

Final Report

Energy and Emissions Balance For County Tipperary

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This work has been completed with assistance from
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Acknowledgements

The authors would like to acknowledge the following:

Name	Organisation
Lisa McGuire	Environmental Protection Agency
Valerie Lawless	Environmental Protection Agency
Elaine Hattie	Bord Gais
Martin Howley	Sustainable Energy Ireland
Jim Linehan	Central Statistics Office
Brendan Power	Tipperary Energy Agency

Executive Summary

The Tipperary Energy Agency (TEA) was established in 1998 to promote and develop sustainable energy in County Tipperary. It completed a Emissions and Energy Balance in 2000 and this report is an update 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. This report focuses on the emission of Carbon Dioxide (CO₂).

The quantity of global energy consumption is increasing as the economies of China, India and other developing countries expand. The developed nations of the world account for the majority of energy usage. Within the EU 25 the change in energy consumption has been significant with 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 requirements and fines, which signatories will have to abide by. The EU has been 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 13.2% 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 new NCCS has been published in April 2007.

Ireland's 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. 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 CO₂ 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 area of County Tipperary. The County is divided in two political areas: North Tipperary situated in the Mid-West Region and South Tipperary, situated in the South-East Region. It has a range of natural resources which present significant opportunities for development of indigenous energy sources. Accounting for approximately 3.5% of the National Population it covers an area of over 4,300 square kilometres. Other principle statistics include a total number of households of approximately 50,000, 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. 3.2% of the National employment in the Industrial and

Commercial Sectors is based in the study region. 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.

Analysis of energy and emissions has been completed within North Tipperary and South Tipperary separately and also on a County basis. The data for North Tipperary has been added to data for Counties Limerick and Clare and Limerick City. 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 region.

There are no major energy users and no major energy producers in County Tipperary. However, seven sites in the County are dealt with under the National Emissions Trading scheme and it is likely that the TEA will have a limited input to action at these sites. These sites all together are allocated 150.65 kt CO₂ emissions per annum.

Within the County, North Tipperary and South Tipperary account for approximately the same share of TFC and of CO₂ emissions. The Transport sector has emerged as the sector with the greatest share of TFC in 2004 at 44.5%. It also accounted for the highest share of CO₂ emissions at 37% followed by the residential sector at 24.3%. This is expected to increase to 40% by 2010. Oil is the predominant fuel used in the area and it accounted for 61% of all CO₂ emissions in 2004.

Analysis of the energy usage per capita in the study region indicated that both North Tipperary and South Tipperary 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 CO₂ emissions per person.

County Tipperary is projected to exceed the requirements as set out under the Kyoto Protocol in terms of CO₂ emissions. The total quantity of CO₂ savings that will be required in the study area is estimated to be approximately 625 kTonnes of CO₂ by 2010. This equates to a value of 4.5 Tonnes of CO₂ per person in the County (4.8 Tonnes of CO₂ per person in North Tipperary and 4.2 Tonnes of CO₂ per person in South Tipperary).

Common trends appeared across the two political areas of County Tipperary:

- Oil is the predominant fuel of choice and accounts for almost 70% of TFC.
- Natural Gas has had limited penetration to date, especially in North Tipperary, 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 areas with a 45% 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 electricity accounts for approximately 30% of all energy related CO₂ 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 CO₂ emissions in the short term.

North Tipperary could exceed the 2010 Kyoto limit by 346 kTonnes of CO₂. This could equate to a Carbon Levy of €12 million. The corresponding figures for South Tipperary are 279 kTonnes and €9.8 million.

However, the potential CO₂ 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. Achieving these reductions will require commitment, financial, technical and administrative support and in some cases specific National action.

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 Tipperary Energy Agency. It is clear that using this study to produce Energy and Emissions Balances for the Mid-West and South-East Regions 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 CO₂ emissions.

The TEA aims to update this report annually and working with Local Authorities and other stakeholders develop a Sustainable Energy Action Plan.

1.0 Conclusions and Recommendations

Climate Change is one of the key challenges that faces humanity at present. This report seeks to outline the particular challenge which is faced in the study area of County Tipperary.

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:

- 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. Extending the access of natural gas and increasing the use of renewables are the two solutions required to replace oil.
- The Transport sector, given its high share of TFC, will need immediate action to implement a range of actions, particularly to ensure the development of public transport. 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 and of CO₂ emissions. However, it presents a focused target area for action for the TEA and also for Ireland. The House of Tomorrow program and the implementation of the Energy Performance of Buildings Directive (EPBD) are two major actions in this sector. North Tipperary has experienced double the volume of new housing when compared to South Tipperary
- The data for the Commercial and Industrial Sector would indicate that while there may be a reduction in the share of TFC and CO₂ 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. As a result the Commercial/SME sector needs particular attention.
- 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 Tipperary Energy Agency

2.1 Establishment and History

The TEA was initially established under the EU SAVE programme in March 1998. Partners in the establishment of the Agency were North and South Tipperary County Council and the Tipperary Institute, with a range of EU Partners. Since the ending of the EU SAVE funding the Agency has operated as a self-financing agency and continues to be a partnership between the original founders.

Tipperary Energy Agency is one of 15 energy agencies that make up the Association of Irish Energy Agencies (AIEA) covering Ireland.

2.2 Mission and Objectives

The mission of the Agency is to lead and support Co. Tipperary to reduce its CO₂ emissions by stimulating and contributing to the implementation of best practise in the field of sustainable energy (www.tea.ie).

The TEA's central objectives are:

- To develop and provide a range of energy services to all sectors in Co. Tipperary and beyond.
- To promote and develop energy efficiency and renewable energy in its region
- That the renewable energy potential of Co. Tipperary will be realised
- That the TEA will be recognised as a leading energy authority in Europe.
- That all sectors will be aware of how they can take action to contribute to sustainable energy development in Co. Tipperary and beyond.
- That energy efficiency will be maximised across all sectors in Co. Tipperary.
- That green house gas emissions will be limited to sustainable levels to assist in the protection of the local and global environment.

2.3 Core Activities

Core areas of activities for the TEA are:

- Energy Management for County Councils,
- Energy Management for Other Public and Private Bodies,
- Energy Data Assimilation, Analysis and Dissemination,
- Energy Auditing, Analysis for Domestic and Commercial Sector
- Renewable Energy Projects (Feasibility Studies, Analysis and Implementation),
- Education and Training,
- Community Based energy related projects

2.4 Core Services & Expertise

The TEA's services include:

- Energy Management Services
- Energy Audits – preliminary, detailed
- Alternative Energy Supply Assessment

- Electrical Energy Measurement
- Pump and Equipment Efficiency Tests
- Feasibility Studies
- Customised Energy Training Courses

Its core expertise includes:

- Energy management and analysis for domestic, commercial and private sector
- Analysis of energy usage, demand
- Securing alternative energy supply
- Small scale renewable energy systems, with particular focus on wood fuel heating

3.0 Global Energy & Environment

3.1 World Energy Consumption

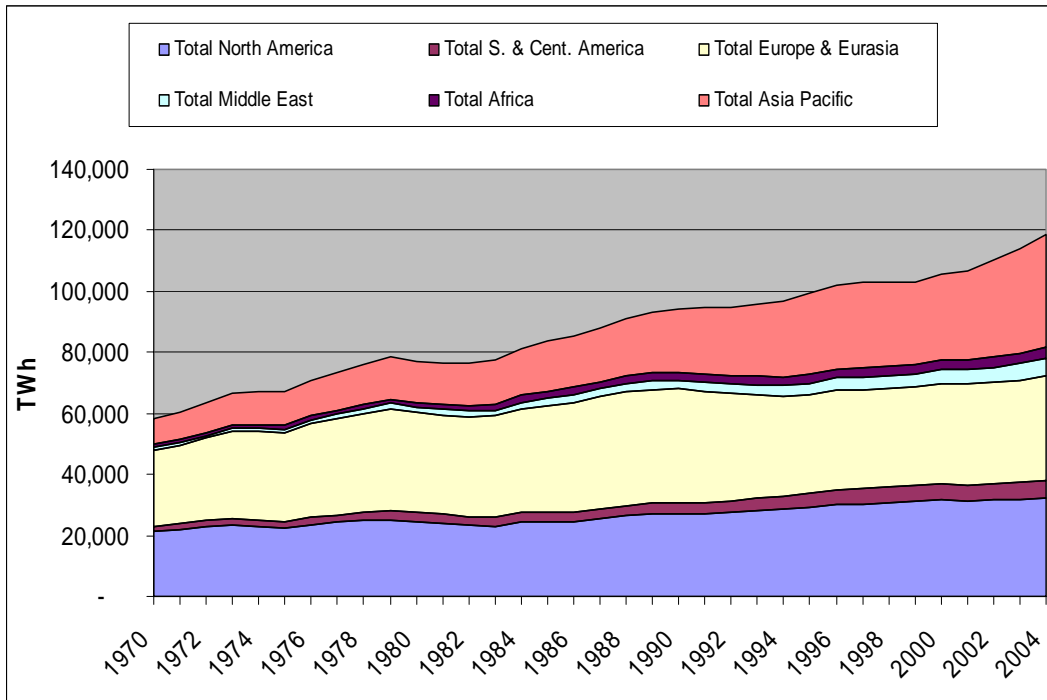


Chart 3.1: Global Total Primary Energy Consumption

Source: BP (2005)

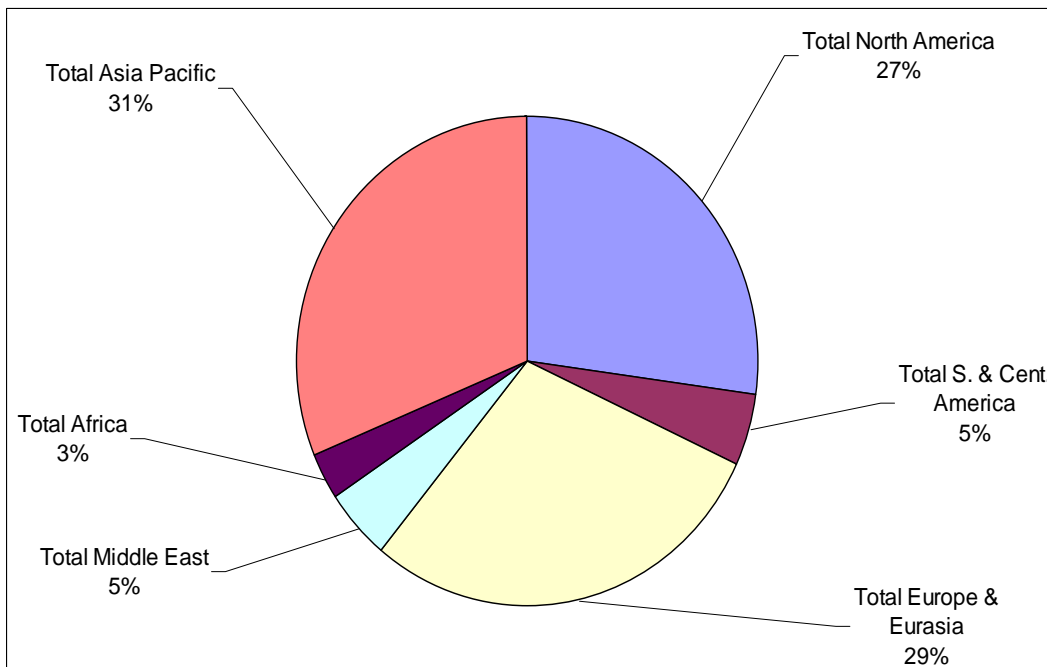


Chart 3.2: Share of Total Global Consumption in 2004

Source: BP (2005)

The profile of global energy consumption between the period of 1970 and 2004 is illustrated in Figure 3.1. An every increasing trend in energy consumption and requirement 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 account for 77% of total world energy consumption.

Analysing the rate of change in different world regions illustrates that the energy demand varies considerably. It is clear across all regions that energy consumption has increased. The % 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 Mid West 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 2000-2004 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.

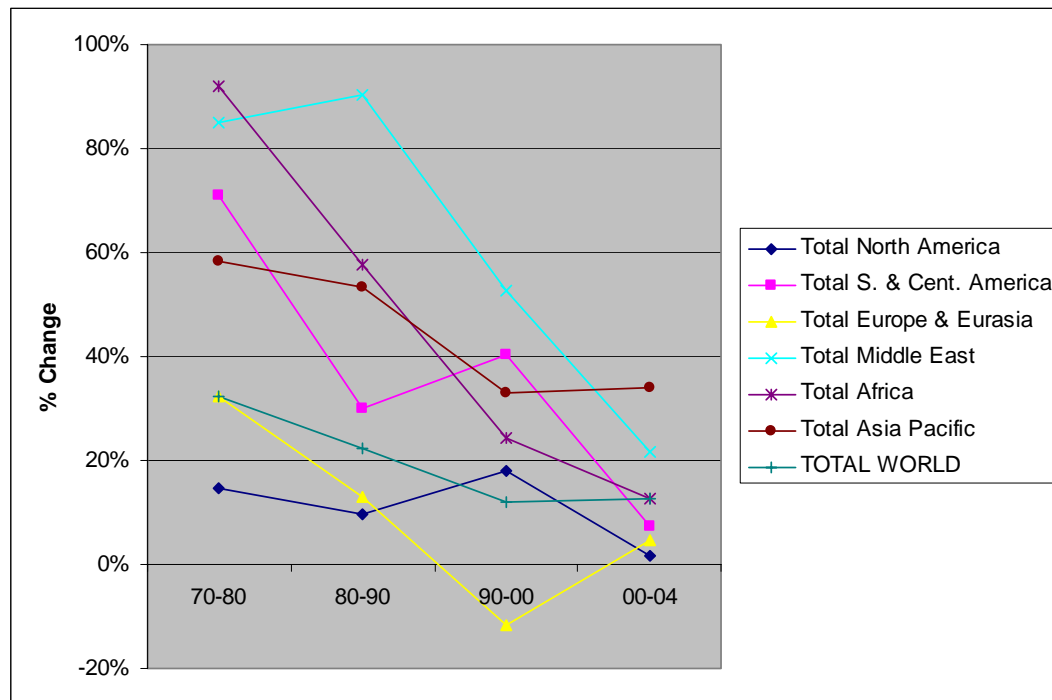


Chart 3.3: Percentage Change in Regional World Consumption

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, it has a global reach. 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 requiring 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%.

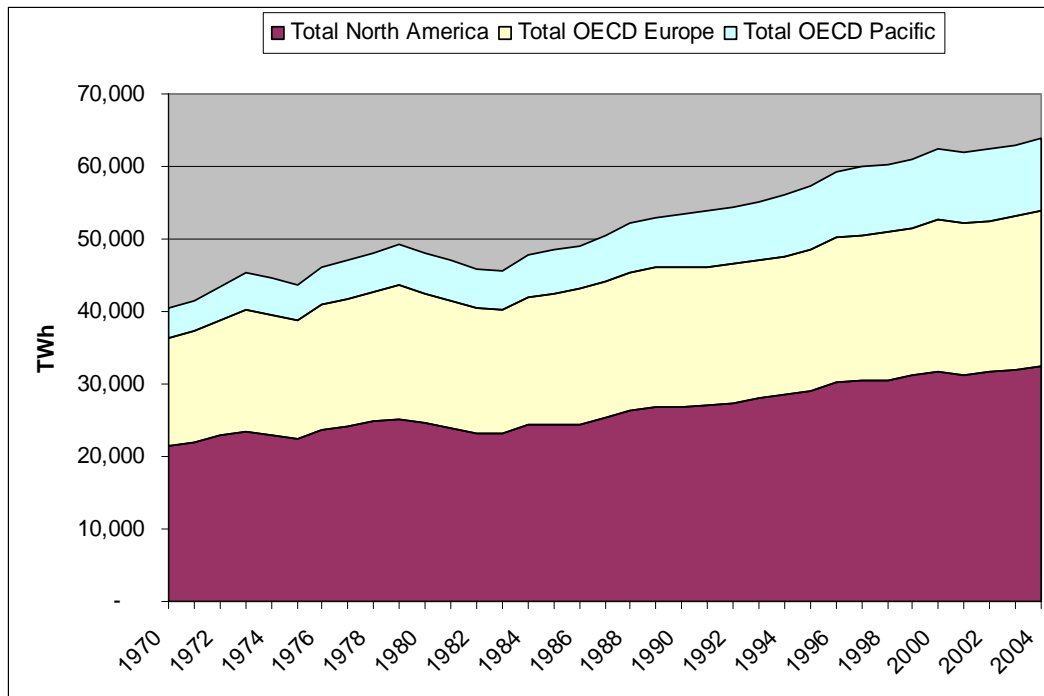


Chart 3.4: OECD Primary Energy Consumption

Source: BP (2005)

3.3 European Union Energy Consumption & Emissions

In the context of the Mid West 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).

- Germany accounted for 20% ,of TPEC in 2003
- France, accounted for 16% of TPEC in 2003
- United Kingdom accounted for 13% of TPEC in 2003
- Italy accounted 11% of TPEC. in 2003 I
- Ireland accounted for 0.88% of primary consumption in 2003.

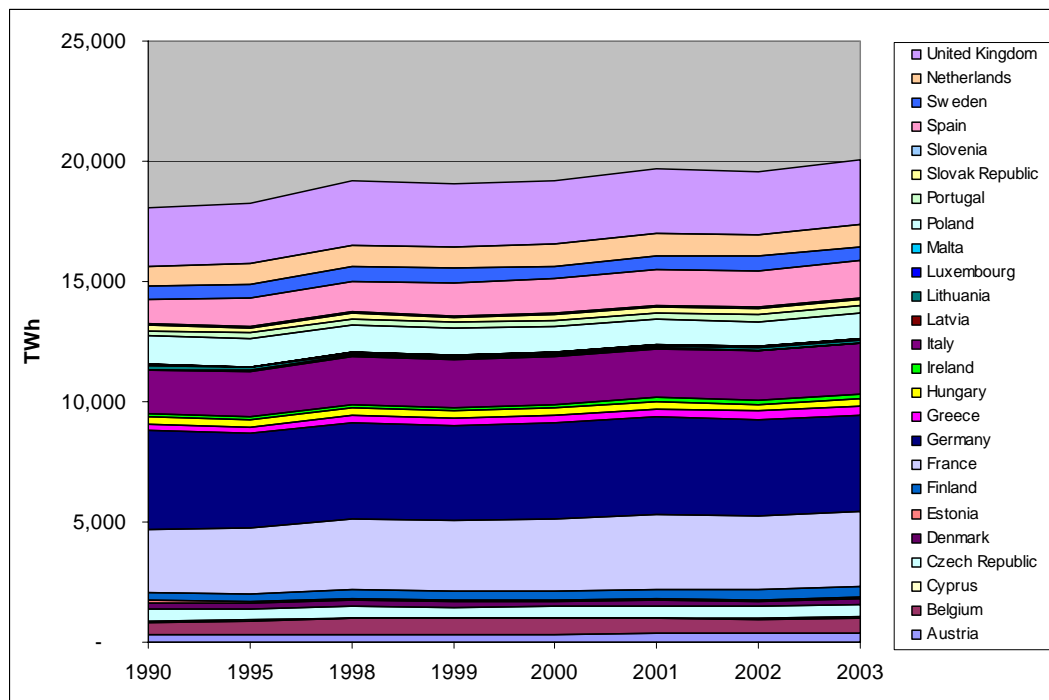


Chart 3.5: Total Primary Energy Consumption by Country

Source: Eurostat (2005)

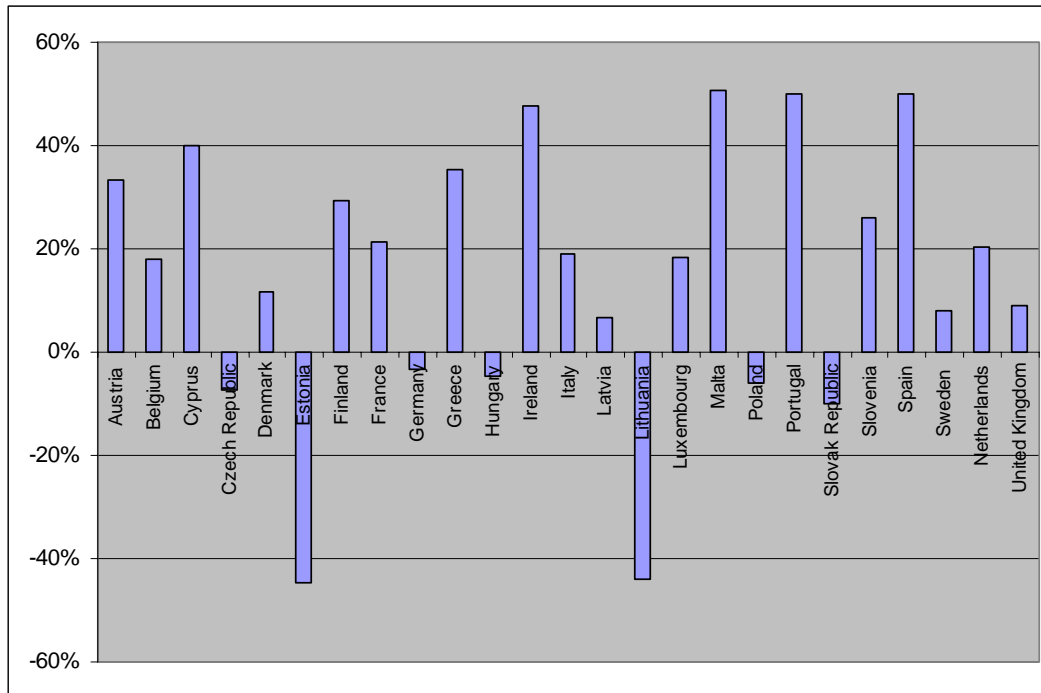


Chart 3.6: Percentage Change in Primary Consumption by Country

Source: Eurostat (2005)

Total Final Consumption for the EU 25 was 13,169 TWhs in 2003, an increase of 12% from 1990. Ireland accounted for 1% of this total consumption. In terms of consumption by fuel oil is the predominant fuel, as seen in Chart 3.8, accounting for 43% of consumption 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 remains only 4% of Total Consumption.

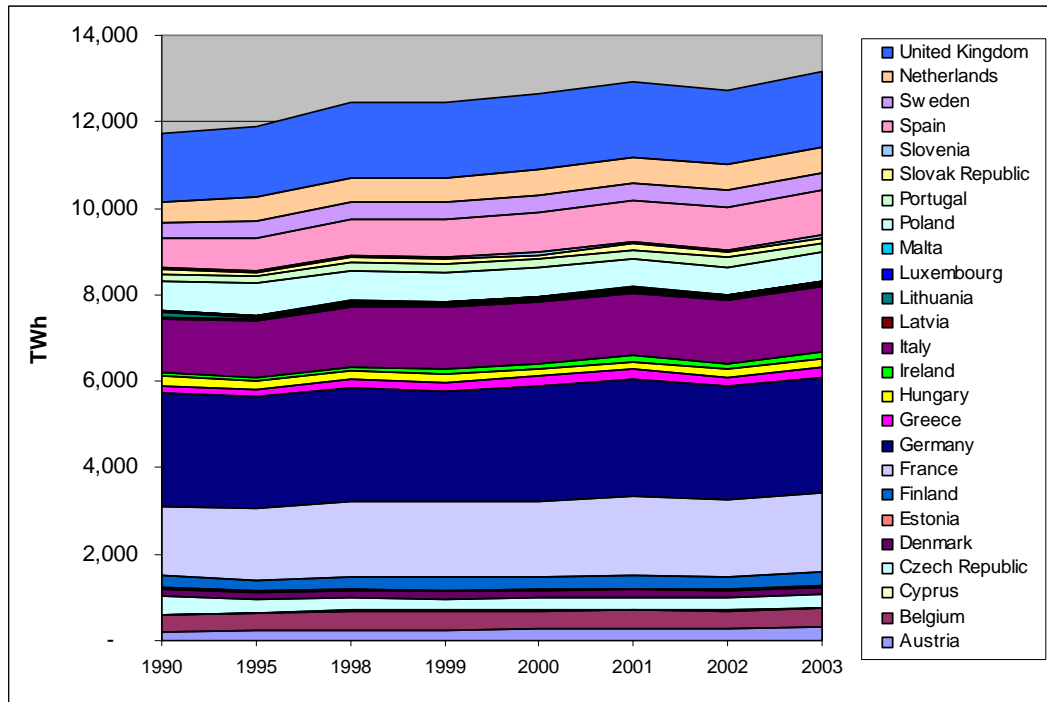


Chart 3.7: Total Final Energy Consumption by Country

Source: Eurostat (2005)

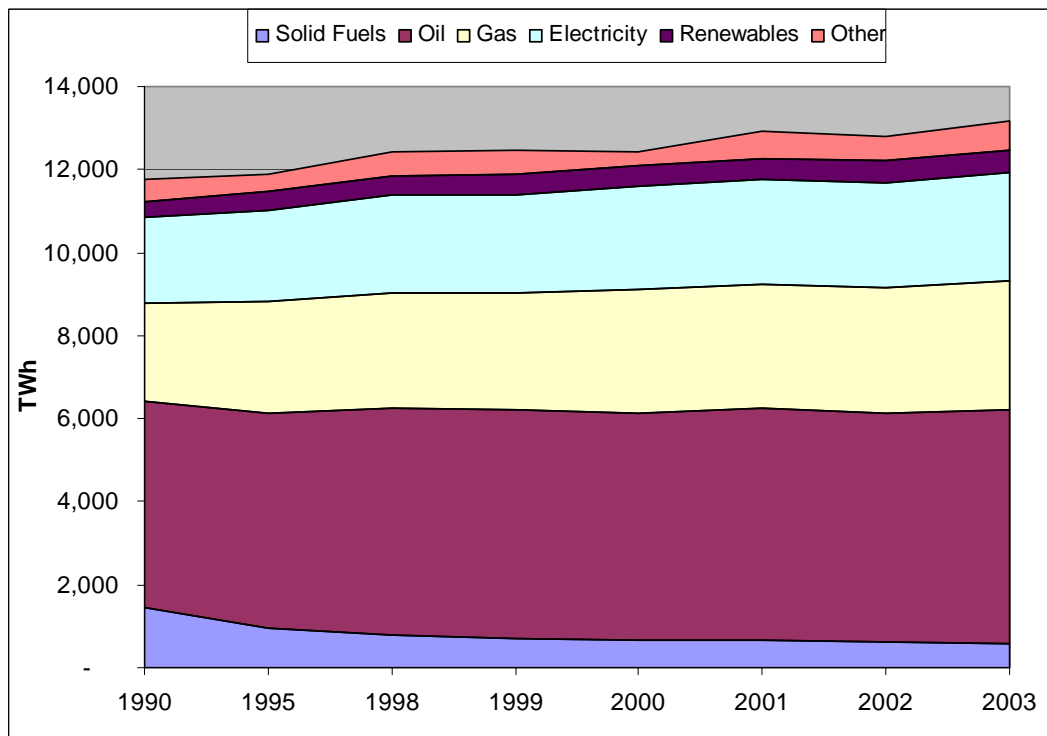


Chart 3.8: Total Final Energy Consumption by Fuel

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.

