenes without wind farms were nearly identical between the two studies with only 0.10 separating them. For the scenes with wind farms, six had lower ratings than the early ratings, while four were higher; overall the difference was -0.27.

Table 6.37 Comparison of ratings from 2003 & 2018 surveys

Scene	2003 Without	2018 Without	2003 With	2018 With
108	7.31	7.65	5.60	5.85
109	8.18	8.36	6.46	6.03
110	8.48	8.65	6.00	6.07
119	7.99	8.19	5.50	5.84
120	8.36	8.28	6.21	5.98
221	8.34	8.38	6.92	6.26
227	8.68	8.83	6.63	6.30
229	8.56	8.52	6.00	6.09
232	8.92	8.96	8.02	6.46
233	8.90	8.90	5.88	5.62
Mean	**8.37**	**8.47**	**6.32**	**6.05**

Weighted spin data



Weighted spin data

Figure 6.36 Comparison of ratings from 2003 & 2018 surveys

6.12 ACCEPTABILITY OF WIND FARMS

The survey included a question on the acceptability of the wind farm in each scene and provided a five-point Likert scale for participants to register their vote.

Very acceptable - Acceptable- Neutral - Unacceptable - Very Unacceptable

The scale implied a progression from very good to very bad so that participants would be able to use the scale to record their judgement of the acceptability of each wind farm. Acceptable is defined as *worth accepting, pleasing, welcome,*

tolerable, considered normal or permissible (*Australian Oxford Concise Dictionary*, 1987).

The mean percentage of respondents who scored each level of acceptability for the 49 scenes with wind farms is summarised by Table 6.38 and Figure 6.37. These indicate the dominance of the Very Acceptable and Acceptable scores – together they were more than three times the ratings for Unacceptable and Very Unacceptable.

Table 6.38 Acceptability scores of scenes

Acceptability	Scenes	%	SD
Very acceptable	9.34	28.86	14.82
Acceptable	12.25	37.88	14.10
Neutral	3.64	11.26	6.09
Unacceptable	3.88	11.98	6.62
Very unacceptable	3.25	10.03	8.99
Total	**33.05**	**100**	

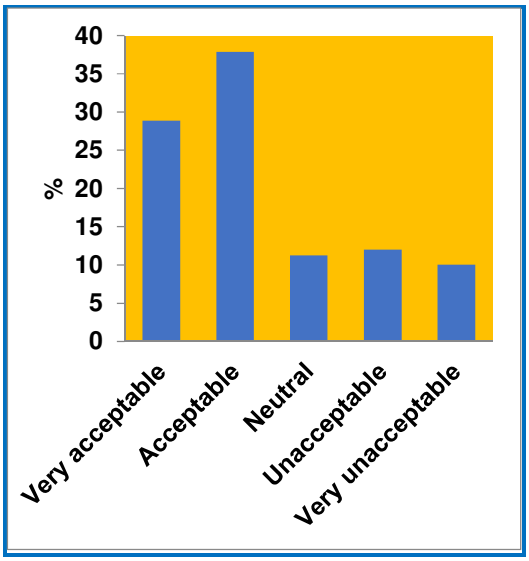


Figure 6.37 Mean acceptability percentages of scenes

Appendix 2 provides the acceptability scores as percentages for each of the scenes with wind farms.

Figure 6.38 Scene #98 with wind farm

Only a single scene, #98, the final scene in the survey (Figure 6.38), scored a higher unacceptable score than the acceptable score - 268 participants scored it unacceptable compared with 180 who scored it acceptable. In all other scenes the reverse applied – all scenes with wind farms were considered acceptable. This scene of Pennington Bay on Kangaroo Island was also the top-rated scene in the author's 2005 Coastal Viewscapes project of coastal landscapes (Lothian, 2005).

It is surprising that the community considered virtually all the scenes as suitable for wind farms, including nine of the ten coastal scenes. This suggests that the public's tolerance for the visual impact of wind farms is far greater than previously assumed.

The acceptability of wind farms is despite the participant's own ratings showing that scenes with wind farms rated lower than scenes without them. In other words, despite their acknowledgement that wind farms diminished scenic quality, they still found them acceptable.

Acceptability by State

The acceptability scores were derived for each of the states (Table 6.39, Figure 6.39) The means are surprisingly uniform among the states, the exception being Tasmania which recorded the highest score for very acceptable (52%) and the second highest score for very unacceptable (13%). States with large numbers of wind farms, NSW, Victoria, and South Australia, all scored high acceptability percentages.

Table 6.39 Acceptability scores of scenes by state %

%	Qld	NSW	ACT	Vic	Tas	SA	WA
Very acceptable	32.1	28.5	27.1	32.5	51.8	24.5	30.8
Acceptable	32.2	37.7	38.8	38.4	28.9	39.5	42.4
Neutral	8.7	11.2	11.3	10.4	4.4	13.3	13.1
Unacceptable	11.3	12.1	11.9	11.0	1.5	13.8	8.7
Very unacceptable	15.7	10.4	10.8	7.6	13.4	8.9	5.0

Note: Excludes NT (3) and Other (4)

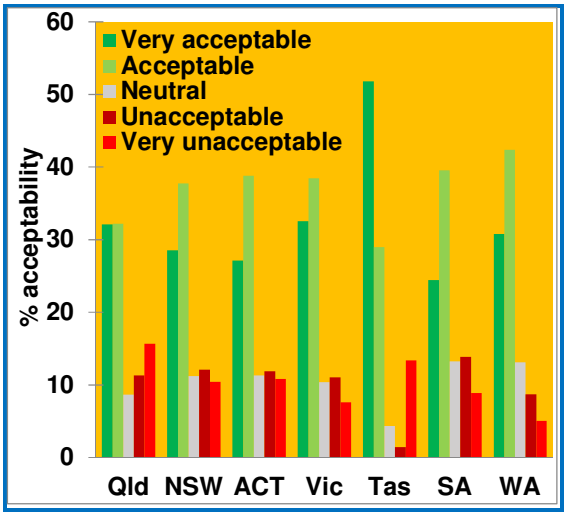


Figure 6.39 Acceptability scores of scenes by state %

Attitudes vs acceptability

There is a clear link between participants' attitudes towards wind farms and their rating of their acceptability (Tables 6.40, 6.41). Attitudes were scored on a three point scale: in favour, against, it depends. The last category, it depends, is because some people were not prepared to vote either for or against because of other factors they think were involved. A 'don't know' category should also have been included.

Table 6.40 Participant attitudes vs acceptability of wind farms (Number)

	In favour	Against	It depends
Very acceptable	6648	62	562
Acceptable	7409	28	2108
Neutral	1448	90	1299
Unacceptable	927	577	1515
Very unacceptable	247	1446	835
Total	16679	2203	6319

Table 6.41 Participant attitudes vs acceptability of wind farms (%)

	In favour	Against	It depends
Very acceptable	39.86	2.81	8.89
Acceptable	44.42	1.27	33.36
Neutral	8.68	4.09	20.56
Unacceptable	5.56	26.19	23.98
Very unacceptable	1.48	65.64	13.21
Total	**100**	**100**	**100**

Tables 6.37 and 6.38 and Figure 6.40 show the relationship between attitudes and acceptability – those who were in favour of wind farms voted heavily for their acceptability whereas those against them voted them unacceptable. A small number took the "it depends" option and their ratings spread from very acceptable to very unacceptable.

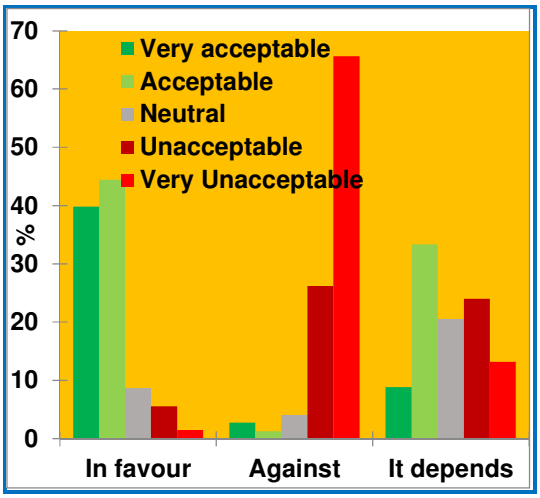


Figure 6.40 Participant attitudes vs acceptability of wind farms

It is also apparent that the strength of the 'against' vote is far stronger than the 'in favour' vote. Those voting very acceptable were 40% compared with 66% who voted very unacceptable. Very acceptable plus acceptable was 84% whereas unacceptable + very unacceptable was 92%.

Table 6.42 summarises the correlations between attitudes and acceptability of wind farms. This combines the very acceptable and acceptable categories, and the very unacceptable and unacceptable categories. The strongest correlations were between the 'against'

attitude and unacceptability and 'in favour' and unacceptability'.

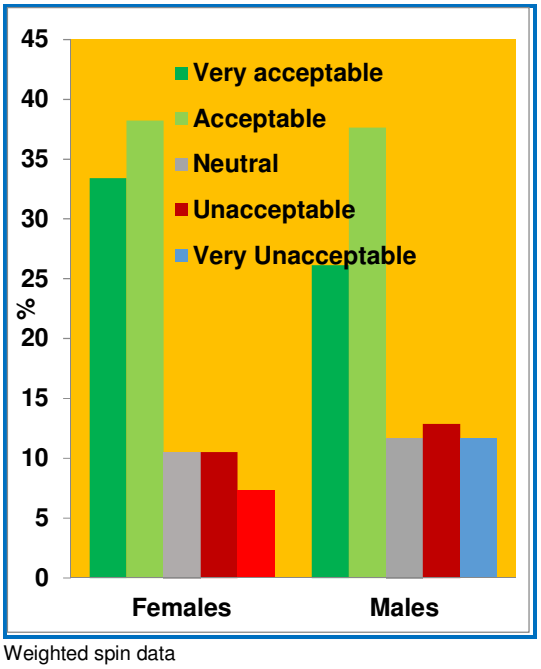
Table 6.42 Correlations between attitude & acceptability

Combination	Correlation
In favour/Acceptability	0.44
In favour/Unacceptability	-0.53
Against/Acceptability	-0.34
Against/Unacceptability	0.54
It depends/Acceptability	-0.25
It depends/unacceptability	0.28

6.13 INFLUENCE OF RESPONDENT CHARACTERISTICS ON ACCEPTABILITY

Gender

Table 6.43 and Figure 6.41 indicate the influence of gender on the acceptability of wind farms. While 72% of females found wind farms acceptable, only 64% of males did so. Nearly a quarter of males, 24.5% found them unacceptable compared with 17.8% females. The difference was significant**:** F = 7.22, df 1, 777, p = 0.007.



Weighted spin data

Figure 6.41 Gender and acceptability

Table 6.43 Gender vs acceptability (%) Scenes with wind farms

	Females %	Male %
Very acceptable	33.40	26.14
Acceptable	38.24	37.66
Neutral	10.53	11.69
Unacceptable	10.52	12.86
Very unacceptable	7.32	11.66

Weighted spin data

Age

Table 6.44 and Figure 6.42 indicate the influence of age on the acceptability of wind farms. While the 18-24, 45 – 64 and 65+ age groups showed similar levels of acceptability, ranging from 63% to 68%, the 25 – 44 age group was considerably higher, 77%. There is also a trend towards higher levels of unacceptability at higher age groups – the 45 – 64 and 65+ groups ranged from 21% to 27% compared with much lower levels of 15% and 12% for the 18 - 24 and 25 - 44 groups respectively. The difference was not significant: F = 1.88, df 3, 785, p = 0.13.

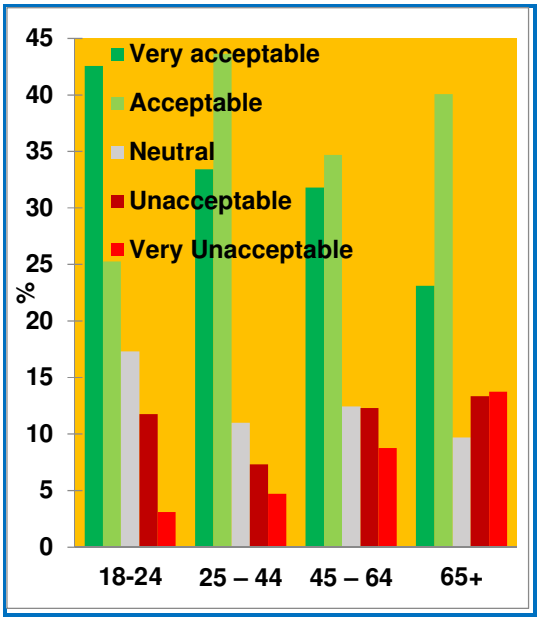


Figure 6.42 Age and acceptability

Table 6.44 Age vs acceptability (%)

%	18 - 24	25 – 44	45 – 64	65+
Very acceptable	42.56	33.41	31.82	23.12
Acceptable	25.26	43.62	34.68	40.06
Neutral	17.30	10.98	12.45	9.71
Unacceptable	11.76	7.30	12.27	13.35
Very unacceptable	3.11	4.70	8.78	13.75
Summary				
Acceptability	67.82	77.03	66.50	63.18
Unacceptability	14.88	11.99	21.05	27.10

Education

Table 6.45 and Figure 6.43 indicate the influence of education on the acceptability of wind farms. There was relatively little difference between ratings based on the level of education: acceptability ranged from 64% to 69% while unacceptability ranged from 20% to 24%. The differences between education levels were not significant: F = 1.21, df 3, 775, p = 0.30.

Table 6.45 Education and acceptability (%)

	No qual.	Cert/ Dip	Degree	Higher degree
Very acceptable	28.36	24.50	31.64	30.47
Acceptable	39.64	39.44	34.98	38.37
Neutral	9.27	11.83	12.08	10.69
Unacceptable	9.70	13.94	12.11	10.88
Very unacceptable	13.03	10.29	9.19	9.58
Summary				
Acceptability	68.0	63.9	66.62	68.85
Unacceptability	22.7	24.2	21.30	20.46

Note; 'Other' category (N=12) included in No qualification.

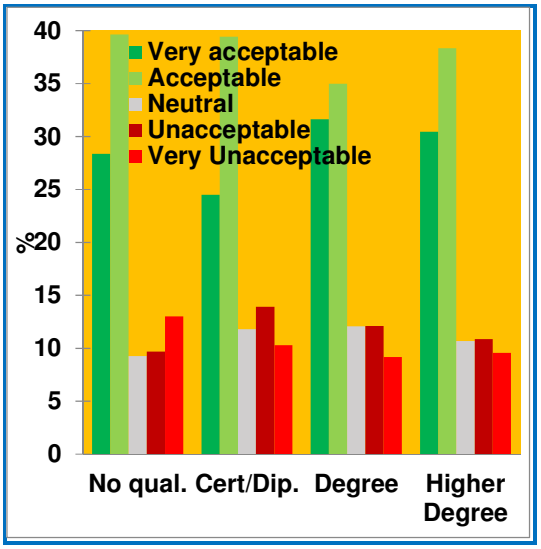


Figure 6.43 Education and acceptability

Birthplace

Table 6.46 and Figure 6.44 indicate the influence of birthplace on the acceptability of wind farms. While 65.5% of those born in Australia found wind farms acceptable, 72% of those not born in Australia did so. The difference in birthplace was not significant: F = 2.73, df 1, 777, p = 0.099.

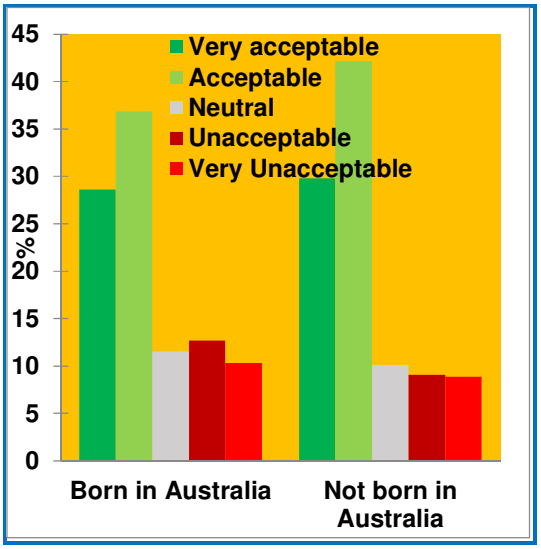


Figure 6.44 Birthplace and acceptability

Table 6.46 Education and acceptability (%)

	Born in Aust.	Not born Aust.
Very acceptable	28.62	29.80
Acceptable	36.83	42.13
Neutral	11.54	10.11
Unacceptable	12.69	9.08
Very unacceptable	10.31	8.88

6.14 ACCEPTABILITY QUOTIENTS

The 5-point Likert scale – very acceptable through to very unacceptable – implies a progression from the very best to the very worst. The strength of feeling regarding 'very acceptable' must be greater than the 'acceptable' rating. Whether the extreme scores are twice that of the less extreme score is unknown, for some respondents it may be much higher, say three or four times, or for some it may be only marginally greater. In the absence of contrary knowledge, two times is adopted here.

By placing numbers which indicate the level of acceptability, the results can be analysed:

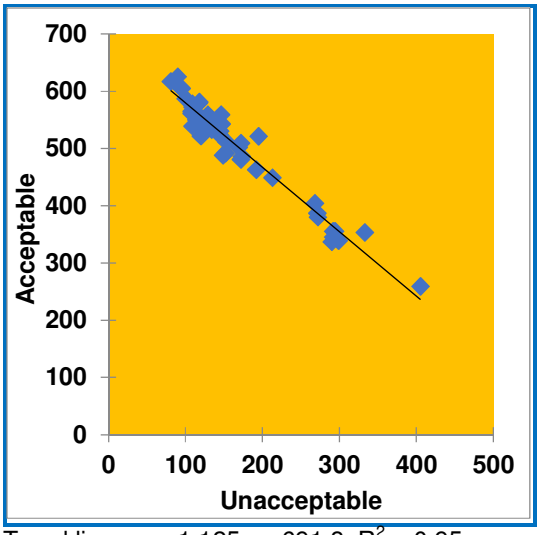
Very acceptable = +2
Acceptable = +1
Neutral = 0
Unacceptable = -1
Very unacceptable = -2

These are applied in the following algorithm:

Acceptability quotient=(2VA+A)-(UA+ 2UVA)

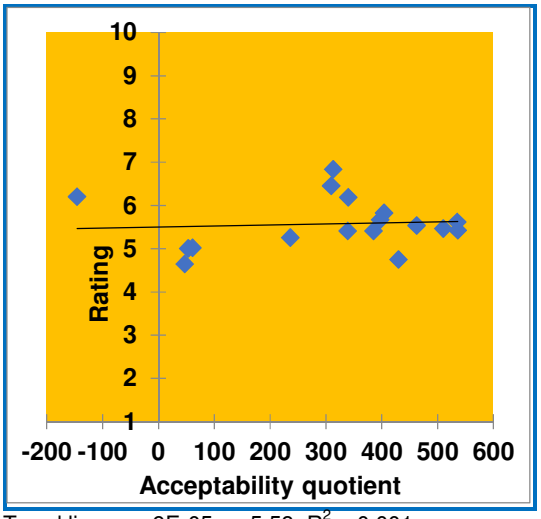
where the very acceptable and very unacceptable ratings per scene were doubled. The sum of the unacceptable and very unacceptable ratings was subtracted from the sum of the very acceptable and acceptable ratings. The result ranged from 40 to 535 with a mean of 336. The numbers are termed Acceptability Quotients. A high score implies high acceptability while a low score implies low acceptability. The analysis was performed on the scenes with wind farms.

Figure 6.45 shows the relationship between acceptability and unacceptability; as acceptability decreases, its converse, unacceptability, increases. Note also that the bulk of the data points are high in acceptability with relatively few points unacceptable.



