1. Winds of Change: Engaging with Conflicting Perspectives in Renewable Energy

1.1 Abstract

This study examines public attitudes towards climate change and policies to limit greenhouse gases such as through the expansion of renewable energy sources. The apparent contradiction between belief in climate change and generalized support for renewable energy, as revealed in this survey, and opposition to the placement of large-scale renewable energy generators such as wind farms, is critically examined. The literature identifies significant psychogenic influences leading to opposition to specific wind farm siting, as well as strong policy support for coal mining in Australia, but these appear to be ignored or dismissed by environmentalists, leading to ineffective communication on the issues and, ultimately, to entrenched opposition to an energy transition. We use social marketing benchmarks to identify engagement strategies that may increase understanding of the need to reduce fossil fuels consumption, alleviate anxiety about wind farm impacts and improve acceptance of renewable energy generation strategies overall.

1.2 Keywords

Renewable energy, acceptance of wind farms, fossil fuels, social marketing.

1.3 Introduction

Climate change, and the need to reduce carbon dioxide (CO_2) and other greenhouse gas emissions, is one of the most urgent issues facing the global community. Climate change is often called a 'wicked problem' since policy making around climate change is characterised by complexity, uncertainly and divergence of values (Head, 2008). The United Nations (UN), guided by reports from the *Intergovernmental Panel of Climate Change* (IPCC), has set a target of limiting average warming to 2°C above pre-industrial temperatures (IPCC, 2014). Recent reports highlight that even a warming of 1.5°C above pre-industrial levels could result in climate impacts that may be long-lasting or irreversible, such as the loss of some ecosystems (IPCC, 2018). There is concern that irreversible 'tipping points' could be activated on Earth, such as the melting of the Greenland and Antartic ice sheets and dieback of the Amazon rainforest (Lenton, 2011). Experiences of extreme weather and climate events, such as heat waves, hurricanes, cyclones and floods over recent years in Australia, the USA and elsewhere, highlight that delaying action on climate change will come at a great cost to society. The socio-economic impacts of natural disasters, caused by storms, floods and bushfires is extensive, with billions in financial costs arising from damage in Australia alone (UNISDR, 2015). The energy sector is the largest contributor to global greenhouse gas (GHG) emissions (IPCC, 2014). Globally around half of global emissions were the result of electricity and heat production in 2014, with transport, buildings, industry, agriculture, residential and commercial sectors also contributing to emissions (Ritchie & Roser, 2019). Global energy-related CO2 emissions grew 1.7 in 2018 to reach a historic high of 33.1Gt CO2, due to a robust global economy, as well as from weather conditions in some parts of the world that led to increased energy demand for heating and cooling (IEA, 2018). Hence, there is a strong focus on reforming the world's energy system and implementing measures such as replacing fossil fuels with renewables, as well as reducing energy consumption, increasing energy efficiency, deploying nuclear power and exploiting carbon dioxide capture and storage (Edenhofer & Flachsland, 2013; Kallies, 2016; IPCC, 2014).

Renewable energy (RE), as outlined in the Intergovernmental Panel of Climate Change (IPCC) report (2014), refers to energy sources such as bioenergy, direct solar energy, geothermal energy, hydropower, ocean and wind energy. Sustainable energy transitions, which typically means moving away from fossil fuels towards renewable resources (Dowling, McGuirk, & Maalsen, 2018), have been the subject of intense debate in academic and political spheres (Geels, 2014; Hall & Taplin, 2008). In Australia, a country rich in both fossil fuels and renewable energy, electricity is mainly generated from fossil fuels (Djerf-Pierre, Cokley, & Kuchel, 2015). Electricity GHG emissions make up a larger proportion of Australia's national GHG emissions than they do for any other OECD country - due to its high dependence on coal-fired electricity (Buckman & Diesendorf, 2010). However, concerns about climate change are driving a debate on how to bring about an orderly transition to renewable energy (RE) in Australia (Nelson, 2016). Within this context, this book chapter examines acceptance of renewable energy in regional Australia, along with the narratives and tensions that underlie the phase-out or closure of coal-fired stations along with the building of large-scale renewable energy infrastructures. Examining these tensions will provide policy makers in countries that are slow to embrace an energy transition with a greater understanding of barriers to, and potential enablers of, attitudinal and behavioral change. The social sciences are therefore now seen as a key contributor towards understanding the socio-cultural complexities (as opposed to the technical barriers) of a renewable energy transition (Minsch, Goldblatt, Flüeler, & Spreng, 2012; Sovacool, 2014). We draw on this field, particularly social marketing, to analyse the reasons for opposition and to identify new

approaches to engaging with opponents in order to increase understanding and acceptance around the need to transition away from coal, alleviate anxiety about wind farm impacts and, ultimately, to support a renewable energy transition.

1.4 Explaining support for coal: politics, ideology and economic rationalism

Coal-fired electricity generation is the single largest source of global temperature increase, accounting for 30% of global CO2 emissions (IEA, 2018). Coal is particularly rich in carbon, and the burning of black coal generates carbon dioxide that is more than twice its weight (Hong & Slatick, 1994). In a growing number of countries, the elimination of coal-fired generation is a key climate goal, while in others coal is abundant and affordable and remains the key source of electricity (IEA, 2018). With the commitment of the Australian government to the Paris Agreement (UNFCCC, 2015), scholars and policy advisors suggest that carbon pricing, such as an emissions trading scheme or a national clean energy target, is essential (Edenhofer & Flachsland, 2013; Finkel, 2017; Queensland Renewable Energy Expert Panel, 2016; Meadowcroft, 2011). However, the federal government has shown inconsistent support for climate change (Nelson, 2016), and according to the Clean Energy Council (2019), this uncertainty surrounding energy and climate policy is a deterrent to investors. In 2018, the Federal government did not implement its own National Energy Guarantee (NEG), hence a bipartisan solution on energy policy remains elusive (Clean Energy Council, 2019). During the Federal election in 2019, the National-Liberal Party pledged its support for the Paris Agreement and to the carbon emissions reduction target, which is 26% by the year 2030, however it did not rule out the building of new coal-fired power stations (Chang, 2019). Unlike the opposition party, Labor, it did not raise the emissions reduction target and the focus was on measures to reign in rising electricity prices (Clean Energy Council, 2019). According to some commentators, the election of Scott Morrison, a Prime Minister who famously brought a lump of coal into Parliament, is a signal of a divided society, and suggests that progressive climate policy is not on the political agenda (Lucas, 2019).

