

**Exploring consumer perception and attitudes towards renewable energy
with a view to developing best practice for marketing renewable energy.**

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Dissertation in Partial Fulfilment of the Requirements for the Degree of **MSc in Marketing Practice**

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ABSTRACT

This study was conducted in County Donegal and the overall purpose is to explore perception and attitudes towards renewable energy with a view to developing best practice for marketing renewable energy in County Donegal as a future source of sustainability.

Literature from government agencies and international sources was reviewed to establish issues surrounding global warming, sustainability and renewable energy.

The European Union imports 50 percent of its energy requirements. If no counteractive measures are taken within the next 20 to 30 years, this figure will rise to 70 percent.

Ireland relies upon imported non-renewable fossil fuels to satisfy around 86 percent of its total energy requirement (electricity, heat and transport). There are risks involved with this high reliance on imports, namely social and economic consequences and susceptibility to increasing energy prices.

The Irish climate is well suited to sourcing renewables such as solar, geothermal and biomass. There is a strong argument for the need to introduce and utilise renewable energy sources globally and locally to create a more sustainable future for generations to come.

The primary research comprised: a comprehensive survey questionnaire of a representative sample of homeowners who were granted commencement notice by the local authority (Donegal County Council) for new house builds in the year 2006; depth interviews with a number of building contractors representing micro and small enterprises comprising the six electoral areas in County Donegal.

The findings of this study indicate that respondents in County Donegal believe that the high cost of installation of renewable energy products influences the volume of sales of same. Respondents largely consider the current government grant aid available is inadequate in assisting homeowners with the installation of renewable energy systems. Furthermore, there is a high potential for Ireland to improve its promotion of renewable energy sources.

DEDICATION

I dedicate this dissertation to my family and friends who supported me throughout my years at college.

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Chapter 1

INTRODUCTION

1.1 Overview

There are many facets to the debate on climate change, global warming and renewable energy with various steps being taken globally to curb and decrease the negative effect of Carbon Dioxide (CO₂) emissions.

The Eurobarometer Survey (2007) reveals that half of European Union (EU) citizens are very concerned about the effects of climate change and global warming, while a further 37 percent say that they are concerned to degree about the issue. The perception of global warming is backed up by a 2005 poll for *The Guardian* which found that 89 percent regarded climate change and global warming as either a current or a future threat. Furthermore, a survey by the MIT laboratory for energy and the environment showed that 70 percent of UK respondents think that ‘action needs to be taken to address global warming’ (Curry, Reiner *et al.*, 2005 cited by Mc Gowan and Sauter, 2005).

1.2 Climate Change

There is a correlation between climate change and the depletion of the ozone layer (EEA, 2007). The ozone layer is located in the stratosphere at an altitude of 12 to 50 kilometers and its purpose is to protect life on earth from the harmful ultraviolet rays of the sun. Compounds (mainly chlorine and bromine) emitted into the atmosphere from human activities, including industry and the use of household products, have caused the ozone layer to become ‘thin’ in recent/previous decades. The thickness of the ozone layer varies annually and scientists predict that if the ozone layer recovers it could be a much denser layer thus leading to very different atmospheric conditions (EEA, 2007). This in turn will lead to global warming as the heat from the sun will become trapped below the ozone layer. The substances that deplete the ozone layer are known as ‘greenhouse gases’ (GHG’s) which possess warming properties up to 10,000 times greater than CO₂. However, the amount of CO₂ emitted through human activities is considered the most important GHG and contributes 80 percent of total GHG emissions. The Teagasc guide to Wood Energy from Farm Forests (2007) also supports this in saying that burning fossil fuels releases huge amounts of CO₂ and other GHG’s into the atmosphere trapping the sun’s heat.

1.3 Definitions of ‘Renewable Energy’ and ‘Sustainability’

To aid the reader definitions of ‘Renewable Energy’ and ‘Sustainability’ are necessary.

Renewable Energy definitions:

‘A renewable energy source is defined as any energy resource naturally regenerated over a short time scale that is derived directly from the sun (such as solar thermal and photo voltaic), indirectly from the sun (such as wind, hydropower and photosynthetic energy stored in biomass), or from other natural movements and mechanisms of the environment (such as geothermal and ocean energy)’ (European Renewable Energy Council, 2007).

‘Renewable energy comes from energy sources that are continuously replenished by nature. The main sources of renewable energy are the wind, the sun (solar energy), water (hydropower, wave and tidal energy), heat below the surface of the earth (geothermal energy) and biomass (wood, biodegradable waste and energy crops)’ (Environmental Protection Agency, 2006).

Sustainability definitions:

The report of the World Commission on Environment & Development (1987) defined sustainable development as being ‘development that meets the needs of the present, without compromising the ability of future generations to meet their own needs’.

Sustainability: ‘It is based on the recognition that when resources are consumed faster than they are produced or renewed, the resource is depleted and eventually used up. In a sustainable world, society's demand on nature is in balance with nature's capacity to meet that demand’. Global Footprint Network cited by Eco-efficiency (2008).

1.4 Renewable Energy

Renewable Energy Sources (RES) supply 14 percent of the total world energy demand. RES are biomass, hydropower, geothermal, solar, wind and tidal/wave energy as listed by Demirbas, (2005) and are an essential alternative to fossil fuels.

The EU is already a world leader in renewable energy and the sector has huge and growing economic importance worldwide. So far, however, development has been uneven across the EU, and renewable energies still represent only a small share of the EU’s total energy mix relative to the dominance of gas, oil and coal (Memo on the Renewable Energy and Climate Change Package, 2008).

Using these sources of RES helps not only to reduce GHG's from energy generation and consumption but also to reduce the EU dependence on imports of fossil fuels and allows the population a sustainable future (EUROPA Summaries of Legislation, 2006).

An assessment of the share of renewable energy in the energy mix and the progress made in the last ten years shows that more and better use could be made of renewables. For example, in 2005 the breakdown of renewable energy produced in the EU by source was as follows: 66.1 percent from biomass, 22.2 percent from hydropower, five point five percent from wind power, five point five percent from geothermal energy and zero point seven percent from solar power (thermal and photo voltaic) (Renewable Energy Roadmap, 2007).

1.5 Types of Renewables

For the purpose of this study the sources chosen are solar (including Photo Voltaic (PV)) Geothermal and Biomass.

1.5.1 Geothermal

Geothermal energy for electricity generation has been produced commercially since 1913 and for four decades on the scale of hundreds of Mega Watts (MW) both for electricity generation and direct use. Geothermal works by extracting heat energy from a low temperature source and upgrading it to a higher temperature through piping laid in the ground at one or more metres deep where the temperature of soil is usually between 8-12°C (Construct Ireland, 2007). Geothermal energy is clean, cheap and renewable, and can be utilized in various forms such as space heating and domestic hot water supply, CO₂ and dry-ice production process, heat pumps, greenhouse heating, swimming and balneology (therapeutic baths), industrial processes and electricity generation, (Demirbas, 2005).

1.5.2 Solar (PV)

'Space satellites have for years used solar cells for their source of electricity' (Hollingum, 2001). Hollingum (2001) also stated that 'direct solar heating of water is widely used in warmer climates and can provide a boost to conventional hot water systems in more northerly areas'.

Solar (PV) systems convert solar radiation into electricity. The PV cell consists of one or two layers of a semi-conducting material, usually silicon. When light shines on the cell, it creates an electric field across

the layers, causing electricity to flow. The greater the intensity of the light, the greater the flow of electricity (Department of Environment, Heritage and Local Government, 2007).

Hoffmann (2006) contends that 'photo voltaic (PV) solar electricity market has shown an impressive 33% growth per year since 1997 until today with market support programs as the main driving force'.

1.5.3 Biomass

Renewable energy in the form of bioenergy is the general term used to denote renewable energy derived from biomass. Biomass is the biodegradable fraction of products, waste and residues from agriculture (including vegetal and animal substances), forestry and related industries, as well as the biodegradable fraction of industrial and municipal waste. It also includes crops specifically grown for energy use (Bioenergy in Ireland, 2004).

Wood as a source of energy does not contribute to global warming because the CO₂ released during the wood burning process is equal to the amount of CO₂ taken out of the atmosphere during tree growth through photosynthesis (Teagasc, 2007).

1.6 Conclusion

There is increasing concern about energy supply and demand with a global majority highly dependent on a limited number of energy sources (oil, coal and gas). The urgent need to do something about climate change is guiding the global population towards renewable energy sources. As stated by the OECD/IEA, (2008) 'The supply of fossil fuels is finite and will eventually be depleted along with causing further substantial emissions affects'. The development of renewable energy sources would reduce our reliance on what is a diminishing supply of fossil fuels (oil, gas and coal).

Chapter 2

LITERATURE REVIEW

2.1 Overview of World Energy Supply, Consumption and Emissions

The supply and consumption of fuel sources on a global scale is important to consider. A comprehensive report has been compiled by the International Energy Agency (IEA), (2007) which contains key international energy statistics. The following is a summary of some of the information contained in the IEA (2007) report (see Appendix 1 for Glossary of Terms)

Table 2.1 World Total Primary Energy Supply (TPES) by Fuel Type *(Mtoe) 1973 and 2005

Fuel Type	1973	2005
Fossil fuels oil, coal and gas	86.6%	81%
Combustible Renewables & Waste, Nuclear, Hydro and Other (geothermal, solar, wind, heat etc.)	13.4%	19%

Adapted from IEA (2007, pp. 7-8) *Mtoe – Million ton oil equivalent

The information above (see Table 2.1) suggests that there were very high percentages of fossil fuels being supplied as energy sources globally in both 1973 and 2005. The combined total of oil, gas and coal in world supply was 86.6 percent in 1973, dropping to 81 percent in 2005. This reveals a 7 percent (approximately) decrease in the amount of fossil fuels used in the period 1973 to 2005. Considering this is over a period of thirty two years, the decrease is not significant. Renewable energy sources such as combustible renewables and waste, nuclear, hydro and other (geothermal, solar, wind, heat etc.) tallied at 13.4 percent and 19 percent for the years 1973 and 2005 respectively. Fossil fuel supply was six times that of renewable energy in 1973, and four times greater in 2005.

Table 2.2 World Total Final Consumption by Sector Coal, Oil and Gas *(Mtoe) for 1973 and 2005

Sector	1973			2005		
	Coal	Oil	Gas	Coal	Oil	Gas
Industry	57.4%	19.8%	54.0%	78.0%	9.4%	35.1%
Other Sectors (see Appendix 1)	36.3%	23.3%	40.7%	17.1%	14.5%	48.5%
Non Energy Use (see Appendix 1).	1.0%	11.5%	2.7%	4.3%	15.8%	10.7%
Transport	5.3%	45.4%	2.6%	0.6%	60.3%	5.7%

Adapted from IEA (2007, pp. 32-34) *Mtoe – Million ton oil equivalent

World trends in the consumption of fossil fuels can be examined in Table 2.2. Consumption in the levels of coal increased for industry and ‘non energy use’ sectors in 2005 over 1973 levels, in turn decreased in ‘other sectors’ and transport. Oil consumption increased in ‘non energy use’ sector and transport from 1973 to 2005. Oil usage decreased in both the industry and ‘other sectors’. The use of gas as a form of energy increased in the non energy, other and in the transport sectors. The only decrease in the consumption of gas was in the industry sector.

Table 2.3 Share of Final Global Energy Consumption & CO₂ Emissions (direct & indirect) by Sector 2005

	Energy measured in EJ (Exajoules, 10 ¹⁸ Joules)	CO ₂ measured in Gt (Gigatonne, 10 ⁹ tonnes)
Manufacturing	33%	38%
Household	29%	21%
Services	9%	12%
Transport	26%	25%
Other (construction, agriculture/fishing)	3%	4%

Adapted from OECD/IEA 2008

The above summary table (see Table 2.3) shows that in 2005, manufacturing industry was the end-use sector that globally consumed the most energy (with a 33 percent share) followed by households (29 percent) and transport (26 percent). Trends in CO₂ emissions are driven by the amount and type of energy used and the indirect emissions associated with the production of electricity. Between 1990 and 2005, global CO₂ emissions from final energy use increased to 21.2 Gt (Giga ton, 10⁹) CO₂, a rise of 25 percent. CO₂ emissions from the manufacturing sector in 2005 were: 38 percent, transport 25 percent, and households 21 percent (OECD/IEA, 2008).

2.2 European Union’s Dependency on Imported Fossil Fuels

With the positive effects of renewable energy in combating negative environmental impacts, there is an opportunity to change current consumption patterns. The EU’s high external dependency on imported fossil fuels will now be examined.

The EU imports 50 percent of its energy requirements and if no counteractive measures are taken, within the next 20 to 30 years this figure will rise to 70 percent. This external dependence has economic, social, ecological and physical risks for the EU. Energy imports represent six percent of total imports, which

means in geopolitical terms that 45 percent of oil imports come from the Middle East and 40 percent of natural gas comes from Russia. (Green Paper on Energy Efficiency, 2005).

2.3 Policies and Legislation Implemented by the European Union towards Climate Change

On 4 February 1991, the Council authorised the Commission to participate on behalf of the European Community in the negotiation of a United Nations Framework Convention on Climate Change (UNFCCC) which was adopted in New York on 9 May 1992. The Framework Convention entered into force on 21 March 1994 and may be considered a success for having made people globally more aware of the problems linked to climate change (Kyoto Protocol on Climate Change, 2002).

In Berlin in March 1995, the Parties to the Convention decided to negotiate a Protocol containing measures to reduce emissions for the period beyond 2000 in the industrialised countries. After much endeavour, the Kyoto Protocol was adopted on 11 December 1997 in Kyoto (Kyoto Protocol on Climate Change, 2002).

