Title: What are the environmental and economic impacts of a wind power system on a small rural community in East Galway?

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Table of Contents

List of Figures

List of Appendices

List of Abbreviations

GMIT	Galway Mayo Institute of Technology
NUIG	National University of Ireland Galway
MW	Mega Watt
kW	Kilo Watt
kV	Kilo Volt
m/s	Meters per second
dB	Decibels
ESB	Electricity Supply Board
IFJ	Irish Farmers Journal
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMI	Electromagnetic Interference
SEAI	Sustainable Energy Authority Ireland
IWEA	Irish Wind Energy Association
AWEA	American Wind Energy Association
CANWEA	Canadian Wind Energy Association
EWEA	European Wind Energy Association

Executive Summary

As the world is getting increasingly more concerned about the environment and the fear that the end of fossil fuels is coming soon; people are researching into different ways of meeting our energy needs in the future. One of these ways is wind energy as it is one of the most efficient and effective methods of generating electricity. Wind energy has the ultimate advantage; its primary fuel is the wind which is a renewable source of energy.

The purpose of this thesis is to investigate the positive and negative environmental and economic impacts of a wind power system are, on a small rural community in East Galway. The author intends to achieve this by interviewing people involved in the manufacturing, installation and maintenance of wind power systems as well as people who have installed wind power systems. As a result the author should gain a greater understanding of the impacts of wind power systems. On completion of the thesis the author hopes to have provided the reader with the main environmental and economic impacts of wind power systems.

1. Chapter One: Introduction

Since the 19th century, electricity has become a ubiquitous and indispensable power source in Ireland. In 1927, the Electricity Supply Board Act was passed to set up the Electricity Supply Board, (ESB) a corporate body to control and develop Ireland's electricity network. However, the electricity industry has been revolutionised since with the introduction of renewable energy sources.

The renewable energy generation has begun and is gaining ground at a tremendous pace with energy being produced by many different mediums such as hydropower, biomass/bioenergy, geothermal and wind energy. All these alternative energy sources are environmentally friendly and in excess supply. They can be used to generate energy effectively and efficiently with minimal impact on the environment.

The focus of the research is based primarily on the environmental and economic impacts of a wind power system on a small rural community in East Galway. Gurteen is the name of this community. It is located ten miles from Mountbellew and Loughrea. The nearest main hub to Gurteen is Galway. There are fifteen households in the community. It is primarily agricultural dominated, (70%) with the remaining 30% employed in the industrial sector in Galway.

The author investigated the environmental and economic impacts of a wind power system on the small rural community of Gurteen. These impacts were based on micro wind generation which is wind generation up to 11kW. They can affect the individual, community, environment and the economy as a whole. The research identified these impacts and the effect they can have.

The primary objective of the research was to investigate the environmental and economic impacts of a wind power system on a small rural community in East Galway. The secondary objectives include:

- A review of the development of the electricity industry to date in Ireland with particular focus on East Galway.
- A review of the development of the wind energy industry to date in Ireland with particular focus on East Galway.
- An investigation of the environmental impacts of a wind power system on a small rural community in East Galway.
- An investigation of the economic impacts of a wind power system on a small rural community in East Galway.

Limitations to the study are that, as this was the authors' first research topic, his lack of experience may have affected the implementation of the proposal. He had a major time constraint as his research was only for a short period and was completed in accordance with college deadlines; therefore the boundaries of his research may have been infringed upon. He would have needed a longer time schedule dedicated specifically for his research to complete a more comprehensive, in-depth analysis on his topic.

Also his research boundaries were very stringent, as his research was based specifically on Gurteen and no information outside this boundary could be utilised. He encountered difficulties in accessing information and achieving responses from his target population, even though he had contacts; as his sample size was small and people are getting increasingly more reluctant and wary of freely giving personal information. However, he received approval from the Ethics Committee (Appendix A) to carry out his research and ensured that all participants fully understood the process before they freely complete the participant's approval form (Appendix B).

The research resulted in many major findings which are as follows:

- There are many positive environmental impacts of a wind power system on a local community such as; reducing global warming, preservation of non-renewable resources, increasing local participation, increasing local electricity generation, wind is abundant and reliable, wind turbines are safe and popular, attracting tourists, enhancing infrastructure and having a positive impact on bio-diversity.
- There are many negative environmental impacts of a wind power system on a local community such as; noise, shadow flicker, the visual impact, impact on birds, electromagnetic interference, safety concern, impact of construction and the impact on ecology, archaeology, geology and heritage.
- There are many positive economic impacts of a wind power system on a local community such as; increasing employment, supplementing income, reducing inflation, increasing our independence, demand is increasing, turbines are affordable, turbines involve a payback period and have a long life span.
- There are many negative economic impacts of a wind power system on a local community such as; the economic policy in place at the moment, impacting jobs in other industries, non-availability of grants and shrewd developers.

Chapter two looks at the literature review to get up to date on the historic and current literature from which the research is launched. This involved reviewing the literature across several disciplines. Chapter three focuses on the research methodology used to accomplish the research and specifies the plan for answering the question and achieving the research objectives. Chapter four comprises the research findings which were based on analysis of the data. Chapter five discusses the findings in light of the literature review and presents the answer to the research question as supported by the data. Chapter six concludes the research question by looking back on the whole process.

2. Chapter Two: The Literature Review

2.1 Introduction

This chapter looks at the literature review to get up to date on the historical and current literature from which the research is launched. This involved reviewing the literature across several disciplines.

2.2 To review the development of the electricity industry to date in Ireland with particular focus on East Galway

2.2.1 Background

In the context of this study it is important to give a historical account of the development of the electricity industry to date in Ireland with particular focus on East Galway. This study attempts to address a gap in the relevant literature. This research revealed the deficit of information on the historical background of the electricity industry as there were only two available readings concerning the topic in question.

Since the 19th century, electricity has become a ubiquitous and indispensable power source in Ireland. Electricity came to Ireland for the first time in 1880. "The first electric light in Ireland was an arc lamp outside the office of the Freeman's Journal in Prince Street, Dublin, in 1880" (Manning, 1984, P1). This resulted in considerable public interest as people were recognising the commercial possibilities of electricity. Also in 1880 the Dublin Electric Light Company supplied electricity to Kildare Street, Dawson Street and part of Stephen's Green by lighting arc lamps on wooden posts and overhead wires (Manning, 1984). "In 1881 there were seventeen arc lamps in circuit and by 1882 this had increased to 114" (Manning, 1984, P1).

In 1883 the Portrush-Giant's Causeway-Bushmills Electric Train Service in the North was one of the first electric railways in the world, which was followed by the Bessbrook-Newry Train Service in 1885 (Manning, 1984). Electricity continued to spread across the country. "The first provincial town in Ireland to have public lighting was Carlow" (Manning, 1984, P2). The Carlow system was opened in 1891 when Charles Stewart Parnell was campaigning in his last by-election (Manning, 1984). "He used the new light as a symbol and an omen of a new and free Ireland" (Manning, 1984, P2).

The main electrical development centred on Dublin though on a small scale. The Alliance Gas Company built a power house in Hawkins Street, which supplied customers with incandescent lighting in the Grafton Street, George's Street and Henry Street areas (Manning, 1984). There were approximately fourteen miles of overhead wires radiating from the power house at one time (Manning, 1984).

From this point on, the Dublin Corporation dominated the electrical supply situation in Dublin and established an 'Electric Lighting Committee' to co-ordinate the process (Manning, 1984). The Committee after much research into electrical systems in the UK concluded, "that an alternating current distributed at high tension, and transformed at convenient positions into a suitably low tensioned current for the consumers' houses" (Manning, 1984, P8), was the best system to meet electricity demand in Dublin.

In September 1892 the first power station at Fleet Street and system of street mains was completed (Manning, 1984). The Corporation commenced supplying the public with electricity at once. In early 1893 an extension of the street mains had to take place, which was followed by further extensions in the winter of 1894 (Manning, 1984). Major structural alternations were completed on the system resulting in decreased consumption. "Consumption decreased in 1898 by 43,000 units" (Manning, 1984, P9). In late 1899 the new mains were completed resulting in a perceptible increase in consumption (Manning, 1984).

Following this a new generation station was built at Pigeon House, which was the site of an old packet station between Ireland and Britain (Manning, 1984). This station fed nineteen substations in different parts of the city (Manning, 1984). "The four-wire network was a radically new step, and Dublin was one of the first cities in the world to adopt this type of supply" (Manning, 1984, P11).

In July 1903 the new generation station at Pigeon House began supplying the new system of mains thus the Fleet Street plant was shut down in September 1903 (Manning, 1984). "In 1904 it had six hundred and fifty consumers, with a revenue of £27,000, and its operation covered one and a half square miles" (Manning, 1984, P11). Then the Corporation started selling electricity, which included advertising in search of new consumers (Manning, 1984). They were successful with a number of consumers linking up to the city system (Manning, 1984).

In 1908 the Dublin and Central Ireland Power Company was formed with the intention of using Ireland's turf resources from the Bog of Allen as a source of electricity supply (Manning, 1984). The Dublin Corporation strongly opposed, as they feared competition in the Dublin area (Manning, 1984). However, this company was never heard of again (Manning, 1984). The First World War led to Irish electricity prices increasing and a shortage of raw materials; services to new consumers were stopped and further loans were unable to be raised (Manning, 1984).

The experiences of the war focused attention on the possibilities of electricity. As peat and coal were vanishing commodities, emphasis was on the country's water resources for the generation of electricity (Manning, 1984). Sir John Purser Griffith, a distinguished engineer established himself as an advocate of the Liffey development (Manning, 1984). He believed it was "the ideal way to meet the demands for cheap power and lighting" (Manning, 1984, P13). He began campaigning for the Liffey to be harnessed for the supply of hydroelectric power to Dublin (Manning, 1984).

Following this the Anna Liffey Power Development Company Ltd was established (Manning, 1984). In late 1921 the Dublin Corporation appointed Herr Buchi, a distinguished Swiss engineer to examine the possibilities of the Liffey (Manning, 1984). In May 1922 he concluded that the Liffey was feasible to supply electricity and recommended the Corporation to take action (Manning, 1984).

Sir John Purser Griffith set up his own company to ensure that the scheme would be adopted as a national programme; that small speculative companies would not take over parts of the Liffey and that non-Irish companies would not intervene (Manning, 1984). Dr Theodor Stevens conducted another study on the scheme on behalf of Sir John Purser Griffith and reported in April 1923 that the scheme was favourable but included; "that control of the whole river was essential for success" (Manning, 1984, P14). Stevens envisaged a capital expenditure of £1.2 million for the scheme (Manning, 1984).

However, after all Sir John Purser Griffith's enthusiasm and effort; "the Free State government adopted the Shannon scheme rather than the Liffey scheme" (Manning, 1984, P14). Nevertheless some of the studies conducted were to be of interest and use in future developments. Also during this period Bray developed its own electricity company in 1891, Galway and Cork in 1897 and Limerick in 1901 (Manning, 1984). "By the time the Irish Free State came into existence they were in all 160 undertakings in the twenty-six counties" (Manning, 1984, P15). The majority of these were privately owned including Galway with the rest in public ownership (Manning, 1984).

Only in the Dublin metropolitan area and Cork did a supplier have more than a thousand consumers (Manning, 1984). "The average number of consumers supplied by any supplier in the country was in the region of two hundred and eighty but outside Dublin and Cork the average number was approximately one hundred and twenty-five" (Manning, 1984, P15). There were different rates charged on the basis of a three-category classification; lighting, heating/cooking and power (Manning, 1984).

Lighting was the major domestic source of demand for power. However electricity "prices were high, the number of consumers was small by international standards and, apart from lighting and heating, little use had been found for electricity in either industry or agriculture" (Manning, 1984, P1). "In Dublin 33 per cent of houses had electricity, in Copenhagen the figure was 99 per cent and in Amsterdam 87 per cent" (Manning, 1984, P16). The Irish electricity industry reflected poorly on the entrepreneurial skill of the Irish enterprise both private and public.

2.2.2 Historical development of the electricity industry from the 1920s to the 1990s

2.2.2.1 Development during the 1920s

The 1920s had a major impact on the electricity industry in Ireland thus it is highly relevant to this study. In 1923 the Shannon Scheme project was initiated (O' Riordan, 2000). In February 1924 the Irish Free State Government and Siemens Schuckert signed an agreement to design the Shannon Scheme, which incorporated a national electricity supply network (O' Riordan, 2000). "The whole success or failure of the Shannon Scheme depends on its ability to provide a cheap supply of electricity to as many consumers as possible and that this objective must never be lost sight of in the search for a proper organisation" (Manning, 1984, P54).

In 1927, the Electricity Supply Board Act was passed to set up the Electricity Supply Board, (ESB) on the 11/8/1927; a corporate body to control and develop Ireland's electricity network (O' Riordan, 2000). There was a single unified authority created (O' Riordan, 2000). A decision was made to supply electricity directly to customers and to acquire existing electricity supply undertakings (O' Riordan, 2000). Siemens selected 110kV, 38kV and 10kV as the nominal voltage levels for the ESB system (O' Riordan, 2000). In October 1929, the first 20MW hydro unit was commissioned at Ardnacrusha (O' Riordan, 2000).

2.2.2.2 Development during the 1930s

The 1930s led to huge development in the country thus it is applicable to this study. The provision of electricity by the ESB contributed to major economic and social development in Ireland in the 1930s (O' Riordan, 2000). "The number of consumers had risen from 47,229 at 31/3/1930 to 81,675 at 31/3/1933" (O' Riordan, 2000, P3-6). There were additional generation units commissioned at Ardnacrusha and Pigeon House to facilitate the huge increase in demand (O' Riordan, 2000). Also the 110kV transmission network was expanded (O' Riordan, 2000). On the 3/9/1939 World War 2 started which would inevitably have an impact on the development of electricity in Ireland.

2.2.2.3 Development during the 1940s

The 1940s led to further development of the electricity industry thus it is important to this study. During the period 1942-1948 electricity was rationed due to World War 2 which ended in Europe on 9/5/1945 and in the Far East on 14/8/1945 (O' Riordan, 2000). This resulted in new customers not being connected and restrictions on the consumption of electricity (O' Riordan, 2000). During the 1940s, there were three Liffey hydro-electric stations commissioned (O' Riordan, 2000). Post World War 2 there was an upsurge in generation and transmission projects (O' Riordan, 2000). Also the Rural Electrification Scheme began which brought electricity to rural areas within Ireland (O' Riordan, 2000). The first ESB pole was erected at Kilsallaghan, Co. Dublin on the 5/11/1946 (Manning, 1984). Also one of the major benefits which electricity brought to homes in rural Ireland was water in the tap (Manning, 1984).

2.2.2.4 Development during the 1950s

The 1950s witnessed huge development in the electricity industry which is applicable to this study. During the first half of the 1950s there was a huge growth in the demand for electricity of 23.9% (O' Riordan, 2000). There were 30MW oil fired generation units introduced at major load centres (O' Riordan, 2000). Also there were major additions to the generation plant mix with peat, hydro, indigenous coal and coal/oil units commissioned (O' Riordan, 2000). The transmission network received the additional boost of 110kV lines and stations while ageing transmission assets were being replaced (O' Riordan, 2000). Also the Load Despatch Office (LDO) was commissioned while the Rural Electrification Scheme was gaining tremendous pace (O' Riordan, 2000).

2.2.2.5 Development during the 1960s

The 1960s saw rural areas being connected to electricity supply which is significant to this study. The 1960s resulted in the completion of the Rural Electrification Scheme with construction and development work in all the 792 areas being accomplished (O' Riordan, 2000). There was sustained high growth in electricity demand with a 1,000MW peak demand being exceeded (O' Riordan, 2000). There were additional peat and oil fired generation units commissioned to meet the increased demand (O' Riordan, 2000). 60MW generation units were introduced along with the 220kV voltage level (O' Riordan, 2000). There were major additions to the 110kV transmission network while it was been sectionalised into a northern and southern part (O' Riordan, 2000).

In March 1962, the Mersey and North Wales Electricity Board (MANWEB) method of feeding was introduced in Dublin (O' Riordan, 2000). There were supply interruptions due to storms, faults and industrial relations problems; the Fogarty Report on Industrial Relations in the ESB was issued (O' Riordan, 2000). Also digital computer programs were used for power system planning (O' Riordan, 2000).

2.2.2.6 Development during the 1970s

The 1970s marked a major milestone as regards the electricity industry which is related to this study. In the 1970s a new management organisation structure was implemented along with the Fletcher Report being issued (O' Riordan, 2000). A joint committee of the Oireachtas on State-Sponsored Bodies was established in accordance with foreign consultancy work commencing (O' Riordan, 2000). In 1977 the Golden jubilee of the ESB was celebrated as it was fifty years established. In October 1973 the first oil crisis occurred which was followed by major fluctuations in electricity demand growth throughout the 1970s due to the economic recession of 1974-1976 (O' Riordan, 2000). This in turn was followed by a second oil crisis in 1979 (O' Riordan, 2000). At Turlough Hill a pumped storage station was commissioned (O' Riordan, 2000).

Also during the 1970s there were major developments in terms of technology with the introduction of larger generation unit sizes of 120MW and 250/270MW and the first large industrial type 83MW combustion turbine at Marina (O' Riordan, 2000). Also natural gas was started to be used for electricity generation while the first combined cycle generation unit at Marina was commissioned (O' Riordan, 2000).

2.2.2.7 Development during the 1980s

The 1980s led to huge organisational changes in the electricity industry which is appropriate to this study. In July 1984 the Miller Barry Report was issued which focused on the organisation structure, relationships and roles in the ESB (O' Riordan, 2000). Also the Jakobsen Report was issued which consisted of a report on electricity prices (O' Riordan, 2000). The Joint Oireachtas Committee on Commercial State Sponsored Bodies Report was also issued (O' Riordan, 2000). The Design and Construction Organisation was transferred to ESB International (O' Riordan, 2000).

In the early 1980s an economic recession was underway again due to the second oil crisis (O' Riordan, 2000). A coal fired generation station was commissioned at Moneypoint while a combined cycle plant was commissioned at North Wall (O' Riordan, 2000). There was a low efficiency generation plant placed in storage (O' Riordan, 2000). 400kV voltage level was introduced and the first 110/10kV station was commissioned in Dublin (O' Riordan, 2000). Also there were a record number of requests for supply to large industrial loads (O' Riordan, 2000). The National Control Centre was commissioned while an international focus was put on environmental issues (O' Riordan, 2000).

2.2.2.8 Development during the 1990s

The 1990s saw the ESB set out their targets regarding electricity supply which is significant to this study. In the 1990s the ESB structure was re-organised into five major business units and a small corporate centre (O' Riordan, 2000). The ESB published their vision statement; "ESB will be a world class company focusing primarily on the energy market, delivering quality products and services to our customers. Through teamwork, innovation and a spirit of enterprise we will:

- Meet competitive challenges;
- Continue to be the electricity supplier of first choice to the people of Ireland, our owners;
- Perform to the highest standards of efficiency and integrity;
- Grow our International Business;
- Behave as a good corporate citizen.

Working together as a creative workforce, sharing common objectives and treating each other with trust and respect, we will succeed" (O' Riordan, 2000, P9-4).

During the 1990s a large 158MW combustion turbine was commissioned at Poolbeg (O' Riordan, 2000). The ESB acquired a strategic 15% stake in Coolkeeragh generation station in Derry (O' Riordan, 2000). IVO Energy was awarded a midlands peat fired 117MW station contract (O' Riordan, 2000). In 1997 the Dublin Planning Group reviewed the Dublin Network by setting out a 25-year plan (O' Riordan, 2000). The Dublin 110kV network was sectionalised while the 110kV line refurbishment programme was commenced (O' Riordan, 2000). Also the 1990s saw the introduction of 110kV live line working (O' Riordan, 2000). In approximately 1995, the Black Valley, a rural community in Co. Kerry was connected to the electricity supply. It was the last rural area in Ireland to be connected to the grid.

2.2.3 Electricity in East Galway

The development of the electricity industry in Gurteen; a small rural community in East Galway is highly relevant to this study as it is the basis on which the research is launched. In 1954 electricity came to Gurteen (Mannion, 2010). During 1953, meetings were held and canvassing of houses was undertaken to investigate who would put electricity into their homes (Mannion, 2010). Engineers worked out the layout of the lines and then workmen started digging the holes for the ESB poles.

The erection of the poles was a very hard job which required at least five to six workmen. The tool they used to erect the poles was called a staff which consisted of two lengths of short light poles tied on one end with a short wire rope (Mannion, 2010). The staff was placed under the light end of the ESB pole and carefully lifted off the ground until the heavier end of the pole was placed into the hole and gradually manoeuvred into position. When the pole was upright; it was backfilled with clay and stone. The lines of poles were always in a straight line. Sometimes at the end of a line of poles, tiebacks were used to keep all the poles in a perfect position.

Then some weeks later the linesmen came and attached the ESB wire onto the pole and to the houses (Mannion, 2010). The ESB poles had two crooks on them to attach the wire onto. The electricity wire had 10,000 volts running through it thus transformers were used to reduce the power output to 240-250 volts for all houses in the area. As the construction work continued, the local people got their houses wired and ready for connection. Finally the ESB wires had to be connected to the meter box and left ready for the big switch on. The local community were all excited waiting for the electricity to be switched on as they had an electric radio ready to be connected (Mannion, 2010).

In early September of 1954 the electricity was switched on just in time for the broadcast of the All Ireland Hurling Final of that year (Mannion, 2010). Payments were made every two months when a person would come to the houses and count the number of units clocked up on the meter. The meter box was sealed and could not be interfered with. The bill would be between £5 and £10 depending on the amount of units used (Mannion, 2010). A copy of an ESB bill for August and September of 1967 (Appendix I) and a copy of a bill for February and March of 1972 (Appendix J) illustrate the billing system used by the ESB (Ward, 2010).

At that time an area of 25 square miles was required for the rural electrification scheme to make it viable (Mannion, 2010). Gurteen was in the Monivea area and the electricity came from a substation in Coshla between Athenry and Carnmore (Mannion, 2010). This could not have taken place without the Shannon Scheme; the harnessing of the Shannon River at Ardnacrusha was a great feat of engineering at that time (Mannion, 2010). The job was undertaken by a German man and he employed more than one thousand men for the years it lasted (Mannion, 2010). "It was indeed an enlightening move literally from darkness to light" (Mannion, 2010).

2.3 To review the development of the wind energy industry to date in Ireland with particular focus on East Galway

2.3.1 Background

In the context of this study it is important to give a historical account of the development of the wind energy industry to date in Ireland with particular focus on East Galway. This study attempts to address a gap in the relevant literature. This research revealed the deficit of information on the historical background of the wind energy industry as there were limited readings available concerning the topic in question.

The wind has played a long and important role in the history of human civilisation. In approximately 900AD, the first windmills were built by the Persians (Manwell, 2002). These windmills had vertical axes with a number of arms on which sails were mounted (Manwell, 2002). They were made from bundles of reeds which were pushed around by the force of the wind and were attached to the central vertical shaft by horizontal struts (Manwell, 2002).

During the Middle Ages, wind energy made its appearance in Europe (Manwell, 2002). These windmills were built on posts, had horizontal axes and normally four blades (Manwell, 2002). Following this, tower mills were introduced where only the top of the windmill would rotate (Manwell, 2002). The use of wind energy expanded until the Industrial Revolution but was replaced then by coal which could be transported to wherever it was needed and used whenever it was desired (Manwell, 2002).

2.3.2 Historical development of the wind energy industry from the 18th Century to the 20th Century

2.3.2.1 Development during the 18th Century

The 18th century witnessed further development regarding the wind energy industry which is applicable to this study. In the 18th century, John Smeaton, an Englishman discovered three basic rules that are still applicable today (Manwell, 2002):

- "The speed of the blade tips is ideally proportional to the speed of the wind.
- The maximum torque is proportional to the speed of wind squared.
- The maximum power is proportional to the speed of wind cubed" (Manwell, 2002, P12).

Late in the 18th century, another variant of a windmill came into widespread use in the USA which was used for pumping water particularly in the West (Manwell, 2002). Big ranchers and farmers primarily used these windmills to supply water to their cattle and to steam railroads.

2.3.2.2 Development during the 20th Century

The 20th century saw the wind energy industry growing rapidly which is highly appropriate to this study. The first half of the 20th century saw the construction of larger wind turbines which substantially influenced the development of today's technology (Manwell, 2002). Between 1891 and 1918 Poul La Cour built more than 100 electricity generating turbines in the 20-35kW range in Denmark (Manwell, 2002). Ever since this, Denmark has established itself as the leader in terms of electricity generated by the wind. In 1922, Irelands first wind farm, located in Bellacorrick, County Mayo, began to generate electricity (The Irish Farmers Journal – Country Living, 6/2/10, P7).

In the USA in the late 1930s, the Smith-Putnam turbine was built at Grandpa's Knob in Vermont (Putnam, 1948). It was the largest two-bladed wind turbine ever built until that time and for many years thereafter, with a diameter of 53.3 metres and a power rating of 1.25MW (Putnam, 1948). Unfortunately, the turbine was too large, too early, therefore suffering a blade failure in 1945 resulting in the project been abandoned (Putnam, 1948). In the 1950s Ulrich Hutter of Germany focused on applying modern aerodynamic principles to wind turbine design; many of his concepts are still used today (Manwell, 2002).

