Review of the Impact of Wind Farms on Property Values

21 July 2016

urbis

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Executive summary

The NSW Office of Environment and Heritage (OEH) commissioned Urbis to undertake an investigation into the potential impact of wind farm developments on property prices in NSW. This study follows on from the 2009 NSW Valuer-General's assessment of the impact of wind farms on property values.

The current study included:

- a literature review of existing reports and papers on the impact of wind farms on property values, both in Australia and overseas
- preparation of six case studies in NSW and Victoria, including analysis of sales data of properties near wind farms over the past 15 years to identify any differences between wind farm impacted properties and the broader property sales market
- a synthesis of the findings from the literature review and data analysis phases to pinpoint key drivers that may impact the value of land around wind farm developments.

There is insufficient sales data to provide a definitive answer to the question of whether wind farm development in NSW impacts on surrounding land values utilising statistically robust quantitative analysis techniques.

Therefore, the study was based on the best available data and traditional valuation sales analysis techniques to compare the change in values around wind farms over time and qualitative information from a review of the international literature on the impact of wind farms on property values.

Based on the outcome of these research techniques, it is our expert opinion that windfarms may not significantly impact rural properties used for agricultural purposes.

There is limited available sales data to make a conclusive finding relating to value impacts on residential or lifestyle properties located close to wind farm turbines, noting that wind farms in NSW have been constructed in predominantly rural areas.

In undertaking this assessment, we encountered limitations in the availability of sales transactions around wind farms in NSW, and some inconsistency in results showing how properties performed relative to the broader market. The limited number of sales transactions over a 15-year period from 2000 to 2015 is typical of rural and rural residential areas, which have a relatively low population density and larger individual properties.

The literature review of Australian and international studies on the impact of wind farms on property values revealed that the majority of published reports conclude that there is no impact or a limited definable impact of wind farms on property values. Those studies which identified a negative impact are based in the northern hemisphere and are associated with countries with higher population densities and a greater number of traditional residential and lifestyle properties affected by wind farms. This is generally contrary to the Australian experience, with most wind farms being located in low population density environments that derive the majority of their value from productive farming purposes.

Changes in the circumstances of future wind farm developments that may warrant future additional studies into value change include:

- development of wind farms near urban centres such as towns and villages that may have direct impacts on the residential amenity of these locations
- a significant increase in the concentration of wind turbines compared to current practice
- significant changes in the planning approval process or policy settings for wind farms.

Introduction

The purpose of this study was to analyse the impact of wind farm development on the value of surrounding properties in NSW.

In 2009, the NSW Valuer-General's Office appointed Duponts in association with Preston Rowe Paterson (PRP) to prepare an assessment of the impact of wind farms on NSW property values. This report was commissioned to address concerns in the community that wind farms have a detrimental impact on property values. The 2009 NSW Valuer-General's assessment of the impact of wind farms on property values concluded that there was no conclusive evidence available at the time to indicate a universal fall in the value of properties surrounding wind farm developments.

To arrive at an understanding of the impact of wind farm projects on land values in NSW, Urbis established a methodology to be undertaken in four phases.

METHODOLOGY

The scope of work included in the study is outlined below and takes account of the project scope as suggested by the NSW Office of Environment and Heritage (OEH):

Phase 1 – Literature review and market research

Phase 2 – Case study preparation

Phase 3 – Assessment of value impact drivers

Phase 4 – Conclusions and recommendations

These key phases are summarised in the following chart and described in more detail on the following pages. A detailed flowchart of the steps in the methodology is provided in Appendix A.

Phase	Process	Outcomes
Phase 1: **Literature review and market research**	• Review relevant literature on impact of infrastructure on surrounding land values • Market research	• Identify key issues to be further researched and tested • Inception meeting
Phase 2: **Case study preparation**	• Identification of case study locations and types • Review before and after value change for each	• Assessment of specific value impacts for each case study
Phase 3: **Assessment of value impact drivers**	• Combine outcomes from literature review and case studies • Prepare a discussion of the key issues	• Discussion of the factors that influence land value
Phase 4: **Conclusions and recommendations**	• Finalise assessment of land value impacts • Compare findings and draw out key recommendations	• Draft report • Final report • Presentation of findings

PHASE 1 – LITERATURE REVIEW AND MARKET RESEARCH

The key tasks in this phase include:

- involvement in an inception meeting with OEH to refine methodology and outcomes
- review of any available previous reports provided to OEH on this topic (e.g. 2009 NSW Valuer-General's assessment of the impact of wind farms on property values)
- research and undertake a literature review of other publications dealing with the impact of infrastructure on surrounding land values (both Australian and international)
- prepare a summary of the literature and identify key themes to be tested.

PHASE 2 – CASE STUDY PREPARATION

The key tasks undertaken in this phase include:

- identify key case study locations and property types to be tested as part of the study. Urbis reviewed all wind farms in NSW and non-coastal wind farms in Victoria (the most comparable with the NSW circumstances)
- utilise sales data to investigate before and after land value for the land around identified infrastructure case studies (note that in most cases a significant volume of transactions was difficult to obtain for analysis given the rural and rural residential nature of existing wind farm locations in NSW)
- where available, review same property resale data to compare the sale of a property transacted before announcement of a proposed wind farm with the sale of the same property after commissioning of the wind farm. The change in value was measured against the change in average value for similar properties within a broader study area (e.g. local government area) over the same period
- review underlying land value growth in the broader market to establish a base growth level
- identify any changes in land values of the impacted land that may differ from land values in the broader market
- review any information on specific local circumstances that may have given rise to any change in value that differs from the rest of the market (e.g. review of media around the time of development and post development)
- report on each case study.

PHASE 3 – ASSESSMENT OF VALUE IMPACT DRIVERS

This phase involved a comparison of the various case study findings and the key themes from the literature review to prepare a discussion on the key drivers that may impact the value of land around wind farm developments.

Note: Data availability

In conducting the research Urbis extracted relevant sales data for NSW and Victoria using the PriceFinder sales and ownership database. Sales were then geocoded using Geographic Information Systems to determine their location relative to a two kilometre radius around the wind farm in question. We note that in most cases there were a limited number of transactions over the 15-year period from 2000 to 2015. This is typical of rural and rural residential areas that have a relatively low population density and larger individual properties.

This limited data availability precluded a broad based statistical analysis (e.g. multiple regression or Monte Carlo analysis) to establish any trends in value change as a result of proximity to wind farm infrastructure.

We note that other studies, in the United States and Europe, have had access to relatively large sales data sets, enabling analysis of value impacts using hedonic regression models. The relatively high population densities of the regions under study and the proximity of a larger number of dwellings to the wind farms facilitated these northern hemisphere analyses and may have also influenced their outcomes and are not readily comparable to NSW.

We have conducted a Power Analysis to determine what sample size is required to undertake an analysis of sales data within a 2 kilometre radius of a wind farm. Adopting a confidence level of 95%, a minimum sample of 97 transactions would be required to arrive at a result accurate within 10%. This increases to a sample size of 385 transactions to arrive at a result accurate within 5%.

The wind farms reviewed in this study have experienced far fewer than 100 sales transactions, ranging from 9 to 44 sales within a 2 kilometre radius over the past 15 years (between 2000 and 2015). On this basis there is insufficient data to undertake a traditional statistical analysis that would produce a result with a sufficient degree of confidence.

Given the limited number of sales, we have therefore adopted a same property repeat sale approach to test value change of properties within 2 kilometres of wind farms relative to the comparable property market within each relevant Local Government Area.

PHASE 4 – CONCLUSIONS AND RECOMMENDATIONS

The key tasks undertaken in this phase include:

- preparation of a set of key conclusions around the impact of wind farm projects on land values in NSW
- provide a draft report summarising the outcomes of Phases 1–3
- finalise the report based on comments from OEH
- Urbis attended weekly meetings with OEH representatives.

1 Wind farms in Australia

1.1 INDUSTRY BACKGROUND

Wind has been used by humans as a power source for centuries, the first use probably being to propel water craft with sails. In the past, land based wind energy has been harnessed to drive windmills used for the processing of grains and for pumping boar water using wind pumps.

The first windmill used to generate of electricity was built in Scotland in 1887 by Professor James Blythe.[1] From the early 20th century through to the early 1970s, wind power development was relatively small-scale and experimental. The concept of large-scale wind farms gained traction in the mid 1970s as a result of the oil crisis, however this trend was somewhat short lived with oil prices returning to lower levels during the 1980s, making wind power uneconomical.

Wind power came back onto the agenda during the early 2000s as a result of concerns around energy security, peak oil and global warming. Countries such as China, the USA, Germany, United Kingdom, Spain and Italy have taken a leading role in developing wind farm capacity. By 2014, over 240,000 commercial-sized wind turbines were operating in the world, producing 4% of the world's electricity.[2]

1.2 THE AUSTRALIAN CONTEXT

Wind energy is the fastest growing renewable energy source for electricity generation in Australia, and its current share of total Australian primary energy consumption is almost 4%. The growth in renewable energy initiatives including wind farms has been driven by the Commonwealth Renewable Energy Target. The target adopted in 2015 for large-scale generation of 33,000 gigawatt hours (GWh) by 2020 will result in approximately 23.5% of Australia's electricity generation being from renewables.

According to the Clean Energy Council, Australia had 1866 wind turbines spread across 71 wind farms at the end of 2014 (Table 1.1). Approximately 82% of these wind turbines were located in wind farms with more than 50 MW installed capacity with the remaining 18% installed in smaller wind farms under 50 MW.

The majority of Australia's wind resources are concentrated in its south-western, southern and south-eastern regions, typically closer to the coast or in elevated exposed areas. The first wind farm connected to the national energy grid was built in 1998 at Crookwell in NSW.

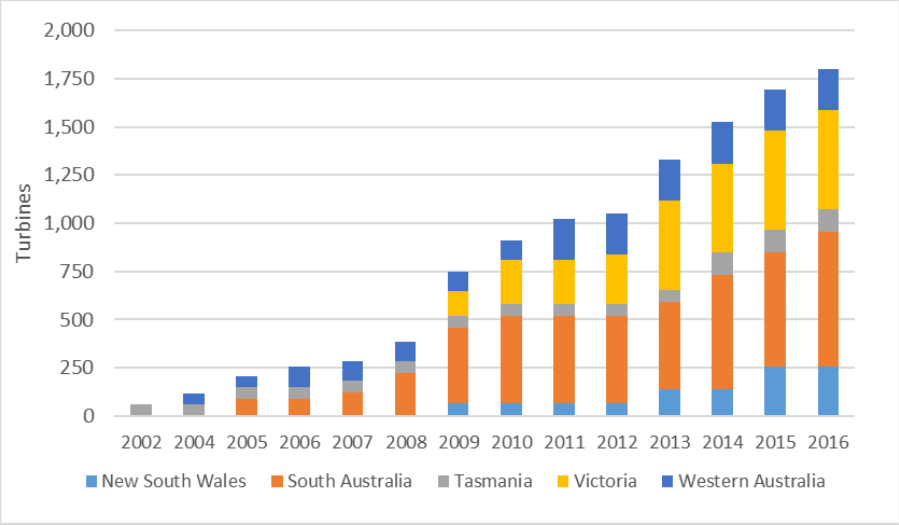
Large-scale wind farms (e.g. over 50 megawatts (MW) capacity) were first established in Australia in 2002, with the commissioning of the Woolnorth Wind Farm in Tasmania. By 2016, 23 additional large-scale wind farms with a capacity of 3,980 MW from 1,798 individual turbines have been developed. This represents a growth in installed capacity of 29% per annum

[1] Price (2005)

[2] World Wind Energy Association (2014), pp. 1–8.

Historic development of wind farm capacity in Australia

WIND FARMS OVER 50 MW CAPACITY – MARCH 2016 CHART 1.1



Source: Urbis, various wind farm websites

South Australia has approximately 42% of the nation's large-scale wind power capacity, followed by Victoria (28%), NSW (13%), Western Australia (9%) and Tasmania (8%).

Installed wind energy in Australia by state (as at end of 2014)

CLEAN ENERGY COUNCIL TABLE 1.1

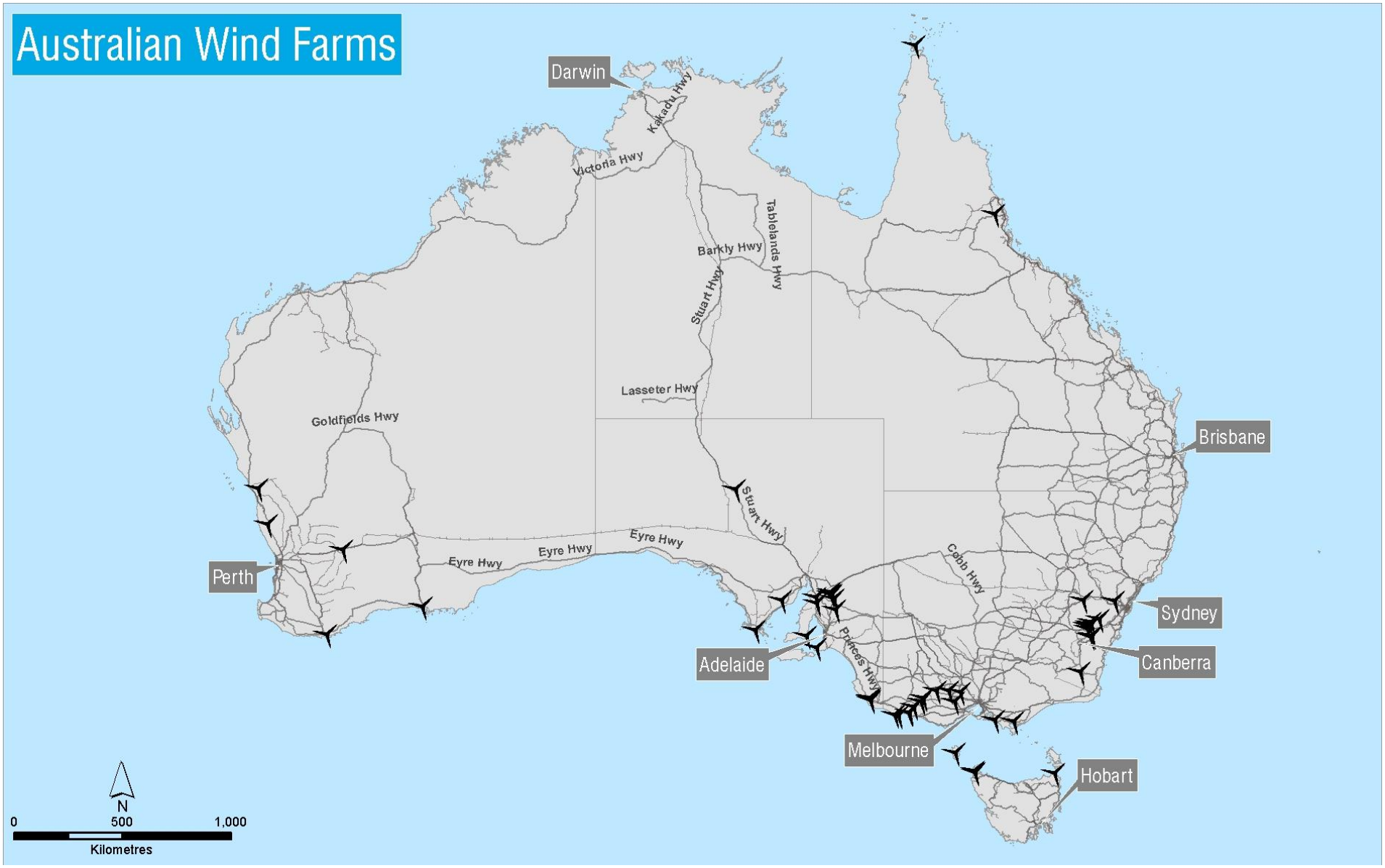
STATE	NUMBER OF PROJECTS
South Australia	17
Victoria	14
Western Australia	21
NSW	10
Tasmania	7
Queensland	2
Northern Territory	0
Australian Capital Territory	0
TOTAL	**71**

Source: Clean Energy Council

Australia's wind energy resources are mainly located in the southern parts of the continent (which lie in the path of the westerly wind flow known as the 'roaring 40s') and reach a maximum around Bass Strait. Areas with high wind potential also lie along the higher exposed parts of the Great Dividing Range in south-eastern Australia, such as the Southern Highlands and New England areas.[3]

The location of these wind resources explains the pattern of wind farm development in Australia (Map 1.1).