Under the Kyoto Protocol most of the industrialised countries need to reduce their emissions of certain GHG's (which are responsible for global warming) by an average of 5 percent. The EU committed itself to reducing its GHG emissions by 8 percent compared to the base year (1990) being used during the period 2008-2012 (Kyoto Protocol on Climate Change, 2002).

After meeting the commitments under the Kyoto Protocol it is the objective of the EU to reduce GHG emissions by an average of 1 percent per year over 1990 levels up to 2020 (20 percent by 2020). This target was shared between the 15 countries that were EU Member States at the moment of the EU's ratification of the Protocol on 31 May 2001 under a legally binding burden-sharing agreement. This agreement sets an individual emissions target for each EU Member State. Each Member State also puts into place a series of further domestic actions according to their individual circumstances. The European Union, with all of its 25 Member States, is making significant efforts to tackle climate change, despite being responsible for only 14 percent of global GHG emissions.

By the first of January 2007, 168 countries and one regional economic integration organisation (EU-15) had ratified the Kyoto Protocol (UNFCCC, cited by EEA 2007). Neither the United States of America (USA), which produced 40 percent of emissions from industrialised countries in 2003, nor Australia, which produced 4 percent of emissions in 2004 (EEA, 2007) - industrialised land masses with high GHG emissions - chose to ratify the Kyoto Protocol.

The targets set out in 1997 of generating 12 percent gross domestic energy consumption from renewable sources 2010 (Renewable Energy Roadmap, 2007) could be considered optimistic.

The Renewable Energy Roadmap (2007) highlights the difficulties encountered, these being the:

High cost of renewable energy owing to the investment required and the fact that externalities (the "external" cost of the different energy sources, particularly their long-term impact on health or the environment) have not been taken into account, which gives fossil fuels an artificial advantage; administrative problems resulting from installation procedures and the decentralised nature of most renewable energy applications; the opaque and/or discriminatory rules governing grid access; inadequate information for suppliers, customers and installers; the fact that the 12% target is expressed as a percentage of primary energy, which puts wind power at a disadvantage (a sector that has experienced considerable growth during the period in question).

(Renewable Energy Roadmap, 2007)

2.4 Renewables in Ireland – Targets, Consumption, Indigenous Production, Imports and Renewable Contribution

In Ireland the growth of renewable energy sources has been slow, but it is improving. Most of the country's fuel is imported.

In April 1996, a national energy strategy called "Renewable Energy – A strategy for the Future" was launched establishing targets up to the year 2010, including specific targets for new generation capacity from wind, hydro and biomass/waste to energy sources. In the case of Ireland the indicative target is that electricity from renewable energy be greater than 15 percent by 2010 compared to a level of 6 percent in 2002/03. Ireland has a large feasible resource for offshore wave energy, mostly concentrated in the West, which receives powerful Atlantic waves (Department of Communications, Marine and Natural Resource, 2005).

The Environmental Protection Agency (EPA), (2006) states that 'Ireland relies upon imported non-renewable fossil fuels to satisfy around 86% of its total energy requirement (electricity, heat and transport)', and that high dependence on imported fuels has significant associated risks. If supply is interrupted there will be both social and economic consequences and susceptibility to increasing energy prices (EPA, 2006). The Consultation Paper on proposed planning exemptions for certain Renewable Energy Technologies (2007) states that 'over 90% of Ireland's total energy demand is met from imported fossil fuels, with oil accounting for around 56% of our total primary energy supply'.

Renewables such as wind, hydro and other renewables (solar, geothermal etc.) were responsible for providing 2.7 percent of Ireland's total energy requirement in 2006.

The Green Paper (2006) states that the United Kingdom (UK) market is now the source of some 80 percent of Ireland's imported natural gas, and the UK is becoming a more significant importer of gas itself.

O'Leary *et al.* (2008) has documented that energy use in Ireland increased by .9 percent in 2006.

O Cleirigh (2006) states that 'demand for electricity in Ireland has been growing at an average of over 5 percent per annum over the past decade'. According to the median growth rate forecast produced by the Economic and Social Research Institute, this growth is expected to continue at an average of under 4 percent per annum to 2011.

The Government white paper on Delivering a Sustainable Energy Future for Ireland (2007) states the following targets for the uptake of renewable energy for the years leading up to and beyond 2020: by 2010, 15 percent of all electricity consumed on a national basis will come from renewable sources, delivering an emissions saving of some 1.47 Mega ton (Mt) annually, rising to 33 percent by 2020; minimum of 5 percent market penetration of renewables in the heat market by 2010, rising to 12 percent penetration by 2020.

The environmental Protection Agency (EPA) recognises that future climate conditions in Ireland are largely already determined by global changes driven by historic GHG emissions. In relation to energy the EPA recognises the contribution made by Sustainable Energy Ireland (SEI) to the reduction in energy demand generally in Ireland, through informing the public of renewable energy sources. (National Climate Change Strategy Review Consultation – Response from the EPA, 2007).

2.5 Statistical Analysis of Energy Trends in Ireland

Energy in Ireland and Energy in the Residential Sector, O’Leary *et al.* (2008) provides useful statistics and data that allow analysis of the energy trends in Ireland between 1990 and 2006. The following Tables 2.4 – 2.7 provide a summary of data from these two reports.

Table 2.4 Total Fuel Consumption in Ireland by Fuel Type for 1990 & 2006 (*Ktoe by % Share)

	1990 (% share)	2006 (% share)
Coal	11.6	2.9
Peat	10.4	2.2
Oil	54.6	64.3
Natural Gas	7.8	12.0
Renewables	1.5	1.4
Electricity	14.0	17.1

Adapted from Energy in Ireland, O’Leary *et al.* (2008, p. 15) * Ktoe – Kilo ton oil equivalent

There are notable variations in the patterns as can be seen in the above table (Table 2.4). The consumption of coal, peat and, surprisingly, also in renewables, has decreased between 1990 and 2006. O’Leary *et al.* (2008) explain this difference by stating ‘use of renewable energy sources increased by 75% (3.5% per annum) in 2006 over 1990 but its share of final energy usage decreased from 1.5% to 1.4%’. There was an increase in the consumption of oil, gas and electricity during the same periods.

Table 2.5 Total Final Energy Consumption in Ireland by Sector for 1990 & 2006 (*Ktoe % Share)

	1990 (% share)	2006 (% share)
Industry	23.7	20.6
Transport	27.8	41.5
Residential	31.1	23.0
Services	13.9	12.4
Agriculture	3.5	2.5

Adapted from Energy in Ireland, O’Leary *et al.* (2008, p. 15) * Ktoe – Kilo ton oil equivalent

The consumption by the industry sector has decreased since 1990 to 2006 (see Table 2.5). An explanation for this is provided by O’Leary *et al.* (2008) thus ‘over the 1990 to 2006 period industry experienced an average growth rate of 2.8% per annum (or 56% in absolute terms) while its share of final consumption fell from 24% to 21%’. There has also been a decrease in consumption in the residential sectors share of energy use. O’Leary *et al.* (2008) contend that ‘while the residential sector’s energy usage has increased by 32%, its share of total energy usage fell from 32% in 1990 to 25% in 2006’. They

go on to say that this is largely the result of the 167 percent growth in energy usage for transport purposes.

Table 2.6 Imported Energy into Ireland by Fuel Type for 1990 & 2006 (*Ktoe % Share)

	1990 (% share)	2006 (% share)
Coal	28.5	11.2
Oil	71.5	62.9
Natural Gas	0.0	24.9
Electricity	0.0	1.1

Adapted from Energy in Ireland, O'Leary *et al.* (2008, p. 19) * Ktoe – Kilo ton oil equivalent

The decrease in the use of coal and oil (see Table 2.6) is compensated by the use of natural gas as an energy alternative.

Table 2.7 Indigenous Production in Ireland for 1990 & 2006 (*Ktoe % Share)

	1990 (% share)	2006 (% share)
Coal	0.4	0.0
Peat	40.7	48.0
Natural Gas	54.1	25.7
Renewables	4.8	26.3

Adapted from O'Leary *et al.* (2008, p. 19) * Ktoe – Kilo ton oil equivalent

Ireland has a plentiful indigenous supply of peat (see Table 2.7). In Table 2.7 it is clear that there is a decrease in the consumption of indigenous natural gas which can in part be attributed to the country's heavy reliance on imported oil being used as a substitute energy source. Furthermore, this decrease is supplemented by the increased share of renewables being consumed in 2006.

2.6 Ireland's Energy Infrastructure

Ireland faces considerable supply challenges. The National Competitiveness Council, Forfás, IBEC, the Irish Academy of Engineering, and others, have pointed to deficiencies in Ireland's energy infrastructure and potential economic impacts, indicating that Ireland compares poorly in this area relative to other developed countries (Green Paper, 2006).

The EPA (2006) suggests that in the short-term biomass could contribute an additional 706 kilo ton oil equivalent (ktoe) of energy to the Irish economy. The CO₂ emissions savings associated with the 706 ktoe represent between 50-65 percent of the expected deficit to attain Kyoto compliance, depending on the fuels displaced.

The Irish Bioenergy Association (2008) states that the:

‘Irish Government’s Energy White Paper – Delivering a Sustainable Energy Future for Ireland, has established ambitious targets for bioenergy by 2020, including: 12% renewable heat – while not directly identifying biomass, nevertheless it is likely that biomass would need to contribute more than 90% of this target if it were to be realised’.

The Consultation Paper on proposed planning exemptions for certain Renewable Energy Technologies (2007) puts forward the argument that solar energy is the most commonly used renewable energy source in Ireland, particularly for domestic applications. It remains the case that the true potential of solar energy in Ireland is also under-utilised. The Consultation paper goes on to say that even in the Irish climate, typical solar contributions to water heating systems can range between 30 percent and 60 percent, and ‘one square metre of solar panelling can provide up to 70 litres of hot water per day’.

Geothermal heat pumps collect heat from solar energy stored in the ground and are ideal for the Irish climate. It is now a proven, safe and environmentally friendly alternative to fossil fuels that is also cost-effective for certain commercial and domestic applications (The Consultation Paper on proposed planning exemptions for certain Renewable Energy Technologies, 2007).

2.7 Consumer Perceptions and Attitudes towards Renewables

Over the years there have been numerous studies addressing public opinions, perceptions, attitudes and views on environmental issues. With respect to the literature on public opinions, the environment and energy were not topping the opinion polls. The main issues of concern to the public were social fears such as crime, terrorism, health and education. The purchasing behaviour of the consumer has to be changed in order to achieve substantial levels of Renewable Energy Source (RES) usage. The Action Plan for Energy Efficiency (2006) states that the EU Commission plans a number of educational measures to raise public awareness of the importance of energy efficiency, including education, training programmes on energy and climate change issues and the Commission considers that 'public authorities should set an example'.

There is overwhelming support for creating tax incentives to encourage the development and use of alternative energy sources, such as solar and wind. On average 80 percent favour this approach, 50 percent of whom do so strongly. The Italians (95% favour, 75% strongly) are especially enthusiastic, followed by the Australians (93% favour, 74% strongly), Canadians (91% favour, 66% strongly), and the French (91% favour, 63% strongly). Chileans (62% favour, 31% strongly) are supportive as are Egyptians (66% favour, 32% strongly) (BBC World Service, 2006).

The BBC World Service (2006) from its research of the 19 countries globally found that there are

Strong majorities across the countries want governments to actively address energy issues, especially through tax incentives to develop renewable energy supplies (80% favour) and higher fuel efficiency standards for automobiles (67% favour).

In a survey addressing public attitudes to quality of life and the environment by the United Kingdom (UK) Department of Environment Food and Rural Affairs (DEFRA, 2001 cited by Ricci 2006), only 10 percent of respondents put the environment in the top three factors that affect the quality of life, whereas health scored the highest position. The only environmental problem that raised concern was linked to air and noise pollution.

A further, more recent survey was conducted by DEFRA (2007), with results presented by British Market Research Bureau (BMRB) on a representative sample of 3,618 individuals in England. The sample was similar in size to the 2001 survey. The environment ranks fourth as an issue of importance at 20 percent, although the proportion mentioning the environment fell from 25 percent in 2001 (DEFRA, 2001 cited by Ricci 2006), to 20 percent in 2007. Crime, health, economic and education issues all ranked higher. Respondents in the survey were more aware of the specific term 'climate change' than in the 2001 survey,

when only 78 percent of respondents had heard of the term. In 2007, 99 percent of respondents had heard of the term 'climate change' and 93 percent knew at least a little about it. Although it is worth noting that in 2001, 99 percent of respondents had heard of at least one of the terms 'climate change', 'global warming' or the 'greenhouse effect'.

When respondents were asked (British Market Research Bureau (BMRB) DEFRA (2007)) if they had a renewable energy source the survey yielded the following results. Only 12 out of 3,618 respondents (less than 0.5 percent) had already fitted solar panels for electricity at their home, but 9 percent said they were seriously considering doing so. However, nine out of ten people were not considering installing solar panels. Just 14 out of 3,618 respondents already had solar water heating at home, but 8 percent were seriously considering it. Again, nine out of ten people were not considering installing solar water heating.

People aged between 30 and 64 were more likely to be considering installing these renewable energy sources than those aged 16 to 29, and those aged 65 or more. Respondents who lived in rural areas and people in detached houses were more likely to be considering these renewable energy sources. People whose household incomes were £40,000 or more and higher social grades (AB - doctor, solicitor, accountant, teacher, nurse, police officer) were more likely to be considering these renewable energy sources. Unsurprisingly, people who were renting their homes were less likely to be considering these renewable energy measures.

A survey-based study of public attitudes towards energy and the environment in the UK was carried out in September 2004 on a sample of 2,640 panellists (1,056 usable responses) selected by YouGov, a company specialising in internet polling (Curry et al., 2005). The study revealed that the environment is not considered among the three most important issues facing the UK in current times. Perceived global threats, such as immigration and terrorism, and social issues (crime, health and education) received comparably more attention.