Some of the new members states have had a dramatic decrease due mainly to reduced economic activity..

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 CO₂ emissions for the EU 25 by country it can be seen that the major economic powers within the EU 25 account for the major CO₂ emissions. Germany, UK and France are the major contributors as shown in Chart 3.10.

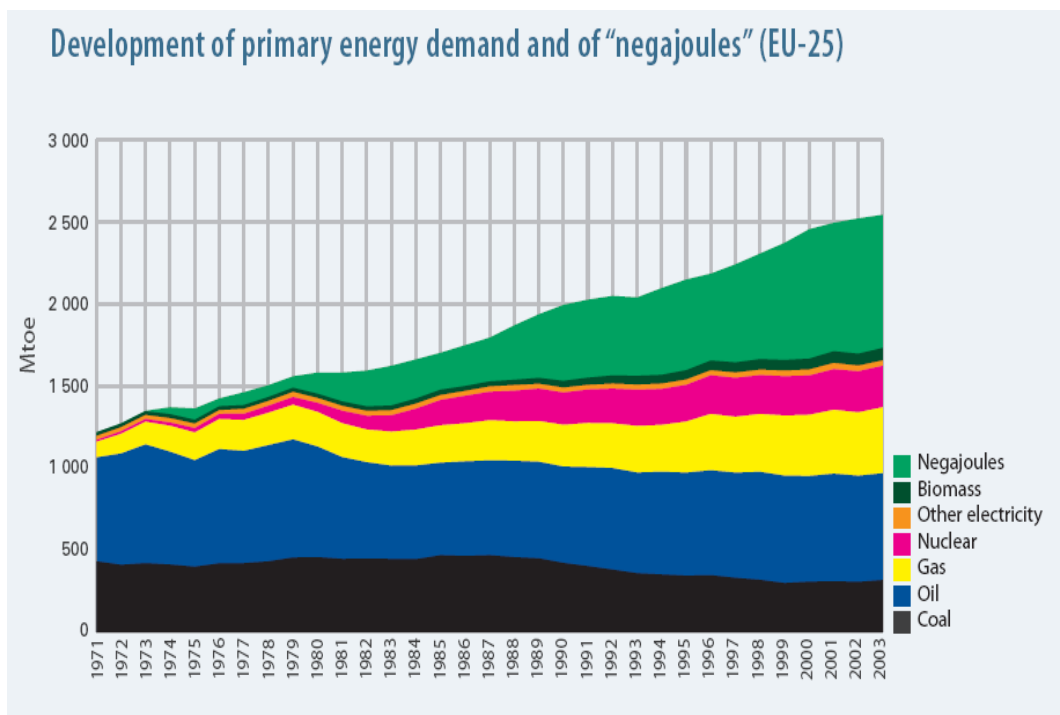


Chart 3.9: Development of primary energy demand and of “negajoules” (EU-25)

Source: EU Commission (2005)

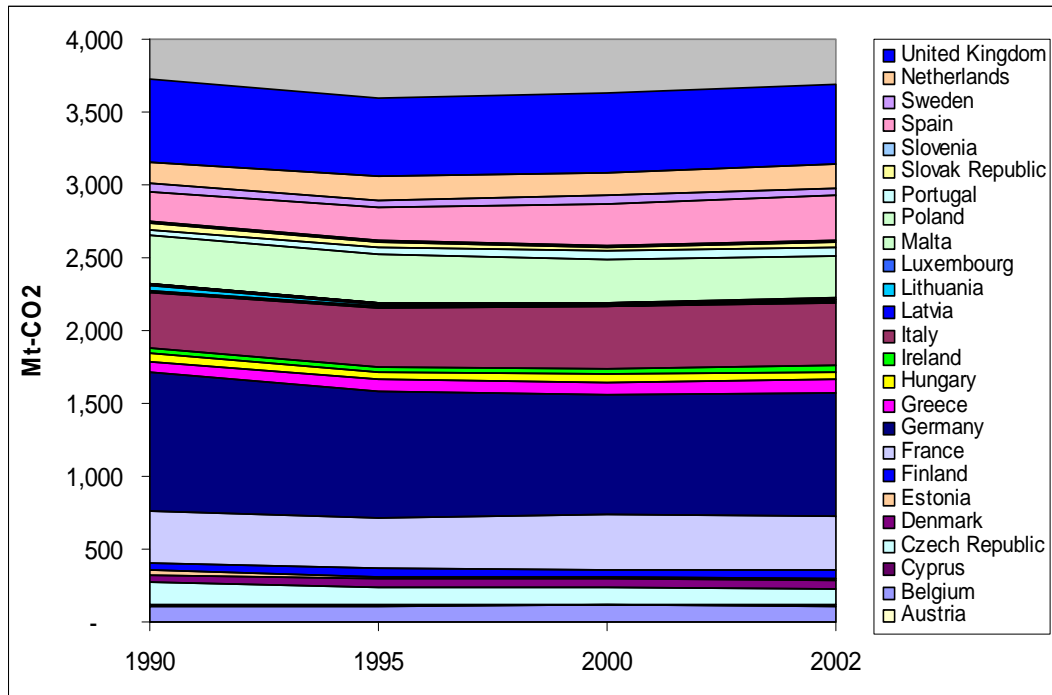


Chart 3.10: Total CO₂ emissions per Country for EU 25

Source: Eurostat (2005)

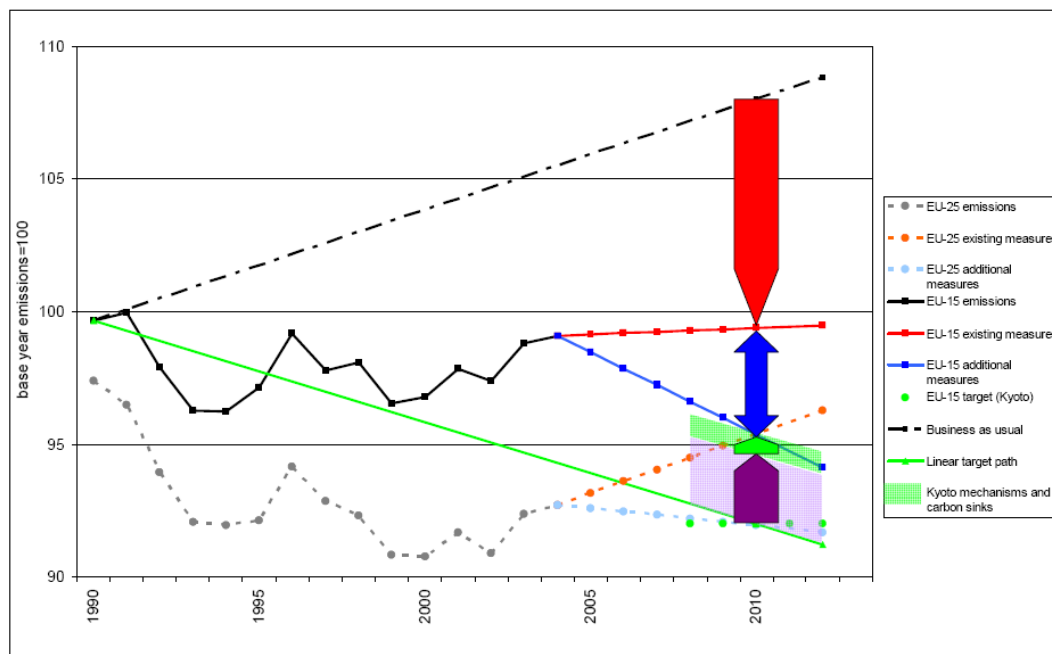


Chart 3.11: Actual and projected emissions for EU-25 and EU-15

Source: EU Commission (2006)

The EU Commission report on progress towards achieving the Kyoto Protocol in 2006 indicated that the EU 15 would not meet its targets without additional measures being

implemented. The Commission proposed in January 2007 that the EU set targets to achieve a reduction in 1990 CO₂ emissions of 20%, with some countries arguing for a 30% reduction.

4.0 Climate Change Conventions

4.1 Climate Change in General

Climate Change has become one of 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. Climate Change has become one of the key issues of the 21st Century.

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 CO₂ 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
2007	IPCC Report on Scientific Evidence of Climate Change	World Scientists agree that human activity the main cause of global warming
2006	COP 12 and COP/MOP 2 (Nairobi, Kenya)	Initiate discussions on post Kyoto Agreements
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 (CO₂) - 50% of GHG emissions

- Methane (CH₄) - 18% of GHG emissions
- Nitrous oxide (N₂O) - 6% of GHG emissions
- Hydro-fluorocarbons (HFCs)
- Per-fluorocarbons (PFCs)
- Sulphur hexafluoride (SF₆)

Note HFCs, PFCs and SF₆ 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 will be achieved. 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 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 Kyoto protocol.

The IPCC reported in January 2007 that there was now no doubt that climate change is being caused by human activity and in particular that the use of fossil fuels is a key factor in contributing to global warming.

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 of a strategy to react to the Kyoto Protocol include

- Department of Environment, Heritage and Local Government
- Department of Communications, Marine and Natural Resources
- Department of Agriculture
- 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. The new National Climate Change Strategy 2007-2012 has been launched in March 2007.

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 30% 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

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

- Green Paper on Sustainable Energy (1999)
- Annual National Inventory Reports compiled by the EPA
- Progress Report on National Climate Change Strategy DoEHLG (2002)
- White paper on Energy (DCMNR, 2007)
- National Climate Change Strategy 2007-2012 (DoEHLG, 2007)

The following chapter will review, in an Irish context, the energy demand and related emissions since 1990 and projected forward to 2020. 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

- firstly to review the total green house gas emissions which are relevant under the Kyoto Protocol
- secondly to address specifically the emissions related to energy production and use
- first to 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 Gas, by IPCC Categories and by Sector. These figures include all GHG emissions expressed in kilotonnes of CO₂ equivalent (kT-CO₂e) Some of the key points of note from these figures include:

- Irelands total green house gas emissions in 1990 was 53.75 Million Tonnes (Mt) of Carbon Dioxide (CO₂) equivalent. 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 CO₂ equivalent by the 2008-2012.
- The National Climate Change Strategy reported in 2000 that emissions in Ireland were expected to reach 73.794 Mt CO₂ equivalent by 2010. The latest data for emissions to date are presented in Table 5.1 and Chart 5.1.
- CO₂ 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 CO₂ 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. The major changes in emissions are therefore confined to the energy sector.

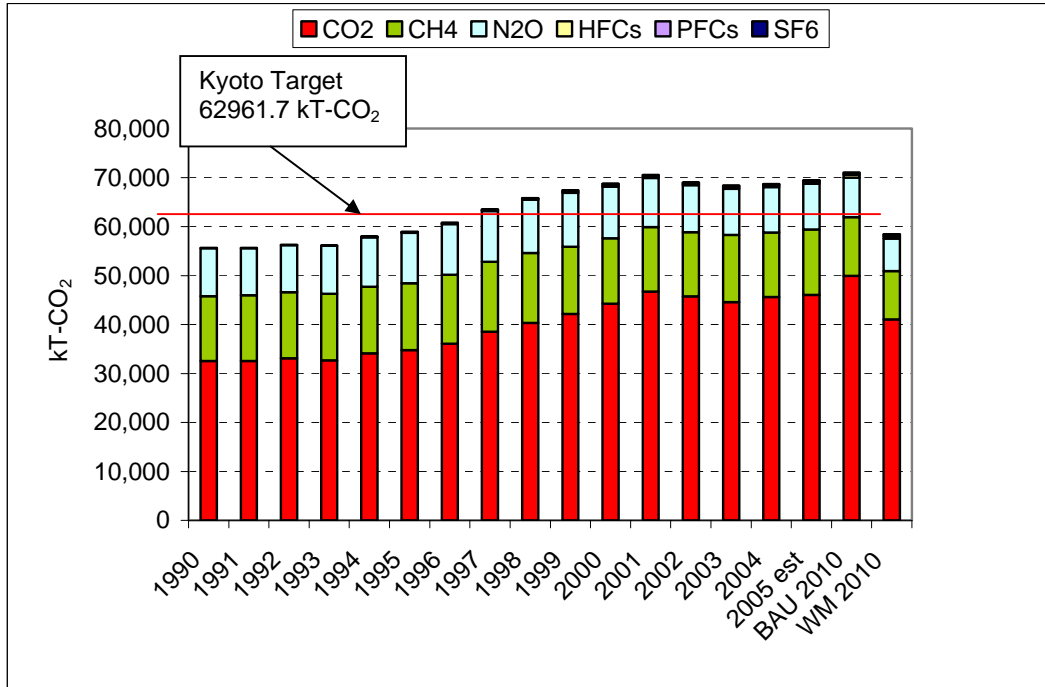


Chart 5.1: Ireland's Greenhouse Emissions 1990-2010, By Gas

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

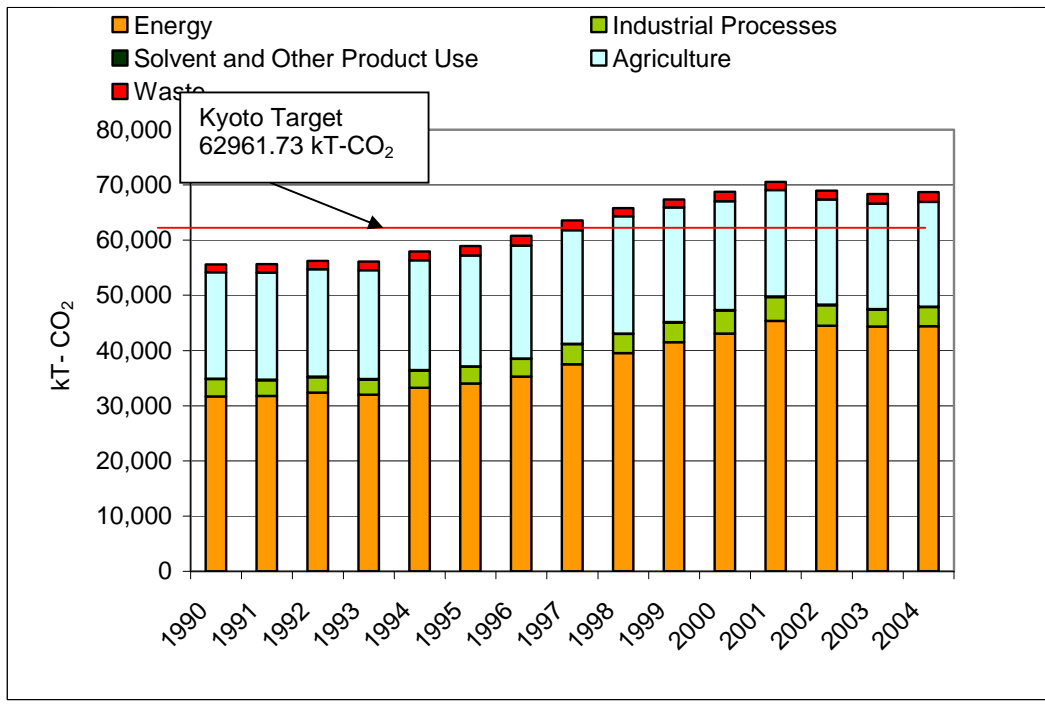


Chart 5.2: Ireland's Greenhouse Emissions 1990-2010, By IPCC Category

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

The latest report by the Environmental Protection Agency (EPA) in February 2007 provided additional indications that Ireland is in danger of not reaching its Kyoto commitments. Key findings from this report include:

Overall

- Total GHG emissions in 2005 were 69.95 million tonnes carbon dioxide equivalent (Mt CO₂eq), which is 1.9 per cent higher than the tonnage of emissions in 2004.

Transport

- By far the greatest increase was in the transport sector where emissions were higher by 868,503 tonnes CO₂eq than in 2004. This represents a 6.9 per cent increase on 2004 and an overall 160 per cent increase on the 1990 transport figures.
- Road transport accounts for 96 per cent of the transport sector emissions.
- The increase in the GHG emissions from the transport sector reflects sustained increases in fuel consumption with petrol usage up 5 per cent and diesel consumption up almost 9 per cent from the previous year.

Energy

- There was an increase of 380,455 tonnes CO₂eq for the energy industries sector, which is 2.4 per cent higher than 2004 and up 38 per cent on 1990 figures.
- Increased peat use was the major contributing factor to increased emissions from the energy industries.

Agriculture

- On the positive side, emissions from Agriculture decreased by 1.8 per cent. Lower sheep and cattle numbers coupled with reduced use of fertiliser resulted in the lower emissions from the agriculture sector.

Residential

- Emissions in 2005 show little change from the 2004 level.

Kyoto Protocol

- Ireland's target in relation to the Kyoto Protocol is to limit emissions to 13 per cent above the baseline estimate in the period 2008-2012. Based on the latest inventory figures, Ireland's emissions in 2005 were 25.4 per cent higher than the baseline estimate that underlies Ireland's allowable emissions of 315 Mt CO₂eq for the period 2008-2012, as proposed to the European Commission in 2006.

Source: EPA, 2007

The long term projections in relation to the Kyoto Target are highlighted in the following figure.

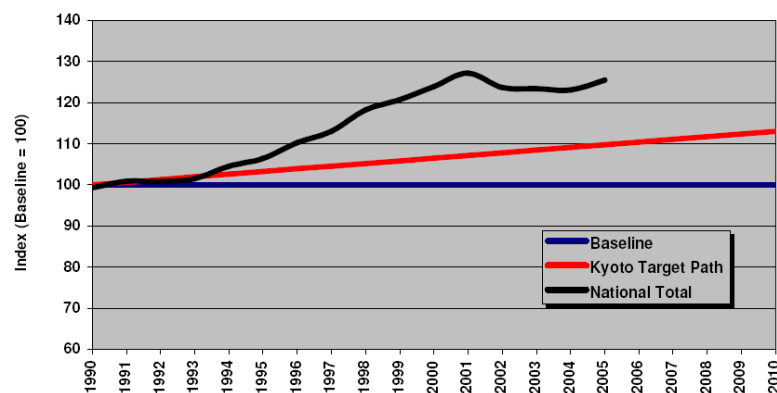


Chart 5.3: Ireland's Total GHG Emissions compared to Baseline Level and Kyoto Target Path

Source EPA (2007)

5.2 Irelands Energy Related Emissions of CO₂ 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. Table 5.2 outlines the CO₂ emissions from 1990 to 2004 and projected to 2015.¹

Table 5.1: Irelands Energy Related CO₂ Emissions by Fuel (k T CO₂)

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

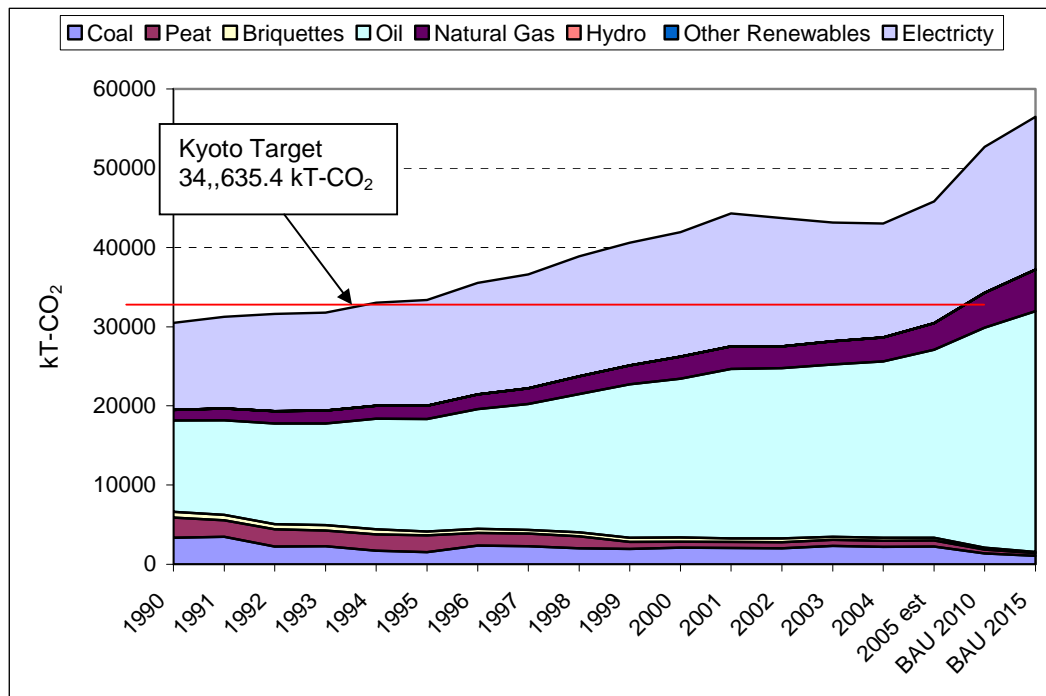


Chart 5.4: Irelands Energy Related CO₂ Emissions by Fuel

Source: SEI (2006), ESRI (2005)

¹ Where possible all projections have been done to 2020. However, National projections have not been available to 2020 for CO₂ emissions and this study was not in a position to complete such analysis, as this is a responsibility of the Department of Environment.

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 CO₂ 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 CO₂ emissions figure indicates a limit of 34,635.4 kT CO₂. Overall energy related CO₂ emissions grew by approximately 42% from 1990 to 2004 and are projected to be 69% above 1990 levels by 2010 (ESRI, 2005)

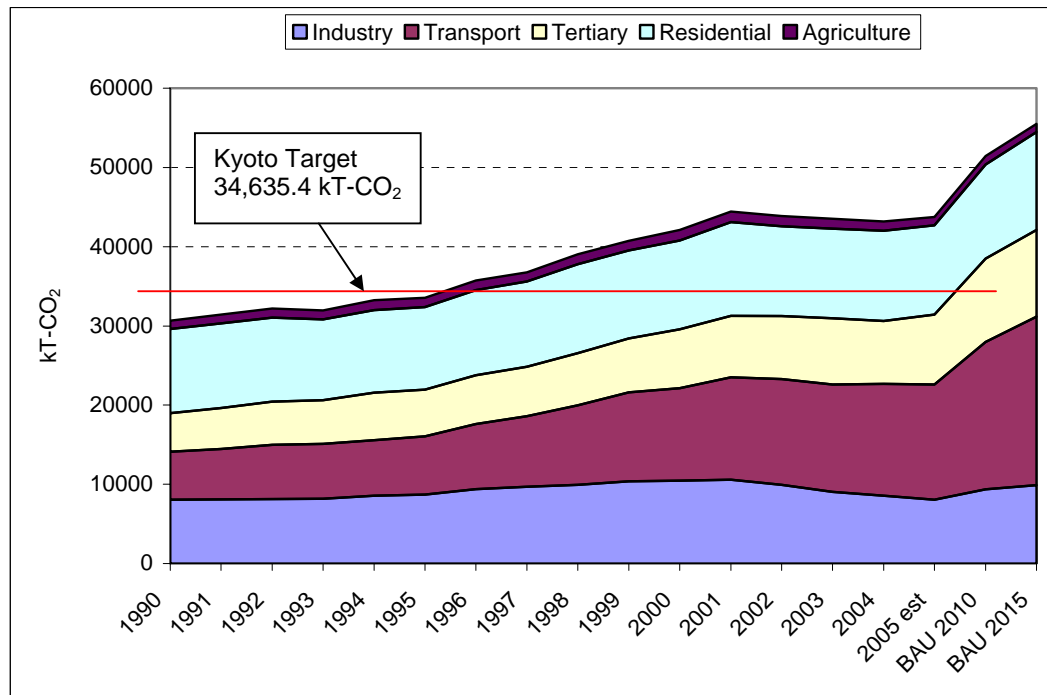
5.3 Ireland's Energy Related Emissions by CO₂ Sector

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 CO₂ emissions. It should be noted that despite the increased number of houses constructed that the level of emissions from this sector has remained relatively level over the period, due in large part to the significant improvements to Part L of the Building Regulations since 1997.

Table 5.2: Irelands Energy Related CO₂ Emissions by Sector (k T CO₂)

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 5.5: Irelands Energy Related CO₂ Emissions by Sector

Source: SEI (2006), ESRI (2005)

5.4 Irelands Total Final Consumption (TFC) by Fuel

The CO₂ 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 5.4 and Chart 5.6 outline the TFC by Fuel in Ireland from 1990 to 2005 and projected to 2020.

- 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 consumption grew by 63% during the period. A BAU Scenario would see TFC grow by approximately 100% by 2010.
- Irelands 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 rapidly.