Barriers such as the strength of the coal lobby, the emphasis placed on coal's contribution to the Australian economy, and the way in which politics impedes an energy transition in a fossil-fuel dependent nation, are well documented in the literature (Dowling et al., 2018; Cheung & Davies, 2017; Muenstermann, 2012). Cheung & Davies (2017), after analyzing four Australian Prime Ministers, suggest that personal ideology drives energy politics. They suggest that there is an inherent contradiction with respect to Australia's energy policy, because despite actions towards renewables, there remains an on-going political disposition to subside the fossil fuel industry. Likewise, Warren, Cristoff & Green (2016) conclude that the failure to integrate climate and energy goals has hampered a renewable energy transition, evident in the contests between the neo-liberalism and sustainable development discourses. Hence, the twin 'pillars' of energy policy, affordability and security of supply, have been given overwhelming priority over climate interests. As noticed by Sovacool (2016), political leadership and adequate incentives are essential elements for an energy transition. Traditionally, management has been strongly influenced by the philosophy of neo-conservatism or economic rationalism (Dunphy, 2003), and arguably, the coal industry is no exception. CEOs may accept the need for change, but ultimately they are driven by the logic of profit, shareholder return and market competition, rather than a clean energy agenda.

Globally, renewable energy sources increased by 4% in 2018, now accounting for over 25% of global power output (International Energy Agency, 2018). There are significant differences across countries in terms of per capita installed renewable energy generation. Australia's reliance on non-renewables for electricity generation is shown in Table 1. It

shows that Australia relies much more heavily on coal than all other member countries of the OECD. Natural gas has a 17.9% share of the energy mix. Gas is seen as a transition fuel, meaning that it allows for a reduction in emissions from power generation through a gradual substitution of coal (Guidolin & Alpcan, 2019). The share of renewables in the energy mix is dominated by hydro, wind and solar. Australia has a slightly lower share of renewables in the energy mix, compared to other OECD countries, even though Australia has the highest solar radiation per square meter of any continent, and some of the best solar and wind resources in the world (Geoscience Australia, 2010). In recent years, performance in renewables has improved significantly. An increase of 21% of total power generation in 2018 now puts renewables at its highest ever level (Clean Energy Council, 2019).

Table 1: Energy Resources (2018)

Australia	**Gigawatt hours (GWh)**	**Share - Australia**	**Share - OECD Total**
Conventional Thermal:	194,509	80.4%	58.2%
Coal	146,439	**60.6%**	**25.3%**
Oil	1,204	0.5%	1.9%
Natural Gas	43,341	17.9%	27.7%
Combustible Renewables	3,525	1.5%	2.7%
Other Combustibles	-	-	0.6%
Nuclear	-	-	17.4%
Hydro	17,642	7.3%	13.8%
Wind	17,414	7.2%	6.9%
Solar	12,275	5.1%	3.0%
Geo-Thermal	0	0.0%	0.5%
Other Renewables	-	-	0.0%
Non-Specified	-	-	0.3%
Renewables	50,856	**21.0%**	**26.9%**
Non-Renewables	190,985	**79.0%**	**73.1%**

Source: International Energy Agency (2019).

Notes: Combustible renewables, according to the International Energy Agency (2019) refers to solid biofuels, biogases, liquid biofuels and municipal renewable waste. Other combustibles refer to production from all other combustible fuels (such as industrial and non-renewable municipal solid waste). Other renewables refer to electricity generated from tide, wave, ocean and other non-combustible sources.

Table 2 shows that Australia ranks number 1 out of a list of OECD countries in terms of coal power generation. The high level of dependence of Australia on "extraction and production of non-renewable resources" (Djerf-Pierre, Cokley, & Kuchel, 2015, p. 635), such as coal for export, is put forward as a reason for its historically low level of renewables in the energy mix.

Table 2: Coal Power Generation: Gigawatts per capita ranking (selected countries), 2018.

Country	**GWh**	**GWh per capita**	**Ranking**
Australia	146439	5953	1
USA	1183559	3617	2
Germany	224160	2708	3
Canada	55571	1499	4

Greece	15679	1456	5
Portugal	11576	1123	6
Denmark	6103	1062	7
Spain	37430	801	8
Ireland	3328	696	9
New Zealand	1519	317	10
Sweden	1964	196	11

Source: International Energy Agency (2019) Note: per capita figures are author-derived.

1.5 Social acceptance and wind energy in Australia

Widespread public support is needed when developing large-scale energy infrastructures, such as wind farms (Batel & Devine-Wright, 2015), Social acceptance is a concept that significantly shapes the implementation of renewable energy technologies and achievement of renewable energy targets (Moula et al., 2013; Wolsink 2012, 2013). Scholars (Batel & Devine-Wright, 2015; Batel, Devine-Wright & Tangeland, 2013) have written extensively about public responses to large-scale energy infrastructures. Despite increased academic attention, no clear definition of social acceptance of renewable energy technologies exists (Wüstenhagen et al., 2007). According to Wolsink (2010, p. 303), *"Social acceptance is not simply a set of static attitudes of individuals; instead it refers more broadly to social relationships and organisations, and it is dynamic as it is shaped in learning processes*". Scholars note that the drivers of social acceptance have not received adequate attention in the literature (Friedl & Reichl, 2016).

There is a considerable body of literature noting that, while support for renewable energy is, in general, high, substantial opposition becomes evident regarding the siting of generation facilities such as specific wind farms (see, for example, Batel & Devine-Wright, 2015; Bell, Gray, Haggett, & Swaffield, 2013). The 'social gap', or 'attitude-behaviour gap' between general support for the concept versus opposition to specific sitings of facilities is receiving increasing focus (Larson & Krannich, 2016; Lennon & Scott, 2015), with the recognition that "*the social dimension of the implementation of wind farms has emerged as a factor of at least equal importance to technology*" (Fournis & Fortin, 2017, p. 2).