Similar findings emerged from the study conducted by MORI in October 2005 on behalf of EDF Energy, by interviewing face-to-face a sample population of 1,931 aged over 15 years and representative of the British population (MORI, 2005 cited by Ricci 2006). When asked which are the most important issues facing the UK, the most cited was crime (44%) followed by terrorism, education, immigration, drug abuse and the National Health Service (NHS) (all around 20%). Global warming and climate change received little attention (13%), as did pollution/environment (8%). Very few respondents cited energy (4%). When asked about major challenges currently facing the British Government, energy issues were chosen

by 37 percent of the sample. However, health care, law and order, immigration, education and pensions achieved comparably more citations.

Mc Gowan and Sauter (2005) carried out extensive desk research in Sussex, England, based on a review of over 30 studies which were conducted since 2000. All of the studies dealt in part, or in whole, with public attitudes to energy technologies and their acceptability. A number also dealt with perceptions of energy technologies and how they contribute to energy policy objectives as well as with public understandings of those technology and policy issues.

Mc Gowan and Sauter (2005) contend that many 'different studies showed that the term 'renewable energy' was neither well 'recognised' nor 'understood' by the public'. Additionally they stated that the Royal Society for the Protection of Birds (RSPB) survey found that only 55 percent of respondents had encountered the term, but that most of the studies did not further investigate the depth of respondents' knowledge about renewable energy sources. However, the results from the studies considering the aspect (DTI, Scottish Executive et al., 2003; London Renewables, 2003; MORI Social Research Institute for Regen SW, 2004 cited by Mc Gowan and Sauter, 2005) of low levels of knowledge indicate that this seems to be very important and would need further investigation. In general the public refers less to the abstract term 'renewable energy', but to a specific renewable energy source.

The study by Mc Gowan and Sauter (2006) also established that the general public are confused as to the meaning of the words 'renewable energy'. For example, when asked 'off the top of their head' what they associated with 'renewable energy', 17 percent responded with the word 'recycling' and a further 17 percent associated the phrase to 're-use of energy'.

Knowledge about specific renewable energy technologies varies considerably. Solar, hydro and wind are rather well known, while biomass is widely ignored. The UK Department of Trade and Industry (2003) study revealed high knowledge of solar, hydro and on-shore wind (around 70%) and low knowledge of biomass/gas (around 20%).

The MORI London survey (2003) showed that 95 percent and 94 percent of respondents have heard about solar and wind power respectively, whereas 43 percent have never heard of Combined Heat & Power (CHP) and 30 percent have never heard of 'incineration of organic waste' (London Renewables, 2003 cited by Mc Gowan and Sauter, 2005).

Poortinga *et al.*, (2006) conducted a large-scale British survey on 1, 491 respondents to elicit public opinion towards future energy options for the nation, with a focus on attitudes to nuclear power in the

context of climate change. The survey revealed that 82 percent of respondents were *very* or *fairly* concerned about climate change/global warming. Also apparent from the research was that a large proportion of respondents suggested that the best way to tackle climate change would be to manage demand through behavioural change (69%). Other popular responses were to increase the use of renewable sources (68%) and to expand the use of energy-efficiency technologies (54%).

The MORI London survey, however, questions a positive correlation between awareness and acceptability since the support remains almost at the same level in spite of higher awareness (London Renewables, 2003 cited by Mc Gowan and Sauter, 2005). Moreover, even where there is awareness, this does not necessarily translate into a willingness to adapt behaviour. A UK Department of Trade and Industry (DTI) commentary on public attitudes to energy and the environment quotes DEFRA research that shows that ‘information does not necessarily lead to awareness or awareness lead to action’ (DTI, 2005)

A more recent study conducted by the UK DTI (2006) on a sample of 2,032 respondents in Great Britain substantiated that there was an overall positive opinion in favour of renewable energy. When respondents were asked to give a rating of 1 to 10, where 10 is ‘totally in favour’, and 1 is ‘totally against’ using renewable energy as an alternative to fossil fuels, they answered favourably in that 27 percent of respondents gave a top rating of 10, the highest proportion of all the ratings. Overall, the mean of the ratings was 7.493. In the same study it was found that 31 percent agreed with the statement that ‘renewable energy sources are too costly and this outweighs the environmental benefits they may have’, while 43 percent disagreed, and 18 percent neither agreed nor disagreed with the statement. A large proportion of respondents (68 percent) stated that their views towards renewable energy were influenced by television (DTI, 2006).

Finally, the DTI (2006) concludes that:

‘Nearly all respondents have heard of some form of renewable energy, although awareness does vary considerably depending on the type of source. Solar, wind and hydroelectric energies are the most well known, whereas less than half of people have heard of biomass or bio-energy’.

Some of the barriers to the uptake of renewables are highlighted by Jager-Waldau (2005), who have documented that ‘the current economic and social system is based on centralised conventional sources of energy (coal, oil, natural gas and nuclear energy) and their distribution system. The second main barrier

is of a financial nature. Renewables need significant initial investment, as was the case for the other energy sources, such as coal, oil and nuclear energy in the past’.

2.8 Conclusion

Although there has been, and continues to be, considerable improvements in the use of renewable energy sources worldwide, renewable energy sources account for only a small percentage of global energy.

There is high potential for Ireland to improve its use renewable energy sources. This is not occurring at the moment. From literature reviewed, it is apparent that the Irish climate is well suited to renewables such as solar, geothermal and biomass. This leads us to question why there is a poor uptake in the use and installation of renewable energy sources?.

Chapter 3

RESEARCH METHODOLOGY

3.1 Introduction

The overall objective was developed based on findings in the literature the researcher had analysed and with the promotion of renewable energy in County Donegal as a future source of sustainability. This was the precursor to the other objectives, one to four, cited in paragraph 3.2 below.

The first objective was developed to get an insight into the knowledge of new build consumers (consumers building new dwelling structures) based on the apparent confusion about renewable energy derived from the literature.

The second objective was for the researcher to gain knowledge of the type of promotion of renewable energy undertaken by the contractor and any other sources of information the respondents were aware of.

The third objective is based on findings in the literature where respondents to previous surveys were either unaware or had little knowledge of government incentives for renewable energy sources.

The fourth objective was based on what the researcher wanted to establish about the number of renewable energy installations in County Donegal.

3.2 Research Objectives

The overall purpose of this study is to explore perception/attitudes and behaviour towards renewable energy, with a view to developing best practice for marketing renewable energy in County Donegal.

The following objectives are to be satisfied:

1. To explore the attitudes/awareness of new build consumers towards renewable energy alternatives for a sustainable future along with their perceptions of global warming and fossil fuels.
2. To explore the role contractors play in the promotion of renewable energy sources to the householder/homeowner.
3. To examine perceptions and level of knowledge of new build consumers and builder/contractors of the effectiveness of government incentives to date for renewable energy installations.
4. To discover the number of renewable energy installations carried out by the builder/contractor.

3.3 Introduction

This study was conducted in two phases, namely Phase 1: Survey Research, and Phase 2: Depth Interviews. The following Table 3.1 shows a breakdown and intersection of the survey research and the depth interview questions in relation to the objectives set out above.

Table 3.1 Survey Research and Depth Interviews breakdown with crossovers.

Objective	Methodology
Objective 1	Survey
Objective 2	Survey & Depth Interviews
Objective 3	Survey & Depth Interviews
Objective 4	Depth Interviews

3.4 Frame Development

For the purposes of this study, the researcher revised a comprehensive body of relevant literature to gain a better understanding of the chosen area of renewable energy. From this research it was apparent that the term ‘renewable energy’ was neither well ‘recognised’ nor ‘understood’ by the general public. Therefore, the researcher conducted this study in an attempt to investigate whether the literature reviewed findings corresponded with the survey and depth interview responses in County Donegal. Prior to this study of attitudes/perceptions and behaviour towards renewable energy in County Donegal, there had been no such other research carried out in the county.

Therefore, for the survey research the researcher had to compile a representative sample list of the relevant respondent’s names and addresses for the study. This was achieved by analysing the records of the Donegal County Council, Commencement Notice for Developments in County Donegal for the year 2006. This list was then segmented into the six County Council (CC) Electoral Areas (EA) and a quota sample was taken from each area based on the number of private households by EA in County Donegal according to the 2006 Central Statistics Office census data.

In order to carry out depth interviews, the researcher obtained a comprehensive list of all types of construction contractors in County Donegal courtesy of Letterkenny Institute of Technology (LyIT) from the Kompas database which contained 310 names. This list was analysed and filtered to obtain the contractors that built houses only (of which there were 49) and then sorted into their respective electoral areas. A further segmentation regarding company size, determined by the number of employees, was then completed. Filtered from this, the researcher used their judgement as to whom to conduct the depth interviews with from the respective combined electoral areas.

3.5 Phase 1 Survey Research

The survey method employed was a questionnaire (see Appendix 2) which was based on the objectives which were issues found to be reoccurring in the literature reviewed by the researcher. Malhotra, (2007) states that the survey method is a structured questionnaire given to a sample of a population and designed to elicit specific information from respondents. Respondents are asked a variety of questions in a structured prearranged non-disguised manner in that the respondents are fully aware of the purpose of the questions they are being asked. The questionnaires were sent by post to the relevant respondents who were the homeowner/ householders that built a new house in the period under review, the year 2006.

Postal surveys have a better response rate if respondents are interested in the subject involved and if they feel that their efforts in completing the survey are valued (Schmidt and Hollensen, 2006). Postal surveys can be used if there is an up-to-date mailing list (Crouch and Housden, 2003). However, as stated by Burns and Bush (2003), there is the problem of nonresponse where the respondents do not return the survey to the researcher. In this study questionnaires were accompanied by a cover letter on LyIT headed paper (see Appendix 3) with a stamped addressed return envelope to encourage a reply. The cover letter contained an outline of the purpose of the survey and gave assurances of confidentiality. A copy of the survey findings were offered to respondents as an incentive to participate. Parasuraman et al., (2004) states that respondents are more cooperative when they know why the information is needed and that there is a guarantee of confidentiality.

3.5.1 Sampling

The researcher identified the target population as those who were new build householders in County Donegal in 2006. The sampling frame was determined by compiling a list of the new single detached house builds from the hard copy records of Commencement Notice for Developments in County Donegal courtesy of Donegal County Council. The county was then broken into by the six electoral areas (EAs) (see Appendix 5) which contained a representative number of elements with respect to the number of households. The sampling method chosen was a probability sample that is an objective procedure in which the probability of selection is known in advance for each population unit (Parasuraman, 2004). From this, a stratified random sample, using the new build householders and building contractors as the relative strata was chosen. According to Parasuraman (2004), in stratified random sampling the sample is chosen which is forced to contain units for each of the segments, or strata, of the population. Within the new build householders stratum the elements were selected by quota sampling. When the quota was reached in each EA, the researcher moved on to the next EA quota to be filled. According to Parasuramann, (2004) a pre-specified quota of units is selected from each population segment or cell based on the judgement of the researcher.

The sample size was determined by taking the Number of Commencement Notices by Local Authority, Month and Residential Units Commenced from the Central Statistics Office Census for 2006. The population of particular interest was 3,648, which was the number of commencement notices filed with Donegal County Council (DCC) for the year 2006.

To determine the sample size from the population of interest size of 3,648, the researcher had to do some statistical calculations and expressions. To better understand the process, some terms need to be explained briefly as described in Naresh *et al.*, (2003) and the formulae used in the calculations to arrive at the final sample size of 348 (rounded from 347.5), see Appendix 4.

In order to have the sample size of 348 representative to the EAs in County Donegal, the number to be sampled from each EA (see Table 3.2) had to be obtained. For the calculations that led the researcher to arrive at the given sample size in each EA see Appendix 6.

Table 3.2 Electoral Areas in County Donegal in 2006 and the number to be sampled from each

Electoral Area	Number to be sampled
Donegal	61
Glenties	61
Inishowen	81
Letterkenny	72
Milford	38
Stranorlar	36
Total	349

Total sample size is 349 due to rounding of figures

3.5.2 Data Collection

A combination of both secondary and primary research was carried out for this study. Secondary data was scrutinised by the researcher from external sources (government publications, statistics, previous research in similar surveys, and journals). The primary research method was conclusive in the form of descriptive quantitative research, namely a survey questionnaire sent to respondents that were a representative sample of the group of interest to the researcher.

Malhotra, (2007) noted exploratory research can define a problem, identify alternative courses of action, develop hypotheses, isolate key relationships and variables, develop an approach to the problem and establish priorities for further research.

Quantitative research has structure and deals with larger more representative samples and is useful in conclusive research projects - Parasuraman, (2004). As Burns and Bush (2003) state, quantitative research is very specific on what information is needed. Data format is clear and well defined in an orderly process that is largely numerical.

3.5.3 Measurement

The researcher designed a survey questionnaire (see Appendix 2) for the purpose of acquiring relevant information pertaining to the research objectives. The questionnaire was then posted out to the elements of interest to the researcher. Measurement is the assignment of numbers to responses based on a set of guidelines - Parasuraman, (2004). The survey design was based on noncomparative scales where each object is scaled independently of the others in the stimulus set with the resulting data considered to be interval or ratio scaled (Malhotra, 2007).

The questionnaire contained several types of questions. These included questions from the Likert Scale, which is a widely used rating scale requiring the respondents to indicate a degree of agreement or disagreement with each of a series of statements about the stimulus objects. Normally five categories exist in a Likert Scale - (Malhotra, 2007).

Another type of question used was multiple choice, where a set of scale items is generated by the judgement of the researcher based on knowledge of the area and should cover the full range of possible alternatives (Malhotra, 2007 and Grover & Vriens, 2006).