Trend line: y = -1.125x + 691.8, R^2 = 0.95
Acceptable = 2VA+A, Unacceptable = UA+2UA

Figure 6.45 Relationship between Acceptability & Unacceptability

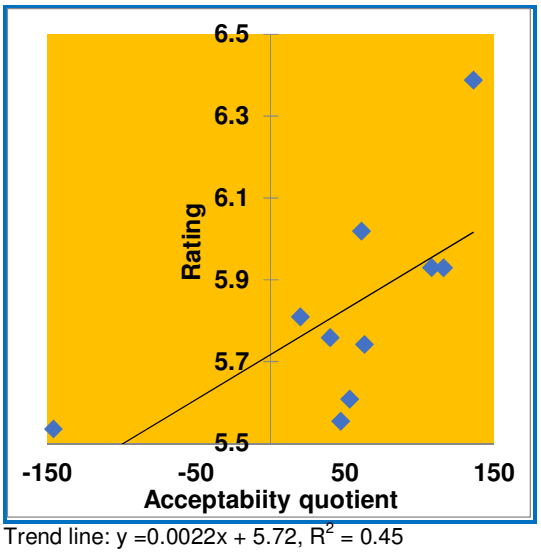


Trend line: y = 9E-05x + 5.58, R^2 = 0.001
Acceptability scores = (2VA+A) - (UA+2UVA)

Figure 6.46 Acceptability quotients for all scenes with wind farms

Figure 6.46 shows the acceptability scores for all scenes with wind farms. Apart from the single negative score, which was the one scene that the majority found wind farms to be unacceptable, all other scenes were on the positive side – in other words, the unacceptable ratings were insufficient

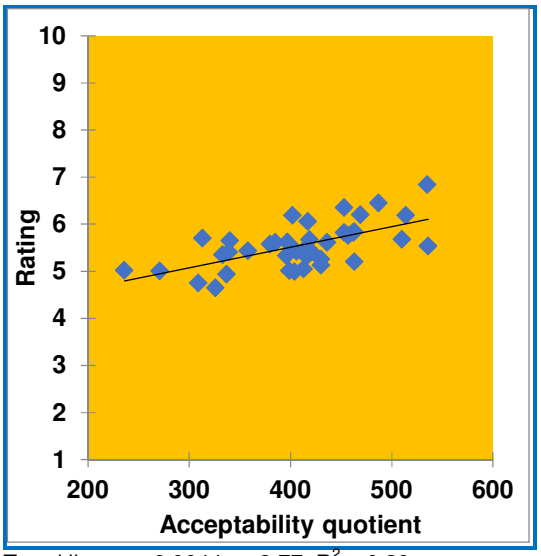
The scenes fell into two clumps, a small group near the zero axis and a larger group ranging from 200 nearly to 600. The small group comprised scenes 79 to 95 with ocean and hypothetical wind farms. Figure 6.47 displays their distribution.



Trend line: y =0.0022x + 5.72, R^2 = 0.45

Figure 6.47 Acceptability quotients for 10 ocean scenes (#79 – 95) with wind farms

Figure 6.48 displays the distribution of acceptability scores for the bulk of scenes, #1 to #77.



Trend line: y = 0.0044x + 3.77, R^2 = 0.39

Figure 6.48 Acceptability quotients for scenes #1 – 77 with wind farms

Adding the scores of Very acceptable and Acceptable, and then Unacceptable and Very unacceptable, produced the graph of Figure 6.49 which shows clearly the coming together of the two lines on the right-hand side for the coastal scenes with the ocean. Whereas the unacceptability quotients are for the most part in the 100 to 200's, the acceptability quotients are in the 500 - 600 range, four times as much.

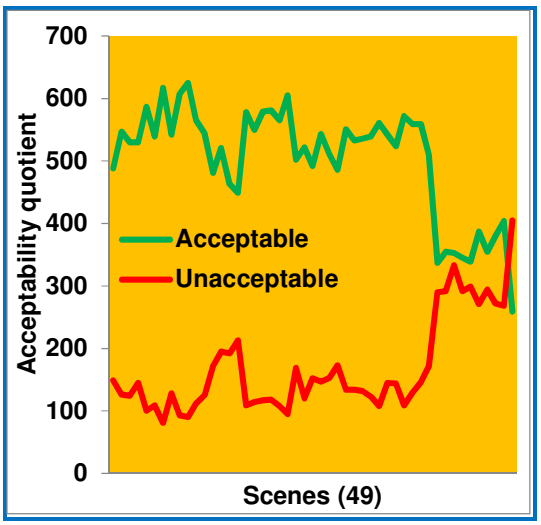


Figure 6.49 Acceptable and Unacceptable scores

Figure 6.50 re-orders the Acceptable scores in descending order so as to smooth out the line.

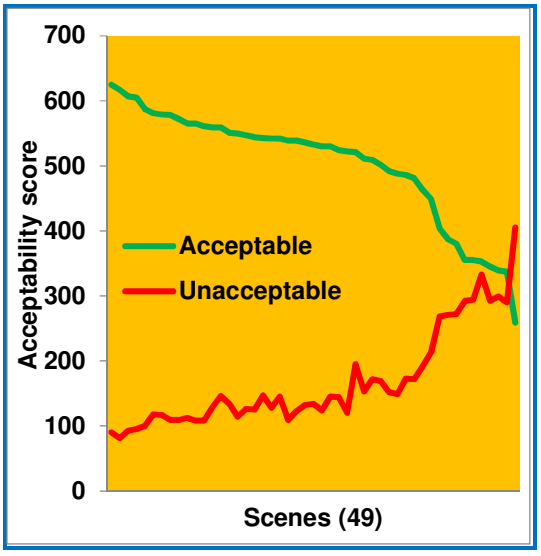
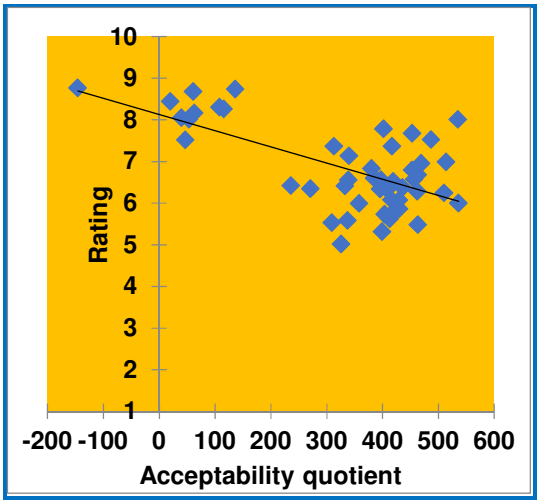


Figure 6.50 Smoothed Acceptable scores

It is apparent from the foregoing analysis that the original assumption at the outset of the project of a cross-over threshold between acceptable and unacceptable has not been fully realized. The one scene that

provided the cross-over is insufficient of itself to establish the threshold. It is, however, apparent from Figure 5.48 that the scores were trending towards a cross-over.

What is particularly surprising is that wind farms are considered acceptable in high quality landscapes. Figure 6.51 and Table 6.47 compare the scenic quality ratings of scenes without wind farms with the acceptability ratings for these landscapes.



Acceptability = 2VA + A
Trend line: y = -0.0039x + 8.12, R^2 = 0.40

Figure 6.51 Acceptability ratings of scenes without wind farms

Table 6.47 Acceptability quotients for scenes without wind farms

Acceptability quotients	Mean rating
-200	8.90
-100	8.51
100	7.73
200	7.34
300	6.95
400	6.56
500	6.17
600	5.78

Based on y = -0.0039x + 8.12

The low acceptability quotients were for the coastal scenes for which wind farms were generally regarded as unacceptable. The high scores are for other inland scenes where there was little objection to wind farms.

6.15 FACTORS AFFECTING RATINGS

The influence of the following environmental and wind farm factors on the scenes was assessed:

- Weather - sunny, scattered clouds, heavy clouds;
- Water - sea or freshwater;
- Land form – flat, undulating, hilly, ridge;
- Land use – cropping, grazing, or natural;
- Vegetation – barren, scattered, clumps or dense;
- Number of turbines in view – full or part view;
- Whether the turbines were arrayed randomly or along ridgelines;
- Height of the turbines;
- Distance to the turbines;
- Generating capacity (MW) of the turbines.

Clouds

The presence of heavy cloud and scattered clouds in the scene reduced ratings of scenes without wind farms slightly while having little effect on scenes with wind farms (Table 6.48). The difference for scenes without wind farms was greater – the difference between sunny conditions and heavy cloud was 0.50 – and was statistically significant: ANOVA F = 1290.2, df 1, 96, p <0.000. Weather has a transient influence, part of the physical environment of the wind farms, but nevertheless, the conditions in which they are viewed affects their perception.

Table 6.48 Influence of weather on ratings

Weather	Without wf	With wf	Scenes
Sunny	7.37	6.11	30
Scattered cloud	7.33	6.38	12
Heavy cloud	6.88	6.17	7

Weighted spin data

Water

The presence of water always boosts ratings and this was apparent in this survey. Table 6.49 and Figure 6.52 show

the influence of the sea or freshwater on ratings of scenes with and without wind farms. For scenes without wind farms, the difference between no water and the sea was 1.54 whereas for scenes with wind farms it was only 0.04. The differences for scenes between scenes with water and non-water were statistically significant (ANOVA):

With wind farms:
F = 3663.61, df 1, 96, p < 0.000.
Without wind farms:
F = 2356.38, df 1, 96, p < 0.000.

Table 6.49 Influence of water on ratings

Water	Without wf	With wf	Scenes
No water	6.91	6.17	36
Sea	8.44	6.13	11
Freshwater	7.86	6.88	2

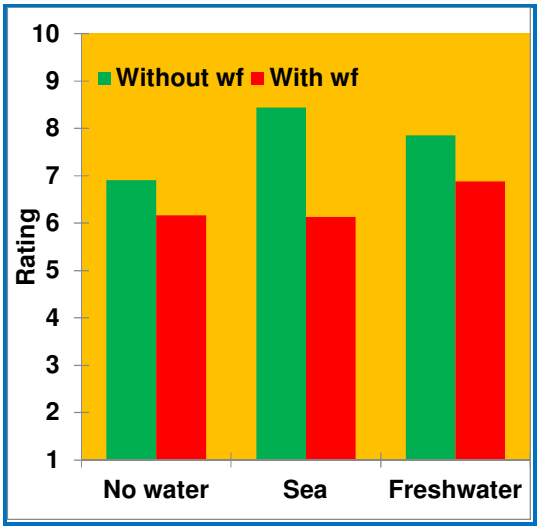


Figure 6.52 Influence of water on ratings of scenes without wind farms

Land form

Table 6.50 and Figure 6.53 show the influence of land form on the ratings of all scenes. For scenes with and without the wind farms, the hillier the land, the higher the ratings, as much as 1.39 for scenes without wind farms comparing flat land with hilly land.

Table 6.50 Influence of land form on ratings

Land form	Without wf	With wf	Scenes
Flat	6.90	5.88	14
Undulating	7.46	6.32	7
Hilly	8.29	6.10	5
Ridge	7.26	6.35	23

The differences in ratings between the various land forms for scenes with and without wind farms were statistically significant:
Without wind farm:
F = 412.4, df = 1, 96, p < 0.000.
With wind farm:
F = 304.8, df = 1, 96, p < 0.000

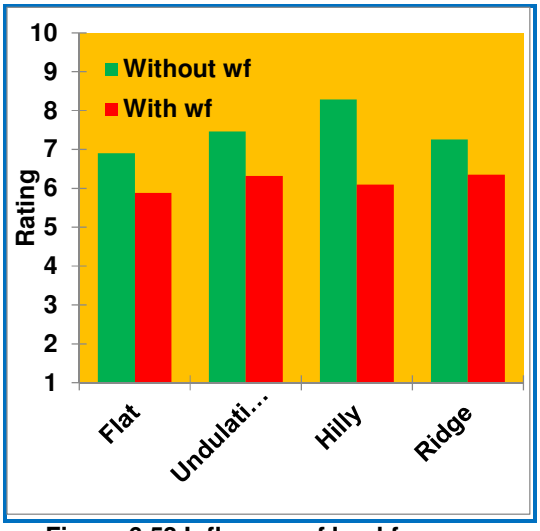


Figure 6.53 Influence of land form on ratings

Land use

Table 6.51 and Figure 6.54 show the influence of land use on ratings for scenes with and without wind farms. For the scenes without wind farms, the increase in ratings towards the natural scenes is very apparent but for the scenes with wind farms the semi-natural scenes rated highest. The natural scenes are the most highly rated although this includes the ten coastal scenes with the strong influence of water. For scenes without wind farms, ratings of natural scenes were 1.34 higher than grazing scenes. The differences in ratings between the various land uses for scenes with and without wind farms were statistically significant:

Without wind farm:
F = 610, df = 1, 96, p < 0.000.
With wind farm:
F = 514, df = 1, 96, p < 0.000

Table 6.51 Influence of land use on ratings of scenes

	Without wf	With wf	Scenes
Cropping	7.03	6.20	11
Pasture	6.86	6.19	16
Semi-natural	7.26	6.31	11
Natural	8.21	6.05	11

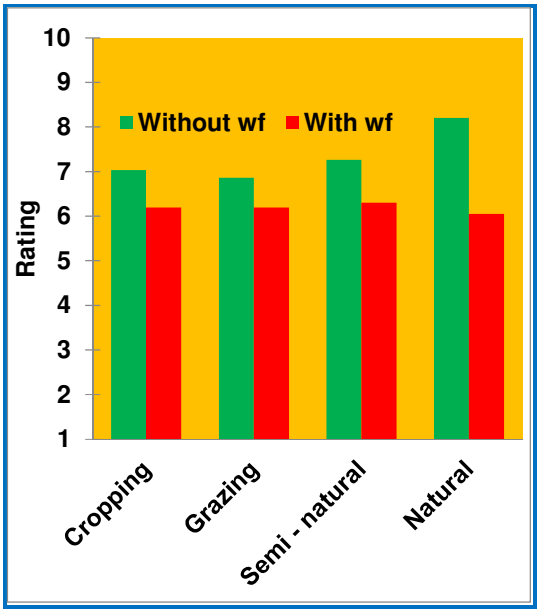


Figure 6.54 Influence of land use on ratings of scenes without wind farms

Vegetation

Table 6.52 and Figure 6.55 show the influence of vegetation on ratings of scenes with and without wind farms. There was a slight trend for higher ratings with denser vegetation. For scenes without wind farms, the difference in ratings between barren land and clumps of vegetation was 0.38. However for scenes with farms, the largest difference, 0.39, was between barren land and land with scattered vegetation. The differences in ratings between the various land uses for scenes with and without wind farms were statistically significant:
Without wind farm:
F = 1276, df = 1, 96, p < 0.000.
With wind farm:
F = 1482, df = 1, 96, p < 0.000

Table 6.52 Influence of vegetation on ratings

Vegetation	Without wf	With wf	Scenes
Barren	7.18	6.07	30
Scattered vegetation	7.38	6.45	12
Clumps or dense veg.	7.55	6.14	7

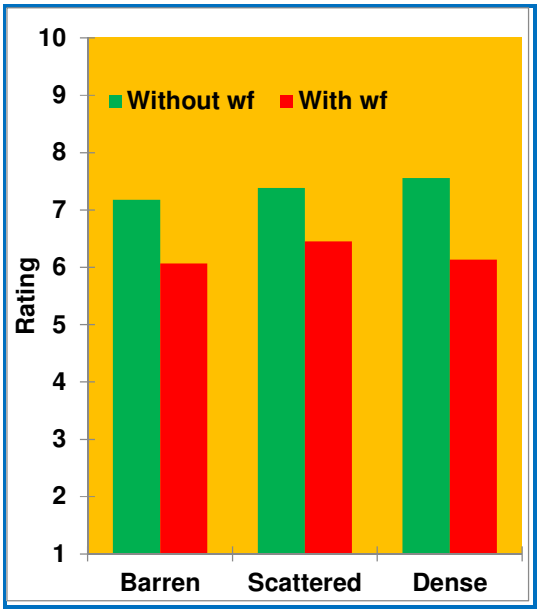


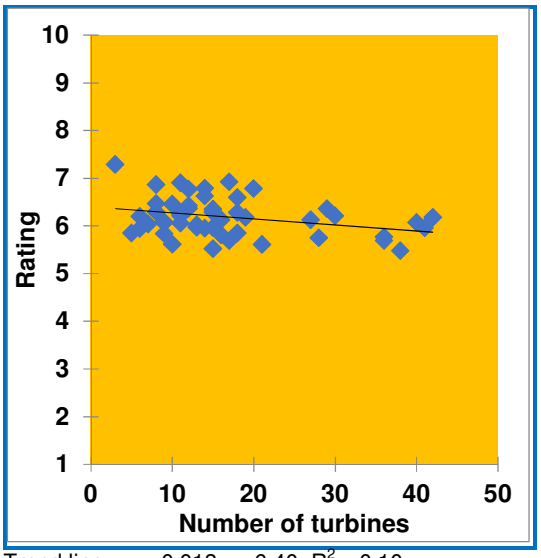
Figure 6.55 Influence of vegetation on ratings of scenes without wind farms

Turbines

Table 6.53 and Figure 6.56 show the slight influence that the number of turbines in the scenes had on ratings. Although the correlation coefficient is low (0.10), it nevertheless shows a slight decrease in the ratings with more turbines. The difference between 1-9 turbines and 40-49 was only 0.20. The difference in rating between the number of turbines for scenes with wind farms was statistically significant:
ANOVA F = 55.25, df = 1, 96, p < 0.000.

Table 6.53 Influence of turbine numbers on ratings

Turbines	Mean	Scenes
1 - 9	6.27	11
10 - 19	6.23	26
20 - 29	6.13	5
30 - 39	5.79	4
40 - 49	6.07	3



Trend line: y = -0.013x + 6.40, R^2 = 0.10

Figure 6.56 Influence of the number of turbines on ratings

Table 6.54 extrapolates the ratings for the number of turbines based on the derived algorithm.

Table 6.54 Predicted ratings for the number of turbines

Turbines	Rating
5	6.34
10	6.27
15	6.21
20	6.15
25	6.08
30	6.02
35	5.96
40	5.90
45	5.83
50	5.77
55	5.71
60	5.64

Based on y = -0.013x + 6.40

Layout

While some wind farms are arrayed linearly along ridgelines to gain full advantage of winds, others are spread out across flat land in a random fashion. Table 6.55 and Figure 6.57 show the ratings for the two layouts with the linear layout being the preferred layout. The difference in ratings according to the turbine lay out was small, 0.26, but statistically significant: ANOVA F = 2533.6, df = 1, 96, p < 0.000.

Table 6.55 Influence of turbine layout on ratings

Layout	Rating	Scenes
Random	6.03	19
Linear	6.29	30

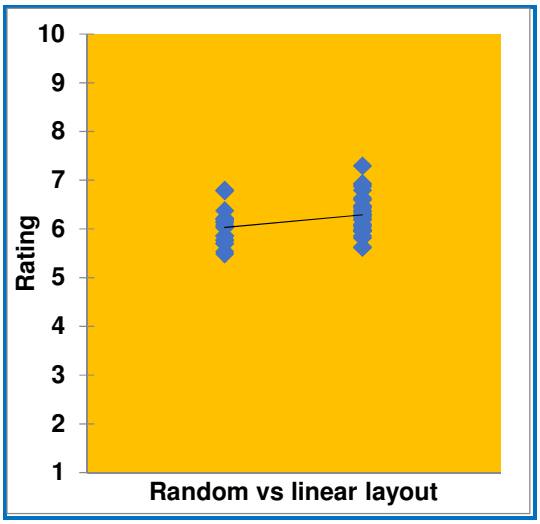


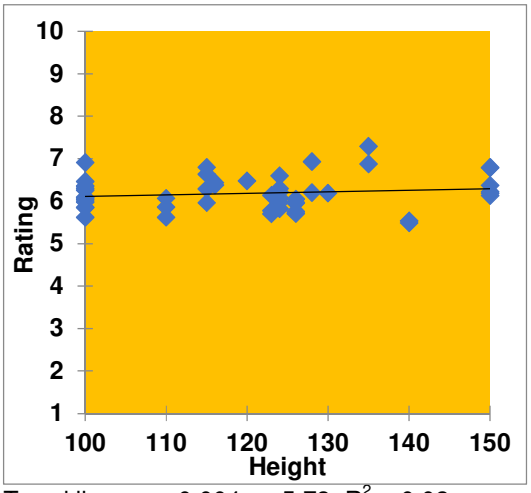
Figure 6.57 Influence of turbine layout on ratings

Turbine height

Table 6.56 and Figure 6.58 indicate the influence that the height of the turbines has on ratings; increasing the height from 100 m to 150 m actually increased ratings by 0.19. The difference in ratings of scenes with wind farms between the turbine height was significant:
ANOVA F = 2496, df = 1, 96, p < 0.000.

