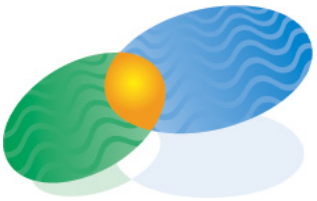

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# Limerick Clare Climate Change Strategy

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# Acknowledgements

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# Executive Summary

## Introduction

The aim of the Climate Change Strategy for Limerick and Clare 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 $CO_2$ 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. It was hoped that the National Climate Change Strategy consultation process would have been on-going in parallel with this study but this has not occurred.

## Study Approach

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

The general approach that has been taken is to 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. It was hoped that the National Climate Change Strategy consultation process would have been on-going in parallel with this study but this has not been possible.

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 Limerick Clare Energy and Emissions Balance used a top down approach in terms of estimating Total Final Consumption and $CO_2$ 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 $CO_2$ emission reduction impacts these will have.

Moneypoint ESB power station, the largest electricity producer in the country and Aughinish Alumina, Irish Cement and Shannon Airport, make up some of the highest energy users in the country, are all located in the study region. The four sites have been estimated to be responsible for over 12,300,000 Tonnes of $CO_2$ per annum. All these sites except Shannon Airport are dealt with under the National Emissions Trading scheme and therefore the LCEA will have a limited input to action in this area. To avoid the data from these large sites skewing the data from other sectors it is not presented with the County data. This allows for a more focused approach on the other sectors and end users within the region.

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 Clare County, Limerick County and Limerick City. Clare County and Limerick County energy related emissions amount to 85% of total emissions for the study area. The Energy and Emissions Balance indicated the level of excess above the Kyoto target by 2010 to be:-

- County Clare: 489,000 tonnes $CO_2$
- County Limerick: 562,000 tonnes $CO_2$
- Limerick City: 150,000 tonnes $CO_2$

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 $CO_2$) in the study area. The table shows that by 2010 the study area could be 1,203,000 tonnes of $CO_2$ over the Kyoto target, and should this progress on a "Business As Usual" basis to 2015 the level of excess could be 1,478,000 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 ($CO_2$) and potential cost for study area**

| | Clare County | | | Limerick County | | | Limerick City | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Emissions** kT-$CO_2$ | **Kyoto Target Excess** kT-$CO_2$ | **Annual Carbon Levy** millions | **Emissions** kT-$CO_2$ | **Kyoto Target Excess** kT-$CO_2$ | **Annual Carbon Levy** millions | **Emissions** kT-$CO_2$ | **Kyoto Target Excess** kT-$CO_2$ | **Annual Carbon Levy** millions |
| **1990** | 828.3 | 0 | 0 | 989 | 0 | 0 | 418.6 | 0 | 0 |
| **1995** | 914 | 0 | 0 | 1,094 | 0 | 0 | 466 | 0 | 0 |
| **2000** | 1,172 | 236.8 | 0 | 1,374 | 257.2 | 0 | 541 | 68.9 | 0 |
| **2002** | 1,222 | 286.5 | 0 | 1,437 | 320 | 0 | 537 | 64.3 | 0 |
| **2004** | 1,206 | 270.9 | 0 | 1,421 | 304.2 | 0 | 531 | 58.2 | 0 |
| **2005 est.** | 1,235 | 299.3 | € 8.0 | 1,456 | 338.5 | € 9.1 | 543 | 70.4 | € 1.9 |
| **BAU 2010** | 1,425 | 489.6 | € 17.1 | 1,680 | 562.8 | € 19.7 | 623 | 150.8 | € 5.3 |
| **BAU 2015** | 1,531 | 595.5 | € 26.8 | 1,806 | 688.3 | € 31.0 | 667 | 194 | € 8.7 |
| Kyoto Target | 936 | | | 1,118 | | | 473 | | |

**Table 2 Summary of $CO_2$ Reductions in Study Area.**

| '000 tonnes $CO_2$ | Clare | | Limerick | | Limerick City | |
|---|---|---|---|---|---|---|
| | 2010 | 2015 | 2010 | 2015 | 2010 | 2015 |
| Energy Production & Supply | 208.4 | 306.9 | 255.3 | 353.7 | 45.0 | 54.0 |
| Transport | 50.7 | 66.5 | 58.2 | 76.9 | 24.0 | 28.8 |
| Built Environment | 38.4 | 51.9 | 35.5 | 45.5 | 15.0 | 18.0 |
| Industry/Commercial Services | 47.0 | 49.2 | 55.4 | 58.0 | 22.5 | 27.0 |
| Agriculture | 12.0 | 22.2 | 16.1 | 29.4 | 7.5 | 9.0 |
| Waste | 5.4 | 5.4 | 19.3 | 19.3 | 4.5 | 5.4 |
| | | | | | | |
| Total | 361.8 | 502.1 | 439.7 | 582.8 | 118.5 | 142.2 |
| | | | | | | |
| Target | 489.0 | 595.0 | 562.0 | 688.0 | 150.0 | 194.0 |
| | | | | | | |
| Gap to Target | 127.2 | 92.9 | 122.3 | 105.2 | 31.5 | 51.8 |

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 $CO_2$ reductions.

## Common Issues

It is clear that locally, regionally and nationally extraordinary measures will be required to reduce $CO_2$ 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 $CO_2$ 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 $CO_2$ 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:

- Increased use of energy efficient modes of transport (walking, cycling, bus etc.)
- Purchase of energy efficient vehicles
- Switching to the use of green fuels
- Car pooling

- The supply infrastructure for wood heating projects will present common issues not only in Clare and Limerick but nationally. The work and experience from the Clare Wood Energy Project should be used to provide a model in the region for future developments

- 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.

- Some provision has been allowed for the development of Tidal in the region but for the full potential to be realised significant investment will be required.

- 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 $CO_2$ reductions.

## County Clare

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 County Clare, Evolution of Energy Emissions ($CO_2$) 1990 – 2015**

| kT $CO_2$ | 1990 | 1995 | 2000 | 2002 | 2004 | 2005 est | BAU 2010 | BAU 2015 |
|---|---|---|---|---|---|---|---|---|
| **Transport** | 168.7 | 205.9 | 332.2 | 346.3 | 341.9 | 410.4 | 515.6 | 586.5 |
| **Residential** | 283.7 | 280.5 | 311.6 | 324.8 | 320.6 | 316.9 | 328.8 | 341.7 |
| **Industry** | 216.4 | 235.4 | 288.1 | 300.3 | 296.4 | 227.3 | 259.2 | 273.0 |
| **Commercial** | 131.0 | 159.6 | 204.8 | 213.4 | 210.7 | 250.0 | 292.0 | 302.0 |
| **Agriculture** | 28.5 | 32.6 | 36.2 | 37.7 | 37.2 | 30.7 | 29.9 | 28.4 |
| **Total** | 828.3 | 914.0 | 1172.8 | 1222.5 | 1206.9 | 1235.3 | 1425.6 | 1531.5 |

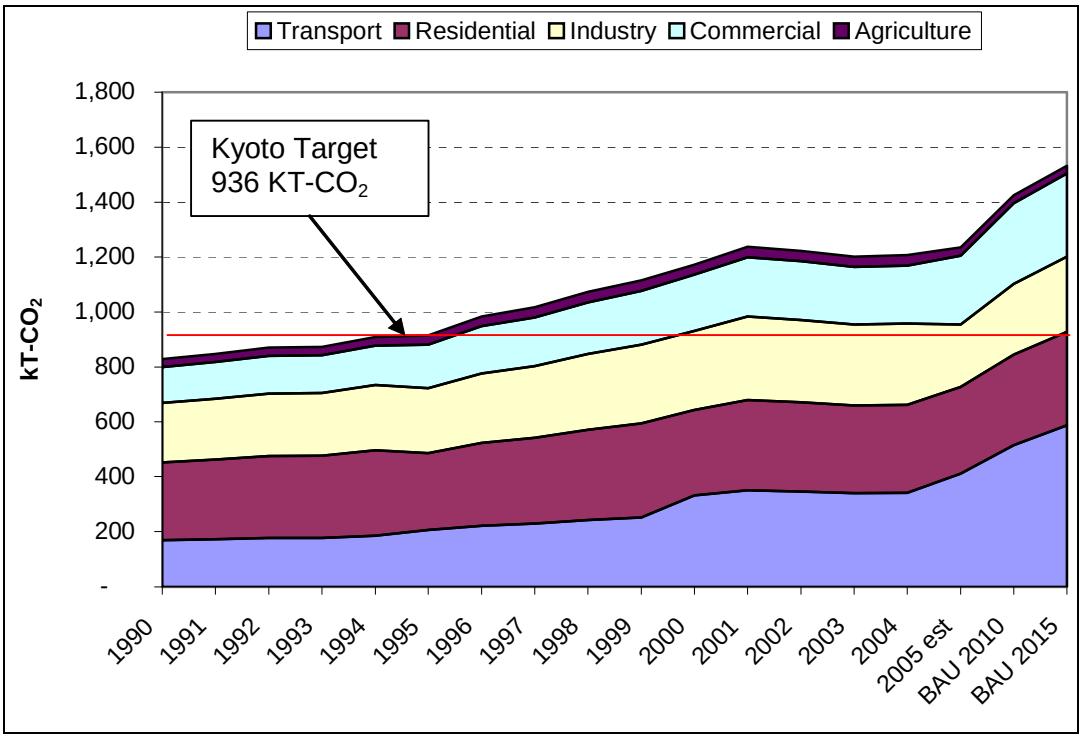


**Chart 1 County Clare, Evolution of Energy Emissions ($CO_2$) 1990 - 2015**

- 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 County Clare is projected to be 123,000 Tonnes of $CO_2$. As can be seen from Table 6.2 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 2015

- Renewables (large, medium and small scale) will make the greatest contribution in terms of $CO_2$ reductions as they result in no or minimal $CO_2$ emissions compared to fossil fuels.

- Wood biomass from forestry thinnings should take a significant step forward in 2007 as a result of the Clare Wood Energy Project. This model should present opportunities for replication in the future.

- 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

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 21,000 new houses built in County Clare between 2002 and 2015. 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 Co. Clare has a potential wood energy supply of 80,000 Tonnes of wood chips. Realising only 10% of this for wood energy use in 2010 could provide 27 $GWh_{th}$ of energy per annum in the region. If the Coillte forestry were also to be used as a resource (approximately 23,000 ha in 2004) the wood energy resource would be almost doubled. Already 6 potential sites have been identified for development of wood heating projects..

The agricultural sector in Co. Clare 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. However, the County could benefit from experience in Co. Limerick in relation to the growing of Miscanthus as an energy crop.

By exceeding its 2010 limit in terms of $CO_2$ emissions related to energy the County could face a relative carbon levy of €17M in 2010. If the savings identified in the report are achieved this could reduce to €4.3M.

The indicative abatement cost to achieve these reductions has been estimated to be in the region of €450/Tonne.

## County Limerick

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 County Limerick, Evolution of Energy Emissions ($CO_2$) 1990 – 2015**

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

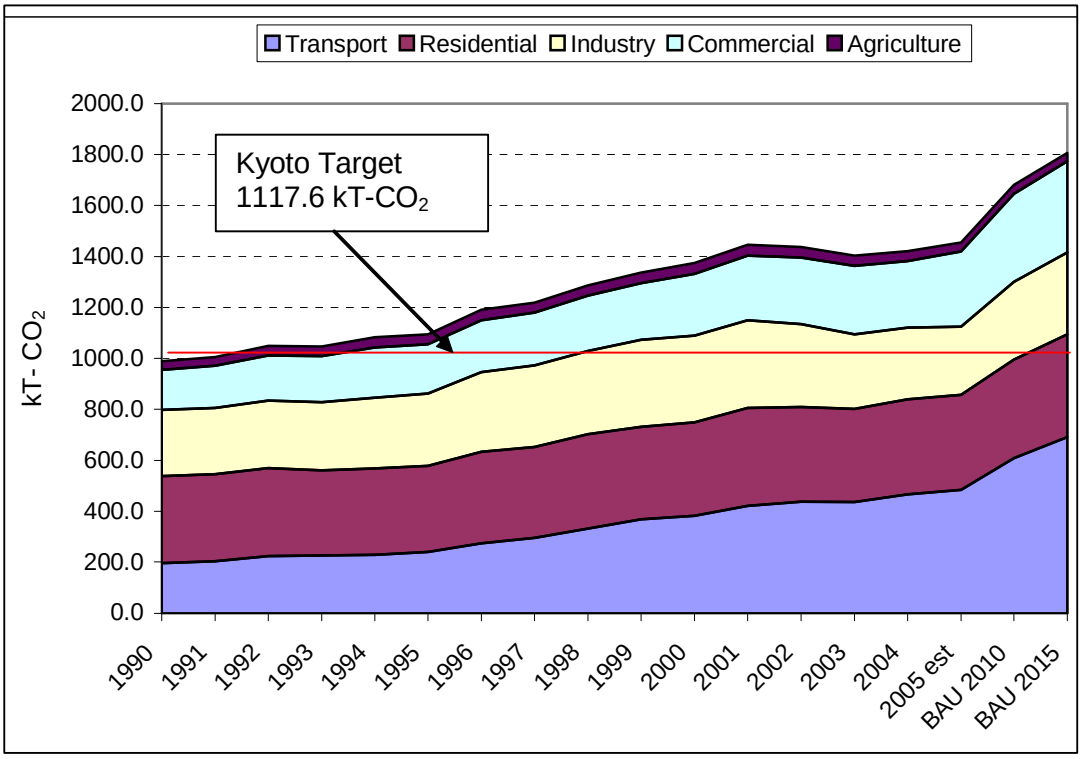


**Chart 2 County Limerick, Evolution of Energy Emissions ($CO_2$) 1990 – 2015**

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

The gap to the 2010 target in County Limerick is projected to be 562,000 Tonnes of $CO_2$ and this is projected to reduce to 69,000 Tonnes by 2015. Energy Production and Supply will result in the greatest $CO_2$ reductions, another indicator that this sector is responding to the need to develop alternatives in this area.

Some key findings for County Limerick include:

- By 2010 it is expected that 94MW of large scale wind installed in the County, increasing to 115MW by 2015

- A number of small scale hydro projects have been completed in the area and specific expertise in the field of energy from poultry wastes has been developed.

- The development of Miscanthus as an energy crop is being driven Nationally from Limerick. Already 150 ha have been planted and this is expected to increase significantly in the future.

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 $CO_2$ 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 Co. Limerick has a shown considerable interest in the development of Miscanthus as an energy crop. 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 $CO_2$ emissions related to energy the County could face a relative carbon levy of €20M in 2010. If the savings identified in the report are achieved this could reduce to €3.8M. The indicative abatement cost to achieve these reductions has been estimated to be in the region of €417/Tonne.

## Limerick City

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

**Table 5 Limerick City, Evolution of Energy Emissions ($CO_2$) 1990 – 2015**

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

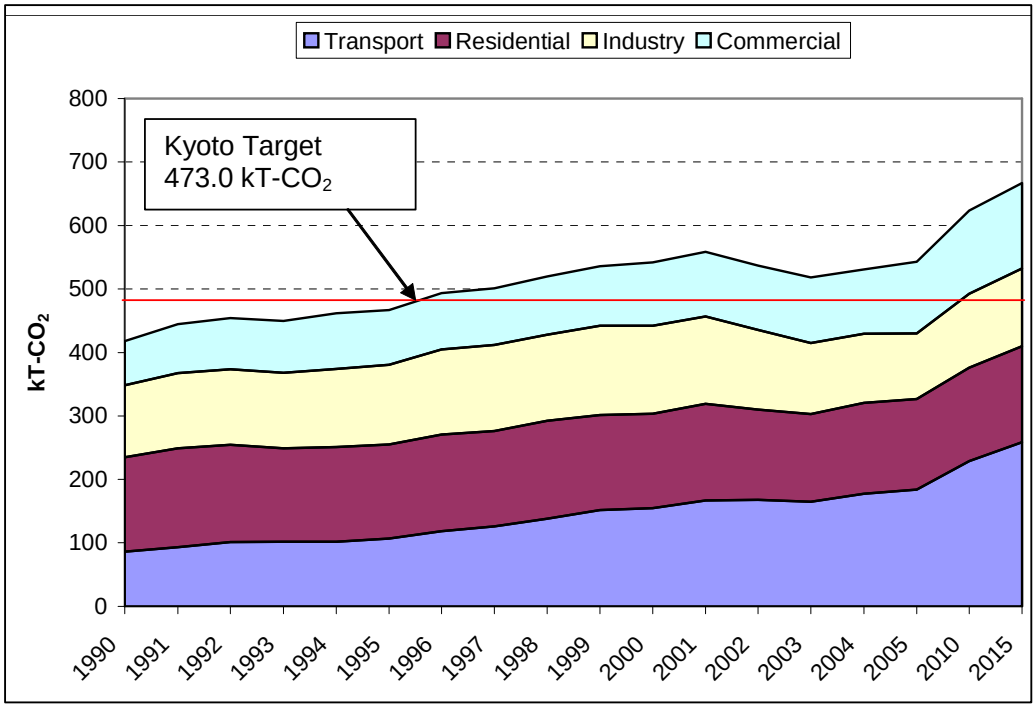


**Chart 3 Limerick City, Evolution of Energy Emissions ($CO_2$) 1990 - 2015**

- The Transport sector has shown the highest increase in level of emissions since 1990 with a 114% increase to 2005, and predicted increase of 200% by 2015.

- The residential sector has seen little or no change in the total emissions in the City since 1990. This is the only sector to see such a trend with the City and surrounding Counties. This reflects increased energy efficiencies within the housing stock and increased use of Natural Gas within this sector.

- The Commercial sector has shown a 61% increase in emissions since 1990.

Limerick City was projected to exceed its Kyoto Target by 150,000 Tonnes of $CO_2$ in 2010. The range of potential measures possible in the City could reduce this to 45,000 Tonnes by 2010. Limerick City presents different issues in terms of implementing a Climate Change Strategy when compared to the County Areas.

Some key recommendations include: -

- Particular focus on transport is clearly important for the City area. Further innovation in terms of car-pooling, park and ride, increased services and mobility management is needed.

- The built environment within the City, given its higher density, presents opportunities for the development of district heating, communal energy systems etc.

- The focus in terms of renewable energy development will have to be moved from the area of wind, as is the case in the County areas, to biomass, solar and other technologies which are integrated into buildings in particular.

- Combined Heat and Power developments need to be increased

## Conclusions

It has been shown that significant progress can be made within the study region towards meeting the Kyoto targets. However, based on a wide range of standard measures, the total $CO_2$ savings identified will still be approximately 25% below that required.

The Energy Production and Supply sector is currently carrying the greatest share of $CO_2$ 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.

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 $CO_2$ sought as an individual responsibility.

**Table 6 $CO_2$ reductions per capita in Limerick & Clare study area.**

| Indicator | Clare County | Limerick County | Limerick City |
|---|---|---|---|
| **$CO_2$ Emissions / Capita**<br>T $CO_2$ / person | 4.7 | 4.6 | 2.8 |

# 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 specifically seeks to identify the measures that can be taken in the counties of Limerick & Clare. The Limerick Clare 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 Limerick Clare 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 $CO_2$ 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 Clare County, Limerick County & City.

The format of this report is presented in summary format for the combined study area with detailed analysis being provided for Limerick County, Limerick City and Clare County. 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 $CO_2$ Abatement via sinks has been ignored. This is due to a focus on actions and measures wish result in direct reduction in $CO_2$ 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 terms 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 $CO_2$ 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 $CO_2$ emissions identified within the Limerick Clare Energy & Emissions Balance. The solutions will enable the study region 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.

## 1.4 Investing in The plan

Tackling climate change will require a multi-sectoral approach and strong co-operation from all stakeholders. This report should assist this process.

The Limerick Clare Energy Agency (LCEA) is an example of how coordinated action can support the development of sustainable energy. The Limerick Clare Energy Agency was established by Limerick and Clare County Councils. It is supported by:-

- West Limerick Resources
- Clare Rural Resources Ltd
- Ballyhoura Rural Development

The LCEA will continue to work with a wide range of partners and organisations to ensure that appropriate resources and invested in the actions identified within the strategy. Local, Regional and National support will be required to meet the targets set out in the document.

# 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. 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 (2002): Department of Environment, Heritage and Local Government (www.irishspatialstrategy.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
- Draft Action Plan for Energy Performance of Buildings Directive proposed
- Renewable Energy Fix Feed in Tarriff Scheme announced.
- 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: -

- Clare County Council
- Limerick County Council
- Limerick City 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 Mid West Regional Authority, 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 Limerick Clare Energy and Emissions 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 ($CO_2$) 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 $CO_2$ Emissions**

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

| Energy Related Emissions | Total Emissions ('000 T $CO_2$) | Projected Difference to Target ('000 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 – Study Region

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 Limerick Clare Energy & Emissions Balance has been to use the current price of €27 per tonne[2] for the 2005 estimate and to assume a value of €35 per tonne for the 2010 scenario. Based on this the Energy and Emissions 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**

| | Clare County | | | Limerick County | | | Limerick City | | |
|---|---|---|---|---|---|---|---|---|---|
| | **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) | **Emissions** ('000 T-$CO_2$ ) | **Kyoto Target Exceedance** ('000 T-$CO_2$ ) | **Annual Carbon Levy** (€millions) |
| **1990** | 828.3 | 0 | 0 | 989 | 0 | 0 | 418.6 | 0 | 0 |
| **Kyoto Target** (1990 + 13%) | 936.0 | 0 | 0 | 1,117.6 | 0 | 0 | 473.0 | 0 | 0 |
| **1995** | 914.0 | 0 | 0 | 1,094.3 | 0 | 0 | 466.8 | 0 | 0 |
| **2000** | 1,172.8 | 236.8 | 0 | 1,374.8 | 257.2 | 0 | 541.9 | 68.9 | 0 |
| **2002** | 1,222.5 | 286.5 | 0 | 1,437.6 | 320.0 | 0 | 537.3 | 64.3 | 0 |
| **2004** | 1,206.9 | 270.9 | 0 | 1,421.8 | 304.2 | 0 | 531.2 | 58.2 | 0 |
| **2005 est** | 1,235.3 | 299.3 | 8 | 1,456.1 | 338.5 | 9.1 | 543.4 | 70.4 | 1.9 |
| **BAU 2010** | 1,425.6 | 489.6 | 17.1 | 1,680.5 | 562.8 | 19.7 | 623.8 | 150.8 | 5.3 |
| **BAU2015** | 1,531.5 | 595.5 | 26.8 | 1,805.9 | 688.3 | 31.0 | 667.0 | 194.0 | 8.7 |

# 4.0 Summary Results – Study Area

## 4.1 $CO_2$ 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 2015.

Analysis has been completed for Clare County, Limerick County and Limerick City. Clare County and Limerick County energy related emissions amount to 85% of total emissions for the study area. The Energy and Emissions Balance indicated the level of excess above the Kyoto target by 2010 to be:-

- County Clare: 489,000 tonnes $CO_2$
- County Limerick: 562,000 tonnes $CO_2$
- Limerick City: 150,000 tonnes $CO_2$

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 $CO_2$ Reductions in Study Area.**

| '000 Tonnes $CO_2$ | Clare | | Limerick | | Limerick City | |
|---|---|---|---|---|---|---|
| | 2010 | 2015 | 2010 | 2015 | 2010 | 2015 |
| **Energy Production & Supply** | 208.4 | 306.9 | 255.3 | 353.7 | 45.0 | 54.0 |
| **Transport** | 50.7 | 66.5 | 58.2 | 76.9 | 24.0 | 28.8 |
| **Built Environment** | 38.4 | 51.9 | 35.5 | 45.5 | 15.0 | 18.0 |
| **Industry/Commercial Services** | 47.0 | 49.2 | 55.4 | 58.0 | 22.5 | 27.0 |
| **Agriculture** | 12.0 | 22.2 | 16.1 | 29.4 | 7.5 | 9.0 |
| **Waste** | 5.4 | 5.4 | 19.3 | 19.3 | 4.5 | 5.4 |
| | | | | | | |
| **Total** | 361.8 | 502.1 | 439.7 | 582.8 | 118.5 | 142.2 |
| | | | | | | |
| **Target** | 489.0 | 595.0 | 562.0 | 688.0 | 150.0 | 194.0 |
| | | | | | | |
| **Gap to Target** | 127.2 | 92.9 | 122.3 | 105.2 | 31.5 | 51.8 |

## 4.2 $CO_2$ 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 2015. 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.