High levels of localized resistance – particularly to wind power – were predicted to significantly hamper renewable energy targets set by the Australian federal, state and territory governments (Hall, Lacey, Carr-Cornish, & Dowd, 2015). Community opposition to siting decisions, has been somewhat dismissively classified as NIMBYISM ('Not In My Back Yard'), and the term has been used uncritically in both policy and academic material (Beben, 2015; Petrova, 2016). Opposition appears to centre on four factors: dislike of their visual impact (Knopper & Ollson, 2011), turbine noise (Botelho et al., 2015; McCunney et al., 2014), potential dangers to wildlife (Marques et al., 2014) and claimed human health impacts. Government inquiries and reviews have been conducted in several countries, including Australia, and they have concluded that that there is no medical evidence of a direct link between turbine operation and human health, although the poor quality of the data has been noted (Chapman, Joshi, & Fry, 2014).

Wind energy is seen as a key component of sustainable power development, decreasing reliance on fossil fuels and thus reducing greenhouse gas emissions and helping address climate change challenges (Crichton & Petrie, 2015). Wind energy is the fastest growing

electricity generation form in the world (Blanes-Vidal & Schwartz, 2016) and is claimed to be the most profitable (Read, Brown, Thorsteinsson, Morgan, & Price, 2013). It is also claimed to be able to produce over five times the current global energy demand (Sahu, 2015). A study in Australia showed that the cost of new wind and solar is now lower than the cost of new coal generation (CSIRO, 2018).

There is a wide variation in the amount of electricity generated by wind: in 2010, it was estimated that Denmark generated 25.5% of its electricity from wind energy sources, compared to only 2% in Australia, although there were substantial differences by state, with South Australia generating 20% of electricity from wind (Aparicio, MacGill, Abbad, & Beltran, 2012). By 2018, Australia's wind energy production stood at 7.2% of total electricity generation, which is slightly above the OECD average at 6.9% (IEA, 2019). Table 3 shows the gigawatts per capita ranking of OECD countries and Australia is ranked 9th out of 11 countries. While this is an improvement on previous years, Australia still lags far behind Denmark, a country that has demonstrated rapid increases in wind power and has made a commitment to increase wind power share to 50% of electricity consumption by 2020 (Hvelplund, Østergaard & Meyer, 2017).

Table 3: Wind Power Generation: Gigawatts per capita ranking (selected countries) 2018.

Country	**GWh**	**GWh per capita**	**Ranking**
Denmark	13899	2418	1
Ireland	8391	1754	2
Sweden	16623	1663	3
Germany	110891	1339	4
Portugal	12513	1214	5
Spain	49571	1061	6
USA	275064	841	7
Canada	29357	792	8
Australia	17414	708	**9**
Greece	6300	585	10
New Zealand	2047	427	11

Source: International Energy Agency (2019). Note: per capita figures are author derived.

Table 4 shows that wind generation in Australia in 2018 was 16,172 gigawatt hours and a breakdown by state is given. Wind generation now accounts for 33.5% of renewable energy generation and another 24 wind farms, with a combined capacity of 5.69 GW were financially committed or under construction at the end of 2018 (Clean Energy Council, 2019).

Table 4: Current Wind Generation (Clean Energy Council, 2019)

	Current (end of 2018)	
	Share	**Capacity (GWh)**
Breakdown by State		
South Australia	35.1%	5692
Western Australia	9.9%	1594

New South Wales	19.3%	3124
Victoria	28.0%	4528
Tasmania	6.8%	1093
Queensland	0.9%	141
Total National	100%	**16,172**

Although high levels of localized resistance were predicted to hamper renewable energy investment (Hall, Lacey, Carr-Cornish, & Dowd, 2015), the Clean Energy Council found that incentives provided by the Federal Renewable Energy Target (RET) and other state policies propelled investment in renewable energy in 2018. Queensland, the second-largest state by area in Australia, is increasingly hosting large-scale projects. The government also delivered its *Solar Farm Guidelines* in 2018, designed to ensure that large-scale projects maintain a strong social license to operate (Clean Energy Council, 2019). The next section examines the factors that affect social acceptance in more detail.

1.6 Explaining opposition to large-scale energy infrastructures: health and environmental impacts, NIMBYISM and Information Deficit Assumptions

There is an increasing body of work showing that developing renewable energy as a climate mitigation option leads to a range of co-benefits for society, e.g., reduced health impacts due to lower air pollution (Xue et al., 2015). Renewable energy supply options have many advantages, but they also have drawbacks and differ with regard to their overall health and environmental impacts (Ellabban, Abu-Rub, & Blaabjerg, 2014). Debates around granting a social license to (the now already established) coal mines were intense, with academics drawing attention to externalities, unpaid social and environmental costs, such as pollution, coal mining accidents and occupational health hazards (Byrnes et al., 2013; Lockie, Franetovich, Sharma, & Rolfe, 2008). Coal is a source of mercury and other toxic metals, harming eco-systems and potentially human life; the surface mining of coal causes a substantial change in land use and leads to mining waste (IPCC, 2014). There are similar debates surrounding the impacts of wind energy today. Opposition towards wind energy appears to be driven more by emotions and psychological issues, rather than rationality (discussed in the next section). Given the intended expansion of wind energy, it is important to understand the nature and impact of any organized opposition to its development. These factors are discussed in more detail below.