Dichotomous questions were also used. These have a 'yes' or 'no' answer and are easy to code and analyse but the response can be influenced by the wording of the question (Malhotra and Birks, 2003).

To enable a profile of the respondents to be built, classification questions were asked at the end of the questionnaire as Parasuraman (2004) infers that asking such questions at the beginning can irritate respondents and affect their willingness to complete the survey.

3.6 Phase 2 Depth Interviews

Malhotra, (2007) defines depth interviews as another method of obtaining qualitative data with greater depth of insight obtained and a free exchange of information. The researcher compiled a theme sheet (see Appendix 7) that was based on both the survey research questionnaires and the literature review.

3.6.1 Sampling

The researcher identified a target population: building contractors in County Donegal in 2006. The sampling frame was determined by compiling a specific list of building contractors from a Kompass database list of building related contractors in County Donegal for 2006. The county was then broken down by EAs which contained a representative number of builder/contractors within each area. The builder/contractors list was segmented based on the number of employees each contractor employed. This resulted in Small Medium Enterprises (SME's) which further segmented into micro, small and medium sized companies in each EA (see Appendix 8).

The electoral areas were then paired to give three main areas (see Appendix 9) with three interviews conducted from each of the segments of micro and small sized SME's. This gave a total requirement of six depth interviews. The researcher used their judgement and the accessibility of the contractors for interview in choosing which contractors to conduct depth interviews with from each combined area. The sampling method chosen was a stratified random sample, using the building contractors as the relative stratum.

3.6.2 Data Collection

A combination of both secondary and primary research was carried out for the study. Secondary data was scrutinised by the researcher from external sources (government publications, statistics, previous research in similar surveys and journals). Primary research conducted was exploratory in the form of qualitative depth interviews with contractors in County Donegal that were in the segments of interest to the researcher.

Malhotra, (2007) noted exploratory research can define a problem, identify alternative courses of action, develop hypotheses, isolate key relationships and variables, develop an approach to the problem and establish priorities for further research.

Qualitative research collects and analyses data that cannot be meaningfully quantified by numbers or statistics and provides insights into understanding a problem (Parasuraman, 2004). Methods include focus groups and depth interviews.

3.6.3 Measurement

The researcher designed a theme sheet (see Appendix 7). The theme sheet was used in six depth interviews face-to-face with builder/contractors in County Donegal. The questions were semi-structured

and allowed the researcher to probe the chosen building contractors for additional information on certain themes.

3.7 Limitations

Limitations occurred due to practical and environmental reasons. Not all respondents to whom the questionnaires were posted would return same completed and correct. It was expected that some questionnaires would be returned and deemed unusable. Also, due to the recession not all medium sized enterprises listed remain currently in business.

Chapter 4

RESEARCH FINDINGS & ANALYSIS

4.1 Introduction

In this research the findings and analysis varied with the literature review by agreement in some instances and disagreement in others. Here the researcher refers to two different groups of respondents namely: survey respondents – householders, and depth interview respondents - builder/contractors.

4.2 Research Findings

Knowledge of how renewable energy systems work varied among the depth interview respondents, with some having good knowledge and giving information, and others having poor knowledge along with giving no information. Among survey respondents there is a high level of awareness of the term ‘renewable energy’, the different types of renewable energy systems available, and a relatively high knowledge of how they work. Just over one third of the survey respondents that completed the survey had a renewable energy installation in their homes. Solar power was only marginally higher as an installation type than biomass and geothermal which achieved the same percentage of popularity. When asked about their level of agreement or disagreement with statements relating to uses, environmental benefits, and cost effectiveness of renewable energy, over 40 percent of survey respondents agreed with all four statements.

The survey showed that 99 percent of survey respondents were aware of the term ‘global warming’ in County Donegal. When asked their level of agreement or disagreement with statements pertaining to global warming, more than half of all survey respondents agreed with all of seven statements. The most popular types of fossil fuels used by survey respondents were oil, coal and gas followed by peat, known generally in Donegal as turf. Survey respondents revealed that their key information sources about renewable energy were print material, websites and the television. Depth interview respondents neither advised nor promoted renewable energy to home owners but directed them to Sustainable Energy Ireland (SEI) for information and would also approach the SEI themselves if information was required. All six of the depth interview respondents agreed that some householders are aware of RES options.

From the survey research it was found that the majority of survey respondents discussed renewable energy with family/friends before building their houses. Discussions with the contractor/architect were also popular, as was advice from the SEI experts. When survey respondents were asked the level of knowledge of the builder/contractor about how renewable energy systems work, respondents believed that the majority of builder/contractors were informed. However, on an almost equal level was the fact that

survey respondents could not identify what level of knowledge the builder/contractor had regarding the benefits of renewable energy. When asked what type of information the builder/contractor gave survey respondents about grants for renewables and energy saving schemes, the highest percentage of survey respondents stated that the builder/contractor gave them no information about grants for renewables and energy saving schemes.

Survey respondents were familiar with government incentive grants and energy saving schemes, while all depth interview respondents were aware of them. When asked about the adequacy of government incentives, 34 percent of survey respondents strongly agreed/somewhat agreed with the statement, alternatively 42 percent somewhat disagreed/strongly disagreed. Depth interview respondents unanimously agreed that government grants would need to be improved to increase uptake of renewables. Almost half of survey respondents would install a renewable energy system in the future choosing biomass as first preference followed by solar.

Depth interview respondents' analysis found that four of the six respondents actually installed renewable energy systems in 2006. When asked which type of renewables the depth interview respondents installed, this question was answered by the four depth interview respondents who undertook installations. Three installed solar panels, two installed biomass and one installed geothermal. In the opinion of all six depth interview respondents the most popular installations were solar panels (4) biomass (2) and geothermal (1). When asked where these installations took place, depth interview respondents (4) said that eight of the eleven installations were carried out in County Donegal and three in Northern Ireland.

The demographics of survey respondents showed: the majority to be aged between twenty five and thirty four, gender mainly male, the majority married and with an income of between twenty and thirty nine thousand euro per annum. The four depth interview respondents that actually installed renewables defined their clients as being from either the lower income bracket (3), or the upper income bracket (1).

4.3 Analysis

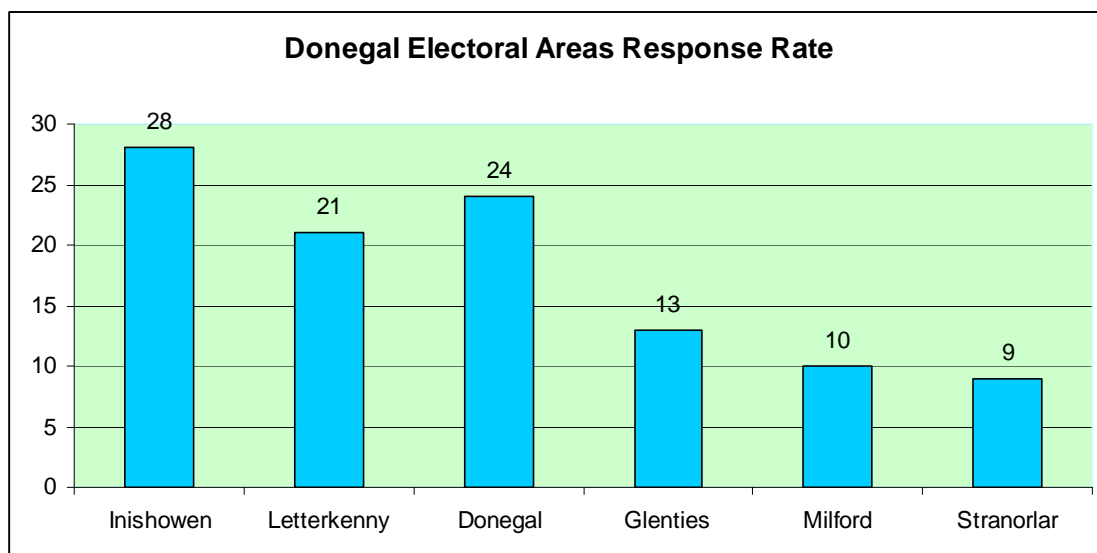
4.3.1 Phase 1 Survey Research

The researcher issued 349 questionnaires to the respective survey respondents. From this total 30 percent (105 questionnaires) were returned completed and correct. A further 5.5 percent (19 questionnaires) were returned to sender marked ‘unknown at this address’, ‘gone away’ and ‘insufficient address’ leaving a total response rate of 35.5 percent. The following Table 4.1 is the breakdown of responses from each of the six Donegal Electoral Areas.

Table 4.1 The breakdown of responses from each of the six, Donegal Electoral Areas

Electoral Area (EA)	Number of Respondents from each EA	Number of Responses	Responses %
Inishowen	82	28	34
Letterkenny	72	21	29
Donegal	61	24	40
Glenties	61	13	20
Milford	38	10	26
Stranorlar	36	9	25

The following column chart depicts Table 4.1 responses from the six Donegal Electoral Areas

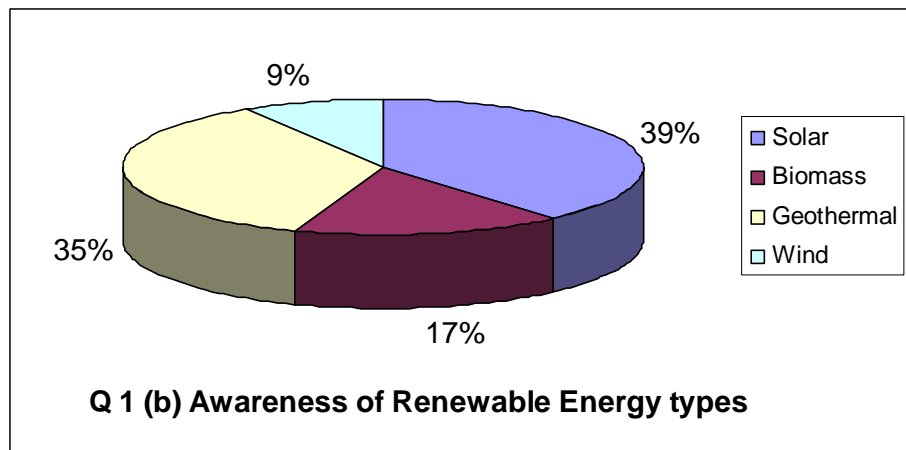


Section I Questions were designed to get an insight into the attitudes/awareness of new build consumers towards renewable energy alternatives with their perceptions of global warming and fossil fuels. Also to clarify the apparent confusion about the term renewable energy derived from the literature reviewed.

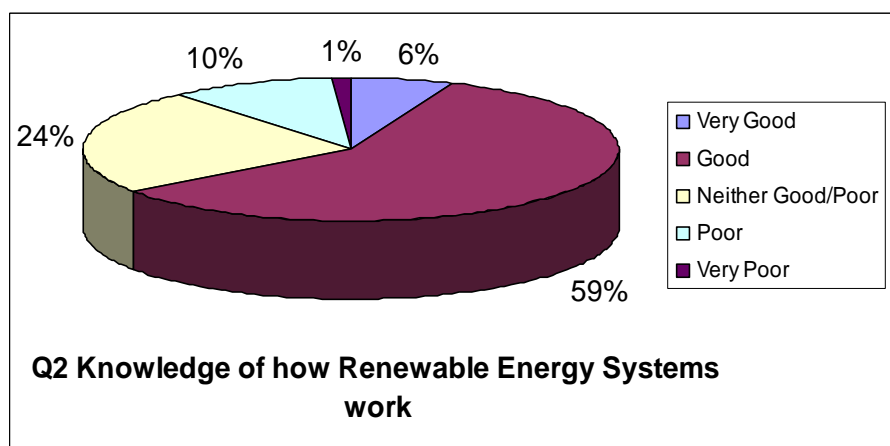
Section I

Q1 (a) Awareness of the term ‘renewable energy’ is high with 96 percent of respondents expressing knowledge of the term.

Q1 (b) Awareness of renewable energy types is good with all respondents knowing at least one or more. Solar was the most popular at 39 percent, followed by geothermal at 35 percent, and biomass at 17 percent. Wind was also well known by 9 percent of respondents. Although respondents were not given the choice of wind as a renewable energy alternative, several had knowledge of it and subsequently added wind into the ‘other’ section of this question.

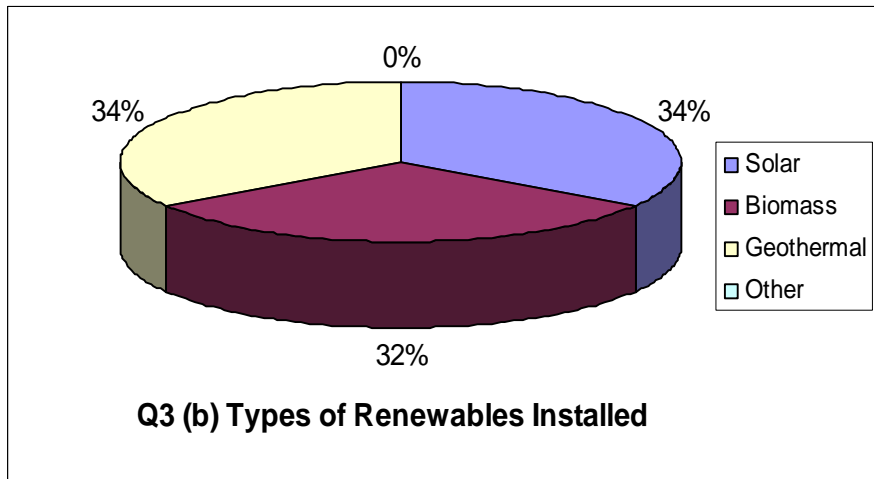


Q2 Fifty nine percent of respondents had a good knowledge of how renewable energy systems work with only 6 percent saying that they had very good knowledge of how they worked. While 24 percent stated that they had neither good nor poor knowledge, 10 percent that had poor knowledge, and 1 percent had very poor knowledge.

