# Energy Efficiency Policies and Measures in Ireland

## Monitoring of Energy Efficiency in EU 27,

## Norway and Croatia (ODYSSEE-MURE)

Sustainable Energy Ireland

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# 1 Executive Summary

This report presents an analysis of energy efficiency trends in Ireland on the basis of indicators extracted from the Odyssee database[1]. The analysis focuses on the period 1997 to 2007. In addition the report examines key polices and measures which are designed to promote energy efficiency. These are taken from the MURE[2] database.

The report also includes a review of recent trends in economic growth, energy consumption and related emissions in order to provide a context for energy efficiency.

**Overall Trends**

In Ireland the energy efficiency of final consumers, as measured by ODEX, improved by 7% over the period 1997 to 2007 (0.7% per annum on average). Over the period 1997 to 2007 primary energy consumption increased by 38% while final energy consumption increased by 52.3%.

The key policy measures for promoting energy efficiency and sustainability in Ireland are outlined in the *Energy White Paper: Delivering a Sustainable Energy Future for Ireland* [3]and the *National Climate Change Strategy 2007 - 2012*[4].

The *National Energy Efficiency Action Plan*[5] was finalised in April 2009 and outlines the proposals to meet the European Energy Servies Directive target and the European target of a 20% improvement in energy efficiency by 2020.

**Industry**

Over the period 1997 to 2007 the ODEX indicator of energy efficiency for the industrial sector improved by 9.9% (1% per annum). The intensity at constant structure improved by 14% over the same period.

Final energy use in industry has grown by 28% (2.5% per annum) to 2.7 Mtoe over the period 1997 to 2007. The share of electricity is 27%, natural gas increased its share from in 18% in 1997 to 24% in 2007 and the renewables share grew from 3.4% to 5.7%.

While industrial energy consumption increased by 28%, the value added of industry increased by 104% resulting in a reduction in intensity of 37%.

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1 http://www.odyssee-indicators.org/

2 www.mure2.com

3 http://www.dcenr.gov.ie/Energy/Energy+Planning+Division/Energy+White+Paper.htm

4 http://www.environ.ie/en/Publications/Environment/Atmosphere/FileDownLoad,1861,en.pdf

5http://www.dcenr.gov.ie/Energy/Energy+Efficiency+and+Affordability+Division/National+Energy+Efficiency+Action+Plan.htm

In the industrial sector measures concerned with information/education/training are the most common. The key energy efficiency measure in the industrial sector is the Large Industry Energy Network (LIEN).

**Residential**

Over the period 1997 to 2007 the ODEX indicator of energy efficiency for the residential sector improved by 13% (1.3% per annum).

Residential final energy use grew by 38% (3.3% per annum) over the period 1997 to 2007 to a figure of 2.9 Mtoe. During this time the number of households in Ireland increased by 31% from approx. 1.14 million to 1.54 million (estimated) at the end of 2007.

Energy usage per dwelling decreased by -1% during the period 1997 to 2007. When this is corrected for climate variations there was 5% increase. Over the period 1997 to 2007, energy usage per square metre fell by 14% (1.5% per annum), fossil-fuel usage decreased by 18% (2% per annum) while electricity usage decreased by 0.24% (0.024% per annum). Over the same period, the average floor area of the housing stock is estimated to have increased by 13% (1.3% per annum).

Key energy efficiency measures in the residential sector are the various iterations of the building regulations and the Power of One information campaign. Legislative–normative are the most common type of measure in the residential sector. Significant measures include changes to the building regulations were introduced in July 2008 and a Home Energy Savings Scheme.

**Transport**

The transport ODEX improved by 2.7% over the period 1997 to 2007 (0.3% per annum) indicating a slight improvement in energy efficiency in that sector.

Transport sector energy use increased by 97%. The road freight category recorded the largest growth over the period of 182%. This is significant because the focus of attention in the sector is often the private car mode, which increased by 62%. The mode with the second largest increase was public passenger services which grew by 174%, air grew by 135% and rail consumption increased by 11%.

The energy intensity of road freight increased of 34% (3% per annum) since 1997. It can be seen that the ratio of fuel usage of road freight (excluding light-duty vehicles) and tonne kilometres decreased by 5.7% (0.6% per annum). This suggests that energy efficiency (i.e. the amount of energy required to transport a given quantity of goods) has started to improve, having remained relatively constant over most of the period. There was a 12% (1.43% per annum) reduction in the ratio of fuel consumption of private cars relative to personal consumption for the period 1997 to 2007.

Key policies in the transport sector designed to promote energy efficiency are Transport 21 infrastructure programme and the vehicle registration tax rebate for hybrid vehicles.

Since July 2008 the vehicle registration tax (VRT) and the annual motor tax (AMT) of all new cars are based on CO2 emissions as opposed to engine size.

Infrastructural (investment in road, rail etc) and fiscal (VRT and AMT tax changes etc.) measures are the most common type of measure in the transport sector.

**Commercial /Public Services**

Final energy use in the commercial and public services (or tertiary) sector grew by 41% (3.5% per annum) over the period 1997 to 2007 to a figure of 1.7 Mtoe. During this period the value added generated by the sector grew by 87% while the numbers employed grew by 74%. Energy intensity decreased by 25% (2.8% per annum) to a figure of 15.7 goe /€ $_{2006}$ in 2007.

The fuel intensity of services was 40% lower in 2007 than in 1997. Electricity intensity increased by 32% from 1997 to 2003, but decreased by 11% since then.

Unit consumption of electricity rose since 1997. By 2003 it was 33% higher than in 1997 but fell back to 19% above 1997 levels in 2007. The increase can be linked to the increasing use of office equipment, computers, printers, photocopiers etc during this time. By contrast, the fuel consumption per employee has declined by 35% since 1997.

The measures for the commercial /public services sector are split evenly between education-information-training (for example the public sector energy efficiency programme), financial (grants for energy efficient boilers), co-operative (voluntary standards and certification) and legislative-normative (building regulations). The public sector programme is a key energy efficiency measure in the services sector.

# 2 The Background to Energy Efficiency

This report presents an analysis of energy efficiency trends in Ireland on the basis of indicators extracted from the Odyssee database[6]. The analysis focuses on the period 1997 to 2007. In addition the report examines key polices and measures which are designed to promote energy efficiency. These are sourced from the MURE[7] database.

The report also includes a review of recent trends in economic growth, energy consumption and related emissions in order to provide a context for energy efficiency.