**Table 4.2 Summary of $CO_2$ Abatement Costs in Study Area.**

| | Clare | | | | | | Limerick | | | | | | Limerick City | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $CO_2$ 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 | 2015 | 2010 | 2015 | 2010 | 2015 | 2010 | 2015 | 2010 | 2015 | 2010 | 2015 | 2010 | 2015 | 2010 | 2015 | 2010 | 2015 |
| Energy Prod & Supply | 208.4 | 306.9 | 130.7 | 197.4 | 627 | 643 | 255.3 | 353.7 | 154.4 | 257.3 | 604 | 727 | 45.0 | 54.0 | 27.9 | 36.7 | 620 | 680 |
| Transport | 50.7 | 66.5 | 7.00 | 12.0 | 138 | 180 | 58.2 | 76.9 | 7.0 | 12.0 | 120 | 156 | 24.0 | 28.8 | 3.1 | 4.9 | 130 | 170 |
| Built Environment | 38.4 | 51.9 | 25.4 | 41.8 | 662 | 806 | 35.5 | 45.5 | 21.0 | 34.6 | 592 | 760 | 15.0 | 18.0 | 9.5 | 14.0 | 630 | 780 |
| Ind & Comm Services | 47.0 | 49.2 | 7.0 | 7.0 | 148 | 142 | 55.4 | 58.0 | 7.0 | 7.0 | 126 | 120 | 22.5 | 27.0 | 3.2 | 3.5 | 140 | 130 |
| Agriculture | 12.0 | 22.2 | 6.6 | 6.7 | 549 | 304 | 16.1 | 29.4 | 6.6 | 6.8 | 410 | 229 | 7.5 | 9.0 | 3.6 | 2.4 | 480 | 270 |
| Waste | 5.4 | 5.4 | 1.0 | 0.1 | 186 | - | 19.3 | 19.3 | 4.0 | 0.1 | 207 | - | 4.5 | 5.4 | 0.9 | - | 200 | - |
| | | | - | - | - | - | | | - | - | - | - | | | | | | |
| Total | 361.8 | 502.1 | 177.7 | 265.0 | 491 | 527 | 439.7 | 582.8 | 200.0 | 317.8 | 454 | 545 | 118.5 | 142.2 | 56.9 | 76.8 | 480 | 540 |

The average cost for reduction of a tonne of $CO_2$ across the study region is approximately €500/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 $CO_2$ 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 $CO_2$ 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 $CO_2$ 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:
    - Increased use of energy efficient modes of transport (walking, cycling, bus etc.)
    - Purchase of energy efficient vehicles
    - Switching to the use of green fuels
    - 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 study 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 Clare and Limerick but nationally. The work and experience from the Clare Wood Energy Project should be used to provide a model in the region for future developments and this will require support.

- Some provision has been allowed for the development of Tidal in the region but for the full potential to be realised significant investment will be required. The Shannon Estuary has perhaps the greatest potential for development in Ireland. In addition, the wave energy resource of the Limerick and Clare coast could make a major contribution to the regionally and nationally electricity demand if captured.

- 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 $CO_2$ reductions.

## 4.4 Financial Implications

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

By taking action, in terms of the standard measures which are outlined in the subsequent sections, the areas in the study region could reduce these levies considerably. Chart 4.1 outlines the impact of taking the proposed standard measures.

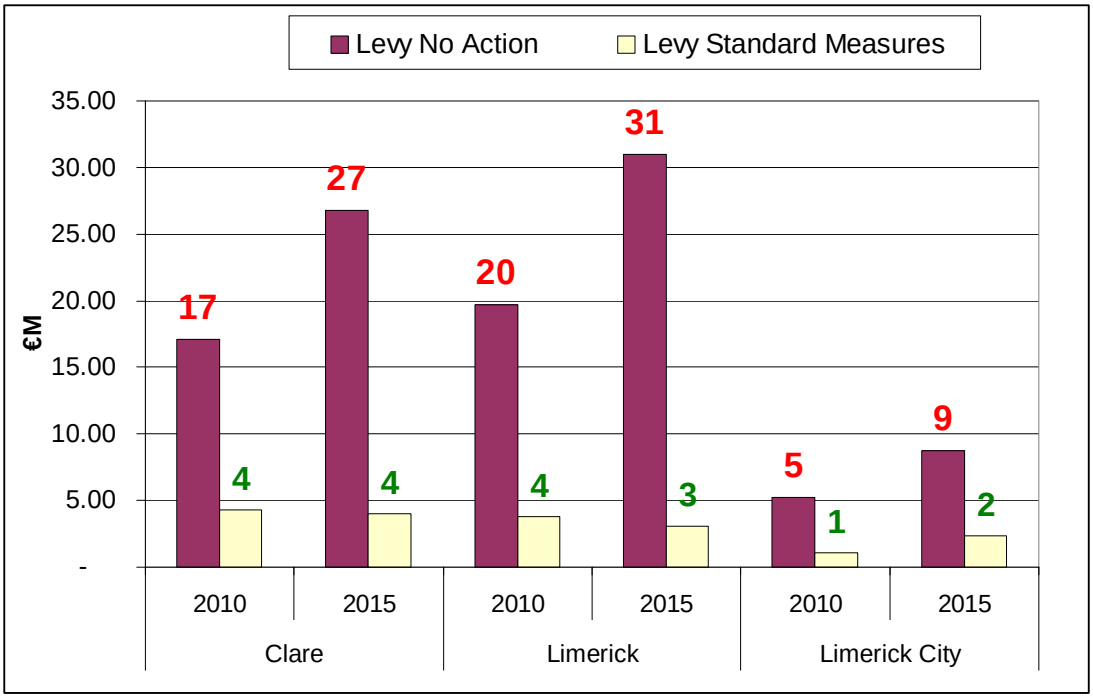


**Chart 4.1 : Carbon Levies within Study Region (Business and Usual (No Action) and by Implementing Standard Measures.**

**Table 4.3: $CO_2$ Reductions Required and Reductions Achieved through Standard Measures**

| | Reduction Required to Reach Kyoto Target | | | Reductions Achieved through Standard Measures | | |
|---|---|---|---|---|---|---|
| **Indicator** | **Clare County** | **Limerick County** | **Limerick City** | **Clare County** | **Limerick County** | **Limerick City** |
| **Energy Related Emissions** kt-$CO_2$ | 489.6 | 562.8 | 150.8 | 365 | 440 | 119 |
| **$CO_2$ Emissions / Capita** T $CO_2$ / Inhabitant | 4.7 | 4.6 | 2.8 | 3.5 | 3.6 | 2.2 |

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

Through the implementation of a wide range of standard measures across all sectors reductions of between 3.6 and 2.2. Tonnes of $CO_2$ per person can be achieved. Within the County areas there is a further reduction of approximately 1 Tonne of $CO_2$ per person required to meet the Kyoto target while the figure is 0.6 of a Tonne of $CO_2$ for Limerick City.

# 5.0 Clare County

## 5.1 Introduction

The Energy and Emissions Balance for Limerick and Clare analysed the energy production and use within Clare County and also assessed the associated $CO_2$ 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.

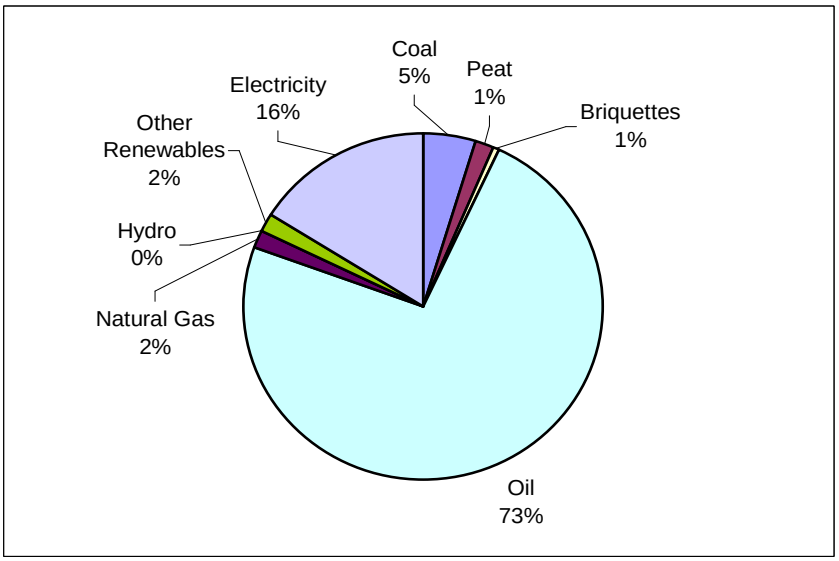


**Chart 5.1: Total Final Consumption by Fuel, Clare County, 2004**

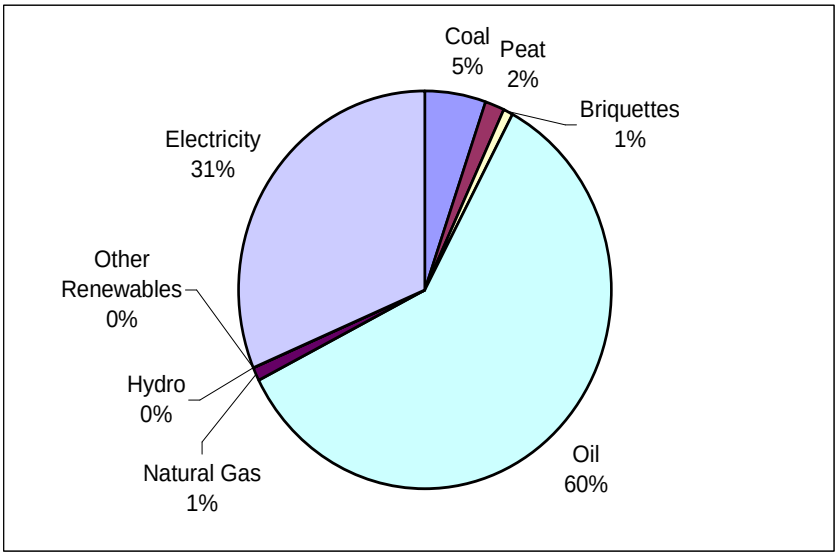


**Chart 5.2: $CO_2$ Emissions by Fuel, Clare County, 2004**

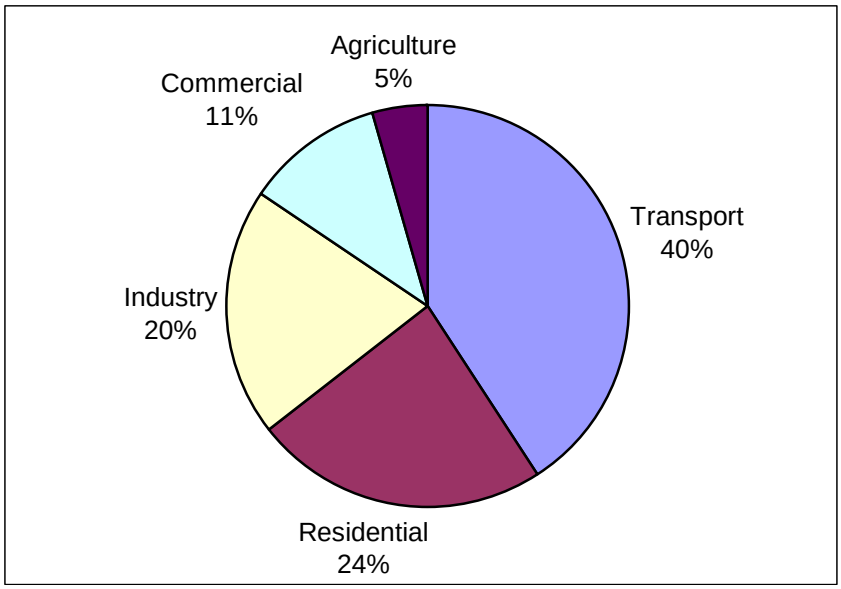


**Chart 5.3: Total Final Consumption by Sector, Clare County, 2004**

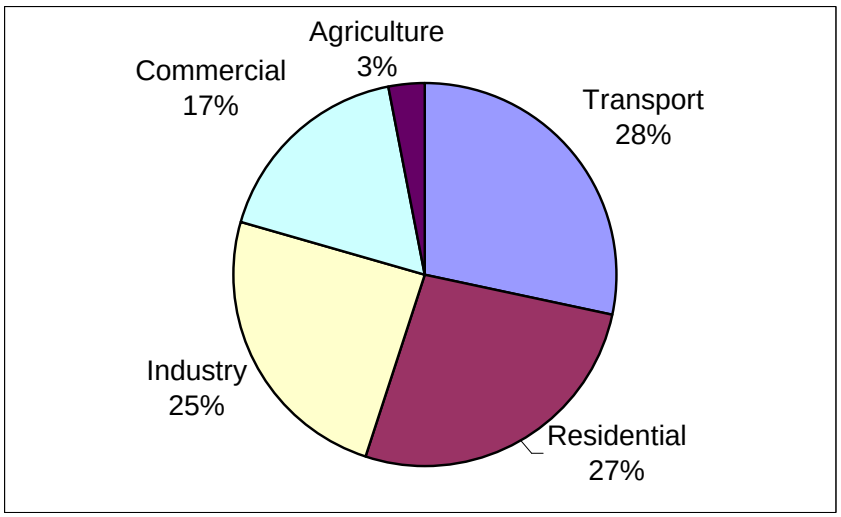


**Chart 5.4: $CO_2$ Emissions by Sector, Clare County, 2004**

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

**Table 5.1: Quantified Indicative Reductions – Clare County**

| **Overall QIRS by sector** | **Quantified Indicative Reductions Proposed** ('000 T-$CO_2$) |
|---|---|
| Energy Production & Supply | 188 |
| Transport | 88 |
| Built Environment & Residential | 30 |
| Industry, Commercial, & Services | 72 |
| Agriculture | 80 |
| Waste | 28 |
| Sinks (Land Use Change & Forestation) | 25 |
| Total | 510 |

## 5.2 Summary of Actions

**Table 5.2: Summary of $CO_2$ Reductions, Investment and Abatement Cost – Clare County**

| **Ref** | **Sector** | **$CO_2$ Reduction** (000 Tonnes) | | **Investment Cost** (€ m) | | **Indicative Abatement Cost** (€ / Tonne) | |
|---|---|---|---|---|---|---|---|
| | | **2010** | **2015** | **2010** | **2015** | **2010** | **2015** |
| 5.3 | Energy Prod & Supply | 208.4 | 306.9 | 130.8 | 197.4 | 627 | 643 |
| 5.4 | Transport | 50.6 | 66.6 | 7.0 | 12.0 | 138 | 180 |
| 5.5 | Built Environment | 38.4 | 51.9 | 25.4 | 41.8 | 662 | 806 |
| 5.6 | Ind and Comm Services | 47.0 | 49.2 | 7.0 | 7.0 | 148 | 142 |
| 5.7 | Agriculture | 12.0 | 22.2 | 6.6 | 6.8 | 549 | 304 |
| 5.8 | Waste | 5.4 | 5.4 | 1.0 | 0.1 | 186 | - |
| | **Total** | **361.8** | **502.1** | **177.7** | **265.** | **491** | **527** |
| | Target | 489 | 595 | | | | |
| | Gap to Target | 127.2 | 92.9 | | | | |

Table 5.2 summaries the data and results from the different sectors which were reviewed in Clare County. 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 €500 per tonne, taking full investment cost into account.

## 5.3 Energy Production & Supply

### 5.3.1 Introduction

Clare County 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, Clare County, (1990 – 2015)**

*(LCEA, 2006)*

| GWh | 1990 | 1995 | 2000 | 2002 | 2004 | 2005 Est | BAU 2010 | BAU 2015 |
|---|---|---|---|---|---|---|---|---|
| **Coal** | 258.5 | 118.3 | 170.6 | 165.6 | 183.0 | 165.8 | 101.2 | 79.1 |
| **Peat** | 172.6 | 148.5 | 55.0 | 54.3 | 55.1 | 50.5 | 32.7 | 21.7 |
| **Briquettes** | 50.0 | 38.0 | 37.8 | 35.2 | 27.9 | 25.6 | 16.6 | 11.0 |
| **Oil** | 1420.4 | 1746.1 | 2544.8 | 2708.0 | 2800.7 | 2883.0 | 3422.6 | 3787.9 |
| **Natural Gas** | 0.0 | 0.0 | 3.5 | 20.6 | 65.0 | 83.9 | 109.7 | 130.9 |
| **Hydro** | | | | | | | | |
| **Other RES** | 34.0 | 40.8 | 45.9 | 51.8 | 65.8 | 65.6 | 64.6 | 63.6 |
| **Electricity** | 320.7 | 399.7 | 549.2 | 603.2 | 608.9 | 631.4 | 757.2 | 791.9 |
| **TFC** | 2256.2 | 2491.4 | 3406.8 | 3638.8 | 3806.3 | 3905.7 | 4504.6 | 4886.1 |

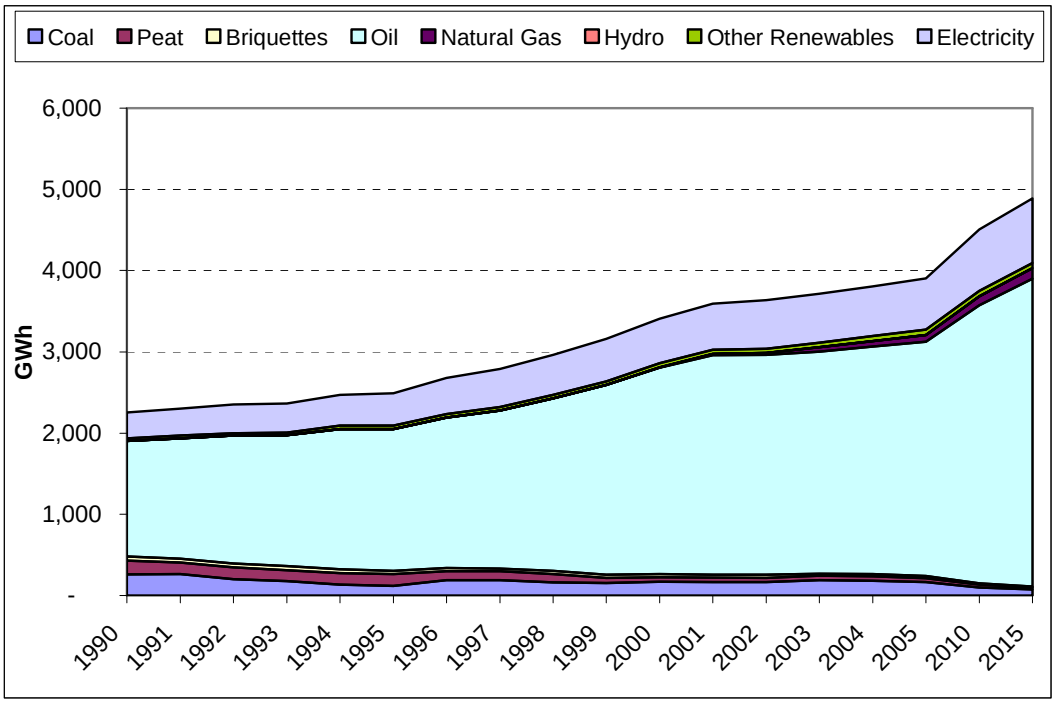


**Chart 5.5: Total Final Consumption by Fuel, Clare County, (1990 – 2015)**

*(LCEA, 2006)*

In 2004 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 Limerick Clare Energy and Emissions Balance (LCEA, 2006).

#### 5.3.1.1 $CO_2$ Reduction Targets

The Limerick Clare Energy and Emissions Balance set Quantified Indicative Reduction Targets for $CO_2$ for Clare County 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 188 kTonnes of $CO_2$. The following table summarises the actual projected savings in terms of $CO_2$ that are projected to be achievable by 2010 and 2015. Details of how these can be achieved are provided in the following sections.

**Table 5.4 : Quantified Indicative Reductions for Clare County – Energy Production and Supply**

| Ref | Energy Production and Supply | Quantified Indicative Reductions Proposed ('000 T-$CO_2$) | |
|---|---|---|---|
| | | **2010** | **2015** |
| **Fossil Fuel** | | | |
| 5.3.2.2 | Fuel switching | 20.9 | 13.8 |
| 5.3.2.3 | Combined Heat & Power | 1.8 | 1.8 |
| **Renewable Energy** | | | |
| 5.3.3.1 | Large Scale Wind Power | 156.9 | 191.4 |
| 5.3.3.2 | Hydro Power Schemes | - | - |
| 5.3.3.3 | Tidal/Wave | 2.2 | 49.4 |
| 5.3.3.4 | Large PV | - | 2.4 |
| 5.3.3.5 | Small Scale RE Electric | 0.2 | 0.7 |
| 5.3.3.6 | Large RE Thermal | 13.0 | 27.1 |
| 5.3.3.8 | Small RE Heat | 13.5 | 20.2 |
| | Total ('000 T-$CO_2$) | 208.4 | 306.9 |

#### 5.3.1.2 $CO_2$ 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 study region 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 2015.

The average cost for the abatement of $CO_2$ emissions for energy production and supply, based on estimated investment costs, is approximately €627/Tonne $CO_2$ in Clare County. 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 $CO_2$ Abatement Costs for Clare County - Energy Production and Supply**

| | 2010 | | | 2015 | | |
|---|---|---|---|---|---|---|
| **Energy Production and Supply** | **QIR Proposed** ('000 T-$CO_2$) | **Indicative Cost** (€ m) | **Indicative Abatement Cost per Tonne $CO_2$** (€ / T-$CO_2$) | **QIR Proposed** ('000 T-$CO_2$) | **Indicative Cost** (€m) | **Indicative Abatement Cost per Tonne $CO_2$** (€/T $CO_2$) |
| **Fossil Fuel** | | | | | | |
| Fuel switching | 20.88 | 0 | - | 13.81 | 0 | - |
| CHP | 1.80 | 1 | 557 | 1.80 | 1 | 557 |
| **Renewable Energy** | | | | | | |
| Large Scale Wind | 156.90 | 84 | 535 | 191.42 | 108 | 564 |
| Hydro Power | - | 0 | - | - | 0 | - |
| Tidal/Wave | 2.20 | 5 | 2,276 | 49.43 | 50 | 1,012 |
| Large PV | - | 0 | - | 2.43 | 10 | 4,108 |
| Small Scale RE E | 0.16 | 1.75 | 10,753 | 0.65 | 4.9 | 7,527 |
| Large RE Thermal | 13.00 | 4 | 308 | 27.12 | 6 | 221 |
| Small RE Thermal | 13.49 | 35 | 2,594 | 20.24 | 17.5 | 865 |
| Total | 208.42 | 130.75 | 627 | 306.90 | 197.4 | 643 |

#### 5.3.1.3 Renewable Energy Supply Targets

The targets for Clare County in terms of renewables are best aligned to the EU and national targets that currently exist. There are a number of EU Policies and Directives in this regard:

- EU White Paper on Renewable Energy Sources (RES):
  - 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 Clare County in 2005 was estimated to be 3,906 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 Clare County the following assumptions have been made

- The Moneypoint power station has been ignored given its scale
- The national target figure has been multiplied by the population ratio to give a target for Clare County.
- Ardnacrusha has been ignored as it has been assumed to contribute to the national figure

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

The data from this analysis is presented in the following Table. It can be seen that by 2010 a total of 39 MW 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.