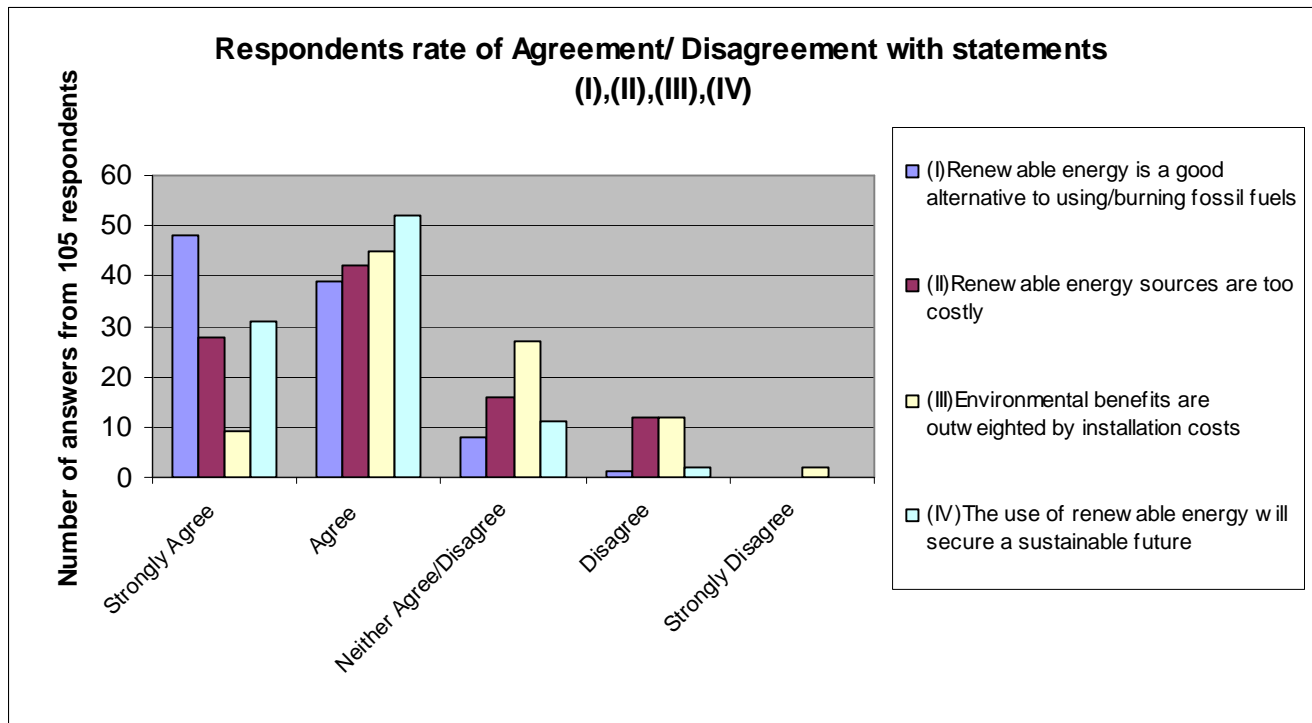


Q3 (a) Installations of renewable energy throughout County Donegal are relatively low with only 38 percent while there is 62 percent with no renewable energy system installed.

Q3 (b) There is only a small difference in percentages in the popularity of the three types of renewable energy systems referred to in the survey. Solar and geothermal are equal at 34 percent and biomass with 32 percent.



Q4 The following column chart and explanations show the respondents' level of agreement or disagreement with statements (Q4 (I) to Q4 (IV)) designed to assess respondents' levels of knowledge of the benefits of renewable energy.



(I) Fifty percent of respondents strongly agreed that renewable energy is a good alternative to fossil fuels, a further 41 percent agreed. Only 8 percent neither agreed nor disagreed with the statement and 1 percent disagreed.

(II) The cost of a renewable energy system was also a factor of consideration for respondents. Twenty nine percent of respondents strongly agreed with the statement while 43 percent agreed. Sixteen percent neither agreed nor disagreed and 12 percent disagreed.

(III) Respondents recognise that the environmental benefits of renewable energy are outweighed by the cost with 48 percent in agreement and a further 9 percent who strongly agreed with the statement. There were 28 percent who neither agreed nor disagreed and 2 percent who strongly disagreed with the statement.

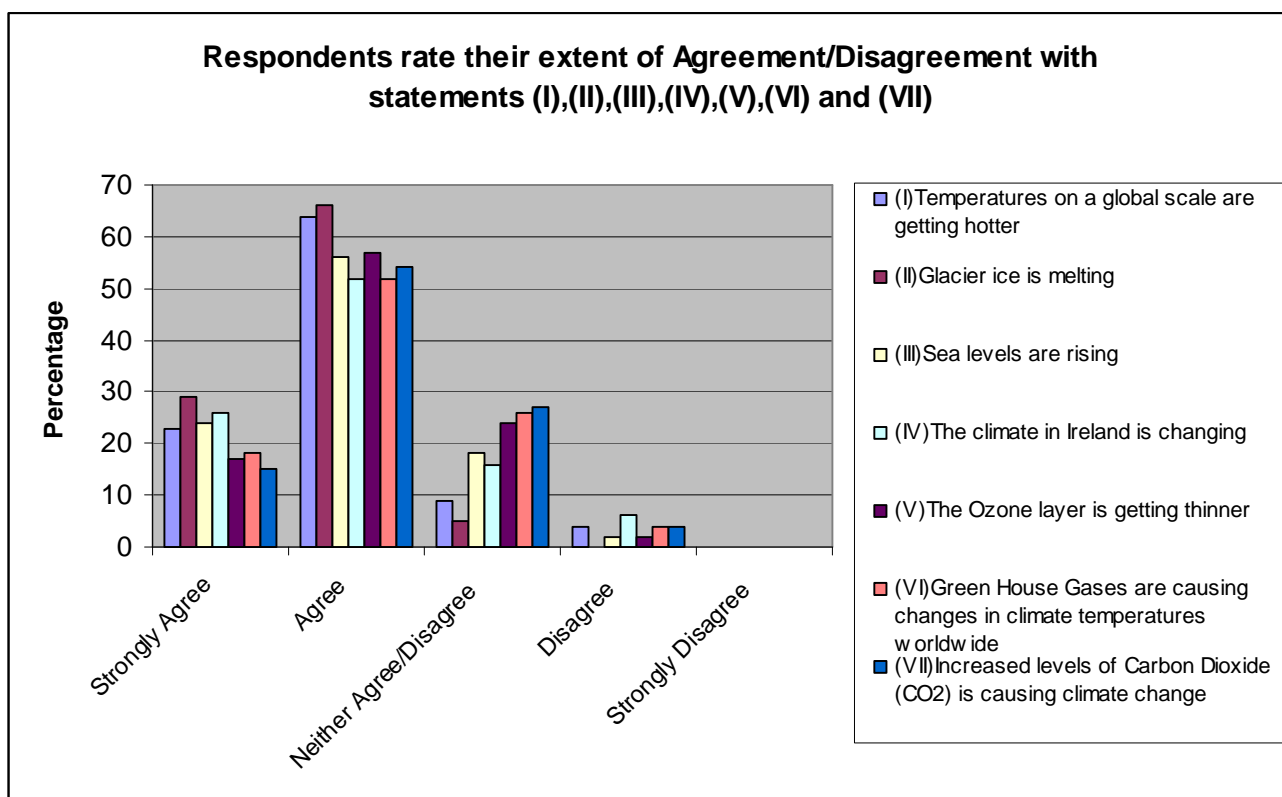
(IV) Respondents also recognise that the use of renewable energy will ensure a sustainable future with 32 percent who strongly agreed and 55 percent in agreement. Only 11 percent neither agreed nor disagreed and 2 percent disagreed.

Section II & Section III questions were for the researcher to gain knowledge of the type of promotion of renewable energy undertaken by the contractor and any other sources of information the respondents were aware of.

Section II

Q1 Ninety nine percent of respondents were ware of the term ‘global warming’ in County Donegal.

Q2 The researcher wanted to investigate the respondents’ level of understanding of the term ‘global warming’. The following column chart and statements list their intensity of agreement or disagreement with statements (Q2 (I) to Q2 (VII)) associated with global warming.



(I) Twenty three percent of respondents agreed with the statement that global temperatures are getting hotter, while 64 percent agreed. Nine percent neither agreed nor disagreed, and a further 4 percent disagreed.

(II) Respondents were aware of the fact that glacier ice is melting with 29 percent strongly agreed and 66 percent in agreement. Only 5 percent neither agreed nor disagreed with the statement.

(III) The statement about sea levels rising gained a 24 percent strong agreement and 56 percent agreement. There were 18 percent that neither agreed nor disagreed with the statement while 2 percent disagreed.

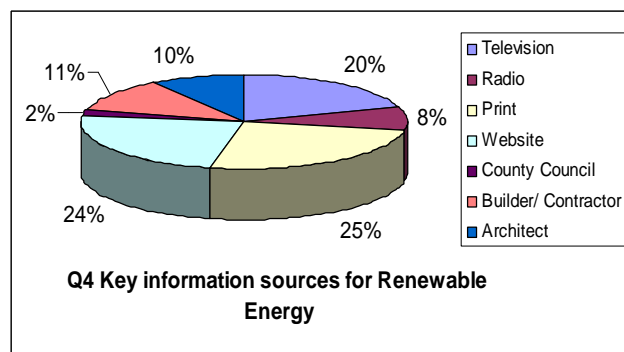
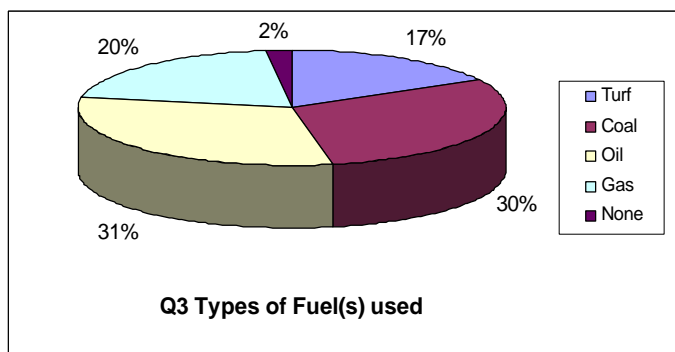
(IV) When asked if the Irish climate is changing, 26 percent strongly agreed with 52 percent in agreement. Sixteen percent neither agreed nor disagreed and 6 percent disagreed.

(V) A large number, 57 percent of respondents, agreed with the statement that the ozone layer is getting thinner and 17 percent strongly agreed. There were 24 percent that neither agreed nor disagreed with 2 percent in disagreement.

(VI) The statement about worldwide climate temperatures changing due to GHG's was strongly agreed with by 18 percent of respondents and a further 52 percent agreed. There were 26 percent that neither agreed nor disagreed, while 4 percent disagreed.

(VII) Fifteen percent of respondents strongly agreed with the statement that increased CO₂ is causing climate change, while 54 percent agreed. There were 27 percent that neither agreed nor disagreed and 4 percent that disagreed.

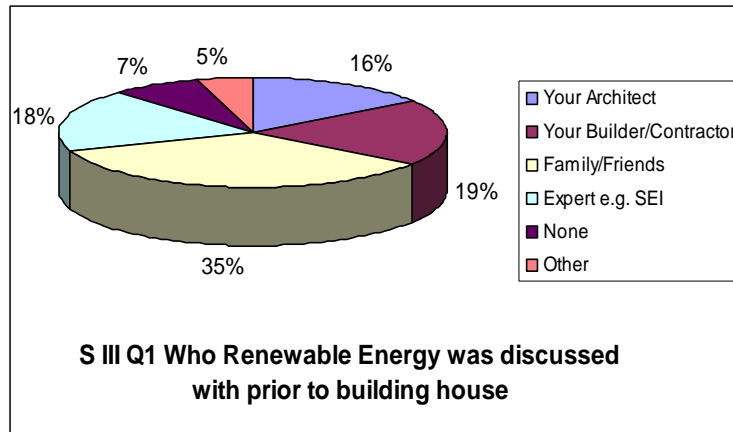
Q3 The most popular types of fuel used by respondents are: oil at 31 percent, coal at 30 percent, gas at 20 percent and turf at 17 percent. Two percent were unspecified.



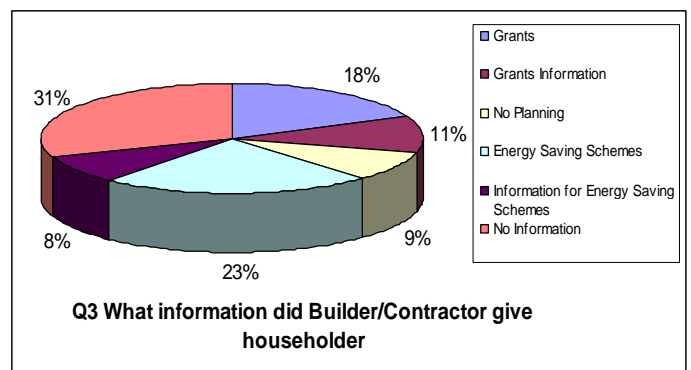
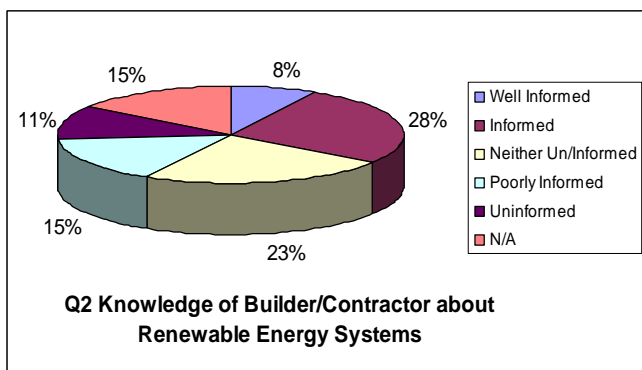
Q4 Print is the most popular information medium for respondents to gain information about renewable energy systems at 25 percent, with websites being the next most popular at 24 percent, followed by television at 20 percent. Only 11 percent got information from the builder/contractor, and 10 percent from their architects, with 2 percent getting information from the County Council.