[3] Geoscience Australia website, March 2016, www.ga.gov.au/scientific-topics/energy/resources/other-renewable-energy-resources/wind-energy


Australian Wind Farms
Darwin
Kakadu Hwy
Victoria Hwy
Barkly Hwy
Tablelands Hwy
Stuart Hwy
Lasseter Hwy
Goldfields Hwy
Stuart Hwy
Eyre Hwy
Eyre Hwy
Eyre Hwy
Perth
Brisbane
Cobb Hwy
Sydney
Canberra
Adelaide
Princes Hwy
Melbourne
Hobart
N
0
500
1,000
Kilometres

1.3 WIND FARMS IN NSW

The distribution of wind farms in NSW is shown in Map 1.2.

The NSW Wind Atlas (Map 1.3) shows that the areas with the highest wind energy potential lie along the higher exposed parts of the Great Dividing Range and very close to the coast, except where there is significant local sheltering by escarpment (NSW Sustainable Energy Development Authority 2002).

The best sites result from a combination of elevation, local topography and orientation to the prevailing wind. Significantly, the map shows that some inland sites have average wind speeds comparable with those in coastal areas of southern Australia.

The distribution of wind farms in NSW generally corresponds with areas with higher wind speeds.

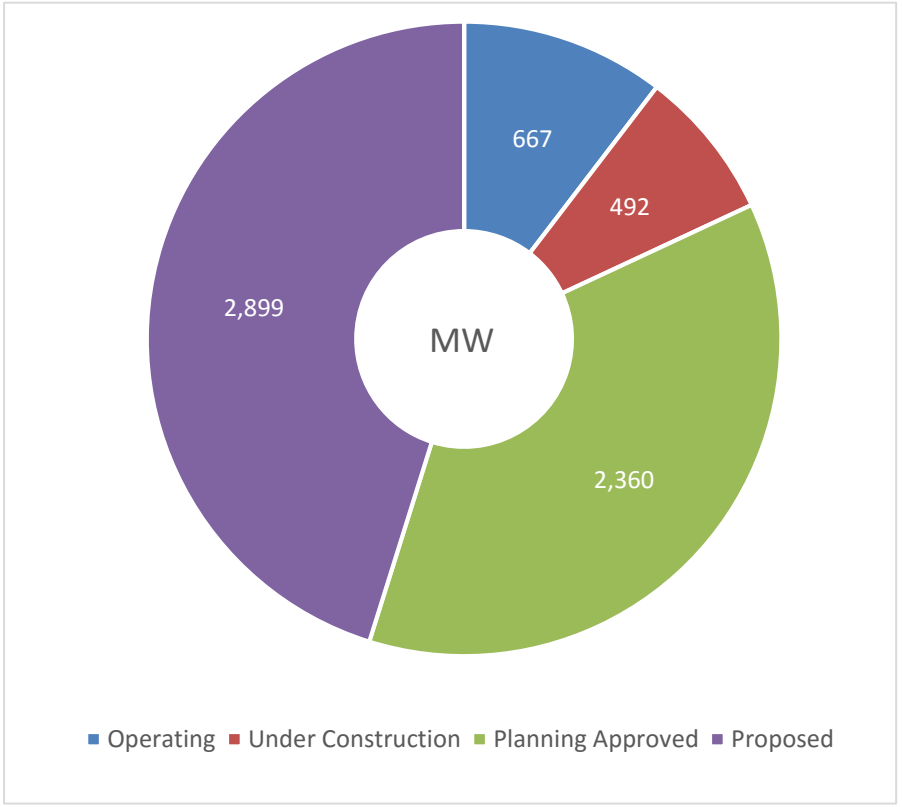
Whilst there are only four wind farms in NSW with a capacity of over 50 MW, there are currently 10 operating commercial wind farms in total, ranging in size from 1.32 MW to 165.5 MW. The total installed capacity of these operating wind farms is approximately 667 MW. Two more wind farms are currently under construction with a combined capacity of 492 MW.

There are also a significant number of proposed wind farms that are awaiting planning approval or are yet to be built (22 in total). These combined proposals could theoretically provide an additional 5,259 MW of installed capacity, close to an 788% increase on the current capacity. In practice, limitations on grid capacity and a highly competitive energy market mean that many of these proposals are unlikely to proceed.

Chart 1.2 and Table 1.2 show the current and proposed supply of wind farms in NSW.

Status of NSW wind farm projects

MEASURED BY MW CAPACITY – JUNE 2016 CHART 1.2



Source: Urbis, various industry websites

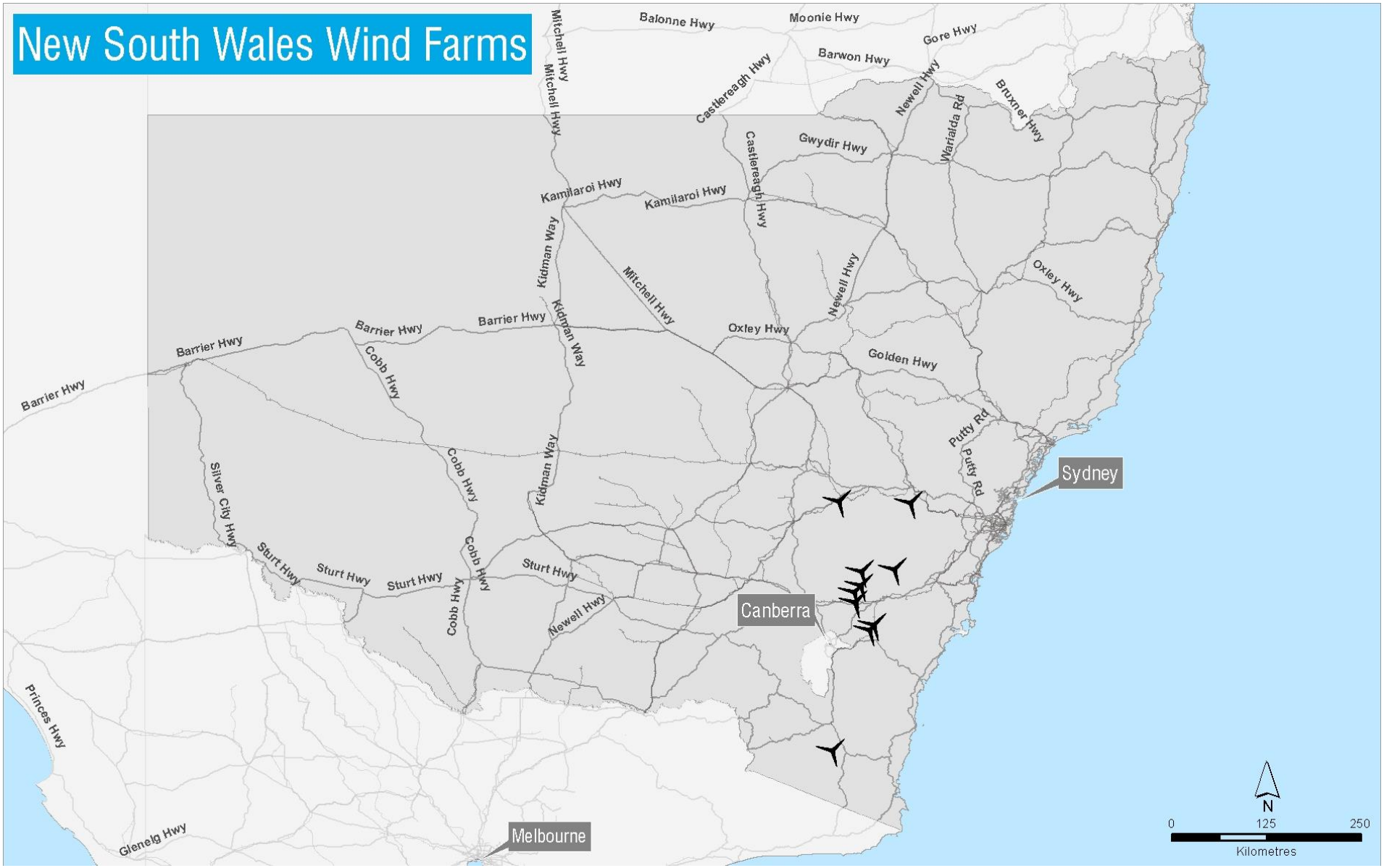
NSW wind farm status

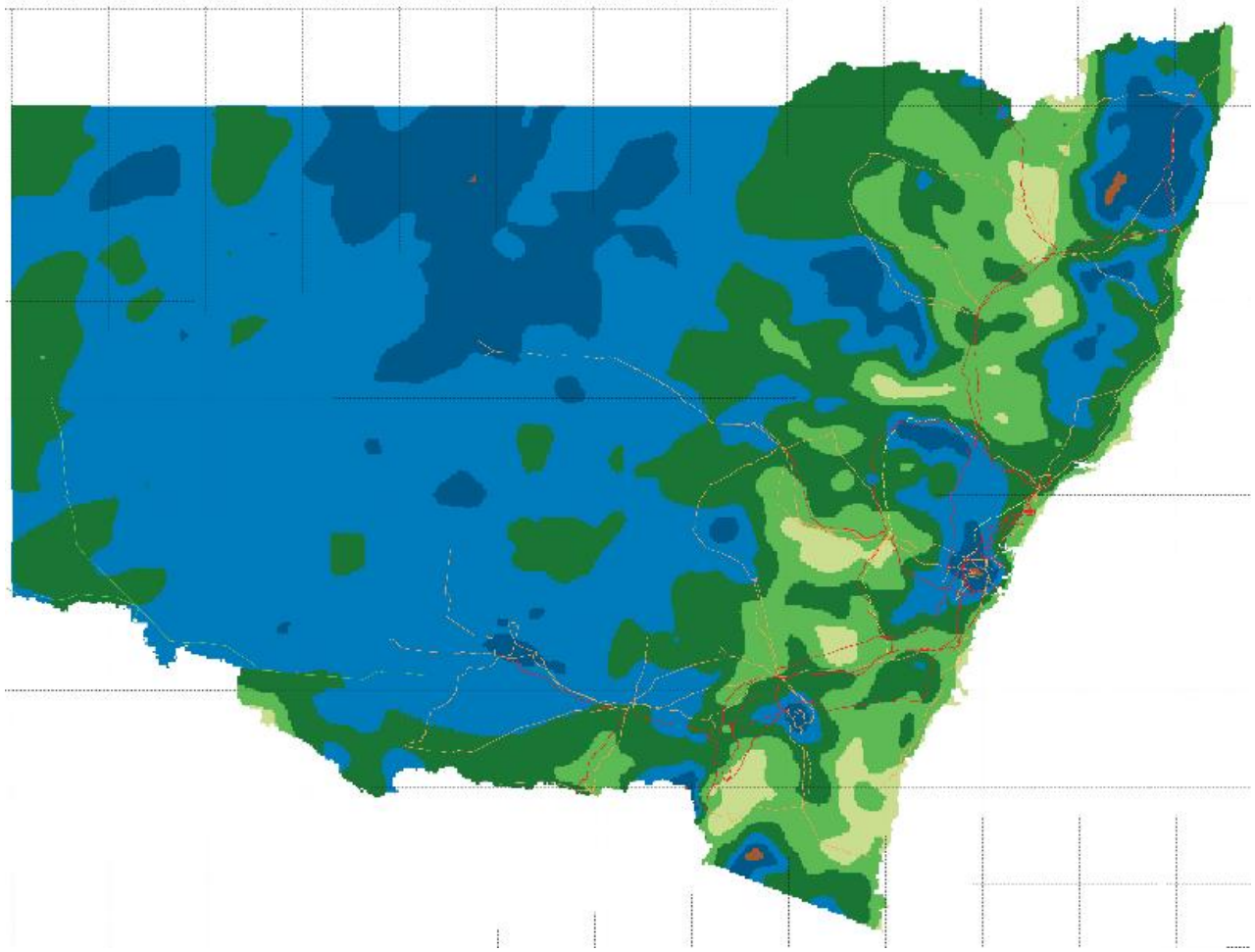
OPERATIONAL AND PROPOSED – AS AT 2016 TABLE 1.2

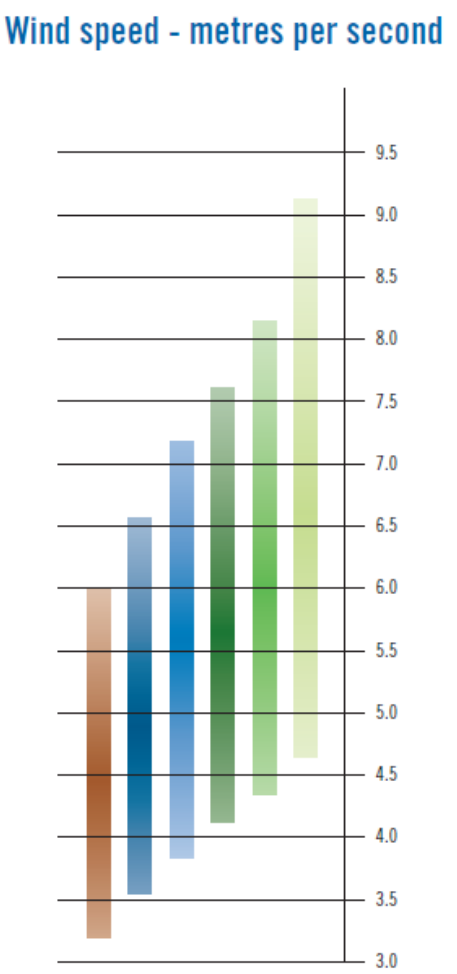
PROJECT NAME	SPONSORING COMPANY	STATUS	CAPACITY (MW)
Blayney Wind Farm	Eraring Energy	Operating	9.9
Boco Rock Wind Farm	CWP Renewables	Operating	113
Capital Wind Farm	Infigen Energy	Operating	140.7
Crookwell Wind Farm	Trustpower	Operating	4.8
Cullerin Range Wind Farm	Duet Group	Operating	30
Gullen Range Wind Farm	Goldwind	Operating	165.5
Gunning Wind Farm	Acciona	Operating	46.5
Hampton Wind Park	Wind Corporation Australia	Operating	1.32
Taralga Wind Farm	Pacific Hydro	Operating	107
Woodlawn Wind Farm	Infigen Energy	Operating	48.3
Crookwell 2 Wind Farm	Union Fenosa	Under construction	92
White Rock Wind Farm	Goldwind	Under construction	400
Black Springs Wind Farm	Wind Corporation Australia	Approved	18.9
Bodangora Wind Farm	Infigen	Approved	100
Capital 2 Wind Farm	Infigen	Approved	90
Collector Wind Farm	Ratch	Approved	165
Conroys Gap Wind Farm	Epuron	Approved	30
Crudine Ridge Wind Farm	CWP Renewables	Approved	135
Flyers Creek Wind Farm	Infigen	Approved	123
Glen Innes Wind Farm	OneWind	Approved	80
Kyoto Energy Park	Pamada	Approved	113
Sapphire Wind Farm	CWP Renewables	Approved	220
Silverton Wind Farm	Epuron	Approved	1,000
Yass Valley Wind Farm	Epuron	Approved	285
Bango Wind Farm	CWP Renewables	Proposed	326

PROJECT NAME	SPONSORING COMPANY	STATUS	CAPACITY (MW)
Biala Wind Farm	Newtricity	Proposed	77.5
Crookwell 3 Wind Farm	Union Fenosa	Proposed	98.6
Jupiter Wind Farm	EPYC Pty Ltd	Proposed	350
Liverpool Range	Epuron	Proposed	1,008
Lord Howe Island Hybrid Renewable Energy Project	Lord Howe Island Board	Proposed	0.6
Paling Yards Wind Farm	Union Fenosa	Proposed	180
Rye Park Wind Farm	Epuron	Proposed	378
Uungula Wind Farm	CWP Renewables	Proposed	400
Woolbrook Wind Farm	Newtricity	Proposed	80

Note: Proposed projects are in the early stages of planning or are in active environmental assessment prior to finalising development applications.
Source: Urbis, OEH, various industry websites


New South Wales Wind Farms
Balonne Hwy
Moonie Hwy
Gore Hwy
Barwon Hwy
Mitchell Hwy
Castlereagh Hwy
Newell Hwy
Bruxner Hwy
Warialda Rd
Gwydir Hwy
Kamilaroi Hwy
Kamilaroi Hwy
Kidman Way
Mitchell Hwy
Oxley Hwy
Barrier Hwy
Barrier Hwy
Barrier Hwy
Barrier Hwy
Cobb Hwy
Golden Hwy
Putty Rd
Putty Rd
Sydney
Silver City Hwy
Sturt Hwy
Sturt Hwy
Sturt Hwy
Sturt Hwy
Cobb Hwy
Cobb Hwy
Cobb Hwy
Kidman Way
Newell Hwy
Canberra
Princes Hwy
Glenelg Hwy
Melbourne
N
0
125
250
Kilometres





Source: NSW Sustainable Energy Development Authority

2 Literature review assessment

The study included a literature review of existing studies and papers on the impact of wind farms on property values. For completeness, we have also included the literature review undertaken as part of the 2009 NSW Valuer-General's assessment of the impact of wind farms on property values.