Table 6.56 Influence of turbine layout on ratings

Height m	Mean	Scenes
100-109	6.15	12
110-119	6.22	9
120-129	6.09	17
130-139	6.78	3
140-149	5.50	2
150-159	6.34	6



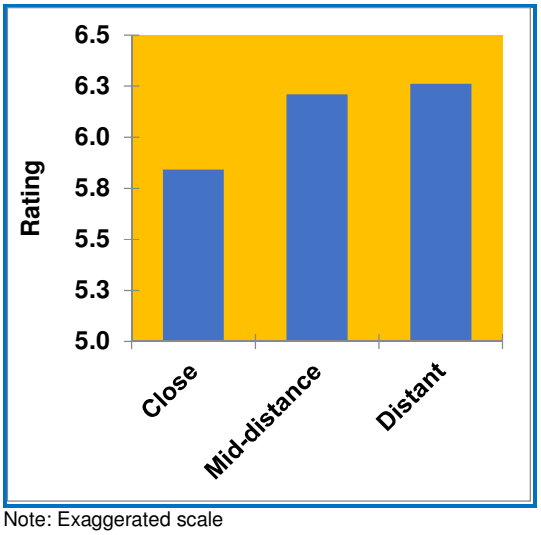
Trend line: y = -0.004x + 5.73, R^2 = 0.02

Figure 6.58 Influence of the height of turbines on ratings

Distance

The distance to the turbines was classified into three categories: close, mid-distant, and distant. Table 6.57 and Figure 6.59 summarises the ratings.

Ratings were lowest for the nearby turbines and increased with distance to the turbines. The turbines that are mid-distant were rated 0.37 higher (6%) than those nearby, while the distant turbines were rated 0.42 higher (7%) than those close by. The difference in ratings according to distance in scenes with wind farms was statistically significant: F = 1201.3, df 1, 96, p < 0.000.



Note: Exaggerated scale

Figure 6.59 Influence of distance on ratings

Table 6.57 Distance to turbines

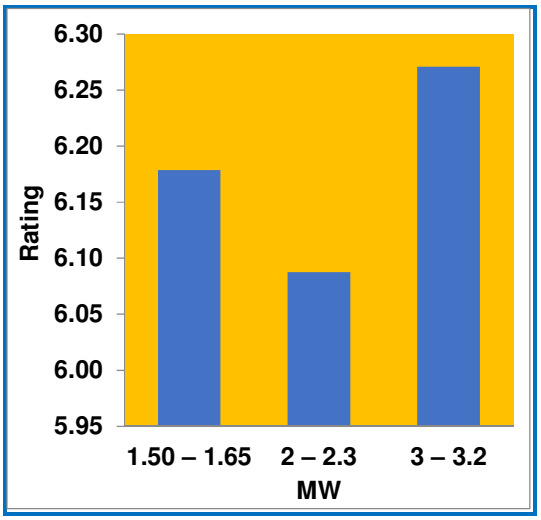
Distance	Number	Mean	%
Close	6	5.84	100.00
Mid-distant	23	6.21	106.33
Distant	20	6.26	107.29

Generating capacity

The generating capacity of the turbines was from 1.5 MW to 3.2 MW. Table 6.58 and Figure 6.60 summarise the ratings.

Table 6.58 Generating capacity of turbines

MW	Mean	Number
1.50 – 1.65	6.18	21
2 – 2.3	6.09	12
3 – 3.2	6.27	16



Note: Exaggerated scale

Figure 6.60 Influence of turbine generating capacity on ratings

The generating size of the turbines had a mixed influence on the ratings; increasing the generating capacity from 1.5 MW to 2 MW reduced ratings by 0.1 but increasing them to 3 MW increased ratings by 0.1 compared with 1.5 MW. Thus the highest ratings were for the largest turbines. The difference in ratings of the various turbine sizes was, however, statistically significant: F = 1228.44, df = 1, 96, p < 0.000.

Summary - Influence of environmental and wind farm factors on ratings

In summary, the context of the wind farms affects their ratings, and although it is a small effect, it is generally statistically significant.

Environmental factors

- Heavy cloud reduced ratings of scenes without wind farms by 0.50 compared with sunny conditions but had little effect on scenes with wind farms.
- The presence of the sea or freshwater increased ratings of scenes without wind farms by 1.54 and for scenes with wind farms by 0.04.
- For scenes with and without the wind farms, the hillier the land, the higher the ratings, as much as 1.39 for scenes without wind farms comparing flat land with hilly land.
- For the scenes without wind farms, the increase in ratings towards the natural scenes is very apparent but for the scenes with wind farms the semi-natural scenes rated highest. For scenes without wind farms, ratings of natural scenes were 1.34 higher than grazing scenes.
- There was a slight trend for higher ratings with denser vegetation. For scenes without wind farms, the difference in ratings between barren land and dense vegetation was 0.38. However for scenes with farms, the largest difference, 0.39, was between barren land and land with scattered vegetation.

Wind farm factors

- Ratings decreased slightly with an increasing number of turbines, the difference between 1-9 turbines and 40-49 was only 0.20.
- Placing turbines linearly along ridges increased ratings by 0.26 compared with random layouts.
- Increasing the height of turbines from 100 m to 150 m increased ratings by 0.19.
- Ratings were lowest for the nearby turbines and increased with distance to the turbines.
- Mid-distant turbines rated 0.37 higher than those nearby, while distant turbines rated 0.42 higher.
- Increasing the generating capacity from 1.5 MW to 2 MW reduced ratings by 0.1 but increasing them to 3 MW increased ratings by 0.1 compared with 1.5 MW: the highest ratings were for the largest turbines.

Key factors for developers to consider are the number of turbines and their distribution layout with alignments along ridges preferred over random layouts. Their height and generating capacity had negligible influence on ratings.

6.16 REGRESSION ANALYSIS

Multiple regression analysis was used to identify the contribution of environmental factors and wind farm characteristics to the ratings.

Without wind farm

ANOVA $F = 10.38$, df 4, 43, $p < 0.000$. $R^2 = 0.49$

Y (rating) = 6.44 + 0.90 water + 0.114 land use + 0.113 vegetation + 0.04 land form

This indicates that the ratings of the scene without wind farms is influenced largely by the presence of water followed by land use, vegetation and land form in that order. The correlation coefficient (R^2) indicates that this algorithm explained nearly half, 49%, of the variance. The water scenes comprised the ten ocean scenes and two inland scenes.

Without wind farm, without water factor

ANOVA $F = 5.37$, df 4, 45, $p = 0.003$.

$R^2 = 0.27$

Y = 6.20 + 0.39 land use + 0.09 land form + 0.03 vegetation

This indicates that without the water factor included, land use is the main factor with land forms and vegetation having minor influence. The algorithm explained only 27% of the variance.

With wind farm
ANOVA F = 8.81, df 8, 39, p < 0.000.
R^2 = 0.64
Y = 4.22 + 0.298 distance + 0.288 water + 0.11 land form + 0.014 height + 0.014 vegetation - 0.02 number - 0.06 MW - 0.18 land use

This indicates that distance to the wind farm, water, and land form are the main determinants of ratings with several of the wind farm-related factors, MW, and the number of turbines, having a negative influence. The algorithm explained 64% of the variance.

Since distance to the wind farm for the photo is not part of the environment or wind farm, omitting it generates a lower correlation coefficient but otherwise similar results. This explained 53% of the variance.

F = 6.73, df 7, 41, p < 0.000. R^2 = 0.53
y = 4.03 + 0.50 water + 0.16 land form + 0.06 vegetation + 0.012 height - 0.11 land use - 0.08 MW - 0.006 number

Since water is in only a dozen scenes, omitting it results in the following:

F = 3.90, df 6, 42, p < 0.0035, R^2 = 0.36
Y = 5.27 + 0.14 land form + 0.04 MW + 0.01 vegetation + 0.006 height - 0.05 land use - 0.01 number

This indicates that without the distance and water factors, that land form is the dominant factor followed by the MW capacity of the turbines. Vegetation and the height of turbines are minor factors. The algorithm explained 36% of the variance.

Applying only environmental factors to the scenes with wind farms results in the following:

F = 6.36, df 4, 44, p = 0.0004, R^2 = 0.37
y = 6.00 + 0.32 water + 0.14 land form + 0.08 vegetation - 0.17 land use

This indicates that water remains the dominant factor followed by land form and vegetation. The algorithm explained 37% of the variance.

Applying only wind farm factors, height, MW and number resulted in the following:

F = 3.28, df 3, 45, p = 0.029, R^2 = 0.18
y = 5.52 + 0.008 height - 0.018 MW – 0.017 number

This indicates that only height has a positive influence, and the algorithm explains only 18% of the variance.

This analysis shows that for scenes without wind farms, the presence of water was a dominant factor, however excluding water, land use was the main factor. For scenes with the wind farm, again water dominated followed by the distance to the wind farm, but excluding these, land form was the main factor.

In summary, multiple regression analysis showed that environmental factors were more important than the turbine characteristics in determining the acceptability of the wind farm. Taken together the environmental and turbine factors explained 64% of the variance, but the environmental factors alone explained 37% compared with only 18% by the turbine factors.

6.17 THRESHOLD OF ACCEPTABILITY

Earlier in Section 3.6, Thresholds of visual impact, the work of Cohen, Stamps and Palmer was examined as means of providing insights into acceptable thresholds of visual impact. Using Cohen's Standardised Mean Difference formula, D (D = mean of scene after – mean of scene before/population SD), the following thresholds were defined (Table 6.59).

Table 6.59 Criteria of visual impact

Criteria	Stamps	Palmer
Trivial, too small to be noticed	0.2	0 – 0.2
Medium effect, noticeable by not adverse	0.5	0.2 – 0.5
Large effect and adverse	0.8	0.5 – 1.1
Unreasonably adverse		>1.1

Table 6.60 Application of criteria to survey data

Without wind farm

	Stamps	Scenes
Small	0.2	5
Medium	0.5	10
Large	0.8	34
	Palmer	**Scenes**
Possibly go unnoticed	0 – 0.2	1
Noticeable but not adverse	0.2 – 0.5	5
Adverse	0.5 – 1.1	23
Unreasonably adverse	>1.1	20

With wind farm

	Stamps	Scenes
Small	0.2	0
Medium	0.5	2
Large	0.8	47
	Palmer	**Scenes**
Possibly go unnoticed	0 – 0.2	0
Noticeable but not adverse	0.2 – 0.5	0
Adverse	0.5 – 1.1	6
Unreasonably adverse	>1.1	43

Weighted spin data

Using weighted data, the majority of scenes were found to have an adverse or unreasonably adverse visual impact (Table 6.60). This puts into question the reliability of these criteria. As Buchan (2002) noted, it is both the magnitude and the significance which are important determinants of visual impact. While agreeing on the magnitude of the visual impact, its significance is disputed.

The surprising finding is that while the participants rated virtually all (but one) scenes as suitable for wind farms – acceptable or very acceptable – these included scenes of high scenic quality rating scenes which previous experience had indicated would be unsuitable for wind farms.

This suggests that the community is far more tolerant of the visual impact of wind farms than previously believed. It might also indicate a substantial shift in opinion over the past decade as wind farms proliferated across Australia. The author's 2003 study was conducted when very few wind farms existed and the responses then may have reflected a fear about their visual impact. Now that most of the community has seen wind farms, their former fears may have been allayed and they seem much more accepting of them.

Thus while there may be protests at wind farm proposals, the results of this survey indicate that by far the majority of the Australian public are not concerned by them and indeed welcome them.

The coast, however, is likely to be a more contentious area as this was the only location in which participants found the wind farm unacceptable - albeit in only one scene.

6.18 VISUAL IMPACT PREDICTIVE MODEL

One of the objectives of the study was to derive a model to predict the likely visual impact of wind farms with applicability Australia-wide. The model is based on the survey's findings as reported in this chapter.

The model comprises the following components:

1. Derive the scenic quality of the area where a wind farm is proposed.

This can be achieved through applying generic criteria as derived by the author in various regions.

2. Derive the visual impact using algorithms derived:

Without wind farm: $y = 0.058x + 5.83$
With wind farm: $y = 0.0135x + 5.85$
Where y is the scenic quality, x is scene number.

Table 6.61 simplifies this by providing the ratings predicted by each algorithm at approximately 0.25 intervals. This can be used to predict the likely scenic quality with the wind farm present. Figure 6.61 illustrate the model. The cross-over point is the rating 5.85.

Table 6.61 Predicted scenic quality ratings

Without wind farm	With wind farm
4.67	5.58
4.84	5.62
5.02	5.66
5.19	5.70
5.37	5.74
5.54	5.78
5.71	5.82
5.89	5.86
6.06	5.90
6.24	5.94
6.41	5.99
6.58	6.03
6.76	6.07
6.93	6.11
7.11	6.15
7.28	6.19
7.45	6.23
7.63	6.27
7.80	6.31
7.98	6.35
8.15	6.39
8.32	6.43
8.50	6.47
8.67	6.51
8.85	6.55

Weighted spin data

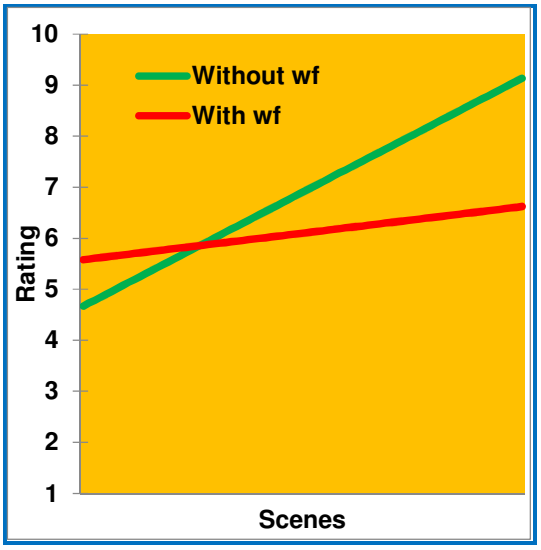


Figure 6.61 Model of predicted scenic quality ratings

6.19 FINAL COMMENTS FROM PARTICIPANTS

There were 216 comments at the end of the survey which, given its length, was an excellent response. Energy and cost issues were not prominent, the main subject being landscape related issues followed by comments on the survey itself, generally positive (Table 6.62). The comments are shown in full in Appendix 6.

Table 6.62 Classification of final comments

Subject	Number of comments
Landscape	120
Location	44
Survey	76
Energy	34
Cost	8
Other	7
Total	331

Note: Many participants covered more than one topic.

Landscape

While some people just made observations about wind farms, the majority indicated either positive or negative attitudes towards them. Interestingly, while 48 comments were negative, 66 were positive, which reflects also the survey findings. A number of participants compared wind farms with coal mining and also with energy powerlines. Some were happy to have wind farms on farmland but opposed them on the coast or in natural areas. Several questioned their colour, white, suggesting other colours to blend them into the landscape. A number saw them as sculptural elements, quite attractive in their own right, one even describing wind farms as “choreographed ballet”! Another compared them with lighthouses, standing against the elements. Some of the comments follow.

- Any wind farm surely looks better then massive black holes in ground and monstrous slag heaps and growing numbers of heavy vehicles carting coal. What is YOUR alternative? It’s easy to criticise everything somebody does I don’t know where you get off
- The sheer size of the equipment results in their dominating any landscape scene. A farm of windmills would the same effect. They cannot fit into a natural vista.

- I really don't have much objection to wind farms on land that is already industrial, ie farmland unless it has high scenic value. In some cases, I think the wind turbines have a sculptural quality which enhances boring monoculture landscapes.
- I can't see how their appearance can come close to the ugliness of a coal-fired power station or massive rows of power lines however 'ugly' people find them!!!
- I was expecting to see how scenic sites might be spoilt by wind farms but I didn't.
- Wind farms on coastal cliff tops are a form of graffiti to the landscape.
- I think wind farms are beautiful in their own right, a tribute to humankind's will to address problems of its own making.
- I like white but if they were coloured they could possibly disappear as a visual eyesore if that is a primary issue.
- Perhaps there is an opportunity to paint them in green or blue to blend into the landscape more?
- Doing the survey made me think about what I find scenic and how windfarms fit into that.
- I thought they were ugly when I first saw them, now I think they are like a choreographed ballet.
- Generally I find the clustered views of wind farms unacceptable but otherwise they can fit/blend with the landscape quite well, and not be too visually dominant.
- One would imagine that Wind Towers could be much like power lines in that we ignore them visually at a predetermined distance, when we look at them each day…
- I find wind farms fascinating. They add to a landscape providing dimension and movement. I like the tall majestic stance of the turbines and the way they face the elements, a bit like lighthouses on rocky wave swept coastline.
- I'd say that electricity lines and urban rail lines are more offensive than wind turbines from visual amenity perspective. But this type of comparison doesn't get raised because electricity lines and rail have long been part of the scenery. People get used to it.
- Wind farms on ridges and headlands generally enhanced horizons in the more dramatic landscapes
- Why the heck do they have to be white!! Definitely not so "in your face" if they were a mid-green or soft brown.
- I actually believe they improve the view of the country. I believe they make the Country side look more modern.

Energy

The majority of comments compared wind farms with coal mines and related infrastructure, saying wind farms are much more preferable. Some suggested that the survey should have included other types of energy production to wind farms. Some of the comments follow.

- They are necessary as clean energy no pollution and low power source.
- Better than an open pit coal mine...better than an underground coal mine....
- Any wind farm surely looks better then massive black holes in ground and monstrous slag heaps and growing numbers of heavy vehicles carting coal.
- I worked in the nuclear industry for decades and I do not want to see Australia go down this route, especially as it has such wonderful solar and wind resources available to it.
- What looks better - Wind Farm or Coal Power station - Wind Farm any day... Worked at a power station.
- Have you in a similar manner measured the landscape quality of refineries and open coal mines?

Cost

Unlike the earlier comments where cost was a major issue, it was barely raised in these final comments. A few mentioned their beneficial payments to farmers and the local community. The main comments follow.

- Windfarms are usually in rural areas and provide employment for local rural communities, providing income for land-owners.
- Expensive and unreliable.
- My concern with Wind Farm Technology is the Cost-Benefit factor where significant Government Funding is applied where the lack of a Commercially viable solution is available
- …should not be subsided in any form.
- They require massive capital outlays and… large subsidies are required to establish them.
- Wind Farms provide power to us and income to the landowner.

Location and placement

Many made suggestions about where wind farms should be located or not located. Some of these suggestions follow.

- They should be placed on all arid land
- I wouldn't want to see is for the wind turbines being put into untouched land which should be left the way it is for heritage and ecological reasons.
- Not right on the coast please.
- Keep the wind farms preferably on the coast, near towns or at least on unproductive ridgelines.
- I think it is better if the turbines are place a little more randomly instead of all in a row...easier on the eye.
- My preference is fewer numbers of wind turbines, large clusters don't do it for me.
- Definitely prefer lower density, lines rather than grids, and not along the coast.
- I think the farm lands look more productive with wind farms on them.

Survey

Survey related issues were the second most prominent issue in the comments, with negative comments, 33, exceeding the positive ones, 20. However, nearly half of the negative comments, 15, were complaints about its length. Otherwise the positive comments exceeded the negative ones.

Although no scene was repeated, a number of people believed that the same photo was used several times, possibly to check the consistency of ratings. A small number complained of the quality of photos or Photoshop manipulation of them. Compared with the author's previous surveys, this number was insignificant. Positive comments were that it was interesting and well structured. Many were looking forward to the results. Some of the comments follow.

- This survey is a trick and not worth the paper it's written on or the time it takes to fill in. Get a life and do something constructive.
- Your superimposing of windfarms on land-scapes where they were not a bit "in your face" they would not look as imposing as your photos.
- Too Bloody long.
- Selection of scenes excluded mountains and deserts. I suggest the selection of scenes is biased in favour of rural and coastal areas.
- You only need a 1/10th of the photos and you get the same result.
- Enjoyed the survey - need more of them.
- Interesting survey, very engaging. Well done.
- I hope your survey is successful & look forward to seeing your findings.
- Well constructed survey.
- Jolly good subject and research to raise Andrew... fantastic. thankyou
- Interesting survey, however, quite enjoyed doing it.
- Clever composition of survey.

Other

These comments were observations made about wind farms, including the following.

- I truly hope we don't get wind farms in Qld. It saddens me that our country is following others in this way. Fiji has 15 wind farms of which only 5 work but Fiji can't afford to repair. These sticks of metal are going through stay there forever not doing anything but cause a visual eye saw to everyone

- If only the political landscape was as productive as these engineering marvels!
- I do not object to wind farms especially if they are on our farm it would be different if they were on our neighbours and they were getting all the rent from the wind farms money talks most languages we need wind farms on our farm too.
- On the bright side, the turbines if placed strategically will most definitely reduce the population of pesky flying foxes and bats.

CHAPTER 7 CONCLUSIONS

7.1 OVERVIEW

It is rather unsettling and more than a little surprising when a research project produces results contrary to what was expected as did this project. What was expected was that as scenic quality increased, so the number of participants who found the wind farms acceptable would decrease markedly. However, what was found was almost the opposite. Except for a single scene, all the scenes were found to be acceptable for wind farms including even scenes of high scenic quality.

The author's original research in 2003 found that the scenes with wind farms rated lower than scenes without wind farms, until the scenic quality went below 5.10 at which point the wind farm enhanced scenic quality. The current research also found that the ratings of scenes with wind farms was lower than those without the wind farm, with a cross-over point of 4.92. This survey which included a further question on the acceptability of the wind farm found that in virtually all cases, this diminution in scenic quality was judged to be acceptable.

