THE PERCEIVED VISUAL IMPACTS AND ATTITUDES OF THE GRAHAMSTOWN COMMUNITY TOWARDS THE WAAINEK WIND-FARM

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ABSTRACT

Renewable energy has become an important feature of most modern economies with clean and non-exhaustible sources of power being given a greater significance. Wind energy is one of the favoured renewable, as it is (2013) generally the cheapest and most mature technology available for commercial use. The South African government, as outlined by the department of energy's Integrated Resource Plan (IRP), aims to install 5 GW (Gigawatts) of wind energy by 2020. However, South Africa has had little experience in the wind energy industry which is limited to two projects, Klipheuwel (2002) and Darling (2008). Much effort has been dedicated to calculating balance sheet costs, which carries uncertainty due to the high reliance on country specific and site specific variables. An aspect which deserves more attention, and is often ignored, is the public's attitudes towards local wind farm developments, which have been known to 'make or break' a project during the planning stages.

Public backlashes have mostly been concerned with the visual 'intrusiveness' of wind farms in the landscape. Detrimental effects on scenery, while seemingly innocuous, are acknowledged as being the single largest barrier to successful wind farm development. Individuals within an area become sentimentally attached to their surroundings, where significant rapid changes in the landscape are viewed as 'damage'. Economics recognises such declines in scenic resources as market failures, where an externalised cost is passed on to the public and is often not accounted for by private parties responsible for the liability. The primary objective therefore was to measure the magnitude of the visual impact, caused by the Waainek Wind Farm, on the Grahamstown community.

Conventional NIMBY[1] (not in my back yard) reasoning, which seeks to explain local wind farm resistance, has attracted criticism with regard to its simplistic approach to wind farm problem identification. Contemporary arguments propose that NIMBY is a poor explanation for the trouble experienced on the local level because it groups problems into one all-encompassing term, leaving much of the discontent unexplained. Instead, the NIMBY explanation is really a broad set of unattended problems, largely resulting from the unsound practices present in the public participation process. Insufficient community involvement and disparities in the negotiation power structures have become the recent focus in wind farm literature. Essentially, these disparities force opposition groups to select factors which may

[1] Problem where individuals support the general concept of wind power, but when it comes to local implementation, opposition to the development arises within the same group.

seem more serious to developers, leading to ineffective remedial measures because the core underlying problems are not being remedied. Thus these considerations formed an additional area of investigation.

No NIMBY effect was found for the Grahamstown community, as support for both the local and general level was roughly 80%. The public participation process on the other hand revealed that while many found the practices of the developer to be unfair, attitudes towards the wind farm were not adversely affected, especially for the lower income Grahamstown East areas. While the public participation process in this instance did not have any effect on people's attitudes, careful inspection of the circumstances need to be given. Wind farms are new to South Africa, where the novelty and benefits are the focus of enthusiasm. Job opportunities as well as clean energy are positive drivers for attitudes; however given time, once the anticipation for wind farms dulls, real problems may be revealed. Thus it is crucial to implement good practice procedures during the public participation process, especially when national adoption rates of wind energy are low. Early implementation of an effective public participation process system will ensure that when major problems do arise in future projects, experience and institutional processes would have had ample opportunity to evolve appropriately over a period of time.

The double bounded Contingent Valuation Method was used to value the impact of the wind farm on the Waainek scenery through a hypothetical scenario based procedure which presented pictures of the landscape before and after the wind farm had been installed. Based on the perceived impact of the wind farm, respondents were asked their Willingness to Pay to relocate the development, based solely on visual impacts. Learning design Contingent Valuation (Bateman *et al.,* 2008) is a novel technique employed to familiarize respondents with the hypothetical market institution as well as the scenic goods being valued. Average Willingness to Pay was found to be R67 per month, with a final total monthly negative visual impact of R104,000 to R121,000 per month for the entire Grahamstown community. Grahamstown Central (middle-high income) residents were more likely to pay than Grahamstown East (low-middle income) East residents because of socio-economic differences present in each area. A ranking exercise determined that while negative visual impacts are present, the overall benefits derived from the wind farm are potentially much higher. Additionally, positive scenic improvements were found, but were not measured due to time constraints, and would have worked to reduce the net visual impact of the Waainek Wind Farm.

Acknowledgements

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Contents

Chapter 1: Introduction

1.1 The problem

Global electricity production is dominated by steam based thermal power plants, fired largely by the same finite fossil fuel resources used over a century ago. Coal power is by far the most popular, constituting over 40% of the world's total energy production (World Coal Association, 2011). While electricity and its applications were originally harnessed to make life easier, a somewhat ironic consequence with the long-term operation of fossil fuel power is the creation of harmful outcomes for both the local and global environment (PEW Centre, 2011). As most of the world's energy is produced through the burning of fossil fuels, a consequence has been increased CO_2 levels in the Earth's Atmosphere. CO_2 acts as an incubator by capturing escaping heat energy and re-emitting the same energy back down to the Earth's surface. The continued addition of CO_2 in the atmosphere has caused concern over a continuous general warming of the planet's surface temperature and the subsequent threat posed to society and the environment. The seriousness of the problem has been highlighted by the Stern Review (2006), a report commissioned by the British Government, warning that if nothing is done about the problem a total of 5% of global GDP will may be lost annually, representing a *permanent* loss. Where a broader range of factors are incorporated into the model, up to 20% of global GDP could be at risk (Stern, 2006). While there are alternative thermal plant technologies (nuclear and natural gas) offering relatively cleaner electricity generation, pollution is still a guaranteed by-product (Ewing *et al.*, 1995: 1).

The consequence has been increased international pressure for all countries to implement cleaner methods of producing electricity. The Kyoto Protocol commits developed country signatories to begin reducing CO_2 emissions to a level below their 1990 output (UNFCCC, 2011). Developing countries, on the other hand, are not required to reduce emissions, but are encouraged to begin mitigation procedures (UNFCCC, 2011: 1). Efficiency gains in existing fossil fuel processes are not enough to solve the problem. Instead, the development of an increasingly diversified energy profile which incorporates renewable energy projects is advantageous for two major reasons; firstly, there are no CO_2 emissions during electricity production[2]; secondly, as Winkler (2005: 2) states, "the fundamental reason for using renewable energy is that it is, precisely, renewable". Fossil fuels on the other hand, are finite.

While a variety of renewable technologies exists, few are able to compete on costs grounds with fossil fuel sources. Over the past 20 years however, innovation and improvements in wind turbine design have reduced costs by 90%, aligning more closely with conventional power sources (AWEA, 2005: 1). The South African Department of Energy (DOE) has recognised the cost effectiveness of wind turbine technology, reflected by the Integrated Resource Plan (IRP), which requires that at least 4,500MW of electricity be derived from wind energy by 2019 (DOE, 2010: 18). Foreign companies and investors will be able to participate, thus bringing needed expertise to the country. One such company, Innowind, has proposed to develop a wind farm at Waainek, near Grahamstown in the Eastern Cape (CES, 2010).

Despite the favour wind energy has garnered among developed countries, it is becoming increasingly evident that local communities do not share in the optimism (Woods, 2003; Wolsink, 2007; Ladenburg, 2008; Meyerhoff *et al.*, 2010). As is often the case, the environmental benefits of wind power are well documented and espoused while negative impacts do not draw the same level of attention. This is especially true concerning externalities, such as the visual aspects, which Meyerhoff *et al.*, (2010) argues to be substantial. Externalities occur when the decisions of "individuals, consumers and firms... affect people not directly involved in the transactions" (Helbling, 2010:1). Importantly, the decision outcomes may impact, in some way, on the consumption or production possibilities of non-involved parties.

The visual impacts of wind farms are a significant potential concern for affected communities, especially where scenery is a cherished feature of the landscape. Indeed, Wolsink (2007: 1191) has categorised wind farm aesthetics, siting and the landscape they occupy as the most important factors influencing the local desirability for such developments. The underlying reasoning for examining the localised visual impacts of wind farms relates the need to better understand the significance that scenic considerations have on demand for wind turbines. Cancellations of wind farms as well as several anti-wind farm resistance groups, such as the European Platform Against Windfarms (EPAW), National Wind Watch

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[22] Pollution does occur during the manufacture of the actual turbine structures or when mining the materials and therefore from a life cycle point of view, no form of electricity production can truly be 100% clean. Some sources are however, cleaner than others. i.e. renewable vs fossil.

(NWW), North American Platform Against Windpower (NAPAW) and Views of Scotland (VOS), have underscored the seriousness of the problem facing future wind farm proposals, leading many developers to shift installations to off-shore sites.

Wind turbine tower masts at Waainek may reach 100 meters in height and have a rotor diameter of around 40 meters (CES, 2010a). Thus these machines do often 'tower' above the surrounding landscape; especially in rural or undeveloped areas. This is precisely where the problem of visual impact arises. Wind farm developers continually seek locations with the most ideal wind conditions to minimize costs. However, high wind speed locations often contain areas of both pristine ecological integrity and scenic beauty (Ibenholt, 2002). Construction of large wind towers in such areas would likely have an adverse effect on the visual characteristics of the landscape. Such considerations apply especially to those who do not frequently interact with nature directly and often perceive "nature [as] a purely visual experience" (Woods, 2003: 272; Krohn and Damborg, 1999: 956).

Fundamentally, visual impacts are subjective, as defining what is attractive and what is 'ugly' involves social valuations, resulting in highly variable responses. Generally speaking, most studies do agree that wind turbines are more inclined to have a negative effect on scenery, especially where 'pristine' rural areas are concerned (Woods, 2003; Ladenburg, 2008). The proposed Waainek Wind Farm will therefore be an interesting case study as it borders both urban (Grahamstown) and rural (farmlands, game reserves) areas. As very little work to date has focused on wind farms in South Africa[3], identifying potential problem areas particular to the region and people could furnish decision-makers with vital information during the early stages of wind farm development.

1.2 Structure of the energy sector in South Africa

Market structure

The electricity supply market of South Africa is "vertically integrated", dominated by Eskom, a public corporation (parastatal) which holds the only electricity transmission license (DMEA, 2008). Distribution, on the other hand, is overseen by Eskom, local municipalities

[3] To the best of the author's knowledge, only Menzies (2011) has done work specifically on wind farm externalities in South Africa. Visual impacts were not the focus; instead a broader impact appraisal was conducted.

and other licensed distributors[4]. Eskom's monopoly has ensured that it produces 96% of the country's electricity with the remaining 4% being generated by local municipalities and independent power producers (IPPs). The role of IPP's is limited to the construction and maintenance of privately owned generation facilities, which sell electricity to the utility (Eskom) who transmits the electricity to the where it is needed. Rates at which Eskom buys electricity from IPP's is set by NERSA (discussed a little further on) and is compensated per kWh.

Governance and policy

Governance of the energy sector is essential because modern economies are highly reliant on electricity as a vital input for the production of goods and services (Stern and Kander, 2012). As electricity is also accessed by many different segments of the economy, where various operating conditions exist (competitive markets and natural monopolies), it is essential that its generation is managed carefully (South African Government, 1995). The creation of the Department of Mineral and Energy Affairs (DMEA) in 1980 consolidated the South African government's involvement in the energy sector, where previous energy functions were reassigned from several former disparate departments (South African Government, 1995). The DMEA was tasked with creation and development of government policy pertaining to the energy industry, including the broad management of energy resources (DME, 1998).

Energy policy in South Africa pre-1993 had concentrated on energy security and self-sufficiency, primarily because of the crippling international sanctions faced by the Apartheid government. The victory of the newly democratically elected African National Congress (ANC) in 1994, coupled with the subsequent lifting of international trade embargoes, allowed for a substantial shift in policy towards social and economic objectives (South African Government, 1995; DEAT, 2005). The issuance of The White Paper on Energy Policy by the Department of Minerals and Energy[5] (DME, 1998) in 1998, provides a "formal framework within which the energy sector will operate" with the stated goals of:

- Increasing access to affordable energy services

[4] The difference between transmission and distribution is important here. Transmission refers to the process of moving electricity from the turbines in a power plant to sub-stations located in population areas. Distribution is the conversion of high voltage electricity in the sub-station, down to a usable voltage, where it can then be channelled to residences, businesses etc.

[5] Department of Minerals and Energy (DME), the newly assigned name of the DMEA at the time.

- Improving energy governance: clarification of roles of various governance institutions and consultation with stakeholders
- Stimulating economic growth: creating investor friendly climate and transparency
- Managing energy-related environmental and health impacts
- Pursuing energy supply through diversity

In 2009 the DMEA was split and reorganised into the Department of Energy (DOE) and the Department of Mineral Resources (DMR), allowing the DOE to focus on fulfilling energy related objectives (DOE, 2012). Since 2006, two key pieces of legislation, the National Energy Act (Act No. 34 of 2008) and the Electricity Regulation Act (Act No. 4 of 2006), have been responsible for enabling the future planning and development of the energy sector (DOE, 2012; Eskom, 2013). Environmental concerns have been given a higher degree of importance in the pursuit of economic growth, where externalities have become an explicit concern. Further, the diversification of the energy mix is mandated, explicitly mentioning higher adoption and consumption rates of renewable energy. Within the National Energy Act (Act 34 of 2008) , provision is made for an Integrated Energy Plan (IEP) which concerns the broad management of several key energy sources including oil, natural gas, coal, hydro, nuclear and biomass (DME, 2003). The Integrated Resource Plan (IRP) forms a subset of the IEP, with a specific focus on electricity supply and demand (DOE, 2012).

The energy industry of South Africa is regulated by the National Energy Regulator of South Africa (NERSA) given by the National Regulator Act 2004 (Act No. 40 of 2004), whose mandate encompasses the gas (Gas Act of 2001), petroleum (Petroleum Pipelines Act of 2003) and electricity (Electricity Act of 1987) sectors (NERSA, 2009). Regulation is done in "accordance with government laws, policies, standards and international best practices in support of sustainable development" (NERSA, 2009). Perhaps the most important feature of NERSA, regarding renewable energy, pertains to the unilateral authority it holds in approving tariffs. Price increases by Eskom need to be approved by NERSA before changes are made.

To encourage investment, NERSA will implement a REFIT tariff of R0.938/kWh to buy electricity from renewable suppliers (Chartered Institute of Purchasing and Supply, 2011). IPP's will therefore receive a subsidy, making renewable projects more viable than if left to the market. These subsidies will incentivise rapid and large wind farm installations which, in conjunction with possible negative visual impacts, may potentially incur substantial social costs. The novelty of wind farms in South Africa presents some degree of uncertainty concerning the effect on community attitudes towards developments. However, it cannot be assumed that the visual impacts at Waainek will only be negative. While the aim of this thesis is to value the visual disamenties created by the Waainek Wind Farm, some respondents have found the appearance of wind turbines to be attractive. Ultimately, the end valuation will need to acknowledge the benefits derived from such projects.

1.3 South African wind map and the Eastern Cape

South Africa is estimated to have a wind energy potential ranging 500 MW to a high of 56,000 MW, where the broad range is accounted for by the variation found between studies (Szewczuk and Prinsloo, 2010). The official wind resource atlas (see Figure 1.1) was compiled through the collaboration of the Department of Energy (DOE), Eskom and the Council for Industrial and Scientific Research (CSIR), where data were obtained from two separate research projects. A major problem with the current wind map derives from the inaccuracy of wind data inputs (at source) and an inadequate wind resource database (Szewczuk and Prinsloo, 2010). A further problem relates to the scarcity of information on the atlas, specifically with concerns over the "correct application of WAsP (Wind Atlas Analysis and Application Program)[6] modelling methodology" (EDRC in Hagemann, 2008).

[6] Software used for modelling local wind climates in order to determine the potential electricity production of wind turbines. Wind data is collected from local stations, where specific factors (topography, temperature) can be taken into account when generating wind maps.

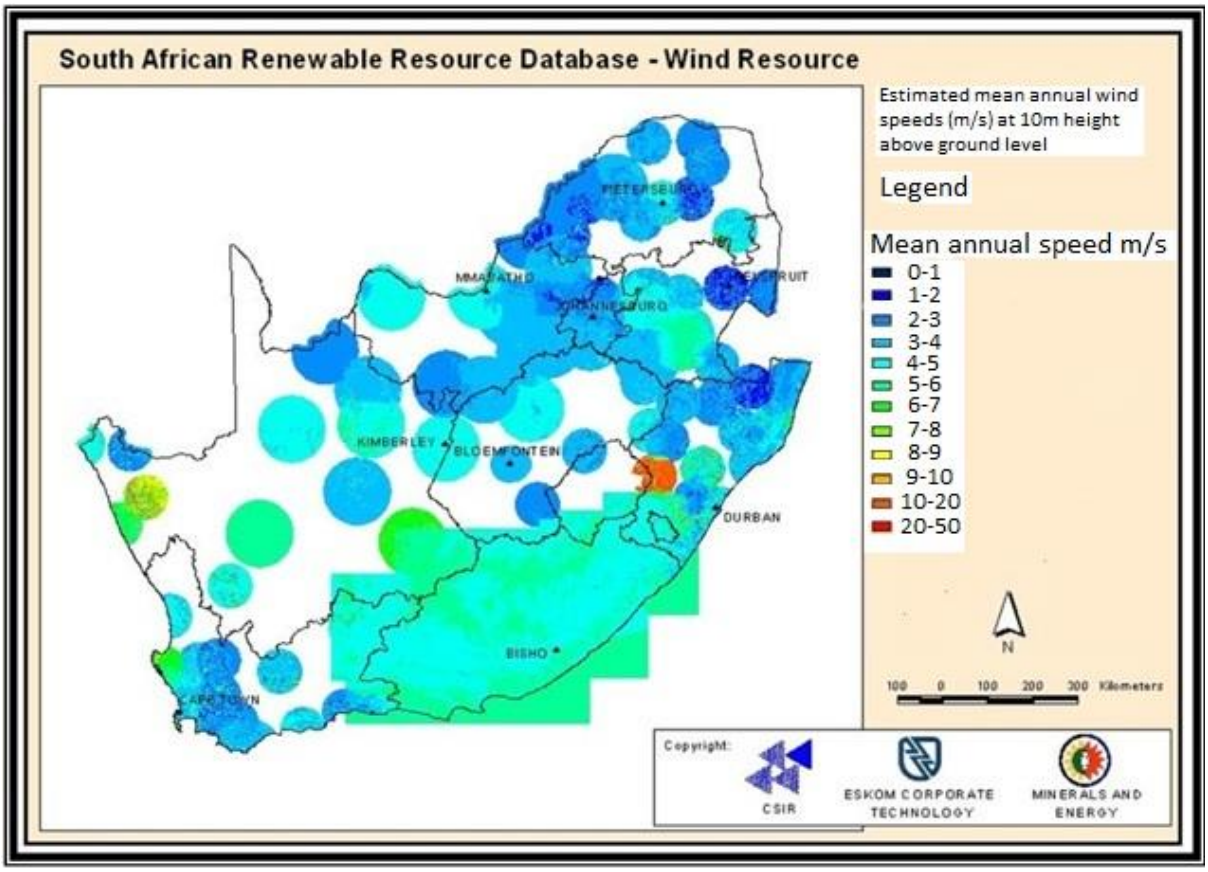

Figure 1.1: Official wind atlas for South Africa generated through a combination of (DOE), Eskom, CSIR and the Danish Co-operation for Environment and Development (now DANIDA). The map displays the different average wind speeds (designated by colours) for each region in South Africa. Note the absence of readings for many inland areas.
[Source: South African Renewable Energy Resource Database (SARERD in Hagemann, 2008)]

In order to improve on earlier wind mapping attempts for the country, Hagemann (2008) produced a mesoscale (scale of intermediate size) wind atlas using an MM5 regional climate model which produced a higher detailed map (Szewczuk and Prinsloo, 2010). The map (Figure 1.2) shows significant wind resources located in the Northern, Western and Eastern Cape Provinces, especially during the winter months. Additionally, Hagemann (2008) notes that the increased winter wind activity corresponds well with the increased electricity demand during the colder time periods. Figure 1.2 maps the average wind speeds for South Africa for the different seasons of the year. Coastal areas are characterised by excellent wind resources, particularly during the colder seasons of the year. Physical constraints were also included in the wind model which specifically considered ease of infrastructure access (road and grid connections).

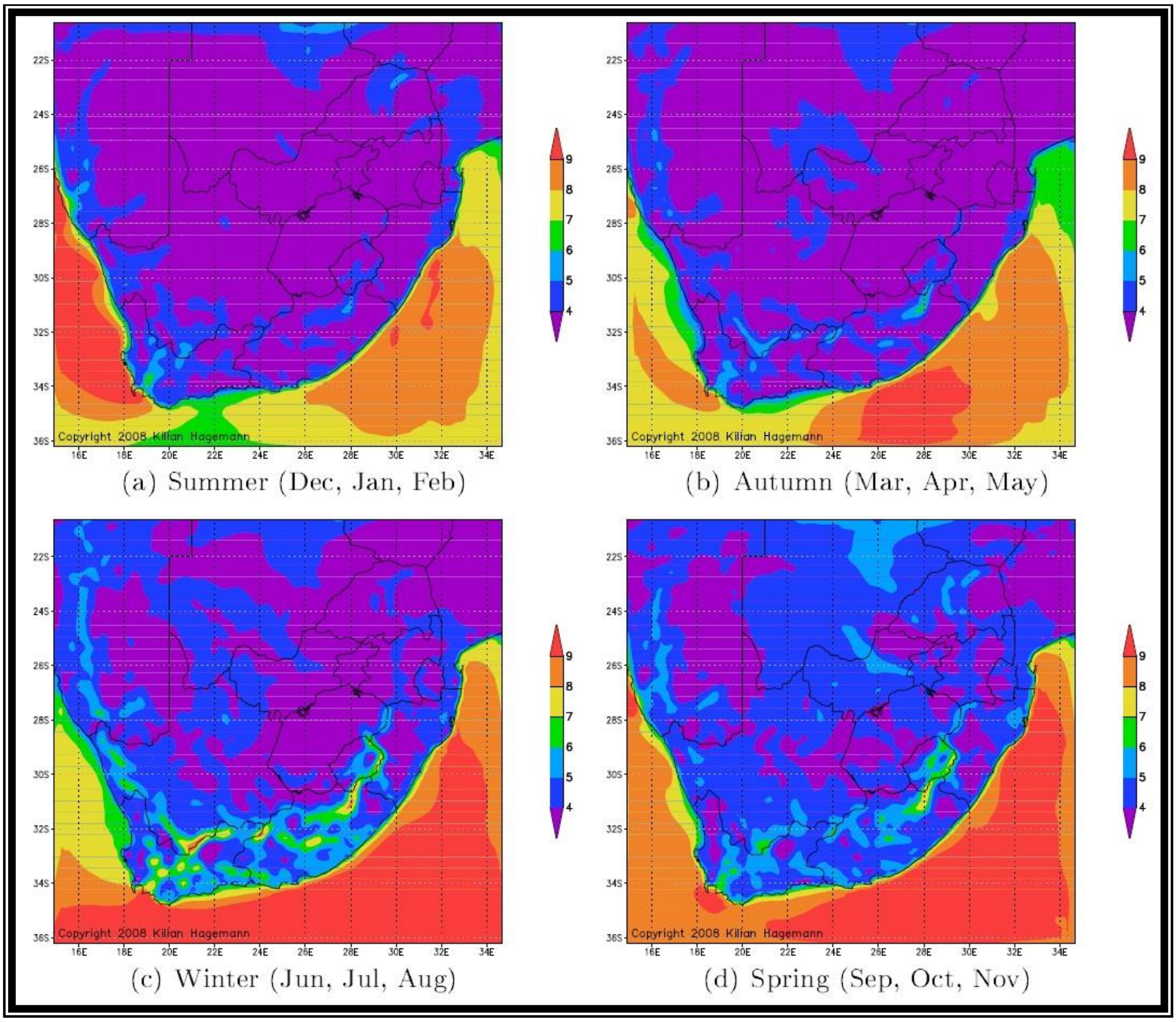

Figure 1.2: Mesoscale wind atlas of South Africa, showing average wind speeds during the different seasons (monthly groupings) of the year.
[Source: Hagemann, 2008]

As evidenced from Figure 1.1 and 1.2, the Eastern Cape offers some of the most promising wind resources in the country. As with much of South Africa, the Eastern Cape is characterised by concentrated areas of highly developed industrial urban centres (Port Elizabeth and East London) while also having widespread rural areas, primarily falling in the former Ciskei and Transkei homelands (ECSECC, 2012). The economy differs structurally from the rest of South Africa, primarily because of the lack of mining activities. While the Eastern Cape holds 13.5% of South Africa's population, the total contribution to GDP was only 7.8% in 2010, indicating the weak state of the provincial economy. Poverty is especially problematic due to intergenerational and structural inequalities that persist from apartheid (traditional homelands), while the HDI index (a measure of human welfare) for the province has fallen from 0.582 in 1995 to 0.513 in 2010 (ECSECC, 2012). Furthermore, the population is characterised by a large number of young job seeking adults, where wind farms have been touted as a possibility for employment creation. Due to the economic status of the province and the limited areas in which construction can proceed, it is imperative that developments are handled with sufficient care.

Grahamstown

Grahamstown is situated in the Eastern Cape province of South Africa, falling within the Makana Municipality (see figure 1.3). The area is also known as 'the frontier country' which takes its name from the early frontier wars between the Xhosas, Afrikaners and British, which lasted over a 100 year period from 1779 to 1881. The presence of crafters and artisans influenced a British architectural style on much of the infrastructure scattered around the city, a good example being the settler's cottages in Artificers' Square. Grahamstown is said to be one of the best preserved Victorian towns outside of England and its architectural appearance is fiercely maintained by a local aesthetics committee. Other notable structures around the city include the Albany Museum complex, the Cory Library for Historical Research, the Eastern Star gallery, History museum, Cathedral of St Michael and St George, International library of African Music, National English Literary Museum, Natural Science Museum, the Observatory Museum, the South African Institute for Aquatic Biodiversity, the 1820 Settlers' Monument and the Provost Prison. Education and the accompanying infrastructure are however, central to the city's current identity. The construction of several schools[7] in the late 1800s and Rhodes University in the early 1900s marked Grahamstown as an educational centre within South Africa.

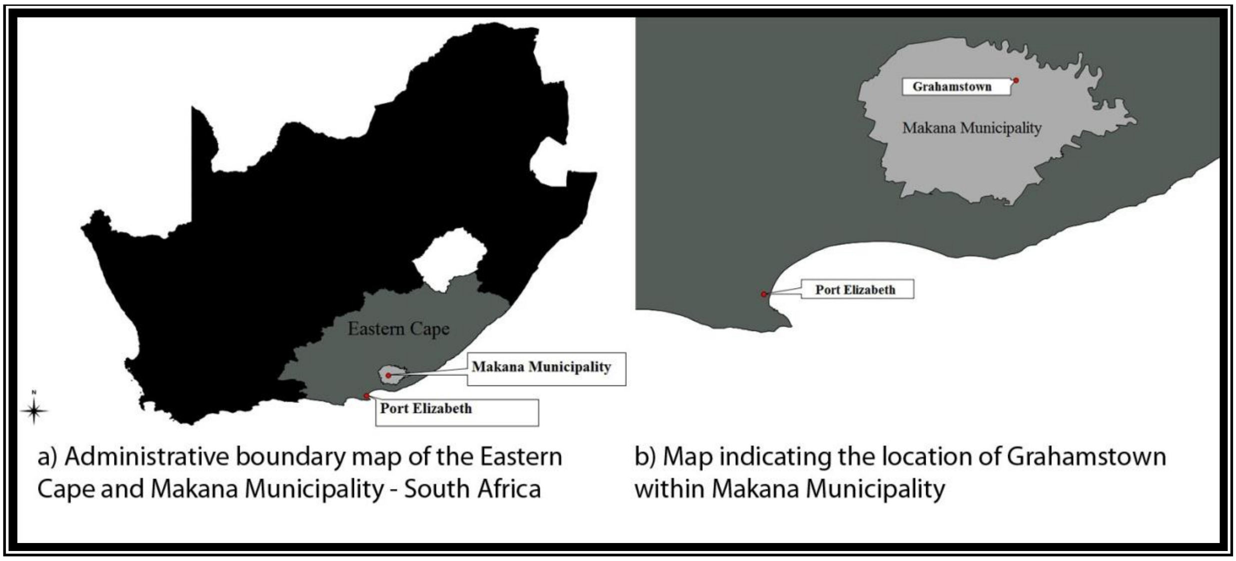

Figure 1.3: Maps showing the location of the Makana Municipality and Grahamstown within Eastern Cape – South Africa

[Source: Mapped using QGIS]

Aside from Grahamstown's historical significance, it is also a cultural hub which celebrates the National Arts Festival annually. The festival has grown to become the largest in South Africa, increasing from 60 events in 1974 to 450 events in 2004 (Snowball and Willis, 2006). During an 11 day period, a large influx of tourists arrive to see the festival with the population of Grahamstown increasing by an average of 50,000 people. It has been estimated that the National Arts Festival brought in R54.3 million in 2005, illustrating its beneficial economic impact on Grahamstown (Bragge, 2010).

The surrounding areas of Grahamstown are both unique and scenic. 'Frontier country' is the meeting place of four different major weather systems, which gives rise to the wide diversity of flora and fauna in the area. Over 300 bird species, 133 reptile species and 97 mammal species make up the diversity of fauna in the area (CES, 2010a). Taking advantage of the high biodiversity, several game parks operate within the area, some of which include Kwandwe, Shamwari, Indwala, Pumba, Kichaka, Kwantu, Fourie Safaris, Rockdale and Thomas Baines. To the south of Grahamstown lies the Toposcope which overlooks Featherstone Kloof, presenting a spectacular view of the Beaumont Valley. The valley also forms the headwaters of the Bloukrans River which is a tributary of the larger Kowie River system (CES, 2010a). Howison's Poort, which is to the south-west of Grahamstown, is a beautiful pass with steep hills and protruding ridges.

Waainek and the exposure of the wind farm on the surrounding area

To the west of Grahamstown lies Waainek[8], the proposed site of the wind farm. The area is largely characterised by livestock farming activities, with much of the land being utilised as grazing. Crops are limited in the area as the top soil is thin (CES, 2010b). An industrial area lies close to Waainek along the Rautenbach Road but hosts only small industrial operations. A number of other small structures occupy the landscape, including houses, a cell phone tower, and Eskom power lines, although these tend to be low in number. The Highlands road, which runs across Waainek, is a scenic route through a topographically diverse area and provides access to farm areas and Jameson Dam which is used for recreational fishing. Members of the community often use the dirt roads near the site for various recreational activities which include cycling, running, off-road motor biking, walking and so on.

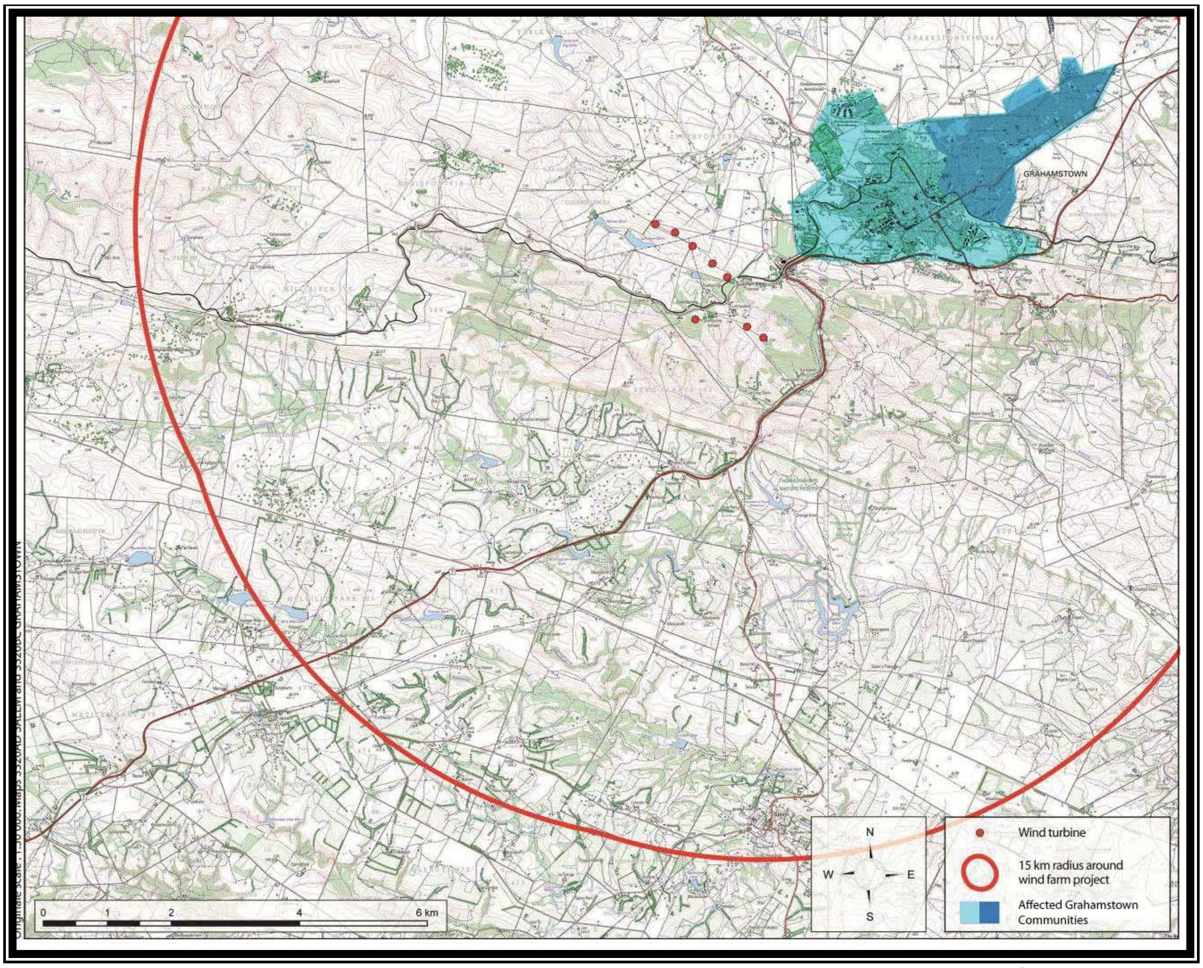

Figure 1.4: Orthographic map depicting Grahamstown and the positions of the proposed wind turbines (red dots) within the Waainek area, along with a 15km turbine visibility buffer zone.

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[8]Afrikaans for 'windy corner'

[Source: adapted from GLES, 2012]

The area is also marked by hilly terrain which derives from the eastern end of the Cape Fold Belt, on top of which the turbines of the wind farm will be situated (CES, 2010). The height of the towers, coupled with the construction of the turbines on the ridges of the hills, will make the wind farm a highly visible feature in the surrounding landscape. The CES environmental impact report (2010b) states that while the wind farm will have some visual impact on the landscape, past farming practices have already ‘damaged’ the original character of the scenery. Vegetation in the area is mainly of the grassy Fynbos type with thicket occurring in richer soils (CES, 2010b). A potential problem arising from having very short endemic vegetation relates to the land’s low visual absorption capacity[9], which refers to the natural landscape features which are able to potentially conceal development (CES, 2010). Turbine machinery will ‘stick out’ as the absence of large natural features, which helps to mitigate some of the visual exposure, are not present at the site.

However, Waainek is not a pristine area by any means, where society has left its mark on the land. Black Wattle and Eucalyptus, vegetation alien to the area, is scattered widely further eroding the ‘natural’ state of the land. Wattle was first introduced into South Africa as a pioneer species in the 19th century when settlements in South Africa required fast growing trees for construction material and fuel wood (Dahl, Jackobsen and Raitzer, 2001). Today, although still largely used as a fuel wood, the Working for Water Programme in South Africa has been tasked with removing wattle as it encroaches on arable land, destroys native flora and presents a threat to water resources (Dahl, Jackobsen and Raitzer, 2001; Department of Environmental Affairs, 2013). Aside from alien vegetation, other interferences are present in the area. The N2 highway which passes nearby to Waainek brings traffic and noise while Rautenbach Road is used by large trucks and smaller vehicles. An old motor-cross dirt track lies vacant in the area with accompanying sand mounds. An open-cast clay mine and landfill are both visible from Waainek, although visually ‘shielded’ from certain angles due to the natural lie of the topography.

[9]ie. topography and vegetation

Impact on Grahamstown and surrounding areas

Aside from Waainek, much of Grahamstown will be within the wind farm's view shed, the visual exposure and impact varying accordingly for different parts of the city. High lying areas[10] will tend to experience a greater degree of visual exposure than lower areas[11] (CES, 2010). As Grahamstown lies in a 'bowl', many parts of the city will be sheltered from the wind farm as the topography will either naturally block the view or housing may face in a different direction from the development. Further 'shielding' by infrastructure and vegetation can be expected. As the closest turbine is located approximately 3kms away from Rhodes University, housing falling to the east of campus may initially experience low visual coverage. However, housing that falls to the east of the topographical 'dip of the bowl', would likely experience an increased probability of exposure due to the slope becoming 'Waainek facing'.

The GIS generated map (Figure 1.5) indicates that most of Grahamstown will be able to see at least some of the wind farm[12]. However, the effects of natural obstructions (topography is considered) are not taken into account for the view-shed and therefore visibility may be significantly less (CES, 2010a). A problem which may cause concern, relates to the perceived incongruency between the modern wind turbine structures and old architecture (discussed earlier) present in the aged portions of town. Strict aesthetic building codes apply to certain parts of town and it is uncertain how residents will react.

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[10]Hill 60, Cradock Heights, Kingswood and Curry Park
[11]Central, Rhodes University Campus, and Oatlands
[12]Red areas should be ignored as these represent exposure from a 12 turbine setup, the proposed wind farm is planned to have eight only.

Figure 1.5: Map depicting specific Grahamstown areas which will be exposed to the Waainek Wind Farm. Note: the areas marked in green correspond to an eight wind turbine configuration, the current proposed project size. Red markings show the extra area exposed to a 12 wind turbine configuration.

[Source: CES, 2010a]

Culturally valuable sites outside of Grahamstown merit mention as these are of special significance to members of the local community. The South African government has recognised the value of such areas and has written legislation to protect heritage sites as well as areas of natural beauty given by the Natural Heritage Resources Act[13] and the Protected Areas Act[14] (Oberholzer, 2005). While visual concerns are implicitly supplied by the Protected Areas Act, a more explicit provision is outlined by the National Environmental Management Act[15] and to a more limited extent, by the Advertising on Roads and Ribbons Act[16] (Oberholzer, 2005). The National Environmental Management Act states that the consideration of visual impacts will need to be included in an EIA if the scenic values are an issue of concern while the Advertising Road and Ribbons Act pertains mainly to road signage

[13]Act No. 25 of 1999
[14](NEMA)(Act 57 of 2003, section 17)
[15](NEMA)(Act No. 107 of 1998)
[16]Act No. 21 of 1940

on public roads. In terms of the wind farm, visual impacts on such areas are potentially high due largely to both structure size and topography.

Several heritage sites and scenic areas will potentially be impacted by the wind farm. This is especially true for the landscape falling in a south westerly direction from Grahamstown better known as Howison's Poort, as current human interference in this area is relatively low. According to the CES (2010) report, heritage sites and the landscape in this area will be susceptible to high exposure mainly due to there being "nothing man-made in the landscape comparable in size and vertical extent to the wind turbines". The most highly exposed areas include the Faraway Natural Heritage site, the Rockdale Game Ranch and home owners living nearby (CES, 2010). Falling outside of the immediacy of Howison's Poort, the Thomas Baines Nature Reserve, the Toposcope and Featherstone Kloof are expected to have varying amounts of exposure depending on where the viewer stands.

For the most part however, there are many heritage sites and protected areas which are favourably located, and may not be affected at all. Indeed, some of the early complaints originated from private game farm owners whose properties do not even hold a view of the proposed development. Concern stems from the potential loss in revenue from international tourists who are argued to dislike the presence of the wind turbines while on game safari (Fox, 2010). Where game farms do not experience any view of the proposed site, there is a fear that by building the initial Waainek Wind Farm in the area, future developers may be encouraged to look for new locations close-by and therefore eventually spoil business. The validity of this argument is difficult to ascertain, but it presents a perceived problem for the people who derive their livelihoods from tourism.

1.4 Aim and method

While the CES (2010a) EIA (Environmental Impact Assessment) report is useful for considering which areas in and around Grahamstown will be *exposed* to the wind farm, it cannot quantify how the exposure will impact on people's welfare. Comments were recorded from one of the public meetings by CES (2010a), however the responses were not comprehensive of the general population's opinion. An additional problem lies with how the potential impacts are freely depicted on the Figure 1.5 map. What cannot be gleaned from the map is the question of whether these impacts are negative, positive or possibly have no real impact at all. Oberholzer (2005) has argued that using only quantitative data, which assesses which areas will be exposed or degree of visibility, is not enough for a comprehensive visual study. Qualitative data, the aesthetic values and sense of place, need to be gathered and analysed to understand which areas require a greater emphasis for protection. A survey based method, as is employed by this study, allows the researcher to capture the community welfare values that are important to the affected parties.

Experience has shown aesthetics to be the major factor responsible for resistance against local level wind farm developments, especially where negative impacts are considered severe. Consequently, while positive visual impacts are possible, budget and time constraints did not allow an in depth investigation into this particularly interesting aspect. The principal interest of the research was therefore to render the perceived negative future visual impacts of the Waainek Wind Farm on the Grahamstown community, into more accessible monetary terms. Monetary values in turn are based on actual or potential changes in personal welfare and therefore are a reflection of preferences for the good in question (Carson and Hanemann, 2005).

Valuing public goods presents a challenge as markets for many of the goods and services are non-existent (Hanneman, 1994: 1). Two main approaches used for public good valuation are split into revealed preference techniques and stated preference techniques (Ladenburg, 2007). Revealed preference techniques rely on market data while stated preferences tend to depend on hypothetical scenarios (Ladenburg, 2007). As the Waainek Wind Farm has not been constructed yet, revealed preference techniques cannot be used as a valuation method. Additionally, due to the nature of the good, no established market exists in which to ‘observe’ the behaviour of consumers buying and selling scenery. The only viable method for valuation in this situation was the use of a stated preferences technique. A controversial[17] yet popular procedure often employed in such cases is the Contingent Valuation Method (Ladenburg, 2007).

Contingent valuation is used to ‘create’ a market for a good, which does not at that time exist. The “contingent” component refers to the hypothetical scenario used to solicit Willingness to Pay (WTP) from respondents, especially because obtained values rely strongly on the details of the “constructed market” (Carson and Hanemann, 2005: 822). Normally, the scenario

[17] See Chapter 3 detailing some of the problems with the Contingent Valuation method.

describes policy measures to either preserve or change the status quo of a good. Respondents would then either openly state their WTP, or agree to some amount supplied by the interviewer through a bidding process[18]. In terms of the current study, the individual WTP values would then be used together to estimate the community's WTP to relocate the Waainek Wind Farm considering aesthetics only.

Several adaptations of Contingent Valuation (CV) are available for use to determine social values an overview of which is presented in the "Elicitation Techniques" section. The National Oceanic and Atmospheric Administration (NOAA, 1993) panel have strongly suggested dichotomous choice as the most reliable and accurate form of CV, where participants are offered a bid amount and simply have to state 'yes' or 'no'. A follow-up bid was introduced on the recommendation of Hanemann, Loomis and Kanninen (1991), who demonstrated the substantial gain in statistical efficiency (assists with small sample size). An experimental approach applied by Bateman *et al.* (2008), termed the learning design Contingent Valuation (LDCV), is applied as an enhancement to the original procedure. LDCV simply postulates that by allowing a respondent to repeatedly value similar unfamiliar goods in a hypothetical market, experience and therefore stable preference formation will be achieved. Through a learning process, respondents will eventually supply valuations which are more accurate and consistent through increased confidence regarding the amount they are truly willing to pay (WTP).

Aside from calculating Willingness to Pay, the differences between demographic groups and their respective reactions towards the visual impacts of the wind farm will be observed. Community attitudes concerning wind farms both on a local and more abstract level will be tested for the often discussed "Not In My Back Yard" (NIMBY) effect, which describes a form of locally undesirable land use (Dubgaard and Ladenburg, 2007; Krohn and Damborg, 1999; Eltham, *et al.*, 2008; Ladenburg, 2008). NIMBY has recently been discredited because of its narrow explanatory power in what can essentially be attributed to a complex collection of problems (Wolsink, 2000; Kempton, Firestone, Lilley, Rouleau and Whitaker, 2005; Ek, 2005; Warren *et al.*, 2005; Wolsink, 2007; Ladenburg, 2008; Swofford and Slattery, 2010). One idea which has gained recent momentum relates to the way communities are consulted and directly involved in local wind farm developments. Top-down decision making approaches have been recognised as producing patterns of opposition common in countries

[18] A detailed treatment of the Contingent Valuation Method is provided in Chapter 3.

where high wind turbine instalment rates have taken place (Ek, 2005; Gross, 2007; Loring, 2007; Wolsink, 2007; Rod, 2011; Wright, 2012). A question of central importance was whether this same issue presented itself in the Grahamstown community. Closer inspection and identification of individual problem areas was necessary to draw-out and remove bundled negative attitudes which may be confused as being visual in nature.

Ranking exercises are employed as a further identification tool to separate out areas of potential problems as well as those which provide benefits. Three 'importance' levels allowed respondents an opportunity to show detailed rankings and a basic perspective or scale of each specific issue. The nearness of turbines has sometimes been found to produce negative reactions by residents in developing countries, although the evidence is conflicted (Warren *et al.*, 2005; Lothian, 2008; Sims, Dent and Oskrochi, 2008; Hull and Bishop (in Lothian, 2008); Swofford and Slattery, 2010; Warren and McFayden, 2010). Instead, context appears to be the primary influence on whether the 'proximity effect' is felt at all, which is why it is necessary to determine the perceptions of the Grahamstown population (Graham, Stephenson and Smith, 2009). A proximity analysis is performed to assess how distance to wind turbines, from households, affect attitudes of residents.

Visual response dynamics will be analysed based on how reactions change when payment is required and when the same measures on offer are for free. The technique uses two similar scenarios, which employs a hypothetical Waainek Wind Farm relocation scheme. The participant's decision to relocate the wind farm will formally be based on aesthetic determinants, where visual impacts are accounted for by demographic criteria previously identified through landscape and wind farm literature (Aoki, 1999; Landenburg and Dubgaard, 2007). The response (a binary yes/no answer) will simply test which demographic characteristics are most likely to trigger a 'yes' reply to relocating a wind farm based on aesthetic concerns. As South Africa is a developing country with one of the highest income inequalities, findings would provide an interesting case to be contrasted with studies commonly based in wealthier developed nations. The scenario question, which requires payment, serves a double purpose as it is also responsible for the derivation of Willingness to Pay data (Lopez-Feldman, 2012). These figures will then be subjected to sensitivity analysis which will 'stress' estimates under different assumptions, providing a blanket of error.

Essentially, the research focuses on the values of the Grahamstown community to judge the extent of visual impacts. Appreciation of scenery is a unique experience to each individual, making it necessary to involve a diverse cross-section of the population (Lothian, 1999). Demographics include low-income and middle-income township residents as well as middle-income to high-income suburban households to obtain a representative sample of town experiences. A series of comparisons between the two population groups will be undertaken to analyse if significant differences in attitudes are present. Where divergences in opinions are observed, procedures for dealing with community resistance may require specific tailoring in order for effective management.

