

Final Report

Climate Change Strategy For County Tipperary

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Executive Summary

Introduction

The aim of the Climate Change Strategy for County Tipperary is to clearly identify the solutions to the challenge of reducing energy related emissions and to outline the actions to be taken to meet the requirements under the Kyoto Protocol. Estimates of the impact of these actions in terms of CO₂ reductions have been made and areas for future work identified.

The general approach that has been taken is to group the actions and measures which should be implemented in a similar fashion as that adopted in the National Climate Change Strategy. This allows for National comparisons.

Study Approach

The approach taken in the study was to present the data by Local Authority in separate Tables and Figures. This allows for analysis of energy and emissions within each Local authority area and also on a County basis.

The general approach that has been taken is to group the actions and measures which should be implemented in a similar fashion as that adopted in the National Climate Change Strategy. This allows for National comparisons.

Actions and measures have been grouped into standard and extraordinary measures. Standard measures are defined as those which can be implemented based on current political, social and regulatory frameworks. Extraordinary measures are those measures which would require significant changes in approach and structures locally, regionally and nationally.

The Tipperary Energy and Emissions Balance used a top down approach in terms of estimating Total Final Consumption and CO₂ emissions by fuel and by sector in the study area. This approach was beneficial in determining the scale of the problem which needs to be addressed in the region and the relevant trends. The Climate Change Strategy is generally based on a bottom up approach which involves analysis of the existing work, actions and projects within the region in relation to energy efficiency and renewable energy and estimating the CO₂ emission reduction impacts these will have.

It is acknowledged that the approach taken has had to include a number of assumptions and methodologies which affect the accuracy of the data presented. However, it is important to note that access to relevant data at a County level is limited and a balance between accuracy, resources and impact had to be achieved by the project partners.

Key Results

Analysis has been completed for North Tipperary and South Tipperary. The Energy and Emissions Balance indicated the level of excess above the Kyoto target by 2010 to be:-

- North Tipperary: 346,000 tonnes CO₂
- South Tipperary: 358,000 tonnes CO₂

The analysis conducted has indicated that, based on a range of standard measures, the Kyoto targets will not be met. For each area, the gap between meeting the Kyoto Requirements is projected to 25% below the Kyoto Target.

Table 1 below illustrates the quantity of energy related emissions (,000 tonnes of CO₂) in each Local Authority area. The table shows that by 2010 County could be 663,000 tonnes of CO₂ over the Kyoto target, and should this progress on a “Business As Usual” basis to 2020 the level of excess could be 790,000 tonnes. The financial implications for the study area are also identified. The reductions that are sought in order to avoid this excess are shown in Table 2.

Table 1: Energy Emissions (CO₂) and potential cost for study area

North Tipperary

	Emissions kT CO ₂	Kyoto Target Exceedance kT CO ₂	2020 Target Exceedance kT CO ₂	Projected Cost of CO₂/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

South Tipperary

	Emissions kT CO ₂	Kyoto Target Exceedance kT CO ₂	2020 Target Exceedance kT CO ₂	Projected Cost of CO₂/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

County 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	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

Table 2: Summary of CO₂ Reductions in Study Area.

'000 tonnes CO ₂	North Tipperary		South Tipperary	
	2010	2020	2010	2020
Energy Production & Supply	212	329	124	200
Transport	42	54	46	60
Built Environment	18	31	20	33
Industry/Commercial Services	31	32	38	40
Agriculture	11	17	13	21
Waste	0	0	-	-
Sinks	0	0	-	-
Total	314	646	240	354
Target	345	575	358	646
Gap to Target	31	112	118	292

Table 2 shows that significant progress toward meeting out Kyoto target can be achieved using standard measures. However in order to avoid the financial implications outlined above some extra ordinary measures must be employed. For each sector in Table 2 specific actions such as renewable energy development, transport initiatives, energy efficiency measures etc. were assessed to determine their impact in terms of CO₂ reductions.

Common Issues

It is clear that locally, regionally and nationally extraordinary measures will be required to reduce CO₂ emissions and to meet our international commitments under the Kyoto Protocol. The standard measures which have been discussed within this report clearly are not enough. The significant savings in terms of CO₂ projected going forward are expected to arise as a result of private investment in the renewable energy sector. While

the private sector can make an impact there is an immediate need for clearly structured and well supported national and regional programmes to meet the challenges of the Kyoto targets.

Some common issues identified within the study area are:-

- A key restriction for the development of renewable energy electricity projects continues to be access to the National Grid for sale of electricity. Continued pressure needs to be applied to facilitate the connection of future projects to the grid.
- The transport sector was shown to account for the highest level of CO₂ emissions. The potential for achieving real reductions in this sector is confined by the growing ownership of cars and increased freight due to economic growth, and in the rural areas by the lack of infrastructure. However, it is perhaps the single most important area where, given appropriate services, individuals can make significant reductions by:
 - o Increased use of energy efficient modes of transport (walking, cycling, bus etc.)
 - o Purchase of energy efficient vehicles
 - o Switching to the use of green fuels
 - o Car pooling
- The supply infrastructure for wood heating projects will present common issues nationally. The work and experience from the Clare Wood Energy Project should be reviewed along with other work in the sector to determine how to maximise the resource in the County.
- While the building regulations have improved dramatically nationally and the implementation of the Energy Performance of Buildings Directive is welcome it is vital that these are implemented fully to achieve the full potential savings.
- The Industrial Sector has already achieved significant reductions in energy consumption per unit of production. However, increased use of green energy through development of biomass and solar heating projects presents a particular opportunity in the region. This also applies to the Commercial Sector. A target campaign of energy awareness, monitoring and targeting and energy auditing within these sectors is a priority for the future.
- The clearest signal from the analysis to date is that all sectors will have to make a contribution to reducing emissions and no one sector or action will meet the requirements in terms of CO₂ reductions.

North Tipperary

The following table and chart illustrates the dramatic increase in energy related emissions in the county since 1990. The chart is analysed by economic sector.

Table 3: North Tipperary, Evolution of Energy Emissions (CO₂) 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

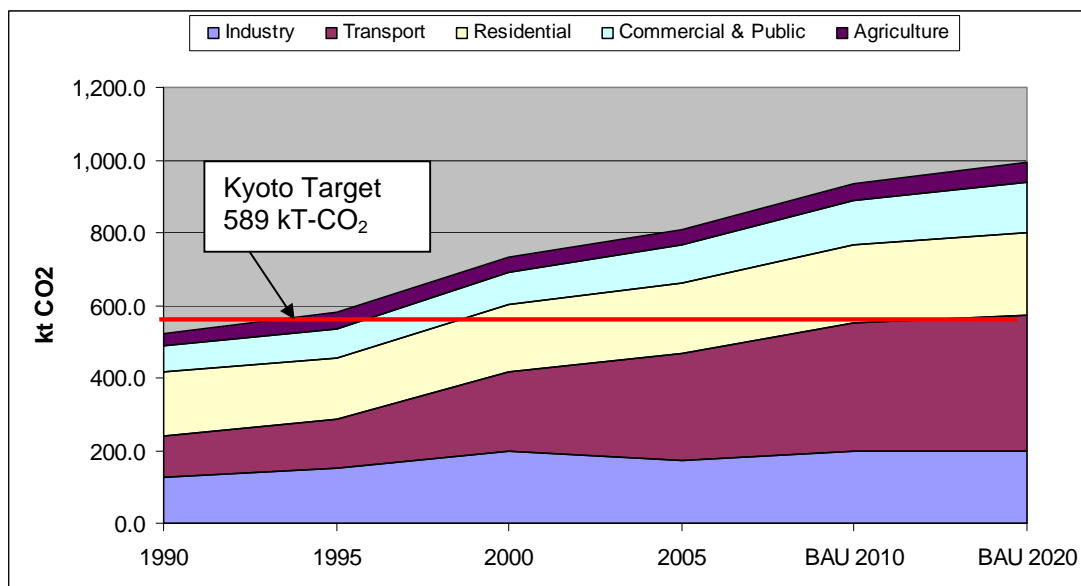


Chart 1: North Tipperary, Evolution of Energy Emissions (CO₂) 1990 - 2020

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

The gap to the 2010 target in North Tipperary is projected to be 345,000 Tonnes of CO₂. As can be seen from Table 3 the main contributor to the reductions in the County is from the Energy Production and Supply Sector. Some key findings from this sector include:

- By 2010 it is expected that 71MW of large scale wind will be installed in the County, increasing to 87MW by 2020
- Renewables (large, medium and small scale) will make the greatest contribution in terms of CO₂ reductions as they result in no or minimal CO₂ emissions compared to fossil fuels.
- Wood biomass from forestry thinnings should take a significant impact in the future but action will need to be taken to capture the resource available.
- The potential for the development of CHP within the County will be restricted by the limited natural gas network and limited installations with sufficient heat demand, but specific action should be taken to maximise its use
- Large scale wind developments in North Tipperary will make the most significant impact in the region in the short term.

Within the built environment the significant reductions are due to savings achieved as a result of legislation and improved building regulations. It is estimated that there will be over 13,000 new houses built in North Tipperary between 2002 and 2020. Potential savings achievable by these houses compared to ones built prior to the 2002 building regulations are approximately 20,000 Tonnes by 2010.

Forestry thinnings from the private sector in North Tipperary has a potential, if only 10% of the resource were captured, to provide 12 GWh_{th} of energy per annum in the region. If the Coillte forestry were also to be used as a resource (approximately 14,000 ha in 2004) the wood energy resource would be almost doubled.

The agricultural sector in North Tipperary currently has limited production of arable crops and this is unlikely to change dramatically in the future. It is likely therefore that resources for liquid biofuels will be imported into the County.

By exceeding its 2010 limit in terms of CO₂ emissions related to energy the County could face a relative carbon levy of €12M in 2010. If the savings identified in the report are achieved this could reduce to €1.1M.

The indicative abatement cost to achieve these reductions has been estimated to be in the region of €700/Tonne.

South Tipperary

The following table and chart illustrates the dramatic increase in energy related emissions in the county since 1990. The chart is analysed by economic sector.

Table 4: South Tipperary, Evolution of Energy Emissions (CO₂) 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

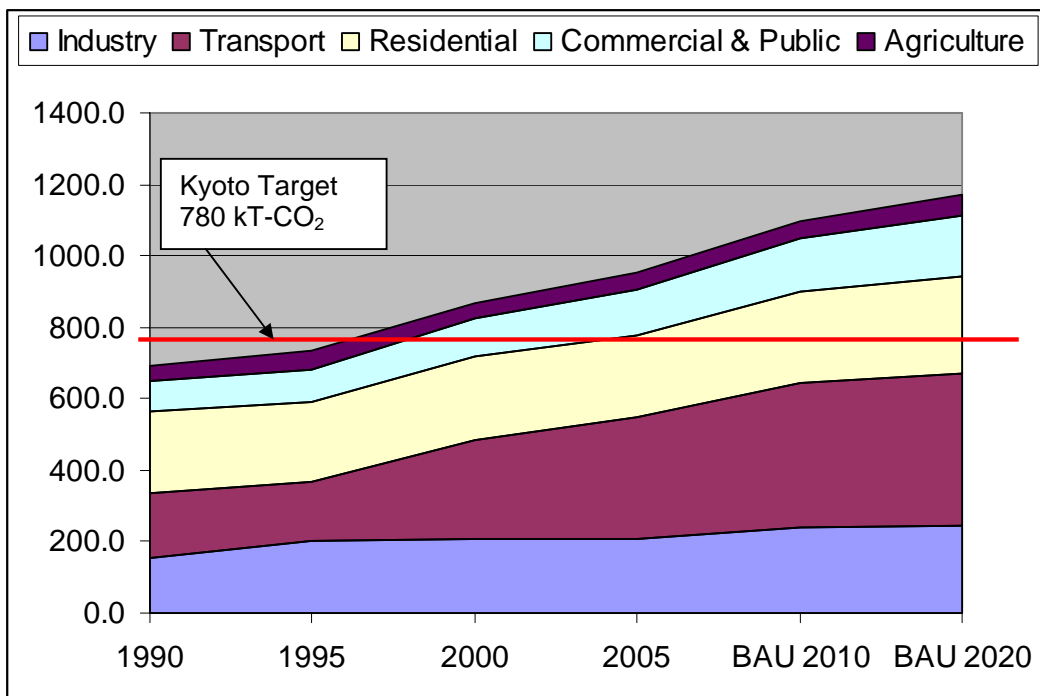


Chart 2: South Tipperary, Evolution of Energy Emissions (CO₂) 1990 – 2020

- The Transport sector has shown the highest increase in level of emissions since 1990 with a 148% increase to 2005, and predicted increase of 255% by 2020.
- Emissions from the residential sector have remained relatively constant with an 10% increase since 1990. This reflects the increase energy efficiency of buildings and heating systems.
- The Commercial sector has shown a 87% increase in emissions since 1990.

The gap to the 2010 target in South Tipperary is projected to be 358,000 Tonnes of CO₂ and this is projected to increase to 390,000 Tonnes by 2020. Energy Production and Supply will result in the greatest CO₂ reductions, another indicator that this sector is responding to the need to develop alternatives in this area.

Some key findings for South Tipperary include:

- By 2010 it is expected that 33MW of large scale wind installed in the County, increasing to 66MW by 2020. This could increase significantly if all projects which have received planning were to receive a grid connection.
- South Tipperary has potential for the development of CHP projects from Natural Gas due to the supply in Clonmel and Carrick on Suir.

Over 10,000 new houses will be developed in the county between 2002 and 2010. Assuming all are built to the 2002 Building Regulations this would result in CO₂ savings of 16,000 Tonnes by 2010. Proper enforcement and inspection will become ever more important to ensure that the regulations are complied with.

The agricultural sector in South Tipperary has a shown considerable interest in the development of energy crops. There is a need to develop this interest further and increase the level of planting of such crops as miscanthus, oil seed rape etc. Similar to the wood energy project in County Clare a key barrier will be the issue of fuel supply infrastructure. In addition, support will be required to overcome the high initial investment costs for the crop.

By exceeding its 2010 limit in terms of CO₂ emissions related to energy the County could face a relative carbon levy of €11.1M in 2010. If the savings identified in the report are achieved this could reduce to €2.1M. The indicative abatement cost to achieve these reductions has been estimated to be in the region of €700/Tonne.

Conclusions

It has been shown that significant progress can be made within the County towards meeting the Kyoto targets. However, based on a wide range of standard measures, the total CO₂ savings identified will still be approximately 10% below that required.

It is clear that measures above and beyond the standard measures proposed will be required for the County to meet its targets. The Energy Production and Supply sector is currently carrying the greatest share of CO₂ savings. Further action is required in the other sectors in the near future. In particular the Transport sector will require collective and individual action to achieve savings.

While the TEA and other actors can make a significant contribution to meeting the targets it is clear that this needs to be done in the context of a long-term, focused and funded national policy in this area.

Individual responsibility for energy consumption and emissions will be an important component factor in reaching our Kyoto Targets. Every individual is responsible for the energy that they use at home, at work and in transport. The following table sets out the reductions of CO₂ sought as an individual responsibility.

Table 6 CO₂ reductions per capita in County Tipperary.

Indicator	North Tipperary	South Tipperary	County Tipperary
CO ₂ Emissions / Capita T CO ₂ / person	4.8	3.7	4.2

1.0 Regional Climate Change Strategy

1.1 Introduction

Climate change has been identified as one of the key challenges facing humanity in the 21st Century. National Governments and International organisations have set it as a key priority. A range of National and International studies have been completed to determine the impact of climate change and to propose solutions and measures.

This report is written in response to the Irish National Climate Change Strategy and its review National Climate Change Strategy 2007-2012 specifically seeks to identify the measures that can be taken in County Tipperary. The Tipperary Energy Agency has commissioned this climate change study.

1.2 Climate Change Strategy Structure & Methodology

The general approach taken has been to adopt a similar model and structure to that taken Nationally. This is beneficial in that it allows for the use of National data for benchmarking and analysis while also allowing the Strategy to feed into future National policies.

This report is based on the data and analysis from the Tipperary Energy and Emissions Balance (EEB). The EEB produced data on the past, current and predicted energy use by fuel and by sector in the study area. It also analysed the energy related CO₂ emissions by fuel and by sector for the area, again based on past data, current status and future predictions. This important document utilises suitable indicators for energy and environmental performance to be set and identifies the scale of the problem to be addressed. This analysis was completed for North and South Tipperary.

The format of this report is presented in summary format for the combined study area with detailed analysis being provided for North Tipperary and South Tipperary. Specific technical and economic information in relation to technologies, methodologies and measures is provided as a reference for project developers in the Appendices.

Within each study are the following sections have been address

- Energy Production and Supply
- Transport
- Built Environment
- Industry and Commercial Services
- Agriculture and Forestry
- Waste

For the purposes of this study CO₂ Abatement via sinks has been ignored. This is due to a focus on actions and measures which result in direct reduction in CO₂ emissions. It is acknowledged that Nationally sinks will play a part in meeting the Kyoto target. Further research should be completed in relation to sinks in the study area given the higher than average levels of forestry in the region.

Actions and measures have been grouped into standard and extraordinary measures. Standard measures are termed as those which can be implemented based on current political, social and regulatory frameworks. Extraordinary measures are those measures which would require significant changes in approach and structures locally, regionally and nationally.

The estimated CO₂ savings have been calculated for each section based on standard measures. In addition, indicative investment costs have been developed to allow an initial estimate of Indicative Abatement Cost (€/T) to be calculated.

1.3 Aim and Objectives

The Aim of the Strategy is to propose solutions to reduce the CO₂ emissions identified within the Tipperary Energy Balance. The solutions will enable the County to meet its commitments under the Kyoto Protocol and to propose measures and actions to address this.

The Objectives of the Strategy are to

- Identify the scale of the climate change problem and suitable actions which can be taken in the study area
- Act as a basis for which all relevant stakeholders can support the development of sustainable energy in the study area
- Provide a basis for future policy in the study area
- Link with and possible influence future policy in the area of climate change.

2.0 Energy / Environmental Regulation

2.1 International Commitments

The Kyoto Protocol came into legal force in February 2005. The 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 all emissions
- Methane (CH₄) 18% of all emissions
- Nitrous oxide (N₂O) 6% of all emissions
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)
- Sulphur hexafluoride (SF₆)

The Protocol sets targets for 39 developed countries and the European Union (EU) as a whole. Overall a target reduction of 5% compared to 1990 emissions within these countries will be achieved. This will be measured in the 2008-2012 period.

Table 2.1: Kyoto Commitments

Source: UNFCC (2006)

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

2.2 EU Directives

In an international context the EU has taken a positive and proactive approach to the issue of Climate Change . Examples of key Directives and Polices related to energy and the environment include:

- COM (2005) 628 final: Biomass Action Plan
- COM (2005) 265 final: Green Paper on Energy Efficiency or Doing More with Less
- COM (2003) 453 final 2003/0172: Proposal for a Directive on establishing a framework for the setting of Eco-design requirements for Energy-Using Products and amending Council Directive 92/42/EEC
- COM (2003) 739 final: Directive on End-use efficiency and Energy Services (approved 13th December 2005)
- COM (2002) /91/EC: Directive on the Energy Performance of Buildings
- COM (2001) 77/EC: Directive on Electricity Production from Renewable Energy Sources
- COM (2001) 508 Final: The European Climate Change Program (ECCP I)/

- COM (2000) 769: Green Paper: Towards a European strategy for the security of energy supply
- COM (1997) 599 final: White Paper: Energy for the future - renewable sources of energy
- Council Directive 92/42/EEC of 21 May 1992 on efficiency requirements for new hot-water boilers fired with liquid or gaseous fuels

2.3 Irish Legislation / Regulation

The Irish Government must transpose all EU Directives into Irish Law appropriately and in addition it has specific requirements under the Kyoto Protocol. The Irish National Climate Change Strategy was launched in 2000 as Ireland's response to the Kyoto Protocol. Recently, this has been revised and the National Climate Change Strategy 2007-2012 was produced in April 2007. Other relevant legislation and regulations include

- Green Paper on Sustainable Energy: Department of Communications, Marine and Natural Resources (1999)(www.dcmnr.gov.ie)
- Irish Building Regulations (2002-2006): Department of Environment, Heritage and Local Government (www.environ.ie).
 - Part L Conservation of Fuel and Energy,
 - Part F Heating Producing Appliances,
 - Part J Ventilation.
- National Spatial Strategy (2000): Department of Environment, Heritage and Local Government (www.irishspatialstrategy.ie)
- White paper on energy (2007): (www.dcmnr.gov.ie)

Examples of actions that have been taken at a National level include: -

- Full market access for renewables and CHP to the grid
- Increase in afforestation grants to increase levels of forestry
- Establishment of Sustainable Energy Ireland as a Statutory body
- Establishment of Commission for Energy Regulation and liberalisation of electricity and gas markets
- Improved building regulations for residential and non-residential sector
- Action Plan for Energy Performance of Buildings Directive
- Renewable Energy Fix Feed in Tarriff Scheme introduced
- Appointment of Environment Protection Agency (EPA) as coordinator of National Carbon Emissions Allocation Plan.

2.4 Local Government

The Local Authorities in the study area are: -

- South Tipperary County Council
- North Tipperary County Council

The local authorities are required to take account of the relevant European and National legislation when framing their development plans. Sustainable Development, support for renewable energy and other aspects are all integrated into the relevant Development Plans in the study area.

In addition, the relevant City and County Development Boards provide a mechanism to complete additional analysis and provide support for further actions in areas relevant to

sustainable energy. The Regional Authorities, through the implementation of the Regional Planning Guidelines is also supporting the sector.

3.0 Energy Emissions Financial Implications

3.1 Carbon Levies - National

The Tipperary Energy Balance highlighted that Ireland is behind in terms of meeting its commitments under the Kyoto Protocol. Table 3.1 illustrates this fact highlighting that, for energy related emissions alone Ireland is currently (2005) 9,125 kilo tonnes above its Kyoto Target, and could be in the region of 17,000 kilo tonnes above by 2010.

The Environmental Protection Agency (EPA) have indicated that Irish consumers and businesses produced 68.46 million tonnes of carbon dioxide (CO₂) and other greenhouse gases in 2004, an increase of just less than 1 per cent on 2003. This is 23 per cent higher than the levels Ireland was producing in 1990. Under the Kyoto Protocol, Ireland is committed to keeping its emissions at 13 per cent above 1990 levels, or a cap of just over 63 million tonnes. Energy accounted for just over 23 per cent of emissions and transport at 18.4 per cent. The increase of greenhouse gases since 1990 has been driven to a large extent by the transport sector. Emission levels have more than doubled from 5.66 million tonnes a year to 12.1 million tonnes in 2004.

Table 3.1: Ireland Financial Costs from Energy Related CO₂ Emissions

Source SEI (2006), ICF BOC (2005)

Energy Related Emissions	Total Emissions (‘000 T CO ₂)	Projected Difference to Target (k T CO ₂)	Projected Cost of CO ₂ /ton Trading Price (€)	Annual CO ₂ Costs (Million €)
1990 Levels	30,649	-	-	-
Kyoto Targets +13%	34,633	-	-	-
2004	43,174	8,541	15	€ 128
2005 Estimate	43,758	9,125	27	€ 246
2010 BAU ¹	51,451	16,818	35	€ 589

3.1 Carbon Levies – County Tipperary

Estimating the cost to the Ireland and within the study area of exceeding the Kyoto requirements is somewhat difficult to achieve given the lack of clarity with regard to the price of carbon as a traded commodity and also with regard to potential levels of fines under the Kyoto Protocol. However, using the current price of Carbon as traded under the EU Emissions Trading scheme provides some basis for analysis. In March 2006 the price for Carbon Credits was approximately €27 per tonne. An EPA commissioned report indicated that this could drop to €15 per tonne, while financial analysts have indicated that it could rise to €50 per tonne (ICF, 2005). The approach taken for this study and the Tipperary Energy Balance has been to use the current price of €27 per tonne² for the 2005 estimate and to assume a value of €35 per tonne for the 2010 scenario. Based on this the Energy Balance reported the financial implications or Carbon Levies within the study area. These are shown in Table 3.2.

¹ BAU – Business and Usual

Table 3.2: Emissions and Potential Carbon Levies within Study Area

	North Tipperary			South Tipperary		
	Emissions (‘000 T- CO ₂)	Kyoto Target Exceedance (‘000 T-CO ₂)	Annual Carbon Levy (€millions)	Emissions (‘000 T- CO ₂)	Kyoto Target Exceedance (‘000 T-CO ₂)	Annual Carbon Levy (€millions)
1990	521.3	-	-	655.3	-	-
Kyoto Target (1990 + 13%)	589.0	-	-	740.4	-	-
1995	581.0	-	-	734.2	-	-
2000	732.1	143.1	-	867.7	127.3	-
2005	807.0	217.9	-	950.4	209.9	-
BAU 2010	934.7	345.7	12.1	1098.9	358.5	12.5
BAU 2020	992.5	403.5	18.2	1170.8	430.4	19.4

4.0 Summary Results – County Tipperary

4.1 CO₂ Reduction Targets

The table at the end of the previous section (Table 3.2) highlighted the fact that the areas covered in the study area will all exceed the Kyoto target substantially in 2010. The Business and Usual scenario shows the trend continuing to 2020.