Table 5.3: Ireland's Total Final Consumption by Fuel ⁽²⁾

Source: SEI (2006), ESRI (2005)

GWh	1990	1995	2000	2002	2004	2005	BAU 2010	BAU 2020
Coal	9,800	3,692	4,634	4,351	4,712	5,061	3,780	1,896
Peat	8,803	7,113	3,525	3,412	3,103	3,180	2,178	909
Oil	46,151	57,171	82,213	86,830	89,849	94,726	111,543	123,906
Natural Gas	6,625	9,271	13,990	13,949	15,436	15,584	20,236	22,702
RES	1,253	1,185	1,632	1,818	2,226	2,449	8,862	13,398
Electricity	11,870	14,854	20,292	21,772	23,061	24,353	28,353	32,433
Total	84,502	93,285	126,285	132,132	138,390	145,353	174,953	195,244

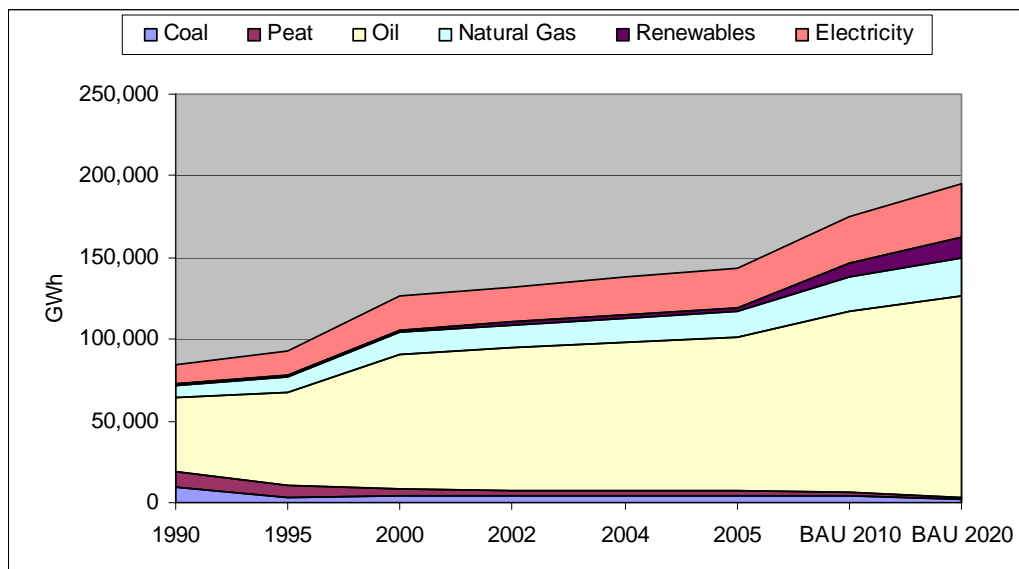


Chart 5.6: Ireland's Total Final Consumption by Fuel (GWh)

Source: SEI(2006), ESRI 2005)

² GWh: Giga Watt Hour – See Appendix 1

5.5 Irelands Total Final Consumption (TFC) by Sector

Table 5.4: Irelands Total Final Consumption by Sector (GWh)

Source: SEI (2006), ESRI (2005)

GWh	1990	1995	2000	2002	2004	2005	BAU 2010	BAU 2020
Industry	20,044	21,876	27,684	26,754	26,660	28,947	33,052	38,751
Transport	23,526	27,774	47,513	52,021	54,641	59,022	76,595	86,411
Residential	26,291	25,892	29,617	30,934	33,522	33,436	35,448	36,204
Commercial	11,709	13,791	17,785	18,655	19,914	20,168	26,159	30,333
Agriculture	2,932	3,953	3,686	3,769	3,652	3,780	3,698	3,544
Total	84,502	93,285	126,285	132,132	138,390	145,353	174,953	195,244

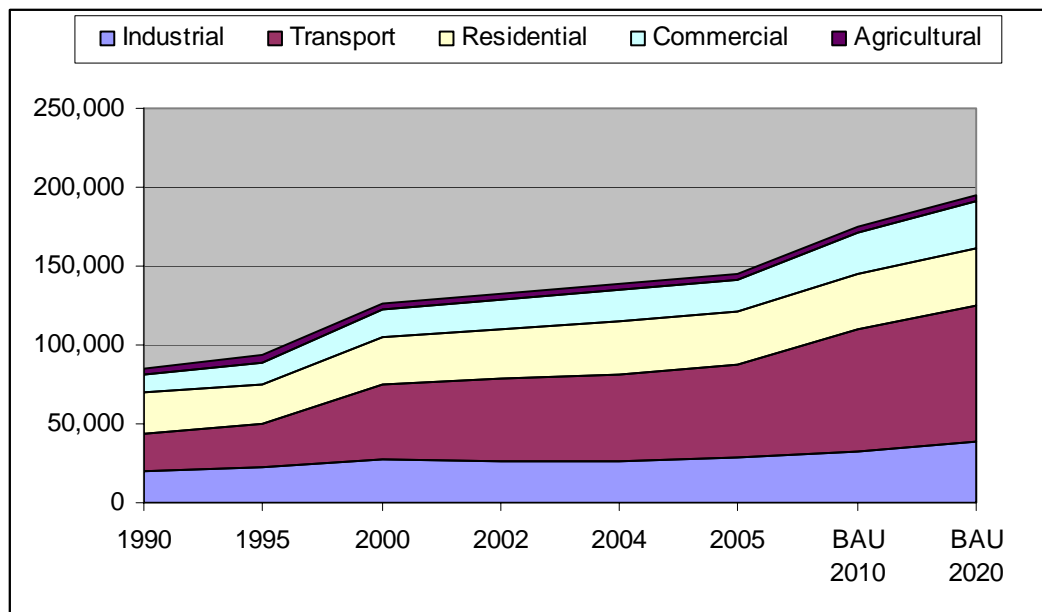


Chart 5.7: Irelands Total Final Consumption by Sector (GWh)

Source SEI (2006), ESRI (2005)

The spread of TFC across the economic sectors is outlined in Table and Chart 5.7.

- Transport is the greatest user of fuel, accounting for 41% of TFC in 2005,
- The residential sector accounted for 23% of TFC in 2005
- Industry accounted for 20% of TFC in 2005.
- The highest growth over the 1990 to 2005 period was experienced by the Transport sector (150%) and Commercial/Public sectors (72%).

5.6 Irish Energy Policy

Prior to 2007 Irish Energy policy dated from 1999, the 'Green Paper on Sustainable Energy'. 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.

In February 2007 the Government launched its White Paper on Energy. This sets forth the plans for tackling energy efficiency, implementing renewable energy projects and ensuring security of supply. Some key extracts from the document include

Ensuring Security of Energy Supply

The Government's overriding policy objective is to ensure that energy is consistently available at competitive prices with minimal risk of supply disruption.

The underpinning Strategic Goals are:

- *Ensuring that electricity supply consistently meets demand*
- *Ensuring the physical security and reliability of gas supplies to Ireland*
- *Enhancing the diversity of fuels used for power generation*
- *Delivering electricity and gas to homes and businesses over efficient, reliable and secure networks*
- *Creating a stable attractive environment for hydrocarbon exploration and production*
- *Being prepared for energy supply disruptions*

Promoting the Sustainability of Energy Supply and Use

Sustainability is at the heart of the Government's energy policy objectives. The challenge of creating a sustainable energy future for Ireland is being met through a range of strategies, targets and actions to deliver environmentally sustainable energy supply and use.

The underpinning Strategic Goals are:

- *Addressing climate change by reducing energy related greenhouse gas emissions*
- *Accelerating the growth of renewable energy sources*
- *Promoting the sustainable use of energy in transport*
- *Delivering an integrated approach to the sustainable development and use of bioenergy resources*
- *Maximising Energy Efficiency and energy savings across the economy*
- *Accelerating Energy Research Development and Innovation Programmes in support of sustainable energy goals*

Enhancing the Competitiveness of Energy Supply

The Government's key policy objective is to ensure a reliable and competitively priced energy supply and competition in energy markets in support of economic growth and national competitiveness.

Ensuring the relative competitiveness of Irish energy prices is a key concern, reflecting the needs of the enterprise sector and all consumers. ...

Structural change will reinforce the benefits which will accrue from the Single Electricity Market.

The Government endorses the case for a process of structural change in the electricity sector and will deliver change, starting now and progressively working with all stakeholders.

The underpinning Strategic Goals are:

- *Delivering competition and consumer choice in the energy market*
- *Delivering the All-Island Energy Market Framework*
- *Ensuring that the regulatory framework meets the evolving energy policy challenges*
- *Ensuring a sustainable future for Semi-State Energy Enterprises*
- *Ensuring affordable energy for everyone*
- *Creating jobs, growth and innovation in the energy sector*

Key actions include

- implementation of an Energy Efficiency Action Plan, including 33% energy consumption reduction for public sector by 2020.
- Targets of 15% (2010) and 30% (2020) of electricity from renewables,

- Targets of 5% (2010) and 12%(2020) of heat from renewables
- 5% biofuels obligation from 2010,
- 40% reduction in energy standards for buildings,
- 500MW of wave energy by 2020,
- review of supports for Local Energy Agencies and many others.

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 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..."

This was added to in Budget 2007 with the allocation of a further €200 million to the Carbon Fund.

The Table 5.6 outlines the potential costs in terms of international fines 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 Quantifiable Indicative Reductions (QIR) for all GHG that would be required per sector and estimated the costs of achieving those reductions. The cost of reducing CO₂ 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.

The review of the Climate Change Strategy indicated the range of reductions that are expected to be achieved across the various sectors. Details of this are provided in Table 5.7 (existing measures) and 5.8 (additional measures to be introduced). The Government has indicated that it feels that these reductions can be achieved and therefore result in Ireland meeting its Kyoto requirements.

It should be noted from Tables 5.7 and 5.8 that the Government is expecting a significant portion of the reductions to come from actions which are driven by external forces i.e. CAP Reform (2.4 Million Tonnes) and Emissions Trading (2.4 Million Tonnes) and these account for nearly 36% of all expected reductions.

Table 5.5: Ireland Financial Costs from Energy Related CO₂ Emissions

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

	Energy Related Emissions k T-CO ₂	Projected Difference to Target	Projected Cost of CO ₂ /ton Trading Price (€)	Annual CO ₂ Costs (Million €)
1990 Levels	30,649	-	-	-
Kyoto Targets +13%	34,635.4	-	-	-
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 by

Source NCCS (2000)

Sector	Quantified Indicative Reductions (QIR) (kT CO ₂)	Estimated Annual Cost of QIR (Million €)	Indicative Abatement Cost (€/T-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	-	Approx 114.276
Agriculture	2,410	126.97	52.69
Sinks	760	-	
Waste	850	-	
Total	15,415	311.09	

Table 5.7: Ireland CO₂ Emissions Average Annual Reductions 2008-2012 by existing measure

Source NCCS 2007-2012 (2007)

Measure	Average annual reduction 2008-2012 Mt CO ₂ e
Electricity generation from renewables sources	1.3
Modernisation of natural gas network	0.06
Technology Improvement	0.48
Rebalancing of motor taxes and fuel economy labelling	0.05
Dublin Traffic Measures	0.27
Mineral Oil Taxes Relief for biofuels	0.27
Buildings Regulations 2002	0.36
Buildings Regulations 2005	0.045
Large Industry Energy Network	0.145
CAP Reform – Decoupling of support from production	2.4
Forest sinks	2.08
Diversion of biodegradable waste from landfill	0.7
Landfill Gas Capture	0.5
Total	8.66

Table 5.8: Ireland CO₂ Emissions Average Annual Reductions 2008-2012 by additional measures

Source NCCS 2007-2012 (2007)

Additional Measures	Average annual reduction 2008-2012 Mt CO₂e
Increases in electricity from renewables to 15% by 2010	0.17
Emissions Trading Scheme (energy supply)	2.42
Modal Shift through Transport 21	0.51
Alignment of transport investment with spatial planning	0.083
Biofuels Obligation – 5.75% by 2010	0.5
Efficient driving awareness campaign	0.13
Greener Homes	0.037
Buildings Regulations 2008	0.12
Emissions Trading Scheme (industrial, commercial, services)	0.6
Energy Agreements Programme	0.037
F-Gases Regulations	0.024
Commercial Bioheat Programme	0.16
CHP Deployment Programme	0.162
Total	4.953

5.8 Irelands Energy & Environmental Indicators

Table 5.9: Energy and Environmental Indicators

Source: Eurostat (2006), CSO (1991)

Indicator	1991		1995		2000		2003	
	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
CO₂ 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 the 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 CO₂ emissions per capita. Ireland's economic development has been staggering with a 100% increase in GDP between 1990 and 2003. This 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 5.10: Energy and Environmental Indicators Relative to Kyoto

Source: SEI (2006), Euorstat (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 CO₂ Emissions (kT-CO ₂)	34,635	43,042	24.3%	51,451	48.6%
CO₂ emissions/Capita (T CO ₂ / Inhabitant)	9.9	10.2	3.8%	12.0	21.2%

6.0 Regional Statistics

6.1 Geographic Locations

Tipperary is a County in the Republic of Ireland, a member state of the European Union. It is located in the South East of the Country and occupies a broad strip of country between the Rivers Shannon and Suir.

Ireland joined the EEC in 1973. The country has undergone 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:

- Mean annual rainfall: It can be seen that the annual rainfall in County Tipperary is 1000 to 1200 mm, except in the mountains area where it is higher (1400 to 1600mm).
- Mean annual rain days: County Tipperary experiences an average of 150 to 175 days rain per annum.
- Mean daily temperature: Tipperary experiences average daily temperatures of 15-16 C in July and 5-6 C in January
- Mean annual hours of sunshine: The County experiences between 1300 and 1400 hours of sunshine per annum.

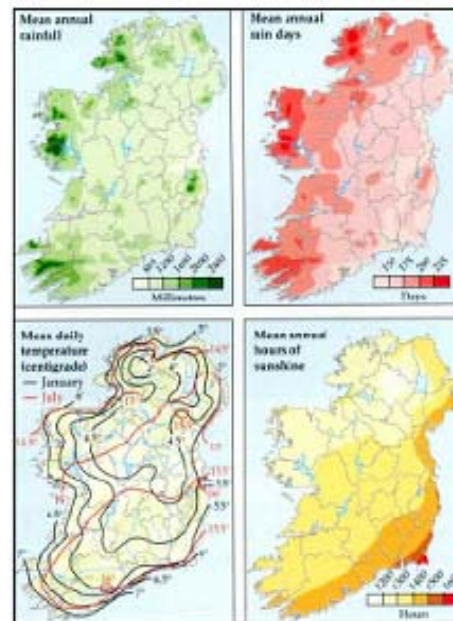


Figure 6.2: Meteorological Data
Source: Met Eireann (2006)

6.3 Relevant Energy Data

Within the County 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 598.6 (Eirgrid, 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 3200MW in 2006 (Eirgrid, 2006)). 8.6 MW of wind is installed in County Tipperary (CER, 2006).

As can be seen Tipperary lies within the region of Ireland with high wind speeds (between 6-7 m/s). Specific wind speeds at wind farm sites can exceed these wind speeds considerably.

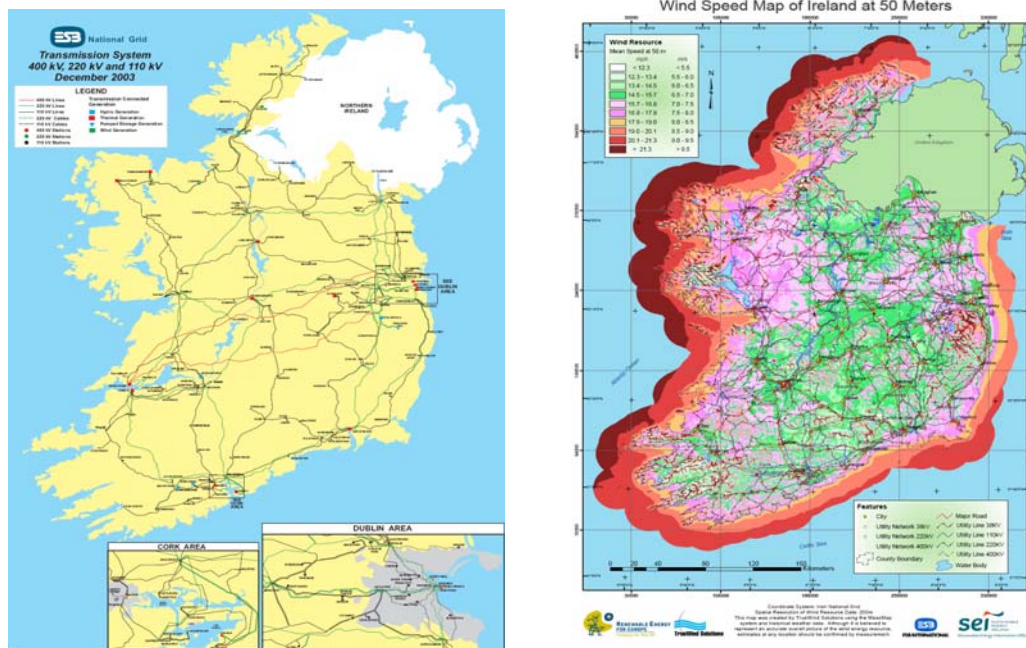


Figure 6.3: Irish Electricity Network and Mean Wind speeds at 100m

Source: ESB (2003), SEI (2005,) AMS Truewinds (2006)

6.3.2 Hydroelectricity

Small scale hydro has limited potential for development as many of the viable sites have been developed already. There are 3 small hydro projects operating in County Tipperary at present.

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. There is a covering of glacial drift, and peat bogs appear between Cashel and Thurles in the Golden Vale and in the upper Suir River valley. Raised bogs are concentrated in North Tipperary. 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 (2001)

6.3.4 Forestry

Tipperary has a total area of 47,793 Ha under forestry in 2005 (Dept of Agriculture 2006). This equates to approximately 11.2% of the land area which is above the National Average of 9.9%. 41% of this forestry is privately owned with the balance (59%) in public ownership. Broadleaf trees make up 29% (Dept. of Agriculture, 2006).

6.3.5 Summary of Renewable Energy Projects in County Tipperary

There is 9.04 MWe of renewable energy installed in County Tipperary generating electricity (Table 6.1).

Table 6.1: List of installed Renewable Energy Sources County Tipperary
Source: ESB (2006), IWEA (2006)

Location	Type	Capacity MWe	Year Connected
Curraghgraique, Templederry	Wind	2.55	2004
Mienvee, Hollyford	Wind	0.85	2004
Ballinlough, Toomevara	Wind	2.6	2006
Ballinveny, Toomevara	Wind	2.6	2006
Newtown, Holycross	Hydro	0.25	1990
Castlegrace, Clogheen	Hydro	0.1	1989
Cahir	Hydro	0.09	1995
Total		9.04	

6.4 Political Regions

Ireland is historically divided into 4 provinces. Tipperary is 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 6.5: 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 6.6). Tipperary is located in the Eastern and Southern Region.



Figure 6.6: EU NUTS 2 Region

Source: Eurostat (2006)

The NUTS3 Regional Authorities are shown in Figure 6.7. County Tipperary is divided in two political parts:

- North Tipperary is located in the Mid West Region and served by the Mid West Regional Authority (MWRA) (Table 6.2).
- South Tipperary is located in the South East Region and served by the South East Regional Authority (SERA).

The specific Local Authorities of interest are North Tipperary County Council and South Tipperary County Council (Table 6.3).

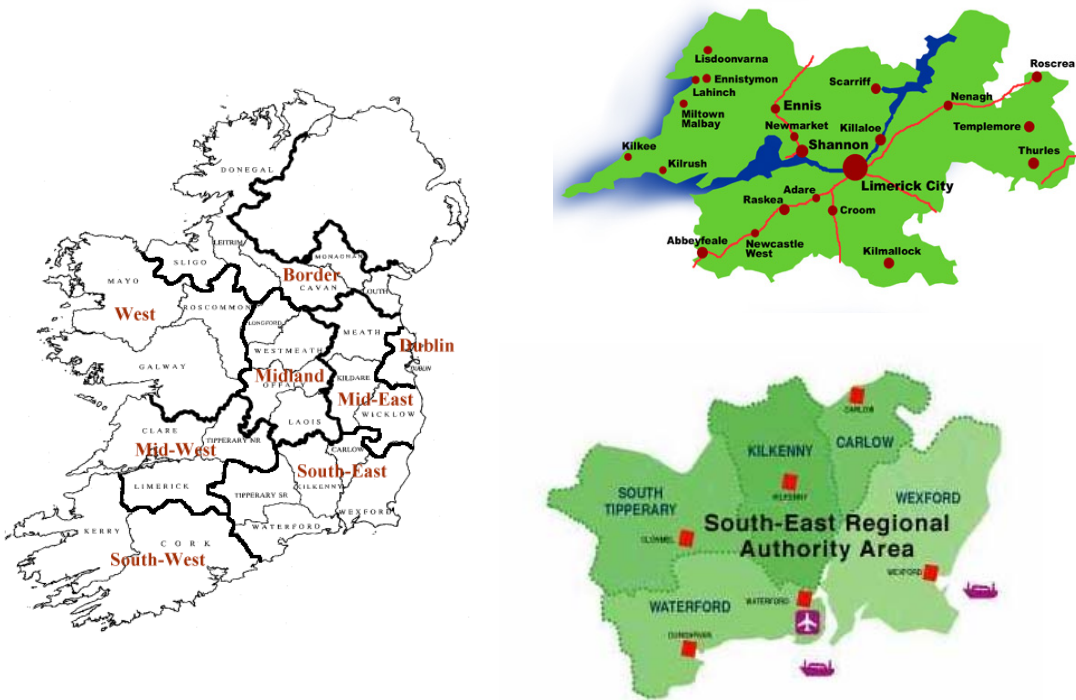


Figure 6.7: MWRA, SERA and Regional Authorities in Ireland (NUTS 3 Regions)
 Source: MWRA (2006), Eurostat (2006)

Table 6.2: NUTS 2 Regions
 Source: The Irish Regions Office, (2006)

NUTS 2 Eastern and Southern Region	
Regions	Sq km
<i>Mid West Regional Authority</i>	8,251
South West Regional Authority	12,203
<i>South Eastern Regional Authority</i>	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
<i>North Tipperary</i>	<i>202,430</i>	<i>2,024</i>
Mid West	825,111	8,251

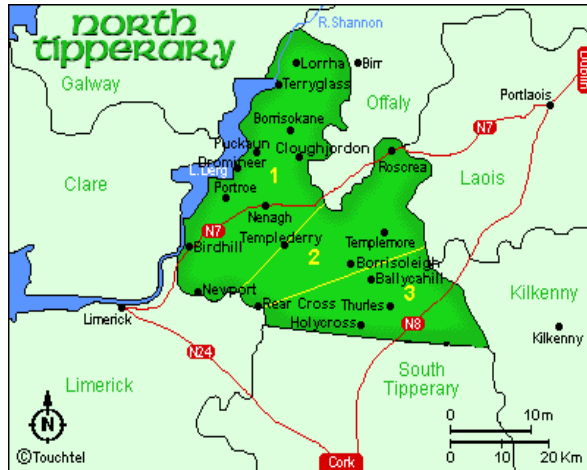
NUTS 3 Southeast		
County	Ha	Sq km
Carlow	89,655	896
Kilkenny	207,289	2,073
<i>South Tipperary</i>	<i>225,836</i>	<i>2,258</i>
Waterford	185,659	1,856
Wexford	236,685	2,366
South East	945,124	9,451

6.5 County Councils

The county has two Local Authorities:

- North Tipperary County Council
- South Tipperary County Council

6.5.1 North Tipperary

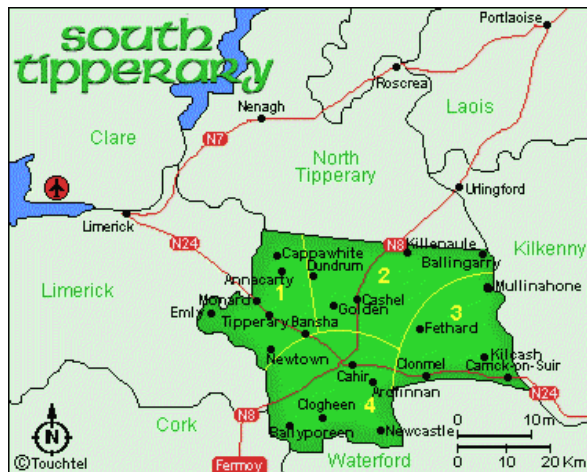


	ha	Sq km
North Tipperary	202,430	2,024

Source: CSO (2003)

Figure 6.8: North Tipperary Source: goireland. (2006)

6.5.2 South Tipperary



	ha	Sq km
South Tipperary	225,838	2,258

Source: CSO (2003)

Figure 6.9: South Tipperary Source: 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 County Tipperary. County Tipperary accounted for 3.52% of the National population in 2006 (the latest census). The population has grown by 19.25% in North Tipperary and by 19.97% in South Tipperary between 1971 and 2006.

Table 6.4: Population data for North Tipperary, South Tipperary and County Tipperary

Source: CSO (2006)

Population	CSO Census 1971	CSO Census 1979	CSO Census 1981	CSO Census 1986	CSO Census 1991	CSO Census 1996	CSO Census 2002	CSO Census 2006
North Tipperary	55,337	58,476	58,984	59,522	57,854	58,021	61,010	66,023
% of national	1.86%	1.74%	1.71%	1.68%	1.64%	1.60%	1.56%	1.56%
South Tipperary	69,228	75265	76,277	77097	74,918	75514	79,121	83,221
% of national	2.32%	2.23%	2.22%	2.18%	2.12%	2.08%	2.02%	1.96%
County Tipperary	124,565	133741	135,261	136619	132,772	133535	140,131	149,040
% of national	4.18%	3.97%	3.93%	3.86%	3.77%	3.68%	3.58%	3.52%
National	2,978,248	3,368,217	3,443,405	3,540,643	3,525,719	3,626,087	3,917,203	4,239,848

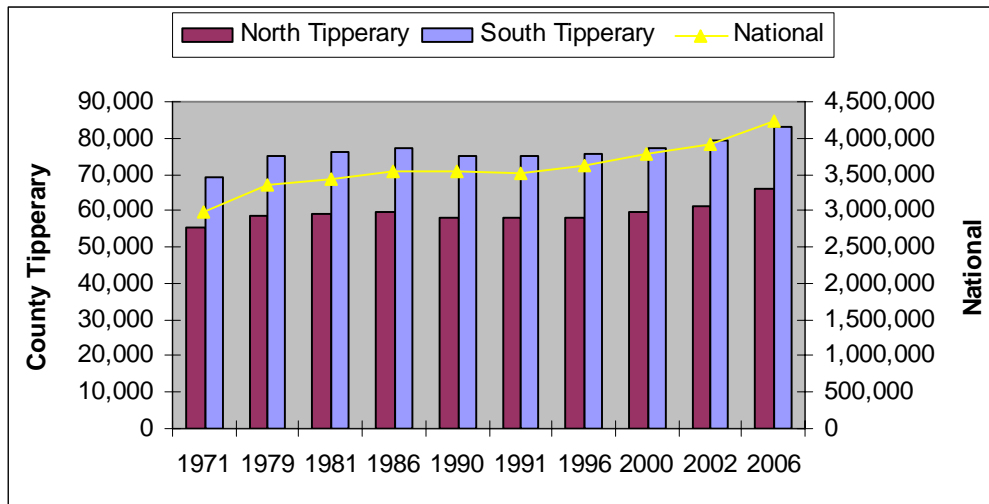


Chart 6.1: Population Trends in Population data for North Tipperary and South Tipperary

Source: CSO (2006)

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 6.5 illustrates the Total Household numbers from CSO census data between 1971 and 2006.