The details of each study considered as part of this report are included in Appendix B.

In undertaking this analysis, we have observed a number of differences between some of the international case studies and the Australian context. In particular, countries such as the United Kingdom, Germany and the USA have significantly higher population densities, combined with well-developed wind energy industries. This is more likely to result in wind farms being located close to villages or towns. In the NSW context, most wind farms are located in low density population areas. These differences are important in considering the case studies as comparisons, as differences in the environment in which wind farms are located are likely to influence the potential impact they may have.

The following discussion details the findings from our analysis and our review of the available literature.

2.1 DISCUSSION ON THE LITERATURE REVIEW

According to the Clean Energy Council of Australia, at the end of 2014 NSW had 10 installed wind farms[4]. In March 2014 NSW had approved more than 2.1 gigawatts (GW) of new wind generation capacity, with an additional 5.6 GW being assessed, which equates to approximately $21 billion in capital investment[5].

Research conducted by Newspoll in 2014 on behalf of OEH found broad support for the use of renewable energy across NSW.

[4] Clean Energy Council of Australia (2016)

[5] NSW Department of Industry (2014)

81% of respondents in non-metropolitan regions of NSW were supportive of wind farms[6].

While wind farms are broadly viewed as a sustainable source of energy by the survey respoondents[6], the level of acceptance begins to fall away the closer respondents reside to the development[7]:

- 81% acceptance rate for a wind farm within NSW
- 73% for one within their local region
- 59% for one 1–2 km from their residence.

While the Newspoll study indicated strong support for wind farms, it revealed a 14% drop in acceptance between wind farms being located within respondents local region and within 1-2 km of their residence, within support falling from 73% to 59%[7].

These survey results illustrate that proximity to the development impacts the level of acceptance of wind farms.

While there appears to be widespread support for wind farms in NSW, some community concerns remain, and these are more likely to receive coverage in the media, possibly making them appear more widespread than they really are[8].

In the Newspoll study when asked about a wind farm being located within 1-2 kilometres of their home respondents specifically highlighted concerns such as noise (61%), negative visual impact (38%) and health (23%)[9]. These community perceptions/attitudes are mirrored in other countries that

[6] Newspoll (2014), p 22

[7] Newspoll (2014), p. 24

[8] Hall et al. (2012)

[9] Newspoll (2014), p. 34

have seen an increase in wind farm development, with a negative view being expressed by 23% of residents surveyed in Scotland, citing a negative visual impact[10]. Those who supported wind farms also expressed these concerns, albeit at a lower rate (32%, 11% and 8% respectively).

The risks and 'stigma' associated with land-use conflicts, and 'unpleasant' land uses can be measured via their impact on land values[11]. The *Wind farm guide for host landholders*[12] outlines a number of potential amenity impacts from wind farm development:

- visual
- shadow flicker
- dust
- noise
- perceived health impacts
- social/community impacts.

The wind farm guide also outlines a number of potential community benefits, namely:

- financial remuneration
- upgraded road infrastructure
- local construction jobs and economic activity
- environmental benefits from CO_2 emissions reduction.

Property owners willing to permit the construction and operation of turbines or transmission facilities on their land can negotiate direct payments from developers. Community benefits are currently focused on local job creation.

An international case study (UK) identified 23 reasons given for objection to wind farms – from these results the five most frequently cited reasons for objection to wind farms were[13]:

1. visual eyesore (22.9%)
2. effect on wildlife (11.4%)
3. turbine noise (11.4%)
4. construction traffic (6.8%)
5. industrialisation of the countryside (6.4%).

Previous studies have established that community perception is a driver of value of residential property, especially if linked with a possible health risk. The impact of this stigma has been tested in a number of studies.

Apart from surveying residents, another way of exploring community perceptions about wind farms is to analyse data from property sales. A range of quantitative evaluation techniques such as hedonic price can identify differences between wind farm affected and non-affected transactions [14]. Put simply, transactions are analysed based on specific characteristics such as proximity to wind farms or other non-amenities. This comes in the form of a 'hedonic analysis', which is effectively a multivariate regression analysis of the impact of 'quality' on the price of a commodity.

Quality can be characterised via observable attributes, and the implicit price of each of these attributes is then estimated. These can include the inherent characteristics of the house (e.g. number of bedrooms, house size, layout,

[10] Gibbons 2014, p. 1
[11] Bond et al. (2013)
[12] GHD (2014)

[13] Bond et al. (2013)
[14] Bond et al. (2013)

age, condition, lot size) and locational factors (e.g. proximity to schools, retail centres, amenities, public transport, high crime areas, busy roads).

Studies have shown that public perception of negative non-physical property attributes such as views, noise and odour can impact the value of residential property[13].

Notwithstanding this, accurately identifying the impact of a dis-amenity, be it wind farms or other impacts, is a challenging exercise that requires a large sample size of property transactions covering a number of years, with data that include a measure of the dis-amenity (e.g. distance from wind farm development, degree of visual impact) to establish statistically significant results[15].

A study by Hoen (2009 & 2013) overcame the typical lack of sales transactions by collecting some 50,000 home sales across 27 counties in seven states across the USA[16] [17]. This included sales that were within 10 miles and one mile of a turbine, with data from periods before the wind farms were announced and after construction was completed.

Hoen (2009 & 2013) found no statistical evidence that home values near wind turbines were affected in the post-construction or post-announcement/ pre-construction periods.

Hoen (2009 & 2013) also concluded that if there was an effect, it is possible that the impact is sporadic, affecting only particular types of homes or in markets where consumer preferences were ill-disposed to wind farms.

In addition there was no significant impact identified pre-construction when the wind farm was announced[18], indicating that the announcement itself did not create any speculative dis-amenity in anticipation of the wind farm being completed.

[15] Bond et al. (2013), p. 1

[16] Hoen et al. (2013)

[17] Hoen et al. (2009)

[18] Laposa & Mueller (2010), p. 398

Other studies found mixed results[19], with Heintzelman and Tuttle (2012) finding when testing across three different US counties, that in some instances there was a negative relationship between proximity to wind turbines and property values; however, it was not consistent and there was no identifiable factor driving the difference. The lack of consistency between the results may point to a qualitative factor associated with the wind farm itself, or a difference in consumer preferences between counties when it comes to co-location with wind farms. This would make it difficult to draw conclusive implications about compensating all landholders in close proximity to wind farms.

A similar hedonic price analysis conducted in Germany by Sunak and Madlener (2014) found that the asking prices for properties whose view was strongly affected by the construction of wind turbines decreased by 10–17%, while properties with a minor or marginal view experienced no price effect. The impact of visual amenity is complex however, with the angle of view, distance and size of the wind farm all playing a part in the potential negative impact on a property's amenity.

In the Australian context, in 2009 the NSW Valuer-General commissioned an analysis of the impact of wind farm development on rural land in NSW and Victoria (2009 NSW Valuer-General's assessment of the impact of wind farms on property values [20], which was a precursor to this current study). The 2009 NSW Valuer-General's assessment of the impact of wind farms on property values compared the sale prices of properties that transacted before and after the development of a wind farm, taking into consideration the percentage movement of the property market in the local area.

The matched pair method compared properties within view of the wind farm with comparable properties that were not visually impacted. If a property located within view of a wind farm sold for less than a comparable property, it was said to be impacted by the wind farm.

[19] Heintzelman & Tuttle (2012), p. 584

[20] 2009 NSW Valuer-General's assessment of the impact of wind farms on property values - Preston Rowe Paterson Newcastle and Central Coast (2009)

The study did not conduct a hedonic analysis like many of the international studies because:

- the sample of comparable sales transactions was limited
- wind farm development occurred on rural land, with low population density
- there was significant variation in property characteristics (view from the dwelling, lot size, improvements, etc.) and the level of visual impact
- the complex array of factors that impact property prices was difficult to capture.

Similar limitations have also impacted this current study by Urbis, despite the time that has passed and the increase in the number of wind farms between the 2009 study and 2016.

The 2009 NSW Valuer-General's assessment of the impact of wind farms on property values reviewed 45 property transactions within eight study areas. Of these only five were identified as potentially being adversely affected by their view of a wind farm: a small impact was observed for one township property, and potential impacts were observed on four out of 13 lifestyle properties. There were no observed impacts on the 12 rural properties analysed.

The 2009 study found that properties in rural/agricultural areas appeared to be the least affected by wind farm development, with no reductions found near any of the eight wind farms investigated. The only properties where a possible effect was observed were lifestyle properties in Victoria within 500 metres of a wind farm, some of which were found to have lower than expected land values.

Generally, the 2009 NSW Valuer-General's assessment of the impact of wind farms on property values found that the separation distance identified in NSW appears to be sufficient to ameliorate any dis-amenity associated with the presence of wind farm development. Separation distances are not standard in NSW. They are determined through a merit assessment

Ultimately the 2009 NSW Valuer-General's assessment of the impact of wind farms on property values found that the wind farms that had been developed up to that time had not negatively affected property values in the majority of cases. For the minority of transactions that showed a fall in value, other factors may have been involved.

The literature review of Australian and international studies on the impact of wind farms on property values revealed that the majority of published reports conclude that there is no impact or a limited definable impact of wind farms on property values. Those studies which identified a negative impact are based in the northern hemisphere and are associated with countries with higher population densities and a greater number of traditional residential and lifestyle properties affected by wind farms. This is generally contrary to the Australian experience, with most wind farms being located in low population density environments that derive the majority of their value from productive farming purposes.

3 Wind farm case study assessment

This chapter outlines our analysis of six wind farm case studies.

3.1 APPROACH

In preparing the case study assessment, we first turned our minds to which wind farms would be appropriate for assessment. Key considerations in this selection process include:

- availability of data
- range of potentially affected property types
- relevance to the broad base of wind farms in NSW.

It was initially our intention to select approximately 6–8 case study locations for analysis, across NSW.

In researching appropriate sales evidence for NSW case studies, it quickly emerged that the volume of available transactions around any one wind farm was limited. For this reason, Urbis searched for sales data for the past 15 years on all wind farms in NSW and as a result a brief case study has been produced for each of these locations.

As data availability was limited within NSW, we then looked to other states. We concluded the following on the applicability of these states:

- Whilst South Australia has the largest concentration of wind farms in Australia, its overall economic profile is quite different to NSW. This difference may have impacts on the growth in property values overall and therefore SA is less likely to be comparable to NSW circumstances.
- As with South Australia, it is considered that the property markets and underlying conditions within Western Australia, Tasmania and Queensland are not comparable with NSW circumstances.
- Victoria has the second largest provision of wind farms (ahead of NSW), and it has attributes that make it more comparable to NSW. There are some broad similarities to southern NSW in terms of agriculture and underlying property values, and overall the state has grown at levels similar to NSW. With Victoria being identified as an appropriate case study base, emphasis has been placed on wind farms in non-coastal locations (the most comparable with the circumstances of wind farms in NSW).

Tables 3.1 and 3.2 list the wind farm locations that were considered as potential case studies, and provide the results for each based on the amount of available sales data.

Wind farm locations considered for case study

NSW TABLE 3.1

WIND FARM	SALES DATA COMMENTS
Capital Wind Farm	Included in case study – 2 same property resales
Woodlawn Wind Farm	Included in case study with Capital Wind Farm
Blayney Wind Farm	Not included in case study – insufficient local sales
Crookwell Wind Farm	Not included in case study – insufficient local sales
Cullerin Range Wind Farm	Not included in case study – insufficient local sales
Gunning Wind Farm	Not included in case study – insufficient local sales
Hampton Wind Park	Not included in case study – insufficient local sales
Boco Rock Wind Farm	Not included in case study – insufficient local sales
Gullen Range Wind Farm	Included in case study – 3 same property resales
Taralga	Included in case study – 1 same property resale

Wind farm locations considered for case study

VICTORIA TABLE 3.2

WIND FARM	SALES DATA COMMENTS
Challicum Hills Wind Farm	Not included in case study – insufficient local sales
Hepburn Community Wind Farm	Included in case study – 3 same property resales
Macarthur Wind Farm	Not included in case study – insufficient local sales
Mortons Lane Wind Farm	Not included in case study – insufficient local sales
Mount Mercer Wind Farm	Included in case study – 1 same property resale
Oaklands Hill Wind Farm	Not included in case study – insufficient local sales
Waubra Wind Farm	Included in case study – 10 same property resales

The limited volume of sales within the study areas has restricted our ability to undertake a detailed statistical analysis of sales relative to the rest of the market. This is not unexpected as the case study locations are generally in areas of low population density with a corresponding low volume of property sales. Compounding this are the significant differences in the nature of sales around wind farms, ranging from land size to the level of improvements. As such not all wind farms have enough available sales transactions that are suitable for analysis.

The adopted methodology relies largely on traditional valuation techniques using sales analysis. This is essentially the same methodology adopted in the 2009 NSW Valuer-General's assessment of the impact of wind farms on property values as they also found limited sales data. There are some methodologic differences between the 2009 Valuer General's report and Urbis approaches, which are described below.

The 2009 NSW Valuer-General's assessment of the impact of wind farms on property values considered eight (8) case studies as part of their assessment, two (2) located in NSW and six (6) in Victoria. This study has considered six (6) case studies comprising three (3) in NSW and three (3) in Victoria.

In undertaking our assessment, we have relied on the following analysis technique:

- **Same property resale analysis** – Where possible we used same property resale analysis, where a property was sold before the wind farm was announced and then again after the wind farm had been commissioned. This has proved to be the most reliable and least subjective of the approaches and has been adopted as our primary method of assessment.

Urbis considered performing a **pre and post development sales comparison** (with comparable average price data) by analysing the sale prices of multiple properties within a defined area around each wind farm both before and after development and comparing these to the average prices in the broader local market to ascertain potential trend differences. We note that the selection of comparative properties is largely subjective due to the limited volume of sales data, therefore this methodology was not relied upon in our conclusion.

3.2 RESULTS OF THE TRANSACTION ANALYSIS

Detailed results of the transaction analyses for each case study are provided in Appendix C. The following is a general survey of the results across all six case studies.

In assessing the potential impact of wind farms on surrounding properties, the analysis is constrained by the following factors:

- limitations in the availability of sales data
- some inconsistency in results showing how properties perform relative to the broader market (which is likely a function of the relatively small sample size and unique attributes of properties in these markets)
- the largely desktop nature of this assessment.

In our opinion, the results of the transaction analysis do not appear to show a consistent trend in property value change for properties within two kilometres of a wind turbine. This finding would indicate that wind farms have not had an across-the-board negative impact on property values for surrounding properties. This finding is consistent with the 2009 NSW Valuer-General's assessment of the impact of wind farms on property values and a number of other studies reviewed as part of the literature review.

The absence of a clear trend is noteworthy, as we have limited the assessment of value impact to properties within a two kilometre radius of wind turbines and these properties are the most likely to experience adverse impacts due to view shed encroachment, noise and shadow flicker. Whilst properties outside a two kilometre radius may be able to see the wind turbines, these properties are less likely to be impacted by noise and shadow flicker.

In relation to the same property resale analysis, all analysed properties demonstrated an increase in value between their pre wind farm sales and their respective post wind farm sales. Measurement of this growth relative to the broader private market revealed that this growth appears to be in line with local market trends.

Same property resale analysis proved to be the most reliable form of assessment in light of the limited amount of sales data overall.

4 Findings

4.1 KEY FINDING OF THE STUDY

There is insufficient sales data to provide a definitive answer to the question of whether wind farm development in NSW impacts on surrounding land values utilising statistically robust quantitative analysis techniques.

Therefore, the study was based on the best available data and traditional valuation sales analysis techniques to compare the change in values around wind farms over time and qualitative information from a review of the international literature on the impact of wind farms on property values.

Based on the outcome of these research techniques, it is our expert opinion that windfarms may not significantly impact rural properties used for agricultural purposes.

There is limited available sales data to make a conclusive finding relating to value impacts on residential or lifestyle properties located close to wind farm turbines, noting that wind farms in NSW have been constructed in predominantly rural areas.