Section III

Q1 Thirty five percent of respondents discussed renewable energy with family/friends prior to building their houses. A total of 19 percent discussed RES with their builder/contractor, while 18 percent talked to an expert like the SEI. Sixteen percent of respondents discussed RES with their architects, while 7 percent did not specify with whom they discussed renewable energy, and 5 percent talked to an unspecified source.



Q2 The question regarding the knowledge of the builder/contractor about renewable energy systems produced interesting results. Twenty eight percent of builder/contractors were thought to be informed, while only 8 percent were thought to be well informed. Twenty three percent were thought to be neither informed/uninformed, while 15 percent of builder/contractors were thought to be poorly informed, with 11 percent thought to be uninformed, and a further 15 percent replied that this question did not apply (N/A) as theirs were self build houses.

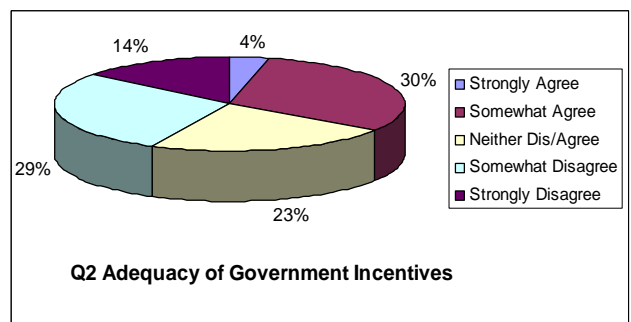
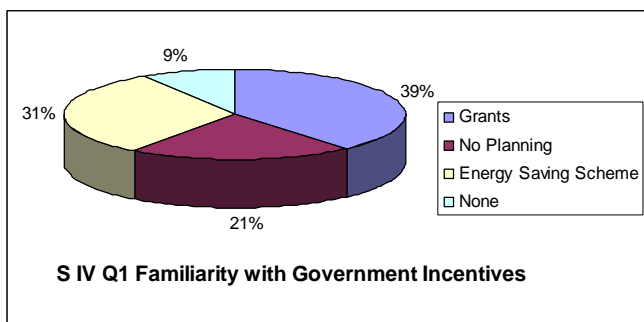


Q3 When asked what information did the builder/contractor give the householder in relation to grants, planning and energy saving schemes, the results were as follows: 31 percent gave no information to the householder, 23 percent gave information on energy savings schemes, and a further 18 percent gave information on grants for the installation of renewable energy systems. Eleven percent received guidance from their builder/contractor about where to look for information regarding grants, while 8 percent received information about the energy saving schemes available.

Section IV questions were based on findings in the literature reviewed where respondents to previous surveys were either unaware or had little knowledge of government incentives for installation of renewable energy sources.

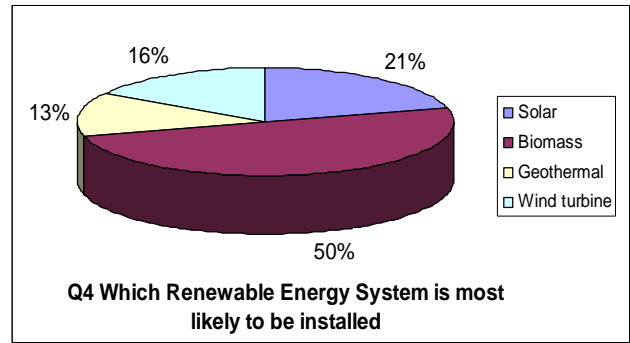
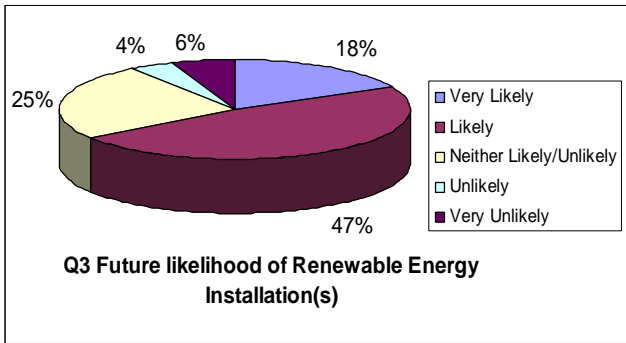
Section IV

Q1 The survey revealed that 39 percent of respondents knew about grants, while 31 percent were familiar with energy saving schemes, and 21 percent had knowledge that there was no planning permission required for renewable energy installations in some cases. Nine percent were not familiar with any government incentive.



Q2 When asked how adequate respondents thought government incentives were to help with the cost of renewable energy installations the following statistics were found. Thirty percent somewhat agreed, 4 percent strongly agreed, 23 percent that neither agreed nor disagreed, 29 percent somewhat disagreed, and a further 14 percent strongly disagreed.

Q3 Respondents were asked the likelihood of their installing a renewable energy source: 47 percent said it was likely, while 18 percent said it was very likely. Twenty five percent said it was neither likely nor unlikely that they would install a renewable energy system, while 4 percent thought that it was unlikely and 6 percent very unlikely.

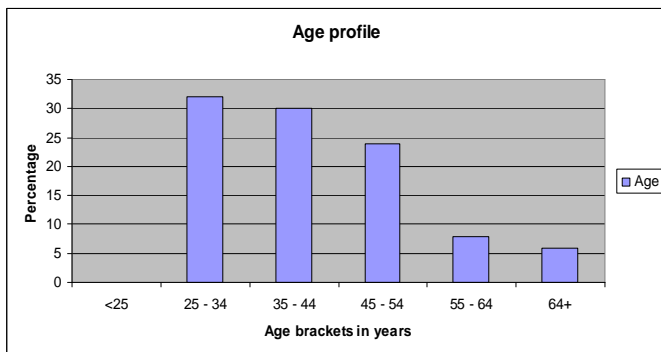


Q4 The most popular renewable energy system installation was biomass at 50 percent, followed by solar at 21 percent, wind turbines at 16 percent, and geothermal at 13 percent.

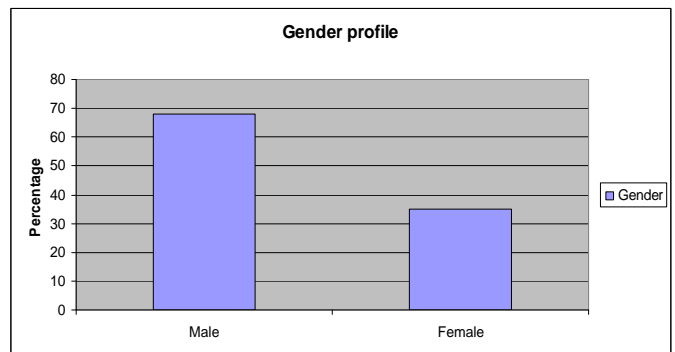
Section V questions were set to gauge the demographics of respondents surveyed. In the literature reviewed it was found that respondents of 30 to 64 years of age were most likely to install renewable energy systems and that only those of higher incomes (€40,000+) would install a renewable energy source.

Section V

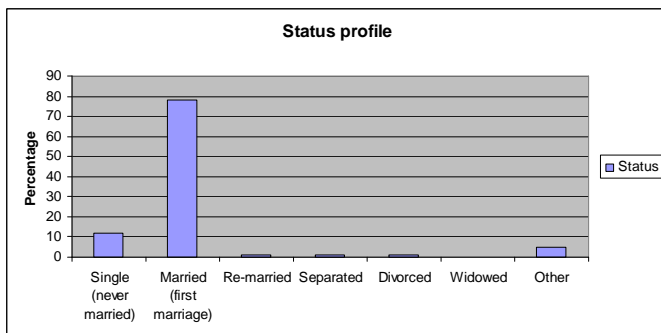
Q1



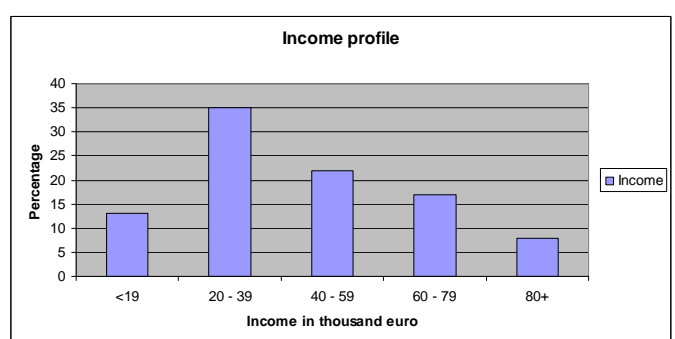
Q2



Q3



Q4



Q1 In the survey conducted in County Donegal, 32 percent of respondents were between the ages of 25 and 34, while 30 percent were between the ages of 35 and 44, with a further 24 percent between the ages of 45 and 54. At 8 percent were the 55 to 64 age group, and 6 percent were 64 plus.

Q2 Sixty four percent of respondents were male, 34 percent female.

Q3 Eighty percent of respondents were married, 12 percent were single, 5 percent were in the 'other' category. There was 1 percent in each of the categories of re-married, separated and divorced.

Q4 In the household income category, there were 37 percent in the 20 to 39 thousand euro bracket, 23 percent in the 40 to 59 thousand euro bracket, 18 percent in the 60 to 79 thousand euro bracket, 14 percent in the less than 19 thousand euro bracket, and finally 8 percent in the 80 plus thousand euro bracket.

4.3.2 Phase 2 Depth Interviews

Depth interviews were conducted with six builder/contractors in County Donegal using a theme sheet. Interviews averaged between 20 and 24 minutes duration due to time constraints, these being the demands of their busy schedules. The researcher was unable to locate the three respondents in the less than 250 employees bracket (SME - medium enterprise) on the list due to the possibility of them having to downsize or fold their businesses possibly attributable to the current recession. Respondents interviewed were three in the bracket of less than ten (SME - micro enterprise) employees, and three in the bracket of less than 50 employees (SME - small enterprise).

The following is the analysis of the theme sheet questions that these builders/contractors were approached with.

S1 Exploring the role contractors play in the promotion of renewable energy sources to the householder/homeowner.

Approximately 17 percent stated that they had a very good awareness of renewable energy, approximately 17 percent said that he had a good awareness. Approximately 34 percent said their awareness of renewables was fair and approximately 34 percent had a poor awareness of renewables.

Only one of the depth interview respondents actually gives advice on renewable energy and the long term benefits of installing and using a renewable energy system. Three of the other depth interview respondents tell homeowners about renewables but do not really advise them of the benefits of RES or advise them to purchase such a system. If the homeowner wants further information, the builder/contractor refers them to an expert like the SEI, or a registered installer. Another of the depth interview respondents will not answer any questions about renewables from householders, but instead refers householders directly to the SEI for advice. The remaining depth interview respondent does not tell householders anything regarding renewables.

None of the six depth interview respondents seemed to promote renewable energy to any of their clients. Five of them told householders about renewables, but refrained from encouraging/discouraging the householders regarding installations.

Again there is consensus from all six depth interview respondents that at least some householders are aware of renewable energy systems. Two of the depth interview respondents said that there are a lot of homeowners who do not want a renewable energy system installed due to the cost of such a system.

Five of the six depth interview respondents would make enquiries to the SEI if further information was required. One depth interview respondent relayed the information published in the renewable energy system installation booklet if asked any questions about a specific system that they had installed.

S2 To examine perceptions of the effectiveness of government incentives to date for renewable energy installations.

Four depth interview respondents said firmly that they had good knowledge of government incentives for renewables. One said that he had heard of the government incentives, while the remaining respondent stated that he did not know much about government incentives for the installation of renewables.

Six depth interview respondents had an awareness of at least one, or more, of the grants for the installation of different types of renewable energy systems available. Four were aware of solar panel grants, three were aware of biomass grants, and one was aware of geothermal grants.

Five depth interview respondents stated that the grants were not an effective incentive in getting homeowners to install renewable energy in their homes as they were 'too small', while another was not aware of the value of grants available.

All six depth interview respondents unanimously agreed that the government would need to increase the value of the grants to entice individuals to spend money on the installation of a renewable energy system. They all agreed that the real value of the grant to the householder is 'very small', or even one respondent replied 'worthless'.

Four of the six depth interview respondents were aware of government regulations regarding energy efficiency (energy saving schemes) in the home, while two had heard of energy efficiency options, but did not seem to know much about the regulations regarding them.

S3 To discover the number of renewable energy installations carried out by the builder/contractor.

Four of the six depth interview respondents actually installed renewable energy systems in 2006. Two depth interview respondents installed five solar panel systems; two others installed a mix of solar, geothermal and biomass totalling eight installations, while the remaining two did not install any renewable energy system.

The frequency of installations for the four depth interview respondents who installed renewables were: two said that installations occurred every few months, while the other two could not remember how many months passed between installations.

When the four depth interview respondents were asked what type of renewables they had installed, they replied: three installed solar panels, two installed biomass, and one installed geothermal.

In the opinion of all six depth interview respondents the most popular installations were solar panels (4), biomass (2), and geothermal (1). (Although two of the depth interview respondents did not install any renewables their opinions are included in this question).

When asked where the installations took place, were they in County Donegal or elsewhere in Ireland, four of the depth interview respondents were able to answer that eight were carried out in County Donegal and three in Northern Ireland.

