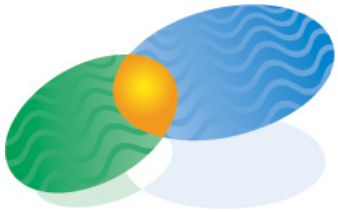

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Executive Summary

The Limerick Clare Energy Agency (LCEA) was established in June 2005 and determined that it was necessary to complete an Energy and Emissions Balance to support the development of sustainable energy in the region it serves. This report is a result of the completion of this study.

The Energy and Emissions Balance addresses energy production and consumption on a sectoral and fuel basis. Building on this data the energy related Greenhouse Gas (GHG) emissions are calculated which presents the LCEA with the data to allow it to target its actions in meeting the regions Kyoto Protocol requirements. This report focuses on the emission of Carbon Dioxide (CO_2).

The quantity of global energy consumption is increasing as the economies of China, India and other developing countries expand. The majority of energy is consumed by the developed nations of the world. Within the Organisation for Economic Cooperation and Development (OECD) North America accounts for over 50% of energy consumption at present, with the European Union (EU) accounting for approximately 34%. Within the EU 25 the change in energy consumption data has been significant in countries such as Ireland, Poland, Spain and Greece showing significant increases between 1990 and 2003. Oil remains the dominant fuel in the EU followed by Natural Gas. Renewables continue to account for a relatively small portion of the market.

The Kyoto Protocol ratified in 2005 sets out legally binding commitments and fines, which signatories will have to abide by. The EU has set a target of a reduction of 8% in GHG Emissions, compared to 1990 levels, by the assessment period (2008-2012). A burden sharing agreement means that Ireland has been set a target of maintaining emissions to a 13.0% increase above 1990 levels. Meeting of this target is the responsibility of the Department of Environment, Heritage and Local Government (DoEHLG). The DoEHLG published a Natural Climate Change Strategy (NCCS) in 2000 to outline policies to achieve these targets. A consultation review of the NCCS is anticipated to be published 2006.

Irelands overall GHG emissions are projected to be 26% above the 1990 levels by 2010 i.e. almost double the Kyoto target (ESRI,2005). Energy accounts for 64% of all emissions in Ireland. This report is concerned specifically with GHG Emissions related specifically to energy usage. The other gases dealt with under the Kyoto Protocol have not been dealt with in any detail. Data from a range of sources at a National level indicates that energy consumption in Ireland is increasing, and is projected to continue. The majority of energy related emissions in Ireland result from the use of Oil and Electricity. Oil is projected to continue to be the main fuel source based on scenarios reported by the Economic, Social and Research Institute (ESRI) (ESRI, 2005). The Transport Sector has shown the greatest increase since 1990 becoming the dominant sector, accounting for 33% of emissions in 2004. Current projections indicate that Ireland will face a potential carbon levy of between €250 and €600 million by 2015 (Bank of Ireland Global Markets, 2006).

Economic and environmental indicators were developed as a basis for analysis and comparison within the report. These include assessment of energy consumption per capita and CO_2 emissions per capita. At a National level Ireland's emissions per person are above the EU average, while our energy consumption per person is approximately equal. However, national energy usage per unit of Gross Domestic Product (GDP) is above the EU average. This has been driven particularly by the economic growth in Ireland.

This report covers the areas of Clare County, Limerick County and Limerick City. The region is situated in the Mid-West of Ireland. It has a range of natural resources which present significant opportunities for development of indigenous energy sources. Accounting for approximately 6% of the National Population it covers an area of over 6,000 square kilometres. Other principle statistics include a total number of households of approximately 96,000, of which oil is the main source of heating. Vehicle ownership has increased dramatically in the region, mirroring the National trends, with a 100% increase between 1990 and 2004. 6.5% of the National employment in the Industrial and Commercial Sectors is based in the study area. The Gross Value Added (GVA) per person is somewhat below the National average but there has been a steady increase since 1990 in this area.

The approach taken in the study was to present the data by County in separate Tables and Figures. This allows for analysis of energy and emissions within each County and also on a Study Area basis. It is hoped that in the future data for North Tipperary can be added to this data to provide a complete analysis for the Mid West Region of Ireland.

The general approach that has been taken is to proportion data at a National level using appropriate ratios. Using Total Final Consumption (TFC) as a basis helps to avoid, in many cases, the skewing of data from major energy sites in the study area.

Moneypoint ESB power station (the largest electricity producer in the country), Aughinish Alumina, Irish Cement and Shannon Airport, make up some of the highest energy users in the country, and all are located in the study area. The four sites have been estimated to be responsible for over 12,300 kTonnes of CO_2 per annum. All these sites except Shannon Airport are dealt with under the National Emissions Trading scheme and therefore the LCEA will have a limited input to action in this area. To avoid the data from these large sites skewing the data from other sectors it is not presented with the County data. This allows for a more focused approach on the other sectors and end users within the region.

Within the study area the two Counties (Clare and Limerick) account for approximately 83% of TFC and 85% of CO_2 emissions. The Transport sector has emerged as the sector with the greatest share of TFC in 2004 at 40%. It also accounted for the highest share of CO_2 emissions at 31% followed by the residential sector at 26.5%. This is expected to increase to 45% by 2010. Oil is the predominant fuel used in the area and it accounted for 58% of all CO_2 emissions in 2004.

Analysis of the energy usage per capita in the study area indicated that Limerick City is lower than the National average, while the two County areas are above the National average. This can be explained by the increased transport costs, restricted access to cleaner, more efficient fuels such as Natural Gas and higher percentage usage of solid fuels in the rural context. A similar trend is experienced when assessing CO_2 emissions per person.

All areas studied are projected to exceed the requirements as set out under the Kyoto Protocol in terms of CO_2 emissions. The total quantity of CO_2 savings that will be required in the study area is estimated to be approximately 1,200 kTonnes of CO_2 by 2010. This equates to a value of 4.6 Tonnes of CO_2 per person in the County areas and 2.8 Tonnes CO_2 within the City.

Common trends appeared across Clare and Limerick Counties

- Oil is the predominant fuel of choice and accounts for almost 60% of TFC.
- Natural Gas has had limited penetration to date and the majority of the remainder of fuel supply is from electricity.
- Solid fuels has experienced a reduction in usage and it is reasonable to assume that this is as a result of a move to more efficient systems which use oil or gas.
- The transport sector is the largest energy user in the two counties with a 40% share of TFC. The residential and industrial sectors are the next highest users in terms of fuel consumption.
- In relation to emissions electricity assumes a much higher share of total emissions given the profile of electricity production in Ireland. In the County areas electricity accounts for approximately one third of all energy related CO_2 emissions.
- Oil produces the highest levels of emissions producing almost 60% of emissions. Without significant change and action it is not projected that renewables will make a major impact in terms of TFC or CO_2 emissions in the short term.

Clare County could exceed the 2010 Kyoto limit by 490 kTonnes of CO_2. This could equate to a Carbon Levy of €17 million, rising to €26 million by 2015.

Limerick County could exceed the 2010 Kyoto limit by 562 kTonnes of CO_2. The corresponding financial carbon levy could be €19.7 million, rising to €31 million by 2015.

However, the potential CO_2 reductions that have been identified Quantified Indicative Reductions (QIR) would indicate that with immediate action across a range of sectors the Kyoto Target could be achieved. Reductions in the region of 510 kTonnes CO_2 for Clare and 590 kTonnes CO_2 in Limerick County have been indicated. Achieving these reductions will require commitment, financial, technical and administrative support and in some cases specific National action.

Limerick City is projected to also exceed its Kyoto Limit by approximately 150 kTonnes of CO_2 thereby potentially resulting in a Carbon Levy of €5.3 per annum. Potential reductions of 160 kTonnes CO_2 were identified as being achievable.

Overall it is clear that the limited action at a National level to seriously tackle climate change combined with the strong economic growth in Ireland has resulted in our inability to date to meet the Kyoto Targets. Unlike other countries there has been limited support or opportunity for this issue to be tackled at a Regional level. This Energy Balance is the beginning of a process to identify the key trends and target areas for action in relation to climate change by the Limerick Clare Energy Agency. It is clear that extending this study to include the area of North Tipperary to produce a combined Mid-West Regional Energy and Emissions Balance would be beneficial.

The key areas which will have the greatest impact in the future in terms of meeting the Kyoto Requirements will be in the area of energy production and transport. The worrying trend of the increased dependence on Oil in the study area is set to continue unless immediate action is taken. There is a clear responsibility on all people and sectors to play their part in terms of reducing CO_2 emissions. The challenge for the LCEA and its partners will be to provide the information, supports and technology to ensure these responsibilities are met.

1.0 Conclusions and Recommendations

Climate Change is one of the key challenges facing humanity at present. This report seeks to outline the particular challenge that is faced in the study area of Counties Clare and Limerick plus the City of Limerick.

It is clear that the Kyoto targets for the area in 2010 will not be achieved based on current practice. Fundamental change is required to meet the targets across all sectors. Transport and energy supply present the greatest opportunities for change but also present significant barriers for action at a local level.

The key recommendations to be made from this report include:

- in the near future the Energy and Emissions Balance should be extended to cover North Tipperary so that the Energy Balance and subsequently the Climate Change Strategy can be linked to the work of the Mid West Regional Authority (MWRA).

- The position of oil as the predominant fuel in the study area should be a key area for focus. This will require action to replace its use as a heating and transport fuel primarily. Given the limited access to natural gas it is expected that this will require increase used of renewables to replace oil

- The Transport sector, given its high share of TFC, will need immediate action to implement a range of actions. This will require the co-operation of the major service suppliers and also National Support.

- The Residential sector, despite the increased numbers of houses being built, has seen limited increases in its share of TFC. However, it presents a focused target area for action for the LCEA

- The data for the Commercial and Industrial Sector would indicate that while there may be a reduction in the share of TFC and CO_2 emissions from the industrial sector this reduction is being offset by the expanding Commercial Sector. This is most likely to be as a result of the move to a service based economy.

- A mechanism for disseminating the results of this study to the relevant sectors of the community is required. This should target individuals and all relevant sectors.

2.0 Limerick Clare Energy Agency

The Limerick Clare Energy Agency was established in July 2005 with joint investment from: -

- Limerick County Council
- Clare County Council

The Agency is also fortunate to receive sponsorship from: -

- Rural Resource Development Ltd. in County Clare
- West Limerick Resources Ltd. in County Limerick
- Ballyhoura Development Ltd. in County Limerick
- University of Limerick.

The support of the sponsors enables the Agency to conduct a number of important projects in both counties, as well as operating from a centre of excellence.

Limerick Clare Energy Agency is one of 16 energy agencies that make up the Association of Irish Energy Agencies (AIEA) covering Ireland. However the agency is unique in that it was established entirely from local authority funding without any external assistance. Limerick & Clare County Councils deserve credit for identifying the importance of energy management for the sustainable development in the Mid West Region.

The mission statement for the agency is: -

"The Limerick Clare Energy Agency aims to provide energy solutions for sustainable development in the region. The agency will provide energy services to all economic sectors and the general public, promoting and facilitating efficiency & sustainability in the production and consumption of energy".

The priorities for the Agency for its first 3 years of operation are: -

- Energy & Emissions Balance for Limerick & Clare
- Climate Change Strategy for Limerick & Clare
- Energy efficiency benchmarking of local authority facilities
- Energy auditing of community facilities
- Energy efficiency & renewable energy training for community groups
- Implement the Energy Performance Buildings Directive
- Promote an Indigenous energy supply
- Promote increased use and understanding of renewable energy technologies
- Advise local authority housing department on energy efficiency
- Establish a Fuel Poverty Programme for Limerick & Clare
- Promote a transport strategy for Limerick & Clare

3.0 Global Energy & Environment

3.1 World Energy Consumption

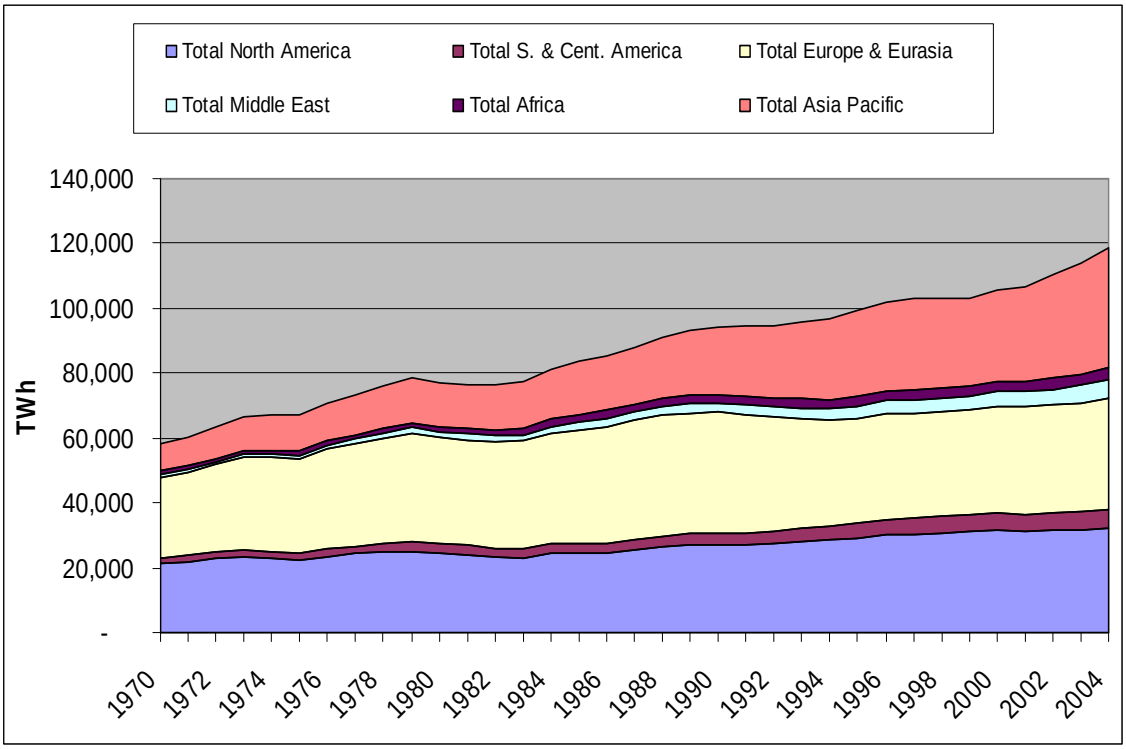

Chart 3.1: Global Total Primary Energy Consumption

Source: BP (2005)

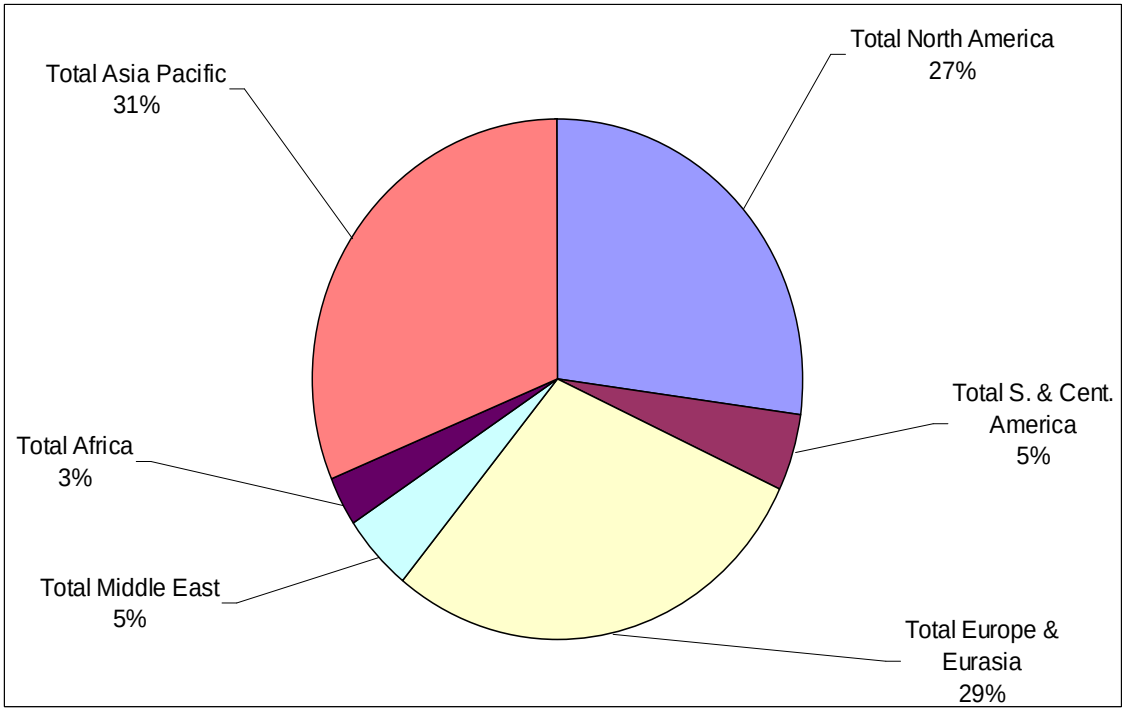

Chart 3.2: Share of Total Global Consumption in 2004

Source: BP (2005)

The profile of global energy consumption between the period of 1970 and 2004 is illustrated in Chart 3.1. An ever increasing trend in energy consumption can be seen across all world regions. Total Global Consumption in 2004 (approx 120,000 TWh) more than doubled since 1970 (approx 60,000 TWh).

Chart 3.2 illustrates the share of consumption across the different regions. It is clear that in 2004 the developed regions of North America, Asia Pacific and Europe accounted for 77% of total world energy consumption.

- Analysing the rate of change in different world regions illustrates that energy demand varies considerably. It is clear across all regions that energy consumption has increased. The percentage increase from 1970 to 1980 globally was 32%, this reduced to 12% between 1990 and 2000. The Middle East, Africa and Asia Pacific regions have been shown to have the highest rate of increase consumption across the world. Chart 3.3 illustrates this data.

- The data with the most relevance to the Limerick and Clare region is in the Europe/Eurasia region. This has shown considerable reduction of 12% in energy consumption from 1990 to 2000. There has been a marked increase in energy consumption from 200-2004 of 20% in this region. This leads us to a more detailed analysis of energy consumption in the European Region, but firstly a short summary of energy use in the OECD is provided, to allow for comparison with Europe.

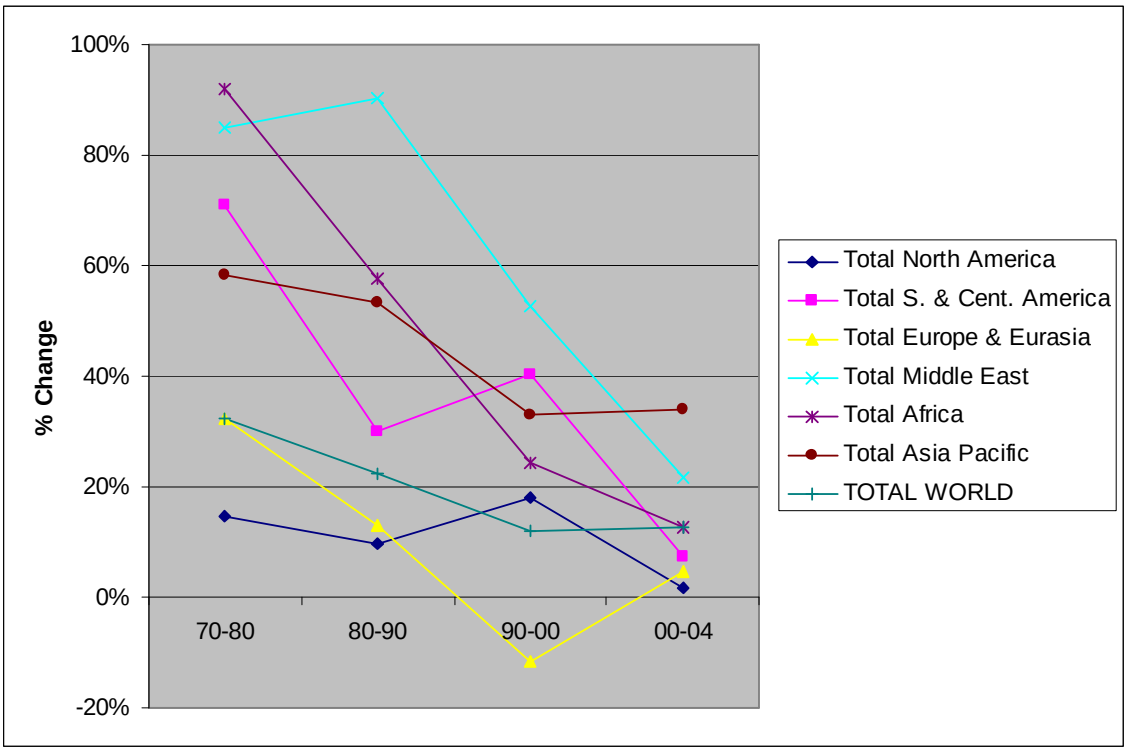

Chart 3.3: Percentage Change in Regional World Consumption

Source: BP (2005)

3.2 OECD

The Organisation for Economic Cooperation and Development (OECD) groups 30 member countries sharing a commitment to democratic government and the market economy. Active relationships exist with some 70 other countries, NGOs and civil society. Its work covers economic and social issues from macroeconomics, to trade, education, development and science and innovation.

The OECD regions have the highest share of total world energy consumption. North America accounted for over 50% of this consumption in 2004 with Europe accounting for 34% of the OECD consumption, or 21,509 TWh in 2004. The effect of the 'oil crisis' in the late 1970s and early 1980s can be seen with the dip in consumption in the OECD. However, the percentage increase in consumption in the OECD from 1990 to 2004 was 20%.

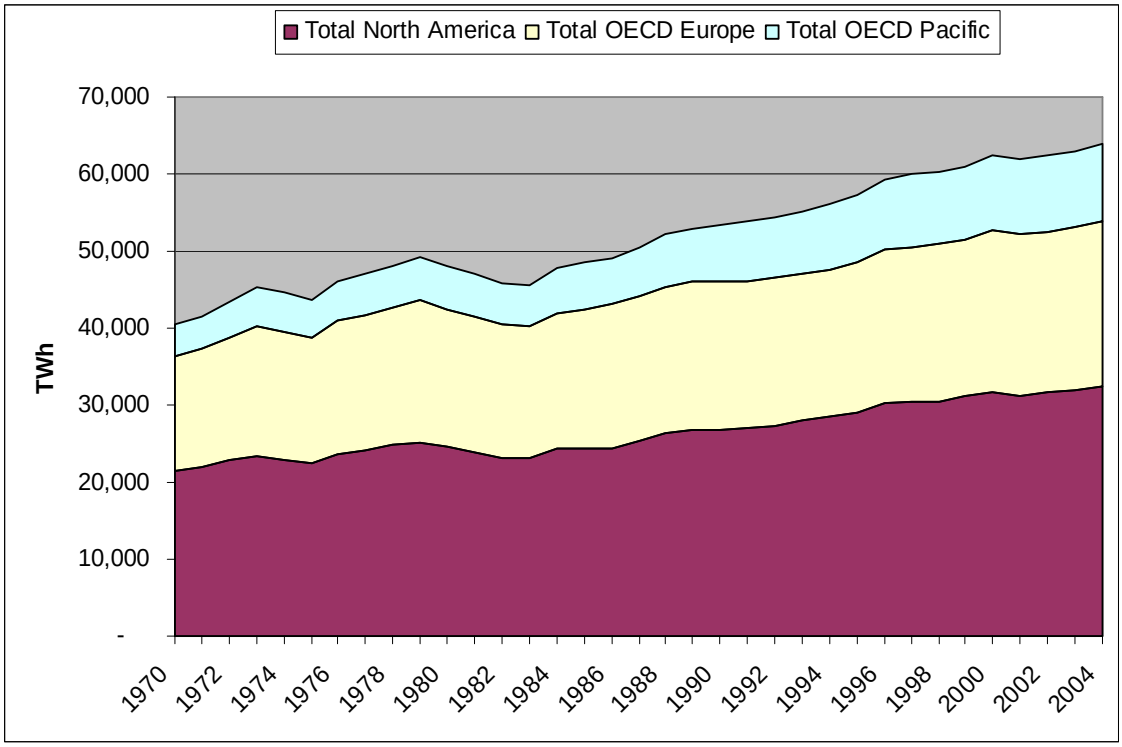

Chart 3.4: OECD Primary Energy Consumption

Source: BP (2005))

3.3 European Union Energy Consumption & Emissions

In the context of the Limerick and Clare region it is important to review the trends within the EU in terms of energy consumption and related emissions.

As would be expected the major countries within Europe account for the largest percentage of Total Primary Energy Consumption (TPEC). In 2003 the TPEC breakdown for the following countries was as follows:

- Germany 20%
- France 16%
- United Kingdom 13%
- Italy accounted 11%
- Ireland 0.88%

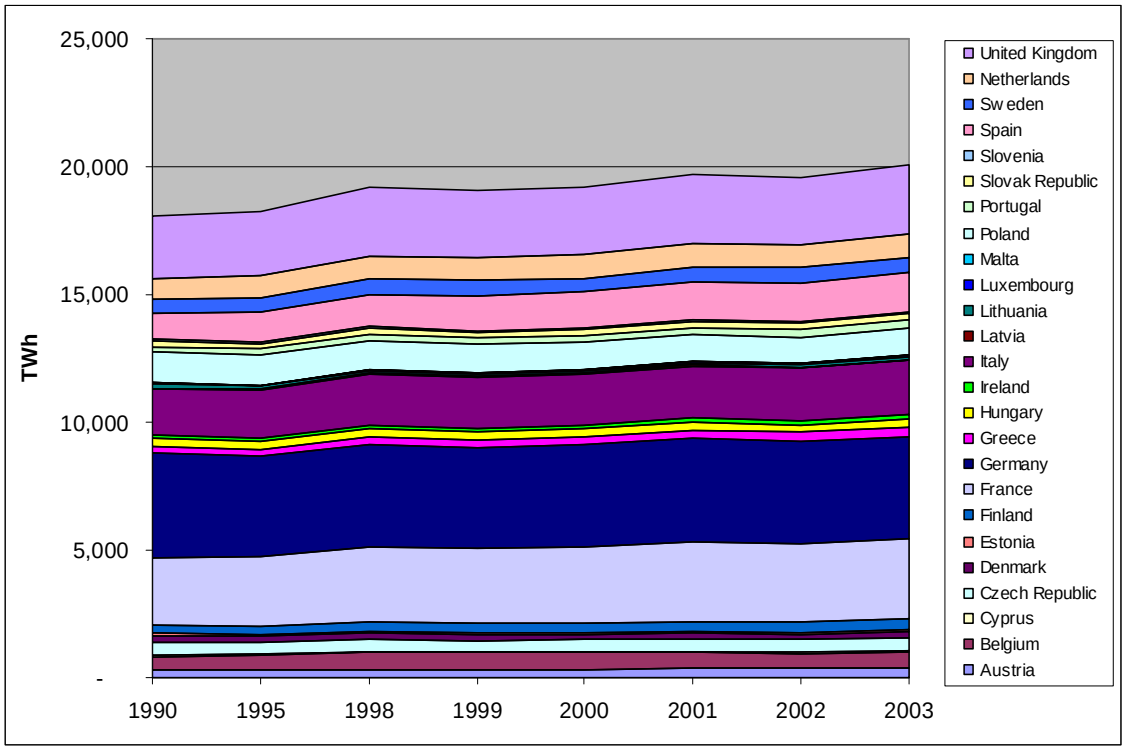

Chart 3.5: Total Primary Energy Consumption by Country

Source: Eurostat (2005))

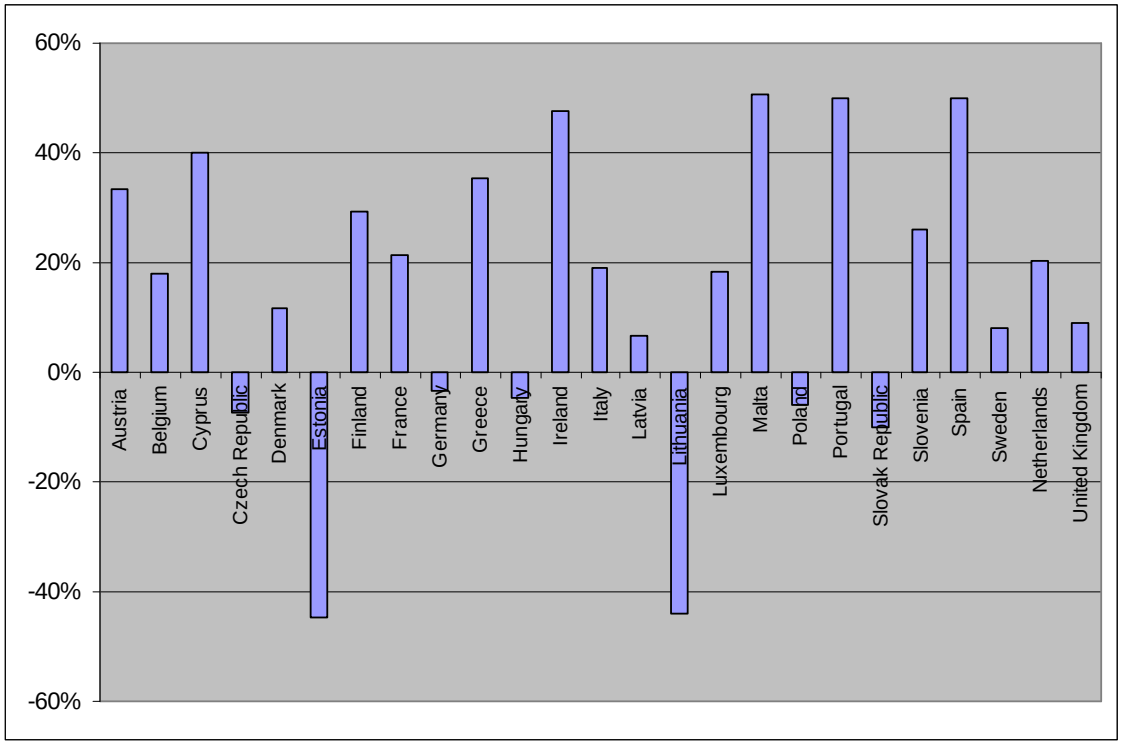

Chart 3.6: Percentage Change in Primary Consumption by Country (1990-2004)

Source: Eurostat (2005)

TFC for the EU 25 was 13,169 TWhs in 2003, an increase of 12% from 1990. Ireland accounted for 1% of this TFC. In terms of consumption by fuel, oil is the predominant fuel, as seen in Chart 3.8, accounting for 43% of TFC in 2003. Solid Fuel was the only sector to see a reduction over the 1990 to 2003 period (approximately 60%). Renewables saw a 39% increase over this period to reach a contribution of 547TWh in 2003, but this accounts for only 4% of TFC.

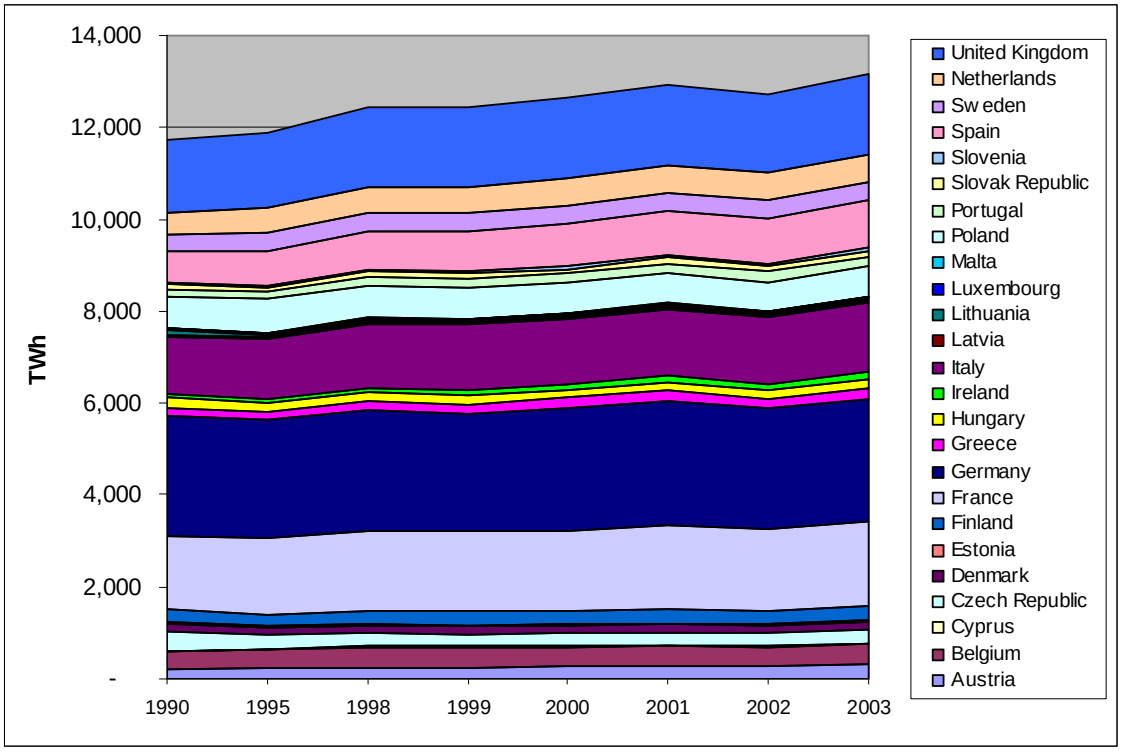

Chart 3.7: Total Final Energy Consumption by Country

Source: Eurostat (2005)

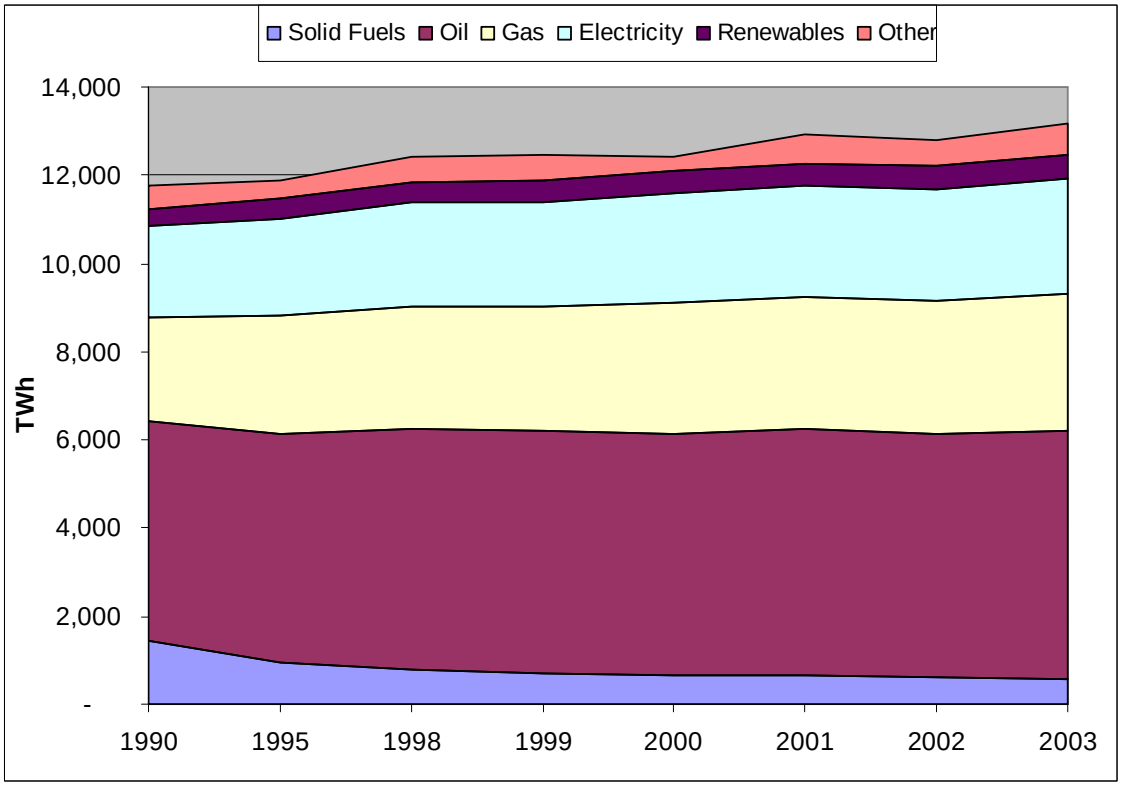

Chart 3.8: Total Final Energy Consumption by Fuel

Source: Eurostat (2005)

The increase in energy consumption varies considerably across the EU25. Ireland had one of the highest levels of increase from 1990 to 2003 (48%), yet the percentage increase from 2002 to 2003 was only 1%. This is in contrast to Estonia which had an increase of 10% from 2002 to 2003 but a 45% decrease from 1990 to 2003.

A recent EU Policy Paper 'Green Paper on Energy Efficiency: Doing more with less' identified that action on increasing energy efficiency has had a significant impact on energy consumption since 1971 i.e. TPEC would be much higher without the actions taken on energy efficiency. The benefit of reduced energy consumption is measured in Negajoules and is illustrated in Chart 3.9.

A Negajoule can be defined as a quantity of energy saved due to energy efficiency measures. The following Chart illustrates the TPEC and that energy which can be accounted for as saved in over the same period. The calculation of Negajoules is done on the basis of energy intensity across the various sectors.

Finally, reviewing the energy related CO_2 emissions for the EU 25 by country it can be seen that the major economic powers within the EU 25 account for the major CO_2 emissions. Germany, UK and France are the major contributors as shown in Chart 3.10.

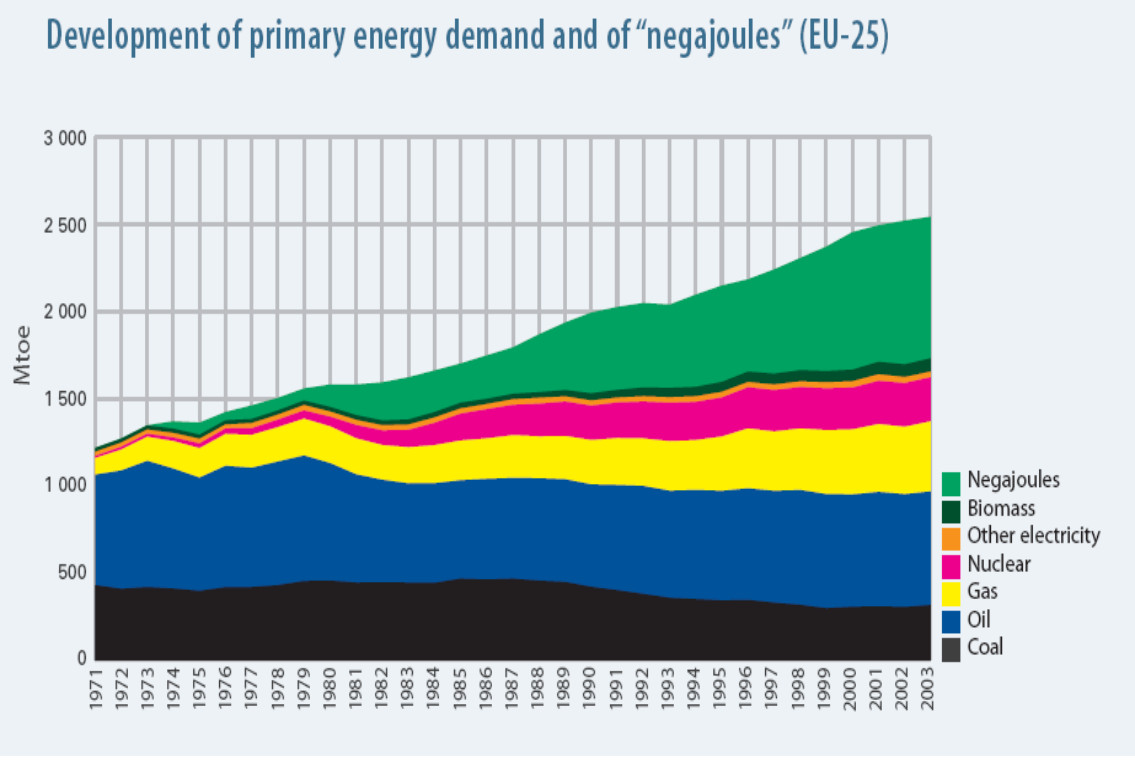

Chart 3.9: Development of primary energy demand and of "negajoules" (EU-25)
Source: EU Commission (2005)

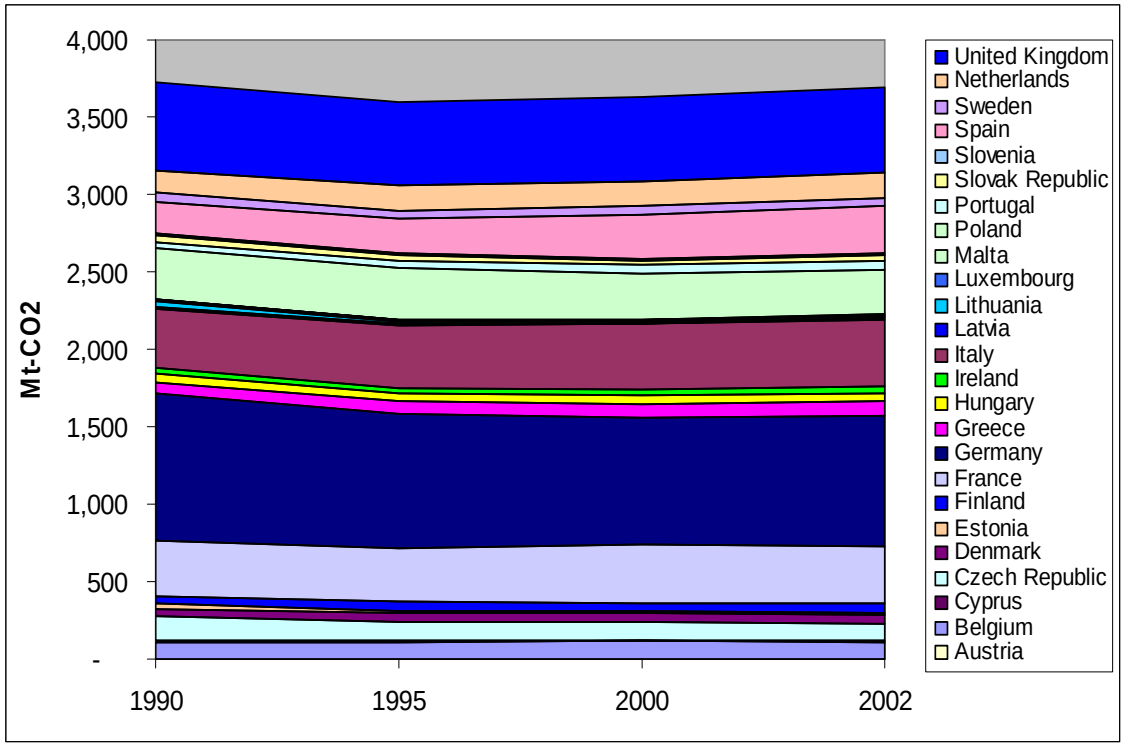

Chart 3.10: Total CO_2 emissions per Country for EU 25

Source: Eurostat (2005)

4.0 Climate Change Conventions

4.1 Introduction

Climate Change has become one the key issues resulting in a global effort to influence change, whether through increased exposure via the world media to the climatic effects attributed to climate change or via international gatherings of Governments to negotiate the mechanisms of change.