What are the implications of these findings? It has significant implications for the wind farm industry, for government regulation of wind farms, for the community, and for the Australian landscape.

The wind farm industry may be commended that in their development of wind farms they have achieved such strong community endorsement of their efforts. It might easily have gone the other way. If the turbine structures were of unpleasant appearance, perhaps of open steel lattice instead of the tubular form, the results may have been different. Undergrounding the powerline infrastructure rather than having it clutter up the landscape has also helped. Providing information days and tours of wind farms has communicated well with the public. Over time, the community's concerns have been allayed by seeing the wind farms and finding them acceptable.

For governments regulating the industry the findings suggest that while care needs to be taken with the layout, number and appearance of wind farms, and proponents need to be held to account to meet all conditions of approval, the public is far more tolerant of the presence of turbines than governments might assume. This does not mean that the regulatory requirement should be relaxed, indeed the current good standing of the industry may be partly attributed to the care with which governments have regulated it.

From a community viewpoint, the findings should not cause dismay, except for those implacably opposed to wind farms – the comments provided in the survey indicate that opponents participated in the survey. There will always be some for whom every wind farm must be opposed. For those who might find a wind farm being proposed in their vicinity, the findings suggest that resorting to public opinion may not be their best course. Rather they should seek to work with the developer and the government in reaching outcomes which minimise the adverse impacts.

The wind farm companies have generally contributed to community funds but this does not assist affected neighbours. One action that could be taken is to spread the largesse, paying rent to the owner of the property on which the turbines are sited but also providing a payment, perhaps equivalent to 10% of the rent annually, spread around the neighbours who are affected but who at present get no compensation. This would go a long way towards reducing local community angst.

The author's greatest concern lies with the future of the Australian landscape. If the findings are seen to provide *carte blanche* to site wind farms in high quality landscapes then this will be disastrous and may well turn the public against the industry. The survey's highest quality scenes were those on the coast with hypothetical, not existing, wind farms. With

the Cape Bridgewater precedent as an example, an actual wind farm proposal may provoke an adverse reaction despite the findings of this survey.

The industry should concentrate wind farms in the lower quality landscapes – the flat land devoid of tree cover, or low ridges with trees, and these would be acceptable. Australia has large areas of such suitable land with good wind resources.

The coast presents particular challenges. While winds are generally higher at the coast, so too is the corrosion and wear and tear of the turbines. While there are some low-lying coasts in which wind farms could be sited – Wattle Point on lower Yorke Peninsula in South Australia is an example - headlands and cliffs should be avoided.

The survey could stimulate further research into the Australian public's attitudes to wind farms, testing the findings of the current study and drilling further into the perceptions that the community has about wind farms. Further research may identify the threshold at which the acceptability of wind farms moves to the unacceptable and the factors involved in this shift.

Three objectives were stated at the beginning of the project:

1. To derive a model of Australia-wide applicability of the visual impact of wind farms;
2. To confirm the findings of the 2003 study that wind farms diminish the scenic quality of high-quality landscapes while enhancing the scenic quality of low-quality landscapes;
3. To determine a threshold of acceptability/ unacceptability of proposed wind farms.

Regarding the first objective, this has been achieved. Section 6.15 (Table 6.51) displayed a model of the expected ratings of a wind farm given the scenic quality rating of the area. As the survey participants came from every State and Territory they provided an Australia-wide view of the visual impact of wind farms. While the images of wind farms were derived from only three states and omitted those in Western Australia, Tasmania and Queensland, it is considered that the range of landscapes covered in the survey were broadly representative of landscapes in these other States.

The second objective to confirm the 2003 findings that wind farms diminish the scenic quality of high-quality landscapes was achieved and the indications from extrapolating the survey's results was that the scenic quality of lower quality landscapes would be enhanced by the presence of wind farms.

The third objective regarding a threshold of acceptability is somewhat problematic. Unexpectedly most participants found that wind farms were acceptable in virtually all land-scapes so it was not possible to define a threshold.

This survey is unique in that it not only asked participants to rate the landscape with and without wind farms but it also asked their opinion of the acceptability of the wind farm in each scene. To the author's knowledge, this had not been accomplished previously either in Australia or overseas.

7.2 SURVEY LESSONS, STRENGTHS AND WEAKNESSES

What were the survey's lessons, strengths and weaknesses?

The first lesson is to recognise that people's subjective opinions of wind farms can be measure objectively. By reaching into respondent's preferences, their likes and dislikes, as well as their attitudes regarding wind farms, the survey elicited information about how the community view wind farms in different landscapes, information that could not be easily obtained otherwise.

A second lesson is the amount of work required to carry it out. A project of this nature requires the dedicated allocation of resources. It is estimated that approxim-ately 500 hours was spent on the project over 3 - 4 months. It was undertaken by

the author who has completed twelve such projects involving either measuring and mapping landscape quality or assessing the visual impact of developments through surveys
(see www.scenicsolutions.world/projects/).

The project required considerable attention to detail through all phases – photography, selection of photographs for the survey, preparation of the Internet survey, issuing invitations to participate in the survey, and compilation and analysis of results. Quality control was critical throughout the project.

Several strengths of the survey are identified:

- It was conducted Australia-wide;
- It rated the scenic quality of the landscape with and without the wind farm and also rated the acceptability of the wind farm;
- Through contacting hundreds of clubs, it reached into the lives of ordinary Australians; nearly 40% had either no qualification or only a certificate or diploma.
- The data was weighted to reflect the Australian population.

Weaknesses of the survey include:

- Static turbines The turbines depicted in the scenes were static, not rotating. However, Grimm (2009) compared the scenic ratings of scenes with rotating turbines and scenes with static turbines and found that apart from nearby turbines, there was no difference.

- Length of survey The survey consisted of 98 scenes, half of which required two judgements of scenic quality and of acceptability, and it length was a bone of contention among about 15 participants who complained. While 848 participated in the survey, only 444 completed it although all scenes were viewed by around 527 participants. These numbers could reflect the drop-off of people choosing not to complete it.

- Gap in the scenic quality of scenes. There was a sizeable gap in ratings between the coastal scenes and the remainder and in hindsight it would have been beneficial if images of higher quality inland sites had been included. However, no wind farms were available on such landscapes and furthermore, at the outset of the survey, the scenic ratings are unknown.

- Self-selected participation. This is a criticism of surveys which use the Internet and over which one has little control over who participates. Stemming from this is the criticism that the participants were biased towards those who favour wind farms. While it is true that those in favour of wind farms numbered 508 compared with only 59 who were against them, there were a further 182 who said “It depends”. The accusation of bias is not valid, however, as the survey went across Australia and through targeting councils and hundreds of clubs, reached into the community to a great extent. That nearly 40% of participants had either no qualification or only a certificate or diploma is proof that the survey reached many ordinary people in the community. It is therefore difficult to sustain the argument that the survey only appealed to those in favour of wind farms. The choice of councils and outdoor-focused clubs biased the survey towards males; the survey should have been sent to a wider range of clubs for female participation.

- Failure to start the survey. There were 69 participants who entered their demographic information and attitudes about wind farms but who then failed to rate any scenes. The probable reason for this, as explained earlier and as suggested by Survey Monkey, is that these had older browsers on their computers. Information was provided in the Instructions about this but inevitably these are not heeded.

- Failure to include other sources of energy generation. This was suggested by many participants in their comments – that judgements about wind farms should be formed cognisant of the alternatives of coal mines and coal-fired power stations. While understanding the argument and its validity, to lengthen the survey with such images would not have been welcomed. Moreover, it would be likely to confuse participants and their inclusion would detract from the project's purpose

Apart from criticism of the survey's length, there were many positive comments about the survey (see Appendix 6) which were encouraging.

7.3 CONCLUSION

Wind farms are likely to proliferate in Australia as the nation moves to a low-carbon economy, particularly in relation to the generation of electricity. It is unlikely that further coal-fired power stations will be commissioned, but wind farms and solar farms are likely to expand significantly.

While protests against wind farms by affected communities and land owners are likely to continue, it is hoped that the finding of this survey may enable Australians to reach solutions which are agreeable and beneficial to both sides.

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APPENDIX 1 AUSTRALIAN WIND FARMS

Source: Australian Energy Market Operator (AMEO) NEM Registration and Exemption List, 2020.

Summary

	State wind generation GWh	Wind farms	Wind turbines	Wind farm capacity MW
Queensland	502.5	7	196	644.45
New South Wales	3836.7	16	620	1613.45
Victoria	4884.8	40	1096	3102.05
Tasmania	1119.9	5	197	641.00
South Australia	5722.4	24	845	2161.61
Western Australia	1864.3	8	456	1023.88
Total	**17930.6**	**106**	**3410**	**9186.44**

Queensland

Wind farm	Turbines	MW/turbine	Total MW
Coopers Gap Wind Farm	48	3.52	174
Coopers Gap Wind Farm	14	3.71	53
Coopers Gap Wind Farm	43	3.53	156
Coopers Gap Wind Farm	18	3.72	69
Mount Emerald Wind Farm	37	3.45	127.65
Mount Emerald Wind Farm	16	3.30	52.8
Windy Hill Wind Farm	20	0.60	12
Total	**196**		**644.45**

New South Wales

Wind farm	Turbines	MW/turbine	Total MW
Silverton Wind Farm	58	3.43	198.94
Boco Rock Wind Farm	58	1.70	113.18
Boco Rock Wind Farm	8	1.62	-
Bodangora Wind Farm	33	3.43	113.19
Crookwell 2 Wind Farm	28	3.43	96.04
Cullerin Range Wind Farm	15	2	30
Gunning Wind Farm	31	1.5	46.5
Capital Wind Farm	67	2	140
Gullen Range Wind Farm	17	1.46	275.5
Gullen Range Wind Farm	56	2.43	-
Gullen Range Wind Farm	31	3.45	-
Taralga Wind Farm	21	1.80	106.8
Taralga Wind Farm	21	2	-
Taralga Wind Farm	8	3	-
Sapphire Wind Farm	75	3.6	270
White Rock Wind and Solar Farm	70	2.5	175
Woodlawn Wind Farm	23	2.1	48.3
Total	**620**		**1613.45**

Victoria

Wind farm	Turbines	MW/turbine	Total MW
Chepstowe Wind Farm	3	2.05	6.15
Macarthur Wind Farm	140	3	420
Oaklands Hill Wind Farm	32	2.1	67
Bald Hills Wind Farm	52	2.05	106.6
Maroona Wind Farm	2	3.40	6.8
Timboon West Wind Farm	2	3.60	7.2
Yawong Wind Farm	2	3.60	7.2
Ararat Wind Farm	31	3.23	241.59
Ararat Wind Farm	32	2.57	82.24
Ararat Wind Farm	43	3.23	138.89
Bulgana Green Power Hub - Units 1-50	50	2	182
Cherry Tree Wind Farm	16	3.56	57.6
Coonooer Bridge Wind Farm	1	19.80	19.8
Dundonnell Wind Farm	40	4.20	168
Dundonnell Wind Farm	11	4.18	46
Dundonnell Wind Farm	29	4.20	121
Codrington Wind Farm	14	1.30	18.2
Yambuk Wind Farm	20	1.50	30
Ferguson North Wind Farm	1	4	4
Kiata Wind Farm	9	3.45	31.05
Elaine Wind Farm	22	3.80	83.6
Yendon Wind Farm	38	3.76	144.4
Mortons Lane Wind Farm	13	1.50	19.5
Mt Gellibrand Wind Farm	14	3.136	43.90
Mt Gellibrand Wind Farm	8	3.14	25.09
Mt Gellibrand Wind Farm	4	3.14	12.54
Mt Gellibrand Wind Farm	8	3.14	28.22
Mt Gellibrand Wind Farm	3	3.14	9.41
Mt Gellibrand Wind Farm	6	3.14	18.82
Hepburn Community Wind Farm	2	2.05	4.1
Mt Mercer Wind Farm	64	2.05	131.2
Challicum Hills Wind Farm	35	1.50	52.5
Crowlands Wind Farm	39	2.05	79.95
Portland Wind Farm	74	2	148
Yaloak South Wind Farm	14	2.05	28.7
Wonthaggi Wind Farm	6	2	12
Waubra Wind Farm	128	1.50	192
Salt Creek Wind Farm	15	3.60	54
Murra Warra Wind Farm	61	3.70	231.8
Toora Wind Farm	12	1.75	21
Total	**1096**		**3102.05**

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Tasmania

Wind farm	Turbines	MW/turbine	Total MW
Granville Harbour Wind Farm	31	3.55	110
Musselroe Wind Farm	56	3	168
Woolnorth Studland Bay / Bluff Point Wind Farm	37	1.75	140
Woolnorth Studland Bay / Bluff Point Wind Farm	25	3	75
Cattle Hill Wind Farm	48	3	148
Total	**197**		**641**

South Australia

Wind farm	Turbines	MW/turbine	Total MW
Hallett 1 Wind Farm	45	2.10	94.5
Hallett 2 Wind Farm	34	2.10	71.4
North Brown Hill Wind Farm	63	2.10	132.3
The Bluff Wind Farm	25	2.10	52.5
Wattle Point Wind Farm	55	1.65	90.75
Canunda Wind Farm	23	2	46
Cathedral Rocks	33	2	66
Hornsdale Wind Farm	32	3.20	102.4
Hornsdale Wind Farm 2	32	3.20	102.4
Hornsdale Wind Farm 3	35	3.20	112
Lake Bonney Stage 2 Windfarm	53	3	159
Lake Bonney Stage 3 Wind Farm	13	3	39
Lake Bonney Wind Farm Stage 1	46	1.75	80.5
Lincoln Gap Wind Farm	59	3.60	212.4
Mt Millar Wind Farm	35	2	70
Clements Gap Wind Farm	27	2	57
Snowtown Wind Farm Units 1 And 47	47	2.10	99
Snowtown South Wind Farm	42	3	126
Snowtown Wind Farm Stage 2 North	48	3	144
Starfish Hill Wind Farm	23	1.50	34.5
Waterloo Wind Farm	37	3	130.8
Waterloo Wind Farm	6	3.30	19.8
Willogoleche Wind Farm	24	3.83	91.92
Willogoleche Wind Farm	8	3.43	27.44
Total	**845**		**2161.61**

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Western Australia

Wind farm	Turbines	MW/turbine	Total MW
Albany Wind Farm	12	1.80	21
Badgingarra Wind Farm	37	3.50	130
Beros Rd Wind Farm	19	0.50	9.5
Collgar Wind Farm	111	2.00	222
Emu Downs Wind Farm	48	1.70	79.2
Karakin Wind Farm	10	0.50	5
Mount Barker Wind Farm	3	0.80	2.4
Mumbida Wind Farm	22	2.50	55
Nine Mile Beach	6	0.60	3.6
Sumich West Hills Wind Farm	10	0.50	5
Ten Mile Lagoon	9	0.20	2.03
Walkaway Wind Farm	54	1.70	89.1
Warradarge Wind Farm	51	3.50	180
Yandin Wind Farm	51	4.20	214.2
Small wind farms (6)	13		5.85
Total	**456**		**1023.88**

APPENDIX 2 SCENES WITH WEIGHTED RATINGS AND ACCEPTABILITY PERCENTAGES

Weighted rating (Unweighted rating)

NSW, Cullerin Range

Scene 2 Without 6.98 (6.56)

Scene 1 With 5.96 (5.41)

	%
Very acceptable	27.31
Acceptable	37.88
Neutral	14.42
Unacceptable	12.12
Very unacceptable	8.27

NSW, Cullerin Range

Scene 4 Without 6.21 (5.81)

Scene 3 With 5.95 (5.41)

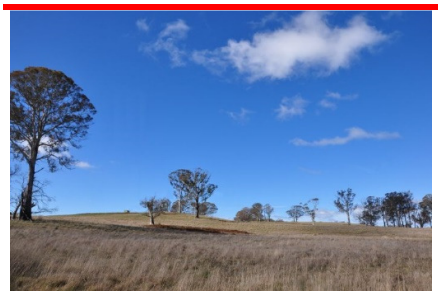
	%
Very acceptable	31.86
Acceptable	40.31
Neutral	11.32
Unacceptable	8.83
Very unacceptable	7.68

NSW, Cullerin Range

Scene 6 Without 6.75 (6.37)

Scene 5 With 6.04 (5.43)

	%
Very acceptable	31.09
Acceptable	38.00
Neutral	12.86
Unacceptable	12.28
Very unacceptable	5.76



NSW, Gullen & Graben Gullen

Scene 8 Without 6.95 (6.61)

Scene 7 With 6.20 (5.62)

	%
Very acceptable	29.12
Acceptable	41.57
Neutral	11.11
Unacceptable	8.62
Very unacceptable	9.58

NSW, Gullen & Graben Gullen

Scene 10 Without 7.89 (7.52)

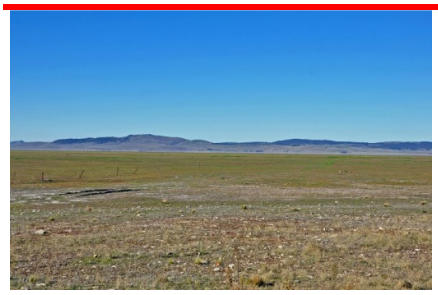
Scene 9 With 6.93 (6.45)

	%
Very acceptable	35.20
Acceptable	41.59
Neutral	8.90
Unacceptable	9.28
Very unacceptable	5.03

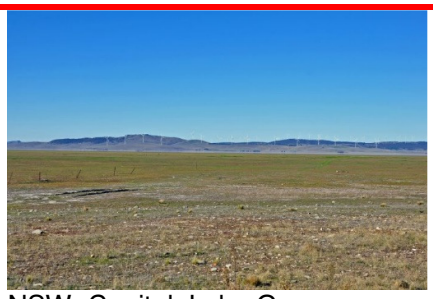
Scene 12 Without 6.44 (6.08)

NSW, Capital, Lake George
Scene11 With 5.82 (5.26)

	%
Very acceptable	30.19
Acceptable	41.73
Neutral	11.73
Unacceptable	11.73
Very unacceptable	4.62



Scene 14 Without 6.38 (6.00)



NSW, Capital, Lake George
Scene 13 With 6.08 (5.54)

	%
Very acceptable	38.57
Acceptable	40.89
Neutral	8.72
Unacceptable	7.95
Very unacceptable	3.88

Scene 16 Without 6.84 (6.41)

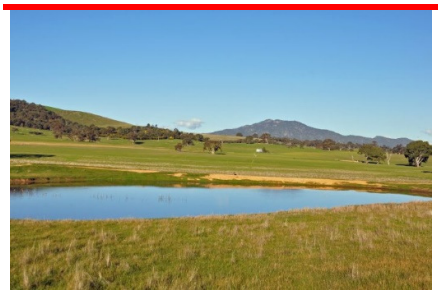
NSW, Taralga
Scene 15 With 6.18 (5.47)

	%
Very acceptable	32.43
Acceptable	39.45
Neutral	11.07
Unacceptable	11.26
Very unacceptable	6.80

Scene 18 Without 7.52 (6.99)

Victoria, Ararat
Scene 17 With 6.87 (6.19)

	%
Very acceptable	36.75
Acceptable	41.97
Neutral	8.51
Unacceptable	7.54
Very unacceptable	5.22



Scene 20 Without 8.42 (8.02)

Victoria, Ararat
Scene 19 With 7.29 (6.84)

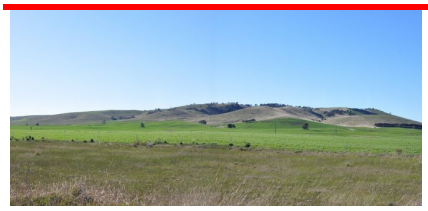
	%
Very acceptable	37.71
Acceptable	41.90
Neutral	7.05
Unacceptable	9.52
Very unacceptable	3.81

Scene 22 Without 7.29 (6.80)

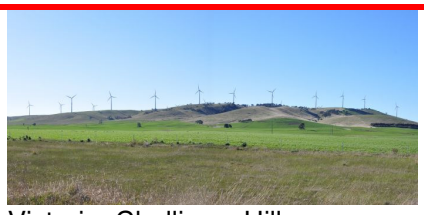
Victoria, Cape Nelson

Scene 21 With 6.47 (5.83)

	%
Very acceptable	32.36
Acceptable	42.83
Neutral	9.69
Unacceptable	8.53
Very unacceptable	6.59