All depth interview respondents answered the question: what was the social status of those whom installed a renewable energy system. The two that had not installed any renewable energy system could only speculate about the type of client who would install renewables, favouring upper income bracket or 'rich'. The four depth interview respondents that actually installed renewables said their clients were either from the lower income bracket (3) or the upper income bracket (1).

Installations were performed in three medium sized three/four bedroom houses and one large five/six bedroom house.

Chapter 5

CONCLUSIONS & RECOMMENDATIONS

5.1 Introduction

The survey was issued to a sample of those in one-off private houses in County Donegal with commencement notice in 2006. The depth interviews were conducted with six builder/contractors segmented by number of employees and combined electoral areas. This study refers to two different groups of respondents these are: survey respondents – householders, and depth interview respondents - builder/contractors.

5.2 Conclusions

Contrary to the literature review, the findings of this study in County Donegal are that there is a high level of awareness (96 percent) of the term ‘renewable energy’, of the various renewable energy types (solar, geothermal and biomass) and how they work. The results of this survey show that slightly above one third (38 percent) of survey respondents had a renewable source of energy appliance installed. In County Donegal, of all three types of installations: solar, geothermal and biomass, each shares a third of the market. Biomass and geothermal are well known in Donegal contrary to the literature research where it was noted that biomass was not well known in previous research.

In the literature researched, the cost of renewables and their environmental benefits were touched upon. Primary research findings indicate that 72 percent of respondents believed that renewables are too costly to install. The majority of survey respondents agreed that environmental benefits outweighed the cost of installing the system. The builder/contractors interviewed also agreed that the high cost of renewable energy installations is a barrier to installation uptake. Although 87 percent of survey respondents agreed that renewable energy will ensure a sustainable future, there is still a poor adoption of renewables in County Donegal. This study supports the literature reviewed findings that awareness has not necessarily led to action in encouraging consumers to purchase and install renewable energy systems.

Awareness of the term ‘global warming’ is very high in County Donegal with 99 percent of survey respondents understanding the term. To investigate survey respondents’ level of understanding, the researcher developed seven statements to which survey respondents were to show their extent of agreement or disagreement. The majority of survey respondents agreed with all seven statements which infers that they have a good level of knowledge regarding the effects of global warming.

The literature researched revealed that fossil fuel dependency is an issue of importance in Ireland. In the survey it was found that 60 percent of respondents used oil and coal, while the remainder used gas and turf. Upon further examination it became apparent that there was a 22 percent difference between the number of renewables' installations, and the use of the two primary fossil fuels: oil and coal. Ninety one percent of survey respondents agreed that renewables were a good alternative to fossil fuels. In the literature reviewed only 27 percent agreed that renewables were a good alternative to fossil fuels. Information reached survey respondents primarily through print media, websites and television. From the literature reviewed, the greatest influence was television.

The researcher wanted to establish the level of awareness of the builder/contractor and what influence, if any, this had on homeowners. Prior to building, a large percentage of survey respondents discussed renewable energy installations with family or friends. The builder/contractor was seldom the key person with whom the survey respondents discussed renewables, likewise with as did the experts: the SEI. Depth interviews conducted with the builder/contractors supported the survey respondents' views that the information on renewable energy systems, and the benefits of such systems, are limited and difficult to assess. Only 38 percent of builder/contractors were thought to be informed about renewable sources, while 23 percent of survey respondents were unable to gauge the level of knowledge of builder/contractors. When asked what information the builder/contractor gave the survey respondents, a high percentage (31) said that they got no information from them. This study showed that 23 percent of builder/contractors were informed about energy saving schemes. The depth interviews conducted with the builder/contractors shows that they neither generally advised, nor promoted, renewables to the householders instead five out of six tell householders renewables exist, while the remaining one did not mention renewables at all.

Contrary to the literature reviewed findings, the survey respondents in County Donegal were familiar with the government incentives for renewable energy installations. The depth interviews also established that the builder/contractors were informed about grants for renewables, particularly the energy saving schemes that are for improving insulation in existing houses.

A total of 91 percent of survey respondents were familiar with several of the various government incentives, as were 100 percent of builder/contractors. When asked about the adequacy of government incentives to help with the cost of renewable energy installations, 43 percent of survey respondents disagreed with the statement, 34 percent were agreeable that government incentives were adequate, 23 percent were unsure. The depth interviews showed that the builder/contractors were of the opinion that the government incentives were 'too small' and were not an incentive for homeowners to install

renewables. From the research, it was also apparent that 65 percent of survey respondents in County Donegal were likely to install a renewable in the future and the most popular installation would be biomass with a 50 percent margin. The next most popular were solar at 21 percent, wind at 16 percent, and geothermal at 13 percent.

Only the builder/contractors were asked how many installations they had conducted in 2006. Four of the six depth interview respondents installed renewables in County Donegal and in Northern Ireland. All three types of renewables were installed by these depth interview respondents with solar being the most popular among this sample of builder/contractors. Installations were mainly in three to four bedroom houses and by lower income bracket clients and one upper income bracket customer in a larger house.

The demographics of the Donegal respondents were somewhat different to that of the literature. The literature reviewed showed that people between the ages of 30 and 64 were the most likely to install a renewable energy system. The age profile of survey respondents was 62 percent between the ages of 25 and 44, with a further 24 percent between the ages of 45 and 54. Two thirds of survey respondents were male. Eighty percent of survey respondents were married. The household income of survey respondents was 37 percent in the 20 to 39 thousand euro bracket, and 23 percent in the 40 to 59 thousand euro bracket. The literature reviewed indicated that upper income bracket (€40,000+) people would avail of renewables. From this research it was apparent that a large percentage of survey respondents were not in a high income bracket but that renewable installations were still taking place.

5.3 Recommendations

Awareness of environmental terms and types of renewables available are well known in County Donegal, but the high installation cost of any one of these renewables is a barrier to the uptake of these sustainable energies for survey respondents. The high cost of these renewables should be considered by the manufacturers and if possible sales made at a reduced rate to increase uptake. The government should reconsider the grants they provide for the installation of renewables and increase these as the grants are considered too small by both the homeowner and the builder/contractor.

The evidence showed that householders tend to think that the builder/contractors and architects are not well enough informed about renewable energy systems. The architect like the builder/contractor should be informed about renewables and have the ability to advise the homeowner about the range of products that are on the market for a sustainable future. This could be improved by providing mandatory courses to teach the builder/contractors and architects about this futuristic area of sustainability. The builder/contractors themselves understand that they have a lack of information about renewables to pass

on to the homeowner. As the builder/contractor is one of the first points of contact for many of the new homeowners when they start the process of building their own home, these people should be well informed as to the renewables available.

The primary channels used by householders to obtain information about renewables are print, websites and television. These primary channels could be better utilised and more awareness could be created through them. There are dedicated print media on the entire area of sustainability and the environment, but the general public may not be aware of these. Therefore, renewable energy information has to be made more main stream and accessible to everyone, with advertisements and information in local press and national press. Websites are an excellent source of information about renewables for those who are computer literate, but not all people are information technology literate and therefore, only those that are can access this source of information. Television is a very good media type through which to create awareness to all ages. Programmes such as 'Eco Eye' and 'About the House' on the Irish terrestrial channels of RTE are excellent ambassadors for renewables. There is a need for more programmes like these to heighten awareness and show the range of renewables currently available on the market.

The information channels that are currently underutilised are radio and County Council literature. Radio has great potential to be further exploited as many people listen to the radio while in their car where they are a captive audience. More advertisements could be broadcast to promote renewables on both regional radio stations and on the national stations. County Councils do not seem to be a source of information for respondents although they could also play a large role in the promotion of renewables through information, advertising, grants and installations in local authority housing estates.

Future Research: with ongoing research and development continuing globally, and within Kyoto protocol conscious countries, there is great scope for expansion in our RES development and usage. With island countries like Ireland, and many countries boasting a coastal border, further use could be made of natural resources such as wind and wave power. With rapid advancement in technology based engineering, further research matching natural resource energy engineering to the needs of domestic end-users is vital for sustainability. With a thinning ozone layer, and our planet warming daily, energy sustainability is not an option, it is imperative.

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Appendices

Appendix 1 Glossary of Terms

Coal Coal includes all coal, both primary (including hard coal and lignite) and derived fuels (including patent fuel, coke oven coke, gas coke, BKB, coke oven gas and blast furnace gas). Peat is also included in this category.

Gas Gas includes natural gas (excluding natural gas liquids) and gas works gas. The latter appears as a positive figure in the "gas works" row but is not part of indigenous production.

Other Sectors include agriculture, commercial & public service, residential and non specific.

Other Other includes geothermal, solar, wind, tide, wave energy, electricity and heat. Unless the actual efficiency of the geothermal process is known, the quantity of geothermal energy entering electricity generation is inferred from the electricity production at geothermal plants assuming an average thermal efficiency of 10 per cent. For solar, wind, tide and wave energy, the quantities entering electricity generation are equal to the electrical energy generated. Direct use of geothermal and solar heat is also included here. Electricity is accounted for at the same heat value as electricity in final consumption (i.e. 1 GWh = 0.000086 Mtoe). Heat includes heat that is produced for sale and is accounted for in the transformation sector.

Petroleum Products Combustible Renewables & Waste

International marine bunkers - covers those quantities delivered to ships of all flags that are engaged in international navigation. The international navigation may take place at sea, on inland lakes and waterways, and in coastal waters. Consumption by ships engaged in domestic navigation is excluded. The domestic/international split is determined on the basis of port of departure and port of arrival, and not by the flag or nationality of the ship. Consumption by fishing vessels and by military forces is also excluded.

Total primary energy supply (TPES) is made up of indigenous production + imports - exports - international marine bunkers ± stock changes. For the World Total, international marine bunkers are not subtracted from TPES.

Non-energy use covers use of other petroleum products such as white spirit, paraffin waxes, lubricants, bitumen and other products. It also includes the non-energy use of coal (excluding peat). These products are shown separately in final consumption under the heading non-energy use. It is assumed that the use of these products is exclusively non-energy use. It should be noted that petroleum coke is included as non-energy use only when there is evidence of such use; otherwise it is included as energy use in industry or in other sectors.

Non-energy use also includes petrochemical feedstocks. The petrochemical industry includes cracking and reforming processes for the purpose of producing ethylene, propylene, butylene, sythesis gas, aromatics, butadiene and other hydrocarbon-based raw materials in processes such as steam cracking, aromatics plants and steam reforming

Appendix 2 Questionnaire

Questionnaire Householder/Homeowner

A full glossary of technical terms and their definitions are available at the end of the questionnaire.

Section I

1. Are you aware of the term 'renewable energy'?

Yes

No (If 'No' go to **Question 4**)

If 'Yes' what type of renewable energy are you aware of? (Please tick as many as you are aware of)

Solar (PV cells)

Biomass

Geothermal

Other(s): (Please list) _____

2. How much knowledge do you have about how renewable energy systems work? (Please tick only one box)

Very Good

Good

Neither Good/Poor

Poor

Very Poor

3. Have you installed a renewable energy system in your home?

Yes

No (If 'No' please go to **Question 4**)

a) If 'Yes' which of the following renewable energy sources did you install?

Solar (PV cells)

Biomass

Geothermal

Other(s):(Please list) _____

4. Please rate your extent of agreement/disagreement with each of the following statements:

(Please tick relevant box for each statement, one tick per statement)

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Renewable energy is a good alternative to using/burning fossil fuels					
Renewable energy sources are too costly					
Environmental benefits are outweighed by installation costs					
The use of renewable energy will secure a sustainable future					

Section II

1. Are you aware of the term 'global warming'?

Yes

No

2. Please rate your extent of agreement/disagreement with each of the following statements:

(Please tick relevant box for each statement, one tick per statement)

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Temperatures on a global scale are getting hotter					
Glacier ice is melting					
Sea levels are rising					
The climate in Ireland is changing					
The Ozone layer is getting thinner					
Green House Gases are causing changes in climate temperatures worldwide					
Carbon Dioxide (CO ₂) is causing climate change					

3. How many of the following types of fuel(s) do you use?

(Please tick all relevant boxes).