Section 3.0 has illustrated that within the developed countries i.e. the OECD, energy consumption has increased dramatically, and this in turn has resulted in significant increases in CO_2 emissions. With the increased development in countries outside of the OECD this trend will continue without action being taken.

The United Nations (UN) has become a central body in the development and implementation of actions at a global level to reduce green house gas emissions and monitor climate change.

4.2 Climate Change Conventions

An extract from the UN Framework Convention on Climate Change (UNFCCC) Guide to Climate Change (UNFCCC, 2005) provides an overview of the need for action

> *"Climate change is caused by an increase of greenhouse gases in the atmosphere. These gases reach the atmosphere as a result of activities of our everyday life: the use of energy from fossil fuels (coal, oil and gas), in industrial processes, when flying or driving, or when using electric equipment at home. But greenhouse gases also come from agricultural production and deforestation.*
>
> *It is clear that the economic stakes are high on all sides: the economic impact of climate change can be huge, and taking measures to reduce emissions will affect economic activity. But we cannot afford not taking action, as the climate system is under threat. The United Nations and its member states, aware of the seriousness of this global problem, as presented by the scientific community, have been engaged in action to deal with it at a global level. They adopted the United Nations Framework Convention on Climate Change in 1992, which, in 1997, was followed by the Kyoto Protocol.*
>
> *The Convention has developed into a broad platform for its 189 Parties to strive, on the one hand, for the stabilization of concentrations of greenhouse gases, and, on the other hand, to prepare societies for the inevitable impacts of climate change. The Kyoto Protocol, which entered into force in February 2005, provides an important first step in this effort. It sets legally binding emission reduction requirements for the industrialized countries that are Party to it. A new range of instruments has been established by the Protocol that will help address climate change. These include market-based mechanisms, which can assist in identifying the most economical ways of bringing harmful emissions down."*

To achieve change on a global scale takes considerable effort and time. This can be evidenced from Table 4.1 which shows the key dates associated with the development of the UNFCCC and the Kyoto Protocol.

Table 4.1: Timeline for implementation of Kyoto Protocol

Source: UNFCCC (2005)

Year	Event	Protocol Milestone
2005	November/December COP 11 and COP/MOP 1 (Montreal, Canada)	February, Entry into Force of Kyoto Protocol
2004	December COP 10 (Buenos Aires, Argentina) Buenos Aires Programme of Work on Adaptation and Response Measures	
2002	October and November COP 8 (New Delhi, India) Delhi Declaration August and September progress since 1992 reviewed at World Summit on Sustainable Development	
2001	United states of America (USA) withdraws from the Kyoto Protocol	
2001	October and November COP 7 (Marrakesh, Morocco)	Marrakesh Accord
2000	November, COP 6 (The Hague, Netherlands)	Talks based on the Plan Break Down
1998	November COP 4 (Buenos Aires, Argentina)	Buenos Aires Action Plan
1997	December, COP 3 (Kyoto, Japan)	Kyoto Protocol Adapted
1995	March and April, COP 1 (Berlin, Germany)	March and April, Berlin Accord
1994	March, Convention enters into force	
1992	May, INC adopts UNFCCC text	June, Convention opened for signature at Earth Summit
1991	First meeting of INC	
1990	IPCC and second WCC call for global treaty on climate change September, United Nations General Assembly negotiations on a framework convention	
1988	IPCC Established	
1979	First World Climate Conference (WCC)	

The Kyoto Protocol set binding agreements for the parties involved in terms of Green House Gas Emission reductions. The Kyoto Protocol deals specifically with the following gases.

- Carbon dioxide (CO_2) - 50% of GHG emissions
- Methane (CH_4) - 18% of GHG emissions
- Nitrous oxide (N_2O) - 6% of GHG emissions
- Hydro-fluorocarbons (HFCs)
- Per-fluorocarbons (PFCs)
- Sulphur hexafluoride (SF_6)

Note HFCs, PFCs and SF_6 make up the 26% balance of GHG emissions.

The Protocol set individual targets for 39 developed countries and the EU as a whole. Overall a target of 5.2% reduction in emissions aggregated for all of these countries when compared to 1990 has been set out. This will be measured in the 2008-2012 period.

Table 4.2: Kyoto Commitments

Source: UNFCCC (2005))

Country/Region	**Commitment**	
European Union	8%	Reduction
United States	7%	Reduction
Canada, Japan, Hungary	6%	Reduction
Croatia	5%	Reduction
New Zealand, Russia, Ukraine,		1990 levels
Norway,	1%	Increase
Australia,	8%	Increase
Iceland	10%	Increase
Total Kyoto Commitment	**5.2%**	**Reduction**

The timeline to bring the Protocol into legal affect has been delayed primarily due to the fact that the USA has decided that the Protocol is not an appropriate mechanism for them in fighting climate change, and they withdrew from the protocol in 2001. However, the EU has remained a strong driving force behind the Protocol.

The most recent UNFCCC event in Montreal, December 2005, also indicated that the USA has been somewhat sidelined in this regard with the remaining parties seeking for action beyond Kyoto. In addition, a number of US Cities have taken independent action to combat climate change, by implementing the climate change policies.

Overall, it can be seen that while acknowledged as a serious issue internationally the implementation of actions within an agreed structure is difficult to achieve. Having reviewed the international context the issue of climate change in an Irish context can be examined.

4.3 Climate Change in Ireland

Under the Kyoto Protocol the European Union negotiated a burden sharing agreement whereby the 8% reduction target for the EU would be redistributed amongst its member states. Within this agreement Ireland committed to limiting its emissions to 13% above 1990 levels.

The relevant Government Departments and Bodies involved in the development a strategy to react to the Protocol include

- Department of Environment, Heritage and Local Government
- Department of Communications, Marine and Natural Resources
- Department of Agriculture and Food
- Sustainable Energy Ireland
- Environmental Protection Agency

The Department of Environmental, Heritage and Local Government (DoEHLG) have prime responsibility for actions in this area and in this regard a National Climate Change Strategy was produced in 2000 to outline how Ireland would meet its commitments under the Kyoto Protocol.

This Strategy predicted the effects of climate change in Ireland as including:

1. Significant increases in winter rainfall, with increased flooding.
2. Lower summer rainfall, which would in turn lead to the erosion of Irelands bog lands, and our main native fuel resource.
3. Rising sea levels and greater storms particularly on the West Coast.
4. Increase in the pests and diseases, not currently native to Ireland.

The National University of Ireland (NUI) Maynooth completed a study on the 'Scenarios and Impacts of Climate Change' (2003) predicts the following scenarios for Ireland:

1. Current mean January temperatures in Ireland are predicted to increase by 1.5°C by mid-century with a further increase of 0.5–1.0°C by 2075.
2. Drier Summers are predicted with up to a 30% drop in rainfall which will impact agriculture both tillage and grazing where measures such as irrigating the land may have to be taken to offset these changes.
3. Flooding in winter with heavier rain due to more frequent heavy rain storms
4. Drier summers, which may cause greater pressure on water supplies in the more densely populated parts of the country
5. Changes to the balance of our ecosystems where some species and plants may decline and others may flourish
6.

Other relevant Government Policies which relate to the field of Climate Change include:

- National Climate Change Strategy (NCCS) (DoEHLG, 2000)
- Green Paper on Sustainable Energy (1999)
- Annual National Inventory Reports compiled by the EPA
- Progress Report on National Climate Change Strategy DoEHLG (2002)

The National Climate Change Strategy is currently under review and it is expected that a a revised Strategy will be produced by the end of 2006, early 2007. This process is being coordinated by the DoEHLG.

The following chapter will review, in an Irish context, the energy demand and related emissions since 1990 and projected forward to 2015. A mid-point year of 2010 has been taken to allow for comparison with achievement of the Kyoto Protocol requirements.

5.0 Energy and Environmental Emissions in Ireland

In analysing the trends in relation to energy and the environment in Ireland the following approach has been used

- a review of the total GHG emissions which are relevant under the Kyoto Protocol
- specifically address the emissions related to energy production and use
- review energy production and consumption in Ireland

In all cases analysis has been done by sector and by fuel, where applicable. The analysis of total emissions data represents the 6 gases to be accounted for under the Kyoto Protocol.

Data is presented for 1990 to 2005 based on reports from relevant bodies such as the DoEHLG and the Environmental Protection Agency (EPA). Projections to 2010 are then provided to show expected trends going forward. These trends are derived from the available data.

5.1 Irelands Environmental Emissions

The analysis of GHG emissions is a complex issue when considering the range of gases covered under the Kyoto Protocol. The Intergovernmental Panel on Climate Change (IPCC) determines the relevant gases, categories and sectors. . The following figures present an overview of Irelands GHG, by IPCCC Categories and by Sector. These figures include all GHG emissions expressed in kilo-tonnes of CO_2 equivalent (kT-CO_2e). Some of the key points of note from these figures include:

- Irelands total GHG emissions in 1990 was 53.75 Million Tonnes (Mt) of Carbon Dioxide equivalent (CO_2e). Based on this figure the 13% increase provided under the EU Burden Sharing Agreement means that Ireland should not exceed emission levels of 60.74 Mt CO_2 e by the 2008-2012 period.
- The NCCS reported in 2000 that emissions in Ireland were expected to reach 73.794 Mt CO_2e by 2010. The latest data for emissions to date are presented in Table 5.1 and Chart 5.1.
- CO_2 emissions account for the majority of GHG in Ireland (66% in 2004)
- A decrease in emissions occurred in 2002 & 2003 primarily due to the closure of the Irish Steel and Irish Fertiliser companies – high CO_2 emission industries
- A Business as Usual (BAU) Scenario to 2010 would see Ireland being approximately 26% above the 1990 Kyoto Target.
- Total emissions increased by 23.2% from 1990 to 2004
- Energy accounts for the greatest proportion of emissions (64.6% in 2003). Agriculture is the next highest contributor to emissions. Emissions in this sector have remained relatively constant from the 1990 to 2003 period. The major changes in emissions are therefore confined to the energy sector.

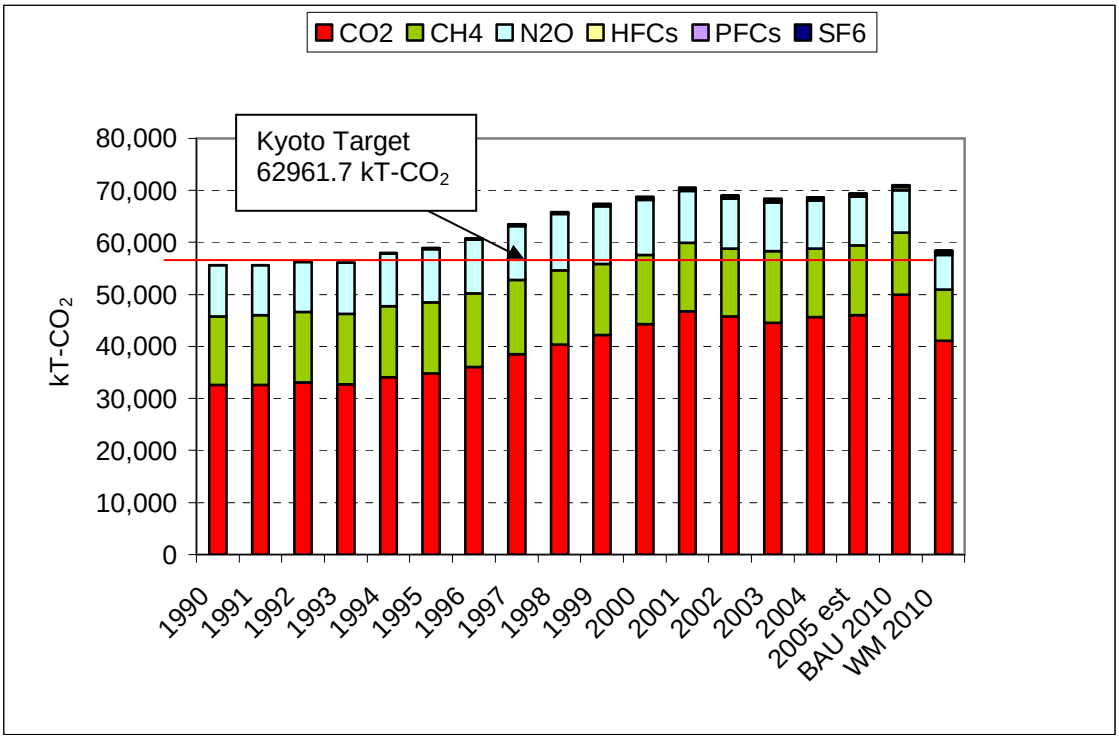

Chart 5.1: Ireland's Greenhouse Emissions 1990-2010, By Gas([1])([2])

Source EPA (2006), ICF-BOC (2005), NCCS (2000)

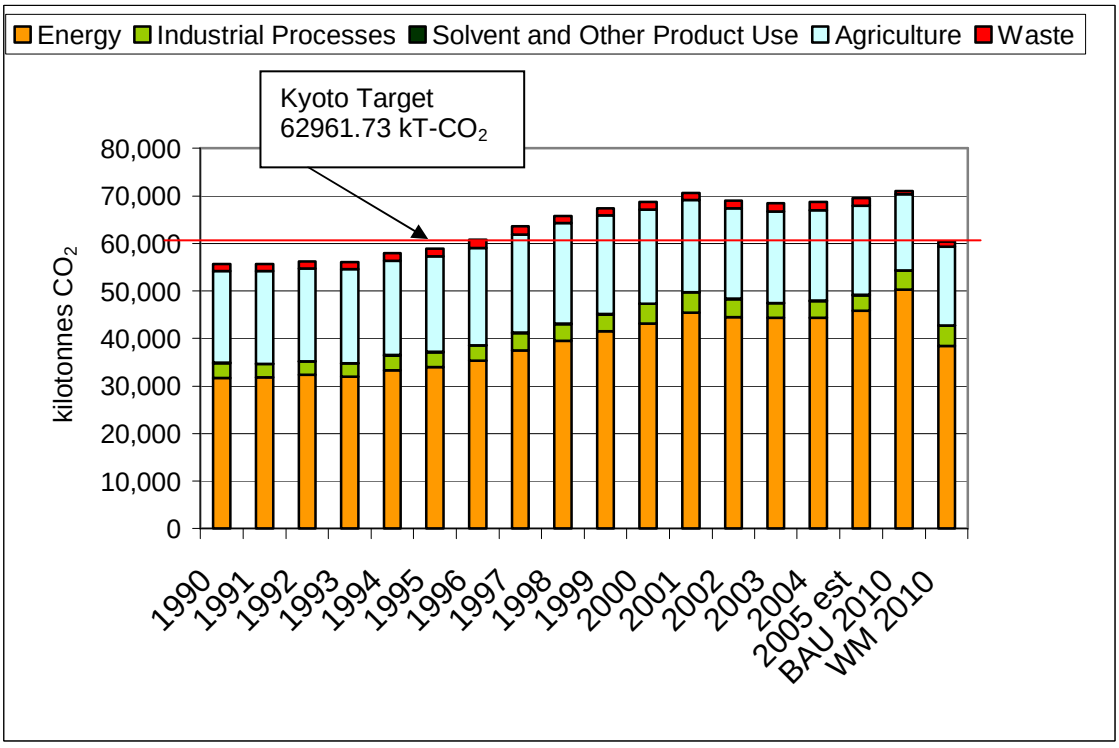

Chart 5.2: Ireland's Greenhouse Emissions 1990-2010, By IPCC Category

Source EPA (2006), ICF-BOC (2005), NCCS (2000)

[1] BAU – Business As Usual reference Glossary in Appendix 1
[2] WM – With Measures reference Glossary in Appendix 1

5.2 Irelands Energy Related Emissions of CO_2 by Fuel

The Kyoto Protocol is concerned with a range of GHG Emissions. It is beyond the scope of this report to focus on all emissions. Energy is the most significant contributor to emissions in Ireland. Therefore specific focus will be placed on the impact of energy related emissions will be analysed in more detail. Table 5.1 outlines the CO_2 energy related emissions from 1990 to 2004 and projected to 2015.

Table 5.1: Ireland's Energy Related CO_2 Emissions by Fuel (kT-CO_2)

Source: SEI (2006), ESRI (2005)

kT-CO_2	1990	1995	2000	2002	2004	2005 est	BAU 2010	BAU 2015
Coal	3,358.1	1,504.8	2,090.9	2,011.7	2,202.0	2,229.5	1,362.2	1,065.2
Peat	2,551.1	2,128.9	779.3	774.9	769.5	762.4	492.6	328.4
Briquettes	707.7	521.4	513.2	480.0	372.9	351.2	226.9	151.3
Oil	11,529.3	14,175.9	20,069.7	21,488.9	22,252.7	23,737.1	27,801.1	30,400.8
Natural Gas	1,324.7	1,697.3	2,766.7	2,757.5	3,053.1	3,371.5	4,406.4	5,250.5
Hydro	-	-	-	-	-	-	-	-
Other RES	-	-	-	-	-	-	-	-
Electricity	11,018.0	13,334.4	15,700.7	16,188.8	14,391.5	15,343.6	18,406.5	19,292.0
Total	30,488.9	33,362.6	41,920.3	43,701.8	43,041.8	43,757.6	51,450.8	55,514.6
Kyoto Target 1990+13%	34,635.4	34,635.4	34,635.4	34,635.4	34,635.4	34,635.4	34,635.4	34,635.4

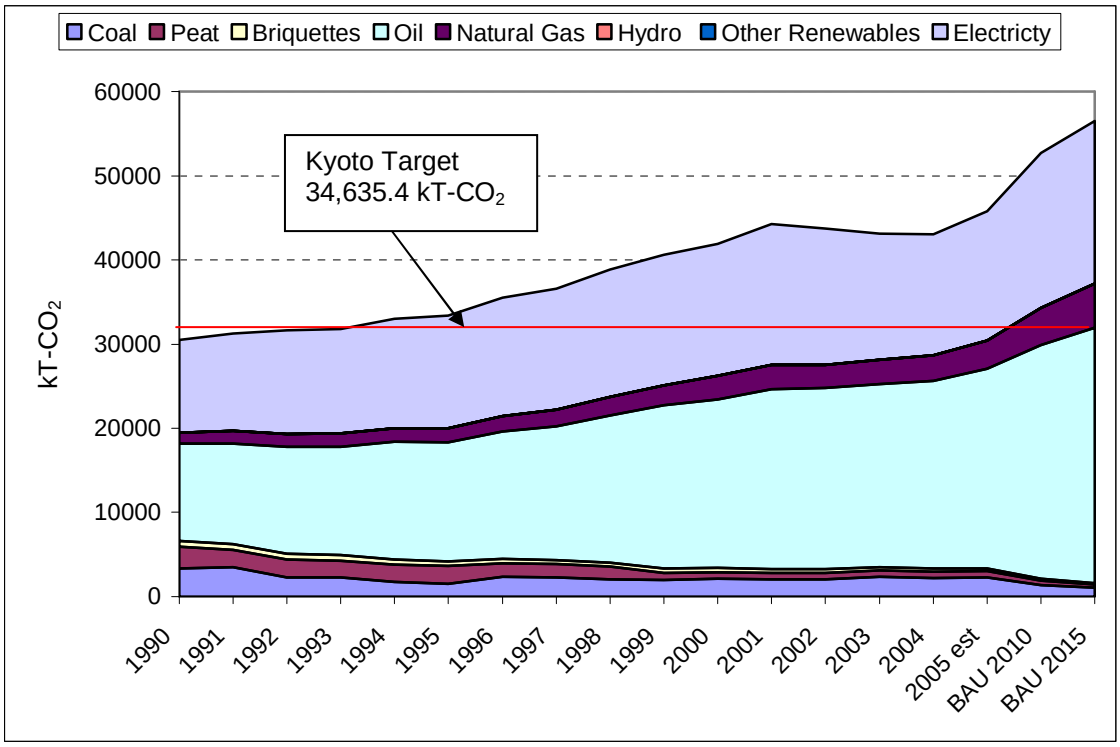

Chart 5.3: Ireland's Energy Related CO_2 Emissions by Fuel

Source: SEI (2006), ESRI (2005)

The data illustrates the impact of emissions from the increased use of electricity, natural gas and oil.

- In 2004 electricity production and use accounted for 33% of all energy related CO_2 emissions.
- This is a drop from 36% in 1990 – mainly due to increased use of natural gas in the electricity mix.
- Oil accounted for 25% of emissions in 2004 with gasoline (petrol) accounting for 19%.
- The marked reduction in emissions from the use of peat is also evident (from 8% in 1990 to 2% in 2004).

Applying the 13% increase to the 1990 energy related CO_2 emissions figure indicates a limit of 34,635 kT CO_2. Overall energy related CO_2 emissions grew by approximately 42% from 1990 to 2004 and an increase of 69% is projected by 2010 (ESRI, 2005).

5.3 Irelands Energy Related Emissions by CO_2 Sector

Having analysed the emissions from energy by fuel it is also vital to assess how these emissions are divided between the different sectors in the economy. This data is presented in the following table. The transport sector accounts for the largest proportion of emissions in 2004 (32.7%). This has grown from a contribution of 20% in 1990 and transport related emissions have nearly doubled in the period 1990 to 2004. The residential sector, was the highest contributor in 1990, and is now the second largest contributor of CO_2 emissions. It should be noted that despite the increased number of houses constructed that the level of emissions from this sector has remained relatively constant over the period, due in large part to the significant improvements to Part L of the Building Regulations since 1997.

Table 5.2 Ireland's Energy Related CO_2 Emissions by Sector (kT CO_2)

Source: SEI (2006), ESRI (2005)

kT - CO_2	**1990**	**1995**	**2000**	**2002**	**2004**	**2005 est**	**BAU 2010**	**BAU 2015**
Industry	8,072.0	8,720.0	10,458.0	9,944.0	8,560.0	8,050.7	9,353.4	9,894.4
Transport	6,039.0	7,347.0	11,679.0	13,338.0	14,123.0	14,538.9	18,610.2	21,260.4
Tertiary	4,880.0	5,900.0	7,420.0	7,944.0	7,932.0	8,854.7	10,540.0	10,945.1
Residential	10,607.0	10,395.0	11,239.0	11,359.0	11,376.0	11,225.8	11,868.0	12,386.8
Agriculture	1,051.0	1,198.0	1,304.0	1,267.0	1,184.0	1,087.4	1,079.3	1,028.0
Total	30,649.0	33,560.0	42,100.0	43,851.0	43,174.0	43,757.6	51,450.8	55,514.6
Kyoto Target	34,635.4	34,635.4	34,635.4	34,635.4	34,635.4	34,635.4	34,635.4	34,635.4

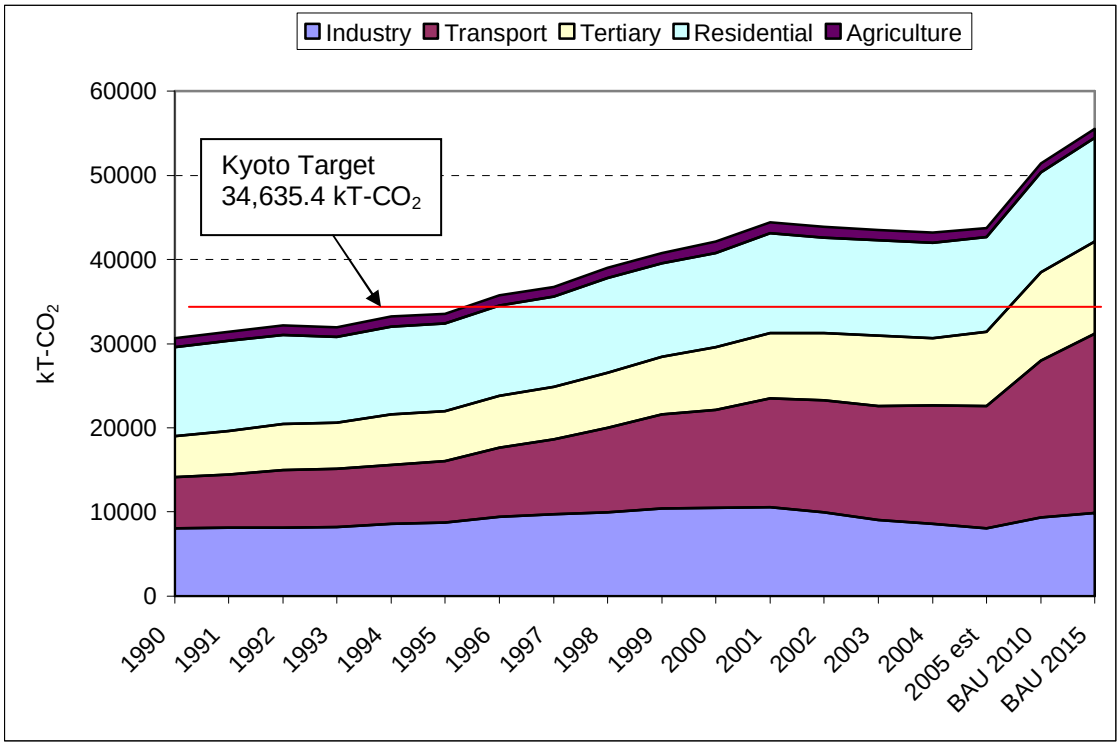

Chart 5.4: Ireland's Energy Related CO_2 Emissions by Sector

Source: SEI (2006), ESRI (2005)

5.4 Irelands Total Final Consumption (TFC) by Fuel

The CO_2 emissions from each fuel are linked directly to the quantity of the fuels consumed and the relative emissions factors for those fuels (Appendix 2). Table 5.3 and Chart 5.5 outline the TFC by Fuel in Ireland from 1990 to 2004 and projected to 2015.

- The use of natural gas as a fuel in Ireland has grown by 130% from 1990 to 2004 and accounted for 11% of TFC in Ireland in 2004.
- Oil consumption almost doubled during this period and represented 63% of TFC in 2004.
- Renewables grew by 76% over the period but still only accounted for 1.6% of TFC in 2004. Renewables now provide 5.2% of Total Electricity Production (SEI, 2006).
- Overall TFC grew by 63% during the period. A Business As Usual (BAU) Scenario would see TFC grow by approximately 100% by 2010.
- Ireland's growing dependence on imported fuels is highlighted by the fact that the use of our main indigenous fuels (peat, briquettes, renewables and natural gas) are declining.

Table 5.3: Ireland's Total Final Consumption by Fuel

Source: SEI (2006), ESRI (2005)

GWh([3])	1990	1995	2000	2002	2004	2005 est	BAU 2010	BAU 2015
Coal	9,860	4,419	6,140	5,907	6,466	6,547	4,000	3,128
Peat	6,814	5,686	2,081	2,070	2,055	2,002	1,294	863
Briquettes	1,988	1,465	1,442	1,349	1,048	1,021	660	440
Oil	45,058	55,302	78,058	83,546	86,430	92,767	108,605	118,721
Natural Gas	6,698	8,581	13,988	13,942	15,436	17,047	22,279	26,546
RES	1,267	1,512	1,628	1,814	2,226	2,209	2,174	2,140
Electricity	12,000	14,930	20,256	22,570	23,056	24,581	29,488	30,907
Total	83,674	91,895	123,593	131,174	136,718	146,174	168,500	182,744

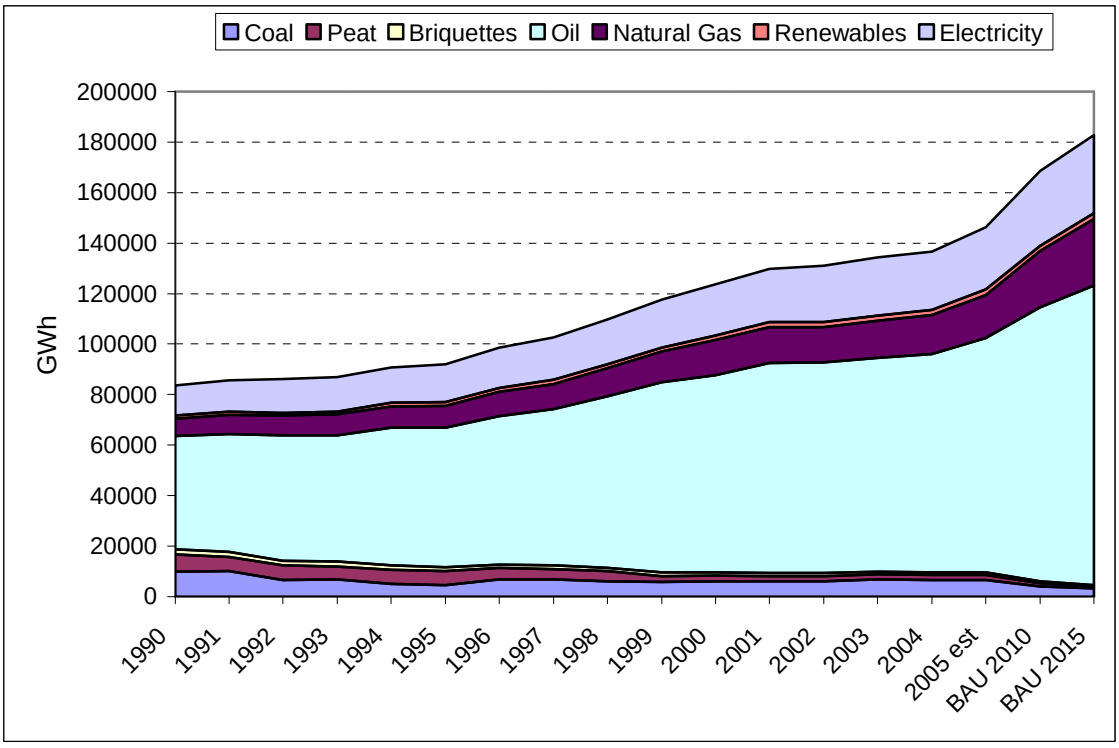

Chart 5.5: Ireland's Total Final Consumption by Fuel (GWh)

Source: SEI (2006), ESRI 2005)

[3] GWH: Giga Watt Hour – Reference Glossary in Appendix 1

5.5 Irelands Total Final Consumption (TFC) by Sector

Table 5.4: Ireland's Total Final Consumption by Sector (GWh)

Source: SEI (2006), ESRI (2005)

GWh	1990	1995	2000	2002	2004	2005 est	BAU 2010	BAU 2015
Industry	20,023	20,337	26,198	25,535	25,084	24,547	28,977	32,163
Transport	23,558	28,616	45,372	51,802	54,627	59,500	72,407	78,442
Residential	25,465	25,314	29,895	31,151	33,534	34,872	35,988	38,663
Commercial	11,698	14,291	18,244	18,872	19,818	23,651	27,698	30,198
Agriculture	2,930	3,349	3,884	3,826	3,655	3,605	3,442	3,291
Total	83,674	91,907	123,593	131,186	136,718	146,174	168,512	182,756

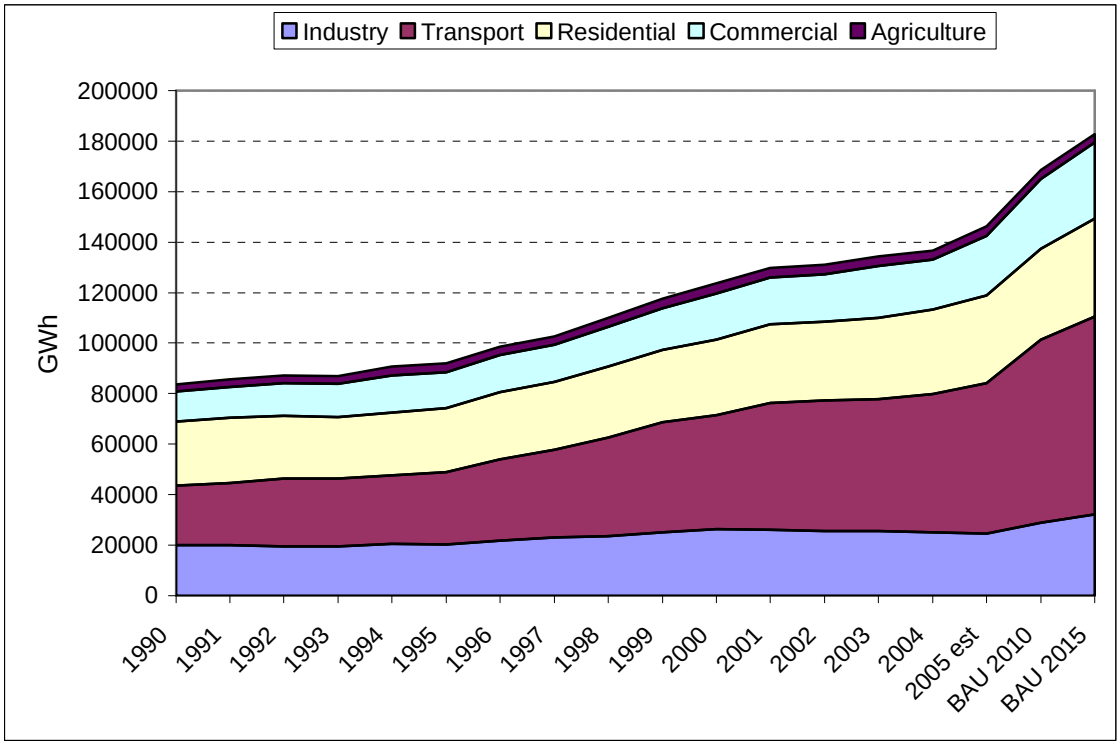

Chart 5.6: Irelands Total Final Consumption by Sector (GWh)

Source SEI (2006), ESRI (2005)

The spread of TFC .across the economic sectors is outlined in Table 5.4 and Chart 5.6.

- Transport is the greatest user of fuel, accounting for 40% of TFC in 2004,
- The residential sector accounted for 25% of TFC in 2004
- Industry accounted for 18% of TFC in 2004.
- The highest growth over the 1990 to 2004 period was experienced by the Transport sector (132%) and Commercial/Public sectors (69%).

5.6 Irish Energy Policy

The current Irish Energy Policy document 'The 'Green Paper on Sustainable Energy' dates from 1999. The Department of Communications, Marine and Natural Resources (DCMNR) have responsibility for the energy portfolio. The Green Paper resulted in the establishment of Sustainable Energy Ireland (SEI), formerly the Irish Energy Centre. SEI is charged with implementing a range of programmes supporting the sustainable energy sector in Ireland.

Currently the Government is considering a new energy policy to 2020 and a particular focus is being placed on the development of an All-Island energy market.

5.7 Financial Implications of Kyoto Protocol for Ireland

When Ireland signed the Kyoto Protocol in 1997 it was not a legally binding agreement. This Protocol was ratified in 2005 giving it international legal status. This means that non-compliance with the targets as set out in the Agreement will result in fines being imposed.

Despite the development of a number of policies, strategies and implementation of actions in Ireland it has been illustrated that while some de-coupling of economic growth with energy demand and energy emissions has been achieved Ireland is unlikely to meet its Kyoto requirements. The cost to Ireland will be significant and the Minister for Finance indicated preparations to meet this cost are being put in place in Budget 2006.

''……that Climate Change is one of the most challenging environmental issues facing this and future generations.

To meet this challenge further, I am announcing today the establishment of a Carbon Fund to enable the State to purchase Carbon Credits. This Fund will be financed on a multi-annual basis and I am providing €20 million in respect of 2006. The National Treasury Management Agency will be the Carbon Credit Purchasing Agency for the State…''

The Table 5.5 outlines the potential costs to Ireland in exceeding its Kyoto targets for the energy related emissions only. The estimated costs for the energy related emissions only could be in the region of €250 million euros.

The National Climate Change Strategy of 2000 estimated the QIRs for all GHG that would be required per sector and estimated the costs of achieving those reductions. The cost of reducing CO_2 emissions is called the 'abatement cost'. Different measures are more expensive to implement than others. Table 5.6, indicates that it will cost €311 million to reduce all GHG emissions examined under the Protocol by 15,000 k Tonnes of CO_2 by 2010 would be in the region of €311 million.

Table 5.5: Ireland Financial Costs from Energy Related CO_2 Emissions

Source SEI (2006), ICF-BOC (2005)

Energy Related Emissions	**Total Emissions** ($kT\text{-}CO_2$)	**Projected Difference to Target** ($kT\text{-}CO_2$)	**Projected Cost of CO_2/ton Trading Price** (€)([4])	**Annual CO_2 Costs** (Million €)
1990 Levels	30,649	-	-	-
Kyoto Targets +13%	34,635	-	-	-
2005 Estimate	43,758	9,125	27	246
2010 BAU	51,451	16,818	35	589

Table 5.6: Ireland Financial Costs related to Green House Gas Emissions

Source NCCS (2000)

Sector	**Quantified Indicative Reductions (QIR)** ($kT\ CO_2$)	**Estimated Annual Cost of QIR** (Million €)	**Indicative Abatement Cost** (€/$T\text{-}CO_2$)
Energy	5,650	44.44	7.87
Transport	2,670	101.58	38.04
Built Environment/Residential	900	38.09	42.32
Industry/Commercial Services	2,175	-	114.27
Agriculture	2,410	126.97	52.69
Sinks	760	-	
Waste	850	-	
Total	15,415	311.09	

[4] CO_2 Trading Price per Tonne taken from Bank of Ireland Global Markets

5.8 Irelands Energy & Environmental Indicators

Table 5.7.: Energy and Environmental Indicators

Source: Eurostat (2006), CSO (1991)

	1991		1995		2000		2003	
Indicator	**EU 15**	**Ireland**	**EU 25**	**Ireland**	**EU 25**	**Ireland**	**EU 25**	**Ireland**
Population (million)	366.0	3.5	445.9	3.6	450.4	3.8	455.0	4.0
GDP (bil Euro)	5,315.0	37.7	6,953.9	52.5	9,090.3	103.1	9,939.0	134.8
GIC / GDP (GWH/1991 MEUR)	2.9	3.0	3.5	3.3	3.6	4.3	3.8	4.6
GIC / Capita (kWh / Inhabitant)	42,471	32,252	41,151	34,538	42,705	43,010.	44,070	43,472
CO_2 Ems / Capita (T CO_2 / Inhabitant)	9.0	8.9	8.7	9.3	8.7	11.0	9.0	10.8

To provide a mechanism to measure performance a number of Energy and Environmental Indicators can be used. There are a number of standard methods that are used to provide comparison across the EU. The indicators that are used in particular by Eurostat refer to Gross Internal Consumption (GIC). This equates to the Total Primary Energy Consumption figures which are used by Sustainable Energy Ireland and the Department of Communications, Marine and Natural Resources in their energy analysis.

Data is available from Eurostat and the CSO for 1995, 2000 and 2003 and this is presented in the following table, along with comparisons with the EU. It can be seen that in 1995 Ireland's energy consumption per GDP and per Capita were below the EU Average but by 2003 Ireland is consistently above average in relation to energy consumption. Ireland has consistently been above the EU average in terms of CO_2 emissions per capita. Ireland's economic development has been staggering with a 100% increase in GPD between 1990 and 2003. This is growth is projected to continue to 2010. Assessing the data relevant to Kyoto requirements and projecting forward to 2010 on a Business and Usual Scenario it is likely that Ireland will remain above the EU average for its indicators.

Table 5.8: Energy and Environmental Indicators Relative to Kyoto

Source: SEI (2006), Eurostat (2006), ICF-BOC (2005)

	Kyoto Target (1990+13%)	**2004**	**% Difference**	**BAU 2010**	**% Difference**
Energy Consumption (GWh)	129,424	174,512	34.8%	213,465	64.9%
GIC/Capita (kWh / Inhabitant)	36,873	41,550	12.7%	49,643	34.6%
Energy CO_2 Emissions (kT-CO_2)	34,635	43,042	24.3%	51,451	48.6%
CO_2 emissions/Capita (T CO_2 / Inhabitant)	9.9	10.2	3.8%	12.0	21.2%

6.0 Regional Statistics

6.1 Geographic Locations

Limerick and Clare are Counties in the Republic of Ireland, a member state of the European Union. They are located in the West of the County.

Ireland joined the EEC in 1973. The country has undergo considerable development which has been assisted by its membership of the EU..

Figure 6.1: Location
Source: Anadigics (2006)

6.2 Meteorological Data

The proximity to the Atlantic coast has a significant effect on the climate of the Limerick and Clare region. Figure 6.2 illustrates the following key data:

a) Mean annual rainfall: It can be seen that the annual rainfall in part of the Limerick/Clare region is above average.

b) Mean annual rain days: County Clare and West Limerick in particular experiences higher than average number of rain days per annum

c) Mean daily temperature: Limerick and Clare experience average daily temperatures of 15-16 C in July and 6-7 C in January

d) Mean annual hours of sunshine: The region experiences between 1300 and 1400 hours of sunshine per annum.