1.5 The layout of the study

Aesthetics is a complex subject, where philosophers have dedicated considerable time in trying to describe the nature of beauty (Lothian, 1999). Discussions involving aesthetics have naturally found favour with those in the field of landscape and land-use management. Chapter 2 sets out modern landscape philosophies, in order to provide a context for the suitability of incorporating both economic and landscape theory. A review of the various factors which significantly affect attitudes towards wind farms are examined because of their usefulness for indicating the potential magnitude of visual impacts of wind turbines. The economic foundation of the study is laid down in the subsequent section, classifying the open access nature of scenery into the troublesome sphere of public goods, which are prone to market failure. Pigouvian taxation and Coase’s (1960) specification of property rights are two different approaches of social cost theory discussed as measures to deal with the eventual externalities arising from such public goods.

As the study aims to capture *ex-ante* values (CVM) based on perceived impacts, measurements on the extent of the damages are adopted in order to provide estimates which could be used in a Cost Benefit Analysis. The Contingent Valuation Method is subsequently introduced (Chapter 3) as the proposed procedural method used in the appraisal of the scenic good. The methodological specifications and pitfalls are highlighted and then ‘placed’ within the broader Contingent Valuation Method family, which is compirsed of several related sub-group practices. The data collection process is then detailed, specifically on how the survey was administered and the design features incorporated into the questionnaire; very crucial to collecting accurate Willingness to Pay (WTP) values.

Chapter 4 provides a summary of collected demographic data in terms of broad (entire sample) and split locality based categorisations. An investigation into the public participation process then proceeds, especially vital for community relations as it provides a platform from which members can express differences in concerns and opinion. If not handled correctly, it is possible that pseudo concerns will hamper and stall wind farm projects, primarily because the misidentification of the core problems does not lead to meaningful solutions. The most significant visual factors affecting how Grahamstown residents respond to the installation of the Waainek Wind Farm are then examined. Insights into people's motivations for wind farm visual attitudes are imperative for the consideration of future projects taking place within South Africa as it provides data on developmental barriers. An understanding of the problems would lead to better solution formulation.

Willingness to Pay is estimated for the Waainek area in Chapter 5 and subsequently tested for validity. Once the base case has been determined, sensitivity analysis provides a margin of error through the adjustment of various model assumptions. Several possible cases are produced and encompass a range in which monetary visual impacts could fall. The total Willingness to Pay, which is calculated using average willingness to pay, forms the monetary basis for a Cost Benefit Analysis if implementation is necessary.

Chapter 2: Literature Review

2.1 Visual ambiguity: defining aesthetic beauty of landscapes

Defining what is visually appealing is a difficult task. The curious individual need only examine the history, stretching over the course of centuries, and evolution of the argument to appreciate its complexity. The debate has roots in classical[19], modern[20]and contemporary philosophy of aesthetics (Lothian, 1999). While it is not the objective to provide a detailed review of these philosophies[21], contemporary thought will be highlighted instead. These approaches provide both an interesting and useful way of explaining the processes influencing the individual's visual valuation of landscape, further accommodating an understanding of the aesthetic impacts of wind farms.

Essentially, paradigms of the visual landscape can be split into two approaches namely; objectivist and subjectivist (Lothian, 1999: 178). Objectivist paradigms seek to explain the "quality of the landscape [as being] an intrinsic attribute of the physical landscape" (Lothian, 1999: 178; Dramstad, Sundli Tveit, Fjellstad and Fry, 2006: 466). Ecological aesthetics, a school falling within the objectivist paradigm, holds that 'scenic aesthetics' are superficial as they are based on socio-cultural perceptions, while maintaining that "landscape aesthetics and environmental ethics are intertwined" (Parsons and Daniel, 2002: 44). Instead, 'environmental aesthetics' should be strived for, arguing that "a thing is right when it tends to preserve the integrity, stability and beauty of the biotic community" (Leopold, 1949). Stated differently, the health of an ecosystem should be the measure of landscape appeal, not simply scenic values. A more conventional and commonly employed form of objectivist theory identifies visible features in the landscape as holding a universal value for all people, regardless of culture and background. Thus it is possible to extend pre-determined criteria to any landscape as beauty lies in the "physical scene" which falls in "front of one's eyes" (Lothian, 1999: 178).

The subjectivist approach is a relatively more recent paradigm, developed through the influence of Descartes' work and with the introduction of psychology (Lothian, 1999: 181-

[19] ancient Greek, Christian, Renaissance
[20] British, German, Romanticism
[21] see Lothian (1999) for an excellent review

183). At its core, visual quality is judged through an individual's experience of the landscape, differing from person to person (Tveit, Ode and Fry, 2006: 230). Although many different landscape theories exist, Tveit *et al.* (2006: 231) identified two major branches being evolutionary and cultural preference theories. Evolutionary theories assert that visual quality is influenced strongly by an innate human drive for survival (Dramstad*et al.*, 2006: 466). The presence of certain features in the landscape[22] would facilitate survival and therefore "landscape preferences reflect landscape qualities satisfying human biological needs" (Tveit *et al.*, 2006: 231; Parsons and Daniel, 2002: 44).

Several studies[23] have found evidence supporting evolutionary theory. For example, Yang and Kaplan (1990) found that Korean and Western groups classify environments similarly to one another, "and prefer the same landscape style and elements" (Yang and Brown, 1992; Parsons and Daniel, 2002: 47). In order to remove potential cultural influences, Balling and Falk (1982) did a landscape comparison between US children[24] and older generations[25]. Photos of several different landscape scenes were shown to the respondents and the reactions were recorded. Results show that children of ages 8 and 11 highly favour savannah landscapes while the older participants also enjoyed savannah along with other 'familiar landscapes', including deciduous and coniferous forests (Balling and Falk, 1982; Parsons and Daniel, 2002: 47). Savannah was thought to be favoured because of its relative openness[26] which would facilitate survival.

The underlying principle of the evolutionary argument is that all humans share a common ancestral path; the implication suggesting that *some* preferences for landscape should also consequently be regarded as being roughly universal. A great deal of research[27] has found significant evidence confirming this contention. Following from this line of thought, evolutionary theories seem to implicitly adopt an objectivist framework, given that people rely on the same set of visual stimuli to judge scenery. Lothian (1999: 193) argues otherwise, instead stating that the "survival enhancing aspects of landscape quality are a perceived quality of the landscape, not an inherent quality". Lothian (1999, 193) further argues that "it

[22] water, food, shelter and protection from predation
[23] see Balling and Falk, 1982; Kwok, 1979; Küller, 1972; Yang and Kaplan, 1990; Yang and Brown, 1992; Yu, 1995
[24] comprising ages of 8, 11 and 12 year olds
[25] students, adults and senior citizens
[26] short grass and dispersed acacia trees allow for easy predator spotting as well as refuge
[27] see Balling and Falk, 1982; Kwok, 1979; Yang and Kaplan, 1990; Yang and Brown, 1992; Yu, 1995

is the interpretation which humans place upon what is viewed in the landscape which ensures their survival, if they perceive wrongly, then their survival may be threatened". For this reason, evolutionary theory is grounded firmly on the subjectivist paradigm in order to function; however where divergences in perceived landscape quality persist, a more clear subjectivist explanation becomes necessary.

Fundamentally, evolutionary theory seeks to explain commonalities in landscape valuation while cultural preference theory tries to account for the differences, relying on socio-cultural factors (Tveit *et al*., 2006: 231). While preferences are partly determined through innate biological endowments[28], learned behaviour also aids in shaping our perceptions through influences such as culture, education and experience (Maulan, Shariff and Miller, 2006: 27). As these determinants contain inherent differences between social groups, so preferences are moulded accordingly. A study by Kaplan and Kaplan (1989) found that preferences differed significantly between wild and managed landscapes when analysing different social groups. However, when cultures demonstrate similarities to one another, landscape preferences also tend to follow common patterns, more so than between dissimilar groups (Parsons and Daniel, 2006: 47). Thus, asymmetries in landscape appeal are essentially brought about through different interpretations within each socio-cultural group. Interestingly, there has been a recent development which seeks to integrate both evolutionary theories and cultural preference theories.

Lothian (1999: 194) has suggested that the objectivist and subjectivist paradigms cannot both be correct. Instead, Lothian (1999) and Daniel (2001) argue in favour of the subjectivist paradigm as becoming a "basis for a broad theory of landscape aesthetics" (Maulan, Shariff and Miller, 2006: 29). The call for one ultimate paradigm is not unfounded, especially when considering the criticisms of each approach. Although the objectivist research tends to be cheaper and simpler to administer, it usually relies on a single visual expert or 'connoisseur' to carry out the analysis (Tveit *et al*., 2006: 232). A survey of the landscape is done according to 'objective' measures, but fails to acknowledge the subjective bias applied by the individual undertaking the study (Lothian, 1999: 194). Highlighting this problem is the lack of agreement between so called 'aesthetic experts', creating a lack of replicability in results, and thus findings are subsequently indefensible in a judicial appeal (Tveit *et al.*, 2006: 232;

[28] evolutionary

Lothian, 1999: 194). Clearly, if inconsistencies are found in the results, given that the same landscape is being valued, there will be no reliable basis for decisions to be made effectively.

The subjectivist approach, on the other hand, is not plagued by the problems inherent in the objectivist methodology. Instead of surveying the landscape directly, the practitioner is required to receive valuations from multiple users, thus reflecting community preferences (Maulan, Shariff and Miller, 2006: 30). Some advantages include: the study can be defended politically, results provide a reasonably permanent assessment of landscape quality, and findings are defensible in a court of appeal (Lothian, 1999: 193). Additionally, statistical analysis can be applied to preference content, allowing for error estimation, a weak area in objectivist methodologies (Lothian, 1999: 194). The main disadvantage of the subjectivist paradigm however, is related to the requirements of the studies; several researchers with specialised knowledge may be needed, while inputs from participants are required, making it relatively more expensive than the objectivist approach (Maulan, Shariff and Miller, 2006: 30).

Despite these minor complications, the subjectivist paradigm seems to be more robust and useful for analysing the visual landscape. Understanding what makes a landscape attractive is not some objective[29] intrinsic value, but instead a "construct of the mind and of feeling" (Tuan, 1979: 89). Such constructs understandably vary between different social and cultural groups. Equally, perceptions within these groups are not static over time, especially when considering the role of exogenous influences (Nassauer, 1995; Nohl, 2001). Thus, what we currently classify as being a 'natural' or 'traditional' landscape may have been differently identified in the past, corresponding to an adjustment in preferences. Since the 19th century for example, traditional American landscape values changed largely due to the "portrayal of wilderness in literature and art, the emergence of tourism and the political advocacy that followed" (Nassauer, 1995: 234). Similarly, in 17th Century England, property owners began viewing land in a "more rational and economic cultivation of the land", whereby large scale deforestation facilitated development of the English landscape gardens (Nohl, 2001: 229).

Tuan (1979: 90) argues that a landscape is more complex than purely aesthetic considerations

[29] This is not to discredit objective measures completely. Objectivist methodologies may emphasize the functional aspect of ecosystems, rather than just being concerned with appearance. However, where EIAs are concerned, these environmental considerations are taken into account. Where aesthetics and visual impacts are concerned, subjective paradigms provide a suitable measure.

and is instead an “ordering of reality from different angles”, separating these ‘angles’ into two distinct groups: side view and vertical view. The side view is “personal, moral and aesthetic”, dealing with the emotions felt by individuals experiencing a landscape ‘first-hand’ (Tuan, 1979: 90). The vertical view is more objective and calculating, viewing the land in terms of a system, whether it is economically, environmentally or topographically. The combination of the side view and vertical view creates the “essential character of landscape” (Tuan, 1979: 90). In other words, when people view an appealing feature in a landscape, such as a rural farm setting, positive aesthetic feelings could be partly triggered by an understanding of how the farm integrates into a greater economic system. Food security, income and a simple way of life associated with the farm, may trigger positive feelings, and thus affect landscape preferences.

In the same way, a landscape may be perceived as ‘natural’ when certain elements of wilderness, such as mountains, vegetation, animals and river systems, are combined within an area (Woods, 2003). The presence of these different features could be interpreted as being necessary for the existence of a healthy and natural ecosystem and therefore, associated with a ‘pristine’ landscape. However, a divide exists between a truly natural area and one that is perceived natural (Ode, Fry, Tveit, Messager and Miller, 2009). Research by Purcell and Lamb (1998) suggests that vegetation is a significant factor in determining visual preferences, especially where perceived, rather than actual, naturalness is considered. Ode, *et al.* (2009) demonstrated that people identify continuous vegetation with unscathed landscapes, rather than growth occurring in clumps, remaining true regardless of cultural background. This phenomenon however, is not confined to ecological laymen; divides endure for those with a high level of understanding on ecosystems. Natural processes are frequently complex and therefore, amendments to “scientific truths” is constant (Ode *et al.*, 2009: 381).

Where a higher degree of human interference is present, landscapes are often sentimentalised by community members *because* features lend themselves to a region’s identity and cultural heritage. A landscape then becomes an area which holds a perceived character based on the “action and interaction of natural and/or human factors” (Council of Europe, 2000) reinforcing powerful ideas that the notion of the “home of a community” relies, to a large extent, on the surrounding scenery (Pedroli, 2000 in Antrop, 2006: 188). In Britain, where much of the populace is urbanised, there is a national “longing” for the ‘countryside’ and rural life (Short, 2002: 49). These desires are reinforced by what Short (2002: 48) refers to as "chocolate box images", the reproduction of attractive countryside depictions on sweet boxes and other mediums which serve as a mental guide in defining 'beautiful landscapes'.

Cultural ideas about landscape beauty become so firmly entrenched through these constant reminders, that alterations to the landscape which do not abide to these fixed images are regarded with disdain and rejected. Therefore, visual aspects of landscapes, although serving no productive use, are a special form of resource, which is highly valued by individuals, society and the economy of a region (Oberholzer, 2005). Further, "this resource may have a scarcity value, can be easily degraded and is usually not replaceable" (Oberhozer, 2005: 2).

Nohl (2001), who broadly agrees with Tuan's (1979) description of landscape, believes that the traditional cultural landscape of 20th century Germany, and indeed many others, encompassed a rich variety of elements, contributing to a "structured wholeness" which has been degraded over time. Features tended to be smaller and perceived to be highly integrated while the contemporary modern landscape has become 'simplistic', 'monotonous' and divided, as the "separation of functions [has] ensured that the original comprehensive character of landscape was lost" (Nohl, 2001: 224). Schwann (in Brittan, 2001: 176) shares a similar sentiment, stating that "the inflation of standardized elements like high tension masts and wind generators... contributes to the landscape standardization caused by industrial agriculture". Simply expressed, Nohl (2001) is concerned that due to increased societal needs, today's landscape is characterised by activities responsible for isolating functions and therefore, features, which historically used to integrate well. The result is a bland landscape which lacks its original character and appeal.

The perception is that wind turbines will transform natural areas, and indeed cultural areas, into "landscapes of power" and contrast with surroundings negatively (Pasqualetti *et al.*,in Warren, Lumsden, O'Dowd and Birnie, 2005: 854). Therefore, the degree or significance which developments contrast and change the existing landscape forms another key consideration. Stamps (1997: 205) defines significance as "an impact large enough to require consideration and possible mitigation". More accurately, any alteration that constitutes a noticeable loss of unity in the landscape would be deemed significant. Visual aesthetics are characterized by several factors namely: order, pattern, balance and scale (Brittan, 2001). Wind farm developments tend to be out of scale with their surroundings, particularly when constructed in undeveloped rural areas (Brittan, 2001: 171; Nohl, 2001: 225). Additionally, some feel that wind turbines take on an 'industrial' appearance and thus 'clash' with the surrounding landscape (Brittan, 2001; Nohl, 2001). The combination of high rates of installation and their perceived incongruency with the surrounding landscape form the basis for current wind farm contention.

Not all are negative towards the changing and modernisation of landscapes. Woods (2003: 280) disputes Nohl's (2001) reasoning by noting that some landscapes seem to be cherished for their "absence of features rather than the presence of them". Landscape changes towards a more simplified vista may eventually be welcomed. Further, as Nohl (2001) admits, the loss of some features may duly be replaced by others. Hewison (in Short, 2002: 48) argues that "landscape is a concept, a mythical place, where expectations have been set by history, through culture and art"; a stagnant blueprint in which land-use should conform. In reality, landforms are dynamic, constantly varying through natural processes and manipulation by anthropogenic forces. The only part of the landscape which remains relatively stuck is what people think landscapes ought to look like (Short, 2002).

Perhaps, a key point to make is that landscape preferences *are* in fact subject to change, often in tandem with shifting land-use practices (Dramstad and Fjellstad, 2011). However, modern society's ability to make alterations to the landscape has increased steadily with time, the contemporary rapidity of which has led many to feel threatened (Dramstad and Fjellstad, 2011). Essentially, cultural adaption to land-use is relatively sluggish when compared to current changes in landscape, thus creating a psychological divide between traditional and modern landscape (Antrop, 2006).mCrucially, these 'divides' are instrumental in the creation of tension between developers and the affected community. In order to mitigate resistance, preferences need to be solicited from the community in question. This sentiment is shared by several authors (Dramstad *et al.*, 2006; Maulan, Shariff and Miller, 2006; Lothian, 1999) highlighting the support for subjectivist methodologies.

As changes in landscape are a certainty the only recourse on offer is, where possible, to dampen the negative impacts. A single visual specialist following a list of guidelines, determined arbitrarily, would find it difficult to appease local opponents. This is especially true in cases where the expert hails from an outside area and may not be sensitive to local community concerns. Consultation with community stakeholders therefore, cannot be overlooked when drastic changes to the land are being proposed. Community preferences assist in landscape valuation as they capture the "diversity, coherence and identity of existing landscapes, which are considered… heritage values" (Antrop, 2005 in Antrop, 2006: 188). Crucially, where the visual damage is unavoidable, it is imperative to analyse the extent of the impact as comparisons could be drawn between different siting options. Economics has a vital role to play in such valuations, as damages are specified in a monetary value, a figure which can be simply understood by many and inputted into cost models when analysing projects.

2.2 Wind Farms: an eye sore or elegant?

Renewable energy is pursued primarily with the aim of generating power from sustainable sources as well as mitigating the negative environmental effects of conventional fossil fuel plants (Warren, Lumsden, O'Dowd and Birnie, 2005). Wind power is just one of many available renewable technologies, which has gained widespread popularity with Governments pursuing clean energy policy. While wind turbines are considered to have a relatively small environmental impact, resistance by some communities [30] have been known to stop developments at the planning stages (Ek, 2005; Toke, Breukers and Wolsink, 2008; BCCRWE, 2011; The Electricity Forum, 2011; Point to Point PEC Foundation, 2011). Others have welcomed the installation of wind turbines, creating a scenario where proponents and opponents are roughly equally split (Warren and McFayden, 2010). The current section therefore aims to highlight and explain the controversial points surrounding wind farms.

Factors influencing the appeal of wind turbines

By far the largest contributor to ill feeling, as argued by Brittan (2001: 169), "is aesthetic in character". Brittan (2001: 170) reveals that opponents perceive wind farms as "mechanised weeds", reasoning that "contemporary windmills… do not conform to a deeply entrenched landscape aesthetic, to a particular conception of scenery". Thus, wind turbines are identified as being visually incongruent with their surrounding landscape. This problem is exacerbated in regions where the environment may be relatively 'unscathed' by development. In the case

[30] Saint-Valentin, Brown County, Fredericksburg

of Cefn Croes[31] in Wales, many residents perceived that a proposed wind farm would disfigure, ruin, cruelly desecrate and abuse the 'natural beauty' of the landscape (Woods, 2003). Scotland has experienced similar concerns, as it contains a relatively higher level of wild landscape than other parts of the UK and therefore holds high scenic values (Warren and McFayden, 2010).

Natural landscapes hold a special significance to society, not only due to their rural untouched character, but also because they are seen as a "purer, nobler and more treasured space than the city" (Woods, 2003: 272). Economic considerations drive wind farm developers to continually seek locations with ideal wind conditions to minimize costs. Ironically, high wind quality is often located in areas of both pristine ecological integrity and scenic beauty (Ibenholt, 2002, Warren and McFayden, 2010). Widespread installations of wind turbines in these areas tend to disrupt and alter established values and thus create tension between developers and communities. As a result, grass root resistance groups[32], especially in England/Wales and Denmark, have become highly influential in determining wind project outcomes (Toke *et al.*, 2008).

Lothian (2008) found that developing wind farms in areas which are prized for their aesthetic beauty detracts and therefore diminishes landscape quality. When a landscape has a high scenic quality, the opposition toward developments tend to be large. On the other hand, where landscapes hold a low visual value, wind farms could work to improve aesthetic worth (Lothian, 2008). Careful consideration needs to be given to decisions involving changes in landscape as "visual, scenic and cultural components of the environment" are a form of resource, providing "value to individuals, to society and the economy of the region" (Oberholzer, 2005: 13). Further, landscape is prized as a living space, "which can compete with wind power as a land use" (Toke *et al.*, 2008: 1137).

Undoubtedly, communities place a high value on their local surroundings, but another serious point of contention is the effect of landscape changes on tourism (Warren *et al*., 2005: 857). Opponents have argued that the installation of wind farms in certain areas would be detrimental to tourism, significantly impacting those local economies which depend on tourism as a main source of income (Eltham, Harrison and Allen, 2008). Although the

[31]an area prized for its natural rustic setting
[32] environmentalists, communities, networks

significance of sensitive siting is acknowledged[33], no concrete evidence has thus far been presented on the negative effects of wind power on visitors (Hanley & Nevin, 1999; Warren *et al.,* 2005; Warren and McFayden, 2010). For example, Warren and McFayden (2010) found that wind turbines had no net impact on Scottish tourism. Interestingly however, other research has shown tourism to be positively affected by wind farms (NFO System Three in Warren *et al.,* 2005). Evidence demonstrates that tourists visiting Scotland associate wind farms more with clean energy rather than with landscape destruction. Thus, instead of wind power merely being tolerated in an area, Elthan *et al.* (2008) suggests that installations could become tourist attractions. BWEA (2005) provides supporting evidence citing the Scroby Sands Visitor Centre, which is visited by35 000 people annually, and the Ecotech Centre in Swaffham, attracting 10 000 annual visitors.

Jallouli and Moreau (2009: 605) conducted a study in Plouguin (France), using an "immersive path-based method", which involved a questionnaire and asked participants to comment during a country walk. Results indicated that wind turbines "attracted curiosity", with participants recognising an improvement in the rural landscape. A key finding, which coincided with Lothian's (2008) results, was that the overall impact of wind turbines on landscape "depend[s] on environmental features" and therefore perceived landscape quality (Jallouli and Moreau, 2009: 597). For example, mountain views are often associated with high scenic values and therefore people are very sensitive to changes in these areas (Meyerhoff, Ohl and Hartje, 2010).

Groothuis, Groothuis and Whitehead (2008) in a comparative study of billboards, cell phone towers and wind turbines in the mountains of North Carolina, tested whether wind farms were disliked in particular, and found that billboards were the most unpopular, followed by cell phone towers while wind turbines were the most tolerated. While the majority found that all these technologies harmed mountain views, the usefulness of each played a role in dampening the visual disamenity (Groothuis *et al.,* 2008). The implication of the finding is that by educating communities and stakeholders about the benefits of wind power, negative perceptions could be altered sufficiently to quell some naysayers.

Research by Krohn and Damborg (1999),Bell, Gray and Haggett (2005), Ek (2005), Warren

[33]see Obermeyer, Manes, Kiesecker, Fargione and Sochi, 2011: 1

et al., (2005), BWEA (2005) and Toke *et al.* (2008) has shown that people in general favour wind power as a renewable source of energy. Resistance crops up when wind farms transform from an abstract idea to a proposed project. A much cited argument is the 'not in my back yard' (NIMBY) reasoning (Dubgaard and Ladenburg, 2007; Krohn and Damborg, 1999; Eltham, *et al.*, 2008; Ladenburg, 2008). NIMBY is the social phenomenon whereby there is initial general public support in favour of a certain idea or development[34], however, when it comes to implementing a project locally, the same group of people become the opposition. Essentially, NIMBY is caused by a "broad problem" known as locally undesirable land use and is fundamentally an issue that a community has when the abstract idea of wind farms become realized into tangible neighbourhood projects (Groothuis *et al.,* 2008: 1546). Local communities bear the costs of a development while the benefits are widely spread through the larger economy, resulting in an "inefficient allocation of resources" (Groothuis *et al.,* 2008: 1546). For wind farms, the 'undesirable' connotation is due to social and therefore subjective valuations, which deserve attention.

Although landscape quality is an extremely significant interactive factor in determining the acceptance of wind farms, the technical specifications of each instalment have significant effects on public perception (Ladenburg, 2008). Wind turbine aesthetics, and their effects on landscape, are judged on several common attributes: scale of the wind farm, size of the wind turbine and vicinity (Warren *et al.,* 2005; Lothian, 2008; Meyerhoff *et al.*, 2010; Möller, 2006). A compromise exists between the scale of wind farms and the impact on the landscape, it is a matter of taste; small scale is followed by many instalments of wind farms whereas, large scale will be associated with fewer farms. The purpose is to achieve the 'correct' balance between visual impacts and scale. Meyerhoff *et al.* (2010) found mixed results when examining the trade-off: a study from Norway showed that most preferred "large farms" while Scotland and Sweden produced somewhat opposite results, with people selecting small scale farms.

Wind turbine size is another important consideration as older turbines tend to be much smaller than contemporary models, as demonstrated in Figure 2.1, particularly those which were installed in the 1980s. Turbines which have reached their useful lifetime age[35] are due for re-powerment schemes, which involve the replacement of older smaller turbines with

[34]such as renewable energy
[35]limited mainly to Denmark

larger modern models (Möller, 2006). While the number of turbines would decrease in such cases[36], larger units would occupy the landscape to a greater degree thus causing higher individual impacts (Möller, 2006). Overall visibility of wind turbines may not have a net impact in this case, but visually important areas may become more affected due to their sensitivity to development.

Product/Rotor diameter (m)	V15	V17	V19	V20	V25	V27	V39	V44	V47	V52	V66	V80	V90
Year of installation	1981	1984	1986	1987	1988	1989	1991	1995	1997	2000	1999	2000	2002
Capacity (kW)	55	75	90	100	200	225	500	600	660	850	1750	2000	3000
MWh/year	217	265	301	346	481	647	1304	1581	1947	2530	4705	6768	9152

Figure 2.1: Wind turbine size increases over the years from 1981 to 2002
[Source: Windfair.net News, 2011]

Apart from the size of turbines, vicinity to wind farms is another "major factor influencing the visual impact" of an area (Möller, 2006: 484). The further a wind farm is located from a given area, the lower the visual impact will be, diminishing the NIMBY effect. Meyerhoff *et al.* (2010) indicate that studies, which have investigated proximity to renewable energy sites, highlight the importance of distance in reducing visual impact. Indeed, this was the case when investigating distance to wind farms in Westsachsen and Nordhessen, while Swofford and Slattery (2010) concluded the same result in their Texas study. However, Lothian (2008) found that increasing distance had no effect in counteracting visual disturbance. A study by Sims, Dent and Oskrochi (2008), examined the effect of a nearby wind farm (Bears Down) on housing prices in St Eval, Cornwall[37]. Using a hedonic price model, houses within a 1.6 km radius were tested to see if the wind farm had any detrimental effect on valuation. Results

[36]higher rated output
[37]UK

indicated that the distance from the wind farm had no effect on housing prices (Sims *et al.*, 2008). An indirect implication of this finding is that close proximity does not play a role in negatively impacting the visual landscape.

Counter intuitively, Hull and Bishop (in Lothian, 2008) found that increases in distance from wind farms actually increased the visual disamenity. The implication is that being closer to a wind farm is preferable to being located further away, which is at odds with NIMBY reasoning. Warren *et al.* (2005) found supporting evidence of an "inverse NIMBY syndrome" in a survey which was carried out in the Scottish Borders and south-west Ireland. An examination by Scottish Executive Social Research (in BWEA, 2005) found that "54% of people living within 20 kilometres (km) of a wind farm would support a 50% expansion of the farm, while support is higher (65%) amongst those living within 5km of a wind farm". In a subsequent survey (2006) consisting of almost 2000 people, 73% stated that "they would be happy to live within 5 km of a windfarm" (Warren and McFayden, 2010: 205). Graham, Stephenson and Smith (2009) concluded in their study of major factors affecting wind farm attitudes in New Zealand that the relationship between proximity and attitudes was highly inconsistent.

While no clear conclusion can be drawn immediately from the plethora of conflicting data, several authors have offered explanations to account for the disparities. Warren *et al.* (2005) have suggested that NIMBY presents itself as a more serious problem in the preconstruction phase of wind farm developments. A comparative study by Warren *et al.* (2005) analysed the differences in attitudes towards proposed and actual wind farms between two different towns in Scotland. Black Hill, which had a proposed wind farm[38], demonstrated a much stronger negative view towards local wind farms than from Dun Law[39], which was more positive in addition to experiencing an improvement of attitudes over time. Krohn and Damborg (1998) cite two European studies which followed a similar pattern, highlighting the eventual improvement of preferences.

Further research by Dudleston (in Eltham *et al.*, 2008: 25), in Scotland, "found that 40% of residents expected to be negatively affected by the construction and operation of a local wind farm", which once built", only 9% experienced any problems". Supporting evidence from

[38]Preconstruction, the wind farm had been planned
[39]Existing wind farm

Braunholtz (in Eltham *et al.*, 2008: 25) revealed that from 10 wind farms surveyed, "48% of residents living locally to them anticipated being negatively impacted by their presence" with only 18% stating a negative effect after commission. Therefore, perceived visual impacts of wind farms generally tend to be significantly higher than the actual impacts (Ek, 2005).

Furthermore, many (Krohn and Damborg, 1999; Wolsink, 2007; Eltham *et al.*, 2008; Warren *et al.*, 2005; Warren and McFadyen, 2010) have written on the existence of U-shaped preference curves, which builds on the basic NIMBY reasoning. NIMBY asserts that a community which supports wind energy as a concept, represented by point A on Figure 2.2, would immediately oppose a wind farm, shown by point B, if it was proposed or located in the nearby vicinity (Dubgaard and Ladenburg, 2007). A further distinction is drawn once the wind farm has been constructed and the community experiences the impact first-hand. As people become more accustomed to the wind farm, so gradually perceptions change, transforming the 'alien' feature into a compatible aspect of the landscape (Kaldellis, 2005). Thus negative stances have an opportunity to relax and become more positive, shown by point C, given that enough time has elapsed for these adjustments to take place. Essentially, if changes in attitudes were depicted as a graph over the entire process, the curve would be Ushaped.

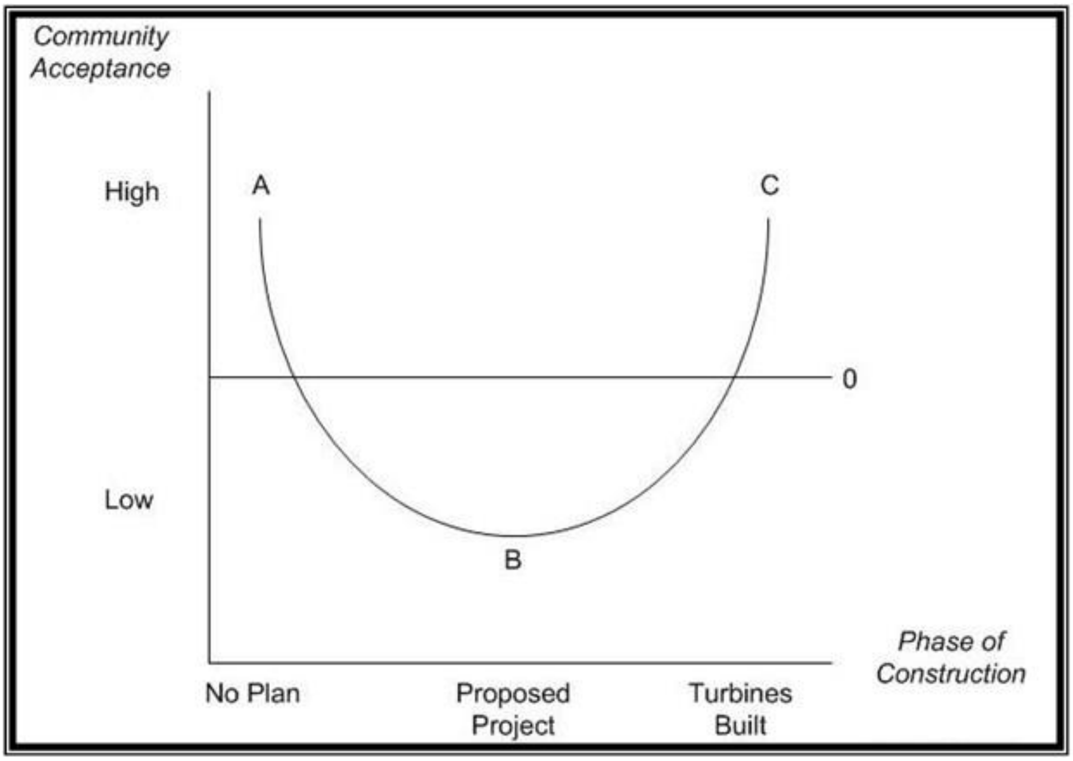

Figure 2.2: U-shaped curve depicting changes in attitudes over time
[Adapted from Krohn and Damborg, 1999: 958; Wolsink, 2007: 1198]

Experience and exposure to wind turbines can aid community acceptability (Krohn and Damborg, 1999). However, people may require a significant amount of time to adjust to new developments, especially when considering the impact of the "mental landscape", which refers to the disparities in meaning and significance individuals place on the same landscape (Ladenburg and Dubgaard, 2007: 4067). For example, older generations may view an unspoilt landscape as one without wind turbines while for younger groups the opposite may hold true. The age effect has been found to be persistent in several studies analysed by Ladenburg and Lutzeyer (2012) who distinguished two possible outcomes. The effect could wear off with time and aging where respondents begin to dislike the look of turbines, in which case decisions made at the present reflect accurately.

Alternatively, a generational effect may be present where age eventually has little or no effect. In these cases current decisions no longer make sense, with smaller "welfare economic benefits" accruing to society in the future (Ladenburg and Lutzeyer, 2012: 6798). Indeed, the cultural subjectivist landscape paradigm supports the latter theory, citing examples of mass societal change since the 17th century when the idea of 'landscape' was first popularised (Nohl, 2001; Dramstad and Fjellstad, 2011). Cognisance should be given to the fact that visual perceptions also differ within generations, not only between them. People oppose wind farms for a myriad of reasons, which may not necessarily be based on personal attributes or physical aspects.

Public participation and community attitudes

While studies (Krohn and Damborg, 1999; Bell*et al.,* 2005; Ek, 2005; Warren *et al.,* 2005; BWEA, 2005; Toke *et al.,* 2008) have shown a consistently large general support base, it has been observed that these figures may be exaggerated. Polling systems, used to determine public support for wind power, have come under scrutiny by McGowan and Sauter, (2005), Ellis, Barry and Robinson (2007) and Aitken (2010b, 1835), arguing that support shown in the polls can easily be affected by a "variety of subjective influences which may play roles in shaping the processes and results" and question whether these views are true reflections of public opinion. Worryingly, Aitken (2010B) further asserts that there has been a tendency in the literature in selecting polls which bolster the affirmation of wide public support of wind power, while ignoring evidence to the contrary.

Indeed, Wolsink (2000: 53) has written about the illusion of widespread general public support for wind power, stating that people who display NIMBY tendencies seem to not favour wind energy at all and that "their behaviour is primarily based on their lack of support for wind turbines anywhere". Essentially, NIMBY is incapable of capturing the "multitude of underlying motivations" for local resistance (Wolsink, 2000: 53). By hastily labelling local opposition as NIMBY, the underlying cause of the resistance is left unexplained, which is obstructive when solutions necessitate identification (Kempton, Firestone, Lilley, Rouleau and Whitaker, 2005). Instead, other factors need to be taken into account such as "local perceptions of economic impacts, the national political environment surrounding wind power, institutional factors, as well as stressing the socially constructed nature of public perceptions" (Ek 2005: 1679; Warren *et al.*, 2005: 858). Therefore, many[40] have scrapped the NIMBY explanation altogether, reasoning that it is far too simplistic to assume that people reject wind farms exclusively based on purely selfish grounds.

Aitken (2010b) raises an interesting point that opposition towards local wind farms are often cast as Nay-Sayers; social deviants who are painted as ignorant and selfish while supporters are viewed as 'forward looking' and informed. Thus the *status quo* or 'natural state' of society is presumed to be unquestionable support for wind power and serves to marginalise the legitimacy of opposition (Aitken, 2010B). The U-shaped curve, as argued by Aitken (2010) presents an argument which implicitly maintains that opposition to wind farms derives from ignorance and that given enough time and experience, attitudes will gradually improve. Experience and knowledge thus serve as a solution to change attitudes 'back' to the *status quo* over time. Ellis *et al.*, (2007) however, found that many of the opposition tended to know a great deal about wind power which makes ignorance an insufficient basis for an argument[41].

Similarly, the lack of experience with wind farms cannot be justified as a reason to dissuade opposition from their negative stance. Wolsink (2000) and Aitken (2010b) have argued that those who eventually 'came to accept' wind turbines in their vicinity through 'personal experience', as displayed in Warren *et al.*'s (2005) study, had lost all influence on the

[40] see Ek, 2005: 1679-1680; Warren *et al.*, 2005: 858; Wolsink, 2007: 1199; Ladenburg, 2008: 116; Swofford and Slattery, 2010: 2510

[41] Preferences for landscape have been found to change over time, but seems to be more of an effect of population turnover than of adjustment within people themselves, although this is not to say it doesn't happen.

outcome of the wind farm and were thus ‘defeated’, losing any subsequent resolve to carry on the conflict. Thus these groups, through their lack of leverage, become subjugated to the will of the ‘majority’. The resulting misidentification of the core problems occur when attitudes are *thought* to have changed, but in reality it is the authors’ “underlying pro-wind voice [that] can be seen as a barrier to true understanding” (Aitken, 2010b: 1837).

Assumptions about public support and opposition cannot continue to be made in this way if success in implementing wind power is to be attained. Such a problem has materialised in the UK, which showed an approval rating of 80% for wind energy but only managed to realise a quarter of all proposed projects (Wright, 2012). ‘Public support’ has given way to very real local social concerns, which have developed over time, especially in countries with increasingly high instalment rates (Toke *et al.,* 2008; Aitken, 2010A). Simply, the strong support that was thought to be present was never very strong in the first place. Public acceptance of wind power “as a reliable source of energy” is governed by a different dynamic to local level “community acceptance as a social phenomenon” (EWEA, 2012). Supporters and opposition cannot continue to be viewed as holding ‘monolithic’ standpoints but, instead have areas of “common ground” (Wright, 2012: 5), with those in the same camp often displaying heterogeneous concerns and forming “discursive coalitions” (Barry *et al.,* 2008: 92). Situations have sometimes shown that “key objectors” only became resistant because of the negative practices undertaken by developers in the planning process (Aitken, 2010B: 1837).

The fundamental problem then is one of properly understanding, addressing and involving those who are impacted by wind farm developments and therefore should be solved through the public participation process. The importance of public involvement has long been acknowledged and successfully implemented by Denmark, where cities and later counties[42] became responsible for siting and planning wind turbines (National Research Council, 2007). Australian and Britain wind associations (AUSWEA and BWEA respectively) have taken steps to become more transparent and inclusive when dealing with the public, a problem acknowledged to be particularly pronounced in the wind farm industry (National Research Council, 2007). Turning our attention to the kinds of practices which have failed and those which have facilitated development allows an informative institutional analysis of the current

[42] Cities were made responsible in 1994 while a new wind turbine circular made counties responsible in 1999 (National Research Council, 2007).

difficulty facing the wind power industry in general (Aitken, 2012A).

The public participation process (PPP) is a legislated procedure allowing stakeholders of a community, and indeed the entire public if they so desire, to be informed and voice concerns over aspects of a proposed development. The key underpinning purpose of a PPP relates to a "rights based approach" of equity, democracy and fairness (Wright, 2012: 6). Through participation, a composite of interests and opinions are hoped to be represented including environmental, economic, social and landscape issues (Coleby, Miller and Aspinall, 2009; EWEA, 2012). While not all opposition can realistically be overcome through the process, Rod (2011) and Loring (2007) have found that by involving the public in planning, greater acceptance can be achieved as problems can be dealt with at the pace of the development. Indeed, a growing body of literature (Ek, 2005; Gross, 2007; Wolsink, 2007; Wright, 2012) has made a compelling case that resistance to local wind farms is largely due to the questionable public participation processes which span the entire project. Thus while purely physical considerations, which has been dominated by aesthetics, are still a major determinant, these have given way to highlight people's emotions where they try to "make sense of the impact on the places in which they live" (EWEA, 2012).

To date, PPP's for the most part have not been handled with the adequate sensitivity due to the public. Differences in opinions on what constitutes an adequate PPP are often found between developers and communities (Wright, 2012). As developers are primarily concerned with financial objectives, incentives provided by law have not been sufficient in pushing developers beyond what is required (Wright, 2012). Consequently, a great deal of the local resistance has stemmed from the practices of developers and authorities. The failure to effectively consult with communities, results in top-down approaches, causing circumstances which ultimately generate negative backlashes (Gross, 2007; Swofford and Slattery, 2010). Essentially, Wolsink (2007: 1204) determines that the key question should focus on "*why* there is bad communication?" and proceeds to answer that "it is mostly caused by the way decision making is framed, e.g. by limiting the options for public participation to only consultation after the design and announcement of a project". When consultation does take place, the difference in influence, which is usually dominated by developers, destroys the legitimacy of the PPP thus rendering it ineffective (Wright, 2012).

Aitken (2010b) has argued that on the whole, the public participation process often gives an illusion of empowerment, with very few changes in the plans actually being made. Community actors thus become "a ghostly presence within the planning process - visible, heard even, but ultimately only there because their involvement lends credibility and legitimacy to decisions that have already been made" (Hildyard, Hegde, Wolvekamp and Reddy, 2001: 59). Core issues are bound to be misidentified when power is uneven as individual agendas are pursued while public problems are not given the seriousness they deserve. Eventual tensions may give rise to outright rejection of the project as has been the case in Britain. Visual impacts, for example, have long been downplayed by decision makers due to their subjective and 'trifling' nature, which has led participants to cite other more objective, measurable problems such as noise, shadow flicker, bird kills, ecological impacts and so on (Coleby *et al.*, 2009). Thus even if developers do remedy the 'problems', local groups will still not be appeased because the most important aspects have not been addressed.

The proposed Grahamstown wind farm, located in an area called Waainek, has encountered its fair share of local resistance. The company developing the project, Innowind, were required to decrease the number of turbines from an initial 13, down to eight (Grocott's Mail, 2012). A public meeting was advertised and held at the Grahamstown city hall on the 22nd July 2009 and was used to inform residents and to allow people to raise problems with the proposed wind farm (CES, 2010). It is curious however, that CES[43] did not host a meeting in one of the community centres in the East of Grahamstown, where lower income participants might find such meetings more accessible.

Some broad problems with the wind farm included construction issues, health and safety concerns, environmental issues and other general concerns (CES, 2010a: 178-192). The major opposition however, derived from residents and monks who lived very near to the wind farm as well as private game farm owners who operate both within and outside the vicinity. Rhodes University, as well as the monks of the nearby monastery[44], raised the point of location selection, specifically why other potential sites had not been presented as options (CES, 2010a). The main reason supplied for the proposed site was because Waainek contained the best wind resources in the area and access to the grid. However, Innowind stated they were open to proposals for alternative siting. Decreasing the number of turbines instead of moving the project to another site suggested however, that the company was

[43]Company who undertook the EIA on Innowind's behalf and was in charge of organizing the PPP.
[44]the Mariya u Mama we Themba Monastery

unlikely to follow through with the compromise. A later Environmental Impact Report by CES (2010b) did identify an alternative site for the wind farm, but was discredited because of several problems relating to inadequate wind speed, inaccessibility and problems with the grid connection. Further testing has shown the Waainek area to have superior wind resources to other sites in the area, including sites in Europe.

Game farm owners, represented by the Indalo group[45], cited concerns over the potential impact the Waainek Wind Farm would have on eco-tourism, resulting in a loss of employment and personal livelihoods (Fox, 2010). The impact would derive primarily from the visual presence of the wind turbines, with Fox (2010) suggesting that the sight of the towers would disturb both national and international[46] tourists. The negative impacts on tourism, as discussed earlier, are debatable primarily because no conclusive evidence has been offered to date. Other factors, such as employment opportunities, stabilisation of the electricity grid and the various listed benefits of wind energy were also censured in the Indalo report (Fox, 2010). While there seems to be agreement on the positive role wind farms play in job creation (Blanco and Rodrigues, 2009; Mathiesen, Lund, Karlsson, 2011; Wood, Medecigo, Romero-Hernandez, Romero-Hernandez, 2012), several points need to be made about the nature of the employment. At the local level, most jobs would require specialist training or higher education e.g. legal, environmental studies, operation and maintenance (Blanco and Rodrigues, 2009). Where the construction of the turbines allows sourcing from contracted unskilled/semi-skilled labour, once the turbines are erected very little opportunity exists for the continuation of building services (Savannah Environmental, 2011).

With the completion of construction, very few people will be permanently required to maintain and manage the wind farm. The La Rumorosa wind farm in Tecate municipality (Mexico), for example, has five 2MW turbines (10MW in total) and a local employee base of three (Romero-Hernandez, Romero-Hernandez, 2012). Instead, the activities which employ the highest numbers in the wind energy sector is found in the manufacturing and component building of wind turbines and greatly depends on the geographical location of operations (Blanco and Rodrigues, 2009). To date (2013), only one local manufacturer in large turbine components exists in South Africa, the Isivunguvungu Wind Energy Converter (I-

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[45]an association of Eastern Cape Game Reserves in the Makana and Ndlande municipal discricts

[46]Claimed that international patrons to these game reserves are first time travelers and that the mere sight of the wind turbines will put tourists off completely and will not return in future.

WEC) plant, located in the Western Cape. The creation of indirect employment holds some promise, but only where local businesses are able to provide adequate ongoing services. EWEA (2009) estimates that 15 jobs/MW is generated through the construction of wind turbines, a benefit which extends to the broader economy rather than any given area.

Long-term impacts of the wind farm would most likely have beneficial transformative impacts on labour, especially where vocational training and education programmes geared towards wind turbine technologies (operation and maintenance, site management, transportation of heavy materials) are correctly implemented (Blanco and Rodigues, 2009). As far as local level ‘green’ job creation in Grahamstown is concerned however, the impact would most likely be gradual, where the greater part of the employment created would be dispersed on a national level (transferrable to other sites).

As it stands, the planning model implemented by the Waainek Wind Farm organisers appears similar to the typical top-down planning model used in many of the developed countries (European) which encounter similar local resistance problems. A valid question which seems pertinent to the situation is why such inflammatory methods are pursued in the first place. It is possible that CES, in trying to fulfil the legal requirements of the EIA, may have undertaken procedures which contributed to some of the opposition to the wind farm, and are therefore unintentional. In response to the problems encountered by local communities, a balance of power needs to be established between developers and the public. Planning is not a one sided affair, but where possible, the community needs to be involved directly, beyond “formal consultation” and as early as possible (Ebert, 1999; Breukers and Wolsink, 2007: 2738; Eliss *et al.*, 2007). The existing language describes community participants as stakeholders, passive entities who merely observe the actions of decision makers. The right to involvement needs to be given a higher degree of significance, especially when dealing with public land, a resource that requires collective management.