## 2.1 Overall economic context

This section gives a brief overview of economic growth and energy trends in Ireland over the period 1997 to 2007. This section draws upon the SEI publications: *Energy in Ireland 1990 – 2007*[8] and *Energy Efficiency in Ireland – 2009 Report*[9].

There has been particularly strong economic growth in Ireland over the period 1997 to 2007. This resulted in GDP in 2007 being almost twice times that of 1997. The highest average annual growth rate was between 1997 and 2000 at 9.5%. For the period 1997 to 2007 there was an overall average annual growth rate of 6.8%. In 2007 the economy grew by 6%.

Figure 1 and Table 1 present the trends in GDP, total primary energy requirement (TPER) and energy related $CO_2$ emissions for the period 1997 to 2007.

Figure 1 shows the relative decoupling of total primary energy requirement (TPER) from economic growth since 1997 in particular during 2002 and 2003[10]. This is a result of changes in the structure of the economy and improvements in energy efficiency. To a lesser extent, the decoupling of $CO_2$ emissions[11] from energy use is also evident, particularly since 2001 and this is due to changes in the fuel mix.

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6 http://www.odyssee-indicators.org/

7 http://www.isis-it.com/mure/index.htm

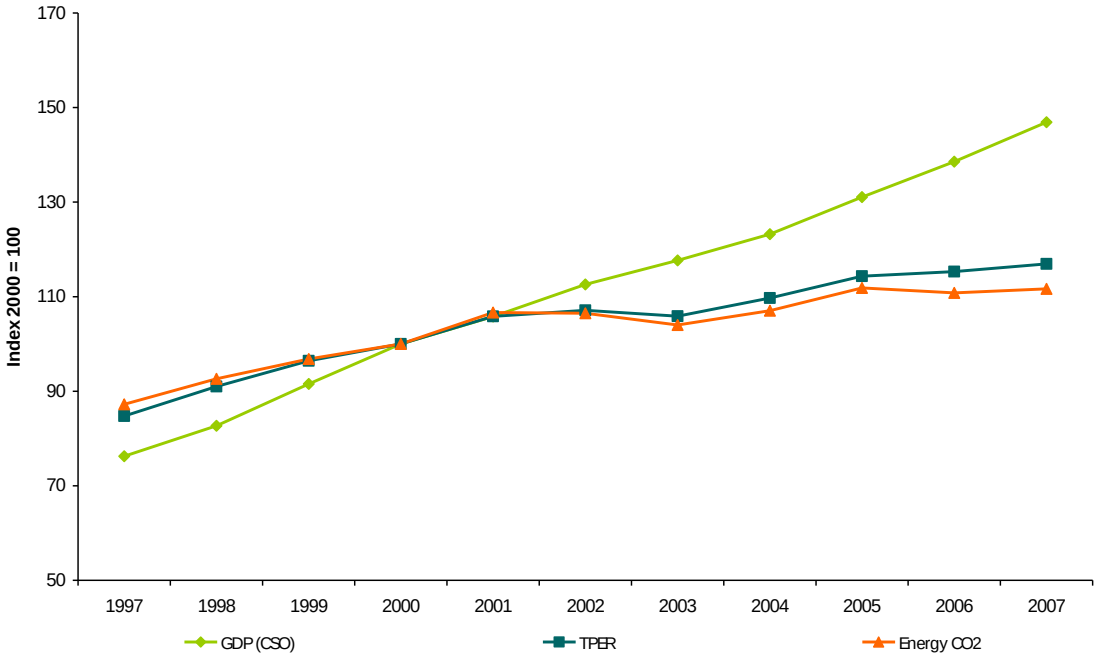
8 Available from www.sei.ie

9 Available from www.sei.ie

10 In 2002 and 2003 the reduction in the carbon intensity was due to the commissioning of two high efficiency gas fired electricity generating plant.

11 Energy-related $CO_2$ emissions shown here (2007 data are provisional) cover all energy related $CO_2$ emissions associated with TPER, including emissions associated with international air transport. These are usually excluded from the national GHG emissions inventory in accordance with the reporting procedures of the UN Framework Convention on Climate Change (UNFCCC) guidelines.

***Figure 1 Macroeconomic Indicators 1997 to 2007***




Source[12]: SEI and CSO[13]

**Table 1 *Macroeconomic Indicators***

| | Growth % | Average annual[14] growth rates % | | | | |
|---|---|---|---|---|---|---|
| | '97 – '07 | '97 – '07 | '97 – '00 | '00 – '05 | '05 – '07 | 2007 |
| GDP | 92.7 | 6.8 | 9.5 | 5.6 | 5.9 | 6.0 |
| TPER | 38.0 | 3.3 | 5.7 | 2.7 | 1.1 | 1.4 |
| Energy $CO_2$ | 28.0 | 2.5 | 4.7 | 2.3 | -0.1 | 0.8 |
| Energy $CO_2$ (excl. international aviation) | 24.2 | 2.2 | 4.4 | 2.1 | -0.7 | 0.5 |

Source: SEI and CSO

## 2.2 Energy consumption trends: by fuel and by sector

Primary energy consumption in Ireland in 2007 was 16.1 million tonnes of oil equivalent (Mtoe) an increase of 38% on 1997.

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12 Data are sourced from SEI or Odyssee unless otherwise stated.

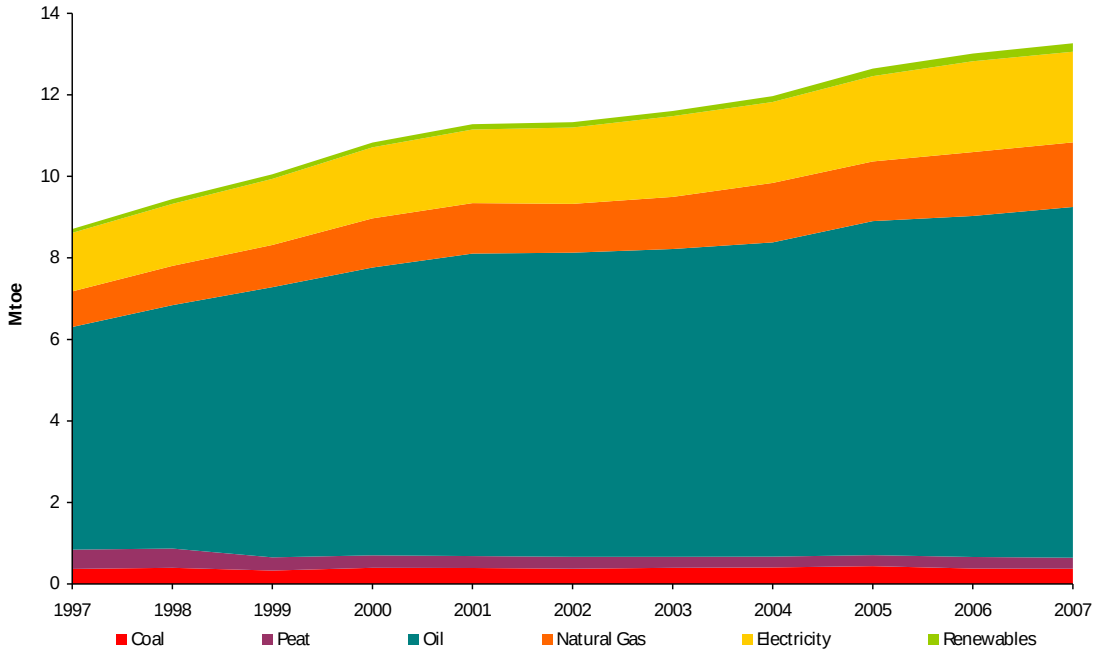
13 Central Statistics Office (CSO) www.cso.ie.