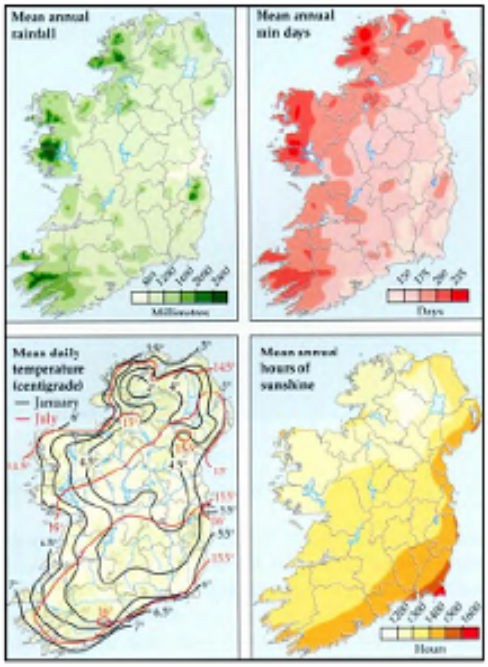

Figure 6.2: Meteorological Data
Source: Met Eireann (2006)

6.3 Relevant Energy Data

Within the region a number of energy resources are available which warrant specific mention.

6.3.1 Wind Speeds & Direction

Wind energy has been the primary renewable energy resource which has been developed in Ireland since 1995. Figure 6.3 illustrates the Irish National Electricity Grid Network and the Mean Wind Speeds around Ireland at a height of 50 metres.

At present in Ireland there is 495.5 (SEI, 2006) MW of wind energy installed. A considerable amount is also under development and within the planning process or awaiting connection to the electricity grid (estimated to be 2000MW in 2005 (SEI, 2005).

As can be seen Limerick and Clare lie within the region of Ireland with some of the highest wind speeds (between 6-7 m/s). Specific wind speeds at wind farm sites can exceed these wind speeds considerably.

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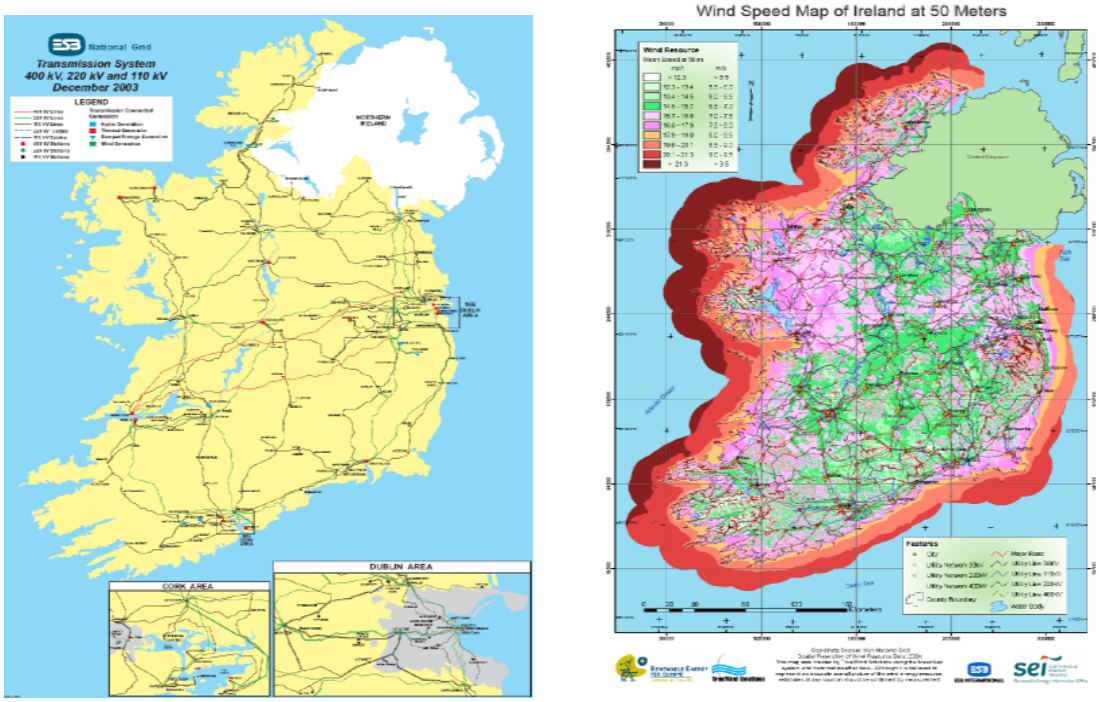

Figure 6.3: Irish Electricity Network and Mean Wind speeds at 100m
Source: ESB (2003), SEI (2005,) AMS Truewinds (2006)

6.3.2 Hydroelectricity

Ireland's largest hydroelectric site is located in the Limerick/Clare region – at Ardnacrusha in Co. Clare. This was developed in 1927 and has a capacity of 89.6MW. There are a number of other small scale (<10MW) hydro electric sites throughout Ireland and within Limerick and Clare.

6.3.3 Peat Bogs

Peat has been the main indigenous fuel source in Ireland. This has been used in domestic/commercial solid fuel boilers and for the production of electricity. The Limerick Clare region has a significant concentration of mountain blanket bogs and some raised bogs. The use of peat as a fuel has declined in recent years and increasingly peat bogs are being classified as areas of environmental importance.

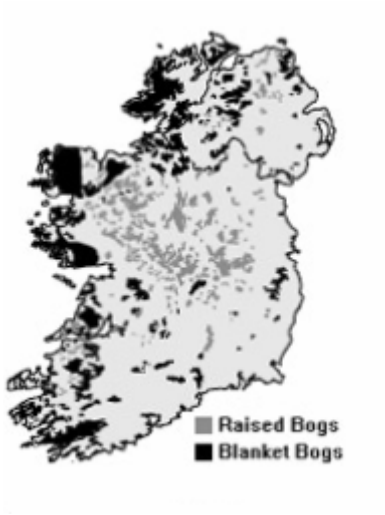

Figure 6.4: Distribution of peatlands in Ireland
Source: Bord Na Mona I(2001)

6.3.4 Tidal and Wave

The West Coast of Ireland has considerable resources in relation to Tidal and Wave Energy. Based on meteorological correlations, the mean overall power available in deep water (100m) off the Irish coast has been estimated at about 25GW, of which about 12GW (Marine Institute 2004) could be convertible into electricity (Marine Institute 2004). Figure 6.5 illustrates the potential resource in Ireland. The Shannon Estuary and the Atlantic Ocean off Clare presents particular opportunities for the Limerick and Clare region in this regard.

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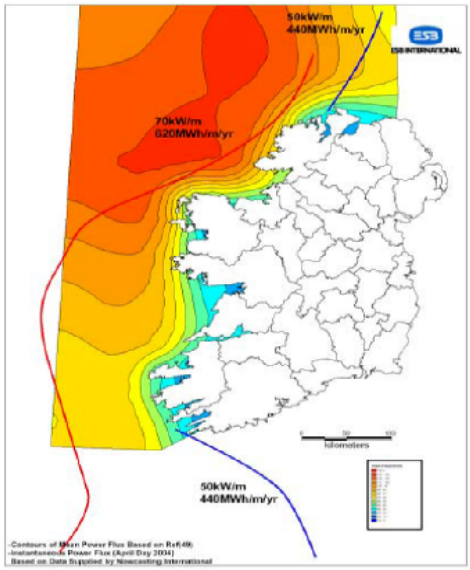


Figure 6.5: Wave Energy Potential Resource in Ireland
Source: Marine Institute (2004)

6.3.4 Forestry

Clare has total area of 43,694Ha under forestry in 2000 (Dept of Agriculture 2001) This equates to approximately 14% of the land area which is above the National Average of 9.9% (Clare CDB, 2001) 47% of this forestry is privately owned with the balance (53%) in public ownership. 1Broadleaf trees make up 15% (Dept. of Agriculture, 2001)

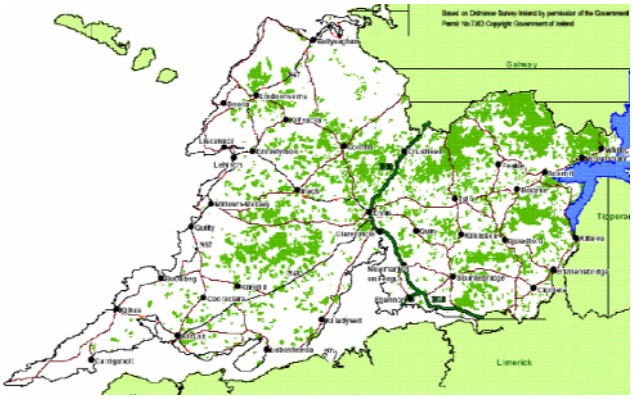


Figure 6.6: Forestry Map of Clare
Source: Clare CDB (2001)

County Limerick has a total area of 20,256 Ha under forestry. This equates to 8% of the land area of the county. 42% of the forestry is privately owned with the balance of 58% in public ownership (Dept. of Agriculture 2001). Broadleaf trees make up 13.5% (Limerick CDB, 2004)

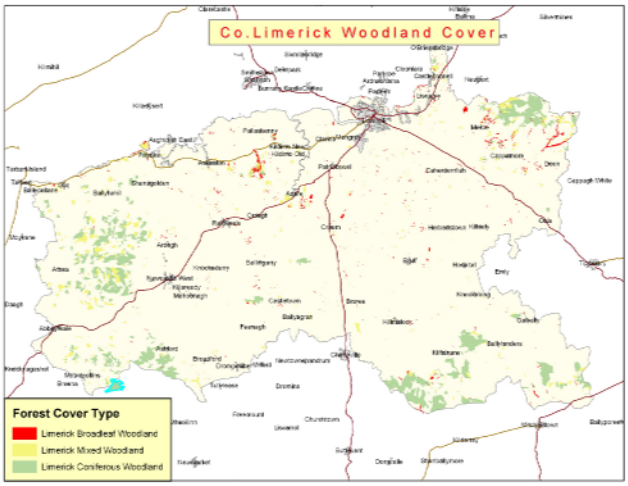


Figure 6.7: Forestry Map of Co. Limerick
Source: Dept of Agriculture (2006)

6.3.5 Summary of Renewable Energy Projects in Limerick and Clare Region

There is 122.12MW of renewable energy installed in the Limerick Clare area generating electricity (Table 6.1).

Table 6.1: List of installed Renewable Energy Sources in Limerick and Clare
Source: ESB (2006), IWEA (2006), DCMNR (2005

County	Location	Type	Capacity MW	Year Connected
Clare	ESB Ardnacrusha	Hydro	89.6	1929
Clare	Booltiagh, Connolly	Wind	19.5	2006
Clare	Moanmore, Kilrush	Wind	12.6	2004
Limerick	Askeaton	Hydro	0.24	1984
Limerick	The Millstream, Abbeyfeale	Hydro	0.18	2004
		Total	122.12	

The ESB Hydropower station at Ardnacrusha, Co. Clare was the first generating station in Ireland opened in 1927 on the River Shannon in East Clare in close proximity to Limerick City and has an operating capacity of 89.6 MW producing approximately 270 GWH of electricity annually (SEI, 2006). There are 2 Wind farms connected in Co. Clare with a generating capacity of 32.1MW (IWEA, 2006). The Wind Farm in Bolltiagh was recently connected in March 2006.

6.4 Political Regions

Ireland is historically divided into 4 provinces. Limerick and Clare are located in the Munster province region. This comprises counties Tipperary, Limerick, Clare, Kerry, Cork and Waterford and covers an area of approximately 2.5 million ha. However, the Munster province is not designated as a political region outside Ireland.

Munster	Ha	Sq-km
Clare	345,004	3450.04
Cork	749,995	7499.95
Kerry	480,689	4806.89
Limerick	275,591	2755.91
Tipperary	430,472	4304.72
Waterford	185,659	1856.59
Total	***2,467,410***	***24,674.1***

Figure 6.8: Munster Province and Statistics
Source: CSO (2002)

It is necessary to examine the regions as defined in 1998 from an EU classification viewpoint. This divided Ireland into two regions, the Eastern and Southern Region and the Border, Midlands and West Region (Figure 6.10). Limerick and Clare are located in the Eastern and Southern Region.

Figure 6.9: EU NUTS 2 Region
Source: Eurostat (2006)

The NUTS3 Regional Authorities are shown in Figure 6.11. Limerick and Clare are located in the Mid West Region and served by the Mid West Regional Authority(MWRA) (Table 6.2). The specific Local Authorities of interest are Clare County Council, Limerick County Council and Limerick City Council (Table 6.3).

Figure 6.10: MWRA and Regional Authorities in Ireland (NUTS 2 Regions)

Source: MWRA (2006), Eurostat (2006)

Table 6.2: NUTS 2 Regions

Source: The Irish Regions Office, (2006))

NUTS 2 Eastern and Southern Region	
Regions	**Sq km**
Mid West Regional Authority	8,251
South West Regional Authority	12,203
South Eastern Regional Authority	9,425
Dublin Regional Authority	921
Mid Eastern Regional Authority	6,059
Total	**36,859**

Table 6.3: NUTS 3 Regions

Source: CSO (2003)

NUTS 3 Midwest		
County	**Ha**	**Sq km**
Clare	***345,004***	***3,450***
Limerick County	***275,591***	***2,756***
Limerick City	***2,086***	***21***
North Tipperary	202,430	2,024
Mid West	**825,111**	**8,251**

6.5 Regional & County Borough

The region has three Local Authorities:

- Limerick County Council: covering all of County Limerick excluding Limerick City
- Clare County Council: covering all of County Clare
- Limerick Corporation: covering the City of Limerick.

6.5.1 Limerick County and City

Limerick	ha	Sq km
Limerick County	275,591	2,756
Limerick City	2,086	21
Total	**277,677**	**2,776**

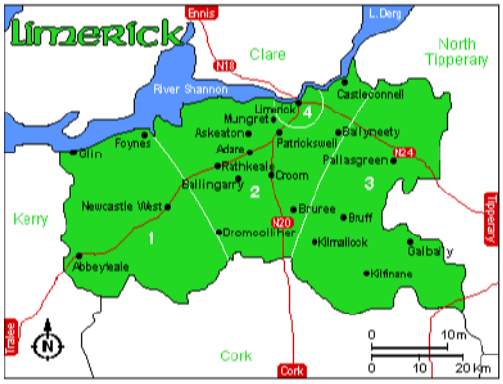
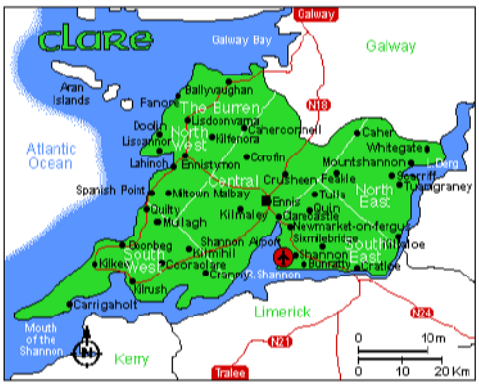


Figure 6.11: Limerick City and County
Source: CSO (2003), goireland. (2006)

6.5.2 Clare County



County Clare	ha	Sq km
Clare	345,004	3,450

Figure 6.12: Clare County
Source: CSO (2003), goireland (2006)

6.6 Regional Data & Statistics

6.6.1 Demographics

Data from the Central Statistics Office (CSO) has been analysed to provide an overview of population changes in Limerick and Clare. Limerick City and Counties Limerick and Clare accounted for 7.12% of the National population in 2002 (the latest census). The Mid West Region including North Tipperary accounted for 8.6% of the National population. The population has grown by 30% in Limerick and Clare between 1971 and 2002.

Table 6.4: Population data for Limerick County, Limerick City and Clare

Source: CSO (2003)

Population	**CSO Census 1971**	**CSO Census 1979**	**CSO Census 1981**	**CSO Census 1986**	**CSO Census 1991**	**CSO Census 1996**	**CSO Census 2002**
Clare	75,008	84,919	87,567	91,344	90,918	94,006	103,277
% of National	*2.52%*	*2.52%*	*2.54%*	*2.58%*	*2.58%*	*2.59%*	*2.64%*
Limerick County	83,298	96,742	110,925	108,920	109,873	113,003	121,281
% of National	*2.80%*	*2.87%*	*3.22%*	*3.08%*	*3.12%*	*3.12%*	*3.10%*
Limerick City	57,161	60,665	60,736	56,279	52,083	52,039	54,023
% of National	*1.92%*	*1.80%*	*1.76%*	*1.59%*	*1.48%*	*1.44%*	*1.38%*
National	2,978,248	3,368,217	3,443,405	3,540,643	3,525,719	3,626,087	3,917,203

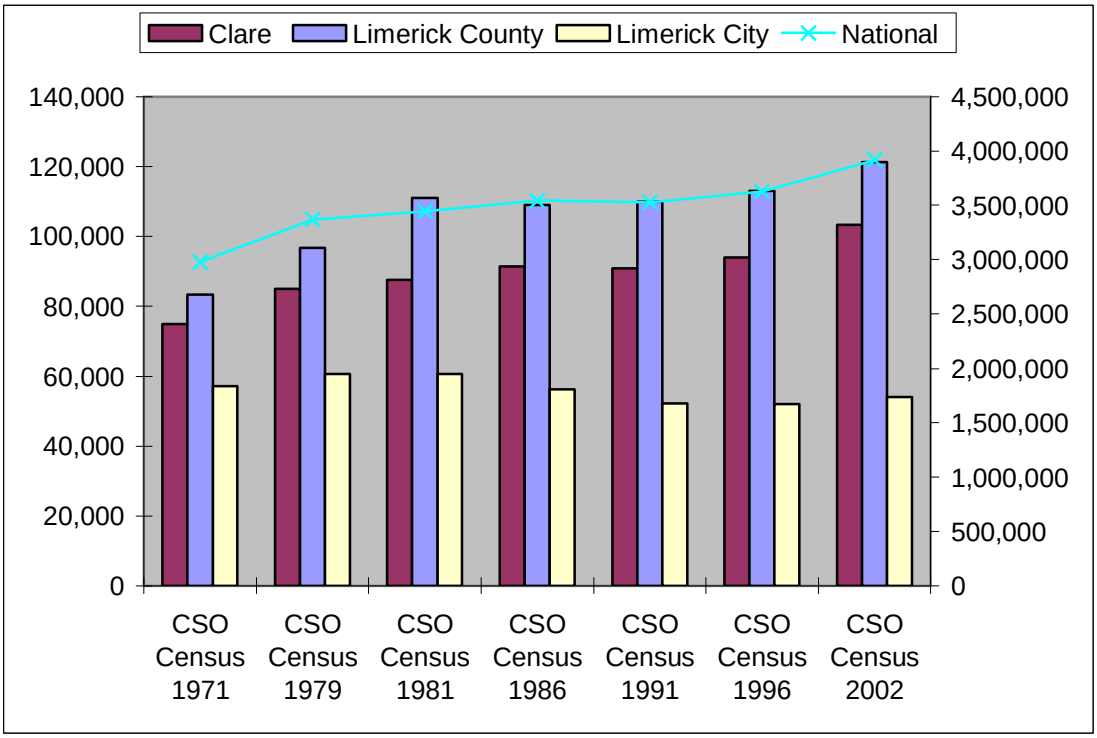


Chart 6.1: Population Trends in Population data for Limerick County, Limerick City and Clare

Source: CSO (2003)

6.6.2 Household Numbers

Given that buildings account for 40% of energy use it is vital that the number of households be assessed as this will form a key part of the energy analysis. Table 6.3 illustrates the Total Household numbers from CSO data between 1971 and 2002 and estimates for 2003 and 2004 using the Housing statistics from DoEHLG (Table 6.5 and Chart 6.2). The increase in household numbers from 1971 to 2004 is outlined as follows:

- 86%, in County Clare
- 98% in County Limerick
- 52%, in Limerick City respectively.

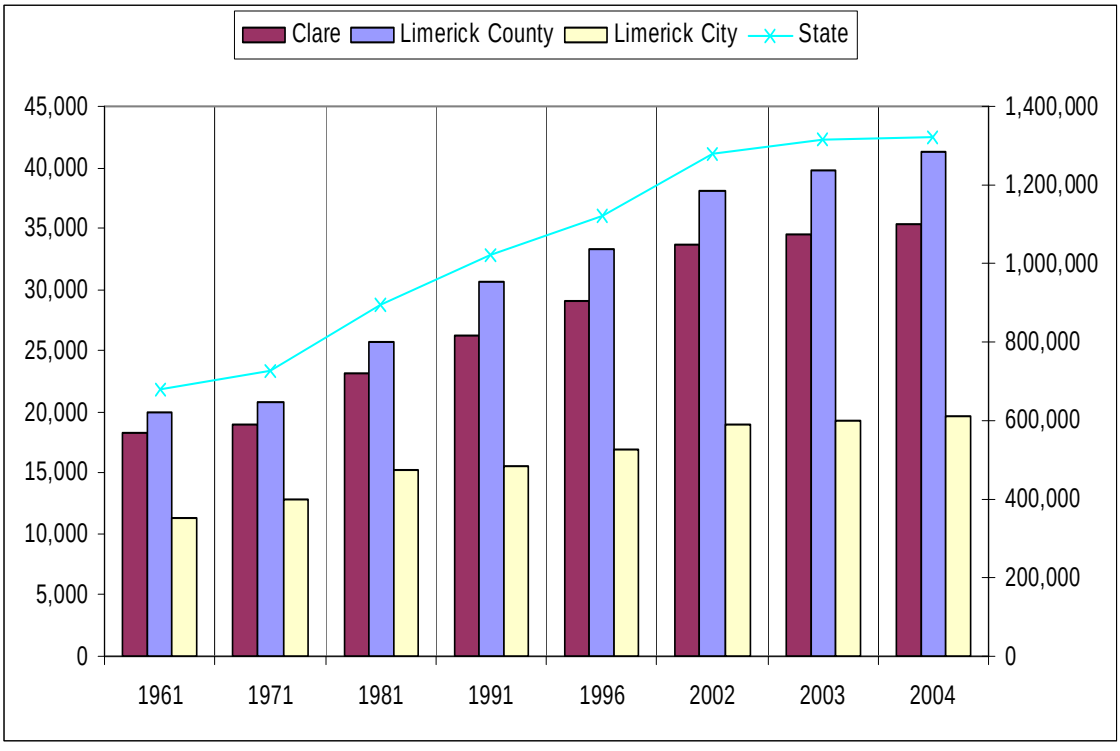
Corresponding increases for the period 1991 to 2004 are shown as follows:

- 35%, in County Clare
- 34% in County Limerick
- 25% in Limerick City

Table 6.5: Household data for Limerick County, Limerick City and Clare Source: CSO (2004)

Source	CSO Census 1971	CSO Census 1981	CSO Census 1991	CSO Census 1996	CSO Census 2002	2003 est	2004 est
Clare	18,989	23,261	26,188	*29,125*	33,635	34,475	35,390
% of National	*2.61%*	*2.60%*	*2.57%*	*171.63%*	*2.63%*	2.62%	2.68%
Limerick County	20,762	25,699	30,570	*33,404*	38,141	39,721	41,255
% of National	*2.86%*	*2.87%*	*3.00%*	*196.84%*	*2.98%*	3.01%	3.12%
Limerick City	12,850	15,181	15,604	*16,970*	18,902	19,235	19,619
% of National	*1.77%*	*1.69%*	*1.53%*	*100.00%*	*1.48%*	1.46%	1.48%
National	726,363	896,054	1,019,723	1,123,238	1,279,617	1,317,467	1,321,172

Chart 6.2: Household Data for the Study area Source: CSO (2004) DoEHLG (2005)



6.6.3 Principal Methods of Heating in Households

Analysing the type of fuels used for heating provides an initial overview of energy supply in the domestic sector. The following table outlines that in line with National figures Oil is the principal heating fuel. The use of Natural Gas from mains is limited compared to National trends. Solid Fuels continue to play an important part of the heating fuel market in the area.

Table 6.6: Principle Heating Fuels in Households (Number of Households)

Source: ESRI (2003)

	County Clare	% of National	County Limerick	% of National	National
Oil	17,827	3.68%	16,604	3.42%	485,069
Mains gas	336	0.13%	1,383	0.55%	251,352
Dual System	5,045	3.30%	3,807	2.49%	153,033
Coal	3,252	3.44%	4,226	4.47%	94,520
Peat	1,835	3.00%	1,035	1.69%	61,134
Electric	336	0.57%	606	1.03%	58,684
Solid Fuel/Other Combination	4,038	7.38%	2,857	5.22%	54,681
Peat briquettes	285	1.70%	175	1.04%	16,809
Wood	95	1.32%	398	5.52%	7,204

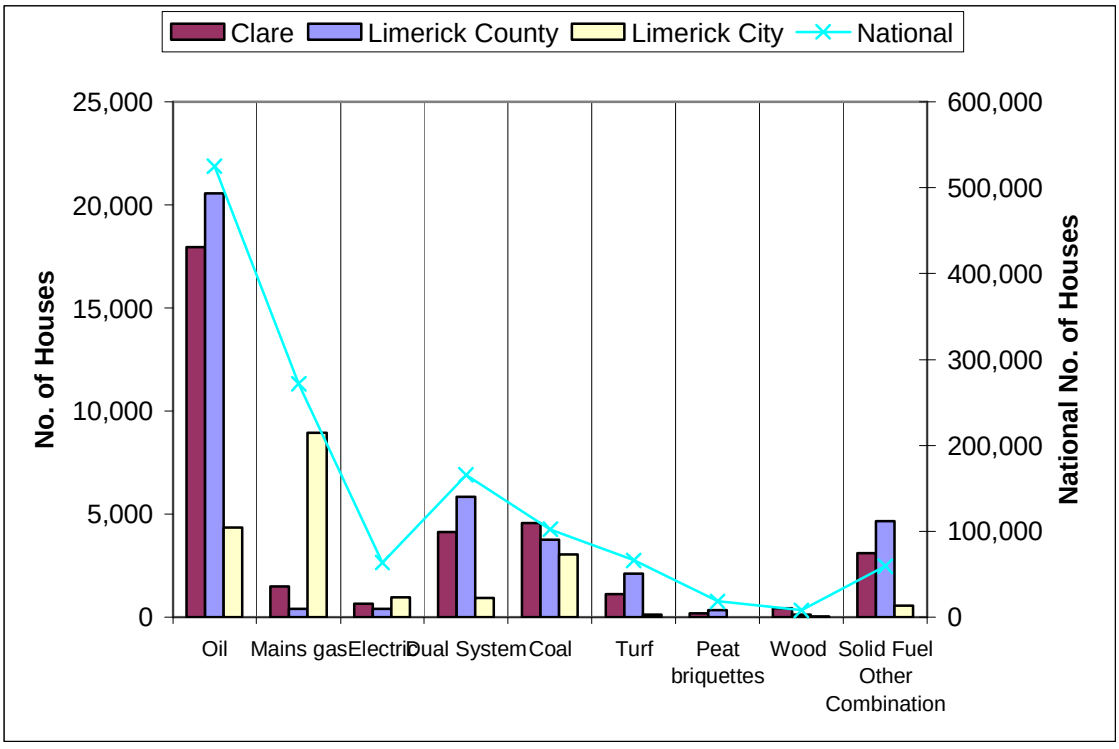


Chart 6.3: Principle Heating Fuels in Households

Source: ESRI (2003)

6.6.4 Vehicles Registered

Transport has a significant and growing impact on energy use and environmental emissions. Analysis of vehicles registered in the respective regions is presented below. The number of vehicles registered increased by between 70-100% between 1990 and 2004 in the areas studies. The National figure was 93% during that period.

Table 6.7: Vehicles Registered in Limerick County, Limerick City and Clare
Source: DoEHLG (1991,1996,2001,2002,2003,2004,2005)

	1990	1995	2000	2001	2002	2003	2004
Clare	28,382	34,084	46,538	49,786	52,283	55,003	57,854
Limerick Co.	36,510	44,277	56,517	59,773	62,737	66,026	68,257
Limerick City	12,851	14,706	18,773	19,166	19,448	19,931	21,815
National	1,054,259	1,262,503	1,682,221	1,769,684	1,850,046	1,937,429	2,036,307

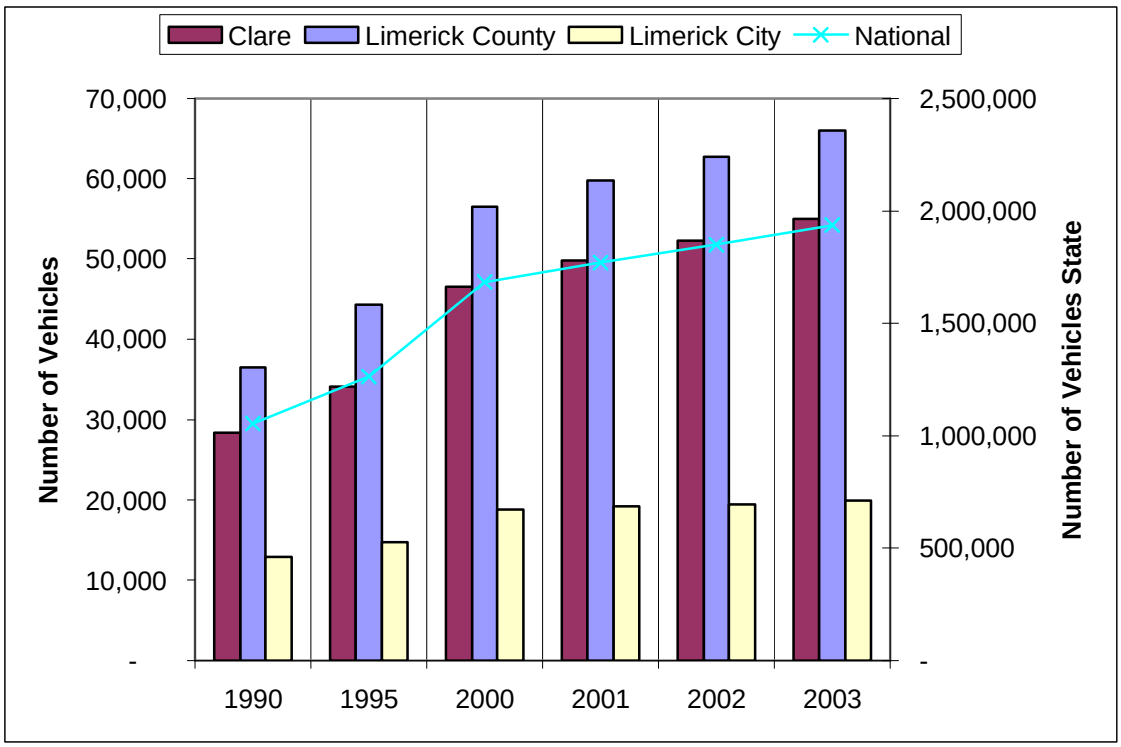


Chart 6.4: Vehicles Registered in the Study area
Source: DOEHLG (1991, 1996,, 2001 ,2002,2003,2004, 2005)

6.6.5 Labour Force Analysis

It is necessary to assess Labour Force employment figures for the Commercial/Public and Industrial sectors as a guide to the potential energy consumption in these sectors in the region. Limerick and Clare have a number of 'heavy' industries involved in cement production, metal production etc. These are analysed separately in Section 8.

- The growth in County Limerick for the Commercial / Public and Industrial sectors was 57 and 77% respectively over this period.
- The growth in County Clare for the Commercial / Public and Industrial sectors was 68 and 74% respectively over this period.
- The growth in Limerick City for the Commercial / Public and Industrial sectors was 46 and 40% respectively over this period.

Table 6.8: Employment Figures in the Commercial/Public Sector Source: CSO (1991, 1996, 2002, 2006)

	Clare Co. No. of Workers	Limerick Co. No. of Workers	Limerick City No. of Workers	Limerick Total No. of Workers	National No. of Workers
1991	14,471	17,806	9,842	27,648	636,858
1995	17,544	21,587	11,195	32,783	772,100
2000	22,850	26,039	13,285	39,324	1,062,800
2001	23,348	26,651	13,436	40,087	1,101,300
2002	24,294	27,559	13,648	41,207	1,152,600
2003	24,857	28,197	13,964	42,161	1,179,300
2004	25,561	28,996	14,359	43,355	1,212,700

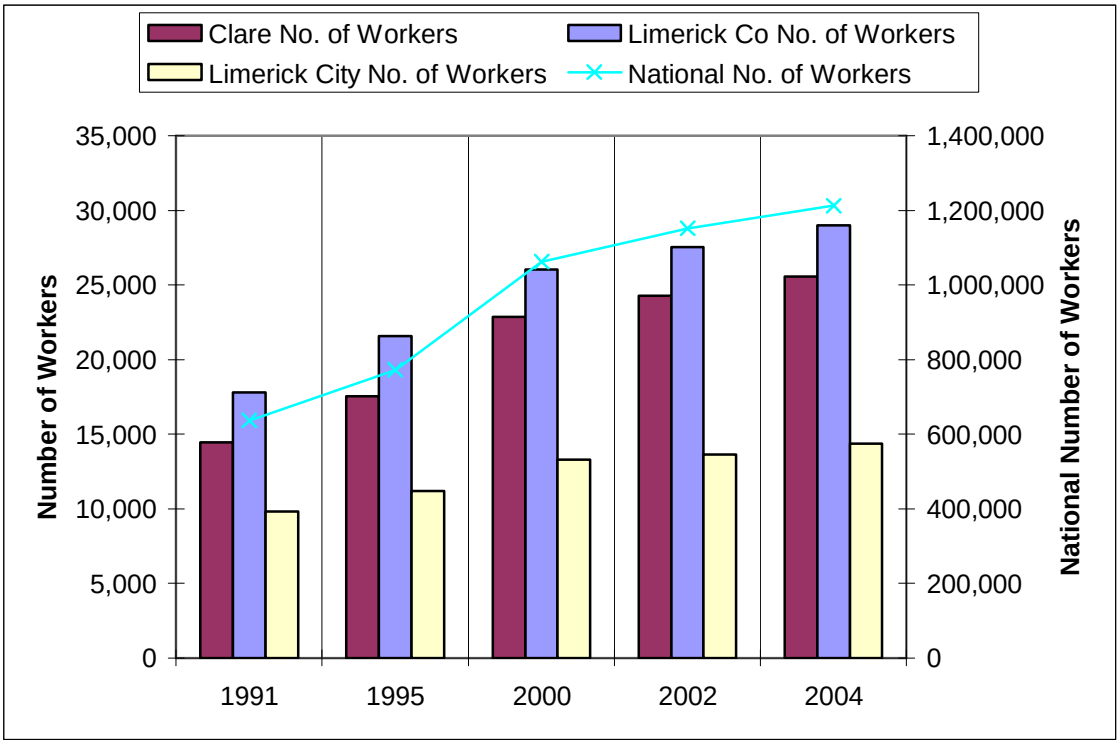


Chart 6.5: Employment Figures in the Commercial/Public Sector in the Study area
Source: CSO (1991, 1996, 2002, 2006)

Table 6.9: Employment Figures in the Industrial Sector

Source: CSO (2003, 2006)

	Clare Co. No. of Workers	Limerick Co. No. of Workers	Limerick City No. of Workers	Limerick Total No. of Workers	National No. of Workers
1991	8,883	10,672	5,017	15,689	313,313
1995	10,238	12,293	5,768	18,061	360,500
2000	14,319	17,553	6,898	24,451	475,700
2001	14,993	18,380	6,973	25,353	498,100
2002	14,864	18,555	6,712	25,267	487,200
2003	15,178	18,948	6,866	25,813	497,500
2004	15,452	19,298	6,990	26,287	506,500

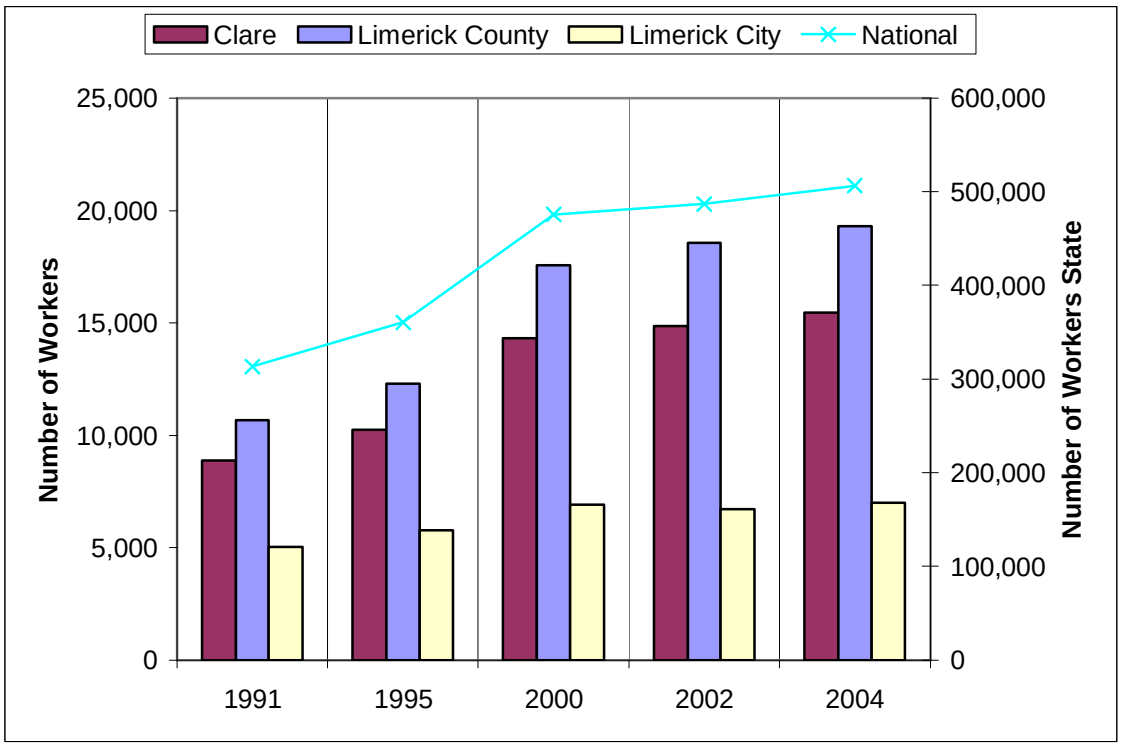


Chart 6.6: Employment Figures in the Industrial Sector in the Study area

Source: CSO (2003, 2006)

6.6.6 Agriculture

Limerick and Clare have a strong history in agriculture. Data on agricultural statistics in provided in the following table (total Hectares farmed). This is an important aspect to consider with regard to the potential for diversification and energy crop production.

Table 6.10: Agriculture Area Farmed (Hectares)

Source: CSO (1991, 2002), Teagasc (1998)

	Hectares				
	1991	**1993**	**1995**	**1997**	**2000**
Limerick	203,157	199,800	198,600	198,900	201,979
Clare	215,636	207,700	203,400	210,300	210,477
Munster	1,699,858	1,667,400	1,657,900	1,676,700	1,659,226
National	4,441,755	4,404,300	4,388,500	4,431,400	4443547

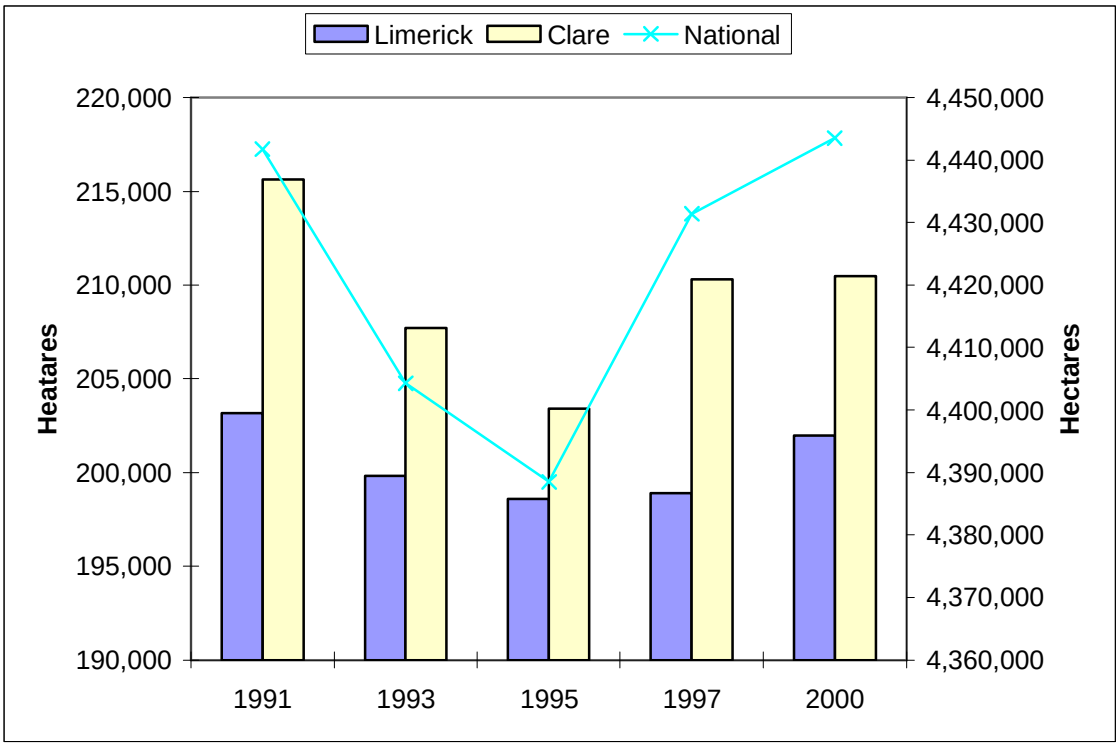


Chart 6.7: Agriculture Area Farmed (Hectares)

Source: CSO (1991, 2002), Teagasc (1998)

6.6.7 Economic Activity

Economic activity is measured in terms of Gross Value Added (GVA) per region and nationally. The Gross Value Added is a measure of the value of goods and services produced in a particular region or nationally. The data presented below is drawn from the 'County Incomes and Regional GDP' Report published by the CSO in March 2005 covering the period 1995-2002 and from the 'National Income and Expenditure 2004' publication (CSO 2005). The GVA figures are broken out by region. GVA for Clare and Limerick 1995-2002 are calculated using Mid-West Regional data and proportioning it out per capita for Clare and Limerick regional accounts. For 2003 and 2004 the National GVA figures are used to estimate the study area GVA figures. The following tables and charts illustrate the remarkable growth in the Irish economy since 1995.