Turf

Coal

Oil

Gas

None

Other(s): (Please

list)

4. When building your house from which of the following sources did you get information about renewable energy systems?

(Please tick all relevant boxes)

Television

Radio

Print

Website

County Council

Builder/Contractor

Architect

Other(s): (Please list)

Section III

1. With whom, if anyone, did you discuss renewable energy sources before construction started on your house?

(Please tick all relevant boxes)

Your architect	<input type="checkbox"/>
Your building contractor	<input type="checkbox"/>
Family/Friends	<input type="checkbox"/>
Expert e.g. Sustainable Energy Ireland (SEI)	<input type="checkbox"/>
None	<input type="checkbox"/>
Other(s): <u>(Please list)</u> _____	

2. How well informed was your building contractor about renewable sources of energy? (Please tick only one box)

Well informed	Informed	Neither Un/Informed	Poorly informed	Uninformed	N/A
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3. What did your contractor inform you about? (Please tick as many as apply to you)

Grants for the installation of a renewable energy system	<input type="checkbox"/>
Where to look for information regarding renewable energy systems	<input type="checkbox"/>
No planning necessary in certain cases	<input type="checkbox"/>
Energy saving schemes (insulation of walls/attic)	<input type="checkbox"/>
Where to look for information regarding energy saving scheme(s)	<input type="checkbox"/>
No information from building contractor	<input type="checkbox"/>

Section IV

1. Which of the following Government incentives are you familiar with? (Please tick all relevant boxes)

Grants for the installation of a renewable energy system	<input type="checkbox"/>
Planning permission not required for installation of a renewable energy source(s) in certain cases	<input type="checkbox"/>
Energy saving schemes (insulation of walls/attic)	<input type="checkbox"/>
None (If 'None' please go to Question 3)	<input type="checkbox"/>

2. From your awareness of government incentives are they:

Adequate to help with the expense of installation? (Please tick only one box)

Strongly Agree	Somewhat Agree	Neither Dis/Agree	Somewhat Disagree	Strongly Disagree
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3. In the future would you consider a renewable energy installation? (Please tick only one box)

Very Likely	Likely	Neither Likely/Unlikely	Unlikely	Very Unlikely
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4. Which of the following renewable energy installations would you consider? (Please tick only one box)

Solar (PV cells)	<input type="checkbox"/>
Biomass	<input type="checkbox"/>
Geothermal	<input type="checkbox"/>

Other(s): (Please list) _____

Section V

1. Age

less than 25	<input type="checkbox"/>
25 - 34	<input type="checkbox"/>
35 - 44	<input type="checkbox"/>
45 - 54	<input type="checkbox"/>
55 - 64	<input type="checkbox"/>
64+	<input type="checkbox"/>

2. Gender

Male	<input type="checkbox"/>
Female	<input type="checkbox"/>

3. Status (Please tick the appropriate box)

Single (never married)	<input type="checkbox"/>
Married (first marriage)	<input type="checkbox"/>
Re-married	<input type="checkbox"/>
Separated	<input type="checkbox"/>
Divorced	<input type="checkbox"/>
Widowed	<input type="checkbox"/>
Other	<input type="checkbox"/>

4. Income (Please tick the appropriate box that best relates to your household income) (thousand euro)

Less than 19	<input type="checkbox"/>	20 - 39	<input type="checkbox"/>	40 - 59	<input type="checkbox"/>	60 - 79	<input type="checkbox"/>	80 +	<input type="checkbox"/>
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A full glossary of technical terms and their definitions

Renewable Energy - Any energy resource naturally regenerated over a short time scale that is derived directly from the sun (such as solar thermal and photovoltaic), indirectly from the sun (such as wind, hydropower and photosynthetic energy stored in biomass), or from other natural movements and mechanisms of the environment (such as geothermal and ocean energy).

Global Warming - The temperature of the earth (globe) is increasing as the heat from the sun is becoming trapped below the ozone layer.

Ozone Layer - The ozone layer is located in the stratosphere at an altitude of 12 to 50 kilometers and its purpose is to protect life on earth from the harmful ultraviolet rays of the sun.

Solar (PV cell) - Solar Photo-Voltaic systems convert solar radiation into electricity. The PV cell consists of one or two layers of a semi-conducting material, usually silicon. When light shines on the cell, it creates an electric field across the layers, causing electricity to flow.

Biomass - Biomass is the biodegradable fraction of products, waste and residues from agriculture (including vegetal and animal substances), forestry and related industries, as well as the biodegradable fraction of industrial and municipal waste.

Geothermal - Geothermal works by extracting heat energy from a low temperature source and upgrading it to a higher temperature so that it can be used for space and water heating. Piping is laid in the ground at one or more metres deep where the temperature of soil is usually between 8-12°C

Fossil Fuel(s) - Fossil Fuel(s) are coal, oil and gas they are finite supplies and are reducing due to greater continued demand.

Green House Gases - Substances that deplete the ozone layer.

Carbon Dioxide (CO₂) - Is emitted through human activity for example burning of fossil fuel(s).

Appendix 3 Cover Letter

Dear Sir/Madam,

My name is Rosemary Gibbons. I am currently undertaking a Master of Science (MSc) in Marketing Practice in Letterkenny Institute of Technology. To successfully complete the MSc course, a thesis must be completed and submitted. The enclosed questionnaire comprises an important part of the research necessary in order to complete an accurate and valid survey, and subsequent thesis.

My chosen area of study is the uptake and interest of homeowners throughout Donegal County in selecting renewable energy options.

The overall purpose of this study is to explore perception/attitudes and behaviour towards renewable energy with a view to developing best practice of marketing renewable energy in Co Donegal.

As part of the thesis, actual research has to be conducted by means of a questionnaire and sent to people like you, people who built new houses in County Donegal during the year 2006.

Your answers on this topic are extremely important for the success of my research, so whether or not you are interested in the area of renewable energy, please complete the questionnaire Sections I, II, III, IV and V. This research will help the producers of renewable energy to better understand the concerns of the purchasers and develop better products for new homeowners.

It will take only a short time to answer the questions on the enclosed questionnaire and to return it in the stamped reply envelope. All answers are confidential and findings will be used anonymously only in combination with those of other new homeowners in Donegal in 2006.

If you are interested in receiving a report on the findings of this research, please just write your name and address on the bottom of the last page of the questionnaire (this is necessary as returned questionnaires remain otherwise anonymous). If desired, I will be happy to send you a complimentary report of the findings when completed.

As stated previously, the success and quality of this report depends on the completed questionnaires being returned to me. Therefore, I would be very grateful if you would take time from your busy schedule to complete and return the enclosed questionnaire Sections I to V.

Thank you for your time and help.

Kind Regards,

Rosemary Gibbons BBS (hons) MII Grad (Student of the Masters in Marketing Practice program)
Letterkenny Institute of Technology

Appendix 4 Sample Size Calculations

An approximate formula for calculating the appropriate sample size N is:

$$N = \frac{1}{e^2}$$

Example:

$$N = \frac{1}{(.05)^2} = 400$$

Where e is equal to the amount of error the researcher is willing to tolerate. (5% in the example)

To determine the sample size for the population of interest of 3,648 the researcher had to do some statistical calculations and expressions. To better understand the process some terms need to be explained briefly as described in Naresh *et al.*, (2003).

Parameter is the measure of the target population if a census were taken instead of a sample.

Precision level is the desired size of the estimating interval. This is the maximum permissible difference between the sample and the population parameter.

Confidence Interval is the plus or minus figure within which the true population parameter will fall, assuming a given level of confidence. Example: a confidence interval of 5 and 50% of the sample choosing an answer the researcher can be 'sure' that if the question had been asked of the entire relevant population between 45% (50-5) and 55% (50+5) would have chosen that answer.

Confidence level is the probability that the confidence interval will include the population parameter.

Example: The researcher can be 95% or 99% sure that the true percentage of the population is within the confidence interval.

When the confidence level and the confidence interval are combined it can be stated that there is (for example) 95% of the population between 45% and 55%.

Therefore the relevant calculations for the population in question using proportions are as follows:

D = difference between the population mean and the sample mean (± 0.05)

Level of confidence 95%

z for 95% confidence level $z = 1.96$

Population proportion that will respond is based on researcher's judgement and at 50% therefore

$\pi = .50$

Formula:

$$n = \frac{\pi(1-\pi) \times z^2}{D^2}$$

$$n = \frac{.50(1-.50) \times (1.96)^2}{(.05)^2}$$

$n = 384$ sample size

As the sample size is greater than 10% of the population the Finite Correction Factor (which is a correction for overestimation of the variance of the population parameter) can be used.

Formula:

$$n_c = \frac{n * N}{N + n - 1}$$

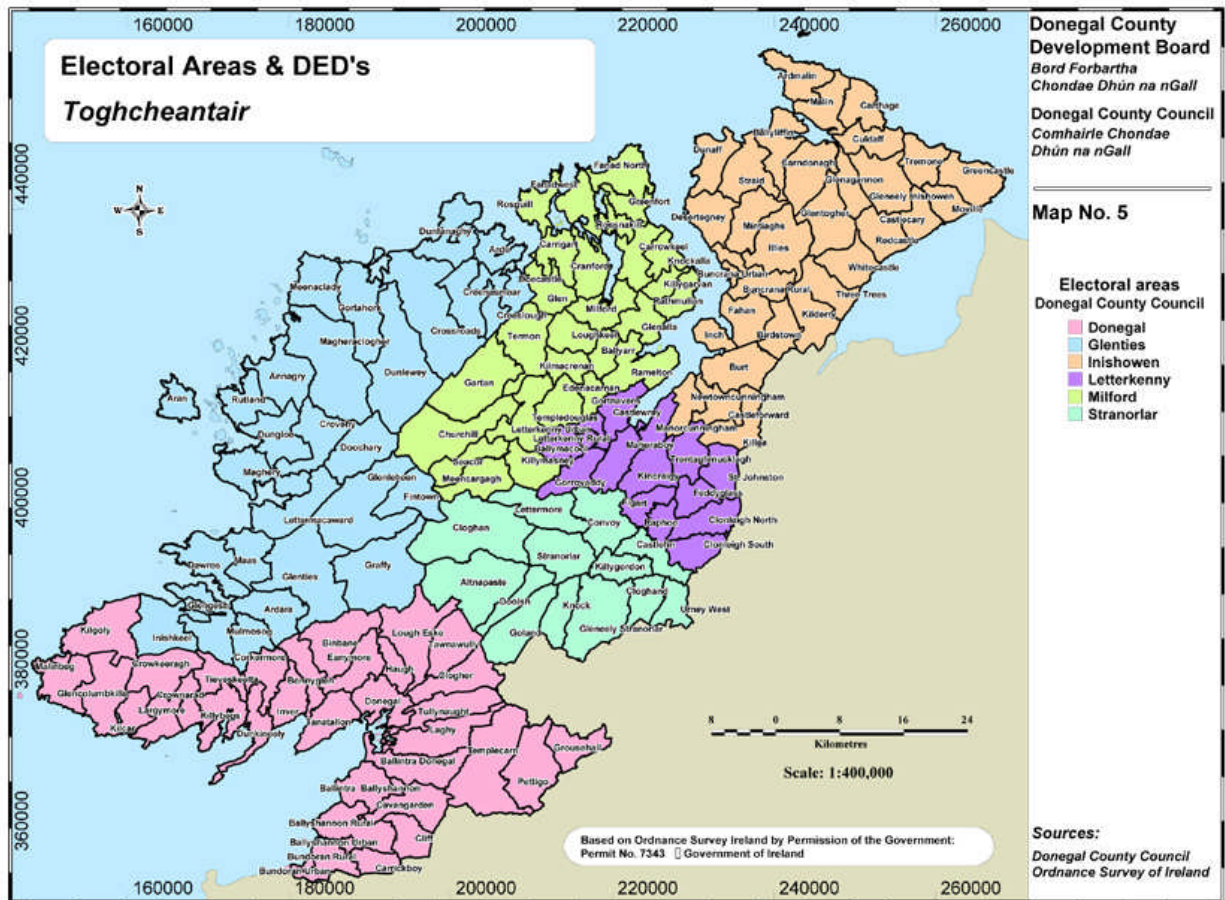
$$= \frac{384 * 3648}{3,648 + 384 - 1}$$

$$= \frac{1400832}{4031}$$

$$= 347.5$$

$$= 348 \text{ of a sample size}$$

Appendix 5 Electoral Areas of County Donegal 2006



Adapted from Donegal County Council website accessed February 2007

Appendix 6 Calculations for sample numbers in each Electoral Area

In order to have the sample size of 348 representative of the electoral areas in Co Donegal the number of households by size of household in 2006 in each electoral area (see Table 3.2) had to be obtained.

Table 3.2 Households in Electoral Areas in Co Donegal in 2006 and the number to be sampled from each.

Electoral Area	Households	Calculation	Number to be sampled
Donegal	8,818	$8,818/50,415*348$	61
Glenties	8,824	$8,824/50,415*348$	61
Inishowen	11,728	$11,728/50,415*348$	81
Letterkenny	10,385	$10,385/50,415*348$	72
Milford	5,460	$5,460/50,415*348$	38
Stranorlar	5,200	$5,200/50,415*348$	36
Total			349 (one above the sample size due to rounding of figures)

Total sample size 349 due to rounding of figures

Appendix 7 Theme Sheet

Theme sheet - Contractor

S1 To explore the role contractors play in the promotion of renewable energy sources to the householder/homeowner.

1. How would you describe your level of awareness of renewables?
2. Did/do you advise homeowners to install a renewable system in their new house?
3. How do you promote the renewables that are on the market to homeowners?
4. Are homeowners aware of renewables?
5. Where do you get your information about renewables?

S2 To examine perceptions of the effectiveness of Government incentives to date for renewable energy installations.

1. Are you aware of the government incentives for renewables?
2. What incentives are you aware of? For geothermal, solar, biomass
3. Are they effective in getting homeowners to install renewables?
4. Would government need to do more?
5. What is the real value of the government grant to the homeowner after the high cost of the installation?
6. Are you aware of the government regulations regarding energy efficiency in new homes?

S3 To discover the number of renewable energy installations carried out by the builder/contractor

1. Roughly how many installations have you completed in 2006/07?
2. How often do you know did you install a renewable? One per month, 2 per month etc
3. What type of renewable did you install? For geothermal, solar, biomass
4. What was most popular?
5. Where did you install them? (Within Donegal or in other counties also)
6. What social status would those you installed renewables have? (Upper class, working class etc)
7. What type of house did you install in? small, medium, large

Appendix 8 SME's in County Donegal Electoral Areas

Table 3.3 SME's in Electoral Areas in Donegal

Electoral Areas	<10	<50	<250	-
Donegal	4	7	1	-
Stranorlar	1	4	1	-
Inishowen	6	4	-	-
Letterkenny	6	2	1	-
Glenties	2	3	-	-
Milford	2	5	-	-
Total	21	25	3	49

Appendix 9 Combined SME's in County Donegal Electoral Areas

Table 3.4 Combined SME's in Electoral Areas in Donegal

Electoral Area	< 10	<50	<250	-
Donegal & Glenties	6	10	1	-
Milford & Stranorlar	3	9	1	-
Inishowen & Letterkenny	12	6	1	-
Total	21	25	3	49

Two interviews conducted from each of SME's segments <10 and <50 from the combined electoral areas, giving a total of six interviews. Those from the <250 SME segment were unavailable for interview.