The increase in household numbers from 1971 to 2006 is outlined as follows:

- 52%, in North Tipperary
- 55% in South Tipperary
- 54%, in County Tipperary

Corresponding increases for the period 1991 to 2006 are shown as follows:

- 23%, in North Tipperary
- 22% in South Tipperary
- 23%, in County Tipperary

Table 6.5: Number of private households in North Tipperary and South Tipperary

Source: CSO (2006)

Source:	CSO Census 1971	CSO Census 1981	CSO Census 1991	CSO Census 1996	CSO Census 2002	CSO Census 2006
Tipperary North	13,266	15,140	16,432	17,719	20,213	22,992
% of national	1.83%	1.69%	1.61%	1.58%	1.57%	1.56%
Tipperary South	17,001	19,785	21,604	23,360	26,410	29,375
% of national	2.34%	2.21%	2.12%	2.08%	2.05%	2.00%
Tipperary	30,267	34,925	38,036	41,079	46,623	52,367
% of national	4.17%	3.90%	3.73%	3.66%	3.62%	3.56%
National	726,363	896,054	1,019,723	1,123,238	1,287,958	1,469,521

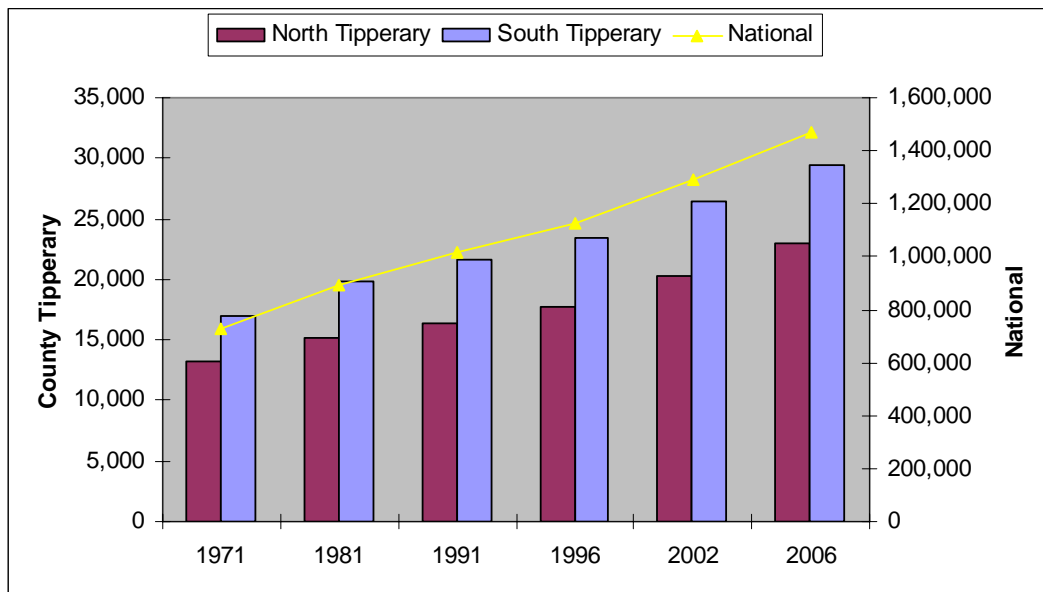


Chart 6.2: Household Data for the Study Region

Source: CSO (2006)

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, especially in North Tipperary. 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)

	North Tipperary	% of National	South Tipperary	% of National	County Tipperary	% of National	National
Oil	10,355	2.09%	14,705	2.97%	25,060	5.06%	494,962
Mains gas	150	0.05%	1,888	0.57%	2,038	0.61%	332,164
Dual System	3,062	1.96%	2,504	1.60%	5,566	3.56%	156,487
Coal	579	0.70%	2,303	2.79%	2,882	3.49%	82,594
Peat	863	1.66%	522	1.00%	1,385	2.66%	52,059
Electric	311	0.61%	259	0.51%	570	1.11%	51,132
Solid Fuel/Other Combination	3,973	4.04%	2,556	2.60%	6,529	6.64%	98,278
Peat briquettes	603	4.41%	757	5.53%	1,360	9.94%	13,682
Wood	316	4.70%	916	13.64%	1,232	18.35%	6,717

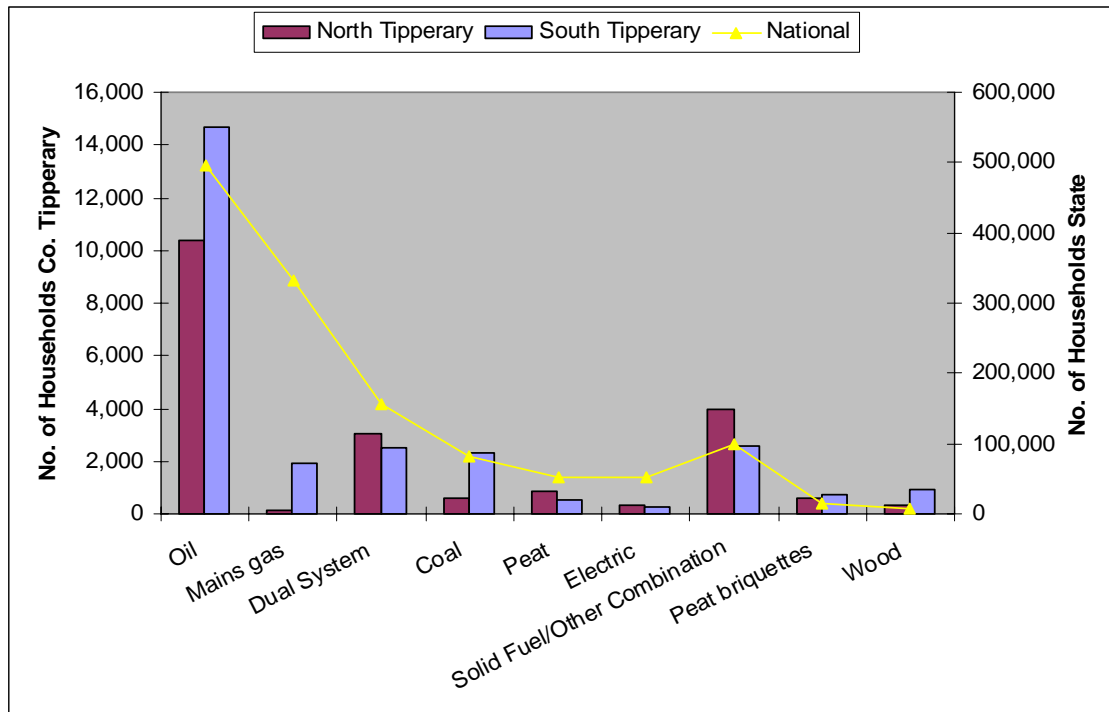


Chart 6.3: Principle Heating Fuels in Households

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 county is presented below. The number of vehicles registered increased by between 83-89% between 1990 and 2004 in the areas studied. The National figure was 102% during that period.

Table 6.7: Vehicles Registered in North Tipperary and South Tipperary

Source: DoEHLG (1991, 1996, 2001, 2002, 2003, 2004, 2005)

	1990	1995	2000	2001	2002	2003	2004	2005
North Tipperary	20,303	23,743	30,136	31,787	33,172	34,966	36,909	38,518
South Tipperary	25,912	29,582	37,854	39,637	41,383	43,127	45,445	47,587
County Tipperary	46,215	53,325	67,990	71,424	74,555	78,093	82,354	86,105
National	1,054,259	1,262,503	1,682,221	1,769,684	1,850,046	1,937,429	2,036,307	2,138,680

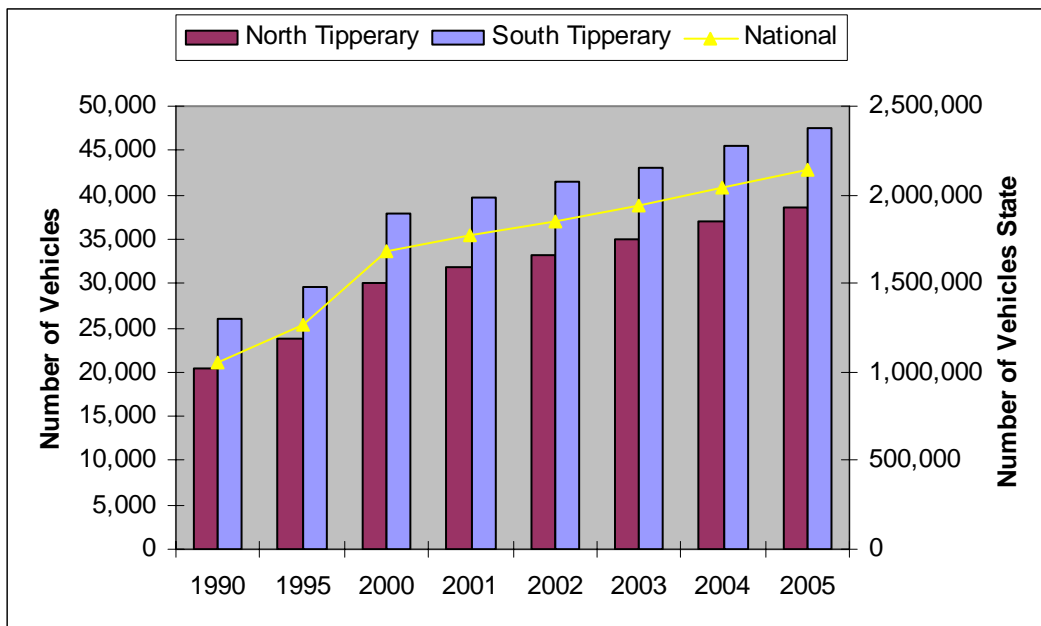


Chart 6.4: Vehicles Registered in the Study Region

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.

In this analysis, Industry sector includes: mining, quarrying and turf production; manufacturing industries; electricity, gas and water supply; construction.

Commercial/Public sector includes: wholesale and retail trade; hotels and restaurants, transport, storage and communications; banking and financial services; real estate, renting and business activities; public administration and defence; education; health and social work; other community, social and personal service activities.

- Nationally employment in the Commercial/Public and Industrial sectors grew by 75 and 70% respectively over the period 1991 to 2005.
- The growth in North Tipperary for the Commercial/Public and Industrial sectors was 70 and 92% respectively over this period.
- The growth in South Tipperary for the Commercial/Public and Industrial sectors was 75 and 91% respectively over this period.
- The growth in County Tipperary for the Commercial/Public and Industrial sectors was 73 and 91% respectively over this period.
- The number of people employed in the Commercial and Industrial Sectors in County Tipperary employment accounted for 3.2% of the total employment in these two sectors in the country.

Table 6.8: Employment Figures in the Commercial/Public Sector

Source: CSO (1991, 1996, 2002, 2006)

	North Tipperary No. of Workers	South Tipperary No. of Workers	County Tipperary No. of Workers	National No. of Workers
1991	8,799	10,886	19,685	662,669
1995	10,547	12,410	22,957	792,152
2000	12,614	15,060	27,674	958,203
2001	12,472	15,755	28,227	995,022
2002	13,530	16,464	29,994	1,031,283
2003	14,080	17,231	31,311	1,062,750
2004	14,259	17,841	32,100	1,099,301
2005	14,981	19,074	34,054	1,157,863

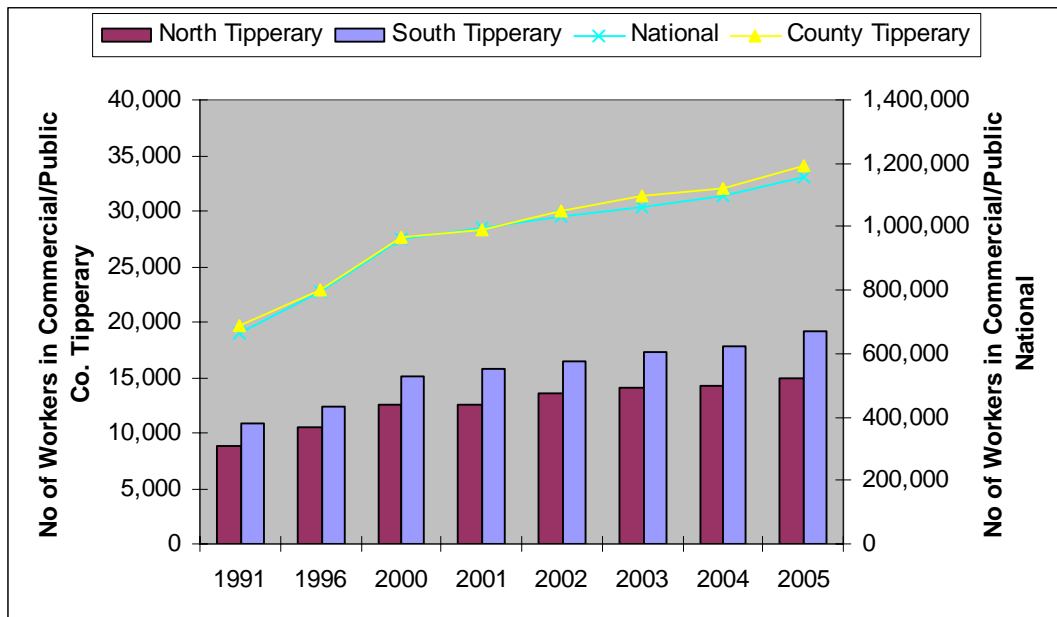


Chart 6.5: Employment Figures in the Commercial/Public Sector in the Study Region

Source: CSO (1991, 1996, 2002, 2006)

Table 6.9: Employment Figures in the Industrial Sector

Source: CSO (2003, 2006)

	North Tipperary No. of Workers	South Tipperary No. of Workers	County Tipperary No. of Workers	National No. of Workers
1991	5,012	6,289	11,301	328,203
1995	6,125	8,433	14,558	381,115
2000	8,847	9,671	18,518	502,844
2001	9,244	10,316	19,559	520,980
2002	8,445	10,865	19,310	513,023
2003	8,431	10,938	19,369	516,123
2004	8,948	11,342	20,290	532,735
2005	9,613	12,009	21,622	556,761

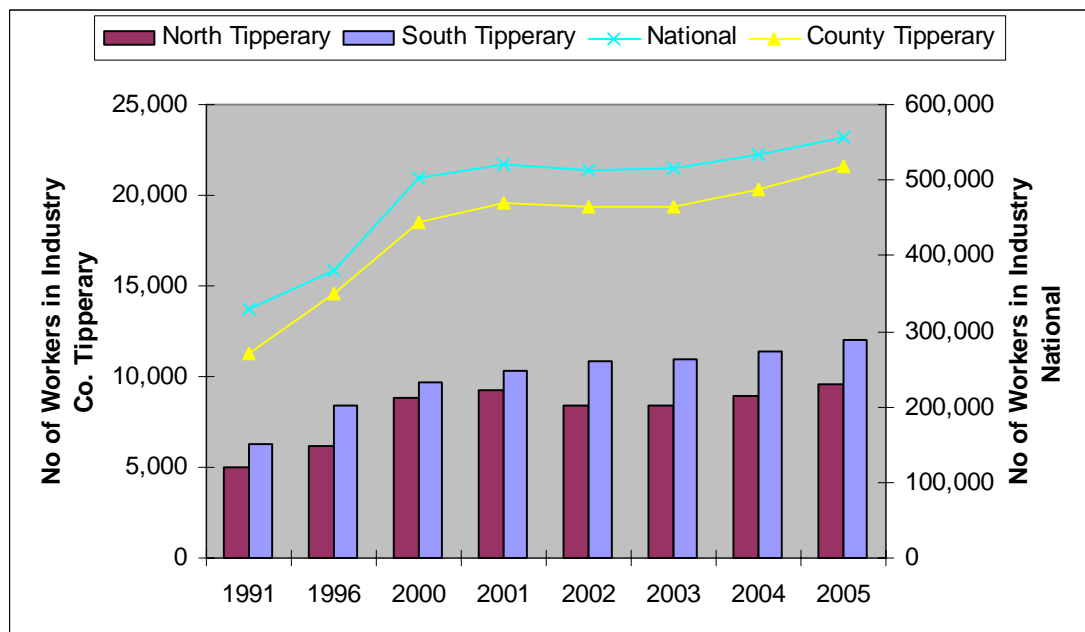


Chart 6.6: Employment Figures in the Industrial Sector in the Study region

Source: CSO (2003, 2006)

6.6.6 Agriculture

Data on agricultural statistics is 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, 1993, 1995, 1997, 2000)

	Hectares				
	1991	1993	1995	1997	2000
North Tipperary	144,578	144,200	142,900	148,300	147,978
South Tipperary	170,420	167,700	166,900	170,600	157,676
County Tipperary	314,998	311,900	309,800	318,900	305,654
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	4,443,547

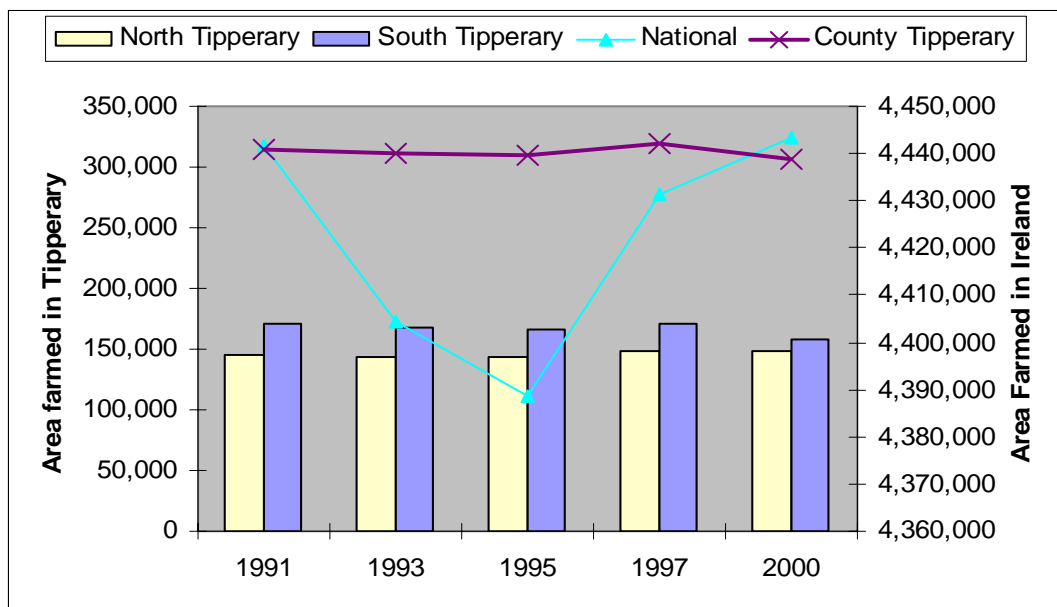


Chart 6.7: Agriculture Area Farmed (Hectares)

Source: CSO (1991, 1993, 1995, 1997, 2002)

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 North Tipperary 1995-2002 is calculated using Mid-West Regional data and proportioning it out per capita for North Tipperary regional accounts. GVA for South Tipperary 1995-2002 is calculated using South-East Regional data and proportioning it out per capita for South Tipperary regional accounts. For 2003 and 2004 the National GVA figures are used to estimate the study region 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
North Tipperary	707	1,317	1,354	1,478	1,569	1,664
% NT of National	1.48%	1.42%	1.28%	1.26%	1.26%	1.26%
South Tipperary	842	1,528	1,782	2,074	2,203	2,336
% ST of National	1.76%	1.65%	1.69%	1.76%	1.76%	1.76%
County Tipperary	1,549	2,845	3,135	3,552	3,772	4,000
% County Tipperary of National	3.24%	3.07%	2.97%	3.02%	3.02%	3.02%
State	47,829	92,781	105,473	117,630	124,919	132,481

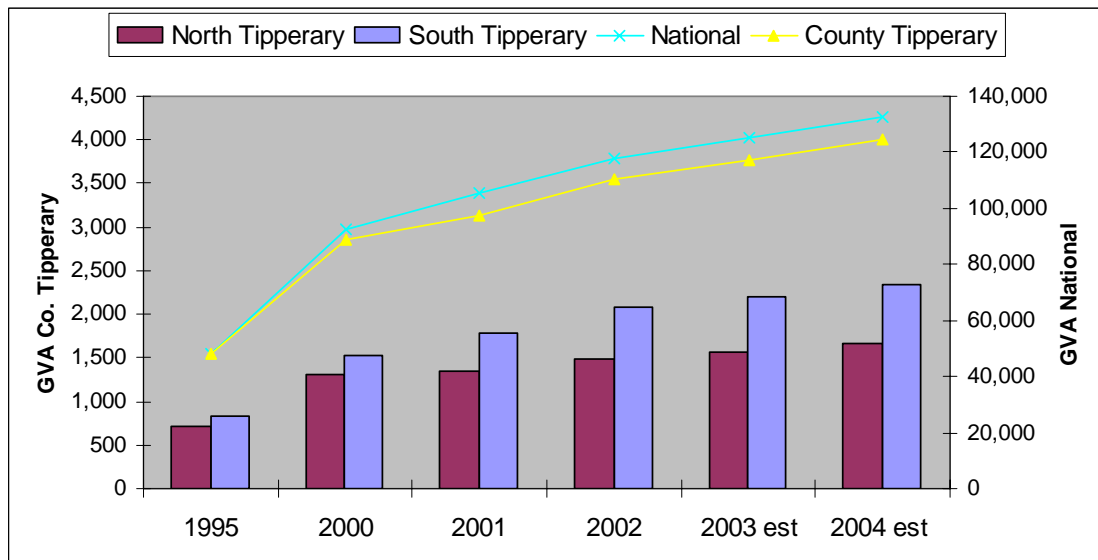


Chart 6.8: GVA at Basic Prices (Million €), 1995 - 2004

Source: CSO (2005)

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

Source: CSO (2006)

	1995	2000	2001	2002	2003 est	2004 est
North Tipperary	12,186	21,950	22,368	24,218	25,214	26,227
South Tipperary	11,164	19,607	22,691	26,215	27,497	28,809
County Tipperary	11,608	20,626	22,551	25,345	26,499	27,675
National	13,111	24,072	26,905	29,371	31,191	33,079

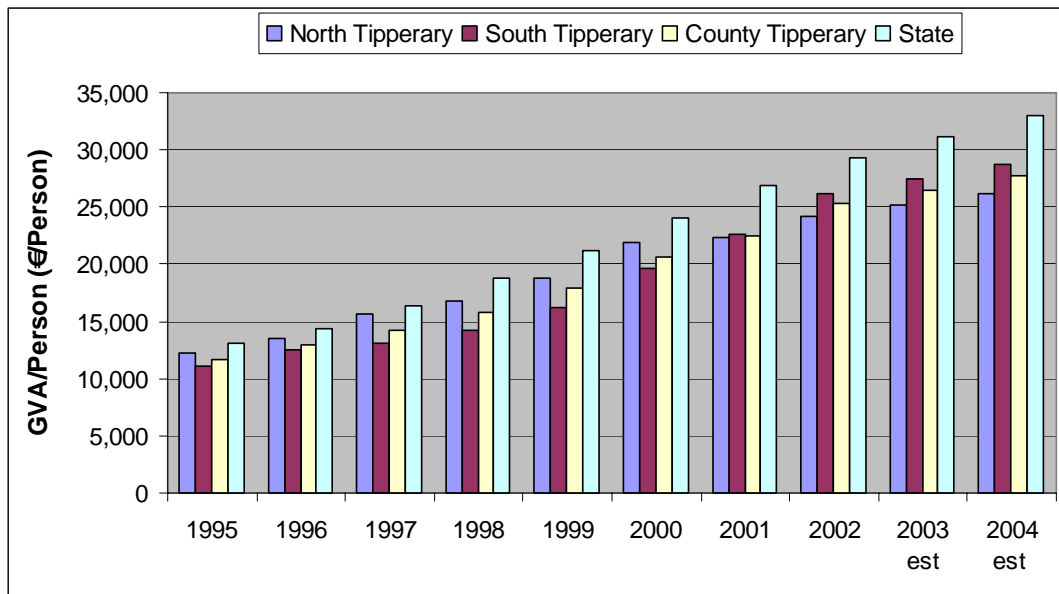


Chart 6.9: GVA per person at Basic Prices, 1995 - 2004 €

Source: CSO (2006)

7.0 Energy Balance Methodology

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

The data is presented by political areas in separate Tables and Figures. This allows for analysis of energy and emissions within North Tipperary and South Tipperary.

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 County Tipperary in this study is based on National figures and proportioned out for the County. There is an urgent need for accurate data on a county basis to facilitate future reports and revisions.

Forecasts in both the TFC and CO₂ Emissions are calculated using projections from the ESRI Mid Term Review 2005-2012 published in 2005. The projections are proportioned out for County Tipperary, 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 Tipperary 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 Tipperary. Energy consumption in Tipperary 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 Tipperary.

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 Tipperary 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 Tipperary. 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 Tipperary 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 Tipperary.

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 Tipperary. Energy consumption in Tipperary 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 Tipperary.

7.6 Other Assumptions

Natural Gas was first supplied into South Tipperary to Clonmel in 1987. It was then expanded to Carrick-on-Suir in 1998 and Ballyderahan in 2003.

In North Tipperary, natural gas was supplied in Ballina in 1998 and in Newport in 1999. For the purpose of the exercise the assumption has been made that natural gas use was negligible in North Tipperary up to 2000.
(Source: 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 CO₂ emissions.

The projected price cost of CO₂ in 2010 and 2020 is forecasted to be €35-50/tonne CO₂ based on Bank of Ireland Global Markets Forecast Price (Bank of Ireland, 2006).

The target for Kyoto has been based on the agreed Irish allocation under the EU Burden Sharing Agreement i.e. 1990 levels plus 13%.

The target for 2020 has been based on the EU aim to reduce emissions by 20% by 2020, compared to 1990 levels.

8.0 Key Energy Sites in County Tipperary

As stated in Chapter 7 the biggest energy users of the commercial and industry sectors in County Tipperary have been listed. However, there are no energy intensive plants and services located in the County. There is also no major energy producer.

The most important industries in terms of energy use and Greenhouse Gas emissions are dealt with under the National Emissions Trading scheme.

Table 8.1: Emissions Allocations in County Tipperary

Source: EPA (2006)

Industry		Emissions allocated (t CO ₂)		
Site	Location	2005	2006	2007
Arrabawn Cooperative Society Limited	Nenagh	22,618	22,618	22,618
Bord na Móna Littleton Briquette Factory	Thurles	66,155	66,155	66,155
Merck Sharp & Dohme (Ireland) Limited	Clonmel	14,461	14,461	14,461
Moy Isover Ltd.	Clonmel	10,395	10,395	10,395
Tipperary Co-operative Creamery Limited	Tipperary	20,433	20,433	20,433
Weyerhaeuser Europe Limited	Clonmel	5,968	5,968	5,968
Munster Proteins / AIBP Cahir	Cahir	10,615	10,615	10,615
	Total	150,645	150,645	150,645

It can be seen from the table above that seven industries are involved in this scheme in County Tipperary. And the overall amount of emissions allocated is 150.65 kTonnes of CO₂. This data must be compared to the CO₂ emissions for County Tipperary (1,700 kTonnes CO₂ in 2004) to demonstrate that these sites, while important, should not form the only focus on action within the County.

9.0 Summary Results

This Chapter provides an overview of energy consumption and environmental emissions for the County of Tipperary. Further details for each individual area (North Tipperary and South Tipperary) are provided in the subsequent Chapters.

9.1 TFC and CO₂ Emissions by Area

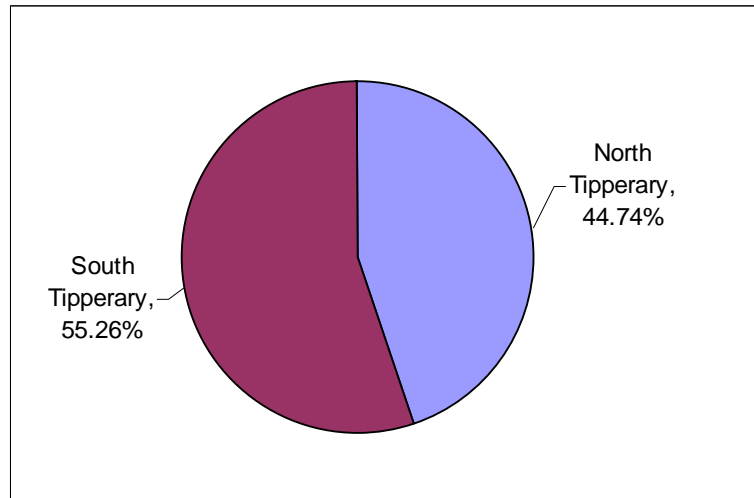


Chart 9.1: % Share of Total Final Energy Consumption by Area

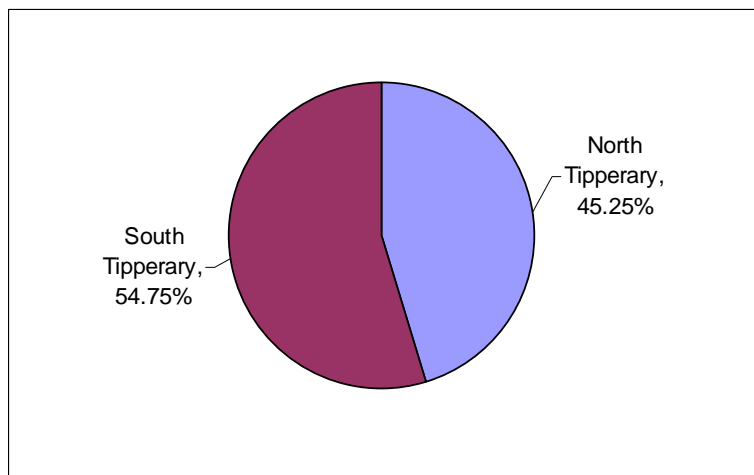


Chart 9.2: % Share of Energy Related CO₂ Emissions by Area

It can be seen that North Tipperary and South Tipperary nearly account for the same proportion of energy consumption and related emissions.