Analysis has been completed for North and South Tipperary. The Energy and Emissions Balance indicated the level of excess above the Kyoto target by 2010 to be:

- North Tipperary: 345,000 tonnes CO₂
- South Tipperary: 358,000 tonnes CO₂

The analysis conducted has indicated that, based on a range of standard measures, the Kyoto targets will not be met. For each area, the gap between meeting the Kyoto requirements is projected to be approximately 25% below the Kyoto Target.

Table 4.1: Summary of CO₂ Reductions in Study Area.

'000 Tonnes CO ₂	North Tipperary		South Tipperary		Tipperary	
	2010	2020	2010	2020	2010	2020
Energy Production & Supply	212	329	124	200	336	529
Transport	42	54	46	60	88	114
Built Environment	18	31	20	33	38	65
Industry/Commercial Services	31	32	38	40	68	72
Agriculture	11	17	13	21	24	38
Waste	0	0	-	-	-	-
Sinks	0	0	-	-	-	-
Total	314	463	240	354	555	816
Target	345	575	358	646	703	1221
Gap to Target	31	112	118	292	148	405

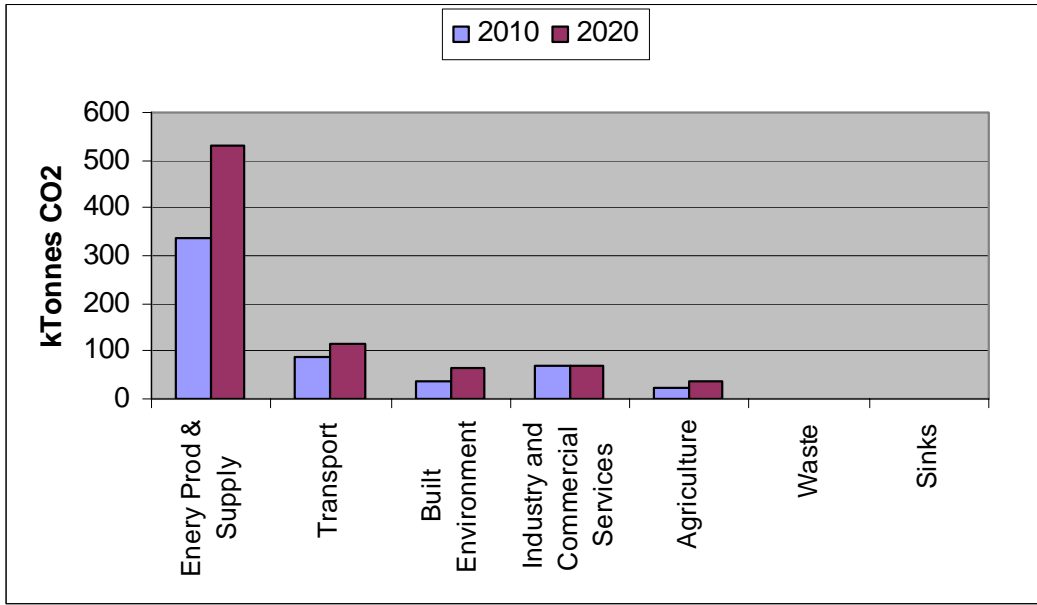


Chart 4.1: Total CO₂ saving per target area, 2010 and 2020

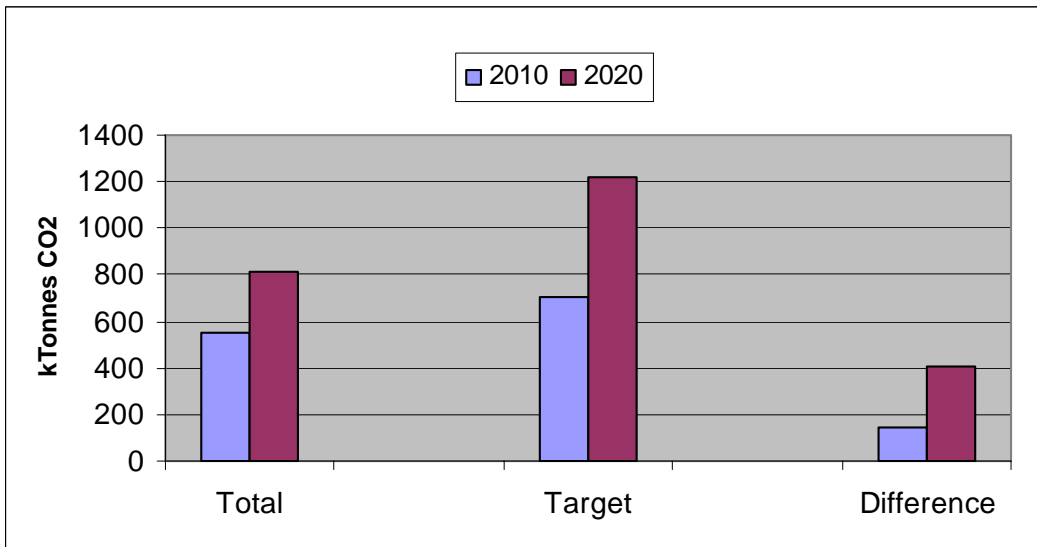


Chart 4.2: Total savings, target and differences -Co. Tipperary- 2010 2020.

4.2 CO₂ Reduction Cost Benefit Analysis

An indicative abatement cost to achieve the relevant reductions has been estimated for each study area. The Indicative Cost is an estimated investment required within the period 2005 to 2010 and 2010 and 2020. It should be acknowledged that this study did not complete a detailed economic analysis of the investment costs, economic returns for each action proposed. However, the indicative costs provide some guidance for planning future actions. A summary of the results for the study area is provided in Table 4.2.

Combined Study Area

Table 4.2: Summary of CO₂ Abatement Costs in Study Area.

	North Tipperary						South Tipperary						Tipperary					
	CO ₂ Red ('000 Tonnes)		Cost (€m)		Cost/Tonne (€/Tonne)		CO ₂ Red ('000 Tonnes)		Cost (€m)		Cost/Tonne (€/Tonne)		CO ₂ Red ('000 Tonnes)		Cost (€m)		Cost/Tonne (€/Tonne)	
	2010	2020	2010	2020	2010	2020	2010	2020	2010	2020	2010	2020	2010	2020	2010	2020	2010	2020
Energy Prod & Supply	212	329	141	275	665	838	124	200	131	197	1057	985	336	529	272	473	809	894
Transport	42	54	6	10	142	185	46	60	7	12	152	201	88	114	13	22	147	194
Built Environment	18	31	21	29	1160	939	20	33	21	29	1060	885	38	65	42	59	1108	911
Ind & Comm Services	31	32	7	7	227	219	38	40	7	7	187	177	68	72	14	14	205	196
Agriculture	11	17	6	6	549	357	13	21	7	7	509	324	24	38	13	13	528	339
Waste	0	0	0	0	0	0	-	-	0	0	0	0	-	-	-	-	-	-
Sinks	0	0					-	-					-	-	-	-	-	-
Total	314	463	181	328	577	708	240	354	173	253	718	714	555	816	354	580	638	711

The average cost for reduction of a tonne of CO₂ across the County is approximately €710/Tonne. The investment cost has been taken as the total capital and operational investment cost. While it is acknowledged that for many projects the capital cost will be repaid through returns from sales it was felt that an illustration of the full investment cost was a useful approach to take. This differs somewhat from the approach taken in the National Climate Change Strategy which appeared to only include the cost to the exchequer to complete the required measures.

4.3 Common Issues

It is clear that locally, regionally and nationally extraordinary measures will be required to reduce CO₂ emissions and to meet our international commitments under the Kyoto Protocol. The standard measures which have been discussed within this report clearly are not enough. The significant savings in terms of CO₂ projected going forward are expected to arise as a result of private investment in the renewable energy sector. While the private sector can make an impact there is an immediate need for clearly structured and well supported national and regional programmes to meet the challenges of the Kyoto targets.

Some common issues identified within the study area are:-

- The transport sector was shown to account for the highest level of CO₂ emissions. The potential for achieving real reductions in this sector is confined by the growing ownership of cars, increased freight due to economic growth and in the rural areas by the lack of infrastructure. However, it is perhaps the single most important area where, given appropriate services, individuals can make significant reductions by:
 - o Increased use of energy efficient modes of transport (walking, cycling, bus etc.)
 - o Purchase of energy efficient vehicles
 - o Switching to the use of green fuels
 - o Car pooling
- A key restriction for the development of renewable energy electricity projects continues to be access to the National Grid for sale of electricity. Continued pressure needs to be applied to facilitate the connection of future projects to the grid and targets raised to facilitate future development. In the short term wind energy will be the dominant supplier of renewable energy electricity in the County area. However, significant developments in the bioenergy field are possible with other technologies also contributing.
- The supply infrastructure for wood heating projects will present common issues not only in Co. Tipperary but nationally. The work and experience from the Clare Wood Energy Project and in other regions should be used to provide a model in the region for future developments and this will require support.
- While the building regulations have improved dramatically nationally and the implementation of the Energy Performance of Buildings Directive is welcome it is vital that these are implemented fully to achieve the full potential savings. The savings in the Built Environment are significant but will only be achieved if the regulations are implemented and fully adopted.
- The Industrial Sector has already achieved significant reductions in energy consumption per unit of production. However, increased use of green energy through development of biomass and solar heating projects presents a particular

opportunity in the region. This also applies to the Commercial Sector. A target campaign of energy awareness, monitoring and targeting and energy auditing within these sectors is a priority for the future.

- The clearest signal from the analysis to date is that all sectors will have to make a contribution to reducing emissions and no one sector or action will meet the requirements in terms of CO₂ reductions.

4.4 Financial Implications

The Tipperary Energy and Emissions Balance estimated the financial implication for the County for not taking action on Climate Change in the context of the Kyoto Protocol. This showed that the potential carbon levies within the County could be considerable.

By taking action, in terms of the standard measures which are outlined in the subsequent sections, these levies could be reduced considerably. Chart 4.3 outlines the impact of taking the proposed standard measures.

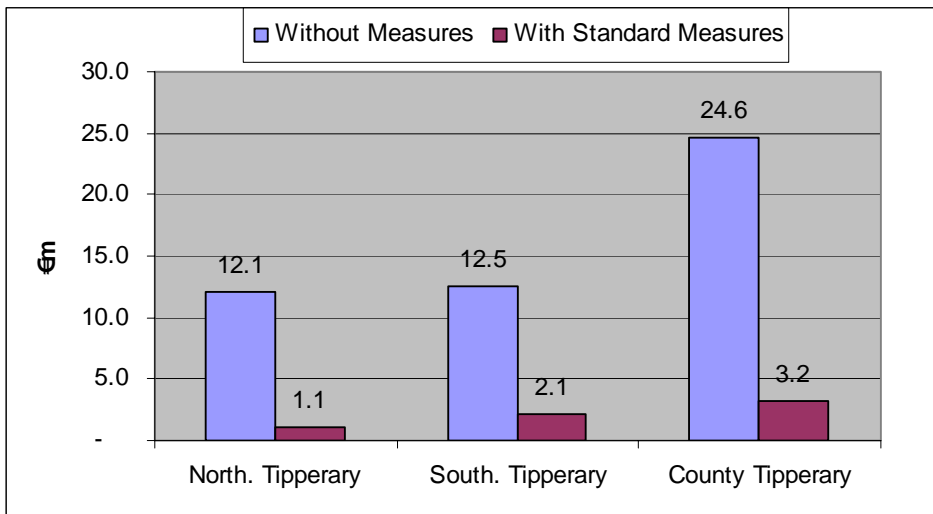


Chart 4.3: Carbon Levies in 2010 within County Tipperary (Business and Usual (No Action) and by Implementing Standard Measures.

Table 4.3: CO₂ Reductions Required and Reductions Achieved through Standard Measures 2010

Indicator	Reduction Required to Reach Kyoto Target			Reductions Achieved through Standard Measures		
	North Tipperary	South Tipperary	Tipperary	North Tipperary	South Tipperary	Tipperary
Energy Related Emissions kt-CO ₂	346	358	704	314	240	554
CO ₂ Emissions / Capita T CO ₂ / Inhabitant	4.8	4.2	4.5	4.8	2.9	3.7

The action required can also be measured in terms of reductions required per person in the County, and these are shown in Table 4.3

Through the implementation of a wide range of standard measures across all sectors reductions of between 4.8 and 2.9. Tonnes of CO₂ per person can be achieved.

5.0 North Tipperary

5.1 Introduction

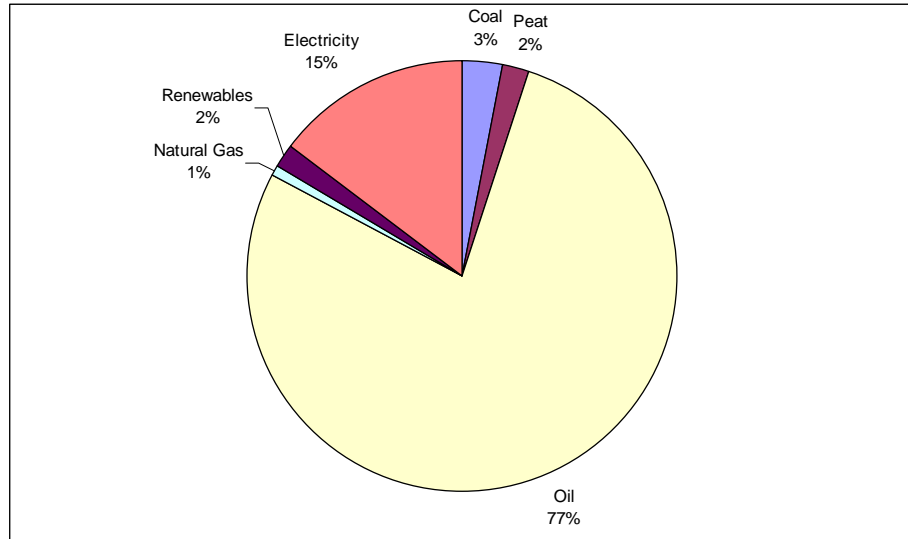


Chart 5.1: Total Final Consumption by Fuel, North Tipperary, 2005

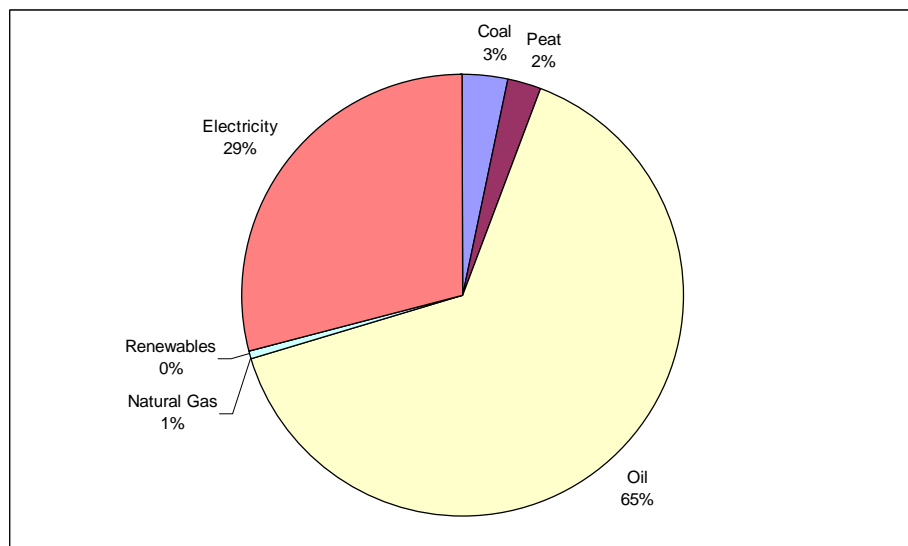


Chart 5.2: CO₂ Emissions by Fuel, North Tipperary, 2005

The Tipperary Energy Balance analysed the energy production and use within North Tipperary and also assessed the associated CO₂ energy emissions. This assessment showed that oil and electricity were the dominant fuels, in terms of use and emissions levels. The transport sector was shown to be the sector which had the greatest growth in terms of emissions and fuel usage.

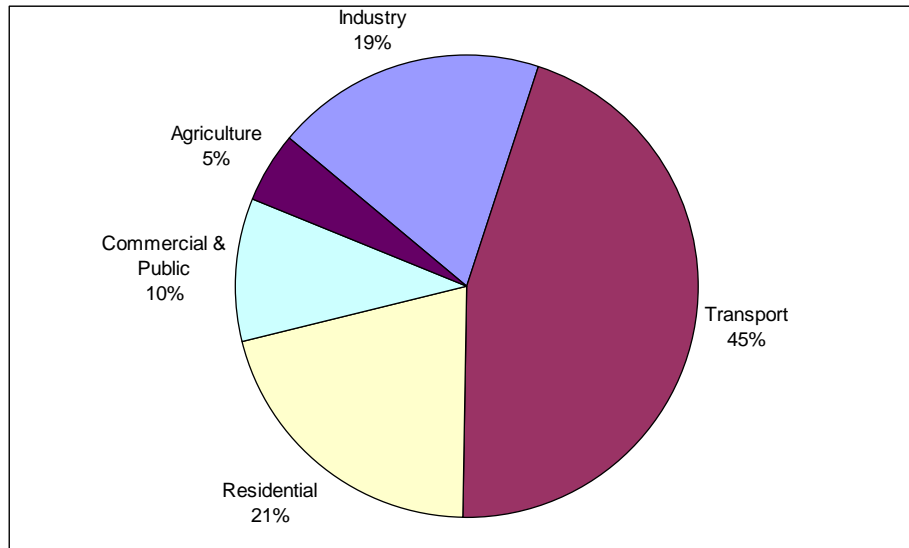


Chart 5.3: Total Final Consumption by Sector, North Tipperary, 2005

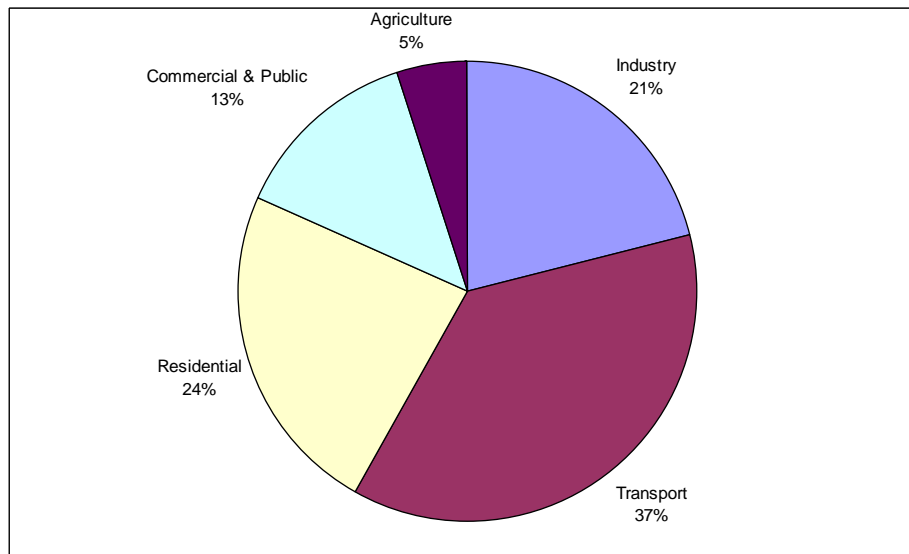


Chart 5.4: CO₂ Emissions by Sector, North Tipperary, 2005

Based on this and other data a set of Quantified Indicative Reductions were proposed for North Tipperary, as shown in the following Table.

Table 5.1: Quantified Indicative Reductions – North Tipperary

Overall QIRS by sector	Quantified Indicative Reductions Proposed ('000 T-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

5.2 Summary of Actions

Table 5.2: Summary of CO₂ Reductions, Investment Cost and Abatement Cost – North Tipperary

Ref	Sector	CO ₂ Reduction		Investment Cost		Indicative Abatement Cost	
		(000 Tonnes)		(€m)		(€/Tonne)	
		2010	2020	2010	2020	2010	2020
8.3	Energy Prod & Supply	212.19	328.68	141.1	275.3	665	838
8.4	Transport	42.19	53.93	6.0	10.0	142	185
8.5	Built Environment	18.28	31.30	21.2	29.4	1,160	939
8.6	Ind and Comm Services	30.83	31.95	7.0	7.0	227	219
8.7	Agriculture	10.97	17.10	6.0	6.1	549	357
8.8	Waste	-	-			-	-
	Total	314.46	462.95	181.3	327.8	577	708
	Target	345.0	575.0				
	Gap to Target	30.5	112.0				

Table 5.2 summaries the data and results from the different sectors which were reviewed in North Tipperary. It can be seen that based on the standard measures which are proposed that the Kyoto Target will not be reached. However, this is based on an assumption that a large wind farm (55MW) will be built in North Tipperary supplying to the Transmission Grid (Lisheen Mines).

The Energy Production and Supply measures can make the biggest contribution in the short term. For the future targets to be reached greater contributions will be required from the other sectors, in particular transport.

The estimated cost to implement the measures outlined is €700 per tonne, taking full investment cost into account.

5.3 Energy Production & Supply

5.3.1 Introduction

North Tipperary is primarily dependent of importing its fuel requirements, which is in line with National trends. The following table and chart outlines this data and the projected trends for the future. The only indigenous fuels which are used are peat and renewables.

Table 5.3: Total Final Consumption, North Tipperary, (1990 – 2020)

(TEA, 2006)

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	2,353.5	2,606.2
Natural Gas	-	-	-	25.4	29.0	32.1
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	3,068.8	3,415.7

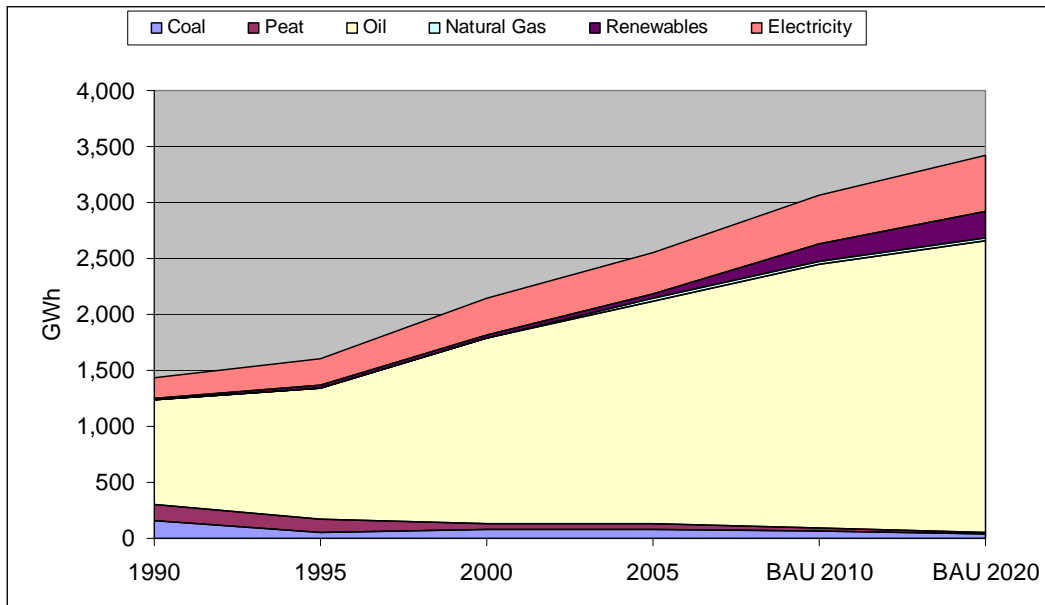


Chart 5.5: Total Final Consumption by Fuel, North Tipperary, (1990 – 2020)

(TEA, 2006)

In 2005 Total Final Consumption was dominated by oil and electricity. Therefore, these will have to be given the greatest focus in terms of production and supply. The above data is taken from the Tipperary Energy Balance (TEA, 2007).

5.3.1.1 CO₂ Reduction Targets

The Tipperary Energy Balance set Quantified Indicative Reduction Targets for CO₂ for North Tipperary for the Energy Production and Supply Sector. The estimated reduction that could be achieved in the relation to energy production and supply was in the region of 100 kTonnes of CO₂. The following table summarises the actual projected savings in terms of CO₂ that are projected to be achievable by 2010 and 2020. Details of how these can be achieved are provided in the following sections.

Table 5.4: Quantified Indicative Reductions for North Tipperary – Energy Production and Supply

Ref	Energy Production and Supply	Quantified Indicative Reductions Proposed ('000 T-CO ₂)	
		2010	2020
	Fossil Fuel		
5.3.2.2	Fuel switching	10.83	6.14
5.3.2.3	Combined Heat & Power	-	-
	Renewable Energy		
5.3.3.1	Large Scale Wind Power	180.00	259.00
5.3.3.2	Hydro Power Schemes	-	-
5.3.3.3	Tidal/Wave	-	-
5.3.3.4	Large PV	-	4.87
5.3.3.5	Small Scale RE Elec	0.12	0.61
5.3.3.6	Large RE Thermal	6.39	13.60
5.3.3.8	Small RE Heat	15.03	44.53
	Total	212.37	328.75

5.3.1.2 CO₂ Reduction, Cost Benefit Analysis

While this study was not designed to provide a full economic analysis of the cost and impact of Climate Change within the County an indicative abatement cost to achieve the relevant reductions has been estimated. The Indicative Cost is an estimated investment required within the period 2005 to 2010 and 2010 and 2020.

The average cost for the abatement of CO₂ emissions for energy production and supply, based on estimated investment costs, is approximately €750/Tonne CO₂ in North Tipperary. The largest investment will be in the development of large scale wind projects. The data presents the estimated capital investment costs. There are additional costs related to support programmes which could also be accounted for.