14 Throughout the report where annual growth rates are across multiple years they always refer to *average annual growth rates*.

Final energy demand is a measure of the energy that is delivered to energy end users in the economy to undertake activities as diverse as manufacturing, movement of people and goods, essential services and other day-to-day energy requirements of living. This is also known as Total Final Consumption (TFC) and is essentially total primary energy less the quantities of energy required to transform primary sources such as crude oil into forms suitable for end use consumers such as refined oils, electricity, patent fuels etc (Transformation, processing or other losses entailed in delivery to final consumers are known as "energy overhead").

Figure 2 shows the shift in the pattern of final energy demand by fuel over the period 1997 – 2007.

***Figure 2 Total Final Consumption by Fuel***




Source: SEI

Ireland's TFC in 2007 was 13 Mtoe, an increase of 1.9% on 2006 and and 52.3% above 1997 levels (representing an average growth rate of 4.3% per annum). This increase in final consumption in 2007 was achieved with just a 1.4% increase in primary energy, indicating continued improvement in efficiency of supply due to efficiency gains in electricity generation and increased contributions from renewables and combined heat & power. Over the period 2005 – 2007, final demand increased by 2.4% per annum compared with primary energy growth of 1.1% per annum.

There have been a number of changes in the growth rates and respective shares of individual fuels in final consumption over the period, as shown in Table 2.

**Table 2** ***Growth rate and shares of TFC of fuels***

| | Growth % | Average annual growth rates% | | | | | Shares % | |
|---|---|---|---|---|---|---|---|---|
| | **'90 – '07** | **'97 – '07** | **'97 – '00** | **'00 – '05** | **'05 – '07** | **2007** | **1997** | **2007** |
| Fossil Fuels (Total) | 51.0 | 4.2 | 7.7 | 2.9 | 2.2 | 2.2 | 82.4 | 81.7 |
| Coal | 1.8 | 0.2 | 2.7 | 1.8 | -7.3 | -0.9 | 4.2 | 2.8 |
| Peat | -42.5 | -5.4 | -13.8 | -2.0 | -0.4 | -4.3 | 5.4 | 2.0 |
| Oil | 57.5 | 4.6 | 8.9 | 3.0 | 2.5 | 2.8 | 62.7 | 64.9 |
| Natural Gas | 81.5 | 6.1 | 11.3 | 4.0 | 4.0 | 1.1 | 10.0 | 11.9 |
| Renewables | 117.0 | 8.1 | 6.9 | 9.4 | 6.0 | 9.5 | 1.1 | 1.6 |
| Combustible Fuels (Total) | 51.8 | 4.3 | 7.7 | 3.0 | 2.3 | 2.3 | 83.5 | 83.2 |
| Electricity | 54.7 | 4.5 | 6.7 | 3.7 | 3.1 | -0.1 | 16.5 | 16.8 |
| | | | | | | | | |
| Total | 52.3 | 4.3 | 7.5 | 3.1 | 2.4 | 1.9 | | |

Source: SEI

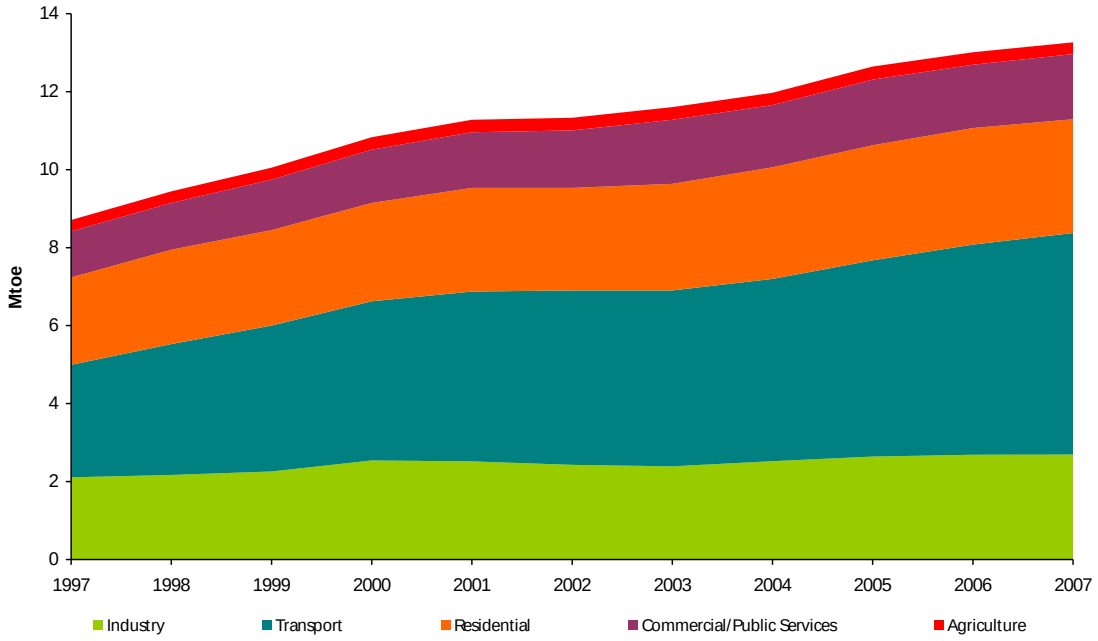
The most significant changes can be summarised as follows:

- Use of renewable energy sources experienced the highest growth in 2007 with final consumption growing by 9.5% in 2007, due to the dramatic increase in biofuels.
- Final consumption of oil grew by 2.8% in 2007 with oil accounting for approximately 65% of final energy consumption.
- Natural gas growth was slower at 1.1% in 2007 compared with 7.1% in 2006. Annual growth between 2005 and 2007 was 4.0%
- Final consumption of coal decreased by 1% in 2007 and by 7.3% per annum between 2005 and 2007.
- From experiencing the second highest growth of 6.3% in 2006, final consumption of electricity in 2007 was flat with a slight 0.1% fall in consumption due largely to reduced electricity demand in industry.