Some early analyses gave localized opposition to the development of the pejorative term NIMBYISM ('Not In My Back Yard'), representing selfishness, ignorance and irrationality, but this concept is now acknowledged as not providing an effective framework for understanding the actual reasons for the opposition (Petrova, 2016). Additional criticisms are that the term is simplistic and inaccurate (Burningham, Barnett, & Walker, 2015), and that the actual causes of opposition are obscured rather than explained (Wolsink, 2012). In spite of this, the term continues to be used in an uncritical way in both policy documents and academic material (see, for example, Beben, 2015). Often neglected in the debates is an "*inverse NIMBY syndrome*" where those living close to wind farms are the strongest supporters, often after initial concerns based on perceptions of potential negative impacts have not been realised (Enevoldsen & Sovacool, 2016; Warren & Birnie, 2009).

Even without invoking the NIMBY perspective, there are assumptions that wind power opposition is 'deviant', founded on ignorance and misinformation (Aitken, 2010).

The assumption that opposition to a concept, issue or development, is based partly on an information deficit (i.e. ignorance) and that it can be overcome by simply providing information is widespread, encompassing issues as diverse as climate change and vaccine hesitancy (Brulle, Carmichael, & Jenkins, 2012; Yaqub, Castle-Clarke, Sevdalis, & Chataway, 2014) as well as for renewable energy (Bidwell, 2016). Reliance on this assumption may explain why communication among stakeholders involved in specific scenarios are acknowledged as frequently inefficient and ineffective (Chen, Liu, & Chuang, 2015). Wind farm opponents may be a minority of any specific population but can have significant influence on siting decision processes and approvals (Bidwell, 2016), resulting in cost escalations, project delays or rejection (Enevoldsen & Sovacool, 2016). Social pressure from others has been shown to predict intentions to oppose wind farm development (Read et al., 2013), therefore information provision alone is unlikely to overcome these pressures. Like the NIMBY concept, the information deficit assumption continues to feature in policy documents across topics as diverse as sustainability, climate change and vaccination hesitancy (Eagle, Low, Case, & Vandommele, 2015; Lorenzoni, Nicholson-Cole, & Whitmarsh, 2007; Marteau, Sowden, & Armstrong, 2008).

In addition to the NIMBYISM and information deficit perspectives presented above, opposition to wind farms centres on four main factors:
(1) dislike of their visual impact (Knopper & Ollson, 2011)
(2) noise from the turbines (Botelho, Arezes, Bernardo, Dias, & Pinto, 2015; McCunney et al., 2014)
(3) potential dangers to wildlife (see, for example, Marques et al., 2014) and
(4) a range of human health impacts.

The first three factors are now reviewed briefly before a more detailed examination of the claims regarding health effects.

Visual Impact: Visual impact is a complex area, with much debate based on subjective views such as whether they are ugly or attractive in appearance (Wilson & Dyke, 2016), with former Australian Prime Minister Tony Abbott publicly declaring in 2013 that wind farms were "*ugly and noisy*" (Green, 2016, p. 1). Others see wind turbines as graceful and visually 'magnificent'(Wilson & Dyke, 2016). Some concern relates to the siting of wind farms in areas that are "*ecologically sensitive and valued for their scenic qualities*" (Larson & Krannich, 2016, p. 3). There is a growing body of literature investigating the impacts of wind farms on tourism (see, for example, Broekel & Alfken, 2015). A detailed discussion of this sector is beyond the scope of this paper. Concern about visual impact may also reflect 'place attachment' (i.e., emotional bonds that form between people and their physical surroundings), and this is increasingly seen as a more significant explanation for resistance to local development than NIMBYISM (Devine-Wright, 2009);

Noise: Noise appears to be addressed in multiple ways, including modern designs but, more importantly, on regulations regarding turbine size and distance ("set back") from homes in order to reduce annoyance from turbine noise (Hall, Ashworth, & Devine-Wright, 2013; Onakpoya, O'Sullivan, Thompson, & Heneghan, 2015).

Wildlife impacts: Claims of mass deaths of wildlife due to turbines appear to be overstated. A review of Canadian avian mortality found that turbine-related deaths were much lower than cat predation, collisions with windows, vehicles and transmission lines (Calvert et al., 2013). This does not mean that efforts should not be made to minimize turbine-related fatalities:

harm minimization strategies appear to be part of modern planning processes (Marques et al., 2014; May, Reitan, Bevanger, Lorentsen, & Nygård, 2015) and a detailed discussion of this area is beyond the scope of this paper.

The focus on the next section is on the adverse health impacts of wind due to the significance of claims made in this area.

1.7 Claimed health impacts of wind energy

The claims regarding adverse health effects from wind farms is an area in which contested, and indeed polarized views regarding the nature and quality of evidence are evident (Blanes-Vidal & Schwartz, 2016). This extends even to government-sponsored reviews. For example, a 2015 Australian Senate inquiry revealed deep divisions between the Senate panel members. The first part of the report criticized previous reviews that did not find evidence of a direct link between wind farms and health issues, yet in another part of the report, it was concluded that there was no evidence of any health-related impacts from wind farms. It was also suggested that some studies (that did not identify adverse health impacts) were of limited value as their authors did not have medical qualifications. This contesting and devaluing of expertise from those whose views diverge from a preferred stance is unfortunately not uncommon (Lennon & Scott, 2015).

There have been frequent claims, supported in part by some academic studies, that wind turbines are a threat to human health, with more than 240 claimed health problems including "*sleep disturbance, headaches, nausea, tinnitus, ear pressure, vertigo or dizziness, visual blurring, irritability, memory and concentration problems, panic episodes, tachycardia, and body vibration*" (Tonin, Brett, & Colagiuri, 2016, p. 77). Additional problems identified by other authors include *fatigue, inability to concentrate, depression, irritability, aggressiveness, chest pains vomiting* and *annoyance*, although the link between this latter problem and specific medical conditions is unclear (Blanes-Vidal & Schwartz, 2016; Chapman, George, Waller, & Cakic, 2013; Havas & Colling, 2011). However the studies on which the academic-based negative health claims are based have been criticized for not controlling for potential confounding effects that may offer alternative explanations of adverse health effects reported by those living near wind farms (Blanes-Vidal & Schwartz, 2016).