9.2 TFC by Area: 1990, 2005, 2010 and 2020

Table 9.1 TFC for Each Area

GWh	North Tipperary	South Tipperary	County Tipperary
1990	1,439.4	1,832.0	3,271.4
2005	2,557.1	3,041.8	5,598.9
BAU 2010	3,068.6	3,652.0	6,720.6
BAU 2020	3,418.0	4,077.9	7,495.9

Table 9.2: % TFC for each Area

% Share	North Tipperary	South Tipperary
1990	44.0%	56.0%
2005	45.7%	54.3%
BAU 2010	45.7%	54.3%
BAU 2020	45.6%	54.4%

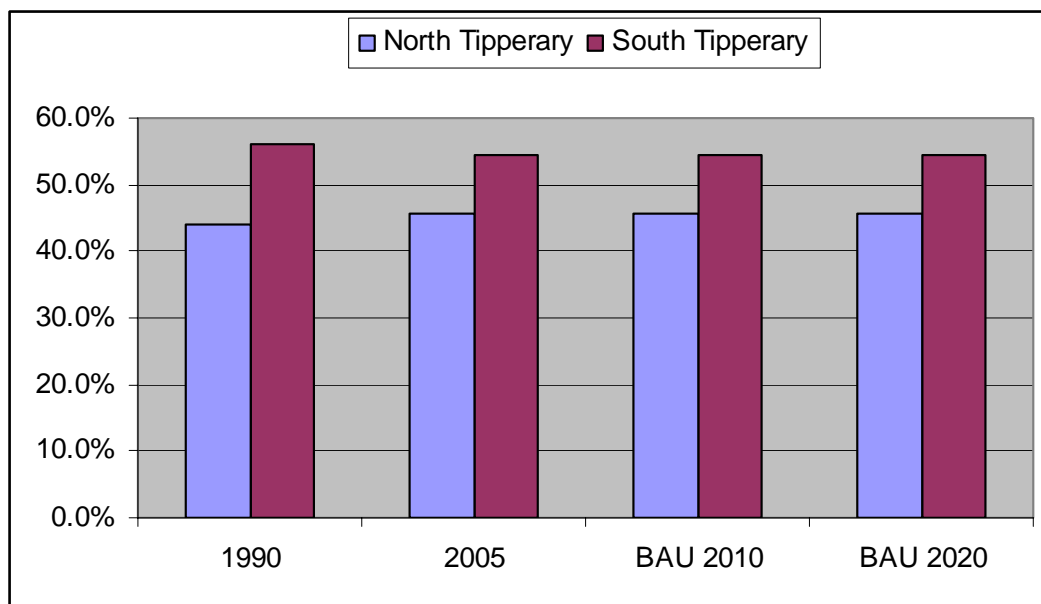


Chart 9.3: % TFC for each Area

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, 2005, 2010, 2020

Table 9.3 Total TFC by Fuel for County Tipperary

GWh	Coal	Peat	Oil	Natural Gas	Renewables	Electricity
1990	358.2	325.9	1988.7	127.4	44.6	426.5
2005	181.8	113.5	4043.2	322.7	90.4	847.3
BAU 2010	137.2	77.7	4771.5	416.0	342.5	975.9
BAU 2020	74.7	32.5	5291.6	464.6	522.5	1107.7

Table 9.4 % TFC by Fuel for County Tipperary

% Share	Coal	Peat	Oil	Natural Gas	Renewables	Electricity
1990	10.9%	10.0%	60.8%	3.9%	1.4%	13.0%
2005	3.3%	2.0%	72.3%	5.8%	1.6%	15.1%
BAU 2010	2.0%	1.2%	71.0%	6.2%	5.1%	14.5%
BAU 2020	1.0%	0.4%	70.7%	6.2%	7.0%	14.8%

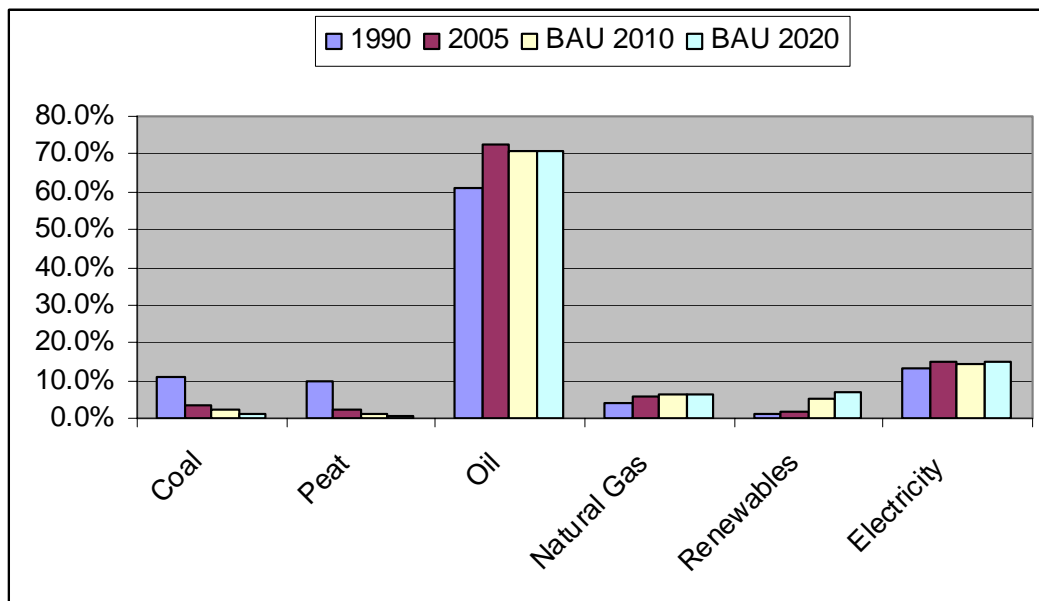


Chart 9.4: % TFC by Fuel for County Tipperary

The main fuel consumed in County Tipperary is oil, accounting for 72% of TFC in 2005. Electricity is the other main energy source. Natural gas has limited penetration in the County. The use of coal and other solid fuels is declining and will continue to do so.

9.4 TFC by Sector 1990, 2005, 2010, 2020

Table 9.5 TFC by Sector for County Tipperary

GWh	Industry	Transport	Residential	Commercial & Public	Agriculture
1990	690.0	1031.1	980.5	361.8	207.9
2005	1081.3	2472.7	1193.7	585.8	260.0
BAU 2010	1284.1	3209.1	1265.1	714.8	248.0
BAU 2020	1494.6	3621.9	1296.5	828.5	248.0

Table 9.6: % TFC by Sector for County Tipperary

% Share	1990	2005	BAU 2010	BAU 2020
Industry	21.1%	19.3%	19.1%	20.0%
Transport	31.5%	44.2%	47.7%	48.4%
Residential	30.0%	21.3%	18.8%	17.3%
Commercial & Public	11.1%	10.5%	10.6%	11.1%
Agriculture	6.4%	4.6%	3.7%	3.3%

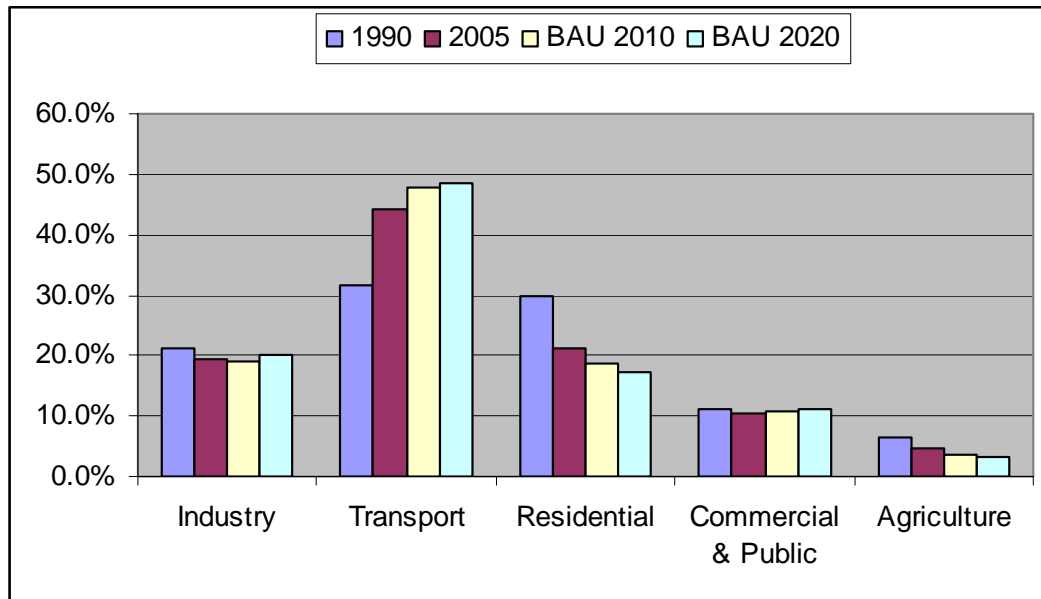


Chart 9.5: % TFC by Sector for County Tipperary

Assessing consumption for County Tipperary 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 and 2020. Residential and Industry are the next most important sectors in terms of consumption.

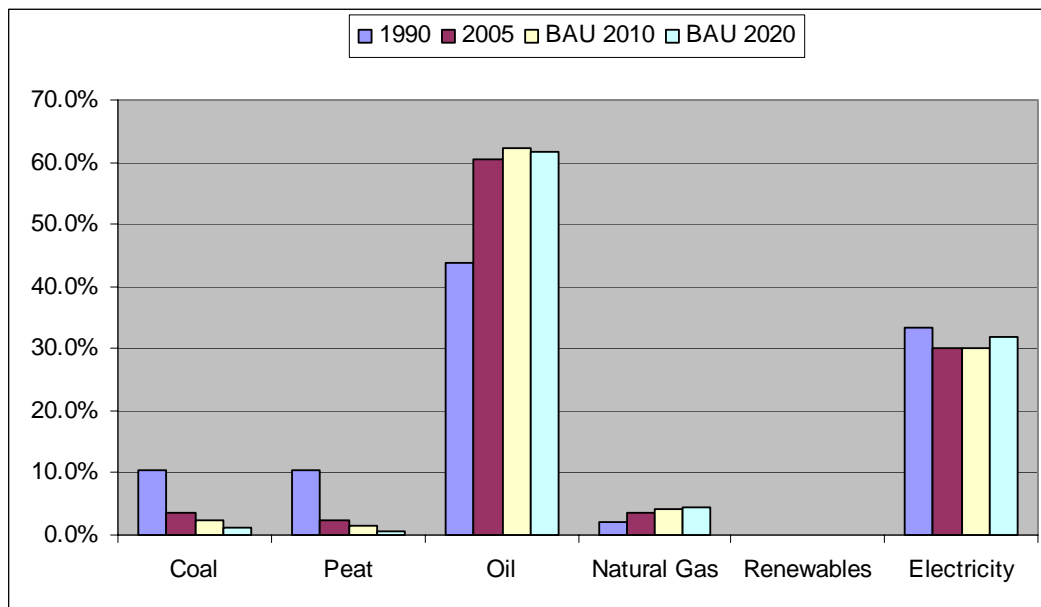
9.5 CO₂ by Fuel: 1990, 2005, 2010, 2020

Table 9.7: CO₂ Emissions by Fuel for County Tipperary

kT-CO ₂	Coal	Peat	Oil	Natural Gas	Renewables	Electricity
1990	122.0	122.0	515.7	25.2	0.0	391.6
2005	61.9	42.5	1060.2	63.8	0.0	528.9
BAU 2010	46.7	29.1	1266.4	82.3	0.0	609.1
BAU 2020	25.4	12.2	1336.0	98.2	0.0	691.5

Table 9.8 % CO₂ Emissions by Fuel for County Tipperary

% Share	1990	2005	BAU 2010	BAU 2020
Coal	10.4%	3.5%	2.3%	1.2%
Peat	10.4%	2.4%	1.4%	0.6%
Oil	43.8%	60.3%	62.3%	61.8%
Natural Gas	2.1%	3.6%	4.0%	4.5%
Renewables	0.0%	0.0%	0.0%	0.0%
Electricity	33.3%	30.1%	30.0%	32.0%

Chart 9.6: % CO₂ Emissions by Fuel for County Tipperary

Oil accounted for 60% of CO₂ energy related emissions in 2005 where its share has increased from 43.8% in 1990 in County Tipperary. Electricity accounts for 30.1% of CO₂ emissions which has reduced from 1990 levels of 33.3%. This is mainly due to fuel switching to cleaner fuels such as natural gas and to electricity production from renewable energy.

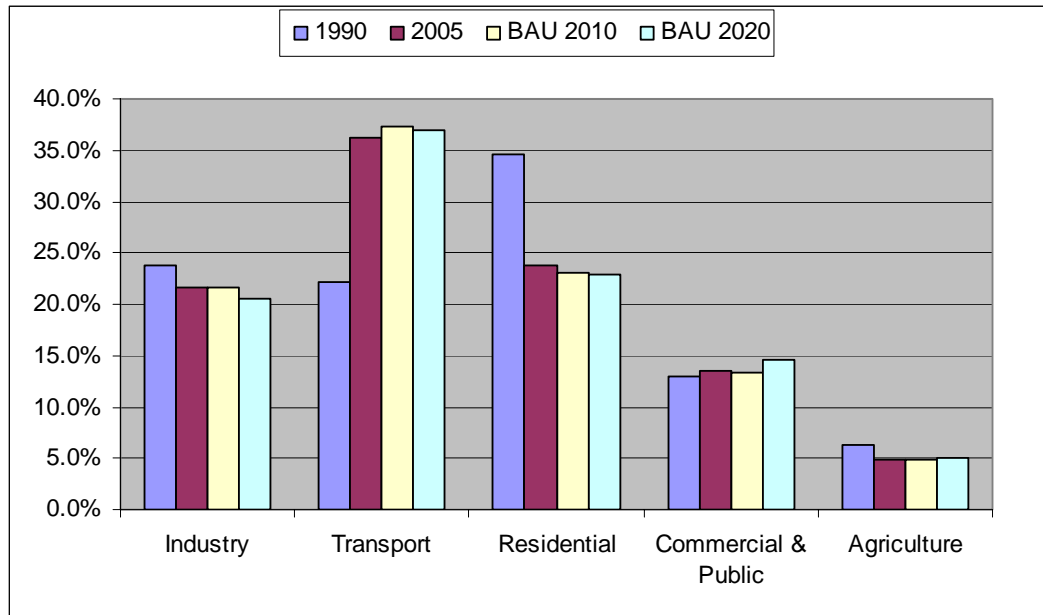
9.6 CO₂ by Sector: 1990, 2005, 2010, 2020

Table 9.9: CO₂ Emissions by Sector for County Tipperary

kT-CO ₂	Industry	Transport	Residential	Commercial & Public	Agriculture
1990	280.6	260.8	407.9	152.5	74.8
2005	378.9	637.5	418.1	238.4	84.5
BAU 2010	438.1	757.1	468.7	271.1	98.6
BAU 2020	445.8	799.9	493.3	315.2	109.2

Table 9.10: % CO₂ Emissions by Sector for County Tipperary

	1990	2005	BAU 2010	BAU 2020
Industry	23.8%	21.6%	21.5%	20.6%
Transport	22.2%	36.3%	37.2%	37.0%
Residential	34.7%	23.8%	23.0%	22.8%
Commercial & Public	13.0%	13.6%	13.3%	14.6%
Agriculture	6.4%	4.8%	4.8%	5.0%

Chart 9.7: %CO₂ Emissions by Sector for County Tipperary

The transport sector accounts for the greatest level of CO₂ emissions in County Tipperary and the % share of emissions has increased by 80% since 1990 and will have doubled by 2010. In line with TFC share the Residential and Industrial Sectors account for the next greatest levels of emissions in 2005.

9.7 Size of the Problem

The following table shows that, for County Tipperary, the targets to be reached for Kyoto and for 2020 are very challenging. By 2010, unless there is immediate action, the County will be 700 kTonnes of CO₂ above the calculated Kyoto limit. The gap to the 2020 target of 20% below 1990 levels is projected to be huge with the same level of emissions having to be saved as was emitted in 1990 i.e. 1.2 Million Tonnes of CO₂.

	Emissions kT CO ₂	Kyoto Target Exceedance kT CO ₂	2020 Target Exceedance kT CO ₂	Projected Cost of CO ₂ /ton Trading Price (€)	Annual Carbon Levy (€millions)
1990	1,176.5	-		-	-
Kyoto Target (1990 + 13%)	1,329.5	-		-	-
2020 Target (1990 - 20%)	941.2				
1995	1,315.3			-	-
2000	1,599.8	270.4		-	-
2005	1,757.3	427.9		-	-
BAU 2010	2,033.6	704.1		35.0	24.6
BAU 2020	2,163.3	833.9	1,222.1	45.0	55.0

9.8 Environmental indicators

A range of environmental indicators have been developed to allow comparison and analysis of the results in County Tipperary 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 CO₂ emissions per capita. It can be seen that in general North Tipperary and South Tipperary have a higher TFC and CO₂ emissions per capita compared to the National averages.

Table 9.11: Environmental Indicators

Indicator	1990			2000			2004		
	Ireland	North Tipperary	South Tipperary	Ireland	North Tipperary	South Tipperary	Ireland	North Tipperary	South Tipperary
Population (000)	3,528.70	58.19	75.35	3,771.60	59.51	77.32	4,076.06	63.5	81.09
TFC Fuel Consumed (GWh)	84,486	1,433	1,824	126,262	2,163	2,627	138,365	2,351	2,903
Energy Related Emissions (kt-CO ₂)	31,245	547	687	41,920	683	879	43,042	749	906
TFC/Capita (kWh/ Inhabitant)	23,943	24,628	24,210	33,477	36,341	33,982	33,946	37,019	35,800
CO₂ Emissions / Capita (T CO ₂ / Inhabitant)	8.9	9.4	9.1	11.1	11.5	11.4	10.6	11.8	11.2

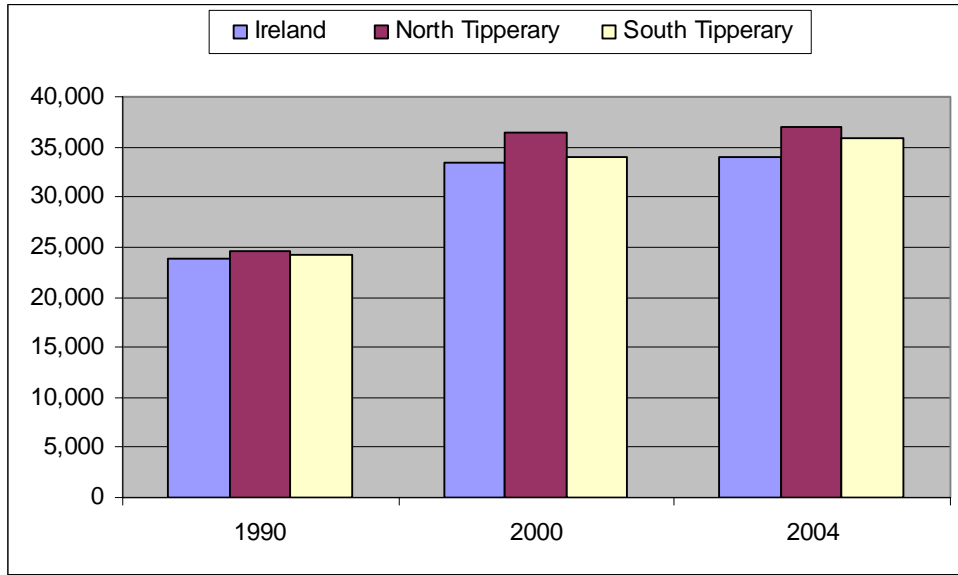


Chart 9.8: Total Final Consumption per capita (kWh/inhabitant)

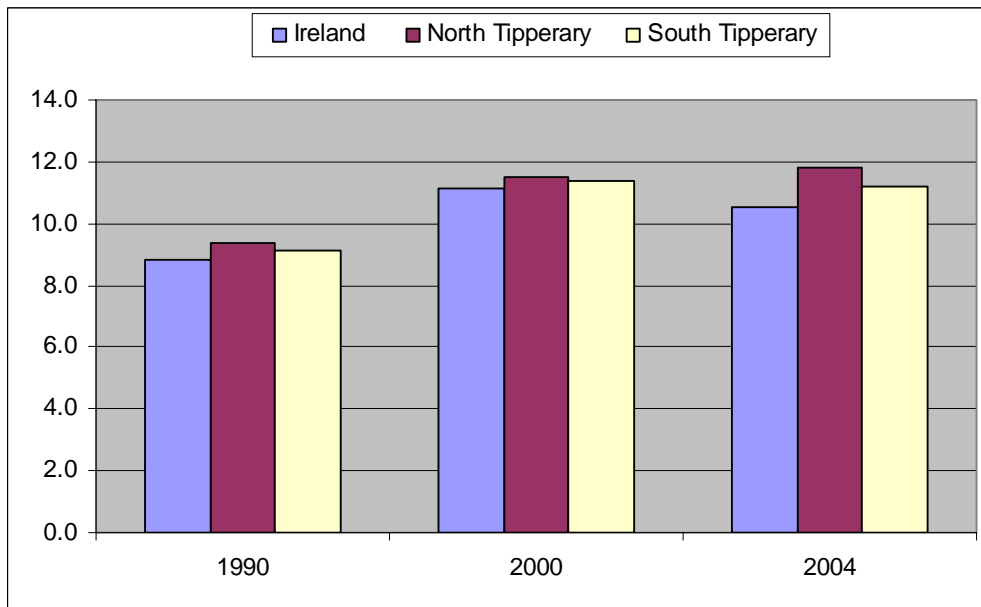


Chart 9.9: Tonnes CO₂ Emissions per capita (Tonnes CO₂/Inhabitant)

9.8 Individual Responsibility

To measure the impact each individual could make to CO₂ reduction an analysis was carried out to calculate the CO₂ reduction required per person to meet the Kyoto targets. This data is summarised in tables 9.12 to 9.14. It shows North Tipperary and South Tipperary will require a reduction of 4.8 and 4.2 tonnes of CO₂ per person respectively.

The table also shows that the increase of energy consumption and CO₂ emissions in County Tipperary is not only due to the growth of population in the County. This is highlighted by the fact that the TFC per Capita and the CO₂ emissions per capita are significantly increasing.

Table 9.12: Individual Responsibility – County Tipperary

Indicator	1990 Tipperary	Kyoto Target Tipperary. 1990 + 13%	2020 Target Tipperary 1990 - 20%	2005 Tipperary	2010 Tipperary	2010 Reduction Sought	2020 Tipperary	2020 Reduction Sought
Population (000)	132.2			146.5	157.4	N/A	172.0	N/A
TFC Fuel Consumed (GWh)	3,271.4			5,598.9	6,720.6	-	7,495.9	-
Energy Related Emissions (kt-CO ₂)	1,176.5	1,329.5	941.2	1,757.3	2,033.6	704.1	2,163.3	1,222.1
TFC/Capita (kWh/ Inhabitant)	24,747.5	-		38,217.5	42,705.6	-	43,580.8	-
CO ₂ Emissions / Capita (T CO ₂ / Inhabitant)	8.9	8.9	5.5	12.0	12.9	4.5	12.6	7.1

Table 9.13: Individual Responsibility – North Tipperary

Indicator	1990 North Tipperary	Kyoto Target North Tipp. 1990 + 13%	2020 Target North Tipperary 1990 - 20%	2005 North Tipperary	2010 North Tipperary	2010 Reduction Sought	2020 North Tipperary	2020 Reduction Sought
Population (000)	58.19	-		63.5	71.37	N/A	80	N/A
TFC Fuel Consumed (GWh)	1,439	-		2,557	3,069	-	3,418	-
Energy Related Emissions (kt-CO ₂)	521	589	417	807	935	346	993	576
TFC/Capita (kWh/ Inhabitant)	24,736	-		40,269	42,995	-	42,725	-
CO ₂ Emissions / Capita (T CO ₂ / Inhabitant)	9.0	9.0	5.2	12.7	13.1	4.8	12.4	7.2

Table 9.14: Individual Responsibility – South Tipperary

Indicator	1990 South Tipperary	Kyoto Target South Tipp. 1990 + 13%	2020 Target South Tipperary 1990 - 20%	2005 South Tipperary	2010 South Tipperary	2010 Reduction Sought	2020 South Tipperary	2020 Reduction Sought
Population (000)	74	-		83	86.0	N/A	92	N/A
TFC Fuel Consumed (GWh)	1,832	-		3,042	3,652	-	4,078	-
Energy Related Emissions (kt-CO ₂)	655	740	524	950	1,099	358	1,171	647
TFC/Capita (kWh/Inhabitant)	24,757	-		36,648	42,465	-	44,325	-
CO ₂ Emissions / Capita (T CO ₂ / Inhabitant)	8.9	8.9	5.7	11.5	12.8	4.2	12.7	7.0

10.0 North Tipperary

10.1 Summary Analysis

10.1.1 Total Final Consumption and Emissions by Fuel

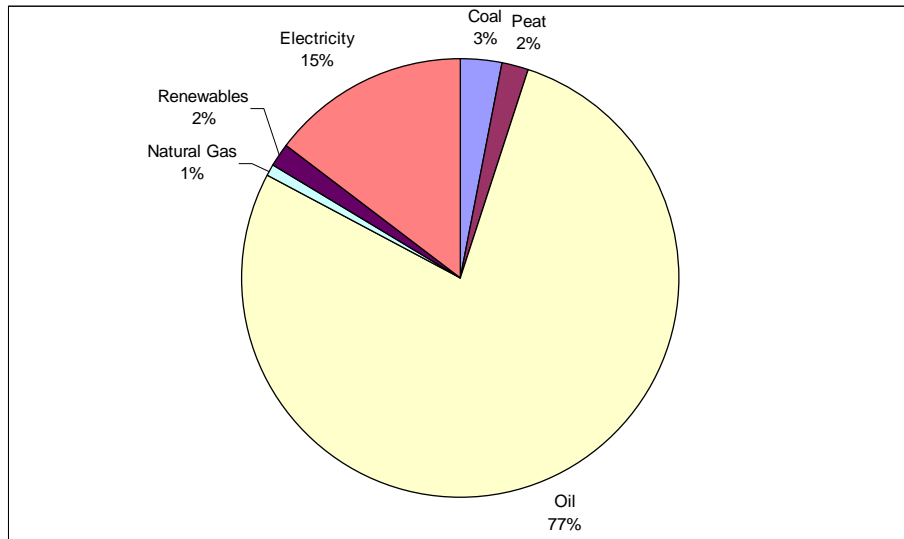


Chart 10.1: Total Final Consumption by Fuel, North Tipperary, 2005

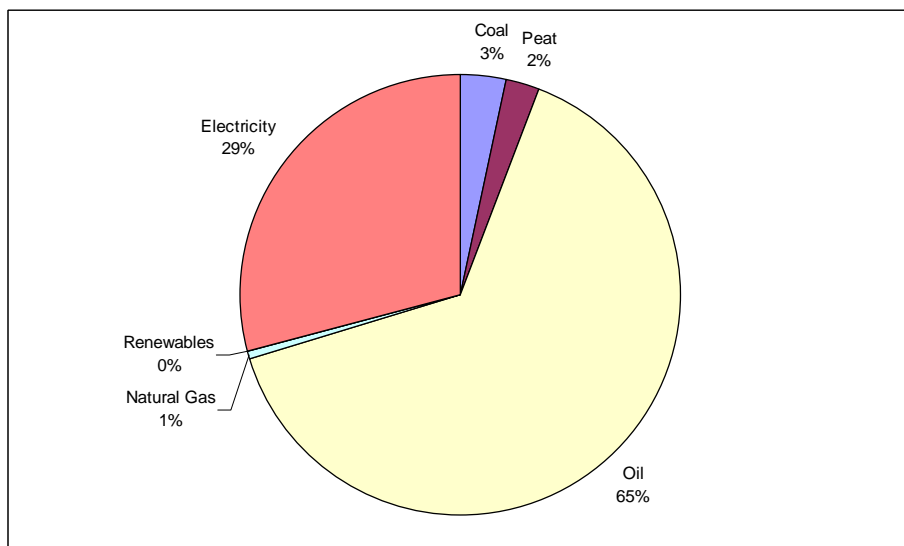


Chart 10.2: CO₂ Emissions by Fuel, North Tipperary, 2005

- From the Charts above it can be seen that oil accounts for the largest proportion of TFC in North Tipperary, and also is the highest contributor in terms of CO₂ emissions.
- While Electricity only accounts for 15% of TFC it accounts for 29% of emissions, due to its high emissions factor.
- Renewables currently make a minor contribution to consumption with the balance being made up of solid fuels.