While the Waainek Wind Farm is being constructed on private land, the perceived impact will potentially extend into the community, which may affect the availability of other public goods (scenery, noise). The PPP therefore needs to be proactive and responsive to views of lay people which will ensure that the important values of the community are captured and reflected in the plan (National Research Council, 2007; National Research Council in EWEA, 2012). Wright (2008) argues that where wind farm projects are clearly not desired, allowance must be made for a community right to veto. Unilateral decision making, of any kind, should be avoided. South African law requires a sufficient basis for decisions to be appealed and is done in accordance with the constitution, where the rights of each individual are stated.

Discussion on South African community and local governance

The South African Constitution is the highest piece of legislation which enables broad provisions for the public participation process, and refers to public involvement as a basic human right; to be accessed at all levels of government (Scott, 2009). Within the constitution, the promotion of public involvement in government has brought about transference of political and administrative power to local level municipalities, local councils and ward committees because it is the peoples' involvement in the state which forms the foundation of democracy (Nyalunga, 2006). It is precisely this local power which is pertinent to the idea of community led decision making.

The concept of community however, is problematic because the term is open to broad interpretation which may pertain to a physical entity; a closed geographical location, or intangible notions; camaraderie or other such social links that transcend physical boundaries (Crow and Allan 1994). For this reason a clarification of what a 'community' constitutes is necessary to determine a reasonable demarcation between insiders and outsiders. Keeping in mind that renewable energy strategies are planned nationally for widespread societal benefits, implementation is local where the direct impacts of the developments are felt (Groothuis *et al.*, 2008). Consequently, while all citizens are entitled to contribute in a public participation process, Wright (2012: 9) argues that for practical reasons numbers should be limited to those who are affected in the immediate area of the development; better referred to as the 'host community'. Since utility scale wind turbines are hefty structures which are able to be seen for many kilometres depending on the terrain, the 'immediate area' could be potentially large, encompassing several different communities (Graham, Stephenson and Smith, 2009; Aitken, 2010a).

The National Environmental Management Act (NEMA, Act No. 107 of 1998) provides a slightly broader designation than Wright (2012), referring to "all potential interested and affected parties" as the constituents to be involved in public participation. A community therefore is able to transcend any one town or geographical area, possibly encompassing various separated individuals toward a common concern; where different groups of people are affected to the degree that it connects them. The SDC (Social Development Commission, 2010: 1) defines a community, where “interests, common objectives and needs” prevail, as a process which serves to create a “sense of belongingness among people”. It is the latter portion of the SDC’s (2010) description, the notion of ‘belonging’, which feeds into the idea that communal social structures are not constrained by time or place for their establishment between people. Rather, and perhaps generally, communities can be seen as groups of citizens who converge to address a matter of interest which is universal to all parties (Crow and Allan, 1995).

The definitions of the SDC and National Environmental Management Act (NEMA) do leave open a wide scope for public involvement. One problem with such inclusive framing is that while ethical, large numbers of people may impede negotiations through the incursion of higher transaction costs (Baumol and Oates, 1988). The emphasis on local governance by the South African state is perhaps the best way to address the uncertainty. As wind farms have a localised direct physical impact on a specific area, those who are exposed or experience ‘first-hand’ effects (visual, noise, health) should be given priority in the decision making procedure and as a result, regarded as the rightful community (Wright, 2012). On the other hand, where the ecosystem is found to be at serious risk, concerned ‘outsiders’ would have cause to participate in the public meetings in order to mitigate harmful operations as these effects have more widespread impacts. Therefore, a community is determined to a large degree by the set of circumstances faced by each development, where people affected immediately by the impacts should be given priority.

The community’s involvement in Waainek Wind Farm is incorporated in the public participation requirement of the scoping report, a preliminary document used to discuss the implications of the construction and operation of a development throughout its lifetime (CES, 2009). The scoping report is the first phase of the Environmental Impact Assessment (EIA) requirement and is necessary (among other things) for informing people about the nature of the project, recording concerns and identifying potential problems with the proposed development (CES, 2009). It should be noted that the public meetings are held by the Environmental Assessment Practitioner (EAP), in this case Coastal and Environmental Services (CES), who is chosen by the developer to carry out the EIA. Representatives of the developer then attend the public meetings held by the EAP in order to establish a dialogue between themselves and the community.

The scoping report also provides information on the proposed method of the EIA process, which is examined by the Department of Environmental Affairs (DEA), returned with the DEA's recommendations if needed, in order for the EIA to proceed (CES, 2009). Throughout the process, drafts of all the EIA reports must first be placed in public spaces (libraries) for review before they are submitted to the Department of Environmental Affairs (CES, 2010b). Common issues which are raised by the public during the scoping and EIA phase must be included and addressed in the final reports and then submitted to the Minister of Environmental Affairs who is responsible for granting the environmental authorisation. Once the project status is decided, an appeal may be lodged with the Member of the Executive Council (MEC) for the host province or the Minister of Environmental Affairs (whoever is the competent authority) "within 20 days after the date of the decision", where the grounds of the appeal must be provided by the appellant (NEMA, Act No.107 of 1998; Environmental Impact Assessment Regulations, 2010). Such a course of action pertains to the EIA process and is available to a community whose concerns, given by NEMA (Act No. 107 of 1998), have not been adequately addressed.

Regarding other provisions for public involvement, section 17 of NEMA (Act No. 107 of 1998) states that where disagreement arises out of "exercise of any of its (Minister, MEC or Municipal Council) functions which may significantly affect the environment" or where "disagreement regarding the protection of the environment is brought under any law", conciliation may be used to consider the activity's desirability. The primary motivation for the appeal must take into consideration environmental violations as set out in section 2 of NEMA (Act No. 107 of 1998) which places "people and their needs at the forefront of its concern". Alternatively, the Municipal Systems Act (2000), section 62, provides the grounds on which decisions may be appealed, specifically where:

> "A person whose rights are affected by a decision taken by a political structure, political office bearer, councillor or staff member of a municipality in terms of a power or duty delegated or sub-delegated by a delegating authority to the political structure, political office bearer, councillor or staff member, may appeal against that decision by giving written notice of the appeal and reasons to the municipal manager within 21 days of the date of the notification of the decision"

Ideally, the major problems should be resolved during the public participation process of the EIA, where a 'reworking' of plans could be pursued to satisfy most (if not all) parties. For developers, the delays brought about by appeals may become very costly if the project is delayed for long periods of time. Rather than rushing the public participation process or only fulfilling the legislative requirements, extra measures would work to build social trust (a form of capital) between developer and community, support thoroughness in process and uphold democratic principles (Devine-Wright, 2005).

Trust can only be earned through a carefully planned time consuming process, which can be easily destroyed in an instant, but ultimately worth the effort in the long-run (EWEA, 2012). Democratic countries have realised how crucial decentralised planning is for success (EWEA, 2012). These collaborative approaches require a strong "national strategic framework for wind farm planning applications", so that authorities have clear guidelines to direct wind farm development and to prevent the misinterpretation of "national strategies" on a local level (Warren *et al.,* 2005: 859). In order to meet these objectives, "investments in institutional capital (knowledge resources, relational resources and capacity for mobilisation) may be a productive instrument to reduce problems with local resistance, thereby [increasing] the rate at which installed wind power capacity is boosted" (Ek, 2005; Wolsink, 2007).

Underpinning these organizational arguments, Toke *et al.,* (2008: 1133) found that geographical endowments of a country, while playing a major role in renewable energy potential, do not dictate the success of actual installed capacity. The major determinant in successful energy policy was due to the "influence of institutional variables" which included local collaboration, a consistent\stable financial support system and local ownership schemes (Toke *et al.,* 2008: 1133). The implementation of a strong institutional structure would assist in managing other important restrictive factors such as local level resistance networks, cultural factors and population density issues. Wolsink (2007), who expresses similar assertions, stresses that correct public participation processes will be instrumental for the success of wind farm implementation.

Equally, credence should be given to the possibility that communication will break down in some instances, especially where local groups (who actively protect and campaign for landscape preservation) "[oppose] wind power planning applications as a matter of strategy"

(Toke *et al.,* 2008: 1137). Where residents are worried about immediate visual impacts, support can come in the form of co-operatives (or compensation), which are local ownership schemes designed to convey dividends to community stakeholders, instead of solely to corporate interests (Krohn and Damborg, 1999; Toke *et al.*, 2008). The benefits of local ownership, it has been argued, "produces more active patterns of local support and higher levels of planning acceptance [while also proving] more equitable" (Warren and McFadyen, 2010: 206). Germany, Denmark and the Netherlands have employed this model quite successfully, while Scotland has experimented with implementation in some small scale projects (Warren and McFadyen, 2010; Toke *et al.*, 2008).

Gigha (Scotland) for example, is a small island population (150 in year 2001) which made the decision to communally "buy-out" the entire island in 2002 following a land reform program in Scotland (Warren and McFadyen, 2010). Once the land was acquired privately (communally owned by all residents), the community then decided to construct a small 3-turbine, 0.7 MW wind farm to produce local electricity and sell the excess off to the grid. The island of Kintyre (Scotland), on the other hand is a larger island than Gigha, with three privately company-owned wind farms (Warren and McFadyen, 2010: 207). Results showed that "Gigha residents were consistently more positive about wind power generally and local wind farms specifically than were the Kintyre residents" (Warren and McFadyen, 2010: 207). Another interesting finding from the study was the reinvigoration of the Gigha community which featured job creation, in-migration and growing local school numbers. Crucially, co-operatives have acted to improve the "political profile of wind power", as new local investors become "energy experts", thus creating "a strong lobby for good conditions for wind energy in the future" (Toke *et al.,* 2008: 1141).Therefore, local ownership[47] has been very successful in fostering positive attitudes towards local wind farms (Groothuis *et al.,* 2008).

Remarkably, people's perception of wind power is also greatly influenced by the level of urbanisation in their hometowns. For example, Bergmann *et al.* (2008) found that by splitting the demographics of a region into urban and rural groups, distinctive patterns in opinions emerged. Urban groups were more opposed to wind farms than rural dwellers. One reason cited for this phenomenon was that rural communities, whose economies may be in decline, benefitted from the job creation of local wind farms and thus were more inclined to accept

[47]Compensation would work in a similar way, although ownership of the wind turbines may be a more effective measure

such developments (Groothuis *et al.,* 2008: 1550). Further, rural occupants tend to view the landscape as a "productive space" especially when considering that the local economy is dominated by farming activities, requiring large tracts of land (Woods, 2003: 284; Bergmann *et al.,* 2008).

City dwellers, on the other hand, tend to have a more "romantic" view of the countryside and are reluctant to have wind farms spoil what they perceive as 'natural beauty' (Krohn and Damborg, 1999: 956; Woods, 2003: 285). The argument centres on the consumptive concept of landscape, mainly through personal appreciation and tourism related activities. The contention is that the ailing farm sector should be replaced by a tourism industry, the success of which is contingent on landscape perseveration (Woods, 2003). Opponents worry that the introduction of a wind farm into the 'pristine countryside' would destroy the features visitors[48] are most keen on.

Pederson and Larsman (2008) reason that city residents, who experience a higher degree of urbanisation than rural inhabitants, are more prone to aesthetic impacts because of their exposure to highly built-up areas. Therefore, holiday destinations may be selected on the criteria of a simpler and less 'busy' landscape setting. However, as discussed earlier, wind turbines appear to have a benign impact on an area's tourism, even becoming an attraction in some cases (Warren *et al.,* 2005). The problem, once again, lies with the pre-construction perceived impact, which tends to be exaggerated. Additionally, urban populations may hold a bias against the modernising development taking place in rural areas, the introduction of which would ruin their 'escape' or 'retreat' into nature (Woods, 2003).

Moving from a centralised to a decentralised power system will exacerbate this problem (among others) as energy production will move away from large isolated plants to localised facilities, bringing generative sources closer to demand centres (Warren and McFadyen, 2010). Essentially, as the existing paradigm of energy production changes, "new and challenging issues of planning, land use and social engagement" will be raised (Warren *et al.,* 2005). People demand more involvement in local decision making, the benefit of which could generate interest within communities as well as creating a climate where citizens become energy experts.

[48]more than likely wealthy urbanites

A greater involvement of citizens in the planning process may smooth wind farm development as people will have a greater freedom to design the landscapes and environments they live in (Short, 2002: 52). As Nassauer (1995: 1) argues, "culture changes landscapes and culture is embodied by landscapes", reflecting not only the temporal element involved with landscape identity but also the mode of life a particular setting conveys. For the modern landscape, wind energy does not have to represent industrial agriculture, but could instead symbolize a movement towards environmentally sound practices and awareness. Convincing stakeholders of such wind farm benefits may not be so simple.

2.3 Market failure: the un-priced scenery of landscape

It is well known that a market functions as an exchange institution in which buyers and sellers meet to trade consumer goods and services, factors of production, etc. (Field and Field, 2006). Through this interaction, prices are determined and operate to allocate scarce resources to those who value them the most (Hanley, Shogren and White, 2007). Ultimately, market processes generate efficient outcomes for both buyers and sellers, thus making society better off. However, markets have problems pricing certain goods and services, leading to understated values and subsequently resulting in market failure (Hanley *et al.*, 2007). Public goods are associated with such problems as they have a "zero opportunity cost of consumption" (non-rivalry) and are non-excludable (Garrod and Willis, 1999: 19). Consumption remains unhindered regardless of the number of participants while at the same time individuals cannot be prevented from using the good or service. The resulting problems cause the existence of 'free riders', making it impossible for price formation by a market (Garrod and Willis, 1999).

Landscape aesthetics is classified as a pure public good (non-excludable, non-rivalry) which is undervalued by markets, leading to economically inefficient outcomes. Economic efficiency is defined as the "balance between Willingness to Pay and the marginal costs of production", where buyer surplus and seller surplus are maximised (Field and Field, 2006: 64). More simply, economic efficiency refers to a situation where a move to reallocate resources cannot result in one person being made better off without making another worse off. The latter definition is also known as Pareto efficiency. An externality results when the activities of individual/group B have an impact on individual/group A's utility function, normally as an unintended consequence (Mishan in Cordato, 2007). The problem therefore impacts on third parties who do not partake in the consumption or production of the good in question (Markandya, 2012). Public goods, or positive externalities, offer benefits not only to individuals paying for them, but also to non-contributors (Rude, 2000: 5). In the case of negative externalities, companies producing goods at a given quantity may be imposing costs on society (externalizing costs), thus forcing a wedge between private costs (the firm) and social costs (Field and Field, 2006). Therefore, negative externalities are produced at a level greater than the Pareto optimum which results in a market price that is lower than the marginal social cost (Cordato, 2007).

As previously discussed, externalities are either positive[49] or negative[50] which identifies whether these goods are being under or overproduced (Field and Field, 2006; Hanley *et al.*, 2007). In the case of the visual impact of wind farms on landscape, if most individuals found turbines unattractive, a negative externality would be present. Figure 2.3 illustrates a private wind power firm producing electricity derived from turbines along the marginal private cost curve (MPC), at a quantity of Q (Megawatt-hours) and an electricity price of P. The private firm produces at the level where MPC=MPB (Marginal Private Benefit), quantity Q. An implicit assumption is that MPB=MSB (Marginal Social Benefit), indicating that there is no positive externality. The public, who dislike the newly impacted landscape, would incur a much higher marginal social cost (MSC) than the firm. In this scenario, wind turbines are oversupplied, creating a social cost equal to the area ABC and thus resulting in an economically inefficient outcome. The efficient outcome would be to scale back electricity generated from wind turbines, which means a reduction in turbines built in the landscape, to the point where MSC=MSB at a quantity of Q1 and the price level of P1. Changes in welfare rely on economic valuation to determine both the extent and nature (positive/negative) of externalised activities.

[49]Education and healthcare are two good examples of this
[50] pollution in its various forms

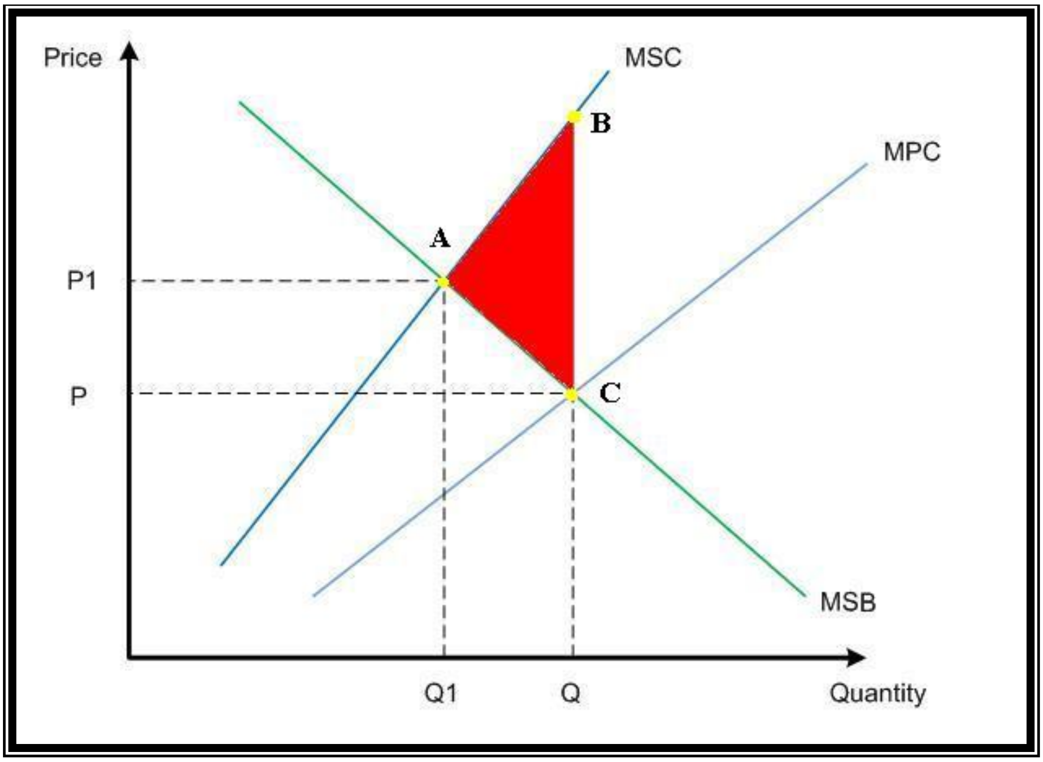

Figure 2.3: A classic depiction of a negative externality which in this case is exhibited by a local wind farm utility. Society as a whole bears the imposed cost (visual disamenity) of the development the extent of which is shown by the red triangle
[Source: Hillman, 2003].

Several options are available to policy makers to correct for this market failure: well defined property rights, Pigouvian taxes and compensation (Baumol and Oates, 1988). Negative environmental externalities are associated with incomplete markets, attributed to the lack of well defined property rights (Hanley *et al.*, 2007). Government intervention would be necessary to resolve the problem unless, as Coase (1960) argued, there were zero transaction costs. Coase (1960: 11) further explained that externalities are a conflict of rights rather than a scenario characterised by a perpetrator and victim (Butler and Garnett, 2003). Therefore, if property rights (visual pollution control) could be assigned freely to non-market goods (scenic view) and allocated to any one party, negotiations between the concerned groups would take place, generating a Pareto efficient outcome (Hanley, *et al*. 2007; Baumol and Oates, 1988). Government intervention would be minimal as private groups would use their own information to make decisions, ultimately achieving the optimal levels of pollutants.

While Coase (1960) did acknowledge that the world he theorized about, with zero transaction costs was not representative of the real world, some additional issues need to be addressed. Firstly, the heavy reliance on small groups is a major flaw with Coase's theorem (Baumol and Oates, 1988). Once participants become too numerous, negotiations would break down or become very expensive to carry out (Coase, 1960). Thus for public policy considerations, statutory assistance would no doubt be needed, calling for some form of government support.

Secondly, externalities are viewed as reciprocal, where both the perpetrator and victim are equally to blame (Butler and Garnett, 2003). Liability for damages, as argued by Coase (1960), should therefore be assigned to the lower cost accommodator, choosing the social arrangement which yields the highest total product. For example, a factory is built nearby an existing residential area. Where previously the air was clean, the smoke emitted from the new works begins to degrade the community's health. Coase (1960) would argue that if it were cheaper for residents to mitigate the effects of these pollutants, the factory should not be held accountable for the damages. While the gains of such an arrangement are explicitly made, equity issues seem to garner very little acknowledgement.

Both Coase (1960) and Butler and Garnett (2003) justify their position by stating that the lowest cost accommodator arrangement would only be acceptable where context is taken into account. On the other hand, the 'polluter pays principle' maintains that the liability of damages should fall on those responsible for damages (Cordato, 2001). While the concept of 'polluter pays' does serve people's "sense of justice", Cordato (2001) argues that there are sometimes difficulties surrounding the definitions used by different groups i.e. how to correctly define pollution and how to identify the polluter. Such complications make it difficult to pin the external damages solely on the polluter. Instead, a careful investigation by a court should reveal which party is liable for damages.

A Pigouvian solution addresses the situation somewhat differently, by inducing "profit maximizing firms and utility-maximizing individuals to satisfy [the] conditions" which "characterize behaviour consistent with [the] social optimum" (Baumol and Oates, 1988: 21). Essentially, the presence of an externality[51] drives a wedge between MPC and MSC, creating a situation where society pays for the external damage. A tax, equal to the marginal external damages experienced by the victims is placed on the perpetrator to solve the problem (Nye,

[51] as seen in figure 2

2008: 34; Baumol and Oates, 1988: 34). The tax should equate MPC with MSC, forcing the firm to reduce production[52] and thus supply a quantity more acceptable to society.

A reduction in quantity, from Q to Q1 in Figure 2.3, would yield an increase in social efficiency, equal to the area ABC (Hillman, 2003: 260). If the social optimum cannot be achieved through Coasian private bargaining, government intervention[53] becomes a necessary solution for internalizing the social cost (Mattiacci, 2003: 3). Taxation and subsidization are the normal avenues pursued to correct for these externalities, the application of which is determined by the allocation of rights (Hillman, 2003: 262). For example, if wind farm operators hold the rights to view-shed areas, production would be subsidized (paid not to produce) and the public would be taxed. On the other hand, if rights belong to the public, producers would be taxed. The externality will be internalized in both instances, the major difference being the forgone government revenue in the subsidization arrangement.

Mankiw (2009: 6) holds that Pigouvian taxes are desirable for two reasons: they tend to be "the least invasive way to correct for market failure" and are able to raise government revenue, which can be used to reduce other distortionary taxes, such as income tax. While a portion of the tax could be used as compensation to the victims of externalities, Baumol and Oates (1988: 24) and Hillman (2003: 263) argue that such measures would not be necessary. Firstly, the tax would align MPC and MSC, creating a socially efficient outcome, removing the need for reparation. Secondly, compensation would also remove any incentives the public might have to mitigate the negative effects of the externality (Baumol and Oates, 1988: 24). Consequently, rent seeking activity, with a loss in Pareto efficiency, will be higher in a climate of compensation, unless clear rules are instituted concerning allocation.

Despite the loss of Pareto efficiency, compensation may still be appropriate in the case of wind turbines. Environmental externalities have a range of effects which creates difficulty in defining harmful activities (Lin, 2006: 900). For example, townspeople injured in an explosion from a nearby facility presents an obvious case of physical harm. The distinction blurs when communities or individuals suffer emotionally (Lin, 2006). By far the greatest impact of wind farms are visual and therefore social. However, according to the law of nuisance, "pure aesthetic considerations" are not ordinarily deemed adequate to gain

[52]Due to higher costs
[53]pertaining to tort law

injunctive relief (Bregmans Attorneys, 2011). Although the law only recognizes severe cases of emotional distress[54], grass-root level resistance has become an issue which needs to be acknowledged, and has been largely due to visual concerns (Lin, 2006).

Toke, Breukers and Wolsink (2008: 1135-1136) highlight the importance of local activist groups in determining the “outcome of planning applications” for wind farms, observing that “developers often take public support for granted”. These groups have notably been responsible for serious backlash in many European countries, causing cancellations of entire wind farm projects (Kaldellis, 2005). While it is imperative to involve communities in the planning process, compensation could also offer a solution where all other avenues have been expended. Equally, Warren and McFayden (2010) and Toke *et al.* (2008) argue that co-operatives[55] play a significant role in determining communities’ preferences for wind farms: ownership is positively related to acceptance. While ownership and compensation seem expensive and detrimental to economic efficiency, it should be remembered that wind energy offers many benefits[56] to society, which is partly why so many governments are eager to subsidize production (NRG Systems, 2008).

Most of the literature to-date on wind farm externalities originates from European studies, where a great deal of investment in renewable energy has taken place. Due to the level of urbanisation and development in the European region, landscapes appear to be highly valued because of the increased scarcity of natural view-sheds. The desire to preserve current resources for future use when they are not being utilised currently, also known as option values, is also plausibly a significant factor contributing to local level resistance (Brookshire, Eubanks and Randall, 1983). While landscape and biodiversity impacts tend to be the most costly externalities for wind turbines (Meyerhoff, Ohl and Hartje, 2010), it is evident that these impacts vary considerably according to locale (at least visually) and cannot be reliably extrapolated to other areas (Markandya, 2012). The latter fact applies especially to visual impacts because landscapes are highly varied in their appearance and structure (Markandya, 2012). Gillingham and Sweeney (2010) argue that even where externalities for renewables are present, the impacts tend to be small, much more so than their fossil fuel counterparts.

[54] fear, anxiety, depression
[55] essentially similar to compensation as there is some form of financial gain to recipients, although ownership is not given and may arguably be less effective
[56] clean, cost competitive, stable long-term prices, job provision, renewable

Negative externalities from wind farms could perhaps play a much smaller role in developing countries where landscape resources are in greater supply and therefore the social cost of converting land to an alternative use would be lower. Conversely, social benefits from renewable energy developments may also be greater than in European countries due to the perceived advantages for poor communities such as job creation (Groothuis *et al.,* 2008) as has been seen in job-poor areas falling in developed countries. The high dependency of South Africa on coal fired plants (93%), a very dirty method of producing electricity, will make the use of a clean, renewable source of power a highly attractive feature in the energy mix (World Coal Association, 2011). Furthermore, as environmental degradation is strongly associated with a reduction in the long-term productive capacity of an economy (Lazkano, 2012), the adoption of cleaner technologies should provide substantial economic and social benefits (positive externalities).

It is vital to note however, that an intergenerational component is present in any consideration of renewable energy. Decisions made today will affect the opportunities of future generations, limiting policy options and trade (Lazkano, 2012). Therefore, the benefits of taking action today will largely defer to future generations. Due to the intergenerational benefits of wind power and because people tend to prefer current consumption to future consumption, present capital investment may not reach the socially optimal level (EPA[57], 2010). Gillingham and Sweeny (2010) have argued that it may be appropriate to provide both firms and consumers more information regarding environmental impacts, thus inducing changes in consumer behaviour or in the way companies choose to produce goods. However, as cost estimates differ for each wind farm project, so net figures (net benefit or cost) also carry with them a degree uncertainty (Galetovic and Munoz, 2013)

Foremost, it is imperative to measure, as accurately as possible, the size of the visual externality because these values guide the correct level of control (Markandya, 2012). While policy considerations are key for encouraging investment in renewable energy, determining the net impact from the construction of the Waainek Wind Farm would precede policy prescriptions. As projects have both costs and benefits associated with the activities taking place in a defined area, determining the extent of these is crucial before proceeding with construction (Hanley and Splash, 1993). The values can be used as inputs in a Cost-Benefit

[57] Environmental Protection Agency based in the United States of America.

Analysis (CBA) procedure, where the net impact is calculated and project alternatives compared (Hanley and Splash, 1993). Performing a CBA ensures that decisions about economic resources are made effectively, resulting in a maximisation of the social welfare function (Hanley and Splash, 1993). The Contingent Valuation Method (CVM), introduced in the next chapter, is employed in this study as the primary instrument for capturing public good values, which can then be used as inputs in a CBA. As the current study examines negative visual impacts of the Waainek Wind Farm, input values would fall on the cost side of the CBA.

The attitudes gathered through the CVM survey will also assist in identifying where potential problems may arise as well as being informative about the benefits people perceive wind farms to provide. Grahamstown is a city with a rich historical legacy evidenced by the various monuments and architecture present in the city. The impacts from the Waainek Wind Farm need not have harmful health manifestations, but may instead only weigh on people's minds through the constant visibility of the turbine structures. Visual stimuli happen to be one of those abstract forces which individuals regard seriously as "they often have cultural and symbolic meaning" (Oberholzer, 2005: 2). Monuments, relics, buildings, statues, landscapes and so on, may embody histories or tales of the past which are cherished by a community; heritage values which are passed on from one generation to the next. The capture of these values is necessary as they are paramount to a clearer understanding of potential disturbances of the landscape 'memory'.

Chapter 3: Methodology, Data collection and Questionnaire

The purpose of this chapter is to introduce the Contingent Valuation Method for the use of capturing Willingness to Pay values and public preferences, regarding the visual impacts of the Waainek Wind Farm. Emphasis is given to the dichotomous choice elicitation technique, one of several sub-procedures available in the CVM, which is employed in this study. A discussion on the theoretical model used to estimate Willingness to Pay values then follows along with a detailed explanation on the questionnaire process (survey instrument) used to solicit individual values.

3.1 The Contingent Valuation Method

History and applicability

As was discussed in Chapter 2, few environmental goods (public goods) can be valued simply through the usual market processes which private goods undergo, due to the associated problems of non-excludability and non-rivalry (Garrod and Willis, 1999; Carson and Hanemann, 2005). Estimation methods have therefore been developed to determine these values, which are divided into two main approaches, namely: revealed preference techniques and stated preference techniques (Ladenburg and Dubgaard, 2007). Revealed preference techniques rely on behavioural data related to "some aspect of the amenity" while stated preferences depend on "information concerning preferences" elicited by directly asking respondents what their preferences are, through the use of hypothetical scenarios (Carson and Hanemann, 2005: 824). Within the stated preference approach, the Contingent Valuation Method (CVM) is the "most widely used approach for obtaining Willingness to Pay (WTP) values for an assortment of environmental and other nonmarket public goods" (Bateman, Day, Dupont and Georgiou, 2009: 806).

Ciriacy-Wantrup (1947) was the first to propose the Contingent Valuation Method, basing it on a simple concept: where normal market mechanisms fail to value an amenity, an interview process could be used instead to solicit valuations by asking individuals directly what they would be willing to pay (Hanemann, 1994). However, the first application of the CVM was only conducted roughly 15 years later by Davis (1963), who used a survey to estimate the benefits accruing to participants from goose hunting (Venkatachalam, 2004). The CVM eventually gained popularity once option values and existence values (non-use values) were "recognised as important components of the total economic values in environmental economics literature" (Venkatachalam, 2004: 90). Further, CV is the only method which can be used "generally" to obtain non-use values for environmental goods (Carson and Hannemann, 2005). The implications, which developed due to the heightened status of the CVM, brought about intense scrutiny regarding whether elicited estimates are indeed valid and reliable (Venkatachalam, 2004). The National Oceanic and Atmospheric Administration (NOAA) commissioned a panel of experts (Arrow, Solow, Portney, Leamer, Redner and Schumar) to create a set of guidelines to be adhered to in order for reliable results to be obtained (NOAA, 1993).

The Contingent Valuation Method uses a hypothetical scenario to value the good in question, creating a market where none had existed before (Carson and Hanemann, 2007). Provision levels for the good are specified and normally include the status quo and some other level determined by the author. Based on the different good allocation levels, Willingness to Pay is specified by respondents, where a variety of different methods of valuation can be used. In order to improve the plausibility of the scenario (incentive compatible: discussed further on), a payment vehicle is specified, which details the form which the WTP would be paid in e.g. tax, surcharge on bills, increased prices for certain goods relating to the amenity being valued, etc (Ivehammer, 2009).

In order to obtain meaningful estimates, validity and reliability need to be firmly addressed in CV studies, as the two major issues which cause controversy over WTP estimates (Mitchell and Carson, 1989; Bateman *et al.,* 2002; Venkatachalam, 2004). Broadly defined, validity refers to the degree a measure is able to determine "the theoretical construct under investigation", which is unobservable and therefore estimates yield an approximate or imperfect value (Mitchell and Carson, 1989: 190). In the Contingent Valuation Method, constructs refer to the maximum amount individuals are willing to pay for a particular public good on the premise that a market for the good in question existed. As the actual value cannot be determined and consequently used as a basis for comparison, three types of validity can be distinguished "for assessing the measure-construct relationship": content validity, criterion validity and construct validity (Mitchell and Carson, 1989).

For a measure to be content valid, the “survey instrument” needs to be accessible and understandable to a multitude of people, coming from a host of different backgrounds and levels of education (Bateman *et al.*, 2002: 296-297). The content contained within a CV survey should be adequately presented while questions may need to be examined to make sure they are asked in an “appropriate manner” and are easily comprehendible (Mitchell and Carson, 1989: 190). Higher accuracy can be achieved by making sure that: the payment vehicle is in a familiar form and relevant to the good being valued, enough time is given to respondents to think over answers, participants accept the WTP format and, sufficient detail is being provided (Garrod and Willis, 1999). Essentially, the ‘domain’ of the survey should incorporate only relevant material for accurate estimation of the good and thus, the study needs to be correctly ‘framed’. Finally, the instrument should be meaningful to respondents, unambiguous, plausible and offer incentives for accurate WTP revelation (Mitchell and Carson, 1989; Bateman *et al.*, 2002). If these criteria are not adequately met (test groups and scrutiny by peers would assist in this regard), serious doubt could be cast on the validity of the results obtained.

Criterion validity, as argued by Mitchell and Carson (1989: 192), “has the greatest potential for offering a definitive test of a measure’s WTP validity”. A criterion is basically a value which lies close to the actual WTP or market value of the proposed good. Hypothetical values obtained through the CVM are then compared to the ‘criterion’ to assess if the instrument is able to produce dependable results (Garrod and Willis, 1999; Venkatachalam, 2004). The hypothetical-simulated market is a technique designed to replicate market conditions for quasi-private goods[58] by forcing people to commit payments according to their WTP (Mitchell and Carson, 1989). The simulated criterion, having been determined, is used as a yardstick for the purely hypothetical stated WTP, which does not require a payment. Benchmarking accuracy for quasi-public goods is a critical step in determining whether the CVM could be successfully extended to the domain of public goods.

Early simulated market studies by Bohm (1972) and Bishop, Herberlin and Kealy (1983) found that there were significant differences between market values and CV values. Mitchell and Carson (1989) attacked these studies, blaming several factors for distorting the final estimates, some of which were: the inclusion of outliers, questionable analyses, inherent

[58] Non-rivalry and non-excludability not exhibited in all cases of public goods thus they are quasi-public. Essentially, access to the goods can be restricted and therefore, charges for use are able to be levied.

study bias, use of Willingness To Accept (WTA)[59] instead of WTP simulated markets, strategic bias and use of an invalid payment vehicle. Later studies by Bishop and Herberlin (1983-1984) in the Sandhill Wildlife Demonstration area[60] analysed WTP for hunting permits. A simulated WTP market was run and used as the criterion. The results demonstrated that hypothetical WTP values were not significantly different from the simulated values and therefore the Contingent Valuation Method was able to measure goods, like hunting permits, with "considerable accuracy" (Mitchell and Carson, 1989: 200).

Further studies[61] were presented and analysed by Garrod and Willis (1999), and demonstrated favourable results for hypothetical valuation. A study by Neill, Cummings, Ganderton, Harrison and McGuckin (1994), did find inaccuracies in the CVM estimate when compared to the simulated market. However, the survey exhibited certain design flaws in the form of not specifying "rules of provision" and the use of a bidding system instead of the referendum method (Garrod and Willis, 1999: 148). Johnston (2006), in a more recent study, analysed the presence of hypothetical bias, and therefore the divergence between WTP and actual payments, using a binding public referendum as the criterion. The good being valued was the public supply of water to the Village of North Scituate, USA, which was elicited using dichotomous choice methodology[62]. Results showed that CV responses correlated closely[63] to the actual referendum votes (Johnston, 2006).

Although these results provided excellent grounds for the valuation of quasi-public goods and therefore adds validity to public good valuation, the absence of markets for public goods presents a concerning case: there "exist[s] no criterion values for public goods against which either simulated market or CV value estimates may be measured" (Bateman *et al.,* 2002: 317). However, it has been postulated, and empirically found, that familiarity and experience assist with accurate estimation of goods (Venkatachalam, 2004; Johnston, 2006; Bateman *et al.,* 2008). Since normal market processes clearly do not exist for public goods, individuals are extremely limited in their ability to properly acquaint themselves with their respective preferences. The core problem then relates to preference uncertainty for "low-experience"

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[59] Willingness To Accept is different from WTP in that respondents are asked what amount they would be willing to accept for a change in an environmental amenity or good, where WTP asks how much the respondent would be willing to pay to prevent the same measure.
[60] Wisconsin
[61] Which largely took part during the 90's
[62] referendum/take-it-or-leave-it
[63] not statistically different from each other

goods which are traded in hypothetical markets, and are unfamiliar to individuals who are expected to make reliable WTP valuations (Bateman *et al.*, 2008: 128). If a significant portion of participants are unsure about their preferences for a particular good, solicited values through the CVM would more than likely be seriously misaligned with the market equilibrium price.

The discovered preference hypothesis (DPH), suggested by Plott (1996), holds that the only way to solve for this experience problem is through the process of trial and error through repeated market interaction, whereby the individual is provided sufficient time to learn "the consequences of alternative actions" (Bruni and Sugden, 2007 :163). As neo-classical economics assumes the nature of preferences are stable and coherent (Rabin, 1998), the challenge for the CV practitioner is to "uncover these well-defined, pre-existing values" (Payne and Bettman, 1999: 245). Market repetition, also known as 'institutional learning', was found to be a key factor in forming "theoretically consistent preferences" by Bateman, Burgess, Hutchinson and Matthews (2004: 2, 2008).

Conversely, Payne and Bettman (1999) argue that the DPH would only apply in situations where preferences for goods were well known and that preferences for unfamiliar goods would need to be 'constructed', instead of merely being discovered. Expressed preferences for an object, in the constructionist framework, are made up of two major components in addition to random error: stable values which remain "relatively constant across situations and a situation-specific component that is the joint effect of the task and context contingencies that are present" (Payne and Bettman, 1999: 246). A further assertion made by Payne and Bettman (1999) is that in most cases the 'situation-specific' component will be large, immediately highlighting the value of achieving content validity, an area dealt with earlier. Evidence provided by Bateman and Mawby (2004), Hanley and Shogren, (2005) and Sugden (2005) has confirmed the constructivist contention, further establishing that preferences are malleable, taking their shape from the "Contingent Valuation frame" (Watson and Ryan, 2007: 478).

Watson and Ryan (2007) found exactly that which has been argued so far; where respondents are familiar with goods, researchers would be able to uncover these underlying values however, in cases where respondents have very little "direct experience" with a good; the framing of a scenario will influence preference building. Hence, assisting respondents to "learn their preferences within a CV experiment may overcome some of the anomalies observed" (Watson and Ryan, 2007: 479). Efforts have been made in this regard, notably by Kenyon, Hanley and Nevin (2001), MacMillan, Phillip and Hanley (2002), Kenyon, Kevin and Hanley (2003) and Bateman *et al.* (2008).

The final test of validity, termed construct validity, is classified into two categories: convergent validity and theoretical validity. Convergent validity assesses the degree to which a measure corresponds to "other measures of the same theoretical construct" (Mitchell and Carson, 1989: 204). In other words, values from CV studies are compared to those obtained through the travel cost method or hedonic price method as theory postulates, that under certain situations, these values should be similar (Garrod and Willis, 1999: 150). A major obstacle in convergent validity assessment, however, concerns the kinds of values that revealed preference (RP) and direct solicitation techniques are able to obtain (Bateman *et al.*, 2002). Direct elicitation methods (CV) include *ex-ante* non-use values while revealed preference techniques are only able to capture observed and therefore *ex-post* use values. Fortunately, if the income effect is small and there are substitutes available for sites and activities, these conditions provide grounds for comparison between the different methods (Willig, 1976). Carson, Flores, Martin and Wright (1996, in Bateman *et al.*, 2002) compared 616 CV and RP techniques and found a high correlation between the measures, although CV estimates tended to be slightly lower on average.

Theoretical validity is simply an assessment of "the degree to which the findings of a study are consistent with theoretical expectations" (Mitchell and Carson, 1989: 206). Essentially, most studies regress WTP estimates against independent variables which are believed to be theoretically influential such as income, age and education (Garrod and Willis, 1999). Validity is then judged if the sign and the size of the coefficients are consistent with theory. Thus only determinants of the inverse demand function should be included in order to achieve good results (Garrod and Willis, 1999). Another way of testing the model is to analyse "different conditions for which the theory suggests different values" (Mitchell and Carson, 1989: 207). An example of such 'conditions' are quantities and associated values, where a higher quantity of an environmental good should have a higher value attached to it than a lower quantity, and less time taken for good provision would be more highly valued than delayed delivery. If there are irregularities present in these theoretical tests, serious doubt can be raised about the instrument and therefore the entire study (Mitchell and Carson, 1989).

Reliability is the second major aspect upon which criticisms of the CVM are centred and refers to the amount that WTP variance is "due to random sources or noise" (Mitchell and Carson, 1989: 211; Venkatachalam, 2004). A reliable CV study requires that in "repeated measurements, (a) if the true value of the phenomenon has not changed a reliable method should result in the same measurement[64] and (b) if the true value has changed a reliable method's measurement of it should change accordingly" (Loomis, 1990 in Venkatachalam, 2004: 91; Onwujekwe, Fox-Rushby and Hanson, 2005). The measure of reliability in this case pertains to the instrument used for obtaining WTP values. If retesting[65] is not possible, researches could alternatively strive for a 'respectable' R^2, which needs to be above 0.15 (Mitchell and Carson, 1989). However, the reliability of a particular instrument says nothing about the validity the measure employs, which could call into question the presence of bias.

Validity and reliability tie in with one another somewhat closely. In order for an instrument to produce reliable estimates, content validity should be strictly adhered to. Survey methodologies need to be stringently followed, while pre-testing the instrument and allowing respondents to think and reconsider answers show promise for higher reliability (Mitchell and Carson, 1989). Statistical methodologies are also crucial for achieving reliable estimates and can be attained through two primary means: "sufficiently large sample sizes" and the employment of techniques which allow for the effective removal of outliers (Mitchell and Carson. 1989: 223). Where the sample size is adequate or even high, variance will still be present as it is unlikely that any two individuals will have the same valuation for a given good. As a consequence, variance will be persistent no matter the quality of the instrument.

Tests for CV reliability by Carson and Mitchell (1993), Carson, Mitchell, Hanemann, Kopp, Presser and Ruud (1994), Whitehead and Hoban (1999), Dong, Kouyate, Cairns, Sauerborn (2003) and Jakus, Stephens and Fly (2006) indicates that estimates are generally reasonably reliable. While some studies[66] have found counter-evidence disproving the reliability of estimates in the CVM, Bateman *et al.* (2002) argue that the occurrence of certain 'events'

[64] given the method's accuracy
[65] A very expensive enterprise
[66] See Thompson, Read and Liang, 1984; Sorum, 1999; Desvousges, Johnson, Dunford, Hudson, Wilson and Boyle, 1993

over time are able to shift preferences sufficiently enough to yield different values. Where shifts in preferences are absent, poor study design as well as “unrepresentative samples” are cited for the discrepancies (Onwujekwe, Fox-Rushby and Hanson, 2005). However, due to the “paucity” of evidence for CVM reliability, much more research is required.

Elicitation techniques

A key component of any CV study involves soliciting values for a good/service from individuals. Since Davis’s (1963) pioneering study, for which he used the bidding game method to solicit WTP values, several elicitation techniques have been developed, namely, open-ended direct elicitation format, payment card/ladder approaches, single-bounded dichotomous choice, one and a half bound dichotomous choice, double-bounded dichotomous choice format, the randomised card sorting procedure and an “alternative set of stated preference techniques”, termed choice modelling (Bateman *et al.*, 2002: 248; Venkatachalam, 2004; Hanley and Barbier, 2009: 48). As each format relies on different techniques for obtaining WTP, disparities in strategic behaviour incentives and the levels of information presented and collected, may yield different estimates (for the same good) between the methods (Bateman *et al.,* 2002: 138). The primary problem then, is one of method selection.

Choice modelling is a general term which covers four stated preference techniques: choice experiments, contingent ranking, contingent rating and paired comparisons (Bateman *et al.,* 2002). The overarching idea of choice modelling is that “any good can be described in terms of its attributes, or characteristics, and the levels that these take” (Bateman *et al.*, 2002: 248; Carson and Hanemann, 2005). Since choice experiments (falling within choice modelling) is the only technique which is compatible with the theory of welfare economics, as well as demonstrating similarities with the CVM, a large constituency of economists have begun to adopt this approach which necessitates a brief discussion (Stewart and Kahn, 2006). In choice experiments, participants are presented with three or four alternative choice scenarios, each encompassing several attributes, but at varying levels to one another, and asked to make a selection on their most preferred alternative. Several choice rounds may be presented for each respondent while a status quo option is included so that welfare estimates can be compared and measured.

By selecting the most valued scenario, respondents are effectively making tradeoffs and substitutions between properties, allowing the researcher to "value changes in individual attributes" (Carson and Hanemann, 2005; 872; Stewart and Kahn, 2006). Essentially, values for choice experiments are obtained through repeatedly asking individuals their choice of scenario while in contrast, the CVM tries to pinpoint and directly elicit the value for one specific attribute (Stewart and Kahn, 2006). For CVM's, the attribute needs to be clearly detailed, otherwise other values may be included, leading to misspecification therefore biasing the final results. Therefore, studies which aim to look at the relative importance of attributes for a particular good would employ choice experiments while CVM is best used for analysing one particular aspect or characteristic of a scenario (Bateman *et al.,* 2002).

As was detailed earlier, the CVM has a range of elicitation formats. The NOAA panel (1993: 11-26) suggested that a single-bounded (SB) dichotomous choice (DC) approach would be the most appropriate selection for sampling, arguing against open ended questions as they lead to erratic responses and opened the floor to strategic bias. Further, the NOAA panel stressed the value of incentive compatibility, involving the incorporation of measures to facilitate the truthful revelation of respondent's Willingness to Pay (NOAA, 1993). According to Bateman, Day, Dupont and Georgiou (2009: 806), "strategic behaviour arguments suggest that the dichotomous nature of SB responses makes the approach incentive compatible". The major reason for the insistence on an 'incentive compatible' method is due to empirical evidence suggesting that in hypothetical market scenarios, "individuals are sensitive to incentives for truthful demand revelation" (Champ, Flores, Brown and Chivers, 2002: 591-601). As public goods are plagued by the problem of free riding, if the proper motivations[67] are not in place, individuals may understate their true valuations. Essentially, if a respondent is given any reason to believe that they can impact the level of provision without having to commit to their stated payment, the instrument will be considered incentive incompatible (Bateman *et al.,* 2002).