- Final consumption of peat fell by 4.3% mainly due to a decline in consumption in the residential sector.

Figure 3 also shows the trend in TFC over the period, here allocated to each of the sectors of the economy.

***Figure 3 Total Final Energy Consumption by Sector***




Source: SEI

Over the period the relative weighting of the sectors has changed. Transport has continued to increase its dominance (since the mid 1990s) as the largest energy consuming sector (on a final energy basis) with a share of 43% while the share of industry and residential have decreased.

**Table 3** ***Growth rate and shares of TFC by sector***

| | Growth % | Average annual growth rates % | | | | | Shares % | |
|---|---|---|---|---|---|---|---|---|
| | '97 – '07 | '97 – '07 | '97 – '00 | '00 – '05 | '05 – '07 | 2007 | 1997 | 2007 |
| Industry | 27.6 | 2.5 | 6.4 | 0.8 | 0.9 | 0.1 | 24.2 | 20.3 |
| Transport | 96.9 | 7.0 | 12.2 | 4.3 | 6.3 | 5.5 | 33.1 | 42.9 |
| Residential | 30.4 | 2.7 | 4.1 | 3.2 | -0.6 | -2.4 | 25.7 | 22.0 |
| Commercial / Public | 41.4 | 3.5 | 5.0 | 4.2 | -0.4 | 3.0 | 13.6 | 12.6 |
| Agriculture | 2.2 | 0.2 | 2.5 | 1.2 | -5.4 | -6.5 | 3.4 | 2.3 |
| Total | 52.3 | 4.3 | 7.5 | 3.1 | 2.4 | 1.9 | | |

Source: SEI

The changes in growth rates are tabulated in Table 3 and summarised as follows:

- Overall final energy consumption increased by 1.9% in 2007. This was achieved with just a 1.4% growth in primary energy requirement.
- Transport final energy use increased by 97% over the period 1997 – 2007. Final consumption of energy in transport was 5.7 Mtoe in 2007. This represents an average annual growth rate of 7% and transport's share of TFC increased from 33% to 43%. Growth in 2007 was 5.5%, the highest sectoral growth in the year. In the period 2005 – 2007, transport energy demand grew by 6.3% per annum, while demand in all other sectors reduced or grew at a rate of less than 1% per annum
- Industry's final energy use increased by 0.1% (to 2.7 Mtoe) in 2007. Over the 1997 – 2007 period industry experienced an average growth rate of 2.5% per annum (or 27.6% in absolute terms) and its share of TFC dropped from 24% to 20%. Since 2000, industry energy demand growth has been less than 1% per annum on average, in contrast to the growth levels in the late 1990s of more than 5% per annum,
- Final energy use in the residential sector fell by 2.4% in 2007 and by 0.6% per annum in the period 2005 - 2007. Fossil fuel use decreased by 3.4% in households and electricity use decreased by 0.2%. Renewable energy use in the residential sector, on the other hand, increased by 42%.
- The commercial and public services sector experienced an increase of 3% in final energy use in 2007 but saw a reduction over the period 2005 – 2007 of 0.4% per annum.

- The agricultural sector's relative share fell from 3.4% in 1997 to 2.3% in 2007 although final energy consumption grew by 2.2% to 0.3 Mtoe (0.2% per annum). In absolute terms, agriculture also experienced a decrease of 6.5% in energy consumption in 2007.

## 2.3 The policy background to energy efficiency

The following section briefly details key policies and measures related to energy efficiency in Ireland. This section is not meant to be an exhaustive list, merely a summary of recent key policies and measures. The MURE database[15] provides details on all measures and a summary in tabular form (by sector) can be found in Annex 2.

**Sustainable Energy Ireland** (SEI) is Ireland's national energy authority. Established on May 1st 2002 under the Sustainable Energy Act 2002, SEI has a mission to promote and assist the development of sustainable energy. This includes implementing significant aspects of the **White Paper on Sustainable Energy** (2007), the **National Climate Change Strategy 2007 – 2012** (NCCS) and also the **National Development Plan 2007 – 2013** such as:

- Improving energy efficiency;
- Advancing the development and competitive deployment of renewable sources of energy and combined heat and power;
- Reducing the environmental impact of energy production and use, particularly in respect of greenhouse gas emissions.

In March 2007 the Government published a White *Paper Delivering a Sustainable Energy Future for Ireland* on sustainable energy. This White Paper sets out the Government's Energy Policy Framework 2007-2020 to deliver a sustainable energy future for Ireland. It is set firmly in the global and European context which has put energy security and climate change among the most urgent international challenges. One of the main goals of the White Paper is to achieve 20% savings in energy across the electricity, transport and heating sectors by 2020, in line with EU target and setting an indicative target of 30% for 2020 to surpass the EU ambition.

Ireland's draft **National Energy Efficiency Action Plan (NEEAP)** was released for public consultation in October 2007 and the final document was published in May 2009. The plan proposes a range of actions and measures to deliver Ireland's energy-efficiency targets both the national 20% savings target for 2020 and the EU ESD 9% energy-savings target for 2016.