An analysis of complaints about noise or health issues relating to wind turbines living near 51 Australian wind farms found that the pattern of complaints did not match either the establishment or location of the wind farms (Chapman et al., 2013). These authors, in common with others who have conducted systematic reviews in this area conclude that wind turbine syndrome is a "*communicated disease*" (Knopper & Ollson, 2011; Schmidt & Klokker, 2014), with its foundations in psychological rather than pathological factors. Thus anxiety and expectations of negative effects appear to be a factor in reported symptoms (Crichton, Dodd, Schmid, Gamble, & Petrie, 2014). The reported effects are thus frequently referred to as reflecting a 'nocebo effect', whereby adverse health effects are produced by the expectation that these effects will occur (Colloca & Miller, 2011; Faasse & Petrie, 2013). This phenomenon that has been recognized in the health academic literature for two decades (Benson, 1997). In the specific context of wind farms, the effect is clearly stated as follows:

> "*The nocebo effect is a negative reaction from exposure to an innocuous substance due to expectations of harm. It is the converse to a placebo which is an inert substance that creates either a beneficial response or no response in a patient. The nocebo effect is*

psychogenic in nature and is a reaction to a patient's expectations and perceptions of how an exposure to a substance will affect them" (Tonin et al., 2016, p. 78).

News and social media coverage of issues can result in large scale nocebo effects, increasing expectations that reported adverse effects will in fact occur (Faasse & Petrie, 2013).

A range of government inquiries and reviews have been conducted in several countries including the UK, Canada, Belgium and Australia. There is general agreement that there is no medical evidence of a direct link between turbine operation and human health but rather an association with a range of psycho-social factors including, among others, annoyance, although the poor quality of data available has been noted (Chapman, Joshi, & Fry, 2014; Knopper & Ollson, 2011). For example, in a review commissioned by the Australian National Health and Medical Research Council (NHMRC), the following comments were made:

"*It is a significant limitation of the available evidence that it was not known whether any of the observed health effects in residents were present or occurring at a different intensity prior to wind turbine exposure (i.e. demonstrating appropriate temporal proximity)*" (Merlin, Newton, Ellery, Milverton, & Farah, 2013, p. 11).

In March 2016, the NHMRC awarded AU$3.3 million over a five year period "*to enrich the evidence-based understanding of the effects of wind farms on human health*" with particular emphasis on infrasound (National Health and Medical Research Council, 2016). Infrasound (low frequency, sub-audible sound) has been claimed to have adverse health effects (Pierpont, 2009). However double-blind tests exposing people to infrasound and sham infrasound, i.e. silence, have found a correlation between reporting of symptoms and expectation of negative effects (Crichton et al., 2014), with Internet-sourced information linking infrasound to health risks creating negative expectations then symptoms (Crichton & Petrie, 2015), suggesting high nocebo effects.

The next section explores the impact of the mass media on people's attitudes toward energy sources.

1.7 Information sources and procedural measures to resolve conflict

Mass media are important sources of information for the general population across a wide range of topic areas including health, science and environmental issues (Dahlstrom, Dudo, & Brossard, 2012) as well as energy issues (Deignan & Hoffman-Goetz, 2015) and can have an impact on attitude and beliefs. In relation to energy sources, the media can unintentionally amplify the anxieties people have in relation to their own personal health or the health of their families:

"*be used as potential cases for appropriate illness behavior responses and can initially alarm those at risk…Too often it is the media-created event to which people respond rather than the objective situation itself*" (Chapman et al., 2013, p. 2).

The news media can intentionally, and unintentionally, spread misinformation, as can Internet sites including social media and once misinformation has been accepted, new information that is not compatible with previous information may struggle for acceptance even if the new information is correct (Lewandowsky, Ecker, Seifert, Schwarz, & Cook, 2012). It is

therefore concerning that a Canadian study of newspaper coverage of health impacts of wind turbines sensationalised negative claims (Deignan & Hoffman-Goetz, 2015). It has been found that media coverage and interaction with lobby groups can increase symptoms (McCunney et al., 2014; Rubin, Burns, & Wessely, 2014). This has the potential not only to add to personal distress, but to have a detrimental impact on policy decisions:

> "*The public's lack of understanding of many issues negatively affects the ability of the government to represent the will of the people. Yet, evidence suggests that decision makers will still side with the public over scientists and experts, even when it is probable the public does not understand the issue*" (Stoutenborough & Vedlitz, 2016, p. 206).

The media claim that they are providing balance in presenting all views 'objectively' and that this stance is a fundamental principle of journalism (Clarke, 2008). This strategy may lead to intentional or unintentional bias especially if one view is clearly in the minority but still receives equal coverage, as has been noted in other areas such as climate change coverage (Boykoff & Mansfield, 2008) and human vaccine controversies (Picard & Yeo, 2011). Further, the news media maintains this balance irrespective of evidence that may support or refute claims (Boykoff & Boykoff, 2004; Gross, 2009; Lewandowsky et al., 2012).

In developing communication strategies to address wind farm anxiety, there is a need for engagement with those affected, recognizing that these people are experiencing genuine, distressing symptoms. There is also the need to recognise that strong emotions are involved (Cass & Walker, 2009; Walker, Devine-Wright, Hunter, High, & Evans, 2010). As noted by Crichton & Petrie (2015), it is necessary to acknowledge the health issues experienced by people who claim to be affected by wind farms:

> *"Understanding what might be causing symptom reports is critical to inform successful interventions to alleviate distress and symptom reporting in communities in which wind farms are proposed and operating. It is noteworthy that experiencing symptoms is a common phenomenon, and is not in and of itself indicative of illness"* (Crichton & Petrie, 2015, p. 450).

Those who dismiss complaints on the grounds of lack of direct medical evidence, while not wrong, are unhelpful in developing the type of genuine public engagement recommended by others (see, for example, Devine-Wright, 2011; Shaw et al., 2015). There is a need to determine people's values as these underpin personal norms and shape attitudes towards wind farm developments (Bidwell, 2013; Steg, Bolderdijk, Keizer, & Perlaviciute, 2014)

Community compensation (Terwel, Koudenburg, & ter Mors, 2014) is seen as a means to help avoid or reduce local public opposition to energy projects, although the use of financial incentives is viewed cynically in some quarters. In the words of one commentator, *"It would seem 'wind turbine syndrome' can be prevented by the wonder drug called money"* (Chapman, 2013, p. 2) and another assessment is:

> "*those who benefit economically from wind turbines (e.g. those who have leased their property to wind farm developers) report significantly lower levels of annoyance than those who received no economic benefits, despite increased proximity to the turbines and exposure to similar (or louder) sound levels*" (Knopper et al., 2014, p. 2).