Respondents therefore, need an instrument which will convince them that the scenario is plausible and ensures truthful WTP values. Where open-ended questions are concerned, respondents may not be familiar with being asked openly about the amount they are willing to pay, possibly leading to unconsidered values. Further, strategic bias will be present where

[67] incentive structures

individual agendas are pursued which are facilitated through the free rein given to valuation decisions (NOAA, 1993; Whitehead, 2000). Open-ended questions are also plagued by non-responses or protest bids, where participants offer no value to the elicitation question (Venkatachalam, 2004). On the other hand, referenda or dichotomous choice allows for incentive compatibility because it is realistic[68] and "there is no strategic reason for the respondent to do other than answer truthfully" (NOAA, 1993: 12).

In the single bounded dichotomous choice (SBDC) format, an individual is asked a single referendum (single-shot) question[69] based on whether they would be willing to accept a proposed environmental change for some amount (X Rand). Several offer amounts are then selected, based on a range, which are obtained through pre-test surveys (Champ *et al.,* 2002: 595). Respondents are then randomly allocated one of these amounts (X Rand) and asked whether they would be willing to pay, a 'yes' answer denoting that the true worth lies above X and 'no' indicates a lower value (Faria, Matsuhita, Nogueria and Tabak, 2007). Unfortunately, the nature of referenda as well as the issue of only determining whether WTP lies above or below the bid amount renders the SB technique statistically inefficient (Faria *et al.,* 2007).

Statistical efficiency is necessary because it facilitates a higher degree of accuracy in estimating respondent's Willingness to Pay (Bateman *et al.*, 2009). For a given level of precision, a more efficient elicitation technique would require a smaller sample size (Hanemann, Loomis and Kanninen, 1991; Faria *et al.*, 2007). Additionally, Bateman, Burgess, Hutchinson and Matthews (2004: 12) call into question "the conventional CV view that first-response DC elicitation formats approximate market situations". In conjunction with prior studies[70], the single bounded approach was discredited by Bateman, *et al.* (2004) for not providing respondents adequate time and practice to learn the market and stabilize preferences.

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[68] People of the United States are used to voting in a referendum format although somewhat limited to South Africa. Despite this minor fact, the procedure still offers the same incentive compatibility to respondents regardless of location.WTA compensation for a deterioration, WTP for an improvement or WTA compensation for foregoing an improvement.

[69] Four variations on the question could be asked depending on whether it is WTP or WTA i.e. WTP to avoid deterioration,

[70] List and Luckling-Reily, 2000; List, 2001, 2002 in Bateman *et al.*, 2004

Hanemann, Loomis and Kanninen (1991) proposed an extension of the SB technique, calling it the double-bounded (DB) dichotomous choice method and included a follow-up question after the initial offer. For example, if a respondent replied 'yes' to an initial bid (X), a higher offer would be made, while if the initial bid (X) was rejected, a lower offer would be proposed (Whitehead, 2000). More information could therefore be elicited from individuals as WTP had a chance of falling within a 'double bound' (interval/range), resulting in a significant increase in statistical efficiency (Hanemann *et al.,* 1991; Bateman *et al.,* 2002; Watson and Ryan, 2007; Bateman *et al.,* 2009). Moreover, the follow-up question provides respondents with an opportunity to gain experience toward hypothetical market valuation and therefore aid in stable preference formation (Bateman *et al.,* 2004).

However, problems which are present in the single-bounded DC persist in the double-bounded DC. A common problem encountered by dichotomous choice formats relates to the elicited values, which tend to be "significantly and substantially larger than those resulting from comparable open-ended questions" (Bateman *et al.,* 2002: 139). Henzein and Bridges (2008: 482) attribute this discrepancy to the "open-ended format['s]... reputation for producing conservative results", which while apt, only forms part of the explanation. The most frequently cited reason for disparities between open-ended and closed-ended values is due to starting point bias, which is induced when a value is introduced in the hypothetical scenario by the interviewer (Mitchell and Carson, 1989; Herriges and Shogren, 1996; Bateman Burgess, Hutchinson and Matthews, 2008). Respondents who are uncertain about their valuations for the good in question, "may regard the proposed amount as conveying an approximate value of the amenity's true value and therefore anchor [their] WTP amount on the proposed amount" (Mitchell and Carson, 1989: 240). The starting point bias is better known as the 'anchoring effect' and constitutes a serious problem for the DB DC elicitation method (Van Soest and Hurd, 2008).

The inflated values are further exacerbated by the 'yea-saying' bias[71], which is the propensity of respondents to agree with any offer put forward by the interviewer, regardless of how they truly value the good. Chien, Huang and Shaw (2005: 364) have suggested that 'yea-saying'[72] is brought on by individuals for several reasons: they are community conscious, the expectation of utilising the public good themselves, social pressure during the interview

[71] only present in DB DC
[72] acquiescence bias

process and the personal feeling of enjoyment from being altruistic, termed ‘warm glow’. Furthermore the acquiescence bias is significantly higher for individuals who are uncertain about their stated WTP, which is largely influenced by education levels, experience with the good and whether respondents are the regular decision makers for their household (Van Soest and Hurd, 2008).

One measure to control for yea-saying, as argued by Van Soest and Hurd (2008), is that questions should be asked in a simple, clear and neutral manner. The design points, which refer to the offer amounts selected for the study, could equally be at fault in which case higher values would need to be included (Carson and Hanemann, 2005). Presence of strategic bias, caused by lack of incentive/believability provided by the payment vehicle, would need to be treated with the Turnbull lower-bound empirical distribution estimator of Willingness to Pay. The methodology provides a more robust estimation across different distributions, especially because a normal distribution is often assumed. Including a “spike parameter” for general cases of ‘yea-saying’ provides an effective procedure for lowering mean WTP by “dropping the right tail”, rendering the inclusion of a ‘yea-saying’ parameter unnecessary (Carson and Hanemann, 2005: 887-888).

The follow-up question of the DB approach, aside from inciting the yea-saying bias, has led to the rejection of the assertion that “first and second responses... are drawn from the same distribution” (McFadden in Bateman *et al.,* 2008). Results from Watson and Ryan (2007) confirm this contention, revealing internal inconsistency problems between SB and DB dichotomous choice, as well as questioning the validity of the *a-priori* assumption of well-formed preferences (Watson and Ryan, 2007; Bateman *et al.,* 2008; Aravena-Novielli, Hutchinson, Longo, 2010). Additionally the “institutional procedures” (follow-up questions) present in DB studies are claimed to “surprise” respondents, giving rise to internal inconsistencies (Bateman *et al.,* 2008).

As argued earlier, Watson and Ryan (2007) state that the problem of preference anomalies is prevalent in goods which are unfamiliar to respondents, and therefore responsible for the problem of preference uncertainty. Individuals who exhibit preference uncertainty have an “underlying valuation distribution”, from which values are randomly drawn at any given instant, and become a “potential source error” (Kingsley and Brown, 2010: 530). Similarly, the market institutions in which public goods are traded are unfamiliar to participants, which provide another avenue for error. A growing body of evidence (Plott, 1996; Bateman *et al.,* 2004; Flachaire, Hollard, Luchini, 2007; Watson and Ryan, 2007; Bateman *et al.*, 2008; Aravena-Novielli *et al.,* 2010; Kingsley and Brown, 2010) however, suggests that repeated market interactions are essential for institutional learning, stable preference formation[73], removal of the anchoring effect and bringing about internal consistency between the DB and SB methods. A process of familiarisation between respondents, the hypothetical market institution and the public good, as argued by Bateman *et al.* (2008), can be achieved through the learning design Contingent Valuation Method.

Learning is facilitated through a series of valuation tasks "both within and across goods" which are "of a similar kind" but are subtly differentiated (Bateman *et al.,* 2008). For example, Bateman *et al.* (2008) examined the living conditions between laying hens, chickens, cows and pigs. The method proposed initiating the learning process with a pair of animals which were similar (small birds) and then move to a pair which were dissimilar enough (large animals) for the learning process to be partially restarted. Results indicated that there was an initial significant difference between the estimated means of the single bounded and double bounded approaches. However, as valuation tasks progressed from laying hens to chickens, the observed disparity between the methods decreased remarkably, producing a non-significant difference between the means (Bateman *et al.,* 2008). Furthermore, once participants undertook the entire public good learning process, which allowed familiarization with the market institution, the disparity in the estimated means of the final good closed to 0.01, an outstanding result.

Other noteworthy findings from the study include greater theoretical consistency through learning, coherence between SB and DB techniques, the gradual erosion of the anchoring effect, discovery of an upward bias inherent in the SB technique and preference establishment which calls into question the *a-priori* assumption of well formed and stable preferences. Bateman *et al.* (2008) acknowledge that these results are not at odds with standard micro-economic theory, instead "the tests presented describe trends which clearly show a movement towards theoretically consistent preferences". Consequently, more time will have to be dedicated to each interview in order for the learning process to be effective, which is a minor trade-off considering the gains in estimate precision.

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[73]Termed value learning

Multi-good studies are also prone to the sequencing effect which refers to the trouble of obtaining significantly different estimates for the same goods by changing the order in which they are valued (Diamond and Hausman, 1994). Boyle, Welsh and Bishop (1993) found that the sequencing effect could be minimized through experience, with individuals being more familiar with the good showing consistent WTP values no matter the order they appeared. As learning design Contingent Valuation allows for experience to be gained through familiarization, the sequencing effect should not be regarded as a serious issue.

Preference formation through learning offers an attractive and effective way of assisting participants who have trouble placing values on abstract goods, through an unfamiliar market. Many of the problems which are unique to the DB method are also conveniently solved by accustoming individuals to the institutional form (Bateman *et al*, 2008). Another notable point to be made concerns the traditional view of economists' functions. Historically, the focus has been confined to preference discovery, which assigned economists the task of 'excavating' underlying and buried preferences, similar to that of an archaeologist. Evidence (Payne and Bettman, 1999; Bateman *et al*, 2008) has shown that where preferences are uncertain for goods, economists can assist in preference building and construction, working instead as architects (Watson and Ryan, 2007).

The CV process, involving how questions are asked and what information is provided, then becomes a powerful tool when combined with the features of a learning design questionnaire. By familiarizing respondents with public goods and the features of a particular market institution, learning design Contingent Valuation is complementary with eliciting accurate, reliable and valid estimates through hypothetical markets. Captured values from the referenda bids require an appropriate technique of estimation as the response data is based on binary choices (yes/no). An overview of the double bounded model, which uses maximum likelihood to estimate the average Willingness to Pay of individuals to relocate the Waainek Wind Farm to a different area based on visual preferences, is the next topic for discussion.

3.2 Theoretical Framework

Much of the theory in this section is based on Lopez-Feldman's (2012) paper which describes the statistical process in STATA© for double bounded estimation. Consequently, it is also Lopez-Feldman's (2012) programming code that was used to run the double bounded model within STATA©. Response data from Contingent Valuation studies are analysed using the random utility model (McFadden, 1974; Hanemann, 1984). Individuals (which will be denoted by i) are assumed to be utility maximisers therefore, the model assumes that when respondents are faced with two choices or alternatives, they will always choose the option which yields the highest utility value. As dichotomous choice (referenda) are of the closed-ended CV type, a binary choice between two states is presented, one where the respondent states 'no' ($y_i = 0$) and the other where the respondent states 'yes' ($y_i = 1$), to a predetermined offer amount (t_i,) and varies at random across individuals. WTP can therefore be modelled using the following linear function:

$$WTP_i(z_i, u_i) = z_i\beta + u_i(1)$$

Where $z_i\beta$ is a vector of explanatory variables as well as their corresponding parameters andu_i is an error term which incorporates individual and question error (Lopez-Feldman, 2012, Watson and Ryan, 2007). In the above case, explanatory variables would include age, gender, education, knowledge, familiarity, occupation, interest, residential background, scenery, income, electricity paid for monthly and wind turbine attractiveness, while the error term represents the random differences in each individual's preferences for a particular good, which in this case is scenery. The random component of utility is not observable therefore the model relies on probabilities for estimation (Aravena-Novielli, Hutchinson and Longo, 2010). If the individual's WTP is higher than the bid amount, t_i, (WTP > t_i) then the expected response would be a 'yes' answer. Accordingly, the probability of a yes response given the values of the explanatory variables is expressed:

$$\begin{aligned}\Pr(y_i = 1|z_i) &= \Pr(WTP_i > t_i)\\ &= \Pr(z_i\beta + u_i > t_i)\\ &= \Pr(u_i > t_i - z_i\beta)\end{aligned}$$

following from Lopez-Feldman (2012), assuming that $u_i \sim N(0, \sigma^2)$, indicating a normal distribution, it then proceeds that:

$$\Pr(y_i = 1|z_i) = \Pr\left(v_i > \frac{t_i - z_i'\beta}{\sigma}\right)$$

$$= 1 - \Phi\left(\frac{t_i - z_i'\beta}{\sigma}\right)$$

$$\Pr(y_i = 1|z_i) = \Phi\left(z_i'\frac{\beta}{\sigma} - t_i\frac{1}{\sigma}\right) \quad (2)$$

where $v_i \sim N(0,1)$ and $\Phi(x)$ denotes that the model uses the standard normal cumulative distribution. Equation (2) is closely related to the probit model, but distinguished by the presence of the variable t_i in addition to the other explanatory variables (Lopez-Feldman, 2012). Estimation of this model can be done by maximum likelihood to solve for β and σ or alternatively using probit[74]. However, equation (2) represents the single bounded model, in which only one response to a bid (t_i) is allowed for. A follow-up bid, as used in the double bounded dichotomous choice procedure, would require some adjustment to the model specified.

The double bounded model, which was originally proposed by Hanemann (1985) and Carson (1985) and later implemented by Hanemann *et al.* (1991), involves a second or follow-up bid after the first offer amount. As explained earlier, a 'yes' response to the first bid would result in a higher follow-up amount being offered and a 'no' response would result in lower follow-up amount being offered, resulting in a 'sharpening' or truncation of the single bounded estimates. Secondly, if a 'no' response is followed by a 'yes' response[75], then a clear bound can be placed on WTP (Hanemann *et al.*, 1991). It is crucial to note that the first bid is determined exogenously[76], but the follow-up bid is endogenous as it depends on the answer given to the first bid[77] (Cameron and Quiggin, 1994). The potential problem arising from assuming a single valuation function for both bids is that the distributions for the first and

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[74] Lopez-Feldman (2012) covers the probit estimation steps in detail and is beyond the scope of this section as the interest lies more specifically with the double bounded model rather than the single bounded model. Further, maximum likelihood is adopted as the method of estimation and not the probit.
[75]This is also true if a 'yes' response is followed by a 'no' response.
[76]The first bid amount is determined randomly by the interviewer
[77]If the response was 'no' in the first case, bids would be restricted to lower amounts than the initial bid. The same applies if the response is 'yes', although this time around, amounts would have to be higher that the initial bid level.

second bids respectively, may be different. However, Arana and Leon (2007) assert that as respondents become accustomed to a second bid offer, they will "settle into a new cognitive regime where the underlying value stabilises".

Looking at the responses for the double bounded model more closely and naming the first bid amount t^1 and the second t^2, we find that the individual will fit into one of four classes:

1. The individual answers 'yes' to the first bid and then 'no' to the second bid. In this case we have $t^1 < t^2$ and we can further infer that $t^1 \leq WTP < t^2$. Willingness to Pay falls between bid 1 and bid 2.
2. The individual answers 'yes' to both the first and second question. In this case we have $t^2 \leq WTP < \infty$. Willingness to Pay is higher than the second bid up to infinity.
3. The individual answers 'no' to the first question and then yes to the second question. In this case we have $t^2 < t^1$ and we can further infer that $t^2 \leq WTP < t^1$. Willingness to Pay has a distinct bound between the first high bid and the second low bid.
4. The individual answers no to both the first and second bid. In this case we have $0 < WTP < t^2$. Willingness to Pay lies between the second lowest bid and zero.

Cases 1 and 3 have well defined intervals for Willingness to Pay, while cases 2 and 4 are similar to the single bounded model except that the values will be closer to the true value of WTP due to truncation (Hanemann *et al*., 1991). Defining y_i^1 and y_i^2 as the first and second responses to the closed bids[78], the probability that an individual will answer 'yes' on the first bid and 'no' on the second bid is expressed as $Pr(y_i^1 = 1, y_i^2 = 0 | z_i) = Pr(s,n)$. Where $Pr(s,n)$ is basically simplified as stating that the probability is conditional on the values of the explanatory variables. Together with this in mind, and the assumption that $WTP_i(z_i, u_i) = z_i'\beta + u_i$ and $u_i \sim N(0, \sigma^2)$, Lopez-Feldman (2012) states that the probability of each of these cases is given by:[79]

1. For cases with 'yes' as the first response and 'no' as the second ($y_i^1 = 1$ and $y_i^2 = 0$):

[78]Dichotomous variables
[79]These equations are simplifications. The details of their derivation can be followed in Lopez-Feldman (2012).

$$\Pr(s,n) = \Pr(t^1 \leq WTP < t^2)$$
$$\Pr(s,n) = \Phi\left(z_i'\frac{\beta}{\sigma} - \frac{t^1}{\sigma}\right) - \Phi\left(z_i'\frac{\beta}{\sigma} - \frac{t^2}{\sigma}\right) \quad (3)$$

2. For cases with 'yes' as the first and second response ($y_i^1 = 1$ and $y_i^2 = 1$):

$$\Pr(s,s) = \Pr(WTP > t^1, WTP \geq t^2)$$
$$\Pr(s,s) = \Phi\left(z_i'\frac{\beta}{\sigma} - \frac{t^1}{\sigma}\right) \quad (4)$$

3. For cases with a 'no' as the first response and 'yes' as the second ($y_i^1 = 0$ and $y_i^2 = 1$):

$$\Pr(n,s) = \Pr(t^2 \leq WTP < t^1)$$
$$\Pr(n,s) = \Phi\left(z_i'\frac{\beta}{\sigma} - \frac{t^2}{\sigma}\right) - \Phi\left(z_i'\frac{\beta}{\sigma} - \frac{t^1}{\sigma}\right) \quad (5)$$

4. For cases with 'no' as the first and second response ($y_i^1 = 0$ and $y_i^2 = 0$):

$$\Pr(n,n) = \Pr(WTP < t^1, WTP < t^2)$$
$$\Pr(n,n) = 1 - \Phi\left(z_i'\frac{\beta}{\sigma} - \frac{t^2}{\sigma}\right) \quad (6)$$

Equations (3) to (6) cannot be estimated using the probit model and as a result a likelihood function needs to be constructed in order to obtain estimates for β and σ using maximum likelihood estimation (Aravena-Novielli *et al.*, 2010; Lopez-Feldman, 2012). To find the parameters of the model, the function that needs to be maximised is given:

$$\sum_{i=1}^{N}\left[d_i^{sn}\ln\left(\Phi\left(z_i'\frac{\beta}{\sigma} - \frac{t^1}{\sigma}\right) - \Phi\left(z_i'\frac{\beta}{\sigma} - \frac{t^2}{\sigma}\right)\right) + d_i^{ss}\ln\left(\Phi\left(z_i'\frac{\beta}{\sigma} - \frac{t^2}{\sigma}\right)\right) + d_i^{ns}\ln\left(\Phi\left(z_i'\frac{\beta}{\sigma} - \frac{t^2}{\sigma}\right) - \Phi\left(z_i'\frac{\beta}{\sigma} - \frac{t^1}{\sigma}\right)\right) + d_i^{nn}ln\left(1 - \Phi\left(z_i'\frac{\beta}{\sigma} - \frac{t^2}{\sigma}\right)\right)\right] \quad (8)$$

where d_i^{sn}, $d_i^{ss}, d_i^{ns}, d_i^{nn}$ are indicator variables which either takes the value of 0 or 1, depending on the responses of the individual. Therefore, out of four possible cases, only one of the indicator variables will be assigned a 1 with the rest being assigned 0. In this approach,

$\hat{\beta}$ y $\hat{\sigma}$ are directly estimated and from this information WTP can be estimated (Lopez-Feldman, 2012).

3.3 Data collection

Initial preparation and design

Questionnaire design for Contingent Valuation studies are just as important as the data collection and estimation components, if not more so. Information provided needs to be unbiased as well as standardised across respondents in order to ensure that WTP valuations are not altered by survey instrument differences. Mitchell and Carson (1989) initially set out rules governing how to properly design and set up a valuation study. In a more updated manual by Carson (2000), succinct recommendations are made on assessing the quality of a CV study. The guidelines to a good CV study include: (1) an introductory section which helps set out the context for respondent decision making, (2) the good being valued needs to be described well to the respondent, (3) the "institutional setting in which the good will be provided", (4) the payment vehicle or method of payment for the good in question, (5) the means that the survey employs to elicit respondent's preferences "with respect to the good", (6) questions which determine why respondents answered questions in the way they did and finally (7) a demographics section which takes into account all the attributes of the respondent (Carson, 2000).

The guidelines specified by Mitchell and Carson (1989), Carson (2000) and Whitehead (2000) were applied to the survey instrument used in this study. The elicitation technique, as discussed earlier, was the dichotomous choice method suggested by the NOAA (1993) panel, except that a follow-up question was included in order to improve statistical efficiency; also known as the Double Bounded Dichotomous Choice (DBDC) method (Hanemann, 1991). Essentially, the use of a follow-up question is aimed to 'fine tune' WTP responses and will achieve a valuation which lies closer to the true amount of a given amenity (Hanemann, Loomis and Kanninen, 1991). Further, because WTP amounts are estimated with greater certainty, a lower number of observations could be afforded in the study, especially useful given the small and restricted dataset. Explanatory variables which concerned visual and monetary aspects of the wind farm were identified by Aoki (1999) and Landenburg and

Dubgaard (2007), and included age, gender, occupation, peoples personal interest in area, education, familiarity of area, attractiveness of scenery (respondents), residential background, income and monthly electricity bill payments[80].

A focus group was held before the questionnaire was applied in the field[81]. An essential feature of a focus group is to gather "perceptions on a defined area of interest in a permissive, non-threatening environment" (Krueger in Myers, 1998: 85). Group interactions allow a "cross-fertilization of ideas" which may not have a chance to develop in one-on-one interviews (Billson, 2006: 3). In terms of the questionnaire, focus group participants were asked to comment on survey questions and any possible implicit bias inherent in the structure of the language. 'Question framing' is especially important as poor wording may have the unintended effect of leading responses (Mitchell and Carson, 1989; Watson and Ryan, 2007). Consequently, collected data could be rendered invalid as reactions would no longer be considered as truly personal reflections, and is also evident for cases where there is a miscomprehension of the question.

It is extremely unlikely that the first draft of any questionnaire will be without flaws (Mitchell and Carson, 1989). Indeed, concerns were raised regarding the language, question formatting and general understanding of the questionnaire during the focus-group meeting. A particularly tricky problem raised, related to the level of competence in English possessed by first language Xhosa speaking groups. Unlike developed European countries where each sovereign tends to have a dominant language[82], South Africa has 11 official languages, each spoken by significantly large portions of the population, which can readily create barriers to understanding (Census, 2011). Grahamstown falls within the province of the Eastern Cape, containing a large predominantly Xhosa speaking population, which necessitated the translation of the survey into Xhosa. Unfortunately, it was not possible to validate the quality of the translated instrument as time and funding constraints did not permit further examination.

[80] This variable could indicate the ability to pay of the respondent. The higher the electricity bill, the more consumption of electricy which may indicate a higher ability to pay.

[81] Check the appendix for the memo on the focus group

[82] i.e. population groups who speak languages, other than the predominant native tongue, and are not numerous enough to be considered significant

After the conclusion of the focus group, a further 10 days were dedicated to a pre-test period, allowing participants to highlight problems and to determine the correct bid levels for the Contingent Valuation section. Open ended valuations from respondents showed the initial WTP figure to be around R50 a month, although these levels were later raised because of the high rates of acceptance at the upper end of the bid range. Six different bid levels were selected and included R10, R40, R70, R100, R130 and R150[83]. Each offer amount was assigned a number and selected using a number generator application on a cell phone. The second bid amount was also drawn from these numbers and depended on whether the first response was a 'yes' or 'no'. Once the bids and the other outstanding problems were resolved, the questionnaire could then be finalised.

Final design layout for questionnaire

The final draft of the questionnaire (see Appendix B) included a total of four sections broadly involving 1) & 2) general questions on attitudes, 3) Contingent Valuation and 4) demographics. The first section of the questionnaire addressed the attitudes towards wind energy in general, the level of knowledge respondents had on wind farms and their response to the public participation process. The data allowed a comparison between general support for wind energy against specific support for the Waainek Wind Farm which will help identify whether the NIMBY effect is in play. Further, factors which fall outside of the NIMBY argument are included in order to determine whether other issues are responsible for the observed limited backlash, instead of solely blaming NIMBY. For this reason it was crucial to isolate whether attitudes towards the wind farm were affected by the way the developers had handled public relations or if they were based on purely visual problems. A variety of questions assessing level of fairness of the public participation process and changes in attitudes were asked to determine if alternative factors had a role in rejection.

The second section collected information on attitudes on the various characteristics of wind energy, familiarity with the Waainek area as well as proximity analysis to further check for the NIMBY effect. The question of familiarity related to how well participants knew the

[83] If the first bid amount was R150 and the response was yes, no follow-up was made. Similarly, if the first bid offer was R10 and the response was no, no second offer would be made. Due to the anchoring effect and because further bids would result in decreasing gains in precision, no further bids were used to 'hone' in on WTP.

Waainek area, how they rated the scenery while also determining whether they had a personal interest in the area. Proximity questions placed participants in a series of situations which gradually distanced wind turbines further away from the respondent's household. Where wind turbine visibility may have had an impact on feedback, each distance recorded how attitudes changed when individuals could and could not see the wind turbine. Thus this doubled as a test for the NIMBY effect while factors other than visual considerations could be specified. Provisions were made for recording participants 'thinking out loud' as they considered questions, allowing for the collection of qualitative data[84].

The third section encompassed the valuation section where WTP would be elicited directly from respondents. As the impact being assessed is visual, photographs of the landscapes with wind turbines, and without, were presented to respondents. Three different areas were selected based around Grahamstown. Each photo had different scenic properties, the first being Featherstone Kloof (site A) which appeared relatively natural or unscathed by development. The second landscape was of Makanaskop (site B), and was located to the East of Grahamstown where there was a high degree of urban development. The third area was Waainek (site C), the site where the wind farm had been proposed and contained elements of both human development and a natural looking landscape.

Participants were then asked if they would be willing to pay an amount (X) to move the wind farm from each of the sites shown (sites A, B and C) to a different area (site D), based solely on visual considerations. Questions were phrased: "If the authorities could introduce ONLY the scheme to preserve the visual landscape of photo A, by relocating the wind farm to area D, would you be willing to pay X in addition to your monthly electricity bill?" Based on the first response, a follow-up question would be offered. A positive reply would result in being asked a higher amount: "if yes, would you be willing to pay Y?" and a negative response would result in a lower amount being offered: "if no, would you be willing to pay Z?" Photographs of the landscapes were shown before each WTP question so that participants knew which landscapes they were valuing. Each landscape (A, B or C) presented a status quo scenario, the absence of wind turbines, and then the after shots once a wind farm had been installed into the landscape. Areas A and B were completely hypothetical due to the fact that these areas had never been considered for wind farms by Innowind. However, the inclusion

[84]For a detailed treatment of the questionnaire refer to Appendix B

of these sites was necessary in order for individuals to learn about their preferences and valuations. Photo C was of the Waainek area and was where the actual development of the wind farm was going to take place[85].

Participants were reminded that by stating their WTP to have the wind farm removed from a particular site, each valuation needed to be treated as mutually exclusive which prevented participants adding up the various valuations and therefore using their entire budget (Carson and Groves, 2007). This was done to prevent WTP values from decreasing based on a diminishing budget. Thus for each landscape, the full budget amount was available, one good's expenditure did not impact on the ability to spend on the next good. Additionally, the area proposed for the relocation of the wind farm (site D) did not correspond to the first three sites (sites A, B and C) and was included so that respondents would not make a trade-off between the first three areas (sites A, B and C).

The inclusion of the fourth area (site D) was done for another good reason. In a reaction to a pre-test, some respondents, who supported the wind farm, were concerned that by paying to remove the turbines, Grahamstown would forfeit the project completely. Therefore, when participants were asked whether they were willing to pay to remove the turbines based solely on visual considerations, a large number of no-responses were present. Site D[86] was then introduced as a hypothetical area close to Grahamstown, which would have little or no problem with visual impacts. By paying to relocate the wind farm to this less intrusive site, Grahamstown could keep the wind farm, but at a lower visual cost remedying the high no-response problem and demonstrates the presence of some positive externality. Respondents were asked to value all three areas, in the order of A, B and C. The reason for the specific order was to ensure that respondents gained some experience in valuing a 'beautiful' landscape (site A) and then one which had a great deal of human disturbance (site B). By the time the participants came to value Waainek, an area which was somewhat intermediate in its disturbance in relation to site A and B, it was postulated that experience would have been gained for the valuation technique as well as having a stabilising effect on preferences for the scenic good (Bateman *et al*., 2008).

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[85] These photographs are shown in the valuation section.

[86] The alternative site was hypothetical and assumed that the wind farm would have no visual impact on Grahamstown or any other residents. Therefore, visual cues for the area were not necessary because obtaining 'pure' visual values for Waainek was the objective. By introducing visual cues for area D, a trade-off between visual characteristics between the two areas would have proceeded, resulting in muddled values.

Payment would have to be made through a realistic and familiar ‘vehicle’ so as not to make the effort of payment greater than respondents would be willing to pay for the particular scenario. The fairly obvious method in this case was the addition of a surcharge to household electricity bills. For those households which operated off pre-paid meters, they were told that specific arrangements would be made with the municipality to adjust tariffs for their meter by the WTP amount they had specified in the study. Respondents were told that payments would be made on a monthly basis and continue for the lifetime of the project; therefore the commitment would be continuous and need careful consideration.

Sampling areas

Grahamstown was split into three areas in order to ensure that a broad sample of the population was obtained, each area contributing 50 respondents with a total goal sample size of 150. The demarcation of areas was done with reference to a Grahamstown map, where decisions on suitable population groupings were made according to spatial and social factors. The three areas sampled for the purposes of this study were called Grahamstown East, Grahamstown North and Grahamstown South. For the middle-income areas, a division was made along African Street (see Figure 3.1) as it was roughly the mid-point between the two Central areas and thus provided a ‘natural’ boundary. The purpose of the division was meant to ensure that the sample was adequately spread in the population, and because of their demographic similarities, Grahamstown North and South were eventually combined to form ‘Grahamstown Central’.

Grahamstown Central refers to the older and more western regions of town, which can be classified as a predominantly white and middle-income. For the purposes of this study ‘Grahamstown Central’ encompasses the suburbs of Hill 60, West Hill, Cradock Heights, Central, Sunnyside, Fort England, Oatlands, Oatlands North, Somerset Heights, Curry Park, Irving Heights and Kingswood along with Rhodes University, as can be seen in Figure 3.1. The visual impact map demonstrates a relatively limited visual impact scope for the wind farm on the Central areas, mainly being visible from Irving Heights, Curry Park, Kingswood, Cradock Heights and Hill 60. These areas are situated on topographically higher ground rendering them more prone to a view of the Waainek Wind Farm. Visual impacts for the remaining suburbs appear limited, with only partial or low visibility (Holland, in CES, 2010a).

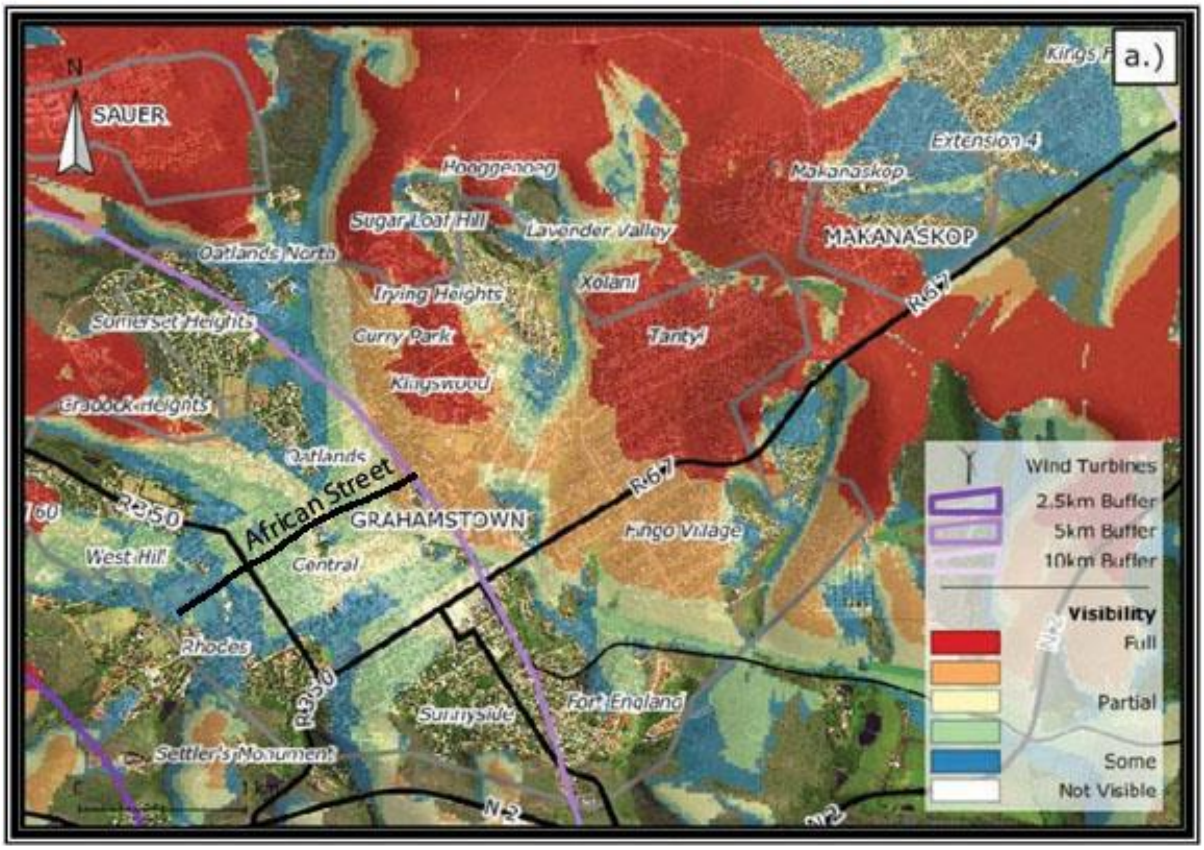

Figure 3.1: Map showing Grahamstown and levels of visibility for the different areas of town.

[Source: adapted from CES, 2010a]

For the purposes of this study Grahamstown East, also officially known as Rhini, includes the suburbs of Fingo Villlage, Sugar Loaf Hill, Hooggenoeg, Lavender Valley, Xolani, Tantyi, Makanaskop, Kings Flats and all of the township extensions which can be seen in Figure 3.1. The demarcation between Grahamstown Central and East can be seen quite roughly in terms of wind turbine visibility (see Figure 3.1), where partial (yellow) meets semi-full exposure (orange) to the wind turbines. Exceptions include Kingswood, Curry Park, Irving Heights, SAUER, Cradock Heights and Hill 60. Grahamstown East makes up the historically low-income black areas, which persist as a consequence of colonial labour planning in the 19th century and apartheid housing/residency policies applied later in the 20th century (Moller, Manona, van Hees, Pillay and Tobi, 2001). While the demarcation appears to be based on wind turbine visibility, no such plan was intentionally made, but rather resulted from coincidence.

The older and more established sections of Grahamstown East are in the western suburbs of Fingo Village and Tantyi running through to Makanaskop and generally have more amenities in the home and better access to services than those in the informal settlements. These same suburbs tend to be situated on west facing hill-slopes, the same direction as the Waainek area. The consequence of this orientation is that there is a high potential visual impact from the wind farm for these areas once construction of the project is complete.

To the east of Makanaskop residences are relatively shielded from the view-shed of the wind farm, as these neighbourhoods fall on a gradual down-slope which is east-facing. These same suburbs also form part of the 'newer' housing construction with extensions 4 and 5 being relatively 'better off' economically than surrounding areas. On the outskirts of the new and growing eastern suburbs however, a large number of informal housing has been constructed and are "typically a mix of 'overspill' from overcrowded township dwellings and in-migrants from the surrounding rural areas" (Moller *et al.,* 2001). These informal settlements on average do not have legal status (no municipal services/utilities), are mostly shacks or mud-huts and are occupied by the poorer pockets of society. Even if the wind farm were visible from these settlements, it is likely that visual impacts would be of lesser concern. Considering Figure 3.1, visual impact exposure seems to be the greatest for Hooggenoeg, Sugar Loaf Hill, Xolani, Tantyi, Fingo Village and Makanaskop.

Collection

Households were individually selected using a sampling technique which involved going to predetermined streets and using a cell phone to generate randomized numbers. Based on these random numbers, the interviewer knew how many houses to skip before conducting the next questionnaire. Household decision makers were the optimal choice for the study as they were better acquainted with the monthly amount spent on electricity and therefore had a better idea of what they would be willing to pay. Therefore, it was suggested by Whitehead (2000) that those respondents who had undertaken the valuation procedure, and were decision makers in the home, would provide more considered and accurate WTP estimates. Younger individuals falling below 18 years old would be less likely to provide reliable estimates, as they are not normally the decision makers in households, and therefore did not feature in the results.

Survey work was done primarily during the week when most of the adult population was at work, which could account for the shortfall in the 35-44 category. To ameliorate for this problem, the address of the workplace[87] was followed up by the interviewer where possible.

Information about the Waainek Wind Farm project was restricted to a two page sheet which participants were provided with at the beginning of the interview. The interviewer was prohibited from divulging any information relating to the questions or the wind farm project in order to guard information from bias. Assistance by the interviewer was only allowed if clarification on questions was needed. Simple questions were asked first as a ‘warm up’ and to prepare respondents for the more difficult questions to come later. The valuation scenario fell in the middle of the questionnaire, with the desired effect that respondents would be more relaxed about the nature of the questions and ready to supply more cognitively demanding answers. Further, a translator accompanied the interviewer into Grahamstown East, an area where Xhosa is predominantly spoken, in order to smooth conversation and translate responses into English ‘on the fly’. Translation was necessary, especially due to the nature of the Contingent Valuation Method and common misunderstandings found with the unfamiliar methodology.

A total of 151 questionnaires were completed, exceeding the target amount of 150 which was a pleasing result. All questionnaires had been completely answered, attributable to the interview process, where the interviewer was responsible for making sure that all answers had been filled in. Sampling started in June 2012 and concluded towards the end of August 2012, taking approximately three months to complete. Most interviews were held at respondents’ houses which allowed more time for each interview and therefore ensured higher quality data. Some convenience sampling was done on Rhodes University campus where unoccupied students, who assured the interviewer that they had enough time to properly answer all questions, were asked to participate. While not ideal, these students did appear to take survey seriously where responses did seem carefully considered[88] (Venkatachalum, 2004: 100).

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[87]Provided by members of the household.

[88] While student sampling did not provide ideal candidates for the visual valuation, complete exclusion of the group would have been equally erroneous. The comments among students were diverse and did highlight interesting insights from younger educated groups. A cross section of the population was therefore necessary; otherwise older groups would have pre-dominated the sample, skewing results. Further, many students live in digs and do actively pay electricity every month, forcing them to consider their budget constraint. The greatest concern is the student’s temporary status as residents of Grahamstown, which may have allowed a more favourable disposition towards the wind farm; resulting in a lower WTP.

The bulk of the interviews, 101 in sum, were conducted by one interviewer in English, while the remaining 50 were administered by a Xhosa translator, where the proceedings were observed by the original interviewer. Interviewers were thus able to gain good experience for the survey instrument allowing for speedier responses and simpler identification of problem areas. The length of interviews varied with each respondent, but on average took approximately 30 minutes per completed questionnaire. Participants who were interested in knowing more about the wind farm were allowed to ask questions *after*[89] the interview. Individuals were encouraged to take their time when considering their answers, which contributed to the variability in the time taken per interview. Additionally, the feedback from participants, on why they had answered questions in a certain way, was documented for qualitative purposes and for the augmentation of answers. The other major factor contributing to the variability in time for the interviews was due to some respondents not being required to answer the Willingness to Pay section, which was mandatory only if stated beforehand that they were willing to make payment.

Once the questionnaire quota had been filled, data were inputted into Microsoft Excel© and formatted for STATA©, where the bulk of the data analysis was undertaken. Graphs were outputted to Excel in order to enable quicker and simpler creation of the necessary graphical features. The next chapter presents the results of the survey for the Grahamstown community. Where possible, qualitative data, in the form of comments recorded during interviews, were used to bolster the results of the analysis to achieve a deeper understanding of how attitudes are shaped by the interplay of visual, socio-economic and institutional factors. By including other influential aspects of the wind farm which affect attitudes, the important issues are able to be compared with one another, in order to establish a clearer perspective.

[89]It is especially important that answers for questions are given only after the interview is completed. Data are likely to change if additional information is provided during the interview, an undesirable consequence.

Chapter 4: Data results and analysis

4.1 Data results and analysis

The next section discusses summary statistics obtained from the survey, dealing with the demographics of the sample. Standard descriptors such as age, gender, employment, education and income will be presented, while factors which pertain and specifically influence visual aspects will form some of the additional ‘key’ explanatory variables. The proceeding “Questions pertaining to the wind farm” section will then begin analysing attitudinal and knowledge based data relating to wind farms in general as well as dealing with the specific context of the Waainek project. Separating purely aesthetic concerns from outside factors will assist in explaining if the NIMBY effect is solely to blame for the current Waainek disagreement, if at all. Visual determinants are then analysed to see which factors contribute to people’s Willingness to Pay to relocate the wind farm. South Africa presents very different socio-economic circumstances for wind energy when compared to European countries and thus people’s responses may reflect this reality.

Demographics

The sample data from 151 completed questionnaires comprised of 55% female and 45% male. Age was broken up into six different brackets, namely 18 or younger (0%), 19-25 (27.81%), 26-34 (18.54%), 35-44 (9.27%), 45-60 (21.85%) and 61 or older (22.52%). The sample was more or less evenly spread across all age groups, as can be seen in graph 1, except for the 35-44 and 18 or younger categories. Occupation demographics shown in Figure 4.2 illustrate that 24.5% of the sample had some form of employment, 13% were business owners and a large proportion (28%) were unemployed[90]. A direct comparison between employed[91] and unemployed categories, omitting all other groups within the occupation category, suggests some skewing in the results, with a 46% unemployment[92] rate and an employment rate of 54%. Using the latest 2011 census data as a comparison, the Makana district has an unemployment rate of 32%, a figure which is above the national

[90]Unemployed, for the purposes of this study, is defined as anyone who was not engaged in some form of employment at the time of the questionnaire.
[91] The “employed” category is the sum of people with jobs and those who run businesses.

average of 23.9%, but is still substantially lower than the unemployment rate recorded in this study (StatsSA, 2011).

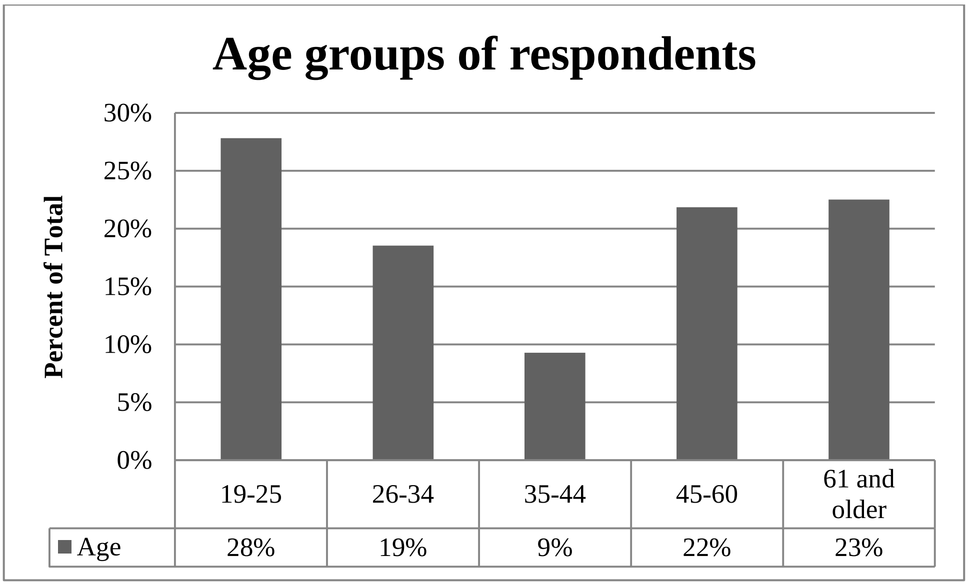

Figure 4.1: Breakdown of age demographics for Grahamstown 2012
[Source: Sample survey]

Three possibilities account for the disparities. Firstly, the ‘high’ figure could be due to sampling error by the interviewers. Secondly, as the Makana district is made up of several towns[93], employment statistics may vary greatly between each locale. Thirdly a large proportion of respondents in townships may not count themselves as employed, especially if the nature of their work is temporary and therefore they may have been inclined to respond negatively to employment questions. An especially important point to consider relates to differences in working definitions of employment by StatSA and the one used in this study. Admittedly, unemployment as used in this study is far more inclusive than what is used officially nationally, which explains the large discrepancy between findings.

[93]Namely Grahamstown, Alicedale and Riebeek East.

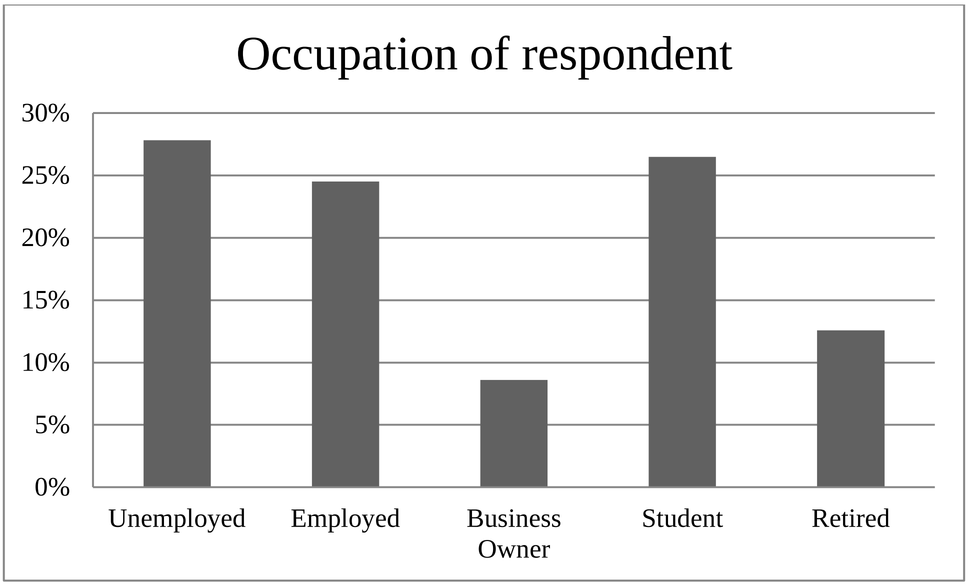

Figure 4.2: Occupation demographics for Grahamstown in 2012
[Source: Sample survey]

Figures for education (Figure4.3) indicate that a high number of respondents (31.8%) had achieved some form of tertiary schooling, which could be largely influenced by the academic status of Grahamstown. Grade 12 holders constituted 27.1% of the sample while grade 11 and below made up 26.5% of the total. Post graduate degree holders and students were the smallest proportion of respondents, constituting 14.6% of the total sample.