One of the most significant developments of the late 20th century was the re-emergence of the wind as a significant source of energy (Manwell, 2002). By the mid 1950s, the advent of the steam engine and the appearance of other technologies for converting fossil fuels to useful energy seemed to have relegated to insignificance the role of the wind in energy generation (Manwell, 2002). However by the late 1960s there were signs of a recovery by the early 1990s it was apparent that a fundamental recovery was underway (Manwell, 2002).

There were five main factors responsible for this change which were; a need for alternatives due to harm being caused by fossil fuels, a huge potential for wind energy as it exists everywhere, the technological capacity which could revolutionise wind turbines, a vision of a new way to use the wind and the political will to make it happen (Manwell, 2002). At the outset of wind's re-emergence, the cost of energy from wind turbines was far greater than that from fossil fuels (Manwell, 2002). Therefore Government support was required to carry out research, development, testing and to offer incentives to help hasten the development of the new technology (Manwell, 2002).

In the US, little developments were made in wind energy until the Oil Crises of the mid-1970s, then a new effort was begun to develop wind energy (Manwell, 2002). "The US federal government, through the Public Utility Regulatory Policy Act of 1978 required utilities (1) to allow wind turbines to connect with the grid and (2) to pay the 'avoided cost' for each kWh the turbines generated and fed into the grid" (Manwell, 2002, P17). As a result of these incentives; wind energy started to become even more popular with many turbines being erected. The cost of energy from the wind became nearly as competitive with conventional sources, even without incentives (Manwell, 2002).

2.3.3 Wind energy in East Galway

The development of the wind energy industry in East Galway is highly relevant to this study as it is the basis on which the research is launched. In June of 2010, there were 143 wind farms in Ireland of which four are in Galway (IWEA, 2010). The installed wind capacity of Ireland is 1679.3 Megawatts (MW) which will on average generate 4,560,307 Megawatt hours (MWh) in a year given a 31% load or capacity factor (IWEA, 2010). The four wind farms in Galway have a combined capacity of 72.64MW (IWEA, 2010). They are located in Inverin, Inis Mean, Sonnagh Old and Derrybrien (IWEA, 2010). The Inverin wind farm has a capacity of 3.96MW and was commissioned in 1999 (IWEA, 2010). The Inis Mean wind farm has a capacity of 0.68MW and was commissioned in 2002 (IWEA, 2010). The Sonnagh Old wind farm has a capacity of 7.65MW and was commissioned in 2004 (IWEA, 2010). The Derrybrien wind farm has a capacity of 60.35MW and was commissioned in 2005 (IWEA, 2010).

2.4 Kyoto Agreement

The Kyoto Agreement is relevant to this study because it is seen as the first step towards a global mission reduction regime and it provides the essential architecture for any future international agreements on climate change. The Kyoto Agreement was initially adopted on 11 December 1997 in Kyoto, Japan. According to Aubrey, (1998, P2), "if the 164 nations at the climate change negotiations in Japan failed to reach a strong agreement on reductions in greenhouse gases, the pollution lobby will no doubt feel well pleased". However, a legally binding agreement between the signed-up countries was reached. These countries agreed to meet emission reduction targets of all greenhouse gases by 2012 relative to 1990 levels. The main points of the agreement are as follows:

- In 1997, 141 countries took part in the discussion. In 2001, 34 industrialised countries ratified the agreement. The reason for this delay was the agreement needed countries that were responsible for 55% of the 1990 emissions to ratify; USA refused in 2001 while Russian ratification was obtained in November 2004.
- An average target of 5.4% for overall emissions, 12.5% target for the UK and 21% for Germany and Denmark. Less advanced countries were allowed to increase emissions; Greece +25%, Spain +15% and Ireland +13%. Large developing countries were not expected to have reduction targets like Brazil, Russia, India and China (BRIC countries).
- Penalty of €40/tonne of greenhouse gas in Europe and after 2012, shortfalls to be added to any new target and multiplied by 1.3 (Kyoto Agreement, 1997).

2.5 National Climate Change Strategy

The National Climate Change Strategy supports this study because it states a plan to limit Ireland's greenhouse gas emissions and to focus on renewable energy in the future. It outlines the strategy to meet Ireland's commitment to limit greenhouse gas emissions to a 13% increase over 1990 levels by 2008-2012. The main points relating to renewable energy in the strategy are as follows:

- Reduction of annual CO2 emissions by 1 million tonnes by 2010 through increased deployment of renewable energy.
- A review of the rate and structure of Energy Taxes.
- Fuel switching from coal to renewable energy.

2.6 Wind Energy in Canada

Wind energy in Canada supports this study as it illustrates how the wind energy industry can grow at a tremendous pace once established and produce adequate electricity for many households. According to the Canadian Wind Energy Association, (CANWEA) Canada has only scratched the surface of its massive wind energy potential, which is already powering almost one million Canadian homes. The industrial heartland of Canada, the province of Ontario has started negotiating with renewable energy producers. Many provinces in Canada have started "to incorporate legislation that will protect our quality of life from the ravages of global warming" (Suzuki, 2008). The Canadian 'Windvision 2025' states; "wind energy can satisfy 20 percent of Canada's electricity demand by 2025" (CANWEA, 2008). The CANWEA are intent on achieving this vision as it "will generate investment, create jobs, produce revenue for municipalities, stabilize electricity prices and cut greenhouse gas emissions" (CANWEA, 2008).

2.7 Wind Energy in Denmark

Wind energy in Denmark supports this study because Denmark is one of the leading countries as regard to electricity being produced by wind. Svend Auken, the Danish Minister for Environment and Energy, believes wind energy is the way forward; "wind is important to us above all because we are tapping a natural resource" (Aubrey, 1998, P8). He maintains that wind can be used for energy supply with little cost and great benefits for the environment in the long run. Svend Auken stated, by 2005,

> "The country could be getting 20% of its power from the wind" (Aubrey, 1998, P8).

In 2005, Denmark was getting 18.2% of its total gross electricity from wind. Denmark asserts; "the trouble is that no realistic technological, economic and political strategies for the warding off of the impacts of a decline in conventional oil supply are in sight" (Illum, 2004). Denmark believes that "if the time horizon for the impending peak in the production of cheap conventional oil is as short as one or two decades or less, the problems involved in handling the situation are of a specific, practical nature. Therefore, economic policies should not rely on general, theoretical assumptions that technological progress will ensure sufficient supplies of oil or substitutes for oil" (Society of Danish Engineers and the Danish Board of Technology, 2004).

2.8 Wind Energy in the United States of America, (USA)

Wind energy targets in the USA are relevant to this study, as they can give direction for Ireland's own targets in the future. In May 2008, the U.S. Department of Energy, (U.S. DOE) believed that the feasibility of generating 20% of U.S. electricity needs from wind power by 2030 was achievable without any major technological breakthroughs. The DOE are determined to achieve their goal, thus having significant environmental benefits, which are:

- This would reduce CO2 emissions by 7,600 million metric tonnes.
- It would almost keep the electric sector emissions from increasing.
- It would displace 50% of electricity generated from natural gas and 18% from coal, alleviating pressure on gas markets and eliminating the need to build new coal capacity.
- It would reduce cumulative water consumption in the electric sector by 8% or four trillion gallons by 2030 (U.S. DOE, 2008).

In a corresponding study, (U.S. Department of Energy, 2008) it "concluded that the 20% wind energy target would reduce natural gas costs to consumers by approximately $128 billion and would lower the cost of compliance with climate legislation by around $98 billion". On the 29th of August 2008, at the Democratic Convention, US Presidential candidate Barack Obama stated,

> "I'll invest $150 billion over the next decade in affordable, renewable sources of energy – wind power and solar power and the next generation of biofuels; an investment that will lead to new industries and five million new jobs" (Aubrey, 2008, P7).

This informs us that Barack Obama is aware of the future that wind energy holds and of the many resulting benefits. This supports this study because it illustrates that investment in wind energy is necessary for a prosperous future.

T. Boone Pickens can't believe how the US has not used wind more efficiently and effectively. On the 2nd of June 2008, the US oil billionaire asserted,

> "Wind power is... clean, it's renewable. It's everything you want. And it's a stable supply of energy. It's unbelievable that we have not done more with wind" (Aubrey, 2008, P7).

2.9 Wind Energy in Europe

Wind energy in Europe is relevant to this study as Ireland is a member of the EU and if the EU is successful at producing electricity from wind, they will encourage and support its members to pursue similar renewable energy practices. In 2009, Europe's population was estimated to be 830 million people, so understandably it uses an excess amount of energy.

In the future Europe needs to explore more of its sustainable energy sources, as it is 50% dependant on imports. "Europe, as we know it will not survive the energy crisis unless it can find a new primary energy resource" and "it is our offshore wind" (EWEA, 2009). This shall not be a problem as Europe has one of the world's best offshore wind resources. This will reduce Europe's dependency on energy imports, as it will own an excess supply of energy itself. By 2050, "Europe will probably be generating 50% of their electricity from wind power, 30% from solar and 10% from new marine renewables" (EWEA, 2009).

2.10 Renewable targets for Ireland

Renewable targets for Ireland support this study as it illustrates how Ireland envisages itself in future years as regards renewable energy. By investigating into the renewable targets; we can see our future goal, which is renewables. Ireland's target for electricity by 2010 is:

2.12 Irelands target for wind energy

Irelands target for wind energy supports this study as it proves that the Irish state is determined of reaching a target of 20% wind energy by 2020. Currently, Ireland is spending €6 billion/year to purchase fuel from abroad. It is argued in the Irish Farmers Journal, (IFJ) that; "Ireland is the most dependent and exposed country in Europe to fluctuations and variables in the marketplace" (IFJ, 7/11/09, P 11). Even though we have the two most suitable locations in Europe to produce wind and wave energy, which are the northern and western counties. According to Padraic Howard, a representative of 'Spirit of Ireland'; "at present only 9% of energy supply came from sources other than fossil fuel" (IFJ, 7/11/09, P 11).

2.13 Wind energy in Ireland

Wind energy in Ireland is relevant to this study because an increasing number of people believe that we can achieve our goal of producing sufficient amounts of energy from our wind. Professor Michael McElroy, from the Environmental Sciences Department at Harvard University in the USA, once stated in response to a question about the potential of nuclear power in Ireland;

> "Ireland is potentially the Saudi Arabia of wind energy and could export electricity all over Europe" (Irish Independent, 1/12/09, P 12).

Eamon Ryan, the Irish Energy Minister, asserted;

> "We need to plan for a world where cheap oil and gas is no longer readily available. We need to halt the onward march of climate change. We must plan Europe's economic recovery and our future growth patterns. Renewable energy and wind specifically provides the answer to these questions" (EWEA, 2009).

2.14 Green Business Loans

Green business loans are relevant to this study because if people can acquire funding for green initiatives like wind power systems; they may erect a system. The Bank of Ireland, (BOI) have launched a new green business loan designed to provide businesses with the finance they need to fund green projects that will help the environment and improve their profits. According to the BOI, applicants can receive the loan by making improvements to an office, by installing a wind energy system, a renewable heat system, etc. There is a green fund of €100m available, which offers:

- Competitive interest rates of 4.99%.
- Choice and flexibility of repayment options available such as capital moratorium for three months.

2.15 Renewable Energy Grants

Renewable energy grants are relevant to this study because they make renewable energy installations like a wind power system more viable and cost effective for the customer. There are a number of grants available to homeowners, businesses and non- profit organisations. The Low Carbon Buildings Program provides the main source of funding for homes. This programme allows you to claim €3,175 for the following renewable energy technologies:

- Solar electricity
- Wind turbines
- Solar hot water
- Ground source heat pumps
- Air source heat pumps
- Wood-fuelled boilers
- Automatic pellet-feed wood burning stoves (Green-Energysaving.com, 2009).

2.16 The Irish Wind Energy Association (IWEA)

The IWEA are relevant to this study as they are responsible for the promotion and education of wind energy to the public. The IWEA comprises two separate entities; the Irish Wind Energy Association which is committed to the promotion and education of wind energy issues and the IWEA which is the legal entity charged with conference organisation, lobbying and policy development (IWEA, 2010). The IWEA is responsible for promoting wind energy in Ireland as an economically and environmentally sound alternative form of energy.

Wind has been the world's fastest growing renewable energy source for the last seven years and this trend is expected to continue with falling costs of wind energy and the urgent international need to tackle CO2 emissions to prevent climate change (IWEA, 2010). The activities of the IWEA are as follows (IWEA, 2010):

- Working to influence government policy on renewable energy.
- Working to ensure fair access to the Irish electricity grid.
- Working to reform and improve the planning process for wind farms.
- Making submissions and proposals to decision-making bodies for the betterment of the Irish wind industry.
- Making recommendations to the Government on proposed legislation.
- Working closely with relevant statutory agencies such as Eirgrid, CER, DCMNR, ESBN and SEAI to progress the main objectives of the Irish wind industry.
- Advancing wind energy through membership of relevant national and international technology and policy bodies.

2.17 Grid 25

Eirgrid's Grid Development Strategy, Grid 25 is significant to this study as it is a strategy for the development of Ireland's electricity grid for a sustainable and competitive future (Eirgrid, 2010). Eirgrid's mission is to develop, maintain and operate a safe, secure, reliable, economical and efficient transmission system for Ireland (Eirgrid, 2010).

Over the last 20 years, there has been a growth of 150% in electricity demand (Eirgrid, 2010). Eirgrid believes that the capacity of the bulk transmission system will need to be doubled by 2025 to meet the excessive demand for electricity. Their strategy will involve an investment of approximately €4 billion over the period to 2025 to upgrade the high voltage system (Eirgrid, 2010). Grid 25 is essential for a number of reasons which are as follows (Eirgrid, 2010):

- To support growth in Ireland and ensure continued reliability and security of supply.
- To provide high-quality, high voltage bulk power supply for Ireland that will enable different regions to attract future industry and boost existing industry.
- To exploit Ireland's natural renewable sources of energy such as wind.
- To reduce Ireland's carbon emissions by transmitting renewable energy in line with Government policy.
- To increase Ireland's connectivity to the European Grid, allowing for both bulk exports of electricity and imports of electricity when appropriate.

The generation of electricity from renewable energy sources such as wind is a key plank in the Strategy in order to reduce carbon emissions and to maintain a sustainable energy supply (Eirgrid, 2010). The Irish Government has set a target of at least 33% of electricity coming from renewable energy sources by 2020 (Eirgrid, 2010).

It is noted in the Government's White Paper on "Delivering a Sustainable Energy Future for Ireland" that wind energy will make a significant contribution to meeting this target (Eirgrid, 2010). Eirgrid has estimated the regional distribution of the renewable generation capacity which is as follows:

- North west – 35%.
- North east – 4%.
- West – 8%.
- East – 4%.
- Midlands – 3%.
- South west – 30%.
- South east – 16%.

With regard to the west region in particular, peak demand for electricity is expected to increase by 60% by 2025 (Eirgrid, 2010, estimated in 2007). This region is expected to have up to 440MW of wind generation (Eirgrid, 2010). The grid development in the region will include (Eirgrid, 2010):

- An investment of approximately €315m in regional transmission network.
- Upgraded networks supplying the large urban centres of Ennis and Limerick.
- Up-rating 250km of existing networks to facilitate higher capacity power flows.

2.18 ESB Strategic Framework

The ESB's strategic framework supports this study as it sets out targets regarding a reduction in our emissions. The ESB has set out a strategic framework which includes reducing emissions by 30% by 2012, 50% by 2020 and to have zero emissions by 2035 (McGrath, 2010). ESB's strategy for sustainable development is to become a world leading commercially successful and environmentally responsible utility (McGrath, 2010). The ESB are aiming for a 30% reduction in their internal carbon footprint by 2012 (McGrath, 2010).

2.19 Summary and Conclusions

The literature review has examined the development of the electricity industry and the wind energy industry to date in Ireland with a particular focus on East Galway. This was highly relevant to the study as it provided a base on which the research could be built upon. The review also focused on key developments within the wind energy industry such as; the Kyoto agreement, the National Climate Change Strategy, wind energy in Canada, wind energy in Denmark, wind energy in the USA, wind energy in Europe, renewable targets for Ireland, the potential for 25% wind energy in Ireland, Irelands target for wind energy, wind energy in Ireland, green business loans, renewable energy grants, the IWEA, Grid 25 and the ESB Strategic Framework. All these developments were appropriate to the study as they had significant impacts on the industry; they incorporated goals and targets which have to be reached in a certain time frame. The following chapter will focus on the research methodology used in the study.

3. Chapter Three: The Research Methodology

3.1 Introduction

This chapter looks at the research methodology used to accomplish the research and specifies the plan for answering the question and achieving the research objectives.

3.2 Target Population

The target population of a study is the collection of individuals or regions that are to be investigated in a statistical study. The target population for this research are all from East Galway and consist of:

- C&F Green Energy in Athenry, who produce, install and maintain wind power systems.
- RoCo Wind Energy in Mountbellew, who produce, install and maintain wind power systems.
- A farmer from Gurteen, who installed a wind power system.
- Two domestic households from Gurteen, who installed wind power systems.
- Residents from the Gurteen community.
- John Lohan of G.M.I.T.

The author got access to C&F Green Energy in Athenry through personal contacts. He got access to RoCo Wind Energy in Mountbellew, also through personal contacts and Gurteen community members. He got access to the farmer and one of the domestic households in the community, who have already installed wind power systems through a mutual friendship. Finally, he made contact with the other domestic household, as he is a resident/member of the Gurteen community.

In carrying out this research, ethical approval was granted from the various participants and committees. Research ethics committees act as a filter with the remit of protecting research participants (appendix A). The researcher obtained written approval and consent from all of the participants prior to the commencement of the study (appendix B). His research was capable of being completed because he has a keen interest in wind energy and can get access to his target population.

3.3 Research undertaken

The author undertook extensive research on the topic primarily because of his limited knowledge of the topic. To complete this research the author used a combination of both quantitative and qualitative research, as they added to the validity and reliability of his research. Quantitative research involves using structured questions or observations where the response options have been predetermined. Quantitative research enabled the author to measure the attitudes of people towards wind power systems. Qualitative research involves collecting, analysing and interpreting data by observing or asking questions in an unstructured method. "Qualitative research is about exploring people's experiences and understanding social practices" (Course Team, 2007, P288). "Qualitative research entails an interaction between the account produced by a participant and the meaning the researcher assigns to the data" (Course Team, 2007, P301). Qualitative research enabled the author to understand why people feel a particular way towards wind power systems.

The author acquired primary data from interviewing people and carrying out questionnaires. He interviewed people who have installed wind power systems, consisting of a farmer and two domestic households to explore their attitudes towards the environmental and economic impacts of the system. He interviewed people involved in the production, installation and maintenance of wind power systems, who include C&F Green Energy in Athenry and RoCo Wind Energy in Mountbellew to explore their opinions towards the environmental and economic impacts of their systems. Also he distributed questionnaires to each one of the fifteen local residents of the Gurteen community to gain their insights and attitudes towards the environmental and economic impacts of wind power systems.

This gave him an in depth insight into the consumers, suppliers and potential consumers perspective's on the environmental and economic impacts of a wind power system on a small rural community in East Galway. Also he met John Lohan, lecturer and researcher at Galway Mayo Institute of Technology, (G.M.I.T.) to discuss the proposed wind power systems to be built on the G.M.I.T. campus site and on the Mountbellew Agriculture College site. With approval granted; the author envisaged that the findings would be relevant for his own research topic.

Secondary research was completed when the author conducted library research in G.M.I.T. and the National University of Ireland Galway, (N.U.I.G.). Information was also gathered from journals, databases, books, newspapers and the Internet. As regards the G.M.I.T. library resources, the author found Business Source Premier and General One File quite useful. Concerning the Internet, the author found the Irish Wind Energy Association, (IWEA), the Sustainable Energy Authority Ireland, (SEAI), the Canadian Wind Energy Association, (CANWEA) and the European Wind Energy Association, (EWEA) websites informative with comprehensive information about wind energy.

The author found newspapers such as the Irish Independent, the Irish Daily Mail, the Irish Times, the Galway Independent, the Connacht Tribune and the Irish Farmers Journal as good sources of information with many articles regarding wind energy. When the author gathered all the information, he analysed it ensuring all the material was relevant to his objectives and accurate in terms of being up to date and creditable. On the successful achievement of his primary and secondary objectives, he produced findings that answered his main research question.

3.4 Thematic Analysis

Thematic analysis is the most commonly used form of qualitative analysis. The author used thematic analysis to organise his interviews in order to draw out meanings in the form of themes. These themes were recurrent topics, ideas and statements that were identified in the interviews. These themes were then coded throughout the interviews.

The author used three post-interview stages to conduct thematic analysis which were transcribing the interviews, familiarising himself with the transcripts and then coding the transcripts. Firstly the author transcribed the interviews and then he read through the transcripts a number of times, keeping his research question in mind throughout. Following this the author started the process of coding the data. There are three levels of coding; first-order (descriptive), second-order (combining descriptive codes) and third-order or pattern coding which is thematic analysis (Course Team, 2007).

First-order coding involves organising and categorising the data in the transcripts by capturing chunks of meaning and giving them codes (Course Team, 2007). The process is purely descriptive with minimal interpretation (Course Team, 2007). To complete this, the author read the transcripts several times looking for ideas which appeared and recurred in the text. Second-order coding involves going beyond a simple description of the data and beginning to interpret the meanings of the participant's words (Course Team, 2007). These superordinate constructs are more generic than first-order descriptive codes.

Third-order coding and thematic analysis involve drawing out the overarching themes within the data (Course Team, 2007). To complete this, the author identified superordinate constructs that were more global and which identified larger-scale patterns than those identified in second-order coding. "These are the themes that give thematic analysis its name and which capture the meaning of your descriptive and interpretative codes" (Course Team, 2007, P295). This process is also referred to as pattern coding, as you are looking for patterns within the data (Course Team, 2007).

The codes used throughout the interviews are as follows:

Domestic Demand =	DD
Business Demand =	BD
Local Involvement =	LI
Awareness =	A
Current Status =	CSt
Self Sufficient =	SS

The above codes are grouped under present.

Operation Itself =	OI
Costs Involved =	CI
Irish Made =	IM
Customer Service =	CSe
Prices =	P
Top Technology =	TT

The above codes are grouped under product.

Positive Environmental Impact =	PEnI
Negative Environmental Impact =	NEnI
Positive Economic Impact =	PEcI
Negative Economic Impact =	NEcI

The above codes are grouped under impacts.

Tariff Problem = TP
Grants Problem = GPr
ESB Policy = ESBP
Government Policy = GPo
SEAI Standards = SEAIS
The above codes are grouped under policy.

Forward Thinking = FT
Future Potential = FP
Advertising Campaign = AC
The above codes are grouped under future.

The code groupings are as follows: present, product, impacts, policy and future.

3.4.1 Present

After analysing the interviews, it was clear that the present circumstances are having a major impact on the wind energy industry. These present circumstances include domestic demand, business demand, local involvement, awareness, current status and self-sufficiency. All these factors can have a positive effect on the industry if encouraged and promoted thus increasing demand at all levels in the industry. An area of major concern at the moment is creating awareness about wind energy and wind turbines. Many people are unfamiliar with the whole wind energy philosophy and until this changes demand will remain static in the near future.

3.4.2 Impacts

After analysing the interviews, it was evident that the impacts of wind turbines are affecting the wind energy industry. These impacts include positive environmental impacts, negative environmental impacts, positive economic impacts and negative economic impacts. All these impacts are having positive effects and negative effects on the industry due to their caliber. If some of the negative impacts could be reduced or minimised by the top people operating the sector in the future; it would have positive results on the industry overall. Also all the positive impacts need to be emphasised to the public to encourage them to erect wind turbines and capture the resulting benefits.

3.4.3 Policy

From the interviews, it was apparent that the policy structures in place in the wind energy industry are having major consequences. These structures include tariff problems, grant problems, ESB's policy, Government's policy and the SEAI standards. These policy structures need to be revised by the people concerned to ensure the wind energy industry grows at a sustainable rate in the coming years which is within its capabilities.

3.4.4 Future

After interpreting the interviews, it was obvious that the future of the wind energy industry looks bright and prosperous. The future incorporates forward thinking on the industry members' behalf, advertising campaigns and the future potential of the industry. With these factors being enforced by all members of the industry; the growth potential is huge as micro wind generation is only in its infancy stage as of yet in East Galway.

3.5 Summary and Conclusions

The research methodology has examined the target population used in the study as well as both the quantitative and qualitative research that was undertaken. It also looked at how the author formed themes out of his interviews using thematic analysis. This was relevant to the study as it specified the plan for answering the research question and achieving the research objectives. The following chapter will focus on the research findings from the study.

4. Chapter Four: The Research Findings

4.1 Introduction

This chapter comprises the research findings which were based on analysis of the data. Wind energy is viewed as having many environmental and economic impacts. However, in general governments, economists, environmentalists and the media have viewed these impacts as having a positive effect on the country as a whole. In this chapter, the author will explore the positive and negative environmental and economic impacts that a wind power system can have on a small rural community in East Galway.