**Table 5.6: Renewable Energy Targets - Clare County**

| | National | | Clare County | |
|---|---|---|---|---|
| | **2004** | **2010** | **2004** | **2010** |
| TPER (GWh) | 175,543 [4] | 214,104 | 4,634 | 5,652 |
| 12% Target (GWh) | 21,065 | 25,692 | 556 | 678 |
| Current RES (MWe) | 736[5] | 1,450[6] | 19 | 38 |

### 5.3.2 Fossil Fuel Energy

#### 5.3.2.1 Electricity Generation - Moneypoint

Moneypoint power station was highlighted as a major $CO_2$ emitter in the Energy and Emissions Balance. The National Climate Change Strategy (DoELHG, 2000) indicated that significant reductions could be achieved through switching to Natural Gas. This proposal has since been rejected due to concerns over security of supply.

A significant programme of upgrades at the plant is underway to capture emissions from the production process. It is unlikely that there will be other significant reductions from this plant in the near future. Developments in the fields of clean coal technology, carbon capture may be possible in the future.

The potential for co-firing with biomass should also be considered. However, significant supply issues will arise in this regard in terms of the scale of resource required to meet even a small percentage of primary fuel requirements at the plant.

$CO_2$ savings from Moneypoint have been ignored in the context of this report.

#### 5.3.2.2 Thermal - Fuel Switching

It can be seen that already in Clare County there has been a move from the use of solid fuel to oil and natural gas (solid fuels only accounted for 6% of TFC in Co Clare in 2004). This has provided some $CO_2$ savings as solid fossils fuels such as coal and peat have high $CO_2$ 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 $CO_2$ neutral fuels such as renewables.

[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)

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 Ennis and Shannon. There are no significant plans to expand this network outside of these areas in the near future (Bord Gais, 2006). As stated earlier the potential for fuel switching at Moneypoint is limited.

Assuming that the projected growth in Natural Gas use in the County, from 83.9 GWh in 2004 to 109.7 GWh per annum in 2010, displaces the use of oil as a fuel this would result in annual $CO_2$ emissions savings of as outlined in the following table.

**Table 5.7 : $CO_2$ Savings from Fuel Switching to Natural Gas**

| Fuel Switching | 2004 | BAU 2010 | BAU 2015 | Change (04-10) | Change (10-15) |
|---|---|---|---|---|---|
| Natural Gas (GWh) | 83.90 | 109.70 | 130.90 | 25.8 | 21.2 |
| Natural Gas $CO_2$ ('000 T) | 16.60 | 21.70 | 25.89 | 5.1 | 4.2 |
| $CO_2$ if Oil ('000 T) | | | | 6.8 | 5.6 |
| Annual $CO_2$ Savings ('000 T) | | | | 0.3 | 0.3 |

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 30 tonnes of $CO_2$ per annum.**

#### 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. 165.8 GWh in 2005. This is projected to reduce to 101GWh in 2010 and 79 GWh in 2015. $CO_2$ emissions are estimated to be 75kTonnes in 2004 and 41 kTonnes in 2010 respectively. The National ban on bituminous coal predicted a national saving of approximately 1 million Tonnes of $CO_2$ (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 $CO_2$ 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 20 kTonnes and 13 kTonnes in 2010 and 2015 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 extensively in Ennis and Shannon. 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.

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 Natural Gas network is significantly more extensive in Galway and therefore the potential in Clare will be less. It could be assumed that the potential within Ennis and Shannon is 40% of this i.e. 8GWhe.

The energy and $CO_2$ 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 $CO_2$ emissions related to electricity is achieved.

**Table 5.8: CHP Potential – Clare County**

| | **CHP Generation** (GWhe) | **Emissions from Conventional Electricity** ('000 Tonnes $CO_2$) | **Emission Reductions CHP** ('000 Tonnes $CO_2$) |
|---|---|---|---|
| **2010** | 8 | 5.4 | 1.8 |

### 5.3.3 Renewable Energy

#### 5.3.3.1 Electricity Generation - Large Scale Wind

Clare County has a number of wind farms which are connected to the National Grid. Details are provided in the following table.

**Table 5.9: Wind Farms in Clare County Connected to National Grid**

| **Site** | **Installed Capacity** (MW) | **Year of Construction** | **Annual Generation** (GWh) | **Annual $CO_2$ Avoided** ('000 T $CO_2$) |
|---|---|---|---|---|
| **Moanmore** | 12.6 | 2004 | 44.10 | 27.5 |
| **Booltiagh** | 19.5 | 2005 | 68.25 | 42.6 |
| **Total** | 32.1 | | 112.35 | 70.1 |

There is currently 1 wind farm that is waiting to be connected to the national grid, representing a total of 21.9 MW. There are also a number of wind farms in the planning process in the county.

**Table 5.10: Wind Farms in Clare County awaiting Connection to the National Grid**

| Site | Capacity (MW) | Year Connection Agreement Signed | Expected Connection Date | Projected Annual Generation (GWh) | Projected Annual $CO_2$ Avoid ed ('000 T $CO_2$) |
|---|---|---|---|---|---|
| **Moneypoint** | 21.9 | May 2005 | Jun 2006 | 76.65 | 47.8 |
| **Total** | 21.9 | | | 76.65 | 47.8 |

By the end of 2006 a total of 54 MW of wind energy will be connected and providing electricity to the National Grid in Clare. Comparing this to the RES-E Target as defined for Clare County in Section 5.1.4 it can be seen that the County will exceed its target of 38MW by 2010. It is likely that this target will be more than doubled by the end of 2010.

It is estimated that a total of 86MW will be connected to the grid in Clare County by 2010, increasing to 105 MW by 2015. 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 2015.

**Table 5.11: Large Wind Energy Installations and $CO_2$ Savings in Clare County**

| | Capacity (MW) | Electricity Generated (GWh) | Annual $CO_2$ Emissions Avoided ('000 Tonnes $CO_2$ ) |
|---|---|---|---|
| **2006** | 32.10 | 112.35 | 70.13 |
| **2007** | 54.00 | 189.00 | 117.97 |
| **2010** | 71.82 | 251.37 | 156.90 |
| **2015** | 87.62 | 306.67 | 191.42 |

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 that exists with regard to grid connection and significant pool of projects awaiting connection (655 MW contracted to be connected (ESBNG, 2006) causes significant problems for new wind energy projects.

In relation to offshore wind, the national study completed in 2004 indicated that the theoretical practical resource from offshore wind in Ireland could be 32% of predicated electricity consumption for 2005. However, it was noted that based on the analysis in the report that the majority of this resource would be located in the east and south east of the island. Some small sites in the west and north would require more detailed analysis. It has been assumed for the purposes of this study that no offshore wind farms will be developed in Clare County by 2010. There may be some potential for development by 2015 but has also been ignored within the context of this report.

#### 5.3.3.2 Electricity Generation - Large scale Hydro

Ardnacrusha in Clare County has operated successfully since 1927 and provides a total of 89.6MW to the national grid. As outlined in Chapter 8 of the Limerick Clare Energy and Emissions Balance it produced 236.7 GWh in 2004 (ESB, 2005) thus avoiding 379 kTonnes $CO_2$ per annum.

There are no other large-scale hydro projects connected to the national grid in Clare County 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.

#### 5.3.3.3 Electricity Generation - Wave & Tidal

These technologies are currently in the Research, Development and Demonstration (RD&D) phases and no commercial applications are available in Ireland at present. A report into the economic viability of developing ocean energy in Ireland (Marine Institute, 2005) indicated a best case scenario of 200MW being installed by 2020, with 45MW in place by 2015, nationally. The Vision for Renewable Energy Electricity (DCMNR, 2005) to 2020 indicated the following targets, nationally.

**Table 5.12: Tidal and Wave Energy Potential Nationally**

*(Source: DCMNR, 2005)*

| | Capacity (MW) | Electricity Generation (GWh) |
|---|---|---|
| **Wave** | 6 | 19 |
| **Tidal** | 651 | 2,103 |

A large proportion of this resource is located in the west coast of Ireland. The EU ATLAS Report indicated that a 400 MW tidal resource could be developed in Ireland with the major site being the Shannon Estuary (EU Commission, 2000).

For this study it has been assumed that a potential of 300 MW could be realised in the Shannon Estuary, but by 2020. A figure of 45 MW has been taken for 2015 and 2 MW for 2010. The resource has been split between the counties of Limerick and Clare as it is a joint resource and it is unclear as to where the developments will be installed.

**Table 5.13: Tidal and Wave Resource Projections – Clare and Limerick Counties**

| Year | Capacity (MW) | Generation (GWh) | Total $CO_2$ Avoided (000 Tonnes) | Clare $CO_2$ Avoided (000 Tonnes) | Limerick $CO_2$ Avoided (000 Tonnes) |
|---|---|---|---|---|---|
| **2010** | 2 | 6.46 | 4.4 | 2.2 | 2.2 |
| **2015** | 45 | 145.37 | 98.8 | 49.4 | 49.4 |
| **2020** | 300 | 969.12 | 659.0 | 329.5 | 329.5 |

#### 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 10.6MW of PV installations in Clare County, producing 13GWh 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 2015.

This would equate to 3MW of PV installed in Clare County generating 3.9GWh of electricity by 2015. This would avoid approximately 2 kTonnes of $CO_2$ 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 5.14: PV Installations and $CO_2$ Savings in Clare County**

| | 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 |
| Clare | 2010 | 0 | 0 | - |
| | 2015 | 3.18 | 3.9 | 2 |
| | 2020 | 10.6 | 13 | 8 |

#### 5.3.3.5 Electricity Generation - Small Scale Renewables

Small-scale renewable energy systems are already in use in Ireland and Clare County in specialised situations. These include parking meters, street signage etc. There are a number of companies in Ireland that 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 Clare County. 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 Clare County by 2010 would equate to approximately 175 installations.
- The penetration rate would increase to 2% by 2015

As can be seen, from the following table, the impact in terms of $CO_2$ emissions is negligible. However, a considerable increase in penetration rate through appropriate supports and policy initiatives could increase this figure.

**Table 5.15: Small Scale RES Electricity Production in Clare County**

| Year | Annual Electricity Consumption per dwelling (kWh) | Annual REe Production per dwelling (kWh) | Estimated No. of Houses Auto generating in Clare County | Total RESe Production (MWh) | $CO_2$ Avoided (Tonnes) |
|---|---|---|---|---|---|
| 2010 | 5,000 | 1,500 | 175 | 262 | 162.8 |
| 2015 | 5,000 | 1,500 | 700 | 1050 | 651 |

#### 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 that 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 Clare County for energy production. Work is on-going with the Clare Wood Energy Project, which has identified a potential 125,000$m^3$ of wood resource from thinnings in private forestry. This is equivalent to the use of 100,000 tonnes of wood per annum, or 266 GWh. Already 6 sites are being actively studied to with respect to the feasibility of installation of wood heating systems.

Reviewing the $CO_2$ emissions from the Commercial and Industrial Sectors in Clare an estimate of 2% reduction rate for 2010 and 4% for 2015 has been assumed based on large biomass or solar installations. The Clare Wood Project alone has indicated that the 6 sites identified could use 2,000 Tonnes of wood chip, or approximately 5.3 GWh. These projects alone would displace 1.5 kTonnes of $CO_2$ if replacing oil.

**Table 5.16: RES Heat Large Scale in Clare County**

| | Industry Sector | | | Commercial Sector | | | Total |
|---|---|---|---|---|---|---|---|
| | (000 Tonnes) | % Reduction | $CO_2$ Saved (000 Tonnes ) | (000 Tonnes ) | % Reduction | $CO_2$ Saved (000 Tonnes ) | $CO_2$ Saved (000 Tonnes ) |
| 2004 | 281.9 | 0% | 0 | 261.2 | 0% | 0.0 | 0.0 |
| 2005 | 267.9 | 0% | 0 | 294.7 | 0% | 0.0 | 0.0 |
| 2010 | 305.5 | 2% | 6.11 | 344.3 | 2% | 6.9 | 13.0 |
| 2015 | 321.9 | 4% | 12.876 | 356.1 | 4% | 14.2 | 27.1 |

#### 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 27% of TFC in Clare in 2004.

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 5.17: RES Heat from Small Renewables in Clare County**

| | 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 | 10 | 3,500 | 20,000 | 70 | 75 | 52.5 | 13.5 |
| 2015 | 15 | 5,250 | 20,000 | 105 | 75 | 78.8 | 20.2 |

#### 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) 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 - 200 kWe generation.

For this study no wood biomass CHP has been assumed to be 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 Clare County since 1990 as can be seen in the following Chart. In 2004 the Transport Sector accounted for 40% of TFC and 28% of emissions. If current trends continue it is expected that the Transport sector will increase TFC from 1552 GWh in 2004 to 2007 GWh in 2010 and further to 2181 GWh in 2015.

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 $CO_2$ Reduction Targets

The Limerick Clare Energy and Emissions Balance set Quantified Indicative Reduction Targets for $CO_2$ for Clare County for the Transport Sector. The estimated reduction that could be achieved in the relation to transport was in the region of 88 kTonnes of $CO_2$. The following table summarises the actual projected savings in terms of $CO_2$ that are projected to be achievable by 2010 and 2015. Details of how these can be achieved are provided in the following sections.

**Table 5.18 : Quantified Indicative Reductions for Clare County – Transport**

| Ref | Action | Quantified Indicative Reductions Proposed ('000 T-$CO_2$) | |
|---|---|---|---|
| | | 2010 | 2015 |
| 5.4.2.1 | Car Efficiency | 25.75 | 29.30 |
| 5.4.2.2 | Unnecessary Trips | 14.86 | 14.86 |
| 5.4.2.3 | Car Pooling | 2.29 | 2.29 |
| 5.4.2.4 | Hybrid Cars | 0.78 | 1.57 |
| 5.4.3.1 | Cycling | 4.70 | 4.70 |
| 5.4.3.2 | Bus | 0.75 | 0.75 |
| 5.4.4 | Green Fuels | 5.16 | 16.9 |
| Total | | 54.29 | 70.34 |

#### 5.4.1.2 $CO_2$ Reduction, Cost Benefit Analysis

The average cost for the abatement of $CO_2$ emissions, based on estimated investment costs, is approximately €129/Tonne $CO_2$ in Clare County 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 5.19: Indicative $CO_2$ Abatement Costs for Clare County - Transport**

| Transport | 2010 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | 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 $CO_2$) |
| Car Efficiency | 25.75 | - | - | 29.30 | - | - |
| Unnecessary Trips | 14.86 | - | - | 14.86 | - | - |
| Car Pooling | 2.29 | 1.00 | 436 | 2.29 | 1.00 | 436 |
| Hybrid Cars | 0.78 | - | - | 1.57 | - | - |
| Cycling | 4.70 | 1.00 | 213 | 4.70 | 1.00 | 213 |
| Bus | 0.75 | - | - | 0.75 | - | - |
| Green Fuels | 5.16 | 5.00 | 970 | 16.9 | 10.00 | 593 |
| Total | 54.29 | 7.00 | 129 | 70.34 | 12.00 | 171 |

#### 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 5.6 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.

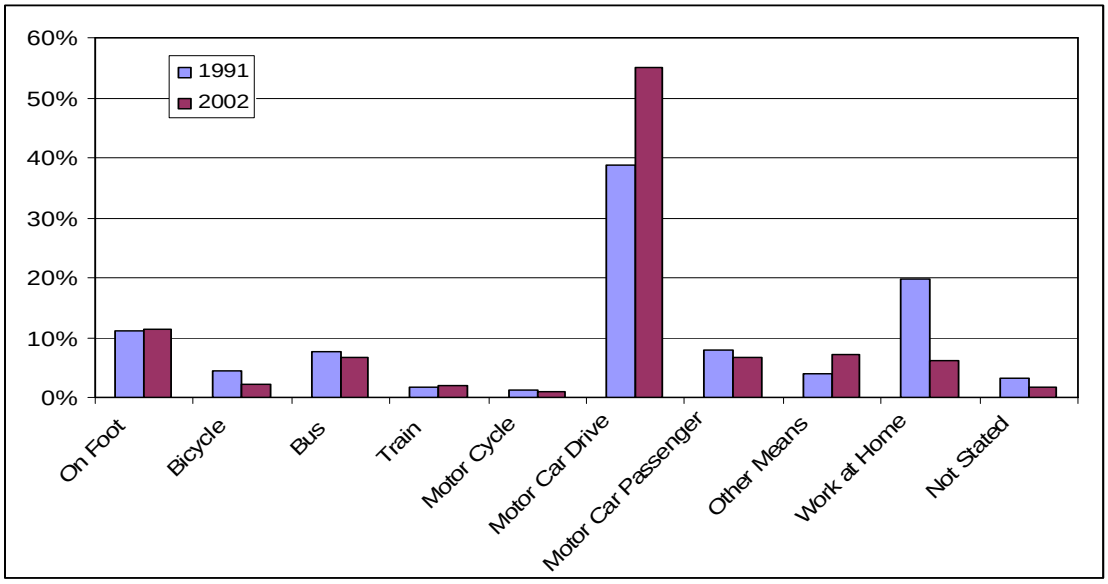


**Chart 5.6: Transport Means in County Clare, % Share in 1991 and 2002**.
*(Source: CSO, 2005)*

### 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 $CO_2$ 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 2015 GHG emissions as a result of technology improvements would drop by 15-40% compared to 2004 levels.

For Clare County 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 a energy efficiency is a key purchasing requirement for new vehicles.

**This would amount to a total $CO_2$ saving of 515 kTonnes $CO_2$ x 5% = 25.75 kTonnes in 2010.**

#### 5.4.2.2 Promotion to minimise unnecessary trips

Census 2002 showed that 34% of households in Clare County 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: 44,495 (2004 figures)
- Total no. of trips avoided: 3.6 trips x 44,495 vehicles = 160,182 trips
- Average trip distance: 8 km
- Total Km Avoided per week: 8 km x 160,182 trips ≈ 1,530,202 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). 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 Limerick between 2004 and 2010, 2015 a constant figure has been taken for annual reductions for 2010 and 2015. Achieving these savings would require significant promotion of the benefits both environmentally and economically of reducing the number of trips made.

**Table 5.20 : $CO_2$ Savings from Reducing Unnecessary Trips – Clare County**

| | Emissions g $CO_2$ /km | Km per Week Avoided | Emissions per annum ('000 T $CO_2$ ) |
|---|---|---|---|
| **Petrol (70%)** | 185.2 | 897,019 | 8.64 |
| **Diesel (30%)** | 139.8 | 384,437 | 2.79 |
| **Total** | | 1,281,456 | 11.43 |

#### 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 $CO_2$ savings for the introduction of car pooling can be developed

- In 2005 there were over 15,000 people working in the industrial sector in Clare County.
- 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 2015) a constant figure has been assumed for both years.

**Table 5.21: $CO_2$ Savings as a result of Car Pooling Initiatives – Clare County**

| | No Employees | Average Annual Trip/person (Km) | Total Trip Length (000 Km) | %Car Pooling | Car Pooling Travel Avoided (Km) | $CO_2$ Avoided ('000 T $_{CO2}$) |
|---|---|---|---|---|---|---|
| **Industry** | 15,452 | 3,080 | 47,592 | 20% | 9,518,432 | 1.63 |
| **Commercial** | 25,561 | 3,080 | 78,727 | 20% | 15,745,576 | 0.66 |
| | | | | | | |
| **Total** | 41,013 | 6,160 | 126,320 | 20% | 25,264,008 | 2.29 |

#### 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 g $CO_2$ /km, providing a saving of 85 g/$CO_2$ 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.

**Table 5.22 : $CO_2$ Savings as a result of Hybrid/Super Efficient Cars**

| | Total Cars | Market Share % | Total Hybrid Cars | $CO_2$ Savings g $CO_2$/ Km) | Average Annual Trip Km | CO2 Savings '000 T $CO_2$ |
|---|---|---|---|---|---|---|
| **2010** | 44,495 | 0.01 | 444 | 85.2 | 16,000 | 0.61 |
| **2015** | 44,495 | 0.02 | 889 | 85.2 | 16,000 | 1.21 |

### 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 Clare County the breakdown of those analysed in terms of final destination is follows:

**Table 5.23 : Total No. of People by Travel Destination**

*Source (CSO, 2002)*

| Category | Total |
|---|---|
| Work | 42,238 |
| School – 4-12 years | 12,073 |
| School – 13-18 years | 8,773 |
| College - >19 years | 2,646 |

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 25% of students (2,740 primary and 2,098 secondary respondents) travelled to school by bicycle or on foot in Clare County. The percentage of use of these modes for the work category was significantly lower at 10% (4,440 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 $CO_2$ 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 5.24: $CO_2$ Savings from Modal Shift to Bicycle/Walking – Clare County**

| Category | Total People | Current Cycle/ Walk (people) | Current Share (%) | New Share (%) | New Cycle / Walk (people) | $CO_2$ Avoided (T $CO_2$ ) |
|---|---|---|---|---|---|---|
| **Work** | 42,238 | 4,440 | 11% | 17% | 7,000 | |
| **School: 4-12 yrs** | 12,073 | 2740 | 23% | 33% | 4,000 | |
| **School: 13-18 yrs** | 8,773 | 2098 | 24% | 34% | 3,000 | |
| **College: >19 yrs** | 2,646 | 1022 | 39% | 38% | 1,000 | |
| **Total** | **65,730** | **10,300** | | **23%** | **15,000** | **4,700** |

#### 5.4.3.2 Public Transport - Buses

Currently in Clare County 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 2% while the use of buses for secondary schools is high at 40%. The figure for primary schools is comparatively lower at 12%.

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 5.25: $CO_2$ Savings from Modal Shift to Bus – Clare County**

| Category | Total People | Current Bus (people) | Current Share (%) | New Share (%) | New Bus (people) | $CO_2$ Avoided (T $CO_2$ ) |
|---|---|---|---|---|---|---|
| **Work** | 42,238 | 794 | 2% | 4% | 1,800 | |
| **School: 4-12 yrs** | 12,073 | 1,501 | 12% | 25% | 3,000 | |
| **School: 13-18 yrs** | 8,773 | 3,514 | 40% | 40% | 3,500 | |
| **College: >19 yrs** | 2,646 | 505 | 19% | 19% | 500 | |
| **Total** | 65,730 | 6,314 | 10% | 13% | 8,800 | 2,486[7] |

[7] Based on move from car to bus. Emissions per km for car assumed at 155 g $CO_2$ /km (average of petrol and diesel) and for bus 55 g $CO_2$ /km

#### 5.4.3.3 Public Transport - Rail

The use of rail for the main transport destinations in Clare County is negligible (approximately 25 respondents in total noted it as a means of transport). The potential for significant change by 2010 is limited given the current rail network links. The Transport 21 Strategy (DoEHLG, 2005) plans the expansion of the rail network between Ennis and Athenry by 2008, eventually continuing to Claremorris.

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

#### 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 5.75% of transport fuels to be supplied by liquid biofuels by 2010. 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 Clare County if the 2% and 5.75% targets were to be achieved are shown in the following Table. Currently the estimated energy consumption for the transport sector is 1,578 GWh which equates to approximately 211 Million Litres of transport fuels. The 2% target in 2010 would require the production and use of 5.4 Million Litres of liquid biofuels in Clare County (generally equally split between ethanol and biodiesel). The more ambitious 5.75% target would raise this to a figure to 15.5 Million Litres.

Given that there is no current production in Clare County 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. A development in the Shannon region by Capway Bioenergy could make a significant impact in the region.

Assuming the 2% target were to be achieved by 2010 this would result in $CO_2$ as liquid biofuels can result in 50% savings in emissions. This would equate to a $CO_2$ saving of approximately 5.2 kTonnes $CO_2$ per annum in 2010.