Table 5.5: Indicative CO₂ Abatement Costs for North Tipperary - Energy Production and Supply

	2010			2020		
	QIR Proposed	Indicative Cost	Indicative Abatement Cost per Tonne CO ₂	QIR Proposed	Indicative Cost	Indicative Abatement Cost per Tonne CO ₂
Energy Production and Supply	('000 T-CO ₂)	(€m)	(€/TCO ₂)	('000 T-CO ₂)	(€m)	(€/T CO ₂)
Fossil Fuel						
Fuel switching	11	0	-	6	0	-
CHP	-	-	-	-	-	-
Renewable Energy						
Large Scale Wind	180	99	551	259	142	548
Hydro Power	-	0	-	-	0	-
Tidal/Wave	-	0	-	-	0	-
Large PV	-	0	-	5	10	2054
Small Scale RE E	0	1.3	10,753	1	4.62	7,527
Large RE Thermal	6	2	313	14	3	221
Small RE Thermal	15	39	2,594	45	115.5	2,594
Total	212	141	665	329	275	838

5.3.1.3 Renewable Energy Supply Targets

The targets for North Tipperary in terms of renewables are best aligned to the EU and National Targets which currently exist. There are a number of EU Policies and Directives in this regard:

- EU White Paper on Renewable Energy Sources:
 - A target of doubling RES supply from 6% to 12% of Total Primary Energy Requirement (TPER) by 2010.
- EU Renewable Energy Electricity Directive:
 - A target to achieving 13.2% of electricity supply from renewables by 2010 is set for Ireland within this Directive.

The TFC for North Tipperary in 2005 was estimated to be 2,327 GWh. The TPER for the County has been estimated by taking the National ratio of TFC to TPER, which in 2004 was 78.7%.³

To assess the current status of reaching these targets within North Tipperary the following assumption has been made

- The National Target figure has been multiplied by the population ratio to give a target for North Tipperary.

The data from this analysis is presented in the following Table. It can be seen that by 2010 a total of 39MW of renewable energy electricity capacity should be installed to meet the requirements of the Directive. To reach the 12% TPER Target a total of 678 GWh of renewable energy should be generated by 2010.

³ National TPER in 2004 = 15,008 kToe, National TFC in 2004 = 11,813 kToe.

Table 5.6: Renewable Energy Targets – North Tipperary County

	National 2004	National 2010	North Tipperary 2004	North Tipperary 2010
TPER (GWh)	175,543 ⁴	214,104	2,738	3,340
12% Target (GWh)	21,065	25,692	329	401
Current RES (MWe)	736 ⁵	1,450 ⁶	8	23

5.3.2 Fossil Fuel Energy

5.3.2.1 Electricity Generation

There is no significant electricity generation within North Tipperary.

5.3.2.2 Thermal - Fuel Switching

It can be seen that already in North Tipperary there has been a move from the use of solid fuel to oil and natural gas (solid fuels only accounted for 5% of TFC in North Tipperary in 2005). This has provided some CO₂ savings as solid fossils fuels such as coal and peat have high CO₂ emission factors.

However, there is potential for more dedicated programme of fuel switching. This programme should seek to

- move from the use of high emission fuels to lower emissions fuels i.e. coal to oil or natural gas
- move from use of oil or natural gas to CO₂ neutral fuels such as renewables.

This section will deal with the switch to Natural Gas and use of smokeless fuels. The savings related to increased use of renewables is dealt with under the renewables section.

5.3.2.2.1 Switching to Natural Gas

The increased use of Natural Gas will be limited by the Natural Gas network in the region, which to date is mainly restricted to Newport and Ballina. There are no significant plans to expand this network outside of these areas in the near future (Bord Gais, 2006).

Assuming that the projected growth in Natural Gas use in the County, from 0 GWh in 2004 to 29 GWh per annum in 2010, displaces the use of oil as a fuel this would result in annual CO₂ emissions savings of as outlined in the following table.

The switch to natural gas will often be accompanied by an increase in energy efficiency at the point of use. This is primarily due to the use of more efficient boilers i.e. gas condensing boilers which have higher efficiencies (typically operating >95% efficiency) that traditional oil boilers (annual efficiencies of <90%). It is reasonable to assume a further 10% reduction in emissions due to increased efficiencies alone, i.e. **a reduction of 40 tonnes of CO₂ per annum.**

⁴ Source: Energy in Ireland 1990 – 2004 (SEI, 2005)

⁵ Source: Renewable Energy in Ireland, 2005 Update (SEI, 2006)

⁶ Source: 2020 Vision for Renewable Energy (Dept of Communications Marine and Natural Resources, 2006)

Table 5.7: CO₂ Savings from Fuel Switching to Natural Gas

Fuel Switching	2004	BAU 2010	BAU 2020	Change (04-10)	Change (10-20)
Natural Gas (GWh)	-	29.00	64.00	29.00	35.00
Natural Gas CO ₂ ('000 T)	-	5.70	12.70	5.70	7.00
CO ₂ if Oil ('000 T)				7.65	9.24
Annual CO ₂ Savings ('000 T)				0.39	0.45

5.3.2.2.2 Switch to Smokeless Solid Fuels

Currently, coal accounts for the largest proportion of solid fuel use in the County i.e. 81 GWh in 2005. This is projected to reduce to 61 GWh in 2010 and 33 GWh in 2020. CO₂ emissions are estimated to be 27.5 kTonnes in 2005 and 20.8 and 11.3 kTonnes in 2010 and 2020 respectively. The National ban on bituminous coal predicted a national saving of approximately 1 million Tonnes of CO₂ (1000 kTonnes). To date the ban has been focused regionally and within specific urban locations. Future elimination of the use of this type of coal will generate CO₂ and other emission savings.

Assuming that the use of this type of coal accounted for 50% of coal use in the County and that it could be displaced through the use of renewable energy the projected savings would be 10.4 kTonnes and 5.65 kTonnes in 2010 and 2020 respectively.

5.3.2.3 Combined Heat & Power

CHP plants, based on fossil fuel, have primarily been developed in Ireland based on Natural Gas. These plants can reach efficiencies in the region of 80% under the right conditions. It is vital that the Natural Gas network is available at the appropriate sites. Currently Natural Gas is only available in Ballina and Newport. There would need to be a significant extension of the Natural Gas network in the County for CHP to be possible.

For this study CHP has been assumed to have negligible impact.

5.3.3 Renewable Energy

5.3.3.1 Electricity Generation - Large Scale Wind

North Tipperary has a number of wind farms which are connected to the National Grid. Details are provided in the following Table.

Table 5.8: Wind Farms in North Tipperary Connected to National Grid

Site	Installed Capacity (MW)	Year of Construction	Annual Generation (GWh)	Annual CO₂ Avoid ed ('000 T CO₂)
Ballinlough	2.6	2006	9.10	5.68
Ballinderry	2.6	2006	9.10	5.68
Templederry	2.6	2004	9.10	1.62
Total	7.8		27.30	17.04

There are currently 4 wind farms which are waiting to be connected to the National Grid, representing a total of 71.8 MW. There are also a number of wind farms in the planning process in the County.

Table 5.9: Wind Farms in North Tipperary to be Connected to the National Grid

Site	Capacity (MW)	Year Connection Agreement Signed	Expected Connection Date	Projected Annual Generation (GWh)	Projected Annual CO ₂ Avoided (‘000 T CO ₂)
Holyford	9	2005	2007	31.50	19.66
Reisk, Silvermine	3.9	2004	2007	13.65	8.52
Templederry	3.9	2005	2007	13.65	8.52
Lisheen	55	2005	2008/9	192.50	120.16
Total	71.8			251.3	156.86

By the end of 2007 a total of 16.8 MW of wind energy will be connected and providing electricity to the Distribution Grid in North Tipperary with a large wind farm of 55MW expected to be connected to the Transmission Grid at Lisheen mines. Comparing this to the RES-E Target as defined for North Tipperary in Section 8.1.4 it can be seen that the County will exceed its target of 23 MW by 2010.

It is estimated that a total of 82MW will be connected to the grid in North Tipperary by 2010, increasing to 118 MW by 2020. These projections are based on projected average annual increases in renewable energy electricity (SEI, 2005) of 11% between 2005 and 2010 and 4.4% between 2010 and 2020.

Table 5.10: Large Wind Energy Installations and CO₂ Savings in North Tipperary

	Capacity (MW)	Electricity Generated (GWh)	Annual CO ₂ Emissions Avoided (‘000 Tonnes CO ₂)
2006	7.80	27.30	17.04
2007	24.60	86.10	53.74
2010	82.31	288.07	179.81
2020	118	351.45	219.37

The realisation of the wind energy potential in the County, and throughout Ireland, is primarily restricted by the ability to connect the wind energy plants to the National Grid. The current pressure which exists with regard to grid connection and significant pool of projects awaiting connection (655MW contracted to be connected (ESBNG, 2006) causes significant problems for new wind energy projects.

5.3.3.2 Electricity Generation - Large scale Hydro

There is no large scale hydro projects connected to the National Grid in North Tipperary and potential for further development is restricted. Therefore it has been assumed for this study that no further large scale hydro projects will be developed.

Micro hydro projects will have an impact but it has been taken to be negligible in the context of this report. There is currently one hydro project in the County in Hollycross with a capacity of 0.25 MW which is estimated to generate 0.85 GWh per annum.

5.3.3.3 Electricity Generation - Wave & Tidal

Not applicable in North Tipperary.

5.3.3.4 Electricity Generation - Photovoltaics – large scale

The Renewable Energy 2020 Vision (DCMNR, 2006) document noted that there could be 408 MW of Photovoltaic (PV) systems installed nationally by 2020 generating over 500 GWh per annum. Assuming that this was proportioned across Ireland relatively equally this could equate to 6.4MW of PV installations in North Tipperary, producing 7.8GWh of electricity per annum.

It can be assumed that there will be limited development of PV up to 2010, which is reflected in the National policy documents, and therefore it will have limited impact in terms of the Kyoto 2010 targets. However, post 2010 the development of PV, if it is to reach the targets as set in the DCMNR Vision document, would have to be significant. It could be assumed that 30% of the target would be reached by 2020.

This would equate to 1.9MW of PV installed in North Tipperary generating 2.3GWh of electricity by 2015. This would avoid approximately 1.5 kTonnes of CO₂ per annum by 2015. However to develop this resource would take considerable investment and support in terms of electricity supply contracts, research and development and industry support.

Table 5.11: PV Installations and CO₂ Savings in North Tipperary

	Year	Installed Capacity (MW)	Electricity Generation (GWh)	CO ₂ Emission Savings (000 Tonnes)
National	2010	-	-	-
	2015	122.40	150.00	93.63
	2020	408.00	500.00	312.10
North Tipperary	2010	-	-	-
	2015	1.91	2.34	1.46
	2020	6.36	7.80	4.87

5.3.3.5 Electricity Generation - Small Scale Renewables

Small scale renewable energy systems are already in use in Ireland and North Tipperary in specialised situations. These include parking meters, street signage etc. There are a number of companies in Ireland which are now providing energy solutions for the domestic/commercial sector which integrate small scale wind and PV panels. The typical scale of these installations is in the region of 0.5 to 6kW.

It is difficult to provide an accurate estimate of the potential for installation of such systems in North Tipperary. The following assumptions have been made to provide an initial estimation:

- Annual electricity load in a residential house is 5,000kWh per annum (SEI, 2005)

- 30% of the load can be met by such a system, which would equate to annual saving of 1,500kWh per house.
- A 0.5% penetration rate for the residential sector in North Tipperary by 2010 would equate to approximately 175 installations.
- The penetration rate would increase to 2% by 2020

As can be seen, from the following table, the impact in terms of CO₂ emissions is relatively negligible. However, a considerable increase in penetration rate through appropriate supports and policy initiatives could increase this figure.

Table 5.12: Small Scale RES Electricity Production in North Tipperary

Year	Annual Electricity Consumption per dwelling (kWh)	Annual RE Production per dwelling (kWh)	No Houses in North Tipperary	Total RES Production (MWh)	CO ₂ Avoided (Tonnes)
2010	5000	1500	130	195	120.9
2020	5000	1500	660	990	613.8

5.3.3.6 Thermal Energy Production - Large Scale Renewables

Given the dominant position of oil as a fuel in the County considerable opportunities exist for its replacement with renewable energy technologies. The sectors where this would be appropriate include the industrial and commercial sectors where larger heat loads exist.

The technologies which are most appropriate to meet the thermal energy demands in such sectors include the use of biomass resources and solar heating systems. In some cases, geothermal energy may be a consideration.

Significant opportunities exist to exploit the forestry sector in North Tipperary for energy production. Work is on-going with the Clare Wood Energy Project which has identified 6 sites which could use wood as a fuel. These sites could use 2,000 Tonnes of wood chip, or approximately 5.3 GWh. These projects alone would displace 1.5 kTonnes of CO₂ if replacing oil. A similar model can be rolled out in North Tipperary to maximise the use of the available resources.

Reviewing the CO₂ emissions from the Commercial and Industrial Sectors in North Tipperary an estimate of 2% reduction rate for 2010 and 4% for 2020 has been assumed based on large biomass or solar installations.

Table 5.13: RES Heat Large Scale in North Tipperary

	Industry Sector (000 Tonnes)	% Reduction	CO ₂ Saved (000 Tonnes)	Comm. Sector (000 Tonnes)	% Reduction	CO ₂ Saved (000 Tonnes)	Total CO ₂ Saved (000 Tonnes)
2004	159	0%	0	96	0%	0.0	0.0
2005	171.2	0%	0	106.8	0%	0.0	0.0
2010	198.1	2%	3.962	121.4	2%	2.4	6.4
2020	199.2	4%	7.968	140.9	4%	5.6	13.6

5.3.3.7 Thermal Energy Production - Small Scale Renewables

There is significant potential for the use of small scale renewable energy heating systems for the substitution of fossil fuels. This is particularly relevant to the residential sector which accounted for 20.8% of TFC in North Tipperary in 2005.

The following assumptions have been made to estimate the potential for implementation of such systems in the County:

- solar water heating, wood biomass heating and geothermal heating systems are the main technologies of choice
- for 2010 a penetration rate of 15% has been targeted
- it is assumed that the technologies will replace oil
- 75% of heating requirements will be displaced by the renewable energy technologies with the remaining being met by electricity and/or oil

Table 5.14: RES Heat from Small Renewables in North Tipperary

	Penetration Rate	No Houses	Av. Annual Heat Cons (kWh)	Total Heat Cons. (GWh)	% of Heat from RES	Total Heat RES (GWh)	CO₂ Avoided ('000 T)
	%				%		
2010	15	3,900	20,000	78	75	58.5	15.03
2020	35	11,500	20,000	231	75	173.25	44.53

5.3.3.8 Renewable Combined Heat and Power

The potential for CHP in relation to renewables can generally be restricted to the use of wood biomass or methane gas at Land Fill Gas (LFG) or Anaerobic Digestion (AD) Sites. LFG will be dealt with under Section 8.9 – Waste and AD under Agriculture.

CHP from biomass at a large scale (>1MW) is dependent on fuel supply and appropriate heat load for economic viability. Small scale CHP (<1MW) using wood gasification is still a developing technology but could be applicable in a number of sites in the future. Typical scales are in the region of 100 to 200 kWe generation.

For this study no wood biomass CHP has been assumed to have been developed in the County.

5.4 Transport

5.4.1 Introduction

The Transport Sector is the sector which has shown the greatest increase in emissions within North Tipperary. In 2005 the Transport Sector accounted for 45% of TFC and 40% of emissions. If current trends continue it is expected that the Transport sector will increase TFC from 1,155 GWh in 2005 to 1,500 GWh in 2010 and further to 1,692 GWh in 2020.

Achieving change in the transport sector is perhaps the most challenging given the current trend towards purchasing of new cars, increased economic activity. In particular, in a rural context the challenge is even greater given the limited access to alternative transport means.

5.4.1.1 CO₂ Reduction Targets

The Tipperary Energy Balance set Quantified Indicative Reduction Targets for CO₂ for North Tipperary for the Transport Sector. The estimated reduction that could be achieved in the relation to transport was in the region of 46 kTonnes of CO₂. The following table summarises the actual projected savings in terms of CO₂ that are projected to be achievable by 2010 and 2020. Details of how these can be achieved are provided in the following sections.

Table 5.15: Quantified Indicative Reductions for North Tipperary – Transport

Ref	Action	Quantified Indicative Reductions Proposed (‘000 T-CO ₂)	
		2010	2020
5.4.2.1	Car Efficiency	17.70	18.70
5.4.2.2	Unnecessary Trips	9.48	9.48
5.4.2.3	Car Pooling	1.40	1.40
5.4.2.4	Hybrid Cars	0.71	1.59
5.4.3.1	Cycling	2.84	2.84
5.4.3.2	Bus	1.21	1.21
5.4.4	Green Fuels	8.85	18.7
	Total	42.19	53.93

5.4.1.2 CO₂ Reduction, Cost Benefit Analysis

The average cost for the abatement of CO₂ emissions, based on estimated investment costs, is approximately €150/Tonne CO₂ in North Tipperary for the Transport sector. The data presents the estimated capital investment costs. There are additional costs related to support programmes which could also be accounted for.

Table 5.16: Indicative CO₂ Abatement Costs for North Tipperary - Transport

	2010			2020		
	QIR Proposed	Indicative Cost	Indicative Abatement Cost per Tonne CO ₂	QIR Proposed	Indicative Cost	Indicative Abatement Cost per Tonne CO ₂
	('000 T-CO ₂)	(€m)	(€/TCO ₂)	('000 T-CO ₂)	(€m)	(€/T CO ₂)
Transport						
Car Efficiency	17.70	-	-	18.70	-	-
Unnecessary Trips	9.48	-	-	9.48	-	-
Car Pooling	1.40	1.00	713	1.40	1.00	713
Hybrid Cars	0.71	-	-	1.59	-	-
Cycling	2.84	1.00	352	2.84	1.00	352
Bus	1.21	-	-	1.21	-	-
Green Fuels	8.85	4.00	452	18.7	8.00	428
Total	42.19	6.00	142	53.93	10.00	158

5.4.1.3 Strategies & Plans

The following are key documents in relation to transport and related infrastructure in the region:

- Strategies to reduce greenhouse gas emissions in transport (SEI, 2004)
- Transport 21 (DoEHLG, 2006)
- Rural Transport Initiative (DoEHLG, 2000)

5.4.1.4 What Moves Us

Relevant data in relation to transport means can be derived from the Census information. As is evident from Chart 8.6 the motor car is the dominant means of transport and its position as the key transport mode has increased significantly between 1991 and 2002. The key challenge will be in reducing this dependence.

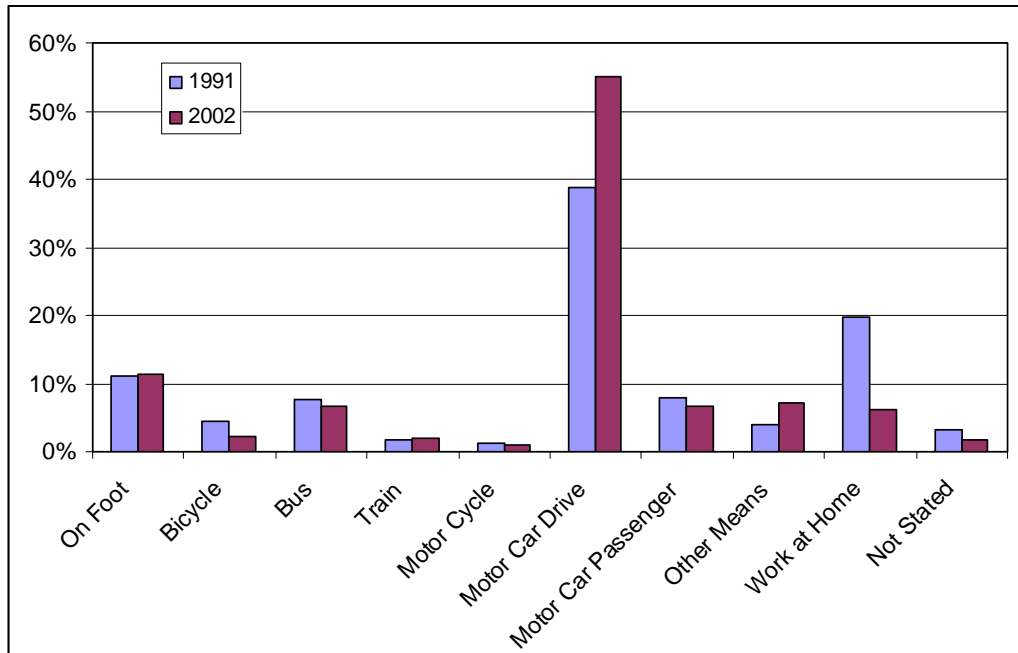


Chart 5.6: Transport Means in Ireland, % Share in 1991 and 2002.

(Source: CSO, 2005)

5.4.2 The Car

The motor car has to be given the major focus in relation to transport. A number of key actions are recommended:

- Energy Labelling and Fuel Efficiency
- Promotion of minimise unnecessary trips
- Car Pooling
- Sustainable Alternatives

5.4.2.1 Energy Labelling and Fuel Efficiency

EU Directives and agreements on the energy efficiency labelling of vehicles will have an overall effect of reducing CO₂ Emissions. The increased efficiency of new vehicles will have an effect given that the motor fleet is being renewed significantly as a result of economic growth. The various directives and policies indicate a reduction in emissions of 5% based on current levels. The SEI Report on Strategies to Reduce Greenhouse Gases from Transport indicated that by 2020 GHG emissions as a result of technology improvements would drop by 15-40% compared to 2005 levels.

For North Tipperary the potential impact of this measure has been assumed to reduce emissions by 5% by 2010. Measures will have to be put in place to ensure that energy efficiency is a key purchasing requirement for new vehicles.

This would amount to a total CO₂ saving of 328.8 kTonnes CO₂ x 5% = 16.44 kTonnes in 2010.

5.4.2.2 Promotion to minimise unnecessary trips

Census 2005 showed that 34% of households in North Tipperary had more than 2 cars, with 42% have one car. In total, 83% of all households had at least 1 car. Within the

County the average distance travelled was 8 km (5 miles). A typical household with access to a car could make an average of 18 trips per week. (GEAL, 2000).

Achieving a 20% reduction in trips could have the following affect in terms of emissions

- Trip reduction per household: 20% x 18 trips = 3.6 trips
- Total no. of vehicles: 36,909 (2004 figures)
- Total no. of trips avoided: 3.6 trips x 36,909 vehicles = 131,872 trips
- Average trip distance: 8 km
- Total Km Avoided per week: 8 km x 132,872 trips ≈ 1,000,000 km

The average emissions per km for diesel and petrol engines have been taken from Tynall (2001). Another source of information on current vehicles is the Society of the Irish Motor Industry (SIMI) (www.simi.ie) and the Vehicle Certification Agency in the UK (<http://www.vcicarfueldata.org.uk>). The percentage split of petrol and diesel vehicles in Ireland is 30% diesel and 70% petrol.

While it is acknowledged that the number of cars will increase in North Tipperary between 2004 and 2010, 2020 a constant figure has been taken for annual reductions for 2010 and 2020. Achieving these savings would require significant promotion of the benefits both environmentally and economically of reducing the number of trips made.

Table 5.17: CO₂ Savings from Reducing Unnecessary Trips – North Tipperary

	Emissions g CO ₂ /km	Km per Week Avoided	Emissions per annum (‘000 T CO ₂)
Petrol (70%)	185.2	744,085	7.17
Diesel (30%)	139.8	318,894	2.32
Total		1,062,979	9.48

5.4.2.3 Car Pooling

Car Pooling or Car Sharing is a mechanism which can make an impact, particular in relation to travel for work. While it is underdeveloped in Ireland at present there is potential for schemes to be developed in industrial estates and large organisations.

Taking the following assumptions the CO₂ savings for the introduction of car pooling can be developed

- In 2005 there were over 9,600 people working in the industrial sector and 15,000 in the Commercial Sector in North Tipperary.
- 60% of these trips are made by car as a driver only (taking the average means for travel to work for the County).
- Average trip distance was 7 km one way and 220 working days per year
- 20% of all trips are reduced by moving to car-pooling

With limited data available on number of employees in these sectors in the future (2010 and 2020) a constant figure has been assumed for both years.

Table 5.18: CO₂ Savings as a result of Car Pooling Initiatives – North Tipperary

	No Employees	Average Annual Trip/person (Km)	Total Trip Length (000 Km)	%Car Pooling	Car Pooling Travel Avoided (Km)	CO ₂ Avoided (‘000 T CO ₂)
Industry	9,613	3,080	29,608	20%	5,921,608	1.02
Commercial	14,981	3,080	46,141	20%	9,228,296	0.39
Total	24,594	3,080	75,749,520	40%	15,149,904	1.40

5.4.2.4 Hybrid and Super Efficient Vehicles

The vehicle manufacturers have introduced a number of initiatives in recent years which are resulted in an increased uptake in the use of hybrid vehicles. The most common example is the Toyota Prius. Emissions from such vehicles are in the region of 100 gCO₂/km, providing a saving of 85 g/CO₂ per km. New diesel engines are now also emerging with similar performance e.g. Renault dCi86.

It is difficult to determine the market share which such vehicles can take in the immediate future. However for this analysis it has been assumed that they can attain a 1% market share by 2010 and 2% to 2020.