4.2 Positive Environmental Impacts

There are a number of positive environmental impacts of a wind power system which are as follows:

4.2.1 Global Warming

One of the major advantages of wind turbines is that they do not contribute to global warming because they do not produce any greenhouse gas emissions, dust particles, waste products, effluent, slag or ash. This is significant as all other forms of non-renewable energy contribute to global warming. "You are saving the carbon emissions and you are not contributing to the greenhouse gasses" (Palmer, 2010, Q15, L40). One modern wind turbine would save over 4,000 tonnes of CO2 emissions annually (CANWEA, 2010). The findings of a community questionnaire carried out by the author showed that three out of six people would erect a wind turbine to help save the environment (Appendix H, Q3). "Turbines have to help the environment" (Farmer, 2010, Q11, L24).

Also wind turbines have no effect on the quality of the local water or air; thus they are the ultimate clean energy source. "Anyone who puts up a turbine is going to be doing the environment a favour; that has to be positive because you are reducing the amount of fossil fuels being used" (Palmer, 2010, Q15, L41). "By erecting a turbine you will reduce the amount of carbon emissions and greenhouse gases being produced" (Householder, 2010, Q11, L18). Ireland has commitments made under the Kyoto Agreement and more recently in Copenhagen whereby there are renewable targets set that we have to achieve; 20% of our energy by 2020 (Roche, 2010, Q13, L77). The results of a community questionnaire indicate that people believe wind turbines are good for the environment, reduce our emissions and overall reduce global warming (Appendix H, Q7).

4.2.2 Non-Renewable Resources

Wind turbines do not deplete non-renewable resources; in actual fact they contribute to the preservation of moors and peat lands for vegetation and wildlife. Energy generated by the wind is real energy (Roche, 2010, Q15, L91). When turbines are erected on peaty sites; no other type of development can take place thus the moors and peat land are safe at least until decommissioning. When a turbine reaches the end of its life; its decommissioning can be every bit as discreet as were its installation and lifetime of service. Turbines are very easy to dismantle and their sites can be quickly restored to their original states due to the small amount of ground they occupy.

4.2.3 Local Participation

Local involvement in renewable energy projects should be encouraged within a community. "It would be a good idea if a local community erected a wind turbine for the whole community" (Farmer, 2010, Q7, L43). This would enable local people to establish their own wind turbine and produce electricity to meet their own needs. If you look across any field in Ireland, there is wind blowing which is kinetic energy; that is real energy. It's a matter of capturing that energy (Roche, 2010, Q15, L92).

This in turn would offset people's electricity bills thus saving them money. "I believe in manufacturing in Ireland, an Irish wind turbine for Irish wind conditions and for Irish consumption" (Roche, 2010, Q15, L96). Also if energy production from a turbine exceeds requirements; it can be exported back to the national grid in return for a payment. If you sell energy into the grid; the ESB pays 9c per unit produced and they also give an extra 10c bonus on top of that which totals 19c per unit which is similar to the price we are paying for a unit of electricity domestically now anyway (Roche, 2010, Q13, L70).

Professor Vincent O' Flaherty of the Energy Research Centre at NUIG asserts; "bridging the gap between environmental initiatives and the community is the key to the success of green energy in Ireland" (The Galway Independent, 21/4/10, P50). "There is a great need for more engagement with the community, a closer sense of engagement and a commitment that such a development will bring jobs and something tangible to the local community" (The Galway Independent, 21/4/10, P50). Close consultation and compensation from developers or opportunities for local populations to join wind energy co-operatives may go along way towards reducing public opposition (Redlinger, 2002, P166).

Meitheal na Gaoithe (M na G), the Irish Wind Farmers Co-operative Society Ltd was established in April 2000 (M na G, 2010). It represents rural communities and individuals dedicated to promoting and harnessing wind energy in Ireland (M na G, 2010). It promotes wind energy so that farmers or community groups can retain the prime social and financial benefits of the growth. M na G has the potential to play a major role in the wind energy industry in the future (M na G, 2010).

4.2.4 Local Electricity Generation

As wind energy can be generated locally; it can be distributed directly to the local network. We have to look at the whole idea of producing energy locally and using it locally; that is what the wind energy philosophy is all about (Roche, 2010, Q5, L21). As a result there would be less electrical loses in transmission and distribution thus saving energy overall. "If you were sending electricity to the national grid and you were producing 5kW of power, by the time it leaves Galway and gets to Dublin, you may only have 0.5kW left through wastage and inefficiencies which all have a cost" (Roche, 2010, Q5, L23). This needs to be looked at from a technology point of view and look at the economic method of installing one wind turbine in a community like the village of Gurteen (Roche, 2010, Q16, L106). It would be a community investment rather than an individual investment (Roche, 2010, Q16, L107).

4.2.5 Abundant and Reliable

Ireland has one of the best wind resources in the world due to the Atlantic coast. In Ireland, wind is one of our greatest resources; our location lends itself to that as we are on the edge of the Atlantic Ocean; we have the North Atlantic drift generating winds coming from the south west constantly in Ireland (Roche, 2010, Q15, L97). Wind is a form of energy that is available to us all; it's a matter of capturing it in the most suitable way (Roche, 2010, Q3, L9). The wind is abundant and reliable because of our prime location thus we have the potential not only to supply our own energy needs but also to export to neighbouring countries. In Ireland, with wind energy, we can become self sufficient and maybe export it (Roche, 2010, Q31, L238). When energy demand reaches its peak during the winter months; this corresponds to the peak of wind speeds also. Therefore wind energy must be viewed with interest as it has the necessary elements to provide a sustainable energy supply to us in the future. The results of a community questionnaire showed that one out of fifteen people believed that wind is abundant (Appendix H, Q7).

4.2.6 Tourism

Wind farms contribute handsomely to tourism in Ireland with many tourists visiting them each year. The United Kingdom's first commercial wind farm at Delabole had 350,000 visitors in its first ten years of operation (Airtricity, 2010). Wind power generates not just electricity, but also strong views (Szarka, 2004, P317). However with wind turbines becoming more popular in every country in the future, tourist attention may decline. The findings of a community questionnaire showed that one out of fifteen people believed that wind power systems add to the scenery (Appendix H, Q7).

4.2.7 Infrastructure

The erection of wind turbines can significantly improve road infrastructure in the local area. At first road conditions will deteriorate due to heavy vehicles transporting turbine components. However when development works are complete, a new road surface will be laid for the local people.

4.2.8 Safe Technology

Wind turbines are one of the safest technologies as no member of the public anywhere in the world has ever been injured by them (Airtricity, 2010). It is a matter of record that no passive member of the public has ever been directly injured during the normal operation of a wind turbine, with over 25 years operating experience and with more than 70,000 machines installed around the world (IWEA, 2010). This illustrates that people do not need to be cautious when erecting a wind turbine as it is a safe machine and injuries are evidently not a concern. The results of a community questionnaire showed that one out of fifteen people believed that wind power systems are a safe technology (Appendix H, Q7).

4.2.9 Popular

Wind energy is one of the most popular energy technologies in the world with opinion surveys showing that just over eight out of ten people are in favour of wind energy and less than one in ten against it (Airtricity, 2010). This illustrates that people want to become 'greener' because they are aware of the excess emissions that we are producing. The results of a community questionnaire carried out by the author showed that thirteen out of fifteen people have heard of wind turbines (Appendix H, Q1) and that six of these people would erect a wind turbine (Appendix H, Q2). Also wind energy is popular with farmers because even if they erect a turbine; their land can still be used for grazing livestock or growing crops (IWEA, 2010). In addition wind turbines do not disturb livestock which is another positive outcome for farmers (IWEA, 2010).

4.2.10 Biodiversity

Wind energy can have a long-term positive impact on biodiversity as it reduces the threat of climate change which is the greatest danger to biodiversity (EWEA, 2009). "Wind energy has a positive impact on biodiversity by reducing the threat of climate change" (Householder, 2010, Q11, L18). As wind energy produces no pollutants, the future of biodiversity looks safe however if our emissions are not reduced substantially; biodiversity will be at risk.

4.3 Negative Environmental Impacts

An Environmental Impact Assessment (EIA) is carried out for the majority of wind farm developments; however it is not a mandatory requirement. Its purpose is to investigate the effects on the environment caused by a proposed development. Also an Environmental Impact Statement (EIS) is produced with an EIA. The EIS analyses the proposed development and the impact it will have on the environment. Generally wind turbines have minimal environmental impacts due to the stringent criteria that must be satisfied to erect a turbine. However, there are a number of negative environmental impacts of a wind power system which are as follows:

4.3.1 Noise

Noise is a major area of disquiet associated with wind turbines. It is an important consideration that is taken into account when a planning application for wind turbines is made. Noise can have different impacts in different locations depending on how rural the site is and the distance of the nearest dwellings. There are two main sources of noise associated with wind turbines which are:

- The mechanical noise from the gearbox and the generator.
- The aerodynamic noise generated by the rotation of the blades.

The mechanical noise has been reduced over the last number of years due to improved engineering. The aerodynamic noise of a turbine depends on the speed of the rotor blades which in turn depends on the speed of the wind; when it is windy, the sound of the wind will eliminate the noise from the turbine. Also manufacturers have changed the thickness of the blades' trailing edges in an attempt to reduce the aerodynamic noise.

More recently turbines are being made "upwind" rather than "downwind", therefore the wind hits the blades first and then the tower thus reducing the amount of noise generated. "With the pitch and control technology, the wind will go through the centre shaft and it will tilt the blades so that they will remain at the same rpm's during high winds or ordinary winds (Palmer, 2010, Q27, L80). The results of a community questionnaire showed that six out of fifteen people believed that wind power systems are noisy (Appendix H, Q8).

The effects of noise from wind energy installations can be classified into two main categories: subjective effects including annoyance, nuisance, dissatisfaction; and interference with activities such as conversation (Manwell, 2002). The following figure illustrates the amount of decibels (dB) produced by wind turbines compared to other every day activities (CANWEA, 2010).

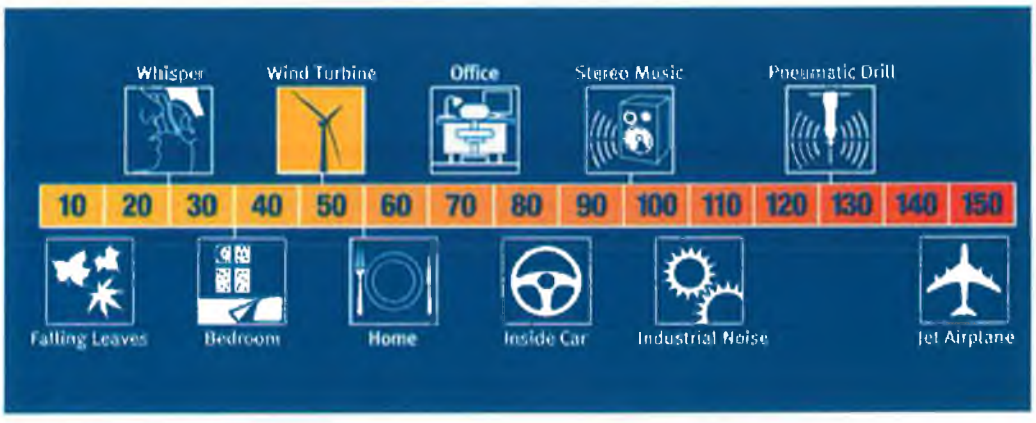

Figure 1: Decibels produced by wind turbines

4.3.1.1 Noise Report on G.M.I.T. Turbines

As regards the proposed development of wind turbines on the G.M.I.T. campus, a noise report was carried out by Eugene McKeown, a chartered engineer from Barna, Co. Galway. The report was conducted during the day and at the night on the 2/12/09. Noise measurements were taken at the boundary wall between the G.M.I.T. site and Belmont houses during the day and in the Belmont Estate at night. The results were as follows (McKeown, 2009):

Time	Duration	LAeq (average level)	LA90 (background level)
16:15	30 minutes	54.7	44.1
00:10	15 minutes	44.1	41.4

Figure 2: Noise measurements

These noise levels were determined by traffic noise levels on the R338 (Dublin Road) and other busy roads in the area. The night time background noise level was measured in low wind conditions (>2m/s). Based on his previous experience, Eugene believed that the background noise level would be likely to increase by approximately 3dB for every 2m/s increase in wind speed.

The planning guidelines for wind farm development indicate that the appropriate noise level limit is background plus 5dB (McKeown, 2009). Therefore the following limits should be applied (McKeown, 2009):

Wind Speed m/s	**2**	**4**	**6**	**8**	**10**
Background Noise Level	41	44	47	50	53
Appropriate Noise Limit	46	49	52	55	58

Figure 3: Noise level limits

The noise level from wind turbines increase as expected with wind speed, as does the background noise level. The appropriate noise limit as set out in the wind farm planning guidelines will not be exceeded at other than very close proximity to the turbines (McKeown, 2009). At no stage will the guideline noise limit be exceeded at or outside the site boundary (McKeown, 2009). As a result, there is no reason from an acoustic point of view, why the turbines could not be located at the proposed site (McKeown, 2009).

4.3.2 Shadow Flicker

Shadow flicker is caused by the rotating shadow of the rotor blades which in turn falls on neighbouring property. This shadow may block the light from a room in a particular house for a period of time. Measures should be taken to prevent any shadow flicker. Shadow flicker has been subject to investigation especially in northern Europe where it is considered a nuisance, although it is not regarded as an issue in the US (Gipe, 1995). The findings of a community questionnaire illustrated that two out of fifteen people believed that wind power systems cause shadow flicker (Appendix H, Q8).

4.3.2.1 Shadow Flicker Report on G.M.I.T. Turbines

As regards the proposed development of wind turbines on the G.M.I.T. campus, a site visit was undertaken by the RPS Galway to undertake a photographic survey of the five residential properties that are at risk of shadow flicker. The five properties are all mid 20th century, two storey semi-detached houses in the Belmont housing estate. The rears of the properties face east towards the proposed turbines location on the G.M.I.T. campus. The properties each have ground floor and first floor windows of similar sizes. There is no vegetation within the rear gardens of the five properties or within the G.M.I.T. site which would significantly affect views of the proposed wind turbines (RPS Consulting Engineers, 2009).

The findings of the shadow flicker report are as follows (RPS Consulting Engineers, 2009):

House 1

- A ground floor and a first floor window were analysed resulting in a total number of shadow flicker hours per year of 18.6, reducing to a likely 5.12 hours with weather de-rating for the ground floor and 19 hours reducing to 5.23 hours for the first floor. The property would be affected during the mornings in early spring and September.

House 2 – North east evaluation

- A ground floor and first floor window were analysed resulting in a total number of shadow flicker hours per year of 20.9 and 21.5 respectively reducing to a likely 5.76 and 5.92 hours. The rooms on this elevation of the property would be affected during the mornings in early spring and September.

House 2 – East evaluation

- A ground floor and first floor window were analysed resulting in a total number of shadow flicker hours per year of 33.4 and 32.5 respectively reducing to a likely 9.20 and 8.95 hours. The rooms on this elevation of the property would be affected during the mornings in mid spring and late summer.

House 3

- A ground floor and a first floor window were analysed, resulting in a total number of shadow flicker hours per year of 39.4 and 61.3 respectively, reducing to a likely 10.85 and 16.88 hours after weather de-rating. The property would be affected in the early morning from late spring to mid summer.

House 4

- A ground floor and a first floor window were analysed resulting in a total number of shadow flicker hours per year of 29.6, reducing to a likely 8.15 hours with weather de-rating for the ground floor and 53.3 hours reducing to 14.68 hours for the first floor. The property would be affected in the early morning from late spring to mid summer.

House 5

- A ground floor and a first floor window were analysed, resulting in a total number of shadow flicker hours per year of 0 and 7 respectively, reducing to a likely 1.93 hours for the first floor after weather de-rating. The property would be affected in the early morning in early summer.

There are no standards for the assessment of the amount of shadow flicker generated by wind turbines in Ireland, although the wind energy development guidelines refer to the issue (RPS Consulting Engineers, 2009). There is an indication that shadow flicker of up to 30 hours per year within an occupied building can be regarded as being of no material significance when assessing a wind turbine project (RPS Consulting Engineers, 2009).

As a result of the weather de-rating calculation there are no properties that are likely to experience more than 30 hours per year of shadow flicker. Houses 2, 3 and 4 experience more than 30 hours a year based on the windfarm software standard calculation however the weather de-rating calculation has been based on a figure of 27.54% of sunshine within daylight hours (RPS Consulting Engineers, 2009). This reduces the shadow flicker, in terms of hours, to an acceptable level.

Although no properties are likely to experience more than 30 hours of shadow flicker within a year, properties would be affected for up to 45 minutes during any single day, which is greater than the recommended 30 minutes (RPS Consulting Engineers, 2009). However, the effects would be experienced within the early mornings in a period between 5am and 7.30am (RPS Consulting Engineers, 2009). And as many people could be asleep at this time of day or curtains or blinds could still be closed; this eliminates the potential for shadow flicker effects.

To eliminate any potential effects on photosensitive epileptic's and to reduce the length of time within a single day that shadow flicker may occur, the operation of the wind turbine could be limited (RPS Consulting Engineers, 2009). A system is available which uses a device to measure intensity of sunlight occurring at a particular moment, and uses this, together with the date and time, location of the turbine and location of the houses to calculate whether shadow flicker will occur (RPS Consulting Engineers, 2009). If these conditions do occur the turbine is automatically turned off.

In conclusion RPS Consulting Engineers believed that the effects of shadow flicker on the surrounding buildings will not cause any material disturbance to occupants in the local area. Also shadow flicker considerations should not stand in the way of the granting of planning permission.

4.3.3 Visual Impact

The visual impact of turbines is another consideration to be taken into account. We have to be very careful about the visual impact in the rural community particularly (Roche, 2010, Q16, L102). Wind turbines are tall machines with large blades propelling on them, therefore they have a visual impact. "There are not many ways to change the visual appearance of turbines; only by changing the colour of the blades or the tower (Palmer, 2010, Q17, L46). Visually, they should be incorporated into our buildings more structurally (Roche, 2010, Q17, L123). "However we are restricted by the SEAI with regard to the erection of turbines; there are standards to be met (Palmer, 2010, Q17, L47).

Also as wind turbines require an exposed location in order to operate they become a visible part of the local area. "I believe wind turbines are actually nice, I like looking at them, but there are people out there that don't and I think that needs to be looked at as well" (Roche, 2010, Q16, L103). Recent experience suggests that opposition to wind turbines is mainly encountered during the planning stage; after commissioning the acceptability is very strong (EWEA, 2009). A community questionnaire carries out by the author showed that four out of fifteen people believed that wind power systems have a visual impact (Appendix H, Q8).

The visual impact of turbines can affect adjacent areas as well as views from a distance. It can be influenced by the existing skyline, existing nature of the landscape, location of the turbines, layout and design of the turbines, number and size of the turbines and rotation of the blades. Vertical axis wind turbines seem to be more visually appealing; they don't take up as much room even though they are not as efficient but we have to get a balance between their negative effects versus their contribution (Roche, 2010, Q17, L126).

Within the EU, wind farms are required to carry out an Environmental Impact Assessment (EIA) which identifies, describes and assesses the direct and indirect effects of the project on the landscape (EWEA, 2009). A "zone of theoretical visibility" maps define the areas from which a wind farm can be totally or partially seen (EWEA, 2009). However visual impact decreases with distance, therefore there are many zones of theoretical visibility which are as follows (EWEA, 2009):

- Zone 1 – Visually dominate: the turbines are perceived as large scale and movement of the blades is obvious. As a result the immediate landscape is altered. Distance up to 2km.
- Zone 2 – Visually intrusive: the turbines are important elements on the landscape and movement of the blades is clearly visible therefore attracting the eye in good visibility conditions. Distance between 1km and 4.56km.
- Zone 3 – Noticeable: the turbines are clearly visible but not intrusive. They are noticeable as an element in the landscape but they appear small in the overall view. Movement of the blades is visible in good visibility conditions. Distance between 2km and 8km.
- Zone 4 – Element within distant landscape: the apparent size of the turbines is very small. They are the same as any other element in the landscape. Movement of the blades is generally indiscernible. Distance of over 7km.

Overall wind turbines have relatively little visual impact, nevertheless certain sites such as National Parks or Amenity Areas need to be avoided. "Some people visually might not like them" (Palmer, 2010, Q16, L42). As wind energy is one of the most environmentally benign ways of producing electricity; we need to adapt it as climate change will severely and irreversibly change the visual appearance of our landscape in the near future.

4.3.4 Birds

Wind turbines cause many bird deaths each year as birds are colliding with power lines, turbine blades and are disturbed from their migration routes. The main causes of bird deaths are as follows (Manwell, 2002):

- Death or injury caused by rotating blades.
- Electrocution from transmission lines.
- Alteration of migration habits.
- Reduction of available habitat.
- Disturbance to breeding, nesting and foraging.

The largest causes of bird mortality include loss of habitat due to human infringement, environmental despoliation and collisions with man-made objects such as wind turbines (Sagrillo, 2003). The world's largest and most carefully monitored wind farm, Altamont Pass in California, is estimated to have killed between 2,000 and 3,000 golden eagles alone in the past 20 years (Booker, 2010). Spain has one of the three highest concentrations of turbines in Europe and, according to the Spanish Ornithological Society; they may be killing up to a million birds each year (Booker, 2010). Also a study carried out by Birdlife International shows that, each year, power lines can be responsible for up to 800 bird kills per mile (Booker, 2010).

The development of a wind farm at Keelderry on the Slieve Aughty Mountains could be halted due to hen harriers (The Connacht Tribune, 2/7/10). "Concern has been expressed about the significant effects the wind farm will have on the Hen Harrier along with the Curlew and Red Grouse" (The Connacht Tribune, 2/7/10). "According to Bird Watch Ireland, the wind farm will result in a loss of their available habitat and will also cause disturbance for the birds" (The Connacht Tribune, 2/7/10).

The findings of a community questionnaire showed that seven out of fifteen people believed that wind power systems cause a hazard to birds while two out of fifteen people believe that they have a negative impact on wildlife habitats (Appendix H, Q8). However wind farms are subject to an Environmental Impact Assessment which helps to ensure that the design and layout of the farm does not interfere with sensitive species or wildlife designated sites. The results of a community questionnaire indicated that five out of fifteen people believed that bird surveys should be undertaken to minimise the negative impact on birds (Appendix H, Q9). The British Society for the Protection of Birds has stated; "the available evidence suggests that appropriately positioned wind farms do not pose a significant hazard for birds" (IWEA, 2010). A comparative study of bird mortality by anthropogenic causes was carried out by Erickson et al. (EWEA, 2009). The results were as follows:

Causes	**Annual Mortality Estimate**
Building/ windows	550m
Cats	100m
High tension lines	130m
Vehicles	80m
Pesticides	67m
Communication towers	4.5m
Airplanes	25,000
Wind turbines	28,500

Figure 4: Bird Mortality

Bird deaths caused by wind turbines can be reduced by following some simply measures which are as follows (EWEA, 2009):

- Avoid important zones of conservation and sensitivity areas.
- Protect sensitive habitats by implementing appropriate working practices.
- Conduct an environmental monitoring programme before, during and after construction to evaluate the impact on birds.
- Design wind farms adequately therefore grouping turbines closely to avoid an alignment perpendicular to main flight paths.
- Provide corridors between clusters of turbines.
- Increase the visibility of the turbines rotor blades.
- Install transmission cables underground, where possible.
- Make overhead cables more visible using deflectors and avoiding use in areas of high bird concentrations.
- Provide adequate environmental training for site personnel.

4.3.5 Electromagnetic Interference

Electromagnetic interference (EMI) is any type of interference that can potentially disrupt, degrade or interfere with the effective performance of an electronic device such as a television, radio or a microwave (EWEA, 2009). "Wind turbines can cause electromagnetic interference which can interfere with televisions, radios or microwaves in the local area" (Householder, 2010, Q12, L19). Wind turbines can actually do damage to radio signals and mobile phones as they create distortion of radio signals (Roche, 2010, Q16, L122). Therefore the possibility of EMI should be assessed and measures taken to avoid interference, including a provision to solve any problems caused by the operation of the wind turbines.

EMI is caused mainly by the turbine blades which sometimes scatter the signals as they rotate, also the tower may reflect signals therefore interfering with the original signal arriving at the receiver (Manwell, 2002). However modern blades are made of synthetic materials which have a minimal impact on the transmission of electromagnetic radiation (EWEA, 2009). If a wind energy project is proposed on the route of an electronic device link (television, microwave, aircraft navigation or landing systems) then any adverse impacts can be avoided by re-sitting the wind turbines or by re-routing the link. Also if the local television signal seems to be affected; this can be resolved by technical solutions.

4.3.6 Safety

Safety is always a major concern when dealing with any construction project. Tourists may be visiting wind farms and there is the remote possibility of a damaged rotor blade being thrown from a turbine; however this concern is limited due to proper maintenance of the turbine taking place annually. Also there is a remote chance of fragments of ice flying from the blades of turbines in extremely cold conditions; however in Ireland we do not experience long periods of frost unlike other countries. Nevertheless it is recommended that an exclusion zone be constructed around areas frequented by large numbers of people. The results of a community questionnaire showed that one out of fifteen people believed that wind power systems are dangerous while another person believed broken blades are a major concern (Appendix H, Q8).

There is no fencing required around wind turbines because they are sealed units thus people and livestock can safely walk right up to the turbines without causing any injury or harm. Also the height and rotation of the blades of the turbines may cause a distraction to motorists resulting in possibly accidents. Each wind farm development consists of safety reports ranging from the manufacturers of the wind turbines to the developing company working on the job.