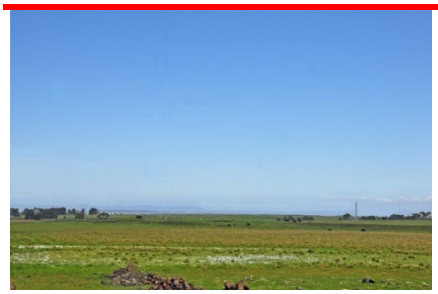
Scene 24 Without 7.03 (6.53)



Victoria, Challicum Hills

Scene 23 With 6.35 (5.67)

	%
Very acceptable	31.43
Acceptable	42.44
Neutral	9.04
Unacceptable	9.63
Very unacceptable	7.47



Scene 26 Without 6.16 (5.54)

Victoria, Macarthur

Scene 25 With 5.53 (4.75)

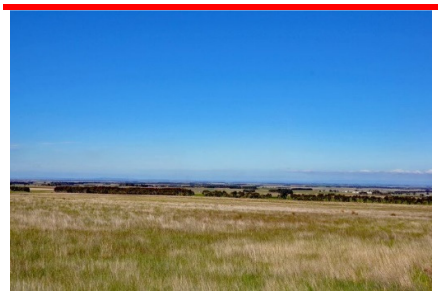
	%
Very acceptable	26.01
Acceptable	39.50
Neutral	13.49
Unacceptable	8.86
Very unacceptable	12.14

Scene 28 Without 5.87 (5.02)

Victoria, Macarthur

Scene 27 With 5.48 (4.65)

	%
Very acceptable	32.51
Acceptable	32.70
Neutral	11.41
Unacceptable	9.70
Very unacceptable	13.69



Scene 30 Without 7.01 (6.35)

Victoria, Mt Mercer

Scene 29 With 5.75 (5.01)

	%
Very acceptable	26.36
Acceptable	35.66
Neutral	12.60
Unacceptable	13.57
Very unacceptable	11.82

Victoria, Mt Mercer

	%
Very acceptable	24.67
Acceptable	35.18
Neutral	12.43
Unacceptable	14.72
Very unacceptable	13.00

Scene 32 Without 7.09 (6.42)

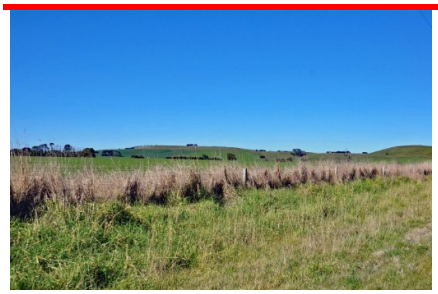
Scene 31 With 5.70 5.02)

Victoria, Waubra

	%
Very acceptable	32.33
Acceptable	42.91
Neutral	9.64
Unacceptable	9.64
Very unacceptable	5.48

Scene 34 Without 7.42 (6.96)

Scene 33 With 6.79 (6.20)

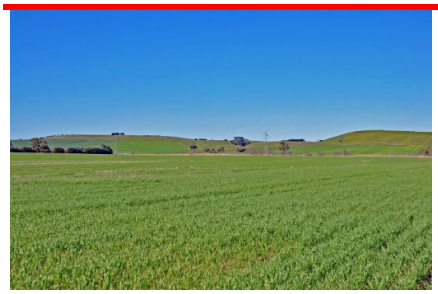


Victoria, Waubra

	%
Very acceptable	31.79
Acceptable	41.23
Neutral	11.37
Unacceptable	9.25
Very unacceptable	6.36

Scene 36 Without 6.99 (6.38)

Scene 35 6.28 (5.61)



Victoria, Waubra

	%
Very acceptable	33.53
Acceptable	42.97
Neutral	8.48
Unacceptable	7.51
Very unacceptable	7.51

Scene 38 Without 6.89 (6.29)

Scene 37 With 6.63 (5.83)

Victoria, Waubra

	%
Very acceptable	34.22
Acceptable	40.68
Neutral	9.51
Unacceptable	8.75
Very unacceptable	6.84

Scene 40 Without 6.08 (5.49)

Scene 39 With 5.96 (5.21)

Victoria, Yambuk

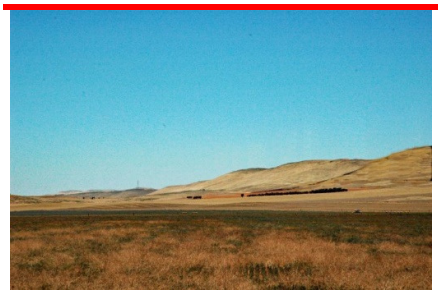
Scene 42 Without 7.19 (6.58) Scene 41 With 6.43 (5.76)

	%
Very acceptable	32.78
Acceptable	43.99
Neutral	9.88
Unacceptable	7.75
Very unacceptable	6.59

Victoria, Yambuk

Scene 44 Without 6.77 (6.25) Scene 43 With 6.37 (5.68)

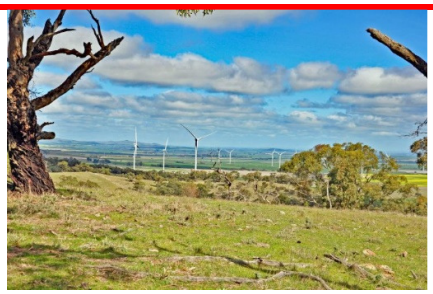
	%
Very acceptable	34.02
Acceptable	44.36
Neutral	9.02
Unacceptable	7.33
Very unacceptable	5.26



SA, Bluff Range

Scene 46 Without 6.76 (6.42) Scene 45 With 5.97 (5.35)

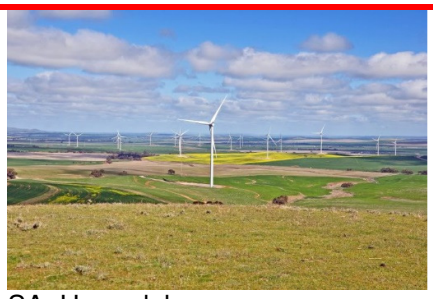
	%
Very acceptable	29.01
Acceptable	36.26
Neutral	13.17
Unacceptable	10.88
Very unacceptable	10.69



SA, Hornsdale

Scene 48 Without 8.14 (7.79) Scene 47 6.78 (6.19)

	%
Very acceptable	27.75
Acceptable	43.97
Neutral	11.95
Unacceptable	9.63
Very unacceptable	6.74



SA, Hornsdale

Scene 50 Without 7.58 (7.13) Scene 49 With 6.18 (5.66)

	%
Very acceptable	26.89
Acceptable	42.43
Neutral	10.56
Unacceptable	9.96
Very unacceptable	10.16

Scene 52 Without 7.09 (6.35)

SA, Hornsdale
Scene 51 With 6.22 (5.33)

	%
Very acceptable	33.27
Acceptable	36.56
Neutral	11.80
Unacceptable	8.32
Very unacceptable	10.06

Scene 54 Without 6.73 (6.00)

SA, Hornsdale
Scene 53 With 6.13 (5.44)

	%
Very acceptable	28.80
Acceptable	41.22
Neutral	10.85
Unacceptable	8.09
Very unacceptable	11.05

Scene 56 Without 7.95 (7.37)

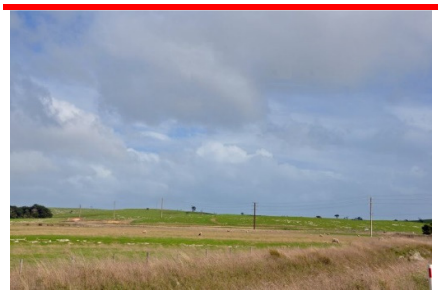
SA, Hornsdale
Scene 55 With 6.37 (5.71)

	%
Very acceptable	27.10
Acceptable	37.21
Neutral	13.74
Unacceptable	11.07
Very unacceptable	10.88

Scene 58 Without 7.87 (7.37)

SA, Hornsdale
Scene 57 With 6.79 (6.06)

	%
Very acceptable	31.55
Acceptable	40.92
Neutral	9.56
Unacceptable	10.33
Very unacceptable	7.65



Scene 60 Without 5.98 (5.32)

SA, Lake Bonney
Scene 59 With 5.69 (5.02)

	%
Very acceptable	31.26
Acceptable	39.81
Neutral	11.26
Unacceptable	9.32
Very unacceptable	8.35

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Scene 62 Without 6.30 (5.73)

SA, Lake Bonney
Scene 61 With 5.77 (5.00)

	%
Very acceptable	31.13
Acceptable	40.27
Neutral	11.28
Unacceptable	8.95
Very unacceptable	8.37

Scene 64 Without 6.72 (6.08)

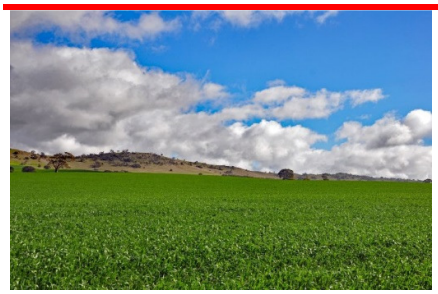
SA, Lake Bonney
Scene 63 With 6.13 (5.32)

	%
Very acceptable	32.03
Acceptable	39.65
Neutral	12.50
Unacceptable	7.62
Very unacceptable	8.20

Scene 66 Without 8.17 (7.68)

SA, Starfish Hill
Scene 65 With 6.91 (6.36)

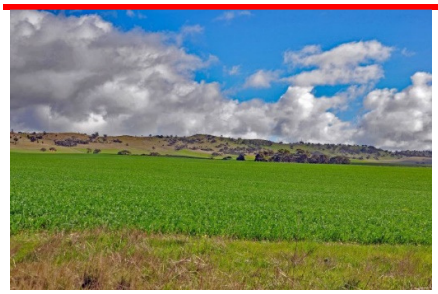
	%
Very acceptable	32.63
Acceptable	41.70
Neutral	10.42
Unacceptable	9.65
Very unacceptable	5.60



Scene 68 Without 7.21 (6.57)

SA, Waterloo
Scene 67 With 6.29 (5.62)

	%
Very acceptable	31.36
Acceptable	39.39
Neutral	10.33
Unacceptable	10.33
Very unacceptable	8.60



Scene 70 Without 7.33 (6.83)

SA, Waterloo
Scene 69 With 6.21 (5.58)

	%
Very acceptable	29.49
Acceptable	41.41
Neutral	9.18
Unacceptable	11.72
Very unacceptable	8.20

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SA, Waterloo

Scene 72 Without 7.32 (6.69)

Scene 71 With 6.60 (5.85)

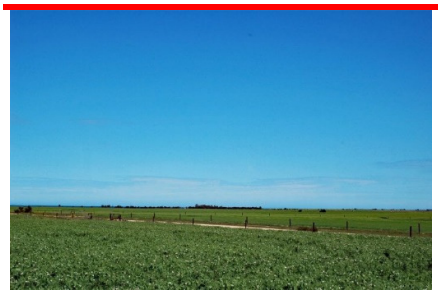
	%
Very acceptable	34.57
Acceptable	40.63
Neutral	8.79
Unacceptable	10.74
Very unacceptable	5.27

SA, Wattle Point

Scene 74 Without 6.47 (5.87)

Scene 73 With 6.06 (5.13)

	%
Very acceptable	32.36
Acceptable	42.50
Neutral	8.19
Unacceptable	8.77
Very unacceptable	8.19

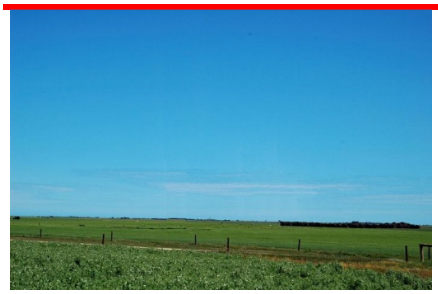


SA, Wattle Point

Scene 76 Without 6.46 (5.63)

Scene 75 With 5.86 (5.05)

	%
Very acceptable	33.78
Acceptable	37.21
Neutral	9.73
Unacceptable	10.69
Very unacceptable	8.59



SA, Wattle Point

Scene 78 Without 6.30 (5.58)

Scene 77 With 5.62 (4.94)

	%
Very acceptable	31.27
Acceptable	34.56
Neutral	12.36
Unacceptable	10.42
Very unacceptable	11.39

SA, Encounter Bay, (hypothetical)

Scene 80 Without 7.65 (7.52)

Scene 79 With 5.85 (5.55)

	%
Very acceptable	16.90
Acceptable	31.63
Neutral	11.59
Unacceptable	22.99
Very unacceptable	16.90

Scene 82 Without 8.36 (8.17)

SA, Kings Head, (hypothetical)
Scene 81 With 6.03 (5.74)

	%
Very acceptable	19.73
Acceptable	27.97
Neutral	15.33
Unacceptable	18.58
Very unacceptable	18.39

Scene 84 Without 8.65 (8.44)

SA, Parsons Beach, (hypothetical)
Scene 83 With 6.07 (5.81)

	%
Very acceptable	18.55
Acceptable	27.46
Neutral	12.24
Unacceptable	22.26
Very unacceptable	19.48

Scene 86 Without 8.19 (8.01)

SA, Troubridge Point, (hypothetica
Scene 85 With 5.84 (5.61)

	%
Very acceptable	18.81
Acceptable	28.21
Neutral	14.78
Unacceptable	20.92
Very unacceptable	17.27

Scene 88 Without 8.28 (8.05)

SA, Daly Head, (hypothetical)
Scene 87 With 5.98 (5.76)

	%
Very acceptable	16.79
Acceptable	30.19
Neutral	15.09
Unacceptable	20.19
Very unacceptable	17.74

Scene 90 Without 8.38 (8.27)

North Balgowan, (hypothetical)
Scene 89 With 6.26 (5.93)

	%
Very acceptable	22.01
Acceptable	29.73
Neutral	12.36
Unacceptable	19.88
Very unacceptable	16.02

Scene 92 Without 8.83 (8.68)

SA, Mt Westall, (hypothetical)

Scene 91 With 6.30 (6.02)

	%
Very acceptable	17.78
Acceptable	31.74
Neutral	12.81
Unacceptable	19.69
Very unacceptable	17.97

Scene 94 Without 8.52 (8.31)

SA, Whalers Way, (hypothetical)

Scene 93 With 6.09 (5.93)

	%
Very acceptable	20.50
Acceptable	31.42
Neutral	12.84
Unacceptable	18.97
Very unacceptable	16.28

Scene 96 Without 8.96 (8.74)

SA, Cape Torrens, Kangaroo Island (hypothetical)

Scene 95 With 6.46 (6.39)

	%
Very acceptable	21.44
Acceptable	33.02
Neutral	11.39
Unacceptable	18.22
Very unacceptable	15.94

Scene 98 Without 8.90 (8.77)

SA, Pennington Bay, Kangaroo Island (hypothetical)

Scene 97 With 5.62 (5.54)

	%
Very acceptable	15.37
Acceptable	19.46
Neutral	13.62
Unacceptable	25.10
Very unacceptable	26.46

APPENDIX 3 COMMENTS BY EMAIL

The following comments were received during the period that the survey was on line.

6 March
Andrew the survey is too long and will skew your results only passionate supporters or objectors will complete. A shame as it is a good idea. I suggest you get some professional assistance with survey design Regards, Madeleine Walker
(My response: Thank you for your comment and advice, Madeleine. I have held longer surveys in the past and gained the requisite number of participants.)

Thank you Andrew
Cr Carol Schofield AM

One of the most difficult surveys I've ever received. I always try to fill out surveys but this one seems to have no end.
Thank you
CR.Owen Sharkey

8 March
G'day Andrew
A little more transparency please.
I reckon that if you are going to expect people to spend that amount of time on your survey, you owe it to us to be very transparent about what will happen with the results.
How do you intend to use them?
Is it for your business?
If so, do you hope to receive financial gain from them?
Have your research been ethically reviewed?
I look forward to hearing from you on this.
Please don't tell me that I don't have to do the survey-I am well aware of that.
I'll be happy to fill it out, once I hear back from you. Your results aren't going to mean all that much if you don't follow correct protocols
Regards
Tony Gleeson
(My response: Thank you for your queries Anthony. I understand your concerns. This is a private project I am doing as a follow up for a project I undertook in 2003 (Lothian, A., 2008. Scenic perceptions of the visual effects of wind farms on South Australian landscapes. Geographical Research, 46:2, 196 – 207). I am retired and am doing the project out of interest in the subject as I like to carry out such projects (see my website: www.scenicsolutions.world for other projects). I am not expecting any financial gain - indeed it has already cost me in travelling to photograph the various wind farms, subscribing to Survey Monkey etc. It has not been ethically reviewed as I am not in a university environment. Hopefully from the results I will write a paper and submit it to a journal for publication. I hope this helps.)

9 March
Hi Andrew
Just for info: Our council e-mail system classified your e-mail as SPAM. I went in and unblocked it and completed the survey. You may encounter the same problem with others in organisations
Cheers, Clr Patrick McGinlay
(My response: Sent future emails in groups of only four addresses).

9 March
It is too long.
Regards
Cr. Janet Wilson, Kyogle Council

19 March
Hi Andrew,
Can you please tell me what the aim of the survey is as it appears to be just a ranking of Australian scenery. Does it include questions on people's support for or against wind farms and what will the survey be used for?
Cheers,
Isaac Smith
Mayor - Lismore City Council
(My response: Hi Isaac. Yes it does include a question on people's attitude towards wind farms. It has photos of a scene with and without the wind farm - randomised so that one doesn't follow the other. These are mostly actual wind farms in NSW, Vic and SA. The study follows an earlier one that I did about 2003 (Lothian, A., 2008. Scenic perceptions of the visual effects of wind farms on South Australian landscapes.

Geographical Research, 46:2, 196 – 207). Hopefully this study will provide a basis for measuring the visual impact of wind farms that can be used for future proposals. Hope this helps.)

12 March
Dear Andrew,
Would you mind explaining the intent of your survey. Has it been approved by anyone, funded etc?
Many thanks,
Jenny Donovan
(My response: Hi Jenny. In 2003 I conducted a survey of wind farms using hypothetical locations on the coast and inland in SA. It was published in 2008 (Lothian, A., 2008. Scenic perceptions of the visual effects of wind farms on South Australian landscapes. Geographical Research, 46:2, 196 – 207.). My specialty is measuring and mapping landscape quality (see my website www.scenicsolutions.world) for the various studies. I am interested in the effect of wind farms (and other developments) on visual quality. This survey extends from the earlier study in that it uses mostly actual wind farms in NSW, Vic and SA. I want to see if it is possible to detect the threshold at which a wind farm moves from being acceptable in the landscape to unacceptable and the factors involved. So the survey asks two questions of the scenes with farms, what is its landscape rating (1-10 scale) and secondly how acceptable or unacceptable do you find it. This is privately funded research I am doing in my retirement. No client is involved. Hopefully the results may assist Governments in their assessment of wind farms. Hope this helps.)

Aren't you marvellous doing this Andrew? I will definitely complete your survey now.
Cheers
Jenny

14 March
Dear Andrew,
Thanks very much for your email to the Mornington Peninsula Shire Mayor and Councillors regarding your survey on the visual impact of wind farms. This is a very interesting topic. I will forward on your survey to my colleagues for their interest.
Good luck with the survey.
Kind regards,
Nicci Tsernjavski
Acting Climate Change Co-ordinator, Mornington Peninsula Shire

15 March
Hi Andrew,
My feedback on the survey is that I found it to be too long! In my view it would have been better with 30-50 questions.
My opinion is that wind farms are not necessarily unappealing visually, and that sometimes they can enhance the aesthetic appeal of the landscape.
They also supply valuable renewable energy.
Kind regards,
Joel Olsder

18 March
Dear Andrew,
I don't think anyone is going to complete a 105 question survey. I could be wrong. I started and gave up. Sorry.
Philip Norris
(My response: Thanks Philip. Actually nearly 300 have completed it so far. But thanks for trying.)

19 March

Hello Andrew,
Before I do this survey, may I please ask if you have a pro- or anti-wind farm agenda?
Thanks, HS Tham, Bass Sydney
(My response: Neither. This is a semi-academic project because my specialty is landscape quality & the assessment of visual impacts. I have no interest in promoting either a pro or anti position. See my website - www.scenicsolutions.world I hope this helps.)

20 March
Thank you very much for this, Andrew. Personally I deplore their visual impact on the landscape, and as we have a club meeting this Saturday I'll put it to the members as to whether they'd like to participate.
Hopefully you get lots of responses!
Cheers, Kerry Milner, Secretary, ClubMan Queensland (car club)

20 March
Dear Andrew,

I took the time to complete your survey but did not want to leave my email at the end. The survey would not save and I lost it. Very frustrating after taking the time to complete it.
I found the survey very demanding – far too many photos.
As I am a great fan of wind farms and clean energy, I was disappointed a) because you won't have my data and b) because I wonder how many people will have the patience to scroll through so many photographs.
I am hoping that my feedback is helpful. I wish you all the best with your project.
Warm wishes, Robyn Pryor
(My response: Hi Robyn. I am sorry for the frustration you had over the survey. I have checked with Survey Monkey and your ratings are saved every time you do one. So your ratings are not lost, they are all in the system. So far I have had nearly 350 people complete the survey which is great.)