Table 6.11: GVA at Basic Prices (€m & %) by Region and County, 1995 - 2004

Source: CSO (2005)

	1995	2000	2001	2002	2003 est	2004 est
Clare	1,159	2,202	2,263	2,501	2,656	2,817
% Clare of National	2.42%	2.37%	2.15%	2.13%	2.13%	2.13%
Limerick County	1,352	2,569	2,644	2,937	3,119	3,308
% Limerick County of National	2.83%	2.77%	2.51%	2.50%	2.50%	2.50%
Limerick City	6,18	1,012	1,132	1,308	1,389	1,473
% Limerick City of National	1.29%	1.09%	1.07%	1.11%	1.11%	1.11%
State	47,829	92,781	105,473	117,630	124,919	132,481

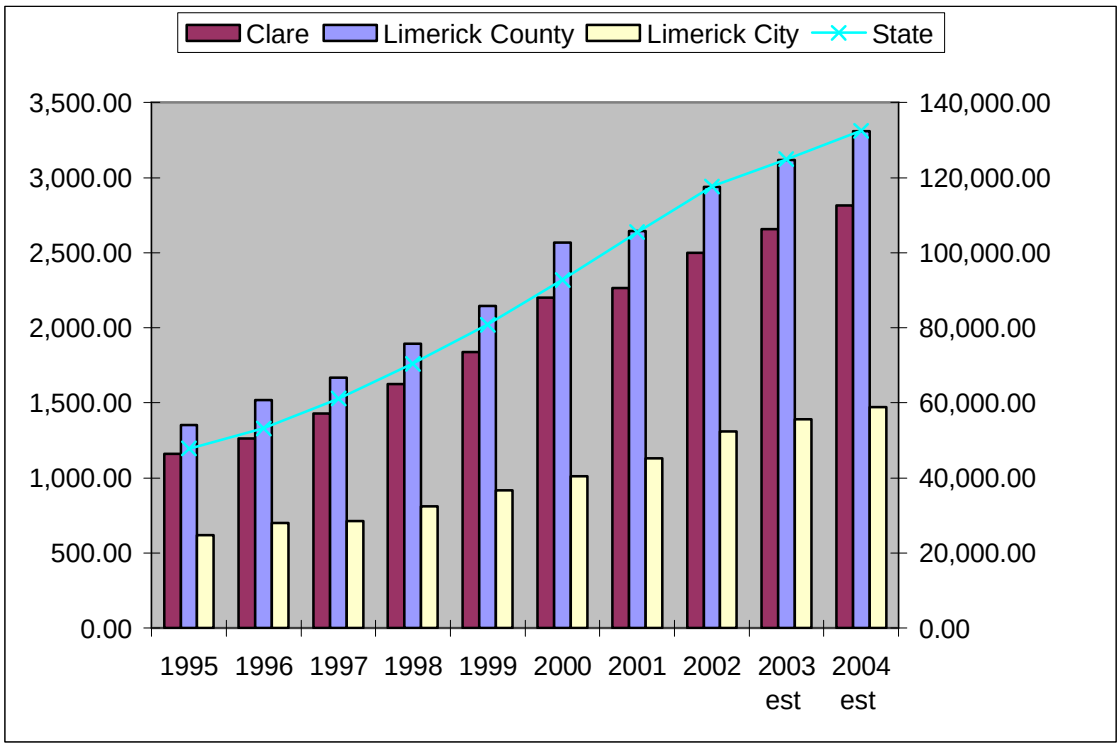


Chart 6.8: GVA at Basic Prices (Million €), 1995 - 2004

Source: CSO (2005)

Table 6.12: GVA per person at Basic Prices (€/Person), 1995 - 2004

Source: Source: CSO (2005)

	1995	2000	2001	2002	2003 est	2004 est
Clare	12,442	22,180	22,437	24,216	25,717	27,273
Limerick County	12,235	21,868	22,121	24,215	25,715	27,272
Limerick City	11,937	20,794	21,035	24,220	25,721	27,278
National	13,111	24,072	26,905	29,371	31,191	33,079

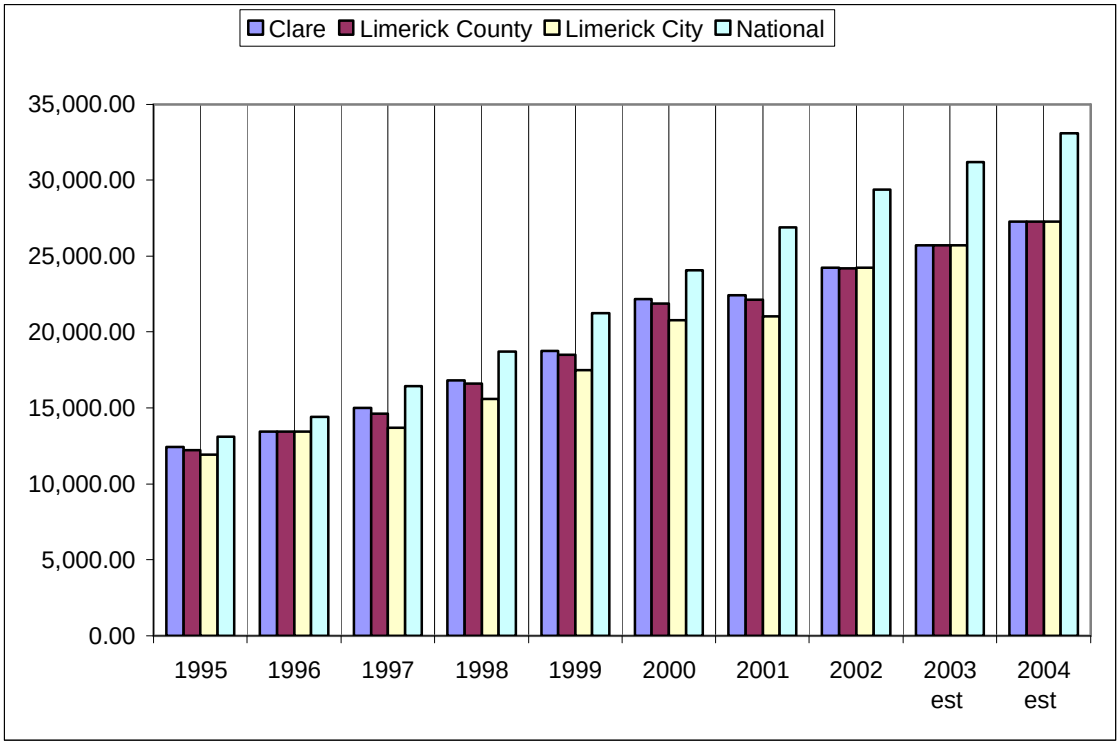


Chart 6.9: GVA per person at Basic Prices, 1995 - 2004 €

Source: CSO (2005)

7.0 Energy Balance Methodology

Clare and Limerick are somewhat unique in relation to the energy intensive industries and energy production that exist in the Counties.

- Moneypoint Power Station in Co. Clare is Irelands largest electricity producer
- Irish Cement in Limerick is Ireland's second largest cement production facility
- Ardnacrusha is the largest run of the river Hydro Electricity station in the country
- Aughinish Alumina in Co. Limerick is one of the largest energy users in the country but has also recently installed a significant Combined Heat and Power (CHP) Plant (150MW).

The general approach that has been taken is to proportion data from at a National level using appropriate ratios. The above sites have been separated out in order not to distort the baseline energy consumption in both counties.

The data is presented by County and City in separate Tables and Figures. This allows for analysis of energy and emissions within each County and Limerick City and also on the Study Area basis. It is hoped that in the future data for North Tipperary can be added to this data to provide an analysis for the full Mid West Region of Ireland.

Sustainable Energy Ireland (SEI) gathers national energy consumption data for the Department of Communications Marine and Natural Resources (DCMNR). All energy imports are recorded by the state through the ports and the conversion of 'Primary Energy' into electricity is obtained from the ESB Networks who manage all sources of electricity being supplied into the National Grid. SEI also gathers data from other Government Departments and Agencies, energy suppliers and distributors. From this data they can determine with some accuracy the following information:

- Total Primary Energy Requirement (TPER)
- Electricity Generated
- Peat Briquette production
- Total Final Energy Consumption (TFEC)

The TFC is broken down by Sector and Fuel and this accurately reflects the energy we consume across the economy. All the figures generated under the four categories listed above are based on National Data. There is very little Regional reporting or analysis and none on a County basis. As a result the data generated for Limerick and Clare in this study is based on National figures and proportioned out for Limerick and Clare. There is an urgent need for accurate data on a county basis to facilitate future reports and revisions.

Forecasts in both the TFC and CO_2 Emissions are calculated using projections from the ESRI Mid Term Review 2005-2012 published in 2005. The projections are proportioned out for Limerick and Clare, and are based on the High Growth Projections up to 2015.

Specific information on data sources for the relevant sectors is provided in the following sections.

7.1 Agricultural Sector

The energy consumption in the agricultural sector has been determined by the percentage of land farmed ('000ha) in Limerick and Clare relative to Ireland. The data for land use was obtained from the Central Statistics Office (CSO) and from Teagasc.

7.2 Commercial Sector

The energy consumption for the commercial sector is calculated from labour data obtained from the CSO using Census Data, and Regional Quarterly Household National Surveys (QHNS). The numbers employed in the Commercial and Public Sector can be determined from the Census Data by county and trends from the QHNS regional data are used to calculate trends in employment in Limerick and Clare. Energy consumption in Clare and Limerick is assumed to be directly related to the level of energy used in this Sector Nationally, and the National Figures are proportioned out based on the numbers working in this sector in Limerick and Clare.

7.3 Residential Sector

Energy Consumption is calculated in the residential sector using the National Residential Data and is proportioned out using Housing Data for Clare and Limerick obtained from the CSO and House Building Data from the Department of Environment Heritage and Local Government (DoEHLG).

The ESRI report 'The National Survey of Housing Quality 2001-2002' was also referred to, to monitor trends around the principal methods of heating homes. The data from this report only included data on houses in private ownership for Limerick and Clare. The trends in this survey were compared to the data obtained from the National figures.

7.4 Transport

Energy consumption is based on the registration of vehicles in Limerick and Clare in relation to the number of vehicles registered nationally. It can be argued that transport data should include energy from railways, ports, airports and ferries but it is very difficult to get accurate data around the energy used in these areas as it is deemed to be commercially sensitive. Also energy used in road transport accounts for 83% of energy used in the transport sector and the proportions used in the other modes of transport is determined to be inline with the proportions used in Limerick and Clare.

7.5 Industry

The energy consumption for the Industry sector is calculated from labour data obtained from the CSO using Census Data, and Regional Quarterly Household National Surveys (QHNS). The numbers employed in the Industry can be determined from the Census Data by county and trends from the QHNS Data are used to calculate trends in employment in Limerick and Clare. Energy consumption in Clare and Limerick is assumed to be directly related to the level of energy used in this sector nationally, and the National Figures are proportioned out based on the numbers working in this sector in Limerick and Clare.

7.5 Other Assumptions

Natural Gas was first supplied into Limerick City in 1987. Between 1987 and 2000 as the natural gas network was expanded in Limerick City, it did overlap into small areas of County Limerick and Clare around the City Environs. However for the purpose of this exercise the assumption has been made that natural gas has not been supplied into County Limerick and Clare before 2000 (Bord Gais, 2006).

The projections made for 2010 and 2015 are based off the ESRI Medium Term Review 2005-2012 using the projected figures they have developed for TFC and CO_2 emissions.

The projected price cost of CO_2 in 2010 and 2015 is forecasted to be €35-50/tonne CO_2 based on Bank of Ireland Global Markets Forecast Price (Bank of Ireland, 2006).

8.0 Key Energy Sites in Limerick Clare Area

As stated in Chapter 7 there are some energy intensive plants and services located in Limerick and Clare. Not only do these operations serve the Study Area but they also serve many of the surrounding regions and in some cases serve the entire country. It was deemed that the energy used by each of these operations should not be specifically broken down for the Limerick Clare area, as the data would skew the regional data. The sites are as follows:

- ESB Power Station, Moneypoint Co. Clare
- Aughinish Alumina, Co. Limerick
- Irish Cement, Castlemungret, Co. Limerick
- Shannon Airport, Co. Clare

Moneypoint, Aughinish Alumina and Irish Cement are all in the Emissions Trading Scheme (ETS) administered by the EPA and have commitments under this National Scheme to monitor and report their levels of Energy usage and GHG Emissions. The following sections address each of these high energy users/producers.

8.1 Primary Energy Production

The ESB Power Station located in Moneypoint, Co. Clare, is the largest electricity generating station in Ireland. The energy generated by Moneypoint is supplied into the National Grid. It supplied 27.6% of Ireland's electricity in 2004 (SEI, 2006). The station uses approximately 2 million tons of coal annually to deliver this energy output. Table 8.1 below shows the total primary energy requirement for Moneypoint since 1990. It is estimated that electricity generated by Moneypoint in 2004 was 5,322. GWh based on an estimated plant efficiency of 33%.

Table 8.1: Total Primary Energy Electricity Requirement (TPER) for Moneypoint
Source: SEI (2006)

	1990	**1995**	**2000**	**2001**	**2002**	**2003**	**2004**
GWh	15,287.3	17,877.7	16,988.4	17,753.6	17,058.1	15,383.7	16,128.1

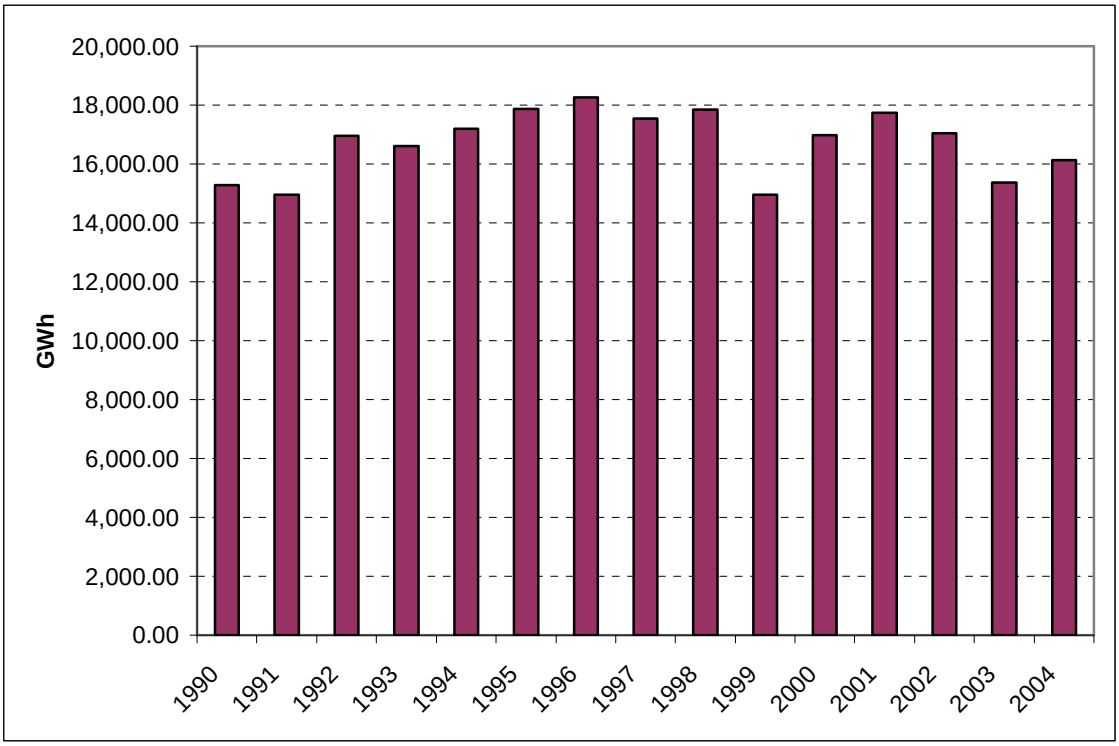


Chart 8.1: Total Primary Energy Consumption (TPEC) for Moneypoint

Source: SEI (2006)

The primary fuel used by Moneypoint is coal, which is burned to generate steam that drives the turbines to generate electricity. There are significant amounts of CO_2 generated in the combustion of coal. Table 8.2 shows the CO_2 emission levels from the station.

Table 8.2: CO_2 Emissions Generated by Moneypoint

Source: EPA (2005), SEI (2006)

	1990	**1995**	**2000**	**2001**	**2002**	**2003**	**2004**
kT-CO_2	5,206.2	6,088.4	5,785.6	6,046.2	5,809.3	5,239.1	5,492.6

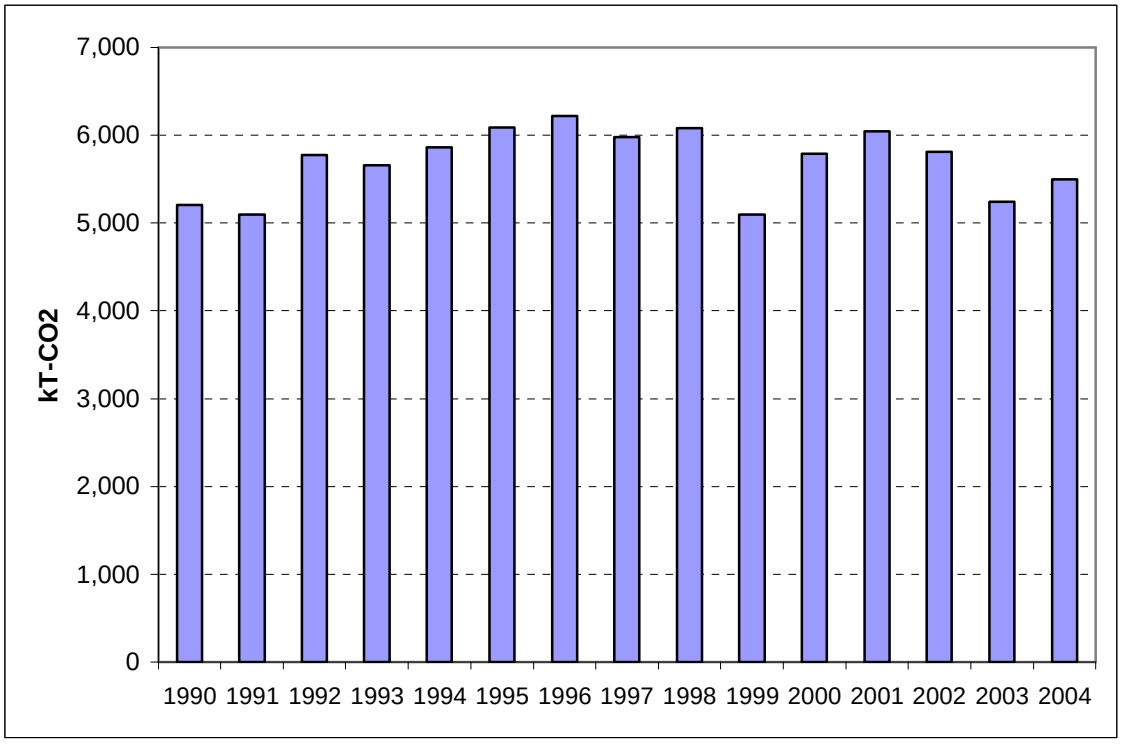


Chart 8.2: CO_2 Emissions Generated by Moneypoint

Source: EPA (2005), SEI (2006)

Moneypoint is regulated under the ETS administered by the EPA where it is given an annual GHG CO_2 allocation and its emissions are monitored and reported on in the National Inventory report published annually by the EPA.

From the data presented in the following chapters it can be seen that these emissions are almost double the combined emissions from the entire study area. This underlines the need to exclude Moneypoint from the analysis as it would dwarf the data from other sectors. Also, this site is governed by legislation and regulations which are generally beyond the scope of the work of Local Energy Agencies.

8.2 High Final Energy Users

- Aughinish Alumina and Irish Cement are two large energy users located in Co. Limerick. The primary fuel that has been used in Aughinish is fuel-oil to provide energy to refine raw bauxite into alumina. Since Spring 2006 a new 150 MW CHP plant fuelled by natural gas has been commissioned at the Aughinish site, which will supply up to two thirds of the plants energy needs going forward.
- Irish Cement located in Castlemungret, Co. Limerick uses mainly petroleum coke and coal to heat the kilns used to produce cement.
- Shannon Airport located in Co. Clare also uses significant quantities of aviation fuel (Jet Kerosene) to fuel airplanes across the globe.

Table 8.3 shows the estimated TFC for these three sites since 1990.

Table 8.3: Estimated Total Final Consumption

Source: EPA (2005), SEI (2006)

GWh	**1990**	**1995**	**2000**	**2001**	**2002**	**2003**
Irish Cement	1,053.6	1,025.8	1,406.6	1,406.6	1,351.0	1,392.7
Aughinish Alumina	2,605.1	2,907.5	3,840.2	3,939.1	3,941.3	3,838.1
Shannon Airport	2,575.0	2,323.8	2,701.9	2,624.8	1,958.4	2,575.1

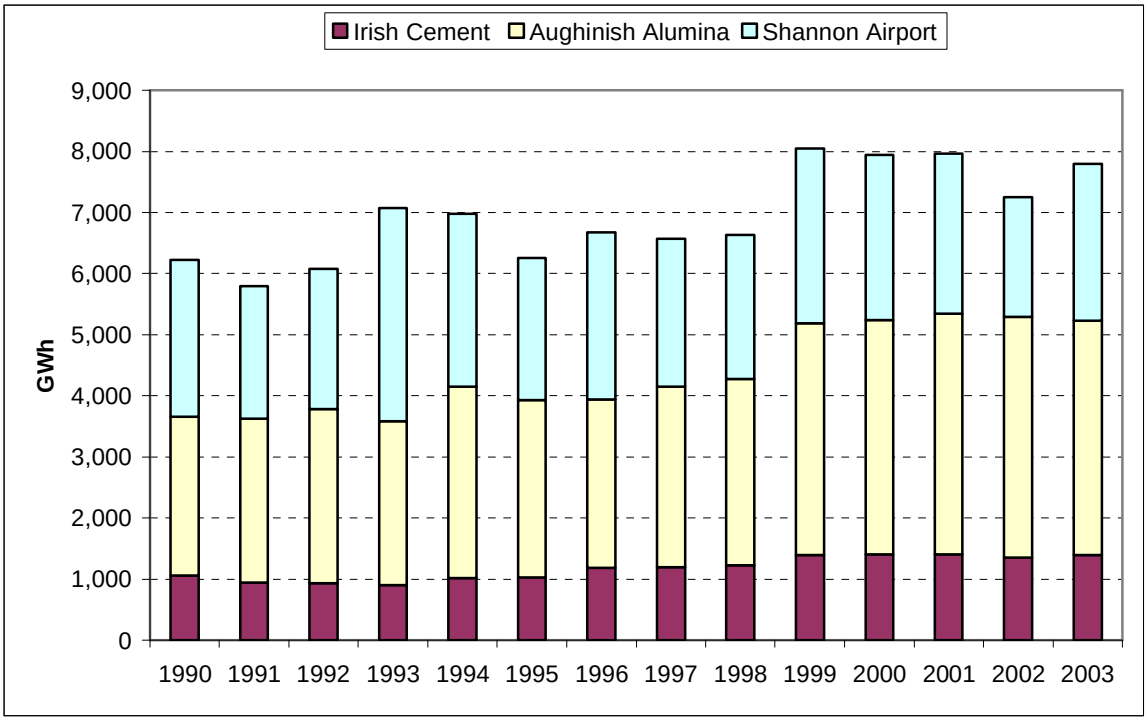


Chart 8.3: Estimated Total Final Consumption

Source: EPA (2005), SEI (2006)

The TFC for Shannon Airport is estimated from the Energy Balance (SEI, 2006) data for Jet Kerosene and from the passenger numbers through the airport. This data should be used as an estimate only and it would require further research and analysis to develop more accurate estimates which is outside the scope of this study.

All these operations are high energy users and the fuels they use produce significant amounts of GHG. Table 8.4 shows the estimated CO_2 emissions for Aughinish, Irish cement and for Shannon Airport.

Table 8.4: CO_2 Emissions

Source: EPA (2005), SEI (2006)

kT-CO_2	**1990**	**1995**	**2000**	**2001**	**2002**	**2003**
Irish Cement	1,053.6	1,025.8	1,406.6	1,406.6	1,351.0	1,392.7
Aughinish Alumina	2,605.1	2,907.5	3,840.2	3,939.1	3,941.3	3,838.1
Shannon Airport	2,575.0	2,323.8	2,701.9	2,624.8	1,958.4	2,575.1
Total	6,233.7	6,257.1	7,948.8	7,970.5	7,250.7	7,805.9

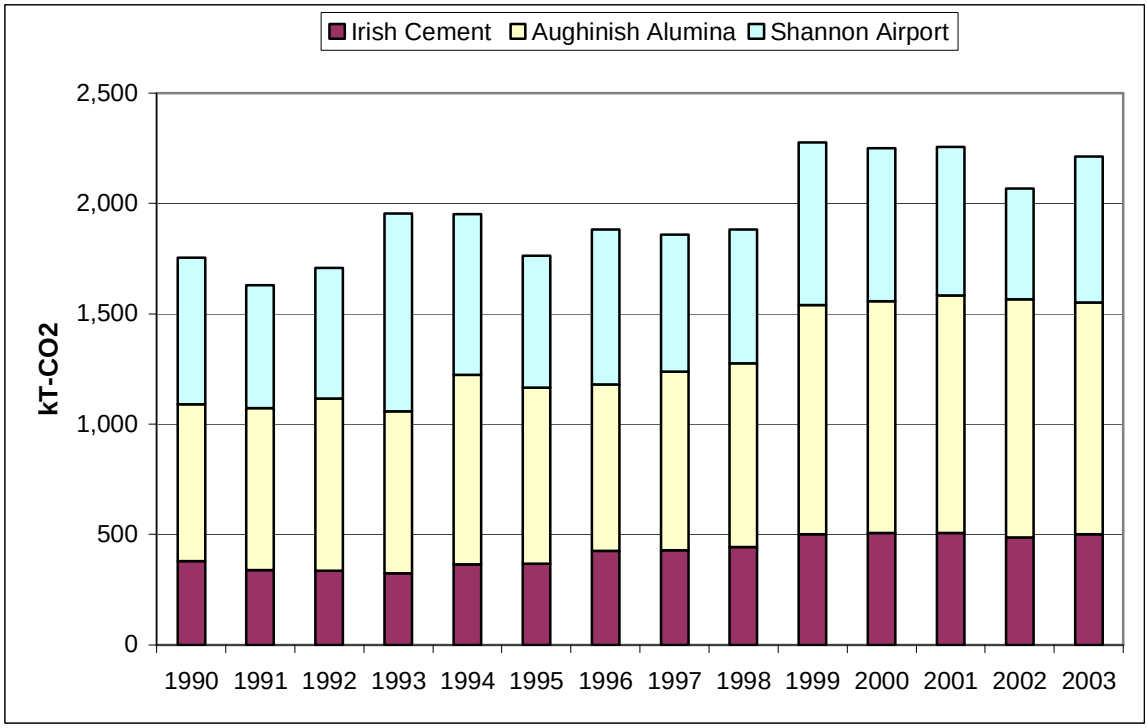


Chart 8.4: CO_2 Emissions

Source: EPA (2005), SEI (2006)

Aughinish Alumina and Irish Cement are both regulated under the ETS administered by the EPA. They have both received allocations for the amount of GHG they can generate annually and can trade. The emissions from aviation fuel are not yet regulated however this is likely to change in the future.

8.3 Conclusion

The total CO_2 emissions from these four sites are estimated to be approximately 12,300 kTonnes CO_2 for 2003. This is approximately 35% of the National energy related CO_2 emissions. Given that the role of Local Energy Agencies is to work at a local level with individuals, communities, business and public bodies it will have a limited input to actions taken in the sites covered in this section. Focusing on the other sectors which use energy and contribute to CO_2 emissions will allow the Limerick Clare Energy Agency to make the best use of its resources and capabilities.

9.0 Summary Results

This Chapter provides an overview of energy consumption and environmental emissions for the combined area of Limerick County, Limerick City and Clare County. Further details for each individual area are provided in the subsequent Chapters.

9.1 TFC and CO_2 Emissions by Area

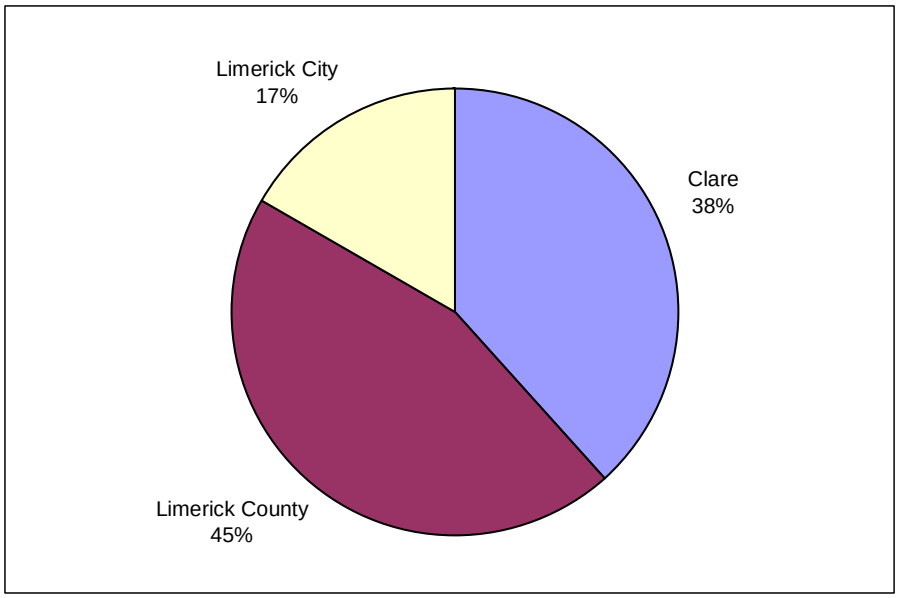


Chart 9.1: % Share of Total Final Energy Consumption by Area

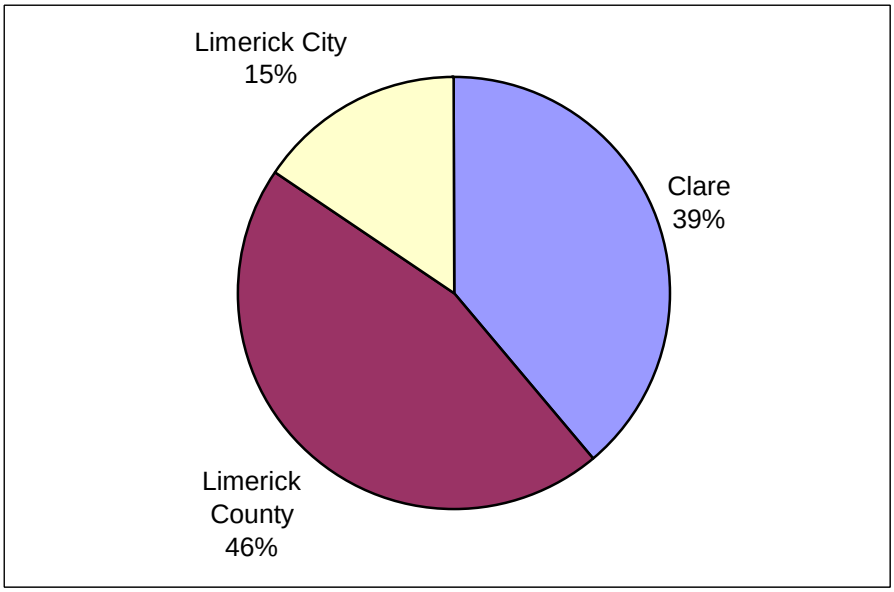


Chart 9.2: % Share of Energy Related CO_2 Emissions by Area

It can be seen that Limerick and Clare Counties account for the majority of energy consumption and related emissions.

9.2 TFC by Area: 1990, 2004, 2010

Table 9.1 TFC for Each Area

GWh	Clare	Limerick County	Limerick City
1990	2256.2	2713.3	1104.9
2004	3806.3	4474.2	1665.2
BAU 2010	4504.6	5014.6	1963.4

Table 9.2: % TFC for each Area

	1990	2004	BAU 2010
Clare	37.2%	38.3%	38.3%
Limerick County	44.6%	45.0%	45.0%
Limerick City	18.2%	16.7%	16.7%

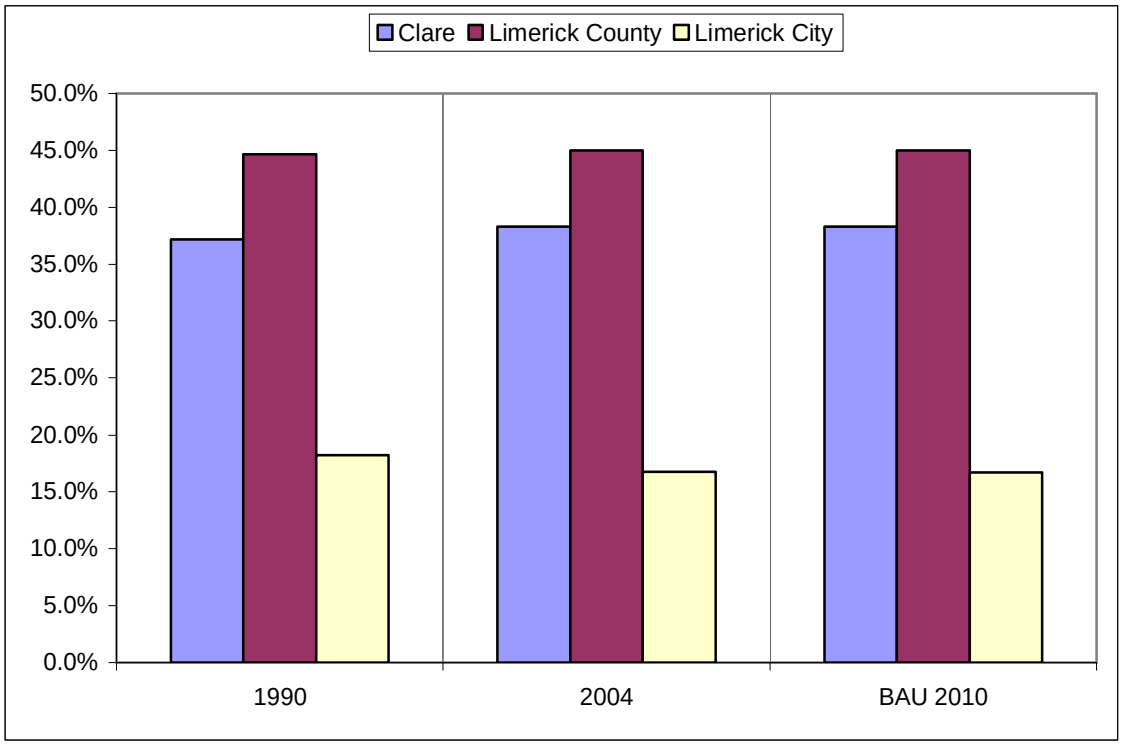


Chart 9.3: % TFC for each Area

Each area has seen an increase in Total Final Consumption since 1990 but the % share of the TFC for the total Study Area has changed very little over that period.

9.3 TFC by Fuel: 1990, 2004, 2010

Table 9.3 Total TFC by Fuel for Study Area

GWh	Coal	Peat	Briquettes	Oil	Natural Gas	Hydro	Other Renewables	Electricity
1990	714.4	477.5	138.8	3,662.8	105.5	0.0	94.8	878.2
2004	495.8	149.8	75.9	7,117.4	301.3	0.0	177.9	1,627.3
BAU 2010	274.2	89.0	45.2	8,714.8	438.1	0.0	174.7	2,023.7

Table 9.4 % TFC by Fuel for Study Area

GWh	Coal	Peat	Briquettes	Oil	Natural Gas	Hydro	Other Renewables	Electricity
1990	11.8%	7.9%	2.3%	60.3%	1.7%	0.0%	1.6%	14.5%
2004	5.0%	1.5%	0.8%	71.6%	3.0%	0.0%	1.8%	16.4%
BAU 2010	2.3%	0.8%	0.4%	74.1%	3.7%	0.0%	1.5%	17.2%

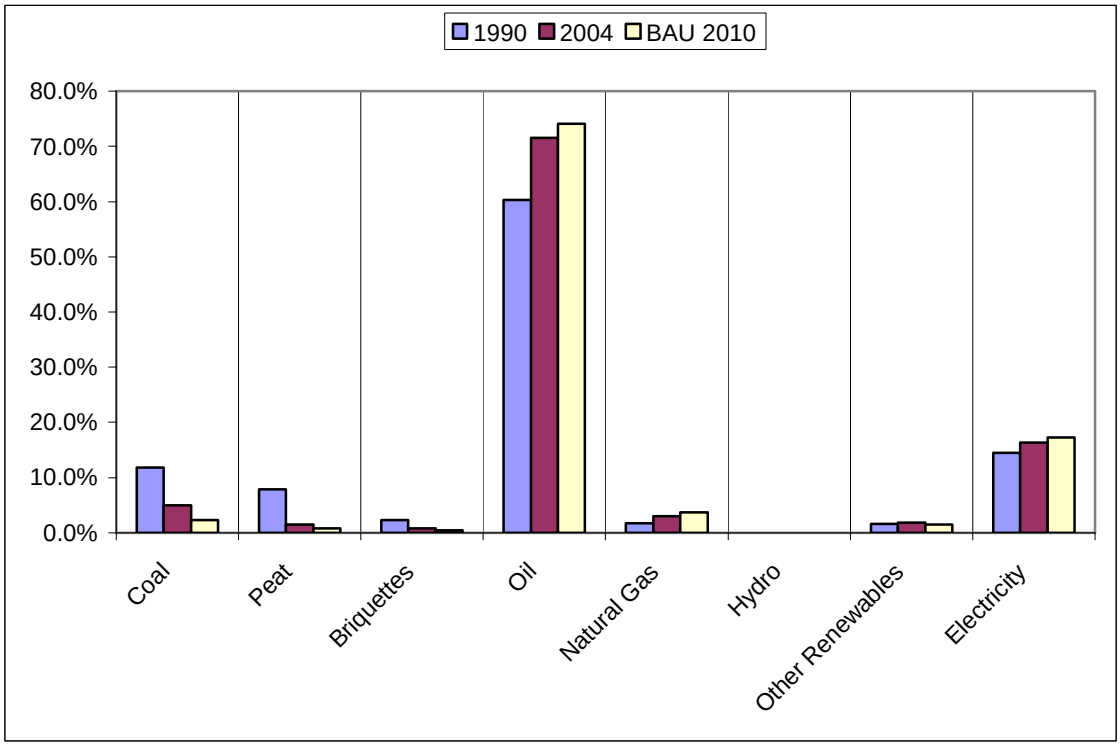


Chart 9.4: % TFC by Fuel for Study Area

The main fuel consumed within the study area is oil, accounting for 58% of TFC in 2004. Electricity is the other main energy source. Natural gas has limited penetration in the study area. The use of coal and other solid fuels is declining and will continue to do so.

9.4 TFC by Sector 1990, 2004, 2010

Table 9.5 TFC by Sector for Study Area

GWh	Transport	Residential	Industry	Commercial	Agriculture
1990	1,737.6	1,787.6	1,568.5	773.7	276.3
2004	3,968.3	2,443.4	2,067.2	1,126.2	339.3
BAU 2010	5,174.4	2,716.9	2,144.5	1,393.0	330.9

Table 9.6: % TFC by Sector for Study Area

GWh	1990	2004	BAU 2010
Transport	28.3%	39.9%	45.1%
Residential	29.1%	24.6%	23.7%
Industry	25.5%	20.8%	18.7%
Commercial	12.6%	11.3%	12.1%
Agriculture	4.5%	3.4%	2.9%

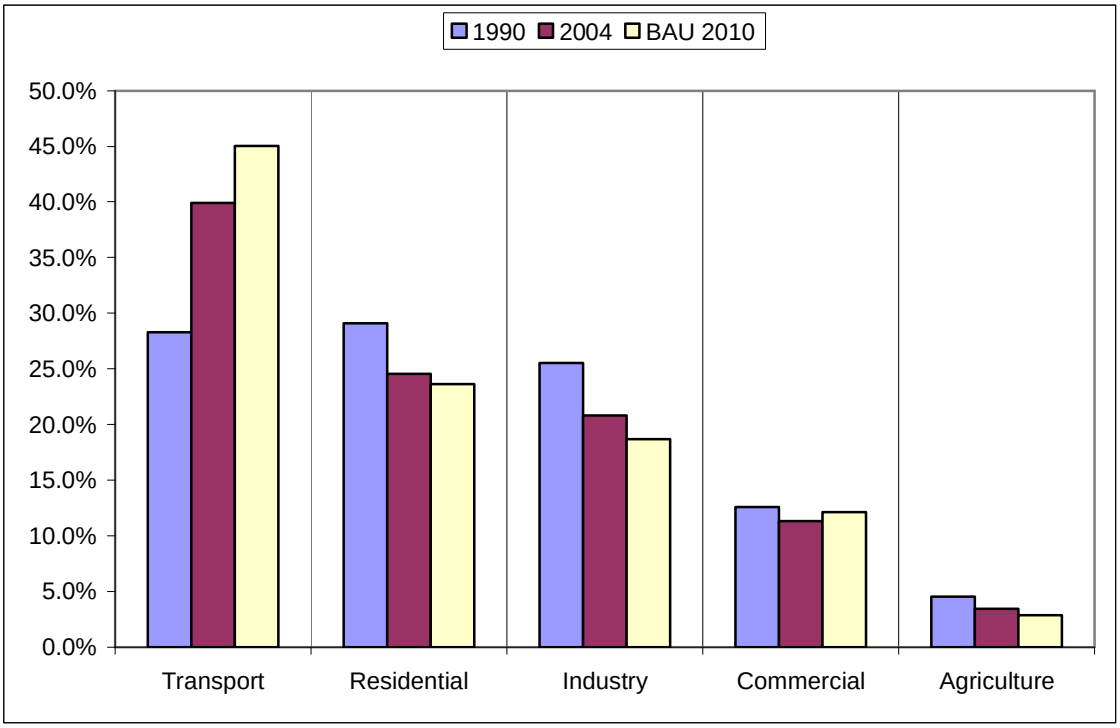


Chart 9.5: % TFC by Sector for Total Study Area

Assessing consumption for the total study area by Sector it is clear that the Transport Sector has experienced the greatest level of growth since 1990 and this is projected to continue to 2010. Residential and Industry are the next most important sectors in terms of consumption.