Also wind energy projects should be sited so as not to cause any hazards to aircraft in the area. Aircraft authorities should be consulted before development takes place to ensure safety for the public at all times. In addition wind turbines located near airports may physically interfere with flight paths therefore a flashing red light is placed on top of the wind turbines to signify their existence.

4.3.7 Ecology, Archaeology, Geology and Heritage

The construction works and operational phases of wind turbines can impact significantly on the ecology, archaeology, geology and heritage of an area. Wind farm construction can cause significant damage to the nearby ground resulting in the drying out of the soil and compaction of peatlands leading to habitat destruction. Peatlands are natural carbon storage systems with a delicate equilibrium of waterlogging (EWEA, 2009). With regard to flora and fauna, it is suggested that wind farms be excluded from blanket bog areas to minimise damage. Flora and fauna needs to be thought of in every wind energy development in relation to their loss of habitat, sensitivity to disturbance and to their importance. Therefore an ecologist needs to be on site at an appropriate time of the year to carry out an assessment on all of the flora and fauna present and to ensure minimum damage is caused to their habitat. The findings of a community questionnaire showed that one out of fifteen people believed that wind power systems are a hazard to biodiversity (Appendix H, Q8).

Overall a well designed wind energy project should not result in the loss of valuable habitat, adverse impacts on protected species or any physical disturbance to possible archaeological sites. From an archaeology point of view, examination of the site plans will identify the existence of any area of significant archaeological importance within or near the site. If there are any areas worth consideration, trial holes should be excavated to investigate into the possibility of any significant discoveries. Nevertheless an archaeologist must be on the wind project site while all excavations are taking place.

4.3.8 Construction

When the construction works begin in a wind energy project; they will inevitably result in a huge increase in the volume of heavy good vehicles on the roads for a period of time. The vehicles transporting the wind turbine components have a considerable amount of weight of board therefore damaging the roads. All planning during construction work should involve the local county council and the local community. Construction works result in many impacts on the environment which are as follows:

- Damage to the local road network due to heavy good vehicles.
- Damage to vegetation due to construction vehicles.
- Difficulty in the re-establishment of vegetation after excavating the site.
- Noise from machinery operating at the construction site.

In early 2010, the construction of a new road to give access to a wind farm in the Corrie Mountains in Co. Leitrim ruined the River Owengar (The Irish Daily Mail, 11/2/10, P21). "One wind farm accident has killed 6,000 fish and destroyed a river" (The Irish Daily Mail, 11/2/10, P21). "The fish, mainly trout, were lost when tonnes of peat swept through the River Owengar" (The Irish Daily Mail, 11/2/10, P21). The ESB and Coillte pleaded guilty and have to pay €500,000 to restore the river (The Irish Daily Mail, 11/2/10, P21).

4.4 Positive Economic Impacts

There are a number of positive economic impacts of a wind power system which are as follows:

4.4.1 Employment

The wind energy industry creates many job opportunities for people. "Wind turbines create jobs as people are required throughout the whole process from designing to maintaining the turbines (Farmer, 2010, Q14, L36). These career opportunities can be in the turbine design, development, manufacturing, installation or maintenance areas. Also spin-off career opportunities exist in the areas of research and development, planning, legal work, engineering, construction, environmental services, consultancy, marketing, sales, finance, publishing and education. The findings of a community questionnaire showed that seven out of fifteen people believed wind power systems create jobs for the local area (Appendix H, Q10).

Also there are employment prospects in the many government agencies being established in accordance with the wind energy industry who offers information and advice to the public such as; Sustainable Energy Authority Ireland (SEAI) and the Irish Wind Energy Association (IWEA). It is important to highlight the need for local communities to perceive that they receive some of the benefits of wind power and not just the costs (Gipe, 1995). "There are major opportunities in the energy sector for jobseekers that may have been made redundant" (The Galway Independent, 21/4/10, P50).

Also Eirgrid have announced plans to upgrade Ireland's electricity network to enable them to transmit power to different parts of Ireland but also to create 300 jobs through sub-contracting work on the network (RTE News, 2010). Also C&F Green Energy in Athenry expect to create up to 200 jobs between 2011 and 2012 in the wind energy sector (Galway News, 2010).

4.4.2 Income

Wind energy can supplement the income of Irish farmers especially along the western seaboard as there is huge potential for wind energy along the Atlantic coast. The incomes of these farmers have decreased substantially over the last number of years thus the majority of them have a job either part-time or full-time. "With the current downturn in rural incomes, and the economy in general, many farmers are looking at alternative methods of generating income and reducing farm costs" (The Irish Independent, 1/12/09, P12). As many of these farmers have land at relatively high altitudes which suits wind farm development; they can be a net beneficiary from it. They can achieve this by a number of ways:

- Leasing land to developers to erect wind turbines.
- Selling land to developers to erect wind turbines.
- Erecting wind turbines themselves to produce electricity thus reducing their electricity costs for the household and the farm.

Dairy farmers can benefit substantially from producing their own electricity through wind turbines as they consume huge amounts of electricity in their daily farming practices. "As I am a dairy farmer for over the last 30 years I thought a wind turbine is just what I needed to produce cheap electricity for my milking parlour and my house" (Farmer, 2010, Q2, L5). The farmer stated that his average ESB bill worked out at approximately €220 every month before he erected his turbine (Farmer, 2010, Q9, L20). After the turbine was erected his average ESB bill reduced to €150 per month (Farmer, 2010, Q10, L22).

As regards a domestic householder, her average ESB bill was costing €90 per month (Householder, 2010, Q9, L13). After she purchased a turbine, the ESB bill reduced to approximately €60 per month (Householder, 2010, Q10, L16). As regards another domestic householder, his average ESB bill was costing €130 per month (Householder, 2010, Q9, L11). After he purchased a wind turbine, his ESB bill reduced to €90 per month (Householder, 2010, Q10, L16).

The results of a community questionnaire showed that nine out of fifteen people are spending €100 or less on their electricity per month, five people are spending €100-€150 per month while one person is spending €150-€200 per month (Appendix H, Q6). If these people erected a wind turbine; their savings would be huge especially for the people spending more than €100 per month on electricity. Also the community questionnaire indicated that four out of fifteen people believed wind power systems help people to save money on their ESB bills (Appendix H, Q10).

4.4.3 Inflation

Ireland is very vulnerable to high energy costs as it spends €6 billion/year to purchase fuel from abroad. It is argued in the Irish Farmers Journal, (IFJ) that; "Ireland is the most dependent and exposed country in Europe to fluctuations and variables in the marketplace" (IFJ, 7/11/09, P 11). In the past there was high unemployment and inflation in Ireland and if we are to ensure that this does not occur again; we need to focus on renewable energy sources such as wind.

4.4.4 Independence

If we start generating our electricity locally by using wind turbines, we will be independent from the national grid (Roche, 2010, Q18, L132). This would have a real positive effect on our disposable incomes. Liam Shannon, an Ennistymon farmer believes in establishing community based wind farms (The Irish Independent, 26/1/10). He asserts that "people in the local community generally miss out on the direct benefits of wind energy" (The Irish Independent, 26/1/10). Liam believes that "this type of development will put real income back into the locality" (The Irish Independent, 26/1/10). The community-based model has worked in the UK and Denmark thus Liam firmly believes "Ireland could now catch up" (The Irish Independent, 26/1/10). "With a wind turbine you have a sense of independence as you are not 100% relying on the ESB for your electricity needs" (Householder, 2010, Q14, L24).

Also it would be particularly useful in places like schools where there is minimal attendance as the kids are there from 9 o'clock to 3 o'clock in the afternoon but wind turbines generate electricity all day every day (Roche, 2010, Q18, L132). This is an area that is definitely worth further investigation as the resulting benefits are huge. A community questionnaire carried out by the author illustrated that three out of six people would erect a wind turbine as they believe wind energy is our future (Appendix H, Q3). Also the community questionnaire indicated that two out of fifteen people believed wind power systems create a sense of independence for their owners (Appendix H, Q10).

4.4.5 Affordable

The price of wind turbines has decreased substantially over the last number of years due to new entrants in the market. Wind turbines are producing electricity more cheaply than coal power stations (Airtricity, 2010). The UK Government's figures show that all wind power will be cheaper than nuclear power by 2020 (Airtricity, 2010). Between 1990 and 2002, world wind energy capacity doubled every three years and with every doubling prices fell by 15% (CANWEA, 2010). Once a wind farm is in place, there are no fuel or waste related costs (CANWEA, 2010).

The RoCo Ampair 600 watt, grid tie wind turbine costs €4,200; the Taos 1.5kW, direct water heating wind turbine costs €3,750; the Taos 2.0kW, grid tie wind turbine costs €5,000 and the Ampair 6.0 kW, grid tie wind turbine costs €16,800 (Roche, 2010, Q8, L43). These prices are competitive prices as RoCo Wind Energy are trying to be the first movers in the market. The C&F Green Energy 6Kw starts off at €22,000; the 11Kw starts off at €30,000 while the 15Kw starts off at €40,000 (Palmer, 2010, Q8, L18).

The results of a community questionnaire carried out by the author illustrated that four out of six people are willing to pay €15,000-€20,000 for a wind turbine while the remaining two people are willing to pay €10,000-€15,000 for a turbine (Appendix H, Q4). People believe turbines are affordable as they are a long-term investment (Farmer, 2010, Q14, L34). Also the community questionnaire showed that one out of fifteen people believed wind power systems are affordable (Appendix H, Q10).

4.4.6 Payback

The payback of a wind turbine depends on the location, size and cost of the turbine. Manufacturers work out the payback associated with each individual turbine. "We evaluate each site and we try to determine the wind speed versus what the customer is actually going to be paying for the turbine then we can work out the payback for a turbine" (Palmer, 2010, Q18, L49). An 11kW turbine costing €30,000 would have a payback of €35,000 (Palmer, 2010, Q18, L50). At the moment, it is very strong for agriculture as farmers can write off the turbine for an eight year period (Palmer, 2010, Q18, L51). "Like many farmers, the decision to invest in renewable energy comes down to payback time" (The Irish Farmers Journal, 3/7/10, P3).

Wind energy is not a quick paying business; it takes time as everyone is learning while the technology is evolving and developing. "While the investment is made today, it still has to pay for itself in 15 years time, we have to ensure that is the case so as a result the producer and manufacturers are being extremely cautious in promoting these products for that reason" (Roche, 2010, Q14, L86).

4.4.7 Life Span of Turbines

Wind turbines are typically designed to last around 20-25 years both on a domestic and commercial front (Palmer, 2010, Q22, L64). This is the case as both types of turbines have exactly the same chassis, same frames and the same high-quality technology of pitch and control (Palmer, 2010, Q23, L65). However during this time they will need annual maintenance and some parts may need replacing. C&F Green Energy provide a three year warrantee and give the customer an option to extend it to ten years for an extra cost of approximately €3,000 (Palmer, 2010, Q7, L16). This means the customer does not have to worry about the turbine for at least 10 years which works out at approximately €400/annum (Palmer, 2010, Q7, L17).

RoCo Wind Energy are looking at the possibilities of spending in the region of €150 to €200 per year just on a routine maintenance (Roche, 2010, Q7, L38). This maintenance would involve a visual inspection, checking the bearings and in some cases cleaning the blades because they can become covered in dust and moss rendering them inefficient (Roche, 2010, Q7, L41). "A wind turbine is long-term investment which is relatively affordable due to its long life span" (Householder, 2010, Q14, L23).

4.4.8 Demand

Wind turbines have become very popular in the countryside over the last number of years. There is a sufficient demand for wind power systems both on a domestic and business front (Palmer, 2010, Q10, L20). Wind turbines are a great long-term investment for any domestic dweller as you are saving the environment and saving money as well (Householder, 2010, Q20, L35). As wind turbines are relatively new to most people; the whole green energy concept is gaining tremendous pace.

Promotional activities such as the Volvo Ocean race and the Ploughing Championships play an important role in bringing wind energy to the forefront. "There has been a huge amount of interest especially at the Ploughing Championships with people queuing up to speak to us about the turbines" (Palmer, 2010, Q10, L23). The Ploughing Championships in 2009 resulted in three days of non-stop business for C&F Green Energy with nearly 500-600 potential customers which was phenomenal (Palmer, 2010, Q10, L25).

As the market for wind energy is only in its infancy stage yet; there is huge potential to expand it. "At the moment, wind energy at a micro level in Ireland is only in its infancy" (Roche, 2010, Q11, L52). "The fact that we can guarantee our product is an Irish product, we are not going to be looking at turbines parked up; this is one thing we will not stand for at C&F" (Palmer, 2010, Q12, L30). The most important issue for manufacturers is making people aware of wind energy (Palmer, 2010, Q24, L66). This can be done through seminars, meeting the public, renewable shows, word of mouth, media and advertising (Palmer, 2010, Q24, L69).

4.5 Negative Economic Impacts

There are a number of negative economic impacts of a wind power system which are as follows:

4.5.1 Economic Policy

At the moment there are tariffs in place by the ESB regarding exporting electricity back to the grid. The main negative economic impact is the fact that tariffs are in place at the moment compared to other European countries (Palmer, 2010, Q19, L57). For example, if you are in Germany and exporting back to the grid; you will receive 40c/unit while if you are in Spain and exporting back to the grid; you will receive approximately 42c/unit (Palmer, 2010, Q18, L53). However with the economic policy in Ireland; you will only receive 19c for the first 3,000 extra kilowatts that you produce and 9c thereafter (Palmer, 2010, Q18, L53). As a result there is no incentive from an Irish point of view to get involved in wind energy.

The findings of a community questionnaire revealed that one out of fifteen people believed the ESB's policy was having a negative impact on the wind industry while two out of fifteen people believed that the reduced export rate was also a major negative for the industry (Appendix H, Q11). Also the community questionnaire revealed that three out of fifteen people believed that the ESB should review their policy to ensure sustained growth in the wind energy industry (Appendix H, Q12).

For example, if you have a house that is producing 20,000 kilowatts per year and you are using 10,000 kilowatts so you have 10,000 more kilowatts that you can sell to the ESB. Out of the excess 10,000 kilowatts, 3,000 units are at 19c while the remaining 7,000 is at 9c where if you were in Germany or Spain you would get 40c and 42c respectively (Palmer, 2010, Q18, L55). These tariffs are set by the ESB until the end of 2012 (Palmer, 2010, Q20, L58).

"I think the ESB have to drive down their own carbon footprint so therefore they will try to make people to become as green as possible whether it will be through wind, solar or hydro" (Palmer, 2010, Q20, L59). Also as part of the legislation regarding wind turbines; there is only one turbine permitted per house. A major disappointment is that, it is one turbine to one house (Palmer, 2010, Q21, L60). This is a disgrace as if a farmer was building two houses for his two sons, he could buy a 15Kw turbine and split the generator to 5kw, 5kw and 5kw for the three houses but the ESB won't allow this (Palmer, 2010, Q21, L61). As a result the parties involved would save a lot of money however this is not allowed. "It's all back to the ESB; they will have to change their policy to incorporate this issue" (Palmer, 2010, Q21, L63).

4.5.2 Jobs

As we know wind energy creates many employment opportunities however some of these may be at the expense of jobs in the fossil fuel industry. Also there are a number of wind turbines still being imported to Ireland even though there are a lot of manufacturers here such as RoCo Wind Energy in Mountbellew, Co. Galway and C&F Green Energy in Athenry, Co. Galway. As a result fewer jobs are being created in designing, manufacturing and installing wind turbines.

4.5.3 Developers

Farmers need to be cautious when they are approached by wind energy developers. "Farmers are often approached by unscrupulous developers who demand an option agreement to allow the land be used before planning is signed" (IFJ, 24/4/10 P14). The farmers are told they must use a solicitor nominated by the wind developer (IFJ, 24/4/10 P14). "This is unacceptable, and farmers should insist they receive adequate independent advice from a solicitor of their choosing" (IFJ, 24/4/10 P14).

Jer Bergin, IFA's climate change and renewable project team chairman is concerned about wind developers 'flipping-over' options, once grid connection and planning is secured (IFJ, 24/4/10 P14). When a farmer enters into an agreement with one company; this company then sells the agreement to another company for hundreds of thousands of euros while the farmer does not get any income from the agreement (IFJ, 24/4/10 P14). "The farmer must ensure that a clause is included in the agreement, which allows the farmer to receive a large percentage of the 'flipping-over' fee" (IFJ, 24/4/10 P14). Also farmers need to be vigilant when they are signing a lease agreement. "It is crazy to think that some farmers sign a lease agreement for €1, which effectively sterilises the land while the wind developer carries out site investigation, works and applies for planning permission and grid connection" (IFJ, 24/4/10 P14).

4.5.4 Grants

There are no grants currently available for erecting wind turbines which is a huge negative for the industry. "There are no grants currently available for wind turbines" (Palmer, 2010, Q13, L34). There were grants available in 2009 but very few customers filled out the paperwork to meet the grant requirements because of the amount of detail required (Palmer, 2010, Q13, L32). A dairy farmer interviewed stated that; "C&F informed me about grants that were available at that time but I looked at an application form for one of them and to be honest with you, I would nearly be still filling it out" (Farmer, 2010, Q6, L13). "The most negative economic impact on me was that of receiving no grant for the erection of the turbine" (Householder, 2010, Q15, L31).

The results of a community questionnaire indicated that four out of fifteen people believed that the non-availability of grants was a having major negative impact on the industry (Appendix H, Q11). Also the community questionnaire revealed that four out of fifteen people believed that grant assistance should be provided as an incentive for people to erect wind turbines (Appendix H, Q12).

However, the SEAI are completing a preliminary study on wind energy at the moment. They have pilot schemes operating around the country and they are hoping to come up with some conclusions from them; in the form of potentially offering people capital grants towards the installation of wind turbines (Roche, 2010, Q13, L68).

4.6 Summary and Conclusions

The research findings has analysed the positive and negative environmental and economic impacts of a wind power system on a small rural community in East Galway. Most importantly wind energy can alleviate our countries dependency of fossil fuels because we have one of the best wind resources in the world. Also wind turbines do not contribute to global warming which is a major concern within our country. On the other side, wind turbines cause a hazard to birds and a visual and noise nuisance to individuals. This was highly relevant to the study as it sectionalised the research question into specific elements and answered them accordingly. The following chapter will focus on discussing the research findings from the study.

5. Chapter Five: Discussion

5.1 Introduction

This chapter discusses the research findings in light of the literature review and presents the answer to the research question as supported by the data. It looks at future proposals regarding our electricity needs such as electric vehicles and smart metering.

5.2 Electric Vehicles

In the Carbon Budget of 2008, the Minister for the Environment John Gormley announced that the Government are planning to have 10% of the national road fleet to be powered by electricity by 2020 (RTE, 2008). Due to its relatively small size, "Ireland is ideally suited for the introduction of electric vehicles and as a pilot for the rest of Europe" (The Connacht Tribune, 16/4/10, P44). This would result in 200,000 electric vehicles on our roads by 2020. There will be many provisions including (RTE, 2008):

- A €1 million research and development fund.
- Tax incentives for companies buying electric vehicles.
- Assistance to individual buyers such as no vehicle registration tax, half the cost of the battery and very low road tax.

As the Irish transport sector is one of the fastest growing greenhouse gas sectors; it is vital that we take action and power electric vehicles from renewable sources such as wind turbines thus significantly reversing the trend (RTE, 2008). As a result Ireland's transport reliance on imported petrol and diesel will be reduced considerable (RTE, 2010). At the moment we are 100% dependent on importing fuels for our cars costing us several billion euros per year (RTE, 2010).

On the 26/3/10, the ESB unveiled Ireland's first on-street points for electric vehicles (RTE, 2010). "Ireland will be one of the first countries in the world to have a nationwide electric charging network which will offer opportunities for enterprise and job creation, as well as the obvious environmental benefits of ultimately having a decarbonised transport fleet" (The Connacht Tribune, 16/4/10, P44). The ESB plans to have 1,500 charging points installed by 2011 between Dublin, Cork, Limerick, Galway and Waterford (RTE, 2010). It is expected that 2,000 drivers will be using electric vehicles by 2011 (RTE, 2010).

5.3 Smart Metering

In terms of micro generation smart metering refers to a sophisticated method of electricity metering which typically calculates the amount of electricity units that a micro generator has consumed as well as amount of units they have exported onto the grid (IWEA, 2010). This information is then connected back via a network to the supplier for the purposes of monitoring and billing (IWEA, 2010). Smart metering is more than just meters; it is a complex engineered system of sensors, devices, communications, and software technologies (McGuinness, 2010). It brings benefits across the industry for customers, the regulator, the economy, networks business and for suppliers which are as follows (McGuinness, 2010):

5.3.1 Customers

- Tariff choices
- Own generation
- Information/control
- Better quality services

5.3.2 Regulator

- Market competition
- New tariff models
- Performance drivers

5.3.3 Economy

- Sustainability target
- Research and development opportunities
- Fuel security

5.3.4 Networks business

- Quality of supply
- Asset utilisation
- Meter reading and operations

5.3.5 Suppliers

- Value added services
- Customer service

5.3.6 Smart Metering Plan

Ireland's national smart metering plan is as follows (McGuinness, 2010):

- Government policy – 2007.
- Ongoing regulatory process – 2007.
- Discussion paper – demand and consumption reduction key – 2008.
- Industry program – steering group – 2009.
- Trials – 2009.
- National business case – 2011.

- Requirements and functionality - ?
- Full roll out commence - ?

Overall, it is an immense challenge but with potentially huge benefits for Ireland and all electricity customers (McGuinness, 2010).

5.4 Recommendations

The author has compiled the following recommendations for the future prosperity of the Irish wind energy industry:

5.4.1 Research and Development

There needs to be further research and development carried out on wind energy in Ireland as we have the resource but we are not utilising it to the full extent we should be. We have an untapped resource and we have huge potential in terms of wind but we also have huge investments to make (Roche, 2010, Q15, L98). At the moment, the whole wind industry is experiencing a learning curve effect (Roche, 2010, Q17, L128). Testing is a big issue; it has to be done over a long period of time (Roche, 2010, Q5, L16). As a result micro wind generation is not a fully developed technology as of yet.

When we are researching and developing wind energy; we have to look at the real costs not just financial costs; there are environmental costs and the impact on our own quality of life and the future for our children (Roche, 2010, Q24, L154). This is where the education and training needs to take place. John Flaherty of C&F Green Energy has completed research and development to a satisfactory level thus his business is growing. Ireland needs to take note and do likewise to ensure we grasp this opportunity with both hands. John saw a niche in the market for green energy and invested resources worth nearly €3 million into research and development (Palmer, 2010, Q2, L3).

As a result of inadequate research and development being carried out on wind energy, people are uncertain of what they should do. In Ireland we are being very cautious about how we are promoting wind energy at a micro level because it is only at an infancy stage yet; it is an evolving technology (Roche, 2010, Q14, L85). "There is a long way to go before it becomes mainstream but we are working on that as a company" (Roche, 2010, Q17, L130). "There is a possibility that micro generation is not a runner at all but we can't discount the fact that it is a possibility" (Roche, 2010, Q16, L111). A community questionnaire resulted positively in terms of future potential when eleven out of fifteen people believed that wind power systems will become popular in the local area (Appendix H, Q15).

5.4.2 Awareness

People's awareness needs to be increased substantially regarding the environmental situation that we are experiencing as our emissions are becoming a major concern. "I think making people aware is very important" (Roche, 2010, Q21, L142). This would involve the generation of awareness in people to inform them of where this energy is coming from and how it is being generated (Roche, 2010, Q21, L143). "I believe awareness of wind turbines has to be definitely increased" (Farmer, 2010, Q18, L47). "People need to be educated about wind energy and how it can save our environment for future generations" (Farmer, 2010, Q19, L52).

The results of the community questionnaire illustrated that 100% of people surveyed believed that there is not adequate awareness of wind power systems in the local area of Gurteen (Appendix H, Q15). Also the community questionnaire revealed that ten out of fifteen people are not aware of the promotion of wind power systems in the local area while five people were aware (Appendix H, Q14). Six out of fifteen people believed awareness should be increased while four out of fifteen people believed advertising should be increased (Appendix H, Q15).

The IWEA, the government and Meitheal na Gaoithe need to make people aware of the alternatives that are available such as wind energy. People can be made aware through seminars, meeting the public, renewable shows, word of mouth, media and advertising (Palmer, 2010, Q24, L69). Thus wind energy needs to be promoted as a renewable source that has the capacity to satisfy our energy requirements in the future.

5.4.3 Centre of Excellence

The author recommends that Galway should be deemed a centre of excellence for wind energy. "I have spoken to the Mechanical Engineering Departments at N.U.I.G. and G.M.I.T. to make Galway a centre of excellence for wind energy" (Roche, 2010, Q30, L225). Galway has one best wind resources not only in Ireland but possibly in the world. We are in the right location, on the edge of the Atlantic Ocean which is probably one of the best wind resources in Europe (Roche, 2010, Q30, L228). Galway can lead the way for the green revolution and be a state of the art knowledge base for wind energy. "We should be leading the continent to be working on green solutions" (Roche, 2010, Q30, L227). "We should set the standard as regards environmental friendly initiatives and wind energy is most definitely one of these" (Householder, 2010, Q22, L43).