Table 5.19: CO₂ Savings as a result of Hybrid/Super Efficient Cars

	Total Cars	Market Share (%)	Total Hybrid Cars	CO ₂ Savings (g CO ₂ /Km) ⁷	Average Annual Trip (Km)	CO ₂ Savings (‘000 T CO ₂)
2010	51,760	1	518	85.2	16000	0.71
2020	58,417	2	1,168	85.2	16000	1.59

5.4.3 Modal Shift

While the above sections have concentrated on actions which are linked directly to the motor vehicle there will be an increased need to move/shift people from the use of the individual car to more energy efficient and environmentally friendly modes of transport.

The main regular use of transport is to travel to work of full time education. Other travel is generally recreational or social. The main impact in terms of modal shift however can be made in terms of destinations that are regular and follow a specific timetable/format. In North Tipperary the breakdown of those analysed in terms of final destination is follows:

Table 5.20: Total No. of People by Travel Destination

Source (CSO, 2002)

Category	Total
Work	24,594
School – 4-12 years	7,225
School – 13-18 years	5,620
College - >19 years	1,471

⁷ Compared to petrol taking Hybrid emissions of 100g CO₂/km and Petrol emissions of 185.2 g CO₂/km

It is clear that the majority of trips are related to work and primary school. The opportunities for modal shifts are different for each category as there are differing needs.

5.4.3.1 Cycling and Walking

The Census data of 2002 showed that within the school categories 33% of students (1,385 primary, 1,204 secondary and 682 college) travelled to school by bicycle or on foot in North Tipperary. The percentage of use of these modes for the work category was significantly lower at 13% (3,226 people).

An increase in the use of cycling/walking within the school categories of 5% and 10% for the work category may be achievable through a dedicated promotion campaign which supports such transport modes. The key modal movement would be from the private car and would save approximately 1 Tonne of CO₂ per 5,000km cycled/walked. The achievement of such a modal shift will require investment in pavements, cycle lanes, safety infrastructure and personnel and training for parents and children.

Table 5.21: CO₂ Savings from Modal Shift to Bicycle/Walking – North Tipperary

Category	Total Persons	Current Cycle/Walk (people)	Current % Share (%)	New % Share (%)	New Cycle/Walk (people)	Additional CO ₂ Avoided (T CO ₂)
Work	24,594	3,226	13%	19%	1447	
School: 4-12 yrs	7,225	1385	19%	29%	710	
School: 13-18 yrs	5,620	1204	21%	31%	538	
College: >19 yrs	1,471	682	46%	56%	142	
Total	38,910	6,497	17%	24%	2,837	2.8

5.4.3.2 Public Transport - Buses

Currently in North Tipperary the main use of the bus for the main destinations is restricted to travel to school. The use of bus for travel to work is currently only 3% while the use of buses for secondary schools is high at 40%. The figure for primary schools is comparatively lower at 21%.

The main focus of seeking to move transport onto the bus should focus on the work category, and perhaps the primary school category. Increased use for recreational and social use will be based on demand requirements. Another significant initiative in the region is the Rural Transport Initiative – however the impact of this is difficult to measure at present as it is developed mainly in a social context focused at those with limited transport means e.g. elderly living in rural areas.

Company schemes to support the use of the bus are available and it is proposed that a doubling of those using the bus to travel to work might be achievable with the use of these and other schemes. Seeking to get the use of buses for primary school transport to 20% from its current level should also be a target for the County. The impacts of these actions are shown in the following table.

Table 5.22: CO₂ Savings from Modal Shift to Bus – North Tipperary

Category	Total Persons	Current Bus (people)	Current % Share (%)	New % Share (%)	New Bus (people)	Additional CO ₂ Avoided (T CO ₂)
Work	24,594	734	3%	7%	1800	
School: 4-12 yrs	7,225	1521	21%	42%	3000	
School: 13-18 yrs	5,620	2248	40%	62%	3500	
College: >19 yrs	1,471	263	18%	34%	500	
Total	38,910	4,766	12%	23%	8,800	1,210 ⁸

5.4.3.3 Public Transport - Rail

The use of rail for the main transport destinations in North Tipperary is negligible. The potential for significant change by 2010 is limited given the current rail network links. The Transport 21 Strategy (DoEHLG, 2005) did not specify specific actions for the upgrade of the Limerick – Nenagh route. There is good access to rail from Thurles to Cork/Dublin and also access in Templemore and CloghJordan.

Further analysis will be required to determine the impact of future development in terms of increased use of rail for access to work, education and for recreation. It has a significant potential for impact also in relation to tourism and freight.

For the purposes of this analysis the impact of rail has been assumed to be negligible

5.4.3.4 Public Transport – Recreational and Other Travel

The total travel which can be characterised in relation to this type of travel is difficult to estimate accurately without detailed transport analysis. However, the development of appropriate public transport services to meet these needs is vital for the future. Further detailed analysis is proposed for this area in the near future.

5.4.4 Green Fuels

The EU Directive of Liquid Biofuels sets indicative targets of 5% of transport fuels to be supplied by liquid biofuels by 2010 and 10% to 2020. Nationally this would require the production of 221 Million Litres of Ethanol and 211 Million Litres of Bio Diesel in 2010 (SEI, 2004). The Budget 2006 announced support of €200m in this regard with the aim of producing 156 Million Litres of biofuels (86 MLitres Biodiesel & 70 MLitres Ethanol), which would achieve 2% of transport fuels Nationally (Dept of Finance, 2005).

The requirements for North Tipperary if the 5% and 10% targets were to be achieved are shown in the following Table. Currently the estimated energy consumption for the transport sector is 1,158 GWh which equates to approximately 155 Million Litres of transport fuels. The 5% target in 2010 would require the production and use of 7.75 Million Litres of liquid biofuels in North Tipperary (generally equally split between ethanol

⁸ Based on move from car to bus. Emissions per km for car assumed at 155 g CO₂ /km (average of petrol and diesel) and for bus 55 g CO₂ /km

and biodiesel). The more ambitious 10% target to 2020 would raise this to a figure to 15.5 Million Litres.

Given that there is no current production in North Tipperary these targets are very ambitious. However, the County and the region will probably see the production of biofuels in the near future as a result of Government Policy and there is also the potential to import such fuels.

Assuming the 5% target were to be achieved by 2010 this would result in CO₂ of approximately 5.2 kTonnes CO₂ per annum in 2010.⁹

Table 5.23: Liquid Biofuels Requirements – North Tipperary

Biofuels	GWh			M Litres		
	2005	2010	2020	2005	2010	2020
Current	1,156.0	1,500.0	1,693.0	174.4	226.3	255.5
Petrol	809.2	1,050.0	1,185.1	135.7	176.1	198.8
Diesel	346.8	450.0	507.9	38.7	50.2	56.7
5% Biofuels	57.8	75.0	84.7	8.7	11.3	12.8
Ethanol	40.5	52.5	59.3	6.8	8.8	9.9
Biodiesel	17.3	22.5	25.4	1.9	2.5	2.8
10% Biofuels	115.6	150.0	169.3	17.4	22.6	25.5
Ethanol	80.9	105.0	118.5	13.6	17.6	19.9
Biodiesel	34.7	45.0	50.8	3.9	5.0	5.7

Table 5.24: CO₂ Savings from the use of Biofuels – North Tipperary

CO ₂ Savings	2005	2010	2020
Current (000 T CO ₂)	298.0	354.0	374.0
5% Target (000 T CO ₂)	7.5	8.9	9.4
10% Target (000 T CO ₂)	14.9	17.7	18.7

⁹ Assuming liquid biofuels achieve a 50% reduction in CO₂ emissions.

5.5 Built Environment & Residential

5.5.1 Introduction

The built environment is second to transport in terms of its importance as an energy consumer and emitter of CO₂ emissions. At a European level 40% of all energy consumption can be attributed to the built environment. This section will deal mainly with the residential and commercial/public sector buildings. Focusing on the residential sector in particular it accounted for 20.8% of TFC in North Tipperary in 2005 and 23.6% of CO₂ emissions.

5.5.2 CO₂ Reduction Targets

The Tipperary Energy Balance set Quantified Indicative Reduction Targets for CO₂ for North Tipperary for the Built Environment Sector. The estimated reduction that could be achieved in the relation to the Built Environment was in the region of 16 kTonnes of CO₂. The following table summarises the actual savings in terms of CO₂ that are projected to be achievable by 2010 and 2020. Details of how these can be achieved are provided in the following sections.

Table 5.25: Quantified Indicative Reductions for North Tipperary – Built Environment

Ref	Action	2010	2020
	Residential		
	Part L	8.91	20.44
5.5.5.3	EPBD New	0.45	1.02
5.5.5.3	EPBD Existing	1.57	2.03
5.5.7.1	Awareness	2.14	2.26
5.5.7.2	Social Housing Upgrades	0.30	0.25
5.5.7.2	LA New Housing	0.09	0.19
	<i>Sub Total</i>	13.45	26.19
	Commercial/Public		
	Part L	1.21	1.41
5.5.5.4	EPBD	0.61	0.70
5.5.6.1	Monitoring and Targeting	1.00	1.00
5.5.6.2	Awareness and Training	0.50	0.50
5.5.6.3	Surveys and Audits	1.50	1.50
	Sub Total	4.82	5.11
	Total	18.28	31.30

5.5.3 CO₂ Reduction, Cost Benefit Analysis

The average cost for the abatement of CO₂ emissions, based on estimated investment costs, is approximately €1000/Tonne CO₂ in North Tipperary for the Built Environment sector. The largest investment will be in the compliance with Part L of the building regulations. The data presents the estimated capital investment costs. There are additional costs related to support programmes which could also be accounted for.

Table 5.26: Indicative CO₂ Abatement Costs for North Tipperary – Built Environment

	2010			2020		
	QIR Proposed	Indicative Cost	Indicative Abatement Cost per Tonne CO ₂	QIR Proposed	Indicative Cost	Indicative Abatement Cost per Tonne CO ₂
Built Environment	(000 T-CO ₂)	(€m)	(€/TCO ₂)	(000 T-CO ₂)	(€m)	(€/T CO ₂)
Residential						
Part L	8.91	10	1,122	20.44	15	734
EPBD New	0.45	0.8	1,796	1.02	1.6	1,566
EPBD Existing	1.57	0.6	382	2.03	3	1,478
Awareness	2.14	1	468	2.26	1	443
Social Housing Upgrades	0.30	0.1	333	0.25	0.1	400
LA New Housing	0.09	0.2	2,133	0.19	0.2	1,067
<i>Sub Total</i>	13.45	12.7	944	26.19	20.9	798
Commercial						
Part L	1.21	3	2,471	1.41	3	2,129
EPBD	0.61	1	1,647	0.70	1	1,419
Monitoring and Targeting	1.00	2	2,000	1.00	2	2,000
Awareness and Training	0.50	0.5	1,000	0.50	0.5	1,000
Surveys and Audits	1.50	2	1,333	1.50	2	1,333
<i>Sub Total</i>	4.82	8.5	1,763	5.11	8.5	1,662
Total	18.28	21.2	1,160	31.30	29.4	939

5.5.4 Legislation / Regulation

5.5.4.1 Irish Building Regulations – Part L

The Building Regulations in Ireland have undergone considerable change since 1991. Houses which are constructed under the current building regulations (2002) should be 30% more efficient than those constructed prior to this. All new housing built from 2002 has been assumed to achieve these savings in practise. From 2006 all buildings (residential and non-residential) will have to achieve similar performance in terms of insulation.

5.5.4.2 Energy Performance Buildings Directive

This Directive requires that qualifying buildings which are constructed, sold or rented should have a Building Energy Rating (BER) provided and also a summary report indicating appropriate energy efficiency upgrades. The BER will be implemented as follows in Ireland

- Jan 2007: New Residential Buildings
- July 2008: New Public and Non Residential Buildings
- Jan 2009: All Existing Buildings

In addition, there are measures in relation to minimum energy performance standards, inspection of oil boilers and air conditioning systems over a certain size and assessment of alternative energy supply options.

5.5.5 Building Regulation Reductions

The savings are projected as a result of the new Building Regulations and the EPBD are shown in the following Table. Further detail is provided in the subsequent sections.

Table 5.27: CO₂ Reductions due to Regulations – North Tipperary

Activity		2010	2020
Residential	Part L	8.91	20.44
	EPBD New	0.45	1.02
	EPBD Existing	1.57	2.03
Commercial/Public	Part L	1.21	1.41
	EPBD	0.61	0.70
Total		12.75	25.60

5.5.5.1 Irish Building Regulations – Part L – Residential Sector

From 2002 to 2006 an average of 700 new houses were built in North Tipperary per annum. Assuming a similar trend going forward a total of 5,940 new houses will have been built under the new Part L regulations by 2010. This will have increased to 13,626 by 2020. This will result in the following CO₂ savings

- **By 2010: 8.91 kTonnes CO₂**
- **By 2020: 20.44 kTonnes CO₂**

5.5.5.2 Irish Building Regulations – Part L – Commercial/Public Sector

With the non-residential buildings new regulations have been introduced as of 2006. It is more difficult to determine potential savings in this regard as there is limited data on size, type of non-residential buildings and their energy use. Assuming however a 1% saving could be achieved on the projected 2010 and 2020 figures from the Energy and Emissions Balance the savings would be

- **By 2010: 1.21 kTonnes CO₂**
- **By 2020: 1.40 kTonnes CO₂**

5.5.5.3 Energy Performance of Buildings Directive – Residential Sector

The EPBD will have an impact on both existing and new residential buildings. The projected savings as a result of the implementation of the Directive are projected to be generated by

- new buildings achieving an 5% additional savings on top of those stimulated by the new Part L regulations
- existing buildings undergoing upgrades as a result of the awareness created by the Directive. These houses are expected to achieve a 20% reduction in emissions or 1.2 Tonnes per house.

5.5.5.4 Energy Performance of Buildings Directive – Non-Residential Sector

The Non-Residential Sector will have CO₂ savings stimulated both through the Building Energy Rating requirement but also inspection of boilers and air conditioning systems. A study in Co. Tipperary (Hoyne, 2005) showed that 5% of non-residential buildings would need to comply with the Directive and CO₂ savings of 7% could be achieved. The Directive has noted that savings in the region of 22% could be achieved. For this study the following assumptions have been made

- 5% of Commercial Sector emissions applicable
- 10% savings achieved

The savings achieved are:

- **By 2010: 0.61 kTonnes CO₂**
- **By 2020: 0.70 kTonnes CO₂**

5.5.6 Public/Commercial Sector Built Environment

This sector is of particular interest to the Tipperary Energy Agency given its focus on Local Authority activities and the Commercial sector. Savings are achievable through a number of different actions, in addition to that stimulation by regulations. A summary of savings is provided in the following Table with detail in subsequent sections.

Table 5.28: CO₂ Reductions Public/Commercial Sector Built Environment – North Tipperary

Activity	2010	2020
Monitoring and Targeting	1.0	1.0
Awareness and Training	0.5	0.5
Surveys and Audits	1.5	1.5
New Buildings	-	-
Sub Total Non Regulation	3.0	3.0

5.5.6.1 Monitoring and Targeting Programme

North Tipperary Council have a number of key Local Authority buildings and sites which could be the focus of a Monitoring and Targeting programme. These include

- County Buildings
- Water Treatment Sites
- Sewage Treatment Sites
- Swimming Pools

All sites will require detailed analysis of their current energy consumption by fuel and point of use. This analysis should be completed on a regular basis. Once this has been completed a range of energy efficiency benchmarks should be development and actions to reduce consumption implemented.

Estimates from best practise indicate that savings of 1,000 Tonnes CO₂ per annum are achievable

5.5.6.2 Awareness and Training

Staff awareness with buildings and sites is a key factor in implementing energy efficiency measures. Training of key personnel is also vital to broaden the level of involvement in the actions required to achieve savings. The TEA is a key resource to achieve this in North Tipperary.

The TEA has estimated that savings in the region of 500 Tonnes CO₂ could be achieved.

5.5.6.3 Energy Auditing

Key energy consumption sites in the County should be targeted for specific, detailed energy audits. This is the next step after Monitoring and Targeting to identify more specific technical and non-technical improvements.

In cooperation with Local Authority and other staff savings in the region of 1,500 Tonnes CO₂ are projected.

5.5.7 Residential Sector Built Environment

Much of the savings within the Residential sector will be stimulated through the new building regulations and the EPBD. There is however additional opportunities which are detailed below.

5.5.7.1 Awareness Programme

Focused local and regional information and awareness programmes, appropriately funded, will stimulate action. A recent EU Barometer report (EU Commission, 2005) indicated that EU citizens wish to contribute to energy efficiency but 43% of those polled noted that information is missing.

If a dedicated programme could achieve 1% reduction in CO₂ emissions estimated savings would be

- **By 2010: 2.14 kTonnes CO₂ per annum**
- **By 2020: 2.26 kTonnes CO₂ per annum**

5.5.7.2 Local Authority/Social Housing

The TEA and Local Authorities can take specific action in relation to social housing, both in new build and refurbishment. An average of 50 new social houses was built per annum in North Tipperary since 2000. Between 2005 and 2010 the Local Authority and TEA could influence an additional 5% saving, over an above those stimulated by the Building Regulations.

In addition, the Local Authority refurbishment programme should take specific action to implement additional sustainable energy measures.

5.5.7.3 Renewable Energy Systems

The residential sector presents a significant market for the use of renewable energy systems. The savings under this area have already been accounted for under Energy Production and Supply Sector for North Tipperary.

5.6 Industry and Commercial Sectors

5.6.1 Introduction

The Industrial Sector accounted for 21.2% of energy related CO₂ emissions in North Tipperary in 2005 which equates to 171.2 kTonnes CO₂ per annum. This figure is not expected to increase going forward. This is in line with National trends with regard to CO₂ emissions.

The Commercial Sector accounted for a percentage of emissions in 2005 (13.2%) but the overall levels of emissions from this sector is projected to increase going forward to 2010 and 2020. The total emissions from the sector are expected to increase from 107 to 141 kTonnes CO₂ between 2005 and 2020.

The savings referred to within this section are in addition to those which impact directly on buildings, which are covered in Section 5.6.

5.6.1.1 CO₂ Reduction Targets

The Tipperary Energy Balance set Quantified Indicative Reduction Targets for CO₂ for North Tipperary for the Industrial/Commercial Sector. The estimated reduction that could be achieved was in the region of 38 kTonnes of CO₂. The following table summarises the actual savings in terms of CO₂ that are projected to be achievable by 2010 and 2020. Details of how these can be achieved are provided in the following sections.

Table 5.29: Quantified Indicative Reductions for North Tipperary – Industry and Commercial Services

Ref	Sector	Action	2010	2020
5.6.2.1	Industry	LIEN	6.9	7.0
5.6.2.3		Monitoring, Targeting and Surveys	4.0	4.0
5.6.2.4		Awareness	4.0	4.0
5.6.2.5		Green Supply	9.9	10.0
	<i>Sub Total</i>		24.8	24.9
	Commercial	Energy Efficiency	1.2	1.4
5.6.3.1		Monitoring, Targeting and Surveys	2.4	2.8
5.6.3.2		Awareness	2.4	2.8
	<i>Sub Total</i>		6.1	7.0
	Total		30.8	31.9

5.6.1.2 CO₂ Reduction, Cost Benefit Analysis

The average cost for the abatement of CO₂ emissions, based on estimated investment costs, is approximately €220/Tonne CO₂ in North Tipperary. The data presents the estimated capital investment costs. There are additional costs related to support programmes which could also be accounted for.

Table 5.30: Indicative CO₂ Abatement Costs for North Tipperary – Industry and Commercial Services

	2010			2020		
	QIR Proposed	Indicative Cost	Indicative Abatement Cost per Tonne CO ₂	QIR Proposed	Indicative Cost	Indicative Abatement Cost per Tonne CO ₂
Industry/Commercial	('000 T-CO ₂)	(€m)	(€/TCO ₂)	('000 T-CO ₂)	(€m)	(€/T CO ₂)
Industry						
LIEN	6.9	1	144.2	7.0	1	143.4
Monitoring, Targeting and Surveys	4.0	2	504.8	4.0	2	502.0
Awareness	4.0	1	252.4	4.0	1	251.0
Green Supply	9.9	0	-	10.0	0	-
<i>Sub Total</i>	24.8	4		24.9	4	
Commercial						
Energy Efficiency	1.2	1	823.7	1.4	1	709.7
Monitoring, Targeting and Surveys	2.4	1	411.9	2.8	1	354.9
Awareness	2.4	1	411.9	2.8	1	354.9
<i>Sub Total</i>	6.1	3		7.0	3	
Total	30.8	7	227	31.9	7	219

5.6.1.3 Legislation / Regulation

The Industrial Sector is perhaps one of the most regulated of all the sectors in relation to environmental and energy related issues. As a result, many actions which are relevant are driven by EU and National legislation. Particular issues that apply include the National Green House Gas Allocation Plan, Integrated Pollution and Prevention Control Licenses (IPPC).

It is important to note that the National Climate Change Strategy also addresses other non energy related emissions which are associated with the industrial sector. These are not covered in this report.

5.6.2 Industrial Sector Reductions

5.6.2.1 Large Industry Energy Network

The Large Industry Energy Network (LIEN) is voluntary network initiative operated by Sustainable Energy Ireland for the largest industrial energy consumers in Ireland, i.e. those with an annual energy spend over €1m, with the average spend around €4m. LIEN has not evolved into the Energy Agreements Programme.

In 2004 LIEN members accounted for over 50% of industry related CO₂ emissions nationally. The Network reported that in 2004 those actions taken by members resulted in CO₂ savings in 2004 of 3.5% (SEI, 2005). The actions which this network stimulates in the member companies includes

- monitoring and targeting
- surveys and auditing
- technology solutions in relation to equipment, processes and systems

It could be assumed that these levels of solutions could be applied from 2005 to 2010 within the industrial sector and achieve the following savings.

- **By 2010: 6.93 kTonnes CO₂ per annum**
- **By 2020: 6.97 kTonnes CO₂ per annum**

5.6.2.2 Combined Heat and Power

Large Industry presents opportunities for introduction of CHP technology, as discussed in Energy Production and Supply Section.

5.6.2.3 Monitoring, Targeting and Auditing

Those Industries which are not served by the LIEN in North Tipperary should be targeted to introduce them into the network or else to develop a specific County or Region wide programme which addresses their needs. This could increase the savings achievable within the sector in North Tipperary. The type of actions which would be expected to be completed include

- monitoring and targeting
- site surveys and auditing
- promotion of best practise

A figure of 2% additional annual savings has been estimated for such an action which would result in savings of

- **By 2010: 3.96 kTonnes CO₂ per annum**
- **By 2020: 3.98 kTonnes CO₂ per annum**

5.6.2.4 Awareness

A dedicated awareness and information programme should also be facilitated within the region in conjunction with appropriate National Bodies such as Sustainable Energy Ireland.

Such a programme could result in the following CO₂ savings based on a 2% reduction

- **By 2010: 3.96 kTonnes CO₂ per annum**
- **By 2020: 3.98 kTonnes CO₂ per annum**

5.6.2.5 Green Electricity Usage

An effective low cost measure to reduce emissions in North Tipperary from the Industrial Sector would be to actively promote, in conjunction with other relevant bodies, the use of electricity produced from renewables i.e. green electricity. While there are already industries using such electricity setting an aggressive target of 5% of all electricity within the sector coming from green sources should be achievable. Given that over 63% of emissions within the industrial sector were associated with electricity use (SEI, 2003) this could make a significant local, regional and national impact.

Savings from this initiative are estimated to be

- **By 2010: 9.9 kTonnes CO₂ per annum**
- **By 2020: 10 kTonnes CO₂ per annum**

5.6.3 Commercial Sector Reductions

As stated in the National Climate Change Strategy it is somewhat difficult to disaggregate reductions between this sector and the Built Environment and Residential Sectors as there is a cross over between measures in relation to building regulation, energy efficiency etc.

However, this report proposes specific actions for this sector to ensure it can contribute to the CO₂ reductions. This is particularly important given the growing role of the Commercial Service Sector in Ireland.

5.6.3.1 Monitoring, Targeting and Auditing

The Commercial sector has not been targeted by any specific National or Regional support programmes to date. It is therefore vital that a programme which supports monitoring and auditing within this sector is implemented as this would stimulate action and savings. The type of actions which would be expected to be completed include

- monitoring and targeting
- site surveys and auditing
- promotion of best practise

A figure of 2% annual savings has been estimated for such an action which would result in savings of

- **By 2010: 2.43 kTonnes CO₂ per annum**
- **By 2020: 2.81 kTonnes CO₂ per annum**

5.6.3.2 Awareness

A dedicated awareness and information programme should also be facilitated within the region in conjunction with appropriate National Bodies such as Sustainable Energy Ireland.

Such a programme could result in the following CO₂ savings

- **By 2010: 2.43 kTonnes CO₂ per annum**
- **By 2020: 2.81 kTonnes CO₂ per annum**

5.7 Agriculture and Forestry

5.7.1 Introduction

The Agriculture sector accounts for the smallest energy consumption and CO₂ emissions in North Tipperary (4.9% of TFC and 5.5% of energy related CO₂ emissions in 2005). It is important to note that this report deals only with those emissions related to energy production and use in the Agricultural sector. The wider National Climate Change Strategy 2007-2012 has specific actions related to emission reductions associated with livestock, methane, fertiliser etc.