10.1.2 Total Final Consumption and Emissions by Sector

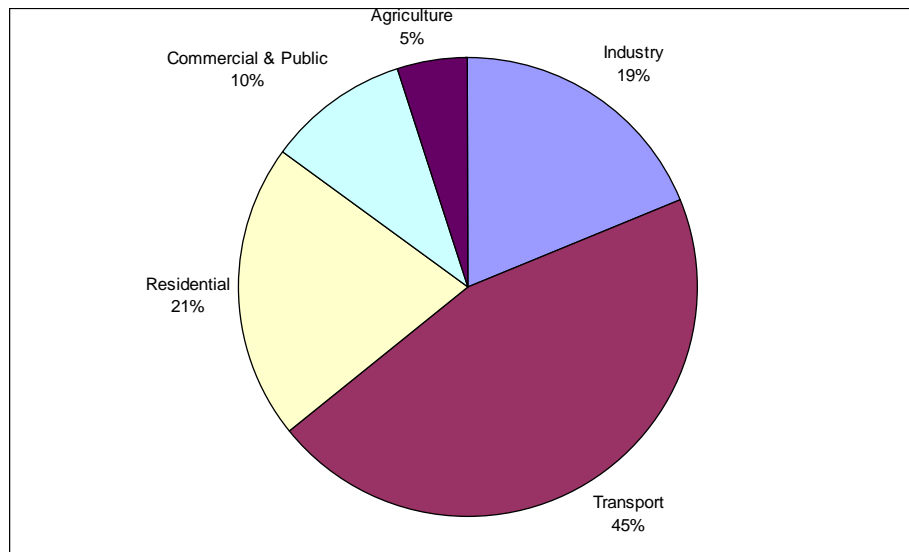


Chart 10.3: Total Final Consumption by Sector, North Tipperary, 2005

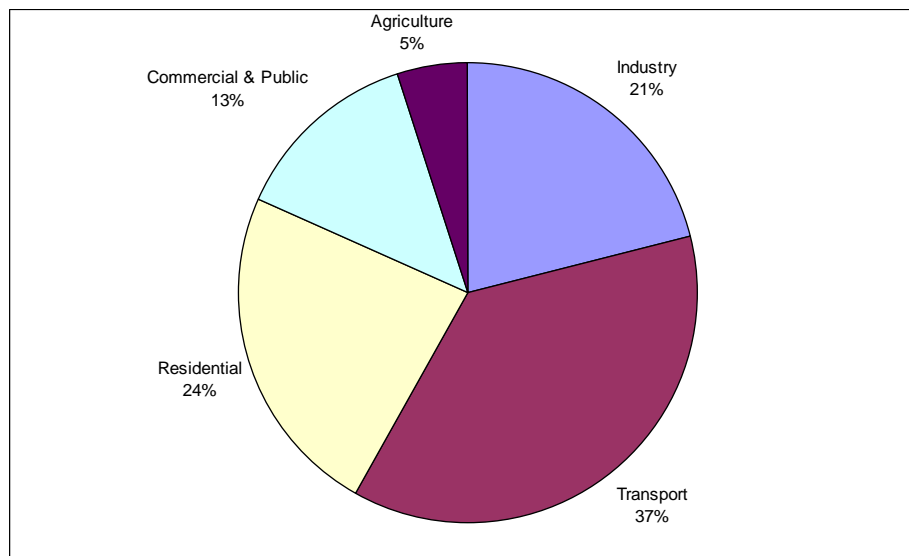


Chart 10.4: CO₂ Emissions by Sector, North Tipperary, 2005

- Clearly the Transport Sector, in 2005, has the highest consumption in energy terms in the North Tipperary, at 45%. It also currently accounts of 37% of CO₂ emissions.
- The Residential Sector is the next highest contributor in terms of emissions, at 24%, while it consumes 21% of TFC in the County.
- The Industrial Sector accounted for 19% of consumption in 2004 and 21% of CO₂ emissions.
- The Commercial Sector currently only accounts for 13% of emissions
- Agriculture has the lowest consumption of energy and lowest emissions, in energy terms, within North Tipperary.

10.1.3 Environmental Indicators

Table 10.1: Environmental Indicators for North Tipperary

Indicator	1990		2000		2004	
	Ireland	North Tipperary	Ireland	North Tipperary	Ireland	North Tipperary
Population (000)	3,528.70	58.19	3,771.60	59.51	4,076.06	63.5
TFC Fuel Consumed (GWh)	84,486	1,433	126,262	2,163	138,365	2,351
Energy Related Emissions (kt-CO ₂)	31,245	547	41,920	683	43,042	749
TFC/Capita (kWh/ Inhabitant)	23,943	24,628	33,477	36,341	33,946	37,019
CO₂ Emissions / Capita (T CO ₂ / Inhabitant)	8.9	9.4	11.1	11.5	10.6	11.8

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

- The TFC per capita in North Tipperary is above the National average, consistently since 1990. 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 North Tipperary. 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 CO₂ emissions have increased by 64% and 37% respectively between 1990 and 2004.

10.2 Energy Analysis

10.2.1 Total Final Consumption by Fuel

Table 10.2: Total Final Consumption, North Tipperary, (1990 – 2020)

GWh	1990	1995	2000	2005	BAU 2010	BAU 2020
Coal	155.6	58.5	75.5	80.9	61.0	33.1
Peat	140.9	112.2	55.5	50.5	34.6	14.5
Oil	935.2	1,173.2	1,658.3	1,982.5	2,353.3	2,576.5
Natural Gas	-	-	-	25.4	29.0	64.1
Renewables	19.6	18.9	27.9	40.2	155.8	236.9
Electricity	188.1	236.9	322.5	377.6	434.9	492.8
TFC	1,439.4	1,599.8	2,139.7	2,557.1	3,068.6	3,418.0

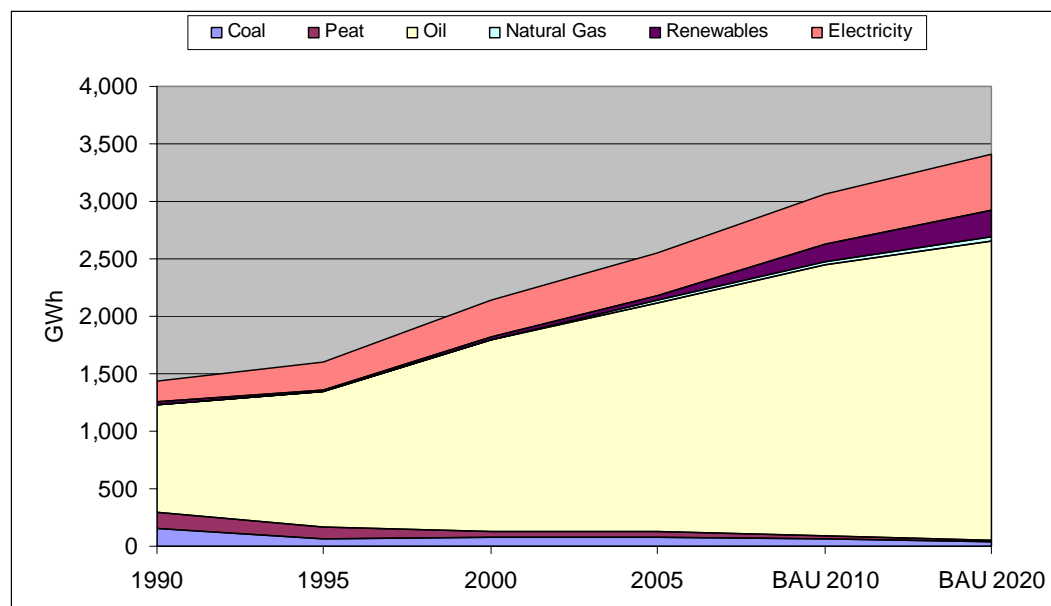


Chart 10.5: Total Final Consumption by Fuel, North Tipperary, (1990 – 2020)

- There is a decreasing dependence on solid fuels within the North Tipperary with coal, peat and briquettes all showing considerable reductions from 1990 to 2005.
- The dependence on oil as a fuel is significant and a cause for concern with a 111% increase in consumption occurring from 1990 to 2005. The BAU scenario will see the 1990 consumption increase by 178% by 2020.
- There is a very limited use of gas in North Tipperary. This is due to the fact that natural gas is only available since 1998 and only in Newport and Ballina.
- Renewables, if current conditions continue, will have a limited impact in the North Tipperary. 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 (188GWh) doubling to 377.6GWh by 2005.

Table 10.3: Total Final Consumption by Fuel, % Share, North Tipperary, (1990 – 2020)

% Share	1990	1995	2000	2005	BAU 2010	BAU 2020
Coal	10.8%	3.7%	3.5%	3.2%	2.0%	1.0%
Peat	9.8%	7.0%	2.6%	2.0%	1.1%	0.4%
Oil	65.0%	73.3%	77.5%	77.7%	76.7%	76.3%
Natural Gas	0.0%	0.0%	0.0%	1.0%	0.9%	0.9%
Renewables	1.4%	1.2%	1.3%	1.6%	5.1%	6.9%
Electricity	13.1%	14.8%	15.1%	14.8%	14.2%	14.4%

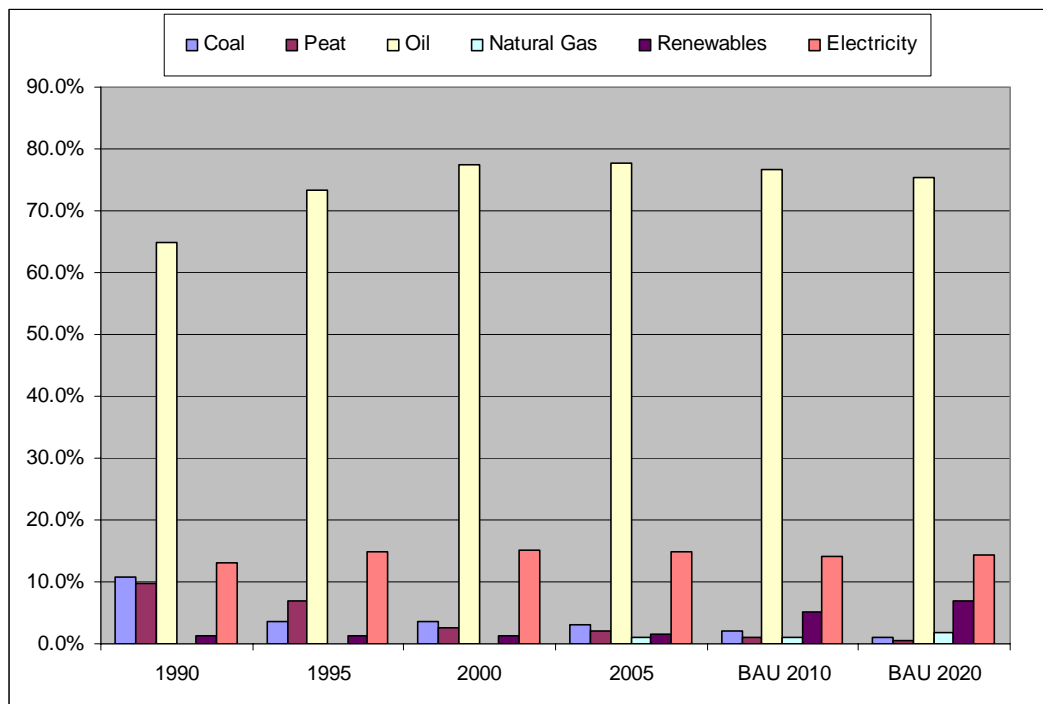


Chart 10.6: Total Final Consumption by Fuel, % Share, North Tipperary, (1990 – 2020)

- The increasing dependence on oil is further emphasised when analysing data by % Share. This has grown from 65% in 1990 to 78% in 2005.
- The % Share of electricity in terms of TFC has remained relatively stable.
- The Business as Usual scenario does not predict a significant increase in the share of renewables use in North Tipperary. However substantial progress is possible from wind and wood resources.

10.2.2 Total Final Consumption by Sector

Table 10.4: Total Final Consumption by Sector, North Tipperary, (1990 – 2020)

GWh	1990	1995	2000	2005	BAU 2010	BAU 2020
Industry	306.0	351.5	487.0	480.7	570.9	658.8
Transport	453.0	522.2	851.0	1,155.8	1,500.0	1,692.9
Residential	423.2	409.0	467.9	531.6	563.4	579.5
Commercial & Public	161.7	188.3	211.0	257.7	314.4	364.5
Agriculture	95.4	128.7	122.7	125.9	120.1	120.1
Total	1,439.4	1,599.8	2,139.6	2,551.7	3,068.8	3,415.7

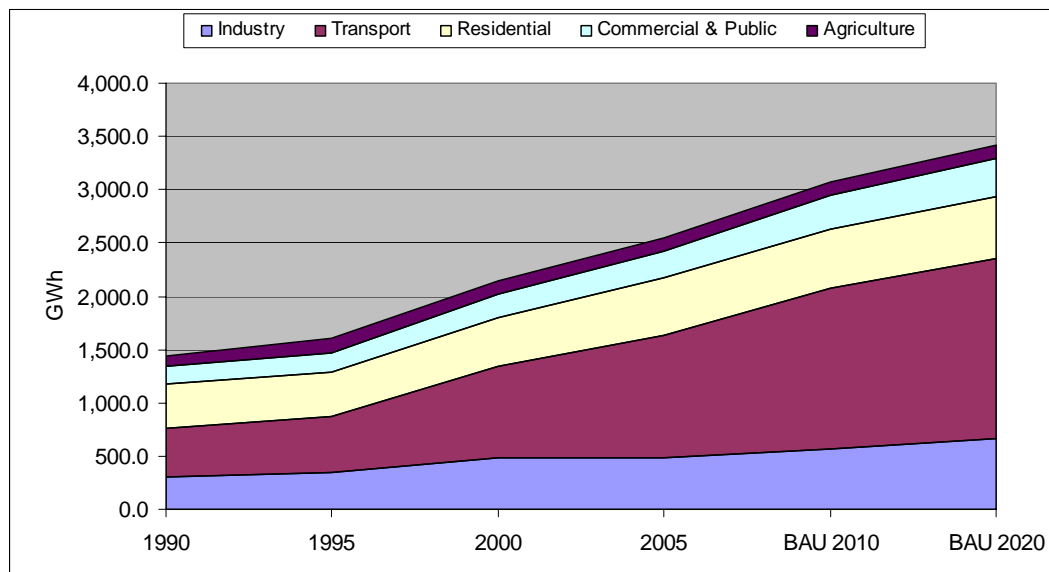


Chart 10.7: Total Final Consumption by Sector, North Tipperary, (1990 – 2020)

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

- The TFC for North Tipperary grew by 77% between 1990 and 2005 and the business as usual forecast indicates the TFC will double from 1,436 GWh to 3,068 GWh in 2010.
- Transport will account for the greatest growth in consumption by 2020, with a predicted increase of over 273% above 1990 levels.
- The increased level of housing is reflected in the fact that the residential sectors final energy consumption has grown by 26% since 1990 and is predicted to increase by another 11% by 2020.
- The commercial sector has shown a higher increase in consumption when compared to the Industrial sector since 1990 (66% for commercial compared to 46% 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, North Tipperary

% Share	1990	1995	2000	2005	BAU 2010	BAU 2020
Industry	21.3%	22.0%	22.8%	18.8%	18.6%	19.3%
Transport	31.5%	32.6%	39.8%	45.3%	48.9%	49.6%
Residential	29.4%	25.6%	21.9%	20.8%	18.4%	17.0%
Commercial & Public	11.2%	11.8%	9.9%	10.1%	10.2%	10.7%
Agriculture	6.6%	8.0%	5.7%	4.9%	3.9%	3.5%

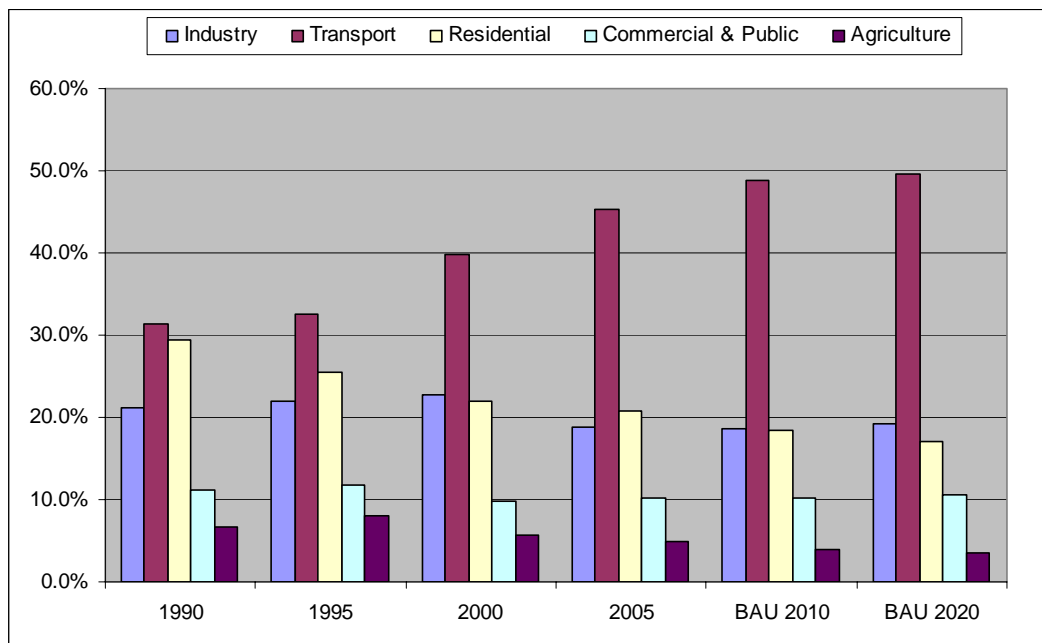


Chart 10.8: Total Final Consumption by Sector, % Share, North Tipperary, (1990 – 2020)

- The transport sector remains the sector with the highest share. The graph highlights the growth of transport sector's share in the TFC from 1990 to 2005. It now accounts for 49% of all TFC in North Tipperary.
- While the TFC for the residential sector has been shown to be increasing its percentage share of the TFC has decreased from 30% in 1990 to 21% 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 17%. The Business As Usual scenarios to 2010 and 2020 would indicate that this will remain relatively constant.
- 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 CO₂ Emission by Fuel

Table 10.6: CO₂ Emissions by Fuel, North Tipperary, (1990 – 2020)

kT CO ₂	1990	1995	2000	2005	BAU 2010	BAU 2020
Coal	53.0	19.9	25.7	27.5	20.8	11.3
Peat	52.7	42.0	20.8	18.9	13.0	5.4
Oil	242.8	307.5	435.7	519.8	623.8	655.5
Natural Gas	0.0	0.0	0.0	5.0	5.7	12.7
Renewables	0.0	0.0	0.0	0.0	0.0	0.0
Electricity	172.7	211.6	249.9	235.7	271.5	307.6
Total	521.3	581.0	732.1	807.0	934.7	992.5
Kyoto Target (1990 + 13%)	589	589	589	589	589	589

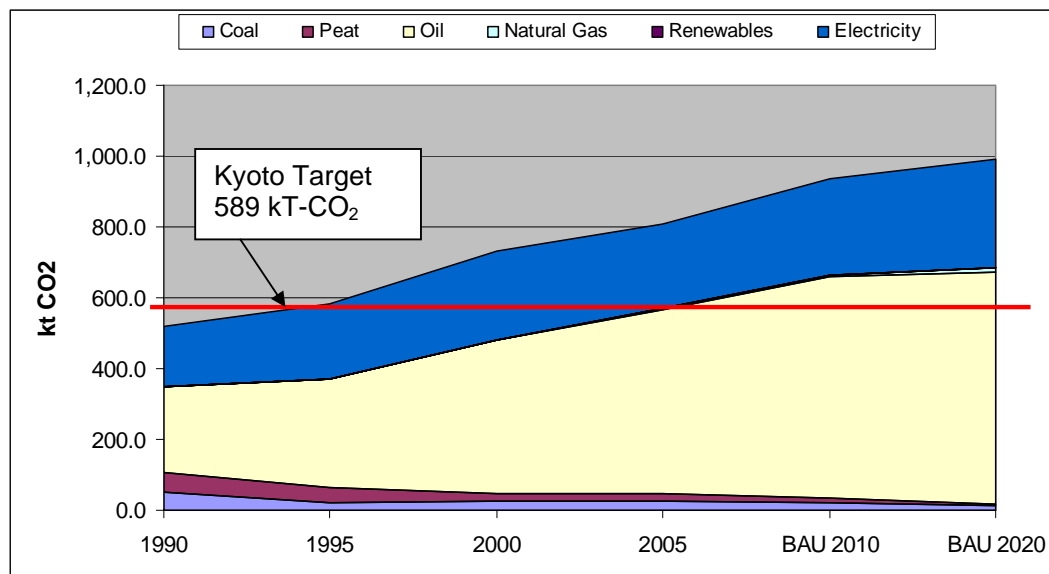


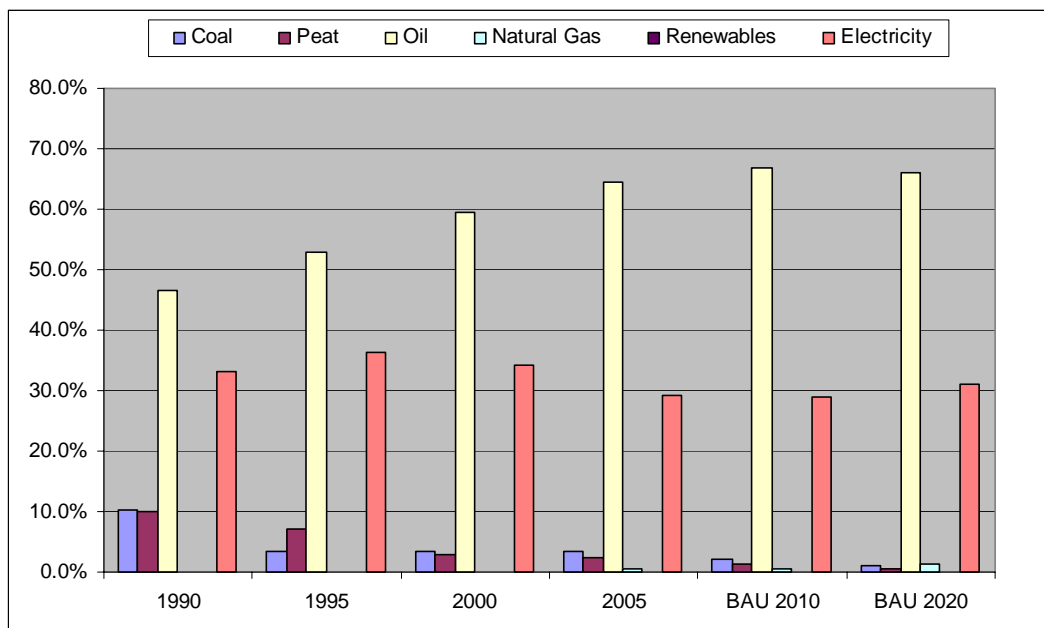
Chart 10.9: CO₂ Emissions by Fuel, North Tipperary, (1990 – 2020)

Analysis of CO₂ emissions related to fuel use in the North Tipperary 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 more than doubled since 1990 from 242 kT CO₂ to 519 kT CO₂ in 2005. Electricity, meanwhile accounted for 36% 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 North Tipperary.
- Emissions from Natural Gas are very low, due the low use of gas in North Tipperary.

Table 10.7: CO₂ Emissions by Fuel, % Share, North Tipperary, (1990 – 2020)

% Share CO ₂	1990	1995	2000	2005	BAU 2010	BAU 2020
Coal	10.2%	3.4%	3.5%	3.4%	2.2%	1.1%
Peat	10.1%	7.2%	2.8%	2.3%	1.4%	0.5%
Oil	46.6%	52.9%	59.5%	64.4%	66.7%	66.0%
Natural Gas	0.0%	0.0%	0.0%	0.6%	0.6%	1.3%
Renewables	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Electricity	33.1%	36.4%	34.1%	29.2%	29.0%	31.0%

Chart 10.10: CO₂ Emissions by Fuel, % Share, North Tipperary, (1990 – 2020)

- Given the predominant use of oil as a fuel its % share of emissions is reflected in the above Table and Chart. It accounts for 64% of CO₂ emissions in 2005.
- Electricity accounts for the bulk for the remainder, i.e. 29%.