5.4.4 Irish Through and Through

The government should ensure that all wind turbines erected in Ireland are manufactured within Ireland thus more employment will be created. "I believe in manufacturing in Ireland, an Irish wind turbine for Irish wind conditions and for Irish consumption" (Roche, 2010, Q15, L96). "For the Irish market we try to produce a wind turbine which is an Irish produced product for the Irish conditions" (Roche, 2010, Q26, L191). "The fact that we can guarantee our product is an Irish product, we are not going to be looking at turbines parked up; this is one thing we will not stand for at C&F" (Palmer, 2010, Q12, L30). Also wind turbines may become cheaper as a result because import levies and transport costs will be eliminated.

As we created the situation that we are in with our emissions becoming a serious worry; we can resolve the problem by changing to wind energy. Primarily, we have an Irish solution to an Irish problem (Roche, 2010, Q26, L194). It may not work for other countries, but certainly we can lead the way if we have the mindset to do it, politically and on all levels (Roche, 2010, Q31, L242).

5.4.5 Grants

There are no grants currently available for erecting wind turbines which is a huge issue within the industry. The SEAI, IWEA and the Irish government need to come together and set out a plan for making grants available to people who erect wind turbines. The SEAI are conducting research in this area at the moment but there are no conclusions as of yet. Jimmy Roche believes that grants have to be offered in order to encourage people to change to wind energy thus saving the environment for future generations. "Grants should be re-introduced to encourage people to erect turbines as they are the way forward (Farmer, 2010, Q16, L41). "I believe there should be grants made available for people putting up turbines as they would act as a major incentive" (Householder, 2010, Q16, L32).

5.5 Summary and Conclusions

This chapter has discussed the research findings in light of the literature review. It looked at future proposals regarding our electricity needs and concluded with recommendations for the industry as a whole. This was highly relevant to the study as it put the future into perspective regarding the wind energy industry. The following chapter will conclude the research question by looking back on the whole process.

6. Chapter Six: Conclusion

This chapter will conclude the research question by looking back on the whole process. Wind energy has played a major role in the past and will have a significant contribution to make in the economy in the future. The industry as a whole is developing rapidly; moving from a technological stage to a commercial stage. It will play a central role in combating climate change in Ireland. As Ireland has one of the best wind resources in the world with the Atlantic coast; it would be a huge shame not to tap into it and acquire the resulting benefits. The red and blue areas on the European Wind Atlas show the highest wind speeds in Europe; almost the entire country of Ireland has either an excellent or very good wind resource (SEAI, 2010). Wind energy produces no waste products, no gas emissions or no pollutants so we should ensure that it is at the centre of our attention in the future.

As regards Gurteen, a small rural community in East Galway, it does not have many incentives at its disposal to offer potential businesses setting up compared to the more developed parts of Ireland. The government was giving generous incentives but this has been cut back due to the amount of debt the country is experiencing at the moment. However, the future for Gurteen and other rural communities in East Galway looks bright as it has the capacity to produce cheap electricity through wind turbines which may be the most attractive incentive of all for businesses to establish themselves in the region.

Wind energy can provide many positive and negative environmental and economic impacts on a small rural community like Gurteen. However we can not continue with our trends in the future as they are unsustainable. We are relying heavily on fossil fuels at the moment which are damaging our environment as well as our own health. In any event the supply of fossil fuels is finite and near exhaustion point. Also we are dependent on energy imports which position us in an extremely vulnerable situation as we are exposed to a number of external influences which we have little or no control.

As a country, there is an urgent need to examine the alternative energy sources available including wind energy in order to be independent and ensure a secure supply of energy for the country in the future. The author hopes that by compiling this thesis; it has given the reader a greater understanding of the many positive and negative environmental and economic impacts of a wind power system on a small rural community in East Galway. It is hoped that this thesis in the future may provide a framework on which wind energy can be further built upon.

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8. Appendix A: Letter to the Ethics Committee

Padhraic Dilleen,
G.M.I.T.,
Dublin Road,
Co. Galway.

Ethics Committee,
Co. Galway.

Dear Ethics Committee,

I am currently undertaking a Masters programme in Business Studies at G.M.I.T. and I am required to undertake a research study as part of my curriculum. I will carry out my research on the environmental and economic impacts of a wind power system on a small rural community in East Galway.

I would be very grateful if you would consider my request to collect data from people who produce, install and maintain wind power systems, people who have installed wind power systems and people who may install wind power systems in the future. All of my target population are from East Galway. I have enclosed a copy of the research proposal. I hope you will consider my application favourably. Any further information that you may require will be forwarded on request.

Yours Faithfully,
Padhraic Dilleen

9. Appendix B: Participants Approval

Padhraic Dilleen,
G.M.I.T.,
Dublin Road,
Co. Galway.

The Participants,
East Galway,
Co. Galway.

Dear _____.

I am currently undertaking a Masters programme in Business Studies at G.M.I.T. Part of the requirements of this study is to undertake research, which I will carry out using participants from East Galway.

The focus of the study I have chosen will explore the environmental and economic impacts of a wind power system on a small rural community in East Galway. In order to carry out this study, I will require your voluntary assistance. It will involve your participation in a survey/interview/questionnaire. All of the surveys/interviews will be tape-recorded. You may ask any questions about the procedure-taking place and you will be answered honestly. You are free to withdraw from this study at any time without this decision affecting you in any way.

If you are willing to participate in the study, please include your contact details, stating a suitable time for me to contact you. I will enclose my name and contact number at the end of this letter.

This is to certify that I _____ hereby agree to participate in the above study.
Participants Signature: _____
Date: _____

Researchers Name: _____

Researchers Signature: _____

Date: _____

10. Appendix C: Interview with RoCo Wind Energy

RoCo Wind Energy has its headquarters in Mountbellew, Co. Galway. They offer on-grid turbines, off-grid turbines and heating systems to the marketplace. Their range includes 0.6kW, 1.5 kW, 2.0 kW and 6.0 kW turbines. All RoCo's products come with a two year warrantee and service can be offered by the company after the warranty period.

The RoCo Ampair 0.6 kW off/on grid wind turbine is available in three versions. The battery charge version is available for charging, 24V or 48V battery banks and the grid-connected version is available for connection to 240V electrical network ('the grid'). The RoCo Taos 1.5 kW wind heating system can be used as a secondary heating for oil/gas boilers to save energy and reduce CO2 emissions. It can produce nearly 10,000Kcal/day at a monthly average wind speed of 6m/sec. In other words it can heat a 200 litre tank up to 50°C and reduces the CO2 emissions by up to 20Kg/day.

The RoCo Taos 2 kW grid tie wind turbine features a downwind passive yawing, a very reliable programmed microprocessor controller and an efficient on-grid inverter. It is the best option for grid applications. Also the RoCo Ampair 6 kW wind turbine is available in the market. When installing a turbine, the mast should be at least twice the height of the house if it is erected beside it. Also the mast should be at least six metres higher than the highest obstacle within 150 metres.

Thematic Analysis Coding

Operation itself =	OI	Forward thinking =	FT
Costs involved =	CI	Future potential =	FP
Irish made =	IM	Advertising campaign =	AC
Customer service =	CSe		
Prices =	P		
Top technology =	TT		
Positive environmental impact =	PEnI		
Negative environmental impact =	NEnI		
Positive economic impact =	PEcI		
Negative economic impact =	NEcI		
Tariff problem =	TP		
Grants problem =	GPr		
ESB policy =	ESBP		
Government policy =	GPo		
SEAI standards =	SEAIS		
Domestic demand =	DD		
Business demand =	BD		
Local involvement =	LI		
Awareness =	A		
Current status =	CSt		
Self sufficient =	SS		

Participants Approval

Padhraic Dilleen,
G.M.I.T.,
Dublin Road,
Co. Galway.

The Participants,
East Galway,
Co. Galway.

Dear Jimmy,

I am currently undertaking a Masters programme in Business Studies at G.M.I.T. Part of the requirements of this study is to undertake research, which I will carry out using participants from East Galway.

The focus of the study I have chosen will explore the environmental and economic impacts of a wind power system on a small rural community in East Galway. In order to carry out this study, I will require your voluntary assistance. It will involve your participation in an interview, which will be recorded. You may ask any questions about the procedure-taking place and you will be answered honestly. You are free to withdraw from this study at any time without this decision affecting you in any way.

This is to certify that I Jimmy Rache hereby agree to participate in the above study.

Participants Signature: Jim Rache
Date: 17-FEB-09

Researchers Name: Padhraic Dilleen
Researchers Signature: Padhraic Dilleen
Date: 17/2/10

RoCo Wind Energy Interview with Jimmy Roche on 17/2/10

Question 1: When did you start manufacturing wind power systems?
Line 1: We started two years ago conducting research and development. (OI)
Line 2: We have developed a couple of different prototypes. (OI)

Question 2: Why did you start manufacturing wind power systems?
Line 3: For a number of years, we are interested in wind energy since the mid seventies when we built our own vertical axis wind turbine in Gurteen. (FT)
Line 4: It's only been removed there recently, we had a 15kW generator on that and it worked but at that time we didn't pursue it any further because there was not a huge amount of interest. (FT)
Line 5: Second reason is because of the economic downturn we had to look at alternatives with our business because you have to be able to re-invent yourself when you are in business to ensure you are not producing the same product for ever and ever. (FT)
Line 6: Particularly in Ireland because it has a very limited market. (FT)

Question 3: How many models of wind power systems do you sell?
Line 7: We have four wind power systems on offer which are not our own brand; the RoCo Ampair 0.6 kW off/on grid, the RoCo Taos 1.5 kW wind heating system, the RoCo Taos 2 kW grid tie wind turbine and the RoCo Ampair 6 kW wind turbine. (P)
Line 8: They are a simple solution and a simple way of capturing wind. (OI)
Line 9: Wind is a form of energy that is available to us all; it's a matter of capturing it in the most suitable way. (OI)
Line 10: When you think about it, we have doing it for many years in the form of putting our clothes outside on the line to dry; that's wind energy. (OI)
Line 11: When you are thinking about wind energy, don't be thinking about electricity, don't be thinking about machines up on poles; it's not just about that. (FT)

Line 12: It's about thinking in terms of ways of renewable energies, it's about discovering renewable energy and the whole philosophy of replacing fossil fuels really which are going to run out and are running out, we have to be ready for that if not for ourselves definitely for our children in the future. (FT)

Question 4: What are the differences between each model?
Line 13: The strength is the main difference between each model. (OI)
Line 14: You can build in efficiencies into them that will change their output. (OI)

Question 5: What costs are involved in the production of wind power systems?
Line 15: The manufacturing cost firstly, we have to employ people and get a manufacturing facility to do a lot of prototyping and testing. (CI)
Line 16: Testing is a big issue; it has to be done over a long period of time. (CI)
Line 17: We would have to access all different types of information. (CI)
Line 18: We look at the Danish market, who are doing what we are thinking about doing for the last 25 years. (FT)
Line 19: We need to look at people who have already worked on wind. (FT)
Line 20: There is no point producing green products if you have a large carbon footprint with it. (NEnI)
Line 21: We have to look at the whole idea of producing energy locally and using it locally; that is what the wind energy philosophy is all about. (LI)
Line 22: Micro wind generation is most ideally used where it is produced. (LI)
Line 23: In other words if you were sending it to the national grid and you were producing 5 kW of power by the time it leaves Galway and gets to Dublin, you may only have 0.5kW left through wastage and inefficiencies which all have a cost. (NEcI)

Question 6: What costs are involved in the installation of wind power systems?
Line 24: The cost of the concrete and steel that are used in the foundation and the manufacturing of the turbine. (CI)
Line 25: Identify a suitable site is a cost, very often the big thing with wind is what you put in you get out. (OI)

Line 26: You could identify a site at the back of your own house which you believe is a good site but you could also move 50 yards down the field and it could be dramatically better or worse. (OI)
Line 27: The way the wind blows; wind is all about direct line flow. (OI)
Line 28: Once you have a tree or anything else that absorbs the energy in the wind and it creates turbulence which puts the wind going in all directions. (OI)
Line 29: So a thing like a house, a tree, a shed, an electricity pole adjacent to the turbine, all create disturbance in the wind. (OI)
Line 30: Wind is most efficient when it is flows in straight lines. (OI)
Line 31: As an initial step in identifying a suitable site; we do a wind site survey. (OI)
Line 32: This is a cost which we charge €250 to do a wind site survey which involves putting up a mast 10 metres high which is the height of micro wind generation and we run an nanometer system with a data logger for 6-8 weeks in order to capture the actual real energy speed, wind energy in the form of wind speed, wind direction, wind temperature and the temperature of the air. (OI)
Line 33: You can do a wind site survey on an actual point rather than an area. (OI)
Line 34: Very often we have a wind map of Ireland which gives you a rough idea of what the wind would be in different parts of the country. (OI)
Line 35: However they are not specific to your site; you have to be site specific because with these maps, they don't take into account general turbulence or trees or anything else that can interfere with the energy of the wind. (OI)

Question 7: What costs are involved in the maintenance of wind power systems?
Line 36: Wind turbines have to be maintained on a regular basis. (CI)
Line 37: We are not long enough into the business to be able to establish that clearly but we are working on it at the moment. (CI)
Line 38: We are looking at possibilities of spending in the region of about €150 to €200 per year just on a routine maintenance. (CI)
Line 39: It is just preventative maintenance as in identifying potential problems. (CSe)
Line 40: There is very little in a wind turbine to wear, just a couple of bearings. (OI)

Line 41: The maintenance would be to just do a visual inspection, check the bearings and in some cases clean the blades because they can become covered in dust and moss rendering them inefficient. (CSe)
Line 42: Maybe after 10 years you might find yourself replacing a bearing. (CSe)

Question 8: What are the retail prices of each model?
Line 43: The Ampair 600 watt, grid tie wind turbine costs €4,200. The Taos 1.5kW, direct water heating wind turbine costs €3,750. The Taos 2.0kW, grid tie wind turbine costs €5,000. The Ampair 6.0 kW, grid tie wind turbine costs €16,800. All prices exclude the mast, installation and VAT. (P)
Line 44: The prices we are quoting are competitive prices at this stage because we are trying to be the first movers into the market. (P)
Line 45: It is difficult to sell at these times in account of the economic downturn. (P)
Line 46: We are trying to get machines out there up and running so we can have good references around the country and establish our business for the future. (AC)
Line 47: We are doing some of the turbines for even cost price. (AC)

Question 9: What is your approximate profit margin on a wind power system?
Line 48: It varies on different machines. (OI)
Line 49: I know our initial stage here at our launch period; we are hoping to be getting a net profit of about 10 to 12%. (OI)

Question 10: Is there a sufficient demand for wind power systems in the local area on a domestic front?
Line 50: There isn't at the moment. (DD)
Line 51: However, there is potential as it is a new business, a new technology thus people are waiting to see what happens. (FP)

Question 11: Is there a sufficient demand for wind power systems in the local area on a business front?

Line 52: Business is about making profit and at the moment wind energy at a micro level in Ireland is in its infancy. (BD)

Line 53: However it is not in its infancy in Denmark; long established there. (FP)

Line 54: In Ireland as time moves on, I think that people are getting really interested in alternatives because they are aware of our dependence on fossil fuels. (FP)

Line 55: We are all trying to find an alternative which is going to be a huge task because we are very energy hungry in Ireland and all over the world in particular the developing western, northern hemisphere. (FP)

Line 56: I was reading a book last night which stated that every person in America consumes energy to the tune of 24 barrels of oil per person per year, in Europe we consume 17 barrels of oil per person per year and in the developing countries they are down to about 4 or 5 barrels of oil per person per year. (NEnI)

Line 57: These barrels of oil are slowing down as they are running out; we have reached peak oil and this is something that people are aware of. (NEnI)

Line 58: Renewables are the only way we can go, such as wave, solar and typically for rural communities like Gurteen, you could sow energy crops like willow which I think for rural Ireland is a great option at the moment particularly when farm incomes are decreasing and also as farmers are paid their headage anyway. (FP)

Line 59: They can produce an energy crop and can actually make money from it. (FP)

Line 60: They are a fairly robust crop; you do not have to spray it every fortnight. (FP)

Line 61: This is the way forward as we are very intensive in our farming at the moment and this is less intensive. (FP)

Line 62: Also farmers could even have a full-time or part-time job. (FP)

Question 12: Is there potential to expand the wind energy market in the local area?

Line 63: Yes there is huge potential. (FP)

Line 64: We are really talking about a waiting game or a first mover market. (FP)

Line 65: There are always people who will experiment with new technology and they are the people we are targeting at the moment. (FP)

Line 66: The mainstream market won't be established for quite a number of years and that is to be expected. (FP)

Question 13: Are you aware of available grants, if any to people who install wind power systems?

Line 67: There are no grants available for the capital costs of wind turbines. (GPr)

Line 68: SEAI are completing a preliminary study on wind energy at the moment; they have a few pilot schemes running around the country and they are hopefully going to come up with some conclusions from that, in the form of potentially offering people capital grants towards the installation of wind turbines. (GPr)

Line 69: What is being offered at the moment is a bonus scheme on the energy that you produce on the wind turbine. (TP)

Line 70: If you sell energy into the grid the ESB pays 9c per unit produced and they also give an extra 10c bonus on top of that which totals 19c per unit which is something similar to the price we are paying for a unit of electricity domestically now anyway. (TP)

Line 71: We are paying 14-15c plus vat plus a levy so it's around 19c maybe 20c. (TP)

Line 72: I am not so sure that the ESB are very happy about taking power from their customers, they don't want their customer to be a provider really. (ESBP)

Line 73: I'm not so sure that it is a good business model for them but they are being forced to by the green agenda and the green politics. (ESBP)

Line 74: The government are not really committed because they are going to be losing a lot of revenue in tax. (GPo)

Line 75: There is no VAT in wind energy therefore the state are not going to benefit anything from it. (GPo)

Line 76: Basically what motivates the state is the carbon levy that is being imposed on them by the Greens which they have to pay. (GPo)

Line 77: We have commitments made under the Kyoto Agreement and more recently there was another agreement in Copenhagen in Denmark whereby there are targets set that we have to achieve, I think it's 20% of our energy by 2020. (GPo)

Line 78: These commitments will have to be adhered to, if they don't then there is going to be fines and levies imposed on us. (GPo)

Line 79: That's the economic side of it and that's why Europe is a world leader as well in this whole area and the EU sees itself as a leader also and wants to ensure that this continues on. (PEcI)

Question 14: What incentives do you use, if any to encourage people to install a wind power system?

Line 80: I don't have any incentive other than telling the story as it is at the moment. (OI)

Line 81: We can't put financing in place for people, which is a major pity. (OI)

Line 82: What is important for us as a company is to ensure that the customer is comfortable with what he/she is doing and that he/she realises that wind is not a short term pay back, it is very much a long term payback. (CSe)

Line 83: We are talking about 8, 10, 12 year paybacks on installations. (CSe)

Line 84: It's also important that they are clear that their site is suitable. (CSe)

Line 85: If you look at most of the people that are selling wind turbines including ourselves in Ireland we are being very cautious about how we are promoting wind energy at a micro level because it's really in it's infancy at the moment, it's really an evolving technology. (AC)

Line 86: The reason for that is it's not a quick paying business, it's going to take time and we also need to learn a lot, the technology is evolving and is developing and the investment is made today, it still has to pay for itself in 15 years from now, we have to ensure that is the case so as a result the producer and manufacturers of these machines are being extremely cautious in promoting these products for that reason. (CSe)

Line 87: We would do business payback plans for people just to let them know what to expect and very often these can be more of a disincentive than an incentive. (CSe)

Line 88: But the reality is that it is a real evaluation of what the gain would be. (CSe)

Line 89: I think there's a lot of idealism connected to wind energy. (AC)

Line 90: They see the advantages and they have a certain sense of responsibility about being prudent in the use of fossil fuels and the resulting global warming but they want to do something about it, but we have to be very careful that people are aware of what they are letting themselves in for because it's not a short term solution; it's a long-term solution. (CSe)

Question 15: Do you know if there are any positive environmental impacts of a wind power system on the local community?

Line 91: Yes, energy generated by wind is real energy. (PEnI)

Line 92: If you think in terms of looking out across any field in Ireland, there's wind blowing around there which is kinetic energy that is real energy. It's a matter of capturing that energy. (OI)

Line 93: From an environmental point of view if we are to capture it, we have to develop technology to capture that wind energy. (TT)

Line 94: We are talking about reducing the carbon footprint enormously. (PEnI)

Line 95: The only carbon footprint that is generated by a wind turbine is in its own initial production and this is why I believe we have to produce our power locally, we also have to use it locally but we also have to manufacture our wind turbines locally as well. (LI)

Line 96: I believe in manufacturing in Ireland, an Irish wind turbine for Irish wind conditions and for Irish consumption. (IM)

Line 97: In Ireland, wind is one of our greatest resources; our location lends itself to that in so far as we are on the edge of the Atlantic Ocean we have the North Atlantic drift generating winds coming from the south west constantly in Ireland. (OI)

Line 98: We have an untapped resource and we have huge potential in terms of wind but we also have huge investments to make as well if we want to go down that road. (FP)

Line 99: Economic conditions at the moment don't lend themselves to that very well, money is scarce banks are not lending. (FP)

Line 100: Banks need to be educated themselves as well. (A)

Line 101: The environment is about protecting our environment for the future. (A)

Question 16: Do you know if there are any negative environmental impacts of a wind power system on the local community?

Line 102: We have to be very careful about the visual impact in the rural community particularly. (NEnI)

Line 103: I myself think that wind turbines are actually nice, I like looking at them, but there are people out there that don't and I think that needs to be looked at as well. (NEnI)

Line 104: I personally wouldn't like to see wind turbines literally in everybody's back yard. (NEnI)

Line 105: I think they would be a blot on the landscape. (NEnI)

Line 106: This needs to be looked at from a technology point of view and look at the economic method of installing one wind turbine in a community like the village of Gurteen. (LI)

Line 107: It would be a community investment rather than an individual investment. (LI)

Line 108: I think that would possibly be a good route to go down. (LI)

Line 109: Again we can look to the Danish model for this; they have done this in conjunction with finances available from the Credit Union movement, a community infrastructure rather than looking at individual infrastructure. (LI)

Line 110: I think that it becomes more sensible. (LI)

Line 111: There is a possibility that micro generation is not a runner at all but we can't discount the fact that it is a possibility. (LI)

Line 112: We need to be above 100 kilowatts to become economically viable. (LI)

Line 113: There are people that will even argue right now as to forget about 5kW, 2kW and 1Kw; they little or no value to be added in terms to offset their own costs and the carbon footprint generated by them. (LI)

Line 114: For example just think about a wind turbine that can produce 1kW in 10 m/s wind speeds. (OI)

Line 115: If it was getting 5 m/s it might just produce 200 watts as a 1Kw wind turbine does not generate 1kW all the time. (OI)

Line 116: Also imagine that this wind turbine has being imported from China. (NEnI)

Line 117: It's being produced in an environment where the actual production of it is not a green production; there are a lot of pollutants generated by the actual production of the product and it's not being monitored very well because China does not have the same interest in the environment as we have. (NEnI)

Line 118: The second thing is that the wind turbine has to be put into a box and shipped three quarters way around the world before it arrives in our back yard. (NEnI)

Line 119: Therefore more pollution is generated by the actual distance of it. (NEnI)

Line 120: Then we have to process it here and handle it and put it up and only then does the 1kW wind turbine start to produce energy. (NEnI)
Line 121: Then we have to ask ourselves how long it takes the life of that wind turbine to negate the greenhouse gases or carbon footprint generated by its very existence. (NEnI)
Line 122: Wind turbines can actually do damage to radio signals and mobile phones as they create distortion of radio signals which can cause problems. (NEnI)

Question 17: How do you believe that these negative environmental impacts could be minimised?
Line 123: They should be incorporated into our buildings more structurally. (NEnI)
Line 124: We should try to include them in the structure of the building. (NEnI)
Line 125: Visually have them fitting in better; structurally design houses to take wind energy as existing houses don't have that. (NEnI)
Line 126: Vertical axis wind turbines seem to be more visually appealing, they don't take up as much room even though they are not as efficient at all but we have to get a balance between their negative effects versus their contribution. (NEnI)
Line 127: They are easier to incorporate in a building; they are just one vertical cylindrical machine as opposed to a horizontal one. (NEnI)
Line 128: It is all about technology really and learning as we go along. (TT)
Line 129: This is what I mean when I say that micro wind generation is not fully a developed technology. (FP)
Line 130: There is a long way to go before it becomes mainstream but we are working on that as a company. (FP)
Line 131: As a company that is our mission because if we can practice what we preach, we will have a real viable business. (FP)

Question 18: Do you know if there are any positive economic impacts of a wind power system on the local community?
Line 132: Yes, by generating our own electricity locally; we are independent from the national grid. (LI)

Line 133: It is particularly useful in places like schools where there is minimal attendance as the kids are there from 9 o'clock to 3 o'clock in the afternoon but wind turbines generate electricity all day every day. (LI)
Line 134: So we are consuming for one quarter of the time, we are producing for all of the time, so from that point of view wind energy is quite valuable. (LI)
Line 135: I think that's something that could be looked at initially. (FP)
Line 136: We should do a site survey on the national school in Gurteen as it is the highest point in Connaught. (LI)
Line 137: That would press some buttons which would prove theories. (OI)

Question 19: Do you know if there are any negative economic impacts of a wind power system on the local community?
Line 138: The initial costs, once that's paid you are making money then. (NEcI)
Line 139: Wind turbines do have a long life and they are very maintainable. (OI)
Line 140: There are not many parts in them to actually go. (OI)