The Forestry sector is included with the Agricultural Sector within this report as both these areas provide specific opportunities for the CO₂ reductions to be achieved through the supply of renewable energy raw materials and production of renewable energy.

The Census of Agriculture 2000 (CSO, 2000) indicated that North Tipperary had total farm land in the region of 148,000 hectares. North Tipperary has total area of approximately 23,890 Ha under forestry in 2000, 11% of the total area.(Dept of Agriculture 2001). 41% of this forestry is Privately owned with the balance 59% in public ownership.

5.7.1.1 CO₂ Reduction Targets

The Tipperary Energy Balance set Quantified Indicative Reduction Targets for CO₂ for North Tipperary for the Agriculture and Forestry Sector. The estimated reduction that could be achieved in the relation to energy production and supply was in the region of 42 kTonnes of CO₂. The following table summarises the actual savings in terms of CO₂ that are projected to be achievable by 2010 and 2020. Details of how these can be achieved are provided in the following sections.

Table 5.31: Quantified Indicative Reductions for North Tipperary – Agriculture

Ref	Sector	Action	2010	2020
5.7.2.1	Agriculture	Liquid Biofuels	-	-
5.7.2.5		Miscanthus	0.45	2.25
5.7.2.3		AD	0.49	1.23
5.7.4		Tractors Efficiency Scheme	1.51	1.51
5.7.3.6	Forestry	Wood Energy	8.53	12.11
		Total	10.97	17.10

5.7.1.2 CO₂ Reduction, Cost Benefit Analysis

The average cost for the abatement of CO₂ emissions, based on estimated investment costs, is approximately €500/Tonne CO₂ in North Tipperary for the Agriculture and Forestry Sector. The data presents the estimated capital investment costs. There are additional costs related to support programmes which could also be accounted for.

Table 5.32: Indicative CO₂ Abatement Costs for North Tipperary – Agriculture

	2010			2020		
	QIR Proposed	Indicative Cost	Indicative Abatement Cost per Tonne CO ₂	QIR Proposed	Indicative Cost	Indicative Abatement Cost per Tonne CO ₂
Agriculture and Forestry	('000 T-CO ₂)	(€m)	(€/TCO ₂)	('000 T-CO ₂)	(€m)	(€/T CO ₂)
Agriculture						
Liquid Biofuels	-	0.0	-	-	0.0	-
Miscanthus	0.45	0.03	67	2.25	0.1	44
AD	0.49	0.5	1,106	1.23	0.5	406
Tractor Efficiency Scheme	1.51	0.5	332	1.51	0.5	332
Forestry						
Wood Energy	8.53	5.0	586	12.11	5.0	413
Total	10.97	6.	549	17.10	6.1	317

5.7.2 Agriculture & Forestry the Energy Producer

5.7.2.1 Liquid Biofuels

The main raw materials for the production of Liquid biofuels from agriculture are

- Rape Seed Oil for the production of Pure Plant Oil or Biodiesel
- Wheat for the production of Ethanol
- Beet for the production of Ethanol

The 2000 Census showed that North Tipperary had the following areas of these crops in production:

- Rape Seed Oil: 91 hectares
- Wheat: 19 hectares
- Beet: 50 hectares

The total area under cereals in the County was 241 hectares in 2000, or approximately 1%. Therefore the raw material for liquid biofuels production is at present limited. The potential for expansion is also perhaps limited due to land type and farm size. It is likely therefore that the production of large quantities of liquid biofuels directly from agricultural sources in North Tipperary will be small. There is potential for raw materials to be exported to producers in other surrounding counties for production however.

Planning permission has been granted for the development of a small biofuels plant in North Tipperary and this may emerge in the future.

5.7.2.2 Agricultural Residues - Straw

The limited cereal base in the County means that there is limited raw material available for use as a fuel.

5.7.2.3 Agricultural Residues – Anaerobic Digestion

Anaerobic Digestion (AD) presents an opportunity to produce heat and/or power through the digestion of organic material. Residues and materials such as animal slurries, straw, grass etc. from agricultural are appropriate materials to act as feed stock.

As of the 2000 Census there were 20 pig farms in the County. The current regulatory regime in relation to the Nitrates Directive means that AD is being explored as an option of dealing with pig slurry. CHP is an option if a suitable heat load is available and a viable price for the sale of electricity is available.

Initial estimates would indicate that it is possible that a number of small scale developments could result in installed capacity of 0.1 MW by 2010 and 0.25MW by 2020.

5.7.2.4 Energy Crops – Short Rotation Coppice

Short Rotation Coppice (SRC) Energy Crops present an opportunity to produce an energy resource from a forestry crop in a short time scale. The typical crop used is willow and extensive research has been conducted by Teagasc and Department of Agriculture in Northern Ireland in relation to its production and use. The introduction of supports for the production of SRC will be required for significant planting to occur.

The Renewable Energy Resource Study completed by ESBI in 1997 (ESBI, 1997) indicated that a technical resource of 2790 GWh/yr could be developed in North Tipperary by 2000. The feasible resource is reduced by 25% and a further 70% reduction is applied to reach the technical resource i.e. 490 GWh/yr. The land in North Tipperary was rated as moderate to good for planting of SRC.

However, given that no SRC plantations have been developed in the County and the limited supports at present it is unlikely that significant impacts will be made from this crop in the near immediate future i.e. before 2020. This is particularly true given the fact that it takes 4 years before an energy crop is harvested.

5.7.2.5 Energy Crops – Miscanthus

Within the North Tipperary miscanthus is an energy crop which is receiving attention. Local growers in Limerick provide an excellent opportunity for farmers in North Tipperary to examine the crop and determine its suitability for their enterprises.

Similar to SRC Miscanthus requires supports for its production but also for the entire supply chain to ensure it can reach its point of use.

It has been proposed that 25 ha of the crop could be planted by 2010. With yields in the region of 22 Tonnes per ha (Leahy, 2006) an energy yield of 3 MWh could be available, which if used to displace oil could result in CO₂ savings of 0.45 kT CO₂ per annum in 2010

5.7.2.6 Forestry – Residues and Thinnings

North Tipperary's large forestry area provides an immediate resource for energy production. The Clare Wood Energy Farm Forestry Project was launched in December 2005 aimed at the development of a market for wood energy in County Clare. The project will promote and develop a proposal for renewable energy projects in the County, fuelled by wood biomass supplied by local farm forest growers. It will facilitate a group of farm forest growers in the County to co-operatively supply new wood energy markets. A similar model can be developed in North Tipperary, or throughout the Mid West Region.

The remainder of the forestry holdings are generally held by Coillte. The potential for use of thinnings and residues from this sector will require detailed analysis and could build upon work within the Wood Energy Project.

It has been assumed that by 2010 10% of the wood energy resource from forestry thinnings in the private sector could be used i.e. 12.8 GWh/yr. This, if used to replace oil would result in CO₂ savings of 3.5 kTonnes per annum. With increased planting expected by 2020 the amount of thinnings available will also increase, the estimated savings for 2020 will be 4.6 kTonnes.

5.7.3 Agriculture & Forestry the Energy Consumer

The primary consumers of energy within the agricultural sector include machinery, equipment (milking machines etc.), buildings etc.

There are approximately 2,400 tractors in North Tipperary (CSO, 2000). Studies in France (AILE, 2006) have shown that through appropriate testing savings of 900 litres of diesel per tractor per year and 2.5 Tonnes CO₂ per tractor per year could be achieved. Assuming a 25% implementation rate in North Tipperary this could result in savings of 1.51 kTonnes CO₂ per annum

Energy audits and surveys of farm operations could also find energy savings within the agricultural buildings and operations. A pilot project is due to be completed by the Wexford and Tipperary Energy Agencies in 2007 and results of this should be reviewed for applications in North Tipperary.

5.8 Waste

Currently there is no landfill gas used for energy production in North Tipperary. There is a proposal being discussed which would link the landfill site to a potential AD plant in a pig farm. This is currently being discuss with North Tipperary County Council but for the purposes for this report no savings have been assumed to be created from the generation of landfill gas.

5.9 Conclusions

5.9.1 Individual Responsibility

The Tipperary Energy Balance calculated indicators for reductions which would be required per person to achieve the Kyoto Target. This has been updated to include the individual reductions required to meet the expected reductions projected in this study. These results are shown in the following Table.

Table 5.33: Individual Responsibility – North Tipperary

Indicator	1990	Kyoto Target (1990 + 13%)	2005	2010	Reduction Required To Reach Kyoto Target	Reduction Achieved through Standard Measures
Population (000)	58.19	-	63.5	71.37		
TFC (GWh)	1,439	-	2,557	3,069		
Energy Related Emissions ('000 T-CO ₂)	521	589	807	935	346	314
TFC/Capita (kWh/Person)	24,736	-	40,269	42,995	-	
CO ₂ Emissions / Capita (T CO ₂ /Person)	9.0	9.0	12.7	13.1	4.8	4.8

5.9.2 Carbon Levies

The Energy and Emissions Balance also calculated the carbon levies that could arise by failing to meet the Kyoto Requirements. These have been compared to the levy that might arise after the standard measures have been implemented in the following Table.

Table 5.34: Carbon Levies in North Tipperary (Business as Usual and with Standard Measures)

	2010	2020
Carbon Levy (€/T)	35	45
Levy BAU (€m)	12.11	25.9
Levy Standard Measures (€m)	1.1	-

6.0 South Tipperary

6.1 Introduction

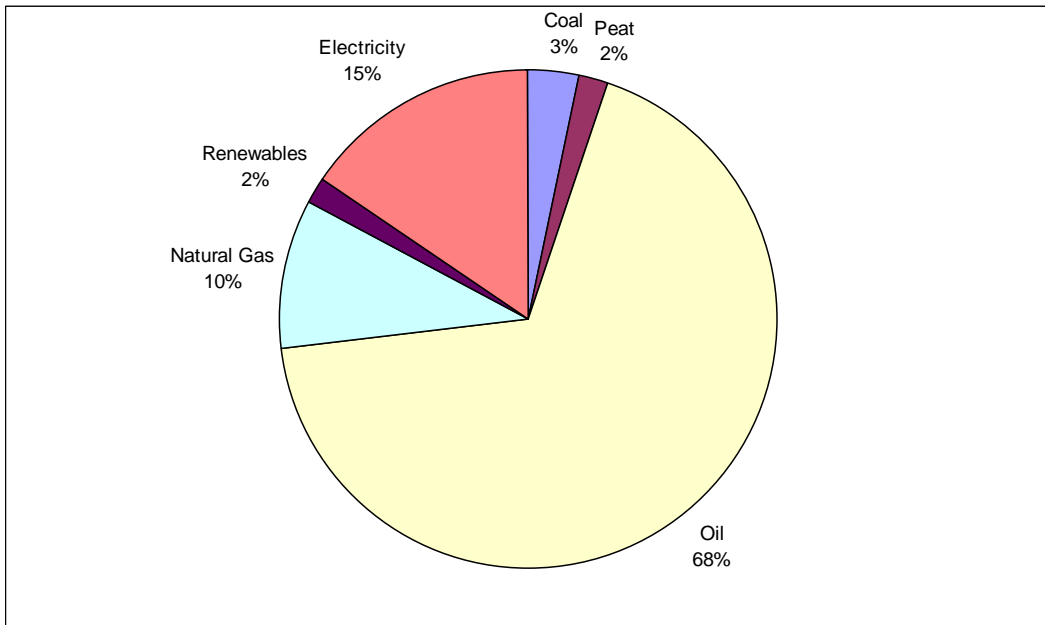


Chart 6.1: Total Final Consumption by Fuel, South Tipperary, 2005

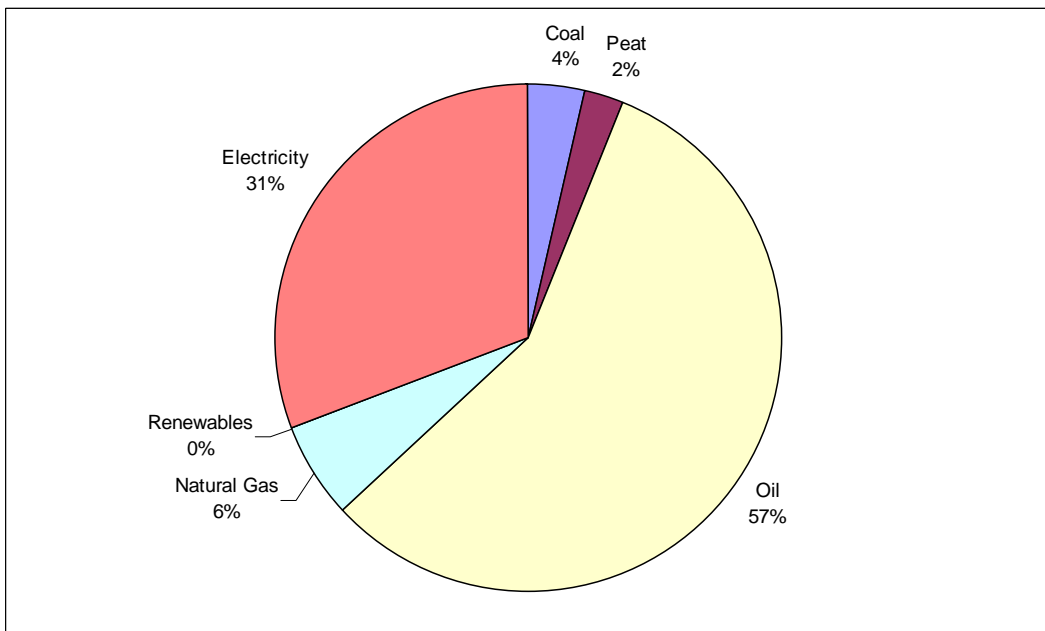


Chart 6.2: CO₂ Emissions by Fuel, South Tipperary, 2005

Oil is the dominant fuel in South Tipperary at present (68% of Total Final Consumption in South Tipperary in 2005) and also is the highest contributor in terms of CO₂ emissions. Similar to the National picture renewables make a minor contribution at present. Natural Gas has had a limited impact to date. The Transport Sector, in 2005, has the highest consumption in energy terms in the County, at 45%. 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 21% of TFC in the County.

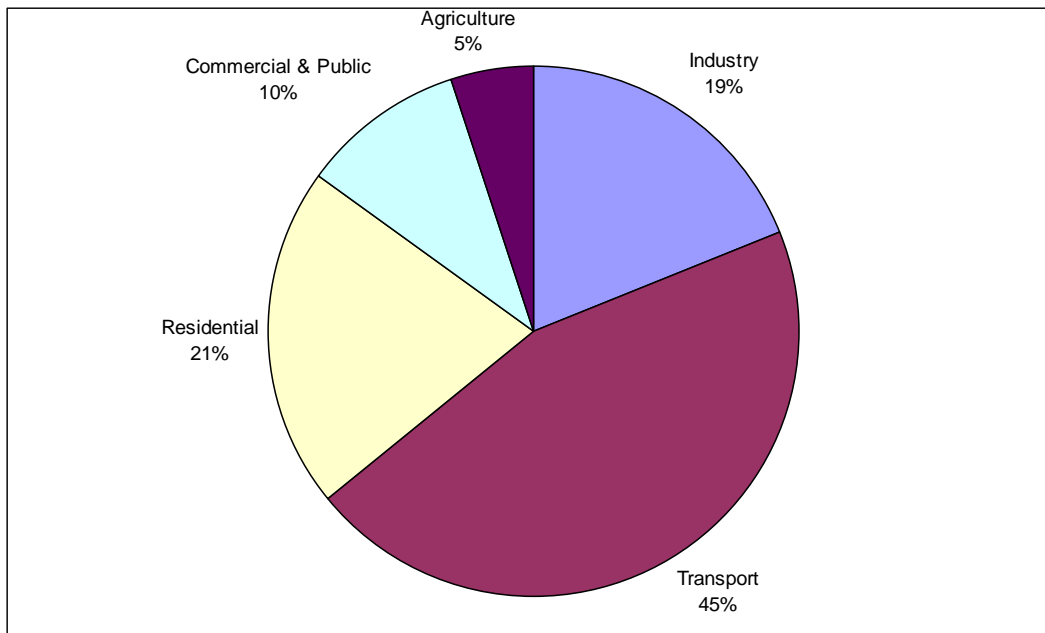


Chart 6.3: Total Final Consumption by Sector, South Tipperary, 2005

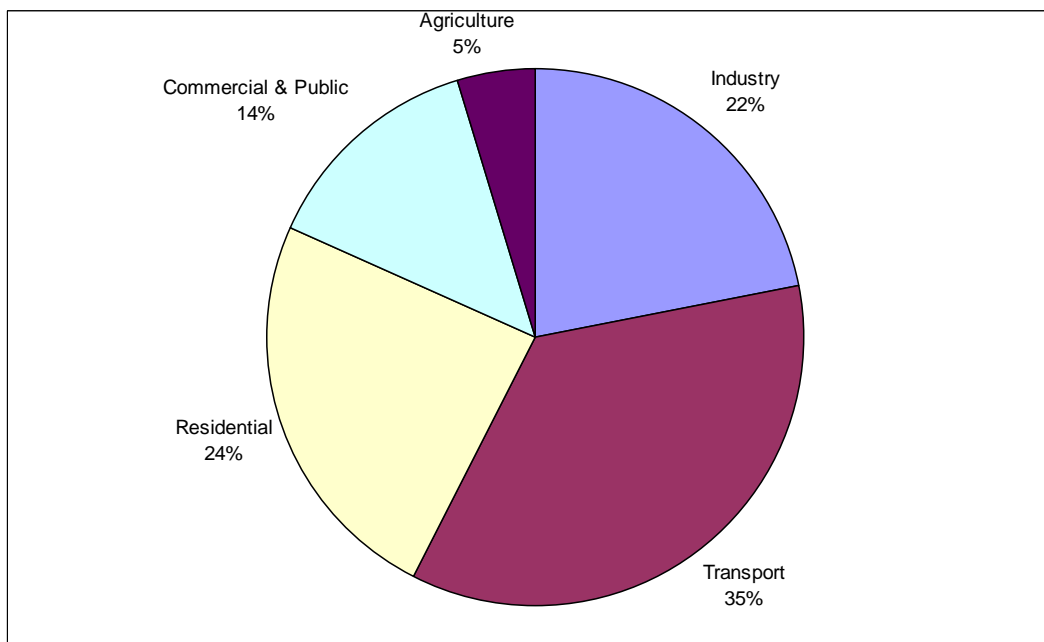


Chart 6.4: CO₂ Emissions by Sector, South Tipperary, 2005

The data from the Energy Balance, combined with other information, was used to develop Quantified Indicative Reductions (QIRs) for CO₂ savings for South Tipperary. These were generally apportioned to the following areas.

Table 6.1: Quantified Indicative Reductions, South Tipperary

Overall QIRS by sector	Quantified Indicative Reductions Proposed ('000 T-CO₂)
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

6.2 Summary of Actions

Table 6.2: Summary of CO₂ Reductions, Investment Cost and Abatement Cost – South Tipperary

Ref	Sector	CO ₂ Reduction		Investment Cost		Indicative Abatement Cost	
		(000 Tonnes)		(€m)		(€/Tonne)	
		2010	2020	2010	2020	2010	2020
6.3	Energy Prod & Supply	124	200	131	197	1057	985
6.4	Transport	46	60	7	12	152	201
6.5	Built Environment	20	33	21	29	1060	885
6.6	Ind and Comm Services	38	40	7	7	187	177
6.7	Agriculture	13	21	7	7	509	324
6.8	Waste	-	-	-	-	-	-
		-	-				
	Total	240	354	173	253	718	714
	Target	358	646				
	Gap to Target	118	292				

Table 6.2 summaries the data and results from the different sectors which were reviewed in South Tipperary. It can be seen that based on the standard measures which are proposed that the Kyoto Target will not be reached.

The Energy Production and Supply measures can make the biggest contribution in the short term. For the full Kyoto target to be reach greater contributions will be required from the other sectors, in particular transport.

The estimated cost to implement the measures outlined is €700 per tonne, taking full investment cost into account.

6.3 Energy Production & Supply

6.3.1 Introduction

Table 6.3: Total Final Consumption by Fuel, 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

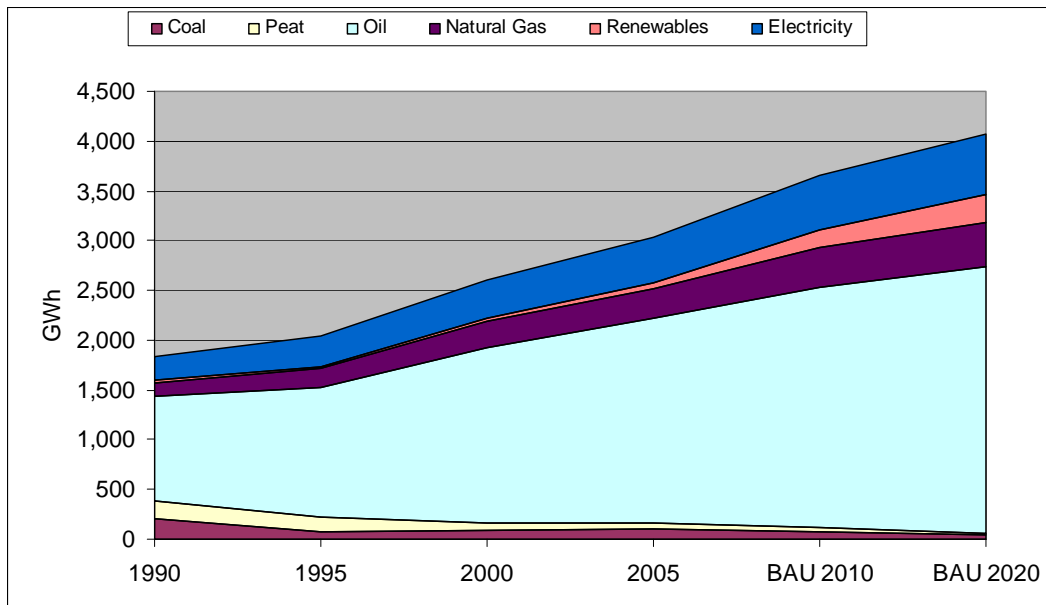


Chart 6.5: Total Final Consumption by Fuel, South Tipperary, (1990 – 2020)

6.3.1.1 CO₂ Reduction Targets

The targeted reductions under the Energy Production and Supply sector in the TEA Energy Balance were 111 kTonnes CO₂. The analysis presented below indicates that based on ordinary measures savings of 123 kTonnes CO₂ are achievable.

Table 6.4: Quantified Indicative Reductions for South Tipperary – Energy Production and Supply

Ref	Energy Production and Supply	Quantified Indicative Reductions Proposed (‘000 T-CO ₂)	
		2010	2020
	Fossil Fuel		
6.3.2.2	Fuel switching	14.29	7.83
6.3.2.3	Combined Heat & Power	0.90	0.90
	Renewable Energy		
6.3.3.1	Large Scale Wind Power	82.09	118.20
6.3.3.2	Hydro Power Schemes	-	-
6.3.3.3	Tidal/Wave	-	-
6.3.3.4	Large PV	-	1.84
6.3.3.5	Small Scale RE Elec	0.15	0.74
6.3.3.6	Large RE Thermal	7.80	16.84
6.3.3.7	Small RE Heat	18.50	53.97
	Total	123.73	200.32

It is clear from this table that the energy production and supply sector can meet the indicative target, with a significant input from the renewable energy sector.

6.3.1.2 CO₂ Reduction, Cost Benefit Analysis

While this study was not designed to provide a full economic analysis of the cost and impact of climate change within the County an indicative abatement cost to achieve the relevant reductions has been estimated. The Indicative Cost is an estimated investment required within the period 2005 to 2010 and 2010 and 2020.

Significant investment in the large scale wind sector will result in an average cost of €1000 per tonne of CO₂ avoided. On average the cost per tonne of CO₂ saved for all actions under the Energy Production and Supply Sector has been estimated to be €1000. There are additional costs related to support programmes which could also be accounted for.

Table 6.5: Indicative CO₂ Abatement Costs for South Tipperary – Energy Production and Supply

Energy Production and Supply	2010			2020		
	QIR Proposed (‘000 T-CO ₂)	Indicative Cost (€m)	Indicative Abatement Cost per Tonne CO ₂ (€/TCO ₂)	QIR Proposed (‘000 T-CO ₂)	Indicative Cost (€m)	Indicative Abatement Cost per Tonne CO ₂ (€/T CO ₂)
Fossil Fuel						
Fuel switching	14.29	0	-	7.83	0	-
CHP	0.90	1	1,114	0.90	1	1,114
Renewable Energy						
Large Scale Wind	82.09	84	1,023	118.20	108	914
Hydro Power	-	0	-	-	0	-
Tidal/Wave	-	5	-	-	50	-
Large PV	-	0	-	1.84	10	5,449
Small Scale RE E	0.15	1.75	11,761	0.74	4.9	6,586
Large RE Thermal	7.80	4	513	16.84	6	356
Small RE Thermal	18.50	35	1,891	53.97	17.5	324
Total	123.73	130.75	1,057	200.32	197.4	985

6.3.1.3 Renewable Energy Supply Targets

The targets for South Tipperary in terms of renewables are best aligned to the EU and National Targets which currently exist. There are a number of EU Policies and Directives in this regard:

- EU White Paper on Renewable Energy Sources:
 - A target of doubling RES supply from 6% to 12% of Total Primary Energy Requirement (TPER) by 2010.
- EU Renewable Energy Electricity Directive:
 - A target to achieving 13.2% of electricity supply from renewables by 2010 is set for Ireland within this Directive.