4.2 ATTRIBUTES THAT MAY AFFECT VALUE

Based on the available literature and the sales evidence analysed around wind farms in Australia, in our professional opinion, there are some factors that may be more likely to negatively influence property values around wind farms. Whilst evidence to support these effects in the present Australian context is somewhat limited, the following factors are worthy of consideration:

- **Proximity to residential dwellings** – Issues surrounding noise, shadow flicker and close visual impacts are likely to be exacerbated if wind turbines are located close to residential dwellings, and therefore any such perceived diminution of residential amenity has the potential to influence property values.

- **Proximity to higher density populations** – The location of wind farms near areas of higher population density could be expected to result, in absolute terms if nothing else, in an increase in perceived and actual impacts on a larger number of residential use properties.

- **Uncertainty** – Community concern around the development of a local wind farm and its potential impacts may increase the amount of time required to sell a property, as potential buyers defer their decision until specific details of the proposed wind farm are known. (note that historic data that allows comprehensive analysis of time-on-market impacts is limited; however, the available evidence does not indicate that an increase in the time required to sell a property near a wind farm has corresponded to a loss in value.)

4.3 CONCLUSION

It is clear that the properties located around wind farms (particularly in NSW) are predominantly rural or rural residential in nature. There are very few smaller residential properties (such as those in towns) that are within close proximity of a wind turbine. For rural properties used for primary production, there is no direct loss of productivity resulting from wind farms; therefore, they are unlikely to negatively impact the value of such properties.

The types of locations chosen to date for wind farms in NSW have differed from many chosen for wind farms in the USA and Europe. Overseas countries with relatively high population densities have situated wind farms close to small urban centres or villages more often. This could account for a small number of overseas studies finding a property value reduction associated with the development of a wind farm; however, most studies undertaken in the northern hemisphere have essentially supported the notion that wind farms have a limited impact on property values.

The findings from the northern hemisphere studies that have identified a negative impact are also more likely to be associated with a greater number of traditional residential and lifestyle properties affected by wind farms.

The findings from our review of case studies in NSW and Victoria did not identify any conclusive trends that would indicate that wind farms have negatively impacted on property values. Our same property resale analysis

indicates that all of the properties examined demonstrated capital growth that aligned with the broader property market of the time.

As such, the circumstances of wind farms in NSW and the differences between those circumstances and those in other countries where similar studies have been conducted, have led us to the following conclusions:

> In our professional opinion, appropriately located wind farms within rural areas, removed from higher density residential areas, are unlikely to have a measurable negative impact on surrounding land values.
>
> There is limited available sales data to make a conclusive finding relating to value impacts on residential or lifestyle properties located close to wind farm turbines, noting that wind farms in NSW have been constructed in predominantly rural areas.

As the results of this study and that of the 2009 NSW Valuer-General's assessment of the impact of wind farms on property values have drawn similar conclusions, there is likely to be little value in undertaking further research into the value impact of wind farms in NSW. The location of wind farms in rural areas with low population densities and the corresponding limited volume of sales are unlikely to produce sufficient additional information to alter the results of this assessment.

Changes in the circumstances of future wind farm developments that may warrant future additional studies into value change include:

- development of wind farms near urban centres such as towns and villages that may have direct impacts on the residential amenity of these locations
- a significant increase in the concentration of wind turbines compared to current practice
- significant changes in the planning approval process or policy settings for wind farms.

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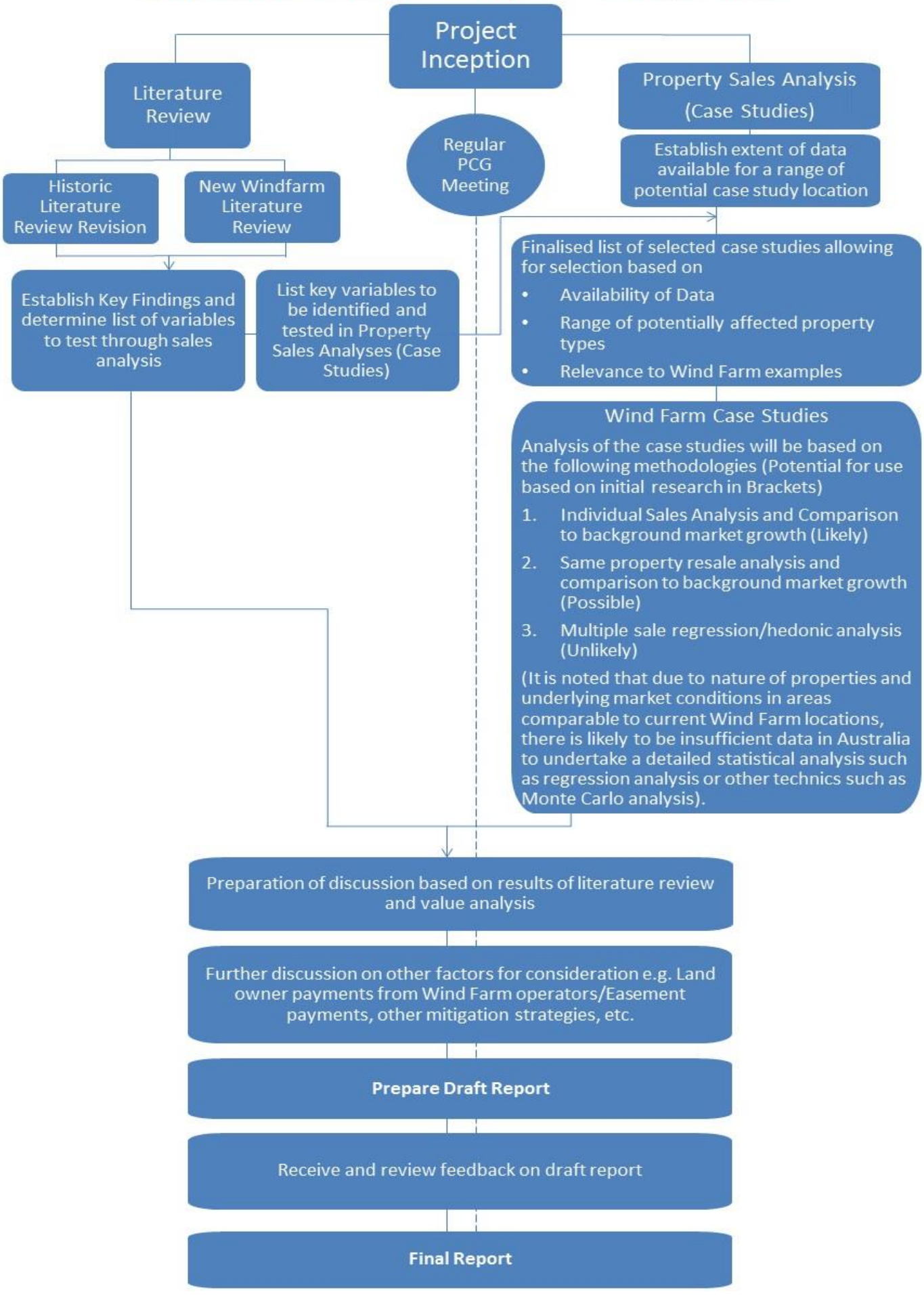
Appendix A Research Plan

Wind Farm Land Value Impact – Analysis Plan



Appendix B Literature review

The study has included a literature review of available studies and papers which consider the impact of wind farms on property values. For completeness we have also included the literature review undertaken as part of the 2009 NSW Valuer-General's assessment of the impact of wind farms on property values in Section B.1. This is a direct transcription of the literature review as it appeared in that study.

B.1 2009 NSW VALUER-GENERAL'S ASSESSMENT OF THE IMPACT OF WIND FARMS ON PROPERTY VALUES

'SOCIAL ASSESSMENT OF WIND POWER: VISUAL; EFFECT AND NOISE FROM WINDMILLS – QUANTIFYING AND VALUATION' – JØRGENSEN (1996) – DENMARK

One of the earliest studies that investigated the impacts of wind farms on property prices was conducted by Jørgensen (1996) in Denmark. The impact of wind farms on property sale transaction prices in 102 locations were analysed using a „hedonic" pricing method. Hedonic modelling investigates the relationship between variables and an item being investigated (such as property value) by deconstructing the item being researched into its constituent characteristics and obtaining estimates of the contributory value of each characteristic. This is usually achieved through a statistical method known as 'regression analysis' (Wikipedia, 2008).

Jørgensen (1996) found that, on average, properties located close to a wind turbine sold for 16,200 DKK (approximately $3,700 AUD) less than those located further afield. Furthermore, on average properties located close to 12 or more wind turbines sold for 94,000 DKK (approximately $21,600 AUD) less than those located further afield. However, as noted by Sims and Dent (2007) the impact overall was relatively small and some of the results were not statistically significant.

'THE EFFECT OF WIND DEVELOPMENT ON LOCAL PROPERTY VALUES' – STERZINGER, BECK & KOSTIUK (2003) – UNITED STATES

One of the largest studies completed to date was undertaken in the USA by Sterzinger, Beck and Kostiuk (2003). The report was commissioned and published by the Renewable Energy Policy Project (REPP). The study compared the average monthly change in value of properties across three scenarios:

- First scenario – compared changes in value of (a) properties located in the view shed of a wind farm with (b) properties in a comparable region for a period of three (3) years before the wind farm started operating and three (3) years after it started operating.
- Second scenario – compared changes in value of properties located in the view shed of a wind farm (a) in the period before the wind farm started operating to (b) changes in the period after it started operating.
- Third scenario – compared changes in value of properties located in the view shed of a wind farm with properties in a comparable region but only for the period after the wind farm started operation.

The view shed of a wind farm was defined to include those properties located within a five (5) mile radius (approximately eight (8) kilometres) of a wind turbine. Comparable regions were selected based on the area not having a view of the turbines and having similar demographics to the view shed areas. This was performed across ten (10) wind farm locations and a total of 25,000 property sales were analysed. This resulted in 30 separate analyses (Sterzinger et al., 2003).

In all but four (4) of their analyses Sterzinger et al. (2003) found that the change in property values was positive and greater in areas affected by the wind farm than in the comparison area.

Sterzinger et al. (2003) concluded that property values generally increased faster after a wind farm started operating and faster within the view-shed of the wind farm than in comparable areas located further away from wind farms.

'PROPERTY STIGMA: WIND FARMS ARE JUST THE LATEST FASHION' – SIMS & DENT (2007) – UNITED KINGDOM

Sims and Dent (2007) investigated the impacts of wind farms on property values in the UK. The study was based on an analysis of 1,052 sales of houses over a period of five (5) years from areas surrounding two (2) wind farms in Cornwall in the UK. The two (2) wind farms were selected based on

a sufficient number of residential properties being located within five (5) miles (approximately 8 kilometres) from the turbines. A third wind farm was also selected for analysis, however, the presence of an open cut mine next to the residences was considered to limit the extent to which conclusions could be drawn in this area.

Sales were adjusted to an inflation index to allow for the analysis of the present value of each property in the sample. The data was then analysed using multiple regression, correlation and frequency analysis with the main variable analysed being the distance between the properties and the wind turbines.

The results of Sims and Dent (2007) were varied for different models. Overall, there was no conclusive relationship found between distance to a wind farm turbine and property price with only terraced and semi-detached properties located in a mid-range (3.5 to 4 miles) from a wind farm found to be related to a reduction in property price.

Sims and Dent (2007) conclude by outlining that their results may be more reflective of the fact that wind farms are developed in suitable sites (e.g. rural areas) where potential impacts are likely to be minimised.

'THE EFFECTS OF WIND FACILITIES ON SURROUNDING PROPERTIES – PRELIMINARY RESULTS' – HOEN & WISER (2008) – UNITED STATES

Hoen and Wiser (2008) recently presented preliminary results of a two (2) year study into the impacts of wind farms on surrounding property values in the United States. The research appears to be one of the most comprehensive studies to be carried out to date. The study employed hedonic pricing models to test the effects of wind farm impacts on sales transaction prices while controlling for variables such as dwelling size, land size, dwelling condition and quality of views. The authors inspected each property and rated the properties quality of views and the extent to which wind turbines impacted on the views. This was carried out at 10 different wind farms across the country with more than 450 property sales at each wind farm investigated. This provided the sample for subsequent statistical analysis.

The study assessed whether sale prices were affected by virtue of being simply located near a wind farm (termed 'area stigma'). This was tested by comparing price changes after the construction of a wind farm with price levels before the announcement of the wind farm while controlling for house price inflation. This was carried out annually for up to four (4) years after the completion to test for effects of time. Preliminary analysis indicated no evidence of price reduction in any period after the construction of a wind farm.

The extent to which views of wind turbines contribute to property price changes (termed 'scenic vista stigma') was also assessed. This was tested by comparing (a) sales of homes with views (based on the qualitative rating of the view) with (b) sales of homes without views. Preliminary analysis indicated that there was no significant difference between sale prices of homes with views and those without views.

The final assessment considered possible 'Nuisance Effects' of dwelling being located very close to wind turbines (within ¼ mile, ½ mile and one (1) mile). This was tested by comparing sales of closely located properties with those located further away. Preliminary analysis indicated that there was no statistical evidence that dwellings located close to a wind farm sell for less than those located further away.

Hoen and Wiser (2008) did note that although there may be isolated cases of reductions in value, the largest potential effect found was a 15% reduction in sale price when located within ¼ mile of a wind turbine, these effects are not widespread in their sample.

At the time of the 2008 interim report, the study was ongoing. The completion of the study was expected to provide a comprehensive piece of research that will likely make a substantial contribution to the issue at hand.

'LAND VALUE IMPACT OF WIND FARM DEVELOPMENT: CROOKWELL NSW' – HENDERSON & HORNING (2006) – AUSTRALIA

Henderson and Horning Property Consultants prepared a report on behalf of Taurus Energy Pty Ltd on the effect of the Crookwell Wind Farm in NSW Australia on local property values. Taurus is the proponent of the wind farm.

The report included an analysis of 78 property sales surrounding the Crookwell Wind Farm over a period of 15 years from 1990 to January 2006. Sales of properties in the view shed of the wind farm (using a 6 kilometre threshold) were compared with sales of those not in the view shed.

No reductions in property values for were found for properties in the view shed of the wind farm.

'Wind Farms: The Local Experience' – Hives (2008) – Australia

In August 2008, two presentations were given by property valuation consultants at the Australian Property Institute's (API) Country Conference on recent work they had completed on wind farms and surrounding property values. Hives (2008) presented an analysis of individual sales transactions from properties surrounding the Waubra wind farm near Ballarat in Victoria. The wind farm was being constructed at the time of the study, although many turbines had already been erected. Hives hypothesised that:

- Agricultural land with turbine leases would become more valuable
- Adjoining agricultural land values would not be affected
- Lifestyle properties and residential properties located in the town might be affected.

Results of 12 individual sales analysis indicated that:

- Properties benefiting from turbine leases increased in value
- Rural properties were unaffected
- Some detrimental effects were evident on lifestyle properties.

Hives (2008) concluded that lifestyle values had the greatest potential to be affected as a large part of their value is typically derived from the aesthetic qualities of the surrounding environment.

'NEGATIVE AFFECTS TO PROPERTY VALUES NEAR WIND FARM DEVELOPMENTS IN SOUTH GIPPSLAND' – JESS (2008) – AUSTRALIA

In a separate presentation at the API Country Conference Jess (2008) presented a range of sales transactions that had occurred at the Toora wind farm in south east Victoria. The sales transactions indicated that the wind farm developer had been purchasing surrounding properties following planning approval and completion. Also, a sales transaction of a „lifestyle" property which sold both before and after the construction of the wind farm was presented. The property was located close to the wind turbines with substantial views of the turbines. It was estimated that the sale after the construction of the wind farm was approximately 30% below the market value of the property had the wind farm not existed. However, this was a single transaction and such a decrease has not been evident in other sales nearby.

'A TALE OF TWO WINDY CITIES: PUBLIC ATTITUDES TOWARDS WIND FARM DEVELOPMENT' – BOND (2009) – AUSTRALIA

Bond (2009) researched public attitudes towards wind farms and property values among residents living in the towns Albany and Esperance, Western Australia (WA). Each town is located close to a wind farm in WA. The siting of the wind farms in these locations was deemed to be too far away (more than 10 kilometres) from residential areas to conduct hedonic modelling. Rather postal surveys were used in order to gain a qualitative understanding of resident's attitudes towards the wind farms. A total of 800 paper surveys were posted to Albany with a 38% response rate. Additionally, 500 surveys were posted to Esperance with a 21% response rate.