9.5 CO_2 by Fuel: 1990, 2004, 2010

Table 9.7: CO_2 Emissions By Fuel for Study Area

kT-CO_2	Coal	Peat	Briquettes	Oil	Natural Gas	Hydro	Other Renewables	Electricity
1990	243.3	178.8	49.4	937.2	20.9	0.0	0.0	806.3
2004	168.9	56.1	27.0	1,832.5	59.6	0.0	0.0	1,015.8
BAU 2010	93.4	33.3	16.1	2,237.2	86.7	0.0	0.0	1,263.2

Table 9.8 % CO_2 Emissions by Fuel for Total Study Area

	1990	2004	BAU 2010
Coal	10.9%	5.3%	2.5%
Peat	8.0%	1.8%	0.9%
Briquettes	2.2%	0.9%	0.4%
Oil	41.9%	58.0%	60.0%
Natural Gas	0.9%	1.9%	2.3%
Hydro	0.0%	0.0%	0.0%
Other Renewables	0.0%	0.0%	0.0%
Electricity	36.1%	32.1%	33.9%

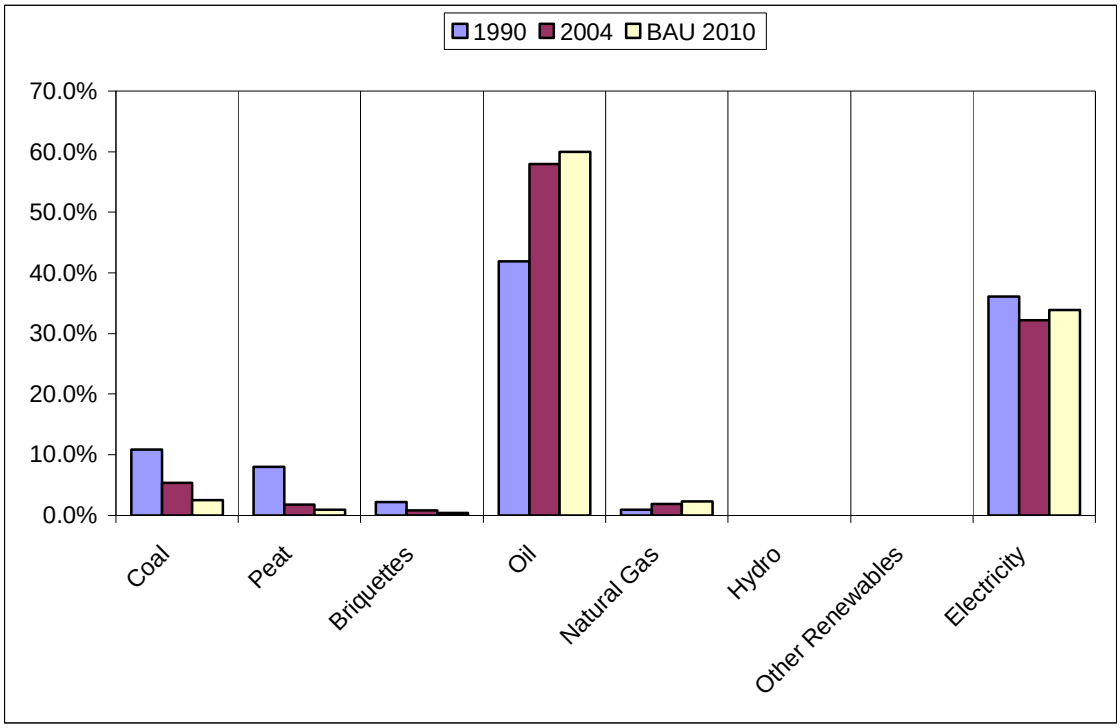


Chart 9.6: % CO_2 Emissions by Fuel for Total Study Area

Oil accounted for 58% of CO_2 energy related emissions in 2004 where its share has increased from 41.9% in 1990 in the study area. Electricity accounts for 32.1% of CO_2 emissions which has reduced from 1990 levels of 36.1%. This is mainly due to fuel switching to cleaner fuels such as natural gas and to electricity production from renewable energy

9.6 CO_2 by Sector: 1990, 2004, 2010

Table 9.9: CO_2 Emissions By Sector for Study Area

kT-CO_2	Transport	Residential	Industry	Commercial	Agriculture
1990	449.6	774.4	590.7	358.7	62.4
2004	984.4	838.8	687.3	573.1	76.2
BAU 2010	1,352.4	863.6	681.3	767.3	65.2

Table 9.10: % CO_2 Emissions By Sector for Study Area

	1990	2004	BAU 2010
Transport	20.1%	31.2%	36.3%
Residential	34.6%	26.5%	23.2%
Industry	26.4%	21.8%	18.3%
Commercial	16.0%	18.1%	20.6%
Agriculture	2.8%	2.4%	1.7%

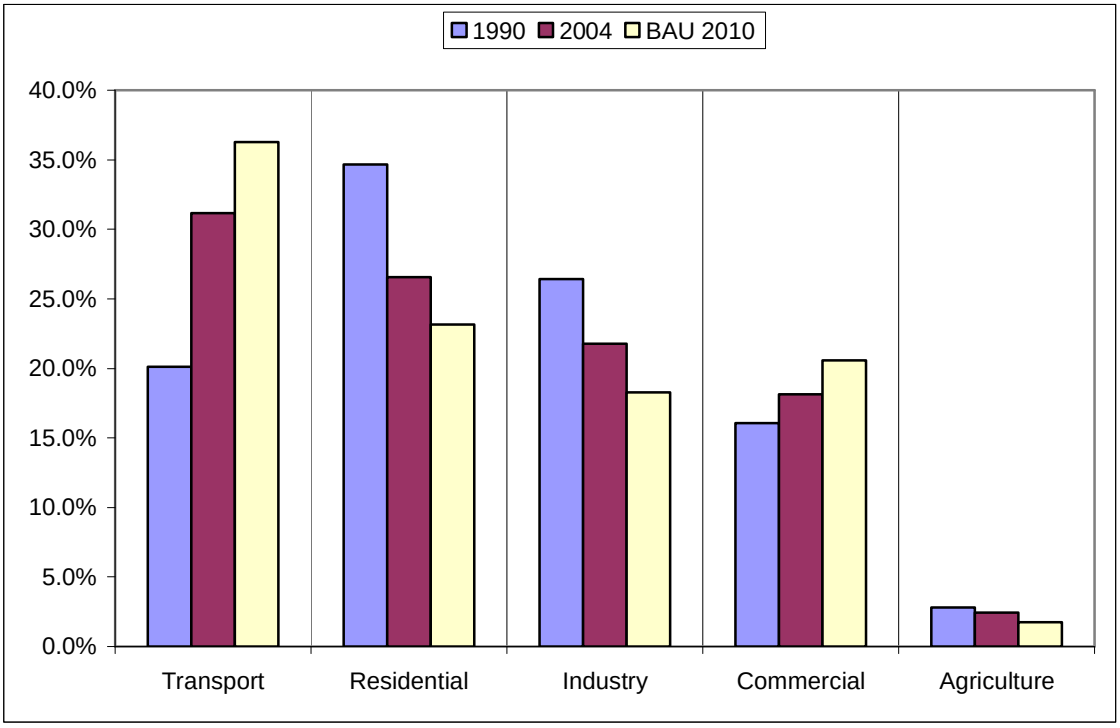


Chart 9.7: %CO_2 Emissions by Sector for Total Study Area

The transport sector accounts for the greatest level of CO_2 emissions in the study area and the % share of emissions has increased by 50% since 1990 and will have nearly doubled by 2010. In line with TFC share the Residential and Industrial Sectors account for the next greatest levels of emissions in 2004 but the Commercial Sector is set to overtake the Industrial sector by 2010.

9.7 Environmental indicators

A range of environmental indicators have been developed to allow comparison and analysis of the results in the Study Area to National environmental indicators. Table 9.11 presents these indicators.

Charts 9.8 and 9.9 present specific data in relation to TFC per capita and CO_2 emissions per capita. It can be seen that in general Clare and Limerick Counties have a higher TFC and CO2 emissions per capita compared to the National averages. Limerick City is generally below the National average. This would reflect the fact of higher building densities, greater access to public transport, and the greater penetration of natural gas.

Table 9.11: Environmental Indicators

	1991				2000				2004			
Indicator	**Ireland**	**Clare**	**Limerick County**	**Limerick City**	**Ireland**	**Clare**	**Limerick County**	**Limerick City**	**Ireland**	**Clare**	**Limerick County**	**Limerick City**
Population (000)	3,525.7	90.9	109.9	52.1	3,780.0	100.7	112.5	53.3	4,043.8	105.0	123.4	54.9
TFC Fuel Consumed (GWh)	85,662.7	2,302.2	2,753.3	1,192.3	123,593.0	3,406.8	4,007.9	1,564.5	136,718.0	3,806.3	4,284.4	1,665.2
Energy Related Emissions (ktT-CO_2)	31,244.9	836.09948	1,006.2	444.9	41,920.3	1172.8	1,374.8	541.9	43,041.7	1,206.9	1,421.8	531.2
GVA (€million)	34,092.0	847.7	1,046.7	496.1	91,458.0	2,202.3	2,569.4	1,011.5	132,481.0	2,816.8	3,307.8	1,473.1
TFC/GVA (kWh/€thousand)	2,512.7	2715.7	2630.5	2403.2	1351.4	1546.9	1559.9	1546.7	1,032.0	1,351.3	1,295.2	1,130.4
TFC/Capita (kWh/ Inhabitant)	24,296.5	25,321.3	25,058.6	22,892.9	32,696.6	33,830.8	35,622.8	29,331.2	33,809.3	36,236.5	34,733.2	30,306.1
CO_2 Emissions / Capita (T CO_2 / Inhabitant)	8.9	9.2	9.2	8.5	11.1	11.6	12.2	10.2	10.6	11.5	11.5	9.7

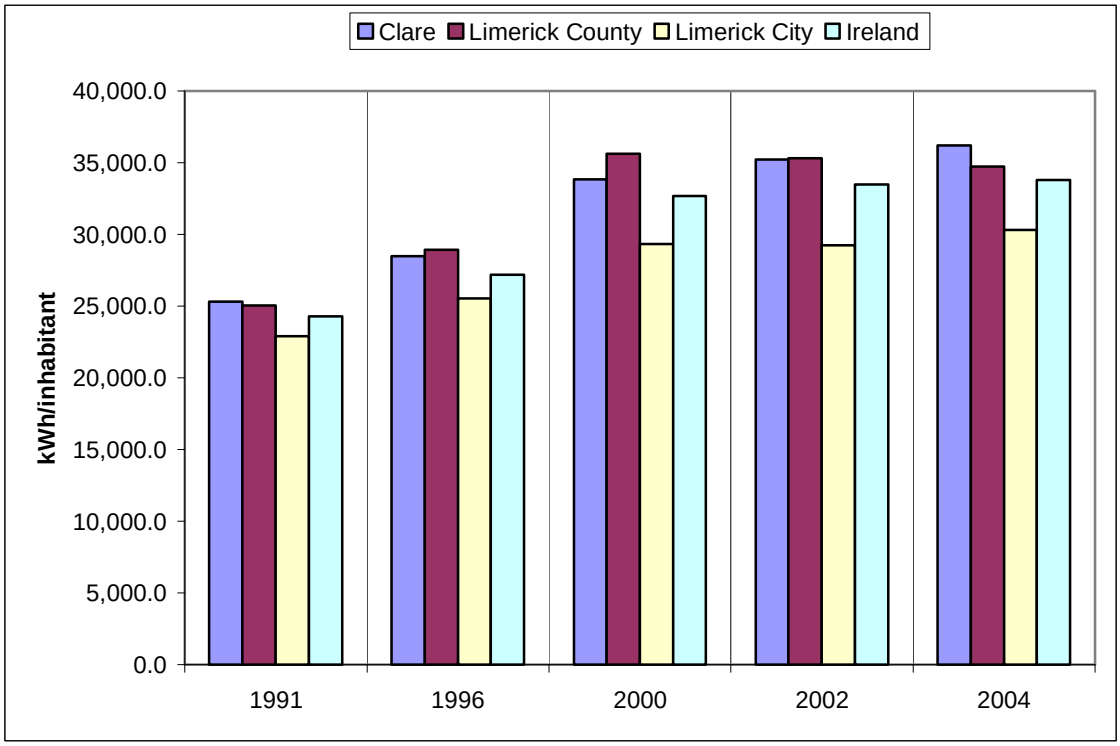


Chart 9.8: Total Final Consumption per capita (kWh/inhabitant)

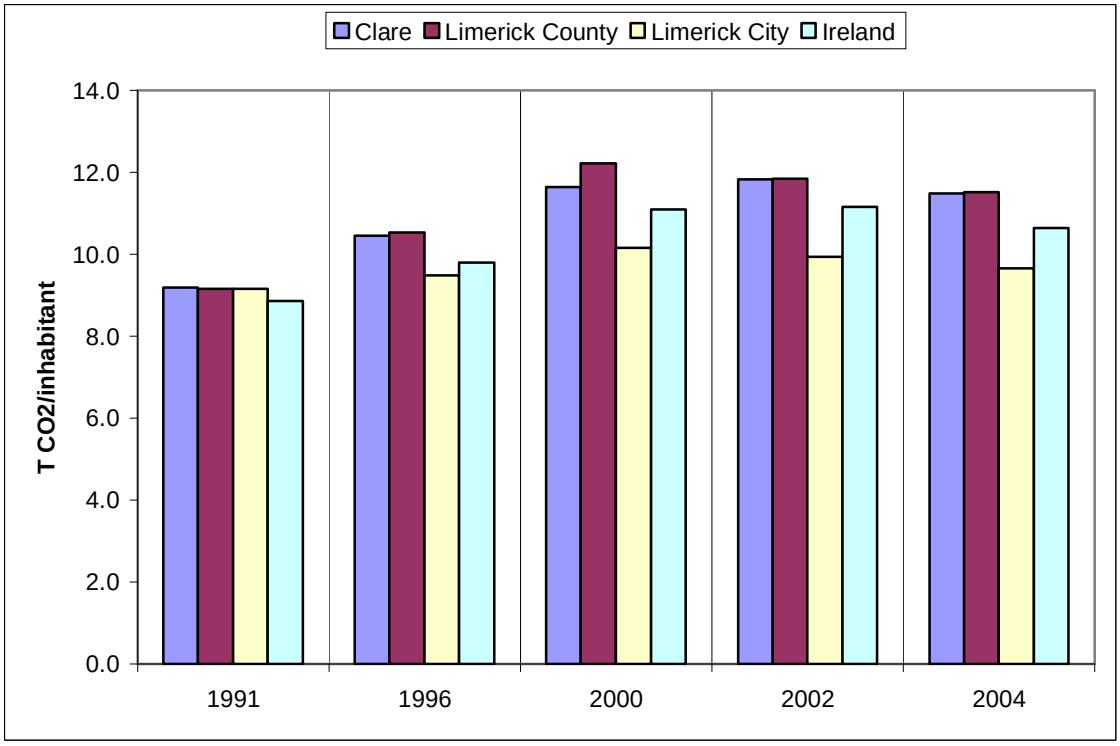


Chart 9.9: Tonnes CO_2 Emissions per capita (Tonnes CO_2/Inhabitant)

9.8 Individual Responsibility

To measure the impact each individual could make to CO_2 reduction an analysis was carried out to calculate the CO_2 reduction required per person to meet the Kyoto targets. This data is summarised in table 9.12. It shows counties Clare and Limerick will require a reduction of 4.6 and 4.7 tonnes of CO_2 per person respectively with a corresponding figure of 2.8 tonnes of CO_2 per person for Limerick City.

Charts 9.8 and 9.9 present specific data in relation to TFC per capita and CO_2 emissions per capita. It can be seen that in general Clare and Limerick Counties have a higher TFC and CO_2 emissions per capita compared to the National averages. Limerick City is generally below the National average. This would reflect the fact of higher building densities, greater access to public transport, and the greater penetration of natural gas.

Table 9.12: Individual Responsibility

	1990			KyotoTarget 1990 + 13%Total			2004			2010			Reduction Sought		
Indicator	**Clare**	**Limerick County**	**Limerick City**	**Clare**	**Limerick County**	**Limerick City**	**Clare**	**Limerick County**	**Limerick City**	**Clare**	**Limerick County**	**Limerick City**	**Clare**	**Limerick County**	**Limerick City**
Population (000)	91.0	109.7	52.8	-	-	-	105.0	123.4	54.9	112.7	133.3	57.6	N/A	N/A	N/A
TFC Fuel Consumed (GWh)	2,256.2	2,713.3	1,174.1	-	-	-	3,806.3	4,474.2	1,663.7	4,504.6	5,014.6	1,963.4	-	-	-
Energy Related Emissions (kt-CO_2)	828.3	989.0	418.6	936.0	1,117	473	1,186.1	1,393.8	531.2	1,425.6	1,680.5	623.8	489.6	562.8	150.8
TFC/Capita (kWh/ Inhabitant)	24,796	24,730	22,243	-	-	-	36,236	36,271	30,278	39,984	37,614	34,080	-	-	-
CO_2 Emissions / Capita (T CO_2 / Inhabitant)	9.1	9.0	7.9	9.1	9.2	8.8	11.3	11.3	9.7	12.7	12.6	10.8	4.7	4.6	2.8

10.0 Clare County

10.1 Summary Analysis

10.1.1 Total Final Consumption and Emissions by Fuel

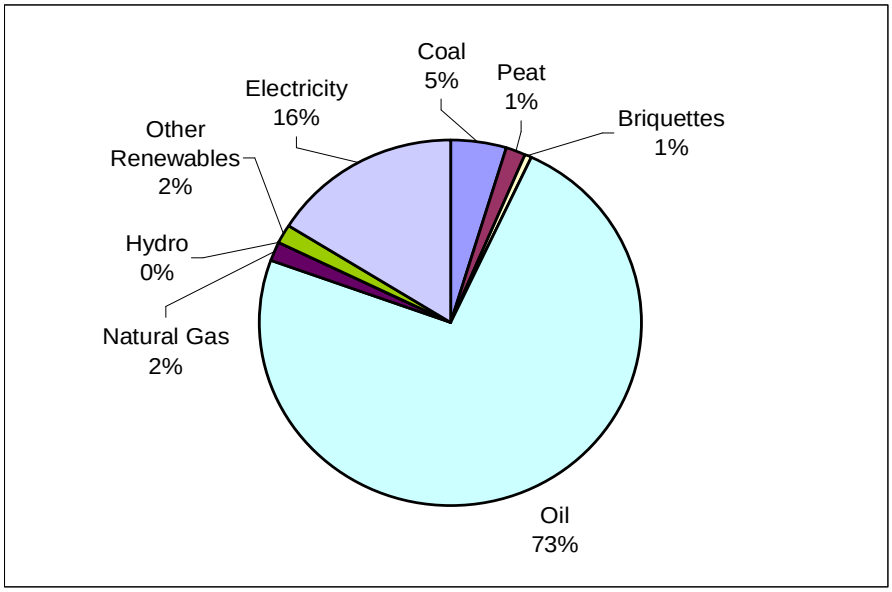


Chart 10.1: Total Final Consumption by Fuel, Clare County, 2004

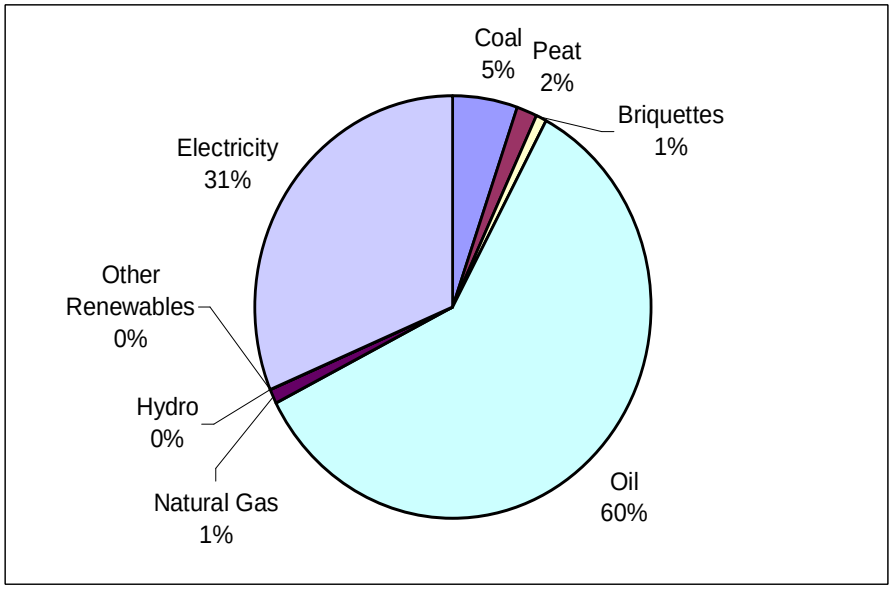


Chart 10.2: CO_2 Emissions by Fuel, Clare County, 2004

- From the Charts above it can be seen that oil accounts for the largest proportion of TFC in County Clare, and also is the highest contributor in terms of CO_2 emissions.
- While Electricity only accounts for 16% of TFC it accounts for over 30% of emissions, due to its high emissions factor.
- Renewables and Hydro currently make a minor contribution to consumption with the balance being made up of solid fuels and natural gas.

10.1.2 Total Final Consumption and Emissions by Sector

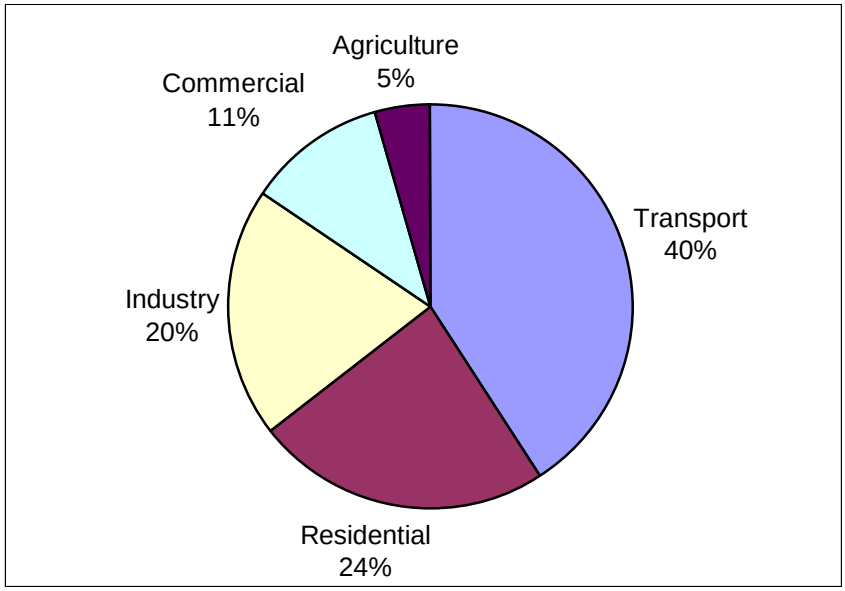


Chart 10.3: Total Final Consumption by Sector, Clare County, 2004

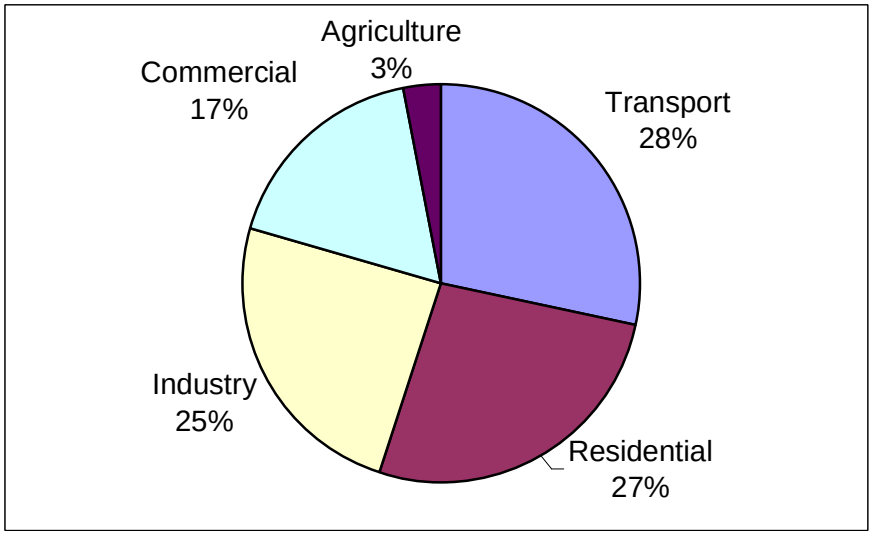


Chart 10.4: CO_2 Emissions by Sector, Clare County, 2004

- Clearly the Transport Sector, in 2004, has the highest consumption in energy terms in the County, at 40%. It also currently accounts of 28% of CO_2 emissions.
- The Residential Sector is the next highest contributor in terms of emissions, at 27%, while it consumes 24% of TFC in the County.
- The Industrial Sector accounted for 20% of consumption in 2004 and one quarter of CO_2 emissions.
- The Commercial Sector currently only accounts for 17% of emissions
- Agriculture has the lowest consumption of energy and lowest emissions, in energy terms, within the County.

10.1.3 Environmental Indicators

Table 10.1: Environmental Indicators for Clare County

	1991		2000		2004	
Indicator	**Ireland**	**Clare**	**Ireland**	**Clare**	**Ireland**	**Clare**
Population (000)	3,525.7	90.9	3,780.0	100.7	4,043.8	105.0
TFC Fuel Consumed (GWh)	85,662.7	2,302.2	123,593.0	3,406.8	136,718.0	3,806.3
Energy Related Emissions (kt-CO_2)	31,244.9	836.1	41,920.3	1,172.8	43,041.7	1,206.9
GVA (€million)	34,092.0	847.7	91,458.0	2,202.3	132,481.0	2,816.8
TFC/GVA (kWh/€thousand)	2,512.7	2,715.7	1,351.4	1,546.9	1,032.0	1,351.3
TFC/Capita (kWh/ Inhabitant)	24,296.5	25,321.3	32,696.6	33,830.8	33,809.3	36,236.5
CO_2 Emissions / Capita (T CO_2 / Inhabitant)	8.9	9.2	11.1	11.6	10.6	11.5

Table 10.1 provides a concise summary of the status of energy consumption and emissions in the County. Key points of note are

- Annual Total Final Consumption per Gross Value Added (TFC/GVA) is lower than the National Average. This trend has increased since 1990 with a 24% difference in 2004.

- The TFC per capita in the County is above the National average, consistently since 1991. This could be influenced by the rural nature of the County, restricted access to more efficient fuels and technologies and more energy inefficient process and buildings.

- Emissions per capita are also higher than the National average. This is primarily influenced by the fuel mix with a very strong dependence on oil in the County. The limited use of natural gas, which has a lower emissions factor, and higher percentage use of solid fuels are contributing factors along with the limited use of renewable energy.

- TFC and CO_2 emissions have increased by 65% and 44% respectively between 1991 and 2004, but GVA has increased by 232%, which would indicate that there has been some decoupling of economic growth from energy consumption and related emissions.

10.2 Energy Analysis

10.2.1 Total Final Consumption by Fuel

Table 10.2: Total Final Consumption, Clare County, (1990 – 2015)

GWh	1990	1995	2000	2002	2004	2005 Est	BAU 2010	BAU 2015
Coal	258.5	118.3	170.6	165.6	183.0	165.8	101.2	79.1
Peat	172.6	148.5	55.0	54.3	55.1	50.5	32.7	21.7
Briquettes	50.0	38.0	37.8	35.2	27.9	25.6	16.6	11.0
Oil	1,420.4	1,746.1	2,544.8	2,708.0	2,800.7	2,883.0	3,422.6	3,787.9
Natural Gas	0.0	0.0	3.5	20.6	65.0	83.9	109.7	130.9
Hydro								
Other RES	34.0	40.8	45.9	51.8	65.8	65.6	64.6	63.6
Electricity	320.7	399.7	549.2	603.2	608.9	631.4	757.2	791.9
TFC	2,256.2	2,491.4	3,406.8	3,638.8	3,806.3	3,905.7	4,504.6	4,886.1

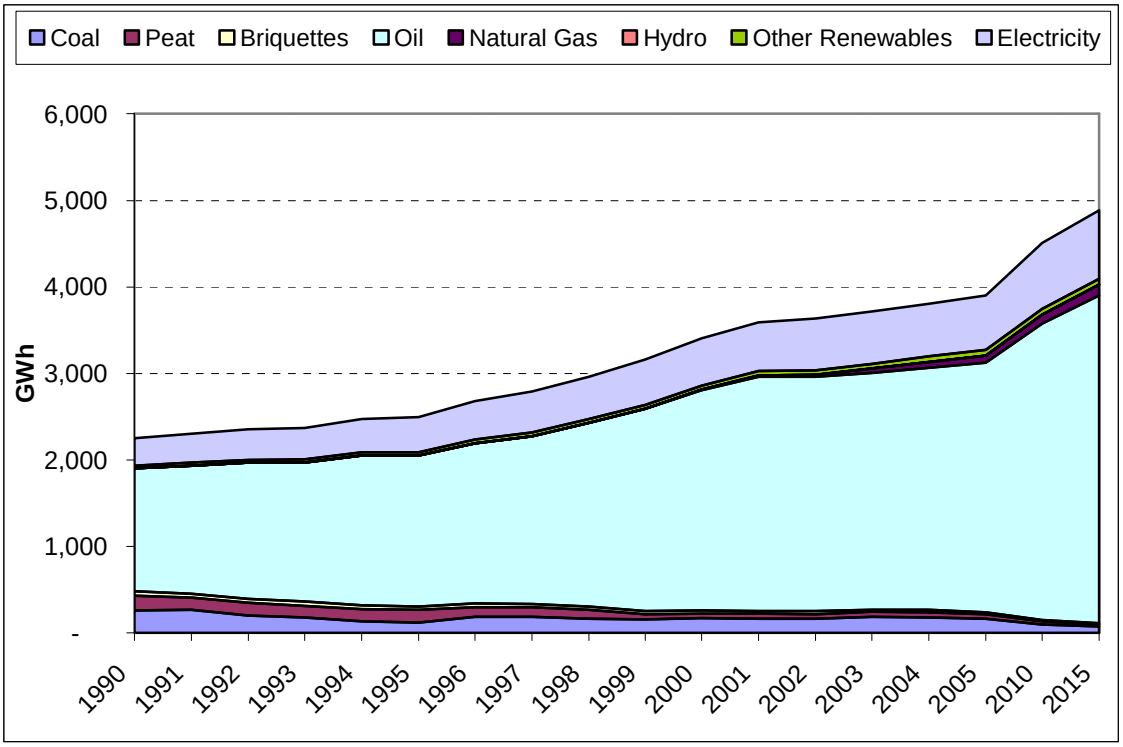


Chart 10.5: Total Final Consumption by Fuel, Clare County, (1990 – 2015)

- There is a decreasing dependence on solid fuels within the County with coal, peat and briquettes all showing considerable reductions from 1990 to 2004.
- The dependence on oil as a fuel is significant and a cause for concern with a 100% increase in consumption occurring from 1990 to 2004. The BAU scenario will see the 1990 consumption increase by 167% by 2015.
- Renewables, if current conditions continue, will have a limited impact in the County. This could change if the potential that exists were to be utilised fully.
- Electricity use continues to grow at a significant rate with consumption in 1990 (320GWh) doubling to 630GWh by 2005.

Table 10.3: Total Final Consumption by Fuel, % Share, Clare County, (1990 – 2015)

% Share	1990	1995	2000	2002	2004	2005 est	BAU 2010	BAU 2015
Coal	11.5%	4.7%	5.0%	4.6%	4.8%	4.2%	2.2%	1.6%
Peat	7.7%	6.0%	1.6%	1.5%	1.4%	1.3%	0.7%	0.4%
Briquettes	2.2%	1.5%	1.1%	1.0%	0.7%	0.7%	0.4%	0.2%
Oil	63.0%	70.1%	74.7%	74.4%	73.6%	73.8%	76.0%	77.5%
Natural Gas	0.0%	0.0%	0.1%	0.6%	1.7%	2.1%	2.4%	2.7%
Hydro	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Other RES	1.5%	1.6%	1.3%	1.4%	1.7%	1.7%	1.4%	1.3%
Electricity	14.2%	16.0%	16.1%	16.6%	16.0%	16.2%	16.8%	16.2%

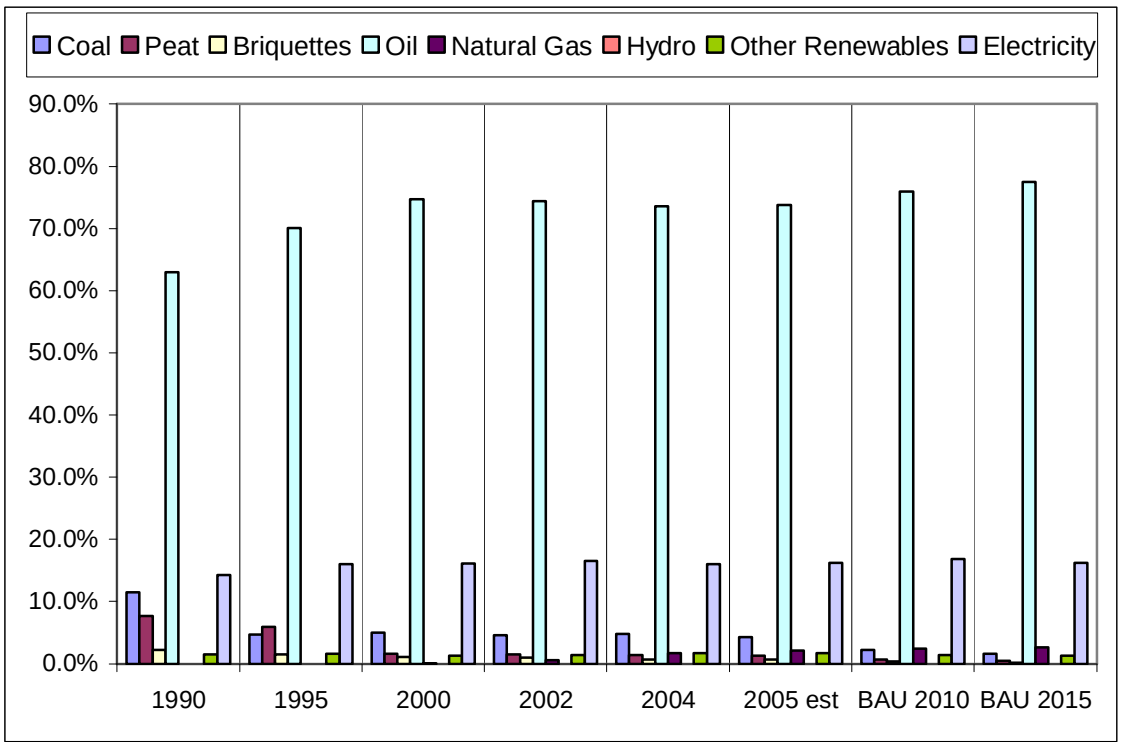


Chart 10.6: Total Final Consumption by Fuel, % Share, Clare County, (1990 – 2015)

- The increasing dependence on oil is further emphasised when analysing data by % Share. This has grown from 63% in 1990 to 74% in 2005.
- The % Share of electricity in terms of TFC has remained relatively stable.
- Natural Gas was introduced into the County in 2000 and currently accounts for approximately 2% of TFC. This is projected to grow slightly by 2015.
- The Business as Usual scenario does not predict a significant increase in the share of renewables use in the County. However substantial progress is possible from wind, wave and wood resources.

10.2.2 Total Final Consumption by Sector

Table 10.4: Total Final Consumption by Sector, Clare County, (1990 – 2015)

GWh	1990	1995	2000	2002	2004	2005 est	BAU 2010	BAU 2015
Transport	634.2	772.6	1,255.2	1,464	1,552	1,578.1	2,007.4	2,181.2
Residential	646.9	661.4	789.2	818.9	898.3	902.3	997.7	1,075.1
Industry	567	577.5	788.5	778.9	765.3	823.5	803.3	894.3
Commercial	265.8	324.7	392.2	397.7	417.7	432.9	527.7	574.1
Agriculture	142.3	155.2	184	181.1	173.2	168.8	168.5	161.4
Total	2,256.2	2,491.4	3,409.1	3,640.6	3,806.5	3,905.7	4,504.6	4,886.1

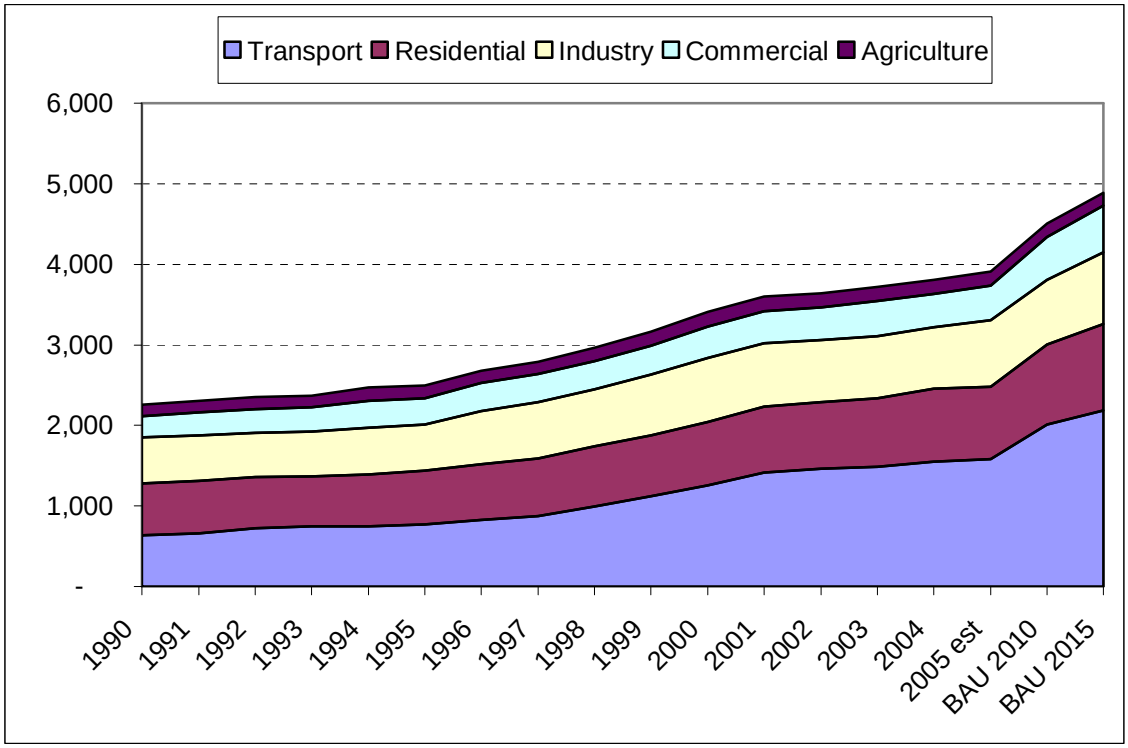


Chart 10.7: Total Final Consumption by Sector, Clare County, (1990 – 2015)

The analysis of consumption by Sector indicates the following key issues:

- The TFC for the county grew by 73% since 1990 and the business as usual forecast indicates the TFC will double from 2256 GWH to 4504 GWh in 2010.
- Transport will account for the greatest growth in consumption by 2015, with a predicted increase of over 240% above 1990 levels.
- The increased level of housing is reflected in the fact that the residential sectors share of TFC has grown by 40% since 1990 and is predicted to increase by another 26% by 2015.
- The commercial sector has shown a higher increase in consumption when compared to the Industrial sector since 1990 (63% for commercial compared to 45% for industry) which would mirror the National trend of a move to more service based employment.

Table 10.5: Total Final Consumption by Sector, % Share, Clare County

% Share	1990	1995	2000	2002	2004	2005 est	BAU 2010	BAU 2015
Transport	28.1%	31.0%	36.8%	40.2%	40.8%	40.4%	44.6%	44.6%
Residential	28.7%	26.5%	23.1%	22.5%	23.6%	23.1%	22.1%	22.0%
Industry	25.1%	23.2%	23.1%	21.4%	20.1%	21.1%	17.8%	18.3%
Commercial	11.8%	13.0%	11.5%	10.9%	11.0%	11.1%	11.7%	11.8%
Agriculture	6.3%	6.2%	5.4%	5.0%	4.5%	4.3%	3.7%	3.3%

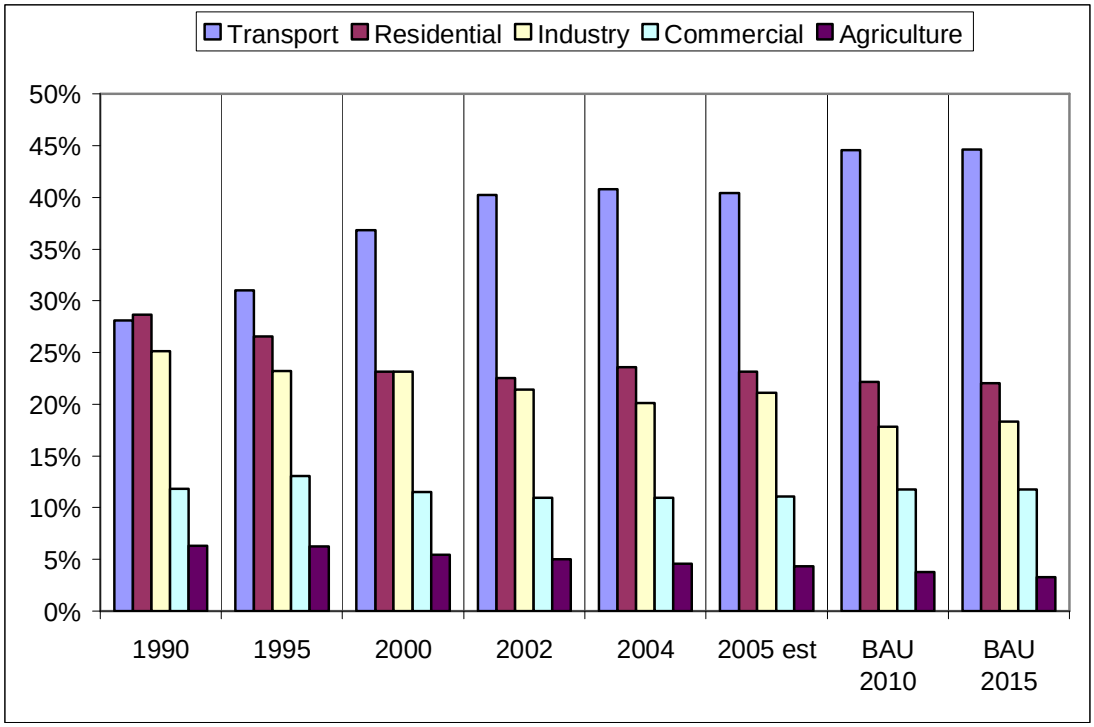


Chart 10.8: Total Final Consumption by Sector, % Share, Clare County, (1990 – 2015)

- The transport sector has grown from the sector with the second highest share of TFC to the sector with the highest share from 1990 to 2005. It now accounts for over 40% of all TFC in County Clare.
- While the total TFC for the residential sector has been shown to be increasing its percentage share of the TFC has remained relatively constant at 28% in 1990 to 23% in 2005. This would indicate that the energy efficiency of the housing stock is improving, as would be expected.
- The industrial sector remains an important sector in terms of its % of TFC, at 21%. The Business As Usual scenarios to 2010 and 2015 would indicate that this will reduce.
- The TFC for the agricultural sector has remained relatively constant since 1990 and will continue to do so, but its % share of TFC is reducing as other sectors increase.