21 March
How about some comparison photos of a coal fired power station and associated coal mine to go along with your wind farm photos.

22 March

Hi Andrew,
Further to your email to the Friends of the Heysen Trail,
We are not looking to email our members, however we find the best way to get out info and participation these days, is to post on social media – facebook in particular. – If you do an acceptable post re the survey access on facebook – we would likely share the post which will be to a much larger audience. And would be picked up by others who are interested in windfarms.
PS I did the survey – It was interesting to help form an opinion on windfarms – I concluded that they are interesting additions for occasional sighting, tho distract from the beauty of most scenes. And I see why it needs so many images in the survey.
Regards, Robert Alcock, Chair, Marketing and Membership committee, Friends of the Heysen Trail

Good Afternoon Andrew,

Thank you for your email and the opportunity to take part in the survey of the visual impacts of wind farms. The scenery in some of the pictures were beautiful and it was interesting to see the impacts of the large propellers in fields and on coastlines. I think there is a real need for such infrastructure and took interest in them whilst travelling through Europe last year.
Kind Regards,
Peta Pinson
Mayor, Pt Macquarie - Hastings

26 March

- I started but did not complete the survey. Not all the images would download to my device.
- Demographically, I am an elderly male with a Master's Degree. I am an Australian citizen having migrated from UK about 50 years ago.
- I have seen several wind farms during tourist travels in SA, NSW & Tas and overseas in UK & Europe.
- In my view wind farms are an acceptable 'trade-off' for eliminating fossil fuels, bearing in mind that the Australian community has sworn off any nuclear option. This continent is poorly provided with hydro opportunities but uses what we've got fairly well.
- Solar power generation on the required scale is unreliable (darkness) and also impacts the visual amenity. Comparison becomes a value judgement.
- We should note the overwhelming majority of our citizens dwell in urban areas so the visual impact of wind farms is a marginal experience.
- My personal view is that overall, the nuclear option will ultimately be the best. Australia has had the ability to set it aside due to cheap generation using non-renewable fossil fuels. Around 30 nations around the globe have adopted nuclear to significant extent. There has been just one major accident in the last 40 years (Fukushima). Australia is in an excellent position to hold its own nuclear waste as the Government already has closed off a very extensive area (Maralinga) due to radio-activity considerations.

Regards,
JOHN PRESTON

28 March

Hi Andrew, As a retired Engineer, working in the Civil Engineering field in the most dynamic era of our civil and structural field in the greatest development time in Queensland, both Corporate Practice and Private over 45 years, I am astounded that you have little understanding of how our society has evolved and has yet to evolve. I understand (correct me if I am wrong) that you have little experience in private Practice, and are a product of our taxpayer funded public education system, which I am forced to state does not allow for a "real state of the nation" down to earth, balls on the line, sink or swim, design of our Civil community expansion. – I, like others, are disappointed that people are allowed to propergate ideas and information as fact, even in the field of surveys. – Appreciate your research (?), and hope it has full balanced publishable fact behind it. – Kind regards, - Rod

(My response: I don't quite understand what you are driving at. Is it that you think surveys of this type are useless? What is it about society evolving? It doesn't make a lot of sense to me. I am trying to objective-based research and am certainly not propagating a particular line of outcome. I must be really dense or perhaps you haven't communicated well.)

29 March

Hi Andrew, - Thanks for your reply, - I have circulated your reply to several of my peers. – The overarching question appears to be, "what is the purpose of this survey? – Is it to demonstrate the ugliness of wind farms? – like 33 kV transmission towers, or over-head suburban 50 Hz 230 V distribution systems, or even fat people on the beach, or the determination of the degree of distaste some members of our society have for Gay Rights demos. – Or is it more to the point of the research as to the effect of the RF saturation and the medical, if indeed there are effects, to our society. – There appears to be a "no brainer" that the visual, audio, and possible (no conclusive evidence as yet?) of the effect of the wind farms RF output are not of benefit, or detrimental, to adjacent societies. - Obviously anything that is a striking feature in a natural landscape is out of place. – Wind farms, solar panel farms, hydro, tidal generation, Nuclear, geo-thermal, coal fired generation, etc. Is not the preferred option if one wants to revert to the pre Industrial Revolution. Therefore, the need for a survey by your self seems to be a self interest event by yourself, possibly/ probably? Invoking a contribution to yourself from the public purse.
Regards, -Enjoy your Easter break, - Rod.

(my response: I guess you are trying to find something wrong with my research.)

APPENDIX 4 COMMENTS ON FAMILIARITY WITH WIND FARMS

- In Australia and especially Germany
- Around the world
- Elsewhere in the world as well as in Australia
- Initially I found their presence intrusive but I now like their presence
- Seen plenty in Scotland and the UK
- Personally seen them in NSW, SA & Tas.
- They are a blight on the vista of the land
- Consider them a blot on the landscape
- Personally I am an environmentalist so I think they are great...the survey may be biased ?
- Overseas
- Traveling around Aust.
- Carried out wind monitoring in the early 90's on the Monaro for the purpose of understanding the availability of usable wind in the region.
- North Qld and Thursday Island
- During my travels I've seen wind farms in SA, Vic & NSW. I was so angry how they have visually damaged the landscape.
- I think they look alien.
- None of the above answers applies to me, because I think I have seen one wind farm.
- Have seen one in particular that I remember up near Ravenshoe in North Queensland.
- Seen many in many parts of the world
- Especially overseas, eg in western China & eastern Europe (Hungary, Slovakia)
- They are a viable way to capture energy.
- Love them. They are mesmerising.
- I am environmentally in favour of them
- Seen them all over the world.
- Have prepared numerous wind farm LVIA.
- Work in construction. worked on several wind farm projects.
- Extensively travelled overseas over LAST 20 YEARS.
- As a glider and power pilot I see them all the time and fly in the near vicinity of many wind farms across Australia.
- I quite like the look of wind farms.
- Successfully fought the Jupiter wind farm for four years. Recommended rejection primarily on VI grounds, although develop withdrew the DA this week.
- In Europe only.
- 'Familiar' in the location of a couple within 50kms from my home. Also interested in articles in my local paper/s & television.
- In SA Victoria and NSW
- Seen them on News and Current Affairs shows on TV.
- In person in SA, photos of them from around the world.
- Travel in rural south Australia.
- I am a town planner and have sought planning permission for wind farms on behalf of developers.
- In Australia and Europe; up close and from far away.
- Familiar with wind farms in SA on the Fleurieu Peninsula, the state's Mid North and Eyre Peninsula.
- Around the world
- Both in Oz and overseas.
- Including in Europe, specifically Hungary and Copenhagen.
- In Australia and overseas.
- In Europe
- Need more of them
- I think they are quite attractive.
- Just walked thru Spain.
- I think they look quite attractive, especially in certain light and weather conditions.
- In USA & Australia.
- I think they are beautiful
- Wind farms are becoming more popular.
- I live in an area where they exist.
- Wind farms look far better than smoking fossil fuel power stations and huge holes left after coal mining!
- I lived with a wind mill for 6 months during my final thesis.
- They are very elegant.
- They are ugly and horrible.
- Hate them rather have nuclear.
- They have invaded our Shire.

- Some in Australia but mostly overseas.
- Travel
- On Way to Melbourne
- I've spent time in Scotland where there are many.
- Bit sceptical as to how effective they are at stopping co2 emissions and as they are heavily subsidised, is it worth it?
- They have been around our for many years. I have visited a wind farm on a tour.
- Only one.
- Seen in Europe, UK and Australia.
- I'm retired and travel regularly in a motorhome. I come across them frequently.
- In UK, Europe and Sth Australia.
- Only fairly small ones.

APPENDIX 5 COMMENTS IN FAVOUR OR OPPOSED TO WIND FARMS

- Prefer that they are in the sea rather than in the middle of areas of scenic beauty. Even have them near built up areas and towns, rather than in remote locations.
- We need to use energy efficient power due to increasing population growth and less employment opportunities.
- Can be unreliable during severe storms as has been proven in South Australia in the summer of 2016.
- Future needed.
- Cost benefit.
- "Free" energy such as wind, thermal, solar, tidal, hydro, coal fired/gas etc., are part of our available solution to our insatiable hunger for energy.
- I am not convinced of any long-term benefits, economically, of unsubsid-ised wind farms.
- They spoil pristine landscapes. SA has the highest power prices in the world due to the rush to renewables. They are necessary for supplying renewable energy.
- Location
- I reckon they are an eye sore on the land.
- Sustainability is more important than anything to me.
- A positive contribution to our energy needs.
- On the area, how close they are to other landmarks.
- USED TO LIKE THEM, BUT THERE ARE WAY TOO MANY IN MY DISTRICT.
- We need clean energy so like all things there is a price.
- Where they are placed.
- They are very ugly and I have serious concerns about the impact low frequency has on animals and humans.
- They are ugly and I have concerns about the impact of low frequency on animals and humans.
- Clean green renewable energy.
- Where they are. What they are used for as they cannot replace base load at present.
- For, provided they are part pf a mix of energy sources due to wind being an intermittent source of energy.
- For, when they provide energy for isolated communities without many energy alternatives.
- For, when they do not impact on scenic views.
- For, provided that they are part of an energy plan which uses a mix of energy sources due to the fact that wind energy is intermittent. For, when they provide energy to isolated communities with few alternatives. For, when they are located sympathetically in the landscape.
- providing you don't take away Clean coal and have only this. It's not fully viable yet you still need a back-up energy... no power in this day and age is just not on.
- Visual and sound pollution. Drives cattle mad.
- very fervent supporter of renewable energies.
- I'm for renewable energy.
- It's a trade off against fossil fuels consumption. Australia is impover-ished for hydro opportunities and has sworn off nuclear. Wind farms constitute our best remaining option. (By the way, I am a great supporter of nuclear as our actual best option. Even acknowledging Fukojima it is the most reliable and acceptable power sower given the scale of the demand 24/7.)
- The visual element is a minor concern for me. My bigger issue is the inefficient nature of them and the extent of raw materials needed to make and maintain them. They are inefficient money pits.
- If wind farms are proved to be commercially competitive with current electricity generating options such as hydro plants and coal fired power stations and do not deserve outlandish funding support unless proved to be for the improvement of the design towards making electricity generation more affordable.

- Better for environment than coal fired generators.
- Noisy, inefficient, visually an eyesore.
- Inefficiency, noise, hazard to birds, visual impact.
- They are unattractive and only work when the wind is blowing and half the time many are not turning at all.
- Eye sore, kill native birds, questionable output, massive cost to build.
- Absolutely for renewable energy! I would much prefer to see land used for a wind farm than for Coal Mining!!
- Low CO2 emissions.
- Generally in favour, as I support increasing renewable energy. My only reservations would be potential to affect birds in flight as in the case of orange bellied parrot or if placed in an area of significant scenic beauty.
- Global impact of carbon is devastating...we need alternatives that are environmentally friendly.
- They look a lot better the coal power stations.
- I am pleased to see evidence of the production of renewable energy.
- Being on solar power only I see them as wow things. I have a 12 volt wind generator and it is an asset to my power supply. I see them as part of the landscape and not as a blotch on it. You can look past them if you want to.
- Sustainable energy generation is important.
- Suitability of the location and its impact on the region.
- sustainable energy source.
- They are not as efficient as solar, and from a maintenance perspective are more costly to maintain.
- Location, community agreement, economic benefit.
- Low environmental impact.
- Renewable energy, good to look at.
- Location, community agreement and economic benefit.
- Environmentally friendly, sustainable in the long term, make sense.
- Alternate source of energy.
- For environment- reduce pollution.
- Apart from being visually ugly, they don't all work. There are restrictions on bill boards and signs but these wind farms are much worse than a bill board. When they stop working they stay that way…a dead piece of junk in the middle of a beautiful landscape.
- Usable resource.
- If it can be proven that, over their lifespan, the windfarm creates more energy than what it took to build in the first place.
- Location should be in low population areas.
- They are preferable to coal fired power & I quite like the majesty of them on the landscape.
- Site specific impact.
- I'm in favor of wind energy but not sure that farms are the best way of harnessing it.
- I believe that if we can harness the power of the wind to create electricity we should do it but wind farms need to be placed in the best positions to take advantage of constant wind.
- The visual impact depends on the location and the benefits are varying depending on location. They require taxpayer subsidies for construction and operation.
- I live beside a coal fired power station and associated coal mine and you want to whinge about a wind farm.
- It's a clean energy source. Anything that can help protect the environment is a step in the right direction.
- We should be increasing clean, non-fossil fuel energy production because of global warming
- They are clean and green.
- Urgent action needed on greenhouse gas emissions.
- Clean energy.
- Source of clean energy.
- Let’s fight pollution and climate change. The country won’t be pretty if its covered in water.
- Sometimes the turbines look like a blot in the landscape and other times they look magnificent, a testament to humankind’s ability to work with nature. I think it depends on whether their location and the surrounding scenery.
- I believe it affects your health. Several years ago we purchased a computer

with a cooling fan in the monitor. When this computer was on in an office in the downstairs area of our house my daughter and I both got headaches and felt unwell when we were anywhere downstairs. We had this fan removed and a computer technician placed a smaller quieter fan in the monitor and our health improved. I have heard people complain of the exact same symptoms when living near wind farms. When they go on holidays on the advice of their doctor the symptoms disappear. They save electricity don't they? Sounds perfect.

- Need to replace coal mines where they are situated.
- I want electricity. I want minimal environmental impact. I want no climate change. The only viable options are wind and solar.
- A lot of wind farms aren't out of place, but then a lot are
- good for the future of all generations
- Depends how many in one location. Too many look awful.
- How it affects the people who are near it, not just visually.
- They seem like a cool way to make electricity
- Fossil fuels and Nuclear fuels are appallingly dangerous for the community.
- Must be 50km away from habitation.
- Need to engage in renewable energy, solar and wind are the most genuinely renewable sources we have.
- Sensible emission-free power generation.
- I do not think they are prevalent enough to prevent one enjoying the scenery. I find them fascinating.
- I understand the need for renewable energy but would not be too keen if a windfarm was proposed next door to me!
- Depends on location of the wind farm.
- Should not be placed close to populated areas and not visible from or in locations considered to be significantly scenic eg, from roads and trains in those areas.
- Depends on total cost /benefit analysis - not sure of ALL costs etc involved.
- OK in moderation.
- No pollution, sustainable, and they look much better than a coal fired power station!
- Passive power generation is the future.
- Depends on location.
- Have some sympathy with the ultra-low sound theory - towers shouldn't affect neighbours
- Renewable energy - good for the environment.
- Sustainability. cleanliness of generation.
- THEY ARE NECESSARY TO GENERATE POWER AND THEIR LOOK IS DIMINISHED BY THEIR USEFULNESS.
- Renewable energy source.
- Mostly in favour as in opinion that development in renewables are far more important than an aesthetic pleasure of visual impacts. Also bearing in mind similar visual impact of Open Cast Coal mine, hydrology or even electricity grid system impact on general landscapes / environment /air qualities etc etc.. .
- How much of a buffer exists between residential development and the wind farm.
- Depends on their visual impact and effectiveness.
- Supplemental power to non-renewable resources. You can't have it both ways - renewables and some impact to visual amenity!
- I'm generally in favour, if the business case stacks up.
- For
- Non-viable for electricity production as extremely expensive and intermittent as well as there being no evidence for anthropogenic global warming.
- A blight on the landscape and a danger to birds.
- Clean electricity generation.
- My general inclination is more against windfarms because of their visual impact and effects on wildlife compared to the actual power output (e.g. nuclear is much more compact, solar can be much better integrated into landscapes and populated areas).

- Solution for which there is no problem. RET/REC results in increased electricity charges.
- Unreliable. Divides communities. How many do you want?
- Alternate forms of power generation are needed as coal will not last forever. Wind and solar are renewable sources.
- I'm absolutely against fossil fuel generated power but personally prefer solar - however am aware that wind farms are an excellent solution for power generation!
- I believe we need to be trying to use more renewable energy.
- Electricity generation is generally messy. See the German Ruhr. Wind farms are generally low impact.
- Ugly, costly, not economical, unreliable, etc etc.
- Where they are manufactured and the manufacturing process.
- Not sure yet whether it is a problem.
- I am always open to 'new' ways of producing power but am aware of environmental factors (sight, 'emissions' & noise/ animal welfare issues & $$ costs. Wind farms are possibly a better long -term choice.
- Better than coal or lng.
- Represent the future..they're high tech, and I do not have any aesthetic issues with them.
- I don't have an opinion one way or the other.
- Prefer wind against smoke stacks.
- I prefer coal-based electricity.
- It depends on where they are located and how intrusive they are on the visual landscape.
- Depends where they are and how much subsidy they receive.
- Provide energy, which we need.
- Located away from people's view & living space seems best.
- On where they are sited.
- Wind farms are a good sustainable source of energy, and it is beneficial to have wind energy in Australia.
- Wind farms provide an environmentally friendly source of energy. If we keep burning coal for energy we won't have any nice scenery to look at in future anyway! I don't think they detract too much from the landscape but they are necessary for future energy supplies.
- Lead to increase in electricity price.
- Need energy storage backup to make them "efficient".
- In favour if they are in the right locations.
- I don't find wind farms displeasing aesthetically.
- Location in relation to people, towns, houses, farms.
- An important renewable energy source.
- I need to understand more of the current research.
- NOT IN FAVOUR OF WIND FARMS FOR THE SAKE OF THEM. THEY HAVE THEIR PLACE IE DENMARK ETC
- A proven, economical and reliable form of renewable energy, especially when coupled with storage.
- Sustainability
- Impacts visual and other depend on location and proximity to other amenities and environmental assets.
- I value wind farms as sources of renewable and low emission energy.
- Wind farms provide renewable energy that, when coupled with storage ability can provide clean, sustainable power production. Obviously they need to be integrated well with the overall power supply system.
- Generally in favour if no environmental impacts.
- Ugly. And the cost of construction and maintenance makes them far less economical against traditional sources of power than is claimed.
- The need for clean renewable energy is vital for our future security and growth.
- Where they are placed; on what landscape.
- I value their role as a provider of renewable energy with few emissions.
- There must be better technology, but when they are in places that don't affect people I am not as concerned.
- Cleaner sustainable energy production.
- They are a cheap and reliable source of renewable energy and therefore are

replacing fossil fuel as a source of power for homes and industry.
- Sustainability
- Depends on the effect on people living nearby.
- I am in favour but not if govt subsidised.
- They are intrusive, visually and audibly. Some people are probably a lot more sensitive to their sound than others.
- It is an intermittent energy supply, not base load.
- On the little defensive island, just at the entrance to the harbour at Copenhagen, we went to the highest point. It was a very windy day. The wind was howling. However, underneath this noise, we could hear the undertones of the turbines. It was very unpleasant. I would not like to live or work nearby. I repeat that the wind itself was very loud, but you could still hear the turbines.
- Noise levels, visual obtrusions, wind erratic, either too strong or not there. Erratic top up of supply.
- A useful source of power without the pollution problems or potential dangers of coal and nuclear.
- Location.
- Location.
- Like the idea of renewable energy. would like to have a turbine myself near our house.
- Seems to be a clean way of energy production.
- Depends on location.
- Wind farms I have seen in NSW and South Australia regularly appear to be doing nothing.
- Some that are very close to roads, I find distracting - they draw attention away from the road - eg just southwest of Goulburn on the Hume Hwy.
- On the effect of those who live in close proximity.
- I absolutely hate the look of them, but I can see the need to have them. I'd rather remove half the world's population.
- I find them attractive but have concerns about the environmental impact - birds and other species and sound waves on humans which I don't believe we understand.
- Depends on the locality to determine the merits.
- We need electricity. Wind farms do it without pollution.
- Depends on impact on landscape.
- I think renewable sources are an important part of a mix of sources for energy production.
- I appreciate that some members of the Community can hear the "buzz" from the blades turning, and that would be annoying on a long-term basis, however I am not sure that the adaptable ability of the human body would overcome this initially foreign sound so that it can be ignored. Not to dissimilar, to those people who live next to a railway line and after time do not hear the trains going past, unlike visitors who feel that the vehicle appears to be "coming through the house".
- They're now a fact of life. The question is like asking "are you in favour of menstruation?"
- They are important environmentally.
- Appropriate location without visual impact.
- The parts, including blades, are likely not made from wind-generated power sources, but rather... coal.
- Location
- Okay in remote rural areas not near farmers or communities.
- Environmental reasons.
- Climate change makes renewable energy urgent and imperative. Wind farms are affordable, proven and with storage capable of serious base load generation.
- Highly environmentally-friendly.
- Look better and have less air pollution than coal.
- They add a great element to the landscape and offer hope for renewable energy use.
- A useful source of energy but must be integrated into the entire electricity distribution network
- Wind farms use natural energy and do not pollute the environment. They are clean and the new ones are quiet.