**Table 5.26 : Liquid Bio fuels Requirements - Clare County**

| Bio fuels | GWh | | | M Litres | | |
|---|---|---|---|---|---|---|
| | 2005 | 2010 | 2015 | 2005 | 2010 | 2015 |
| **Current** | 1,578.1 | 2,007.4 | 2,181.2 | 211.5 | 269.1 | 292.4 |
| **Petrol** | 631.2 | 803.0 | 872.5 | 105.9 | 134.7 | 146.4 |
| **Diesel** | 946.9 | 1,204.4 | 1,308.7 | 105.7 | 134.4 | 146.0 |
| | | | | | | |
| **2% Bio fuels** | 31.6 | 40.1 | 43.6 | 4.2 | 5.4 | 5.8 |
| **Ethanol** | 12.6 | 16.1 | 17.4 | 2.1 | 2.7 | 2.9 |
| **Bio diesel** | 18.9 | 24.1 | 26.2 | 2.1 | 2.7 | 2.9 |
| | | | | | | |
| **5.75% Bio fuels** | 90.7 | 115.4 | 125.4 | 12.2 | 15.5 | 16.8 |
| **Ethanol** | 36.3 | 46.2 | 50.2 | 6.1 | 7.7 | 8.4 |
| **Bio diesel** | 54.4 | 69.3 | 75.3 | 6.1 | 7.7 | 8.4 |

**Table 5.27 : $CO_2$ Savings from the use of Biofuels - Clare County**

| $CO_2$ Savings | 2005 | 2010 | 2015 |
|---|---|---|---|
| **Current** (000 T $CO_2$ ) | 410.4 | 515.6 | 586.5 |
| **2% Target** ('000 T $CO_2$ ) | 4.1 | 5.2 | 5.9 |
| **5.75% Target** (000 T $CO_2$ ) | 11.8 | 14.8 | 16.9 |

## 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 $CO_2$ 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 23% of TFC in Clare County in 2005 and 26% of $CO_2$ emissions.

### 5.5.2 $CO_2$ Reduction Targets

The Limerick Clare Energy and Emissions Balance set Quantified Indicative Reduction Targets for $CO_2$ for Clare County for the Built Environment Sector. The estimated reduction that could be achieved in the relation to the Built Environment was in the region of 30 kTonnes of $CO_2$. The following table summarises the actual savings in terms of $CO_2$ that are projected to be achievable by 2010 and 2015. Details of how these can be achieved are provided in the following sections.

**Table 5.28 : Quantified Indicative Reductions for Clare County – Built Environment**

| Ref | Action | 2010 '000 T-$CO_2$ | 2015 '000 T-$CO_2$ |
|---|---|---|---|
| **Residential** | Part L | 19.7 | 31.7 |
| 5.5.5.3 | EPBD New | 1.0 | 1.6 |
| 5.5.5.3 | EPBD Existing | 3.1 | 3.5 |
| 5.5.7.1 | Awareness | 3.3 | 3.4 |
| 5.5.7.2 | Social Housing Upgrades | 0.3 | 0.3 |
| 5.5.7.2 | LA New Housing | 0.1 | 0.2 |
| *Residential Sub Total* | | *31.1* | *44.5* |
| **Commercial / Public** | Part L | 2.6 | 2.7 |
| 5.5.5.4 | EPBD | 1.3 | 1.4 |
| 5.5.6.1 | Monitoring and Targeting | 1.0 | 1.0 |
| 5.5.6.2 | Awareness and Training | 0.5 | 0.5 |
| 5.5.6.3 | Surveys and Audits | 1.5 | 1.5 |
| *Commercial / Public Sub Total* | | 7.3 | 7.4 |
| ***Grand Total*** | | ***38.4*** | ***51.9*** |

### 5.5.3 $CO_2$ Reduction, Cost Benefit Analysis

The average cost for the abatement of $CO_2$ emissions, based on estimated investment costs, is approximately €662/Tonne $CO_2$ in Clare County 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 5.29: Indicative $CO_2$ Abatement Costs for Clare County – Built Environment**

| Built Environment | 2010 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | QIR Proposed '000 T-$CO_2$ | Indicative Cost (€ million) | Indicative Abatement Cost per Tonne $CO_2$ (€ / T-$CO_2$) | QIR Proposed '000 T-$CO_2$ | Indicative Cost (€ million) | Indicative Abatement Cost per Tonne $CO_2$ (€ / T -$CO_2$) |
| **Residential** | | | | | | |
| Part L | 19.67 | 10 | 509 | 31.67 | 15 | 474 |
| EPBD New | 0.98 | 0.8 | 814 | 1.58 | 1.6 | 1,011 |
| EPBD Existing | 3.06 | 0.6 | 196 | 3.54 | 3 | 848 |
| Awareness | 3.29 | 1 | 304 | 3.42 | 1 | 293 |
| 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 |
| *Sub Total* | *31.07* | *12.7* | *409* | *44.50* | *20.9* | *470* |
| **Commercial** | | | | | | |
| Part L | 2.59 | 3 | 1,157 | 2.73 | 3 | 1,099 |
| EPBD | 1.30 | 1 | 772 | 1.37 | 1 | 733 |
| 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 |
| *Sub Total* | *7.30* | *8.5* | *1.165* | 7.37 | *8.5* | *1.154* |
| **Grand Total** | **38.37** | **12.7** | **662** | **51.86** | **20.9** | **806** |

### 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.

#### 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
- Jan 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 5.30: $CO_2$ Reductions due to Regulations – Clare County**

| Activity | 2010 '000 T-$CO_2$ | 2015 '000 T-$CO_2$ |
|---|---|---|
| Residential | | |
| Part L | 19.7 | 31.7 |
| EPBD New | 1.0 | 1.6 |
| EPBD Existing | 3.1 | 3.5 |
| Commercial/Public | | |
| Part L | 2.6 | 2.7 |
| EPBD | 1.3 | 1.4 |
| **Total** | **27.6** | **40.9** |

#### 5.5.5.1 Irish Building Regulations – Part L – Residential Sector

From 2002 to 2004 and average of 1,600 new houses were built in Clare County per annum. Assuming a similar trend going forward a total of 13,110 new houses will have been built under the new Part L regulations by 2010. This will have increased to 21,110 by 2015. This will result in the following $CO_2$ savings

- **By 2010: 19.7 kTonnes $CO_2$**
- **By 2015: 31.7 kTonnes $CO_2$**

#### 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 2015 figures from the Energy and Emissions Balance the savings would be

- **By 2010: 2.6 kTonnes $CO_2$**
- **By 2015: 2.7 kTonnes $CO_2$**

#### 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 $CO_2$ 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 $CO_2$ 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: 1.3 kTonnes $CO_2$**
- **By 2015: 1.3 kTonnes $CO_2$**

### 5.5.6 Public/Commercial Sector Built Environment

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

**Table5.31: $CO_2$ Reductions Public/Commercial Sector Built Environment – Clare County**

| Activity | 2010 '000 T-$CO_2$ | 2015 '000 T-$CO_2$ |
|---|---|---|
| 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

Clare County 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 the LCEA indicate that savings of 1,000 Tonnes $CO_2$ 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 LCEA is a key resource to achieve this in Clare County. **The LCEA has estimated that savings in the region of 500 Tonnes $CO_2$ 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 $CO_2$ 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 $CO_2$ emissions estimated savings would be

- **By 2010: 3.3 kTonnes $CO_2$ per annum**
- **By 2015: 3.4 kTonnes $CO_2$ per annum**

#### 5.5.7.2 Local Authority/Social Housing

The LCEA and Local Authorities can take specific action in relation to social housing, both in new build and refurbishment. An average of 75 new social houses were built per annum in Clare County since 2000. Between 2005 and 2010 the Local Authority and LCEA 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 Clare County.

## 5.6 Industry and Commercial Sectors

### 5.6.1 Introduction

The Industrial Sector accounted for 18.4% of energy related $CO_2$ emissions in Clare County in 2005 which equates to 227.3 kTonnes $CO_2$ per annum. This figure is not expected to increase going forward. This is in line with National trends with regard to $CO_2$ emissions.

The Commercial Sector accounted for a similar percentage of emissions in 2005 (20%) but the overall levels of emissions from this sector is projected to increase going forward to 2010 and 2015. The total emissions from the sector are expected to increase from 250 to 300 kTonnes $CO_2$ between 2005 and 2015.

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 $CO_2$ Reduction Targets

The Limerick Clare Energy and Emissions Balance set Quantified Indicative Reduction Targets for $CO_2$ for Clare County for the Industrial/Commercial Sector. The estimated reduction that could be achieved was in the region of 72 kTonnes of $CO_2$. The following table summarises the actual savings in terms of $CO_2$ that are projected to be achievable by 2010 and 2015. Details of how these can be achieved are provided in the following sections.

**Table 5.32: Quantified Indicative Reductions for Clare County – Industry and Commercial Services**

| Ref | Sector | Action | 2010 | 2015 |
|---|---|---|---|---|
| 5.6.2.1 | Industry | LIEN | 9.1 | 9.6 |
| 5.6.2.3 | | Monitoring, Targeting and Surveys | 5.2 | 5.5 |
| 5.6.2.4 | | Awareness | 5.2 | 5.5 |
| 5.6.2.5 | | Green Supply | 13.0 | 13.7 |
| *Sub Total* | | | *32.4* | *34.1* |
| | | | | |
| | Commercial | Energy Efficiency | 2.9 | 3.0 |
| 5.6.3.1 | | Monitoring, Targeting and Surveys | 5.8 | 6.0 |
| 5.6.3.2 | | Awareness | 5.8 | 6.0 |
| *Sub Total* | | | *14.6* | *15.1* |
| **Total** | | | 47.0 | 49.2 |

#### 5.6.1.2 $CO_2$ Reduction, Cost Benefit Analysis

The average cost for the abatement of $CO_2$ emissions, based on estimated investment costs, is approximately €662/Tonne $CO_2$ in Clare County. The data presents the estimated capital investment costs. There are additional costs related to support programmes which could also be accounted for.

**Table 5.33: Indicative $CO_2$ Abatement Costs for Clare County – Industry and Commercial Services**

| Industry & Commercial | 2010 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | 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 | 9.1 | 1 | 110 | 9.6 | 1 | 104 |
| Monitoring, Targeting and Surveys | 5.2 | 2 | 385 | 5.5 | 2 | 366 |
| Awareness | 5.2 | 1 | 192 | 5.5 | 1 | 183 |
| Green Supply | 13.0 | 0 | - | 13.7 | 0 | - |
| *Sub Total* | *32.4* | 4 | | *34.1* | 4 | |
| **Commercial** | | | | | | |
| Energy Efficiency | 2.9 | 1 | 342 | 3.0 | 1 | 331 |
| Monitoring, Targeting and Surveys | 5.8 | 1 | 171 | 6.0 | 1 | 165 |
| Awareness | 5.8 | 1 | 171 | 6.0 | 1 | 165 |
| *Sub Total* | *14.6* | 3 | | *15.1* | 3 | |
| **Total** | 47.0 | 7 | 148 | 49.2 | 7 | 142 |

#### 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.

In 2004 LIEN members accounted for over 50% of industry related $CO_2$ emissions nationally. The Network reported that in 2004 that actions taken by members resulted in

$CO_2$ 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: 9.1 kTonnes $CO_2$ per annum**
- **By 2015: 9.6 kTonnes $CO_2$ 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 Clare 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 Clare County. 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: 5.2 kTonnes $CO_2$ per annum**
- **By 2015: 5.5 kTonnes $CO_2$ 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 $CO_2$ savings based on a 2% reduction

- **By 2010: 5.2 kTonnes $CO_2$ per annum**
- **By 2015: 5.5 kTonnes $CO_2$ per annum**

#### 5.6.2.5 Green Electricity Usage

An effective low cost measure to reduce emissions in Clare County 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 10% 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: 13.0 kTonnes $CO_2$ per annum**
- **By 2015: 13.5 kTonnes $CO_2$ 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 $CO_2$ 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: 5.8 kTonnes $CO_2$ per annum**
- **By 2015: 6.0 kTonnes $CO_2$ 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 $CO_2$ savings

- **By 2010: 5.8 kTonnes $CO_2$ per annum**
- **By 2015: 6.0 kTonnes $CO_2$ per annum**

## 5.7 Agriculture and Forestry

### 5.7.1 Introduction

The Agriculture sector accounts for the smallest energy consumption and $CO_2$ emissions in Clare County (4.5% of TFC and 3% of energy related $CO_2$ emissions in 2004). 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.

The Forestry sector is included with the Agricultural Sector within this report as both these areas provide specific opportunities for the $CO_2$ 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 Clare had total farm land in the region of 210,000 hectares. Clare has total area of 43,694Ha under forestry in 2000 (Dept of Agriculture 2001). This equates to approximately 14% of the land area which is above the National Average of 9.9% (Clare CDB, 2001). 47% of this forestry is Privately owned with the balance 53% in public ownership.

#### 5.7.1.2 $CO_2$ Reduction Targets

The Limerick Clare Energy and Emissions Balance set Quantified Indicative Reduction Targets for $CO_2$ for Clare County 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 80 kTonnes of $CO_2$. The following table summarises the actual savings in terms of $CO_2$ that are projected to be achievable by 2010 and 2015. Details of how these can be achieved are provided in the following sections.

**Table 5.34: Quantified Indicative Reductions for Clare County – Agriculture**

| Ref | Sector | Action | 2010 | 2015 |
|---|---|---|---|---|
| 5.7.2.1 | Agriculture | Liquid Biofuels | - | - |
| 5.7.2.5 | | Miscanthus | 1.8 | 6.3 |
| 5.7.2.3 | | Anaerobic Digestion (AD) | 1.0 | 2.4 |
| 5.7.4 | | Tractors Efficiency Scheme | 1.9 | 1.9 |
| | | | | |
| 5.7.3.6 | Forestry | Wood Energy | 7.3 | 11.6 |
| | | | | |
| **Total** | | | 12.0 | 22.2 |

#### 5.7.1.3 $CO_2$ Reduction, Cost Benefit Analysis

The average cost for the abatement of $CO_2$ emissions, based on estimated investment costs, is approximately €550/Tonne $CO_2$ in Clare County 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 5.35: Indicative $CO_2$ Abatement Costs for Clare County – Agriculture**

| Agriculture and Forestry | 2010 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | QIR Proposed '000 T-$CO_2$ | Indicative Cost € million | Indicative Abatement Cost per Tonne $CO_2$ € / $TCO_2$ | QIR Proposed '000 T-$CO_2$ | Indicative Cost € million | Indicative Abatement Cost per Tonne $CO_2$ € / T $CO_2$ |
| **Agriculture** | | | | | | |
| Liquid Biofuels | - | 0.0 | - | - | 0.0 | - |
| Miscanthus | 1.80 | 0.1 | 56 | 6.31 | 0.25 | 40 |
| AD | 1.00 | 1.0 | 1,000 | 2.40 | 1.0 | 417 |
| Tractor Efficiency Scheme | 1.88 | 0.5 | 267 | 1.88 | 0.5 | 267 |
| | | | | | | |
| **Forestry** | | | | | | |
| Wood Energy | 7.33 | 5.0 | 682 | 11.62 | 5.0 | 430 |
| | | | | | | |
| **Total** | | 6.6 | 550 | 22.20 | 6.75 | 304 |

## 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 Clare 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 Clare County will be small. There is potential for raw materials to be exported to producers in other surrounding counties for production however.

### 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 40 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 0.2MW by 2010 and 0.5MW by 2015.

#### 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 3142 GWh/yr could be developed in Clare County by 2000. The feasible resource is reduced by 25% and a further 70% reduction is applied to reach the technical resource i.e. 700 GWh/yr. The land in Clare County was rated as moderate to good for planting of SRC.

However, given that no SRC plantations have been developed in the County and the lack of supports at present it is unlikely that significant impacts will be made from this crop in the near immediate future i.e. before 2015. This is particularly true given the fact that it takes 4 years before an energy crop is harvested.

#### 5.7.3.5 Energy Crops – Miscanthus

Within the Clare/Limerick Region Miscanthus is the energy crop which has received the most attention in the past 24 months. Local growers in Limerick provide an excellent opportunity for farmers in Clare County 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 100ha of the crop could be planted by 2010. With yields in the region of 22 Tonnes per ha (Leahy, 2006) an energy yield of 6,600 MWh could be available, which if used to displace oil could result in $CO_2$ savings of 2 kT $CO_2$ per annum

#### 5.7.3.6 Forestry – Residues and Thinnings

Clare Countys' 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 Clare County. 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.

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. 26 GWh/yr. This, if used to replace oil would result in $CO_2$ savings of 7 kTonnes per annum. With increased planting expected by 2015 the amount of thinnings available will also increase.

### 5.7.4 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 3,000 tractors in Clare County (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 $CO_2$ per tractor per year could be achieved. Assuming a 25% implementation rate in Clare County this could result in savings of 1.9 kTonnes $CO_2$ 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 in Clare County.

## 5.8 Waste

### 5.8.1 Introduction

The waste sector presents a number of opportunities for energy reduction and also $CO_2$ savings. A particular focus has been placed on the production of Land Fill Gas within this report. Additional savings, through monitoring and targeting within specific sites and buildings within the local authority buildings have been accounted for already in appropriate sections.

#### 5.8.1.1 $CO_2$ Reduction Targets

The Limerick Clare Energy and Emissions Balance set Quantified Indicative Reduction Targets for $CO_2$ for Clare County for the Waste Sector. The estimated reduction that could be achieved in the relation to energy production and supply was in the region of 28 kTonnes of $CO_2$. The following table summarises the actual savings in terms of $CO_2$ that are projected to be achievable by 2010 and 2015. Details of how these can be achieved are provided in the following sections.

**Table 5.36: Quantified Indicative Reductions for Clare County – Waste**

| Ref | Action | 2010 | 2015 |
|---|---|---|---|
| | Land Fill Gas | 5.7 | 5.7 |
| **Total** | | 5.7 | 5.7 |

#### 5.8.1.2 $CO_2$ Reduction, Cost Benefit Analysis

The average cost for the abatement of $CO_2$ emissions, based on estimated investment costs, is approximately €550/Tonne $CO_2$ in Clare County for the Waste Sector. The data presents the estimated capital investment costs. There are additional costs related to support programmes which could also be accounted for.

**Table 5.37: Indicative $CO_2$ Abatement Costs for Clare County – Waste**

| Waste | 2010 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | QIR Proposed | Indicative Cost | Indicative Abatement Cost per Tonne $CO_2$ | QIR Proposed | Indicative Cost | Indicative Abatement Cost per Tonne $CO_2$ |
| | '000 T-$CO_2$ | € million | € / $TCO_2$ | '000 T-$CO_2$ | € million | € /T $CO_2$ |
| Land Fill Gas | 5.36 | 1.0 | 183 | 5.36 | 0 | 0 |

### 5.8.2 Legislation / Regulation

The legislation and regulation related to the Waste sector is significant and details and information are available in the relevant Regional Waste Management Plan which covers Clare County.

### 5.8.3 Landfill Gas

The landfill at Inagh, Clare County has the potential for the development of a CHP plant based on Land Fill Gas. It has been estimated that this would have a capacity in the region of 1 MWe. This would result in $CO_2$ savings of 5.4 kTonnes per annum assuming it is displacing electricity from the current electricity mix.

## 5.9 Conclusions

### 5.9.1 Individual Responsibility

The Limerick Clare Energy and Emissions Balance calculated indicators for reductions which would be require per person to achieve the Kyoto Target. This 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 5.38: Individual Responsibility – Clare County**

| Indicator | 1990 | Kyoto Target (1990 + 13%) | 2004 | 2010 | Reduction Required To Reach Kyoto Target | Reduction Achieved through Standard Measures |
|---|---|---|---|---|---|---|
| **Population** (000) | 91.0 | - | 105.0 | 112.7 | | |
| **TFC** (GWh) | 2256.2 | - | 3,806.3 | 4504.6 | | |
| **Energy Related Emissions** ('000 T-$CO_2$ ) | 828.3 | 936.0 | 1,186.1 | 1425.6 | 489 | 365 |
| **TFC/Capita** (kWh/Person) | 24,796.4 | - | 36,236.4 | 39,984.0 | | |
| **CO2 Emissions / Capita** (T $CO_2$/Person) | 9.1 | 9.1 | 11.3 | 12.7 | 4.7 | 3.5 |

### 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 5.39 : Carbon Levies in County Clare (Business as Usual and with Standard Measures)**

| **Carbon Levy** (€ / Tonne $CO_2$) | 2010 | 2015 |
|---|---|---|
| | € 35.00 | € 45.00 |
| **Levy BAU** (€ ) | € 17,100,000 | € 26,800,000 |
| **Levy Standard Measures** (€ ) | € 4,500,000 | € 4,200,000 |

# 6.0 Limerick County

## 6.1 Introduction

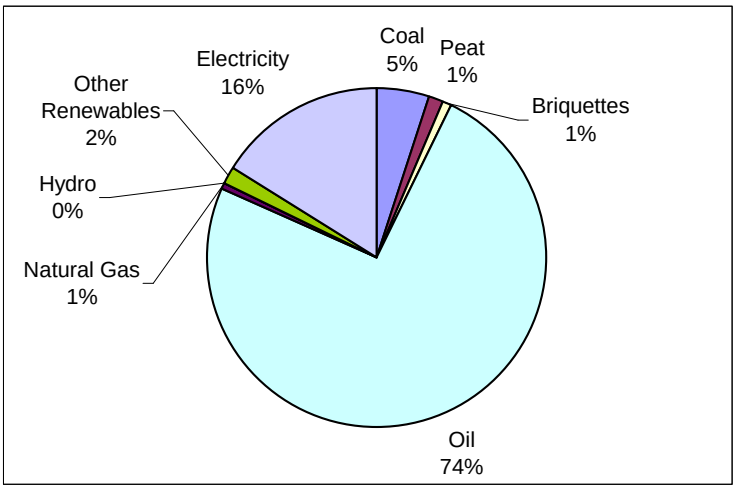


**Chart 6.1: Total Final Consumption by Fuel, Limerick County, 2004**

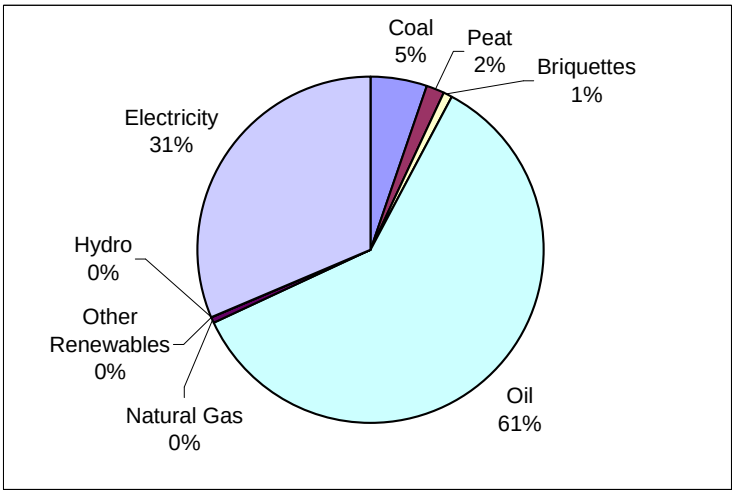


**Chart 6.2: $CO_2$ Emissions by Fuel, Limerick County, 2004**

Oil is the dominant fuel in Limerick County at present (74% of Total Final Consumption in Limerick County in 2004) and also is the highest contributor in terms of $CO_2$ 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 2004, has the highest consumption in energy terms in the County, at 41%. It also currently accounts of 33% of $CO_2$ emissions. The Residential Sector is the next highest contributor in terms of emissions, at 26%, while it consumes 23% of TFC in the County.