[15] www.mure2.com

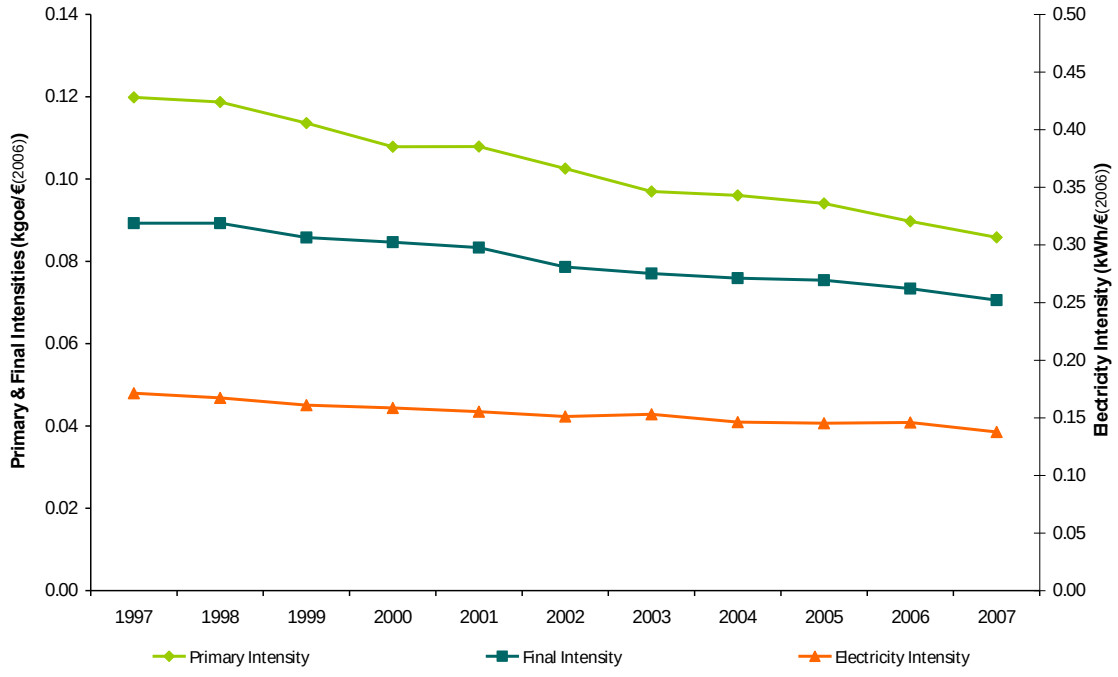
# 3 Overall Assessment of Energy Efficiency Trends

## 3.1 Overall trends in energy intensity

Energy intensity is defined as the amount of energy required to produce some functional output. In the case of the economy, the measure of output is generally taken to be gross domestic product (GDP). GDP measured in constant prices is used to remove the influence of inflation.

The intensity of primary, final energy and electricity requirements have been falling (improving) since 1997 as shown in Figure 4. The primary energy intensity of the economy fell by 28% between 1997 and 2007 (3.3% per annum). In 1997 it required 0.12 kilograms of oil equivalent (goe) to produce one euro of GDP (in constant 2006 values), whereas in 2007 just under 86 goe was required. Final intensity decreased by 21% (2.3% per annum on average) to 71 goe /€$_{2006}$[16].

***Figure 4 Primary, Final and Electricity Intensity 1997 to 2007***




Source: SEI

Figure 4 shows the trend in both primary (TPER/GDP) and final (TFC/GDP) energy intensities (at constant 2006 prices). The difference between these two trends reflects the amount of energy required in the transformation from primary energy to final energy – primarily used for electricity generation. The convergence of these trends

16 Intensity as measured by the ratio of final energy usage to GDP in constant 2006 money value. This is expressed as kilograms of oil equivalent per euro of GDP (kgoe /€ $_{2006}$).

mostly reflects the increasing efficiency of the electricity generation sector. The recent improvement in the transformation sector is illustrated from 2001 onwards when primary intensity fell at a faster rate than final intensity. The decrease in primary intensity since 2001 was 20% whereas for final intensity the decrease was 15%.

Newer transformation units coming on stream, such as combined-cycle gas turbine generators (CCGT), tend to be of higher efficiency. This has contributed to increasing the aggregate efficiency of the transformation process. In August 2002, the 392 MW Dublin Bay Power CCGT plant was commissioned, thus improving 2002 generating efficiency. Huntstown's 343 MW CCGT plant also contributed from late 2002. These developments had full effect in 2003, with both plants operational all year. In addition, increasing contributions from renewable sources, imports and the closure of old peat-fired stations have increased the efficiency of electricity supply and helped bring the trends in primary and final energy intensity (Figure 4) closer together.

There was an increase in electricity supply efficiency from 42% in 2006 to 45% in 2007, due largely to the commissioning of two further CCGT plants – Tynagh (384 MW) in 2006 and Huntstown 2 (401 MW) in 2007 – and the increase in renewable electricity. Renewables contributed 9.4%[17] of Ireland's gross electricity in 2007. Combined heat and power plants (CHP) contributed 6.2% of Ireland's gross electricity in 2007. The CHP contribution also increased significantly in 2006 due to the commissioning of the Aughinish Alumina 160$MW_e$ plant.

Final electricity intensity of the economy has not been falling as fast as primary or final energy intensities. Over the period 1997 – 2007 the electricity intensity fell by 20%. This is attributed to the shift towards increased electricity consumption in energy end use. While electricity consumption increased by 55% since 1997 (4.5% average annual growth), final energy demand increased by 52% (4.3% annual growth).

There are many factors that contribute to how the trend in energy intensity evolves. These factors may be technological efficiency, choice of fuel mix, economies of scale and not least the structure of the economy. Economic structure in Ireland's case has changed considerably over the past ten years. The structure of the economy has shifted in the direction of the high value added sectors such as pharmaceuticals, electronics and services. Relative to traditional "heavier" industries, such as car manufacturing and steel production these more recently added sectors are not highly energy intensive. Major changes to the industrial structure include the cessation of steel production in 2001 and fertiliser production in 2002 contributed to reductions in intensity.

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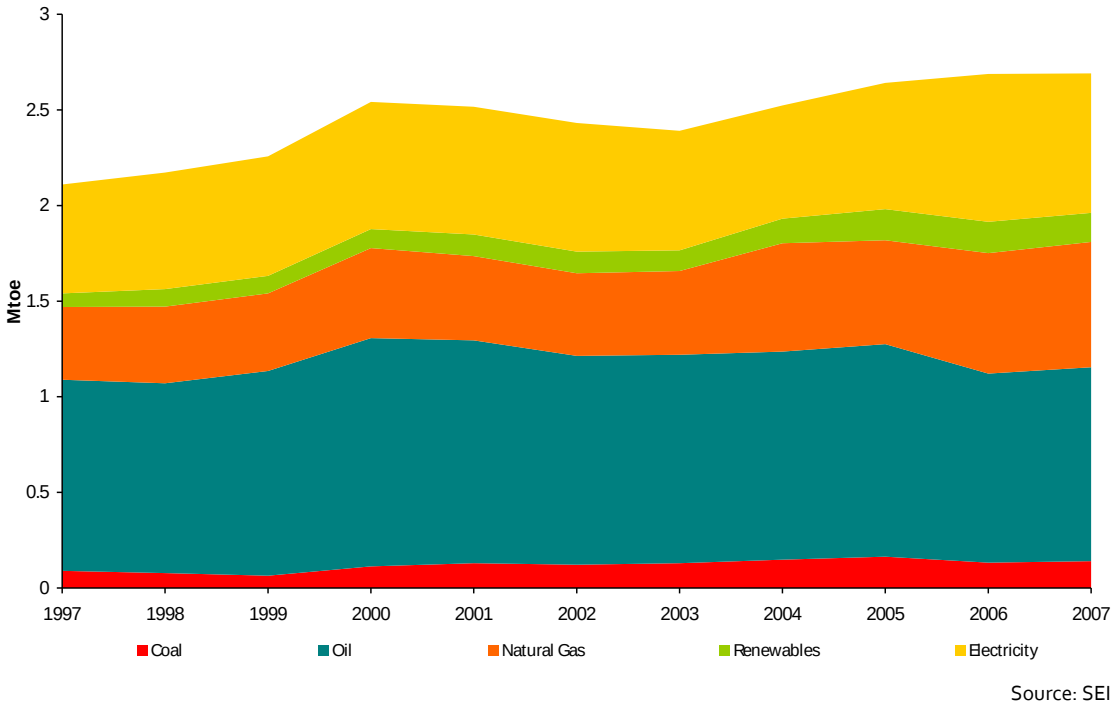
17 SEI, 2008: *Renewable Energy in Ireland 2008 Report.* Available from: www.sei.ie/Publications/Statistics_Publications/SEI_Renewable_Energy_2008_Update/Renewable%20Energy%20Update%202008.pdf