Question 20: How do you believe that these negative economic impacts could be reduced?
Line 141: There are very little negative economic impacts. (NEcI)

Question 21: In your opinion, are there any other impacts of a wind power system on the local community?
Line 142: I think making people aware is very important. (A)
Line 143: Generation of awareness in people to inform them of where this energy is coming from and how it is being generated. (A)
Line 144: People would have more respect for it, all we have on the wall is just a plug, once we go beyond the plug we don't know what is going on but if we did knew we would be horrified as to the lengths which human beings have to go to retrieve our oil from under sea floors and ground drilling up to five miles deep. (A)

Line 145: Deep well drilling which is a new technology, they are talking about half a mile deep at sea and then drill the sea bed and go down another four and a half miles deep after that so it's a phenomenal amount of energy and technology. (A)
Line 146: In the 1960s the cost of producing a barrel of oil was 1 barrel for every hundred barrels in energy and in 2005 the cost was 1 barrel for every 14 barrels produced, you can see the amount of energy it takes to produce oil has increased phenomenally. (A)
Line 147: The 1960s was called the golden era of oil where oil was cheap. (NEcI)
Line 148: So there is actually a real cost in producing oil ; at one time oil used to spring up out of wells and springs like water but that doesn't happen any more. (NEcI)

Question 22: How long does the average wind power system last for on a domestic front?
Line 149: A lifetime of 20 years. (FP)

Question 23: How long does the average wind power system last for on a business front?
Line 150: A lifetime of 20 years. (FP)

Question 24: What do you think are the pros about developing a strong ethos/awareness about the benefits of wind energy in the local area?
Line 151: I think that's very important. (A)
Line 152: It's not all about financial costs. (A)
Line 153: We value things in terms of money in this country and in this hemisphere. (A)
Line 154: We have to look at the real costs not just financial costs; there are environmental costs and the impact on our own quality of life. (A)
Line 155: This is where the education needs to happen. (A)
Line 156: The value can't be measured in dollars. (A)
Line 157: It's like the ad for the credit card master card - a pair of shoes 20 euros, the party you go to in the evening is priceless; there is no value in it. (A)
Line 158: But that actually is capturing a thought that is important for this whole future and that's why I believe there's a whole shift where the age we are at the end of the industrial revolution as we know it. (A)

Line 159: We are now going into the green revolution or the green age and we have to protect our planet and we have to reduce emissions in order to continue to survive and I mean that in a whole ethos and a philosophy in how we value things. (A)

Line 160: We are looking at the whole area of wind energy and wind capturing items such as clothes lines. (OI)

Line 161: We have a particular design which I think is particularly good and we have to look at it very broadly; we are looking at things like poly tunnels. (OI)

Line 162: We are looking at not only the development of wind turbines, but to develop the whole thinking around alternative energies and working on the principle of producing locally and consuming locally. (LI)

Line 163: Say the whole philosophy of buying a head of cabbage that was grown in your back garden has a less impact as opposed to buying a head of cabbage that was grown in Dublin or Israel or Cyprus. (LI)

Line 164: This is what I mean about the whole idea of community based. (LI)

Line 165: I think globalisation means that we buy flowers that were grown in Brazil and they are in the forecourts of our petrol stations in the morning with jumbo jets flying them around the world because we want flowers. (NEnI)

Line 166: The impact of these flowers on the environment is colossal. (NEnI)

Line 167: We have to look at all these things and that is called the globalisation of the flower industry. (NEnI)

Line 168: We have to look at the opposite which is called local production. (LI)

Line 169: I think that this is probably where wind energy fits into a community like Gurteen, destroyed by the whole philosophy of globalisation, that's what has happened to rural parts of Ireland. (LI)

Line 170: The politicians think that we need focal points for people to work in and to live in rather than have a community spread out across; sustainable development. (LI)

Line 171: Like people from Gurteen having to go to Galway to work. (NEcI)

Line 172: We have to think in terms of bringing the work to the people rather than people to the work. (PEcI)

Line 173: The cost of shipping all these people from Gurteen to Galway is huge. (NEcI)

Line 174: Or from Mountbellew to Galway, in our own business here part of our own philosophy which is deep rooted within the company; we built a factory in Mountbellew for that exact reason to bring the jobs to the people rather than the people to the jobs. (LI)
Line 175: I know it's booking the trend but I think that is where the future lies. (LI)
Line 176: I think that's what the environmental impact on villages like Gurteen and all the other villages around need to look at, developing themselves and generating their own energy, their own food in so far as they can locally. (LI)
Line 177: Globalisation is breaking down what's sustainable in terms of the carbon footprint it generates. (NEnI)
Line 178: Buying in wind turbines from China, buying flowers from Brazil and potatoes from Cyprus and shipping them in to Gurteen; it's wrong. (NEnI)
Line 179: That is where I'm coming from. (LI)
Line 180: It's not just about wind energy but wind is something that blows across everyone's field and it is blowing in Gurteen as well as everywhere else. (LI)

Question 25: What do you think are the cons about developing a strong ethos/awareness about the benefits of wind energy in the local area?
Line 181: If you're a multinational that wants to produce computers in China and ship them to Ireland, anyone who would argue that you should be producing them locally, you would have a problem because your business model doesn't work any more. (NEcI)
Line 182: A lot of business models will not work in the future. (NEcI)
Line 183: It's all about cost reduction and cost reduction on the backs of the people that are actually producing them. (PEcI)
Line 184: It's all about how much people are getting paid in a week's wages that's what generates the cost of a computer. (PEcI)
Line 185: Carbon cost as well but it's the actual cost of the standard of living of the people that are making the product, that's the cost. (NEcI)
Line 186: And if we benefit from a cheap computer from Lidl in Galway, certainly I am sure that there is someone else suffering somewhere to make it, only interest is to make it cheap; that is what globalisation is all about. (NEcI)

Line 187: The cheapness comes from labour costs and human cost; environmental costs do not be taken into account by multinationals. (NEnI)
Line 188: Again I'm talking about a small company like our own company here that can generate local business and local activity. (LI)
Line 189: I hope we are not too far ahead of our time but I think we maybe because a lot of people say we're mad to be in business for these reasons. (LI)

Question 26: Are you pursuing a market for wind turbines focused on the local area?
Line 190: Primarily yes. (FP)
Line 191: For the Irish market we try to produce a wind turbine which is an Irish produced product for the Irish conditions in an Irish market. (IM)
Line 192: That's the basis for what we want to produce. (IM)
Line 193: If we get orders from abroad great. (FP)
Line 194: Primarily, we have an Irish solution to an Irish problem. (IM)

Question 27: Are you pursuing a broad market for wind turbines?
Line 195: If it comes yes, we will have to look at the model as we don't want to be contradicting ourselves. (LI)
Line 196: If we develop a technology that suits a market abroad then the possibility is that we should be looking at licensing our product rather than manufacturing it here and shipping it abroad. (FP)
Line 197: If we want to be true and honest to our ethos. (LI)

Question 28: Do you believe that Gurteen is a typical rural community in East Galway in the West of Ireland as regards wind energy?
Line 198: No I think it has a particular advantage in its elevation. (LI)
Line 199: I think there's a lot of learning to be done there. (A)
Line 200: A question in the economic area is how much is it and can we afford it. (PEcI)
Line 201: Gurteen wouldn't be a particularly wealthy community I don't think but it has got huge natural resources for a small place. (LI)
Line 202: I think Gurteen is a good model of what a small community is. (LI)

Line 203: I think it's important to maintain it and to look after it because if we don't it won't survive. (LI)

Line 204: If we keep going the way we're going, take for instance they want to shut down the post office, everything like that isolates a community even more and more, the average age of the people living in Gurteen is high. (LI)

Line 205: It has to be a two way thing. (LI)

Line 206: I think that if somebody opened a shop in Gurteen it would have to be supported and this is where the education needs to come in from the point of view of sustaining the local community. (A)

Line 207: Lidl or Aldi or Tesco are not interested in Gurteen. (LI)

Line 208: That's a globalised grocery market, there's obviously good reasons, you get cheaper products, there's advantages and that's why people do that but again it's all down to asking a certain question; what is the cost. (NEcI)

Line 209: And the second question is what is the real cost, there's a cost in terms of financial but there's a secondary cost which is a social cost. (NEnI)

Line 210: People are not aware of that, this is where education needs to be focused on people; what is the real cost. (A)

Line 211: It's a thing that is being generated by top people (Government). (A)

Line 212: It is not a fundamental human need; it is only a means of measuring a financial cost. (PEcI)

Line 213: I'm doing a European project at the moment called the future SME, multinational companies in 15 different countries in Europe. (A)

Line 214: It's all about discussing small medium enterprises, like our own as to what the future holds for us and one of the big points that I am bringing up there myself is to talk about the measurement of value. (A)

Line 215: How do you measure value? (A)

Line 216: Is value measured in dollars or is it measured in social terms. (A)

Line 217: We have started to look at it more in broader terms like carbon footprint and they have started to convert carbon levies into financial form in order to understand it, effectively a form of tax. (NEnI)

Question 29: What are your future expectations as regards wind power systems in the local area?

Line 218: I don't know that is all unfolding; I don't have a real answer to that. (FP)

Line 219: It's an environmental thing, it's dynamic and it's not developed. (FP)

Line 220: I would hope that we would have micro generation produced locally and using locally, that is the principle that needs to be developed. (LI)

Line 221: Not producing locally and shipping our electricity into Dublin because that's a waste. (LI)

Line 222: Every unit of electricity that is manufactured in a power station like Moneypoint, by the time it gets to Gurteen for even 1 kilowatt you probably have 20% of it actually coming out at the end of your plug. (NEcI)

Line 223: That makes it inefficient and not viable. (NEcI)

Line 224: So what we have to do is to think of solutions like the heating, possibly using the energies produced to charge our electric cars and bicycles which you literally plug a wind turbine into your car at night and that you are using locally the energy that is generated locally, heating your house is another way of storing the energy. (LI)

Question 30: What are your future expectations as regards wind power systems in Ireland?

Line 225: I have already made presentations to NUIG and GMIT and I have spoken to the Mechanical Engineering Departments there asking them to participate and to make Galway a centre of excellence for wind energy, because that is what it is. (FP)

Line 226: We are in the right place, right time and in the right location in Europe. (FP)

Line 227: We should be leading the continent to be working on green solutions. (FP)

Line 228: We are in the right location in the right area, on the edge of the Atlantic Ocean which is probably one of the best wind resources in Europe and possibly in the world. (FP)

Line 229: We need to become like Denmark and maybe even better than Denmark and try to be the state of the art knowledge base for wind generation in the world. (FP)

Line 230: While the Germans are good at making cars, we should be good at wind energy and natural resources. (FP)

Line 231: Galway is probably the best location of all in Ireland to do that. (FP)
Line 232: I have spoken to them about it and they are in total agreement. (FP)
Line 233: It is all up to an idealistic type level, but you have to start to develop it. (FP)
Line 234: Then you have to get people on board and the network; it takes time. (FP)
Line 235: As a goal Ireland should be a state of the art. (FP)
Line 236: We should be leading the world in wind energy. (FP)
Line 237: That would be my vision for Ireland whether it will happen or not or whether we will be here to exploit it, is another issue. (FP)

Question 31: What are your future expectations as regards the wind energy industry as a whole?
Line 238: In Ireland, with wind energy, we can become self sufficient. (SS)
Line 239: We are in a very good position to do that. (FP)
Line 240: We are particularly lucky to know that, we have to recognise our advantages in the world that we live in today. (FP)
Line 241: That's a distinct advantage that we have over a lot of other countries. (FP)
Line 242: It may not work for other countries, but certainly we can lead the way if we have the mindset to do it, politically and on all levels. (FP)
Line 243: In the world, I'd say, particularly for the developing world rather than the developed world, wind energy is something that should be looked at in the initial stages when they are investing in infrastructure, they should look at green energy as well as fossil fuel based energies. (FP)
Line 244: It's a waste of time really investing in fossil fuels as they will not be there in the future. (NEcI)

11. Appendix D: Interview with C&F Green Energy

Established in 1989, C&F is a very successful Irish engineering company with a large global footprint. Its headquarters are based in Athenry, Co. Galway. They have six companies worldwide – Ireland, UK, Germany, Czech Republic, China and the Philippines. Globally they employ approximately 1,000 people. The group's sales revenue has grown steadily over the past five years and turnover has reached $100 million.

C&F Green Energy is a member of the Irish Wind Energy Association (IWEA). Their motto is 'Energy through Innovation'. The current C&F Green Energy range of turbines target the domestic, agricultural and light commercial markets offering products of 6 kilowatt (Kw), 11Kw and 15Kw output. These medium sized turbines have been designed to incorporate the same advanced technologies that are used in Mega-Watt sized machines – the blade pitch, nacelles yaw angle and generator load are automatically controlled which improves performance and affords significant flexibility. Leveraging off their expertise in manufacturing and their global reach, C&F can offer this advanced technology at very competitive prices. C&F are committed to continuous product improvement and are currently investing almost €2 million per annum in R&D.

The Wind Turbine

The blades are made from an aerospace carbon fibre composite material. This material affords superb mechanical properties, such as excellent stiffness/weight ratio and impact resistance – in fact, the material is stronger than steel. Importantly, the blade is fully recyclable which is quite unique when considering typical blade composite materials.

The blade pitch is automatically controlled to optimise aerodynamic performance under different operating conditions. It is also used to turn the blades out of the wind in extreme weather so that the turbine can survive hurricane force winds. Due to the efficient aerodynamic design of the blades, the noise level will not exceed 43 decibel (A) at maximum revs per minute (rpm).

The yaw control constantly monitors the wind direction so that the turbine is always directed into the wind. This facility has a significant impact on stability and efficiency. C&F's turbines employ an Axial Flux Permanent Magnet Generator. The design is modular which facilitates separate power outputs and allows flexibility work load control. This feature enables the turbine to start producing power at very low wind speeds (1.2metres/second or 3 miles/hour).

The turbine can be installed and commissioned in two days by qualified installers and RECI Electricians. The mast is made up of six sections and can be assembled on site and the turbine is erected using a hydraulic ram. The turbine head will arrive on site fully assembled. The installers deliver all the equipment necessary to connect the turbine to the premises including an appropriate inverter.

Participants Approval

Padhraic Dilleen,
G.M.I.T.,
Dublin Road,
Co. Galway.

The Participants,
East Galway,
Co. Galway.

Dear Pat,

I am currently undertaking a Masters programme in Business Studies at G.M.I.T. Part of the requirements of this study is to undertake research, which I will carry out using participants from East Galway.

The focus of the study I have chosen will explore the environmental and economic impacts of a wind power system on a small rural community in East Galway. In order to carry out this study, I will require your voluntary assistance. It will involve your participation in an interview, which will be recorded. You may ask any questions about the procedure-taking place and you will be answered honestly. You are free to withdraw from this study at any time without this decision affecting you in any way.

This is to certify that I Pat Dolan hereby agree to participate in the above study.

Participants Signature: Pat Dolan
Date: 12/02/2010

Researchers Name: Padhraic Dilleen
Researchers Signature: Padhraic Dilleen
Date: 12/2/10

C&F Green Energy - Interview with Pat Palmer on the 12/2/10

Question 1: When did you start manufacturing wind power systems?
Line 1: We are manufacturing wind power systems since August 2008. (OI)

Question 2: Why did you start manufacturing wind power systems?
Line 2: John Flaherty is a very forward thinking individual. (FT)
Line 3: He saw a niche in the market for green energy and put resources into it with nearly €3 million at the moment spent on R&D. (FT)
Line 4: The fact that he was a global operator; he knew he had a big revenue so he could enter the market and use his expertise to capture it. (FT)

Question 3: How many models of wind power systems do you sell?
Line 5: At the moment we have six different models; two models in the 6Kw range, two models in the 11Kw range and two models in the 15Kw range. (OI)
Line 6: We will be increasing as time progresses by going up to 30Kw turbines. (FT)

Question 4: What are the differences between each model?
Line 7: The 6Kw wind turbine produces 6Kw/hr of power at 10m/sec wind. (OI)
Line 8: The 11Kw wind turbine produces 11Kw/hr of power at 10m/sec wind. (OI)
Line 9: The 15Kw wind turbine produces 15Kw/hr of power at 10m/sec wind. (OI)

Question 5: What costs are involved in the production of wind power systems?
Line 10: The costs are substantial, increasing on each model. (CI)
Line 11: The turbines are competitively priced; top in the market at the moment. (P)
Line 12: The turbines are guaranteed Irish products as we are the first manufacturers of wind turbines in Ireland. (IM)

Question 6: What costs are involved in the installation of wind power systems?
Line 13: Every site is different; we look at each site and carry out different assessments on the soil. (OI)

Line 14: We ask the customer to prepare his own site by digging out the site, foundation and the channels or else we will do the whole process for the customer. (OI)
Line 15: On average digging the foundation can cost €2,000 - €5,000. (CI)

Question 7: What costs are involved in the maintenance of wind power systems?
Line 16: At the moment we come with a 3 year warrantee and we give the customer an option to extend the warrantee from 3 years out to 10 years for an extra cost of approximately €3,000. (CSe)
Line 17: This means the customer doesn't have to worry about the turbine for at least 10 years which work out at approximately €400/annum. (CSe)

Question 8: What are the retail prices of each model?
Line 18: The 6Kw starts off at €22,000; the 11Kw starts off at €30,000 while the 15Kw starts off at €40,000. (P)

Question 9: What is your approximate profit margin on a wind power system?
Line 19: I am in no position to answer that question, sorry Padhraic.

Question 10: Is there a sufficient demand for wind power systems in the local area on a domestic front?
Line 20: On a domestic front there is huge interest to be honest with you Padhraic. (DD)
Line 21: Wind turbines are new to a lot of people and this idea of going into the whole green energy concept while carbon credits are becoming very popular also. (FP)
Line 22: We have a lot of news generation with promotional activities, the Volvo Ocean race and the Ploughing Championships. (AC)
Line 23: There has been a huge amount of interest especially at the Ploughing Championships with people queuing up to speak to us about the turbines. (AC)
Line 24: These people would be genuinely interested in the turbines. (DD)
Line 25: The Ploughing Championships in 2009 resulted in three days of non-stop business with nearly 500-600 potential customers which was phenomenal. (AC)

Question 11: Is there a sufficient demand for wind power systems in the local area on a business front?

Line 26: The business front is relatively strong but the problem is there are no tariffs in place from the ESB at the moment. (BD)

Line 27: For example, if you have a garage or a shop and you erect a turbine and use the electricity from the turbine to power the shop, the excess electricity produced at night time by your turbine which you don't use will not be bought by the ESB. (TP)

Line 28: There are only tariffs at the moment for domestic and agriculture, not for commercial which is very poor form really but this due to the ESB. (TP)

Question 12: Is there potential to expand the wind energy market in the local area?

Line 29: Absolutely, there are turbines up at the moment from other competitors and I suppose the fact that we are so new; people are really regretting that we didn't establish ourselves sooner in the market. (FP)

Line 30: The fact that we can guarantee our product is an Irish product, we are not going to be looking at turbines parked up which unfortunately some of the turbines out there are at the moment due to problems; this is one thing we will not stand for at C&F. (IM)

Question 13: Are you aware of available grants, if any to people who install wind power systems?

Line 31: The grants available are very limited; they are through Sustainable Energy Authority Ireland (SEAI). (GPr)

Line 32: There were grants available in 2009 but very few customers filled out the paperwork to meet the grant requirements because of the amount of detail required. (GPr)

Line 33: To be honest with you Padhraic; it would have turned off a lot of people. (GPr)

Line 34: The grant was given to a certain amount of people but there are no grants currently available for wind turbines. (GPr)

Question 14: What incentives do you use, if any to encourage people to install a wind power system?

Line 35: The incentive that we use is the fact that we are an Irish product and that we are the first Irish manufacturer of turbines. (IM)

Line 36: Problems will arise no matter what machinery is used but we are on your doorstep and we will fix them. (OI)

Line 37: We have the network to deal with the problems and we rectify them. (OI)

Line 38: Also the turbines are very well priced and they are based on the pitch and control technology which is the same as the mega-watt turbine. (P)

Line 39: This is a top-end technology that is used in the small-scale wind turbines therefore the customer will be getting a top-quality product. (TT)

Question 15: Do you know if there are any positive environmental impacts of a wind power system on the local community?

Line 40: The main positive environmental impacts are that you are saving the carbon emissions and you are not contributing to the greenhouse gasses. (PEnI)

Line 41: Anyone who puts up a turbine is going to be doing the environment a favour; that has to be positive because you are reducing the amount of fossil fuels being used. (PEnI)

Question 16: Do you know if there are any negative environmental impacts of a wind power system on the local community?

Line 42: There are not too many really, maybe from the point of view that some people visually might not like them. (NEnI)

Line 43: I couldn't come across a whole pile to be honest with you Padhraic. (NEnI)

Line 44: Its all about reducing carbon emissions and greenhouse gases which is the number one priority. (PEnI)

Line 45: People want to become greener and they are looking at ideas of becoming self-sufficient by producing electricity from their own turbine as opposed to the line of the ESB. (SS)

Question 17: How do you believe that these negative environmental impacts could be minimised?

Line 46: There are not many ways to change the visual appearance of turbines only by changing the colour of the blades or the tower. (NEnI)

Line 47: However we are restricted by the SEAI as we are not allowed to put up any kind of turbine; there are standards to be met in the erection of turbines. (SEAIS)

Question 18: Do you know if there are any positive economic impacts of a wind power system on the local community?

Line 48: From a costs perspective, you are going to look at the payback from an economic point of view. (PEcI)

Line 49: We evaluate each site and we try to determine the wind speed so if we can determine the wind speed versus what the customers is actually going to be paying for the turbine then we can work out the payback for a turbine. (PEcI)

Line 50: For example, a turbine costing €30,000 there will be a payback of €35,000 on it.

Line 51: From an economic point of view, it's very strong at the moment for agriculture as farmers can write off the turbine for an eight year period. (PEcI)

Line 52: On a commercial front it would be indifferent; a commercial unit would be using the electricity continuously as opposed to relying on the ESB, however each situation is different. (PEcI)

Line 53: At the moment with the economic policy, if you are in Germany and are exporting/selling back to the grid, you will receive 40c/unit, if you are in Spain and are exporting/selling back to the grid, you will receive approximately 42c/unit however in Ireland you will only receive 19c for the first 3,000 extra kilowatts that you produce and 9c there after. (TP)

Line 54: There is no real incentive at all from an Irish point of view. (TP)

Line 55: For example, if you have a house that is producing 20,000 kilowatts per year and you are using 10,000 kilowatts so you have 10,000 more kilowatts that you can sell to the ESB, out of that 10,000 kilowatts, 3,000 is at 19c while the remaining 7,000 is at 9c where if you were out in Germany or Spain you would get 40c and 42c respectively. (TP)

Line 56: It all comes down to the ESB and their status. (TP)

Question 19: Do you know if there are any negative economic impacts of a wind power system on the local community?
Line 57: The main negative economic impact is the fact that tariffs are in place at the moment compared to other European countries. (TP)

Question 20: How do you believe that these negative economic impacts could be reduced?
Line 58: The tariffs are set until the end of 2012, that's the agreement with the ESB and what happens after that I don't know. (TP)
Line 59: I think the ESB have to drive down their own carbon footprint so therefore they will try to make people to become as green as possible whether it will be through wind, solar or hydro. (FP)

Question 21: In your opinion, are there any other impacts of a wind power system on the local community?
Line 60: No not really, one disappointment is that it is one turbine to one house. (ESBP)
Line 61: In an ideal scenario I might go to a farmer who is building two houses for his two sons, he could buy a 15Kw turbine and split the generator to 5kw, 5kw and 5kw for the three houses but the ESB won't allow this. (ESBP)
Line 62: It's an awful pity because that would make a lot of sense and save a lot of money as well. (ESBP)
Line 63: It's all back to the ESB; they will have to change their policy to incorporate this issue. (ESBP)

Question 22: How long does the average wind power system last for on a domestic front?
Line 64: On a domestic front, you would be looking at 20-25 years in that respect. (FP)

Question 23: How long does the average wind power system last for on a business front?
Line 65: On a business front, you would be looking at 20-25 years as well because domestic and business turbines have exactly the same chassis, same frames and the same high-quality technology of pitch and control. (FP)

Question 24: What do you think are the pros about developing a strong ethos/awareness about the benefits of wind energy in the local area?

Line 66: Making people aware is the most important thing, if people have the money and want to invest it in wind energy. (A)

Line 67: They look at their electricity bill and want to drive down their own costs by installing a turbine. (CSt)

Line 68: People maybe buying or building houses and put in geothermal but it is costly compared to wind turbines. (CSt)

Line 69: People can be made aware through seminars, meeting the public, renewable shows, word of mouth, media and advertising. (A)

Question 25: What do you think are the cons about developing a strong ethos/awareness about the benefits of wind energy in the local area?

Line 70: Start by making people aware and by looking at turbines and then someone else's turbine to compare. (A)

Line 71: Some people are totally dominant in price; price doesn't always necessarily work, quality is just as important. (TT)

Line 72: Some individuals are just price mad and forget about the quality; they worry about that later which is a bad attitude to have. (TT)

Question 26: Are you pursuing a market for wind turbines focused on the local area?

Line 73: No we are not entirely focused on the Irish market however Ireland would mean a certain percentage to us but there is a huge interest worldwide in wind energy. (FP)

Question 27: Are you pursuing a broad market for wind turbines?