10.3.2 Emission by Sector

Table 10.8: CO₂ Emissions by Sector, North Tipperary, (1990 – 2020)

kt CO ₂	1990	1995	2000	2005	BAU 2010	BAU 2020
Industry	126.8	151.0	198.3	171.2	198.1	199.2
Transport	114.6	133.9	219.1	298.0	353.9	373.9
Residential	176.9	170.9	182.8	190.1	213.6	225.7
Commercial & Public	68.7	81.0	89.9	106.8	121.4	140.9
Agriculture	34.3	44.2	42.1	40.9	47.7	52.9
Total	521.3	581.0	732.1	807.0	934.7	992.5
Kyoto Target (1990 + 13%)	589	589	589	589	589	589

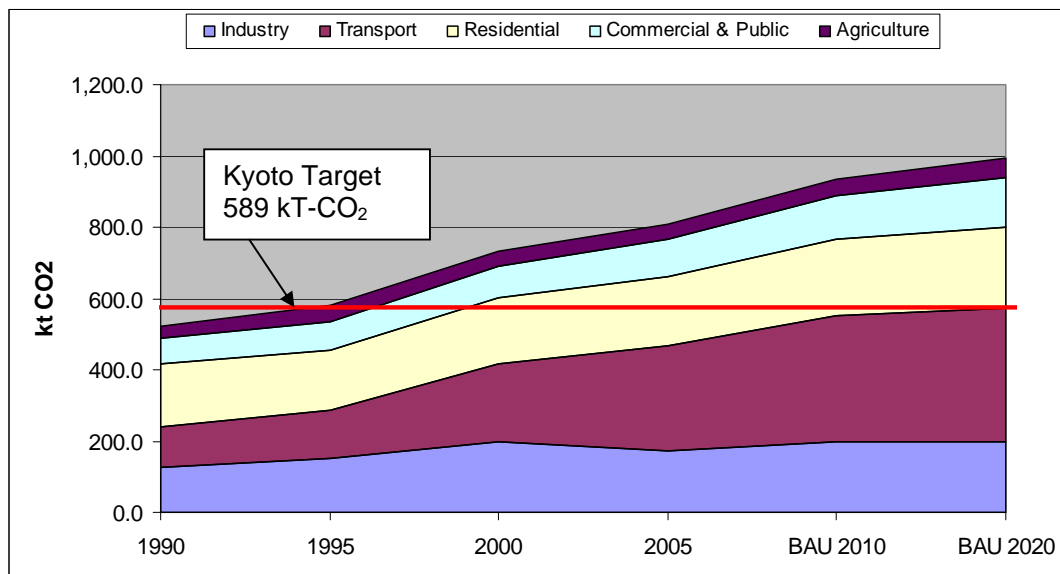
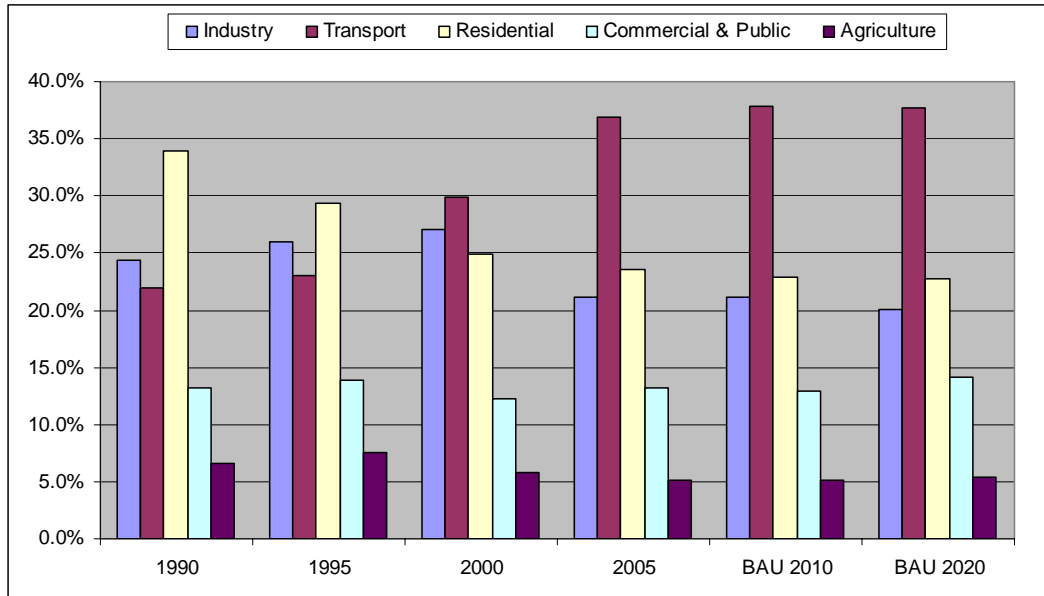


Chart 10.11: CO₂ Emissions by Sector, North Tipperary, (1990 – 2020)

- The transport sector has shown the highest increase in level of emissions since 1990 with a 109% increase to 2005. This mirrors in the increased use of oil as a fuel also.
- Emissions from the residential sector have remained relatively constant since 1990. This reflects the increase energy efficiency of buildings and heating systems used.
- There was a 43% increase in emissions from the commercial sector since 1990 in North Tipperary.

Table 10.9: CO₂ Emissions by Sector, % Share, North Tipperary, (1990 – 2020)

	1990	1995	2000	2005	BAU 2010	BAU 2020
Industry	24.3%	26.0%	27.1%	21.2%	21.2%	20.1%
Transport	22.0%	23.0%	29.9%	36.9%	37.9%	37.7%
Residential	33.9%	29.4%	25.0%	23.6%	22.9%	22.7%
Commercial & Public	13.2%	13.9%	12.3%	13.2%	13.0%	14.2%
Agriculture	6.6%	7.6%	5.7%	5.1%	5.1%	5.3%

Chart 10.12: CO₂ Emissions by Sector, % Share, North Tipperary, (1990 – 2020)

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

- While in 1990 the residential sector accounted for the greatest proportion of emissions i.e. 33%, it now only accounts for 23% of emissions.
- Transport emissions and their % share within North Tipperary show an increasing trend with predictions that this sector will account for close to 40% of all emissions in 2020.

10.4 Response to Kyoto

10.4.1 The size of the problem

Table 10.10: Analysis of Compliance with Kyoto and Potential Costs, North Tipperary.

	Emissions kT CO ₂	Kyoto Target Exceedance kT CO ₂	2020 Target Exceedance kT CO ₂	Projected Cost of CO ₂ /ton Trading Price (€)	Annual Carbon Levy (€millions)
1990	521.3	0.0		-	0
Kyoto Target (1990 + 13%)	589.0	0.0		-	0
2020 Target (1990 - 20%)	417.0				
1995	581.0	0.0		-	0
2000	732.1	143.1		-	0
2005	807.0	217.9		-	0
BAU 2010	934.7	345.7		35	12.1
BAU 2020	992.5	403.5	575.5	45	25.9

It can be seen from the above Table that North Tipperary exceeded its Kyoto Target before 2000 and the BAU scenario would see it generating approximately 345 kT CO₂ above its Kyoto Limit by 2010. Based on a potential price of €35 per tonne of CO₂ this could equate to a Carbon Levy of over €12.1 million per annum. Projected forward to 2020 the levy could increase to €25.9 million if the 20% reduction compared to 1990 levels is not reached.

10.4.2 Sectoral Solutions

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

10.4.2.1 Energy Supply and Production

Energy Production and Supply	QIRs 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	100

10.4.2.2 Transport

Transport	QIRs Proposed (kT-CO₂)
Alternative Fuels (Biofuels, Electric, Hybrids, etc.)	
Increased Public Transport Networks	
Convert Local Authority Fleets to Biofuels	
Electric Bicycles & Mopeds (PV Solar Charging Stations)	
Total	46

10.4.2.3 Built Environment and Residential

Public Buildings and Facilities	QIRs Proposed (kT-CO₂)
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.	5

Residential sector	QIRs Proposed (kT-CO₂)
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	11

10.4.2.4 Industrial/Commercial

Industry/Commercial	QIRs Proposed (kT-CO₂)
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	38

10.4.2.5 Agriculture

Agriculture	QIRs Proposed (kT-CO₂)
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	42

10.4.2.6 Waste

Waste	QIRs Proposed (kT-CO₂)
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	15

10.4.2.7 Sinks (Land Use Change & Forestation)

Land Use Change & Forestation	QIRs Proposed (kT-CO₂)
Regional Forestry / Afforestation Inventory	
Local Authority Tree Planting	
Cultivation of "Energy Crops"	
Development of Private Forests	
Total	14

10.4.2.8 Sectoral Solution Summary

Overall QIRS by sector	QIRs Proposed (kT-CO₂)
Energy Production & Supply	100
Transport	46
Built Environment & Residential	16
Industry, Commercial, & Services	38
Agriculture	42
Waste	15
Sinks (Land Use Change & Forestation)	14
Total	270

10.4.3 Individual Responsibility

- The TFC per person will increase from 24,700 kWh in 1990 to approximately 43,000 kWh in 2010(BAU). It reached 40,000 kWh in 2005. This has had a corresponding increase in emissions per person which has risen from 9.0 Tonnes CO₂ per person to 12.7 Tonnes CO₂ per person by 2005, and will increase to 13.1 Tonnes CO₂ per person in 2010.
- North Tipperary will be 346 kT CO₂ above its Kyoto Limit in 2010 and this will equate to a reduction of 4.8 Tonnes of CO₂ per person in the area if the Kyoto commitments is to be achieved.

Table 10.11: TFC and CO₂ emissions Per Capita and Reductions Sought, North Tipperary:

Indicator	1990 North Tipperary	Kyoto Target North Tipp. 1990 + 13%	2020 Target North Tipperary 1990 - 20%	2005 North Tipperary	2010 North Tipperary	2010 Reduction Sought	2020 North Tipperary	2020 Reduction Sought
Population (000)	58.19	-		63.5	71.37	N/A	80	N/A
TFC Fuel Consumed (GWh)	1,439	-		2,557	3,069	-	3,418	-
Energy Related Emissions (kt-CO ₂)	521	589	417	807	935	346	993	576
TFC/Capita (kWh/ Inhabitant)	24,736	-		40,269	42,995	-	42,725	-
CO ₂ Emissions / Capita (T CO ₂ / Inhabitant)	9.0	9.0	5.2	12.7	13.1	4.8	12.4	7.2

11.0 South Tipperary

11.1 Summary Analysis

11.1.1 Total Final Consumption and Emissions by Fuel

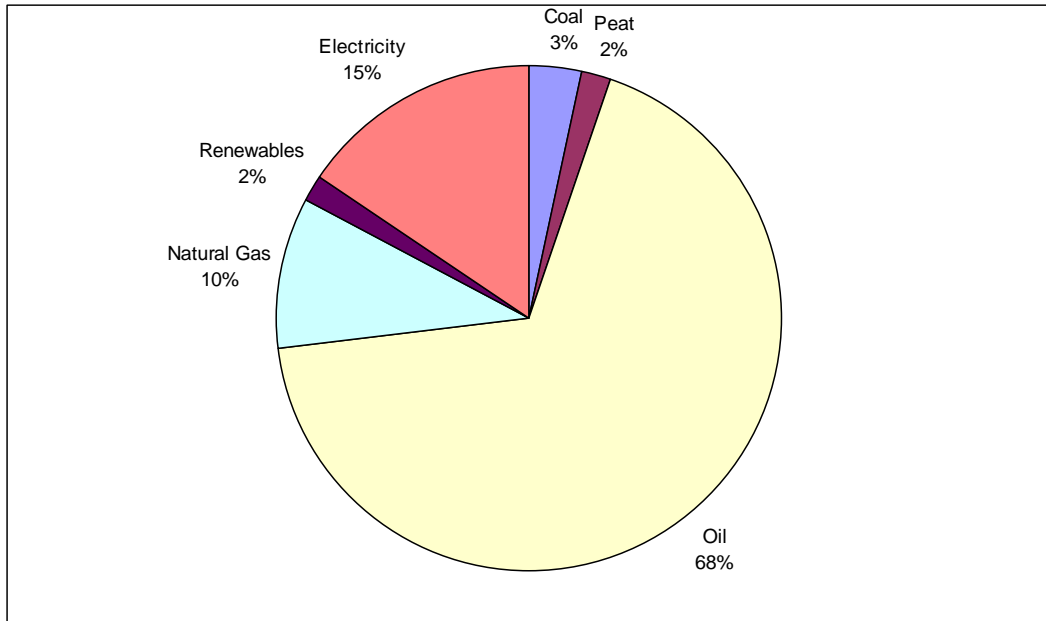


Chart 11.1: Total Final Consumption by Fuel, South Tipperary, 2005

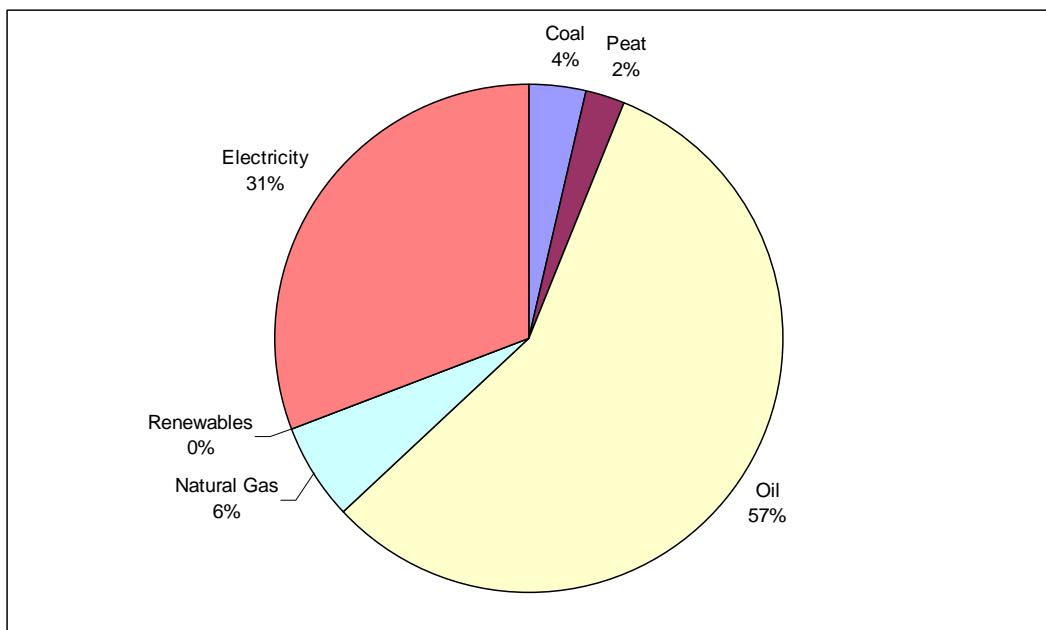


Chart 11.2: CO₂ Emissions by Fuel, South Tipperary, 2005

- From the Charts above it can be seen that oil accounts for the largest proportion of TFC in South Tipperary, and also is the highest contributor in terms of CO₂ emissions.
- While Electricity only accounts for 15% of TFC it accounts for over 31% of emissions, due to its high emissions factor.
- Renewables currently make a minor contribution to consumption with the balance being made up of solid fuels and natural gas.

11.1.2 Total Final Consumption and Emissions by Sector

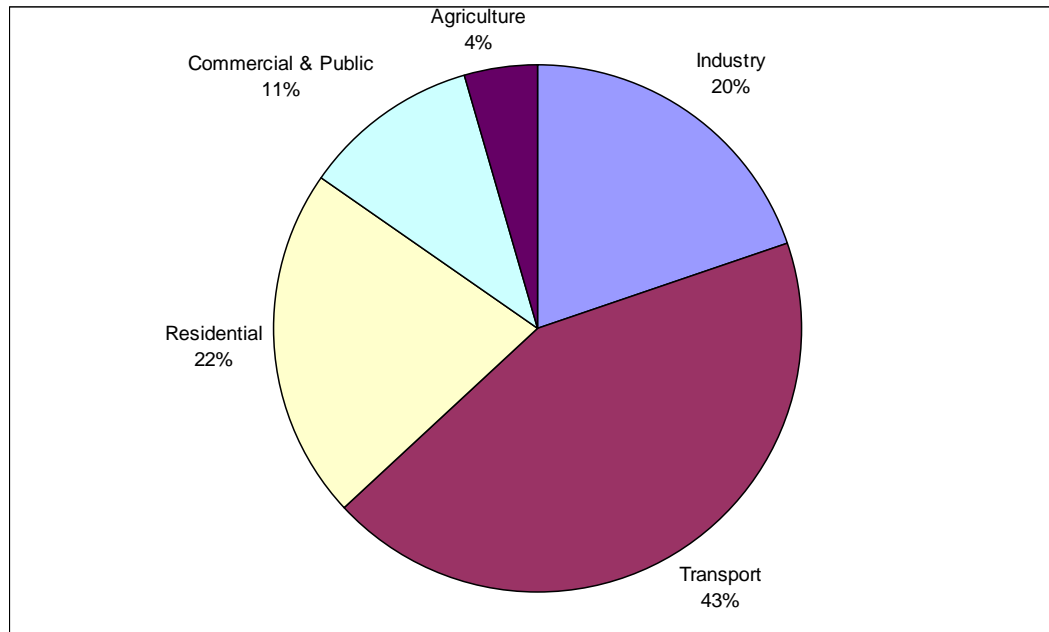


Chart 11.3: Total Final Consumption by Sector, South Tipperary, 2005

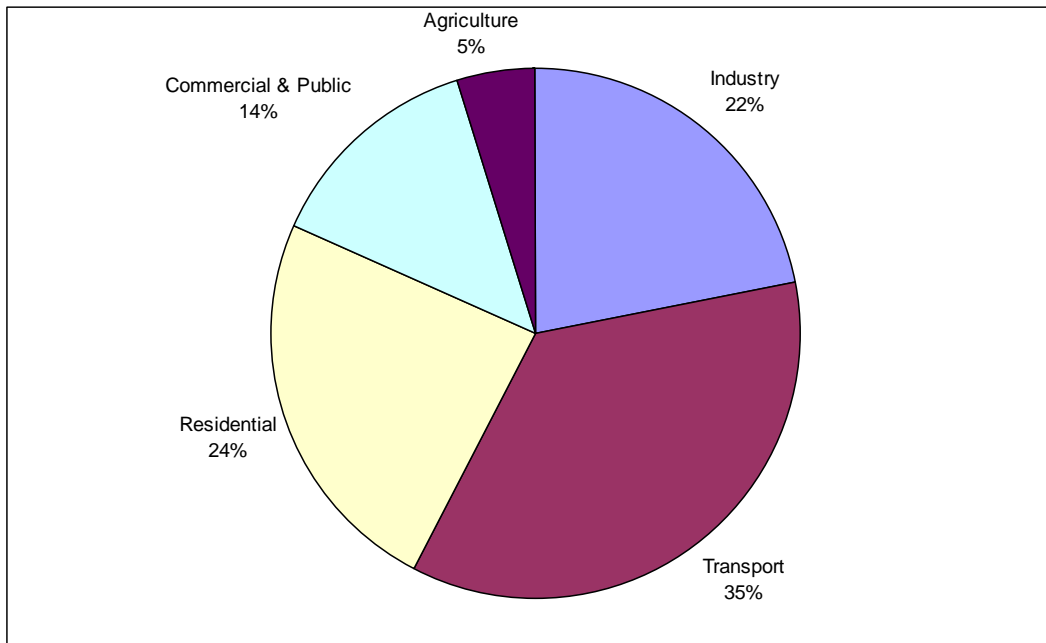


Chart 11.4: CO₂ Emissions by Sector, South Tipperary, 2005

- Clearly the Transport Sector, in 2004, has the highest consumption in energy terms in South Tipperary, at 43%. It also currently accounts of 35% of CO₂ emissions.
- The Residential Sector is the next highest contributor in terms of emissions, at 24%, while it consumes 22% of TFC in South Tipperary.
- The Industrial Sector accounted for 20% of consumption in 2004 and 22% of CO₂ emissions.
- The Commercial Sector currently only accounts for 14% of emissions
- Agriculture has the lowest consumption of energy and lowest emissions, in energy terms, within South Tipperary.

11.1.3 Environmental Indicators

Table 11.1: Environmental Indicators for South Tipperary

Indicator	1990		2000		2004	
	Ireland	South Tipperary	Ireland	South Tipperary	Ireland	South Tipperary
Population (000)	3,528.70	75.35	3,771.60	77.32	4,076.06	81.09
TFC Fuel Consumed (GWh)	84,486	1,824	126,262	2,627	138,365	2,903
Energy Related Emissions (kt-CO ₂)	31,245	687	41,920	879	43,042	906
TFC/Capita (kWh/ Inhabitant)	23,943	24,210	33,477	33,982	33,946	35,800
CO₂ Emissions / Capita (T CO ₂ / Inhabitant)	8.9	9.1	11.1	11.4	10.6	11.2

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

- The TFC per capita in South Tipperary is above the National average consistently and increasingly since 1990.
- As a consequence, emissions per capita are also above the National average.
- TFC and CO₂ emissions have increased by 59% and 32% respectively between 1990 and 2004.

11.2 Energy Analysis

11.2.1 Total Final Consumption by Fuel

Table 11.2: Total Final Consumption, South Tipperary, (1990 – 2020)

GWh	1990	1995	2000	2005	BAU 2010	BAU 2020
Coal	202.6	77.9	94.3	100.9	76.2	41.6
Peat	185.1	147.6	73.0	62.9	43.1	18.0
Oil	1,053.4	1,297.0	1,759.6	2,060.7	2,418.0	2,685.3
Natural Gas	127.4	188.8	259.8	297.3	387.1	432.5
Renewables	25.1	25.6	32.1	50.2	186.7	285.6
Electricity	238.4	308.2	381.2	469.7	541.0	614.9
TFC	1,832.0	2,045.0	2,600.0	3,041.8	3,652.0	4,077.9

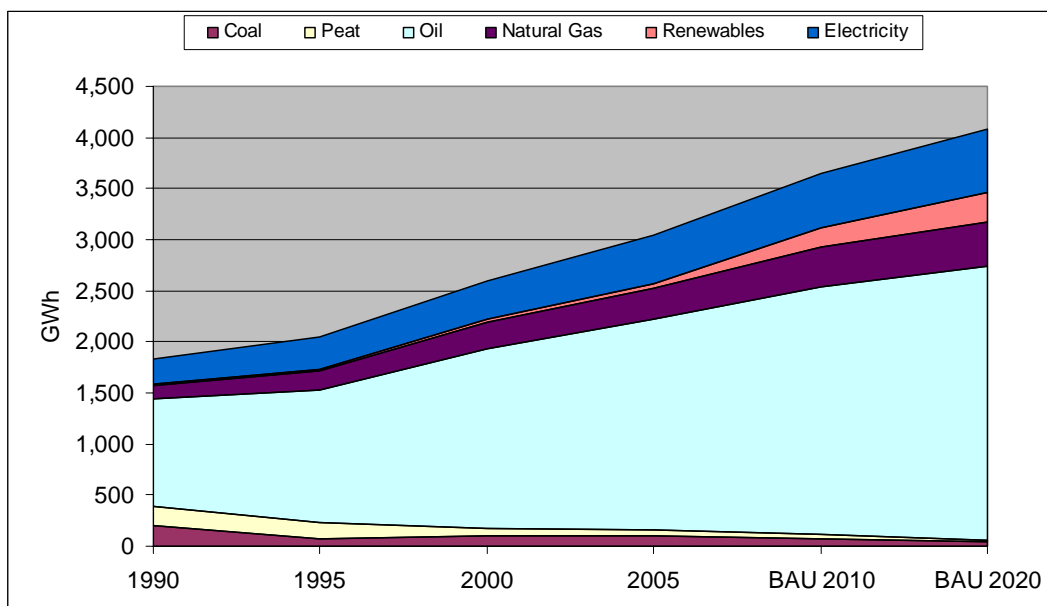


Chart 11.5: Total Final Consumption by Fuel, South Tipperary, (1990 – 2020)

- There is a decreasing dependence on solid fuels within South Tipperary with coal, peat and briquettes all showing considerable reductions from 1990 to 2005.
- The dependence on oil as a fuel is significant and a cause for concern with a 100% increase in consumption occurring from 1990 to 2005. The BAU scenario will see the 1990 consumption increase by 154% by 2020.
- Electricity use continues to grow at a significant rate with consumption in 1990 (238GWh) doubling to 469GWh by 2005.
- The TFC for South Tipperary has increased by 66% since 1990 and is projected to increase by 125% to 2020.

Table 11.3: Total Final Consumption by Fuel, % Share, South Tipperary, (1990 – 2020)

% Share	1990	1995	2000	2005	BAU 2010	BAU 2020
Coal	11.1%	3.8%	3.6%	3.3%	2.1%	1.0%
Peat	10.1%	7.2%	2.8%	2.1%	1.2%	0.4%
Oil	57.5%	63.4%	67.7%	67.7%	66.2%	65.9%
Natural Gas	7.0%	9.2%	10.0%	9.8%	10.6%	10.6%
Renewables	1.4%	1.3%	1.2%	1.7%	5.1%	7.0%
Electricity	13.0%	15.1%	14.7%	15.4%	14.8%	15.1%

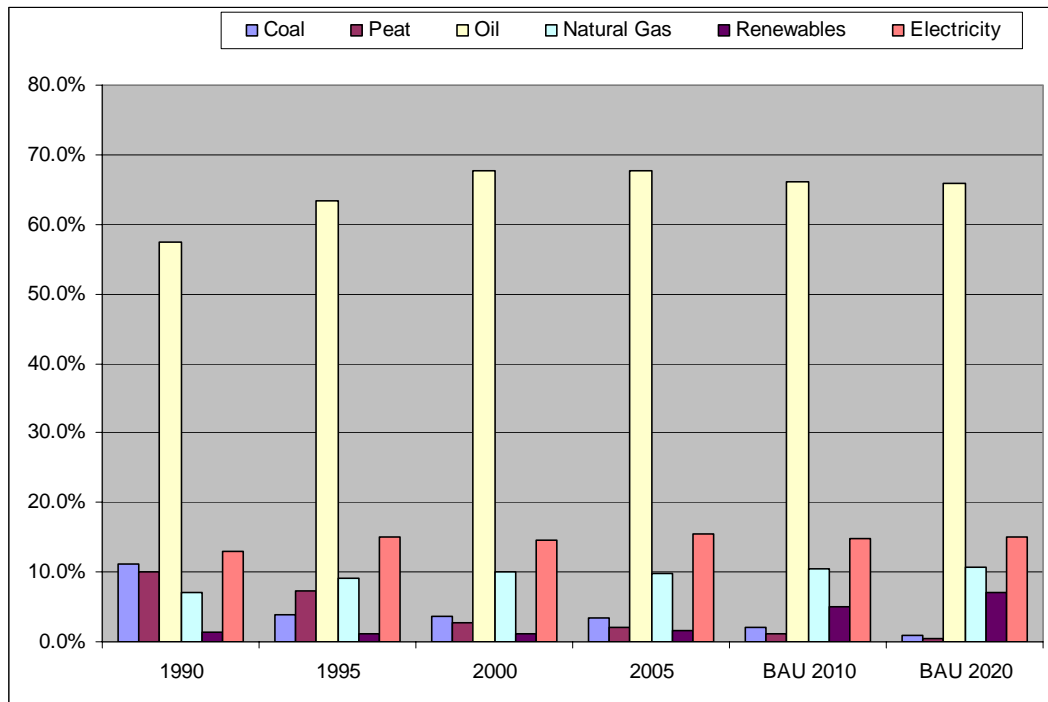


Chart 11.6: Total Final Consumption by Fuel, % Share, South Tipperary, (1990 – 2020)

- The increasing dependence on oil is further emphasised when analysing data by % Share. This has grown from 57% in 1990 to 68% in 2005.
- The % Share of electricity in terms of TFC has remained relatively stable since 1990. Electricity currently accounts for 15%.
- Natural Gas was first introduced into the County in 1987 and currently accounts for approximately 10% of TFC. This is projected to grow slightly by 2020.