Energy intensity will continue to show a decreasing trend if, as expected, the economy continues to move away from low value-added high energy consuming sectors to one that is dominated by high-value added low energy consuming sectors. This results in a more productive economy from an energy perspective but does not necessarily mean that the actual processes used are more energy efficient. There may therefore still be room for improvement.

## 3.2 Industry

Final energy use in industry has grown by 28% (2.5% per annum) to 2.7 Mtoe over the period 1997 – 2007. The share of natural gas has risen from 18% to 24%, and renewables from 3.4% to 5.7%. The increase in renewables is mainly due to the use of biomass in the wood processing industry and the use of tallow in the rendering industry. The total final energy use by fuel in the industrial sector is show in Figure 5 and the growth rates are presented in Table 4.

***Figure 5 Industry Final Energy Use by Fuel***




Source: SEI

Electricity is the second most dominant energy form in industry at 27% behind oil at 38%. Growth of electricity use in industry averaged 2.5% per annum over the period 1997 – 2007. In 2007 the consumption of electricity in industry fell by 5.7%, this contrasts with the period 2005 – 2007, when electricity use in industry increased by 5.1% per annum.

**Table 4** ***Growth rate in Industry Final Energy Use by Fuel***

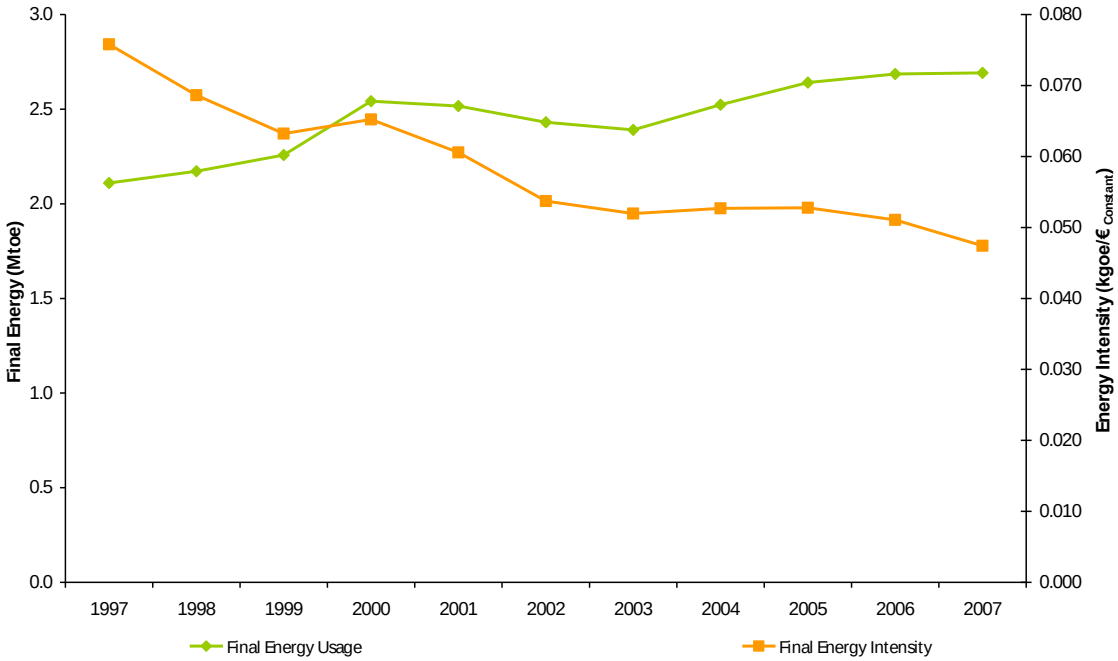
| | Growth % | Average annual growth rates % | | | | | Shares % | |
|---|---|---|---|---|---|---|---|---|
| | **'97–'07** | **'97–'07** | **'97–'00** | **'00–'05** | **'05-'07** | **2007** | **1997** | **2007** |
| Fossil Fuels (Total) | 23.2 | 2.1 | 6.6 | 0.5 | -0.2 | 3.4 | 69.6 | 67.3 |
| Coal | 56.0 | 4.5 | 7.8 | 7.7 | -7.4 | 5.4 | 4.3 | 5.2 |
| Oil | 1.6 | 0.2 | 6.1 | -1.4 | -4.5 | 2.7 | 47.4 | 37.7 |
| Gas | 72.3 | 5.6 | 7.4 | 2.9 | 9.9 | 4.0 | 18.0 | 24.3 |
| Renewables | 111.6 | 7.8 | 11.7 | 10.3 | -3.5 | -7.2 | 3.4 | 5.7 |
| Combustible Fuels (Total) | 27.3 | 2.4 | 6.8 | 1.1 | -0.5 | 2.5 | 73.0 | 72.9 |
| Electricity | 28.2 | 2.5 | 5.3 | -0.1 | 5.1 | -5.7 | 27.0 | 27.1 |
| | | | | | | | | |
| Total | 27.6 | 2.5 | 6.4 | 0.8 | 0.9 | 0.1 | | |

Source : SEI

Overall final energy use in industry increased by just 0.1% in 2007 relative to the previous year, with renewables and electricity experiencing reductions. Overall fossil fuel use in industry increased by 3.4% in 2007.