- We need more renewable and carbon neutral electrical energy.
- Believe we need renewable energy. The sight of them mesmerizes me.
- If agricultural land under it, land host remunerated and not too close to neighbours home.
- Depends on Location and proximity to alternate sources of electricity being available locally.
- Provide free (after the initial capital cost) power and no pollution.
- We need renewable energy.
- Natural resources are best.
- Wind is a good, free and non-polluting source of energy.
- I'm not opposed but don't think they produce enough electricity
- I am in favor of renewable energy.
- SA needs all the natural energy it can find, but have you considered the noise factor also ????
- Not particularly for or against them. - effectiveness of the turbines and minimal impact on the community - their effectiveness, minimal impact to local community. They provide energy from wind. Free, sustainable, non-polluting energy- it's a no-brainer! That, and I've been to Denmark many times, they have many windmills there and they are not a blight on the landscape at all. Great way to convert wind energy to electric energy.
- They can be elegant.
- Cheap form of energy.
- They were introduced without proper consideration of their impact or their regulation.
- Any sort of greener energy needed in the world.
- Ugly and horrible, destroy the beauty of the countryside. On its location.
- Prefer renewable energy.
- We need 'clean' energy. It runs surveys such as this..
- Need to phase out fossil fuels.
- I can see a need for cleaner energy, but sometimes they can detract from the natural beauty of our environment.
- Less polluting
- I am in favour of renewable energy but am not sure if the impact of producing the steel for the turbines outweighs their benefits. I favour the individual turbines used in parts of Europe.
- To save the planet and have clear energy.
  As long as the farm is far away from the community it will be fine.
- They are usually located in rural areas in localities where there is a high probability of low to mid-range air movement. Hence they generally do not have a highly negative impact on the majority of the population. The value they provide, in my opinion, outweighs the possible negative impacts.
- Complementary to solar.
- Location
- They are clean power and far more attractive than an open cut coal mine.
- Low emissions
- Environmentally destructive and visually ugly.
- We can't do without them if there is to be any hope coping with climate change.
- Ugly and we need to save power go to bed earlier, no night footy or cricket, no street light plenty of savings.
- Am in favour in certain cases we shouldn't just drop them everywhere.
- Electricity generated by renewable energy sources is essential to prevent disaster for many species.
- Electricity generated from renewable energy sources is essential to curb climate change and prevent disaster for large numbers of species.
- Inefficient at anything but reducing the amenity of neighbours.
- In the right place and utilized to capacity they have merit.
- I would like to have wind farms on our property they look graceful and the income would be great.
- An excellent source of readily available energy.
- Like waves.
- In most circumstances they don't detract from the scenery and it's clean renewable energy.
- I gather that the noise factor disturbs some people who live nearby.
- Renewable energy, cleaner energy, climate change, pollution.

- Depends on the positioning and taking into account concerns of close neighbours and communities.
- We need an alternate energy and need to use natural resources solar, wind, sea water.
- Non-polluting... sustainable.
- I heard a discussion between a geologist and environmental scientist on wind farms which has left me pondering their merits.
- A practical way to generate renewable energy.
- Global Warming and its latest manifestation "Climate Change" is the biggest hoax ever. Wind farms, supposedly produce "green energy" and only exist because of massive subsidies, paid for by the very poorest members of society.
- Without proper restriction I believe they are too intrusive, impacting disproportionately on the amenity of landscape. On this basis, I consider that they constitute an unsustainable form of renewable energy as the only way they can respond to an expanding energy market is to proliferate indefinitely.
- Where it is and if there is wind.
- Lack of trees in the area of wind farms.
- I think they are good.
- It would depend on the need of the farm, and how it is being utilized.
- Because they take up about 50 acres of land, average about 400 tonnes of concrete and 260 tonnes of steel and don't produce reliable power.
- Uses renewable resources.
- They are essential for our future needs, and they are attractive.
- We must change to renewables if we are to survive.
- Good for the planet and i think they are beautiful. Health concerns are a beat up if you ask me!
- Wind farms provide electricity without polluting the atmosphere. We are in a climate emergency and we need to get to zero carbon emissions as quickly as we can.
- Location and cost effectiveness of generating power.
- Heavily subsidised. Power bills go up more. Many do not give anything back to the community where they are situated.
- I think they look great and are a better choice for energy.
- Low emission energy source.
- Is subject to location.
- Need to be isolated from people as much as possible to minimise impacts.
- Where they don't impact on existing or proposed infra structure. Benefits from installation need to be shared by host communities. They should not impact on the amenity of close neighbours.
- Still learning.
- Saving the planet.
- Generally in favour depending on placement. If the landscape is ruined I would be not in favour.
- They symbolise clean energy- they are better than looking at a coal or gas fired power station which pollute!
- Generally in favour but if they ruin or transform the landscape I would be not in favour.
- Generally think they are a suboptimal solution and a “blot on the landscape”.
- Location is a key factor.
- Renewable and clean.
- Better than coal!!
- I consider the power generated by them to be important in the mix of energy necessary to meet demand.
- Are you talking the view – No. Or practicality – Yes.
- We must reduce our fossil fuel dependency.
- I find them attractive and not dissimilar to the thousands of "freelights" that dotted the countryside many years ago generating 32-volt lighting. They are not much different to all the powerlines across every state in Australia
- Some locations are not suitable for variety of reasons include visual amenity impacts.
- Renewable energy is beautiful and essential.
- It depends on whether a) they are carbon neutral (in terms of construction and the additional infrastructure required to build and connect to grid - compared to what they generate over their serviceable lifespan. Also b) location - if located in sea channels (UK/Europe) then I have

a lower opposition to them as compared to land installations that look ugly.
- We need to have more renewable energy options.
- There is a place for wind farms but largely depends on location.
- Detrimental impact on high scenic quality areas should be avoided.
- Visually they are imposing and intimidating; while fascinating and eye catching they are ugly and menacing at the same time. Like speed skaters in their tight suits: very athletic, but reptilian to look at watch with their ungainly arm movements. The world can do better than destroy the visual environment in this way.
- Are the surrounding community in favor of the windfarms?
- How close to important structures/ impeding things are they?
- Location a key.
- Wind farms are renewable energy and reduce greenhouse emissions. They are preferable to smoky power stations. In gently rolling agricultural country they can be quite attractive.
- Useful addition to power supply; provide extra income to farmers. Not sure about whether there are negative health effects.
- Can be visually intrusive.
- It's one important source of next gen energy and they look quite good! If they are helpful and not blocking the view, I kind of like them. If they are placed in a beautiful scenic spot I don't like it.

APPENDIX 6 FINAL COMMENTS FROM PARTICIPANTS

- I have seen the wind farms along miles of the German coastline on the North Sea. They look horrible from either the land or the sea. The ones off the coast and in the North Sea and out of sight are ideal.
- They are necessary as clean energy no pollution and low power source. They should be placed on all arid land.
- Better than an open pit coal mine...better than an underground coal mine....
- The photos in this survey confirm my own observations: wind farms spoil landscape views everywhere.
- A rural landscape that has been cleared for farming as in south Gippsland is visually very uninteresting to me. but as soon as you install a wind farm I love the visual of denuded landscape much more as I love seeing the use of natural renewable resources to provide electricity.
- This survey does not address the importance or otherwise of energy generated by this method!
- Sometimes 'neutral' isn't the right alternative. But I used it to mean wind farms ok in that landscape but better if there were fewer. I wish it had said 'ok but prefer lower density'.
- We need wind & solar farms. We do not want coal power.
- Wind farms need wind and possibly elevation so we must decide how much aesthetic are we willing to give in exchange for power. Wind farms do not supply an awful lot of power in exchange for the intrusion they make visually. Then there is the noise factor. Renewables at this time not capable of total replacing fossil fuel. we need nuclear FUSION not fision.
- Wind farms are the way of the future. This survey is a trick and not worth the paper it's written on or the time it takes to fill in. Get a life and do something constructive.
- I like single lines of turbines very dramatic and enhance otherwise featureless landscapes. But multiple rows look a bit too industrial.
- It's important to me that we don't have too many wind farms within a given area or that the wind farms themselves aren't too dense or large, so that they start dominating the landscape. Or too close to roads or along ridge-lines for a long stretch. A few are OK.
- Expensive and unreliable. Noise pollution. Disturbing to look at. Have some major fires. I think it's important to discriminate between scenery that is degraded (e.g., farms with virtually everything cleared and little habitat remaining) and land that is a better state.
- Windfarms to me are ideally placed on degraded land rather than clearing pristine land on which to put them. This I am not in favour of. I am happy to see them on our farms as bare hills does nothing for me scenically speaking. My concern with Wind Farm Technology is the Cost-Benefit factor where significant Government Funding is applied where the lack of a Commercially viable solution is available as compared to the current options of Hydro and Coal would be a more viable solution until such time as the cost of wind farm solutions is more reasonable.
- Any wind farm surely looks better then massive black holes in ground and monstrous slag heaps and growing numbers of heavy vehicles carting coal. What is YOUR alternative it’s easy to criticise everything somebody does I don’t know where you get off.
- The sheer size of the equipment results in their dominating any landscape scene. A farm of windmills would the same effect. They cannot fit into a natural vista.
- Wind farms look so much better than open cut coal mines & chimney stacks!
- I think that Wind Farms are a great asset to Australia. We have a vast countryside and it is great to see farming working beside renewable energy. I am a supporter of renewable energy and wind farms but what I wouldn't want to see is for the wind turbines being put into untouched land which should be left the way it is for heritage and ecological reasons.

- It was interesting to do. As I progressed through it I noticed that I really don't have much objection to wind farms on land that is already industrial, ie farmland unless it has high scenic value. In some cases I think the wind turbines have a sculptural quality which enhances boring monoculture landscapes.
- Why would you waste such a commodity as wind and sun rather than digging up fuel and burning it. Polluting the air.
- Your superimposing of windfarms on landscapes where they were not was a bit "in y or face". They would not look as imposing as your photos. Would love to know what the results were. Compared to the alternatives wind farms are light on the environment. The visually much better than an ugly power station and compared to a nuclear power station with all its potential impacts. I worked in the nuclear industry for decades and I do not want to see Australia go down this route, especially as it has such wonderful solar and wind resources available to it.
- Some of the plainer landscapes are enhanced by the wind farms.
- Windfarms are not in themselves unattractive - sometimes they may intrude on a coastal landscape but not always. They could also feel imposing if too close to a town or if there were too many in a confined location.
- I can't see how their appearance can come close to the ugliness of a coal-fired power station or massive rows of power lines however 'ugly' people find them!!!
- Survey was much too long. Only determination kept me going.
- Many vista's here in the NSW Sth Highlands are already affected by WF's. From here in Berrima I can clearly see the WF's in Taralga.
- In Sth Gippslands the coastal view has been permanently disfigured by WF's - it is a crying shame.
- I truly hope we don't get wind farms in Qld. It saddens me that our country is following others in this way. Fiji has 15 wind farms of which only 5 work but Fiji can't afford to repair. These sticks of metal are going through stay there forever not doing anything but cause a visual eye saw to everyone.
- Wind farms are dotted throughout Europe and are located in differing locations depending on the Country they are in. France, Netherlands and England all have them and after traveling extensively in all of these countries, one hardly recognizes them after a while. In fact depending on the day, they can actually look quite elegant against the sky.
- I like the idea of wind farms. Sometimes they can actually enhance the scene. Sometimes the scene is not particularly interesting one way or the other so that is not a bad place (aesthetically) to put them.
- You will find that I have agreed to your survey because you showed land that was useless for anything but wind farms?
- Farm or grazing land being used for windfarms is perfectly fine by me. The land has generally already been developed at some stage for the purposes of farming or grazing. Windfarms located on foreshores or close to beaches, headlands, or other locations close to the oceans is not acceptable to me, as they ruin a picturesque landscape.
- The only place I could accept a wind farm is at sea away from coast or in a desert kind of country.
- Most ugly things that spoil our beautiful landscape.
- I think that there was some bias in the depiction of larger towers on the landscape in some of the coastal scenes. I have not yet seen a wind farm that I felt completely objectional. I find wind farms quite aesthetic and elegant and a far more acceptable addition to the landscape than coal fired power stations. As they do not add any carbon to the atmosphere, that is also a plus
- I was expecting to see how scenic sites might be spoilt by wind farms but I didn't.
- I must admit to not overly caring about the positioning of the wind turbines if I did not consider the photo to be particularly scenic, although putting them too close together will always make them appear crammed in to the picture

and sometimes downright ugly. Where they can enhance the landscape they are more aesthetically pleasing.
- I think wind farms are beautiful in their own right, a tribute to humankind's will to address problems of its own making.
- Survey was a little too long. Too many images.
- Your choices of either coastal or farm land make the results a little obvious, farm land is like commercial property the decision has already been made.
- I think the wind farms are best enhancing boring landscapes (such as flat landscapes with little features). On coastal areas, it can look sculptural and sea-faring, but depending on the area can also get in the way of a good view. In some hilly areas, the wind farms can be a bit hidden.
- As I generally prefer natural landscapes/ scenery over over-cleared farmland or scenes with weeds in them (eg sea spurge) & believe in Australia, we should be utilizing more renewable energy sources, my answers may be a bit skewed om the low side of the scales. Often I thought the wind generators enhanced the scenery!
- I struggle to understand the controversy over wind farms. I'm all for harnessing our natural resources for energy production.
- We need natural power rather than coal.
- The survey is way too long and repetitive - required a lot of stamina to get through. 50 images would be better.
- Selection of scenes excluded mountains and deserts. I suggest the selection of scenes is biased in favour of rural and coastal areas.
- Some of the photo-shopped in windfarms got lower ratings than the actual windfarms because they looked more false or seemed too large in the landscape. I imagine my responses will not seem very consistent - but hopefully they are of some value in getting up your numbers.
- The country/farm style ones are very active wotabke (?) but I don't like the huge ones on the headlands and coastlines, they are too bold.
- A lot of the pictures showed a great lack of trees. Lots of cleared land which is the problem in our landscape.
- Too Bloody long.
- Unfortunately most of the scenes had already been ruined by farmland clearing, leaving only undulations and some few other features as interest. Nevertheless, many of the coastal scenes had geographical magnificence.
- How boring. I am so happy to have my eyesight that all scenes are good and people with no sight would give anything to see all the displays.
- Wind farms on coastal cliff tops are a form of graffiti to the landscape. Wind farms are big business now and can't be stopped. Unfortunately! Thanks for the survey.
- Not right on the coast please.
- I hope you will see that for me the presence of a windfarm makes almost no difference to my appreciation of a landscape. If the landscape has no feature, such as hills, cliffs or rivers it scores very low with me. I had doubts about treating clouds as features but a skyscape is just as valid for me, with or without a Windmill/turbine.
- What looks better - Wind Farm or Coal Power station - Wind Farm any day... Worked at a power station.
- You only need a 1/10th of the photos and you get the same result. Don't ask people to answer so many questions next time.
- Farmers have historically used wind mills to pump water, we accept power poles and electricity towers - why are we so against wind turbines which are less damaging to the environment overall. I am a sustainability student at Griffith Uni this trimester.
- The wind turbines start to become a distraction on a scene when the density of them is high in the eye's view.
- Survey is way too long.
- Keep the wind farms preferably on the coast, near towns or at least on unproductive ridgelines.
- No need to use arable land.
- In my view the visual impact of any development has a lot to do with expectation. ie walking in a national park the same view including a wind farm will

seem less acceptable compared to if I am walking down a rural road - as I am sure you are aware. The survey is then difficult as it lack a context component - but then maybe you have structured it that way deliberately.

- Some photomontage in the coastal locations are a little poor in terms of quality, turbine spacing, scale of turbines etc... and do not present an image on which reasonable impressions can be made, or from which any serious conclusions should be drawn - this will add some level of bias against coastal locations (which are generally avoided by developers anyway - apart from Tasmania). Previous experience should result in a higher degree of landscape appreciation for coastal images and those showing more variation in topography. Enjoyed the survey - need more of them. Didn't spot any of my wind farm projects!
- The turbines seem to detract from the natural feelings surrounding the scenes.
- About 6, maybe 8, of the images included obviously Photoshopped wind turbines. I found it hard to evaluate these images. Nearly all the scenes were drab and uninteresting so wind turbines could not make them worse.
- Very flat lighting does not lift scenic appeal in these images.
- Sometimes the wind farm adds an element of interest and other times it doesn't detract. I find the combination of nature and man-made interesting and complementary.
- Obviously I am not into wind farms. I do not think the benefit sufficiently outweigh other alternatives and they are ugly. May be more effective if they were in natural colours or camouflaged with shiny blades to deter birdlife and aircraft. Like mushrooms one or two appear and all of a sudden there are hundreds.
- Thanks for the opportunity to do this survey. I am in favour of wind farms but my responses highlighted to me that personally, they invariably spoil coastal landscapes but are an asset to rural landscapes as long as they are not crowded and have been placed with an aesthetic eye for symmetry in the landscape; a new professional niche perhaps. Also. I like white but if they were coloured they could possibly disappear as a visual eyesore if that is a primary issue.
- Wind farms are awesome.
- Interesting survey, very engaging. Well done.
- Proximity to the towers and viewing angle would be contributing factors in the answers. When more are established the novelty value will no doubt diminish and could be less satisfaction.
- This survey was ridiculously long and boring.
- Solar farms in Australia are a far better alternative to unsightly wind farms. We have almost unlimited sun.
- Cheaper to maintain and install.
- I know that windfarms generate clean energy, but I do feel that they are rather unsightly. Almost a necessary evil.
- I do not like wind turbines especially so all were unacceptable, I may have given 1 neutral.
- Massed wind turbines very unacceptable.
- I can not see any problems with wind farms. I have been quite close to a few and the noise is very little and quite soothing. The sheep milling around seemed totally relaxed and serene. Go alternative power!!
- Hello interesting survey, discovered I don't think I like flat land much must be a mountainy or coastal person. I have driven past many wind farms and would like to visit some to find out more about them eg are they noisy, do birds really fly into them etc.
- I know you want a good survey but in the real world I don't think may people will finish this ... too long. Good luck.
- Wind farms produce some unreliable power but they are here to stay. I feel that they must be as far away from public view as possible. The land owners get well paid for having them it could be hard to prevent. I have flown over the wind farms in SA I did not think too much on the visual impact, & there is one, as long as they are hidden from view as best as possible.
- Survey too long and repetitive - you really test your participants patience.

Bad image quality will ruin and nice scenery - some look like a scan from a 70's photo. Likewise bad photoshop makes windfarms look worse than necessary. I found a few large wind turbines much less visually impacting than a forest of small ones. Most rural images already have electricity lines in the image - was that intended? Regards, Johannes

- I feel agricultural land has its own beauty that is not impacted by wind farms. Ur photos are almost all green winter photos & well taken so all aesthetic. Some of the pristine landscapes, especially cliff tops are not enhanced by the turbines, but not destroyed either.
- Very unacceptable that you failed to include any off-shore wind farms in your survey. As with all new technologies there will be the 'lovers of it' & 'the fighters against it'. Some of your pics that I answered '10' to were actually a bit 'dull' BUT it is farming land & I am still not convinced that wind power does not cause any health issues. I personally loath TV aerials on roofs & power lines in the streets but I use the power from those lines everyday & for me & my community, underground power is not an option; we just have to accept what's available for our $$budgets. I live in a town that is not directly 'benefitting' from Wind Power & 'Solar' is at the residents' discretion/budget, so I imagine I am not likely to ever live next door to a wind turbine. If I lived on neighbouring farms or townships as your photos hinted at, I may have issues - mainly with the 'eyesore' value; particularly many grouped together or in a continuous line along the top of a ridge or mountain. I really feel that we as a 'civilized & educated' race should be concentrating on less powered gadgets etc for living & enjoying ourselves. Do we have to speak to our friends every moment? Do we have to have bigger & faster tele's/ cooking equipment / computers etc etc etc etc? My heart breaks when I think of the landfill issues associated with providing more power for more electric stuff for humans that have learnt that 'more' is better than 'less'. But I rave - Apologies....I hope your survey is successful & look forward to seeing your findings Mr. Lothian & team.
- They are becoming a necessary evil, would be better with our coal fired power stations or better nuclear power stations.
- It was very hard to be consistent. Up close shots of wind farms don't look as good as distant shots, so hard to be fair.
- They look ugly in a open land and up close.
- I don't think wind farms are any less attractive than electricity infrastructure, in fact they are probably more attractive! Perhaps there is an opportunity to paint them in green or blue to blend into the landscape more? They only time I felt they detracted from the scene was when there was a large cluster of them but that didn't occur very often in the images provided here.
- Enjoyed the "perception" options.
- Should be placed in areas of lower scenic importance and blend in with the landscape in a valley rather than stick out like a sore thumb on the horizon.
- When there was a wind farm in the image, I tried to give a scenic rating imagining that the wind farm wasn't present...My 'unacceptability rating' indicated my level of dislike doing the survey made me think about what I find scenic and how windfarms fit into that. "Scenery" is usually BIGscapes and where the grandeur of windfarms fit with the scale of the landscape I quite like them. I also like landscapes with mixed 'uses' or 'cover' and where windfarms complement a mix I quite like them: where they dominate, I don't. Scattered turbines across productive landscapes is not attractive and don't fit! Thanks for making me think about it.
- In most cases the wind farms did not detract markedly from the overall scene, because most areas shown were predominantly agricultural land which had been heavily cleared and was not scenically attractive to me (except the seascapes)
- HAVE A PROBLEM WITH GOOD AGRICULTURAL LAND BEING UN USABLE
- Interesting ..... thanks.
- I thought they were ugly when I first saw them, now I think they are like a

choreographed ballet. It's a state of mind really. Working to prevent bird deaths and properly integrating into the grid are important issues. Coastal views are precious but like Norfolk Island Pines they are an aid to sailors.