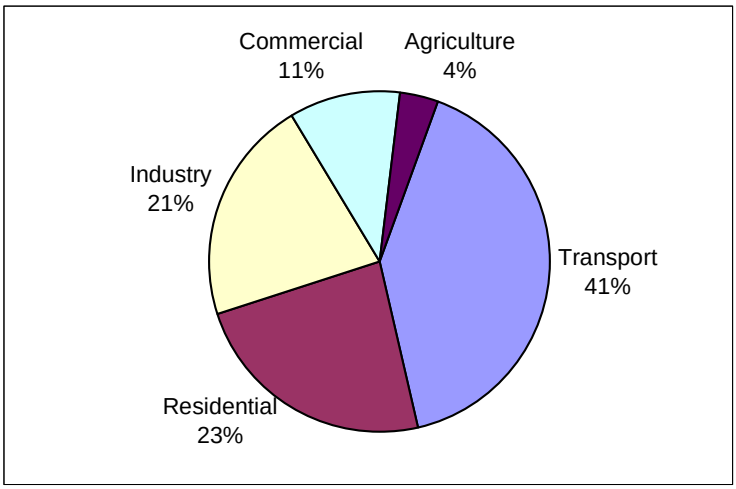


**Chart 6.3: Total Final Consumption by Sector, Limerick County, 2004**

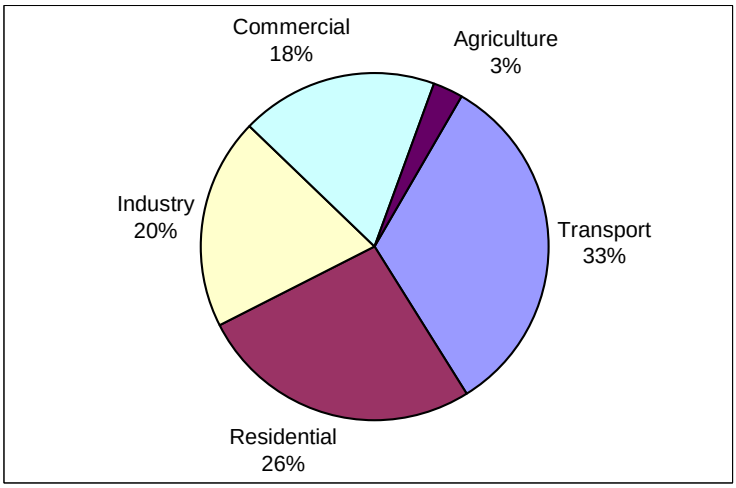


**Chart 6.4: $CO_2$ Emissions by Sector, Limerick County, 2004**

The data from the Energy Balance, combined with other information, was used to developed Quantified Indicative Reductions (QIRs) for $CO_2$ savings for Limerick County. These were generally apportioned to the following areas.

**Table 6.1: Quantified Indicative Reductions, Limerick County**

| **Overall QIRS by sector** | **Quantified Indicative Reductions Proposed** ('000 T-$CO_2$) |
|---|---|
| Energy Production & Supply | 215 |
| Transport | 100 |
| Built Environment & Residential | 40 |
| Industry, Commercial, & Services | 83 |
| Agriculture | 92 |
| Waste | 32 |
| Sinks (Land Use Change & Forestation) | 29 |
| Total | 590 |

## 6.2 Summary of Actions

**Table 6.2: Summary of $CO_2$ Reductions, Investment Cost and Abatement Cost – Limerick County**

| Ref | Sector | $CO_2$ Reduction (000 Tonnes) | | Investment Cost (€m) | | Indicative Abatement Cost (€/Tonne) | |
|---|---|---|---|---|---|---|---|
| | | **2010** | **2015** | **2010** | **2015** | **2010** | **2015** |
| 6.3 | Energy Prod & Supply | 255.3 | 353.7 | 154.4 | 257.3 | 605 | 728 |
| 6.4 | Transport | 58.2 | 76.9 | 7.0 | 12.0 | 120 | 156 |
| 6.5 | Built Environment | 35.5 | 45.5 | 21.0 | 34.6 | 592 | 761 |
| 6.6 | Ind and Comm Services | 55.4 | 58.0 | 7.0 | 7.0 | 126 | 121 |
| 6.7 | Agriculture | 16.1 | 29.4 | 6.6 | 6.8 | 411 | 230 |
| 6.8 | Waste | 19.3 | 19.3 | 4.0 | 0.1 | 207 | - |
| | **Total** | **439.7** | **582.8** | **200.0** | **317.8** | **455** | **545** |
| | Target | 562 | 688 | | | | |
| | Gap to Target | 122.3 | 105.2 | | | | |

Table 6.2 summaries the data and results from the different sectors which were reviewed in Limerick County. 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 €500 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, Limerick County, (1990 – 2015)**

| GWh | 1990 | 1995 | 2000 | 2002 | 2004 | 2005 est | BAU 2010 | BAU 2015 |
|---|---|---|---|---|---|---|---|---|
| **Coal** | 304.5 | 137.5 | 199.7 | 196.4 | 221.0 | 200.2 | 122.2 | 95.6 |
| **Peat** | 201.7 | 170.0 | 62.2 | 61.6 | 64.2 | 58.9 | 38.2 | 25.3 |
| **Briquettes** | 58.6 | 43.7 | 42.8 | 39.9 | 32.5 | 29.8 | 19.3 | 12.8 |
| **Oil** | 1727.7 | 2133.7 | 2998.2 | 3194.2 | 3335.1 | 3450.7 | 4106.4 | 4553.9 |
| **Natural Gas** | 0.0 | 0.0 | 8.3 | 18.4 | 22.9 | 26.2 | 34.2 | 40.8 |
| **Hydro** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Other RES** | 40.6 | 48.1 | 57.2 | 65.4 | 80.9 | 80.7 | 79.5 | 78.3 |
| **Electricity** | 377.8 | 471.8 | 639.6 | 708.6 | 717.3 | 743.8 | 892.0 | 932.8 |
| **TFC** | 2710.9 | 3004.8 | 4007.9 | 4284.4 | 4474.0 | 4590.2 | 5291.7 | 5739.5 |

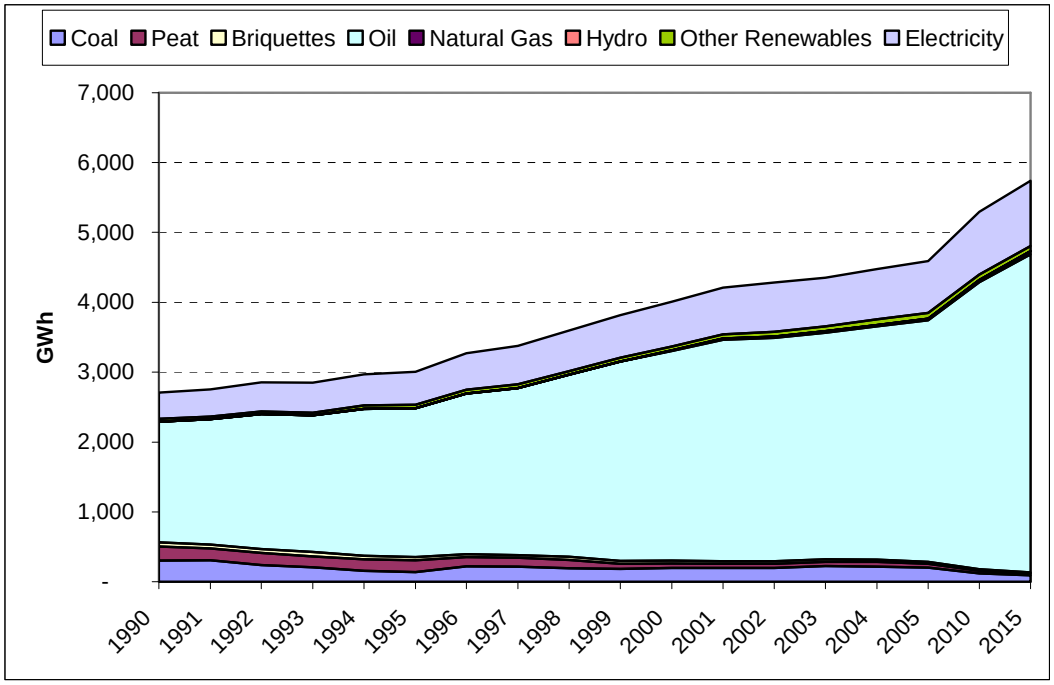


**Chart 6.5: Total Final Consumption by Fuel, Limerick County, (1990 – 2015)**

#### 6.3.1.1 $CO_2$ Reduction Targets

The targeted reductions under the Energy Production and Supply sector in the LCEA Energy Balance were 215 kTonnes $CO_2$. The analysis presented below indicates that based on ordinary measures savings of 274 kTonnes $CO_2$ are achievable.

**Table 6.4: Quantified Indicative Reductions for Limerick County – Energy Production and Supply**

| Ref | Energy Production and Supply | Quantified Indicative Reductions Proposed ('000 T-$CO_2$) | |
|---|---|---|---|
| | | **2010** | **2015** |
| **Fossil Fuel** | | | |
| 6.3.2.2 | Fuel switching | 20.7 | 16.1 |
| 6.3.2.3 | Combined Heat & Power | 9.5 | 9.3 |
| **Renewable Energy** | | | |
| 6.3.3.1 | Large Scale Wind Power | 206.6 | 252.4 |
| 6.3.3.2 | Hydro Power Schemes | 1.7 | 1.7 |
| 6.3.3.3 | Tidal/Wave | 2.2 | 49.4 |
| 6.3.3.4 | Large PV | - | 2.9 |
| 6.3.3.5 | Small Scale RE Elec | 0.2 | 0.2 |
| 6.3.3.6 | Large RE Thermal | 19.2 | 41.4 |
| 6.3.3.7 | Small RE Heat | 14.7 | 22.0 |
| Total | | 274.5 | 395.0 |

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 $CO_2$ 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 study region 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 2015.

Significant investment in the large scale wind sector will result in an average cost of €420 per tonne of $CO_2$ avoided. On average the cost per tonne of $CO_2$ saved for all actions under the Energy Production and Supply Sector has been estimated to be €562. There are additional costs related to support programmes which could also be accounted for.

**Table 6.5: Indicative $CO_2$ Abatement Costs for Limerick County – Energy Production and Supply**

| | 2010 | | | 2015 | | |
|---|---|---|---|---|---|---|
| **Energy Production and Supply** | **QIR Proposed** ('000 T-$CO_2$) | **Indicative Cost** (€m) | **Indicative Abatement Cost per Tonne $CO_2$** (€/T$CO_2$) | **QIR Proposed** ('000 T-$CO_2$) | **Indicative Cost** (€m) | **Indicative Abatement Cost per Tonne $CO_2$** (€/T $CO_2$) |
| **Fossil Fuel** | | | | | | |
| Fuel switching | 20.7 | 0 | - | 16.1 | 0 | - |
| CHP | 9.3 | 5 | 535 | 9.3 | 2 | 214 |
| **Renewable Energy** | | | | | | |
| Large Scale Wind | 206.6 | 95 | 460 | 252.0 | 115 | 456 |
| Hydro Power | 1.7 | 0.5 | 290 | 1.7 | 0 | - |
| Tidal/Wave | 2.2 | 10 | 4,552 | 49.4 | 100 | 2,023 |
| Large PV | - | 0 | - | 2.9 | 10 | 3,445 |
| Small Scale RE E | 0.2 | 1.9 | 10,753 | 0.2 | 5.32 | 30,108 |
| Large RE Thermal | 19.2 | 4 | 208 | 41.4 | 6 | 145 |
| Small RE Thermal | 14.7 | 38 | 2,594 | 22.0 | 19 | 865 |
| **Total** | **274.5** | **154.4** | **562** | **395.0** | **257.32** | **651** |

#### 6.3.1.3 Renewable Energy Supply Targets

The targets for Limerick County 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 Limerick County in 2005 was estimated to be 4590 GWh. The TPER for the County has been estimated by taking the National ratio of TFC to TPER, which in 2004 was 78.7%.[8]

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 Clare County.

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

[8] National TPER in 2004 = 15,008 kToe, National TFC in 2004 = 11,813 kToe.

the requirements of the Directive. To reach the 12% TPER Target a total of 807 GWh of renewable energy should be generated by 2010.

**Table 6.6: Renewable Energy Targets for Limerick County**

| | National 2004 | National 2010 | Limerick County 2004 | Limerick County 2010 |
|---|---|---|---|---|
| TPER (GWh) | 175,543 | 214,104 | 5,833 | 6,724 |
| 12% Target (GWh) | 21,065 | 25,692 | 700 | 807 |
| | | | | |
| Current RES (MWe) | 737 | 1,450 | 23 | 45 |

### 6.3.2 Fossil Fuel Energy

#### 6.3.2.1 Electricity Generation

Unlike in Clare there are no large scale, fossil fuel based, electricity generation plan 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 Limerick County 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 $CO_2$ 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.

##### 6.3.2.2.1 Switching to Natural Gas

Similar barriers arise in Limerick County with restricted access to the Natural Gas grid. 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 83.9 GWh in 2004 to 109.7 GWh per annum in 2010, displaces the use of oil as a fuel this would result in annual $CO_2$ emissions savings of as outlined in the following table.

**Table 6.7 : $CO_2$ Savings from Fuel Switching to Natural Gas – Limerick County**

| Fuel Switching | 2004 | BAU 2010 | BAU 2015 | Change (04-10) | Change (10-15) |
|---|---|---|---|---|---|
| **Natural Gas** (GWh) | 4.50 | 6.80 | 8.10 | 2.30 | 1.3 |
| **Natural Gas $CO_2$** ('000 T) | 0.89 | 1.35 | 1.60 | 0.45 | 0.3 |
| **$CO_2$ if Oil** ('000 T) | | | | 0.61 | 0.3 |
| **Annual $CO_2$ Savings** ('000 T) | | | | 0.15 | 0.1 |

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 20 tonnes of $CO_2$ per annum.**

#### 6.3.2.2.2 Switch to Smokeless Solid Fuels

Currently, coal accounts for the largest proportion of solid fuel use in the County i.e. 200 GWh in 2005 reducing to 95 GWh by 2015. The National ban on bituminous coal predicted a national saving of approximately 1 million Tonnes of $CO_2$ (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 $CO_2$ 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 20 kTonnes and 16 kTonnes in 2010 and 2015 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. Currently Natural Gas is only available extensively in Ennis and Shannon. 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.

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. Given the similar structures in Clare and Limerick and similar potential for Limerick County has been assumed i.e. 8GWhe.

The energy and $CO_2$ 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 $CO_2$ emissions related to electricity is achieved.

**Table 6.8 : CHP Potential for Limerick County**

| | CHP Generation (GWhe) | Emissions from Conventional Electricity ('000 Tonnes $CO_2$) | Emission Reductions ('000 Tonnes $CO_2$) |
|---|---|---|---|
| 2010 | 8 | 5.44 | 1.80 |

#### 6.3.2.3.1 Aughinish Alumina

A 150MW Natural Gas Combined Heat and Power (CHP) plant has been commissioned in 2006 at this site. This will provide heat and electricity to the plant and export some electricity to the National Grid.

This plant avoids the production of approximately 280 kTonnes of $CO_2$ per annum when compared to conventional consumption. For the purposes of this study it has been decided to exclude this the overall figures as this plant was specifically developed based on a call from the Commission for Energy Regulation (CER).

#### 6.3.2.3.2 Wyeth Nutritionals Ireland

A 5MW Natural Gas Combined Heat and Power (CHP) plant has been commissioned at this site. This provides heat and electricity to the plant.

This plant avoids the production of approximately 9.34 kTonnes of $CO_2$ per annum when compared to conventional consumption

### 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 Limerick County to date but this is due to change in 2006/07, table below.

**Table 6.9: Wind Farms in Limerick 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 $CO_2$ ) |
|---|---|---|---|---|
| Athea | 51.00 | Aug-07 | 178.50 | 111.4 |
| Rathkeale | 12.50 | Sep-07 | 43.75 | 27.3 |
| Tournafulla | 7.60 | Sep-06 | 26.60 | 16.6 |
| | | | | |
| Total | 71.10 | | 26.60 | 16.6 |

By the end of 2007 a total of 71 MW of wind energy will be connected and providing electricity to the National Grid in Limerick. 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 86MW will be connected to the grid in Clare County by 2010, increasing to 105 MW by 2015. 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 2015.

**Table 6.10: Large Wind Energy Installations and $CO_2$ Savings in Limerick County**

| | **Capacity** (MW) | **Electricity Generated** (GWh) | **Annual $CO_2$ Emissions Avoided** ('000 Tonnes $_{CO2}$ ) |
|---|---|---|---|
| **2006** | - | - | - |
| **2007** | 71.10 | 248.85 | 155.3 |
| **2010** | 94.56 | 330.97 | 206.6 |
| **2015** | 115.37 | 403.78 | 252.0 |

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.

In relation to Off-Shore wind the National Study completed in 2004 indicated that the theoretical practical resource from offshore wind in Ireland could be 32% of predicated electricity consumption for 2005. However, it was noted that based on the analysis in the report that the majority of this resource would be located in the east and south east of the island. Some small sites in the west and north would require more detailed analysis. It has been assumed for the purposes of this study that no off-shore wind farms will be developed in Limerick County by 2010. There may be some potential for development by 2015 but has also been ignored within the context of this report.

#### 6.3.3.2 Electricity Generation - Hydro

There are no large (>10MW) scale hydro projects connected to the National Grid in Limerick County 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 $CO_2$ savings, are detailed in the following table.

**Table 6.11: Small Scale Hydro in Limerick County**

| | **Capacity** (MW) | **Year** | **Generation** (GWh) | **$CO_2$ Avoided** ('000 Tonnes $CO_2$ ) |
|---|---|---|---|---|
| **Askeaton** | 0.24 | 1984 | 1.58 | 1.0 |
| **Abbeyfeale** | 0.18 | 2004 | 1.18 | 0.7 |
| | | | | |
| **Total 2010** | 0.42 | | 2.76 | 1.7 |
| **Total 2015** | 0.42 | | 2.76 | 1.7 |

It has been assumed that there will be no additional projects initiated by 2010 or 2015 in the County. In total the current projects avoid 1.72 kTonnes $CO_2$ per annum.

#### 6.3.3.3 Electricity Generation - Wave & Tidal

These technologies are currently in the Research, Development and Demonstration (RD&D) phases and no commercial applications are available in Ireland at present. A report into the economic viability of developing ocean energy in Ireland (Marine Institute, 2005) indicated a best case scenario of 200MW being installed by 2020, with 45MW in place by 2015, nationally. The Vision for Renewable Energy Electricity (DCMNR, 2005) to 2020 indicated the following targets, nationally.

**Table 6.12: Tidal and Wave Energy Potential Nationally**

*(Source: DCMNR, 2005)*

| | Capacity (MW) | Electricity Generated (GWh) |
|---|---|---|
| Wave | 6 | 19 |
| Tidal | 651 | 2,103 |

A large proportion of this resource is located in the west coast of Ireland. The EU ATLAS Report indicated that a 400MW Tidal resource could be developed in Ireland with the major site being the Shannon Estuary (EU Commission, 2000).

For this study it has been assumed that a potential of 300MW could be realised in the Shannon Estuary, but by 2020. A figure of 45MW has been taken for 2015 and 2MW for 2010. The resource has been split between the counties of Limerick and Clare as it is a joint resource and it is unclear as to where the developments will be installed.

**Table 6.13: Wave/Tidal Resource development in Limerick and Clare**

| Year | Capacity (MW) | Generation (GWh) | Total $CO_2$ Avoided | $CO_2$ Avoided Clare | $CO_2$ Avoided Limerick |
|---|---|---|---|---|---|
| **2010** | 2 | 6.46 | 4.4 | 2.2 | 2.2 |
| **2015** | 45 | 145.37 | 98.8 | 49.4 | 49.4 |
| **2020** | 300 | 969.12 | 659.0 | 329.5 | 329.5 |

#### 6.3.3.4 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 Limerick 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 2015.

This would equate to 3.8MW of PV installed in Limerick County generating 4.65 GWh of electricity by 2015. This would avoid approximately 3 kTonnes of $CO_2$ 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 6.14: PV Installations and $CO_2$ Savings in Limerick County**

| | 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 |
| Clare | 2010 | 0 | 0 | - |
| | 2015 | 3.8 | 4.65 | 3 |
| | 2020 | 12.6 | 15.5 | 10 |

#### 6.3.3.5 Electricity Generation - Small Scale Renewables

Small scale renewable energy systems are already in use in Ireland and Limerick County 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 Limerick County. 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 Limerick County by 2010 would equate to approximately 175 installations.
- The penetration rate would increase to 2% by 2015

As can be seen, from the following table, the impact in terms of $CO_2$ emissions is relatively negligible. However, a considerable increase in penetration rate through appropriate supports and policy initiatives could increase this figure.

**Table 6.15: Small Scale RES Electricity Production in Limerick County**

| | Annual Electricity Consumption per dwelling (kWh) | Annual RE Production per dwelling (kWh) | No Houses in Limerick County | Total RES Production (MWh) | $CO_2$ Avoided (Tonnes) |
|---|---|---|---|---|---|
| 2010 | 5,000 | 1,500 | 190 | 285 | 176.7 |
| 2015 | 5,000 | 1,500 | 760 | 1,140 | 706.8 |

#### 6.3.3.6 Thermal Energy Production - Large Scale Renewables

The profile for the development of large renewable energy thermal projects in Limerick County 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. It is noted that there are developments in relation to Miscanthus and poultry litter in the County and these are discussed further in Section 6.7.

A similar approach as to that used in Clare County has been used i.e. based on $CO_2$ emissions from the commercial and industrial sectors

- 2% reduction rate for 2010 and
- 4% for 2015 has been assumed based on large biomass or solar installations.

**Table 6.16: RES Heat from Large Scale in Limerick County**

| | Industry Sector | | | Comm. Sector | | | Total |
|---|---|---|---|---|---|---|---|
| | Emission ('000 T) | % Reduce | $CO_2$ Saved ('000 T) | Emission ('000 T) | % Reduce | $CO_2$ Saved ('000 T) | Total $CO_2$ Saved ('000 T) |
| 2004 | 281.9 | 0% | 0 | 261.2 | 0% | 0 | 0 |
| 2005 | 267.9 | 0% | 0 | 294.7 | 0% | 0 | 0 |
| 2010 | 305.5 | 2% | 6.11 | 344.3 | 2% | 6.9 | 13.0 |
| 2015 | 321.9 | 4% | 12.876 | 356.1 | 4% | 14.2 | 27.1 |

#### 6.3.3.7 Thermal Energy Production - Small Scale Renewables

The residential sector in Limerick County 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 6.17: RES Heat from Small Renewables in Limerick County**

| | 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 | 15% | 5,700 | 20,000 | 114 | 0.75 | 85.5 | 22.0 |
| 2015 | 20% | 7,600 | 20,000 | 152 | 0.75 | 114 | 29.3 |

#### 6.3.3.8 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) 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.

The use of poultry litter in small scale CHP fluidised beds is covered in Section 6.7.

## 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 $CO_2$ emissions has been very significant since 1990. Transport accounted for over 33% of energy related $CO_2$ emissions in Limerick County in 2005 (484 kTonnes of $CO_2$). This is a 148% increase.

The rural context in Limerick County presents particular challenges to achieve major reductions in terms of $CO_2$.

#### 6.4.1.1 $CO_2$ Reduction Targets

The Limerick Clare Energy and Emissions Balance set Quantified Indicative Reduction Targets for $CO_2$ for Limerick County for the Transport Sector. The estimated reduction that could be achieved in the relation to transport was in the region of 100 kTonnes of $CO_2$. The following table summarises the actual projected savings in terms of $CO_2$ that are projected to be achievable by 2010 and 2015. Details of how these can be achieved are provided in the following sections.