Industrial energy intensity is the amount of energy required to produce a unit of value added, measured in constant money values. Figure 6 shows the industrial energy intensity between 1997 and 2007 in kilograms of oil equivalent per euro of industrial value added (in 2006 values) (kgoe/€2006). Over the period, industrial energy consumption increased by 28% while value added increased by 104% resulting in a reduction in intensity of 37%. It should be noted that a downward trend in energy intensity signifies an improvement.

***Figure 6 Industry Energy Intensity***




Source: SEI

To eliminate the effects of structural changes an index of energy intensity at constant structure [18] is also shown in Figure 7.

This indicator measures the impact of structural changes in industry by comparing the variations of the actual intensity with that of a fictitious or notional intensity at constant structure (using 1995 structure as a reference). It can be seen that structural changes have had a significant effect but other factors are also responsible for the improvement in energy productivity.

The dark line in Figure 7 is the trend in energy intensity in industry. Over the period 1997 to 2007 intensity of industry declined by 37% (4.5% per annum). This change in intensity includes structural changes that were brought about by global economic influences and Irish industrial policy. Over the period, industrial policy concentrated on moving the sector up the value chain to manufacture high value goods such as pharmaceuticals, electronics and value added foodstuffs. This resulted in increased economic efficiencies, contributing to the further reduction in intensity shown in Figure 7.

18 This section draws on methodology developed under the Odyssee project. See Bosseboeuf D. et al, 1999, *Energy Efficiency Indicators – The European Experience and* Bosseboeuf D. et al, 2005, *Energy Efficiency Monitoring in the EU-15* both published by ADEME and the European Commission. http://www.odyssee-indicators.org/

***Figure 7 Index of Energy Intensity of Industry 1997 - 2007***


Source: Odyssee

The light green line in Figure 7 represents the evolution of industrial energy intensity had the structure not changed over time. This is known as energy intensity at constant structure and effectively removes the effects of structural change from energy intensity. The intensity at constant structure fell by 14% over the period. This means that 62% of the change in actual energy intensity of industry was as a result of structural changes and the remainder of the change (intensity at constant structure) is as a result of efficiency and other effects.

## 3.3 Households

Figure 8 graphs the climate-corrected[19] final energy usage and unit consumption[20] for the residential sector over the period 1997 to 2007.

Final energy usage in the sector increased by 38% to 2,918 ktoe (3.3% per annum on average) while average energy use per dwelling increased by 5% (0.5% per annum), to 25,899[21] kWh (or 2,227kgoe) per dwelling.

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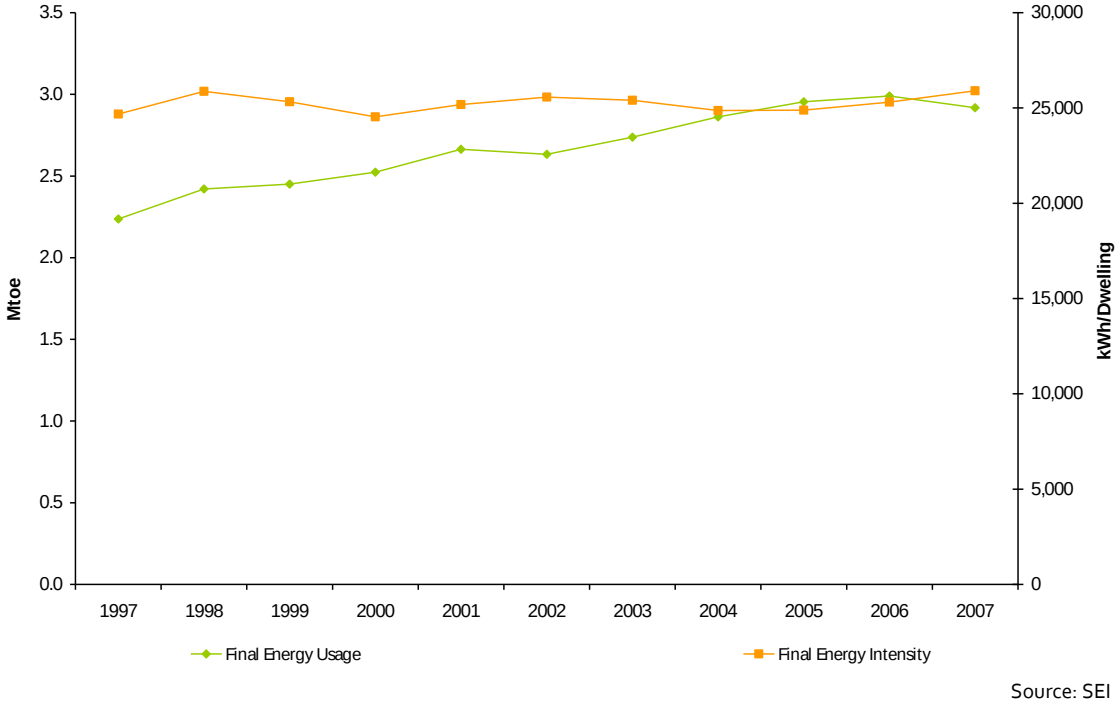
19 Climate correction involves adjusting the energy used for space heating by benchmarking the climate in a particular year with that of a long-term average measured in terms of number of degree days.

20 The energy intensity of the residential sector is measured using unit consumption, defined as energy usage per dwelling.

21 Not climate-corrected.

***Figure 8 Residential – Final Energy Usage and Unit Consumption 1997 - 2007***




Source: SEI

Over the period 1997 to 2007, the number of households[22] in the State increased by 31% (2.8% per annum on average) from approximately 1.14 million to 1.5 million. Figure 9 shows the trend in unit consumption per dwelling (actual values and climate-corrected), with a distinction between electricity and fossil fuels.