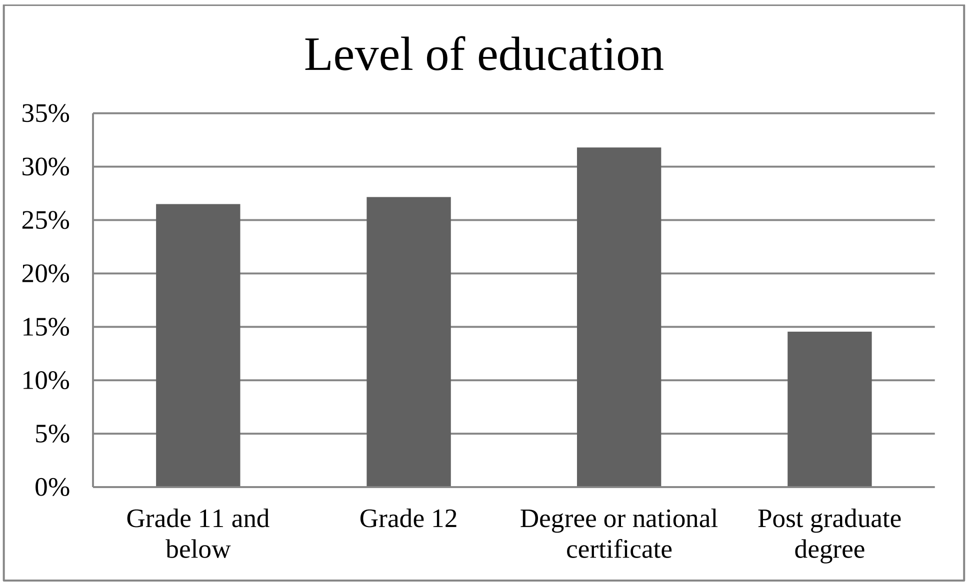

Figure 4.3: The highest level of education attained by respondents 2012
[Source: Sample survey]

A total of 12 income brackets were used in the study, however due to sample size constraints, the brackets were reorganised and revised down to five. Having specified the scope of the five brackets to increase the frequency of observations in each bracket, the intention was to broaden the size or inclusiveness of the bracket with each successive tier, allowing for a greater chance to capture respondents at higher income levels. A good reason for proceeding in such a manner is due to the persistent unequal income distribution in South Africa which is shown by a Gini[94] index of 0.63, which means that the majority of the population are concentrated in the lower income brackets while fewer fall in the higher tiers (World Bank, 2012). Figure 4.4 has been reorganised into fewer groups and will be used for the duration of the study. Starting from the lowest bracket, the sample for monthly income was as follows: R1000 and below (32.5%), R1001-R5000 (30.5%), R5001-R15 000 (13.9%), R15 001-R35 000 (17.8%) and R35 000 and above (5.3%).

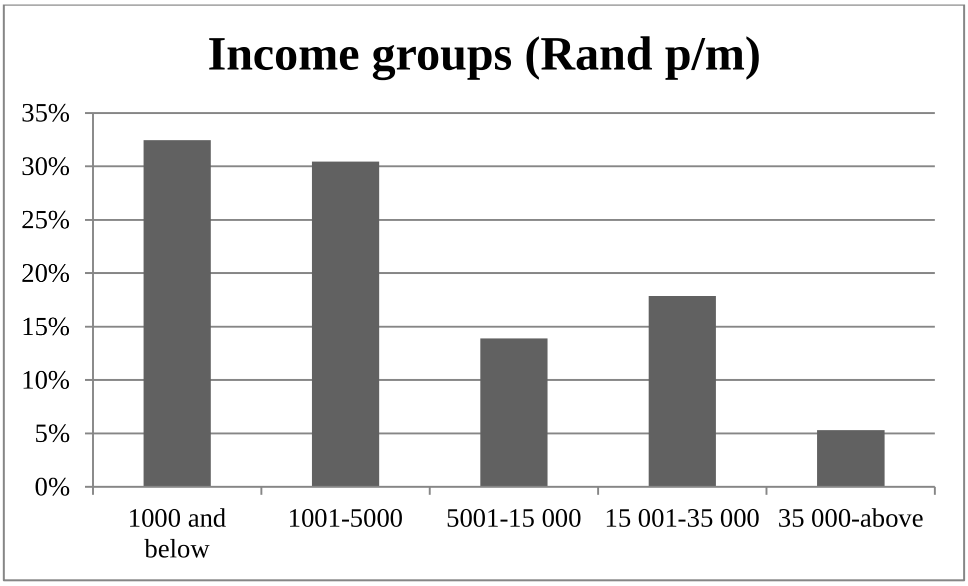

Figure 4.4: Reorganised income groups for people living in Grahamstown
[Source: Sample survey]

The number of people living in a single house is an important demographic because it affects the pressure on a household's budget constraint and therefore the ability to pay. Additionally, the data will be used later as a basis to construct average household sizes to aid the calculation of the visual impact. Graph 4.5 shows a decrease in observations as the number of

[94]The Gini index is a measure of how much the distribution of income or income expenditure within a country "deviates from a perfectly equal distribution" (World Bank, 2012). A line of absolute equality, which is perfectly linear and positively sloped, is compared to a Lorenz curve depicting the state the country is in at the time. The difference between the line of absolute equality and the Lorenz curve provides the Gini index, with a figure of 0 meaning absolute equality and 1 being absolute inequality.

people living in the same residence increases. Most people (22.5%) interviewed, lived by themselves with a large proportion (59%) of this same sub-group being students who lived in Rhodes University residences. Respondents who had 5-8 individuals in the same house had the highest frequency among unemployed groups, possibly due to cost cutting behaviour. Lastly, observations in the 2-4 category appeared evenly spread among different livelihoods.

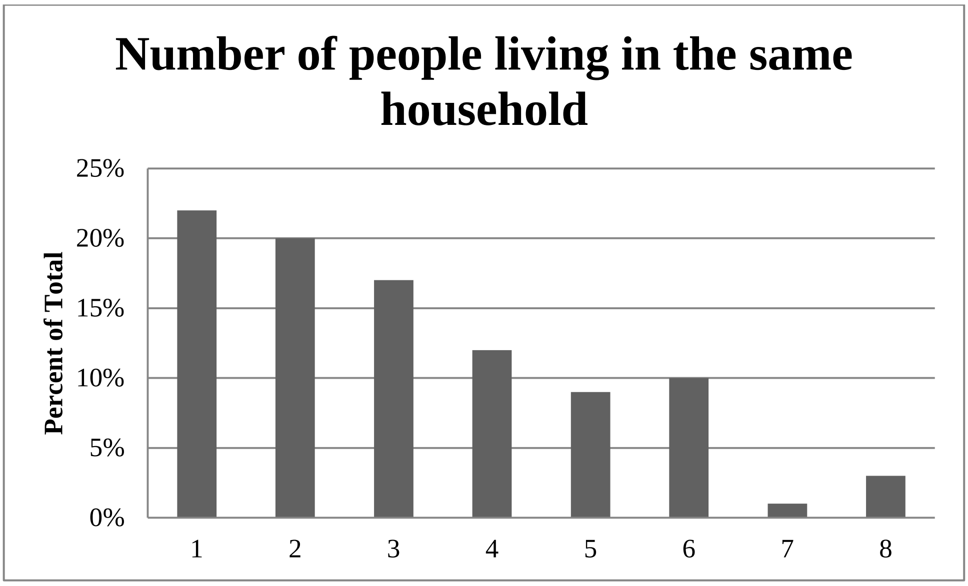

Figure 4.5: Households in Grahamstown can have large variances in the number of people per household which would affect ability to pay
[Source: Sample survey]

The majority of the sample (62.91%) stated that they were usually responsible for paying the electricity bill in the household. As previously discussed, the purpose of the question was to gauge who would be better equipped to answer the Willingness to Pay section. From a total of 23 Willingness to Pay responses, 16 were responsible for the electricity bill of the house, close to 70% of the sub-sample, garnering greater confidence for the estimates.

People originating from urban backgrounds constituted a large share of the sample (74%), while those who grew up in traditionally rural areas made up the remainder. Members of environmental organisations were very limited with only 18% of the sample declaring that they had participated in these groups while fewer (11.3%) stated that other members of their household had been involved with an environmental organisation. As these figures are very broad, a brief examination of the different sample areas of Grahamstown is necessary in order to better understand the realities facing each locale. The dynamics for each of these areas can then be examined to provide supplementary detail for responses.

Grahamstown Central

An overview of demographics reveal that gender was very nearly equally split at 49% of the sample being male and most (36%) of these respondents being between that ages of 19-25. The youthfulness of the sample is owed to the high proportion of students residing within these areas. Ages for the remainder of the sample were 26-34 (16%), 35-44 (8%), 45-60 (19%) and 61 and older (21%). As can be seen from Figure 4.6, respondents also tended to be very well educated, being a university town, with 63% having achieved some form of tertiary education. Roughly a third (31%) of participants had obtained a grade 12 level while only a minority (6%) had not completed a grade 12.

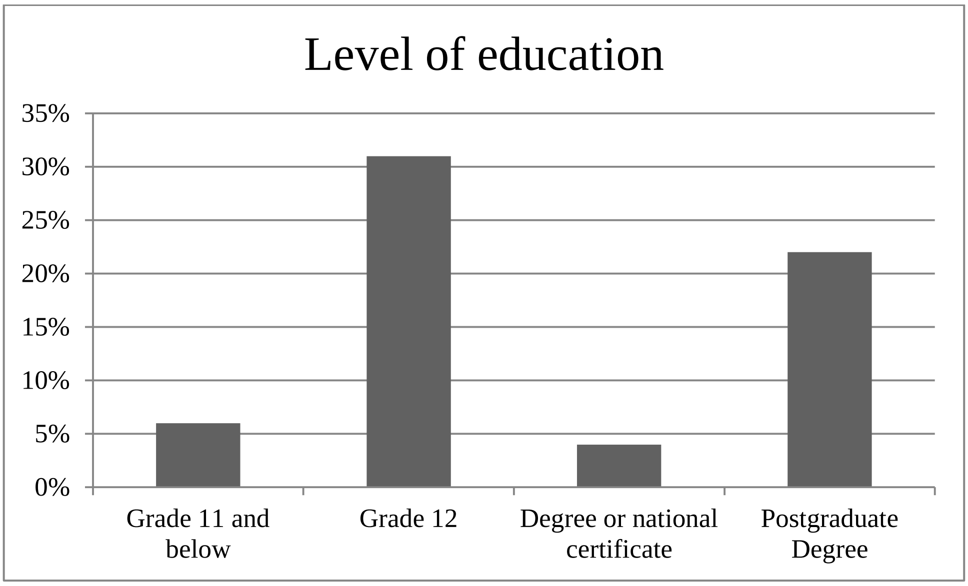

Figure 4.6: The distribution for level of education of Grahamstown Central respondents broken down into four categories
[Source: Sample survey]

Occupation data show that 34% were employed, 12% were business owners, 39% were full time students, 14% were retirees and the remaining 1% were unemployed. The statistics illustrate the prominence of students living in the central areas. High levels of employment are also typical of these areas, which when using the official measure of employment, was 97%. The proportions of respondents in each income group was relatively evenly spread (Figure 4.7), except for lower earners who made up 18% of the sample, however this group comprised almost exclusively of students who lived in the Rhodes University residences. Income brackets show that the majority of respondents were relatively well-off.

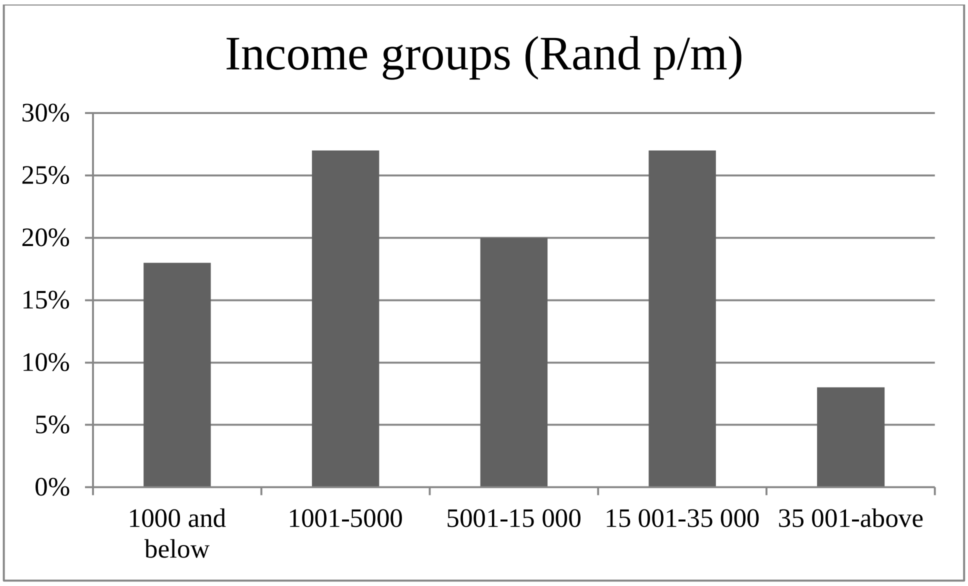

Figure 4.7: Distribution of income between groups for Grahamstown Central
[Source: Sample survey]

The number of people in a household fell primarily within the 1-4 brackets, which when combined, accounted for 86% of the sample. Average people per household for the area was 2.62, close to three. The remaining brackets were as follows, 5 (7%), 6 (6%), 7 (1%) with no households having 8 members. Environmental organisation participation was isolated to the central areas, with 27% of the subsample stating that they had been a member. Members of the household who were part of environmental organisations were also limited to the central areas and were 17% of the sample. Finally, 35% of the entire sample stated that they had read up or watched documentaries on wind farms, with 84% of this number coming from Grahamstown Central.

Grahamstown East\Rhini

The data show that the sample favoured female respondents with 63%. Age distribution leans towards older groups, primarily in the 45-60 (27%) and 61 and older (25%) cohorts, while the 19-25 and 35-44 groups contributed 12% each. Finally, the 26-34 group made up the remaining 24% of the sample. Education statistics indicate that 67% of the respondents had attended schooling to grade 11 and below, while 19% had obtained their grade 12. A minority (14%) of respondents had achieved a degree or national certificate. Contrasting these results with Grahamstown Central, education figures for the east areas was relatively low.

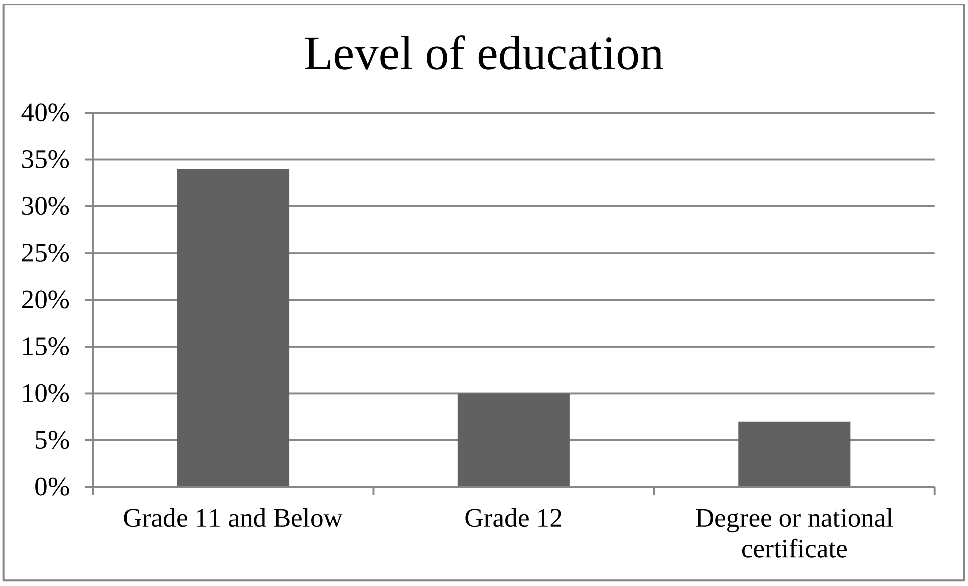

Figure 4.8: Distribution of education groups within Grahamstown East
[Source: Sample Survey]

Occupation statistics illustrate the unemployment problem in Grahamstown East. An overwhelming majority of respondents classified themselves as being unemployed (80%), with 8% of the sample counting themselves as being employed. Retired persons accounted for 5% of respondents while 2% stated that they were attending some form of educational institution. The high rate of unemployment and low education explains income distribution among respondents, with most (61%) earning R1000 and below a month and 37% bringing in R1001-R5000 a month. Only one reply for R5001-R15 000 was observed with no responses for the brackets falling above R15 000.A high proportion of households had 3-6 members and a mean of 4.5 people per household, with fewer falling into the 1, 2, 7 and 8 categories. Thus there were generally more people living in a single house than was the case in Grahamstown Central. As determined before, no respondents within Grahamstown East were members of environmental organisations; however 20% of the sample had watched or read-up on information pertaining to wind farms.

4.2 The visual determinants and impacts of the Waainek Wind Farm

The first question asked respondents to personally assess their level of knowledge on wind farms, after the required reading of the information sheet. Very little information on wind farms was provided in the preliminary reading (see appendix B) with only the most basic function of electricity generation by the turbines being explained. The bulk of the reading summarised the proposed plan regarding the wind farm along with a brief description of the Waainek area. Most respondents were not very well informed on wind farms, with 34% indicating that they knew little while 26% stated that they had no prior knowledge at all. There was a tendency for the number of people with a reasonable understanding to decrease as higher levels of knowledge were acquired, demonstrated by the figures of 27.9% initially showing a moderate amount of understanding and the remaining 9.5% being more comprehensive. Not a single participant considered their knowledge to be on an engineering level, which led to this category being omitted for the duration of the study.

An overwhelming majority (85%) of people were in favour of wind energy in general, corresponding with what Krohn and Damborg (1999), Bell, Gray and Haggett (2005), Ek (2005), Warren *et al.*, (2005), BWEA (2005) and Toke *et al.* (2008) found. The primary reasons for being positive towards wind power were attributed to clean energy production and due to the inexhaustible nature of the electricity supply. Others had stated that they had visited countries which had installed large scale wind farms and due to their first-hand experience, had found them agreeable. Various participants identified wind power as being a fundamentally integral source of electricity for the future energy mix. Oddly, while some were concerned about local bat populations being killed by the moving turbine blades, one person expressed delight arguing that it would help to “keep bats away”. The remaining 15% of respondents, who were negative towards wind energy, expressed concern over the high costs of production and how the resulting impact would exacerbate the already escalating electricity price climate of South Africa. Energy production, or the reliability/interruption of electricity supply from wind farms, was also largely responsible in triggering scepticism, especially considering the country-wide load shedding undertaken by Eskom during early 2008.

While very few people in the survey opposed the abstract idea of wind farms, a major question of concern was whether the locally proposed wind farm of Waainek garners a similarly high rate of support from the same group of people. Figure 4.9 displays the demographic distribution of attitudes towards the Waainek project and reveals a surprisingly high rate of positive support of 80%[95]. Opposition, on the other hand, to the wind farm were very few in number, amounting to little over 5%, with 14.6% opting for neutrality. The findings suggest that the support for the local Waainek Wind Farm in Grahamstown corresponds closely with the support for wind energy in general however, further verification is required.

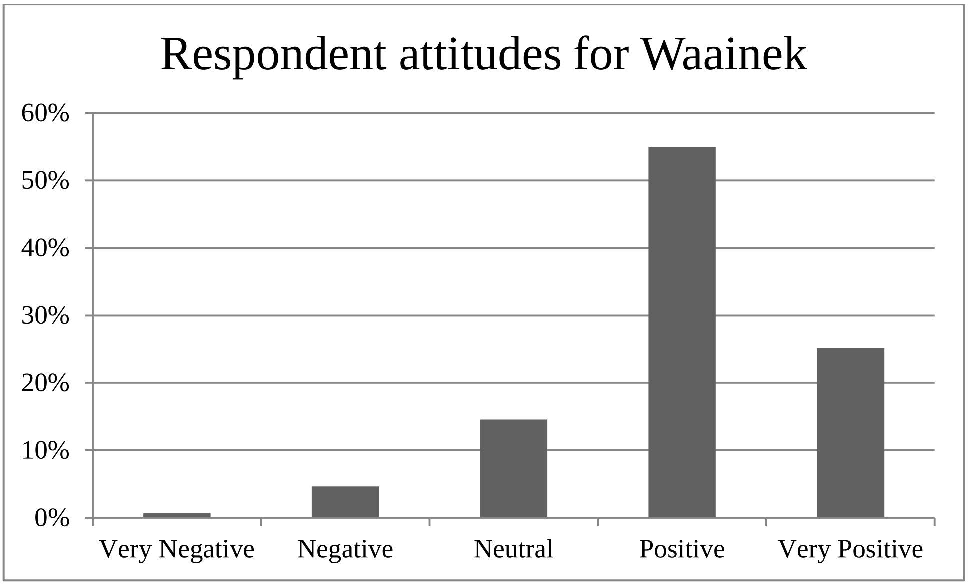

Figure 4.9: Grahamstown attitudes towards the Waainek Wind Farm project.
[Source: Sample survey]

In order to establish whether there is a relationship between general and local level wind energy support, a chi-squared test was necessary. Essentially, the chi-squared test determines whether there is a relationship present or if the distribution is due to chance. Testing at the 95% confidence level confirmed a relationship between general and local level support, however the test does not admittedly explain the association ($\chi^2 = 4.4017$; $P = 0.036$). An inspection of the frequency table confirmed that those in favour of wind energy in general were also supporters of the local Waainek Wind Farm. The result is rather surprising, given that other studies (Warren *et al.,*2005: 866, Krohn and Damborg, 1998 and Dudleston in Eltham *et al.*, 2008) have found that these two figures frequently diverge. McGowan and

[95]Adding positive and very positive together to get a figure of 80%.

Sauter (2005), Ellis *et al.* (2007) and Aitken (2010) blame existing opinion polls, which they argue tend to exaggerate changes in attitudes between local projects and general concepts. Failing to mention the economic disposition of a country may be equally to blame. Is general widespread support only an illusion peculiar to developed countries or does it extend to nations still enduring the phases of 'development'?

South Africa's socio-economic context as a developing country, the novelty of wind power in the nation, as well as the recent problems with grid electricity supply, seem powerful factors influencing the levels of support. Indeed Toke *et al.* (2008) and Aitken (2010A) have highlighted that countries with high instalment rates tend to produce the most local opposition, implying that regions with few wind farms should initially yield a more supportive populace. Additionally, local development is associated with job creation, a powerful driver of public support in a country where the official unemployment rate rests at 25%. Context evidently cannot be ignored.

Increasing and stabilising the supply of electricity was an often cited benefit, which once again, plays into the uncertainty surrounding the current grid supply situation faced by South Africans. However, the diversification of supply into cleaner sources is an equally major driver for the positive feedback towards Waainek. South Africa currently derives 93% of its energy from coal power plants, emitting large amounts of CO_2 and SO_2, which contribute significantly towards global warming and localised respiratory problems respectively. The construction of Kusile and Medupi, two new massive coal plants within the Mpumalanga and Limpopo provinces respectively, will put further pressure on the carbon footprint of South Africa (Eskom, 2012). Indeed, Greenpeace Africa has already voiced their opposition to the construction of these two energy plants, previously holding protests at both construction sites. Clean alternatives are therefore a welcome change, with local wind power in Grahamstown being viewed as "modern", "safe" and "clean".

Another aspect which seems to be important to residents is the fact that the supply of electricity from the wind farm will be localised, where the production process is clearly visible and within the serviceable vicinity of the Grahamstown demand centre. Interestingly, as a result of the wind farm being located nearby, residents have become convinced that they will be shielded from load-shedding should it happen, provided that the wind is blowing. While this 'protective' aspect does present itself as an attractive feature, the reality may be very different. Innowind is merely the owner and operator of the Waainek Wind Farm, once electricity is produced and supplied to the grid, Eskom takes over the distribution (Minkoff, 2013). There is no guarantee that electricity will be channelled solely to the Grahamstown municipality. However, the belief in energy security no doubt operated as a powerful positive driver in favour of the Waainek Wind Farm, especially in township areas where electricity is often unreliable.

The high support received in favour of the Waainek Wind Farm makes any case for the NIMBY effect very thin indeed. As mentioned earlier, a degree of concern has been expressed by among others, Ek (2005), Warren *et al.* (2005), Wolsink (2007), Ladenburg (2008) and Swofford and Slattery (2010) about the frequent and 'erroneous' labelling of local wind farm opposition as typical NIMBY behaviour. Instead, the floor has been opened up to other overlooked factors, which may exclude land use considerations, and could equally be to blame for community opposition. Inclusiveness or the lack thereof, in the planning process is one of the features addressed earlier, which has potentially inflammatory repercussions (Gross, 2007; Aitken, 2010A). The *status-quo* use of top-down decision making creates tension between developers and the affected community, where plans are made without consulting stakeholders. The notion of fairness, as argued by Lind and Tyler (in Gross, 2007), is a necessary prerequisite in determining attitudes toward wind farms and projects in general.

The public participation process, as previously discussed, provides the necessary platform for community members to raise concerns. Specific guidelines pertaining to the public participation requirements of an EIA are given by section 32 (2) of the EIA regulations (2006). According to the EIA regulations, the PPP measures undertaken by CES (2010) in the *Environmental Impact Report* satisfied all the statutory requirements. Survey results from the community however, indicate that while the public participation process claims openness and inclusiveness, the reality for the Waainek project was different. While advertising measures did meet regulatory requirements, many Grahamstown residents remained oblivious to the project.

The promotion measures taken by CES appear to have been met with varying degrees of success across Grahamstown. Community awareness for the Waainek Wind Farm indicated that 42% had heard about the project. Comparatively, 58% of people from Grahamstown Central knew about the wind farm while only 12% from Grahamstown East were informed.

Awareness in the eastern areas was clearly lower than those of Central, which is concerning. Advertisements for the wind farm were placed in the Grocott's Mail and Eastern Province Herald (CES, 2010) however, these papers were evidently not effective in disseminating information among township residents. The causes for such a failure could be attributed to the township people having a preference for different newspapers, as will be discussed in the next paragraph, or perhaps the advertisements were simply overlooked.

Cross examining Waainek awareness with area showed that only three people in Grahamstown East had read about the proposed wind farm in the paper compared to the 42 respondents inside Grahamstown Central. While the attendance rate of respondents was only 4%, five out of the six individuals who had been to the meetings had also read about Waainek in a newspaper. A copy of the draft scoping report for the Waainek project was left for the public in the Joza-Duna library although Rhini respondents did not indicate any evidence of having read it (CES, 2010). No mention was made about whether the report or advertisements were translated into Xhosa, to enable those who struggle with English an opportunity to understand sections of complex language and terminology. It is likely that such a course was not followed and those who may have been interested, would have been faced with language barriers.

One particular inadequacy, which seems difficult to justify, pertains to the neglect of organisers to host meetings in the Grahamstown East area and presents the consultative process with an ethical problem. Rhini residents make up a large proportion of households in Grahamstown, the figure lying in the region of 70-80%[96], yet public participation for this area was trifling. Meetings were held exclusively in Grahamstown Central[97], imparting an added difficulty to attend for those without transport. Walking from Joza Location or King Flats to Grahamstown Central (see figure 3.1: Chapter 3) can take up to an hour[98]; transportation via taxi is much quicker but costly keeping in mind that fares are priced atR7 (2012 prices) per person[99] for a one way trip. It seems unfair that the meeting venues were allowed to be situated so far away from the bulk of the population.

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[96]These figures are arrived at in the next section.
[97]Specific venues included Scouts hall, Town hall and Rhodes University.
[98]The interviewer, having walked this route himself daily, had a good idea of time taken
[99]Determined through conversation with Grahamstown locals. Also needs to be kept in mind that R7 is high relative to daily earnings of people who come from low-income township areas and should not be compared with middle class incomes.

A sense obtained from the process is that organisers doubted any significant interest from Rhini residents, and perhaps did not think it necessary to insist on holding a meeting in the area. However, this line of thinking is presumptive and unfounded, for interest and participation would be largely reliant on the level of awareness a community possesses. Evidence during interviews demonstrates a mood much in the opposite track of apathy, with people often being very optimistic and inquisitive about the project. Thus, arguments that Grahamstown East residents would not attend meetings in the Rhini area cannot be made based on a perceived lack of enthusiasm .A more suitable query should address the efficacy of the EIA regulations which govern advertising requirements.

A provision in the questionnaire was made for those who would have liked to be involved in the public participation process, asking respondents “If a new set of public meetings were held for those who did not participate in the first sessions, allowing for new input and concerns to be raised, would you attend?” The response showed that 96% of participants from Grahamstown East would have liked to attend the meeting, a very high proportion. Certainly, while the stated level of attendance is unlikely and therefore should not be taken at face value, a high degree of support can be affirmed for a more representative inclusiveness in the public participation process; this holds true for the poorer township areas and for those who misunderstand the nature of community meetings. A number of participants living in Grahamstown Central viewed public participation processes as ‘forums of complaint’, dominated by “a few knowledgeable people” who tended to “bog down and sidetrack” the main focus initially intended. Others did acknowledge the positive informational aspects of the meetings, but felt they had acquired enough knowledge on the wind farm and therefore did not need any further participation. No mention was made of any ‘influential’ participation which Devine-Wright (2005) maintains is a two-way process, where community members are encouraged and involved in the planning of local resources.

An assessment of whether respondents found the public participation process fair was appropriate given that a large number had not known about the project. The criteria selected for fairness, being highly subjective in nature, was defined as a composite of the following factors: organisers provided a sufficient level of advertising, adequate consultation of the community in question and that it allowed participants to voice concerns. Difficulty in answering the question was found for those who had not heard or attended the PPP and could only base their judgement on part of the criteria. These responses were still sufficient for the purposes of the fairness assessment as it covered the ‘information provision’ aspect and a neutral selection could be made if there was a great deal of uncertainty. A marginal majority considered the public participation process to be handled fairly with a total of 57% selecting this option.

Oddly, the greatest support came from Grahamstown East, the same area which had the lowest awareness of the wind farm. One of the theories (discussed in more detail a little further on) for their response was attributed to the finding that most of the people who had indicated that the process was fair were themselves unemployed. The hope of employment is an immediate concern among desperate job-seekers and thus support is expected to be readily given; a perceived ‘employment effect’ as observed by Groothuis *et al.* (2008). One confirmation of an ‘employment effect’ arose when the translator was asked by several participants in Grahamstown East whether the interviewer was a prospective employer for a company. Running a chi-square test revealed that occupation did have a statistically significant effect on perceived fairness ($P < 0.00$, $\chi^2 = 37.42$). Among the unemployed, 93% considered the process to be fair. Of the individuals who were involved in some form of full time activity/retired/occupation on the other hand (students, job, business owner, retired), only 43% of these respondents considered the process fair. Therefore the presence of an ‘employment effect’ may be partly responsible for the response patterns regarding attitudes towards fairness.

Excluding this apparent bias and analysing Grahamstown Central only, results show a more even spread of opinion concerning the fairness of the PPP. Figure 4.11 displays a reduction in those who considered the process fair from 57% to a substantially lower figure of 37%. The newly specified sample indicated a gain for those who thought the process was unfair to 24%. Neutral respondents made up the remainder with the largest share of 39%. Thus overall the results still confirm that people believed the public participation process to be fair, albeit by a smaller margin. Advertising was by far the most controversial issue among Grahamstown Central residents. Several people felt that they had not been given enough notice, with a woman remarking that her job as a shop clerk should have given her ample exposure to news on the wind farm. One man, while voting that the process was fair, acknowledged that “not many people knew about the meetings”, while another was of the opinion that plenty of time had been allowed and that a lot of people had heard about the meetings.

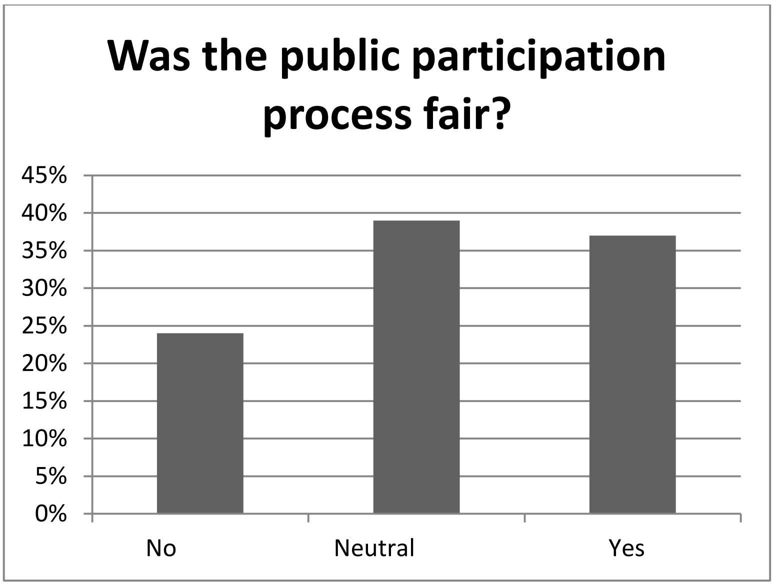


Figure 4.11: Responses of the Grahamstown community on whether the organised public participation process for the Waainek Wind Farm was handled fairly
[Source: Sample survey]

A questionable input suggested that the Grahamstown East areas do not sell newspapers in the shops. It is true that large shopping complexes are exclusively based in Grahamstown Central, but some small shops, known as Spaza's, do operate within Rhini. Further, even if the comment held some truth, most of the important shopping by Rhini residents is done 'in town' where newspapers are available, which makes the validity of this argument disputable. Incidentally, a sensible proposal to increase awareness in low-income areas was offered by a respondent, which could compliment future PPP advertising in newspapers. As spaza shops are widely dispersed around the township area and are frequented by nearby residents, a few shops could be selected for displaying notices pertaining to a local development project. Through the regular patronage of customers, PPP posters would have a good chance of being noticed and read, rendering a more effective form of advertising. The same concept could be applied to known public areas or gathering points, where larger media could be displayed.

Despite the wider distribution of views for Grahamstown Central, results show that while 24% were of the opinion that the public participation process was fair, there were very few whose initial view of the project was impacted due to 'institutional' problems. Only 2% of respondents were negatively affected by the way the PPP was handled while 4% became more positive. The net impact of the PPP seems to have been positive, but under different circumstances the result may have been very different. Keeping in mind that wind farms are novel in South Africa, turbines present themselves as objects of "interest" in a landscape where the structures are rare. Thus respondents seem to be reluctant to forfeit anticipated interest ‘opportunities’. While this phenomenon works in a project’s favour in the earlier stages of wind farm development within a country, as penetration rates increase, if public participation processes are found lacking, the same level of support may not be successfully encouraged (Toke *et al.,* 2008; Aitken, 2010A). Further, perceived employment opportunities are a large positive driving factor which has also been identified by Bergmann, Hanley, and Wright (2006), Groothuis *et al.* (2008) and EWEA (2012). Comments suggested that much of the observed unfair treatment was instead extended to the public organiser of the wind farm, and not to the actual project itself.

It is evident however, that despite some of the perceived problems with the meetings, the developer (Innowind) was willing to listen and compromise for the community. A noise specialist study by January (in CES, 2010a) found that by removing two specific turbines[100], located nearby to the dwellings, audible sound problems could be mitigated down to a “moderate-slight” level. Currently, the project has seen a greater reduction down to eight wind turbines, with a layout plan which facilitates an even lower potential audio disturbance level of ‘slight’ for those households in the area. Additionally, other concerns (health, visual, proximity and so on) by residents also contributed to the decrease of wind turbines at the site.

The objective of questioning people about the fairness of the project was to resolve if institutional and organisational factors may have contributed to opposition. The public participation process did not yield any problems with the developer per se. NIMBY also failed a basic test to positively check whether the development yielded changes in attitudes due to locally undesirable land use problems (Groothuis *et al.,* 2008). Even if NIMBY had managed to pass the basic test, serious error can be realised if ‘disguised’ factors are mistakenly bundled into a single term, ultimately contributing to a misdiagnosis of the core problem(s) (Coleby *et al.,* 2009). The shortfalls of NIMBY can better be averted by examining specific problems that people associate with wind farm developments and will be the focus of the next sub-section. Detail on actual problems can be brought to the fore through extensive public meetings, while also giving developers greater opportunity to address issues as they arise.

[100]Elimination of wind turbine 3 and 6, see appendix for layout.

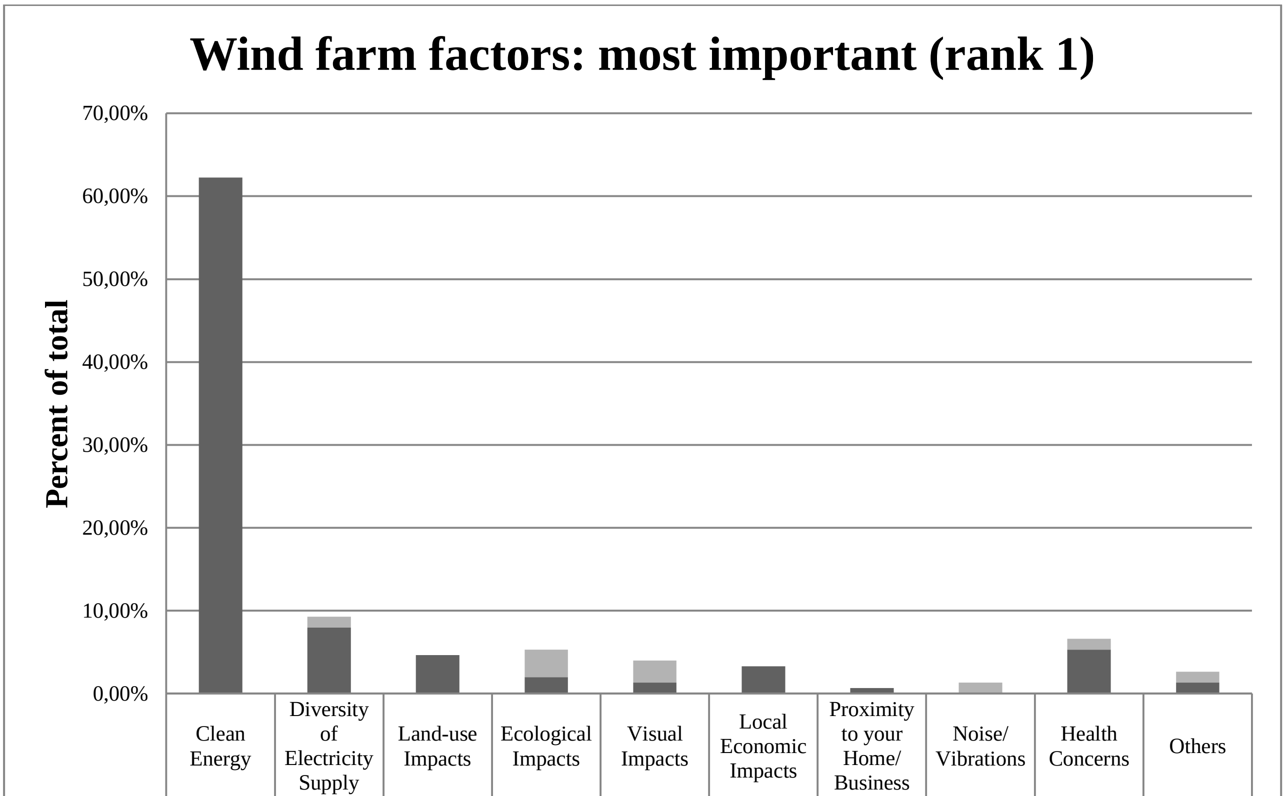
4.3 Ranking Exercise

A ranking exercise was used to identify trends for negative and positive attitudes to gauge which factors of wind farms were of the highest concern to respondents. Ten categories were pre-determined based on the main issues identified concerning wind farms, which can be seen in Figure 4.12. From these ten different factors, respondents were asked to select three, the first being the most crucial with subsequent choices falling into lower classifications of importance. To keep the process cognitively simple, and because further ranking would be increasingly meaningless, only three selections were required from each respondent. As participants selected each factor, they were asked to state whether it presented a negative or positive implication. These opposing viewpoints could then be lumped together in each tier to obtain a more comprehensive picture of attitudes towards the different wind farm factors.

First Selection

Analysing the first selections (i.e. most important) it is plain to see that on the whole respondents were very positive about the benefits from the different factors of wind farms. The feature which drew the most significant support of 62% concerned the benefit of producing electricity cleanly through the power of the wind. Pollution emitted during coal power production was recognised as a serious problem, perhaps extending to the natural environment itself as observed when looking at the subsequent ranks (ecological benefits of rank two and three). Further, it seems people made an implicit link between clean and renewable energy, which explains why so many considered this aspect to be important. Factors aside from clean energy were relatively snubbed in comparison; however more even mixtures of negative and positive factors did arise. Diversity of electricity supply, not unpredictably, featured as quite important especially considering the needs for greater redundancy (fail-safe) of electricity production in South Africa. Health concerns were likely positively related to the absence of air pollution during production.

Local economic impacts did not feature very strongly in the first rank, which is surprising considering that employment could fit into this category. Perhaps one problem was related to the broad reach of each category which did not allow for detailed specification of impacts. If employment had been included as a separate factor, more responses reflecting the importance of job growth may have been obtained. Some respondents indicated that expected economic impacts were reliant on electricity supply stability because it was an essential requirement for businesses to operate. Where negative aspects were selected, concerns were very limited. The greatest worry lay with ecological and visual impacts from a negative standpoint, with visual impacts receiving the second highest vote after ecological, albeit both being minute in absolute and relative terms. Clearly, positive factors dominated in the first selection round indicating the substantial perceived benefits accruing from the Waainek Wind Farm project.

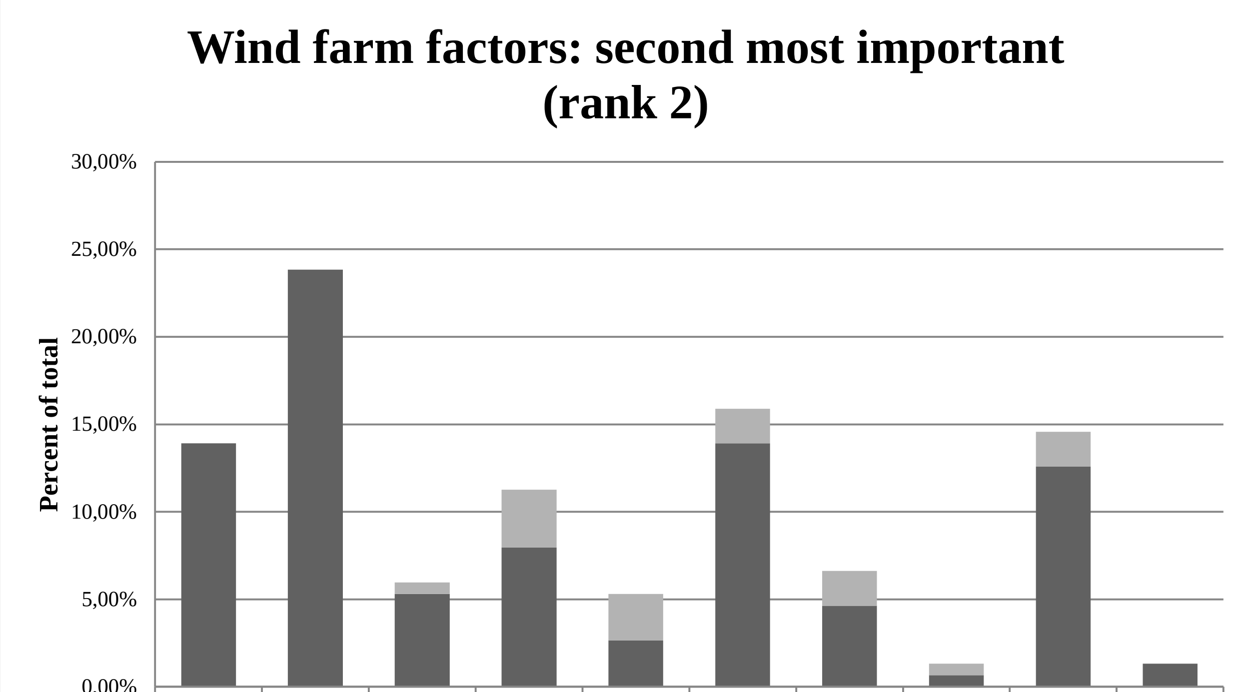


	Clean Energy	Diversity of Electricity Supply	Land-use Impacts	Ecological Impacts	Visual Impacts	Local Economic Impacts	Proximity to your Home/ Business	Noise/ Vibrations	Health Concerns	Others
Negative	0,00%	1,32%	0,00%	3,31%	2,65%	0,00%	0,00%	1,32%	1,32%	1,32%
Positive	62,25%	7,95%	4,64%	1,99%	1,32%	3,31%	0,66%	0,00%	5,30%	1,32%

Figure 4.12: First selection factors of respondents for both positive and negative factors [Source: Sample survey]

Second selection

Figure 4.13 is much more dispersed among the different categories. For the most part, people appear to be very positive (87%) about the various aspects of the wind farm. Diversity of electricity supply takes up approximately a quarter of all responses and does indeed illustrate some degree of agitation about the current electricity supply circumstances. Clean energy dropped expectedly as the sample moved to other factors from the first selection to the second, yet still occupied a large proportion of the total selection. Local economic impacts increased very nearly to 14% positivity with the remaining 2% being negative. Negative visual impacts show the same response rate as in the first level, while the numbers of people who consider turbines be attractive concurrently increased. However, visual impacts (2.65%) were still not considered as important as ecological impacts (3.31%), instead receiving the second highest number of negative votes. Proximity was viewed as a positive aspect as some respondents stated that it would be closer to walk to ‘work’, while others were more concerned with access to electricity. Health concerns were mostly positive with only a few stressing concerns over health risks associated with the electric fields generated by the turbines.