Line 74: Yes, we are going worldwide, as there is a huge interest at the moment in global terms to be honest with you Padhraic. (FP)

Line 75: There is a huge market for wind turbines worldwide, the market is growing considerably and there is great potential for more sales. (FP)

Line 76: A major advantage to us is that our turbines are able to cope with category 1 storms which are required in global countries. (FP)

Line 77: Therefore the turbines are shipped out of Athenry. (FP)

Line 78: During these storms, a huge amount of energy would be produced. (FP)
Line 79: Most of the standard turbines would power off in high winds; foreign countries don't want that to happen. (FP)
Line 80: With the pitch and control technology, the wind will go through the centre shaft and it will tilt the blades so that they will remain at the same rpm's during high winds or ordinary winds. (TT)
Line 81: Once the wind reaches 10m/sec the turbine will be producing 6Kw, 11Kw or 15Kw so even if the winds increase it will still rotate at the same speed. (OI)
Line 82: 10m/sec is around 20m/hr wind however we would be putting up turbines on sites that would not have sufficient wind. (OI)
Line 83: At some sites we would install a nanometer to gather wind data over a few weeks if we were not entirely happy with a site as there is no point in tricking a customer because after two months he/she will get an ESB bill and say to us why has it not reduced. (OI)
Line 84: At the end of the day, the decision is with the customer but we will give our opinion. (SS)
Line 85: Two or three customers in particular that really wanted a turbine; I would have said to them you are not going to have sufficient wind speed for a turbine but they insisted to erect a turbine, so we did because otherwise they would have gone to our competitors. (SS)

Question 28: What are your future expectations as regards wind power systems in the local area?
Line 86: At the moment when you drive from Galway to Dublin, there are just two turbines that you see, one of them is C&F's and the other is a competitors. (FP)
Line 87: Even this illustrates that the market hasn't be tapped into yet. (FP)
Line 88: It can only increase but at what rate I don't really know. (FP)
Line 89: However the demand that we are seeing at the moment is very high. (FP)

Question 29: What are your future expectations as regards wind power systems in Ireland?

Line 90: We have agents around the country and they are seeing a huge interest from the public in turbines. (FP)

Line 91: There are a lot of orders coming in which is extremely positive. (FP)

Line 92: And as Ireland has one of the best wind resources in Europe with the Atlantic Coast; it would be a shame not to tap into it as it is free and clean. (FP)

Question 30: What are your future expectations as regards the wind energy industry as a whole?

Line 93: It is all very positive with a lot of people coming on board. (FP)

Line 94: The government and ESB are getting behind the whole wind energy aspect. (FP)

Line 95: The government are holding wind energy seminars for the major companies to attend. (FP)

Line 96: The big companies are trying to drive down their carbon emissions and they have to be looking at alternatives. (PEnI)

Line 97: Many people are thinking green energy is the future and they are correct. (FP)

Line 98: Through wind energy, fossil fuels are saved and greenhouse gases are not contributed to. (PEnI)

Line 99: Also people will save money in the long run and help our environment. (PEcI)

Line 100: Our products are competitively priced as they are top-quality products. (TT)

Participants Approval

Padhraic Dilleen,
G.M.I.T.,
Dublin Road,
Co. Galway.

The Participants,
East Galway,
Co. Galway.

Dear John,

I am currently undertaking a Masters programme in Business Studies at G.M.I.T. Part of the requirements of this study is to undertake research, which I will carry out using participants from East Galway.

The focus of the study I have chosen will explore the environmental and economic impacts of a wind power system on a small rural community in East Galway. In order to carry out this study, I will require your voluntary assistance. It will involve your participation in an interview, which will be recorded. You may ask any questions about the procedure-taking place and you will be answered honestly. You are free to withdraw from this study at any time without this decision affecting you in any way.

This is to certify that I John Finn hereby agree to participate in the above study.

Participants Signature: John Finn
Date: 16.7.10

Researchers Name: Padhraic Dilleen
Researchers Signature: Padhraic Dilleen
Date: 16/7/10

12. Appendix E: Interview with a Dairy Farmer in East Galway on 16/7/10

Question 1: When did you erect your wind turbine?

Line 1: I put up my turbine in early 2009. (OI)

Question 2: Why did you erect your wind turbine?

Line 2: I put up the turbine because I thought it would be a cheap method for me to produce my own electricity. (SS)

Line 3: At that time, Irish manufactured turbines were fairly new to the market and a lot of praise was given to them. (IM)

Line 4: They were referred to as the new way of producing cheap electricity for you needs by using the abundant and reliable wind. (SS)

Line 5: As I am a dairy farmer for over the last 30 years I thought a wind turbine is just what I needed to produce cheap electricity for my milking parlour and my house. (SS)

Question 3: Who did you purchase the wind turbine from?

Line 6: I purchased the wind turbine from C&F Green Energy in nearby Athenry. (IM)

Line 7: I thought they were very efficient erecting the turbine and completing all the necessary work involved. (OI)

Question 4: How much did the wind turbine cost you?

Line 8: The turbine cost me €22,000 at the time which I was told was competitive. (P)

Question 5: What size is your wind turbine?

Line 9: The wind turbine is 6Kw which produces 6Kw/hr of power at 10m/sec wind. (OI)

Line 10: This is relatively good for me as my site is fairly windy. (OI)

Question 6: Did you receive any grant for the erection of the wind turbine?

Line 11: No I did not receive any grant for the erection of the turbine. (GPr)

Line 12: This was a disappointment because if I received a grant from SEAI or the government; it would have reduced the overall cost of the turbine. (GPr)

Line 13: C&F informed me about grants that were available at that time but I looked at an application form for one of them and to be honest with you, I would nearly be still filling it out. (GPr)
Line 14: It was so complicated and detailed that I didn't know where to start. (GPr)
Line 15: In comparison to agricultural forms; it was extremely difficult. (GPr)
Line 16: Also as I was very busy on the farm I didn't have the necessary time. (GPr)

Question 7: Did the contractor do all the work involved in the erection of the wind turbine?
Line 17: Yes, C&F Green Energy did all the work involved in putting up the turbine. (OI)

Question 8: Did you do any work in the erection of the wind turbine?
Line 18: They asked me if I wanted to dig out the site but as I was busy on the farm; I let them do the whole job which they did extremely well. (OI)
Line 19: Anyway I would not be 100% sure on the way to dig out the site so I left it to their capable hands. (OI)

Question 9: What was your average ESB bill costing you before the erection of the wind turbine?
Line 20: My average ESB bill worked out at approximately €220 every month which included the milking parlour and the house. (P)
Line 21: It was relatively high therefore I decided to put up a turbine. (FT)

Question 10: What is your average ESB bill costing you now with the wind turbine in operation?
Line 22: My average ESB bill is costing me €150 every month at the moment. (P)
Line 23: Saying this, it does be more some months and less other months due to variations in the wind speed and my demand for electricity in the parlour. (P)
Question 11: Do you know if there are any positive environmental impacts of a wind power system on the local community?

Line 24: Well with all the talk about global warming and greenhouse gases in the past few years; turbines have to help the environment. (PEnI)
Line 25: They are a clean method of producing your own electricity. (PEnI)
Line 26: They do not produce any waste like other machines thus they are environmentally friendly. (PEnI)

Question 12: Do you know if there are any negative environmental impacts of a wind power system on the local community?
Line 27: For instance when I put up my turbine; people were saying it does not look right, it looks out of place. (NEnI)
Line 28: And I said to them that it is because you are not used to seeing them around the countryside yet. (NEnI)
Line 29: That is what happened; as more turbines are being erected, people are not complaining as much I think anyway. (NEnI)
Line 30: Also noise was mentioned to be a factor but my turbine is very quiet. (NEnI)

Question 13: How do you believe that these negative environmental impacts could be minimised?
Line 31: You could change the colour of the turbine but I think white is the correct colour for them as they look beautiful in the distance. (NEnI)
Line 32: As I am farming all my life, noise would not bother me much anyway. (NEnI)
Line 33: Nevertheless my turbine doesn't make much noise. (NEnI)

Question 14: Do you know if there are any positive economic impacts of a wind power system on the local community?
Line 34: Turbines are affordable as they are a long-term investment. (PEcI)
Line 35: Once it is paid for after 8 or 10 years; the following 15 years you will be making money from it. (PEcI)
Line 36: Also wind turbines create jobs as people are required throughout the whole process from designing to maintaining the turbines. (PEcI)

Line 37: There are also people employed in wind related associations (IWEA) to promote wind energy to the people of the country. (PEcI)

Question 15: Do you know if there are any negative economic impacts of a wind power system on the local community?
Line 38: My biggest problem from an economic point was receiving no grant. (GPr)
Line 39: The grant application forms should have been simpler to complete but this may have only been a ploy so that the authorities would not have to give you a grant. (GPr)
Line 40: I'm not 100% sure but I think there are no grants available now. (GPr)

Question 16: How do you believe that these negative economic impacts could be reduced?
Line 41: Firstly, grants should be re-introduced to encourage people to erect turbines as they are the way forward. (NEcI)
Line 42: The grant application forms need to be made easier than before otherwise people may turn away from the idea of wind energy. (NEcI)

Question 17: In your opinion, are there any other impacts of a wind power system on the local community?
Line 43: No not really, I suppose it would be a good idea if a local community erected a wind turbine for the whole community. (LI)
Line 44: The turbine would produce electricity for everyone in the community thus saving them money. (LI)
Line 45: Also the investment costs would be small due to the amount of investors. (LI)
Line 46: This could be an alternative if people were not able to afford a turbine. (LI)

Question 18: What do you think are the pros about developing a strong ethos/awareness about the benefits of wind energy in the local area?
Line 47: I believe awareness of wind turbines has to be definitely increased. (A)
Line 48: People are uncertain as regards the whole wind energy philosophy. (A)
Line 49: They need to be informed about the benefits of erecting turbines. (FP)

Line 50: Since I erected my turbine; the awareness of turbines has not increased at whole lot which is a major pity. (A)

Question 19: What do you think are the cons about developing a strong ethos/awareness about the benefits of wind energy in the local area?
Line 51: There are no cons in my opinion. (A)
Line 52: People need to be educated about wind energy and how it can save our environment for future generations. (FP)
Line 53: This must be done sooner rather than later. (FP)

Question 20: Would you recommend other dairy farmers to erect wind turbines?
Line 54: Yes and I have done already as they do work. (FP)
Line 55: And after the payback period is over; you will save money. (FP)
Line 56: As dairy farmers are constantly using electricity in their daily duties; they need to consider wind turbines as a cheap alternative. (FP)

Question 21: What are your future expectations as regards wind power systems in the local area?
Line 57: I hope and believe that they will become popular in future years. (FP)
Line 58: If they are promoted accordingly in the coming years; I have no doubt that people will erect them. (FP)
Line 59: They are the future as regards our electricity requirements. (FP)

Question 22: What are your future expectations as regards wind power systems in Ireland?
Line 60: I believe that they will get popular all over Ireland also when people recognise the advantages they have to offer. (FP)
Line 61: And as Ireland I think has one of the best wind resources in Europe; they are a step in the right direction for the country as a whole. (FP)
Question 23: What are your future expectations as regards the wind energy industry as a whole?

Line 62: The industry will grow and grow in the future; creating more jobs. (FP)

Line 63: It is only in its infancy stage yet but in 5-10 years I believe it will be maturing considerably. (FP)

Line 64: Wind energy is our future and the sooner we acknowledge this fact the better for us all. (FP)

Participants Approval

Padhraic Dilleen,
G.M.I.T.,
Dublin Road,
Co. Galway.

The Participants,
East Galway,
Co. Galway.

Dear Kathleen,

I am currently undertaking a Masters programme in Business Studies at G.M.I.T. Part of the requirements of this study is to undertake research, which I will carry out using participants from East Galway.

The focus of the study I have chosen will explore the environmental and economic impacts of a wind power system on a small rural community in East Galway. In order to carry out this study, I will require your voluntary assistance. It will involve your participation in an interview, which will be recorded. You may ask any questions about the procedure-taking place and you will be answered honestly. You are free to withdraw from this study at any time without this decision affecting you in any way.

This is to certify that I Kathleen Lawlor hereby agree to participate in the above study.

Participants Signature: Kathleen Lawlor
Date: 18/7/10

Researchers Name: Padhraic Dilleen
Researchers Signature: Padhraic Dilleen
Date: 18/7/10

13. Appendix F: Interview with a Domestic Householder in East Galway on 18/7/10

Question 1: When did you erect your wind turbine?
Line 1: I erected my wind turbine in late 2008. (OI)

Question 2: Why did you erect your wind turbine?
Line 2: I put up my wind turbine because I felt that people need to acknowledge the fact that our environment is being ruined by its residents every day we get up. (NEnI)
Line 3: The amount of emissions and greenhouse gases that we produce daily is out of control. (NEnI)
Line 4: Therefore I thought about putting up a turbine to play my part in saving the environment for future generations. (PEnI)

Question 3: Who did you purchase the wind turbine from?
Line 5: I bought the turbine from RoCo Wind Energy in Mountbellew as I know Jimmy Roche all my life. (OI)

Question 4: How much did the wind turbine cost you?
Line 6: The turbine cost me €5,000 which excludes the mast, installation and VAT. (P)
Line 7: The final cost worked out at approximately €7,000. (P)

Question 5: What size is your wind turbine?
Line 8: The turbine is called a RoCo Taos 2 kW grid tie wind turbine. (OI)

Question 6: Did you receive any grant for the erection of the wind turbine?
Line 9: No, I did not receive any grant as there were no grants available at that time. (GPr)
Line 10: I was very disappointed at this because a grant would have shortened the payback period of the turbine considerably. (GPr)

Question 7: Did the contractor do all the work involved in the erection of the wind turbine?

Line 11: Yes, RoCo Green Energy did all the necessary work. (OI)

Question 8: Did you do any work in the erection of the wind turbine?

Line 12: No, I left all the work for them as they knew what to do correctly first time round. (OI)

Question 9: What was your average ESB bill costing you before the erection of the wind turbine?

Line 13: My average ESB bill was costing me €90 per month. (P)

Line 14: I know this was not very expensive but it was not the main reason why I put up the turbine either. (P)

Line 15: I put up the turbine to help save our environment and play my part. (PEnI)

Question 10: What is your average ESB bill costing you now with the wind turbine in operation?

Line 16: My ESB bill costs me approximately €60 per month presently which is a fair return. (P)

Line 17: This is an added bonus of putting up a turbine; you will even save money on your ESB bill. (PEcI)

Question 11: Do you know if there are any positive environmental impacts of a wind power system on the local community?

Line 18: Of course there are, by erecting a turbine you will reduce the amount of carbon emissions and greenhouse gases being produced. (PEnI)

Line 19: The impacts of global warming will be reduced also. (PEnI)

Line 20: Overall you are helping to save our environment for future generations. (PEnI)

Line 21: As you know we are only caretakers of the environment and at the moment we are doing a bad job of that. (NEnI)

Question 12: Do you know if there are any negative environmental impacts of a wind power system on the local community?

Line 22: As with all technologies, there are good points and some bad ones as well. (NEnI)

Line 23: Wind turbines have been known for causing bird deaths and a visual impact on our landscape. (NEnI)

Line 24: From my point of view, if we don't take action on our environment now, all our birds may die and our landscape will be ruined forever. (NEnI)

Line 25: Therefore we must take the risk and erect turbines to ensure the safety of our environment overall. (PEnI)

Question 13: How do you believe that these negative environmental impacts could be minimised?

Line 26: I believe there are tests that can be carried out to investigate into the bird population in the area of a turbine. (NEnI)

Line 27: Visually I like looking at turbines that is another reason why I put one up at the back of my house. (PEnI)

Line 28: I know some people do not like turbines but they must change their attitude sooner rather than later. (NEnI)

Question 14: Do you know if there are any positive economic impacts of a wind power system on the local community?

Line 29: Well as I said already, not only am I saving the environment but in the process I am saving money on my ESB bill too. (PEcI)

Line 30: Also there are a lot of people employed with the whole wind energy sector from promoting through to installing and maintaining them. (PEcI)

Question 15: Do you know if there are any negative economic impacts of a wind power system on the local community?

Line 31: The most negative economic impact on me was that of receiving no grant for the erection of the turbine. (GPr)

Question 16: How do you believe that these negative economic impacts could be reduced?

Line 32: I believe there should be grants made available for people putting up turbines as they would act as a major incentive. (GPr)

Line 33: Also a grant would shorten the payback period of a turbine thus saving people more money and while saving the environment also. (PEcI)

Question 17: In your opinion, are there any other impacts of a wind power system on the local community?

Line 34: No not really, wind turbines need to be erected in every community in order to help save our environment. (PEnI)

Question 18: What do you think are the pros about developing a strong ethos/awareness about the benefits of wind energy in the local area?

Line 35: I think it is very important to illustrate to the local people how many benefits wind energy has. (A)

Line 36: If people don't know the many benefits; then definitely wind turbines will not be erected. (A)

Question 19: What do you think are the cons about developing a strong ethos/awareness about the benefits of wind energy in the local area?

Line 37: I don't believe there are any cons as wind energy is our future and we must play our part in saving the environment. (FP)

Question 20: Would you recommend other domestic dwellers to erect wind turbines?

Line 38: Most definitely and I have done so already. (FP)

Line 39: Not only are you saving our environment by erecting a wind turbine but also you are saving money so it is a win-win situation. (FP)

Question 21: What are your future expectations as regards wind power systems in the local area?

Line 40: I believe they will become popular as people realise the awful situation we are in as regards our emissions. (FP)

Line 41: People must step forward and take responsibility for their actions to ensure our environment is safe for future generations. (PEnI)

Question 22: What are your future expectations as regards wind power systems in Ireland?

Line 42: As Ireland has one of the best wind resources in possibly the world; we must use it to our advantage. (FP)

Line 43: We should set the standard as regards environmental friendly initiatives and wind energy is most definitely one of these. (FP)

Question 23: What are your future expectations as regards the wind energy industry as a whole?

Line 44: The wind energy industry has to grow in the future. (FP)

Line 45: And I believe that it will grow as more and more people are looking at ways of becoming self-sufficient in their every day needs. (FP)

Participants Approval

Padhraic Dilleen,
G.M.I.T.,
Dublin Road,
Co. Galway.

The Participants,
East Galway,
Co. Galway.

Dear Mary,

I am currently undertaking a Masters programme in Business Studies at G.M.I.T. Part of the requirements of this study is to undertake research, which I will carry out using participants from East Galway.

The focus of the study I have chosen will explore the environmental and economic impacts of a wind power system on a small rural community in East Galway. In order to carry out this study, I will require your voluntary assistance. It will involve your participation in an interview, which will be recorded. You may ask any questions about the procedure-taking place and you will be answered honestly. You are free to withdraw from this study at any time without this decision affecting you in any way.

This is to certify that I Mary Connor hereby agree to participate in the above study.

Participants Signature: Mary Connor
Date: 15-7-10

Researchers Name: Padhraic Dilleen
Researchers Signature: Padhraic Dilleen
Date: 18/7/10

14. Appendix G: Interview with a Domestic Householder in East Galway on 18/7/10

Question 1: When did you erect your wind turbine?
Line 1: I put up my turbine in June of 2009. (OI)

Question 2: Why did you erect your wind turbine?
Line 2: I put up the wind turbine because I believe more use has to be made of our wind in the future. (FP)
Line 3: Wind energy is a cheap alternative to produce your own electricity. (SS)

Question 3: Who did you purchase the wind turbine from?
Line 4: I bought the wind turbine from C&F Green Energy. (IM)

Question 4: How much did the wind turbine cost you?
Line 5: The turbine cost me €22,000 which was quite an investment. (P)

Question 5: What size is your wind turbine?
Line 6: The wind turbine is 6Kw. (OI)

Question 6: Did you receive any grant for the erection of the wind turbine?
Line 7: No, I did not receive any grant. (GPr)
Line 8: This was a major pity because a grant would have reduced the initial investment for me quite a bit. (GPr)

Question 7: Did the contractor do all the work involved in the erection of the wind turbine?
Line 9: Yes, C&F Green Energy did all the work involved. (OI)

Question 8: Did you do any work in the erection of the wind turbine?
Line 10: No, I left all the work for C&F Green Energy. (OI)

Question 9: What was your average ESB bill costing you before the erection of the wind turbine?
Line 11: My average ESB bill was costing me €130 per month. (P)

Question 10: What is your average ESB bill costing you now with the wind turbine in operation?
Line 16: My average ESB bill costs me €90 per month presently which I am happy with. (P)

Question 11: Do you know if there are any positive environmental impacts of a wind power system on the local community?
Line 17: Wind turbines have a positive impact on the environment as they reduce the amount of emissions and gases we produce every day. (PEnI)
Line 18: Also they can have a positive impact on biodiversity by reducing the threat of climate change. (PEnI)

Question 12: Do you know if there are any negative environmental impacts of a wind power system on the local community?
Line 19: Wind turbines can cause electromagnetic interference which can interfere with televisions, radios or microwaves in the local area. (NEnI)
Line 20: Also turbines can cast a shadow which is called shadow flicker on the nearby houses.

Question 13: How do you believe that these negative environmental impacts could be minimised?
Line 21: Qualified electricians and engineers can ensure that the signal of a turbine will not cause electromagnetic interference quite easily. (NEnI)
Line 22: As regards the shadow cast by a turbine; it may only be visible for a few minutes depending on the rising and setting of the sun. (NEnI)

Question 14: Do you know if there are any positive economic impacts of a wind power system on the local community?
Line 23: A wind turbine is long-term investment which is relatively affordable due to its long life span. (PEcI)
Line 24: Also with a wind turbine you have a sense of independence as you are not 100% relying on the ESB for your electricity needs. (PEcI)

Question 15: Do you know if there are any negative economic impacts of a wind power system on the local community?
Line 25: Well as I said already I received no grant for the erection of my wind turbine. (GPr)
Line 26: Also if I produce excess electricity and I export it back to the grid; the ESB will only pay 19c for the first 3,000 units and 9c for the remainder which is a disgrace. (NEcI)

Question 16: How do you believe that these negative economic impacts could be reduced?
Line 27: Grants will have to be introduced in the future to encourage more people to install wind turbines. (GPr)
Line 28: The ESB needs to review its policy immediately with regard to increasing the price it pays for importing electricity from suppliers like me. (NEcI)

Question 17: In your opinion, are there any other impacts of a wind power system on the local community?
Line 29: To be honest with you; I believe wind turbines should be erected in every community for the needs of the local people. (LI)
Line 30: This would help people save money on their ESB bills. (PEcI)

Question 18: What do you think are the pros about developing a strong ethos/awareness about the benefits of wind energy in the local area?
Line 31: Certainly this needs to be done as many people are unaware of the huge benefits of wind energy, both on themselves and the environment. (A)

Line 32: When people are aware of these benefits; they will surely erect a turbine. (A)

Question 19: What do you think are the cons about developing a strong ethos/awareness about the benefits of wind energy in the local area?
Line 33: I don't see any cons to be honest with you as wind energy is our future. (FP)

Question 20: Would you recommend other domestic dwellers to erect wind turbines?
Line 34: Yes and I have done so already. (FP)
Line 35: They are a great long-term investment for any domestic dweller as you are saving the environment and saving money as well. (FP)

Question 21: What are your future expectations as regards wind power systems in the local area?
Line 36: I believe that they will become popular in the future once awareness is increased. (FP)
Line 37: They are the future for our generation as well as future generations. (FP)

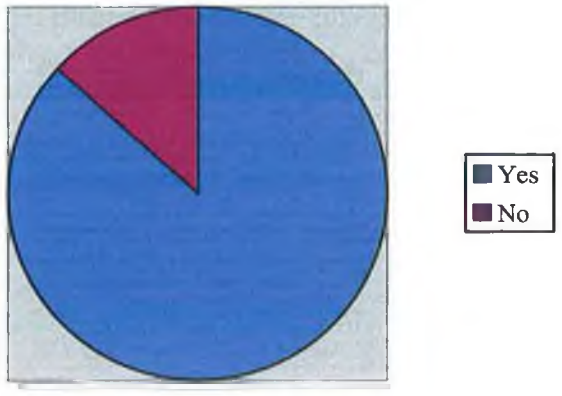
Question 22: What are your future expectations as regards wind power systems in Ireland?
Line 38: I believe wind turbines will become very popular in Ireland as people gain awareness of their benefits as well as our great location for wind energy. (FP)

Question 23: What are your future expectations as regards the wind energy industry as a whole?
Line 39: The micro-generation wind energy industry is only in is infancy stage yet. (FP)
Line 40: It will most definitely grow in the future with more people erecting turbines. (FP)
Line 41: This will result in more jobs being created and our environment being saved for future generations. (FP)

15. Appendix H: Gurteen Community Questionnaire carried out on 20/7/10

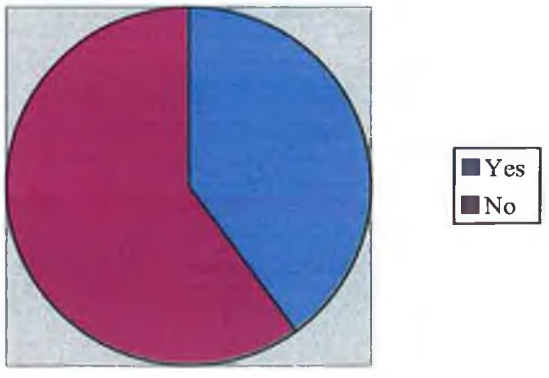
1. Have you ever heard of wind turbines?