Survey responses indicated that residents generally considered wind farm developments to be positive providing they were located a sufficient distance away from homes as to not disturb them. The distance reported to be acceptable was generally over five (5) kilometres away. Approximately two thirds of Albany residents and one third of Esperance residents felt more in favour of the wind farms after the farms were completed.

Over two thirds of survey respondents indicated that a wind farm would not influence the price they would be willing to pay for a property. On the other hand, nearly a quarter of survey respondents indicated that they would pay

less, with 38% indicating they would pay 1–9% less, while 22% of respondents indicated they would pay 10–19% less.

'IMPACT OF WIND FARMS ON THE VALUE OF RESIDENTIAL PROPERTY AND AGRICULTURAL LAND' – RICS (2004) – UNITED KINGDOM

A survey of members of the UK Royal Institute of Chartered Surveyors in 2004 found that 60% of the 405 respondents believed residential property values decreased if the property was in view of a wind farm. Further, 72% of respondents believed wind farm developments had either no effect or a positive effect on the agricultural value of the land. Visual impact, fear of blight and the proximity of a property to a wind farm were considered the main drivers to reductions in property values.

BALD HILLS WIND FARM PANEL INQUIRY (2004) – AUSTRALIA

As reported in the Bald Hills Wind Farm Panel Inquiry (2004), similar views on the impact of wind farms were expressed by Australian property industry professionals. In June 2004 the Victorian Minister for Planning appointed a panel to examine a proposal for a wind farm at Bald Hills, near Tarwin Lower in South Gippsland, Victoria. The Panel's inquiry included a report on the effects of the wind farm development on property values. The Panel considered a number of submissions from property valuers and real estate agents. The Panel's response to the submissions was:

'*All that appears to emerge from the range of submissions and evidence on valuation issues is the view that the effect of wind energy facilities on surrounding property values is inconclusive, beyond the position that the agricultural land component of value would remain unchanged. On this there appeared to be general agreement. It therefore follows that it has not been demonstrated to the satisfaction of this Panel that significant value changes, transfers or inequities would result from the project proceeding.'*

In their final conclusion on property values, the Panel noted that valuation effects from the wind farm development may occur, specifically, devaluation of the amenity, lifestyle and non-agricultural development component of the surrounding land. However, the Panel also noted that these effects would not impact the planning permit as the wind farm is permissible within the rural land use zone and is consistent with relevant planning guidelines (Bald Hills Wind Farm Panel Inquiry, 2004).

Judicial Interpretation on Compensation Issues – Australia

The issue of compensation in regards to the reduction in values of surrounding properties of a wind farm development has been ruled upon in a case in the Land and Environment Court of NSW.

In February 2007, in Taralga Landscape Guardians Inc v Minister for Planning and RES Southern Cross Pty Ltd, the plaintiff (Taralga Landscape Guardians) argued that properties surrounding the wind farm development would suffer from blight in the form of loss of future property value or from loss of amenity and, consequently, there should be payment of compensation if the project where to proceed. The judgement ruled in favour of the defendant:

> *'If the concepts of blight and compensation, as pressed by the Guardians, were to be applied to this private project (a proposition which I reject) than any otherwise compliant private project which had some impact in lowering the amenity of another property (although not so great as to warrant refusal on general planning grounds when tested against the criteria in s 79C of the Act) would be exposed to such a claim.*
>
> *Creating such a right to compensation (for creating such a right it would be) would not merely strike at the basis of the conventional framework of land use planning but would also be contrary to the relevant objective of the Act, in s 5(a)(ii), for 'the promotion and co-ordination of the orderly and economic use and development of land.'*

While this case does not answer the question as to whether a property reduces in value due to the development of a wind farm, it sets a clear precedent as to how the courts may view compensation claims in relation to this.

B.2 URBIS LITERATURE REVIEW

HOEN, B, WISER, R, CAPPERS, P, THAYER, M AND SETHI, G (2009), THE IMPACT OF WIND POWER PROJECTS ON RESIDENTIAL PROPERTY VALUES IN THE UNITED STATES: MULTI-SITE HEDONIC ANALYSIS, OFFICE OF ENERGY AND RENEWABLE ENERGY WIND & HYDROPOWER TECHNOLOGIES PROGRAM, U.S. DEPARTMENT OF ENERGY WASHING DC.

The preliminary assessment conducted for the NSW Valuer-General in 2009 reviewed the preliminary results of this study, which assesses the impact of wind farms on surrounding property values in the United States, using a hedonic pricing model. The authors of the study inspected each property and rated the properties based on their views and the extent to which the wind turbines impacted them. The outcome of the preliminary study found that there was no significant difference between sale prices of homes with views and those without views.

The finalised study completed in 2009 was expanded to 7500 sales of single family homes situated within 10 miles of 24 existing wind facilities across nine different US states. The analysis found consistently that wind farms had no impact on house values, and that isolated negative impacts were too small or infrequent to constitute a statistically observable impact.

GIBBONS, S (2014), GONE WITH THE WIND: VALUING THE VISUAL IMPACTS OF WIND TURBINES THROUGH HOUSE PRICES, SERC DISCUSSION PAPER NO. 159

Similar to other quantitative studies, this study considers the price impact of wind farm visibility on local house prices. The methodology uses a regression analysis comparing the average change in housing prices in areas where and when wind farms become operational and visible, with the average change in housing prices in a comparable group of houses that had wind farms nearby but not visible. The outcome of the analysis indicates that wind farms reduce house prices in postcodes where the turbines are visible, and reduce prices relative to postcode close to wind farms where the wind farms are not visible. Houses within 2 km had a price reduction of 5–6%, 2% between 2 km and 4 km and less than 1% to 14 km. The size of the wind farm was found to be important when it comes to visibility affects, with small wind farms having no impact on houses beyond 4 km, while large wind farms (20+ turbines) reduced prices within 2 km.

The limitations of this study are primarily the geocoding of wind turbines relative to postcodes which contain residential properties. As such there may be measurement error associated with sales transactions classified as visually affected, which isn't as robust a measurement method as Hoen (2009), where all properties were physically inspected to determine the visual impact of wind farms which determined no impact. The other difference between Hoen (2009) and Gibbons (2014) was the location of the studies, with Hoen (2009) conducted in the USA while Gibbons (2014) was conducted in England and Wales.

HEINTZELMAN, M AND TUTTLE, C (2012), VALUES IN THE WIND: A HEDONIC, LAND ECONOMICS, 88 (3)

Using 11,331 property transactions over nine years in northern New York State to explore the impact of new wind facilities on property values, this study found that in two out of three counties examined there was a negative impact on house prices.

The study used a hedonic analysis of a sample of 11,331 residential and agricultural property transactions in the Clinton, Franklin and Lewis Counties from 2000 to 2009. Sample transactions were geocoded with a geographic information system (GIS) with distance between the residential property and wind turbine used as a proxy to estimate the nuisance effect of turbines (i.e. viewscapes, noise impacts, perceived health effects).

It measured the price impact at the date of the submission of the draft environment impact statement (EIS) to the New York State Department of Environmental Conservation, the date when the EIS was approved and the date the turbines became operational.

There was no identifiable factor driving the difference in results across counties. The lack in consistency between the results may point to a qualitative factor associated with the wind farm itself, or a difference in consumer preferences between counties when it comes to co-location with wind farms, which makes it difficult to draw conclusive implications about compensating all landholders in close proximity to wind farms.

There are a number of limitations associated with this analysis:

- a limited sample size within a three mile distance of the wind farms

- the assumption that distance is a proxy for visual impact – while this is noted, Hoen (2009) inspected properties to determine visual dis-amenity, providing a more robust measure for visual amenity.

The study concludes that there was inconsistent impact between counties, with a number of explanations for this:

- consumer preferences changing between counties
- design / placement of wind turbines that mitigate the effect in the unaffected county
- where there was an impact, the magnitude of impact was dependent on the property's proximity to the turbine.

HOEN, B, BROWN, J, JACKSON, T, WISER, R, THAYER, M AND CAPPERS, P (2013), A SPATIAL HEDONIC ANALYSIS OF THE EFFECTS OF WIND ENERGY FACILITIES ON SURROUNDING PROPERTY VALUES IN THE UNITED STATES, OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY WIND AND WATER POWER TECHNOLOGY OFFICE U.S. DEPARTMENT OF ENERGY

This study overcame the typical issue associated with hedonic analysis of wind farms – lack of sample sales transactions, collecting some 50,000 home sales among 27 counties in seven states across the USA. This included sales that were within 10 miles and one mile of a turbine, with data including periods before the wind farms were announced and after construction was completed.

The study found that there was no statistical evidence that home values near wind turbines were affected in the post-construction or post-announcement/pre-construction periods. The study concluded also that if there was an effect it is possible that the impact is sporadic, affecting only particular types of homes or in markets where consumer preferences were ill-disposed to wind farms.

LAPOSA, SP AND MUELLER, A (2010), WIND FARM ANNOUNCEMENTS AND RURAL HOME PRICES: MAXWELL RANCH AND RURAL NORTHERN COLORADO, JOSRE, 2 (1)

This study analyses the effect of the announcement of proposed wind farm development on an 11,000 acre ranch in Northern Colorado on surrounding rural housing prices. The study uses a hedonic price model using sales of existing homes in close proximity to the wind farm development.

This study analyses 2910 home transactions in two rural census areas adjacent to the proposed wind farm before and after the wind farm's announcement. Due to the rural nature of the area, many of the residential properties had little or no view of the proposed wind turbines, while some of the homes in adjacent developments were shielded from view. The area had a relatively low population density, reflecting its rural nature.

The results account for the timing of the announcement in March 2007, which coincided with the beginning of national and regional housing price declines, and still shows insignificant and minimal impacts to surrounding home values and sales, adjusted for the economic recession.

While many of the other reviewed literature examined residential sales, this study illustrated that there is limited impact on rural residential areas.

SUNAK, Y AND MADLENER, R (2014), LOCAL IMPACTS OF WIND FARMS ON PROPERTY VALUES: A SPATIAL DIFFERENCE-IN-DIFFERENCES ANALYSIS, INSTITUTE FOR FUTURE ENERGY CONSUMER NEEDS AND BEHAVIOUR (FCN), NUMBER 1/2014

A hedonic price analysis conducted in Germany by Sunak and Madlener (2014) found that the asking prices for properties whose view was strongly affected by the construction of wind turbines decreased by 10–17%, while properties with a minor or marginal view experienced no price effect.

The impact of visual amenity is complex however, with the angle, distance and size of the wind farm playing into the potential negative impact on a residential amenity.

B.2.1 SAME PROPERTY RESALE ANALYSIS

The following approach was adopted for the analysis of properties within the study areas that recorded a transaction before announcement of the proposed wind farm and then a transaction after the wind farm was commissioned for operation.

- First, property transactions for the past 15 years were extracted in a broad area surrounding the subject wind farm.
- Each wind farm was mapped including establishing the location of each wind turbine. A radius of two kilometres was established around each wind turbine to reflect areas of potential high impact (note that properties that were only partially located within the radius area were included).
- The sales were investigated based on available data and recorded status at the time of sale (e.g. vacant land, dwelling, etc.) to ensure no significant change that may skew value had occurred.
- The change in value of that property between the sale prior to and after the wind farm was then calculated relative to the time period between the sales.
- The percentage change in the property was compared to the change in the average price of similar properties within the broader local government area in which the property was located (e.g. similar size range, similar zoning, similar improvement status), over the same time scale.
- The variation in sales price growth was then discussed, combined with the specific factors of the property that may have resulted in a negative impact.

This is a similar approach to the 'before and after' method adopted in the 2009 NSW Valuer-General's assessment of the impact of wind farms on property values. As also noted in the Valuer General's study, the average price change in an LGA compared to the change in an actual property can vary due to the large range of complex circumstances that determine value across a broad geography. We note however that the volume of sales at a smaller suburb level were insufficient to provide a consistent average assessment, therefore an LGA based assessment will be the most reliable.

B.2.2 PRE AND POST DEVELOPMENT SALES COMPARISON

This approach is considered to be less reliable than the same property resale analysis approach, however as there is a limited number of sales that meet the same property resale criteria this is a necessary form of assessment.

We note that the 2009 NSW Valuer-General's assessment of the impact of wind farms on property values adopted a 'matched pairs' analysis, analysing sales that occurred after the commissioning of the wind farm. A sale within the identified view shed of the wind farm was compared to a similar sale property located outside the view shed.

Urbis have taken a slightly different approach in that we have compared sales within a two kilometre radius of a wind farm against the average price for similar sale properties in the broader LGA. This has been completed for sales before and after the wind farm. The key difference between the 2009 NSW Valuer-General's assessment of the impact of wind farms on property values and the Urbis approach is the choice of comparable evidence.

Whilst the 2009 NSW Valuer-General's assessment of the impact of wind farms on property values 'matched pairs' method is a valid method of assessment it could be considered somewhat more subjective, as there are a broad number of variables that influence value from one property to another. The Urbis assessment compared the relativity of sales in the wind farm radius area both before and after the wind farm, compared to the broader market and seeks to identify changes in the relativity of local sales compared to the broader market.

The Urbis approach involves:

- First, property transactions for the past 15 years were extracted in a broad area surrounding the subject wind farm.
- Each wind farm was mapped including establishing the location of each wind turbine. A radius of two kilometres was established around each

wind turbine to reflect areas of potential high impact (note that properties that were only partially located within the radius area were included).

- Sales in the radius area were then compared to the average value of similar properties in the broader LGA in the same sale year (both before the wind farm and after commissioning).

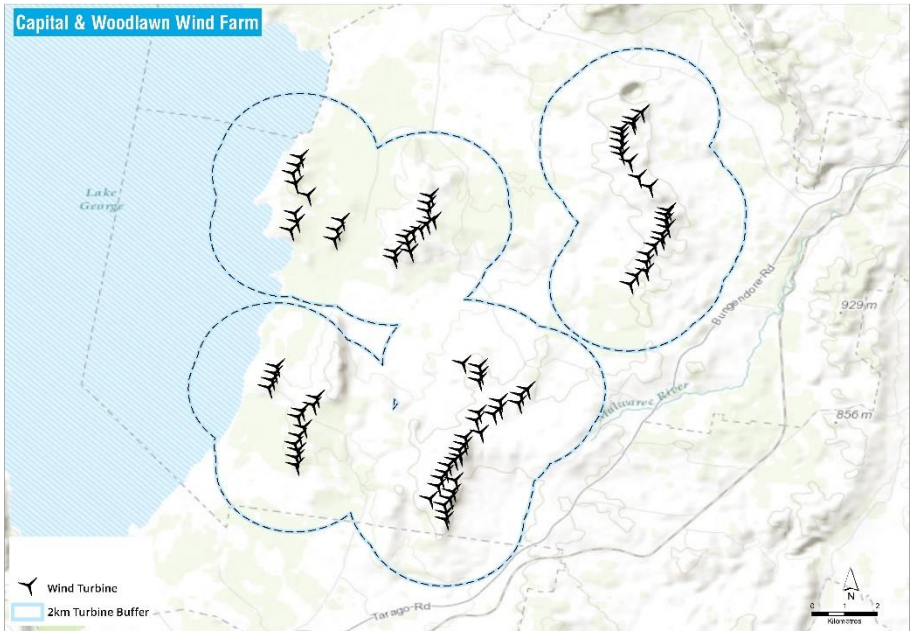
- The relative differences between properties in the radius area and those in the broader area were then compared over time to highlight any patterns that would indicate a difference in the change of value.

- The variation in sales price growth is then discussed, combined with the specific factors of the property that may have resulted in a negative impact.

The detailed analysis for each case study is provided in Appendix C.