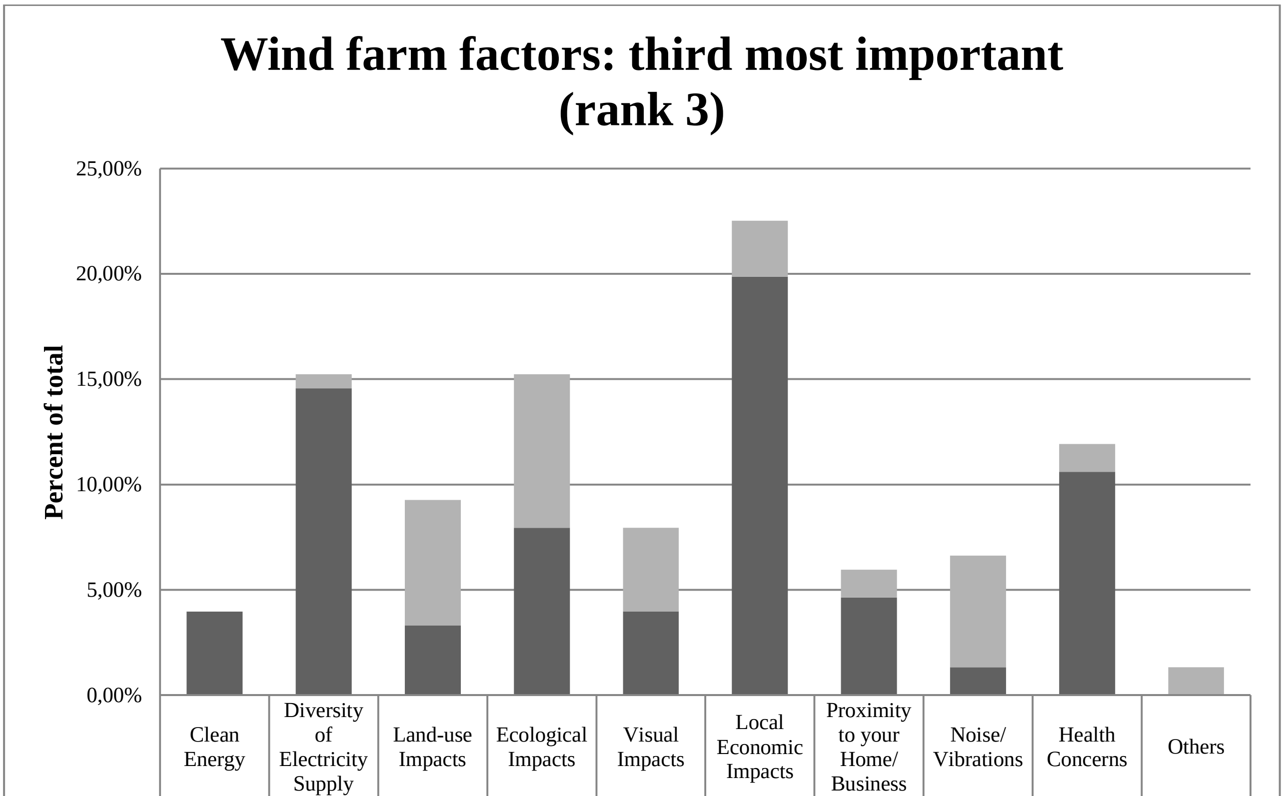


	Clean Energy	Diversity of Electricity Supply	Land-use Impacts	Ecological Impacts	Visual Impacts	Local Economic Impacts	Proximity to your Home/ Business	Noise/ Vibrations	Health Concerns	Others
Negative	0,00%	0,00%	0,66%	3,31%	2,65%	1,99%	1,99%	0,66%	1,99%	0,00%
Positive	13,91%	23,84%	5,30%	7,95%	2,65%	13,91%	4,64%	0,66%	12,58%	1,32%

Figure 4.13: Second selection factors of respondents for both positive and negative factors [Source: Sample survey]

Third selection

While positive benefits still dominate overall, negative aspects do appear more pronounced in Figure 4.14. Local economic impacts illustrate a high selection rate in the third ranking and accounts for about 20% of the responses for benefits with the remaining 2.65% being negative. Diversity of electricity supply has fallen to 14.5%, but is still an area largely dominated by beneficial concerns, while positive health factors have remained relatively steady at 10.6%. Factors which drew the most negative concern were ecological impacts (7.28%) land-use impacts (approx 6%) and noise/vibrations (5.3%). Visual impacts, both positive and negative, increased marginally to 4% but remain an insignificant matter, especially considering that other negative aspects have taken precedence.



	Clean Energy	Diversity of Electricity Supply	Land-use Impacts	Ecological Impacts	Visual Impacts	Local Economic Impacts	Proximity to your Home/ Business	Noise/ Vibrations	Health Concerns	Others
Negative	0,00%	0,66%	5,96%	7,28%	3,97%	2,65%	1,32%	5,30%	1,32%	1,32%
Positive	3,97%	14,57%	3,31%	7,95%	3,97%	19,87%	4,64%	1,32%	10,60%	0,00%

Figure 4.14: Third selection factors of respondents for both positive and negative factors [Source: Sample survey]

Overall, the graphs confirm the results in the attitudinal surveys. Benefits dominate over negative concerns, especially in the first two selection ranks. Only by the third ranking level did attitudes begin to reflect greater numbers acknowledging the possible disamenities from the wind farm. Where negative aspects did eventually become more evident, visual impacts still remained relatively unimportant compared to the other problems. Ecological issues were directed towards the potential bird and bat kills resulting from the spinning blades. Although there are no monetary benefit figures to gauge aesthetic impacts against, the ranking exercise does put the negative visual impacts into perspective when considering the other attributes potentially on offer by the Waainek Wind Farm. Choice modelling is a useful approach for measuring these different attribute levels relative to one another and is suggested where future studies may be interested.

Proximity Analysis with variations in the visibility of wind turbines

The effect of proximity on the visual impacts and attitudes towards wind turbines, has been tested extensively in prior studies (Warren *et al.* 2005; Möller, 2006; Lothian, 2008; Sims *et al.*, 2008; Graham, Stephenson and Smith, 2009; Meyerhoff *et al.*, 2010; Swofford and Slattery, 2010; Warren and McFayden, 2010; Ladenburg and Lutzeyer, 2012), but with varying results. Consequently, no general rule has been established on the effect of distance on attitudes towards wind turbines and seems to be largely based on context and social factors. These studies also typically assess two different criteria, namely visual impacts versus proximity and wind farm attitudes versus proximity. The latter relationship includes all those aspects of the wind farm which people are concerned i.e. health, noise, visual and so on while the former focuses solely on the visual determinants.

For the purposes of this study, both of these aspects were examined. One crucial difference should be noted. Two instances were presented to respondents, one in which turbines were visible from the home and located successively further away (scenario A) and the other where no turbines could be seen at these same distance increments (scenario B). Respondents were then asked about their attitudes at different proximities to wind farms at 1km, 5km and 10km. The resulting attitude changes could then be examined between the benchmark (scenario B) and the visual state (scenario A), separating purely aesthetic concerns from the other usual confounding factors.

Examining Figure 4.15, the relationship between increasing distance to wind farms and attitudes is very clear. In both scenarios A and B, attitudes became more positive with increases in distance to a wind turbine, although this change was more pronounced in case A where turbines were visible from the home. Negative attitudes for scenario B tended to be stable regardless of distance and may represent certain problems which proximity alone cannot address. Expectedly, the greatest decline in negative attitudes were observed where wind turbines were visible from the home, decreasing rapidly at first (1-5km), but then tapering off for the distance of 10km. Thus these findings agree with studies done by Möller (2006), Ladenburg (2007) and Swofford and Slattery (2010) where marginal utility increases at a decreasing rate at greater distances.

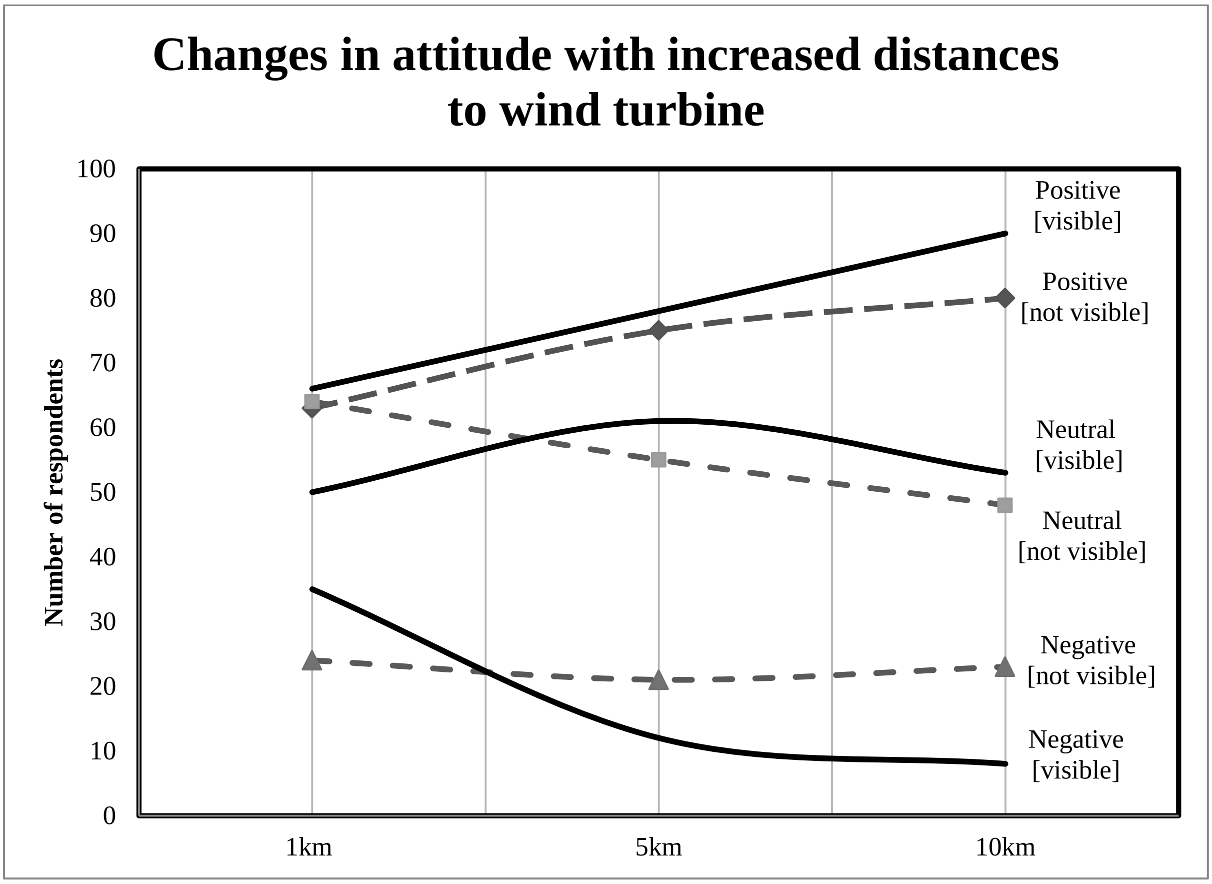


Figure 4.15: Plots showing the changes in attitudes with increased distances to a wind turbine when it is visible and when is cannot be seen.

[Source: Sample survey]

A series of four Fisher's exact tests (P = 0.00 for all) confirmed a significant relationship between distance and changes in attitudes for turbines that are visible and not visible between the distances of 1-5km and 5-10km. Thus for the Grahamstown community, increases in distance would aid to reduce the visual disamenity associated with the wind farm. Additionally, the baseline results depict underlying proximity concerns, other than visual influences, that may affect residents. Ranking selection results indicate that health, land-use and noise may be to blame. Indeed, a few respondents were not sure about the noise levels produced by wind turbines which did visibly cause unease during the proximity section questions. Perhaps the most interesting finding to note is that the proximity effect is found to be more of a problem in the Central sample than those for East residents.

Interestingly, positive attitudes were generally higher when the wind farm was observable. While it is tempting to surmise that this is an indication that people enjoy seeing wind farms (rather than not seeing them at all), such an assertion is difficult to ascertain. Perhaps people do enjoy seeing wind farms, but at greater distances where the view-scape is not dominated by the structures. The more likely explanation is that the desire for greater distance between viewer and structure is not related to visual impacts, but rather due to health concerns: confirmed at least in part by the base level where no wind turbines can be seen. An exploration of the reasons for the difference will be undertaken in the next section when analysing the various typical demographic characteristics in the split samples.

4.4 Visual impacts: Grahamstown community views

As discussed previously, the anticipated presence of the Waainek Wind Farm has produced mixed feelings among the Grahamstown community, where residents exhibited divergences in opinion about the appearance of the turbines. The purpose of this section therefore seeks to identify and investigate the key factors which influence the community’s visual preferences for the wind farm. The demographic characteristics of Grahamstown residents provide a profile for those who would most likely be positively/negatively affected by the introduction of wind turbines into the Waainek landscape. Two different models are used to identify whether payment affected people’s decision to support a hypothetical measure to relocate the Waainek Wind Farm based on aesthetic degradation.

Scenario 1: Relocation of wind turbines from Waainek without payment

A preliminary question asked whether respondents would be willing to support an option to preserve the Waainek landscape based solely on visual considerations. Crucially, respondents were *not* required to pay for this procedure in this first instance, allowing individuals free choice based on personal preferences rather than monetary constraints. The scenario was the same as when respondents were willing to pay; the wind farm would be relocated instead of cancelled outright. The aim of the question was to remove respondents' concern about their ability to pay for the benefits of the option, thus providing residents in lower income brackets with the opportunity to state their true attitudes towards the visual impacts.

From a sample of 151, 85 (56%) indicated that they would be willing to have the wind farm relocated if the option did not require any payment, while the remaining 44% were not interested in the relocation measure. The results raise an interesting question: why did such a large proportion (56%) of respondents state that they would like to move the wind farm from Waainek, when most of the sample (80%) did not find the look of the turbines offensive? A likely possibility is that the scenario incentivised a 'yes' response to opt for the relocation, as the benefit would be offered at no personal financial loss. As the relocation was based on purely visual considerations, one way to determine the strength of the incentive would be to break down and analyse how people perceived the visual impact of the wind farm. Approximately half (53%) of the respondents believed that the installation of the wind farm would improve the scenery at Waainek, with another 26% stating that there would be no detriment or improvement. Very few (21%) believed that the wind farm would actually dampen the scenery, providing some evidence to support the presence of a 'yes' incentive.

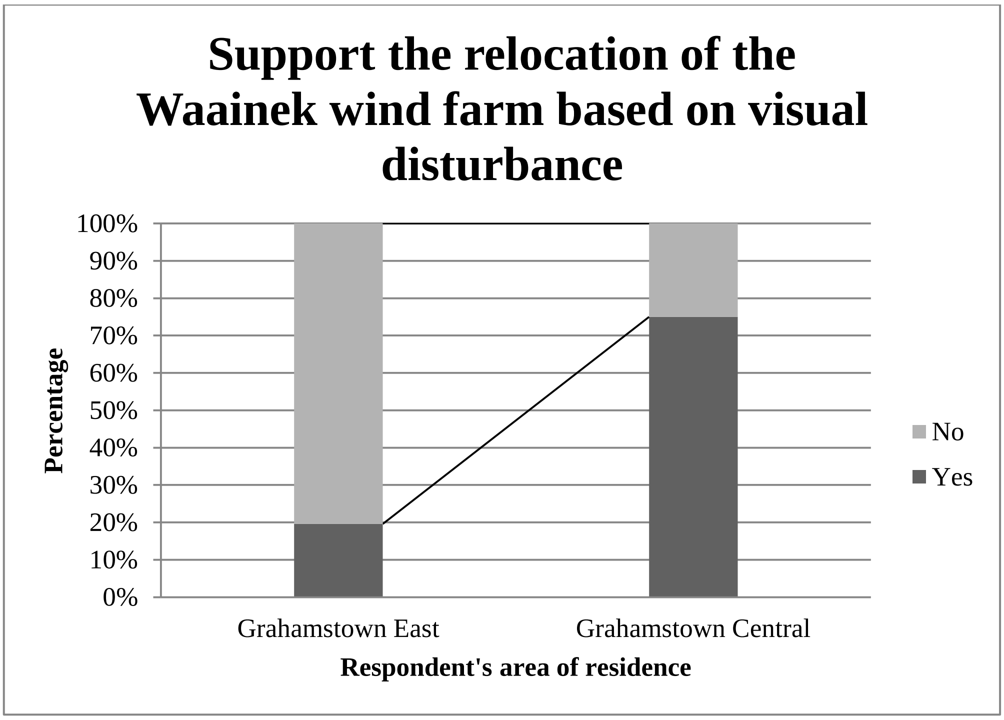


Figure 4.16: Differences in visual disturbance between Grahamstown East and Central.
Central sample size = 100 vs. East = 51
[Source: Sample survey]

A breakdown of responses per area shown in Figure 4.16 illustrates that most respondents who supported the scenario originated from Grahamstown Central while households from Grahamstown East were less inclined to support the scenario, with a negative correlation of 0.53. While those from the township areas appear more reluctant to support the relocation policy, the specific reasoning or factors influencing the choice requires further investigation. A probit model was estimated using maximum likelihood based on several key *visual* factors, displayed in model 1A. Economic factors were not included as there was no monetary WTP component present in the question.

Model 1A

$\beta X = \beta_0 + \beta_1 Age + \beta_2 Gender + \beta_3 Education + \beta_4 Knowledge + \beta_5 Familiarity + \beta_6 Occupation + \beta_7 Interest + \beta_8 ResidentialBackground + \beta_9 Scenery$

where βX is the binary response (yes/no) of respondents to the question of whether they would be willing to support the relocation of the wind farm from Waainek based solely on visual considerations. The initial model yielded very weak results. Evidence of multi-collinearity was suspected between education and occupation due to the relatively high standard errors in relation to the accompanying coefficients which resulted in very wide confidence intervals (Gujurati and Porter, 2009). Additionally, the variables were correlated with one another which provided further evidence.

Multi-collinearity has been challenged by Goldberger (1998) as more of a problem associated with small sample sizes than the traditional view of a linear relationship between some or all explanatory variables, labelling this problem as *micronumerosity*. Despite the small sample size of this study, Kennedy (1992) has argued that the estimating problems discussed by Aldrich and Nelson (1984) do warrant steps to mitigate multi-collinearity. Dropping one of the problem variables, education in this case, presented the simplest solution discussed by Gujurati and Porter (2009). Education was dropped from the sample because, in the context of South Africa, occupation is thought to have more explanatory power which was confirmed by both a higher LR chi-squared ($P = 0.00$) and Pseudo r-squared.

Because of the poor performance of the initial model, a univariate regression analysis was used to identify the most important variables to be used in a reduced model. The confidence level for testing was lenient at the initial selection stage, with an alpha level of $\alpha = 15\%$ (85% confidence level) suggested by Bursac, Gauss**,** Williams and Hosmer (2008). The significant variables from this selection process included age, knowledge, familiarity, occupation, interest in the area and were specified into a multivariate model. In order to assess whether the reduced model (1B) did not underperform compared to the full model (1A), a likelihood ratio test was performed to assess the reduction in goodness of fit (IDRE, 2013). Results showed no significant difference between the fit of the full model and reduced model (LR chi2 (2) = 0.03, P = 0.9873) and therefore no significant loss in explanatory power. The reduced model thus took the specification where

Model 1B: reduced model

$\beta X = \beta_0 + \beta_1 Age + \beta_2 Knowledge + \beta_3 Familiarity + \beta_4 Occupation + \beta_5 Interest$

Table 4.1: Results from a reduced probit model showing the marginal effects (probability) that an independent variable has on the willingness to relocate based on visual factors – no payment required

[Source: Sample survey]

Support Policy – Dependent variable	dF/dx	Standard Error	P>z
Age of respondent			
19-25 - Base	-	-	-
26-36	0.3746074	0.1303865	0.029
35-44	0.0897371	0.2343352	0.71
45-60	0.1248371	0.205073	0.556
61 and older	-0.0569145	0.2581018	0.825
Knowledge on wind farms			
None - Base	-	-	-
Little	0.2849501	0.1279191	0.039
Moderate	0.2316621	0.1314583	0.098
Comprehensive	0.2804146	0.1330472	0.088
Familiarity with Waainek area			
None - Base	-	-	-
Vague	-0.0658777	0.1759105	0.708
Familiar	0.1822634	0.1821684	0.337
Know the area well	0.3203976	0.1581368	0.108
Occupation			
Unemployed - Base	-	-	-
Employed	0.2397855	0.1319561	0.095
Business Owner	0.399149	0.1017472	0.021
Student	0.3866968	0.1549326	0.041
Retired	0.1187149	0.2069781	0.582

Personal interest	-0.2086627	0.1150044	0.075
Number of observations = 151			
LR chi2(15) = 56.71			
Prob > chi2 = 0.0000			
Pseudo R2 = 0.2741			

Table 4.1 displays the results of the estimated reduced probit model with marginal effects being run as a post-estimation. A close inspection of the causal factors shows that when payment was not required, knowledge had a positive influence on responses. In other words, an increased general understanding of wind farms, compared to knowing nothing at all, increased the probability of saying ‘yes’ to relocate the wind farm solely based for aesthetic purposes, holding age, familiarity, occupation and interest constant ($P < 0.1$). However, the magnitudes of the probabilities are similar across the different knowledge levels, ranging from 0.23 to 0.28 which indicates that increasingly higher levels of knowledge above the ‘little’ category would have a small effect on the probability of voting ‘yes’ holding age, familiarity, occupation and personal interest constant. These results, along with that of the existing *a-priori* assumptions, present no convincing evidence for the positive effect of knowledge on wind farm support attitudes to date, which have been disregarded as a factor by Wolsink (2007) and Ellis *et al.* (2007). Ignorance cannot credibly be blamed for wind farm opposition which concords with Aitken’s (2010B) argument. On the other hand, the reply could be due to the presence an incentivised ‘yes’ response present in the question.

Partial evidence for this ‘incentive’ was found in the inclusive model when the influence of Waainek’s visual quality on the responses established that scenery quality played no significant role in determining whether people supported the relocation based on *visual impacts*, even at the highest level of quality ($P < 0.1$). The finding suggests that *some* of those who were in favour of the relocation scheme did not support it because they themselves found the wind farm to be visually disturbing, but rather perhaps because *others* may have benefited and therefore could indicate the presence of public preferences[101]. Individuals who exhibit public preferences tend to derive indirect increases in utility when others directly benefit from some action. Ek (2005) has argued that individuals who hold public preferences respond differently to political decisions from those who are more orientated towards private

[101] The question did indicate that by moving the wind farm, visual impacts on others would be reduced and therefore they may benefit from the wind farm’s relocation.

preferences. For example, market based support schemes may be less effective for people with public preferences (Ek, 2005). Unfortunately, further exploration of private and public preferences was not possible as they fell outside the scope of the survey instrument.

A negative relationship was found for unemployed[102] groups and willingness to relocate the wind farm, a contextually relevant source given the socio-economic conditions faced by many in South Africa. Being employed, as opposed to unemployed, *increased* the probability that a person would be willing to have the wind farm moved from the Waainek area by 0.23, based solely on visual impacts and holding all other factors constant. Additionally, students and business owners had a significantly higher probability of replying 'yes' to the relocation scenario compared to unemployed individuals, holding all other factors in the model constant. Perhaps most interestingly, the implied inverse interpretation reveals that unemployed groups were therefore less likely to support the relocation of the wind farm from Waainek, holding all other variables in the model constant. Reactions from respondents strongly supported the notion that the Waainek Wind Farm would bring with it employment opportunities. The result is especially relevant considering the 25.6% unemployment rate in South Africa. When compared to the unemployment rates in developed nations (America: 7.9%, UK: 7%, Germany: 14.2%), and taking into account that general resistance for turbines in these countries tend to be relatively high, the result supports the findings of Ek (2005) and Groothuis (2008), specifically that the propensity to accept wind farms in the landscape is positively influenced by anticipated economic and employment opportunities.

Age was only found to be significant for the group 26-34 ($P < 0.05$), indicating that compared to the 19-25 year old group, people aged 26-34 had an increased probability of 0.37 to support the relocation scenario, holding all other factors in the model constant. Thus there is some evidence to support the age effect discussed by Ladenburg and Dubgaard (2007), Ladenburg and Lutzeyer (2012) and found in Ek's (2005) research, although the outcome is constrained to the younger age categories. Older age groups did not have significant p-values which demonstrate that there is indifference among older generations in Grahamstown towards visual effects of the wind farm. Older people are normally opposed to the visual impacts of wind turbines and therefore the result does not correspond to *a-priori* expectations. While familiarity with the Waainek area was not statistically significant at the 90% confidence level, a marginal adjustment of the alpha level to $\alpha = 0.2$ (80% confidence

[102]Significant at the 1% level.

level) did qualify the highest category of familiarity as significant. Simply, a person who is very familiar with the Waainek area compared to someone who does not know the area at all, increases the probability of voting ‘yes’ to remove the wind farm by 0.32, holding all other variables in the model constant and conforms with *a-priori* expectations. The reasoning is straightforward; people are more inclined to be attached to an area they know well than one that they have never personally experienced before.

Finally, people with a personal interest in the area, who use it for sports or recreation, were less inclined to vote ‘yes’ by a probability of 0.21 than those who did not have a personal interest in the area, holding all other factors in the model constant ($P < 0.1$). The question made it clear to respondents that ‘personal interest’ did not involve financial gain, but instead included recreational activities. The negative sign does not conform to *a-priori* expectations, and could be due to the fact that many respondents expressed enthusiasm towards the Waainek project, preferring to have the wind turbines in the landscape rather than nothing at all. Wind turbines therefore seem to be embraced because of their novelty in the Waainek landscape instead, of a perceived nuisance.

Discussion of influential model factors

Unemployment is a key issue within South Africa; a point repeatedly echoed at the local level by respondents who would often communicate their desperation for jobs. In many cases (especially in the Rhini areas), when detail on the wind farm project was provided during the survey, unemployed interviewees expressed optimism about the potential job creation prospects. While no mention of jobs was made on the information sheet or by the interviewer, a strong link between the project and employment appeared to have been made. The scenario proposing to move the turbines, and therefore potential jobs, away from Waainek was frequently met with a negative reaction, or in the case of the question, a ‘no’ response.

Table4.2: Establishing links between occupation and how respondents respond to visual impacts
[Source: Sample survey]

Occupation of respondent	**Visual Impact on Waainek**			
	None	**Improve**	**Dampen**	**Total**
Unemployed	3	39	0	42
Employed	13	14	10	37
Business Owner	7	2	4	13
Student	11	17	12	40
Retired	6	8	5	19
Total	**40**	**80**	**31**	**151**

Taking the state of the labour market into consideration, it seems likely that visual impacts were relegated into a trivial issue by participants in light of the perceived job creation potential. Table 4.2 demonstrates the overwhelmingly positive response of unemployed persons toward the visual impacts of the wind farm as compared to different occupation groups, who tended to be more evenly spread across the different impact categories. Further, some respondents stated their eagerness for locating the wind farm closer to their residences, in order to shorten the commute distance and therefore decrease travel expenses. Warren *et al.* (2005) has labelled this phenomenon as "inverse NIMBY", where reactions by the public are opposite to what NIMBY predicts. Instead of experiencing a negative visual impact, the Waainek Wind Farm appears to symbolise economic upliftment to those who have no official employment, to the degree that turbines in the landscape were classified as appealing. The proximity effect (further away is better) was also found to be stronger for those in Central areas, where the employment rate was significantly higher than for those in Grahamstown East, further strengthening the function of anticipated job creation.

While those classified as unemployed contributed the bulk of 'no' responses (willingness to relocate), the remainder of the sample were more evenly distributed. Recorded comments during the survey allowed for greater detail to be collected on wind farm attitudes and therefore provided essential insight through qualitative analysis. A common reason for not wanting to relocate the wind farm was due to the concern that no matter where the wind farm was located, someone was bound to be upset with the new arrangement, therefore the relocation procedure would be a waste of time. Others were happy with the Waainek site, stating that the developer had clearly chosen the area based on maximising resource availability and therefore they considered the movement unnecessary. Another intriguing argument reasoned that relocating the wind farm to a new site would become a time consuming exercise, requiring new impact studies and approval from government, a prospect which was not welcomed. An overall sense of impatience can be gleaned from the responses, seemingly because there is an eagerness to have the project constructed sooner rather than later.

Positive mention was also made regarding the “modern” appearance of the wind turbines, an attribute which some participants thought the Grahamstown community should embrace. When the sample was asked directly if they found the wind turbine structures to be visually appealing, 77% replied ‘yes’, a strong majority. While the reasons ranged widely between respondents, the main themes can be broken down into three categories. The first determinant involved visual factors, where responses concentrated on the appearance of the wind turbines, concerning comments such as ‘attractive’, ‘elegant’, ‘graceful’ and ‘natural’, but also included the technical and functional aspects such as being ‘amazed by the feat of engineering’, the ‘massive size and spinning of the blades’ while the wind turbines were also described as a ‘useful landmark’.

Category two relates to the greater benefits that wind turbines confer on society and indicates public preference concerns (electricity supply, clean energy, renewable). Eagerness was expressed about the inspiration provided to the youth by the wind farm and the benefits that would accrue to society once the project had been constructed. It is important to note that the role of the wind farm as it features in society seems to have had an influence on the visual attractiveness of the turbines. Members of the community, who considered the wind farm as being beneficial to society, were also inclined to find the turbine structures in the landscape to be aesthetically attractive. This idea ties in well with the arguments discussed earlier by Tuan (1979) who stressed the importance of conceiving the landscape as a system rather than solely relying on the belief that something is beautiful merely because it appears a certain way; perceived employment opportunities, as discussed earlier, provides a further excellent case in point.

The third category involved participant’s contextualizing the relative visual merits of the turbines against fossil fuel alternative sources and other such ‘ugly’ structures. Some of the comments included: the wind farm would look “better than most buildings in Grahamstown”, the turbines were far more appealing than coal plants and the masts would be less visually offensive than the general energy infrastructure. Therefore, the concern that the wind farm would clash with Grahamstown's antiquated infrastructure, as previously discussed, does not seem to be a widely held opinion. Instead, the general belief suggests the opposite; wind turbines may actually work to update the ageing aesthetics of the city, engendering a more "modern" appearance which could perhaps compliment and co-exist with the existing infrastructure. Those who had first-hand experience with smaller versions of wind turbines held a far more favourable disposition toward the project, which corresponds to the findings of Krohn and Damborg (1999) and Kaldellis (2005), who assert that prior experience with wind turbines is likely accompanied by positive perceptions. Most respondents, who grew up with "wind chargers", as they were often referred to, understood them better and did not mind their appearance.

While few respondents considered the wind farm to be unattractive, the reactions were generally stronger than those given for positive visual impacts. Some stated that the turbines were "not pretty", "certainly not attractive" and that the turbines were "mechanical monstrosities". The latter attitude was expressed by a landowner within the Waainek area, where the most vocal opposition were located. The Mariya uMama weThemba Monastery, also located within the Waainek area, identified the wind farm as an "Electricity Factory", which was prone to interrupt both the natural environment and the "human ecology" (CES, 2009: 103). An appreciation of the functional aspects of the wind farm did not always translate into favourable attitudes towards the aesthetics of the turbines. One participant stated that although he understood that the wind farm was useful and beneficial, he was certain that it would not produce an aesthetically pleasing view. Despite the few negative attitudes, the feedback from the bulk of the sample indicated that the appearance of wind turbines were not offensive.

Attitudes towards visual aspects of wind farms are equally dependent on the scenic qualities a landscape possesses. In the discussion of Waainek (Chapter 1: Introduction) the area was described as relatively agricultural and undeveloped. Some urban influence is present (industrial area, N2 National Road) but for the most part, Waainek remains largely rural. In order to assess how well acquainted respondents were with the area, the level of familiarity was determined by directly asking each participant. The responses provided an indirect gauge for how confident participants were about their answers and therefore offered a measure of reliability. Only 8% did not know the Waainek area at all while 46%of the sample had some idea where the area was and what it looked like. Numbers dwindled the higher the level of familiarity, being 31% for those who knew the area and the remaining 23% were very well acquainted with the area. Many respondents who were vaguely familiar with Waainek did acknowledge that they had driven past it on the N2 highway and thus had a basic acquaintance.

The beauty of an area determines to a large extent the degree to which alterations will offend the local community. The relationship is straightforward; the better the view, the higher a development's impact will be on the aesthetics of the landscape. Table4.3 provides a basic rundown of the community's aesthetic valuation for the Waainek area, where "Very Low" indicates a low aesthetic worth and "High-Extremely Beautiful" represents a high evaluation. According to the Grahamstown residents' opinions, most regard the Waainek scenery to be medium (44%) to highly attractive (19%), collectively making up 63% of the sample. Few thought the area dull or unsightly (17%), while the remainder were indifferent 20%.

Table 4.3 Grahamstown respondents' attitudes towards the scenery of the Waainek area [Source: Sample survey]

Scenery of Waainek	Freq.	Percent
Very Low	1	0.66
Low-Dull	25	16.56
Neutral	30	19.87
Medium-Attractive	66	43.71
High-Extremely Beautiful	29	19.21
Total	**151**	**100**

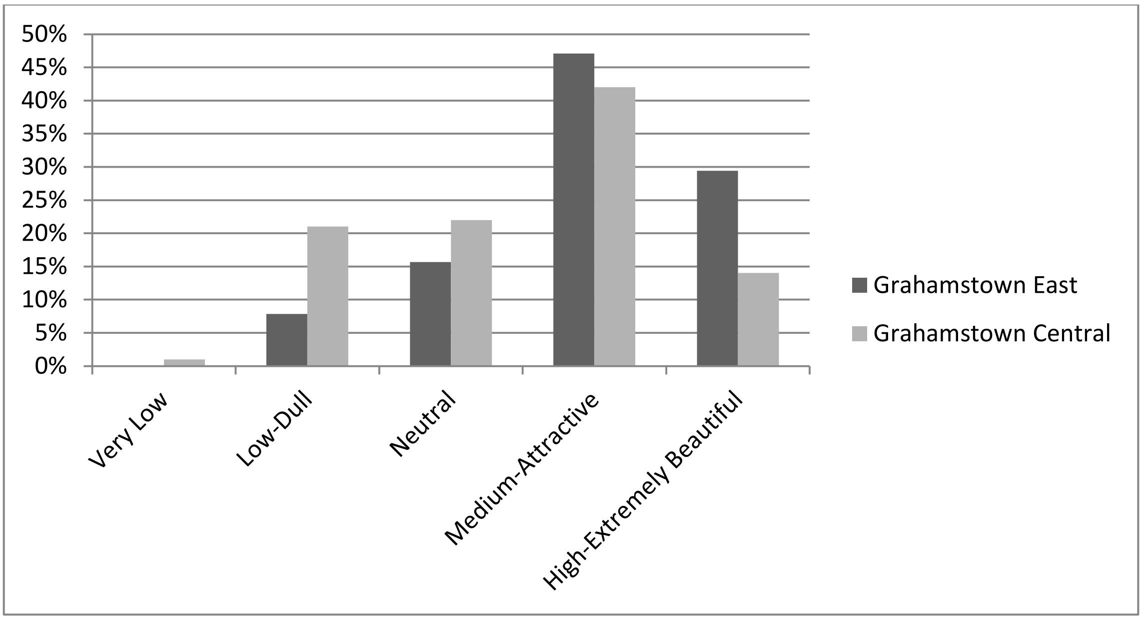


Figure 4.18: Breakdown of attitudes towards the scenery of Waainek per area of Grahamstown
[Source: Sample survey]

Splitting the sample between Grahamstown East and Central, Figure 4.18 illustrates the difference in opinion of Waainek scenery quality between the two areas. For the most part, Grahamstown East residents appear to value the Waainek scenery more than respondents from Central areas. In order to test statistically whether responses on scenery quality were similar between the two areas, a chi-squared test was appropriate. However, the expected frequency values of some of the cells were five and lower, rendering the Pearson chi-squared test inaccurate. Instead, a Fisher's exact test is recommended as an alternative to the chi-squared test and produces a single p-value output (IDRE, 2013). The test confirmed a significant association between the area of origin and their respective valuations of the Waainek scenery at the 95% confidence level ($p = 0.047$). Thus there is a difference between how residents from Grahamstown East and Central rate the visual quality of Waainek.

One explanation for the differences in opinion between the areas regarding Waainek could be due to the way residents visualise the area. Where Waainek is thought of as including the 'industrial area', the landscape may be viewed as 'ugly' or degraded. On the other hand, if Waainek is understood only as the hills (where unfamiliarity with the area prevails), without the inclusion of the industrial area, the perception would favour a more scenic and beautiful interpretation. As Grahamstown East lies further away from Waainek than Grahamstown Central, perhaps the greater distance does increase the propensity of seeing only the 'hills' and not the uglier features, primarily due to the unfamiliarity with the area. For Grahamstown

Central, 54.5% were very familiar with the area (know well/very well), while for Grahamstown East residents only 30% of the residents knew the area well and was confirmed by a Fisher's exact test (Familiarity vs. Scenery: p =0.004).

As the valuations of scenery quality were dissimilar between the areas, it was hypothesized that the visual effects of the instalment of the wind farm area would also impact the respondents from the respective areas differently. A subsequent Fisher's exact test confirmed the hypothesis at the 99% confidence level (p = 0.00). Respondents from Grahamstown East were positive about the visual impacts of the wind farm on Waainek, regardless of scenery quality; confirmed when the null hypothesis (no association) failed to be rejected at the 90% confidence level (p = 0.501). However, respondents from Grahamstown Central did exhibit significant differences in perceived visual impacts with variations in landscape quality (p = 0.053) which can be observed in figure 4.19. The graph shows the differences in attitudes of Grahmastown Central residents when introducing the wind farm to Waainek at different levels of perceived quality.

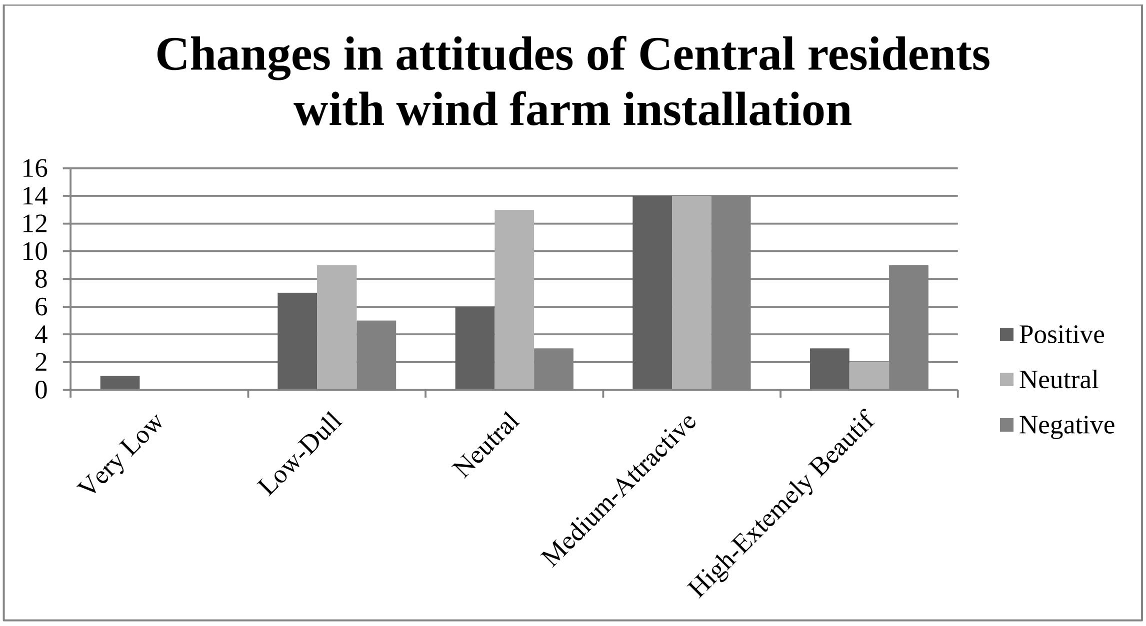


Figure 4.19: Grahamstown Central differences in attitudes towards the visual impacts of the Waainek Wind Farm. A significant difference in attitudes only occurs from mild to very attractive scenery
[Source: Sample survey]

While Pearsons chi-squared and Fisher's exact test confirms correlations, they do not provide any further detail on the nature of the relationship. Figure 4.19 provides some insight into how Grahamstown Central residents' attitudes differed at the various levels of self valuated scenic quality when wind turbines were installed into the landscape. Where the scenery was considered medium-attractive, residents were divided on the impacts of the development. However, where residents found the scenery for Waainek to be extremely beautiful/high, the differences clearly show strong negative attitudes. Most objections against the wind farm were raised by those living in the Waainek area and may have felt differently if they had lived in town.

One expectation from these results is that respondents who find Waainek attractive would also be more inclined to pay to have the wind farm relocated to a different area. The motivation is logical primarily because these same individuals would also experience the greatest negative visual impact according to the results from the Fishers exact test. Occupation status has an influence on the willingness to relocate the wind farm even when no payment was required. Some argument strength is lost because an unemployed person's ability to pay would usually be less than someone who is in a better financial position to afford such a luxury.

Scenario 2: Relocation of wind turbines from Waainek with payment

A second probit model was run to determine which factors contribute to the probability that people would be willing to pay to relocate the wind farm from the Waainek area. Variables in probit model 1A were reused in addition to two influential monetary variables because of the required payment. The two added variables included monthly income of the respondent and the amount of money (Rand) spent on electricity in a month. Two observations were dropped from probit model 2A because of invalid response data which confused and confounded results[103].

<u>Model 2A</u>

$\beta X = \beta_0 + \beta_1 Age + \beta_2 Gender + \beta_3 Education + \beta_4 Knowledge + \beta_5 Familiarity + \beta_6 Occupation + \beta_7 Interest + \beta_8 ResidentialBackground + \beta_9 Scenery + \beta_{10} IncomeG + \beta_{11} ElectricityMonthly$

where βX is the binary outcome yes/no for whether respondents were willing to pay to relocate the wind farm to an alternative site. Results of the model were once again very poor and thus required re-specification. Univariate regression analysis revealed age, familiarity,

[103] See Chapter 5: Calculating Willingness to Pay for a more detailed explanation of the respondents.

occupation, scenery, education and income to be significant initially (Bursac, Gauss, Williams and Hosmer, 2008). A new model was specified with all the identified individually significant variables to perform a multivariate analysis. Familiarity, scenery, occupation and income were significant at the 90% confidence level. To remove the adverse effects of multicollinearity, education was omitted from the model but age was kept even though it did not perform well individually. The reduced model did not lose a significant amount of explanatory power when compared to the full model (P = 0.6881) and was therefore appropriate for the current analysis.

Model 2B

$\beta X = \beta_0 + \beta_1 Age + \beta_2 Familiarity + \beta_3 Occupation + \beta_4 Scenery + \beta_5 Income$

The results of the probit model can be seen in Table 4.4 and are presented in the form of marginal effects compared to the base level. Age was not significant for all groups and therefore did not warrant an interpretation. Familiarity with the Waainek area was significant ($P < 0.01$), but only when respondents knew the area well. The probability of paying to relocate the Waainek Wind Farm increased by 0.22 when respondents knew the Waainek area well, compared to having a vague acquaintance, holding all other variables in the model constant. Evidence suggests that those who are well acquainted with Waainek, whether it be through regular visits or perhaps through living in the area, were more prepared to pay than those who did not have similar familiarity or connection and does conform to *a-priori* expectations.

For occupation, only the ‘employed’ group comparator was significant ($P < 0.05$). If a respondent was employed compared to being unemployed, the probability of paying to relocate the wind farm increased by 0.18, holding all other variables in the model constant. The findings correspond to those found in the previous unpaid scenario, showing unemployed individuals to be less likely to support the relocation policy. Those who were employed therefore displayed a lower tendency to pay to relocate the wind farm than in the case where no payment was required. The results are therefore not surprising.

Scenic considerations became significant once payment was required, removing the previously discussed incentive for ‘yes’ responses. Where the scenery of Waainek was considered extremely beautiful, the probability that a respondent would be willing to pay increased by 0.27, in comparison to those who perceived the Waainek area to be low-dull, holding all other factors in the model constant. The beauty of landscape scenery is therefore a large determining factor on whether people were willing to pay, but only when respondents perceived the landscape to have a high scenic worth, corresponding to Wolsink (2007) and Lothian's (2008) arguments. Siting wind farms in beautiful areas is therefore likely to result in a greater social loss than in areas where the landscape is considered boring, bland or scathed. Once again, these results are not surprising.

Income levels did have a significant impact, but only for those who earned at higher monthly levels. Compared to a base level of earning R1000 and below, people who earn R35,000 and above would have an increased probability of 0.37 of being willing to pay to relocate the Waainek Wind Farm, holding all other variables in the model constant. An income effect is therefore present when Willingness to Pay is considered. Findings earlier suggest that people in Grahamstown Central would be more likely to pay to relocate the wind farm, than those living in the township, because they were less receptive to changes in the Waainek scenery. A Fisher's exact test confirmed the relationship (significant) while the frequency table did indeed indicate that Central residents were more willing to pay (P = 0.001). Additionally, income distribution was found to be significantly related to the area people lived in, confirming that Grahamstown Central was home to higher income earners (Fischer's: P = 0.00). Thus Central respondents, who were wealthier and more prone to be affected by scenic changes in the Waainek area were also more likely to be willing to pay to relocate the wind farm than those who live in township areas.

Table 4.4: Probit model results of the main effects on the determining factors for those willing to pay for the relocation of the Waainek Wind Farm
[Source: Sample survey]

Pay to relocate wind farm	dF/dx	Standard Error	P>z
Age			
19-25 - Base	-	-	-
26 -36	.09956	.1083005	0.358
35-44	-.0511495	.1063914	0.631
45-60	-.0555273	0.210563	0.573
61 and older	.1204991	.1440319	0.403
Scenery at Waainek			
Low-Dull - Base	-	-	-
Neutral	.1069191	.0868332	0.218
Medium-attractive	.0574462	.0545997	0.293

High-extremely beautiful	.272741	.0885008	0.002
Income (monthly)			
R1000 and below - Base	-	-	-
R1001-R5000	.0717621	.0560116	0.200
R5001-R15 000	-.0189442	.0459772	0.680
R15 000 - R35 000	.2491122	.0981026	0.011
R35 000 - above	.3799145	.173729	0.029
Occupation			
Unemployed - Base	-	-	-
Employed	.1878959	.0924807	0.042
Business owner	--.0185965	.0637469	0.770
Student	.0913146	.1081861	0.399
Retired	.1273295	.1027963	0.215
Familiarity of Waainek			
Vague - Base	-	-	-
Familiar	.0235787	.052091	0.651
Know the area well	.2280485	.0814017	0.005
Number of obs = 137			
LR chi2(22) = 54.77			
Prob > chi2 = 0.0000			
Pseudo R2 = 0.4808			

Concluding remarks

A total of 23 respondents were willing to pay to remove the wind farm from Waainek, based solely on visual considerations, and made up only 15% of the sample. As expected, most of these respondents hailed from the more affluent Central areas (91%) with the remainder from Grahamstown East (9%). Very few people experienced problems with the visual impacts of the wind farm, where concerns were directed at other factors such as ecological problems. For the most part, it seems respondents were extremely positive about the clean energy benefits and aspects of the wind farm. Basic tests for NIMBY showed little evidence for the effect and was largely discredited.

The public participation process, while considered fair in the Grahamstown East areas, did attract some criticism from Central residents where attitudes tended to be more widely distributed. Attitudes towards the wind farm were not affected by the public participation process which coincides with what Warren *et al.* (2005) found in their study. Proximity was also found to be an influential factor when analysed on its own and was amplified when wind turbines were visible. However, related to other characteristics of the wind farm, visual impacts featured only as a minor problem. Interestingly, unemployment was found to be a major factor when considering attitudes towards wind farms because of perceived employment benefits from the project and primarily constituted those from the township areas. People from Grahamstown Central on the other hand were found to be more prone to the visual effects of the wind farm on the Waainek area, but only significantly so when scenery was perceived as extremely beautiful. Grahamstown East residents were extremely positive towards the project because of the perceived job opportunities and also enjoyed the appearance of the turbines. Further, it seems that when the perceived benefits from the wind farm are great, people would not mind or may even enjoy the aesthetics of the turbines. The novelty factor and low instalment rates of turbines in the South African landscape was further identified as being a powerful component in the turbines attractiveness, but cannot last indefinitely. Despite visual concerns being minor, some impact will be felt by the Grahamstown community, which needs to be assigned a monetary measurement. The next section aims to calculate the extent of said ‘damage’ and presents different sensitivity cases to account for potential error.