Social acceptance of large-scale wind energy projects is not a given, but the literature shows that procedural issues show promise in resolving conflict. These measures include the following: identifying the expectations and interests of different stakeholders; providing balanced and objective information; gaining trust at local level; adopting benefit-sharing mechanisms and developing mechanisms for articulating conflict and engaging in negotiation (Hall, 2014; Hall, Ashworth, & Devine-Wright, 2013; Howard, 2015; Terwel et al., 2014). While public concerns about large-scale energy infrastructures cannot be entirely eliminated, addressing these concerns is a key part of many jurisdictions' planning, siting, and permitting processes (IPCC, 2014).

1.8 Research Objectives and Methodology

This study aims to evaluate consumers' support for renewable energy sources, including wind farms, and examine priorities placed on factors such as human health, the economy and climate change mitigation. A quantitative methodology was chosen and a questionnaire was developed, which is the norm in renewable energy studies (Stoutenborough et al., 2015; Dockerty et al., 2012). Data was collected through field sampling and online distribution. A total of 325 usable responses were obtained. Respondents came from a regional city, Townsville, with an even spread of males and females and a variety of ages and income groups. Questions were informed by the literature (Poortinga et al., 2006; Eagle et al., 2016), noting that the various energy technologies have different environmental, economic and social impacts. 5-point Likert-type scales were used (with 1= strongly disagree and 5 = strongly agree), with one question specifically measuring support for wind energy and a second question providing benchmark data on attitudes. A rank order question was used (1= most important, 6= least important) to examine perceived priorities for generation decisions. Ethics approval was secured from the Human Ethics Committee at the authors' university (H6601).

1.9 Results

The section presents the results from the survey on acceptance of energy supply sources, energy-related attitudes and public policy preferences.

Acceptance of energy supply sources by Australian consumers

Table 1 shows the level of support for each energy source. It indicates a high level of support for renewable energy, with solar and wind energy receiving the highest mean scores. Nuclear energy was by far the least favoured technology. Battery storage enjoyed strong support from the sample, along with hydroelectric and marine power. The public clearly preferred renewable energy over fossil fuels (which received lower scores).

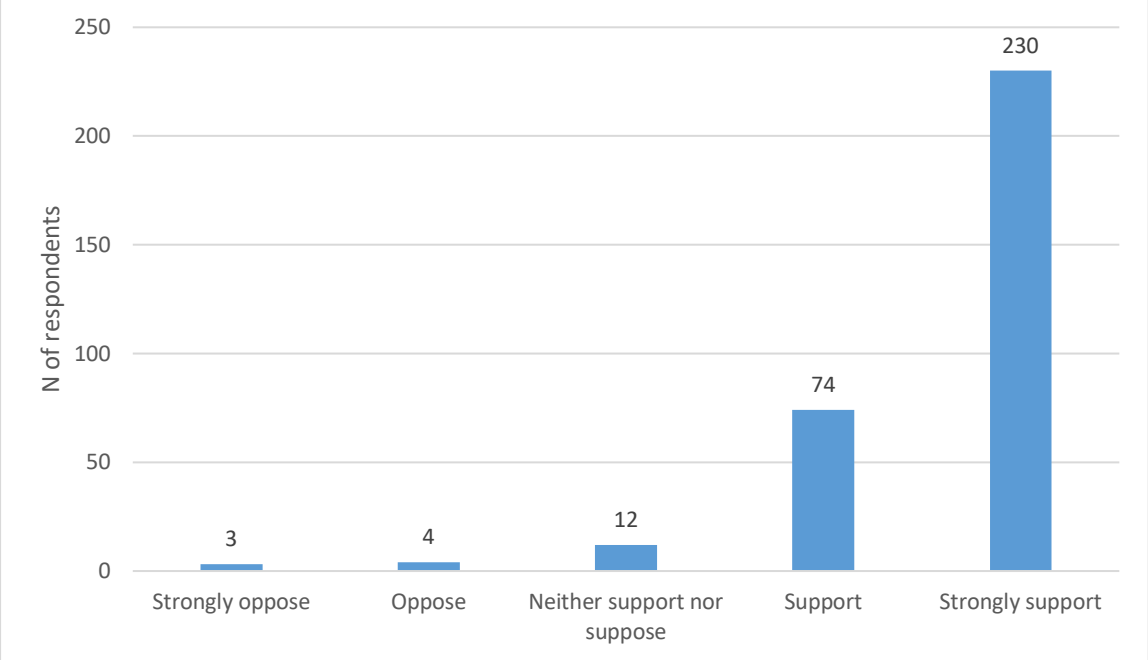
Table 1: Acceptance of energy technologies (5= strongly agree)

Energy	Mean	n	SD
Solar (producing energy from the sun)	4.70	322	0.53
Wind (producing energy from the wind)	4.62	323	0.71
Marine Power (generated from the movement of tides, waves or ocean)	4.37	319	0.87
Hydroelectric Power (energy generated from flowing water)	4.27	319	0.76

Battery Storage (a storage device connected to any source of energy, including solar and hydro)	4.07	324	0.89
Biomass (energy produced from sugar cane, landfill gas, wood, or sorghum crops specifically grown for energy)	4.01	322	0.81
Geothermal (generated from energy stored in the Earth, such as hot, dry rock)	3.81	323	0.99
Fuel Cell Technology (generated from hydrogen)	3.61	329	0.92
Natural Gas (drilling wells into the ground to reach the gas, including coal seam and shale gas)	2.98	322	1.21
Oil (producing energy from oil reserves)	2.72	314	1.19
Coal (i.e., coal-fired power stations)	2.63	323	1.07
Nuclear (i.e., generated from nuclear fission)	2.55	320	1.32

Figure 1 shows the support for wind in more detail, with 230 respondents who strongly support wind, 74 who support wind and 12 who are neutral about wind. These groups are labelled “wind gusters” (n=230), “wind breezers” (n=74) and “wind draggers” (n= 12) based on level of support for wind. Further analysis on this data is presented below.