Appendix C Case studies

C.1 CAPITAL WIND FARM AND WOODLAWN WIND FARM NSW



NUMBER OF TURBINES	67 (CAPITAL WIND FARM) 23 (WOODLAWN WIND FARM) (NOTE: THESE WIND FARMS HAVE BEEN COMBINED DUE TO THEIR RELATIVELY CLOSE PROXIMITY)
Total capacity	140.7 MW (Capital Wind Farm) 48.3 MW (Woodlawn Wind Farm)
Start of operation	October 2009 (Capital Wind Farm) October 2011 (Woodlawn Wind Farm)

Location	Located south-east of Lake George between the towns of Bungendore and Tarago in open landscape on a smooth topography. In relation to Capital Wind Farm Bungendore is located 10 km south-west of the wind farm. Tarago is located 15 km north-east of the wind farm.
Project information	Construction of Capital Wind Farm began in early 2008, with the wind farm becoming fully operational in October 2009. Project approval for Woodlawn was granted by the NSW Minister for Planning in October 2005. Construction proceeded in June 2010. Operation began in October 2011.
Property sales within 2 km radius	18 (Capital Wind Farm) 22 (Woodlawn Wind Farm)
Number of property sales within 2 km radius before operation	10 (Capital Wind Farm) 17 (Woodlawn Wind Farm)
Number of property sales within 2 km radius before operation	8 (Capital Wind Farm) 5 (Woodlawn Wind Farm)
Agent interview commentary	Properties with the turbines on the land have increased in value and have become quite attractive for farmers due to the leasehold rental income from the wind turbines on 20-year contracts. Landholders have sold these interests to investors, and have been an attractive purchase for SMSFs. There are no apparent signs of property values falling in the area.

In the case of transactions around the Capital Wind Farm and Woodlawn Wind Farm two same property resales were noted within the defined two kilometre radius area (these wind farms adjoin each other and therefore share the same sales properties for analysis purposes).

Property one is a vacant rural property of 16 hectares approximately 0.8 kilometres from the nearest wind turbine. It experienced a growth in value of 71% between 2004 and 2011. An analysis of similar size vacant rural property sales in the Palerang LGA over the same period demonstrated an 84% increase. This property was located closer to the wind turbines of the two sales, albeit with no dwelling.

The second property is an18 hectare property with a rural residence approximately 1.7 kilometres from the nearest wind turbine. It experienced a 111% increase in value between 2000 and 2010, compared to the average change of benchmark properties of 77% over the same period. This was located to the east of the Capital Wind Farm with the dwelling potentially shielded by tree plantings.

Both of these properties experienced growth over the period before and after the wind farms as generally consistent with underlying market growth, with one being slightly under and the other being slightly over.

Discreet enquiries with real estate agents in the area indicated a consistent view that the wind farms had had no recognisable negative value impacts in the area. The majority of properties being utilised for primary production purposes are not negatively affected by the wind farms.

Same property resale analysis – Property 1

CAPITAL WIND FARM AND WOODLAWN WIND FARM

TABLE C.1

Property 1

Address	Property Type	Sale Date	Area	Sale Price	$/ha
Taylors Creek Rd, Tarago	Vacant Land	May-04	160,200	115,000	7,179
Taylors Creek Rd, Tarago	Vacant Land	Apr-11	160,200	197,000	12,297

Year of 1st Sale	2004
Year of 2nd Sale	2011
Price Increase between Sale Date	71%
Annual increase	8%
Average Palerang LGA $/ha 2004*	9,881
Average Palerang LGA $/ha 2011*	18,199
Price Increase between Sale Date	84%
Annual increase	9%

Comments: Vacant land. North-east of Capital Wind Farm and south of Woodlawn Wind Farm with the nearest wind turbine approximately 0.8km away. The first sale occurred before the construction of the wind farms. The second sale occurred after Capital Wind Farm was commissioned.

** Average $/ha for similar property types and lot sizes*

Same property resale analysis – Property 2

CAPITAL WIND FARM AND WOODLAWN WIND FARM

TABLE C.2

Property 2

Address	Property Type	Sale Date	Area	Sale Price	$/ha
Taylors Creek Rd, Tarago	Rural Residence	Mar-00	188,200	272,500	14,479
Taylors Creek Rd, Tarago	Rural Residence	Apr-10	188,200	574,000	30,499

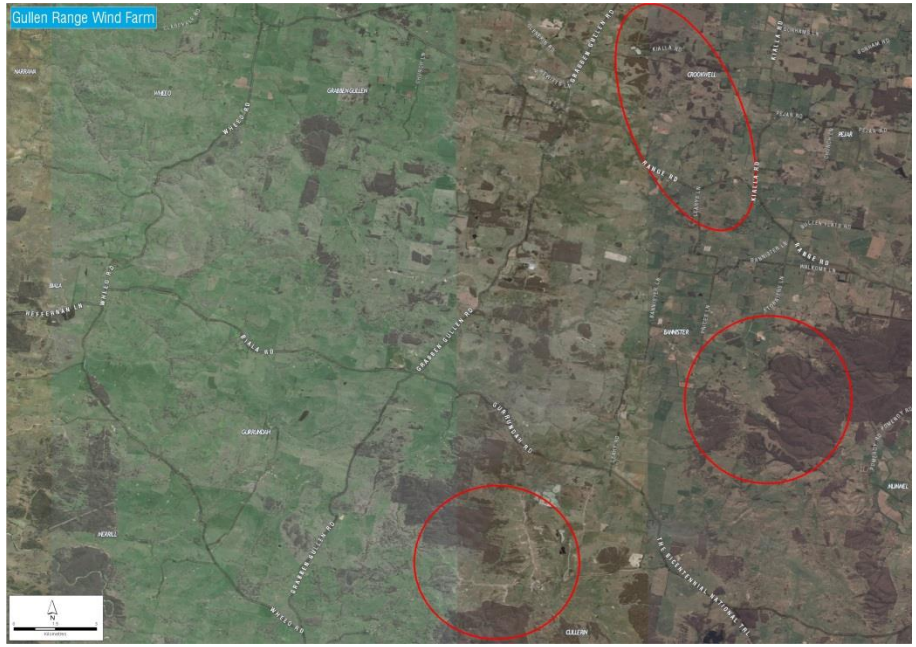
Year of 1st Sale	2000
Year of 2nd Sale	2010
Price Increase between Sale Date	111%
Annual increase	8%
Average Palerang LGA $/ha 2000*	20,055
Average Palerang LGA $/ha 2010*	35,497
Price Increase between Sale Date	77%
Annual increase	6%

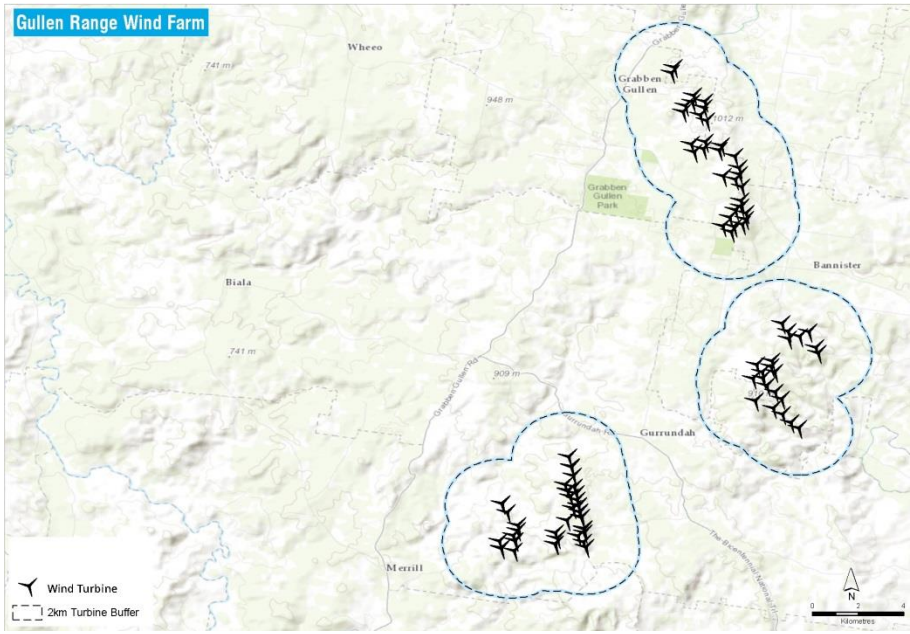
Comments: Rural Residence with three bedroom, one bathroom and two car. North-east of Capital Wind Farm and south of Woodlawn Wind Farm with the nearest wind turbine approximately 1.7 km away. View of wind farm potentially shielded by trees. The first sale was prior to the construction of the wind farms. The second sale occured after Capital Wind Farm was commissioned.

** Average $/ha for similar property types and lot sizes*

Source: APM PriceFinder ; Urbis

C.2 GULLEN RANGE WIND FARM NSW





NUMBER OF TURBINES	73
Total capacity	165.5 MW
Start of operation	Last quarter 2014
Location	Located 20 km south of Crookwell and approximately 20 km west of Goulburn.
Project information	Planning approval for the wind farm was granted in August 2010. Construction began in 2012. The wind farm began operation in the last quarter of 2014.

Property sales within 2 km radius	23
Number of property sales within 2 km radius before operation	20
Number of property sales within 2 km radius before operation	3
Agent interview commentary	Properties that have recently sold within 5 km of the turbines have had no negative impact on values.

The Gullen Range Wind farm recorded three same property resales within two kilometres of the wind farm turbines.

The first property of 113 hectares recorded three sales, one before the wind farm was announced, one during construction and one after the wind farm was commissioned. The property first sold in 2001 and then resold in 2014 and again in 2015. The change in value between 2001 and 2014 was 170% and between 2001 and 2015 was 222%. Sales of similar Upper Lachlan Shire rural properties demonstrated relative growth of 116% between 2001 and 2014 and 135% between 2001 and 2015. This property appears to have a direct view towards a wind turbine from the house, however has not shown an apparent decline in value.

The second sale is for a 69 hectare improved property sold in 2001 and again in 2015. This is slightly farther away from the first property, however is also likely to have some view of the wind farm from the house. It recorded a price growth of 100% between 2001 and 2015, whereas similar sized improved properties in the Upper Lachlan Shire demonstrated a growth rate of 64% over the same period.

The final sale occurred between 2001 and November 2010 (note that planning approval for the Gullen Range Wind Farm was granted in August 2010, however construction did not commence until 2012). This property is located 1.3 kilometres from the nearest wind turbine and sold prior to any significant construction activity occurring. This is a smaller 44 hectare property improved with a cottage that demonstrated an increase in value of 126% between 2001 and 2010. In comparison, comparable size improved properties within the Upper Lachlan LGA grew by 95% over this time period.

None of the repeat sales around Gullen Range Wind Farm indicate a reduction in values.

Similar to comments received for Capital Wind Farm, real estate agents active around the Gullen Wind Farm also felt that the wind farm would have had no real impact on values.

Same property resale analysis – Property 1

GULLEN RANGE WIND FARM

TABLE C.3

Property 1

Address	Property Type	Sale Date	Area	Sale Price	$/ha
Storriers Lane, Bannister	Rural Residence	Sep-01	1,128,000	200,000	1,773
Storriers Lane, Bannister	Rural Residence	May-14	1,128,000	540,000	4,787
Storriers Lane, Bannister	Rural Residence	Jun-15	1,128,000	644,721	5,716

Year of 1st Sale	2001	Year of 1st Sale	2001
Year of 2nd Sale	2014	Year of 3rd Sale	2015
Price Increase between Sale Date	170%	Price Increase between Sale Date	222%
Annual Increase	8%	Annual Increase	9%

Average Upper Lachlan LGA $/ha 2001*	2,411	Average Upper Lachlan LGA $/ha 2001*	2,411
Average Upper Lachlan LGA $/ha 2014*	5,203	Average Upper Lachlan LGA $/ha 2015*	5,664
Price Increase between Sale Date	116%	Price Increase between Sale Date	135%
Annual Increase	6%	Annual Increase	6%

Comments: Rural residence with three bedroom, one bathroom and four cars. The property is located in the middle of Gullen Range Wind Farm with wind turbines south and north of the property. The closest wind turbine to the property is approximately 0.3 km away. Direct view of wind turbine from the house. The first sale occurred before the wind farm was annouced. The second and third sale occurred after the wind farm was comissioned.

** Average $/ha for similar property types and lot sizes*

Same property resale analysis – Property 2

GULLEN RANGE WIND FARM

TABLE C.4

Property 2

Address	Property Type	Sale Date	Area	Sale Price	$/ha
Bannister Lane, Bannister	Rural Residence	Sep-01	688,170	360,000	5,231
Bannister Lane, Bannister	Rural Residence	Jan-15	698,170	720,000	10,313

Year of 1st Sale	2001
Year of 2nd Sale	2015
Price Increase between Sale Date	100%
Annual increase	5%

Average Upper Lachlan LGA $/ha 2001*	4,792
Average Upper Lachlan LGA $/ha 2015*	7,871
Price Increase between Sale Date	64%
Annual Increase	4%

Comments: Rural residence with three bedroom, two bathroom and four cars. The property is located in the middle of Gullen Range Wind Farm with wind turbines south and north of the property. The closest wind turbine to the property is approximately 1 km away. The first sale occurred before planning approval for the wind farm. The second sale occured after the wind farm was commissioned.

** Average $/ha for similar property types and lot sizes*

Same property resale analysis – Property 3

GULLEN RANGE WIND FARM

TABLE C.5

Property 3

Address	Property Type	Sale Date	Area	Sale Price	$/ha
Prices Lane, Bannister	Rural Residence	Nov-01	438,500	115,000	2,623
Prices Lane, Bannister	Rural Residence	Nov-10	438,500	260,000	5,929

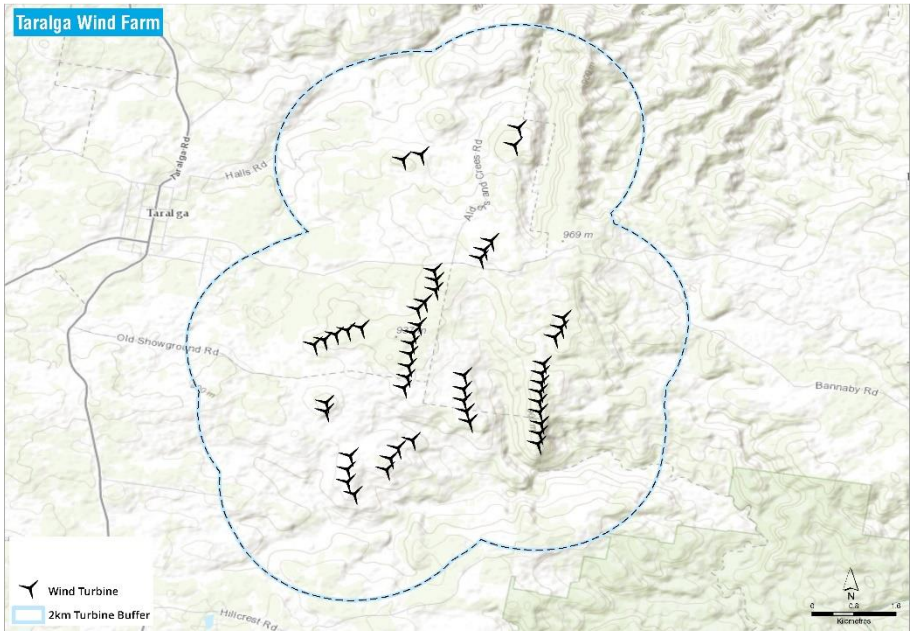
Year of 1st Sale	2001
Year of 2nd Sale	2010
Price Increase between Sale Date	126%
Annual increase	9%
Average Upper Lachlan LGA $/ha 2001*	4,267
Average Upper Lachlan LGA $/ha 2010*	8,329
Price Increase between Sale Date	95%
Annual Increase	8%

Comments: The property is located in the middle of Gullen Range Wind Farm with wind turbines south and north of the property. The closest wind turbine to the property is approximately 1.3 km away. The first sale occurred prior to the planning approvals for the wind farm. The second sale occurred after planning approval was granted and before the start of construction.

** Average $/ha for similar property types and lot sizes*

Source: APM PriceFinder ; Urbis

C.3 TARALGA WIND FARM NSW



NUMBER OF TURBINES	51
Total capacity	107 MW
Start of operation	Last quarter 2015
Location	Located 20 km south of Crookwell and approximately 20 km west of Goulburn.
Project information	Approval granted by the NSW Government in February 2012. Early construction works commenced in 2013 and were largely complete by late 2015.

Property sales within 2 km radius	23
Number of property sales within 2 km radius before operation	20
Number of property sales within 2 km radius before operation	3
Agent interview commentary	Whilst the wind farm has only recently been completed, there have been no obvious negative impacts on property values in the area 5–10 kilometres around the wind farm.

The Taralga Wind Farm is one of the newer established wind farms in NSW, being located in relative proximity to the Taralga township. Given its recent completion, there is limited evidence available to measure long-term impacts in the area.

There was one same property resale within the two kilometre radius, comprising an 11 hectare property improved with a semi-modern dwelling. This would best be considered a lifestyle property due to its relatively small size and limited rural productivity value.