Chapter 5: Calculating Willingness to Pay for Waainek

Following the visual valuation procedure set out in the method section, the three different landscapes were each valued in the order of A: Featherstone Kloof, B: Makanaskop and C: Waainek. While the data provided from the first two landscapes (A and B) cannot be used to value the impact of the Waainek Wind Farm, the obtained Willingness to Pay should reflect prior value expectations and therefore add a degree of validity to the estimation. For example, an area which has a lower expected visual quality should be impacted less by a wind farm than a landscape with a higher expected scenic value. Of course this will not always be the case, as other factors may influence the outcome especially where uncertainty around preferences is concerned. Each set of photographs were accompanied by a map in order to 'place' the area within the surrounds of Grahamstown.

Calculating Willingness to Pay was not straightforward due to the varied reactions respondents showed towards the wind farm, culminating in the reclassification of the sample into three separate groups. Grouping A incorporated those responses which were neutral, opting not to pay while simultaneously deriving no satisfaction\dissatisfaction from the appearance of the wind farm. Respondents classified into Grouping B derived satisfaction from the appearance/aesthetics of the wind turbines, essentially resulting in values that were less than zero (Negative values). Both group A and B therefore could not be used when calculating WTP to relocate the wind farm, as only negative visual impacts were sought after[104].

Grouping C incorporated the remainder of the sample with the addition of two conditions. The definition included those who were willing to pay to relocate the wind farm from Waainek (or other areas when stated) to a nearby location called area D[105]. In addition, those who stated that they were not willing to pay and were not students[106] but found the visual impacts of turbines unappealing, were assigned zero values and combined with those willing to pay. Simply, those (except students) who disliked the view specifically from wind turbines were included in the calculation of WTP. As the grouping method involved only a portion of

[104] WTP for this study cannot assume zero values for neutral respondents. The primary reason for this is that these same respondents, if the study allowed, could not then be used as 0 values for positive values as this would essentially be double counting. Only if positive, negative and neutral values were used simultaneously, could the results be relied upon. As it currently stands, no positive values were determined and therefore neutral respondents will have to be dropped.

[105] Area D is a hypothetical area within the Grahamstown area which serves as the wind farm relocation site.

[106] As students are temporary residents, they were only included if they had stated that they were willing to pay.

the total sample, so these same proportions were used to make assumptions about the size of the population who would be willing to pay.

5.1 Obtaining visual impacts

The first set of photographs is of Featherstone Kloof an area well known for its beauty and frequented by hikers, cyclists and other such activities. Figure 5.1A depicts the landscape as it currently stands and is characterised by an infrastructure free landscape and 'picturesque' scenery. One large residence is present in the area and is prominent from much of Grahamstown, but likely detracts little from the view. Figure 5.1B is a photomontage of a hypothetical wind farm development. The first observation by participants regarded the relatively 'pristine condition' the landscape was in, with no human interference clearly visible in the pictures. Respondents often recognised the area, stating that they frequently visited it on walks or drives and described it as 'beautiful'. The estimated average Willingness to Pay per person to relocate the wind farm from Featherstone Kloof to area D was R87. The valuation is indicative of the landscape's attractiveness, which many stated they enjoyed, while also being well recognised within the Grahamstown community.

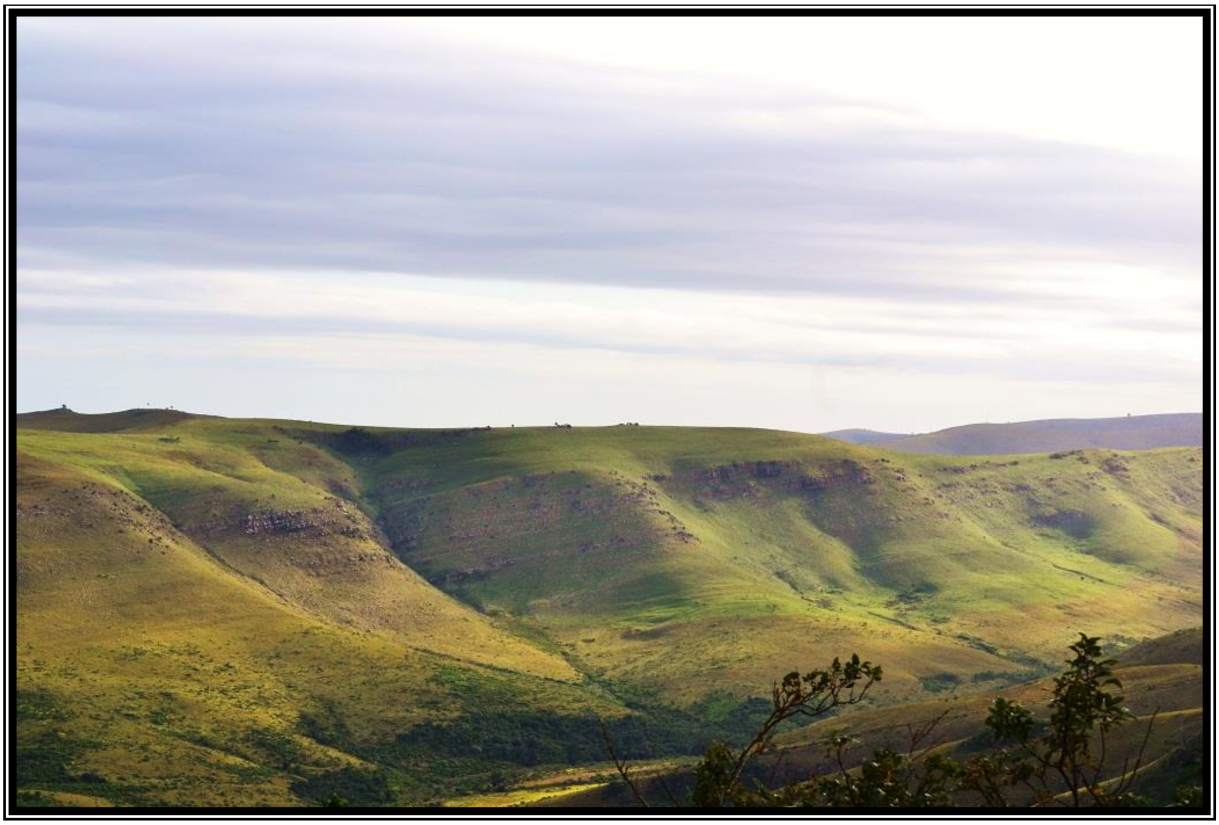


Figure 5.1A: Vista of Featherstone Kloof as the landscape currently stands
[Source: Self photographed]

Figure 5.1B: Featherstone Kloof with photo-montaged wind turbines in the landscape
[Source: Self photographed and manipulated]

Makanaskop (figure 5.2A) was the second landscape to be valued and presents a more ‘busy’ and urban setting. Residences within the Grahamstown East area are clearly visible, mainly displaying the historically black and poorer areas of town. In the foreground are power lines, the N2 highway with the Settlers’ Monument falling about midway within the frame. Grey Dam, along with the highly vegetated area it occupies, is also present. A ridge was selected for placement of the hypothetical wind farm (figure 5.2B), nearby to the township residences at the start of Makanaskop, extending rightwards to the N2. The disruption to the landscape appears less severe than in Featherstone Kloof’s case because the presence of urban structures seems to offset the visual addition of the wind farm.

Respondent comments confirmed that the area had already been partly aesthetically degraded; where the introduction wind turbines did not feel very “intrusive”. Some remarked that the wind farm was better suited for Makanaskop, rather than Featherstone Kloof, and simply asked why it had not been planned for this area initially. However, some were disturbed that the wind farm should be constructed nearby to people’s living areas. A woman asked “why should they live with that?” while another revealed that she was “worried about the people” living just under the structures. One participant was relieved that he could not see the turbines from his house when placed at Makanaskop. Thus while respondents did find the location to make a lot more sense visually, concerns about human health and inequity made the site unattractive. Such reservations however, did not feature very strongly with the average Willingness to Pay estimate which amounted to R33 per person, considerably lower than what was arrived at for Featherstone Kloof.

Figure 5.2A: Photograph of Makanaskop which includes much of Grahamstown East
[Source: Self photographed]

Figure 5.2B: Photograph of Makanaskop with the photo-montaged wind farm added
[Source: Self photographed and manipulated]

Waainek, the third area valued, included two sets of photographs in order to provide a more comprehensive coverage of the scenery. The first pair of photographs depicts a landscape characterised by relatively flat land in the foreground accompanied by rolling hills in the background. Structures in the industrial area, as well as along the Highlands Road, are visible but they do not dominate the view to the extent seen in Makanaskop (Figure 5.3A). Urban disturbance is present but not prominent. Studying the second frame (Figure 5.3B), the installation of the wind farm does create a noticeable change on the area, especially due to the contrast of the turbines against the sky. As few structures occupy the landscape, the addition of the wind farm does seem to blend in better than was the case for Featherstone Kloof.

The second set of photographs were taken south of Waainek, in the area near the Mariya uMama we Themba Monastery, along the Highlands Road, where two additional wind turbines will be constructed (Figure 5.4A). The second area appears more mountainous than the industrial area of Waainek and more closely related to Featherstone Kloof, which is located nearby, where both form part of the escarpment. Topographically, a ridge extends towards Faraway, with the land in the foreground sloping and dropping off into a valley. While the photograph does not immediately show any man-made structures in the landscape, there are some farm houses and power lines scattered in the vicinity, falling outside of the photo frame. Introducing the wind turbines into this particular area (Figure 5.4B) does provide a clear and stark change from the *status quo*, and may be inclined to offend those who frequent the site.

Figure 5.3A: Photograph of the Waainek area as seen from Hill 60 with the industrial area present in the mid-ground
[Source: Self photographed]

Figure 5.3B: Waainek area with photo-montaged wind farm in the landscape
[Source: Self photographed and manipulated]

Figure 5.4A: Second photo south of the Waainek area where the remainder of the turbines would be installed
[Source: Self photographed]

Figure 5.4B: Area south of Waainek with photo-montaged images of wind turbines in the landscape
[Source: Self photographed and manipulated]

The average Willingness to Pay to relocate the wind farm away from Waainek amounted to R82, an unexpected result. Comments made on the site were very few, but generally indicated that it was suitable for the wind farm. It is unexpected that Featherstone Kloof, which appeared to be more pristine and scenic than Waainek, was valued only slightly higher at an average Willingness To Pay of R87. It is worth mentioning that the Waainek area is located in an area which is closer to residences than Featherstone Kloof. As proximity to wind farms was found to be an issue in the earlier findings addressed in this study, it could be argued that proximity costs have been included in the valuation of the scenery. The high values for Waainek may therefore reflect people's reluctance to live nearby the wind farm development.

Alternatively, inconsistent respondent valuations may be to blame. Data trimming is a recommended practice, but only for those outliers or extreme cases that may pose a problem for the estimates as a whole (Stevens, 1984). Two participants did display some behaviour which appeared incongruous with the general direction of their responses. For example, while one respondent found Waainek's scenery to be of medium/attractive quality, the installation of the wind turbines would improve the scenery significantly for him. When the same respondent was asked whether he would pay to remove the wind farm based solely on visual considerations, he replied "yes", at odds with what had been stated before. The amounts he agreed to pay far exceeded his monthly expenditure on electricity, the bills of which he did not handle himself. Further, the individual was unemployed and earned less than R1000 a month, calling into question the reliability of the data provided. The best guess is that either acquiescence is to blame or the respondent simply did not understand the scenario and questions being asked. Thus this respondent was dropped from the sample.

The second respondent, a student, also provided inconsistent data according to her answers. To cite a few problems: she did not know the area well, she found wind turbines to be unappealing yet thought that the wind farm would improve the scenery at Waainek. Payments were refused for both Featherstone Kloof and Makanaskop, even where low offers were made. Another problem involved visual impacts, which did not rank at all as a problem for her concerning wind farms, yet she was still willing to pay to have them removed. Such responses prove problematic and may have been due to acquiescence bias; therefore the individual was also dropped from the Willingness to Pay estimates. The remaining respondents appeared rational in their selections and no further culling was required.

Willingness to Pay results for the revised dataset presented a significant change for only one of the three sites through the removal of the two anomalous respondents. For Featherstone Kloof, the average WTP dropped from R87 to R81 while the valuation for Makanaskop remained relatively stable at an average WTP of R30, a decrease of 3 Rand. The greatest change in average WTP was found for Waainek, which dropped from a high of R82 to R67, and was more in line with the initial expectations; an 'improvement' on the first set of estimates. However, it may be observed that Waainek is still highly valued based on aesthetic value relative to Featherstone Kloof which is likely related to proximity. Based on the newly acquired estimates, the build site rankings for the wind farm, if based solely on visual considerations, would fall in the following order: Makanaskop, Waainek and then Featherstone Kloof.

The learning design Contingent Valuation Method employed in this study assumes a greater degree of uncertainty for 'goods' valued earlier than those which occur successively (Bateman *et al.*, 2008). Preference uncertainty produces monetary values which do not reflect true valuations and apply especially to non-use values which people are not used to quantifying. Further, the market institution or mechanism used to elicit values would further exacerbate the problem until respondents become accustomed to the procedure, only properly solved through successive 'trials'. Goods valued earlier are consequently less accurate than those values later on in the bidding process. Estimates may reflect upwards or downwards once respondents become more confident about their Willingness to Pay, depending on the changes in quality or the good itself and based on preference learning. The point is simply: estimates for Waainek are likely to be more reliable than those for Featherstone Kloof and Makanaskop because of the stabilising effect of preference learning. Perhaps then, preceding area estimates (Featherstone Kloof, Makanaskop) cannot be relied on as reference points for Waainek taking into account the respondent uncertainty for these values.

Interestingly, once respondents had gone through the entire valuation exercise, some asked if it would be possible to redo the section. Respondents were allowed to redo their WTP bids, which provided a useful method for further stabilising WTP, especially when people realised that first round estimates may have been exaggerated. Further, where future studies concentrate only on the WTP scenario, more elaborate learning methods could be employed to guarantee the accuracy of estimates. Theoretically, the estimates for Waainek, obtained through the learning design Contingent Valuation Method, should have stabilised sufficiently to provide a high degree of accuracy. As estimates are influenced by the design of the survey instrument, diagnostics are required to check the integrity of the questionnaire, which is undertaken in the next section.

5.2 Validity checking

In order to assess whether the Willingness to Pay estimates are accurate, reliability and validity need to be addressed, concepts previously discussed, but presented briefly again for ease of reference[107]. The first test is content validity which refers to the accessibility or understandability of the survey instrument (Carson, 1989; Garrod and Willis, 1999 and Bateman *et al.*, 2002).

- The questionnaire underwent a focus group and pre-test stage which lasted approximately two weeks in order to observe any problems respondents may have had.
- Where people were not first language English speakers, the survey was translated into Xhosa and a translator was employed to conduct the interviews. Clarity was provided by the interviewer where respondents encountered difficulty.
- The Willingness to Pay question was slightly confusing for some respondents, however, interviewers were on hand to assist in understanding what was being asked. Additionally the payment vehicle was a simple surcharge added onto the monthly electricity bill of respondents and was a well understood payment vehicle.

Criterion validity is difficult to assess because public goods do not have active markets allowing for price comparisons. Simulated markets have in the past been the only avenue in which to run appraisals for public goods, but require more time and extra cost to the researcher which rendered the procedure unviable. The alternative discussed by Johnston (2006) and Bateman *et al.* (2008) is to use repeated market simulations in which experience for the good can be accumulated with each successive valuation. Three different landscapes around Grahamstown were selected as imperfect scenic substitutes. Respondents were required to value each in a pre-determined order, facilitating the development of experience for the market institution (dichotomous choice) and for the scenic good.

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[107] For a more detailed coverage, see Chapter 2: History and applicability (The Contingent Valuation Method).

Finally, construct validity refers to how closely the Willingness to Pay (WTP) figure compares to other methodologies' estimates valuing the same good (or similar), termed convergent construct. Further, findings need to have some uniformity with theory and is termed theoretical construct. Most studies to date have been conducted in foreign countries which require currency conversion, with the added complication of differences in socio-economic conditions. Ladenburg and Dubgaard (2007) found that people were willing to pay 46, 96 and 122 Euros/year/household to remove a wind farm from distances of 12, 18 or 50km away (8km baseline). The study analysed relocating an off-shore wind farm, generally thought to be less visually disturbing than on-shore. In Krueger's (2007) study, the average Willingness to Pay in the State of Delaware (USA) increased from $328, $449, $535, $613, $666 and $734, with distances of 3.6, 6, 9, 12, 15, and 20 miles respectively. While unrelated to wind turbines, respondents in Denmark were asked by Navrud, Ready and Magnussen (2008) their WTP to bury power lines in order to improve an existing view. Estimated household WTP was $130 per year. Using current exchange rates and average inflation rates for the respective regions over a five year period, monthly rand amounts were calculated as displayed in Table5.1.

Table 5.1: WTP in **v**isual studies in Denmark and the USA of off-shore wind farms and power line removal.

Authors	Year of Study	Area of study	Object(s) valued	WTP value (foreign)	AdjustedWTP (monthly/rand)[108]
Ladenburg and Dubgaard	2007	Denmark	Off-shore wind farm	46-122 Euros/year	R51 – R134
Krueger	2007	USA: Delaware	Off-shore wind farm	109-244 Dollars/year	R94 – R211
Navrud, Ready and Magnussen	2008	Denmark	Power-lines	130 Dollars/year	R107

The Waainek WTP estimate (R67) falls into the lower range of Landenburg and Dubgaard's (2007) and well below the Navrud, Ready and Magnussen's (2008) WTP findings. The much higher estimates of Krueger (2007) is likely due to the temporary payment conditions which

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[108] In top down order of estimates: 2% inflation rate, exchange rate of R11.95/Euro; 3% inflation rate, exchange rate of R8.95/Dollar; 2.5% inflation rate, exchange rate of R8.95/Dollar.

were constrained over a three year period instead of in perpetuity as had been used in the other studies. While there is some overlap present for the WTP amounts in the three studies, it should be noted that these figures derive from countries which are developed and therefore have higher average income levels than Grahamstown. A divergence in WTP (with Waainek being lower) is indeed more encouraging than a correspondence as this conforms to the socio-economic differences between wealthy and emerging economies. WTP therefore may reflect the disparity in ability to pay between developed (lower WTP) and developing countries, the differences in scarcity of scenic resources and the quality of the landscapes in each case.

It should be noted that the disparity between figures may have been greater than is currently observed. A strong reason for this argument lies with the fact people have a general visual preference for wind farms located on the ocean rather than those built on land (Ladenburg and Lutzeyer, 2012). WTP would therefore generally be lower for off-shore wind farms than on-shore, and thus it wouldn't be erroneous to assume a greater difference between WTP if on-shore turbines were instead the focus of the comparison studies.

As a local comparison, a South African study of Willingness To Accept a wind farm in Jeffrey's Bay by Menzies (2011) provided an estimate of R12/household/month to cancel the wind farm project. Included in the estimate were all undesired and desired external effects over and above visual considerations. Therefore, there was a difference in scope of goods being valued by each study. For Waainek, only negative visual impacts (gross) were considered while Menzies' (2011) research encompassed an entire range of goods (visual, clean energy, renewable, bird strikes, etc.). As all externalised effects were potentially considered (perhaps on an individual level), the result of the study was consequently a net impact, where the benefits would have had an opportunity to offset costs. Therefore, the Menzies (2011) study cannot accurately be used as a basis for comparison because the two studies measure fundamentally different aspects of wind farm developments.

One way to check if estimates are unreasonably high is by comparing the WTP amount to average income. Data collected for income was categorical and not continuous which makes accurate estimation difficult. Averages for each category were taken (i.e. 5000 - 10,000 = R7500 per month) and multiplied by the frequency of respondents falling into each group. Adding together all these subtotals and dividing by the sample size (151) gave an average monthly income of R9000 [109] for Grahamstown. The Quantec (in IDP, 2011) report of 2007

[109] Rounding off applied, original figure was R9003.31

estimated monthly income to be around R8400 per month/household for the Makana Municipality as a whole. Average inflation over a 5 year period from 2007 to 2012 was 2.5% which after adjustments, determined average household income to be R9400 in 2013 prices. Therefore the estimates acquired through the survey were deemed reasonable. Dividing average Willingness to Pay by income gives the portion of the budget that would have to be paid over monthly which is 48/9000 = 0.53%, a small share.

For Menzies (2011) study in contrast, the proportion of the budget would be 0.001%[110]. Most of the sample in Menzies (2011) study were retired (53.9%) which may explain the low WTA obtained in the study. Indeed, the odds of retired individuals voting for the wind farm to proceed in Jeffrey's Bay increase by 6.11 compared to those still in the workforce, which worked to underestimate WTA. Another probable reason for the difference between the two figures is accounted for by the scenarios. The Waainek Wind Farm scenario posited that the turbines would be *relocated* and therefore would still proceed within the Grahamstown area. The Jeffrey's Bay wind farm scenario gave respondents a vote to choose whether the wind farm *proceeded*, no option for relocation was given which effectively meant that the Jeffrey's Bay Wind Farm would be cancelled (Menzies, 2011). As both wind farms showed strong support, cancelling a project outright may have been met with opposition and thus wind farm advocates would likely not reject lower compensation bids, keeping willingness to accept estimates low.

Perhaps an important point to revisit is that the enjoyment value of scenery differs between person to person and from place to place. The dynamics create complexity between factors which determine values and makes comparison to other estimates misleading. However, the comparison to other estimates does provide a 'ballpark' range, allowing researchers to gauge if their findings are on the right track. Construct validity also provides a useful theoretical guide to judge estimates (Grafton, Adamowicz, Dupont, Nelson, Hill and Renzetti, 2004). While no covariates were included in the double bounded model as observations were too few, a probit model in the previous section determined that income, scenery and knowledge of wind farms were significant factors in determining who were more likely to pay for the Waainek Wind Farm relocation and conformed to *a-priori* theoretical assumptions. An R^2 value could not be generated in the estimation because covariates were necessary for its computation, but p-values for WTP estimates were significant at the 99% confidence level (P

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[110]Average monthly income of R10,990 and average WTA of R12

= 0.00). The model performed better when two outliers with inconsistent responses were removed from the WTP model.

Overall, the majority of the criteria prescribed by Mitchell and Carson (1989) were met in the study. The survey instrument fulfilled all the requirements demanded for content validity with the design ensuring maximum accessibility by respondents from different language and cultural backgrounds. Criterion validity is a costly and difficult procedure to undertake but Bateman *et al.* (2008) argued that learning design Contingent Valuation would assist in exposing respondents to the novel market institutions and yield more accurate WTP estimates. Comparisons were made against research which had performed similar visual impact analyses (convergent construct), with estimates falling at the lower ranges of the developed country WTP averages. Such a finding is reasonable considering the higher general income of developed countries as compared to developing countries. The proportion of the budget consumed on visual goods was also found to be minor and mainly fell on wealthier groups within the sample. Finally, the theoretical underpinnings (theoretical construct) of the model conformed to *a-priori* expectations and thus made up the remaining component.

To conclude, the lower estimates obtained through this study (as compared with developed nations) are encouraging as they reflect likely reflect socio-economic contrasts between nations. Differences between wealthy and developing nations provide an obvious leniency for the stringent criteria guidelines regarding construct validity, especially because locality can have a significant impact on calculated figures. However, as more studies on the visual impacts of wind farms in developing countries are undertaken, the comparability of figures will work to strengthen and improve the understanding of the unique circumstances faced by emerging economies.

5.3 Calculation of the extent of the visual impact of the Waainek Wind Farm

In order to calculate the magnitude of the visual impact, Willingness to Pay estimates need to be extended to the population of Grahamstown. The best estimates of population available however, vary significantly (Moller, Manona, van Hees, Pillay and Tobi, 2001; National Treasury, 2011), with the further problem relating to the age of the data. An updated Rhini study by Moller (2007) provided little improvement on population size estimates or the ratio living in the Rhini area. The Grahamstown/Makana Municipality adopted a figure of 124,758 in 2000 primarily for planning purposes, which falls on the higher end of the spectrum (Moller *et al.*, 2001). As can be seen from Table 5.2, the population estimates range from a low of 70,706 to a high of 140,120 for the most recent years. Rather than rely on any one figure, an average of the latest (2007) statistics was used instead. A range was then specified for sensitivity analysis to provide a blanket estimate due to error.

Table 5.2: Population estimates of the Grahamstown area by various research bodies. [Source: National Treasury, 2011]

Source	Population	Year
Quantec Research	70,706	2007
CDM 2009 SDF	74,561	2007
Makana 2008 SDF	140,120	2007
CDM IDP 2008 review	84,111	2003
2003 Makana IDP 2008 review	82,682	2001
Makana IDP 2007-2012	75,302	2001

Using the figures obtained by Quantec Research, the CDM 2009 SDF and Makana 2008 SDF, the average estimated population for 2007 was 95,000. As these figures are outdated by over 5 years, some basic recalculation of the population was necessary. Quantec Research (in National Treasury, 2011) found that the Makana population as a whole had stabilised and in some instances shrank between the years 1995 and 2007, which was in line with population trends in the Eastern Cape as a whole over this period. Data from the latest census [111] (2011) confirmed these figures as an overall increase in the Eastern Cape population was only 4.5% during the period from 2001 to 2011, a very low rate (ECSECC, 2012). Despite the population "plateau" for most of Grahamstown, evidence suggests that informal settlements in East Grahamstown\Rhini area have defied these trends and continued to grow due to in-migration from farming communities.

[111] Data from the latest 2011 census was released sequentially, staged at completed processing intervals. Thus, much of the needed population data only became available after the current section had been written.

The next step involved splitting the population into areas, following the East and Central sample categories used for the Waainek study. Moller *et al.* (2001: 13-14) provides an implicit guide on the ratios that should be used to split the population into their respective areas, which required some calibration. The 1996 census estimated Grahamstown to have a total of 62,637 people of which 44 696 originated from Grahamstown East[112] (Moller *et al,* 2001). Survey research by the ISER in 1999 indicated this figure to be around 54,252, much higher than the census level (Moller *et al,* 2001). While the survey was conducted three years after the census in 1999, the growth rate of Rhini would have to be 4410 people per year if this discrepancy were attributed to the growth rate and is therefore highly unlikely (Moller *et al*, 2001). Thus a compromise between the two figures is necessary, where the average was taken.

The average for those staying in Rhini was recalculated to 49,000 of a total 63,000[113], which amounts to a ratio of one in Grahamstown Central for every 4.5 in Grahamstown East. Applying the ratio to the total population of 95,000, the number living in Grahamstown Central becomes 21,000 with the remaining population of 74,000 originating from Grahamstown East. Considering the relative population stagnation for the Eastern Cape and the growing informal settlements of Grahamstown, any changes in population will assume no growth[114] in the Central areas while using 2.25% growth for Rhini[115]. Thus the Rhini population is estimated to be approximately 76,000 people.

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[112]While the ratio calculation is based on the census data, Moller *et al,* (2001) argued that the 1996 census evidenced instances of undercounting and thus the population figures are understated as can be evidenced from later surveys (2007).

[113]These numbers have been rounded to the nearest thousand mainly because original estimates are not exact.

[114] Simplifying assumption

[115] 4.5%/2= 2.25%. Roughly halfway point between 2001 and 2011, with 2007 being the population measurement year for Grahamstown. Official statistics give a percentage increase over a number of years while the calculated figure assumes a ‘break point’, associated with compound interest. Figures will therefore be slightly inflated but should suffice since the population of Rhini seems officially underestimated anyway (Moller, 2001).

Table 5.3: Determining the current population size of Grahamstown using growth figures for the Eastern Province and Moller *et al* (2001)
[Source: Figures derived from a combination of National Treasury (2011) and Moller *et al.* (2001)]

Calculations	
Population	(74,561 + 70,706 + 140,120)/3 = 95,000
Ratio - Establishing population of Rhini	(44,696 + 54,252)/2 = 49,000
Ratio - Calculating ratio once population of Rhini obtained	63,000 – 49,000 = 14,000
	63,000/14,000 = 4.5
Current population of Grahamstown Central	95,000/4.5 = 21,000
Current population of Grahamstown East	95,000 - 21,000 = 74,000 + 2.25% = 76,000

Not long after the population size of Grahamstown was estimated, census 2011 data was released indicating that Makana municipality had a population of 80,000 (StatsSA. 2011). The large sample size of the census arguably presents a more reliable estimate. However, local opinion about the earlier 1996 census and proceeding population counts stirred "doubts about the accuracy" of the official estimated statistics (Moller *et al.*, 2001). Indeed, Moller *et al.* (2001) concluded that it would be prudent to use Williams and Davies' (1989) estimate of 100,000 people for the Rhini area alone in the year 2001, which is close to the current study's 97,000 estimate. However, there is little reason to doubt the up-to-date 2011 estimates and for prudence sake, these will be used for the baseline population. Additionally, Moller *et al* (2001) and Williams and Davies' (1989) estimates are outdated which does work to decrease their reliability.

The 97,000 estimate will instead be used as a higher population threshold in the sensitivity analysis while the calculated ratios between the Rhini and Central areas still play a pivotal role in dividing up the population. Assuming that the sample is representative of the population, observations for those who were keen on paying to remove the wind farm and the Willingness to Pay estimates will be used to estimate the total visual damage. Table 5.4 displays the number of respondents who were willing to pay to move the wind farm and the area of Grahamstown they reside. In addition, those who were not willing to pay but were negatively impacted by the wind farm and were not students were added to the calculation of WTP[116] . Grahamstown Central received a total of 39 'yes' responses while Grahamstown

East obtained three. It is necessary that the ratios for each area are used so that estimates can be extended to the population as a whole.

Table 5.4: Respondents who were willing to pay to have the wind farm relocated from the respective areas of Grahamstown in addition to those who did not enjoy the visual impacts of the turbines and were not willing to pay.
[Source: Sample survey]

	All sample areas of Grahamstown		
Support Scenario	Central	East	**Total**
No	79	49	**128**
Yes	20	1	**21**
Negatively impacted by turbines/not willing to pay			
No	80	48	**128**
Yes	19	2	**9**
Total included in WTP calculation			**32**

As the surveys were undertaken on a per household basis, the population needed to reflect this grouping. Household size according to this study is determined according to the area a particular population falls in, divided by the average number of people living in a single residence. Additionally, the Willingness to Pay response rate differs per area and will be accounted for by adjusting the recalculated population ratio.

Using the census population of 80,000 for Grahamstown East, the estimated population size for the area is 62,222. The average number of people living in each residence was found to be 4.6, which leads to a figure of 13,526 total households. The response rate for those who were classified as "yes" for the valuation section was a very low 2%. However, from personal interaction and communication with members of the households in Grahamstown East, it seems likely that even 2% is still high. Sensitivity analysis will hopefully account for this concern and for now the figure will not be altered. From 13,526 households, assuming that the positive response rate is 2%, results in 271 households agreeing to make a payment. The final perceived visual damage for Grahamstown East is R18,000 per month.

The Grahamstown North assumptions are now discussed. The population for this area amounted to 17,778 with two different household sizes being used, in order to differentiate between families and bachelor students. Students on average tended to live fewer in number in a house of 2.3 on average while families had an average of 2.8, closer to three. Splitting the population for Grahamstown Central to account for these differences showed students to comprise of approximately 6500 of the 17,778 population, leaving the remaining 11,278 as family residences. Dividing these figures by the different average people per household gives 2826 for students and 4028 for family households. The percentages of each individual category that would be willing to pay, namely 3% for students and 36% for households, which yielded 85 and 1450 households respectively. Multiplying these figures by an average Willingness to Pay of R67 results in R5,700 and R97,000 respectively. Adding students, Grahamstown Central and East residents together yields a total Willingness to Pay of R121,000 (with rounding) a month to relocate the wind farm away from Waainek based solely on visual considerations.

5.4 Sensitivity analysis

Model 1 - Base Case

The assumptions used to derive total Willingness to Pay to relocate the wind farm forms the basis for the sensitivity analysis. Three factors were selected as the most likely sources of error within the model and included population size, percent of households who would be willing to pay to relocate the wind farm and the Willingness to Pay estimate. The term ‘factor’ refers to any input present in a model which can be manipulated and changed “prior to its execution” and examines influences which present the highest degree of uncertainty (Saltelli, Tarantola, Campolongo, Ratto, 2004). Slight manipulation in certain factors could yield very different results and thus analysing these variations, the models sensitivity, is the purpose of this section. Table 5.5 presents the ‘Base Case’ where factors are based on the assumptions used to derive the current total Willingness to Pay of R121,000. Included in the table are also the Conservative Case model and the Likely Case model, where assumptions have been adjusted in relation to the base model.

Table 5.5: Total willingness to pay based on three different sets of model assumptions. [Source: Sample survey]

Comparison of Models 1, 2 and 3			
	Model 1 - Base Case	**Model 2 - Conservative Case**	**Model 3 - Likely Case**
Main variable assumptions			
Population size	80,000	80,000	80,000
Percent of households willing to pay			
Central	0.36	0.252 (-30% base)	0.324 (-10% base)
Students	0.03	0.021 (-30% base)	0.021 (-30% base)
East	0.02	0.014 (-30% base)	0.014 (-30% base)
Average Willingness to Pay	R 67	R 36	R 67
Total Willingness to Pay per month	R121,000	R45,000	R104,000

Model 2 – Conservative Case

Keeping the population in line with the base case, but decreasing the percentage of people willing to pay by 30% in each area, and the average Willingness to Pay down to R36 per person, provides the conservative estimates (model 2) in Table 5.5. The assumptions postulate that fewer people would be willing to pay than stated in all areas. For those who are willing to pay, the amount stated in the survey is assumed to have been exaggerated due to some form of hypothetical bias, despite the evidence supporting the incentive compatibility of the learning design Contingent Valuation (Mitchell and Carson, 1989; Johnston, 2006; Bateman *et al.,* 2008). Confidence intervals provided the range in which the lowest WTP estimate possible was selected as the most ‘likely’ candidate. Willingness to Pay in this case was much lower than in the base case, being R45,000 monthly to relocate the wind farm based on visual impacts.

Model 3 – Likely Case 1

Model 3 provides the most likely case for estimates. Population size has been set to the base level. Central households are also set to 10% below the base but students and Grahamstown East households are reduced by 30% each. Students tend to be temporary residents of Grahamstown and therefore would be less likely to mind the view impact than those who are permanent residents. For households in Grahamstown East, the financial realities for many would likely concentrate budget on necessities rather than 'visual luxuries'. Comments and analysis from earlier sections of the study also found that households in Grahamstown East strongly liked the look of the wind turbines, further presenting opportunity in the form of job creation. Thus even at a base rate of 2%, the commitment rate seems unlikely and is reflected by the household assumption values (-30% base value). Average Willingness to Pay is left as estimated for Waainek. The likely case model estimates the total WTP to be R104,000 per month and can be seen in Table 5.5.

Table 5.6: An unlikely and 'Central' case of peoples' Willingness to Pay to relocate the Waainek Wind Farm in Grahamstown.
[Source: Sample survey]

Comparison of Models 1, 3 and 4			
	Model 1 - Base Case	Model 4 – Grahamstown Central	Model 5 – Unlikely Case
Main variable assumptions			
Population size	80,000	80,000	97,000
Percent of households willing to pay			
Central	0.36	0.324 (-10% base)	0.396 (+10% base)
Students	0.03	0.0 (-100% base)	0.033 (+10% base)
East	0.02	0.0 (-100% base)	0.022 (+10% base)
Average Willingness to Pay	R 67	R 67	R 98
Total Willingness to Pay per month	R121,000	R87,000	R253,000

Model 4 – Grahamstown Central

The assumptions of the Grahamstown Central model is dissimilar to all others presented thus far. Both Grahamstown East and student respondents do not feature at all in the calculation of total WTP. The main motivation pertains to the low acceptance rates of payment shown by East residents. Indeed, estimating WTP from such a low sample number may not provide a meaningful WTP figure for the Rhini area. Additionally, as many students live on campus residences and are therefore not likely to pay electricity bills themselves, this group has also been excluded from the model. Therefore the total WTP relies only on Grahamstown Central residents, falling 10% below the base level while both Rhini residents and students are assumed to contribute 0%. The total WTP under these circumstances is R87,000 per month (figure 5.6) to relocate the Waainek Wind Farm based on visual concerns only.

Model 5: Unlikely Case

All factors are assumed to be above the base case. Population is adjusted up to 97,000 which was estimated in the previous section and provides a possible current cap. The percentage of households willing to pay was also adjusted 10% above the baseline amount for Central, students and East households. Willingness to Pay was similarly adjusted to the upper limit allowed for by the confidence intervals. Assumptions used in this model are unlikely for several reasons. While the population size is perfectly reasonable, Willingness to Pay is argued to be prone to 'inflated', rather than depressed, values through various biases (Chien, Huang and Shaw, 2005). Actual or real WTP is therefore more likely to be below the base case. Additionally, there is a great deal of uncertainty surrounding whether those who stated that they would be willing to pay would actually make payment if the measure was implemented. Therefore, a total Willingness to Pay of R254,000 (figure 5.6) a month needs to be considered with care and does form an unlikely case.

Synopsis

The most probable scenario lies between the 'base' and 'likely' models which falls in a range between R104,000 and R121,000 per month. While the sincerity of respondents willing to pay cannot be empirically tested, a 'sense' obtained during the interview process was that certain groups, when confronted with actual payment obligations, would ‘change’ their mind and not commit. Demographically, low-income and temporary residents of Grahamstown would be the most likely groups for these discrepancies and are accounted for by model 3. Estimates are more likely to be erroneous above the base case, with favour given to lower cost models. The total estimated project cost is R380 million, which results in a total externality size of 7.6%[117] over the lifetime of the project. However, even 7.6% may change over time as preferences adjust; existing residents move out and if there is an absence of an age effect. Further, topographical features of the Grahamstown area and Waainek need to be noted in addition to quantitative reasoning, as landforms are largely responsible for visual impact exposure.

The Waainek Wind Farm is situated approximately 5kms away from the Central areas of Grahamstown which is moderately far away, but not enough to be visually inconspicuous. Thomas (in University of Newcastle, 2002) found a minimum of 20kms was required to significantly remove adverse effects for large scale wind farm developments with mast sizes of 95 meters, where turbines are situated on plateaus. Argonne National Laboratory (2012) did an extensive study in Wyoming and Colorado assessing wind turbine visibility under different conditions of lighting and weather conditions. Findings were similar to the University of Newcastle (2002) where “wind facilities were judged to be major foci of visual attention at up to 19km” (Argonne National Laboratory, 2012). The major difference from the study areas, however, is that Grahamstown lies in a bowl where part of the city will be shielded from the view-shed of the turbines. Buildings facing away from Waainek, as well as those in the ‘dip’, should have the least exposure to visual impacts from the wind farm and could further lower WTP. However, this assumes that people are only concerned with views from their homes and not the Waainek area itself, which unfortunately extends beyond the scope of the present research.

Perhaps the most critical point to be made is for future studies, in addition to negative impacts, to measure and estimate the positive aspects of wind farms and therefore the benefit side of the CBA equation. As it stands, the measured impact can only be considered as a gross estimate because no counter (positive) figure can be offered to calculate the net impact. Respondents did express a Willingness to Pay to keep the wind farm in the landscape, albeit indirectly, because several thought the turbines looked ‘elegant’ and intriguing. Even if visual

[117] (121,000*12)*20 = 29,040,000 | 29,040,000/380,000,000 = 0.076

benefits are trivial, the findings of the survey have found substantial benefits derived from other characteristics of the wind farm which should be included when analysing the viability of a project from a cost-benefit perspective.

Chapter 6: Conclusion

6.1 Reconciling subjective and objective frameworks

As concluded in chapter 2, traditional methods of scenery valuation have found it simpler to rely on the advice of a single visual expert, who determines impacts based on seemingly ‘objective’ criteria. The major criticism of so called objective studies is that results accord to the classification of a single person, whose personal taste may differ to another’s. Thus consulting different practitioners to do a valuation of the same area may yield very different results and this is precisely where the power of subjective studies has appeal. By studying and incorporating an assortment of varying viewpoints, the concerns and valuations of the affected community, key problem areas can be more readily identified. Further, through the aggregation of collected sample data, statistical models can be used to establish the specific significant factors influencing a community’s aesthetic values. Monetary valuations of visual impacts on scenery offer a supplementary facet to landscape studies, providing policymakers with workable quantitative figures. Economics seeks to bolster the traditional sentimental notions of landscape, by arguing that scenery is a form of resource, which can be easily degraded, requiring effective management (Oberholzer, 2005).

It is fair to mention however, that objective studies do provide useful methods for the preliminary identification of potential impact areas exposed to a new development. Nevertheless, determining the coverage of wind farm view sheds does not suffice as a standalone procedure because of the large amount of guesswork involved in determining whether the visual impact is beneficial or detrimental. Predetermined ‘objective’ criteria are therefore, at best, a set of static guidelines which seeks to describe a landscape’s inherent beauty, but fails to capture the complex diversity of social values held by the community. In order for future landscape studies to be more robust, collaboration between subjective and objective methodologies should be undertaken to form a truly comprehensive idea of a landscape’s ‘character’. The marriage of geographical information systems and survey based data would provide the optimal mix of analysis for future visual studies. However, the addition of survey based methods will increase the costs of visual impact research because of the labour intensive methods needed for acquiring good solid data; a necessity considering the improvement in decision making when more information is made available (Lothian, 1999).

Wind farms present a special challenge to those who are involved with scenery valuation. Not only are the structures massive, able to be seen for up to 50 km, but they are commonly labelled as being highly intrusive (Brittan, 2001; Nohl, 2001; Argonne National Laboratory, 2012). Notions of natural aesthetics often clash with what some perceive as modern industrial agriculture, even where the development is acknowledged as addressing widely held environmental concerns. Wind farm aesthetics has been the single largest factor contributing to the limitation of higher instalment rates in the EU (EWEA, 2012). However, existing literature has dealt mainly with wind farm impacts experienced in foreign wealthy Western countries, which are characterised by high turbine installation rates, contracting scenic resources and aggressive renewable energy policies and targets. Within these countries, rapid development has become a threat to those who clutch at deeply ingrained culturally defined scenic values, creating a tension between developers and communities (Antrop, 2006: 188, Dramstad and Fjellstad, 2011).

6.2 Findings and recommendations

Grahamstown provides an interesting case study and contrast to findings in the Western literature as South African society is faced with a very different set of socio-economic circumstances. Within the Grahamstown community, divisions between low income and middle income members translate into clear social and geographical bounds typically found in much of South Africa. Often, these divisions are also cultural, extending beyond economic differences, where the views and values of people in different areas can contrast starkly. Interestingly, people from Grahamstown Central exhibited similar characteristics and concerns to those found in wealthier nations. Grahamstown East residents however face harsher living conditions where unemployment, low education and low income are prevalent in the community and are additional powerful drivers in their differences of opinion. As most people in South Africa live in similar circumstances as Rhini\East residents, data obtained from these groups provide vital information for future wind farm management within the country.

Attitudes towards wind farms are commonly found to greatly diverge between local level and general support of wind power in European countries (Warren *et al.*,2005: 866, Krohn and Damborg, 1998 and Dudleston in Eltham *et al.*, 2008). In contrast to the common tendency, local level support for wind energy in the Grahamstown community was found to mirror general support, which amounted to approximately 80% for both levels. The recent electricity supply issues, novelty of wind farms in the South African landscape and clean generation of electricity provide but a few reasons for such high positive support. Most decisively wind farms are perceived to provide opportunities of employment, found to be a major factor influencing wind farm attitudes, although with a higher emphasis for those groups who are not fortunate enough to have stable job conditions. Unemployed persons were also found to mostly originate from low-income Grahamstown East localities, which explains the high support patterns that correspond to these same areas.

In terms of involvement in the public participation process, Grahamstown Central had a much higher realization than East residents. Advertising was found to be the primary cause for the asymmetry, due to the lack efficacy in raising awareness. Comparatively, only 12% of those from Grahamstown East had heard about the Waainek Wind Farm, while 58% had known from Grahamstown Central, which demonstrates a significant unevenness between the two areas. As most of the population live in Grahamstown East, the measures employed in disseminating information were consequently questioned. CES (2010), the organiser of the PPP meetings, adhered to all regulations governing advertising and meeting requirements, by putting up notices at the development site and running public calls for meetings in the Eastern Province Herald and Grocott's Mail newspapers.

The main concern lies with the requirements of the regulations which govern the public participation process. Regulation specifies that PPP advertising should be provided in at least two newspapers in order to inform the public. However, some areas may have problems accessing newspapers and where prints are available; the usual content may not be popular with certain groups. Information boards are a legal requirement, to be used in the development area, but wind turbines can be seen over great distances therefore creating a need for other forms of localised media (the use of notice boards in common or frequented areas, small shops, sports fields and so on). Special attention needs to be given to low-income areas, which need additional avenues of advertising, especially because these areas are usually neglected. Further, because most people in the township are not first language-

English speakers, language barriers need to be addressed through the translation of documents and notices into the predominant language.

Public meetings were confined to Grahamstown Central which may possibly have posed transportation problems for those who would have liked to attend, but reside in the township areas. Accessibility, in terms of language barriers, may have also been a problem. The solution is simple; additional meetings should have been held within the township areas (BB Zondani Hall and Recreation Hall), conducted in Xhosa, which would have removed logistical and language barriers simultaneously. Results indicated that many residents in Grahamstown East were very interested in the wind farm project, making these additional meetings not only worthwhile, but more importantly, necessary. Indeed, the future success of wind farm projects in South Africa will depend increasingly on public acceptance, which can only be won through a well organised and inclusive public participation process for all groups residing within the affected community. Despite the differences in attendance, Grahamstown East residents did not believe the public participation process to be unfair. Most of the criticism was lodged by Central residents who were principally concerned with the proceedings within meetings.

Conceptions of the PPP were that they were “forums of complaint” rather than a collaborative effort between developer and community. Concerted interaction did not seem to be a driving feature of the PPP, which may not be problematic at the current stage of wind farm development in South Africa, but with higher instalment rates, greater inclusiveness and institutional capital will become a necessary requirement for success (Ek 2005: 1679; Warren *et al.*, 2005; Toke, Breukers and Wolsink, 2008). The recommendation then is to implement bottom-up approaches as early as possible during the Integrated Resource Plan (IRP) rollout so that sufficient experience and institutional structures are already in place when problems do *eventually* arise. Further, public involvement needs to take place before an adequate site is determined within an area because it places all parties on an equal footing from project inception (Ebert, 1999; Breukers and Wolsink, 2007; Eliss *et al.*, 2007).

Essentially, the public participation process enables developers to identify and plan for issues which may take place as a development project proceeds. Meetings allow the community a voice in managing collective resources which may be highly valued (Frey, Benz and Stutzer, 2004; Oberholzer, 2005). Unbundling problems from the common NIMBY assessment also allows a more thorough diagnostic of specific confounding factors, which facilitates proactive rather than responsive measures. While the Waainek Wind Farm achieved a high support rate from the Grahamstown community, a ranking exercise allowed the identification of specific characteristics which had the most influence on attitudes. Foremost, the idea of clean electricity provided by the wind was found to garner an overwhelmingly positive reaction from most respondents. The country's dependence on coal power plants and a growing awareness of global climate issues were likely responsible for affecting the emphasis on clean energy. Other dominant positive factors included diversity of electricity supply, health impacts, ecological impacts and economic impacts.