Figure 1: Support for Wind Energy



Consumers' attitudes towards energy supply sources

Responses in relation to the social, ecological and economic indicators of acceptance are shown in Table 2. Respondents agreed with the statement that 'Queensland's renewable energy sources (solar, wind) should be fully exploited', and that Queensland 'is rich in renewable resources'. Respondents also agreed with statements such as 'it is our responsibility to develop renewable energy for future generations' and 'high levels of energy use will impact future generations'. The majority of respondents believed in human-induced climate change ($\mu = 4.19$). Respondents disagreed with the statement 'there is no link between electricity used in the home and climate change'. ($\mu = 2.43$). In relation to fossil fuels, they were neutral with regard to their environmental impacts and support for the economy, and interestingly they agreed with the statement that 'we are using up supplies of fossil fuels (coal, oil, gas) too fast'.

Table 2: Attitudes towards energy supply sources (5 = strongly agree)

Attitudinal Item	**Mean**	**n**	**SD**
Queensland's renewable energy sources (solar, wind) should be fully exploited	4.33	323	0.95
Queensland is rich in renewable energy sources (e.g. solar, wind)	4.10	320	0.98
It is our responsibility to develop renewable energy for future generations	4.45	323	0.74
High levels of energy use will impact future generations' standard of living	4.27	322	0.85
Human-induced climate change is occurring at some level	4.19	323	0.85
There is no link between electricity used in the home and climate change	2.43	321	1.19
Investment in renewable energy is a means of stimulating economic growth	3.95	318	0.92
We are using up supplies of fossil fuels (i.e. coal, oil, gas) too fast	3.89	321	1.19
Fossil fuels (i.e. coal, gas, oil) should not be avoided because they support the economy	2.74	322	1.14
The environmental impacts associated with coal-fired power stations are often overstated	2.69	323	1.22

Preferences for government investment

The survey harnessed insight into what consumers believe are investment priorities for the government in terms of energy supply. Respondents were asked to rank six different factors (in order of importance) in determining which methods of energy generation should be prioritised. Table 3 displays the proportion of ranked priority for the six investment factors.

Table 3: Consumers' attitudes towards government investment priorities

	1	**2**	**3**	**4**	**5**	**6**
Investment areas	*% (n)*	*% (n)*	*% (n)*	*% (n)*	*% (n)*	*% (n)*
Natural Environment	29.0 (61)	26.7 (56)	17.6 (37)	13.8 (29)	9.5 (20)	3.3 (7)
Climate Change	27.6 (58)	13.3 (28)	15.7 (33)	14.3 (30)	12.4 (26)	16.7 (35)
Human Health & Safety	19.5 (41)	20.0 (42)	23.8 (50)	21.9 (46)	9.5 (20)	5.2 (11)
Cost of Electricity	11.4 (24)	5.2 (11)	12.3 (26)	7.1 (15)	25.7 (54)	38.1 (80)
Pollution	9.5 (20)	27.6 (58)	22.8 (48)	24.3 (51)	9.0 (19)	7.6 (16)
Economy	2.8 (6)	7.1 (15)	8.6 (18)	18.6 (39)	33.8 (71)	29 (61)

Note. 1 = ranked as first preference to 6 = ranked as last preference for government investment.

Respondents' preferences for investment priorities varied greatly. Effects on the natural environment was perceived as more important than other investment areas with 117 respondents ranking this in their top two preferences. Then, helping to prevent climate change and effects on human health and safety were of second-most importance; these factors had relatively equal proportions of respondents across the top four preferences. Level of pollution was of medium importance whereas the cost of electricity to consumers and effects on the economy were the lowest ranked investment priority areas.

Finally, analysis was performed on respondents who displayed varying levels of support for wind energy, and one group in particular, people who were neutral about wind, was of interest. Those who were neutral about wind ('wind dragger') had different priorities from those who strongly supported wind ('wind guster'). The 'wind dragger' ranked human health and climate change first whereas the strong supporters of wind ranked the natural environment and climate change first. Looking at the second ranked factor, human health was ranked alongside the natural environment and pollution as priorities for the 'wind dragger'. Pollution also featured highly as the third ranked factor for this group.

Table 4: Support for wind and attitudes towards government investment priorities

Rank	Support for Wind	Natural Environment	Human Health	Climate Change	Level of Pollution
First	Wind "dragger"	10.0% (1)	30.0% (3)	30.0% (3)	0.0% (0)
	Wind "breezer"	19.5% (8)	22.0% (9)	22.0% (9)	22.0% (9)
	Wind "guster"	31.3% (51)	19.0% (31)	29.4% (48)	7.4% (12)
Second	Wind "dragger"	22.2% (2)	22.2% (2)	0.0% (0)	22.2% (2)
	Wind "breezer"	34.1% (14)	19.5% (8)	12.2% (5)	22.0% (9)
	Wind "guster"	25.3% (41)	19.8% (32)	13.6% (22)	29.6% (48)
Third	Wind "dragger"	0.0% (0)	0.0% (0)	12.5% (1)	50.0% (4)
	Wind "breezer"	17.1% (7)	19.5% (8)	14.6% (6)	12.2% (5)
	Wind "guster"	18.9% (31)	23.8% (39)	15.9% (26)	23.8% (39)