This property originally sold in 2002 before the proposed wind farm had been announced. It has subsequently sold two more times, once in 2013 (just before commencement of construction of the wind farm) and again in 2015. The sale between 2002 and 2013 demonstrated an increase in value of 34% (from $350,000 to $470,000), however the subsequent sale in 2015 showed a reduction in value of 19% in two years to $380,000.

Upon further investigation, it appears that the 2013 sale was to Taralga Wind Farm Nominees No. 1 Pty Ltd, the owner of the adjoining wind farm. The timing of the sales also indicates that the sale may have been made to manage impact issues during construction, with the wind farm owner reselling the property after completion of construction. As such, this becomes an unreliable sale due to the adjoining owner nature of the purchaser / vendor for the second and third transactions.

Whilst this sale is unreliable, the circumstances would need further investigation that was not possible as part of this study.

Same property resale analysis – Property 1

TARALGA WIND FARM

TABLE C.6

Property 1

Address	Property Type	Sale Date	Area	Sale Price	$/ha
Alders and Crees Rd, Taralga	Rural Lifestyle	Oct-02	110,700	350,000	31,617
Alders and Crees Rd, Taralga	Rural Lifestyle	Aug-13	110,700	470,000	42,457
Alders and Crees Rd, Taralga	Rural Lifestyle	Jul-15	110,700	380,000	34,327

Year of 1st Sale	2002	Year of 2nd Sale	2013
Year of 2nd Sale	2013	Year of 3rd Sale	2015
Price Increase between Sale Date	34%	Price Increase between Sale Date	-19%
Annual Increase	3%	Annual Increase	-10%

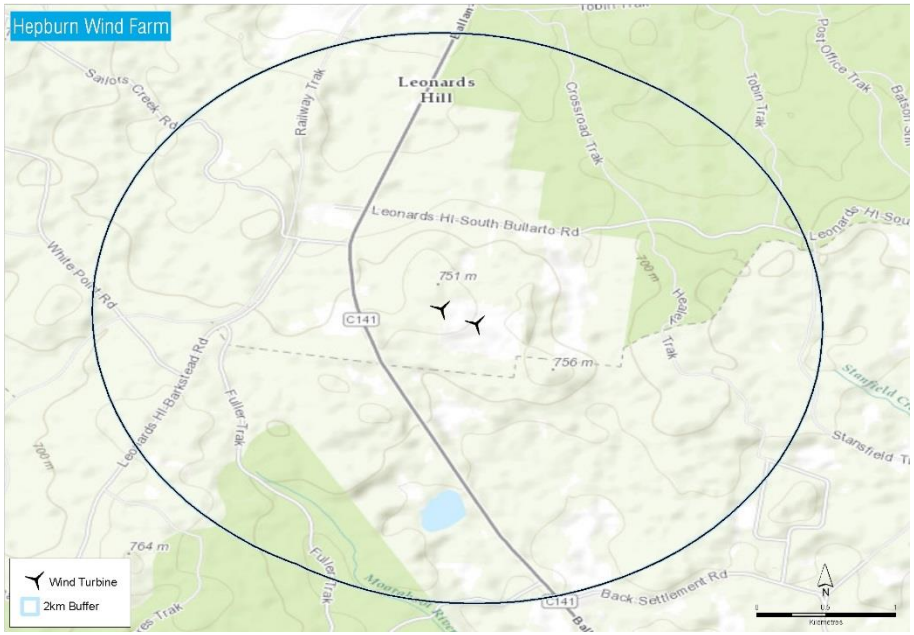
Average Upper Lachlan LGA $/ha 2002*	23,348	Average Upper Lachlan LGA $/ha 2013*	36,017
Average Upper Lachlan LGA $/ha 2013*	36,017	Average Upper Lachlan LGA $/ha 2015*	40,687
Price Increase between Sale Date	54%	Price Increase between Sale Date	13%
Annual Increase	4%	Annual Increase	6%

Comments: Rural lifestyle property with a semi-modern dwelling. Located in the middle of Taralga Wind Farm with wind turbines north and south of the property with the closest wind turbine 0.7 km away. First sale occurred prior to the annoucement of the wind farm. The second sale occurred just prior to the construction of the wind farm. Third sale occurred when the wind farm was largely completed. The property was purchased by the wind farm owner in the second sale and then sold by wind farm owners in the third sale.

** Average $/ha for similar property types and lot sizes*

Source: APM PriceFinder ; Urbis

C.4 HEPBURN WIND FARM VICTORIA



NUMBER OF TURBINES	2
Total capacity	4.1 MW
Start of operation	July 2011
Location	Located at Leonards Hill approximately 100 km north-east of Melbourne. The small town of Korweinguboora is 2 km south of the wind farm. Daylesford is 10 km north of the wind farm.
Project information	First community-owned wind farm in Australia. Planning permit for the wind farm was issued by Hepburn Shire Council in February 2007 and upheld by VCAT in July 2007. Construction began in November 2010. The

	project reached practical completion in July 2011.
Property sales within 2 km radius	28
Number of property sales within 2 km radius before operation	19
Number of property sales within 2 km radius before operation	9

Hepburn Wind Farm is the first community-owned wind farm in Australia.

Hepburn Wind Farm recorded three same property resales within two kilometres of the wind farm turbines.

The first property of 1.2 hectares is a rural lifestyle property approximately two kilometres south of the wind farm. The property was first sold as a vacant residential lot in 2003 prior to the beginning of planning for the wind farm and then resold as a rural lifestyle property with improvements such as a four bedroom, two bathroom house in 2015, after the wind farm was commissioned. The change in value between 2003 and 2015 was 662% at an annual growth rate of 18%. Comparison of sales of similar vacant residential lots in Hepburn Shire in 2003 and rural lifestyle properties in Hepburn Shire in 2015 demonstrated a price growth of 924%, which represents an annual growth rate of 21%. While the price of the affected property grew slightly less than the Hepburn Shire LGA benchmark, this result should be used with caution as it is a comparison of the prices of two different property types across the period.

The second property of eight hectares is a rural lifestyle property with three bedrooms and one bathroom approximately 1.5 kilometres south of the wind farm. It recorded two sales, one before the formation of consultation groups to discuss the potential development of a wind farm and one after discussions were held with the various consultation groups. The property was first sold in 2003 and then resold in 2006. The change in value between 2003 and 2006 was 30% at an annual growth rate of 9%. Sales of similar sized rural lifestyle properties in the Hepburn Shire LGA recorded a price growth of 22% at an annual growth rate of 7% between 2003 and 2006.

The third property, also of eight hectares, is a rural lifestyle dwelling with three bedrooms and two bathrooms, approximately two kilometres south of the wind farm. The property was first sold in 2004 before planning approval was granted for the wind farm and then resold in 2008 after planning approval was upheld by VCAT. The change in value between 2004 and 2008 was 28% at an annual growth rate of 6%. Sales of similar sized rural lifestyle properties in the Hepburn Shire LGA recorded a price growth of 26% at an annual growth rate of 6% between 2004 and 2008.

None of the available repeat sales around Hepburn Wind Farm indicate a reduction in value.

Same property resale analysis – Property 1

HEPBURN WIND FARM VICTORIA

TABLE C.7

Property 1

Address	Property Type	Sale Date	Area	Sale Price	$/ha
Ballan-Daylesford Rd, Korweinguboora	Vacant Land	Sep-03	12,190	63,000	51,682
Ballan-Daylesford Rd, Korweinguboora	Rural Lifestyle	May-15	12,190	480,000	393,765

Year of 1st Sale	2003
Year of 2nd Sale	2015
Price Increase between Sale Date	662%
Annual increase	18%
Average Hepburn Shire LGA $/ha 2003*	36,174
Average Hepburn Shire LGA $/ha 2015*	370,271
Price Increase between Sale Date	924%
Annual increase	21%

Comments: Located 2km south of the wind farm. First sold as a vacant residential lot in 2003 prior to the beginning of planning for the wind farm. Resold in the second sale in 2015 with improvements such as a four bedroom, two bathroom house after the wind farm was commissioned. Use this result with caution as it is a comparison of prices of two different property types across the period.

** Average $/ha for similar property types and lot sizes*

Same property resale analysis – Property 2

HEPBURN WIND FARM VICTORIA

TABLE C.8

Property 2

Address	Property Type	Sale Date	Area	Sale Price	$/ha
Ballan-Daylesford Rd, Korweinguboora	Rural Lifestyle	May-03	80,790	142,000	17,576
Ballan-Daylesford Rd, Korweinguboora	Rural Lifestyle	Mar-06	80,790	185,000	22,899

Year of 1st Sale	2003
Year of 2nd Sale	2006
Price Increase between Sale Date	30%
Annual increase	9%
Average Hepburn Shire LGA $/ha 2003*	30,938
Average Hepburn Shire LGA $/ha 2006*	37,875
Price Increase between Sale Date	22%
Annual increase	7%

Comments: Rural lifestyle property with three bedrooms and one bathroom approximately 1.5 km south of the wind farm. The first sale occurred before the formation of consultation groups to discuss the potential development for a wind farm. The second sale occurred after discussions were held with various consultation groups.

** Average $/ha for similar property types and lot sizes*

Same property resale analysis – Property 3

HEPBURN WIND FARM VICTORIA

TABLE C.9

Property 3

Address	Property Type	Sale Date	Area	Sale Price	$/ha
Ballan-Daylesford Rd, Korweinguboora	Rural Lifestyle	Jun-04	81,164	265,000	32,650
Ballan-Daylesford Rd, Korweinguboora	Rural Lifestyle	Feb-08	81,164	338,000	41,644

Year of 1st Sale	2004
Year of 2nd Sale	2008
Price Increase between Sale Date	28%
Annual increase	6%

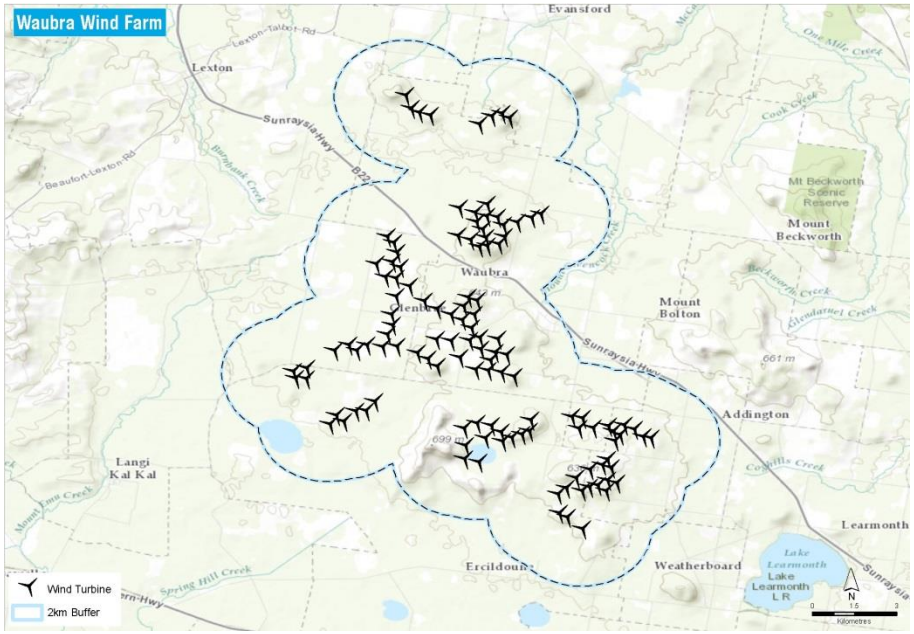
Average Hepburn Shire LGA $/ha 2004*	33,629
Average Hepburn Shire LGA $/ha 2008*	42,534
Price Increase between Sale Date	26%
Annual increase	6%

Comments: Rural lifestyle dwelling with three bedrooms and two bathrooms approximately 2km south of the wind farm. The first sale was before planning approval was granted for the wind farm. The second sale was after planning approval was upheld by VCAT.

** Average $/ha for similar property types and lot sizes*

Source: APM PriceFinder ; Urbis

C.5 WAUBRA WIND FARM VICTORA



NUMBER OF TURBINES	128
Total capacity	192 MW
Start of operation	July 2009
Location	Located on both sides of the Sunraysia Highway 35 km north-west of Ballarat on hills and flat plains. The town of Waubra is located approximately 2 km from the wind farm.
Project information	Planning approvals were granted in May 2005. Construction of the wind farm began in December 2007 with the site fully operational by July 2009.

Property sales within 2 km radius	141
Number of property sales within 2 km radius before operation	93
Number of property sales within 2 km radius before operation	48
Agent interview commentary	Has not had any complaints or issues with selling properties within the 2 km radius

Waubra Wind Farm recorded 10 same property resales.

The first property is a 1300 square metre residential block with a shed within the town of Waubra. The wind farm is located to the west and south of the property with the closest wind turbine approximately two kilometres away. The property recorded three sales, one in 2007 prior to the start of construction of the wind farm, one in 2012 and one in 2013 after the wind farm was commissioned. The change in value between 2007 and 2012 was 83% and the change in value between 2007 and 2013 was 115%. In comparison, similar sized vacant land in Pyrenees Shire LGA grew by 79% in 2007 to 2012 and 113% in 2007 to 2013.

The second property is a 2500 square metre rural lifestyle dwelling with three bedrooms, one bathroom and one car. The property is surrounded by wind turbines to the north, east and south with the closest wind turbine approximately 0.8 kilometres away. The property was first sold in 2004 prior to planning approval for the wind farm and resold in 2010 after the wind farm was commissioned. The change in value between 2004 and 2010 was 55%, well above the average price increase of similar sized rural lifestyle property in Pyrenees Shire LGA of 4% during the same period.

Upon further investigation, it appears that the 2010 sale was to Acciona Energy Oceania Pty Ltd, the owner of the Waubra Wind Farm. The purchase of the property by the owner of the wind farm may have been made to minimise the impact of the wind farm on nearby residents. As such, this becomes an unreliable measure due to the adjoining owner nature of the purchaser for the second transaction.

The third property was an 8600 square metre vacant lot located 1.8 kilometres from the closest wind turbine that was sold in 2003 prior to planning approval for the wind farm, and resold in 2010 after the wind farm was commissioned. The change is value between 2003 and 2010 was 181%. In comparison, similar properties in Pyrenees LGA demonstrated a 113% growth in value during the same period.

The fourth property was vacant land located 1.7 kilometres from the closest wind turbine that was sold in 2008 after the start of construction of the wind farm and resold in 2010 after the wind farm was commissioned. The change in value between 2008 and 2010 was 12%. In comparison, similar properties in Pyrenees LGA demonstrated a 14% price growth during the same period.

The fifth property is a one hectare rural lifestyle property with three bedrooms. The property is in the middle of the wind farm with the closest wind turbine approximately 0.6 kilometres north of the property. The first sale occurred in 2006 after planning approval was granted and the second sale occurred in 2010 after the wind farm was commissioned. The price of the property increased by 44% from 2006 to 2010 compared to 18% for similar properties in Pyrenees LGA during the same period.

Similar to the second property, it appears the 2010 sale was to Acciona Energy Oceania Pty Ltd, the owner of the Waubra Wind Farm. The purchase of the property by the wind farm owners may have been to mitigate the impact of the wind farm on nearby residents and as such it is an unreliable transaction due to its related party nature.

The sixth property is a 1.1 hectare rural lifestyle property with four bedrooms, two bathrooms and two cars. The wind farm is located south and west of the property with the closest wind turbine approximately 1.6 kilometres away. The first sale occurred in 2004 prior to planning approval for the wind farm and the second sale occurred after the wind farm was commissioned. The value of the property grew by 24% from 2004 to 2009 at

an average annual rate of 4%. Similar sized rural lifestyle properties within Pyrenees LGA demonstrated price growth of 40% at an average annual rate of 7% over the same period. The value of the property appeared to have lagged behind the LGA average.

The seventh property is a 1.2 hectare, rural lifestyle property with three bedrooms, three bathrooms and three cars. The property recorded three sales. The first sale occurred in 2001 prior to planning approval. The second sale occurred in 2009 during the construction of the wind farm. The third sale occurred in 2013 after the wind farm was commissioned. The value of the property grew by 53% at an average annual rate of 5% from 2001 to 2009. In contrast similar properties within Pyrenees Shire LGA grew by 139% at an average annual rate of 12% over the same period. While the property value was lagging similar to the sixth property, it appeared to have caught up with Pyrenees Shire LGA benchmark from 2009 to 2013 as it increased in value by 38% compared to 8% for comparable properties in the LGA during the same period.