**Table 6.18: Quantified Indicative Reductions for Limerick County – Transport**

| Ref | Action | Quantified Indicative Reductions Proposed ('000 T-$CO_2$) | |
|---|---|---|---|
| | | 2010 | 2015 |
| 6.4.2.1 | Car Efficiency | 25.8 | 29.3 |
| 6.4.2.2 | Unnecessary Trips | 14.8 | 14.9 |
| 6.4.2.3 | Car Pooling | 4.0 | 4.0 |
| 6.4.2.4 | Hybrid Cars | 0.9 | 1.9 |
| 6.4.3.1 | Cycling | 2.6 | 2.6 |
| 6.4.3.2 | Bus | 0.7 | 0.7 |
| 6.4.4 | Green Fuels | 6.1 | 20.0 |
| | | | |
| | Total | 54.9 | 73.2 |

#### 6.4.1.2 $CO_2$ Reduction, Cost Benefit Analysis

The average cost for the abatement of $CO_2$ emissions, based on estimated investment costs, is approximately €127/Tonne $CO_2$ in Limerick County 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 6.19: Indicative $CO_2$ Abatement Costs for Limerick County – Transport**

| | 2010 | | | 2015 | | |
|---|---|---|---|---|---|---|
| **Transport** | **QIR Proposed** ('000 T-$CO_2$) | **Indicative Cost** (€m) | **Indicative Abatement Cost per Tonne $CO_2$** (€/T$CO_2$) | **QIR Proposed** ('000 T-$CO_2$) | **Indicative Cost** (€m) | **Indicative Abatement Cost per Tonne $CO_2$** (€/T $CO_2$) |
| Car Efficiency | 25.8 | - | - | **2015** | - | - |
| Unnecessary Trips | 14.8 | - | - | 29.3 | - | - |
| Car Pooling | 4.0 | 1.00 | 251 | 14.9 | 1.00 | 251 |
| Hybrid Cars | 0.9 | - | - | 4.0 | - | - |
| Cycling | 2.6 | 1.00 | 384 | 1.9 | 1.00 | 384 |
| Bus | 0.7 | - | - | 2.6 | - | - |
| Green Fuels | 6.1 | 5.00 | 823 | 0.7 | 10.00 | 503 |
| Total | 54.9 | 7.00 | 127 | | 12.00 | 164 |

#### 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 ** 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.

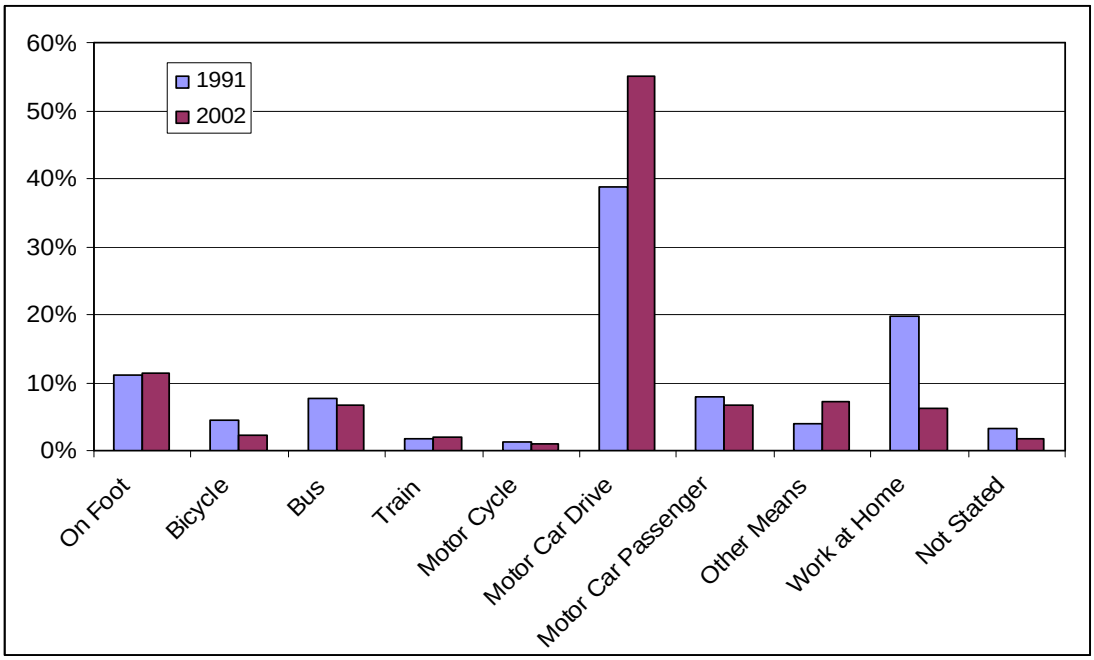


**Chart 6.6: Transport Means in Limerick County, % Share in 1991 and 2002.**
*(Source: CSO, 2005)*

### 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

Limerick County 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 2015 GHG emissions as a result of technology improvements would drop by 15-40% compared to 2004 levels.

For Limerick County 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 $CO_2$ saving of 608 kTonnes $CO_2$ x 5% = 30 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 take in Clare County 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 57,854 vehicles = 208,274 trips
- Average trip distance: 8 km
- Total Km Avoided per week: 8 km x 208,274 trips ≈ 1,666,000 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.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 increased in Clare between 2004 and 2010 and 2015 a constant figure has been taken for annual reductions for 2010 and 2015. Achieving these savings would require significant promotion of the benefits both environmentally and economically of reducing the number of trips made.

**Table 6.20: $CO_2$ Savings from Reducing Unnecessary Trips – Limerick County**

| | **Emissions** (g $CO_2$ /km) | **Km per Week Avoided** (km) | **Emissions per annum** ('000 T $CO_2$ ) |
|---|---|---|---|
| **Petrol (70%)** | 185.2 | 1,166,200 | 11.23 |
| **Diesel (30%)** | 139.8 | 499,800 | 3.63 |
| **Total** | | 1,666,000 | 14.86 |

#### 6.4.2.3 Car Pooling

Using appropriate integration, cooperation and supports schemes the development of carpooling schemes could be another mechanism which can contribute to $CO_2$ reductions in Limerick County. The following assumptions, as used in Clare County, are taken

- In 2005 there were over 19,300 people working in the industrial sector in Limerick County.
- 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 2015) a constant figure has been assumed for both years.

**Table 6.21: $CO_2$ Savings as a result of Car Pooling Initiatives – Limerick County**

| | 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** | 19,298 | 4,400 | 84,911 | 20% | 16,982 | 2.9 |
| **Commercial** | 28,996 | 4,400 | 127,582 | 20% | 25,516 | 1.1 |
| **Total** | 48,294 | 8,800 | 212,493 | 20% | 42,498 | 4.0 |

#### 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 $CO_2$ emissions. Emissions from such vehicles are in the region of 100 g $CO_2$ /km, providing a saving of 85 g/$CO_2$ 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 $CO_2$ savings which these cars can make in Limerick County, compared to the normal cars, it has been assumed that they can attain a 1% market share by 2010.

**Table 6.22 : $CO_2$ Savings as a result of Hybrid/Super Efficient Cars – Limerick County**

| | Total Cars | Market Share (%) | Total Hybrid Cars | $CO_2$ Savings (g $CO_2$/ Km)[9] | Average Annual Trip (Km) | CO2 Savings '000 T $_{CO2}$ |
|---|---|---|---|---|---|---|
| **2010** | 53,132 | 1% | 531 | 85.2 | 16,000 | 0.7 |
| **2015** | 53,132 | 2% | 1062 | 85.2 | 16,000 | 1.5 |

### 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 $CO_2$ 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 6.23: Total No. of People by Travel Destination – Limerick County**

| Category | Total |
|---|---|
| Work | 37,454 |
| School – 4-12 years | 10,229 |
| School – 13-18 years | 8,403 |
| College - >19 years | 3,212 |

[9] Compared to petrol taking Hybrid emissions of 100g $CO_2$ /km and Petrol emissions of 185.2 g $CO_2$ /km

#### 6.4.3.1 Cycling and Walking

The Census data of 2002 showed that only 8% of people cycled/walked to work while 45% of students >19 years use this means of transport. 1,663 primary and 1,140 secondary students travelled to school by bicycle or on foot in Limerick County.

Projected increases in the use of cycling/walking in the County is 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 $CO_2$ 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. The project

**Table 6.24: $CO_2$ Savings from Modal Shift to Bicycle/Walking – Limerick County**

| Category | Total Persons | Current Cycle/ Walk (people) | Current % Share (%) | New % Share (%) | New Cycle/ Walk (people) | Additional $CO_2$ Avoided (T $CO_2$ ) |
|---|---|---|---|---|---|---|
| **Work** | 37,454 | 3,160 | 8% | 11% | 4000 | |
| **School: 4-12 yrs** | 10,229 | 1,663 | 16% | 20% | 2000 | |
| **School: 13-18 yrs** | 8,403 | 1,140 | 14% | 24% | 2000 | |
| **College: >19 yrs** | 3,212 | 1,430 | 45% | 62% | 2000 | |
| **Total** | 59,298 | 7,393 | 12% | 17% | 10,000 | 2,607 |

#### 6.4.3.2 Public Transport - Buses

Similar to Clare County 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 $CO_2$. Specific focus should also be placed on the primary school sector if possible.

**Table 6.25: $CO_2$ Savings from Modal Shift to Bus – Limerick County**

| Category | Total Persons | Current Bus (people) | Current % Share (%) | New % Share (%) | New Bus (people) | Additional $CO_2$ Avoided (T $CO_2$ ) |
|---|---|---|---|---|---|---|
| **Work** | 37,454 | 532 | 1% | 3% | 1000 | |
| **School: 4-12 yrs** | 10,229 | 1956 | 19% | 29% | 3000 | |
| **School: 13-18 yrs** | 8,403 | 4155 | 49% | 60% | 5000 | |
| **College: >19 yrs** | 3,212 | 441 | 14% | 16% | 500 | |
| **Total** | 59,298 | 7,084 | 12% | 16% | 9,500 | 725 |

#### 6.4.3.3 Public Transport - Rail

The rail infrastructure within Limerick County is limited at present and no major changes are due within the life of this strategy (to 2015). The rail link to Shannon from Limerick continues to be under review and this may develop in time.

Further analysis will be required to determine the impact of this development in terms of increased used 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 5.75% of transport fuels to be supplied by liquid biofuels by 2010. 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 Clare County if the 2% and 5.75% targets were to be achieved are shown in the following Table. Currently the estimated energy consumption for the transport sector is 1,578 GWh which equates to approximately 211 Million Litres of transport fuels. The 2% target in 2010 would require the production and use of 5.4 Million Litres of liquid biofuels in Clare County (generally equally split between ethanol and biodiesel). The more ambitious 5.75% target would raise this to a figure to 15.5 Million Litres.

The limited production of arable crops in Limerick County will likely result in a large proportion of the biofuels requirements for the region being imported from outside the region. A development in the Shannon region by Capway Bioenergy could make a significant impact in the region. Table 6.** outlines the demand which would exist in the County based on the 2% and 5.75% targets.

The different liquid biofuels can result in differing $CO_2$ 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 $CO_2$ saving of approximately 6 kTonnes $CO_2$ per annum in 2010.

**Table 6.27: Liquid Biofuels Requirements – Limerick County**

| Biofuels | GWh | | | M Litres | | |
|---|---|---|---|---|---|---|
| | 2005 | 2010 | 2015 | 2005 | 2010 | 2015 |
| **Current** | 1,876.20 | 2,399.40 | 2,635.50 | 283.1 | 362.1 | 397.7 |
| **Petrol** | 1,313.3 | 1,679.6 | 1,844.9 | 220.3 | 281.7 | 309.5 |
| **Diesel** | 562.9 | 719.8 | 790.7 | 62.8 | 80.3 | 88.2 |
| | | | | | | |
| **2% Biofuels** | 37.5 | 48.0 | 52.7 | 5.7 | 7.2 | 8.0 |
| **Ethanol** | 26.3 | 33.6 | 36.9 | 4.4 | 5.6 | 6.2 |
| **Biodiesel** | 11.3 | 14.4 | 15.8 | 1.3 | 1.6 | 1.8 |
| | | | | | | |
| **5.75% Biofuels** | 107.9 | 138.0 | 151.5 | 16.3 | 20.8 | 22.9 |
| **Ethanol** | 75.5 | 96.6 | 106.1 | 12.7 | 16.2 | 17.8 |
| **Biodiesel** | 32.4 | 41.4 | 45.5 | 3.6 | 4.6 | 5.1 |

**Table 6.28: $CO_2$ Savings from the use of Biofuels – Limerick County**

| $CO_2$ Savings | 2005 ('000 T $CO_2$ ) | 2010 ('000 T $CO_2$ ) | 2015 ('000 T $CO_2$ ) |
|---|---|---|---|
| **Current Fuel Mix** | 483.8 | 607.8 | 691.6 |
| **2% Biofuel Target** | 4.8 | 6.1 | 6.9 |
| **5.75% Biofuel Target** | 13.9 | 17.5 | 19.9 |

# 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 Limerick County the residential and commercial sectors were shown to account for 34% of TFC and 45% of all energy related $CO_2$ emissions.

### 6.5.1.1 $CO_2$ Reduction Targets

The Limerick Clare Energy and Emissions Balance set Quantified Indicative Reduction Targets for $CO_2$ for Limerick County for the Built Environment Sector. The estimated reduction that could be achieved in the relation to the built environment was in the region of 40 kTonnes of $CO_2$. The following table summarises the actual savings in terms of $CO_2$ that are projected to be achievable by 2010 and 2015. Details of how these can be achieved are provided in the following sections.

**Table 6.29: Quantified Indicative Reductions for Limerick County – Built Environment**

| Ref | Action | 2010 ('000 T-$CO_2$) | 2015 ('000 T-$CO_2$) |
|---|---|---|---|
| **Residential** | | | |
| **6.5.2.1** | Part L | 16.0 | 24.7 |
| 6.5.2.3 | EPBD New | 0.8 | 1.2 |
| | EPBD Existing | 2.7 | 3.1 |
| 6.5.4.1 | Awareness | 3.9 | 4.0 |
| 6.5.4.2 | Social Housing Upgrades | 0.3 | 0.3 |
| 6.5.4.3 | LA New Housing | 0.1 | 0.2 |
| *Sub Total - Residential* | | *28.0* | *38.0* |
| | | | |
| **Commercial/Public** | | | |
| 6.5.2.2 | Part L | 2.9 | 3.0 |
| 6.5.2.4 | EPBD | 1.5 | 1.5 |
| 6.5.3.1 | Monitoring and Targeting | 1.0 | 1.0 |
| 6.5.3.2 | Awareness and Training | 0.5 | 0.5 |
| 6.5.3.3 | Surveys and Audits | 1.5 | 1.5 |
| *Sub Total Commercial / Public* | | *7.5* | *7.5* |
| | | | |
| *Grand Total* | | 35.5 | 45.5 |

### 6.5.1.2 $CO_2$ Reduction, Cost Benefit Analysis

The average cost for the abatement of $CO_2$ emissions, based on estimated investment costs, is approximately €662/Tonne $CO_2$ in Clare County 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 6.30: Indicative $CO_2$ Abatement Costs for Limerick County – Built Environment**

| Built Environment | 2010 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | 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 $CO_2$ ) |
| **Residential** | | | | | | |
| Part L | 16.0 | 8 | 501 | 24.7 | 12 | 485 |
| EPBD New | 0.8 | 0.6 | 752 | 1.2 | 1 | 809 |
| EPBD Existing | 2.7 | 0.6 | 221 | 3.1 | 3 | 978 |
| Awareness | 3.9 | 1 | 258 | 4.0 | 1 | 248 |
| Social Housing Upgrades | 0.3 | 0.1 | 333 | 0.3 | 0.1 | 400 |
| LA New Housing | 0.1 | 0.2 | 2,133 | 0.2 | 0.2 | 1,067 |
| *Sub Total* | *28.0* | *10.5* | *375* | *38.0* | *17.3* | *456* |
| | | | | | | |
| **Commercial** | | | | | | |
| Part L | 2.9 | 3 | 1,027 | 3.0 | 3 | 993 |
| EPBD | 1.5 | 1 | 685 | 1.5 | 1 | 662 |
| Monitoring and Targeting | 1.0 | 2 | 2,000 | 1.0 | 2 | 2,000 |
| Awareness and Training | 0.5 | 0.5 | 1,000 | 0.5 | 0.5 | 1,000 |
| Surveys and Audits | 1.5 | 2 | 1,333 | 1.5 | 2 | 1,333 |
| *Sub Total* | *7.5* | *8.5* | *1,139* | *7.5* | *8.5* | *1,132* |
| | | | | | | |
| **Grand Total** | **35.5** | **12.7** | **592** | **45.5** | **20.9** | **761** |

#### 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 6.31: Building Regulation Reductions – Limerick County.**

| Ref | Activity | 2010 '000 T-$CO_2$ | 2015 '000 T-$CO_2$ |
|---|---|---|---|
| **Residential** | | | |
| 6.5.2.1 | Part L | 16.0 | 24.7 |
| 6.5.2.3 | EPBD New | 0.8 | 1.2 |
| | EPBD Existing | 2.7 | 3.1 |
| | | | |
| **Commercial/Public** | | | |
| 6.5.2.2 | Part L | 2.9 | 3.0 |
| 6.5.2.4 | EPBD | 1.5 | 1.5 |
| | | | |
| **Total** | | 23.9 | 33.6 |

#### 6.5.2.1 Irish Building Regulations – Part L – Residential Sector

Assuming a similar construction trend for new house in Limerick County from 2004 to 2010 has occurred between 2000 and 2004 (approx 1,100 new units per annum) a total of 10,600 new houses will have been built under the new Part L regulations by 2010. This will have increased to 16,500 by 2015. This will result in the following $CO_2$ savings

- **By 2010: 16 kTonnes $CO_2$**
- **By 2015: 25 kTonnes $CO_2$**

#### 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 2015 $CO_2$ emission figures for this sector taken from Energy and Emissions Balance the savings would be:

- **By 2010: 2.9 kTonnes $CO_2$**
- **By 2015: 3.0 kTonnes $CO_2$**

#### 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: 0.8 kTonnes $CO_2$ for New Houses and 2.72 kTonnes $CO_2$ for existing houses**
- **By 2015: 1.24 kTonnes $CO_2$ for New Houses and 3.0 kTonnes $CO_2$ for existing houses**

#### 6.5.2.4 Energy Performance of Buildings Directive – Non-Residential Sector

The Non-Residential Sector will have $CO_2$ 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 $CO_2$ 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: 1.4 kTonnes $CO_2$**
- **By 2015: 1.5 kTonnes $CO_2$**

### 6.5.3 Public/Commercial Sector Built Environment

The LCEA 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 6.32: Public/Commercial Sector Built Environment Reductions.**

| **Activity** | **2010** '000 T-$CO_2$ | **2015** '000 T-$CO_2$ |
|---|---|---|
| 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

Limerick County 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

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 LCEA indicate that savings of 1 kTonne $CO_2$ 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 LCEA is a key resource to achieve this.

**The LCEA has estimated that savings in the region of 0.5 kTonnes $CO_2$ 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 $CO_2$ 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 LCEA, 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 $CO_2$ emissions estimated savings would be

- **By 2010: 3.8 kTonnes $CO_2$ per annum**
- **By 2015: 4.0 kTonnes $CO_2$ per annum**

#### 6.5.4.2 Local Authority/Social Housing

The LCEA and Local Authorities can take specific action in relation to social housing, both in new build and refurbishment. An average of 160 new social houses were built per annum in Limerick County since 2000. Between 2005 and 2010 the Local Authority and LCEA 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 18.2 and 20.5% of $CO_2$ emissions in Limerick County 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 $CO_2$ Reduction Targets

The Limerick Clare Energy and Emissions Balance set Quantified Indicative Reduction Targets for $CO_2$ for Clare County for the Industrial/Commercial Sector. The estimated reduction that could be achieved in the relation to this sector was in the region of 72 kTonnes of $CO_2$. The following table summarises the actual savings in terms of $CO_2$ that are projected to be achievable by 2010 and 2015. Details of how these can be achieved are provided in the following sections.

**Table 6.33: Quantified Indicative Reductions for Limerick County – Industry/Commerce and Services**

| Reference | Action | 2010 '000 T-$CO_2$ | 2015 '000 T-$CO_2$ |
|---|---|---|---|
| **Industry** | | | |
| 6.6.3.1 | LIEN | 10.7 | 11.3 |
| 6.6.3.3 | Monitoring, Targeting and Surveys | 6.1 | 6.4 |
| 6.6.3.4 | Awareness | 6.1 | 6.4 |
| 6.6.3.5 | Green Supply | 15.3 | 16.1 |
| *Sub Total Industry* | | *38.2* | *40.2* |
| | | | |
| **Commercial** | | | |
| 6.6.4.2 | Energy Efficiency | 3.4 | 3.6 |
| 6.6.4.1 | Monitoring, Targeting and Surveys | 6.9 | 7.1 |
| 6.6.4.3 | Awareness | 6.9 | 7.1 |
| *Sub Total Commercial* | | *17.2* | *17.8* |
| | | | |
| **Grand Total** | | **55.4** | **58.0** |

### 6.6.1.2 CO2 Reduction, Cost Benefit Analysis

The average cost for the abatement of $CO_2$ emissions, based on estimated investment costs, is approximately €662/Tonne $CO_2$ in Clare County 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 6.34: Indicative $CO_2$ Abatement Costs for Limerick County – Industry, Commerce and Services**

| | 2010 | | | 2015 | | |
|---|---|---|---|---|---|---|
| **Industry / Commercial** | **QIR Proposed** '000 T-$CO_2$ | **Indicative Cost** (€m) | **Indicative Abatem't Cost per Tonne $CO_2$** (€/T$CO_2$ ) | **QIR Proposed** '000 T-$CO_2$ | **Indicative Cost** (€m) | **Indicative Abatem't Cost per Tonne $CO_2$** (€/T $CO_2$ ) |
| **Industry** | | | | | | |
| LIEN | 10.7 | 1 | 93 | 11.3 | 1 | 88 |
| Monitoring, Targeting and Surveys | 6.1 | 2 | 327 | 6.4 | 2 | 310 |
| Awareness | 6.1 | 1 | 163 | 6.4 | 1 | 155 |
| Green Supply | 15.3 | 0 | - | 16.1 | 0 | - |
| *Sub Total Industry* | *38.2* | *4* | | *40.2* | *4* | |
| **Commercial** | | | | | | |
| Monitoring, Targeting and Surveys | 6.9 | 1 | 145 | 7.1 | 1 | 140 |
| Energy Efficiency | 3.4 | 1 | 290 | 3.6 | 1 | 281 |
| Awareness | 6.9 | 1 | 145 | 7.1 | 1 | 140 |
| *Sub Total Commercial* | *17.2* | *3* | | *17.8* | *3* | |
| **Grand Total** | **55.4** | **7** | **126** | **58.0** | **7** | **121** |

### 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 $CO_2$ 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

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: 10.7 kTonnes $CO_2$ per annum**
- **By 2015: 11.3 kTonnes $CO_2$ 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 Limerick County. 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: 6.2 kTonnes $CO_2$ per annum**
- **By 2015: 6.1 kTonnes $CO_2$ per annum**

#### 6.6.3.4 Awareness

As has been shown earlier awareness programmes have an impact in terms of energy savings and $CO_2$ 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 $CO_2$ savings based on a 2% reduction

- **By 2010: 6 kTonnes $CO_2$ per annum**
- **By 2015: 6 kTonnes $CO_2$ 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 Clare County, of 10% 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: 15.3 kTonnes $CO_2$ per annum**
- **By 2015: 16.1 kTonnes $CO_2$ 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: 5.8 kTonnes $CO_2$ per annum**
- **By 2015: 6.0 kTonnes $CO_2$ 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 $CO_2$ emissions within the sector being achieved has been assumed giving the following savings.

- **By 2010: 3.4 kTonnes $CO_2$ per annum**
- **By 2015: 3.6 kTonnes $CO_2$ 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 $CO_2$ savings

- **By 2010: 6.9 kTonnes $CO_2$ per annum**
- **By 2015: 7.1 kTonnes $CO_2$ 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 (2.5% 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 200,000 Ha of farmed land in Limerick County (CSO, 2000). County Limerick has a total area of 20,256 Ha under forestry. This equates to 8% of the land area of the county. 42% of the forestry is privately owned with the balance of 58% in public ownership (Dept. of agriculture 2001). Broadleaf trees make up 13.5% (Limerick CDB 2004).

#### 6.7.1.1 $CO_2$ Reduction Targets

The Limerick Clare Energy and Emissions Balance set Quantified Indicative Reduction Targets for $CO_2$ for Clare 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 $CO_2$. The following table summarises the actual savings in terms of $CO_2$ that are projected to be achievable by 2010 and 2015. Details of how these can be achieved are provided in the following sections.