Negative factors hardly featured as a problem at the first ranking, where visual impacts were less of a concern than ecological impacts. By the third ranking exercise, where negative concerns became more prominent, aesthetics were considered to be less important than ecological, land-use and noise impacts. Interestingly, attitudes were stronger for positive characteristics throughout the different ranking levels, dominating negative attributes in most aspects. Visual impacts only had a higher negative response rate at the first level, albeit marginally. For the second and third ranking levels, positive and negative visual impacts were balanced, indicating that the overall net effect on the scenery would only be slightly detrimental. Thus taking all factors concerning the wind farm into consideration, visual impacts comprise a very small portion of the total outcome of the Waainek project.

A separate proximity analysis found that people were more likely to be positive when wind turbines were situated further away. The 'proximity effect' was amplified when a wind turbine could be seen from the home, with increases in utility increasing at a decreased rate the further the wind turbine, which confirms the findings of Möller (2006), Ladenburg (2007) and Swofford and Slattery (2010). Where wind turbines were not visible, attitudes still improved with increases in distance most likely because of other concerns such as noise, health, land-use, proximity and so on. Visual influences did however, have a significant effect on attitudes, but could not be measured in relation to other factors and therefore the result remains demonstrative.

An examination of the factors affecting visual perceptions found that when people were asked if they were willing to relocate the wind farm, based only on aesthetic considerations, most people from Grahamstown East (62%) were unwilling to support the relocation. The most likely reason was attributed to perceived employment opportunities offered by the wind farm, which was often mentioned by respondents during interviews (Ek, 2005). East residents were also more likely to be unemployed which supports the 'employment opportunities' hypothesis. Township residents anticipated the wind turbines to be an improvement to the scenery at Waainek, stating that the development would serve to 'modernize' Grahamstown. As no relationship was found between scenic beauty at Waainek and the impact of the wind turbines on the surrounding landscape, the case for employment effects is made stronger, mainly because visual impacts seemed to be trivialised in relation to other perceived benefits.

For Grahamstown Central however, there was a significant relationship between scenery quality at Waainek and the visual impact of the wind farm. People were more likely to be willing to pay to relocate the wind farm if they classified the scenery at Waainek as being extremely beautiful compared to dull. Central residents were also relatively better off than people from the township which allowed them a higher ability to pay. Indeed an income effect was found in the probit model, where people falling in the higher income groups were more likely to pay to relocate the Waainek Wind Farm. Wealthier households are better able to afford a wider range of luxuries, scenery preservation being one such good, contrasted to lower income households who would buy normal goods used for 'subsistence'. The income differences translate into geographical areas, with wealth concentrated in Grahamstown Central and lower incomes present in the township.

Aside from wealth determination, familiarity with the Waainek area increased the probability that respondents would be willing to pay to relocate the wind farm. It is most likely that the memories developed when living in an area (or through use), built over a long period of time, and imprints a relatively cherished static image of the landscape. Rapid or even immediate significant changes do affect people negatively, especially when the scenery is well known (Antrop, 2006; Dramstad and Fjellstad, 2011). As a result, it is essential that people feel comfortable with local changes, which can only be effectively addressed through the public participation process. Where the landscape is not particularly attractive, familiarity may become a less important factor, but depends solely on context and the people involved.

Average Willingness to Pay to have the wind farm relocated from the Waainek area was R67 per person, but only after two observations were removed due to the inconsistencies shown in the responses. Validity checking confirmed the reliability of the WTP figure through an analysis of the survey instrument and also by scrutiny of construct validity. Other Willingness to Pay studies calculated estimates which were in a higher range of the Waainek WTP. These criteria merely provided ballpark comparisons because scenic values and 'sense of place' differ between countries and people. Additionally, differences between developed and developing countries partly explains the discrepancies between the figures, which could indeed be a reflection of the socio-economic circumstances present in each nation. The total negative visual impact on Grahamstown was calculated at R121,000 per month for the base case. Sensitivity analysis was undertaken where several factors were adjusted to test for their effect on the end product of Willingness to Pay.

An extreme, conservative, Central and a likely case were estimated, providing a variety of possible outcomes. Sensitivity ranges of total monthly Willingness to Pay started from a low of R45,000 to a high of R253,000 per month. Specific factors adjusted included percentage of households willing to pay, Willingness to Pay and population size. A sense from respondents during the interview process suggested that conservative figures would be optimal. Thus the range of total Willingness to Pay per month is most likely to fall between the ‘likely’ and ‘base’ case where the range is between R104,000 and R121,000 per month. Over the course of the entire project, of which the purchasing power agreement is 20 years, the externality would amount to approximately 7.6% of the total cost, assuming that visual preferences stay constant. Preference stability over a 20 year period cannot be guaranteed. Indeed, landscape theory states that preferences for scenery can in fact change dramatically over time and with it, the extent of the perceived visual impact (Dramstad and Fjelstad, 2011; Nassauer, 1995; Nohl, 2001).

Coase (1960) argued that the specification of property rights would allow for the developer and the affected party to undertake litigation until the total amount of compensation was agreed upon. In the case of Grahamstown, no explicit mention is made about who owns the right to the view-shed. An argument could be made in favour of the Grahamstown community because it has existed for roughly two centuries. The developer appears to implicitly acknowledge the unofficial right of the community to the view-shed through the allocation of an equity based trust fund called “The Makana Winds of Change Trust[118]”. While not wholly owned, the trust forms part of a hybrid ownership structure, which exhibits qualities of both a community cooperative and private company.

118 More detail provided in “Recommendations and future research”.

6.3 Recommendations and future research

A point which should be noted is that these findings represent gross estimates because they do not take into account the positive visual impacts of the wind farm. While the net result for visual impacts is still likely to be negative, substantial benefits derived from the wind farm through the other characteristics does indicate that the Waainek Wind Farm could provide an overall net benefit to the Grahamstown area. Choice modelling provides an excellent method for valuing individual characteristics of wind farms and should be pursued by future research in order to value these other attributes. While no measurement is currently available for said benefits, government subsidies towards renewable energy projects are indicative of a broad consensus on the substantial positive effects of wind turbines. Taxing wind farm developers (which would effectively be a decrease in their subsidy) would not result in an efficient outcome because net benefits would likely decrease. Instead, the focus should be shifted to community ownership schemes, a form of subsidy.

Communities require a larger degree of participation in wind farm planning in order to ensure that the goals of the integrated resource plan are met. While only a handful of people oppose the Waainek Wind Farm, with higher instalment rates in the country, people may eventually tire of wind turbines in the landscape as the novelty of the structures wears off. Active participation between the stakeholders and developers is necessary to ensure all problems are identified early on in the process and can be remedied as they appear. Thus the approach is proactive rather than reactive and would immediately serve to place all parties on friendly/equal terms. Where consultation fails to produce agreement, compensatory packages or ownership schemes could be organised for the community while the right to veto should also be respected.

As mentioned earlier, the Makana Winds of Change Community Trust has been funded a by the IDC with a 26% stake in the Waainek Wind Farm for the benefit of Grahamstown (NERSA, 2012). The trust has a Broad Based Black Economic Empowerment objective which aims at social upliftment and local projects for the poorer areas of Grahamstown, more specifically in township areas. While such schemes may not be appropriate for all development sites in South Africa, different arrangements could be made to accommodate those who do require compensation. As determining who is liable for recompense is difficult, free riding being problematic, broad community ownership presents itself as a more viable alternative. Future research on different ownership structures would be extremely helpful for devising equitable distribution of benefits and should be investigated.

6.4 Limitations of study

The scope of the study was confined to the Grahamstown community and neglected the visual impact on tourism based businesses such as private game parks. If these businesses had been included, results may have reflected substantially larger visual impacts due to tourism business owners inflating potential loss estimates relating to decreases in their customer base. Evidence for wind farm impacts on tourism to date has not been conclusive and therefore makes potential loss claims unfounded (Hanley & Nevin, 1999; Warren *et al.*, 2005: 857; Warren and McFayden, 2010: 210). An *ex post* study of how the Waainek Wind Farm impacts the local game parks profits would empirically determine whether future business loss claims should be seriously considered. An alternative would be to directly survey tourists about how wind farms would impact on their game park experience and visiting habits.

The photomontages of wind turbines photo-shopped into the pictures of this study may be a potential source of error for WTP. While care was taken to represent Waainek with wind turbines installed in the landscape accurately, errors in sizing and visibility may have persisted. However, such problems present themselves even in professional representations and where development impacts can never be rendered perfectly. Indeed, the same is true for all visual studies where participants are presented static frames of landscapes. Much of the personal experience of a landscape is lost when relying solely on photographic material. Computer based methodology through virtual reality is currently being tested to provide a more immersive and multi sensory experience for individuals, where movement by the participant and objects within the space is provided.

The framing of photo-montaged wind turbines may not provide an accurate representation of day to day reality, as the view-scapes are limited in scope. If most of the Grahamstown residents who were sampled do not venture into the areas where the photographs had been taken, then the actual visual impact experienced may differ from what was shown in the photographs. Ultimately, people’s day to day experience with the turbines may not correspond to the depictions in the photographs.

Focus groups were not representative of the population at large as most members derived from privileged backgrounds. Nearly all respondents were part of an environmental organisation, which would have introduced bias into the discussion, especially considering that the topic centred on perceptions of wind energy. Perhaps the most regretful aspect of the misrepresentation was that several important issues concerning poorer communities (i.e. job opportunities role in creating positive feeling, benefits accruing to the town, practical and social differences arising between developing versus developed countries, ability to pay versus willingness to pay) would have been touched on during the meetings. The revelations may have allowed for a much better questionnaire design, tailored specifically to the specific realities faced by South Africa as a developing country.

Finally, the number of observations used to calculate Willingness to Pay were very few (21), not optimal for accurate estimation. Ideally, more respondents should be used when calculating WTP, but budget and time constraints prevented further sampling. Moreover, students were accepted in the sample, but they are not good candidates for valuation because they are more than likely temporary residents rather than concerned homeowners. Additionally, sampling was done during business hours when ‘breadwinners’ were at work. While this was not optimal, sampling in the evening would have been risky for some areas, and therefore was restricted to daylight hours (especially considering the data collectors were on foot).

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Appendix A: Survey and information sheet (English)

Introducing the Survey

This questionnaire forms part of an economics masters research thesis at Rhodes University, which aims to evaluate the visual impacts of the proposed Waainek Wind Farm. While the wind farm has not been built yet, assessing pre-construction responses from the Grahamstown community will assist in estimating the perceived visual impact. Historically, the role of anticipated visual impacts from local communities in other countries of the world have played a major role in determining the outcomes of wind farm projects. Perceptions towards wind farm projects are therefore, a significant factor, which needs to be carefully considered in policy formation. Your participation and opinions expressed in this questionnaire are crucial for the research project and will be greatly appreciated.

Your household was selected using a randomised sampling procedure. A detailed property map of Grahamstown was used, with the entire area being split into three separate regions. Splitting Grahamstown into different areas ensured the sample was evenly distributed across the entire population. Within each area, streets and household numbers were randomly selected, using an online software package.

This questionnaire is completely anonymous and you have the right to refuse to answer any question that you are not willing to. Additionally, if you wish to do so, you may end the interview process at any time.

1.Introduction.(Read)

1.1. Please indicate your level of knowledge on wind farms.

1)none	2)little	3)moderate	4)comprehensive	5)comprehensive/engineering level

1.2. Are you in favour of wind energy in general? ☐ 1. Yes ☐ 2. No ☐ 3. Unsure

1.3. Had you heard of the proposed Waainek Wind Farm before this survey?

☐ 1. Yes 2. No ☐

1.4. If yes, how did you hear about it?

☐ 1. Word of mouth
☐ 2. Newspaper or any other hard copy media
☐ 3. Radio
☐ 4. Internet news site
☐ 5. Other ____

____

1.5 Before a project such as Waainek can proceed, a public participation process (PPP) has to be undertaken. The key elements of the PPP are to inform the community about the various details concerning the project while also allowing residents to voice any issues they may have. Various meetings were held at different venues around Grahamstown (City hall, Rhodes) while background information of the proposed development was provided by newspaper advertisements (Grocott's Mail and the Eastern Province Herald), site notice boards and notification letters. Did you read or hear of these meetings?

☐ 1. Yes ☐ 2. No ☐ 3. Did not live here

1.6 Did you attend the public discussion on the proposed Grahamstown wind farm project, held at the Grahamstown town hall in 2009?

☐ 1. Yes (go to question 1.8) ☐ 2. No (go to question 1.7 only if Q 1.5 = yes)

1.7 Why did you not attend this meeting?

☐ 1. The wind farm is not a big concern for you

☐ 2. Your time is very restricted/busy

☐ 3. You don't feel that you would be represented in these meetings

☐ 4. Transportation problems

☐ 5. Other ____

1.8 If Innowind were to host another public meeting for those who did not participate in the first session, allowing for new input and concerns to be raised, would you attend?

☐ 1. Yes ☐ 2. No

1.9 [Only answer if 'No' in 1.8] Why would you not attend this meeting?

☐ The wind farm is not a big concern for you

☐ 2. Your time is very restricted/busy

☐ 3. You don't feel that you would be represented in these meetings

☐ 4. Transportation problems

☐ 5. Other ____

1.10 [Only answer if 1.5 was 'Yes']In your opinion, was the public participation process fair? A fair process would have adequately consulted the community about the project and given participants an opportunity to voice concerns.

1. unfair	2. neutral	3. fair

1.11 Did the manner in which the public participation process was handled and your level of involvment,affect your attitude towards the Waainek Wind Farm project?

☐ 1. Yes ☐ 2. No

1.12 [Only answer if 1.11 is yes] To what extent has your attitude been affected?

1. verynegatively	2. negatively	3. neutrally	4. positively	5. verypositively

READ 2nd para

1.12 Did you know of these (solar, hydroelectricity, wind) alternative renewable resources before this survey?

☐ 1. Yes ☐ 2. No

1.13 If yes, do you have a preference and why?

____

____

1.14 How familiar are you with the Waainek area?

☐ 1. Not familiar at all ☐ 2. Vaguely familiar ☐ 3. Familiar ☐ 4. I know the area well

1.15 How would you rate the visual quality or scenery of the Waainek area?

1.Very low/unsightly	2.Low/dull	3.Neutral	4.Medium/attractive	5.High/extremely beautiful

1.16 Do you have any personal interest in the Waainek area?

☐ 1. Yes: a. Walks
b. Scenery
c. Live in the area
d. Other ________________________________

☐ 2. No

1.17 What is your attitude towards the Waainek Wind Farm?

1) Very negative	2) Negative	3) Neutral	4) Positive	5) Very positive

1.18 Please provide a motivation for your choice in 1.17

____

____

1.19 Please rank the following factors of the Waainek Wind Farm, which you personally feel are the most important considerations, in descending order (1 being most important consideration). Please keep in mind that these factors can be positive or negative. [C]

☐ a. Clean energy
☐ b. Diversity of electricity supply
☐ c. Land-use impacts
☐ d. Ecological impacts
☐ e. Visual impacts
☐ f. Local economic impacts
☐ g. Proximity to your home/business
☐ h. Noise/vibrations
☐ i. Health concerns
☐ j. Other ____

1.20 Do you find wind turbines visually appealing?

☐ 2. Yes ☐ 2. No

1.21 Regarding the visual impacts ONLY, the installation of a wind farm in the Waainek landscape would...

☐ 1. Dampen/decrease the quality of the scenery
☐ 2. No change in quality of the scenery
☐ 3. Improve the quality of the scenery

1.22 Considering your answer in question 1.21, how significant do you feel the impact will be?

1.Insignificant	2.Neutral	3.Significant

1.23 How would you feel if a wind turbine were built 1km from your home and it was not visible?

☐ 1. Negative ☐ 2. Neutral ☐ 3. Positive

1.24 How would you feel if a wind turbine were built within 1km from your home and was visible?

☐ Negative ☐ 2. Neutral ☐ 3. Positive

____

____

1.25 How would you feel if a wind turbine were built 5km from your home and it was not visible?

☐ 1. Negative ☐ 2. Neutral ☐ 3. Positive

1.26 How would you feel if a wind turbine were built 5km from your home and it was visible?

☐ 2. Negative ☐ 2. Neutral ☐ 3. Positive

____

____

1.27 How would you feel if a wind turbine were built 10km from your home and it was not visible?

☐ 1. Negative ☐ 2. Neutral ☐ 3. Positive

1.28 How would you feel if a wind turbine were built 10km from your home and it was visible?

☐ 2. Negative ☐ 2. Neutral ☐ 3. Positive

____

____

2.Valuation Scenario

Suppose there was an option to preserve the current scenery of the Waainek landscape. The wind farm would still be constructed in the neighbouring Grahamstown area, but on municipal land where it would have a much lower visual impact on ALL residents and smallholders. In order to pay for the relocation of the Waainek Wind Farm, funding would need to be paid by the members of the community who support the policy. The payment amount, or monthly rate, will be determined by how much YOU are personally willing to pay, and not by the authority in charge of the relocation. If the response rate is sufficient and the project is moved to the alternative site, your accepted amount will be binding and payment will be made by simply adding it onto your monthly electricity bill.

2.1 If an option existed to preserve the Waainek visual landscape, involving the relocation of the wind farm to an alternative site, and no payment was required; would you be willing to support the policy?

☐ 1. Yes ☐ 2. No (move onto question 2.3)

2.2 Would you be willing to pay to have the wind farm relocated to another area? [Remind respondents that any amount would be considered]

☐ 1. Yes (Skip Question 2.3) ☐ 2. No (move onto question 2.3)

2.3 Please supply a reason for why you are not willing to make payment to preserve the Waainek landscape? (End section 2 and proceed onto section 3 once an answer is given). [conclude section 2]

☐ 1) Income constraints/unable to pay
☐ 2) Don't feel strongly enough about this issue
☐ 3) The scenario does not seem plausible or realistic
☐ 4) Other ____

Waainek, including two additional areas, will be presented as before wind farm and after wind farm shots. In each case, you have to state 'yes' if you are willing to pay the amount offered to preserve that particular area or 'no' if you do not wish to. The alternative relocation site (D) is NOT any of the three landscapes presented in this study, but instead, in an area (municipal land mentioned earlier) which will have a MUCH lower visually intrusion. Each set of photographs, and therefore, the landscapes valued, should be treated as separate scenarios. This means that values accepted in one scenario will not be added to the values accepted in the other two scenarios. Please keep in mind that by committing to a payment, you will have less money every month to spend on other items such as general household expenditure, hobbies, petrol, socialising etc.

2.4 How much does your household spend on electricity monthly?

____

2.5 *Valuation Questions*

1.) If the authorities could introduce ONLY the scheme to preserve the visual landscape of photoA, by relocating the wind farm to area D, would you be willing to pay ________ in addition to your monthly electricity bill?

☐ Yes ☐ No

If yes, would you be willing to pay ________ ? ☐ Yes ☐ No

If no, would you be willing to pay ________ ? ☐ Yes ☐ No

2.) If the authorities could introduce ONLY the scheme to preserve the visual landscape of photo B, by relocating the wind farm to area D, would you be willing to pay ________ in addition to your monthly electricity bill?

☐ Yes ☐ No

If yes, would you be willing to pay ________ ? ☐ Yes ☐ No

If no, would you be willing to pay ________ ? ☐ Yes ☐ No

3.) If the authorities could introduce ONLY the scheme to preserve the visual landscape of Waainek, by relocating the wind farm to area D, would you be willing to pay ________ in addition to your monthly electricity bill?

☐ Yes ☐ No

If yes, would you be willing to pay ________ ? ☐ Yes ☐ No

If no, would you be willing to pay ________ ? ☐ Yes ☐ No

3.Demographics

3.1 Gender: 1.Male ☐ 2. Fema☐

3.2 Age:

☐ 1. 18 or younger ☐ 2. 19-25 ☐ 3. 26-34 ☐ 4. 35-44 ☐ 5. 45-60 ☐ 6. 61 and older

3.3 Occupation: ____
Full/Part time (circle)

3.4 Education [C]

☐ 1. Gr11 and below ☐ 2. Gr12 ☐ 3. degree/national certificate ☐ 4. postgraduate degree

3.5 Income: Please select the monthly income bracket you fall under before deductibles (taxes and rent) [C]

1. Household

☐ 1000 and below ☐ 1001-5000 ☐ 5001-10,000 ☐ 10,001-15,000 ☐ 15,001-20,000 ☐ 20,001-25,000

☐ 25,001-30,000 ☐ 30,001-35,000 ☐ 35,001-40,000 ☐ 40,001-45,000 ☐ 45,001-50,000
☐ 50,001 and above

3.6 How many are there in your household? ____________________

3.7 Are you normally responsible for paying your electricity bill in the household?
☐ 1. Yes ☐ 2. No

3.8 Would you say that you were traditionally from an urban background (city, suburb or town dweller) or from a more rural setting (farm, isolated area).
☐ 1. Urban
☐ 2. Rural

3.9 Have you watched any documentaries or read up on information about wind farms? (excluding this survey)
☐ 1. Yes
☐ 2. No

3.10 Are you a member of an environmental organisation?
☐ 1. Yes: Please state ____________________
☐ 2. No

3.11 Are any other members of your household members of an environmental organisation?
☐ 1. Yes: Please state ____________________
☐ 2. No

1.Introduction

A French company, Innowind, has begun preparations for the construction of a wind farm at Waainek, located to the west of Grahamstown. A total of eight turbines are proposed to be built along an elevated ridgeline, a portion of which will run parallel to the N2 highway and continue further inland. Wind farms are used for the production of electricity and vary in number according to an area's particular features and needs. Each turbine structure will have a three bladed rotor, mounted onto a tower which could reach up to 100 meters high and is used for the capture and conversion of wind power into electricity. The project forms part of South Africa's national energy strategy, broadly aiming to increase the use of renewable sources and to lessen the reliance on fossil fuel plants (coal, gas). Currently, South Africa only has two wind farms in operation consisting of the Klipheuwel and Darling wind farm projects, both located in the Western Cape.

According to Innowind, the construction of the wind farm will benefit Grahamstown in the following ways:

- Electricity generated from the turbines will be fed into the local and national grid which can then be accessed by local households, businesses and Rhodes University, which has recently been expanding its teaching and residence facilities.
- The wind farm will also provide Grahamstown with a secondary source of power, and so Grahamstown will continue to receive electricity during load shedding, provided that the wind speed is adequate.

- There will be zero-emissions of pollutants during production, as the electricity is generated by the wind, and is therefore a clean source of power.
- Wind is a free and infinite resource, which is highly desirable for energy security.

However, some concerns with wind turbines include:

- Production reliability may be an issue, as wind fluctuates according to the prevailing conditions at each site and may result in intermittent electricity production. However, wind resource testing for Waainek has shown that during winter months, when cold fronts and higher wind yields are common, the increased electricity production corresponds well with increased demand. The wind farm should therefore assist in stabilising and supplementing the local grid during colder periods of the year.
- The other major consideration for wind energy is costs, which are currently higher than those experienced by thermal plants ie coal and gas. For example, electricity produced by thermal plants, such as coal, is currently cheaper per kW/h than wind turbines. The public will have to pay for these higher costs, whether through taxes or higher electricity prices.

❖ **Questions to follow**

As mentioned earlier, renewable energy projects form part of the South African government’s energy plan and as such, funding is provided for projects which meet certain criteria. If the Waainek Wind Farm is not constructed, there are alternative renewable energy sources available such as hydro electric power from dams and solar energy farms. These alternatives provide the same non-exhaustible and clean electricity as wind power, but each comes with their own set of problems.

Currently, the Waainek area is dominated by livestock farming activities, with some of the land being left fallow. A number of structures occupy the landscape, including houses, a cell phone tower, and Eskom power lines. However, these tend to be low in number. Members of the community often use the dirt roads near the site for various recreational activities which involve cycling, running, off-road motor biking, walking etc. With the introduction of wind turbines, the visual landscape will be impacted significantly. Due to the height of the turbine masts and the circumference of the blades, the wind farm will be visible from much of Grahamstown and the surrounding area.

❖ **Questions to follow**

2.Valuation Scenario

Suppose there was an option to preserve the current scenery of the Waainek landscape. The wind farm would still be constructed in the neighbouring Grahamstown area, but on municipal land where it would have a much lower visual impact on ALL residents and smallholders. In order to pay for the relocation of the Waainek Wind Farm, funding would need to be paid by the members of the community who support the policy. The payment amount, or monthly rate, will be determined by how much YOU are personally willing to pay, and not by the authority in charge of the relocation. If the response rate is sufficient and the project is moved to the alternative site, your accepted amount will be binding and payment will be made by simply adding it onto your monthly electricity bill.

❖ **Questions to follow**

Waainek, including two additional areas, will be presented as before wind farm and after wind farm shots. In each case, you have to state ‘yes’ if you are willing to pay the amount offered to preserve that particular area or ‘no’ if you do not wish to. The alternative relocation site is NOT any of the three landscapes presented in this study, but instead, in an area (municipal land mentioned earlier) which will have a MUCH lower visually intrusion. Each set of photographs, and therefore, the landscapes valued, should be treated as separate scenarios. This means that values accepted in one scenario will not be added to the values accepted in the other two scenarios. Please keep in mind that by committing to a payment, you will have less money every month to spend on other items such as general household expenditure, hobbies, petrol, socialising etc.

Appendix B: Survey (Xhosa)

Ukwaziswa koluphando

Eli phepha lemibuzo yinxalenye yophando lwezifundo ezingezimvo kwezoqoqosho oluqhutywa yi Rhodes Yunivasiti ejongise ekuhleleni ungquzulwano olubonakalayo ngefama yomoya ecetywayo eWaainek.Noxa lefama yomoya ingekakhiwa nje, ukukhangela iimpendulo zaphambi kolwakhiwo kubahlali base Rhini kuyakunceda ekuthekeleleni ungquzulwano eselubonakala.Ngokwembali, indima yongquzulwano olubonakalayo nolulindelekileyo ngokwabahlali kumanye amazwe ehlabathi, adlale indima engundoqo ekufumaniseni imiphumela yeeprojekthi zefama zomoya. Ngenxa yoko izimvo ngokubhekiselele kwii projekthi zeefama zomoya ziyinto ebalulekileyo ekufuneka inikwe ingqwalasela epheleleyo xa kuqulunqwa umgaqo. Inxaxheba neembono zakho onokuzivakalisa kweliphepha lemibuzo zibaluleke kakhulu koluphando yaye ziyakuxatyiswa kakhulu.

Ikhaya lakho likhethiwe kusetyenziswa inkqubo yokuhlela, ekukutyumba nje kungalandelwa kwaziwa kwalo.Kusetyenziswe imephu yokwazisa ngeRhini apho kuhlulwe lendawo iphela yaziingingqi ezi ntathu ezahluka-hlukeneyo.Ukwahlula idolophu yase Rhini ibe ziingingqi ezahluka-hlukeneyo ithe yaqinisekisa ukuba esisiboniselo sahlulwa-hlulwe ngokwaneleyo ngokwabahlali bephela. Kwingingqi nganye, iziztalato neenombolo zemizi zithe zanyulwa zingaziwanga kusetyenziswa ubuchwepheshe be kompyuta. Eliphepha lemibuzo alinasazisi sakho yaye unelungelo lokwala ukuphendula nawo nawuphina umbuzo ongazimiselanga ukuwuphendula.Singongeza ngelithi ukuba unqwenela njalo ungayiphelisa lemfuna-lwazi nangaliphina ixesha.

1.Intshayelelo(funda)

1.5. Nceda uphawule izinga lolwazi onalo ngee fama zomoya.

1)alukho	2)luncinci	3)luphakathi	4)lwanele	5)lwanele/ngokwezinga lemfundo

Uyakholiseka ngamandla omoya? 1. Ewe ☐ ☐ 2. Hayi ☐ 3. Andiqinisekanga

1.6. Ukhe weva ngefama yomoya ecetywayo yase waainek ngaphambi koluphando?
1. Ewe 2. Hayi ☐ ☐

1.7. Ukuba ewe, uve njani ngayo?
☐ 2. Ngentetha yomlomo
☐ 2. Iphephandaba okanye nalo naluphina ujelo losasazo
☐ 3. Unomathotholo/Radio
☐ 4.Uhlelo lwendaba ze internet
5. Olunye

1.6 Phambi kokuba iprojekthi enjenge waainek iqhubekeke, inkqubo yothatho nxaxheba olusesidlangalalenikufanele ibekho. Izinto ezingundoqo zalenkqubo kukwazisa uluntu ngee nkcukacha ezahluka-hlukaneyo ngaleprojekthi ngaxeshanye ibe ivumela abahlali bavakalise imiba abanayo. Iintlagnaniso ezahlukileyo zibekho kwii ndawo ezahlukaneyo apha eGrahamstown (City hall, Rhodes)ngaxeshanye imbali yolwazi ngoluphuhliso yanikezelwa ngabamapephandaba (Grocott's Mail and the Eastern Province Herald), Iibhodi zesazisi, neeleta ezazisayo. Ukhe wafunda okanye weva ngezi ntlanganiso?
☐ 1. Ewe ☐ 2. Hayi ☐ 3. Bendingahlali apha

1.6 Wawukho na kwii ngxoxo zasesi dlangalaleni ngale projekthi icetywayo ngefama zomoya zase Grahamstown etown hall ngo 2009?

☐ 1. Ewe (yiya kumbuzo 1.8) ☐ 2. Hayi (yiya kumbuzo 1.7 kuphela ukuba umb.1.5 = ewe)

1.7 Kutheni ungayanga nje kulentlanganiso?

☐ 1. Ifama yomoya ayindibandakanyi/chaphazeli kakhulu
☐ 2. Ixesha lakho selibopheleleke kakhulu/ndixakekile

- ☐ 3. Akuziva umelwe kwezi ntlanganiso
- ☐ 4. Iingxaki zezothutho
- ☐ 5. Okunye____

1.8 Ukuba abakwa Innowind bebe ngabamba enye intlanganiso ukuze kuxhamle abo bangazange babekho kwixa elingaphambili, besamkela izongezelelo neenkxalabo ezingathi ziphakanyiswe, ubungabakho?

☐ 2. Ewe ☐ 2. Hayi

1.9 [Phendula kuphela ukuba impendulo ngu hayi ku 1.8?

- ☐ 1. Ifama yomoya ayindibandakanyi/chaphazeli kakhulu
- ☐ 2. Ixesha lakho selibopheleleke kakhulu/ndixaxekile
- ☐ 3. Akuziva umelwe kwezi ntlanganiso
- ☐ 4. Iingxaki zezothutho
- ☐ 5. Okunye____

1.10 [Phendula kuphela ukuba u1.5 ngu ewe']Ngokoluvo lwakho, lenkqubo yothatho-nkxaxheba ibe ilungile? Inkubo elungileyo ibe inxulumane ngokwaneleyo nabahlali nge projekthi yaze yabanika ithuba lokuvakalisa iinkxalabo zabo .

1. Ayilunganga	2. Phakathi	3. Ilungile

2.11 Ingaba indlela eyaqhutywa ngayo lenkqubo yothatho nxaxheba lwasesidlangalaleni yayiphethwe kakuhle laza izinga lokubandakanyeka kwakho lwayichaphazela imo yakho ngokubhekiselele kwifama yase waainek?

☐ 1. Ewe ☐ 2. Hayi

1.12 [Phendula kuphela ukuba u1.11 ngu ewe] Leliphi iqondo eyathi imo yakho yachaphazeleka ngalo?

1. Ngokungalunganga kakhulu	2. Ngokungalunganga	3. phakathi	4. Lungileyo	5. Ngokulunge kakhulu

FUNDA esesi 2 Isiqendu

1.13 Ube usazi ngezi (solar, hydroelectricity, wind) ezingovimba abahlaziyekayo abanokusetyenziswa phambi kolu phando?

☐ 1. Ewe ☐ 2. Hayi

1.14 Ukuba ewe, kukho okukhethayo na yaye ngoba?

____

____

1.15 Uyiqhele kangakanani lengingqi yase waainek?

☐ 1. Andiyiqhelanga tu kwaphela ☐ 2. Andiyiqhelanga kangako ☐ 3. Ndiyiqhelile ☐ 5. Ndiyazi ngokupheleleyo

1.16Ungabubeka kweliphi izinga ubunjani benkangeleko yengingqi ye waaainek ?

1.Ezantsi kakhulu/ ukungabonakali	2.Ezantsi/gqolileyo	3.Ngokuphakathi	4.Iphakathi/ inomtsalane	5.Ngokuphezulu/ Intle ukwedlula

1.17 Unawo umdla ongowakho kulengingqi ye waainek?

☐ 1. Ewe: a. Ngokuhamba
b. Ngokwembonakalo
c. Ndihlala kule ngingqi
d. Okunye ______________________________

☐ 2. Hayi

1.18 Uziva njani ngefama yomoya yase waainek?

1) Kakubi kakhulu	2) Kakubi	3) Phakathi	4) Kakuhle	5) Kakuhle kakhulu

1.19 Nceda unikezele ngezizathu zempendulo yakho ku 1.17

____

____

1.20 Nceda uhlele ezi ngongoma zilande layo ze zefama yomoya ye waainek, ocinga ukuba zezona ngqwalasela zibalulekileyo, uzihlele ngokuhla kwazo (u-1 iyeyona ngqwalasela ibalulekileyo) Nceda khumbula ukuba ezi ngongoma zisenokuba zezi lungileyo okanye ezinga lunganga. [C]

- ☐ k. Amandla acocekileyo
- ☐ l. Iyantlukwa-ntlukwano ekwabiweni kombane
- ☐ m. Ungqzuzulwano lokusetyenziswa komhlaba
- ☐ n. Ungqzuzulwano ngokwendalo nezityalo
- ☐ o. Ungqzuzulwano ngokwembonakalo
- ☐ p. Ungqzuzulwano lwezoqoqosho ekuhlaleni
- ☐ q. Ukuba kufuphi ekhayeni lakho/ kwezomsebenzi
- ☐ r. Ingxolo/ iintshukumo
- ☐ s. Iinkxalabo ngokwe zempilo
- ☐ t. Okunye ______________________________

1.21 Ubafumanisa abamatshini bomoya benomtsalane?

☐ 3. Ewe ☐ 2. Hayi

1.22 Ngokubhekiselele kungquzulwano ngokwembonakalo KUPHELA, ukumiswa kwefama yomoya ewaainek, inga…..

- ☐ 4. Ingahlisa ixabiso lalendawo
- ☐ 5. Akukho lutshintsho kwixabiso lalendawo
- ☐ 6. Ingaphucula ixabaso ;a;endawo

1.23 Xa ulandelana nempendulo yakho kumbuzo 1.21, ucinga ukuba ungquzulwano luyakuba nentsingiselo engakanani na?

1.Ayinantsingiselo	2.Phakathi	3.Inentsingiselo

1.24 Ubungeva njani ukuba umatshini womoya ube wakhiwe kumgama we 1km ukusuka ekhayeni lakho yaye ibingabonakali?

1. ☐ubi 2. Phakathi ☐ 3.Kakuhle ☐

1.25 Ubungeva njani ukuba umatshini womoya ube wakhiwe kumgama we 1km ukusuka ekhayeni lakho yaye ubonakala ?

☐ 1. Kakubi ☐ 2. Phakathi ☐ 3.Kakuhle

1.26 Ubungeva njani ukuba umatshini womoya ube wakhiwe kumgama we 5km ukusuka ekhayeni lakho yaye ungabonakali?

☐ 3. Kakubi ☐ 2. Phakathi ☐ 3. Kakuhle

1.27 Ubungeva njani ukuba umatshini womoya ube wakhiwe kumgama we 5km uksuka ekhayeni lakho yaye ubonakala?

☐ 4. Kakubi ☐ 2. Phakathi ☐ 3. Kakuhle

1.28 Ubungeva njani ukuba umatshini womoya ube wakhiwe kumgama we 10km ukusuka ekhayeni lakho yaye ubungabonakali?

☐ 3. Kakubi2. Phakathi ☐ 3. Kakuhle ☐

1.29 Ubungeva njani ukuba umatshini womoya ube wakhiwe kumgama we 10km ukusuka ekhayeni lakho yaye ubonakala?

☐ 4. Kakubi ☐ 2. Phakathi ☐ 3. Kakuhle

2.Imo Yoqikelelo

2.5 Masithi bekukho ukuzikhethela ukuyigcina lemeko ikhoyo yobume be waainek. Ifama yomoya bihleli izakwakhiwa kwingingqi ephahlileyo ye Rhini, kodwa kumhlaba ka mansipala apho inge ino ngquzulwano oluncinci kakhulu kubo bonke abahlali naba lawuli abasakhulayo. Ukuze kuhlawulelwe ukutshintshwa kwefama ese waainek, ingxowa-mali bekungafuneka ihlawulwe ngamalungu omphakathi(abahlali) abawuxhasayo lomgaqo(policy). Imali eyi ntlawulo okanye umrhumo wenyanga, uya kuqingqwa kukuba wena uzimisele ukuhlawula kangaka nani na, hayi ngosomagunya abalawula olutshintsho.Ukuba izinga lokuphendula lelanelisayo yaza iprojekthi yasiwa kwindawo engenye, umnyinge wakho wokuhlawula owamkelweyo uyakuba usisibophelelo yaye intlawulo iyakwenziwa ngokusuka yongezelelwe kwintlawulo yakho yombane ngenyanga.

2.1 Ukuba ukuzikhethela bekukho ukuze lendawo yase Waainek igcinwe kubandakanywa ukususwa kwe fama yomoya isiwa kwenye indawo, lefama yomoya, yaye kungabikho ntlawulo ifunekayo, ubungawuxhasa lomgaqo?

☐ 2. Ewe ☐ 2. Hayi (dlulela kumbuzo 2.3)

2.2 Ubungavuma ukuhlawulela ukuba ifama yomoya ibe kwenye indawo? [Khumbuza umphenduli ukuba nayiphina intlawulo ibingamkeleka]

☐ 2. Ewe (tsiba umbuzo 2.3) ☐ 2. Hayi (dlulela kumbuzo 2.3)

2.3 Nceda unike isizathu sokuba ungavumi ukwenza intlawulo ukuze lomhlaba we waainek ugcinwe ? (lishiye icandelo 2 uye kwicandelo 3 emva kokuba impendulo inikiwe). [Gqibezela icandelo 2]

☐ 5) Ingxaki zemali/andikwazi ukubhatala
☐ 6) Andina ngqiniseko ingako ngalomba
☐ 7) Lemeko ayikhangeleki iyenokwenzeka/inokubakho
☐ 8) Okunye ____________________

I-Waainek, kuquka neendawo ezimbini ezongezelelweyo, ziyakuboniswa njengezindululo zaphambi kwefama yomoya nasemva kwefama yomoya.Kwimeko nganye kofuneka uthi “ewe”ukuba uzinikele ekuhlawuleni isixa esimisiweyo ukuze igcinwe lendawo okanye “hayi”xa unganqweneli njalo.Umhlaba ongomnye onokusetyenziswa AWUKHO kule mithathu iseyichaphazelwe kwesi sifundo, kodwa ibekho kwindawo ka mansipala ebi chaphazelwe ngaphambili, yona leyo eyoba nencinci kakhulu imbonakalo ephazamisayo/engumqobo.Ingqokelela nganye yeefoto imele ijongwe ngokwee meko ezahlukeneyo.Loonto ithetha ukuthi ixabiso ngalinye elithe lamkelwa kumboniso/kwimeko enye, alinakho ukongezwa kumaxabiso amabini angamanye amkelweyo.Nceda ugcine engqondweni ukuba ukuzibophelela kulentlawulo kokwenza waphule kwimali oqhele ukuyisebenzisa kwezinye izinto inyanga nenyanga, njenga kwizinto zenkcitho yendlu, yezokonwaba, imidlalo, ipetrol, ezokuhlobana, njalo-njalo.

2.4 Ikhaya lakho lisebenzisa imali engakanani ngenyanga embaneni?

____

2.5 Imibuzo Yoqikelelo

4.) Ukuba oosomagunya bebengaveza KUPHELA icebo/isvumelwano sokugcina indawo ebonakala kwifoto A ngokuthi bayifudusele lefama yomoya kwindawo engenye, ubungavuma na ukuhlawula, usongezelela kwintlawulo yakho yenyanga embaneni?

☐ Ewe ☐ Hayi

Ukuba ‘ewe”, ubungavuma ukuhlawula ________ ☐ EweH☐?

Ukuba "Hayi", ubungavuma ukuhlawula______ ☐ Ewe ? ☐ Hayi

5.) Ukuba oosomagunya bebengaveza KUPHELA icebo/isivumelwano sokugcina indawo ebonakala kwifoto B ngokuthi bayifudusele lefama yomoya kwindawo engenye, ubungavuma na ukuhlawula, usongezelela kwintlawulo yakho yenyanga embaneni?

☐ Ewe ☐ Hayi

Ukuba "ewe", ubungavuma ukuhlawula______? ☐ Ewe Hayi ☐

Ukuba "hayi", ubungavuma ukuhlawula ______ ☐ Ewe Hayi ☐

6.) Ukuba oosomagunya bebengaveza KUPHELA icebo/isivumelwano sokugcina indawo ese waainek ngokuthi bayifudusele lefama yomoya kwindawo engenye ubungavuma na ukuhlawula, isongezelela kwintlawulo yakho yenyanga embaneni?

☐ Ewe ☐ Hayi

Ukuba "ewe" ubungavuma ukuhlawula ______? Ewe ☐ Hayi ☐

Ukuba "hayi" ubungavuma ukuhlawula______? Ewe ☐ Hayi ☐

3.Iminininingwane Yobume Bakho

3.12 Isini: 1.Indoda ☐ 2. Ibhinqa ☐

3.13 Ubudala:

☐ 1. 18 okanye ngaphantsi ☐ 2. 19-25 ☐ 3. 26-34 ☐ 4. 35-44 ☐ 5. 45-60 ☐ 6. 61 nangaphezulu

3.14 Ingqesho: ____
Isigxina/okwexeshana (bonisa ngesangqa)

3.15 Ezemfundo [C]

☐ 1. Gr11 nangaphntsi ☐ 2. Gr12 ☐ 3. degree/national certificate ☐ 4. postgraduate degree

3.16 Ingeniso: Nceda ukhethe umrholo wenyanga ongena phantsi kwawo xa kungeka tsalwa (taxes and rent) [C]

2. Ikhaya

☐ 1000 and below ☐ 1001-5000 ☐ 5001-10,000 ☐ 10,001-15,000 ☐ 15,001-20,000 ☐ 20,001-25,000
☐ 25,001-30,000 ☐ 30,001-35,000 ☐ 35,001-40,000 ☐ 40,001-45,000 ☐ 45,001-50,000

☐ 50,001 nangaphezulu

3.17 Nibangaphi abakhoyo ekhayeni lakho? ______________________________

3.18 Ingaba nguwe onoxanduva lokuhlawula ityala lombane ekhayeni?
☐ 1. Ewe ☐ 2. Hayi

3.19 Ungatsho ukuba wena kwasekuqaleni ubungowase zidolophini (Isixeko, indawo zabafumileyookanyeumhlali wedolophu) okanye usuka emaphandleni (efama, indawo eshiywe yodwa).
☐ 3. Indawo zabafumileyo
☐ 4. Emaphandleni

3.20 Ukhe wabukela naluphina uhlobo lomboniso wezenzekayo okanye wafunda ngolwazi kwezefama zomoya? (ngokungaphandle kwakolu phando)
☐ 3. Ewe
☐ 4. Hayi

3.21 Ingaba ulilungu lombutho wezokusingqongileyo/ezendalo?
☐ 3. Ewe: Nceda uchaze ______________________________
☐ 4. Hayi

3.22 Ingaba kungakhona amanye amalungu ekhaya lakho angamalungu wombutho wezokusingqongileyo/wezendalo?
☐ 3. Yes: Nceda uchaze ______________________________
☐ 4. Hayi

Appendix C: Focus Group Memo

A focus group meeting was held on the 11th of May 2012 and was attended by Roy Lubke, Dan Wylie, James Kinghorn and Nikki Kohly. The purpose of the meeting was to discuss, critique, make suggestions and ‘iron out’ any problems associated with the Contingent Valuation questionnaire before administering it ‘in the field’. Nikki was assigned as chairperson and put in charge of introducing and laying out the objectives of the focus group while also coordinating and leading the session. Additionally, Nikki participated in the questionnaire discussion, along with the other group members, to make up for the low numbers. My (Kyle Cruickshank) role was to record and note suggestions put forward by the group while, where necessary, also assisting participants to understand my motives for certain questions. Clarity was essential for correctly identifying and making the requisite changes to the questionnaire.

Issues and changes encountered in the questionnaire are as follows:

1. Standardised information on the Waainek Wind Farm was provided to all participants who would be asked to read the text at certain points during the questionnaire. The focus group found this information, for the most part, to be satisfactory. Some minor editing was done to paragraphs which contained instances of redundancy while also simplifying language for those groups who were not first language English speakers. The group suggested some changes to the paragraph structure where certain sections were rearranged, in order for a more logical question-paragraph ordering, while also facilitating a smoother questionnaire ‘flow’. Major changes include:

    - It was suggested that the Contingent Valuation scenario be moved up in the questionnaire structure. This restructuring allowed respondents the opportunity to read through the scenario before they were asked if they would be willing pay to preserve the Waainek scenery.

    - Pros and Cons were listed along with headings, instead of being presented in paragraph form.

2. Categorical questions initially had a wide and varying range for different questions. Some asked respondents to choose an answer from a range of 1-10 while others used a more condensed selection of 5 possible choices. For consistency and simplification, the focus group suggested the following:

- Questions with ranges should be limited to a maximum of 5 selections for consistency and to simplify choices. This measure was adopted.

- For consistency, “very negative” choices should always start on the left and proceed to the right. This consideration was extended to questions which presented respondents with answers ranking from some low order classification to a high order classification.

3. Several questions needed to be reworded and restructured. This was due to problems in question clarity and redundancy. In the case of the ranking question, which asked respondents to rank what they considered the most important aspects of the wind farm, the group suggested that it be split in two, with one side dealing with positive aspects and the other dealing with the negatives. However, in the later pre-test/pilot survey, it was found that there were too few factors in each category and therefore the question was returned to its original form, but reworked. Two other questions, asking for reasons why respondents did not attend a meeting, were combined into one as they were similar enough to be compiled.

4. Photographs, used in the Contingent Valuation section, were reduced from four to three. The main reason for this was due to the fact that the fourth landscape being valued was similar to one of the other areas and could be removed without much impact on WTP figures. Additionally, by the third photograph, respondents should have gained sufficient experience in valuing the different landscapes and therefore, estimated WTP would have stabilised, as shown by Bateman *et al* (2008). Further:

    - It was suggested that comments on the different landscapes should be recorded, while respondents were looking at the respective landscapes being valued, for qualitative purposes. This procedure would assist in explaining and differences in values between landscapes.

5. Enough space should be provided after each question so that responses and comments can be recorded for qualitative purposes.

It is worthwhile to note that the pre-testing also played an important role in further clarifying and restructuring the questionnaire, especially where the valuation section is concerned. A whole paragraph was added in order to better explain what was expected from respondents as the whole process of Contingent Valuation and valuing landscape was a novel experience. For this reason, 10 days were dedicated to ‘ironing out’ problems with the questionnaire as well as assisting in determining the valuation bounds for the Contingent Valuation section.

A consideration which cannot be overlooked, are the focus group participants. Dan and Roy were part of the Grahamstown branch of the Wildlife and Environment Society of South Africa (WESSA) while Nikki was the chairperson of the Kowie Catchment Campaign, which may have introduced some bias into the process. However, pre-testing indicated that the questionnaire presented questions and content neutrally, dispelling any concerns of bias. Further application of the questionnaire confirmed this contention.