10.3 Environmental Analysis

10.3.1 CO_2 Emission by Fuel

Table 10.6: CO_2 Emissions by Fuel, Clare County, (1990 – 2015)

kT CO_2	1990	1995	2000	2002	2004	2005 est	BAU 2010	BAU 2015
Coal	88.0	40.3	58.1	56.4	62.3	56.5	34.5	27.0
Peat	64.6	55.6	20.6	20.3	20.6	18.9	12.3	8.1
Briquettes	17.8	13.5	13.5	12.5	9.9	9.1	5.9	3.9
Oil	363.5	447.6	654.3	696.5	721.1	740.1	878.6	972.4
Natural Gas	0.0	0.0	0.7	4.1	12.8	16.6	21.7	25.9
Hydro	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other RES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Electricity	294.4	357.0	425.7	432.6	380.0	394.1	472.6	494.3
Total	828.3	914.0	1,172.8	1,222.5	1,206.9	1,235.3	1,425.6	1,531.5
Kyoto Target (1990 + 13%)	936.0	936.0	936.0	936.0	936.0	936.0	936.0	936.0

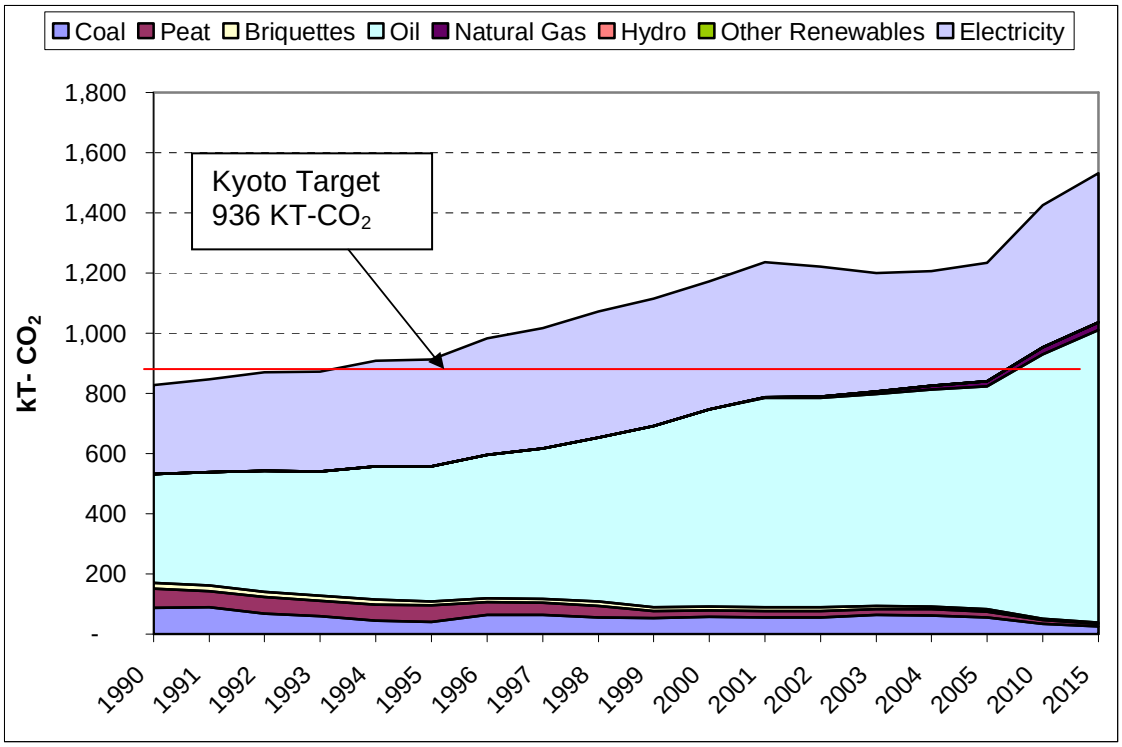


Chart 10.9: CO_2 Emissions by Fuel, Clare County, (1990 – 2015)

Analysis of CO_2 emissions related to fuel use in the County provides the following indicators:

- Oil and electricity account for the greatest proportion of Emissions and have shown the greatest increases. Emissions from oil use have doubled since 1990

from 363 kT CO_2 to 740 kT CO2 in 2005. Electricity, meanwhile accounted for 34% more emissions in 2005 than it did in 1990.

- Emissions from solid fuels have reduced significantly, in line with their decreasing use as fuels in the County.
- The introduction of Natural Gas into the County in 2000 saw emissions rise from 0.7 kT in 2000 to 16.6 kT in 2005.
-

Table 10.7: CO_2 Emissions by Fuel, % Share, Clare County, (1990 – 2015)

% Share CO_2	1990	1995	2000	2002	2004	2005 est	BAU 2010	BAU 2015
Coal	10.6%	4.4%	5.0%	4.6%	5.2%	4.6%	2.4%	1.8%
Peat	7.8%	6.1%	1.8%	1.7%	1.7%	1.5%	0.9%	0.5%
Briquettes	2.2%	1.5%	1.2%	1.0%	0.8%	0.7%	0.4%	0.3%
Oil	43.9%	49.0%	55.8%	57.0%	59.8%	59.9%	61.6%	63.5%
Natural Gas	0.0%	0.0%	0.1%	0.3%	1.1%	1.3%	1.5%	1.7%
Hydro	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Other RES	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Electricity	35.5%	39.1%	36.3%	35.4%	31.5%	31.9%	33.2%	32.3%

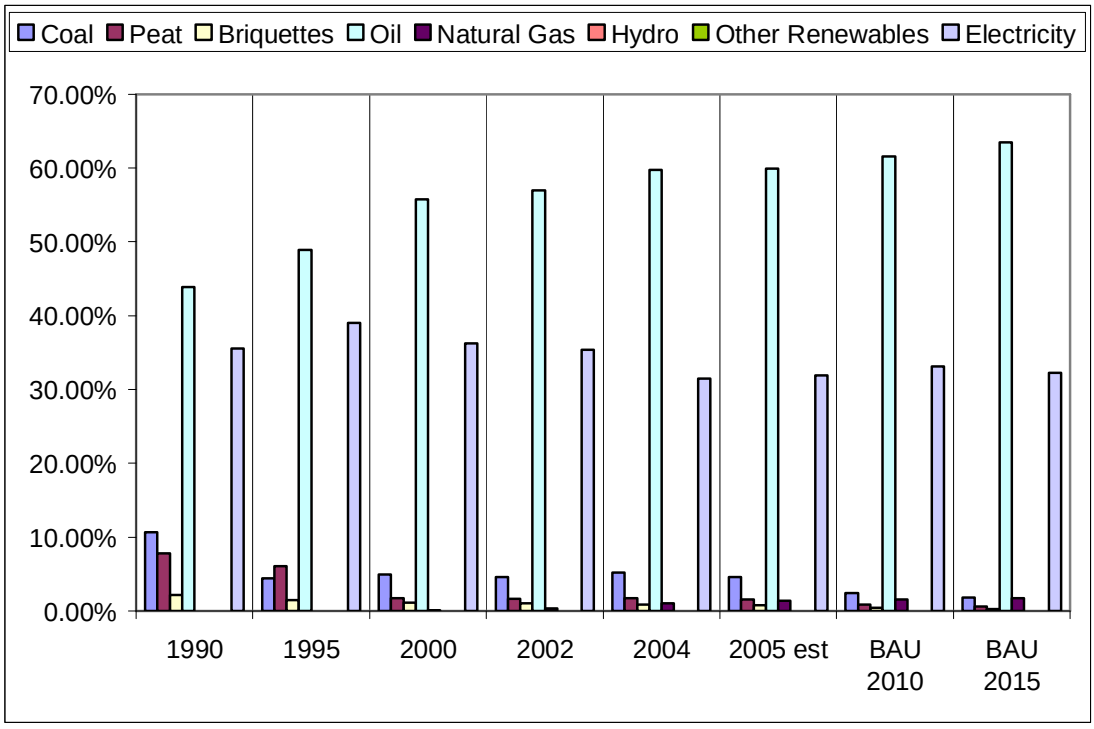


Chart 10.10: CO_2 Emissions by Fuel, % Share, Clare County, (1990 – 2015)

- Given the predominant use of oil as a fuel its % share of emissions is reflected in the above Table and Chart. It accounts for 60% of CO2 emissions.
- Electricity accounts for the bulk for the remainder, i.e. 32%.

10.3.2 Emission by Sector

Table 10.8: CO_2 Emissions by Sector, Clare County, (1990 – 2015)

kT CO_2	1990	1995	2000	2002	2004	2005 est	BAU 2010	BAU 2015
Transport	168.7	205.9	332.2	346.3	341.9	410.4	515.6	586.5
Residential	283.7	280.5	311.6	324.8	320.6	316.9	328.8	341.7
Industry	216.4	235.4	288.1	300.3	296.4	227.3	259.2	273.0
Commercial	131.0	159.6	204.8	213.4	210.7	250.0	292.0	302.0
Agriculture	28.5	32.6	36.2	37.7	37.2	30.7	29.9	28.4
Total	828.3	914.0	1,172.8	1,222.5	1,206.9	1,235.3	1,425.6	1,531.5
Kyoto Target 1990 + 13%	936.0	936.0	936.0	936.0	936.0	936.0	936.0	936.0

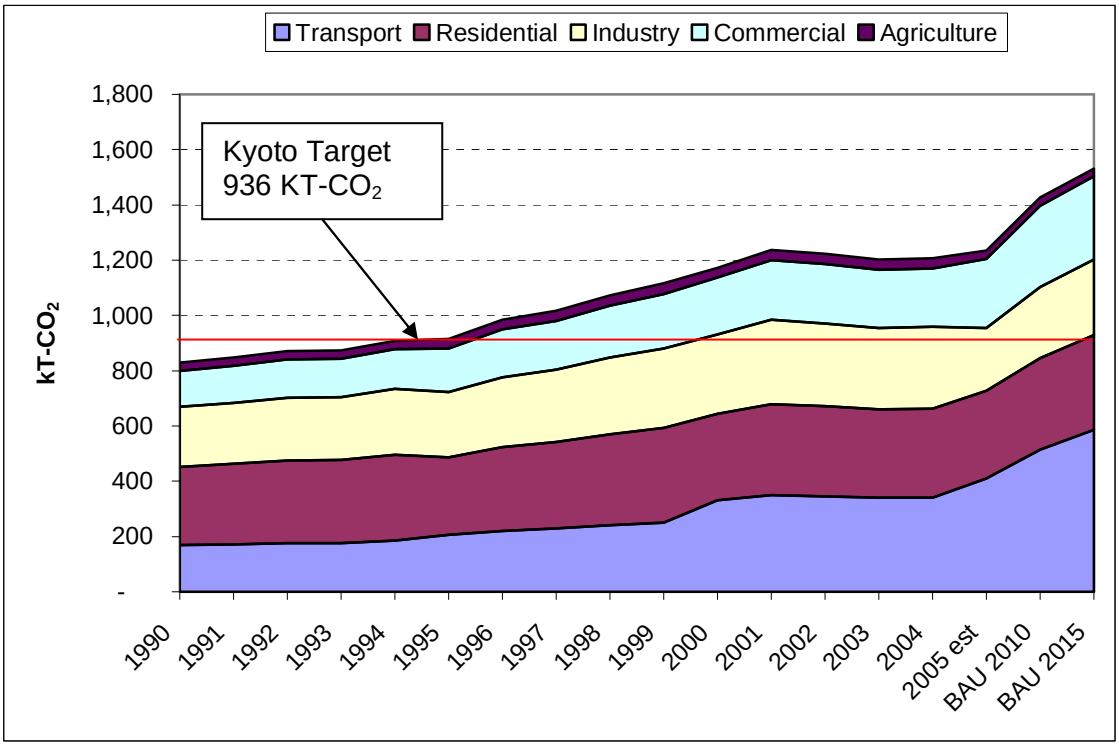


Chart 10.11: CO_2 Emissions by Sector, Clare County, (1990 – 2015)

- The transport sector has shown the highest increase in level of emissions since 1990 with a 143% increase to 2005. This mirrors in the increased use of oil as a fuel also.
- Emissions from the residential sector have remained relatively constant with an 11% increase since 1990. This reflects the increase energy efficiency of buildings and heating systems used
- There was a 60% increase in emissions from the commercial sector since 1990 in the County.

Table 10.9: CO2 Emissions by Sector, % Share, Clare County, (1990 – 2015)

	1990	1995	2000	2002	2004	2005 est	BAU 2010	BAU 2015
Transport	20.4%	22.5%	28.3%	28.3%	28.3%	33.2%	36.2%	38.3%
Residential	34.3%	30.7%	26.6%	26.6%	26.6%	25.7%	23.1%	22.3%
Industry	26.1%	25.8%	24.6%	24.6%	24.6%	18.4%	18.2%	17.8%
Commercial	15.8%	17.5%	17.5%	17.5%	17.5%	20.2%	20.5%	19.7%
Agriculture	3.4%	3.6%	3.1%	3.1%	3.1%	2.5%	2.1%	1.9%

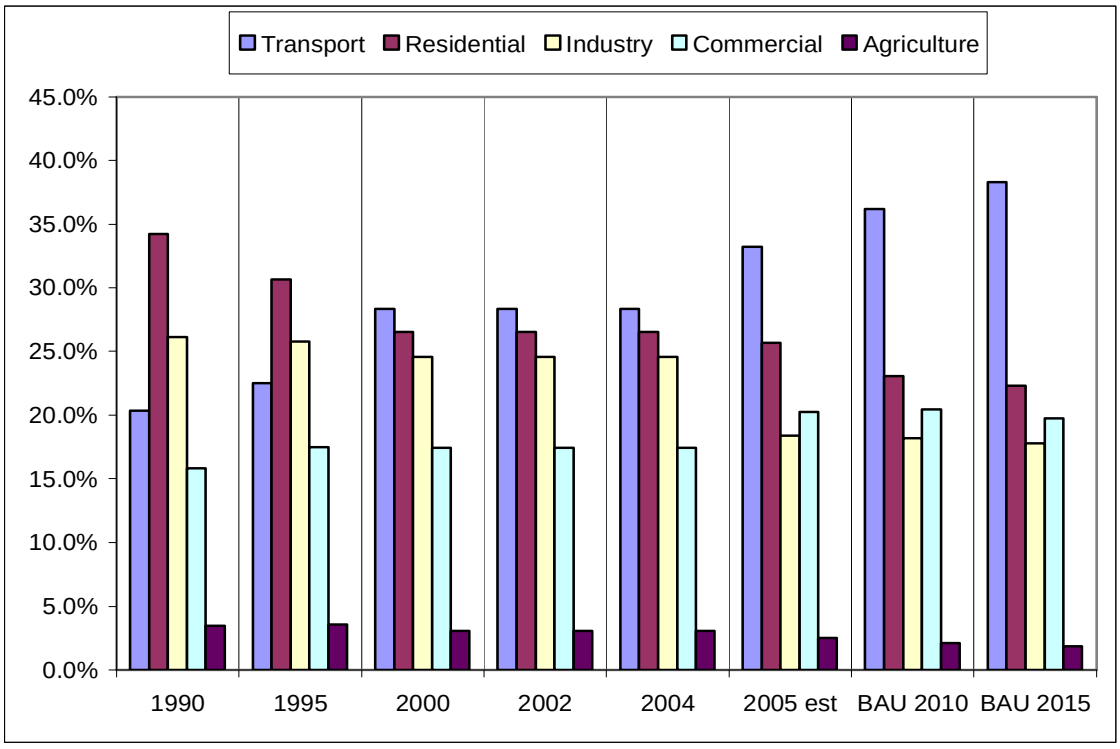


Chart 10.12: CO_2 Emissions by Sector, % Share, Clare County, (1990 – 2015)

The changing in trend in emissions by Sector is clearly illustrated in the above Table and Chart.

- While in 1990 the residential and industrial sectors accounted for the greatest proportion of emissions i.e. 34% and 26% respectively, they now only account for 26% and 18% of emissions respectively.
- Industry has been overtaken by the commercial Sector in terms of share of emissions.
- Transports emissions and their % share within Clare County show an increasing trend with predictions that this sector will account for close to 40% of all emissions in 2015.

10.4 Response to Kyoto

10.4.1 The size of the problem

Table 10.10: Analysis of Compliance with Kyoto and Potential Costs, Clare County.

	Emissions kT CO_2	**Kyoto Target Exceedance** kT CO_2	**Projected Cost of CO2/ton Trading Price** (€)	**Annual Carbon Levy** (€millions)
1990	828.3	0.0	-	0.0
Kyoto Target (1990 + 13%)	936.0	0.0	-	0.0
1995	914.0	0.0	-	0.0
2000	1,172.8	236.8	-	0.0
2002	1,222.5	286.5	-	0.0
2004	1,206.9	270.9	-	0.0
2005 est	1,235.3	299.3	27	8.0
BAU 2010	1,425.6	489.6	35	17.1
BAU2015	1,531.5	595.5	45	26.8

It can be seen from the above Table that County Clare exceeded its Kyoto Target before 2000 and the BAU scenario would see it generating approximately 490 kT CO_2 above its Kyoto Limit by 2010. Based on a potential price of €35 per tonne of CO_2 this could equate to a Carbon Levy of over €17 million per annum.

10.4.2 Sectoral Solutions

The following tables provide information on the range of actions that might be applicable in Clare County to reduce emissions. This list is indicative only and the QIRs are discussed in further detail with the Climate Change Strategy.

10.4.2.1 Energy Supply and Production

Energy Production and Supply	**Quantified Indicative Reductions Proposed** (kT-CO_2)
Large Scale Wind Power - Hydro Power Schemes	
Small scale Wind Power - Biomass Wood	
Combined Heat & Power - Increased Electricity Generating Efficiency	
PV Solar - Small Scale Projects - Solar Panels for DHW	
Solar/Wind Powered Street Lighting	
Fuel switching	
Total	188

10.4.2.2 Transport

Transport	Quantified Indicative Reductions Proposed ($kT\text{-}CO_2$)
Alternative Fuels (Biofuels, Electric, Hybrids, etc.)	
Increased Public Transport Networks	
Convert Local Authority Fleets to Biofuels	
Electric Bicycles & Mopeds (PV Solar Charging Stations)	
Total	88

10.4.2.3 Built Environment and Residential

Public Buildings and Facilities	Quantified Indicative Reductions Proposed ($kT\text{-}CO_2$)
Energy Performance Buildings Directive	
Energy Efficiency at Local Authority Buildings	
Energy Efficient Design for New LA Buildings	
Energy Monitoring and Targeting Systems	
Staff Energy Awareness and Training	
Annual Energy Surveys and Auditing	
Sustainable Public Buildings Energy Programmes	
Energy Management of Swimming Pools etc.	10

Residential sector	Quantified Indicative Reductions Proposed ($kT\text{-}CO_2$)
Sustainable L.A. Housing, Energy Policy - New Builds	
Sustainable Energy Measures in Remedial Works.	
Energy Performance Buildings Directive	
Switching to Natural Gas (Condensing Boilers)	
Existing Dwelling Insulation Measures Upgrade (Walls/Roofs/Windows)	
Energy Efficient Heating Systems and Controls	
Existing and New Dwellings Alternative Heating Systems	
Energy Efficient Electrical Appliances	
Domestic Green Energy Tariffs	
Energy Efficiency in Construction and Material Practices	
Total	20

10.4.2.4 Industrial/Commercial

Industry/Commercial	Quantified Indicative Reductions Proposed ($kT\text{-}CO_2$)
Commercial Buildings, Energy Rating Scheme	
Energy Performance Indicators per Operation Type	
Energy Performance Indicators for Water and Sewage Treatment	
Fuel switching to Natural Gas (Condensing Boilers)	
Existing Insulation Measures Upgrade (process pipe & ducts)	
Combined Heat & Power	
Green Energy Supply Tariffs	
Energy Monitoring & Targeting	
Energy Surveys & Audits	
Total	72

10.4.2.5 Agriculture

Agriculture	Quantified Indicative Reductions Proposed ($kT\text{-}CO_2$)
Agricultural Contractors National Tractor Test (Engine Efficiency)	
Anaerobic Digestion Integration to Biogas	
Small Scale Wind Projects	
Small Scale Hydroelectricity projects	
Energy Crops (Willow Coppice etc.)	
Total	80

10.4.2.6 Waste

Waste	Quantified Indicative Reductions Proposed ($kT\text{-}CO_2$)
Landfill Gas.	
Anaerobic Digestion Biogas - Organic / Green Wastes	
CHP - Sewage Waste Treatment Plants	
Transport Efficiency in Waste Collection Services	
Energy From Wood / Forestry Residues	
Total	28

10.4.2.7 Sinks (Land Use Change & Forestation)

Land Use Change & Forestation	Quantified Indicative Reductions Proposed ($kT\text{-}CO_2$)
Regional Forestry / Afforestation Inventory	
Local Authority Tree Planting	
Cultivation of "Energy Crops"	
Development of Private Forests	
Total	25

10.4.2.8 Sectoral Solution Summary

Overall QIRS by sector	Quantified Indicative Reductions Proposed ($kT\text{-}CO_2$)
Energy Production & Supply	188
Transport	88
Built Environment & Residential	30
Industry, Commercial, & Services	72
Agriculture	80
Waste	28
Sinks (Land Use Change & Forestation)	25
Total	510

10.4.3 Individual Responsibility

Table 10.11: TFC and CO_2 emissions Per Capita and Reductions Sought, Clare County:

Indicator	1990 Clare	KyotoTarget Clare 1990 + 13%	2004 Clare	2010 Clare	Reduction Sought
Population (000)	91.0	-	105.0	112.7	N/A
TFC Fuel Consumed (GWh)	2256.2	-	3806.3	4504.6	-
Energy Related Emissions (kT-CO2)	828.3	936.0	1,186.1	1425.6	489.6
TFC/Capita (kWh/ Inhabitant)	24,796.4	-	36,236.4	39,984.0	-
CO2 Emissions / Capita (T CO2 / Inhabitant)	9.1	9.1	11.3	12.7	4.7

- The TFC per person will increase from just under 25,000kWh in 1990 to approximately 40,000 kWh in 2010(BAU). It reached 36,236.4kWh in 2004. This has had a corresponding increase in emissions per person which has risen from 9.1 Tonnes CO_2 per person to 11.8 Tonnes CO_2 per person by 2002, and will increase to 12.7 Tonnes CO_2 per person in 2010.
- County Clare will be 489 KT CO_2 above its Kyoto Limit in 2010 and this will equate to a reduction of 4.7 Tonnes of CO_2 per person in the County if the Kyoto commitments is to be achieved.
- If the total range of QIRs indicated in Section 10.4.2 could be achieved the levels of reduction would be in the region of 20 kT CO_2 above the required reduction for the County.

11.0 Limerick County

11.1 Summary Analysis

11.1.1 Total Final Consumption and Emissions by Fuel

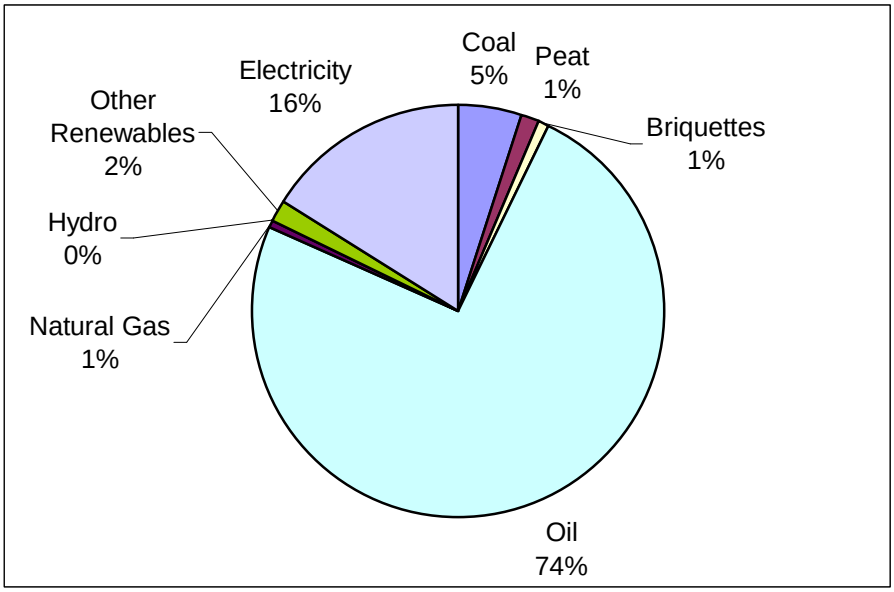


Chart 11.1: Total Final Consumption by Fuel, Limerick County, 2004

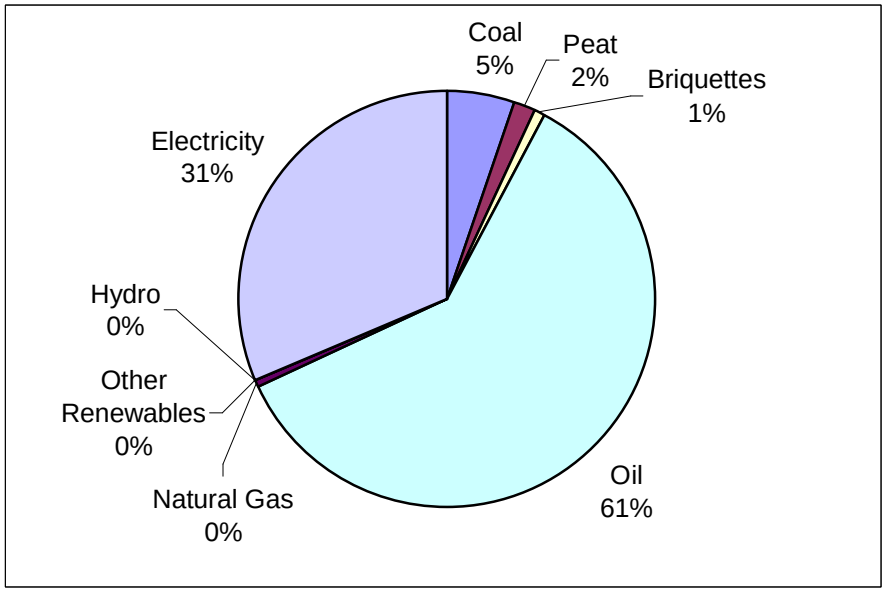


Chart 11.2: CO_2 Emissions by Fuel, Limerick County, 2004

- From the charts above it can be seen that oil accounted for 74% of TFC in Limerick County in 2004, and is also the highest contributor in terms of CO_2 emissions. This is similar to Clare County.
- While electricity only accounts of 16% of TFC it accounts for over 30% of emissions, due to its high emissions factor.
- Renewables and Hydro currently make a minor contribution to consumption with the balance being made up of solid fuels and natural gas.

11.1.3 Total Final Consumption and Emissions by Sector

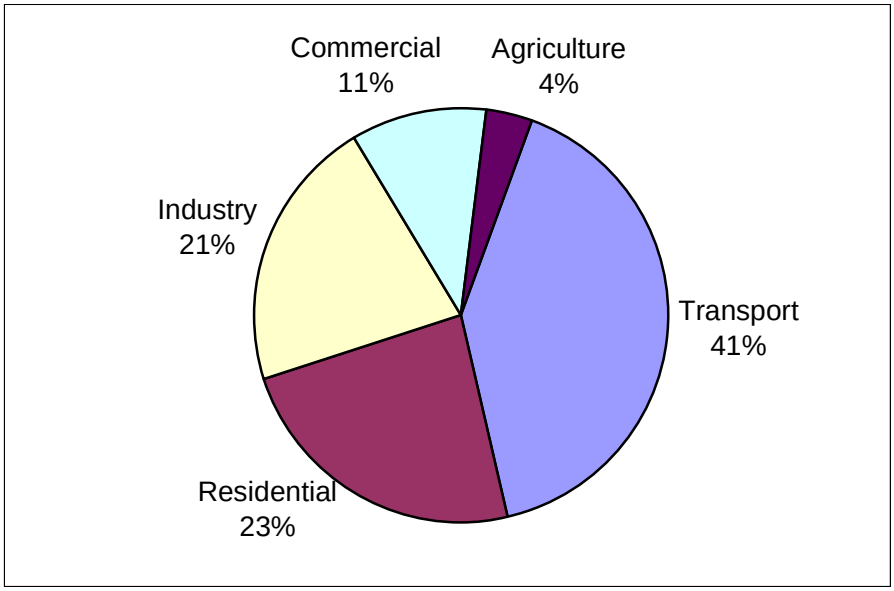


Chart 11.3: Total Final Consumption by Sector, Limerick County, 2004

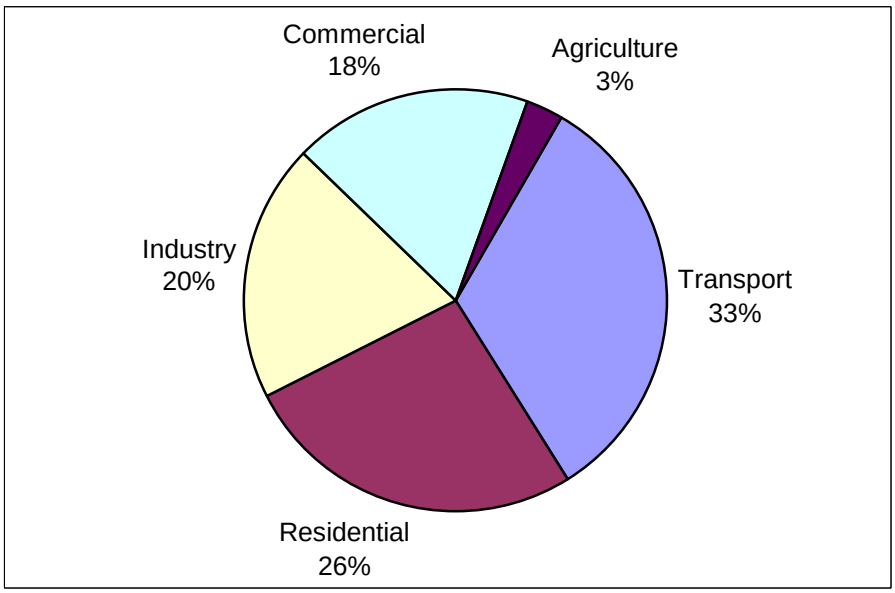


Chart 11.4: CO_2 Emissions by Sector, Limerick County, 2004

- Clearly the transport sector, in 2004, has the highest consumption in energy terms in the County, at 41%. It also currently accounts of 33% of CO_2 emissions.
- The residential sector is the next highest contributor in terms of emissions, at 26%, while it consumes 23% of TFC in the County.
- The industrial sector accounted for 21% of consumption in 2004 and 20% of CO_2 emissions.
- The commercial sector currently only accounts for 18% of emissions.
- Agriculture has the lowest consumption of energy and lowest emissions, in energy terms, within the County.

11.1.4 Environmental Indicators

Table 11.1: Environmental Indicators for Limerick County

	1991		2000		2004	
Indicator	**Ireland**	**Limerick County**	**Ireland**	**Limerick County**	**Ireland**	**Limerick County**
Population (000)	3,525.7	109.9	3,780.0	112.5	4,043.8	123.4
TFC Fuel Consumed (GWh)	85,662.7	2,753.3	123,593.0	4,007.9	136,718.0	4,284.4
Energy Related Emissions ($kt\text{-}CO_2$)	31,244.9	1,006.2	41,920.3	1,374.8	43,041.7	1,421.8
GVA (€million)	34,092.0	1,046.7	92,781.0	2,569.4	132,481.0	3,307.8
TFC/GVA (kWh/€thousand)	2,512.7	2,630.5	1,332.1	1,559.9	1,032.0	1,295.2
TFC/Capita (kWh/ Inhabitant)	24,296.5	25,058.6	32,696.6	35,622.8	33,809.3	34,733.2
CO_2 Emissions / Capita (T CO_2 / Inhabitant)	8.9	9.2	11.1	12.2	10.6	11.5

Table 11.1 provides a concise summary of the status of energy consumption and emissions in the County. Key points of note are

- Annual TFC per Gross Value Added (TFC/GVA) is consistently higher than the National Average. This would indicate that more energy needs to be used in County Limerick to generate economic activity when compared to the National average. It is reasonable to assume that this is driven by the types of fuels available and efficiencies of energy conversion.
- The TFC per Capita or individual in the County is above the National Average, consistently since 1991. This could be influenced by the rural natural of the County, restricted access to more efficient fuels and technologies and more energy inefficient process and buildings
- Emissions per capita are also higher than the National average. This is primarily influenced by the fuel mix with a very strong dependence on oil in the County. The limited use of natural gas, which has a lower emissions factor, and higher % use of Solid Fuels are contributing factors along with the limited use of renewable energy.
- The strong economic growth in Ireland (288% increase in GVA from 1991 to 2004) has had a knock-on effect in the County with a corresponding increase of 216% over the period. TFC and CO_2 emissions have increased by 55% and 41% respectively over the same period.

11.2 Energy Analysis

11.2.1 Total Final Consumption by Fuel

Table 11.2: Total Final Consumption, Limerick County, (1990 – 2015)

GWh	1990	1995	2000	2002	2004	2005 est	BAU 2010	BAU 2015
Coal	304.5	137.5	199.7	196.4	221.0	200.2	122.2	95.6
Peat	201.7	170.0	62.2	61.6	64.2	58.9	38.2	25.3
Briquettes	58.6	43.7	42.8	39.9	32.5	29.8	19.3	12.8
Oil	1,727.7	2,133.7	2,998.2	3,194.2	3,335.1	3,450.7	4,106.4	4,553.9
Natural Gas	0.0	0.0	8.3	18.4	22.9	26.2	34.2	40.8
Hydro	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other RES	40.6	48.1	57.2	65.4	80.9	80.7	79.5	78.3
Electricity	377.8	471.8	639.6	708.6	717.3	743.8	892.0	932.8
TFC	2,710.9	3,004.8	4,007.9	4,284.4	4,474.0	4,590.2	5,291.7	5,739.5

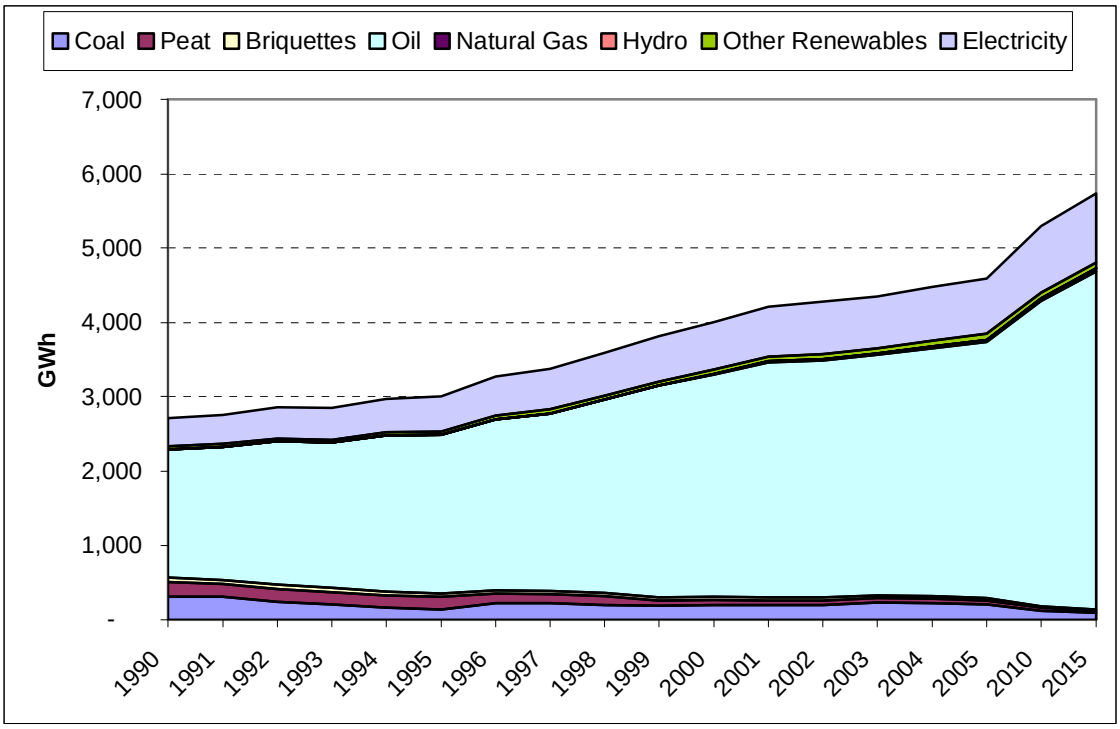


Chart 11.5: Total Final Consumption by Fuel, Limerick County, (1990 – 2015)

- There is a decreasing dependence of solid fuels within the County with coal, peat and briquettes all showing considerable reductions from 1990 to 2004.
- The dependence on oil as a fuel is significant and a cause for concern with a 93% increase in consumption occurring from 1990 to 2004. The BAU scenario for 2015 projects oil consumption to increase by 163% over 1990 levels.
- Electricity use continues to grow at a significant rate with consumption in 1990 (378GWh) doubling to 744GWh by 2005.
- The TFC for the County has increased by 70% since 1991 and is projected to double by 2015.

Table 11.3: Total Final Consumption by Fuel, % Share, Limerick County, (1990 – 2015)

	1990	1995	2000	2002	2004	2005 est	BAU 2010	BAU 2015
Coal	11.2%	4.6%	5.0%	4.6%	4.9%	4.4%	2.3%	1.7%
Peat	7.4%	5.7%	1.6%	1.4%	1.4%	1.3%	0.7%	0.4%
Briquettes	2.2%	1.5%	1.1%	0.9%	0.7%	0.7%	0.4%	0.2%
Oil	63.7%	71.0%	74.8%	74.6%	74.5%	75.2%	77.6%	79.3%
Natural Gas	0.0%	0.0%	0.2%	0.4%	0.5%	0.6%	0.6%	0.7%
Hydro	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Other RES	1.5%	1.6%	1.4%	1.5%	1.8%	1.8%	1.5%	1.4%
Electricity	13.9%	15.7%	16.0%	16.5%	16.0%	16.2%	16.9%	16.3%

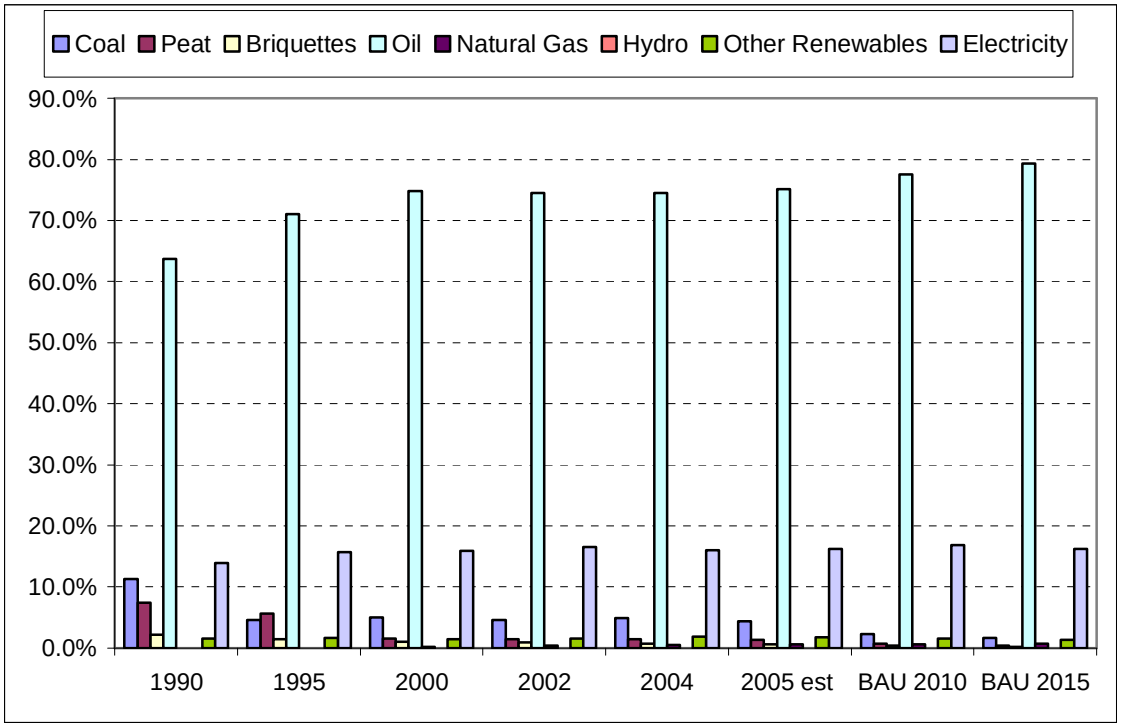


Chart 11.6: Total Final Consumption by Fuel, % Share, Limerick County, (1990-2015)

- The increasing dependence on oil is further emphasised when analysing the data by % share. This has grown from 64% in 1990 to 75% in 2005.
- The % share of electricity in terms of TFC has remained relatively stable since 2000 at 16%.