**Table 6.35: Quantified Indicative Reductions for Limerick County – Agriculture**

| Ref | Action | 2010 '000 T-$CO_2$ | 2015 '000 T-$CO_2$ |
|---|---|---|---|
| **Agriculture** | | | |
| 6.7.2.1 | Liquid Biofuels | | |
| 6.7.2.5 | Miscanthus | 9.0 | 13.5 |
| 6.7.2.3 | AD | 1.0 | 2.4 |
| 6.7.3 | Tractors Efficiency Scheme | 1.9 | 1.9 |
| | | | |
| **Forestry** | | | |
| | Wood Energy | 4.2 | 11.6 |
| **Total** | | **16.1** | **29.4** |

#### 6.7.1.2 CO2 Reduction, Cost Benefit Analysis

The average cost for the abatement of $CO_2$ emissions, based on estimated investment costs, is approximately €550/Tonne $CO_2$ in Clare County 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 6.36: Indicative $CO_2$ Abatement Costs for Limerick County – Agriculture**

| | 2010 | | | 2015 | | |
|---|---|---|---|---|---|---|
| **Agriculture And Forestry** | **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 $CO_2$ |
| **Agriculture** | | | | | | |
| Liquid Biofuels | | 0.0 | - | | 0.0 | - |
| Miscanthus | 9.0 | 0.1 | 11 | 13.5 | 0.25 | 19 |
| Anaerobic Digest | 1.0 | 1.0 | 1,000 | 2.4 | 1.0 | 417 |
| Tractor Efficiency | 1.9 | 0.5 | 267 | 1.9 | 0.5 | 267 |
| | | | | | | |
| **Forestry** | | | | | | |
| Wood Energy | 4.2 | 5.0 | 1,193 | 11.6 | 5.0 | 430 |
| | | | | | | |
| **Total** | **16.1** | **6.6** | **411** | **29.4** | **6.75** | **230** |

### 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 Clare 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

Limerick has developed some expertise in the area of using poultry litter as a fuel. A joint project involving the University of Limerick and private investors have developed a technology for the combustion of poultry litter at a small scale. This technology now needs to be further developed and brought forward for replication and further development.

#### 6.7.2.3 Agricultural Residues – Anaerobic Digestion

As of the 2000 Census there were 19 pig farms in the County accounted for approximately 55,500 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 0.2MW by 2010 and 0.5MW by 2015.

**Assuming that the energy produced from these plants is displacing oil and electricity the annual $CO_2$ savings could be expected to be 1 kTonne in 2010 and 2.4 kTonnes in 2015.**

#### 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 Limerick County was estimated to be over 2,000 GWh/yr in 2000. Applying appropriate restrictions the practical resource was estimated to be 700 GWh/yr. The land in Limerick County 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. It is understood that supports may become available in 2006/07 and a review of this should be undertaken at that time.

#### 6.7.2.5 Energy Crops – Miscanthus

Local growers and developers in Limerick County are taking the lead nationally on 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 500ha of the crop could be planted by 2010, with an additional 250 planted by 2015. With yields in the region of 22 Tonnes per ha (Leahy, 2006) an energy yield of 6,600 MWh could be available. **If used to displace oil could result in $CO_2$ savings of 9 kT $CO_2$ 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 Limerick County. With private forestry accounting for some 8,000 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. 15 GWh/yr. **This, if used to replace oil would result in $CO_2$ savings of 4 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 2870 tractors in Limerick County (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 $CO_2$ per tractor per year could be achieved. **Assuming a 25% implementation rate in Limerick County this could result in savings of 1.9 kTonnes $CO_2$ 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

### 6.8.1 Introduction

The main focus on $CO_2$ savings within the waste sector related to the production of Landfill Gas at Local Authority sites. Particular buildings and sites where waste is processed or dealt with will have savings which have been accounted for in previous sections.

#### 6.8.1.1 $CO_2$ Reduction Targets

The Limerick Clare Energy and Emissions Balance set Quantified Indicative Reduction Targets for $CO_2$ for Clare County for the Waste Sector. The estimated reduction that could be achieved in the relation to waste was in the region of 32 kTonnes of $CO_2$. The following table summarises the actual savings in terms of $CO_2$ that are projected to be achievable by 2010 and 2015. Details of how these can be achieved are provided in the following sections.

**Table 6.37: Quantified Indicative Reductions for Limerick County – Waste**

| Ref | Action | 2010 | 2015 |
|---|---|---|---|
| 6.8.2 | Land Fill Gas | 19.3 | 19.3 |
| Total | | 19.3 | 19.3 |

#### 6.8.1.2 $CO_2$ Reduction, Cost Benefit Analysis

The average cost for the abatement of $CO_2$ emissions, based on estimated investment costs, is approximately €550/Tonne $CO_2$ in Limerick County for the Waste Sector. The data presents the estimated capital investment costs. There are additional costs related to support programmes which could also be accounted for.

**Table 6.38: Indicative $CO_2$ Abatement Costs for Limerick County – Waste**

| Waste | 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 $CO_2$ ) |
|---|---|---|---|---|---|---|
| Land Fill Gas | 19.3 | 4.0 | 207 | 19.3 | | |

#### 6.8.1.3 Legislation / Regulation

The legislation and regulation related to the Waste sector is significant and details and information are available in the relevant Regional Waste Management Plan which covers Limerick County.

### 6.8.2 Landfill Gas

The landfill at Gortadruma in the west of the County is planning the installation of a lanfill gas CHP plant. This plant is projected to be a 3.6MW plant.. This would result in $CO_2$ savings of 19.3 kTonnes per annum assuming it is displacing electricity from the current electricity mix.

## 6.9 Conclusion

### 6.9.1 Individual Responsibility

The Limerick Clare Energy and Emissions Balance calculated indicators for reductions which would be require per person to achieve the Kyoto Target. This 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 6.39: Individual Responsibility – Limerick County**

| Indicator | 1990 | Kyoto Target (1990 + 13%) | 2004 | 2010 | Reduction Sought To Reach Kyoto Target | Reduction Achieved through Standard Measures |
|---|---|---|---|---|---|---|
| **Population** (000) | 109.7 | - | 123.4 | 133.3 | N/A | |
| **TFC** (GWh) | 2713.3 | - | 4474.2 | 5014.6 | - | |
| **Energy Related Emissions** '000 T-$CO_2$ ) | 989.0 | 1117.6 | 1393.8 | 1680.5 | 562.8 | 440 |
| **TFC/Capita** (kWh/Person) | 24,730.6 | - | 36,271.8 | 37,614.2 | - | |
| **CO2 Emissions / Capita** (T $CO_2$/Person) | 9.0 | 9.2 | 11.3 | 12.6 | 4.6 | 3.6 |

### 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 6.40 : Carbon Levies in Limerick County (Business as Usual and with Standard Measures)**

| | 2010 | 2015 |
|---|---|---|
| **Carbon Levy** (€ / T) | € 35.00 | € 45.00 |
| **Levy BAU** (€ ) | €19,700,000 | € 31,000,000 |
| **Levy Standard Measures** (€) | € 4,300,000 | € 4,700,000 |

# 7.0 Limerick City

## 7.1 Introduction

The analysis for Limerick City, completed at a macro level, presents many similar trends and requirements. However, there are also significant differences in that

- the potential for renewable energy development will not have the significant contribution from wind as is the case in Limerick and Clare Counties.
- The opportunities for action in the transport field are increased due to the increased housing density and existing public transport supply infrastructure.
- Specific programmes for the industrial and commercial sector could be given increased focus
- The agricultural sector will have no impact in the Limerick City area.

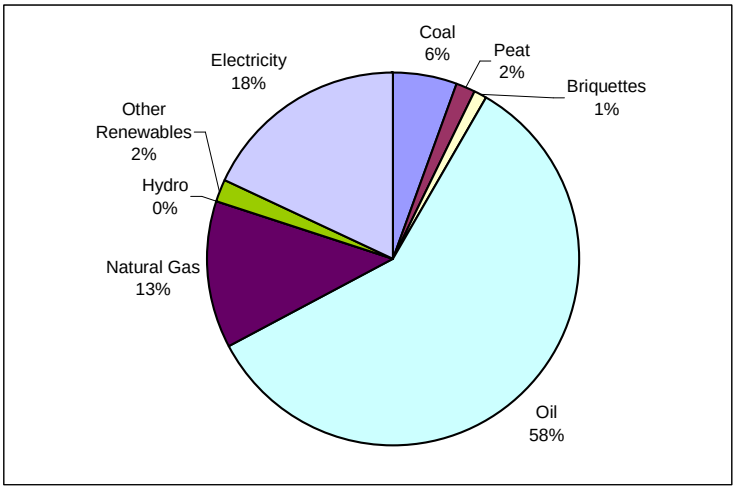


**Chart 7.1: Total Final Consumption by Fuel, Limerick City, 2004**

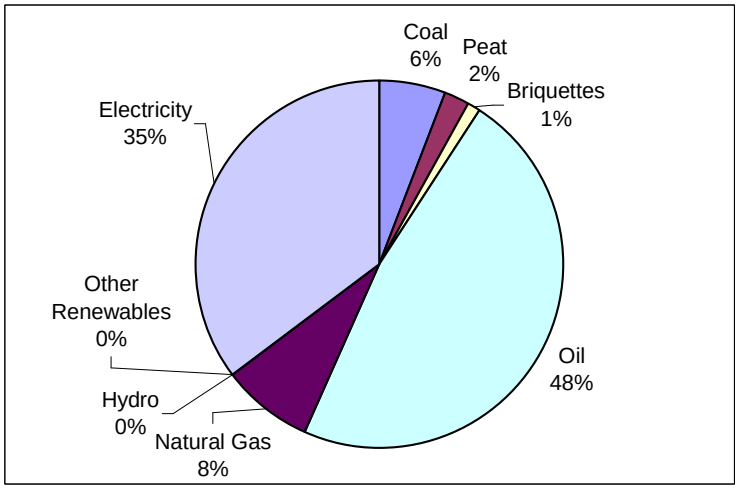


**Chart 7.2: $CO_2$ Emissions by Fuel, Limerick City, 2004**

- From the Charts above it can be seen that Oil accounts for the largest proportion of Total Final Consumption in Limerick City, and also is the highest contributor in

terms of $CO_2$ emissions. While Electricity only accounts of 18% of TFC it accounts for 35% of emissions, due to its high emissions factor.

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

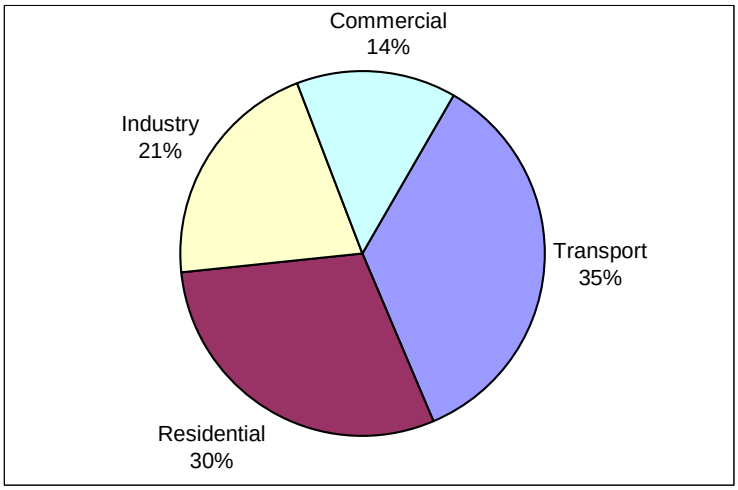


**Chart 7.3: Total Final Consumption by Sector, Limerick City, 2004**

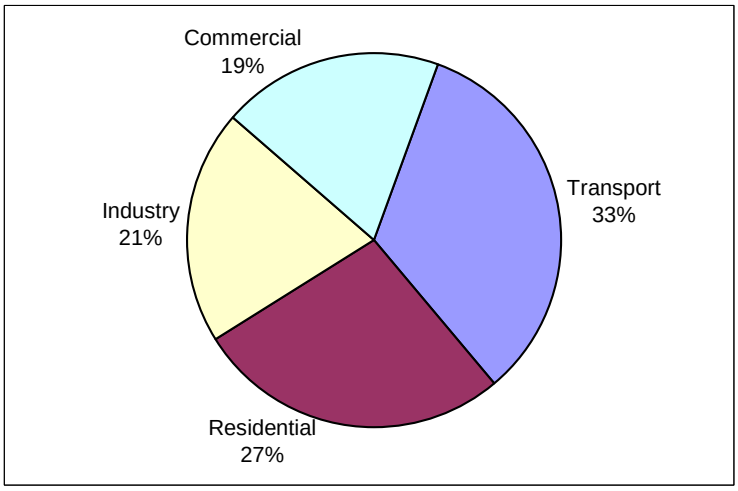


**Chart 7.4: $CO_2$ Emissions by Sector, Limerick City, 2004**

- Clearly the Transport Sector, in 2004, has the highest consumption in energy terms in the City, at 35%. It also currently accounts of 33% of $CO_2$ emissions.
- The Residential Sector is the next highest contributor in terms of emissions, at 27%, while it consumes 30% of TFC in the County.
- The Industrial Sector accounted for 21% of consumption in 2004 and a similar % of $CO_2$ emissions.

## 7.2 Summary of Actions

**Table 7.1: Summary of $CO_2$ Reductions, Investment Cost and Abatement Cost – Limerick City**

| Ref | Sector | $CO_2$ Reduction (000 Tonnes) | | Investment Cost (€m) | | Indicative Abatement Cost (€/Tonne) | |
|---|---|---|---|---|---|---|---|
| | | **2010** | **2015** | **2010** | **2015** | **2010** | **2015** |
| 7.3 | Energy Prod & Supply | 45.0 | 54.0 | 27.9 | 36.7 | 620 | 680 |
| 7.4 | Transport | 24.0 | 28.8 | 3.1 | 4.9 | 130 | 170 |
| 7.5 | Built Environment | 15.0 | 18.0 | 9.5 | 14.0 | 630 | 780 |
| 7.6 | Industry and Commerce | 22.5 | 27.0 | 3.2 | 3.5 | 140 | 130 |
| | Agriculture | 7.5 | 9.0 | 3.6 | 2.4 | 480 | 270 |
| | Waste | 4.5 | 5.4 | 0.9 | - | 200 | - |
| | | | | | | | |
| | **Total** | **118.5** | **142.2** | **56.9** | **76.8** | **480** | **540** |
| | | | | | | | |
| | Target | 150 | 194.0 | | | | |
| | | | | | | | |
| | Diff | 31.5 | 51.8 | | | | |

Table 7.2 summaries the data and results from the different sectors which were reviewed in Limerick city. 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 €480 per tonne, taking full investment cost into account.

## 7.3 Energy Production & Supply

### 7.3.1 Introduction

**Table 7.2: Total Final Consumption, Limerick City, (1990 – 2015)**

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

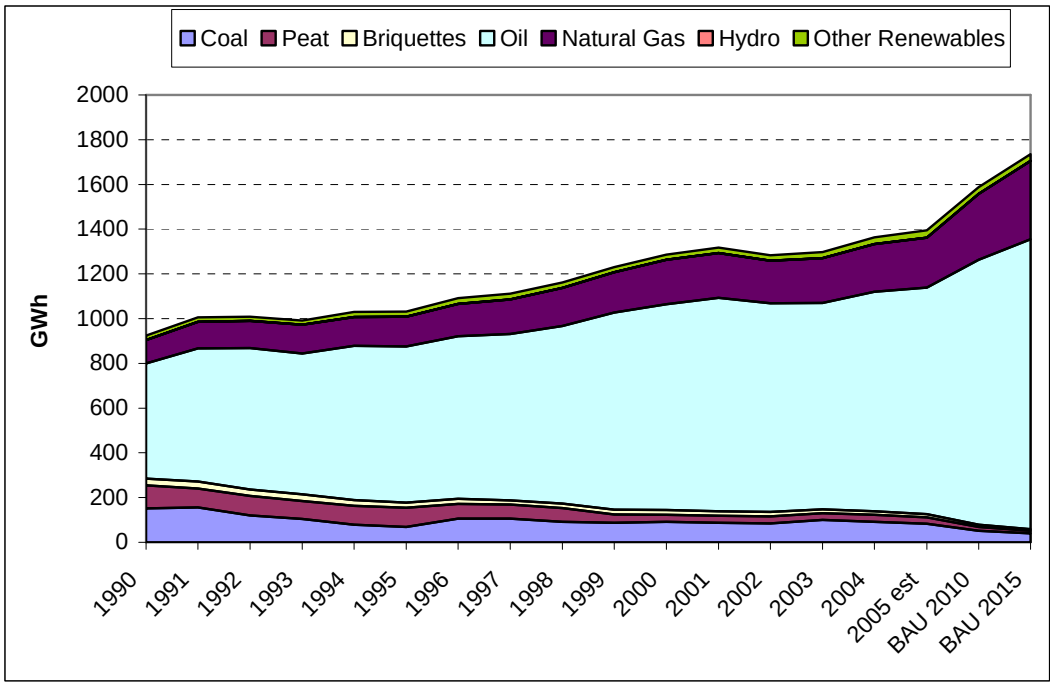


**Chart 7.5: Total Final Consumption by Fuel, Limerick City, (1990 – 2015)**

### 7.3.2 Renewable Energy Supply Targets

The targets for Limerick City 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 Limerick City in 2005 was estimated to be 4590 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 Clare County.

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.

**Table 7.3 : Renewable Energy Targets for Limerick City**

| | National 2004 | National 2010 | Limerick County 2004 | Limerick County 2010 |
|---|---|---|---|---|
| TPER (GWh) | 175,543 | 214,104 | 2,116 | 2,494 |
| 12% Target (GWh) | 21,065 | 25,692 | 254 | 299 |
| | | | | |
| RES (MWe) | 737 | 1,450 | 11 | 21 |

### 7.3.3 Fossil Fuel Energy

The recommendations for actions in relation to fossil fuels in Limerick City include

- Increased use of Combined Heat and Power to take advantage of the extensive natural gas network in the City. Specific requirements for inclusion of CHP within new developments could be considered
- Continued ban on the use of bitumous coal and promotion of increase use of natural gas to reduce emissions and increase efficiency.
- District Heating systems should be considered for residential and commercial developments within the urban environment

### 7.3.4 Renewable Energy

The focus on renewable energy within Limerick City will differ considerably to that in the rural counties. Wind energy has been shown to make a major contribution within Limerick and Clare Counties (with close to 200MW expected to be in place by 2015).

Within Limerick City the recommended focus on renewables are as follows:

- Development of Photovoltaic systems, initially at a pilot scheme level on innovative developments, to extend to incorporation as standard practise in the future.

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

- Adoption of standards and requirements for the inclusion of solar thermal systems in future developments. The developments in Fingal in relation to Local Area Plans should be reviewed to determine for the potential for inclusion.

- Large scale development of wood biomass heating systems presents opportunities in hotels, industry, commercial premises etc.

- The potential for renewable based CHP should be given considerable consideration with future developments with technology in the future.

- The potential for wind turbines to be installed within industrial or other appropriate sites e.g. Third level education locations should be accounted for within future development plans.

## 7.4 Transport

### 7.4.1 Introduction

The estimated contribution to emissions from transport within Limerick city for 2005 was 183 kTonnes $CO_2$. The challenges that are presented by the rural context in Limerick and Clare Counties are not present in Limerick City. An analysis of modes of transport, compared to the rural counties, shows that there is an increased use of public transport and travel on foot within the city. Chart * shows the data for travel to work for those >19 years. It can be seen that 7% use the bus in Limerick City compared to 2% in Limerick County. Approximately double the amount of people travel to work on foot in Limerick City compared to Clare and Limerick County.

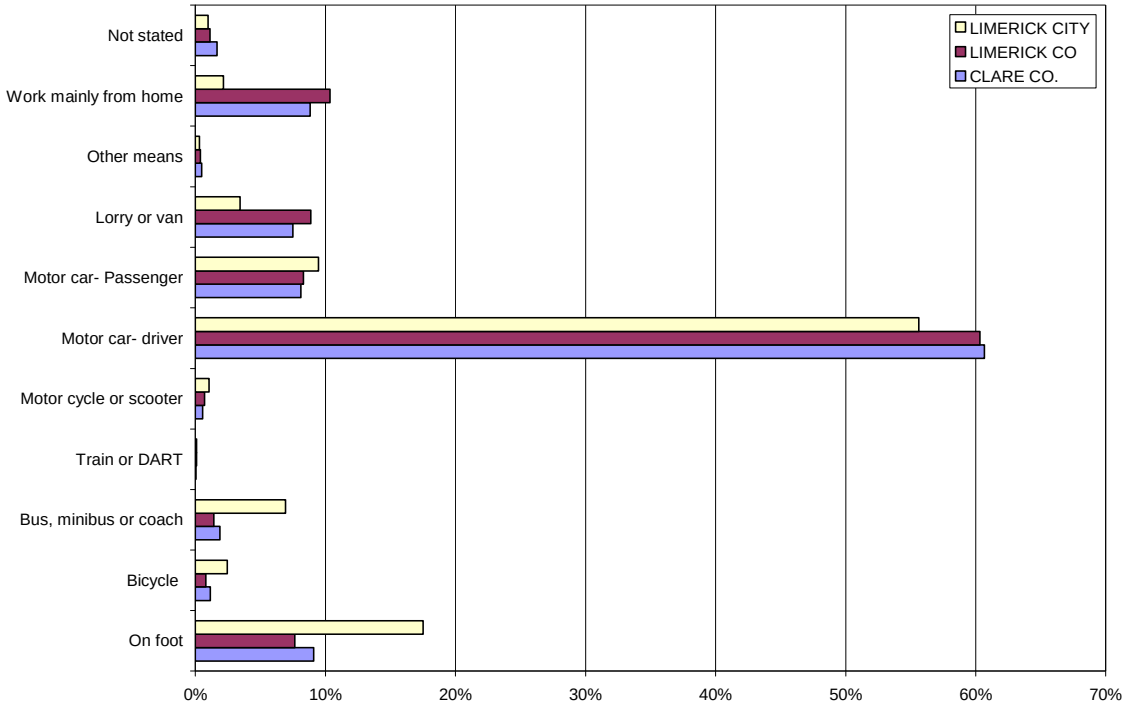


**Chart 7.6: Comparison of Modes of Travel to Work (Limerick County, Clare County and Limerick City.**

### 7.4.2 The Car

The following actions are proposed to achieve the required savings in terms of emissions within Limerick City:

- Consideration of the use of fiscal measures to reduce the use of private cars within the city i.e. congestion and parking charges
- Support of car-pooling schemes for public and private organisations with fiscal and other supports.
- Development of an infrastructure for the use of electric vehicles
- Provision of specific infrastructure to encourage the use of energy efficient vehicles

### 7.4.3 Modal Shift

Public transport infrastructure in Limerick City is generally restricted to the bus. The network provides a reasonable level of services at present. The following actions are recommended for the next 10 years to achieve reductions in $CO_2$ reductions:

- Increase the use of public transport with particular focus being applied to new residential developments to provide an appropriate service.
- Further integration of the public transport infrastructure to provide suitable linkages between the local bus, regional bus and train services.
- Development of infrastructure to further support the use of walking and cycling as a mode of transport within the city. In particular this should be focused at areas where schools and significant work forces are located.
- The public bus fleet and local authority vehicles within the City should be used as demonstrations of the use of green fuels (biofuels). These provide particular benefits as there are clear operation schedules, appropriate storage facilities and large exposure to the general public.

## 7.5. Built Environment & Residential

Within Limerick City there are a range of opportunities to achieve large $CO_2$ savings within the built environment. The higher density of development and range of building types by public and private developers should result in medium large scale demonstrations of energy efficiency in buildings and renewable energy.

The action in this area in Limerick City should focus specifically on the following

- Full implementation of the EPBD with specific focus on alternative energy supply for buildings above 1,000m2. A particular focus on CHP and commercial scale renewable energy systems is required. Further demonstration buildings similar to the Limerick County Council buildings are necessary.

- Local Area Plans which demonstrate energy performance over an above National Targets could be modelled on the experience in Fingal.

- Targets for compliance with the building regulations should be set and appropriate resources provided to Local Authorities to enforce the regulations.

- Sector based awareness and monitoring and targeting programmes should be developed within Limerick City, with an initial focus on public buildings. Advanced

compliance with the EPBD through display of energy performance should be encouraged.

## 7.6 Industry, Commerce and Services

These sectors represent a large targeted opportunity for savings within the City. It is expected that many of the large industrial sectors should have energy management programmes in place. The commercial sector will require considerable resources as these sector has had limited focus even nationally in relation to energy efficiency.