1.10 Discussion and conclusion

Our study demonstrates a high level of social acceptance for wind energy and renewable energy overall. These results confirm previous literature which reports strong support for renewable energy (Devine-Wright, 2007; Dockerty, Appleton & Lovett, 2012; Stoutenborough et al., 2015; Sütterlin & Siegrist, 2017; Truelove, 2012; Warren, Lumsden, O'Dowd & Birnie, 2005). The survey revealed positive attitudes towards renewable energy and recognition of benefits such as supporting the economy, exploiting abundant natural resources, climate change mitigation and providing for the needs of future generations. Other studies also highlight common indicators of acceptance such as climate change concern, perceptions of cost and economic impact (Devine-Wright, 2008; Carr-Cornish et al., 2011; Moula et al., 2013). Contrary to expectations from the academic literature (for example, Marques et al., 2014; McCunney et al., 2014), we find no evidence of the NIMBYISM ('Not In My Back Yard') concept (Pidgeon & Demski, 2012). The overwhelming support for wind energy is not too surprising. Queensland is the largest state in Australia and wind farms, which are few in number, are located in sparsely populated rural areas; hence, proximity to wind farms is not an issue for this sample of predominantly urban respondents. Although the perceived risks associated with the exploitation of renewable energy are relatively low

(Bronfman, Jiménez, Arévalo, & Cifuentes, 2012), there has been considerable discussion in the literature on sources of community opposition to wind farms, such as health risks (Hall et al., 2013). This survey reveals some degree of concern with human health and safety. Our study revealed three groups of wind supporters, the 'wind gusters', 'wind breezers' and 'wind draggers' and analysis suggests that concern about human health and safety distinguishes the strong supporters from those who are neutral about wind. The following section offers recommendations as to how low support for wind farms (albeit in a minority of respondents) and potential health concerns could be addressed.

Social Marketing has a role to play in facilitating an energy transition. Given the contradiction between public support for RE, and the reluctance of the Federal government to support renewable energy development at the expense of coal generation, Social Marketing would appear to have an important role to play in strengthening social acceptance. Hence, investors and other proponents of wind energy need to do more in terms of recognizing emotional barriers to wind energy acceptance and communicating effectively with policy makers, the media and the general public. Muenstermann (2012) argues that it is critical to counter misinformation from the coal lobby, and this could occur through inoculation strategies such as advocated by Cook et al., (2017) at downstream, midstream and upstream levels of society (Gordon, 2013; Luca, Hibbert, & McDonald, 2016). An explanation of these terms is given below:

- *Upstream:* influencing the environment in which behaviour occurs including policy makers, the media, lobby groups and influential organisations
- *Midstream:* working with partners, communities and institutions (for example, schools and other educational agencies)
- *Downstream:* working with specific individuals and groups of individuals (including families, peers and immediate neighbourhoods or communities) (Dibb, 2014; Kamin & Anker, 2014; Russell-Bennett, Wood, & Previte, 2013)

Traditionally, social marketing activity has encompassed a wide range of health-related behaviours, such as smoking cessation, sun safety, genetic screening, and so on. While the focus is on encouraging sustained, positive behavioural change among individuals and groups, social marketing also encompasses environmental factors and major shifts in society, such as encouraging an energy transition. It is now recognized that the role of social marketing goes beyond individual behavioral change (Saunders et al., 2015). Social marketing offers a framework for designing pro-environmental behavioral change programs and is flexible enough to be applied to a range of policy issues (Corner & Randall, 2011). However, it is not a panacea, and the role of legislation and incentives in conjunction with both education and social marketing, must be recognised (Rothschild, 1999; Sheavly & Register, 2007). As noted by Šćepanović et al. (2017), policy makers can help communities achieve positive social outcomes through information-based or rewards-based interventions. Hence, it is argued that the benefits of wind farms, and other forms of renewable energy (i.e., climate change mitigation, low pollution, security of supply, abundance of the natural energy resource, local employment benefits) need to be presented to Australian society to reinforce acceptance. In addition, it is argued that the negative impacts of wind farms (i.e., health and safety, impacts on natural environment) be acknowledged rather than ignored. Social marketing has featured in some debates as a means of "overcoming" opposition and reducing conflict (see, for example, Beben, 2015; Chen et al., 2015; Menegaki, 2012), although some social marketing campaigns could be counterproductive and even strengthen opposition (Corner & Randall, 2011). It is recognized that reliance on the mere provision of information, based on the assumption that a lack of knowledge (i.e. an 'information deficit') is the reason

for any lack of support for wind energy, will not be effective; information provision alone will not change attitudes (Costello et al., 2009; Owens & Driffill, 2008; Semenza et al., 2008). Similar to other researchers in the area of wind energy (Hall, 2014; Hall, Ashworth, & Devine-Wright, 2013; Howard, 2015; Terwel et al., 2014), we recognize that a focus on procedural issues is crucial to social acceptance. These may include community consultation, securing the trust of local residents and using incentives, such as jobs for local residents during the construction and maintenance phase of wind farm development or even some form of local ownership of wind projects (Hvelplund, Østergaard, & Meyer, 2017).

In relation to health, the literature highlights the significance of psychogenic influences on the opposition to wind farms (Cass & Walker, 2009; Walker, Devine-Wright, Hunter, High, & Evans, 2010). Whether or not wind turbines pose a risk to human health is a matter of heated debate and still poses a barrier to acceptance of wind farms; thus, investors, developers and local government need to understand more comprehensively how large-scale wind energy infrastructures could potentially harm constituents' well-being, if not on physical health grounds, but emotionally. As in clinical practice, there is a need for "reassuring, empathetic, and supportive communication" (Colloca & Miller, 2011, p. 602). There is a growing acknowledgment that adopting the principles or benchmarks of social marketing (Andreasen, 1995; National Social Marketing Centre, n.d; French & Russell-Bennett, 2015), particularly when underpinned by theory-driven approaches, can lead to more persuasive messages rather than information-only messages. For instance, adopting a customer orientation, undertaking qualitative and quantitative research, fully understanding people's anxieties about wind energy, maximizing benefits and minimizing costs of a renewable energy transition, segmenting audiences and tailoring messages based on values, knowledge and attitudes and pre-testing communications.

In conclusion, social acceptance of wind energy, and recognition of the need to reduce reliance on coal-fired electricity, is crucial if Australia is to make a sustainable energy transition.

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