11.2.2 Total Final Consumption by Sector

Table 11.4: Total Final Consumption by Sector, Limerick County, (1990 – 2015)

GWh	1990	1995	2000	2002	2004	2005 est	BAU 2010	BAU 2015
Transport	815.8	1,003.5	1,524.4	1,757.0	1,831.4	1,876.2	2,399.4	2,635.5
Residential	755.2	757.3	893.1	928.6	1,047.1	1,072.8	1,192.6	1299
Industry	681.2	693.4	966.7	972.4	955.7	979.1	960.2	1,080.6
Commercial	327.1	399.4	447.0	451.2	473.8	498.7	577.1	576.3
Agriculture	134.0	151.2	176.7	175.2	166.1	163.5	162.4	148.1
Total	2,713.3	3,004.8	4,007.9	4,284.4	4,474.2	4,596.8	5,014.6	5,365

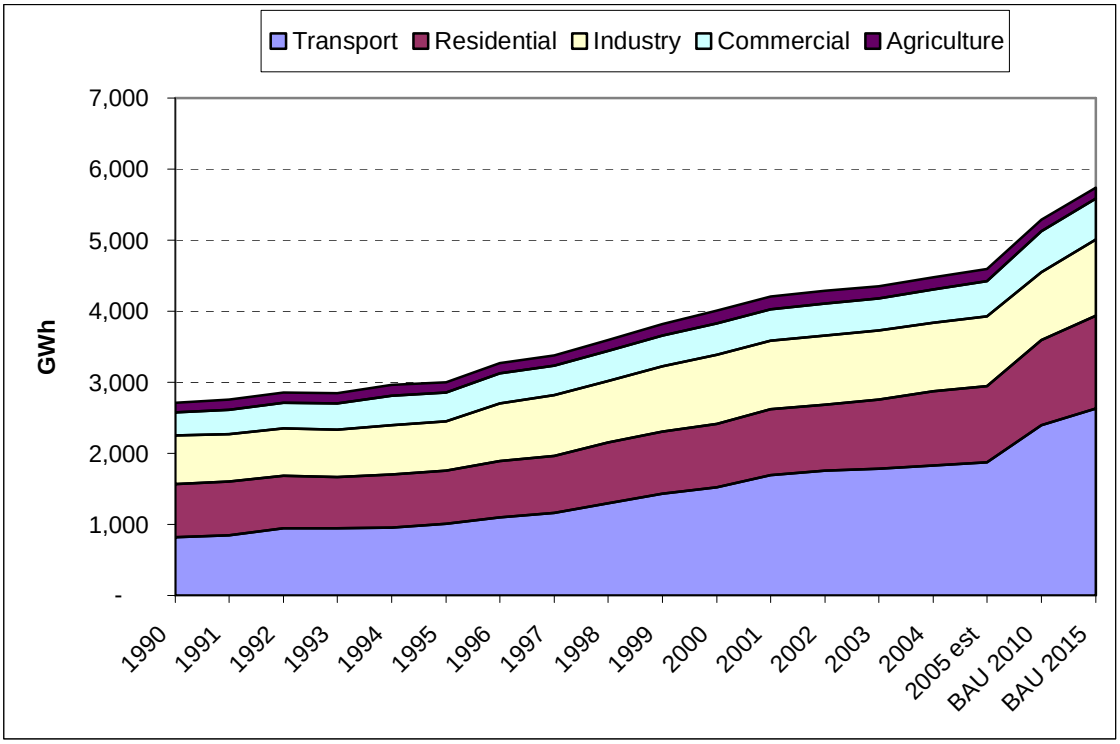


Chart 11.7: Total Final Consumption by Sector, Limerick County, (1990 – 2015)

The analysis of consumption by Sector indicates the following key issues:

- The TFC for the County will has grown by 70% since 1990 and the business as usual forecast indicates the TFC will nearly double from 2713 GWh to 5365 GWh in 2010.
- Transport will account for the greatest growth in TFC by 2015, with a predicted increase of over 223% above 1990 levels.
- The increased level of housing is reflected in the fact that the residential sectors share of TFC has grown by 42% since 1990 and is predicted to increase by another 30% by 2015.
- The commercial sector has shown a higher increase in TFC when compared to the Industrial sector since 1990 (52% for commercial compared to 44% for industry) which would mirror the National trend of a move to more service based employment.

Table 11.5: Total Final Consumption by Sector, % Share, Limerick County, (1990 – 2015)

	1990	1995	2000	2002	2004	2005 est	BAU 2010	BAU 2015
Transport	30.1%	33.4%	38.0%	41.0%	40.9%	40.8%	47.8%	49.1%
Residential	27.8%	25.2%	22.3%	21.7%	23.4%	23.3%	23.8%	24.2%
Industry	25.1%	23.1%	24.1%	22.7%	21.4%	21.3%	19.1%	20.1%
Commercial	12.1%	13.3%	11.2%	10.5%	10.6%	10.8%	11.5%	10.7%
Agriculture	4.9%	5.0%	4.4%	4.1%	3.7%	3.6%	3.2%	2.8%

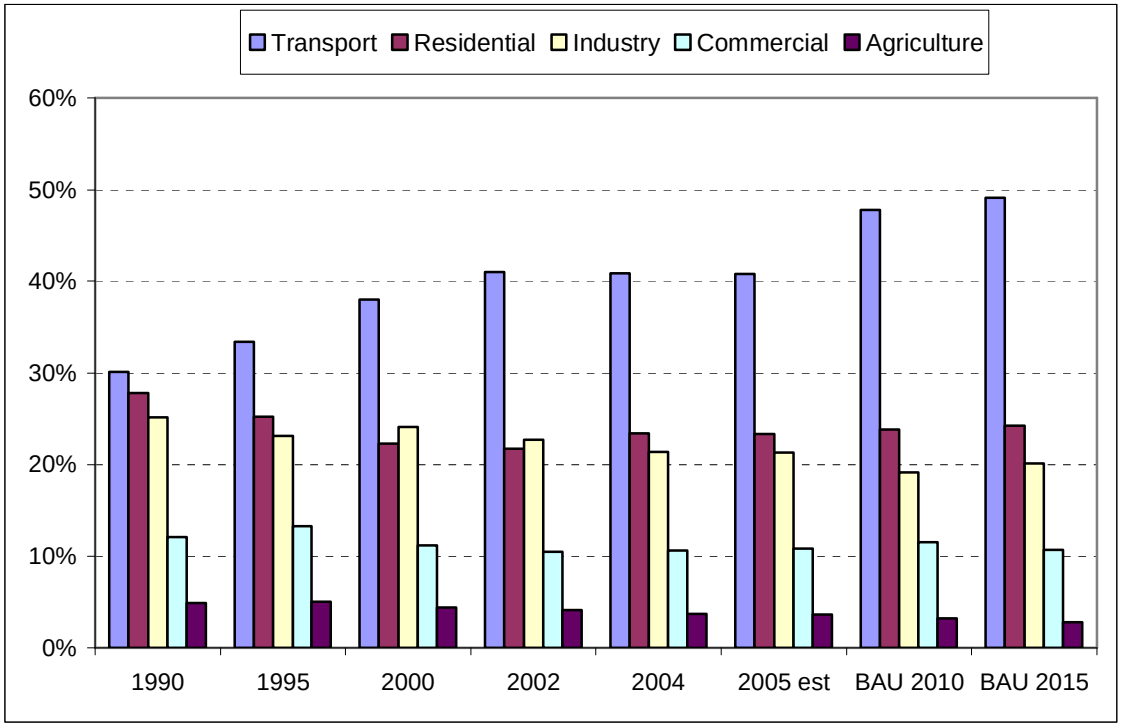


Chart 11.8: Total Final Consumption by Sector, % Share, Limerick County, (1990 – 2015)

- Similar to trends nationally and in other Counties the transport sector is now the main energy consumer, accounting for 41% of TFC in 2005. This is predicted to increase to 50% by 2015.
- While the total TFC for the residential sector has been shown to be increasing its % share of the TFC has remained relatively constant (between 25 to 23% since 1995). This would indicate that the energy efficiency of the housing stock is improving, as would be expected.
- The commercial sector has been shown to have higher growth rates in terms of TFC than the industrial sector but the industrial sector still remains the third highest consumer at 21% in 2005.

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11.3 Environmental Analysis

11.3.1 CO_2 Emission by Fuel

Table 11.6: CO2 Emissions by Fuel, Limerick County, (1990 – 2015)

kT-CO_2	1990	1995	2000	2002	2004	2005 est	BAU 2010	BAU 2015
Coal	103.7	46.8	68.0	66.9	75.3	68.2	41.6	32.6
Peat	75.5	63.7	23.3	23.1	24.0	22.0	14.3	9.5
Briquettes	20.9	15.6	15.2	14.2	11.6	10.6	6.9	4.6
Oil	442.1	546.9	770.9	821.6	858.7	885.8	1,054.1	1,169.0
Natural Gas	0.0	0.0	1.6	3.6	4.5	5.2	6.8	8.1
Hydro	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other RES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Electricity	346.9	421.3	495.8	508.3	447.7	464.3	556.8	582.3
Total	989.0	1,094.3	1,374.8	1,437.6	1,421.8	1,456.1	1,680.5	1,805.9
Kyoto Target (1990 + 13%)	1,117.6	1,117.6	1,117.6	1,117.6	1,117.6	1,117.6	1,117.6	1,117.6

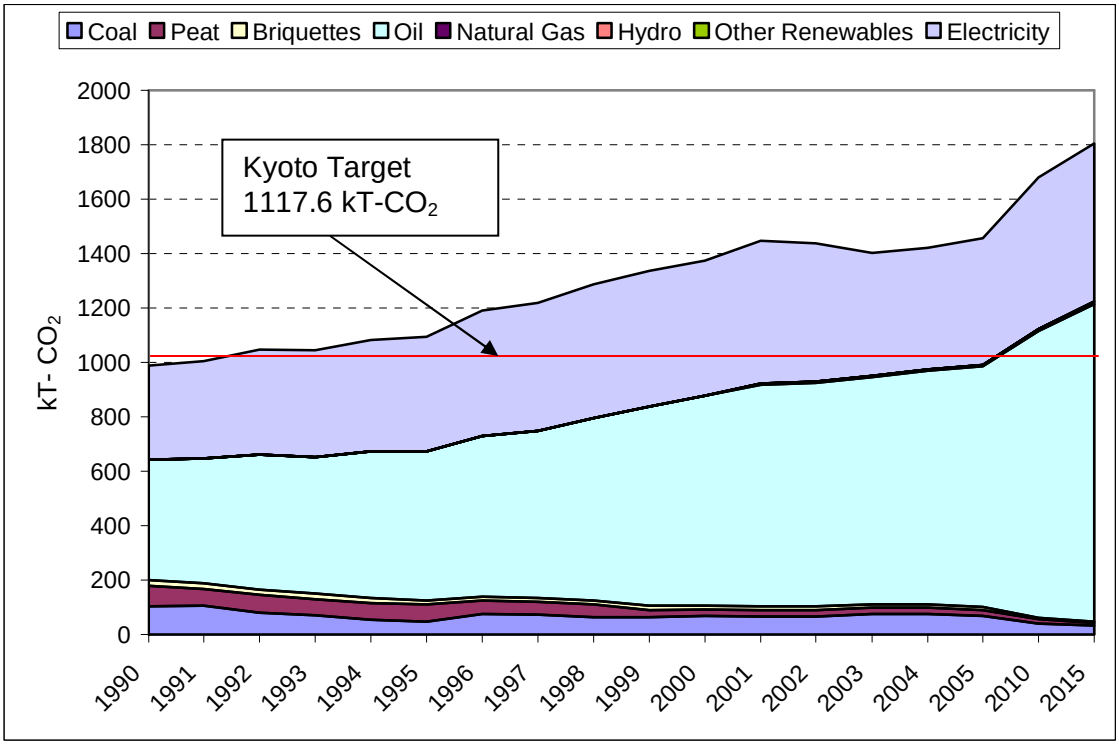


Chart 11.9: CO_2 Emissions by Fuel, Limerick County, (1990 – 2015)

Analysis of CO_2 emissions related to fuel use in the County provides the following indicators:

- Oil and electricity account for the greatest proportion of emissions and have shown the greatest increases. Emissions from oil use have increased from 442 kT CO_2 to 885 kT CO_2 since 1990. Emissions from electricity have increased by 34% since 1990 and will have increased by 70% by 2015.
- Emissions from solid fuels have reduced significantly and will continue to do so into the future.

Table 11.7: CO2 Emissions by Fuel, % Share, Limerick County, (1990 – 2015)

% Share CO_2	1990	1995	2000	2002	2004	2005 est	BAU 2010	BAU 2015
Coal	10.48%	4.28%	4.95%	4.65%	5.29%	4.68%	2.48%	1.80%
Peat	7.64%	5.82%	1.69%	1.60%	1.69%	1.51%	0.85%	0.52%
Briquettes	2.11%	1.42%	1.11%	0.99%	0.81%	0.73%	0.41%	0.25%
Oil	44.70%	49.98%	56.07%	57.15%	60.39%	60.83%	62.73%	64.73%
Natural Gas	0.00%	0.00%	0.12%	0.25%	0.32%	0.36%	0.40%	0.45%
Hydro	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Other REN	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Electricity	35.07%	38.50%	36.06%	35.35%	31.49%	31.88%	33.13%	32.24%

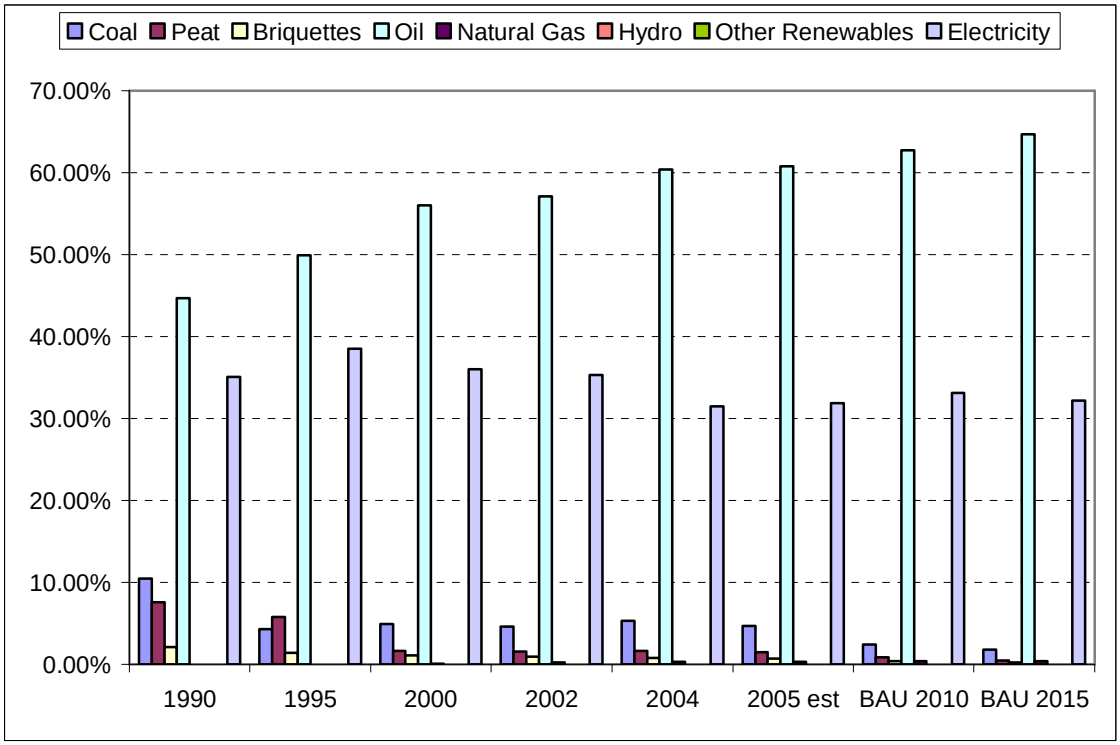


Chart 11.10: CO_2 Emissions by Fuel, % Share, Limerick County, (1990 – 2015)

- The increased use of oil and its contribution to emissions is an important trend which will need serious action to affect change. As it accounts for 61% of current emissions in Limerick County, with a predicted increase to 65% in 2015 considerable action will be required to reduce this consumption.
- Electricity accounts for the bulk for the remainder, i.e. 32%.

11.3.2 Emissions by Sector

Table 11.8: CO2 Emissions by Sector, Limerick County, (1990 – 2015)

kT-CO_2	1990	1995	2000	2002	2004	2005 est	BAU 2010	BAU 2015
Transport	194.9	239.6	381.4	437.3	465.1	483.8	607.8	691.6
Residential	342.3	338.9	367.0	372.4	374.6	373.6	387.6	403.0
Industry	260.5	284.3	341.5	326.0	281.9	267.9	305.5	321.9
Commercial	157.5	192.4	242.3	260.4	261.2	294.7	344.3	356.1
Agriculture	33.9	39.1	42.6	41.5	39.0	36.2	35.3	33.4
Total	989.0	1,094.3	1,374.8	1,437.6	1,421.8	1,456.1	1,680.5	1,805.9
Kyoto Target	1,117.6	1,117.6	1,117.6	1,117.6	1,117.6	1,117.6	1,117.6	1,117.6

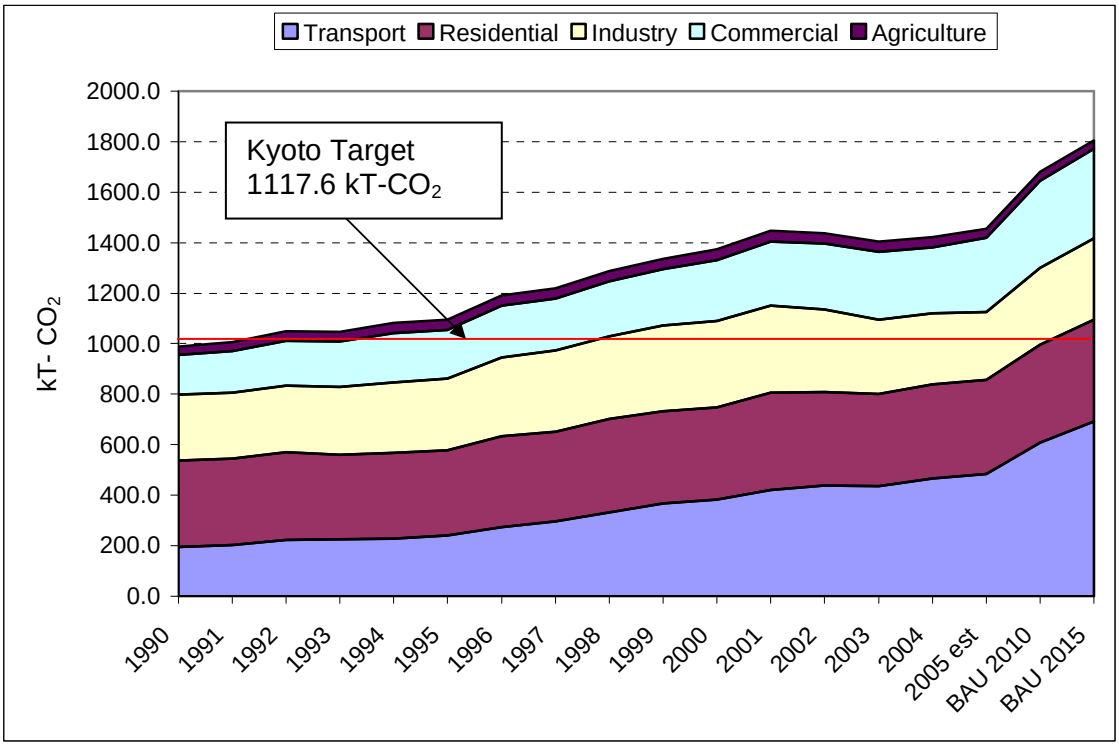


Chart 11.11: CO_2 Emissions by Sector, Limerick County, (1990 – 2015)

- The transport sector has shown the highest increase in level of emissions since 1990 with a 148% increase to 2005, and predicted increase of 255% by 2015.
- Emissions from the residential sector have remained relatively constant with an 10% increase since 1990. This reflects the increase energy efficiency of buildings and heating systems.
- The commercial sector has shown a 87% increase in emissions since 1990.

Table 11.9: CO2 Emissions by Sector, % Share, Limerick County, (1990 – 2015)

	1990	1995	2000	2002	2004	2005 est	BAU 2010	BAU 2015
Transport	19.7%	21.9%	27.7%	30.4%	32.7%	33.2%	36.2%	38.3%
Residential	34.6%	31.0%	26.7%	25.9%	26.3%	25.7%	23.1%	22.3%
Industry	26.3%	26.0%	24.8%	22.7%	19.8%	18.4%	18.2%	17.8%
Commercial	15.9%	17.6%	17.6%	18.1%	18.4%	20.2%	20.5%	19.7%
Agriculture	3.4%	3.6%	3.1%	2.9%	2.7%	2.5%	2.1%	1.9%

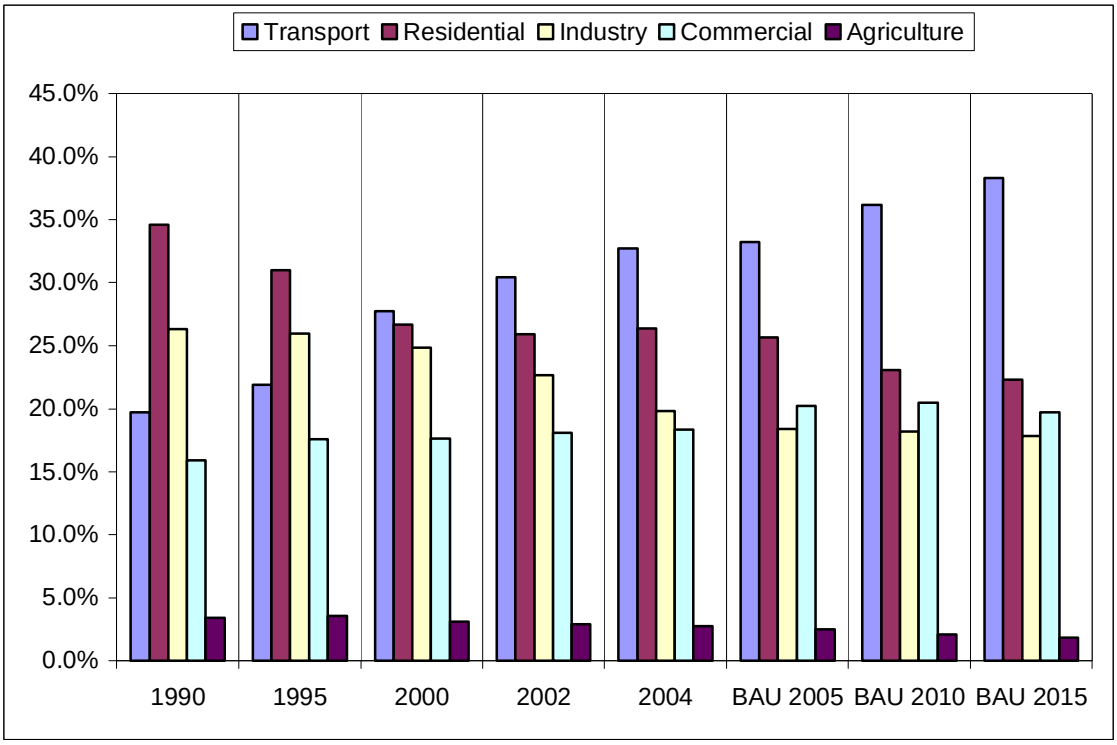


Chart 11.12: CO_2 Emissions by Sector, % Share, Limerick County, (1990 – 2015)

The changing in trend in emissions by Sector is clearly illustrated in the above Table and Chart.

- While in 1990 the residential and industrial sectors accounted for the greatest proportion of emissions i.e. 34% and 26% respectively, they now only account for 26% and 20% of emissions respectively.
- Industry has been overtaken by the commercial sector in terms of share of emissions.
- Transports emissions within the County show an increasing trend with BAU projections that this sector will account for close to 40% of all emissions in 2015.

11.4 Response to Kyoto

11.4.1 The size of the problem

Table 11.10: Analysis of Compliance with Kyoto and Potential Costs, Limerick County.

	Emissions (kT-CO2)	**Kyoto Target Exceedance** (kT-CO2)	**Projected Cost of CO2/ton Trading Price** (€)	**Annual Carbon Levy** (€millions)
1990	989.0	0.0	-	0.0
Kyoto Target (1990 + 13%)	1,117.6	0.0	-	0.0
1995	1,094.3	0.0	-	0.0
2000	1,374.8	257.2	-	0.0
2002	1,437.6	320.0	-	0.0
2004	1,421.8	304.2	-	0.0
2005 est	1,456.1	338.5	27.0	9.1
BAU 2010	1,680.5	562.8	35.0	19.7
BAU2015	1,805.9	688.3	45.0	31.0

It can be seen from the above Table that County Limerick has exceeded its Kyoto Target before 2000 and the Business and Usual scenario would see it generating approximately 563 kT CO_2 above its Kyoto Limit by 2010. Based on a potential price of €35 per tonne of CO_2 this could equate to a Carbon Levy of over €20 million per annum.

11.4.2 Sectoral Solutions

The following tables provide information on the range of actions that might be applicable in Limerick County to reduce emissions. This list is indicative only and the QIRs are discussed in further detail with the Climate Change Strategy.

11.4.2.1 Energy Supply and Production

Energy Production and Supply	**Quantified Indicative Reductions Proposed** ($kT\text{-}CO_2$)
Large Scale Wind Power - Hydro Power Schemes	
Small scale Wind Power - Biomass Wood	
Combined Heat & Power - Increased Electricity Generating Efficiency	
PV Solar - Small Scale Projects - Solar Panels for DHW	
Solar/Wind Powered Street Lighting	
Fuel switching	
Total	215

11.4.2.2 Transport

Transport	Quantified Indicative Reductions Proposed ($kT\text{-}CO_2$)
Alternative Fuels (Biofuels, Electric, Hybrids, etc.)	
Increased Public Transport Networks	
Convert Local Authority Fleets to Biofuels	
Electric Bicycles & Mopeds (PV Solar Charging Stations)	
Total	100

11.4.2.3 Built Environment and Residential

Public Buildings and Facilities	Quantified Indicative Reductions Proposed ($kT\text{-}CO_2$)
Energy Performance Buildings Directive	
Energy Efficiency at Local Authority buildings	
Energy Efficient Design for New LA Buildings	
Energy Monitoring and Targeting Systems	
Staff Energy Awareness and Training	
Annual Energy Surveys and Auditing	
Sustainable Public Buildings Energy Programmes	
Energy Management of Swimming Pools etc.	
Total	15

Residential sector	Quantified Indicative Reductions Proposed ($kT\text{-}CO_2$)
Sustainable L.A. Housing, Energy Policy - New Builds	
Sustainable Energy Measures in Remedial Works.	
Energy Performance Buildings Directive	
Switching to Natural Gas (Condensing Boilers)	
Existing Dwelling Insulation Measures Upgrade (Walls/Roofs/Windows)	
Energy Efficient Heating Systems and Controls	
Existing and New Dwellings Alternative Heating Systems	
Energy Efficient Electrical Appliances	
Domestic Green Energy Tariffs	
Energy Efficiency in Construction and Material Practices	
Total	25

11.4.2.4 Industrial/Commercial

Industry/Commercial	Quantified Indicative Reductions Proposed ($kT\text{-}CO_2$)
Commercial Buildings, Energy Rating Scheme	
Energy Performance Indicators per Operation Type	
Energy Performance Indicators for Water and Sewage Treatment	
Fuel switching to Natural Gas (Condensing Boilers)	
Existing Insulation Measures Upgrade (process pipe & ducts)	
Combined Heat & Power	
Green Energy Supply Tariffs	
Energy Monitoring & Targeting	
Energy Surveys & Audits	
Total	83

11.4.2.5 Agriculture

Agriculture	Quantified Indicative Reductions Proposed ($kT\text{-}CO_2$)
Agricultural Contractors National Tractor Test (Engine Efficiency)	
Anaerobic Digestion Integration to Biogas	
Small Scale Wind Projects	
Small Scale Hydroelectricity projects	
Energy Crops (Willow Coppice etc.)	
Total	92

11.4.2.6 Waste

Waste	Quantified Indicative Reductions Proposed ($kT\text{-}CO_2$)
Landfill Gas.	
Anaerobic Digestion Biogas - Organic / Green Wastes	
CHP - Sewage Waste Treatment Plants	
Transport Efficiency in Waste Collection Services	
Energy From Wood / Forestry Residues	
Total	32

11.4.2.7 Sinks (Land Use Change & Forestation)

Land Use Change & Forestation	Quantified Indicative Reductions Proposed ($kT\text{-}CO_2$)
Regional Forestry / Afforestation Inventory	
Local Authority Tree Planting	
Cultivation of "Energy Crops"	
Development of Private Forests	
Total	29

11.4.2.8 Sectoral Solution Summary

Overall QIRS by sector	Quantified Indicative Reductions Proposed ($kT\text{-}CO_2$)
Energy Production & Supply	215
Transport	100
Built Environment & Residential	40
Industry, Commercial, & Services	83
Agriculture	92
Waste	32
Sinks (Land Use Change & Forestation)	29
Total	590

11.4.3 Individual Responsibility

Table 11.11: TFC and CO_2 emissions Per Capita and Reductions Sought, Limerick County

Indicator	1990 Limerick County	KyotoTarget Limerick County 1990 + 13%Total	2002 Limerick County	2004 Limerick County	BAU 2010 Limerick County	Reduction Sought Limerick County
Population (000)	109.7	-	121.3	123.4	133.3	N/A
TFC Fuel Consumed (GWh)	2,713.3	-	4,284.4	4,474.2	5,014.6	-
Energy Related Emissions (kt-CO2)	989.0	1,117.6	1,437.6	1,393.8	1,680.5	562.8
TFC/Capita (kWh/ Inhabitant)	24,730.6	-	35,326.2	36,271.8	37,614.2	-
CO2 Emissions / Capita (T CO2 / Inhabitant)	9.0	9.2	11.9	11.3	12.6	4.6

- The TFC per person will have increased from just under 25,000kWh in 1990 to approximately 37,600 kWh in 2010. It reached 36,271 kWh in 2004. This has had a corresponding increase in emissions per person which has risen from 9.0 Tonnes CO_2 per person to 11.3 Tonnes CO_2 per person for 2004, and this is projected to increase to 12.7 Tonnes CO_2 per person in 2010.

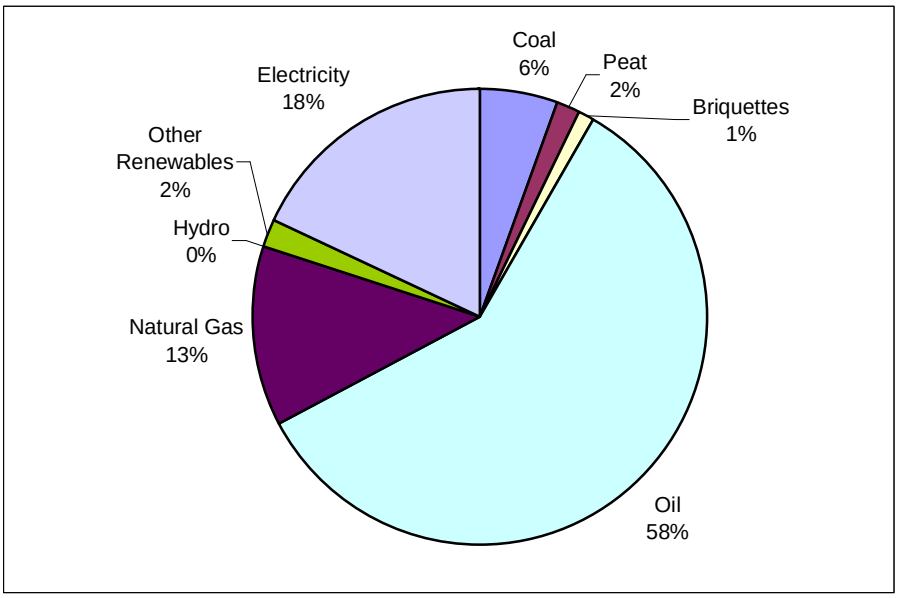
- County Limerick will be 563 KT CO_2 above its Kyoto Limit in 2010 and this will require a reduction of 4.6 Tonnes of CO_2 per person in the County if the Kyoto requirement is to be achieved.
- If the total range of QIRs indicated in Section 10.4.2 could be achieved the levels of reduction would be in the region of 30 kT CO_2 above the required reduction for the County.

12.0 Limerick City

12.1 Summary Analysis

12.1.2 Total Final Consumption and Emissions by Fuel

Chart 12.1: Total Final



Consumption by Fuel, Limerick City, 2004

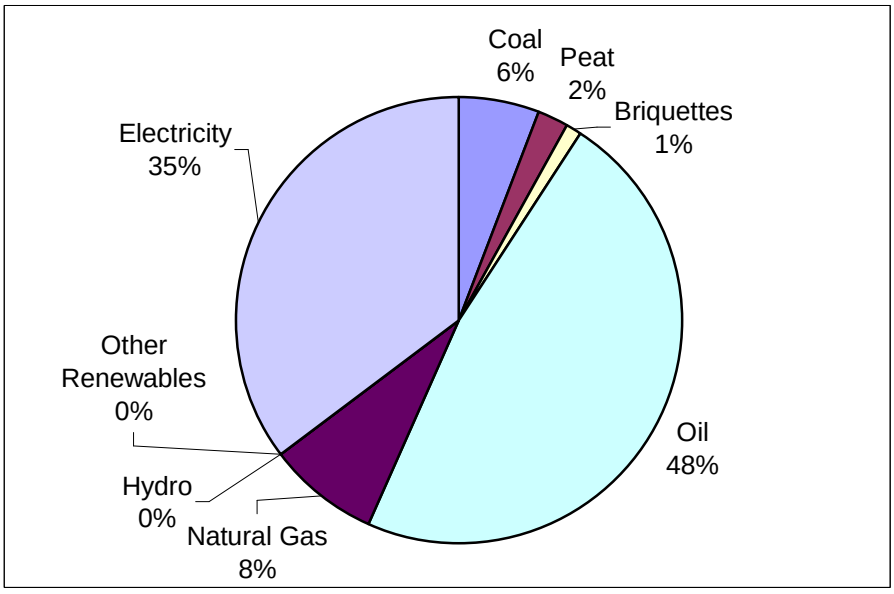


Chart 12.2: CO_2 Emissions by Fuel, Limerick City, 2004

- From the Charts above it can be seen that Oil accounts for the largest proportion of TFC in Limerick City, and is also the highest contributor in terms of CO_2 emissions.
- While electricity only accounts for 18% of TFC it accounts for 35% of emissions, due to its high emissions factor.

- Natural gas has an impact in terms of TFC and emissions in the City when compared to the County areas. It accounted for 13% of TFC in 2004 and continued to 8% of CO_2 Emissions.

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12.1.3 Total Final Consumption and Emissions by Sector

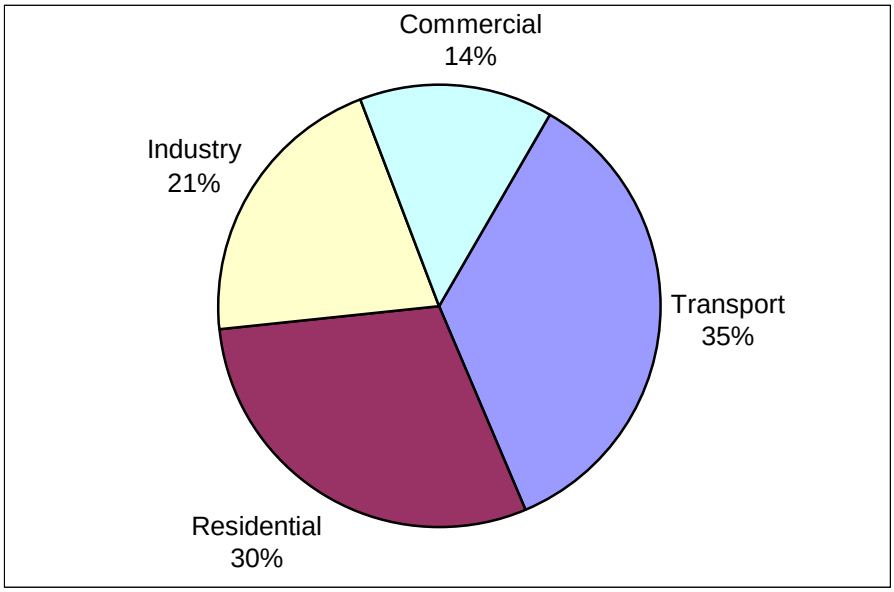

Chart 12.3: Total Final Consumption by Sector, Limerick City, 2004

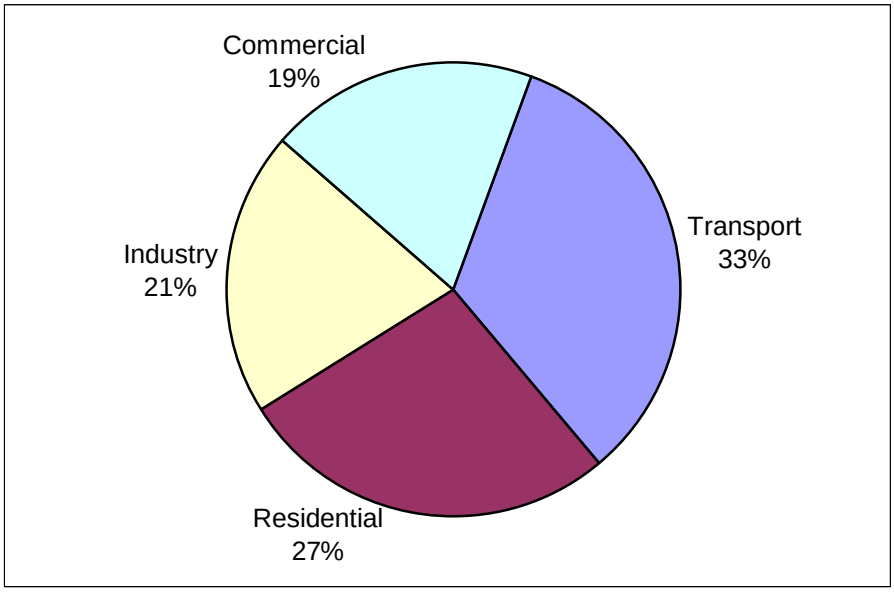

Chart 12.4: CO_2 Emissions by Sector, Limerick City, 2004

- Clearly the transport sector, in 2004, has the highest consumption in energy terms in the County, at 35%. It also currently accounts for 33% of CO_2 emissions.
- The residential sector is the next highest contributor in terms of emissions, at 27%, while it consumes 30% of TFC in the County.

- The industrial sector accounted for 21% of consumption in 2004 and a similar % of CO_2 emissions.
- The commercial sector currently only accounts for 19% of emissions

12.1.4 Environmental Indicators

Table 12.1: Environmental Indicators for Limerick City

	1991		2000		2004	
Indicator	**Ireland**	**Limerick City**	**Ireland**	**Limerick City**	**Ireland**	**Limerick City**
Population (000)	3,525.7	52.1	3,780.0	53.3	4,043.8	54.9
TFC Fuel Consumed (GWh)	85,662.7	1,192.3	123,593.0	1,564.5	136,718.0	1,665.2
Energy Related Emissions (kt-CO_2)	31,244.9	444.9	41,920.3	541.9	43,041.7	531.2
GVA (€million)	34,092.0	496.1	92,781.0	1,011.5	132,481.0	1,473.1
TFC/GVA (kWh/€thousand)	2,512.7	2,403.2	1,332.1	1,546.7	1,032.0	1,130.4
TFC/Capita (kWh/ Inhabitant)	24,296.5	22,892.9	32,696.6	29,331.2	33,809.3	30,306.1
CO_2 Emissions / Capita (T CO_2 / Inhabitant)	8.9	8.5	11.1	10.2	10.6	9.7

Table 12.1 provides a concise summary of the status of energy consumption and emissions in the City. Key points of note are

- Annual TFC/GVA is higher than the National Average. This would indicate that more energy needs to be used in the Limerick City to generate economic activity when compared to the National average. However it is considerably lower than the corresponding indicators for Limerick and Clare counties.
- The TFC per Capita in the City has been consistently below the National average, since 1991. This reflects the urban nature of the area under consideration, access to energy efficient fuels and the use of energy efficient technologies.
- Emissions per capita are also lower than the National average. This is primarily influenced by the fuel mix with access to natural gas having a positive affect.
- TFC and CO_2 emissions have increased by 39% and 19% respectively between 1991 and 2002, but GVA has increased by 164%, which would indicate that there has been some decoupling of economic growth from energy consumption and related emissions.