The eighth property is a 1.3 hectare vacant lot in Waubra. The wind farm is located south and west of the property with the closest wind turbine 1.5 kilometres away. The first sale occurred in 2006 before the construction of the wind farm. The second sale occurred in 2011 after the wind farm was commissioned. The value of the property increased by 70% over the period. In comparison, similar properties in Pyrenees LGA grew more slowly at 33% during this period. The property appears to have grown faster than the underlying LGA average.

The ninth property is a 1.6 hectare rural lifestyle property with three bedrooms, two bathrooms and one car. The wind farm is located to the south and west of the property with the closest wind turbine approximately 1.1 kilometres away. The property achieved three sales. The first sale occurred in 2006 after planning approval was granted. The second sale occurred in 2009 prior to the completion of the wind farm project. The third sale occurred after the wind farm was commissioned. The value of the property grew by 18% from 2006 to 2009, in line with similar properties within the Pyrenees Shire LGA. The value of the property increased by 19% from 2006 to 2011, compared to 20% for similar properties within the Pyrenees Shire LGA during that period.

The tenth property is a two hectare rural lifestyle property with three bedrooms, two bathrooms and four cars. The wind farm is located south and west of the property with the closest wind turbine approximately one kilometre away. The property had two sales. The first sale occurred in 2002 prior to planning approval for the wind farm. The second sale occurred in 2010 after the wind farm was commissioned. The change in value between 2002 and 2010 was 55% at an annual growth rate of 6%. Sales of similar sized rural lifestyle properties in Pyrenees Shire LGA recorded price growth of 76% at an annual growth rate of 7% during the same period.

Same property resale analysis – Property 1

WAUBRA WIND FARM

TABLE C.10

Property 1

Address	Property Type	Sale Date	Area	Sale Price	$/ha
Sunraysia Hwy, Waubra	Vacant Land	Feb-07	1,344	30,000	223,214
Sunraysia Hwy, Waubra	Vacant Land	Feb-12	1,344	55,000	409,226
Sunraysia Hwy, Waubra	Vacant Land	Nov-13	1,344	64,500	479,911

Year of 1st Sale	2007	Year of 1st Sale	2007
Year of 2nd Sale	2012	Year of 3rd Sale	2013
Price Increase between Sale Date	83%	Price Increase between Sale Date	115%
Annual Increase	13%	Annual Increase	14%

Average Pyrenees Shire LGA $/ha 2007*	293,384	Average Pyrenees Shire LGA $/ha 2007*	293,384
Average Pyrenees Shire LGA $/ha 2012*	525,957	Average Pyrenees Shire LGA $/ha 2013*	626,294
Price Increase between Sale Date	79%	Price Increase between Sale Date	113%
Annual Increase	12%	Annual Increase	13%

Comments: Residential block with a shed. Wind farm is located to the west and south of the property with the closest wind turbine 2km away. First sale occurred prior to the start of construction of the wind farm. The second and third sale occurred after the wind farm was commissioned.

** Average $/ha for similar property types and lot sizes*

Same property resale analysis – Property 2

WAUBRA WIND FARM

TABLE C.11

Property 2

Address	Property Type	Sale Date	Area	Sale Price	$/ha
Beaufort-Waubra Rd, Ercildoune	Rural Lifestyle	Jun-04	2,538	145,000	571,316
Beaufort-Waubra Rd, Ercildoune	Rural Lifestyle	Jul-10	2,538	225,000	886,525

Year of 1st Sale	2004
Year of 2nd Sale	2010
Price Increase between Sale Date	55%
Annual increase	8%

Average Pyrenees Shire LGA $/ha 2004*	619,992
Average Pyrenees Shire LGA $/ha 2010*	647,757
Price Increase between Sale Date	4%
Annual Increase	1%

Comments: Rural lifestyle dwelling with three bedrooms, one bathroom and one car. Surrcounded by wind turbines with the closest wind turbine 0.8 km away. First

** Average $/ha for similar property types and lot sizes*

Same property resale analysis – Property 3

WAUBRA WIND FARM

TABLE C.12

Property 3

Address	Property Type	Sale Date	Area	Sale Price	$/ha
Kimberley Dr, Waubra	Vacant Land	Sep-03	8,600	26,000	30,233
Kimberley Dr, Waubra	Vacant Land	Jul-10	8,600	73,000	84,884

Year of 1st Sale	2003
Year of 2nd Sale	2010
Price Increase between Sale Date	181%
Annual increase	16%
Average Pyrenees Shire LGA $/ha 2003*	24,464
Average Pyrenees Shire LGA $/ha 2010*	52,226
Price Increase between Sale Date	113%
Annual Increase	11%

Comments: Vacant land 1.7km from the closest wind turbine. First sale was prior to planning approval for the wind farm. Second sale was after the wind farm was

** Average $/ha for similar property types and lot sizes*

Same property resale analysis – Property 4

WAUBRA WIND FARM

TABLE C.13

Property 4

Address	Property Type	Sale Date	Area	Sale Price	$/ha
Kimberley Dr, Waubra	Vacant Land	Jul-08	8,790	57,000	64,846
Kimberley Dr, Waubra	Vacant Land	Apr-10	8,790	64,000	72,810

Year of 1st Sale	2008
Year of 2nd Sale	2010
Price Increase between Sale Date	12%
Annual increase	6%
Average Pyrenees Shire LGA $/ha 2008*	45,693
Average Pyrenees Shire LGA $/ha 2010*	52,226
Price Increase between Sale Date	14%
Annual Increase	7%

Comments: Vacant land 1.7 km from the closest wind turbine. First sale was after the start of construction for the wind farm. Second sale was after the wind farm

** Average $/ha for similar property types and lot sizes*

Same property resale analysis – Property 5

WAUBRA WIND FARM

TABLE C.14

Property 5

Address	Property Type	Sale Date	Area	Sale Price	$/ha
Beaufort-Waubra Rd, Ercildoune	Rural Lifestyle	Oct-06	10,000	156,000	156,000
Beaufort-Waubra Rd, Ercildoune	Rural Lifestyle	Oct-10	10,000	225,000	225,000

Year of 1st Sale	2006
Year of 2nd Sale	2010
Price Increase between Sale Date	44%
Annual increase	10%
Average Pyrenees Shire LGA $/ha 2006*	162,645
Average Pyrenees Shire LGA $/ha 2010*	191,789
Price Increase between Sale Date	18%
Annual Increase	4%

Comments: Rural lifestyle property with three bedrooms. Located in the middle of the wind farm with the closest wind turbine approximately 0.6 km north of the

** Average $/ha for similar property types and lot sizes*

Same property resale analysis – Property 6

WAUBRA WIND FARM

TABLE C.15

Property 6

Address	Property Type	Sale Date	Area	Sale Price	$/ha
Kimberley Dr, Waubra	Rural Lifestyle	Apr-04	11,480	185,000	161,150
Kimberley Dr, Waubra	Rural Lifestyle	Aug-09	11,480	230,000	200,348

Year of 1st Sale	2004
Year of 2nd Sale	2009
Price Increase between Sale Date	24%
Annual increase	4%
Average Pyrenees Shire LGA $/ha 2004*	185,539
Average Pyrenees Shire LGA $/ha 2009*	258,993
Price Increase between Sale Date	40%
Annual Increase	7%

Comments: Rural lifestyle property with four bedrooms, two bathrooms and two cars. Wind farm is located south and west of the property with the closest wind

** Average $/ha for similar property types and lot sizes*

Same property resale analysis – Property 7

WAUBRA WIND FARM

TABLE C.16

Property 7

Address	Property Type	Sale Date	Area	Sale Price	$/ha
Troy Rd, Waubra	Rural Lifestyle	Jun-01	11,560	154,000	133,218
Troy Rd, Waubra	Rural Lifestyle	Feb-09	11,560	235,000	203,287
Troy Rd, Waubra	Rural Lifestyle	Jun-13	11,560	325,000	281,142

Year of 1st Sale	2001	Year of 2nd Sale	2009
Year of 2nd Sale	2009	Year of 3rd Sale	2013
Price Increase between Sale Date	53%	Price Increase between Sale Date	38%
Annual Increase	5%	Annual Increase	8%

Average Pyrenees Shire LGA $/ha 2001*	108,408	Average Pyrenees Shire LGA $/ha 2009*	258,993
Average Pyrenees Shire LGA $/ha 2009*	258,993	Average Pyrenees Shire LGA $/ha 2013*	278,698
Price Increase between Sale Date	139%	Price Increase between Sale Date	8%
Annual Increase	12%	Annual Increase	2%

Comments: Rural lifestyle property with three bedrooms, three bathrooms and three cars. Wind turbines are located south and west of the property with the closest wind turbine approximately 1.6km away. First sale occurred prior to planning approvals. The second sale occurred during the construction of the wind farm. The third sale occurred after the wind farm was commissioned. Property value initally lagged from 2001 to 2009 then caught up from 2009 to 2013.

** Average $/ha for similar property types and lot sizes*

Same property resale analysis – Property 8

WAUBRA WIND FARM

TABLE C.17

Property 8

Address	Property Type	Sale Date	Area	Sale Price	$/ha
Kimberley Dr, Waubra	Vacant Land	Apr-06	12,710	44,756	35,213
Kimberley Dr, Waubra	Vacant Land	Feb-11	12,710	76,000	59,795

Year of 1st Sale	2006
Year of 2nd Sale	2011
Price Increase between Sale Date	70%
Annual increase	11%
Average Pyrenees Shire LGA $/ha 2006*	32,536
Average Pyrenees Shire LGA $/ha 2011*	43,193
Price Increase between Sale Date	33%
Annual Increase	6%

Comments: Wind farm is located south and west of the property with the closest wind turbine 1.5 km away. First sale occurred before the construction of the wind

** Average $/ha for similar property types and lot sizes*

Same property resale analysis – Property 9

WAUBRA WIND FARM

TABLE C.18

Property 9

Address	Property Type	Sale Date	Area	Sale Price	$/ha
Edmonston Rd, Addington	Rural Lifestyle	Nov-06	16,180	286,000	176,761
Edmonston Rd, Addington	Rural Lifestyle	May-09	16,180	338,000	208,900
Edmonston Rd, Addington	Rural Lifestyle	Feb-11	16,180	340,000	210,136

Year of 1st Sale	2006	Year of 1st Sale	2006
Year of 2nd Sale	2009	Year of 3rd Sale	2011
Price Increase between Sale Date	18%	Price Increase between Sale Date	19%
Annual Increase	6%	Annual Increase	4%

Average Pyrenees Shire LGA $/ha 2006*	119,423	Average Pyrenees Shire LGA $/ha 2006*	119,423
Average Pyrenees Shire LGA $/ha 2009*	141,271	Average Pyrenees Shire LGA $/ha 2011*	143,051
Price Increase between Sale Date	18%	Price Increase between Sale Date	20%
Annual Increase	6%	Annual Increase	4%

Comments: Rural lifestyle property with three bedrooms, two bathrooms and one car. The wind farm is located to the south and west of the property with the closest wind turbine approximately 1.1 km away. First sale occurred after planning approval was granted for the wind farm. The second sale prior to the completion of the wind farm project. The third sale occurred after the wind farm was commissioned.

** Average $/ha for similar property types and lot sizes*

Same property resale analysis – Property 10

WAUBRA WIND FARM

TABLE C.19

Property 10

Address	Property Type	Sale Date	Area	Sale Price	$/ha
Wilcar Dr, Waubra	Rural Lifestyle	Jul-02	20,640	167,500	81,153
Wilcar Dr, Waubra	Rural Lifestyle	Aug-10	20,640	260,000	125,969

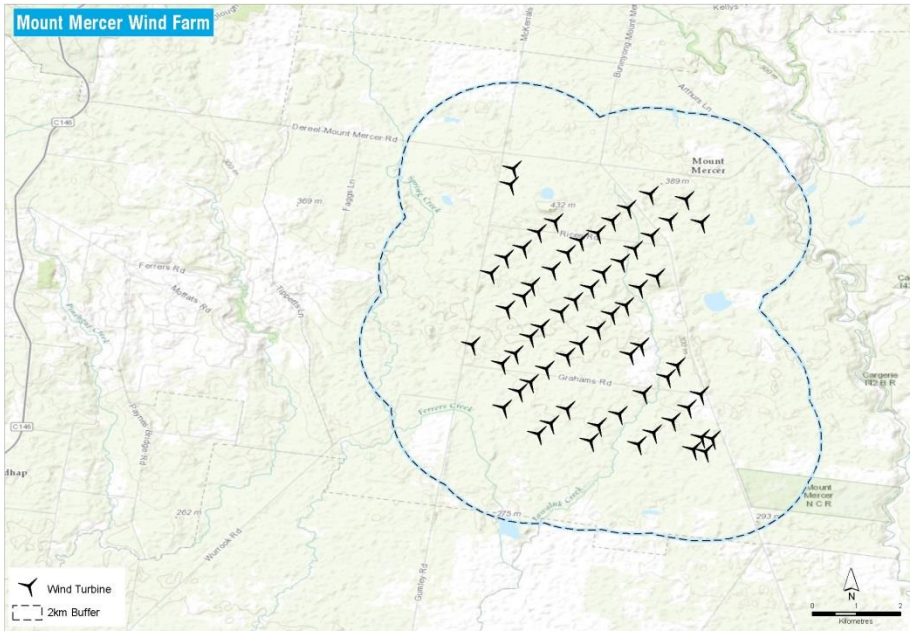
Year of 1st Sale	2002
Year of 2nd Sale	2010
Price Increase between Sale Date	55%
Annual increase	6%
Average Pyrenees Shire LGA $/ha 2002*	69,058
Average Pyrenees Shire LGA $/ha 2009*	121,647
Price Increase between Sale Date	76%
Annual Increase	7%

Comments: Rural lifestyle property with three bedrooms, two bathrooms and four cars. Wind farm is located south and west of the property with the closest wind

** Average $/ha for similar property types and lot sizes*

Source: APM PriceFinder ; Urbis

C.6 MT MERCER WIND FARM VICTORA



NUMBER OF TURBINES	64
Total capacity	131 MW
Start of operation	September 2014
Location	Located at Mount Mercer approximately 30 km south of Ballarat.
Project information	Planning approval was granted in April 2007. Construction was set to commence in September 2009 however it was delayed until December 2012 due to ownership changes and the GFC. The project reached

	practical completion in September 2014.
Property sales within 2 km radius	35
Number of property sales within 2 km radius before operation	35
Number of property sales within 2 km radius before operation	0
Agent interview commentary	Limits buyer's profile as some buyers do not want to live close to the wind farm. Owner of the wind farm purchased had to purchase a property within a few hundred metres of the wind farm.

One same property resale was noted within the defined two kilometre radius.

This property of nine hectares is located north of the wind farm with the closest wind turbine approximately 1.5 kilometres away. The property was first sold in 2002 as a vacant residential lot before planning approval for the wind farm and then resold in 2008 after planning approval for the wind farm was granted, with subsequent improvements such as a four bedroom, one bathroom and two car house. The change in value between 2002 and 2008 was 703% at an annual growth rate of 42%. Comparison of sales of similar vacant residential lots in Golden Plain Shire LGA in 2002 and rural lifestyle properties in 2008 demonstrated a price growth of 636% which represents an annual growth rate of 39%. While the price of the affected property grew at a slightly higher rate than the Golden Plain Shire LGA benchmark, this result should be used with caution as it is a comparison of prices of two different property types across the period.

Same property resale analysis – Property 1

MT MERCER WIND FARM

TABLE C.20

Property 1

Address	Property Type	Sale Date	Area	Sale Price	$/ha
Buninyong-Mt Mercer Rd, Mount Mercer	Vacant Land	Sep-02	89,960	30,000	3,335
Buninyong-Mt Mercer Rd, Mount Mercer	Rural Lifestyle	Apr-08	89,960	241,000	26,790

Year of 1st Sale	2002
Year of 2nd Sale	2008
Price Increase between Sale Date	703%
Annual increase	42%
Average Golden Plain Shire LGA $/ha 2002*	6,017
Average Golden Plain Shire LGA $/ha 2008*	44,283
Price Increase between Sale Date	636%
Annual increase	39%

Comments: Located north of the wind farm with the closest wind turbine approximately 1.5 km away. Property was first sold in 2002 as a vacant residential lot before planning approval for the wind farm. Resold in 2008 with improvements such as a four bedroom, one bathroom and two car house. This result should be used with caution as it is a comparison of prices of two different property types across the period.

** Average $/ha for similar property types and lot sizes*

Source: APM PriceFinder ; Urbis

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