The TFC for South Tipperary in 2005 was estimated to be 3,041 GWh. The TPER for the County has been estimated by taking the National ratio of TFC to TPER, which in 2004 was 78.7%.¹⁰

To assess the current status of reaching these targets within County the following assumptions have been made

- The National Target figure has been multiplied by the population ratio to give a target for South Tipperary.

The data from this analysis is presented in the following Table. It can be seen that by 2010 a total of 45MW of renewable energy electricity capacity should be installed to meet the requirements of the Directive. To reach the 12% TPER Target a total of 807 GWh of renewable energy should be generated by 2010.

¹⁰ National TPER in 2004 = 15,008 kToe, National TFC in 2004 = 11,813 kToe.

Table 6.6: Renewable Energy Targets for South Tipperary

	National 2004	National 2010	North Tipperary 2004	North Tipperary 2010
TPER (GWh)	175,543 ¹¹	214,104	3,441	4,196
12% Target (GWh)	21,065	25,692	413	504
Installed RES (MWe)	736 ¹²	1,450 ¹³	1	23

6.3.2 Fossil Fuel Energy

6.3.2.1 Electricity Generation

There are no large scale, fossil fuel based, electricity generation plants and this scenario is unlikely to change in the future. Actions in relation to CHP and renewables are considered separately.

6.3.2.2 Thermal - Fuel Switching

The national trend of a move away from solid fuels is mirrored in South Tipperary also. However, there is potential for more dedicated programme of fuel switching. This programme should seek to

- move from the use of high emission fuels to lower emissions fuels i.e. coal to oil or natural gas
- move from use of oil or natural gas to CO₂ neutral fuels such as renewables.

This section will deal with the switch to Natural Gas and use of smokeless fuels. The savings related to increased use of renewables is dealt with in the renewables section.

6.3.2.2.1 Switching to Natural Gas

Similar barriers arise in South Tipperary with restricted access to the Natural Gas grid. The west of the County beyond Clonmel has no access and there are no significant plans to expand this network outside of these areas in the near future (Bord Gais, 2006).

Assuming that the projected growth in Natural Gas use in the County, from 295 GWh in 2004 to 387 GWh per annum in 2010, displaces the use of oil as a fuel this would result in annual CO₂ emissions savings of as outlined in the following table.

Table 6.7: CO₂ Savings from Fuel Switching to Natural Gas – South Tipperary

Fuel Switching	2004	BAU 2010	BAU 2020	Change (04-10)	Change (10-20)
Natural Gas (GWh)	295.00	387.00	432.00	92.00	45.00
Natural Gas CO₂ (‘000 T)	59.50	77.90	86.00	18.40	8.10
CO₂ if Oil (‘000 T)				24.28	11.88
Annual CO₂ Savings (‘000 T)				1.18	0.76

¹¹ Source: Energy in Ireland 1990 – 2004 (SEI, 2005)

¹² Source: Renewable Energy in Ireland, 2005 Update (SEI, 2006)

¹³ Source: 2020 Vision for Renewable Energy (Dept of Communications Marine and Natural Resources, 2006)

The switch to natural gas will often be accompanied by an increase in energy efficiency at the point of use. This is primarily due to the use of more efficient boilers i.e. gas condensing boilers which have higher efficiencies (typically operating >95% efficiency) that traditional oil boilers (annual efficiencies of <90%). It is reasonable to assume a further 10% reduction in emissions due to increased efficiencies alone, i.e. **a reduction of 118 tonnes of CO₂ per annum.**

6.3.2.2 Switch to Smokeless Solid Fuels

Currently, coal accounts for the largest proportion of solid fuel use in the County i.e. 101 GWh in 2005 reducing to 42 GWh by 2020. The National ban on bituminous coal predicted a national saving of approximately 1 million Tonnes of CO₂ (1000 kTonnes). To date the ban has been focused regionally and within specific urban locations. Future elimination of the use of this type of coal will generate CO₂ and other emission savings.

Assuming that the use of this type of coal accounted for 50% of coal use in the County and that it could be displaced through the use of renewable energy the projected savings would be 13 kTonnes and 7 kTonnes in 2010 and 2020 respectively.

6.3.2.3 Combined Heat & Power

CHP plants, based on fossil fuel, have primarily been developed in Ireland based on Natural Gas. These plants can reach efficiencies in the region of 80% under the right conditions. For it to be Natural Gas based it is vital that the Natural Gas network is available at the appropriate sites. The data on appropriate sites and potential for development is commercially sensitive and difficult to obtain.

A specific programme to determine the potential for Natural Gas CHP should be completed in conjunction with relevant players. Sites for consideration would include Hotels, Hospitals, Public Buildings, Swimming Pools etc. Increased gas prices are challenging the viability of CHP, however the potential environmental and economic savings to be derived in the future from more efficient energy production could help address this issue. Experiences from the CHP development in Clonmel Swimming Pool should be promoted to other potential sites.

To provide some guidance on the potential for CHP development reference was made to the Galway Climate Change strategy which referenced data from Bord Gais. This indicated that for Galway the market potential for CHP was 60GWhe while the practical potential was 20GWhe. The potential resource in South Tipperary is lower and therefore the potential for South Tipperary County has been assumed i.e. 4GWhe.

The energy and CO₂ savings that result from a CHP development are particularly site specific. For the purposes of this analysis it has been assumed that a 33% reduction in CO₂ emissions related to electricity is achieved.

Table 6.8: CHP Potential for South Tipperary

	CHP Generation (GWhe)	Emissions from Conventional Electricity (‘000 Tonnes CO ₂)	Emission Reductions (‘000 Tonnes CO ₂)
2010	4	2.72	0.90

6.3.3 Renewable Energy

6.3.3.1 Electricity Generation - Large Scale Wind

There have been no large scale wind projects connected to the National Grid in South Tipperary to date but this is due to change in 2006/07, table below.

Table 6.9: Wind Farms in South Tipperary County to be Connected to the National Grid

Site	Capacity (MW)	Expected Connection Date	Projected Annual Generation (GWh)	Projected Annual CO ₂ Avoid ed (‘000 T CO ₂)
Falleennafinnoga - DG155	4	2007	14.00	8.74
Tooreen DG156	4	2007	14.00	8.74
Moanvaun DG197	3	2007	10.50	6.55
Garracumer DG90	22	2007	77.00	48.06
Total	33		115.50	72.09

By the end of 2007 a total of 33 MW of wind energy will be connected and providing electricity to the National Grid in South Tipperary. Comparing this to the RES-E Target as defined in Section 6.2.4 it can be seen that the County will exceed its 2010 target.

It is estimated that a total of 37 MW will be connected to the grid in South Tipperary by 2010, increasing to 54 MW by 2020. These projections are based on projected average annual increases in renewable energy electricity (SEI, 2005) of 11% between 2005 and 2010 and 4.4% between 2010 and 2020.

Table 6.10: Large Wind Energy Installations and CO₂ Savings in South Tipperary

	Capacity (MW)	Electricity Generated (GWh)	Annual CO ₂ Emissions Avoided (‘000 Tonnes CO ₂)
2006	0.85	2.98	1.86
2007	33.85	118.48	73.95
2010	37.57	131.51	82.09
2020	54.11	189.37	118.20

The realisation of the wind energy potential in the County, and throughout Ireland, is primarily restricted by the ability to connect the wind energy plants to the National Grid. The current pressure which exists with regard to grid connection and significant pool of projects awaiting connection (655MW contracted to be connected (ESBNG, 2006) causes significant problems for new wind energy projects.

6.3.3.2 Electricity Generation - Hydro

There are no large (>10MW) scale hydro projects connected to the National Grid in South Tipperary and it has been assumed for this study that no further large scale hydro projects will be developed.

There are a number of small scale hydro projects in the County and these, and their relevant CO₂ savings, are detailed in the following table.

Table 6.11: Small Scale Hydro in South Tipperary.

	Capacity (MW)	Year	Generation (GWh)	CO ₂ Avoided ('000 Tonnes CO ₂)
Clogheen, Cahir	0.1	1989	0.35	
Cahir Mills, Cahir	0.09	1995	0.315	
Total 2010	0.19		0.365	
Total 2020	0.19		0.365	

It has been assumed that there will be no additional projects initiated by 2010 or 2020 in the County. In total the current projects avoid 1.72 kTonnes CO₂ per annum.

6.3.3.3 Electricity Generation - Photovoltaics – large scale

The Renewable Energy 2020 Vision (DCMNR, 2006) document noted that there could be 408 MW of PV installed nationally by 2020 generating over 500 GWh per annum. Assuming that this was proportioned across Ireland relatively equally this could equate to 12.6MW of PV installations in South Tipperary County, producing 15.5GWh of electricity per annum.

It can be assumed that there will be limited development of PV up to 2010, which is reflected in the National policy documents, and therefore it will have limited impact in terms of the Kyoto 2010 targets. However, post 2010 the development of PV, if it is to reach the targets as set in the DCMNR Vision document, would have to be significant. It could be assumed that 30% of the target would be reached by 2020.

This would equate to 3.8MW of PV installed in South Tipperary generating 9.8 GWh of electricity by 2020. This would avoid approximately 6 kTonnes of CO₂ per annum by 2020. However to develop this resource would take considerable investment and support in terms of electricity supply contracts, research and development and industry support.

Table 6.12: PV Installations and CO₂ Savings in South Tipperary

	Year	Installed Capacity (MW)	Electricity Generation (GWh)	CO ₂ Emission Savings ('000 Tonnes)
National	2010	0	0	-
	2015	122.4	150	94
	2020	408	500	312
South Tipperary	2010	0	0	-
	2015	2.40	2.94	2
	2020	8.00	9.8	6

6.3.3.4 Electricity Generation - Small Scale Renewables

Small scale renewable energy systems are already in use in Ireland and South Tipperary in specialised situations. These include parking meters, street signage etc. There are a number of companies in Ireland which are now providing energy solutions for the domestic/commercial sector which integrate small scale wind and PV panels. The typical scale of these installations is in the region of 0.5 to 4kW.

It is difficult to provide an accurate estimate of the potential for installation of such systems in South Tipperary. The following assumptions have been made to provide an initial estimation:

- Annual electricity load in a residential house is 5,000kWh per annum (SEI, 2005)
- 30% of the load can be met by such a system, which would equate to annual saving of 1,500kWh per house.
- A 0.5% penetration rate for the residential sector in South Tipperary by 2010 would equate to approximately 175 installations.
- The penetration rate would increase to 2% by 2020

As can be seen, from the following table, the impact in terms of CO₂ emissions is relatively negligible. However, a considerable increase in penetration rate through appropriate supports and policy initiatives could increase this figure.

Table 6.13: Small Scale RES Electricity Production in South Tipperary

	Annual Electricity Consumption per dwelling (kWh)	Annual RE Production per dwelling (kWh)	No Houses in South Tipperary	Total RES Production (MWh)	CO ₂ Avoided (Tonnes)
2010	5,000	1,500	160	240	148.8
2020	5,000	1,500	800	1200	744

6.3.3.5 Thermal Energy Production - Large Scale Renewables

The profile for the development of large renewable energy thermal projects in South Tipperary will need to be focused on the commercial and industrial sectors. The dominance of oil in these sectors as a fuel presents significant opportunities as typically it can be more difficult to compete with natural gas on an economic basis. Technologies such as biomass, solar and geothermal are all applicable in the County.

A similar approach as to that used in North Tipperary has been used i.e. based on CO₂ emissions from the commercial and industrial sectors

- 2% reduction rate for 2010 and
- 4% for 2020 has been assumed based on large biomass or solar installations.

Table 6.14: RES Heat from Large Scale in South Tipperary

	Industry Sector ('000 T)	% Reduction	CO ₂ Saved ('000 T)	Comm. Sector ('000 T)	% Reduction	CO ₂ Saved ('000 T)	Total CO ₂ Saved ('000 T)
2004	195	0%	0	117	0%	0.0	0.0
2005	208	0%	0	132	0%	0.0	0.0
2010	240	2%	4.8	150	2%	3.0	7.8
2020	247	4%	9.88	174	4%	7.0	16.8

6.3.3.6 Thermal Energy Production - Small Scale Renewables

The residential sector in South Tipperary presents opportunities for the development of small scale renewable energy thermal systems. Recent developments have seen significant increases in the public interest in these systems and their installation.

The following assumptions have been made to estimate the potential for implementation of such systems in the County:

- solar water heating, wood biomass heating and geothermal heating systems are the main technologies of choice
- for 2010 a penetration rate of 10% has been targeted
- it is assumed that the technologies will replace oil
- 75% of heating requirements will be displaced by the renewable energy technologies with the remaining being met by electricity and/or oil

Table 6.15: RES Heat from Small Renewables in South Tipperary

	Penetration Rate	No Houses	Av. Annual Heat Cons (kWh)	Total Heat Cons. (GWh)	% of Heat from RES	Total Heat RES (GWh)	CO ₂ Avoided ('000 T)
	%				%		
2010	0.15	4800	20000	96	0.75	72	18.50
2020	0.35	14000	20000	280	0.75	210	53.97

6.3.3.7 Renewable Combined Heat and Power

The potential for CHP in relation to renewables can generally be restricted to the use of wood biomass or methane gas at Land Fill Gas (LFG) Sites. LFG will be dealt with under Section 5.9 - Waste. CHP from biomass at a large scale (>1MW) is dependent on fuel supply and appropriate heat load for economic viability. Small scale CHP (<1MW) using wood gasification is still a developing technology but could be applicable in a number of sites in the future. Typical scales are in the region of 100 to 200 kWe generation.

For Renewable CHP to develop there will need to be a significant change in the supports available for development along with a dedicated focus on potential sites.

6.4 Transport

6.4.1 Introduction

In line with National and regional trends the impact of the transport sector in terms of energy consumption and CO₂ emissions has been very significant since 1990. Transport accounted for over 35.7% of energy related CO₂ emissions in South Tipperary in 2005 (339 kTonnes of CO₂). This is an 87% increase.

The rural context in South Tipperary presents particular challenges to achieve major reductions in terms of CO₂.

6.4.1.1 CO₂ Reduction Targets

The Tipperary Energy and Emissions Balance set Quantified Indicative Reduction Targets for CO₂ for South Tipperary for the Transport Sector. The estimated reduction that could be achieved in the relation to transport was in the region of 51 kTonnes of CO₂. The following table summarises the actual projected savings in terms of CO₂ that are projected to be achievable by 2010 and 2020. Details of how these can be achieved are provided in the following sections.

Table 6.16: Quantified Indicative Reductions for South Tipperary – Transport

Ref	Action	Quantified Indicative Reductions Proposed (‘000 T-CO ₂)	
		2010	2020
6.4.2.1	Car Efficiency	20.15	21.30
6.4.2.2	Unnecessary Trips	9.23	9.23
6.4.2.3	Car Pooling	1.76	1.76
6.4.2.4	Hybrid Cars	0.58	1.66
6.4.3.1	Cycling	3.62	3.62
6.4.3.2	Bus	0.75	0.75
6.4.4	Green Fuels	10.08	21.3
	Total	46.17	59.62

6.4.1.2 CO₂ Reduction, Cost Benefit Analysis

The average cost for the abatement of CO₂ emissions, based on estimated investment costs, is approximately €200/Tonne CO₂ in South Tipperary for the Transport sector. The data presents the estimated capital investment costs. There are additional costs related to support programmes which could also be accounted for.

Table 6.17: Indicative CO₂ Abatement Costs for South Tipperary – Transport

	2010			2020		
	QIR Proposed (‘000 T-CO ₂)	Indicative Cost (€m)	Indicative Abatement Cost per Tonne CO ₂ (€/TCO ₂)	QIR Proposed (‘000 T-CO ₂)	Indicative Cost (€m)	Indicative Abatement Cost per Tonne CO ₂ (€/T CO ₂)
Transport						
Car Efficiency	20.15	-	-	21.30	-	-
Unnecessary Trips	9.23	-	-	9.23	-	-
Car Pooling	1.76	1.00	568	1.76	1.00	568
Hybrid Cars	0.58	-	-	1.66	-	-
Cycling	3.62	1.00	276	3.62	1.00	276
Bus	0.75	-	-	0.75	-	-
Green Fuels	10.08	5.00	496	21.3	10.00	469
Total	46.17	7.00	152	59.62	12.00	201

6.4.1.3 Strategies & Plans

The following are key documents in relation to transport and related infrastructure in the region:

- Strategies to reduce greenhouse gas emissions in transport (SEI, 2004)
- Transport 21 (DoEHLG, 2006)
- Rural Transport Initiative (DoEHLG, 2000)

6.4.1.4 What Moves Us

Relevant data in relation to transport means can be derived from the Census information. As is evident from Chart 6.6. The motor car is the dominant means of transport and its position as the key transport mode has increased significantly between 1991 and 2002. The key challenge will be in reducing this dependence.

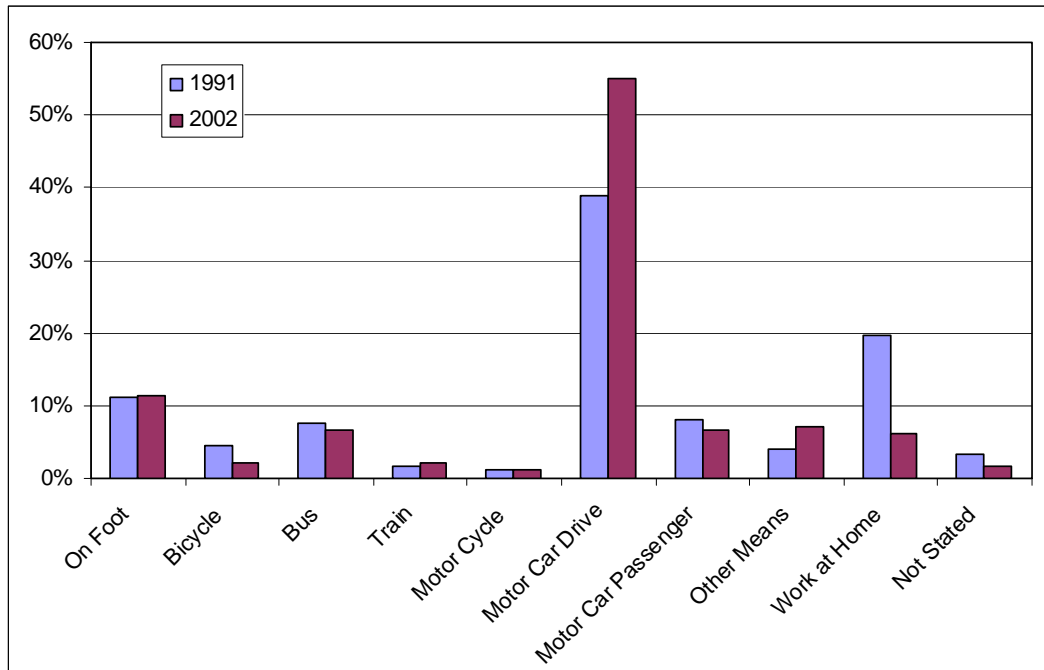


Chart 6.6: Transport Means in South Tipperary, % Share in 1991 and 2002.

(Source: CSO, 2005)

6.4.2 The Car

The motor car has to be given the major focus in relation to transport. A number of key actions are recommended:

- Energy Labelling and Fuel Efficiency
- Promotion of minimise unnecessary trips
- Car Pooling
- Sustainable Alternatives

6.4.2.1 Energy Labelling and Fuel Efficiency

South Tipperary should benefit from global developments to reduce emissions from motor cars. The increased efficiency of new vehicles will have an effect given that the motor fleet is being renewed significantly as a result of economic growth. The various directives and policies indicate a reduction in emissions of 5% based on current levels. The SEI Report on Strategies to Reduce Greenhouse Gases from Transport indicated that by 2020 GHG emissions as a result of technology improvements would drop by 15-40% compared to 2005 levels.

For South Tipperary the potential impact of this measure has been assumed to reduce emissions by 5% by 2010. Measures will have to be put in place to ensure that energy efficiency is a key purchasing requirement for new vehicles.

This would amount to a total CO₂ saving of 403 kTonnes CO₂ x 5% = 20 kTonnes per annum in 2010.

6.4.2.2 Promotion to minimise unnecessary trips

In total, 85% of all households had at least 1 car. Within the County the average distance travelled was 8 km (5 miles). A typical household with access to a car could make an average of 18 trips per week. (GEAL, 2000).

A similar approach to that taken in North Tipperary was taken to estimate the savings that could be achieved through reduce use of private cars.

- Trip reduction per household: 20% x 18 trips = 3.6 trips
- Total no. of vehicles: 57,854 (2004 figures)
- Total no. of trips avoided: 3.6 trips x 35,911 vehicles = 129,279 trips
- Average trip distance: 8 km
- Total Km Avoided per week: 8 km x 129,279 trips \approx 1,034,237 km

The average emissions per km for diesel and petrol engines have been taken from Tynall (2001). Another source of information on current vehicles is the Society of the Irish Motor Industry (SIMI) (www.simi.ie) and the Vehicle Certification Agency in the UK (<http://www.vcacarfueldata.org.uk>).

It is acknowledged that the new diesel engines are capable of achieving significantly lower emissions but the higher figure has been taken to reflect the current vehicle mix. The percentage split of petrol and diesel vehicles in Ireland is 30% diesel and 70% petrol. While it is acknowledged that the number of cars will increase in South Tipperary between 2004 and 2010 and 2020 a constant figure has been taken for annual reductions for 2010 and 2020. Achieving these savings would require significant promotion of the benefits both environmentally and economically of reducing the number of trips made.

Table 6.18: CO₂ Savings from Reducing Unnecessary Trips – South Tipperary

	Emissions (g CO ₂ /km)	Km per Week Avoided (km)	Emissions per annum (‘000 T CO ₂)
Petrol (70%)	185.2	723,966	6.97
Diesel (30%)	139.8	310,271	2.26
Total		1,034,237	9.23

6.4.2.3 Car Pooling

Using appropriate integration, cooperation and supports schemes the development of car pooling schemes could be another mechanism which can contribute to CO₂ reductions in South Tipperary. The following assumptions, as used in North Tipperary, are taken

- In 2005 there were over 12,000 people working in the industrial sector and 19,000 in the commercial sector in South Tipperary.
- 60% of these trips are made by car as a driver only (taking the average means for travel to work for the County).
- Average trip distance was 7km one way and 220 working days per year
- 20% of all trips are reduced by moving to car-pooling

With limited data available on number of employees in these sectors in the future (2010 and 2020) a constant figure has been assumed for both years.

Table 6.19: CO₂ Savings as a result of Car Pooling Initiatives – South Tipperary

	No Employees	Average Annual Trip/person (Km)	Total Trip Length (000 Km)	%Car Pooling	Car Pooling Travel Avoided (000 Km)	CO ₂ Avoided (‘000 T CO ₂)
Industry	12,009	3,080	36,987	20%	7,397	1.27
Commercial	19,074	3,080	58,747	20%	11,749	0.49
Total	31,083	6,160	95,735	40%	19,147	1.76

6.4.2.4 Hybrid and Super Efficient Vehicles

The Toyota Prius is one of the best know cars amongst the general public in relation to energy efficiency and low CO₂ emissions. Emissions from such vehicles are in the region of 100 g CO₂ /km, providing a saving of 85 g/CO₂ per km. New diesel engines are now also emerging with similar performance e.g. Renault dCi86. Further developments are expected in this area in the future. To determine the CO₂ savings which these cars can make in South Tipperary, compared to the normal cars, it has been assumed that they can attain a 1% market share by 2010.

Table 6.20: CO₂ Savings as a result of Hybrid/Super Efficient Cars – South Tipperary

	Total Cars	Market Share (%)	Total Hybrid Cars	CO ₂ Savings (g CO ₂ /Km) ¹⁴	Average Annual Trip (Km)	CO ₂ Savings (‘000 T CO ₂)
2010	42791	1	427.91	85.2	16000	0.58
2020	60759	2	1215.18	85.2	16000	1.66

6.4.3 Modal Shift

While certain actions can be taken to reduce car use and increase the efficiency of use, the greatest impact in terms of CO₂ reductions are likely by creating a shift from the private transport mode to that of public transport.

Analysis is presented here for savings which can arise from creating modal shifts to public transport means for regular trips i.e. to work and full time education. The Census of 2002 presents information on total number of people travelling to particular destinations, as follows:

Table 6.21: Total No. of People by Travel Destination – South Tipperary

Category	Total
Work	31,083
School – 4-12 years	9,121
School – 13-18 years	6,982
College - >19 years	1,857

¹⁴ Compared to petrol taking Hybrid emissions of 100g CO₂/km and Petrol emissions of 185.2 g CO₂/km

6.4.3.1 Cycling and Walking

The Census data of 2002 showed that only 13% of people cycled/walked to work while 46% of students >19 years use this means of transport. 1,748 primary and 1,520 secondary students travelled to school by bicycle or on foot in South Tipperary.

Projected increases in the use of cycling/walking in the County are presented in the following table. Achieving a modal shift to this means would mean reduced use of the private car and would save approximately 1 Tonne of CO₂ per 5,000km cycled/walked. The achievement of such a modal shift will require investment in pavements, cycle lanes, safety infrastructure and personnel and training for parents and children.