12.2 Energy Analysis

12.2.1 Total Final Consumption by Fuel

Table 12.2: Total Final Consumption, Limerick City, (1990 – 2015)

GWh	1990	1995	2000	2002	2004	2005 est	BAU 2010	BAU 2015
Coal	151.5	68.4	91.2	84.8	91.8	83.2	50.8	39.7
Peat	103.2	86.8	31.4	30.5	30.5	28.0	18.1	12.0
Briquettes	30.2	22.3	21.6	19.8	15.5	14.2	9.2	6.1
Oil	514.7	698.1	920.2	933.1	981.6	1,013.0	1,185.8	1,296.4
Natural Gas	105.5	132.2	198.9	191.0	213.4	225.2	294.3	351.2
Hydro	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other RES	20.2	23.4	23.2	24.8	31.2	31.1	30.6	30.2
Electricity	179.8	221.7	278.0	295.8	301.2	312.4	374.6	391.8
TFC	1,104.9	1,253.0	1,564.5	1,579.8	1,665.2	1,707.0	1,963.4	2,127.3

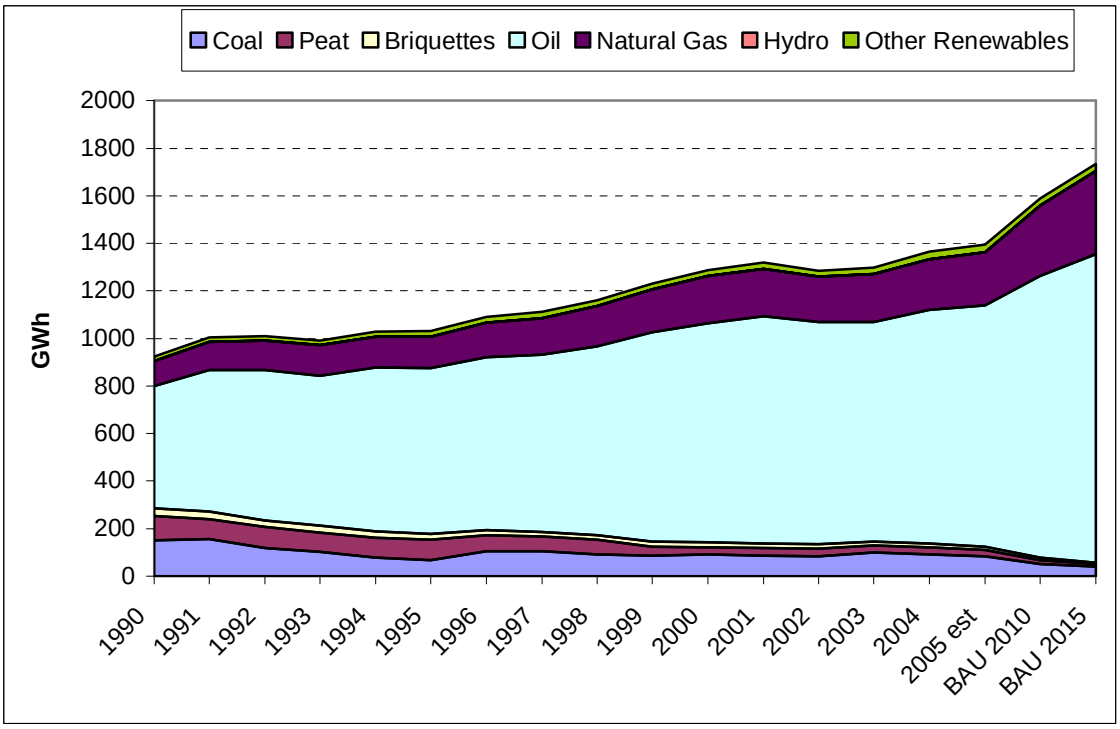

Chart 12.5: Total Final Consumption by Fuel, Limerick City, (1990 – 2015)

- The dependence on oil as a fuel is significant and a cause for concern with a 90% increase in consumption occurring from 1990 to 2004. The BAU scenario will see the 1990 consumption increase by 150% by 2015.
- The use of natural gas as a fuel is increasing significantly, and this is reflected with a doubling in consumption between 1990 and 2005. By 2015 the usage of natural gas could have increased by 233%.
- Electricity use continues to grow at a significant rate with consumption in 1990 (180 GWh) doubling to 312GWh by 2005.
- The TFC for the City has increased by 55% since 1991 and is projected to nearly double by 2015.

Table 12.3: Total Final Consumption by Fuel, % Share, Limerick City, (1990 – 2015)

	1990	1995	2000	2002	2004	2005 est	BAU 2010	BAU 2015
Coal	11.2%	4.6%	5.0%	4.6%	4.9%	4.4%	2.3%	1.7%
Peat	7.4%	5.7%	1.6%	1.4%	1.4%	1.3%	0.7%	0.4%
Briquettes	2.2%	1.5%	1.1%	0.9%	0.7%	0.7%	0.4%	0.2%
Oil	55.8%	62.1%	64.1%	64.8%	64.1%	64.5%	65.4%	66.0%
Natural Gas	8.0%	8.9%	10.9%	10.2%	11.0%	11.3%	12.8%	14.1%
Hydro	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Other RES	1.5%	1.6%	1.4%	1.5%	1.8%	1.8%	1.5%	1.4%
Electricity	13.9%	15.7%	16.0%	16.5%	16.0%	16.2%	16.9%	16.3%

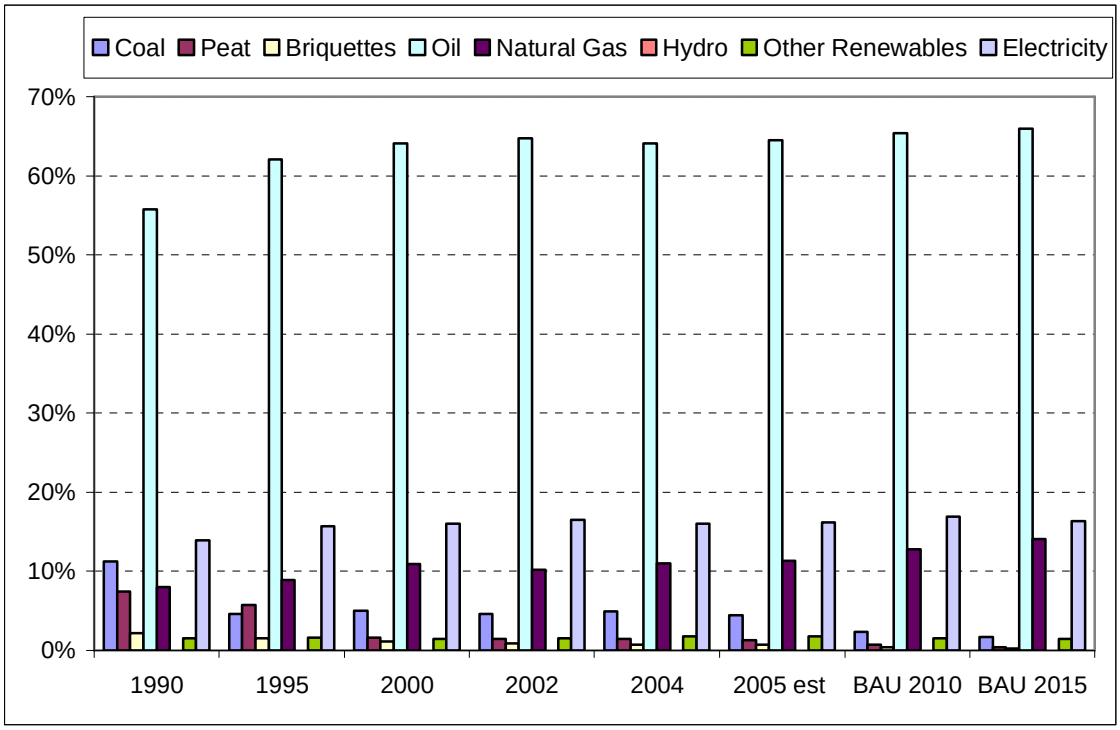

Chart 12.6: Total Final Consumption by Fuel, % Share, Limerick City, (1990 – 2015)

- The increasing dependence on oil is further emphasised when analysing the data by % Share. This has grown from 55% in 1990 to 65% in 2005.
- The % Share of electricity in terms of TFC has remained relatively stable since 2000 at 16%.
- Natural gas was introduced into the City around 1987 and currently accounts for approximately only 11% of TFC. This is projected to grow slightly by 2015.

12.2.2 Total Final Consumption by Sector

Table 12.4: Total Final Consumption by Sector, Limerick City, (1990 – 2015)

(GWh)	1990	1995	2000	2002	2004	2005 est	BAU 2010	BAU 2015
Transport	287.6	333.7	505.8	544.2	584.9	618.2	767.6	885.9
Residential	385.5	386.5	450.5	460.2	498.0	506.4	526.6	557.1
Industry	320.3	325.4	379.9	351.7	346.2	334.7	381.0	407.1
Commercial	180.8	207.1	228.1	223.5	234.7	247.6	288.2	277.2
Total	1,174.1	1,252.8	1,564.3	1,579.6	1,663.7	,1707.0	1,963.4	2,127.3

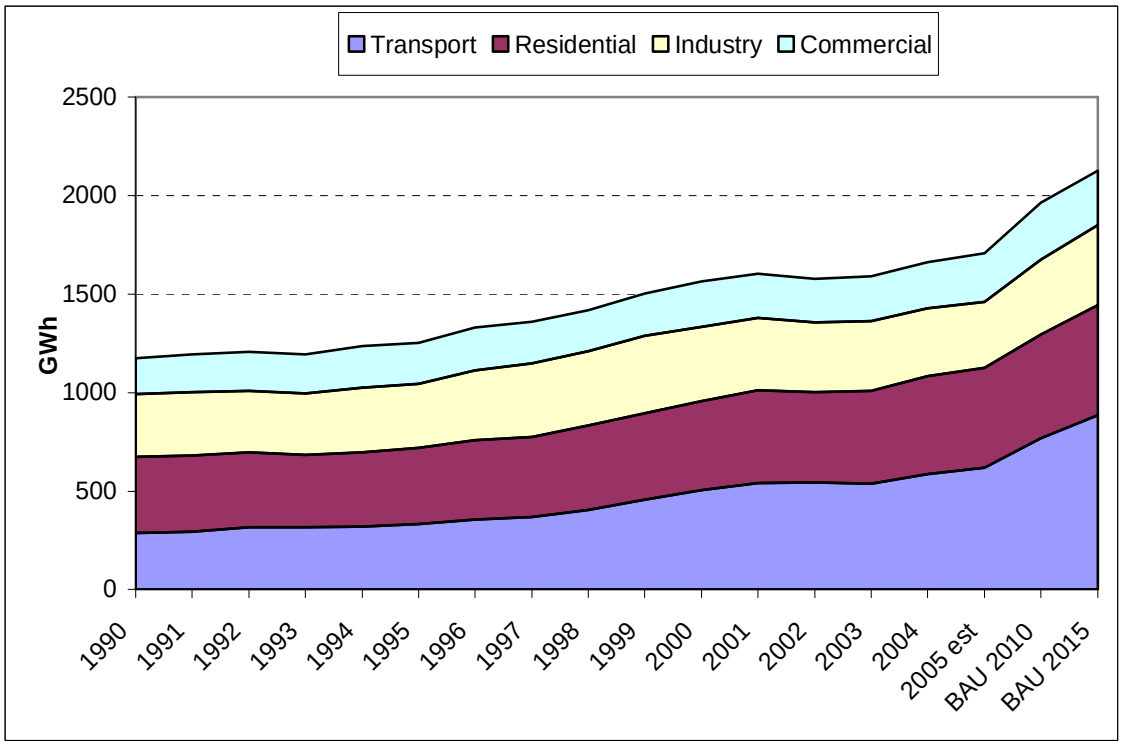

Chart 12.7: Total Final Consumption by Sector, Limerick City, (1990 – 2015)

The analysis of consumption by sector indicates the following key issues:

- The TFC for the City has grown by 45% since 1990 and the business as usual forecast indicates the TFC will nearly double from 1,174 GWh to 2,127 GWh in 2010.
- Transport will account for the greatest growth in TFC by 2015, with a projected increase of 208% above 1990 levels.
- The increased level of housing is reflected in the fact that the residential sectors TFC has grown by 32% since 1990 and is predicted to increase by another 15% by 2015.
- The commercial sector has shown a higher increase in consumption when compared to the Industrial sector since 1990 (37% for commercial compared to 5% for industry). The low increase in TFC for the industrial sector could reflect significant improvements in energy intensity within the industrial sector over the period.

Table 12.5: Total Final Consumption by Sector, % Share, Limerick City, (1990 – 2015)

% Share	1990	1995	2000	2002	2004	2005 est	BAU 2010	BAU 2015
Transport	24.5%	26.6%	32.3%	34.5%	35.2%	36.2%	39.1%	41.6%
Residential	32.8%	30.9%	28.8%	29.1%	29.9%	29.7%	26.8%	26.2%
Industry	27.3%	26.0%	24.3%	22.3%	20.8%	19.6%	19.4%	19.1%
Commercial	15.4%	16.5%	14.6%	14.1%	14.1%	14.5%	14.7%	13.0%

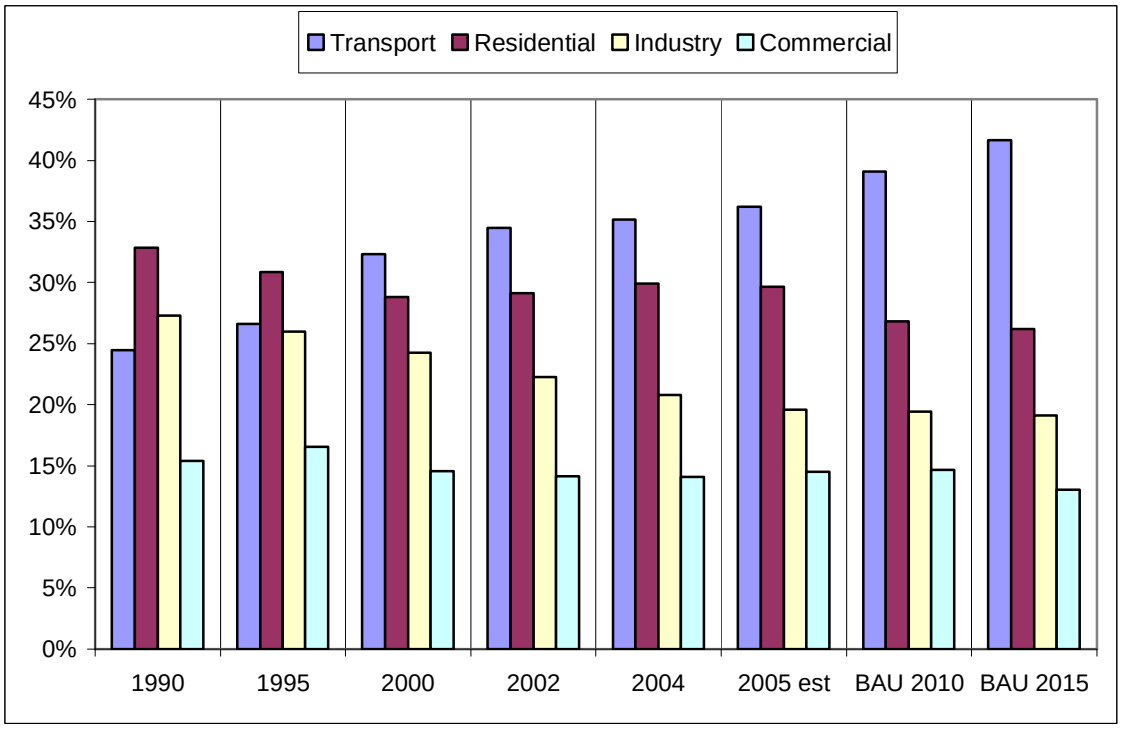

Chart 12.8: Total Final Consumption by Sector, % Share, Limerick City, (1990 – 2015)

- Similar to trends Nationally and in the surrounding Counties the transport sector is now the main energy consumer, accounting for 36% of TFC in 2005. This is projected to increase to 42% by 2015.
- While the total TFC for the residential sector has been shown to be increasing its % Share of the TFC has remained relatively constant (32%-29%). This would indicate that the energy efficiency of the housing stock is improving, as would be expected.
- While the commercial sector has been shown to have higher growth rates in terms of TFC the industrial sector still remains as the third highest consumer at 20% in 2005.

12.3 Environmental Analysis

12.3.1 CO_2 Emission by Fuel

Table 12.6: CO_2 Emissions by Fuel, Limerick City, (1990 – 2015)

kT-CO_2	1990	1995	2000	2002	2004	2005 est	BAU 2010	BAU 2015
Coal	51.6	23.3	31.1	28.9	31.3	28.3	17.3	13.5
Peat	38.6	32.5	11.7	11.4	11.4	10.5	6.8	4.5
Briquettes	10.7	7.9	7.7	7.0	5.5	5.1	3.3	2.2
Oil	131.7	178.9	236.6	240.0	252.7	260.0	304.4	332.8
Natural Gas	20.9	26.2	39.3	37.8	42.2	44.5	58.2	69.5
Hydro	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other RES	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Electricity	165.0	198.0	215.5	212.2	188.0	195.0	233.8	244.5
Total	418.6	466.8	541.9	537.3	531.2	543.4	623.8	667.0
Kyoto Target (1990 + 13%)	473.0	473.0	473.0	473.0	473.0	473.0	473.0	473.0

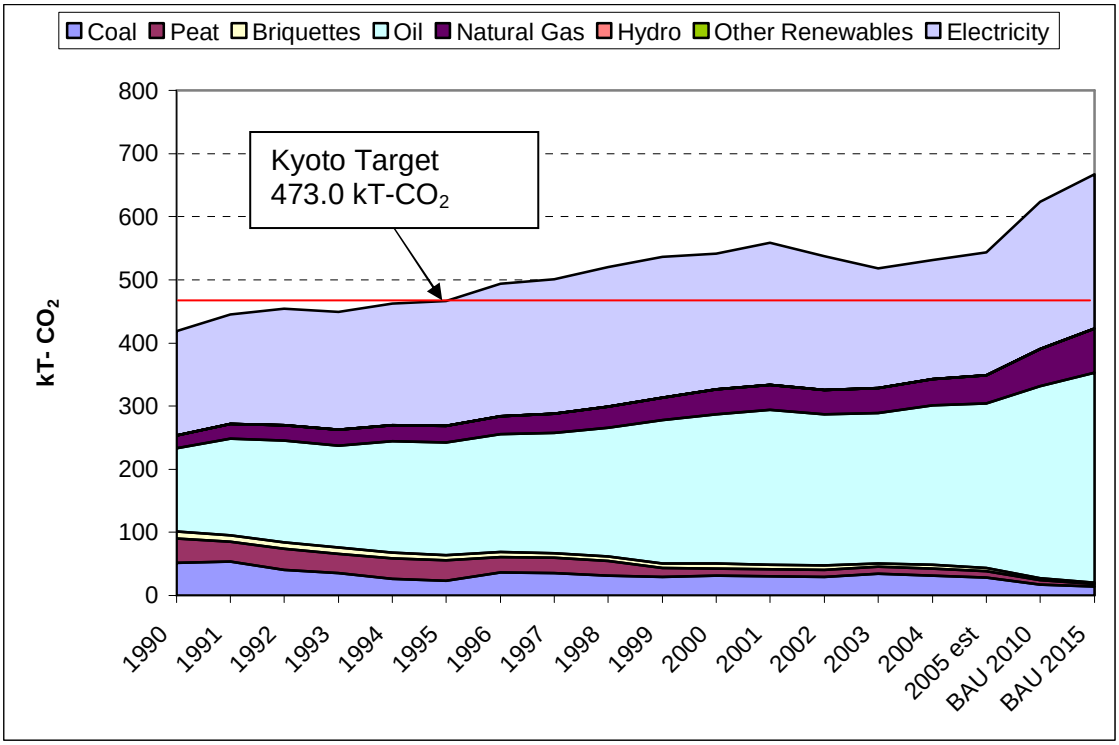

Chart 12.9: CO_2 Emissions by Fuel, Limerick City, (1990 – 2015)

- Emissions from oil use have increased from 131 to 260 kT CO_2 since 1990. Emissions from electricity have increased by 20% since 1990 and will have increased by 50% by 2015.
- Natural gas emissions have increased by over 100% since 1990, reflecting its increased penetration into the City.

- Limerick City exceeded its Kyoto Target before 2000.

Table 12.7: CO2 Emissions by Fuel, % Share, Limerick City, (1990 – 2015)

% Share CO_2	1990	1995	2000	2002	2004	BAU 2005	BAU 2010	BAU 2015
Coal	12.3%	5.0%	5.7%	5.4%	5.9%	5.2%	2.8%	2.0%
Peat	9.2%	7.0%	2.2%	2.1%	2.2%	1.9%	1.1%	0.7%
Briquettes	2.6%	1.7%	1.4%	1.3%	1.0%	0.9%	0.5%	0.3%
Oil	31.5%	38.3%	43.7%	44.7%	47.6%	47.9%	48.8%	49.9%
Natural Gas	5.0%	5.6%	7.3%	7.0%	7.9%	8.2%	9.3%	10.4%
Hydro	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Other RES	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Electricity	39.4%	42.4%	39.8%	39.5%	35.4%	35.9%	37.5%	36.7%

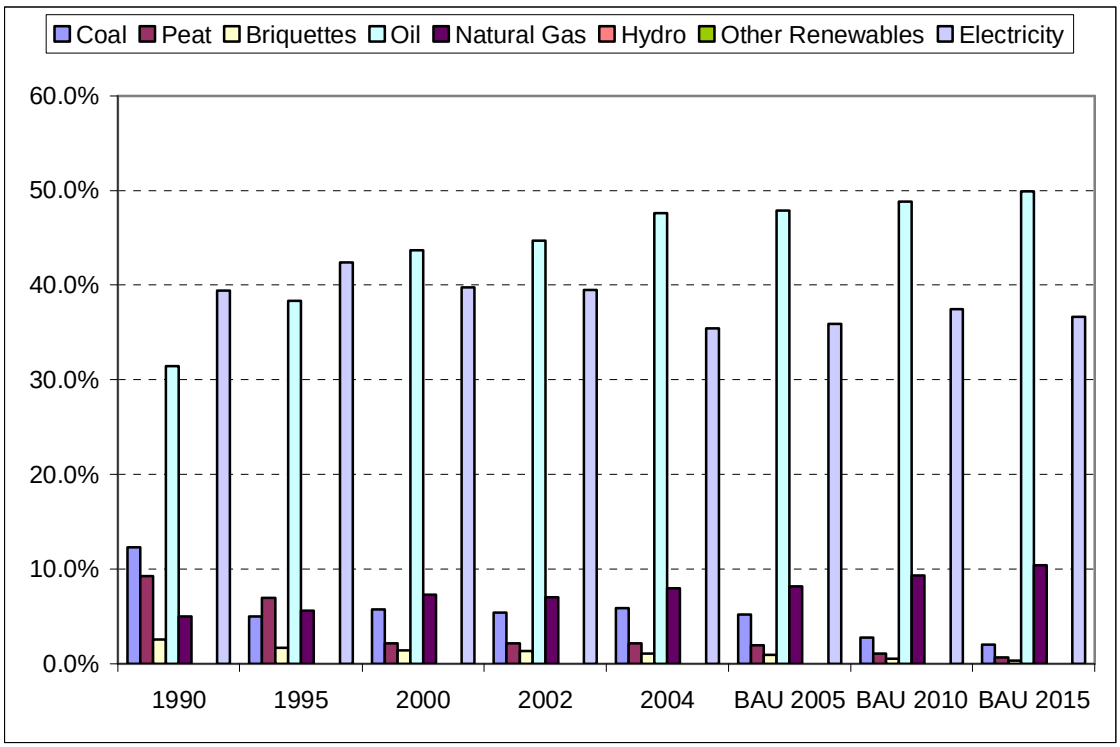

Chart 12.10: CO_2 Emissions by Fuel, % Share, Limerick City, (1990 – 2015)

- The increased use of oil and its contribution to emissions is an important trend which will need serious action to affect change. As it accounts for close to 50% of current emissions in Limerick City considerable action will be required to reduce this consumption.
- Electricity is the next highest contributor with 35% of emissions, with natural gas accounting for 8% in 2005. This emissions profile differs from the County profiles with natural gas replacing emissions from oil.

12.3.2 Emission by Sector

Table 12.8: CO_2 Emissions by Sector, Limerick City, (1990 – 2015)

kT-CO_2	1990	1995	2000	2002	2004	2005 est	BAU 2010	BAU 2015
Transport	86.1	106.4	154.5	167.3	177.4	183.9	228.9	258.5
Residential	148.4	148.8	148.9	143.1	143.6	142.8	147.2	151.9
Industry	113.8	125.5	138.8	125.7	109.0	103.4	116.7	122.0
Commercial	70.2	86.2	99.7	101.2	101.2	113.3	131.1	134.6
Total	418.6	466.8	541.9	537.3	531.2	543.4	623.8	667.0
Kyoto Target	473.0	473.0	473.0	473.0	473.0	473.0	473.0	473.0

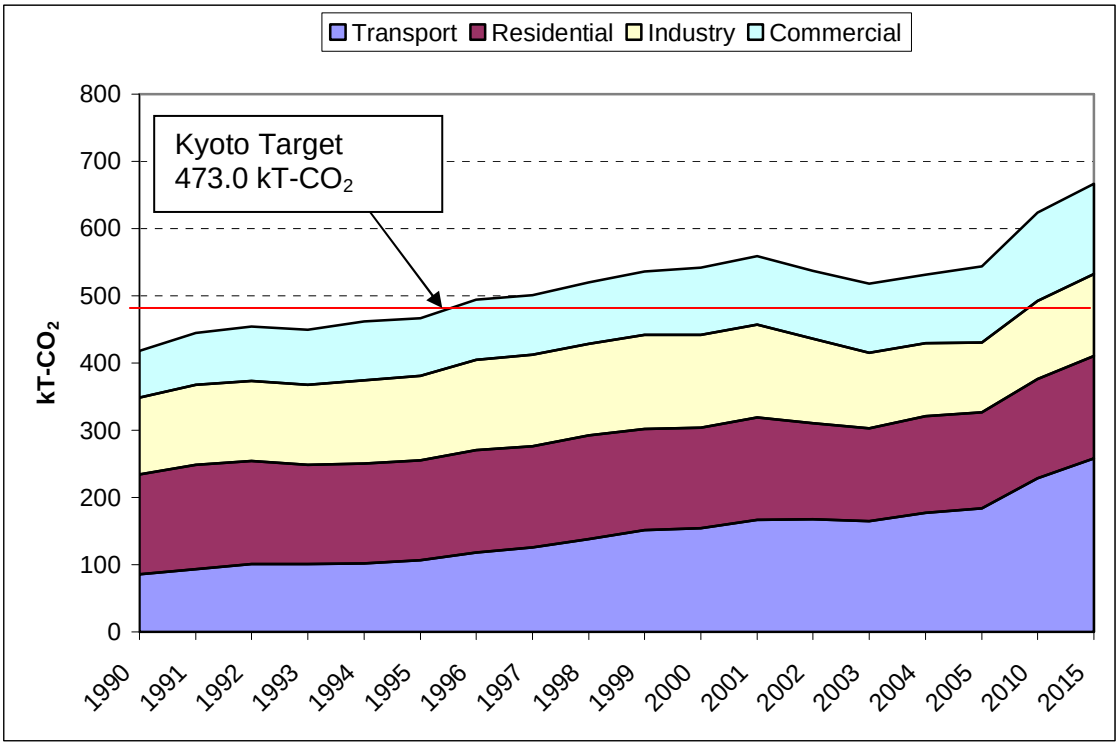

Chart 12.11: CO_2 Emissions by Sector, Limerick City, (1990 – 2015)

- The transport sector has shown the highest increase in levels of emissions since 1990 with a 114% increase to 2005, and projected increase of 200% by 2015.
- The residential sector has seen little or no change in the total emissions in the City since 1990. This is the only sector to see such a trend with the City and surrounding Counties. This reflects increased energy efficiencies within the housing stock and the increased usage of natural gas within this sector.
- The commercial sector has shown a 61% increase in emissions since 1990.
- The industrial sector emissions have fluctuated over the period with emissions in 2005 being 10% below those in 1990
- Total emissions for Limerick City have shown a 30% rise since 1990 and this is projected to double to 60% by 2015 under the BAU Scenario.

Table 12.9: CO_2 Emissions by Sector, % Share, Limerick City, (1990 – 2015)

	1990	1995	2000	2002	2004	2005 est	BAU 2010	BAU 2015
Transport	20.6%	22.8%	28.5%	31.1%	33.4%	33.8%	36.7%	38.8%
Residential	35.5%	31.9%	27.5%	26.6%	27.0%	26.3%	23.6%	22.8%
Industry	27.2%	26.9%	25.6%	23.4%	20.5%	19.0%	18.7%	18.3%
Commercial	16.8%	18.5%	18.4%	18.8%	19.1%	20.9%	21.0%	20.2%

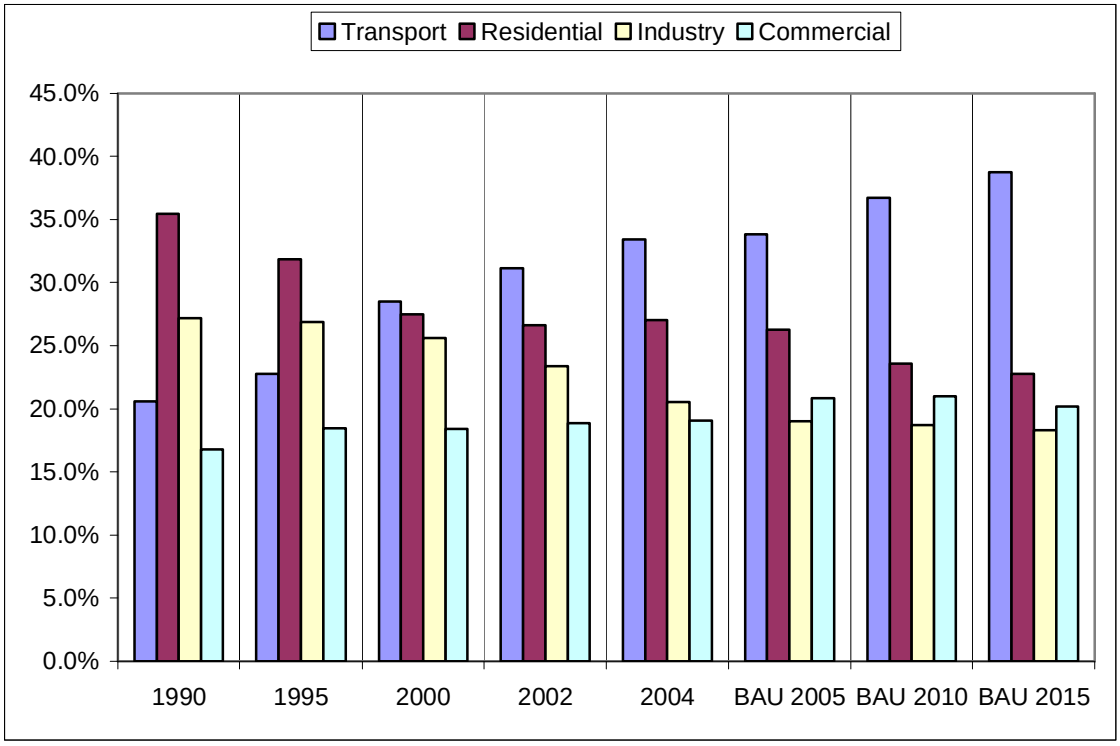

Chart 12.12: CO_2 Emissions by Sector, % Share, Limerick City, (1990 – 2015)

The changing in trend in emissions by Sector is clearly illustrated in the above Table and Chart.

- While in 1990 the residential and industrial sectors accounted for the greatest proportion of emissions i.e. 36% and 27% respectively, they now only account for 26% and 19% of emissions respectively.
- Industry and commercial sector are also most equal in terms of share of emissions.
- Transport's emissions and its % share within the City show an increasing trend with projections that this sector will account for close to 40% of all emissions in 2015.

12.4 Response to Kyoto

12.4.1 The size of the problem

Table 12.10: Analysis of Compliance with Kyoto and Potential Costs, Limerick City

	Emissions ($kT\text{-}CO_2$)	**$K_y$oto Target Exceedance** ($kT\text{-}CO_2$)	**Projected Cost of CO2/ton Trading Price (€)**	**Annual Carbon Levy** (€millions)
1990	418.6	0	-	0
Kyoto Target (1990 + 13%)	473.0	0	-	0
1995	466.8	0	-	0
2000	541.9	68.9	-	0
2002	537.3	64.3	-	0
2004	531.2	58.2	-	0
2005 est	543.4	70.4	27	1.9
BAU 2010	623.8	150.8	35	5.3
BAU2015	667	194	45	8.7

It can be seen from the above Table that Limerick City has exceeded its Kyoto Target since before 2000 and the BAU scenario would see it generating approximately 150 kT CO_2 above its Kyoto Limit by 2010. Based on a potential price of €35 per tonne of CO_2 this could equate to a Carbon Levy of over €5.3 million per annum.

12.4.2 Sectoral Solutions

The following tables provide information on the range of actions that might be applicable in Limerick City to reduce emissions. This list is indicative only and the Quantified Indicative Reductions (QIRs) are discussed in further detail with the Climate Change Strategy.

12.4.2.1 Energy Supply and Production

Energy Production and Supply	**Quantified Indicative Reductions Proposed** ($kT\text{-}CO_2$)
Combined Heat & Power - Increased Electricity Generating Efficiency	
PV Solar - Small Scale Projects - Solar Panels for DHW	
Solar/Wind Powered Street Lighting	
Fuel switching	
Total	60

12.4.2.2 Transport

Transport	Quantified Indicative Reductions Proposed ($kT\text{-}CO_2$)
Alternative Fuels (Biofuels, Electric, Hybrids, etc.)	
Increased Public Transport Networks	
Convert Local Authority Fleets to Biofuels	
Electric Bicycles & Mopeds (PV Solar Charging Stations)	
Total	32

12.4.2.3 Built Environment and Residential

Public Buildings and Facilities	Quantified Indicative Reductions Proposed ($kT\text{-}CO_2$)
Energy Performance Buildings Directive	
Energy Efficiency at Local Authority Builidnigs	
Energy Efficient Design for New LA Buildings	
Energy Monitoring and Targeting Systems	
Staff Energy Awareness and Training	
Annual Energy Surveys and Auditing	
Sustainable Public Buildings Energy Programmes	
Energy Management of Swimming Pools etc.	5

Residential sector	Quantified Indicative Reductions Proposed ($kT\text{-}CO_2$)
Sustainable L.A. Housing, Energy Policy - New Builds	
Sustainable Energy Measures in Remedial Works.	
Energy Performance Buildings Directive	
Switching to Natural Gas (Condensing Boilers)	
Existing Dwelling Insulation Measures Upgrade (Walls/Roofs/Windows)	
Energy Efficient Heating Systems and Controls	
Existing and New Dwellings Alternative Heating Systems	
Energy Efficient Electrical Appliances	
Domestic Green Energy Tariffs	
Energy Efficiency in Construction and Material Practices	
Total	15

12.4.2.4 Industrial/Commercial

Industry/Commercial	Quantified Indicative Reductions Proposed ($kT\text{-}CO_2$)
Commercial Buildings, Energy Rating Scheme	
Energy Performance Indicators per Operation Type	
Energy Performance Indicators for Water and Sewage Treatment	
Fuel switching to Natural Gas (Condensing Boilers)	
Existing Insulation Measures Upgrade (process pipe & ducts)	
Combined Heat & Power	
Green Energy Supply Tariffs	
Energy Monitoring & Targeting	
Energy Surveys & Audits	
Total	30

12.4.2.5 Agriculture

Agriculture	Quantified Indicative Reductions Proposed ($kT\text{-}CO_2$)
Agricultural Contractors National Tractor Test (Engine Efficiency)	
Anaerobic Digestion Integration to Biogas	
Small Scale Wind Projects	
Small Scale Hydroelectricity projects	
Energy Crops (Willow Coppice etc.)	
Total	N/A

12.4.2.6 Waste

Waste	Quantified Indicative Reductions Proposed ($kT\text{-}CO_2$)
Landfill Gas.	
Anaerobic Digestion Biogas - Organic / Green Wastes	
CHP - Sewage Waste Treatment Plants	
Transport Efficiency in Waste Collection Services	
Energy From Wood / Forestry Residues	
Total	10

12.4.2.6 Sinks (Land Use Change & Forestation)

Land Use Change & Forestation	Quantified Indicative Reductions Proposed ($kT\text{-}CO_2$)
Regional Forestry / Afforestation Inventory	
Local Authority Tree Planting	
Cultivation of "Energy Crops"	
Development of Private Forests	
Total	N/A

12.4.2.7 Sectoral Solution Summary

Overall QIRS by sector	Quantified Indicative Reductions Proposed ($kT\text{-}CO_2$)
Energy Production & Supply	60
Transport TBA 100	32
Built Environment & Residential	20
Industry, Commercial, & Services	30
Agriculture	0
Waste	10
Sinks (Land Use Change & Forestation)	0
Total	154

12.4.3 Individual Responsibility

Table 12.11: TFC and CO_2 emissions Per Capita and Reductions Sought, Limerick City:

Indicator	1990 Limerick City	KyotoTarget Limerick City 1990 + 13%Total	2004 Limerick City Total	2010 Limerick CityTotal	Reduction Sought Limerick City
Population (000)	52.8	-	54.9	57.6	N/A
TFC Fuel Consumed (GWh)	1,174.1	-	1,663.7	1,963.4	-
Energy Related Emissions ($kt\text{-}CO_2$)	418.6	473.0	531.2	623.8	150.8
TFC/Capita (kWh/ Inhabitant)	22,243.9	-	30,278.2	34,080.3	-
CO2 Emissions / Capita (T CO2 / Inhabitant)	7.9	8.6	9.7	10.8	2.7

- The TFC per person will have increased from 22,243.9kWh in 1990 to 34,080.3 kWh in 2010. It reached 30278.2 kWh in 2004. This has had a corresponding increase in emissions per person which has risen from 7.9 Tonnes CO_2 per person to 9.7 Tonnes CO_2 per person in 2004, and this will increase to 10.8 Tonnes CO_2 per person in 2010.

- Limerick City will be 150 kT-CO_2 above its Kyoto Limit in 2010. This will require a reduction of 2.8 Tonnes of CO_2 per person in the City if the Kyoto requirement is to be achieved.
- If the total range of QIRs indicated in Section 10.4.2 could be achieved the levels of reduction would be in the region of 4kT CO_2 above the required reduction for the City.

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APPENDICES

Appendix 1: Glossary

Abatement Costs	Costs involved to reach targets set out in the NCCS to reduce GHG Emissions
IPCC	International Panel on Climate Change
Mt:.....	Million Tonnes
BAU	Business As Usual where projections of Greenhouse Gas Emissions are calculated based on measures that have been implemented to date with no further actions over the the projected time period
CH_4, ...	Methane Gas
CO_2, ...	Carbon Dioxide
COP.....	Conference of Parties
COP/MOP.....	Conference of the Parties seving as the meeting of the parties to the Kyoto Protocol,
CSO.....	Central Statistics Office
DCMNR	Department of Communciations Marine and Natural resources
DoEHLG	Department of Environment, Heritage and Local Government
ESRI	Economic Social Research Institute
EU.....	European Union
EU25.....	European Union of 25 Member States following enlargement in
GHG ……..	Greeenhouse Gases made up of the following 6 gases • Carbon dioxide (CO_2) • Methane (CH_4) • Nitrous oxide (N_2O) • Hydrofluorocarbons (HFCs) • Perfluorocarbons (PFCs) • Sulphur hexafluoride (SF_6)
GIC	Gross Internal Consumption is the quantity of Enegry consumed with in the borders of the country and it equates to Total Primary Energy Consumption.
GVA	Gross Value Added at basic prices is a measure of the value of goods and services produced priced at the value received by the producer minus product taxes payable and plus subsidies on products receivable.
GWh,.....	Gigawatthours (1 million kWh)
Ha, ...	Hectares
HFCs,.....	HydroFlourocarbon Gas
INC,	ıntergovernmental Negotiating Committee for the)
kT, ...	kilo-Tonne (1,000 tonnes)
kW, ...	kilo-Watt (1,000 Watts)
LCEA, ...	Limerick Clare Energy Agency
MW	MegaWatt (1,000 kW)
MWRA	MidWestern Regional Authority
N_2O.....	Nitrous Oxide Gas
NUI ……	National University of Ireland
OECD ….....	Organisation for Economic Cooperation and Development
Other RES…….	Other Renewable Energy Sources
PFCs.....	Perfluorocarbons
SF_6.....	Sulphur Hexafluoride
QIR	Quantified Indicative Reductions measures the reductions required in CO_2 to Reach Kyoto Target

TFC.....	Total Final Consumption is eqult to Total Primary Energy less the
.....	energy loses occur in transforming Primary Energy into forms
.....	suitable for the end user
TPEC	Total Primary Energy Consumption, is equal to the total amunt of
.....	energy used within the borders of a country in a ny given year
TWh, ...	Tetrawatthours
UK,.....	United Kingdom
UNFCCC.....	United Nation Framework Convention on Climate change
US, ...	United States
WCC, 20.....	World Climate Conference
WM	With Measures which takes account of actions laid out in the NCCS to reduce GHG emissions

Appendix 2: CO_2 Emission Factors

	Conversion Factor	
Fuel	**t CO_2/TJ**	**g CO_2/kWh**
Coal	94.60	340.56
Peat (Milled)	110-115	396-414
Briquettes	98.86	355.90
Sod Peat	104.00	374.40
Gasoline	69.96	251.86
Kerosene	71.40	257.04
Fuel Oil	76.00	273.60
LPG	63.70	229.32
Gasoil	73.30	263.88
Natural Gas (Kinsale)	54.94	197.78
Natural Gas (UK)	57.20	205.92
Natural Gas (import and indigenous average)	56.77	204.38

Source: "Energy Trends in Ireland, 1995 – 2004. SEI, 2006.

	Conversion Factor	
Electricity (Year)	**t CO_2/TJ**	**g CO_2/kWh**
1990	918.17	255.15
1991	927.32	257.69
1992	929.98	258.43
1993	915.66	254.45
1994	925.56	257.20
1995	893.11	248.18
1996	881.61	244.99
1997	856.58	238.03
1998	850.67	236.39
1999	816.20	226.81
2000	775.12	215.39
2001	790.90	219.78
2002	717.28	199.32
2003	650.54	180.78
2004	624.20	173.45

Source: "Energy Trends in Ireland, 1995 – 2004. SEI, 2006.