- By the end I was not being consistent. Too many pics. Also would have been good to compare with views of trees and forests instead of paddocks.
- The images didn't seem to capture the more spectacular mountain range landscapes (e.g. Tothill Range, Northern Mt Lofty) where windfarms are proposed/erected - or if they did it was from a distance that flattened out the height - whereas the flat land views were more close-up. For people living near hills, windfarms dominate the skyline, and I feel that wasn't captured well enough in these images.
- I find wind farms an eyesore and wonder what will be left when they are past their use-by date. I do believe they do affect people's health. A lot of carbon is emitted in their manufacture.
- I understand the need to have windfarms close to the coast. But having them too close (with erosion and just how it ruins the sea/ocean view).
- I don't mind wind farms, I've seen lots in Australia and the UK, France, and think they are necessary for sustainability.
- Windfarms are usually in rural areas and provide employment for local rural communities, providing income for land-owners and generating sustainable power to be fed into the grid.
- If only the political landscape was as productive as these engineering marvels!
- The sight of wind turbines destroying the open country and the high electricity cost they require is unacceptable. Some countries are eliminating them.
- They look disgusting. Heaps of them in UK. LOOK TERRIBLE.
- It is not about aesthetics only although this is a big issue especially in areas that are natural. Noise impact, impact on fauna (birds, bats).
- Perspectives play a big part in these pictures. The numbers and extent of wind farms in the immediate area are also relevant. The presence of farm houses and towns is an important issue.
- Wind farms are a necessary evil; some are okay and some are pretty ugly. I know that sea-breezes are a boon, but gawd; the poles and fans ruin a sea-scape.
- I am in favour of wind farms as a source of renewable power. They are no different as seeing power poles etc on our landscape.
- I found wind farms on the coast highly unacceptable.
- Also unacceptable when very visible on the skyline, when very close up, when they impinge upon a serene rural landscape and when there are large numbers of them together.by doing this survey I realised that I was concerned more about how it looked more than I thought. Also sometimes the view was enhanced with the windfarms providing there are not too many!
- Spacing of towers is dependent on landscape and vegetation. Towers look better in a dryer landscape.
- Interesting. Some windfarms were relatively distant, less obtrusive or fewer in number. Some actually added to the landscape. However some windfarms had too many 'mills, or really detracted from the scene. Sone scenes were just not that scenic anyway...
- I understand windfarms are useful, I don't want to see fields of them tho.
- Generally I find the clustered views of wind farms unacceptable but otherwise they can fit/blend with the landscape quite well, and not be too visually dominant.
- If there were to be some they cannot be to close together, appears that the fewer and further apart they are, the better my acceptance.
- Some of the farms (conditions permitting) in the water off the coast as in Europe.
- Well constructed survey.
- One would imagine that Wind Towers could be much like power lines in that we ignore them visually at a predetermined distance, when we look at them each day, and there a lot of power lines.....

- I find wind farms fascinating. They add to a landscape providing dimension and movement. I like the tall majestic stance of the turbines and the way they face the elements, a bit like lighthouses on rocky wave swept coastline. If I'm travelling in an area with a wind farm, I will take the time to visit and enjoy the scenery like a tourist drawcard. My teenage sons have travelled in Europe on a Rotary exchange and were awed by the scale and number of wind farms and how amazing the looked. Much more attractive on the landscape than a great big black or brown hole in the ground. Maybe your next survey could compare wind turbine scenery with scenic shots of open pit coal mines and their power generators. Not so pretty. I feel wind turbines are much more pleasing to the eye that ugly solar panels.
- Wind is a good source of energy and although the Cutty Sark was a fine ship powered by wind that was 19th century thinking and surely solar must be the modern alternatives to windfarms. My Dutch wife suggest windmills as an alternative? I realise land owners can make good money from this development but to me it this seems a poor outcome from a visual and technical aspect.
- They should be out of the way of scenic views.
- In my opinion, wind farms would mitigate the deficits of land currently being used by sheep and cattle farms ruining the land and is less ugly than power lines.
- I felt the difference in lighting (e.g. long shadows and warm light) clouds, green pastures had a huge impact separate to other factors. The real turbines in images always looked more benign, perhaps because of lack of an identical repeating image grabbing the eye.
- Wind Farms provide power to us and income to the landowner.
- My opinion - There was too many slides. Some of the coastal wind turbine shots were excessive. They looked more appropriate in a farm setting, more than power lines or antennas.
- When selecting scenes with windfarms, my quality of scene included the windfarms presence.
- I suspect my reactions to the wind farms might have been influenced by how attractive I found the scene -- be interesting to see how consistent my responses were.
- I think it is better if the turbines are place a little more randomly instead of all in a row...easier on the eye.
- My preference is fewer numbers of wind turbines, large clusters don't do it for me.
- As I answered the survey I realised I don't like the wind farms too close to me or the turbines too close to each other. Usually the wind farm generates income for the landowner and clean energy for the planet which is good.
- Geometrically placed so the eye doesn’t trail over the country side preferably flat grazing or flat wild country with a specific group away from hill top and sea coast.
- I think from an aesthetic point the wind farms can add character and context to a landscape photo. It depends on how you look at it. Many of the presented photos were very unappealing in their own right but the addition of the windfarms added a point of interest. I guess it depends on your biases toward these structures to start with that will end up framing your opinion as to how they add or detract from the landscape. I would rather see these than a billowing smoke stack!
- Very interesting survey! Hard to remain consistent and scale and density definitely impact on your objectiveness. Look forward to the results.
- Think you should do some mine sites & csg aerial sites. I fly over windfarm at Guyra last week, looks magnificent from the air.
- Wind farms should not be near beaches.
- I believe designer of survey would be aware that numerous other contextual factors would influence my judgement re acceptability. Eg could totally reverse my judgement if visible from a ‘wilderness area’ or is adjacent to a extensive industrial zone etc.
- I found I didn't mind seeing them in the distance or in just a part of the picture. Didn’t like them right on the water’s edge especially where it looked like victor harbour ugh.. I didn’t mind them in fields of otherwise bland scenery. Do we

know how animals react to them and the noise??? would they change the farming use of the land?? do crops and plants react to the noise, as they do to music. would the cows go crazy.. if in the same field? would they be stressed and give less milk?? etc Jolly good subject and research to raise Andrew... fantastic thankyou.

- I'd say that electricity lines and urban rail lines are more offensive than wind turbines from visual amenity perspective. But this type of comparison doesn't get raised because electricity lines and rail have long been part of the scenery. People get used to it. And given the benefits of wind turbines they will become more prevalent and an accepted part of everyday life.
- I understand the value in wind farms. However, when they are compacted onto arable land, I find them too intrusive on people's lifestyles. If they could be spaced, away from view they would be more palatable to me.
- Did notice you used same photos with different number of and arrangements of wind turbines to get varied opinions. tried to answer accurately.
- I lived next to several wind farms in Germany several years ago. The closest wind mill was just over a km away. We had no sound impact but we could see the wings moving slowly through the air. The scenery was otherwise not very interesting, farmland and flat. It was a place to take visitors, riding our pushbikes through the fields and having a picnic at the base of a wind mill. Good survey
- In general terms Australians have to get used to wind farms. They are part of our energy generation mix.
- I find visual amenity of the landscape to be closely linked to how healthy the grass is looking/the colours of the landscape. I think that wind turbines look really cool, and in certain contexts can enhance an otherwise featureless landscape - but in other circumstances can detract visually from a naturally stunning locality. In terms of the obtrusiveness/appeal of wind farms with regards to existing landscape infrastructure, I don't feel wind farms are significantly different to visual impacts of existing infrastructure - I would rather have a landscape dominated by wind farms as opposed to power lines, for example.
- A lot of the scenes were quite ordinary and wind farms did not affect them much. Wind farms on ridges and headlands generally enhanced horizons in the more dramatic landscapes.
- Mobile phone doesn't do justice to the photos.
- All wind farms are ugly and unacceptable. also try making your survey shorter.
- Why the heck do they have to be white!! Definitely not so "in your face" if they were a mid-green or soft brown. And I can't see that a colour change would make any difference to safety. Has any research been done? Definitely prefer lower density, lines rather than grids, and not along the coast.
- I think that wind farms in rural areas are things of beauty, but I do not like them in natural areas with high scenic values.
- A narrow range of landscapes presented, perhaps reflecting what's available in SE Aust. Nearly all were disturbed landscapes, especially agricultural. Hard to separate response to windfarm vs good/not so good land management practices. Repetition of scenes was annoying, though I can see you might look at consistency of response, maybe linking it to rank order in the survey as filled in.
- Adding windfarms to some scenes made them more interesting. Seaside scenes, however, would benefit from less visually intrusive windfarms, and the winds there should be stronger, anyway.
- I am in full support of wind farms, but struggle with understanding the need to go through 100 very similar pictures of land with and without turbines on them.
- I actually believe they improve the view of the country. I believe they make the Country side look more modern.
- The more I look the more acceptable they became. When they were symmetrical they looked better. But that would just be my engineering brain.
- Wind Farms: Prefer to have wind farms than smoke belching, wasteful, fossil fuel

fired power stations! We just need to be a bit sensitive about location of windfarms to maximise power delivery and minimise visual (and other) impacts. Survey quite interesting - well structured.

- I am not a fan of farm lands in views, much nicer to see unspoiled natural vegetation and eco systems, in untouched environment. Putting wind farms on land farms is a natural fit and looks much better than the alternatives. I prefer the turbines to power lines, much better to bury the lines. To be fair should include photos of other forms of power stations, of coal mines, of railway lines, of power transmission lines, ships, etc as comparison.
- Wind farms are a great resource, however, they should be planned in a way not to impact on landholders and their way of life. Noise pollution in close proximity to houses needs to be avoided. On the bright side, the turbines if placed strategically will most definitely reduce the population of pesky flying foxes and bats.
- I'd prefer wind generators any day compared to Coal Seam Gas extractions, that do nothing but line the pockets of huge overseas companies and ruin our great country.
- A very hard survey to concentrate on. I must admit my rational mind overrules aesthetics. I would prefer wind farms in land than on the coast but rationally prefer these than other sources of fuel.
- Very costly to the visual environment also the manufacturing of these towers is not environmentally friendly and should not be subsided in any form.
- In most of the photos the wind farms made the photos more interesting. Looking at the photos as a photographer lots were absolutely boring.
- You didn't really include any ugly scenes to compare to. For example, an open cut coal mine in comparison to a wind farm - I will be very interested to know how you really intend to compare this to any other forms of power generation.
- Interesting to participate. Your choices on acceptability seem to relate strongly to your perceived value based on attractiveness of the landscape!
- I think you need to show more of the whole view so that more of the total landscape is presented. Also suggestion of where eg cliffs if on Nullabor w/farms acceptable if its KI not.
- Made my comments at the start hate them.
- I don't mind the look of wind farms. I would prefer them to be located on less scenic, agricultural blocks than on coastline or mountain locations. If we want renewable energy, we have to accept the look of wind farms. To me they are not an eyesore but I would like them situated away from iconic scenic locations.
- Generally land in farming areas is cleared and run down therefore ideally suited to wind farms. Coastal areas should be handled more carefully although I am not against wind farms in coastal zones.
- It is difficult to determine if a wind tower is more detrimental to an exquisite landscape or an ordinary one. The sense of insult is tangible.
- Very interesting.
- No houses appeared in any rural scenes. These wind farms are impacting on some more built up areas that depicted in survey.
- I do not object to wind farms especially if they are on our farm it would be different if they were on our neighbors and they were getting all the rent from the wind farms money talks most languages we need wind farms on our farm too.
- I found that the majority of pictures were cleared farmlands - I think the farm lands look more productive with wind farms on them - I was less inclined to favour highly the wind farms in more natural places.
- That was hard work!
- Impact depends also on whether its a highly visible iconic scene, or rarely visited country, except coastal which I think we should keep free of wind farms. Plus while its OK to have a wind farm here and there, I'd hate for them to take over all or most of our landscapes.
- This Is a tedious survey and almost designed so people will never complete it...

- It felt like an intelligence test & I dare say the computer will compare with & without wind generator photos.
- Congratulations & all the best for this and River water issues too.
- I noticed as I was doing the survey that scenes I thought not very scenic (generally flat or low hills or brown/barren looking) were enhanced or improved by the presence of a wind farm. Conversely, scenes I found very scenic (generally coastal scenes) were detracted from by wind farms. Generally speaking, I am happy with wind farms in inland farming areas, but not happy with them on a scenic coastline. I think, however, that some wind farms look better in real life than in many of your photos - for example, Star Fish wind farm is quite scenic even though it's near the coast. However, that is surrounded by farm land. On the other hand, I dislike the wind farm visible from Whaler's Way (Eyre Peninsula) as I think this detracts from the wilderness scenery. I also couldn't help noticing that some of the wind farms in the photos were not quite to scale with the photo and consequently in at least a couple of cases looked worse in the photo than they likely would in real life. As with some of your past surveys, in doing the scenery ratings, one had to struggle a bit against the photo and imagine what the scene would look like in real life, as the photo did not always do the scene justice. The photo of the Bluff being an example (and the colours of Scott's Cove looked very different from when I saw it in January this year). Also, when the photo was of a place I was familiar with, I was choosing "very unacceptable" for the wind farm based on my knowledge of that location rather than on purely scenic value - the Bluff and Scott's Cove again being examples.
- Interesting survey, however, quite enjoyed doing it.
- Recognised the same or similar photos a number of time and felt like this was also a memory test!
- Clever composition of survey.....good luck with your conclusions.
- Survey too long.
- We need to have storage batteries, detractors are talking about too much energy. So let's store it or change the system.
- Wind farms look particularly bad in natural areas.
- Abominations which destroy both the landscape visually and the low frequency hum has negative health consequences. They require massive capital outlays and like solar, large subsidies are required to establish them. The fact that at present over 85% of electrical energy is produced via fossil fuels, and barely 5% from the wind sector says it all. The wind does not blow all the time, and if it is too strong then the turbines are shut down.
- Windfarms look no worse that electricity pylons and phone lines and 'manicured' farm land or ugly farm sheds that litter the countryside.
- I think wind farms are good but not along direct coast lines. They also look better in smaller density rather than covering a whole landscape.
- For me, it seemed like the windfarms detracted from the 'more' beautiful scenes, but made only a small difference, or maybe even at times improved some of the more 'boring' scenes. Have you in a similar manner measured the landscape quality of refineries and open coal mines?
- Wind farms are a good source of natural energy which has less impacts than burning coal. I understand there could be noise issues generated by the wind turbines, however, there could be solutions for those issues. In terms of the visual impact, I believe reducing the air pollution is more important than the views. While it could be prominent in certain landscapes, it could blend in with others landscapes.
- Density of wind turbines makes a large difference, as does spatial distribution. I.e. when constructed in a grid it looks industrial, or when it becomes the dominant feature on the landscape in particular when the landscape is naturally inspiring such as along coastlines. Similarly there are some locations that well spaces turbines can

add an attractive feature to an otherwise boring and lifeless skyline.
- Some people will be strongly against or strongly for wind farms, no matter how they look! I would guess that people who love the architecture and sky view of big cities would also like the architecture and skyline of wind farms? Those who prefer nature as it is, won't care for it.
- Scenes showing degraded farm land rated lower for me, regardless of the wind farms. Photos can closer to the towers will probably rate lower too. will be very interested to see the results.
- In my experience wind farms to blend in to the landscape a lot more than many of these photos show, especially the photos that have been contrast enhanced and where the windfarms have been added.
- I think they look great.
- I think the acceptability of windfarms in certain landscapes would also depend on the population and visitor numbers. An isolated area would be more acceptable.
- The photographs did not depict any situations with houses, buildings or livestock in them. I would have rated lower if this was the case and not sure how much research has been entered into on their impact on humans and animals.
- Generally think they are appalling particularly when compared to solar farms. Consider they should have the strictest planning rules and the damage to the landscape and visual impact should be a major consideration.
- Seemed to be asked to rate the same photos multiple times.
- Wind farms need to seen in the wider context. eg some coastal maybe okay. Also the impact on neighbours. Also access. I have come to "accept" them with time.
- Boring and repetitive (yawn).
- Survey too long. Know you were testing answers but surely 50 would have done. Got bored. Also shots of remote and isolated coast of course are beautiful but my score was influenced by the fact that few if any people will see the turbines.
- I find that my perceptions are very much influenced by the nearness and angles used when assessing wind farms. The nearer they are the lower the rating. Some areas are so dull intrinsically that a few mills improve the situation.
- A bit long but I get the point.
- Windfarms best located in places land already cleared (cattle & grains).
- Personally, wind farms have a minimal visual impact when viewed from distance and appropriately spaced between them. Issues arise when they are sited near high-populated transit routes and tourist routes, or when sited in high concent-rations.
- Have seen wind farms all over the world and I can see no problems at all. Many of them across Europe are even built out to sea. Have one wind farm locally for many years with NO adverse reactions from anyone in the community.
- I think windfarms always add to the scenic value of the landscapes that have been heavily modified - I'd much rather see a windfarm than cleared land-scapes!
- Would be interesting to get the summary of this research. I think people might accept wind farms aesthetically only because they feel they are good for the environment in reducing greenhouse gases. However they require lots of steel and concrete to build and significant (steel) infrastructure to connect to grid, and only operate in optimum conditions (shut down in strong winds!), so not convinced. Also not reliable for base line energy needs.
- Don’t agree with your wording that wind farms have become a feature of Australian landscape. This can be misleading from the start of the survey. In your opinion it is a feature or distinctive attribute of Australian landscape not necessarily that of the person taking the survey. Photos don’t give a true perspective of the real thing. Photos don’t include movement of the blades which would change people’s opinion of the scenic value of the landscapes. Scenic value would be perceived and rated different if one lived in the area as opposed to a visitor. Most photos were seasonal with green grass (winter, spring) so more pleasing to the eye. There were no

photos of wind farms at sea or remote inland sites. I believe this survey is flawed and will not give a true indication of people's perspective of visual impact because of the above reasons.

- Ok, that was probably very inconsistent. As an ecologist, I'm concerned that there is so much badly degraded farmland in the country! The wind farms add interest. As a member of ATA and ASC, I'm in favour of wind farms in most environments where there is sufficient wind and the economics stack up.
- I prefer the look of windmills over the look of powerlines.
- See my earlier comments comparing the ugliness of these windmills to speed skaters.
- A very long survey. Your drop-out rate must be high.
- It was difficult to give consistency to my ratings.
- An interesting survey. It would be interesting to do this for other types of energy production too
- As a static photo, some of these windfarms are not all attractive. Driving past a windfarm however is a bit more interesting. Possibly because you can see the blades moving with a certain degree of grace.
- I really don't like turbines on the coast but have no problem with seeing them out at seas-as in Denmark.
- Surprised that none of your coastal sites showed housing developments on the landscape and rural sites did not include the expanse of high voltage power lines and poles. Also avoided situations of telecommunication towers.
- I really like these windmills because I think it's useful energy, no radiation or pollution.
- In my opinion wind farms should not be close to people due to visual and noise pollution.

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