11.2.2 Total Final Consumption by Sector

Table 11.4: Total Final Consumption by Sector, South Tipperary, (1990 – 2020)

GWh	1990	1995	2000	2005	BAU 2010	BAU 2020
Industry	384.0	484.0	532.3	600.5	713.2	835.9
Transport	578.1	650.7	1,069.0	1,317.0	1,709.1	1,929.0
Residential	557.3	538.5	615.9	662.0	701.6	717.1
Commercial & Public	200.1	221.6	252.0	328.1	400.4	464.1
Agriculture	112.5	150.3	130.8	134.1	127.9	127.9
Total	1,832.0	2,045.0	2,600.0	3,041.8	3,652.3	4,073.9

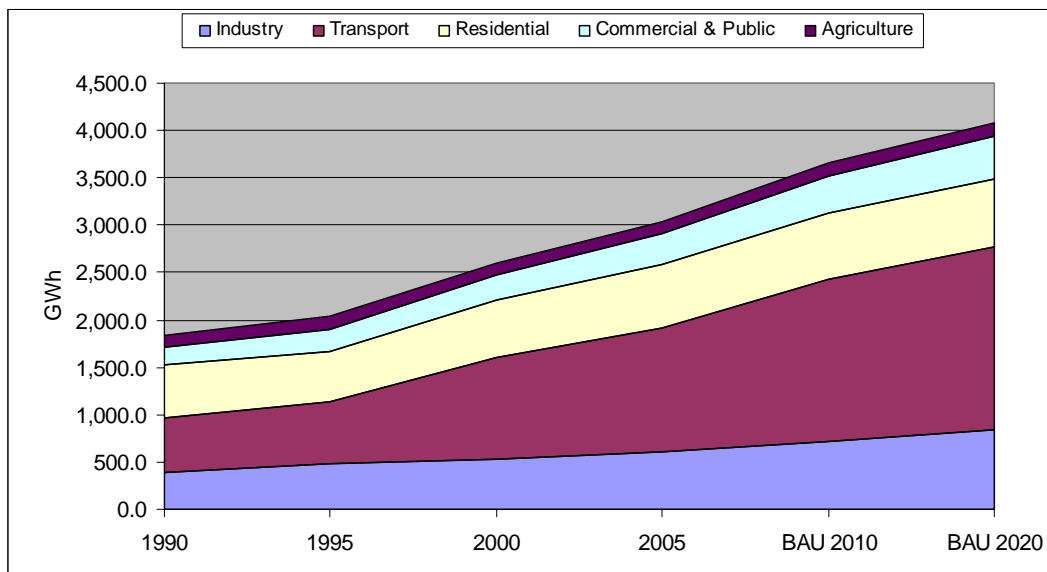


Chart 11.7: Total Final Consumption by Sector, South Tipperary, (1990 – 2020)

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

- Transport will account for the greatest growth in consumption by 2020, with a predicted increase of over 233% above 1990 levels.
- The increased level of housing is reflected in the fact that the residential sectors share of TFC has grown by 18% since 1990 and is predicted to increase by another 10% by 2020.
- The commercial sector has shown a higher increase in consumption when compared to the Industrial sector since 1990 (64% for commercial compared to 56% for industry) which would mirror the National trend of a move to more service based employment.
- The TFC of the agricultural sector has remained relatively constant since 1990 and will continue to do so.

Table 11.5: Total Final Consumption by Sector, % Share, South Tipperary

% Share	1990	1995	2000	2005	BAU 2010	BAU 2020
Industry	21.0%	23.7%	20.5%	19.7%	19.5%	20.5%
Transport	31.6%	31.8%	41.1%	43.3%	46.8%	47.3%
Residential	30.4%	26.3%	23.7%	21.8%	19.2%	17.6%
Commercial & Public	10.9%	10.8%	9.7%	10.8%	11.0%	11.4%
Agriculture	6.1%	7.3%	5.0%	4.4%	3.5%	3.1%

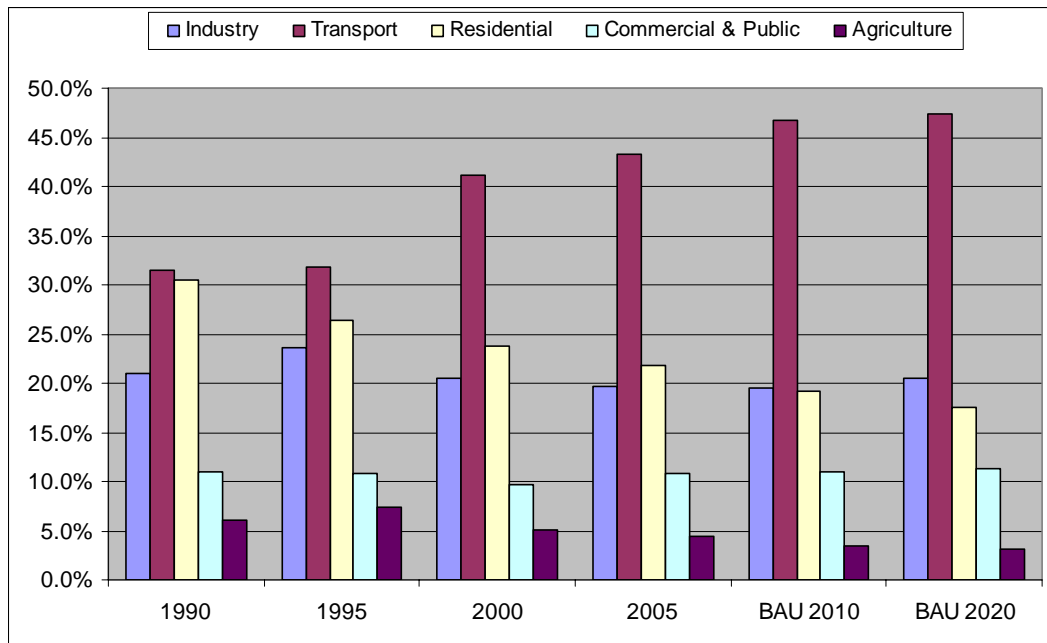


Chart 11.8: Total Final Consumption by Sector, % Share, South Tipperary, (1990 – 2020)

- Similar to trends nationally and in North Tipperary the transport sector is now the main energy consumer, accounting for 43% of TFC in 2005. This is predicted to increase to 47% by 2020.
- While the total TFC for the residential sector has been shown to be increasing its percentage share of the TFC has decreased from 30% in 1990 to 21% 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 19%. 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 higher consumer.
- The agricultural sector's % share of TFC is reducing as other sectors increase.

11.3 Environmental Analysis

11.3.1 CO₂ Emission by Fuel

Table 11.6: CO₂ Emissions by Fuel, South Tipperary, (1990 – 2020)

kT CO ₂	1990	1995	2000	2005	BAU 2010	BAU 2020
Coal	69.0	26.5	32.1	34.4	25.9	14.2
Peat	69.3	55.3	27.3	23.6	16.1	6.7
Oil	308.2	339.9	461.4	540.4	642.6	680.5
Natural Gas	25.2	37.3	51.4	58.8	76.6	85.5
Renewables	0.0	0.0	0.0	0.0	0.0	0.0
Electricity	218.9	275.2	295.5	293.2	337.7	383.8
Total	690.5	734.2	867.7	950.4	1098.9	1170.8
Kyoto Target (1990 + 13%)	780	780	780	780	780	780

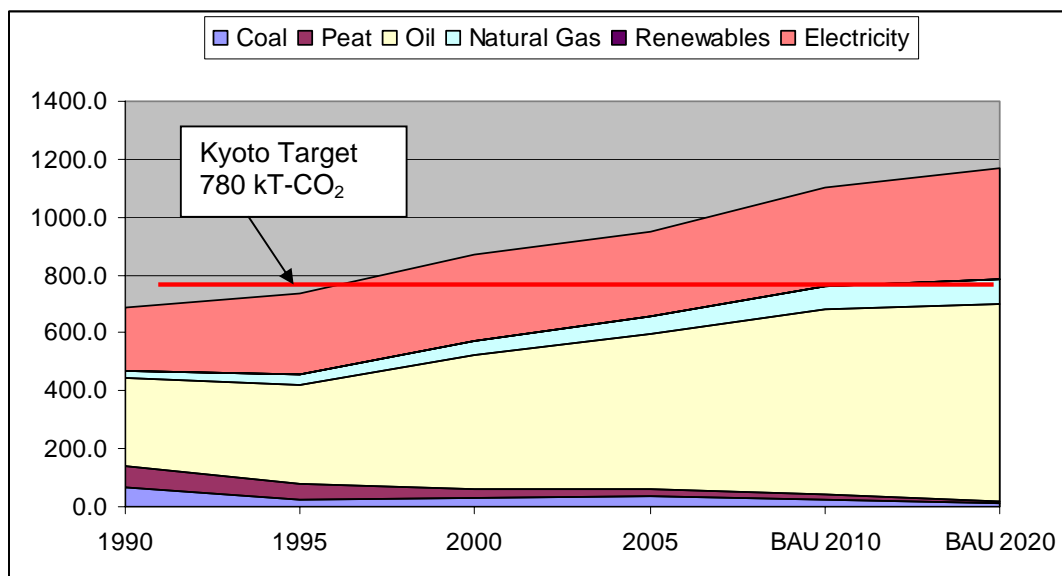


Chart 11.9: CO₂ Emissions by Fuel, South Tipperary, (1990 – 2020)

Analysis of CO₂ emissions related to fuel use in South Tipperary 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 by 75% since 1990 (from 308 kT CO₂ to 540 kT CO₂ in 2005). Electricity, meanwhile accounted for 37% more emissions in 2005 than it did in 1990. Oil is projected to increase by 26% between 2005 and 2020 and electricity by 30% for the same period.
- Emissions from solid fuels have reduced significantly, in line with their decreasing use as fuels in the County.

- The introduction of Natural Gas into South Tipperary in 1987 saw emissions rise from 25 kT in 1990 to 58 kT in 2005.

Table 11.7: CO₂ Emissions by Fuel, % Share, South Tipperary, (1990 – 2020)

% Share CO ₂	1990	1995	2000	2005	BAU 2010	BAU 2020
Coal	10.0%	3.6%	3.7%	3.6%	2.4%	1.2%
Peat	10.0%	7.5%	3.1%	2.5%	1.5%	0.6%
Oil	44.6%	46.3%	53.2%	56.9%	58.5%	58.1%
Natural Gas	3.7%	5.1%	5.9%	6.2%	7.0%	7.3%
Renewables	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Electricity	31.7%	37.5%	34.1%	30.9%	30.7%	32.8%

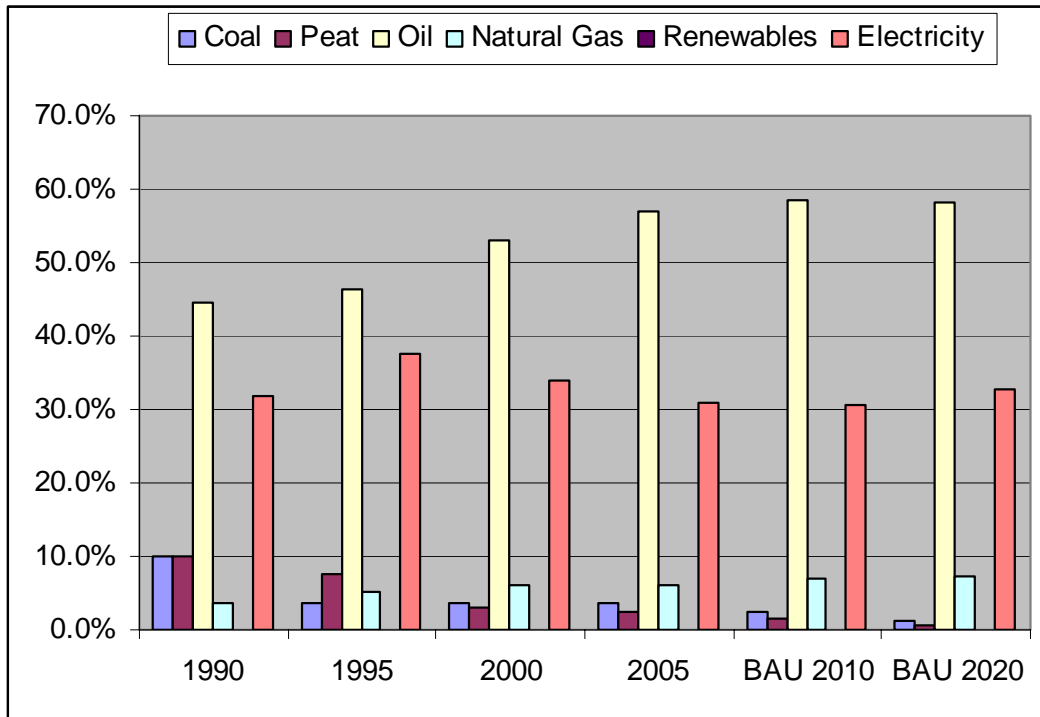


Chart 11.10: CO₂ Emissions by Fuel, % Share, South Tipperary, (1990 – 2020)

- The increased use of oil and its contribution to emissions is an important trend. It accounts for 57% of current emissions in South Tipperary, with a predicted increase to 58% in 2020. Serious actions will be required to affect change.
- Electricity accounts for the bulk for the remainder, i.e. 31%.

11.3.2 Emission by Sector

Table 11.8: CO₂ Emissions by Sector, South Tipperary, (1990 – 2020)

kT CO ₂	1990	1995	2000	2005	BAU 2010	BAU 2020
Industry	153.8	201.6	209.8	207.8	240.0	246.6
Transport	181.5	166.8	275.2	339.5	403.2	426.0
Residential	231.0	221.0	233.6	228.0	255.1	267.5
Commercial & Public	83.8	93.1	104.1	131.6	149.7	174.3
Agriculture	40.5	51.6	45.0	43.6	50.9	56.3
Total	690.5	734.2	867.7	950.4	1098.9	1170.8
Kyoto Target 1990 + 13%	780	780	780	780	780	780

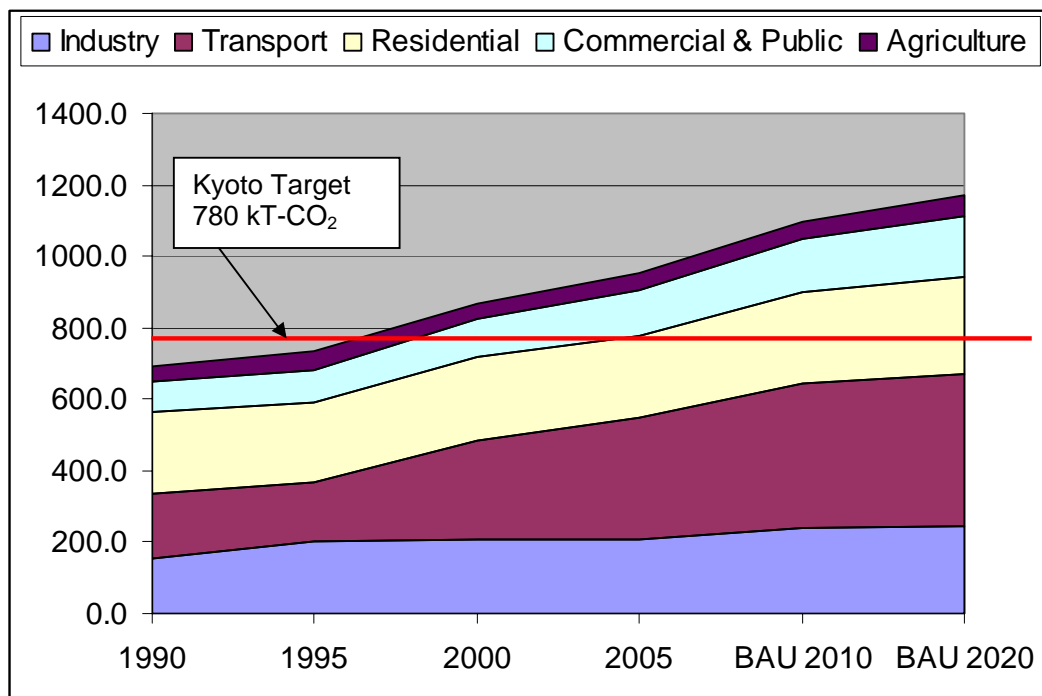
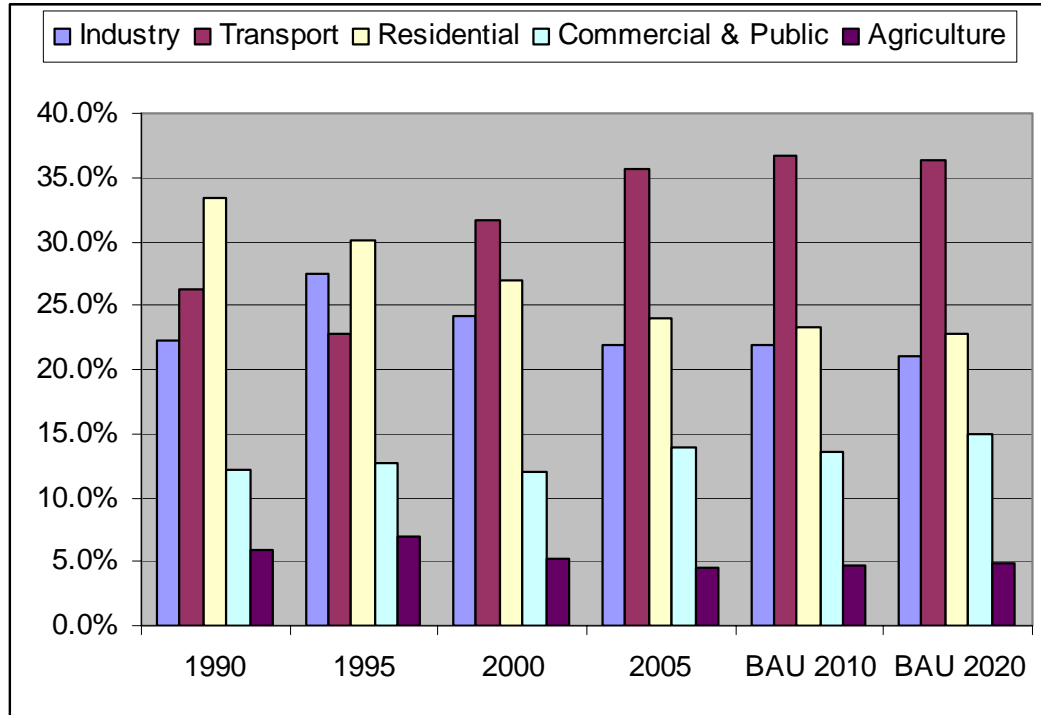


Chart 11.11: CO₂ Emissions by Sector, South Tipperary, (1990 – 2020)

- The transport sector has shown the highest increase in level of emissions since 1990 with an 87% increase to 2005 and predicted increase of 134% by 2020 compared to 1990.
- Emissions from the residential sector have remained relatively constant since 1990 whereas the TFC of this sector has increased by 18% for the same period. This shows a shift in the fuel mix in the Residential sector in South Tipperary. This is also due to the improvement of the emission factor of electricity.
- The commercial sector has shown a 57% increase in emissions since 1990 in South Tipperary.

Table 11.9: CO₂ Emissions by Sector, % Share, South Tipperary, (1990 – 2020)

	1990	1995	2000	2005	BAU 2010	BAU 2020
Industry	22.3%	27.5%	24.2%	21.9%	21.8%	21.1%
Transport	26.3%	22.7%	31.7%	35.7%	36.7%	36.4%
Residential	33.5%	30.1%	26.9%	24.0%	23.2%	22.8%
Commercial & Public	12.1%	12.7%	12.0%	13.8%	13.6%	14.9%
Agriculture	5.9%	7.0%	5.2%	4.6%	4.6%	4.8%

Chart 11.12: CO₂ Emissions by Sector, % Share, South Tipperary, (1990 – 2020)

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

- While in 1990 the residential sector accounted for the greatest proportion of emissions i.e. 33%, it now only accounts for 24% of emissions and it is projected to account for 22% of the emissions in 2020.
- Transport is now the highest producer of emissions with 35% of the CO₂ emission in 2005 in South Tipperary. And its share is projected to keep on increasing (by 36% in 2020).
- % share of the commercial sector has constantly increased since 1990 (from 12% in 1990 to 14% in 2005) and is projected to continue to do so.

11.4 Response to Kyoto

11.4.1 The size of the problem

Table 11.10: Analysis of Compliance with Kyoto and Potential Costs, South Tipperary.

	Emissions kT CO ₂	Kyoto Target Exceedance kT CO ₂	2020 Target Exceedance kT CO ₂	Projected Cost of CO ₂ /ton Trading Price (€)	Annual Carbon Levy (€millions)
1990	655.3	0.0		-	0
Kyoto Target (1990 + 13%)	740.4	0.0		-	0
2020 Target (1990 - 20%)	524.2				
1995	734.2	0.0		-	0
2000	867.7	127.3		-	0
2005	950.4	209.9		-	0
BAU 2010	1098.9	358.5		35	12.5
BAU 2020	1170.8	430.4	646.6	45	29.1

It can be seen from the above Table that South Tipperary exceeded its Kyoto Target before 2000 and the Business As Usual scenario would see it generating approximately 358 kT CO₂ above its Kyoto Limit by 2010. Based on a potential price of €35 per tonne of CO₂ this could equate to a Carbon Levy of €12.5 million per annum. By 2020 this will have risen to €29 m as emissions are 646 kTonnes of CO₂ above the 2020 limit.

11.4.2 Sectoral Solutions

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

11.4.2.1 Energy Supply and Production

	Quantified Indicative Reductions Proposed (kT-CO ₂)
Energy Production and Supply	
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	111

11.4.2.2 Transport

	Quantified Indicative Reductions Proposed (kT-CO₂)
Transport	
Alternative Fuels (Biofuels, Electric, Hybrids, etc.)	
Increased Public Transport Networks	
Convert Local Authority Fleets to Biofuels	
Electric Bicycles & Mopeds (PV Solar Charging Stations)	
Total	51

11.4.2.3 Built Environment and Residential

	Quantified Indicative Reductions Proposed (kT-CO₂)
Public Buildings and Facilities	
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.	6

	Quantified Indicative Reductions Proposed (kT-CO₂)
Residential sector	
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	12

11.4.2.4 Industrial/Commercial

	Quantified Indicative Reductions Proposed (kT-CO₂)
Industry/Commercial	
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	42

11.4.2.5 Agriculture

	Quantified Indicative Reductions Proposed (kT-CO₂)
Agriculture	
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	47

11.4.2.6 Waste

	Quantified Indicative Reductions Proposed (kT-CO₂)
Waste	
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	16

11.4.2.7 Sinks (Land Use Change & Forestation)

	Quantified Indicative Reductions Proposed (kT-CO₂)
Land Use Change & Forestation	
Regional Forestry / Afforestation Inventory	
Local Authority Tree Planting	
Cultivation of "Energy Crops"	
Development of Private Forests	
Total	15

11.4.2.8 Sectoral Solution Summary

	Quantified Indicative Reductions Proposed (kT-CO₂)
Overall QIRS by sector	
Energy Production & Supply	111
Transport	51
Built Environment & Residential	18
Industry, Commercial, & Services	42
Agriculture	47
Waste	16
Sinks (Land Use Change & Forestation)	15
Total	300

11.4.3 Individual Responsibility

- The TFC per person will increase from just above 24,000kWh in 1990 to approximately 40,000 kWh in 2010(BAU). It reached 36,000 kWh in 2005. This has had a corresponding increase in emissions per person which has risen from 9.3 Tonnes CO₂ per person to 11.5 Tonnes CO₂ per person by 2005, and will increase to 12.8 Tonnes CO₂ per person in 2010.
- South Tipperary will be 319 kT CO₂ above its Kyoto Limit in 2010 and this will equate to a reduction of 4.2 Tonnes of CO₂ per person if the Kyoto commitments is to be achieved.

Table 11.11: TFC and CO₂ emissions Per Capita and Reductions Sought, South Tipperary:

Indicator	1990 South Tipperary	Kyoto Target South Tipp. 1990 + 13%	2020 Target South Tipperary 1990 - 20%	2005 South Tipperary	2010 South Tipperary	2010 Reduction Sought	2020 South Tipperary	2020 Reduction Sought
Population (000)	74	-		83	86.0	N/A	92	N/A
TFC Fuel Consumed (GWh)	1,832	-		3,042	3,652	-	4,078	-
Energy Related Emissions (kt-CO ₂)	655	740	524	950	1,099	358	1,171	647
TFC/Capita (kWh/Inhabitant)	24,757	-		36,648	42,465	-	44,325	-
CO ₂ Emissions / Capita (T CO ₂ / Inhabitant)	8.9	8.9	5.7	11.5	12.8	4.2	12.7	7.0

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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 serving 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	Greenhouse Gases made up of the following 6 gases <ul style="list-style-type: none"> • Carbon dioxide (CO₂) • Methane (CH₄) • Nitrous oxide (N₂O) • Hydrofluorocarbons (HFCs) • Perfluorocarbons (PFCs) • Sulphur hexafluoride (SF₆)
GIC.....	Gross Internal Consumption is the quantity of Enegy 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,.....	Gegawatthours
Ha,	Hectares
HFCs,.....	HydroFlouorocarbon Gas
INC,	intergovernmental Negotiating Committee for the)
kT,	kilo-Tonne
kW,	kilo-Watt
LCEA,.....	Limerick Clare Energy Agency
MW.....	MegaWatt
MWRA.....	MidWestern Regional Authority
N ₂ O	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 to Reach Kyoto Target ₂

TFC	Total Final Consumption is equal to Total Primary Energy less the energy losses occur in transforming Primary Energy into forms suitable for the end user
TPEC.....	Total Primary Energy Consumption, is equal to the total amount of energy used within the borders of a country in a 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: CO₂ Emission Factors

Fuel	Conversion Factor		
	t C/TJ	t CO ₂ /TJ	g CO ₂ /kWh
Coal	25.80	94.60	340.56
Peat (Milled)	30.00-31.36	110-115	396-414
Briquettes	26.96	98.86	355.90
Sod Peat	28.36	104.00	374.40
Gasoline	19.08	69.96	251.86
Kerosene	19.47	71.40	257.04
Fuel Oil	20.73	76.00	273.60
LPG	17.37	63.70	229.32
Gasoil	19.99	73.30	263.88
Natural Gas (Kinsale)	14.98	54.94	197.78
Natural Gas (UK)	15.60	57.20	205.92
Natural Gas (import and indigenous average)	15.48	56.77	204.38