Table 6.22: CO₂ Savings from Modal Shift to Bicycle/Walking – South Tipperary

Category	Total Persons	Current Cycle/Walk (people)	Current % Share (%)	New % Share (%)	New Cycle/Walk (people)	Additional CO ₂ Avoided (T CO ₂)
Work	31,083	4,072	13%	19%	1834	
School: 4-12 yrs	9,121	1748	19%	29%	897	
School: 13-18 yrs	6,982	1520	22%	32%	714	
College: >19 yrs	1,857	861	46%	56%	179	
Total	49,043	8,201	17%	17%	3,624	3,624

6.4.3.2 Public Transport - Buses

Similar to North Tipperary the use of bus as a transport mode is primarily within the secondary school sector. It is limited with regard to work (1% only) and has a reduced impact in the primary school sector.

The use of bus as a transport means for social/recreational study would require more in-depth analysis locally and regionally based on needs. In addition, the Rural Transport Initiative will have an impact but this initiative is driven mainly from a social perspective. A specific focus on the use of bus for the work category could present significant savings in terms of CO₂. Specific focus should also be placed on the primary school sector if possible.

Table 6.23: CO₂ Savings from Modal Shift to Bus – South Tipperary

Category	Total Persons	Current Bus (people)	Current % Share (%)	New % Share (%)	New Bus (people)	Additional CO ₂ Avoided (T CO ₂)
Work	31,083	410	1%	3%	1000	
School: 4-12 yrs	9,121	1921	21%	33%	3000	
School: 13-18 yrs	6,982	2838	41%	50%	5000	
College: >19 yrs	1,857	331	18%	27%	500	
Total	49,043	5,500	11%	16%	9,500	750

6.4.3.3 Public Transport - Rail

The rail infrastructure within South Tipperary is reasonable at present and no major changes are due within the life of this strategy (to 2020). There is currently a service from which serves the County on the Limerick to Waterford line. The level of service on this line has recently been increased and it does connect the major towns within the County (Tipperary Town, Cahir, Clonmel and Carrick-on-Suir).

Further analysis will be required to determine the impact of this development in terms of increased use of rail for access to work, education and for recreation. It has a significant potential for impact also in relation to tourism and freight.

6.4.3.4 Public Transport – Recreational and Other Travel

The total travel which can be characterised in relation to this type of travel is difficult to estimate accurately without detailed transport analysis. However, the development of appropriate public transport services to meet these needs is vital for the future. Further detailed analysis is proposed for this area in the near future.

6.4.4 Green Fuels

The EU Directive of Liquid Biofuels sets indicative targets of 5% of transport fuels to be supplied by liquid biofuels by 2010 and 10% to 2020. Nationally this would require the production of 221 Million Litres of Ethanol and 211 Million Litres of Bio Diesel in 2010 (SEI, 2004). The Budget 2006 announced support of €200m in this regard with the aim of producing 156 Million Litres of biofuels (86 MLitres Biodiesel & 70 MLitres Ethanol), which would achieve 2% of transport fuels Nationally (Dept of Finance, 2005).

The requirements for South Tipperary if the 5% and 10% targets were to be achieved are shown in the following Table. Currently the estimated energy consumption for the transport sector is 1,317 GWh which equates to approximately 176 Million Litres of transport fuels. The 5% target in 2010 would require the production and use of 8.8 Million Litres of liquid biofuels in South Tipperary (generally equally split between ethanol and biodiesel). The more ambitious 10% target would raise this to a figure to 17.6 Million Litres.

The limited production of arable crops in South Tipperary will likely result in a large proportion of the biofuels requirements for the region being imported from outside the region.

The different liquid biofuels can result in differing CO₂ reductions. For this analysis it has been assumed that a 50% savings in emissions is achieved compared to mineral fuels (SEI, 2005). This would equate to a CO₂ saving of approximately 6 kTonnes CO₂ per annum in 2010.

Table 6.24: Liquid Biofuels Requirements – South Tipperary

Biofuels	GWh			M Litres		
	2005	2010	2020	2005	2010	2020
Current	1,317.0	1,709.0	1,929.0	198.7	257.9	291.1
Petrol	921.9	1,196.3	1,350.3	154.6	200.7	226.5
Diesel	395.1	512.7	578.7	44.1	57.2	64.6
2% Biofuels	65.9	85.5	96.5	9.9	12.9	14.6
Ethanol	46.1	59.8	67.5	7.7	10.0	11.3
Biodiesel	19.8	25.6	28.9	2.2	2.9	3.2
5.75% Biofuels	131.7	170.9	192.9	19.9	25.8	29.1
Ethanol	92.2	119.6	135.0	15.5	20.1	22.7
Biodiesel	39.5	51.3	57.9	4.4	5.7	6.5

Table 6.25: CO₂ Savings from the use of Biofuels – South Tipperary

CO ₂ Savings	2005	2010	2020
Current (‘000 T CO ₂)	340	403	426
2% Target (‘000 T CO ₂)	3.4	10.1	10.7
5.75% Target (‘000 T CO ₂)	9.8	20.2	21.3

6.5 Built Environment & Residential

6.5.1 Introduction

40% of all energy consumption can be attributed to the built environment and this can generally be assigned to the residential and commercial/public sectors. With South Tipperary the residential and commercial sectors were shown to account for 23% of TFC and 38% of all energy related CO₂ emissions.

6.5.1.1 CO₂ Reduction Targets

The Tipperary Energy and Emissions Balance set Quantified Indicative Reduction Targets for CO₂ for South Tipperary for the Built Environment Sector. The estimated reduction that could be achieved in the relation to the built environment was in the region of 18 kTonnes of CO₂. The following table summarises the actual savings in terms of CO₂ that are projected to be achievable by 2010 and 2020. Details of how these can be achieved are provided in the following sections.

Table 6.26: Quantified Indicative Reductions for South Tipperary – Built Environment

Ref		Action	2010	2020
6.5.2.1	Residential	Part L	9.39	21.02
6.5.2.3		EPBD New	0.47	1.05
		EPBD Existing	1.96	2.43
6.5.4.1		Awareness	2.55	2.68
6.5.4.2		Social Housing Upgrades	0.30	0.25
6.5.4.3		LA New Housing	0.09	0.19
		<i>Sub Total</i>	14.77	27.61
	Commercial/Public			
6.5.2.2		Part L	1.49	1.74
6.5.2.4		EPBD	0.75	0.87
6.5.3.1		Monitoring and Targeting	1.00	1.00
6.5.3.2		Awareness and Training	0.50	0.50
6.5.3.3		Surveys and Audits	1.50	1.50
		<i>Sub Total</i>	5.24	5.61
		<i>Total</i>	20.01	33.22

6.5.1.2 CO₂ Reduction, Cost Benefit Analysis

The average cost for the abatement of CO₂ emissions, based on estimated investment costs, is approximately €1000/Tonne CO₂ in South Tipperary for the Built Environment sector. The largest investment will be in the compliance with Part L of the building regulations. The data presents the estimated capital investment costs. There are additional costs related to support programmes which could also be accounted for.

Table 6.27: Indicative CO₂ Abatement Costs for South Tipperary – Built Environment

	2010			2020		
	QIR Proposed	Indicative Cost	Indicative Abatement Cost per Tonne CO ₂	QIR Proposed	Indicative Cost	Indicative Abatement Cost per Tonne CO ₂
Built Environment	('000 T-CO ₂)	(€m)	(€/TCO ₂)	('000 T-CO ₂)	(€m)	(€/T CO ₂)
Residential						
Part L	9.39	10	1,064	21.02	15	714
EPBD New	0.47	0.8	1,703	1.05	1.6	1,523
EPBD Existing	1.96	0.6	306	2.43	3	1,237
Awareness	2.55	1	392	2.68	1	373
Social Housing Upgrades	0.30	0.1	333	0.25	0.1	400
LA New Housing	0.09	0.2	2,133	0.19	0.2	1,067
<i>Sub Total</i>	14.77	12.7	860	27.61	20.9	757
Commercial						
Part L	1.49	3	2,013	1.74	3	1,724
EPBD	0.75	1	1,333	0.87	1	1,149
Monitoring and Targeting	1.00	2	2,000	1.00	2	2,000
Awareness and Training	0.50	0.5	1,000	0.50	0.5	1,000
Surveys and Audits	1.50	2	1,333	1.50	2	1,333
<i>Sub Total</i>	5.24	8.5	1,622	5.61	8.5	1,515
Total	20.01	21.2	1,060	33.22	29.4	885

6.5.1.3 Legislation / Regulation

6.5.1.3.1 Irish Building Regulations – Part L

The Building Regulations in Ireland have undergone considerable change since 1991. Houses which are constructed under the current building regulations (2002) should be 30% more efficient than those constructed prior to this. All new housing built from 2002 has been assumed to achieve these savings in practise.

6.5.1.3.2 Energy Performance Buildings Directive

This Directive requires that qualifying buildings which are constructed, sold or rented should have a Building Energy Rating (BER) provided and also a summary report indicating appropriate energy efficiency upgrades. The BER will be implemented as follows in Ireland

- Jan 2007: New Residential Buildings
- Jan 2008: New Public and Non Residential Buildings
- Jan 2009: All Existing Buildings

In addition, there are measures to require inspection of oil boilers and air conditioning systems over a certain size and assessment of alternative energy supply options.

6.5.2 Building Regulation Reductions

The savings projected as a result of the new Building Regulations and the EPBD are shown in the following Table. Further detail is provided in the subsequent sections.

Table 6.28: Building Regulation Reductions – South Tipperary.

Ref	Activity		2010	2020
	Residential	Part L	9.39	21.02
		EPBD New	0.47	1.05
		EPBD Existing	1.96	2.43
	Commercial/Public	Part L	1.49	1.74
		EPBD	0.75	0.87
	Total		14.06	27.10

6.5.2.1 Irish Building Regulations – Part L – Residential Sector

Assuming a similar construction trend for new house in South Tipperary from 2006 to 2010 has occurred between 2002 and 2006 (approx 750 new units per annum) a total of 6,260 new houses will have been built under the new Part L regulations by 2010. This will have increased to 14,000 by 2020. This will result in the following CO₂ savings

- **By 2010: 9.39 kTonnes CO₂**
- **By 2020: 21 kTonnes CO₂**

6.5.2.2 Irish Building Regulations – Part L – Commercial/Public Sector

With the non-residential buildings new regulations have been introduced as of 2006. It is more difficult to determine potential savings in this regard as there is limited data on size, type of non-residential buildings and their energy use. Assuming however a 1% saving could be achieved on the projected 2010 and 2020 CO₂ emission figures for this sector taken from Energy and Emissions Balance the savings would be:

- **By 2010: 1.49 kTonnes CO₂**
- **By 2020: 1.74 kTonnes CO₂**

6.5.2.3 Energy Performance of Buildings Directive – Residential Sector

The EPBD will have an impact on both existing and new residential buildings. The projected savings as a result of the implementation of the Directive are assumed to be generated by

- new buildings achieving an 5% additional savings on top of those stimulated by the new Part L regulations
- 5% of existing buildings undergoing upgrades as a result of the awareness created by the Directive. These houses are expected to achieve a 20% reduction in emissions or 1.2 Tonnes per house.

The savings achieved are:

- **By 2010: 0.47 kTonnes CO₂ for New Houses and 1.96 kTonnes CO₂ for existing houses**
- **By 2020: 1.05 kTonnes CO₂ for New Houses and 2.43 kTonnes CO₂ for existing houses**

6.5.2.4 Energy Performance of Buildings Directive – Non-Residential Sector

The Non-Residential Sector will have CO₂ savings stimulated both through the Building Energy Rating requirement but also inspection of boilers and air conditioning systems. A study in Co. Tipperary (Hoyne, 2005) showed that 5% of non-residential buildings would need to comply with the Directive and CO₂ savings of 7% could be achieved. The Directive has noted that savings in the region of 22% could be achieved. For this study the following assumptions have been made

- 5% of Commercial Sector emissions applicable
- 10% savings achieved

The savings achieved are:

- **By 2010: 0.75 kTonnes CO₂**
- **By 2020: 0.87 kTonnes CO₂**

6.5.3 Public/Commercial Sector Built Environment

The TEA should have a particular input into this sector given its work with the local and public authorities in the region. In addition, through the influence of other designers and building owners savings can be achieved. A summary of savings is provided in the following Table with detail in subsequent sections.

Table 6.29: Public/Commercial Sector Built Environment Reductions.

Activity	2010	2020
Monitoring and Targeting	1.00	1.00
Awareness and Training	0.50	0.50
Surveys and Audits	1.50	1.50
Total	3.00	3.00

6.5.3.1 Monitoring and Targeting Programme

South Tipperary County Council has a number of key Local Authority buildings and sites which could be the focus of a Monitoring and Targeting programme. These include

- County Buildings
- Water Treatment Sites
- Sewage Treatment Sites
- Swimming Pools

Regular and detailed analysis of energy consumption at these and other sites will be vital to develop Key Performance Indicators and benchmarks to be achieved.

Estimates from the TEA indicate that savings of 1 kTonne CO₂ per annum are achievable

6.5.3.2 Awareness and Training

Training of key personnel is vital to broaden the level of involvement in the actions required to achieve savings. This combined with awareness creation across all staff will result in savings, achieved at a local or minimal cost. The TEA is a key resource to achieve this.

The TEA has estimated that savings in the region of 0.5 kTonnes CO₂ could be achieved.

6.5.3.3 Energy Auditing

Key energy consumption sites in the County should be targeted for specific, detailed energy audits. This is the next step after Monitoring and Targeting to identify more specific technical and non-technical improvements.

In cooperation with Local Authority and other staff savings in the region of 1.5 kTonnes CO₂ are projected.

6.5.4 Residential Sector Built Environment

Much of the savings within the Residential sector will be stimulated through the new building regulations and the EPBD. There is however additional opportunities which are detailed below.

6.5.4.1 Awareness Programme

Access to appropriate and accurate information on energy related issues is becoming vitally important to influence the general public to make changes in their lifestyles. The TEA, in cooperation with other appropriate bodies regionally and nationally, should seek to develop a dedicated awareness programme around energy. If a dedicated programme could achieve 1% reduction in CO₂ emissions estimated savings would be

- **By 2010: 2.55 kTonnes CO₂ per annum**
- **By 2020: 2.68 kTonnes CO₂ per annum**

6.5.4.2 Local Authority/Social Housing

The TEA and Local Authorities can take specific action in relation to social housing, both in new build and refurbishment. An average of 50 new social houses was built per annum in South Tipperary since 2000. Between 2005 and 2010 the Local Authority and TEA could influence an additional 5% saving, over an above those stimulated by the Building Regulations.

In addition, the Local Authority refurbishment programme should take specific action to implement additional sustainable energy measures.

6.5.4.3 Renewable Energy Systems

The residential sector presents a significant market for the use of renewable energy systems. The savings under this area have already been accounted for under Energy Production and Supply Sector.

6.6 Industry, Commerce and Services

6.6.1 Introduction

The Industrial Sector and Commercial Sectors accounted for 21.9 and 13.8% of CO₂ emissions in South Tipperary in 2005. While the expected increase in emissions for these sectors is projected to be limited when compared to the transport sector in particular.

These sectors present opportunities for energy savings and emission reductions across a wide range of actions. The savings referred to within this section are in addition to those which impact directly on buildings, which are covered in Section 5.6.

6.6.1.1 CO₂ Reduction Targets

The Tipperary Energy and Emissions Balance set Quantified Indicative Reduction Targets for CO₂ for South Tipperary County for the Industrial/Commercial Sector. The estimated reduction that could be achieved in the relation to this sector was in the region of 42 kTonnes of CO₂. The following table summarises the actual savings in terms of CO₂ that are projected to be achievable by 2010 and 2020. Details of how these can be achieved are provided in the following sections.

Table 6.30: Quantified Indicative Reductions for South Tipperary – Industry/Commerce and Services

Ref	Sector	Action	2010	2020
6.6.3.1	Industry	LIEN	8.4	8.6
6.6.3.3		Monitoring, Targeting and Surveys	4.8	4.9
6.6.3.4		Awareness	4.8	4.9
6.6.3.5		Green Supply	12.0	12.4
	<i>Sub Total</i>		30.0	30.9
6.6.4.2	Commercial	Energy Efficiency	1.5	1.7
6.6.4.1		Monitoring, Targeting and Surveys	3.0	3.5
6.6.4.3		Awareness	3.0	3.5
	<i>Sub Total</i>		7.5	8.7
	Total		37.5	39.6

6.6.1.2 CO₂ Reduction, Cost Benefit Analysis

The average cost for the abatement of CO₂ emissions, based on estimated investment costs, is approximately €180/Tonne CO₂ in South Tipperary for the Industry/Commercial sector. The data presents the estimated capital investment costs. There are additional costs related to support programmes which could also be accounted for.

Table 6.31: Indicative CO₂ Abatement Costs for South Tipperary – Industry, Commerce and Services

Industry/Commercial	2010			2020		
	QIR Proposed '000 T-CO ₂)	Indicative Cost (€m)	Indicative Abatement Cost per Tonne CO ₂ (€/TCO ₂)	QIR Proposed '000 T-CO ₂)	Indicative Cost (€m)	Indicative Abatement Cost per Tonne CO ₂ (€/T CO ₂)
Industry						
LIEN	8.4	1	119	8.6	1	116
Monitoring, Targeting and Surveys	4.8	2	417	4.9	2	405
Awareness	4.8	1	208	4.9	1	202
Green Supply	12.0	0	-	12.4	0	-
Sub Total	30.0	4		30.9	4	
Commercial						
Monitoring, Targeting and Surveys	1.5	1	667	1.7	1	575
Energy Efficiency	3.0	1	333	3.5	1	287
Awareness	3.0	1	333	3.5	1	287
Sub Total	7.5	3		8.7		
Total	37.5	7	187	39.6	7	177

6.6.2 Legislation / Regulation

Particular issues that apply include the in terms of legislation and regulation include

- National Green House Gas Allocation Plan
- Integrated Pollution and Prevention Control Licenses (IPPC).

It is important to note that the National Climate Change Strategy also addresses other non energy related emissions which are associated with the industrial sector. These are not covered in this report.

6.6.3 Industrial Sector Reductions

6.6.3.1 Large Industry Energy Network

The Large Industry Energy Network (LIEN) is voluntary network initiative operated by Sustainable Energy Ireland for the largest industrial energy consumers in Ireland, i.e. those with an annual energy spend over €1m, with the average spend around €4m.

The latest report indicated that annual CO₂ savings of 3.5% were achieved by members of LIEN. The actions which this network stimulates in the member companies includes

- monitoring and targeting
- surveys and auditing
- technology solutions in relation to equipment, processes and systems

The LIEN has now evolved into the Energy Agreements Programme. It could be assumed that these levels of solutions could be applied from 2005 to 2010 within the industrial sector and achieve the following savings.

- **By 2010: 8.4 kTonnes CO₂ per annum**
- **By 2020: 8.6 kTonnes CO₂ per annum**

6.6.3.2 Combined Heat and Power

Large Industry presents opportunities for introduction of CHP technology, as discussed in Energy Production and Supply Section.

6.6.3.3 Monitoring, Targeting and Auditing

The work and actions completed under LIEN should be expanded to ensure that all companies are included or targeted by similar actions in South Tipperary. The type of actions which would be expected to be completed include

- monitoring and targeting
- site surveys and auditing
- promotion of best practise

A figure of 2% additional annual savings has been estimated for such an action which would result in savings of

- **By 2010: 4.8 kTonnes CO₂ per annum**
- **By 2020: 4.9 kTonnes CO₂ per annum**

6.6.3.4 Awareness

As has been shown earlier awareness programmes have an impact in terms of energy savings and CO₂ reductions. Through cooperation with other national and regional organisations dedicated awareness and information programmes should also be facilitated within the region. This is a very low cost action with clear benefits.

Such a programme could result in the following CO₂ savings based on a 2% reduction

- **By 2010: 4.8 kTonnes CO₂ per annum**
- **By 2020: 4.9 kTonnes CO₂ per annum**

6.6.3.5 Green Electricity Usage

Over 63% of emissions within the industrial sector were associated with electricity use (SEI, 2003). Not all industries will be in a position to produce their own green electricity but the market now provides the opportunity for sites to purchase electricity from green suppliers.

An aggressive target, similar to that set for North Tipperary, of 5% of all electricity usage in the industrial sector being sourced from renewables could make a significant impact.

Savings from this initiative are estimated to be

- **By 2010: 12.00 kTonnes CO₂ per annum**
- **By 2020: 12.35 kTonnes CO₂ per annum**

6.6.4 Commercial Sector Reductions

A common difficulty arises when trying to divide the emissions with the Commercial and Public sectors in relation to energy as much of the consumption is related to buildings. The emissions and respective savings associated with buildings in this sector have already been covered.

However, there are important actions which are specific to this sector and are applicable to building and non-building applications, and these are discussed here. This is particularly important given the growing role of the Commercial Service Sector in Ireland.

6.6.4.1 Monitoring, Targeting and Auditing

The Commercial sector has not been targeted by any specific National or Regional support programmes to date in a dedicated fashion. Some general information has been developed for Small to Medium Enterprises (SMEs) and Hotels by SEI. However, a programme which supports monitoring and auditing within this sector is would stimulate action and savings. The type of actions which would be expected to be completed include

- monitoring and targeting
- site surveys and auditing
- promotion of best practise

A figure of 2% annual savings has been estimated for such an action which would result in savings of

- **By 2010: 3.0 kTonnes CO₂ per annum**
- **By 2020: 3.4 kTonnes CO₂ per annum**

6.6.4.2 Energy Efficiency Measures

Results of the surveys and actions undertaken as part of the monitoring and targeting programme should stimulate investment in energy efficiency measures. This could include installation of improved systems (pumps, lighting, air handing etc.) within organisations. The range of measures will vary considerable between sites.

A general and conservative approach, of 1% savings on CO₂ emissions within the sector being achieved has been assumed giving the following savings.

- **By 2010: 1.5 kTonnes CO₂ per annum**
- **By 2020: 1.7 kTonnes CO₂ per annum**

6.6.4.3 Awareness

The awareness programmes mentioned earlier for the residential and industrial sectors should also be applied within the commercial sector. Again, this low cost measure can create significant benefits within the sector, and also benefits in the wider community.

Such a programme could result in the following CO₂ savings

- **By 2010: 3.0 kTonnes CO₂ per annum**
- **By 2020: 3.4 kTonnes CO₂ per annum**

6.7 Agriculture and Forestry

6.7.1 Introduction

It is important to note that this report deals only with those emissions related to energy production and use in the Agricultural sector. The wider National Climate Change Strategy has specific actions related to emission reductions associated with livestock, methane, fertiliser etc. As an energy consumer this sector makes up the smallest share of TFC in the County (4.4% in 2005).

The real focus for the agricultural and forestry sector in terms of energy is for the supply of raw materials for renewable energy production. In addition, many of the sites for wind farms are located in agricultural or forestry land.

There is approximately 157,000 Ha of farmed land in South Tipperary (CSO, 2000). South Tipperary has a total area of 23,890 Ha under forestry. This equates to 10.5% of the land area of the county. 41% of the forestry is privately owned with the balance of 59% in public ownership (Dept. of agriculture 2001).

6.7.1.1 CO₂ Reduction Targets

The Tipperary Energy and Emissions Balance set Quantified Indicative Reduction Targets for CO₂ for South Tipperary County for the Agriculture and Forestry Sector. The estimated reduction that could be achieved in the relation to agriculture/forestry sector was in the region of 92 kTonnes of CO₂. The following table summarises the actual savings in terms of CO₂ that are projected to be achievable by 2010 and 2020. Details of how these can be achieved are provided in the following sections.

Table 6.32: Quantified Indicative Reductions for South Tipperary – Agriculture

Ref	Sector	Action	2010	2020
6.7.2.1	Agriculture	Liquid Biofuels		
6.7.2.5		Miscanthus	0.45	2.25
6.7.2.3		AD	2.46	4.92
6.7.3		Tractors Efficiency Scheme	1.51	1.51
	Forestry	Wood Energy	8.53	12.11
		Total	12.96	20.80

6.7.1.2 CO₂ Reduction, Cost Benefit Analysis

The average cost for the abatement of CO₂ emissions, based on estimated investment costs, is approximately €400/Tonne CO₂ in South Tipperary for the Agriculture and Forestry Sector. The data presents the estimated capital investment costs. There are additional costs related to support programmes which could also be accounted for.

Table 6.33: Indicative CO₂ Abatement Costs for South Tipperary – Agriculture

	2010			2020		
	QIR Proposed	Indicative Cost	Indicative Abatement Cost per Tonne CO ₂	QIR Proposed	Indicative Cost	Indicative Abatement Cost per Tonne CO ₂
Agriculture and Forestry	'000 T-CO ₂)	(€m)	(€/TCO ₂)	'000 T-CO ₂)	(€m)	(€/T CO ₂)
Agriculture						
Liquid Biofuels		0.0	-		0.0	-
Miscanthus	0.45	0.1	222	2.25	0.25	111
AD	2.46	1.0	406	4.92	1.0	203
Tractor Efficiency Scheme	1.51	0.5	329	1.51	0.5	329
Forestry						
Wood Energy	8.53	586	1,193	12.11	5.0	413
Total	12.96	6.6	509	20.80	6.75	324

6.7.2 Agriculture & Forestry the Energy Producer

6.7.2.1 Liquid Biofuels

The main raw materials for the production of Liquid biofuels from agriculture are

- Rape Seed Oil for the production of Pure Plant Oil or Biodiesel
- Wheat for the production of Ethanol
- Beet for the production of Ethanol

The 2000 Census showed that South Tipperary had the following areas of these crops in production:

- Rape Seed Oil: 47 hectares
- Wheat: 91 hectares
- Beet: 20 hectares

The total area under cereals in the County was 941 hectares in 2000, or approximately 0.5%. Therefore the raw material for liquid biofuels production is at present limited. The potential for expansion is also perhaps limited due to land type and farm size. A major deciding factor for the increased production of raw material for liquid biofuels will be the economic return available to farmers when compared to other crops.