Yes □ 13 No □ 2



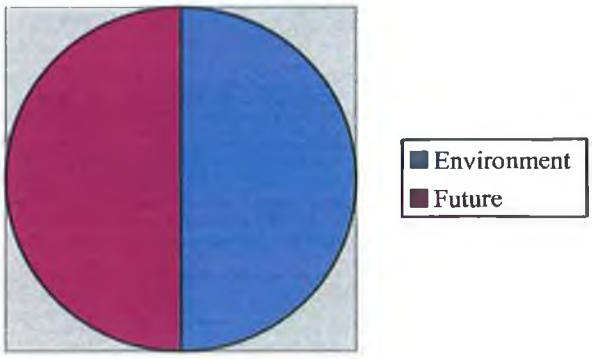
2. Would you erect a wind turbine?

Yes □ 6 No □ 9



3. If yes, what are your reasons for erecting a wind turbine?

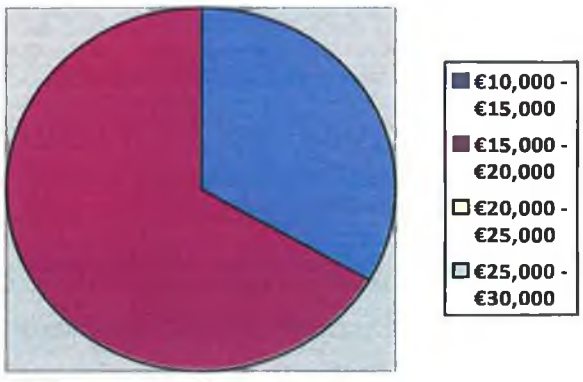
   Environment □ 3 Future □ 3



4. If yes, how much would you be willing to pay for a wind turbine?

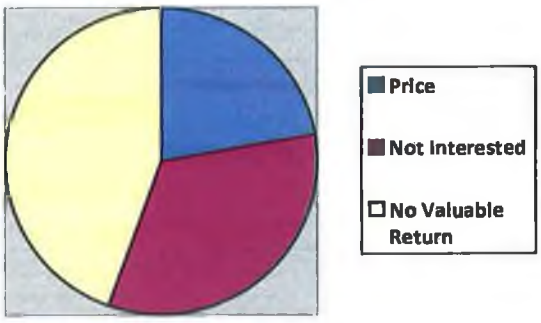
   €10,000-€15,000 □ 2 €15,000-€20,000 □ 4

   €20,000-€25,000 □ 0 €25,000-€30,000 □ 0



5. If no, what are your reasons for not erecting a wind turbine?

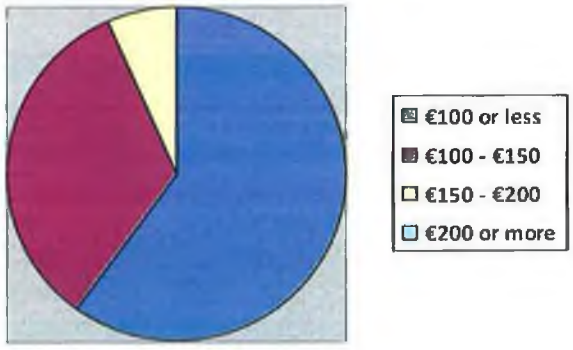
   Price □ 2 Not Interested □ 3 No Valuable return □ 4



6. What does your average ESB bill per month cost you at the moment?

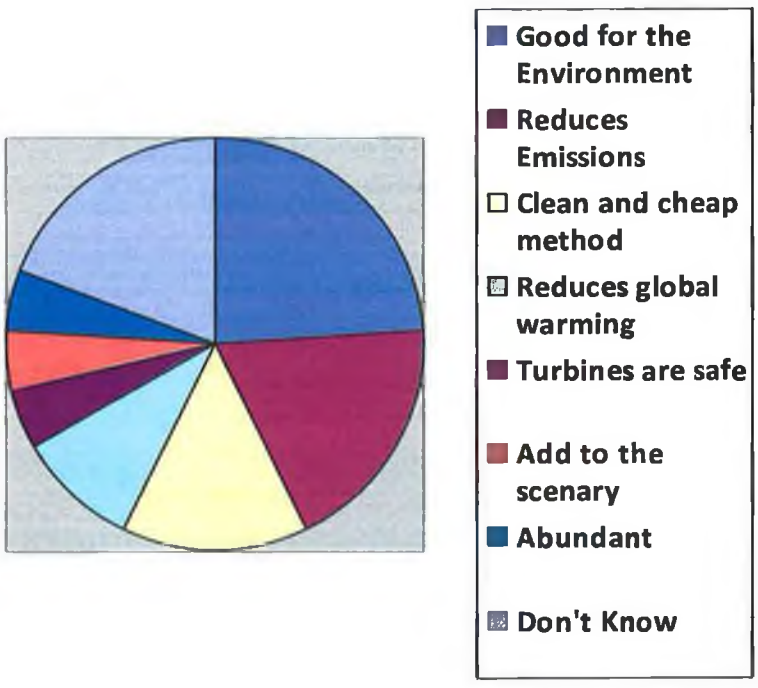
   €100 or less □ 9 €100-€150 □ 5

   €150-€200 □ 1 €200 or more □ 0



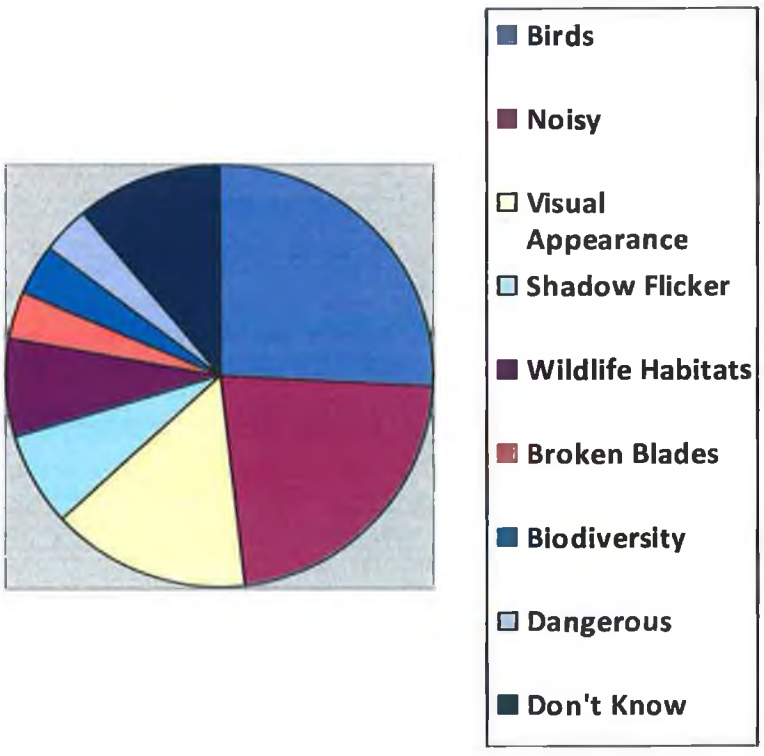
7. Do you know if there are any positive environmental impacts of a wind power system on the local community?

Good for the Environment □ 5
Clean and cheap method □ 3
Turbines are safe □ 1
Abundant □ 1
Reduces emissions □ 4
Reduces global warming □ 2
Add to the scenery □ 1
Don't know □ 4



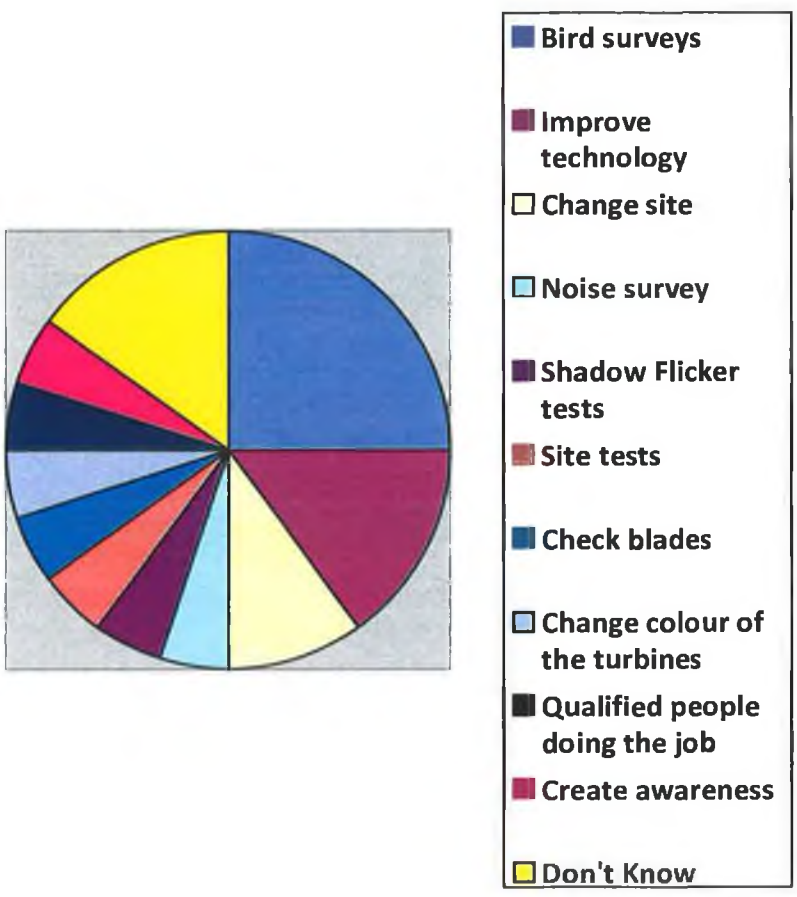
8. Do you know if there are any negative environmental impacts of a wind power system on the local community?

Bird's □ 7
Noisy □ 6
Visual Appearance □ 4
Shadow Flicker □ 2
Wildlife Habitats □ 2
Broken Blades □ 1
Biodiversity □ 1
Dangerous □ 1
Don't know □ 3



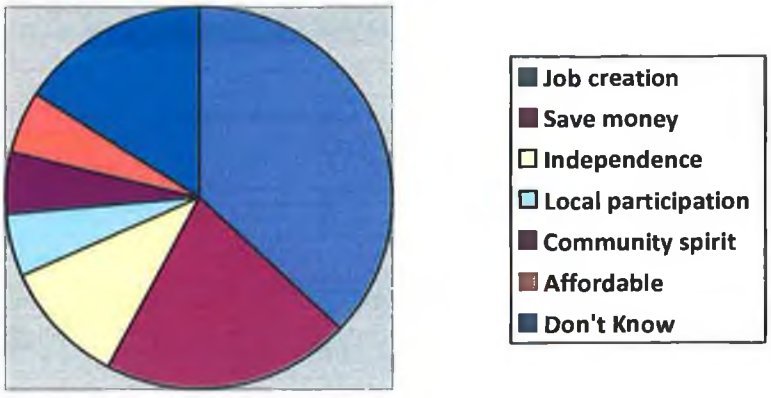
9. How do you believe that these negative environmental impacts could be minimised?

Bird surveys □ 5
Change site □ 2
Shadow Flicker tests □ 1
Check blades □ 1
Qualified people doing the job □ 1
Don't know □ 3
Improve technology □ 3
Noise survey □ 1
Site tests □ 1
Change colour of the turbines □ 1
Create awareness □ 1



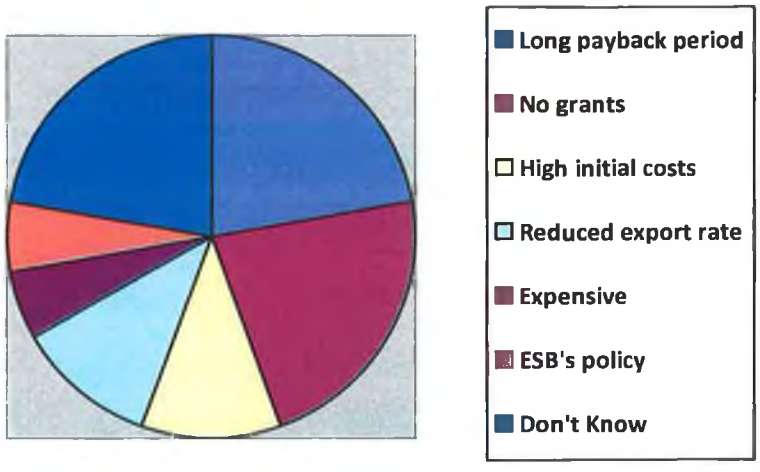
10. Do you know if there are any positive economic impacts of a wind power system on the local community?

Job creation □ 7
Save money □ 4
Independence □ 2
Local participation □ 1
Community spirit □ 1
Affordable □ 1
Don't know □ 3



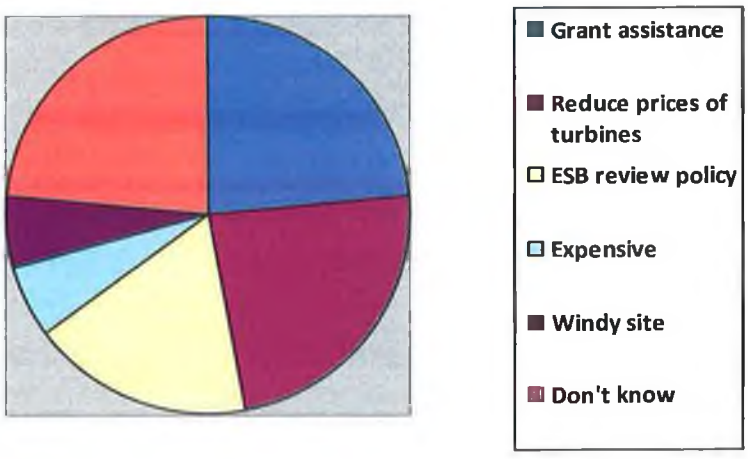
11. Do you know if there are any negative economic impacts of a wind power system on the local community?

Long payback period □ 4
No grants □ 4
High initial costs □ 2
Reduced export rate □ 2
Expensive □ 1
ESB's policy □ 1
Don't know □ 4



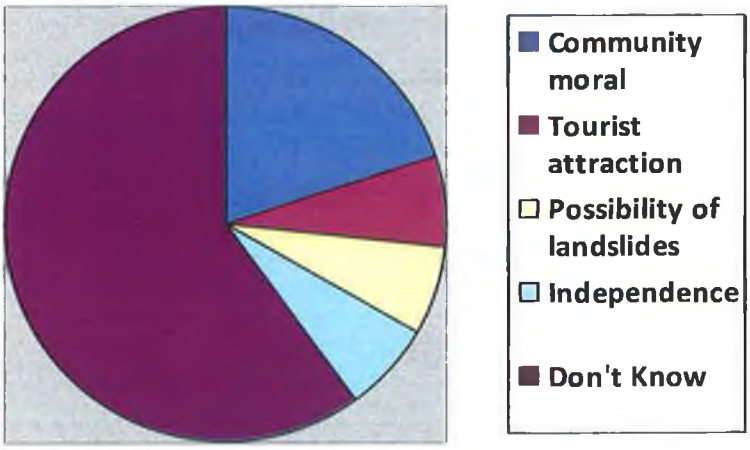
12. How do you believe that these negative economic impacts could be minimised?

Grant assistance □ 4
Reduce prices of turbines □ 4
ESB review policy □ 3
Expensive □ 1
Windy site □ 1
Don't know □ 4



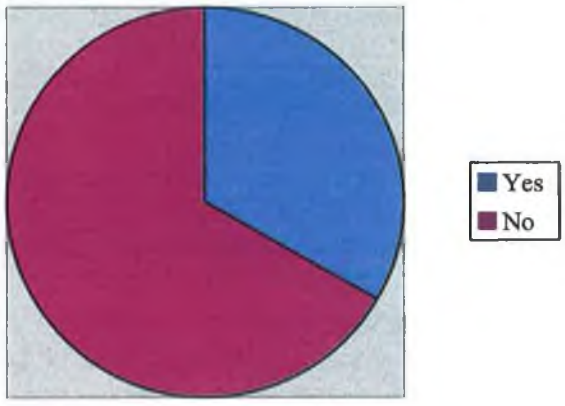
13. In your opinion, are there any other impacts of a wind power system on the local community?

Community moral □ 3
Tourist attraction □ 1
Possibility of landslides □ 1
Independence □ 1
Don't know □ 9



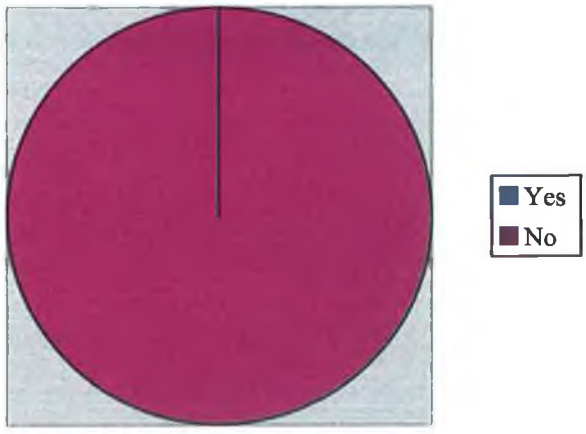
14. Are you aware of promotion for wind power systems in the local area?

Yes □ 5 No □ 10



15. Do you believe that there is an adequate awareness of wind power systems in the local area?

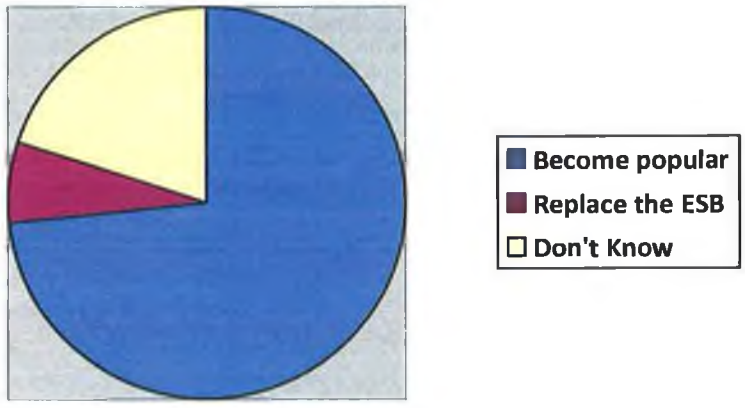
Yes □ 0 No □ 15



16. What are your future expectations as regards wind power systems in the local area?

Become popular □ 11 Replace the ESB □ 1

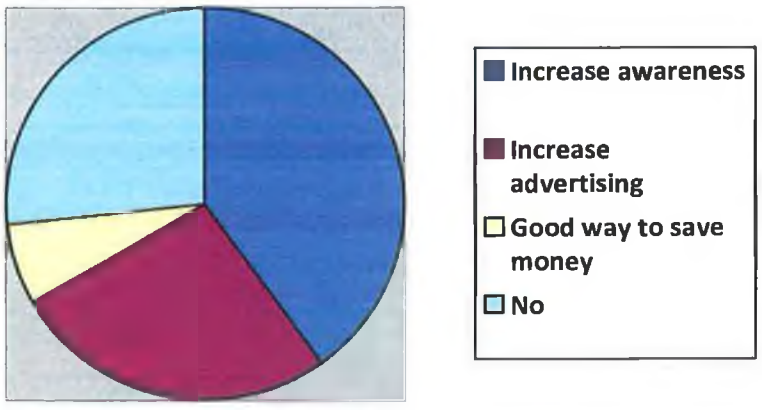
Don't know □ 3



17. Any other comments?

Increase awareness □ 6 Increase advertising □ 4

Good way to save money □ 1 No □ 4



postas íoctha
baile átha cliath
ceadúnas 1

8099 11 10 MICHAEL WARD ESQ
13 CLONKEENKERRILL
146 BALLINASLOE CO GALWAY

METER READING E—ESTIMATED	M—Príomh S—Fo METERS M-MAIN S-SUB	CONSUMPTION AND RATE Aonaid UNITS	Táille (Pingin) RATE (PENCE)	Aonaid UNITS	Táille (Pingin) RATE (PENCE)	Táille-Cód CHARGE CODE	CHARGES CR—Creidmheas CREDIT £	s.	d.
4878 E	1	70	3.4	30	1.6	13	1	3	10
						12		10	6
153									

PERIOD AUG-SEP 67 READING DATE 25 9 67 TO BE PAID BEFORE 11 11 67 1 14 4

ESB

bord soláṫair an leictreaċais

ELECTRICITY SUPPLY BOARD

príoṁoifig, baile áṫa cliaṫ 2

Head Office, Dublin 2

[illegible]

THIS ACCOUNT IS PAYABLE AND SHOULD BE PAID WITHIN 10 DAYS, BUT IF IT INCLUDES ARREARS (CODE 27) THE TOTAL AMOUNT DUE MUST BE PAID AT ONCE, OTHERWISE THE SUPPLY MAY BE DISCONTINUED WITHOUT FURTHER NOTICE.

Ba ċóir íocaíoċt a ḋéanaṁ ag [illegible] áitiúil an Ḃoird agus admháil a fáil, a [illegible] ar an [illegible] admhála [illegible] admhála eile.

[illegible] seo in éineacht [illegible] toil.

[illegible] orduiṫe poist [illegible] a ḋéanaṁ a le "[illegible] láṫair an Leictais" agus a [illegible] le "Cuntas [illegible]."

PAYMENT SHOULD BE MADE AT THE BOARD'S LOCAL CENTRE AND A RECEIPT OBTAINED, MACHINE PRINTED ON THE ACCOUNT OR IN WRITING ON AN OFFICIAL RECEIPT FORM. NO OTHER RECEIPT FORM IS VALID.

PLEASE PRESENT THIS ACCOUNT WITH YOUR PAYMENT.

CHEQUES, POSTAL AND MONEY ORDERS SHOULD BE MADE PAYABLE TO "ELECTRICITY SUPPLY BOARD," AND CROSSED "A/C. PAYEE."

míniú táille cóid		EXPLANATION OF CHARGE CODE
téaṁ uisce	01—09	WATER HEATING
táille bunaiḋ	12	FIXED CHARGE
leictreaċas faoin dleaċt déċodaċ	13—19	ELECTRICITY ON TWO PART TARIFF
cíos ar ṁéadair agus araile	21	METER AND OTHER RENTS
íocaíoċt bannaiṫe	24	REVENUE GUARANTEE
cíosċeannaċ	25	HIRE PURCHASE
deisiúċáin	26	REPAIRS
riaráistí	27	ARREARS
cáin láiṁdeaċais	28	TURNOVER TAX
soilsiú	31—39	LIGHTING
téaṁ	41—49	HEATING
cuṁaċt gluaisteaċta	51—59	MOTIVE POWER
cócaireaċt agus próisteáṁ	61—69	COOKING AND PROCESS HEATING

E—Réiteoṗar meastaċán le méadar-léaṁ ina ḋiaiḋ.

Eisítear an cuntas seo de réir na gCoinníollaċa maidir le soláṫar leictreaċais ag an mBord.

E — SUBSEQUENT READINGS WILL ADJUST ESTIMATES.

THIS ACCOUNT ISSUES IN ACCORDANCE WITH THE GENERAL CONDITIONS RELATING TO ELECTRICITY SUPPLY BY THE BOARD.

méid iníoctá

AMOUNT DUE

16. Appendix I: ESB bill for August and September of 1967

Appendix I: ESB bill for August and September of 1967

17. Appendix J: ESB bill for February and March of 1972


POSTAS ÍOCTHA
BAILE ÁTHA CLIATH

ESB
BORD SOLÁTHAIR AN LEI[illegible]
ELECTRICITY SUPPLY [illegible]ARD
PRÍOMHOIFIG, BAILE Á[illegible] CLIATH 2
Head O[illegible], Dublin 2

8099 22 4 MR JOHN J WARD
13 CLONKEENKERRILL
146 COLMANSTOWN
BALLINASLOE

Meter No.	Meter Multiplier	Previous Units	Rate (Pence)	Units	Rate (Pence)	Charge Code	Charges
10493	1	75	1.57	235	0.84	13	3.57
	1			184	0.80	13	1.47
						12	0.60
						26	0.28
	HP INSTALMENT NO 11 OF 18					25	3.42

FEB-MAR 72 20 4 72 NOW DUE £9.34

ÍOCTHA [illegible] PAID E.S.B.
1 VI 21923 009.34 *

MÍNIÚ TÁILLE-CHÓID EXPLANATION OF CHARGE CODE

Irish	Code	English
Téamh Uisce	01—09	Water Heating
Táille Bhunaidh	12	Fixed Charge
Leictreachas Faoin Dlíeacht Déchódach	13—13	Electricity On Two Part Tariff
Cíos, ar Mhéadair agus Araile	21	Meter and Other Rents
Íocaíocht Bhunaithe	24	Revenue Guarantee
Cíoscheannach	25	Hire Purchase
Deisiúcháin	26	Repairs
Riaráistí	27	Arrears
Táille de bharr Cháin Láimhdeachais	28	Charge Due to Turnover Tax
Soilsiú	31—39	Lighting
Téamh	41—49	Heating
Cumhacht Ghluaiseachta	51—59	Motive Power
Cócaireacht agus Próiséas-téamh	81—89	Cooking and Process Heating

E.&E.E. E.&O.E.