Similar measures as those proposed for the County areas should also be applied in the City. These include:

- An industrial level monitoring and targeting programme which should be linked with the Large Industry Energy Network, or similar.
- Promotion of CHP at appropriate sites
- Energy Auditing Programme
- A dedicated energy awareness programme
- Promotion of green electricity usage with targeted sectors

## 7.7 Waste

Currently the majority of waste is dealt with at the County Landfill site and is therefore dealt with in Section 6.0. The sewage and waste water treatment plants should be given particular focus as they are large energy users with options for renewable energy production through anaerobic digestion.

## 7.8 Conclusions

### 7.8.1 Individual Responsibility

The Limerick Clare Energy and Emissions Balance calculated indicators for reductions which would be require per person to achieve the Kyoto Target. This 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 7.4: Individual Responsibility – Limerick City**

| Indicator | 1990 | Kyoto Target (1990 + 13%) | 2004 | 2010 | Reduction Sought To Reach Kyoto Target | Reduction Achieved through Standard Measures |
|---|---|---|---|---|---|---|
| **Population** (000) | 52.8 | - | 54.9 | 57.6 | N/A | |
| **TFC** (GWh) | 1,174.10 | - | 1,663.70 | 1,963.40 | - | |
| **Energy Related Emissions** ('000 T-$CO_2$ ) | 418.6 | 473 | 531.2 | 623.8 | 150.8 | 119 |
| **TFC/Capita** (kWh/Person) | 22,243 | - | 30,278 | 34,080 | - | |
| **CO2 Emissions / Capita** (T $CO_2$/Person) | 7.9 | 8.6 | 9.7 | 10.8 | 2.7 | 2.2 |

### 7.8.2 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 7.5: Carbon Levies in Limerick County (Business as Usual and with Standard Measures)**

| | 2010 | 2015 |
|---|---|---|
| **Carbon Levy** (€/T) | € 35.00 | € 45.00 |
| **Levy BAU** (€) | € 5,250,000 | € 8,730,000 |
| **Levy Standard Measures** (€ ) | € 1,100,000 | € 2,330,000 |

# 8.0 Limerick & Clare Energy & Environmental Indicators –Summary

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

| | 1991 | | | | 2000 | | | | 2004 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Indicator** | **Ireland** | **Clare** | **Limerick County** | **Limerick City** | **Ireland** | **Clare** | **Limerick County** | **Limerick City** | **Ireland** | **Clare** | **Limerick County** | **Limerick City** |
| **Population** (000) | 3,525.7 | 90.9 | 109.9 | 52.1 | 3,780.0 | 100.7 | 112.5 | 53.3 | 4,043.8 | 105.0 | 123.4 | 54.9 |
| **TFC Fuel Consumed** (GWh) | 85,662.7 | 2,302.2 | 2,753.3 | 1,192.3 | 123,593.0 | 3,406.8 | 4,007.9 | 1,564.5 | 136,718.0 | 3,806.3 | 4,284.4 | 1,665.2 |
| **Energy Related Emissions** (ktT-$CO_2$) | 31,244.9 | 836.09948 | 1,006.2 | 444.9 | 41,920.3 | 1,172.8 | 1,374.8 | 541.9 | 43,041.7 | 1,206.9 | 1,421.8 | 531.2 |
| **GVA** (€ million) | 34,092.0 | 847.7 | 1,046.7 | 496.1 | 91,458.0 | 2,202.3 | 2,569.4 | 1,011.5 | 132,481.0 | 2,816.8 | 3,307.8 | 1,473.1 |
| **TFC/GVA** (kWh/€thousand) | 2,512.7 | 2,715.7 | 2,630.5 | 2,403.2 | 1,351.4 | 1,546.9 | 1,559.9 | 1,546.7 | 1,032.0 | 1,351.3 | 1,295.2 | 1,130.4 |
| **TFC/Capita** (kWh/ Inhabitant) | 24,296.5 | 25,321.3 | 25,058.6 | 22,892.9 | 32,696.6 | 33,830.8 | 35,622.8 | 29,331.2 | 33,809.3 | 36,236.5 | 34,733.2 | 30,306.1 |
| **$CO_2$ Emissions / Capita** (T $CO_2$ / Inhabitant) | 8.9 | 9.2 | 9.2 | 8.5 | 11.1 | 11.6 | 12.2 | 10.2 | 10.6 | 11.5 | 11.5 | 9.7 |

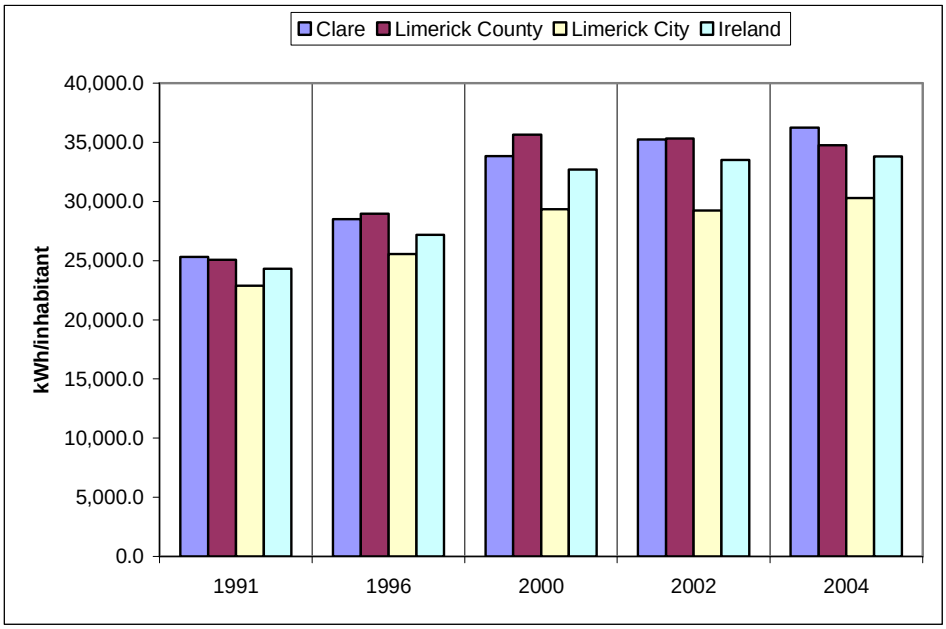


**Chart 8.1: Total Final Consumption per capita (kWh/inhabitant)**

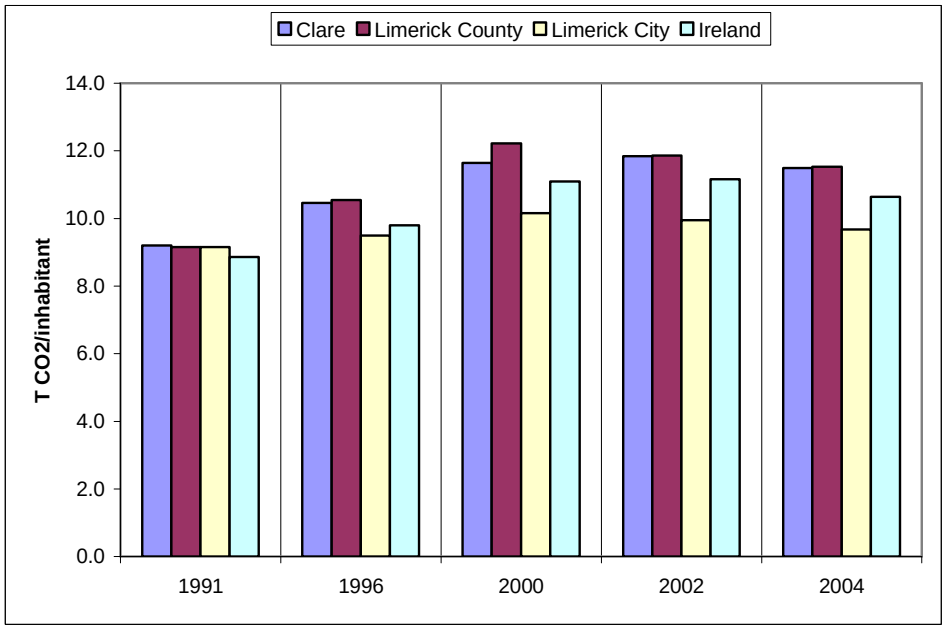


**Chart 8.2: Tonnes $CO_2$ Emissions per capita (Tonnes $CO_2$/Inhabitant)**

Charts 8.1 and 8.2 present specific data in relation to TFC per capita and $CO_2$ emissions per capita. It can be seen that in general Clare and Limerick Counties have a higher TFC and $CO_2$ emissions per capita compared to the National averages. Limerick City is generally below the National average. This would reflect the fact of higher building densities, greater access to public transport, and the greater penetration of natural gas.

# 9.0 Limerick & Clare Energy Balance - Review

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

## 9.1 TFC and $CO_2$ Emissions by Area

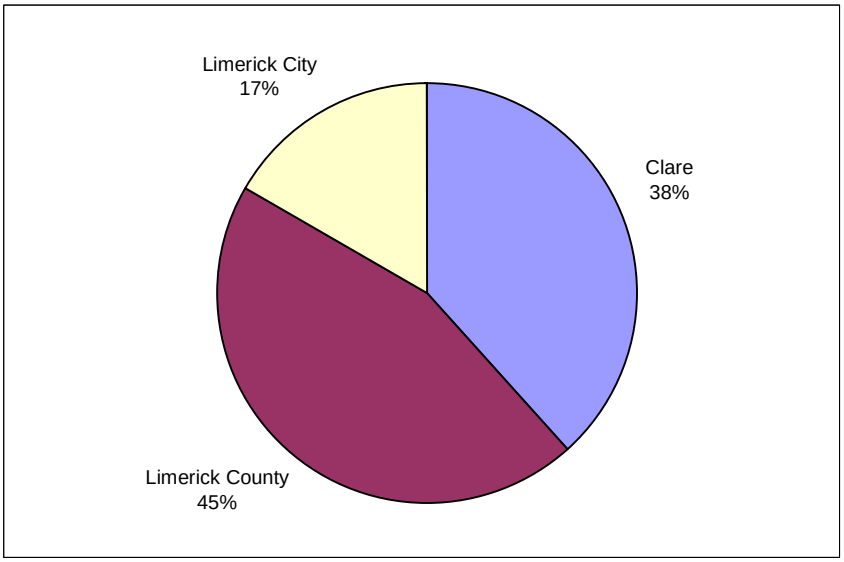


**Chart 9.1: % Share of Total Final Energy Consumption by Area**

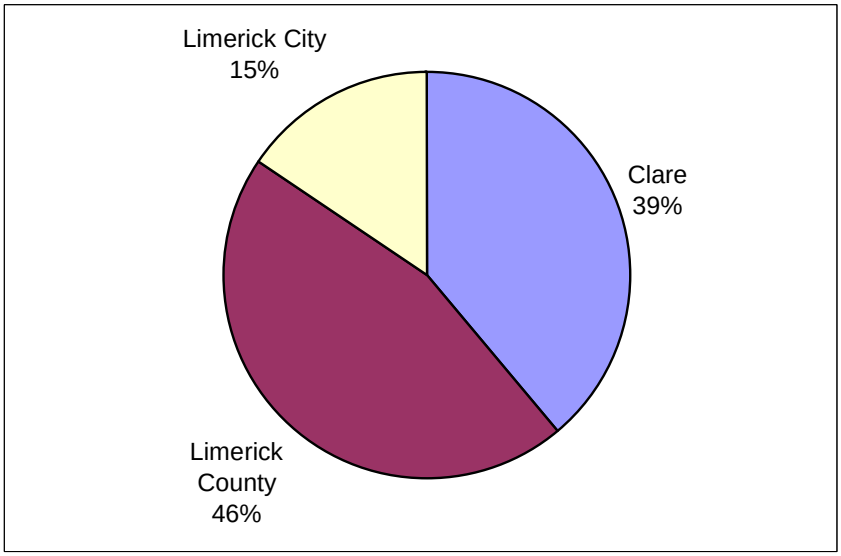


**Chart 9.2: % Share of Energy Related $CO_2$ Emissions by Area**

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

## 9.2 TFC by Area: 1990, 2004, 2010

**Table 9.1 TFC for Each Area**

| GWh | Clare | Limerick County | Limerick City |
|---|---|---|---|
| **1990** | 2,256.2 | 2,713.3 | 1,104.9 |
| **2004** | 3,806.3 | 4,474.2 | 1,665.2 |
| **BAU 2010** | 4,504.6 | 5,014.6 | 1,963.4 |

**Table 9.2: % TFC for each Area**

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

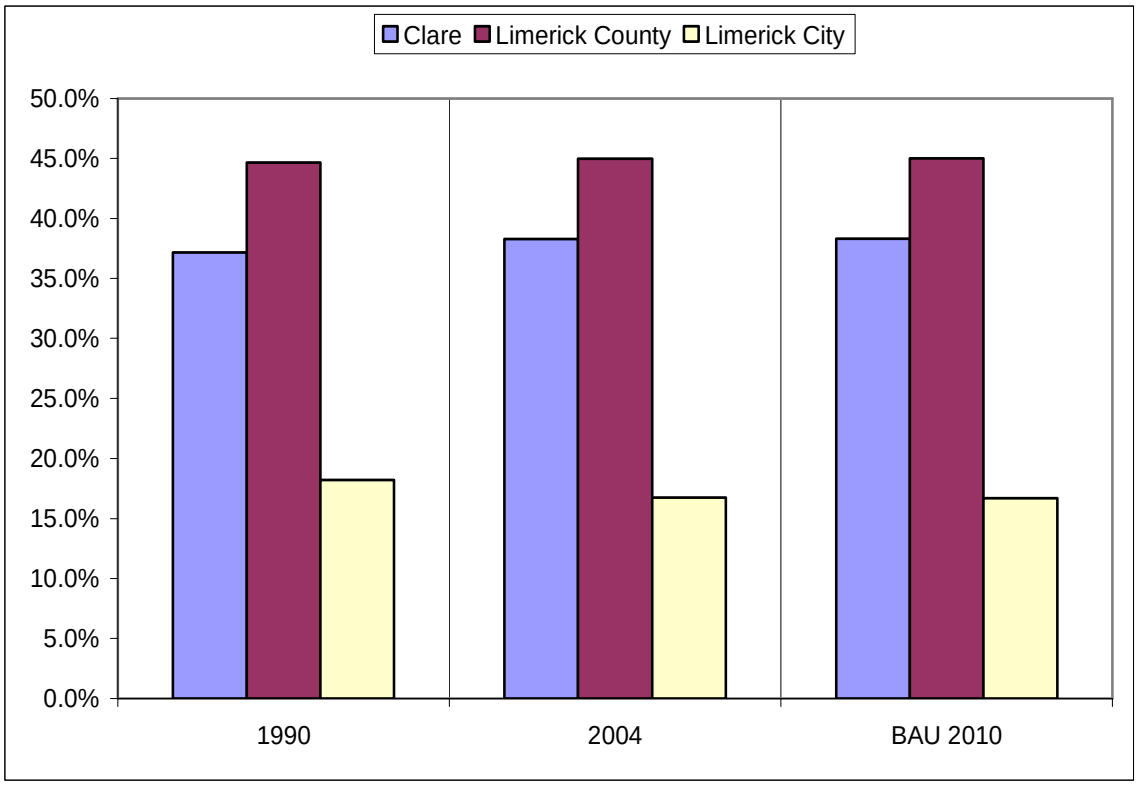


**Chart 9.3: % TFC for each Area**

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

## 9.3 TFC by Fuel: 1990, 2004, 2010

**Table 9.3 Total TFC by Fuel for Study Area**

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

**Table 9.4 % TFC by Fuel for Study Area**

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

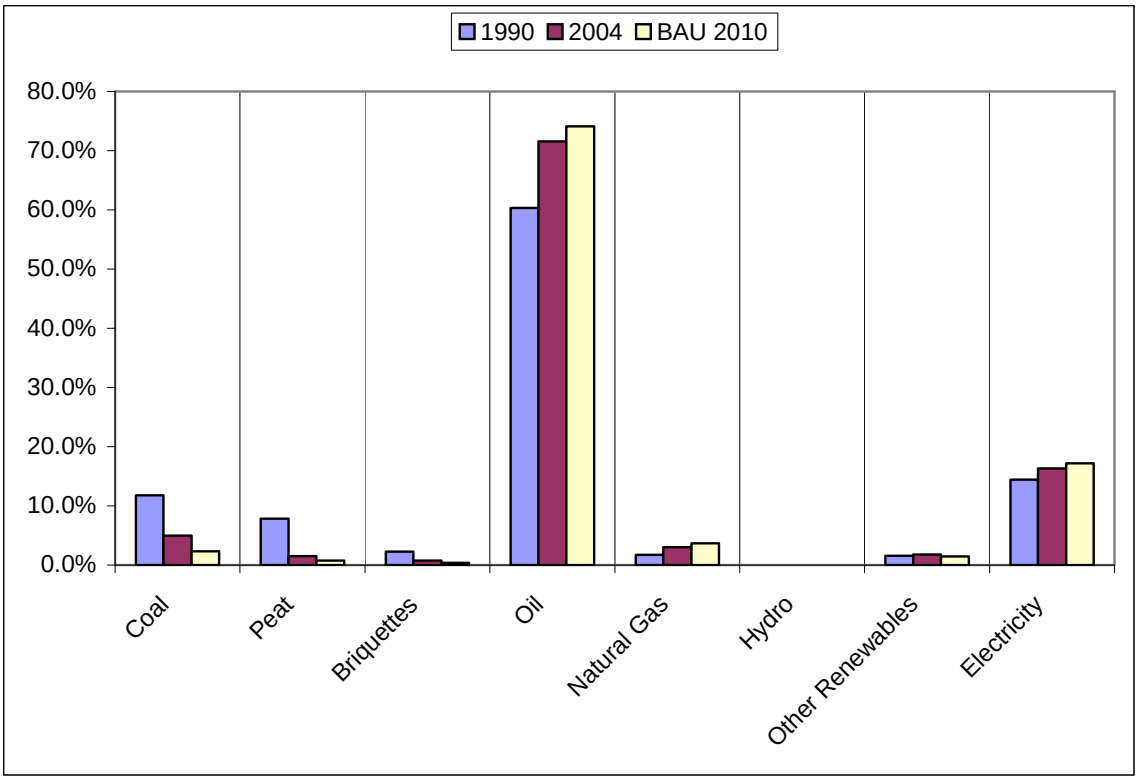


**Chart 9.4: % TFC by Fuel for Study Area**

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

## 9.4 TFC by Sector 1990, 2004, 2010

**Table 9.5 TFC by Sector for Study Area**

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

**Table 9.6: % TFC by Sector for Study Area**

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

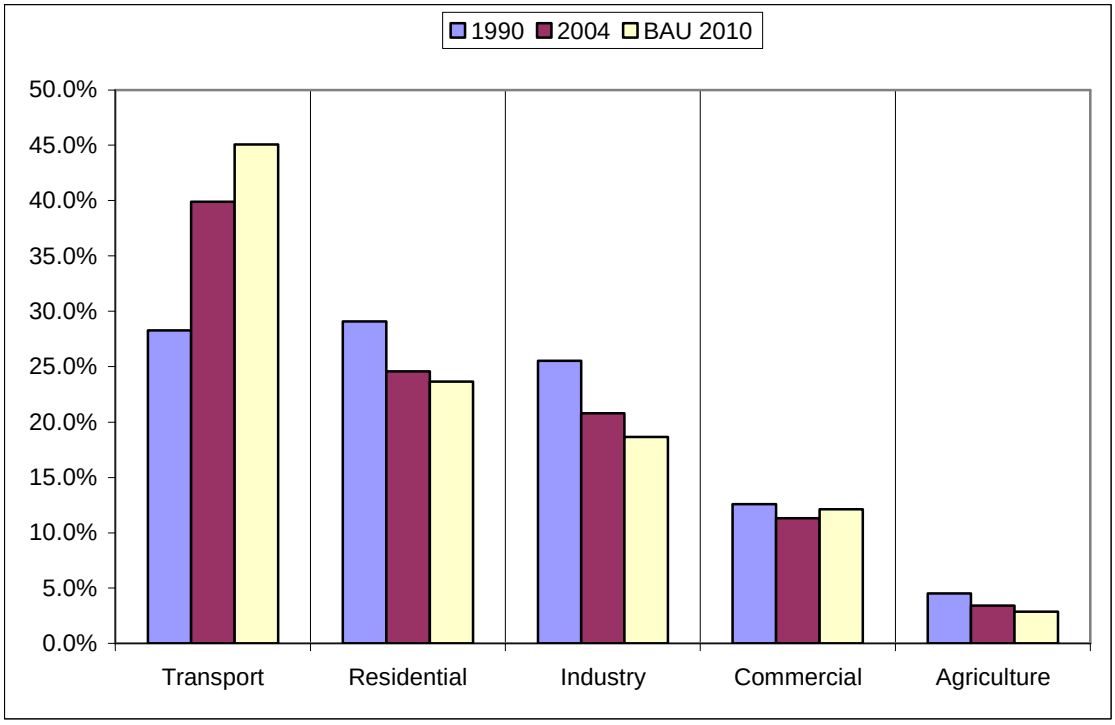


**Chart 9.5: % TFC by Sector for Total Study Area**

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

## 9.5 $CO_2$ by Fuel: 1990, 2004, 2010

**Table 9.7: $CO_2$ Emissions By Fuel for Study Area**

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

**Table 9.8 % $CO_2$ Emissions by Fuel for Total Study Area**

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

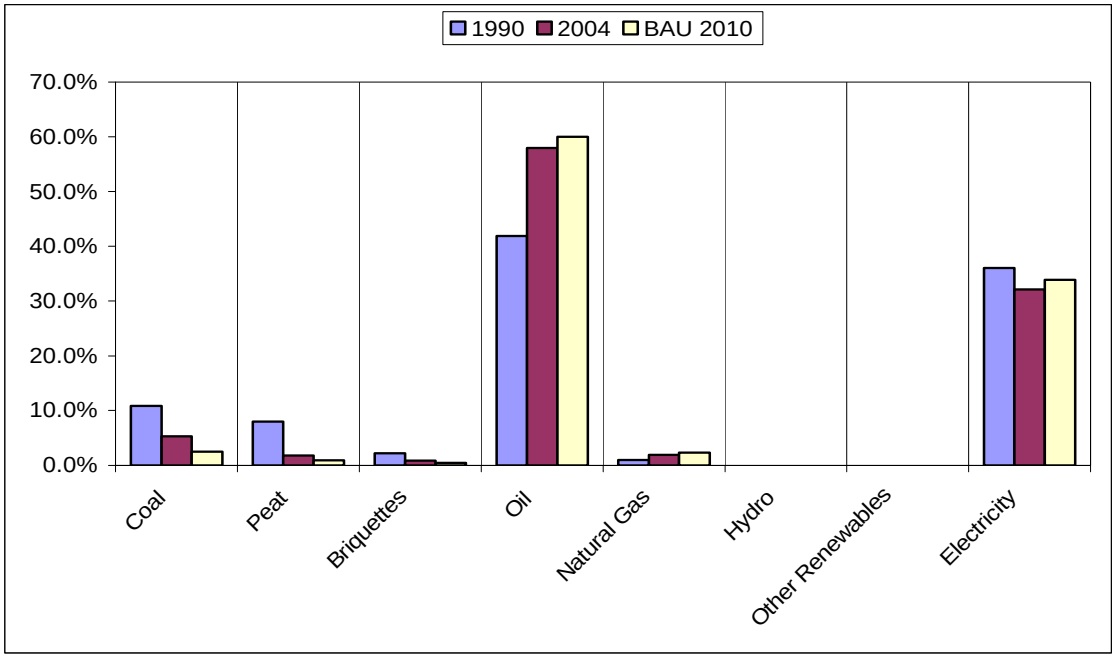


**Chart 9.6: % $CO_2$ Emissions by Fuel for Total Study Area**

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

## 9.6 $CO_2$ by Sector: 1990, 2004, 2010

**Table 9.9: $CO_2$ Emissions By Sector for Study Area**

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

**Table 9.10: % $CO_2$ Emissions By Sector for Study Area**

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


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

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

## 9.8 Individual Responsibility

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

**Table 9.11: Individual Responsibility**

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

# APPENDICES