6.7.2.2 Agricultural Residues – Poultry Litter

There is limited or no large scale poultry production in the County at present.

6.7.2.3 Agricultural Residues – Anaerobic Digestion

As of the 2000 Census there were 60 pig farms in the South Tipperary accounted for approximately 97,000 pigs. The current regulatory regime in relation to the Nitrates Directive means that Anaerobic Digestion (AD) is being explored as an option of dealing with pig slurry. CHP is an option if a suitable heat load is available and a viable price for the sale of electricity. Other materials can also be used a raw material e.g. straw, grass,

poultry litter etc. There is also the opportunity to take in other organic wastes for treatment. However, there are significant barriers to be overcome in relation to the spreading of digestate from an AD system which uses such materials on agricultural land.

Initial estimates would indicate that it is possible that a number of small scale developments could result in installed capacity of 0.5 MW by 2010 and 1 MW by 2020.

Assuming that the energy produced from these plants is displacing oil and electricity the annual CO₂ savings could be expected to be 2.46 kTonne in 2010 and 4.92 kTonnes in 2020.

6.7.2.4 Energy Crops – Short Rotation Coppice

Short Rotation Coppice (SRC) Energy Crops were assessed under the Renewable Energy Resource Study completed by ESBI in 1997 (ESBI, 1997). The technical resource with South Tipperary was estimated to be over 2,790 GWh/yr in 2000. Applying appropriate restrictions the practical resource was estimated to be 490 GWh/yr. The land in South Tipperary was rated as moderate to good for planting of SRC.

The current lack of supports to overcome the high establishment costs for SRC energy crops means that it is unlikely that there will be significant impact in this area in the short term. The new supports programme for establishment of this crop will require a review in the immediate future of the impact of this in the future..

6.7.2.5 Energy Crops – Miscanthus

Local growers and developers in South Tipperary can learn from farmers in Limerick about the development of Miscanthus as a fuel and alternative agricultural crop. Similar to SRC Miscanthus requires supports for its production but also for the entire supply chain to ensure it can reach its point of use.

It has been proposed that 25 ha of the crop could be planted by 2010, with an additional 100 planted by 2020. With yields in the region of 22 Tonnes per ha (Leahy, 2006) an energy yield of 3.00 MWh could be available. **If used to displace oil could result in CO₂ savings of 0.45 kT CO₂ per annum in 2010.**

6.7.2.6 Forestry – Residues and Thinnings

The Clare Wood Energy Project should provide a model on which similar projects could be developed in South Tipperary. With private forestry accounting for some 9,800 Ha there is a significant resource and create economic opportunities for the farming sector. There are also opportunities for forestry under ownership by Coillte to be used for energy.

It has been assumed that by 2010 10% of the wood energy resource from forestry thinnings in the private sector could be used i.e. 12 GWh/yr. **This, if used to replace oil would result in CO₂ savings of 5.03 kTonnes per annum.**

6.7.3 Agriculture & Forestry the Energy Consumer

The primary consumers of energy within the agricultural sector include machinery, equipment (milking machines etc.), buildings etc.

There are approximately 2,400 tractors in South Tipperary (CSO, 2000). Studies in France (AILE, 2006) have shown that through appropriate testing savings of 900 litres of diesel per tractor per year and 2.5 Tonnes CO₂ per tractor per year could be achieved.

Assuming a 25% implementation rate in South Tipperary this could result in savings of 1.52 kTonnes CO₂ per annum.

Energy audits and surveys of farm operations could also find energy savings within the agricultural buildings and operations. A pilot project is due to be completed by the Wexford and Tipperary Energy Agencies in 2006 and results of this should be reviewed for applications.

6.8 Waste

Currently there is no landfill gas used for energy production in South Tipperary. Given the nature of the landfill sites in South Tipperary it is unlikely that a LFG project will be developed in the short term.

Future Landfill developments should be monitored with regard to the potential for LFG.

6.9 Conclusion

6.9.1 Individual Responsibility

The Tipperary Energy and Emissions Balance calculated indicators for reductions which would be required per person to achieve the Kyoto Target. These have been updated to include the individual reductions required to meet the expected reductions projected in this study. These results are shown in the following Table.

Table 6.34: Individual Responsibility – South Tipperary

Indicator	1990	Kyoto Target (1990 + 13%)	2005	2010	Reduction Sought To Reach Kyoto Target	Reduction Achieved through Standard Measures
Population (000)	74	-	83	86.0	N/A	
TFC (GWh)	1,832	-	3,042	3,652	-	
Energy Related Emissions ('000 T-CO ₂)	655	740	950	1,099	358	240
TFC/Capita (kWh/Person)	24,757	-	36,648	42,465	-	
CO ₂ Emissions / Capita (T CO ₂ /Person)	8.9	8.9	11.5	12.8	4.2	2.79

6.9.2 Carbon Levies

The Energy and Emissions Balance also calculated the carbon levies that could arise by failing to meet the Kyoto Requirements. These have been compared to the levy that might arise after the standard measures have been implemented in the following Table.

Table 6.35: Carbon Levies in South Tipperary (Business as Usual and with Standard Measures)

	2010	2020
Carbon Levy (€T)	35	45
Levy BAU (€m)	12.53	26.01
Levy Standard Measures (€m)	4.13	10.08

7.0 North and South Tipperary Energy & Environmental Indicators –Summary

The Tipperary Energy and Emissions Balance developed a range of Indicators, which are presented here. Full details are available in the Energy and Emissions Balance Report.

Indicator	1990				2000				2004			
	Ireland	North Tipp	South Tipp	County Tipp	Ireland	North Tipp	South Tipp	County Tipp	Ireland	North Tipp	South Tipp	Tipp
Population (000)	3,528.70	58.19	75.35	133.54	3,771.60	59.51	77.32	136.83	4,076	63.5	81.09	144.59
TFC Fuel Consumed (GWh)	84,486	1,433	1,824	3,257	126,262	2,163	2,627	4,790	138,365	2,351	2,903	5,254
Energy Related Emissions (ktT-CO ₂)	31,245	547	687	1,234	41,920	683	879	1562	43,042	749	906	1655
GVA (€million)	34,092.0	504	600	1,104	91,458.0	1,317	1,528	2,845	132,481	1,664	2,336	4,000
TFC/GVA (kWh/€thousand)	2,512.7	2,843.2	3,040	2,950	1351.4	1,642	1,719	1,684	1,032	1,413	1,243	1,314
TFC/Capita (kWh/ Inhabitant)	23,943	24,628	24,210	23.39	33,477	36,341	33,982	35.01	33,946	37,019	35,800	36.34
CO₂ Emissions / Capita (T CO ₂ / Inhabitant)	8.9	9.4	9.1	9.2	11.1	11.5	11.4	11.4	10.6	11.8	11.2	11.4

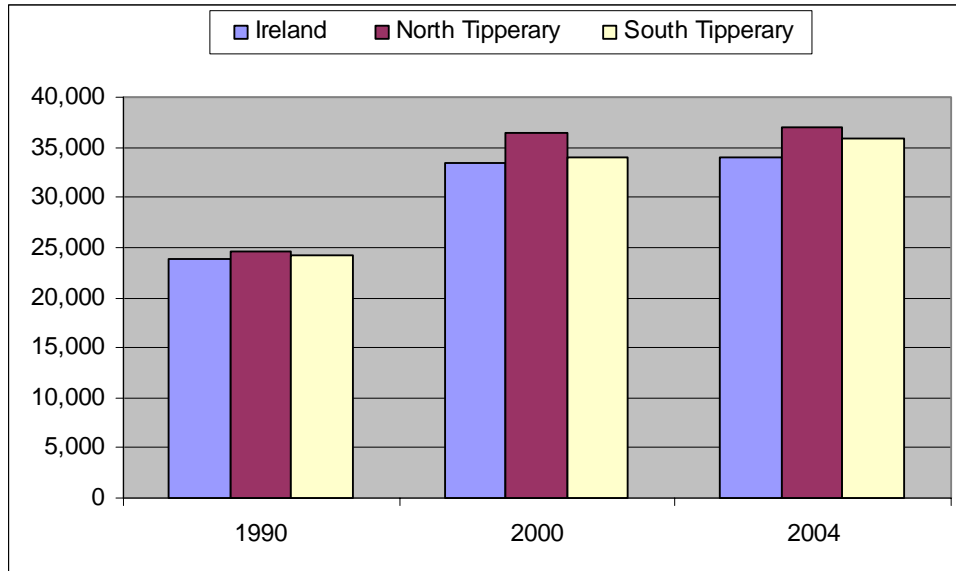


Chart 7.1: Total Final Consumption per capita (kWh/inhabitant)

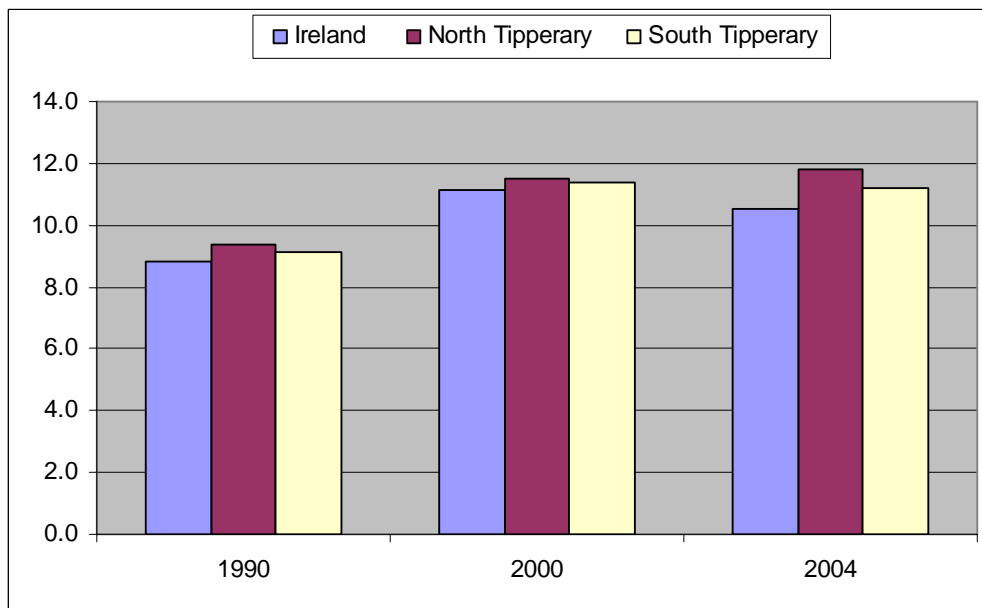


Chart 7.2: Tonnes CO₂ Emissions per capita (Tonnes CO₂/Inhabitant)

Charts 7.1 and 7.2 present specific data in relation to TFC per capita and CO₂ emissions per capita. It can be seen that in general North and South Tipperary have a higher TFC and CO₂ emissions per capita compared to the National averages. This would reflect the fact of fact that the rural counties have reduced access to public transport, lower building densities and less access to energy efficient fossil fuel sources such as Natural Gas..

8.0 Tipperary Energy & Emissions Balance - Review

This Chapter provides an overview of energy consumption and environmental emissions for the combined area of North and South Tipperary.

8.1 TFC and CO₂ Emissions by Area

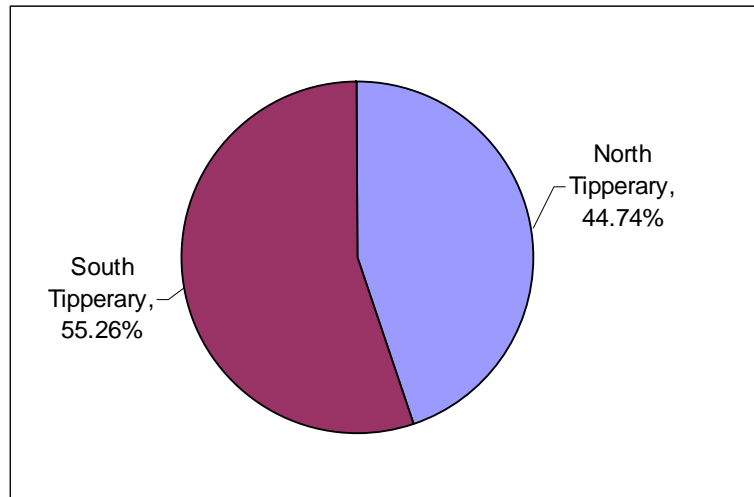


Chart 8.1: % Share of Total Final Energy Consumption by Area

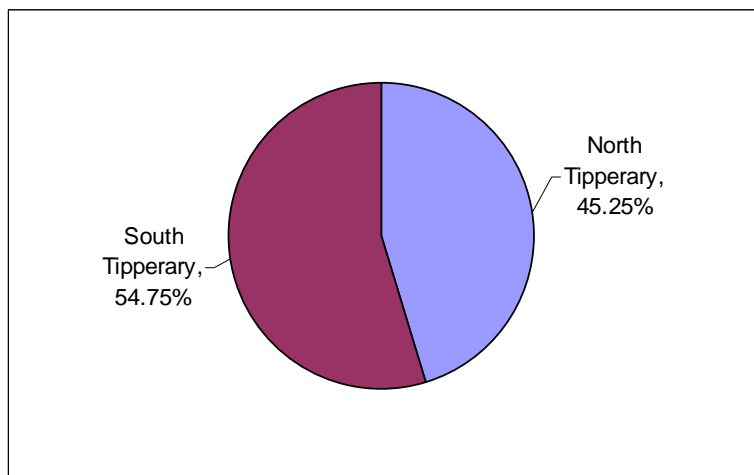


Chart 8.2: % Share of Energy Related CO₂ Emissions by Area

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

8.2 TFC by Area: 1990, 2005, 2010, 2020

Table 8.1 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	3,068.8	3,652.0	6,720.8
BAU 2020	3,415.7	4,077.9	7,493.6

Table 8.2: % 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%

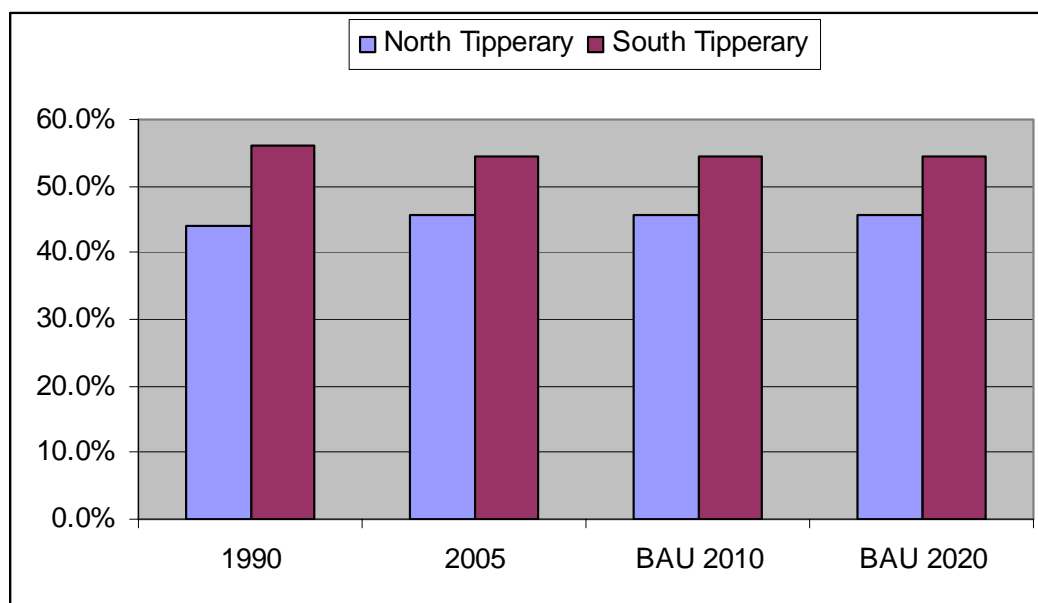


Chart 8.3: % TFC for each Area

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.

8.3 TFC by Fuel: 1990, 2005, 2010, 2020

Table 8.3 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 8.4 % 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%

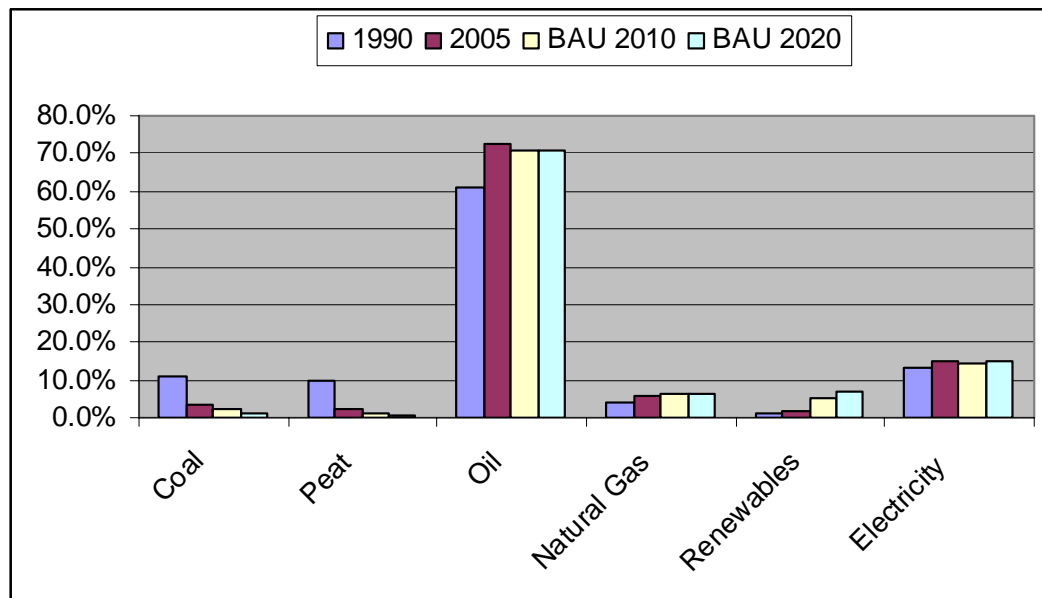


Chart 8.4: % TFC by Fuel for County Tipperary

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.

8.4 TFC by Sector 1990, 2005, 2010, 2020

Table 8.5 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 8.6: % 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%

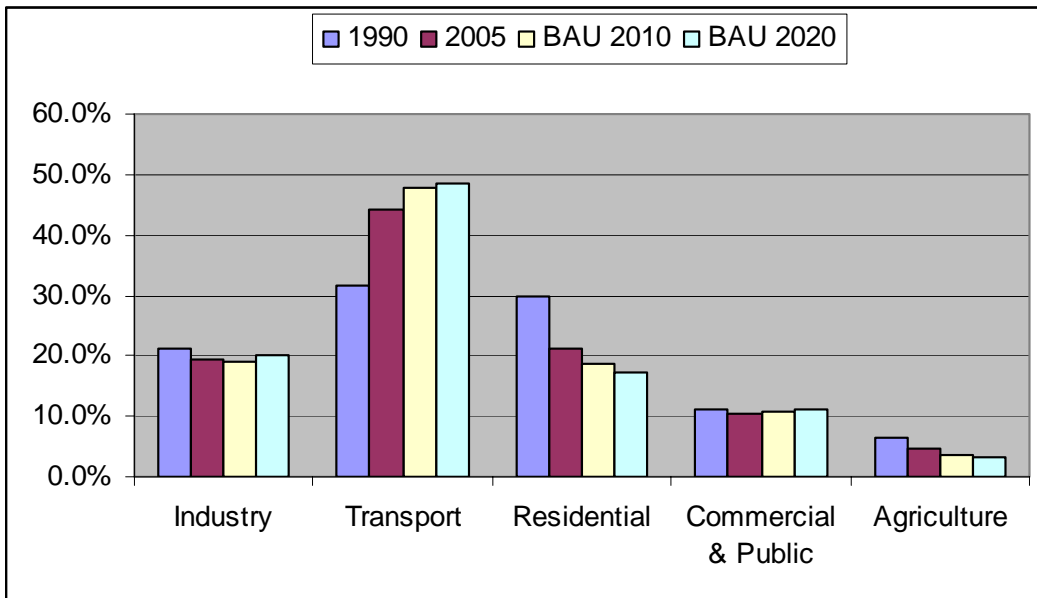


Chart 8.5: % TFC by Sector for County Tipperary

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.

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

Table 8.7: 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 8.8 % 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%

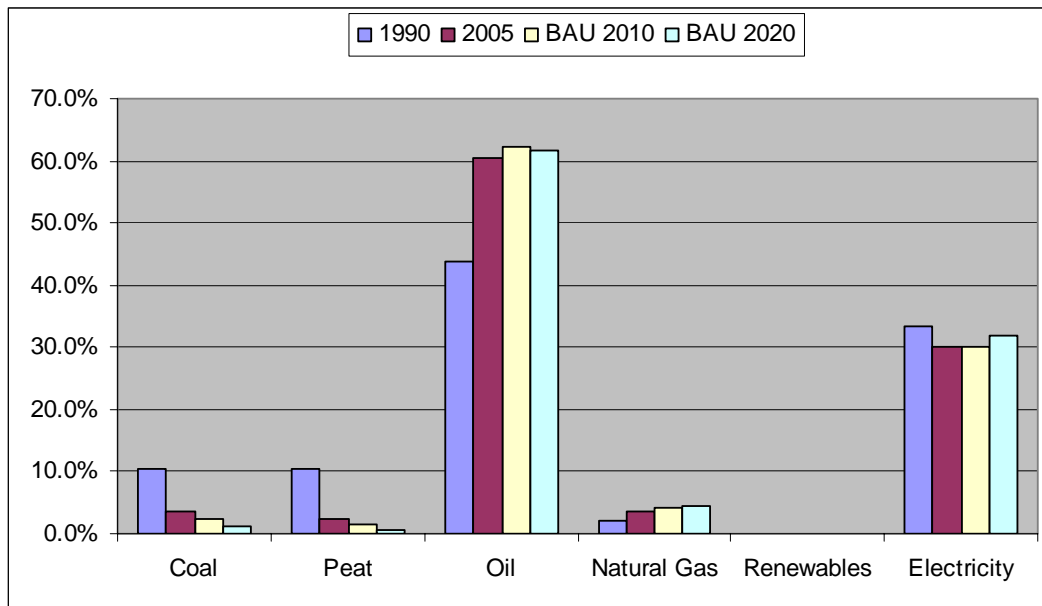


Chart 8.6: % CO₂ Emissions by Fuel for County Tipperary

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.

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

Table 8.9: 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 8.10: % 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%

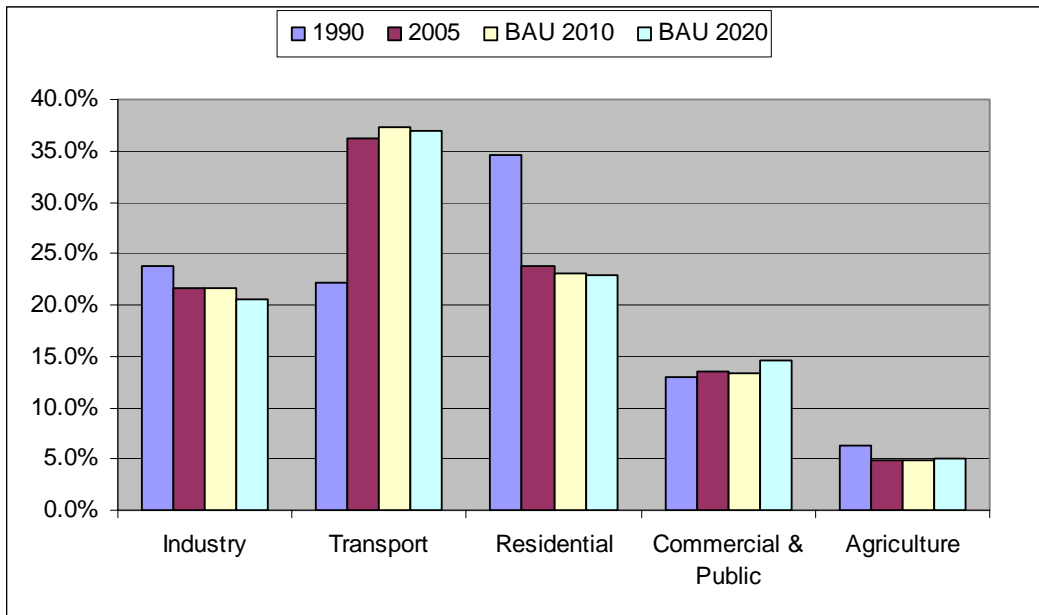


Chart 8.7: %CO₂ Emissions by Sector for County Tipperary

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.

8.8 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 8.12 to 8.14. 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 8.12: 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-CO2)	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	-
CO2 Emissions / Capita (T CO2 / Inhabitant)	8.9	8.9	5.5	12.0	12.9	4.5	12.6	7.1

Table 8.13: 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 8.14: 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

APPENDICES