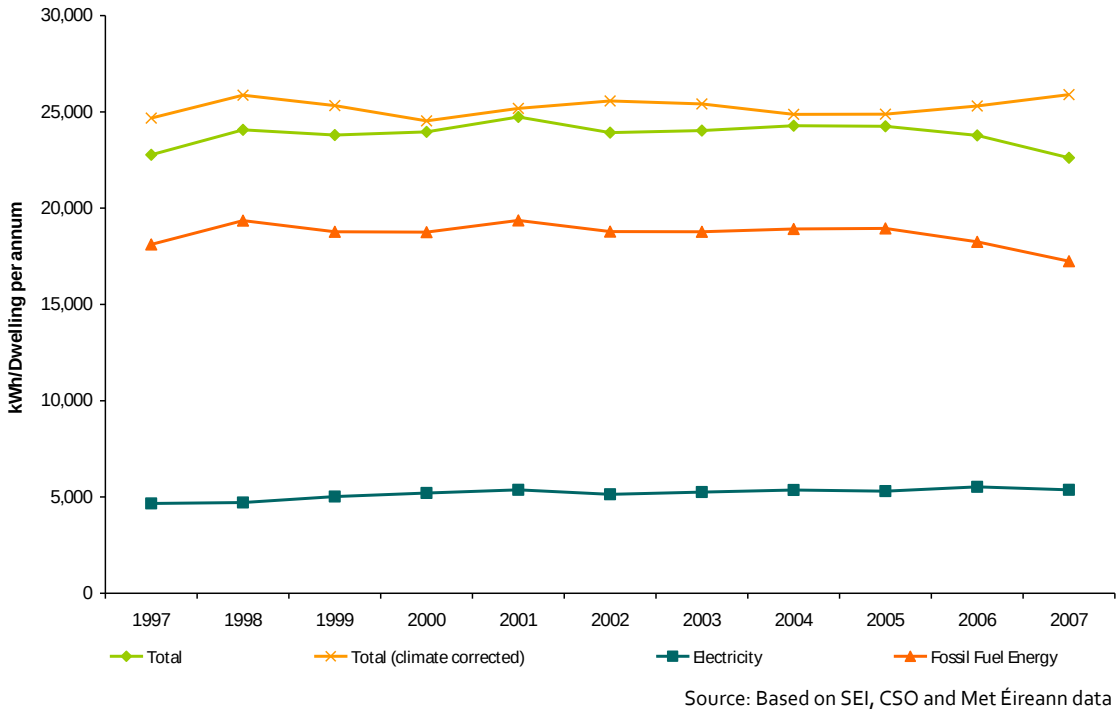
While overall unit energy use per dwelling has decreased, Figure 9 also shows an increasing trend in electricity consumption per dwelling. This has risen by 15% since 1997. The increasing penetration of household electrical appliances such as washing machines, dishwashers, clothes driers, computers and multiple televisions as well as convenience appliances is believed to have contributed to this increase. In contrast, fossil-fuel consumption per dwelling has decreased by 5% over the period.

In 2007 the 'average'[23] dwelling consumed a total of 25,999 kWh of energy, based on climate-corrected data. This comprised 20,395 kWh (79%) in the form of direct fossil fuels and the remainder (5,505 kWh) as electricity.

[22] Defined as the number of private households in permanent housing units.

[23] This average is calculated as the total energy consumption divided by the number of private households in permanent housing units.

***Figure 9 Unit Consumption of Energy per Dwelling (Permanently Occupied) 1997 - 2007***




Source: Based on SEI, CSO and Met Éireann data

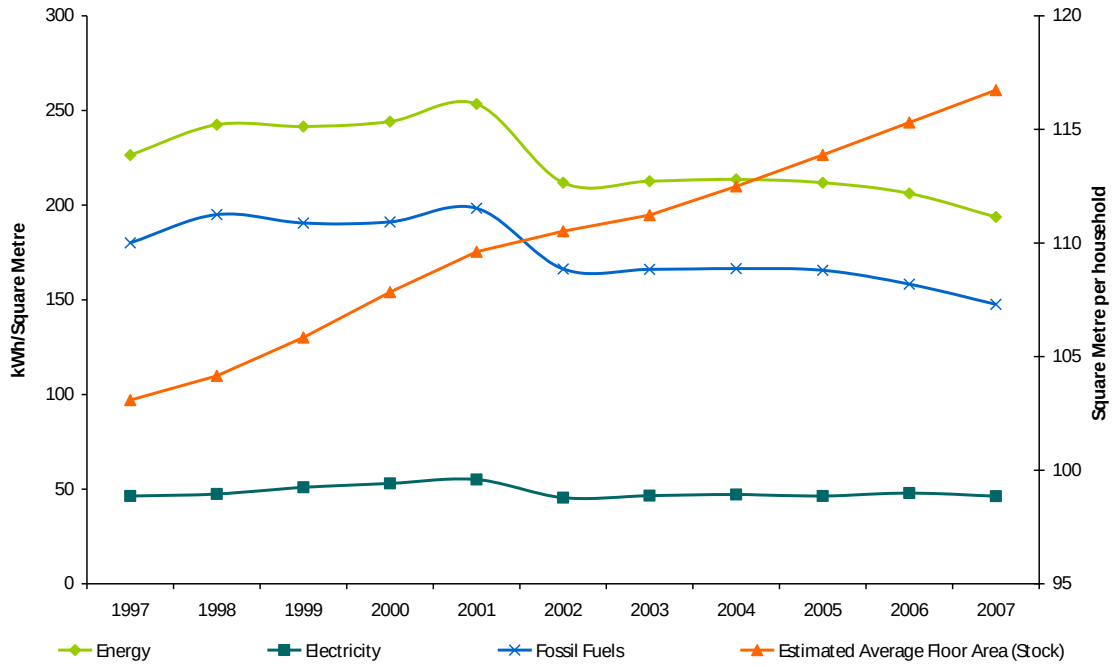
Figure 9 also shows overall unit energy use per dwelling, corrected for climate variations. The increase in climate-corrected energy use per dwelling over the period 1997 to 2007 was 5% while the uncorrected energy use decrease was 1%. (A more detailed discussion is available in the *Energy in the Residential Sector* 2008 report: www.sei.ie/statistics.)

Figure 10 and Table 5 present the trend in energy, electricity and fossil fuels per estimated square metre[24] for the residential sector.

Over the period 1997 to 2007, energy usage per square metre fell by 14% (1.5% per annum), fossil-fuel usage decreased by 18% (2% per annum) while electricity usage decreased by 0.24% (0.024% per annum). Over the same period, the average floor area of the housing stock is estimated to have increased by 13% (1.3% per annum).

[24] The methodology for estimating the floor area of the stock is contained in *Energy Consumption and $CO_2$ Emissions in the Residential Sector*, available from the 'Statistics' section of www.sei.ie

***Figure 10 Estimated Energy Usage per Square Metre 1997 - 2007***




Source: SEI and CSO

**Table 5** ***Estimated Energy Usage per Square Metre 1997 to 2007***

| | Growth % | Average Annual Growth Rates % | | | | |
|---|---|---|---|---|---|---|
| **Usage per Square Metre** | **'97 – '07** | **'97 – '07** | **'97 – '00** | **'00 – '05** | **'05 – '07** | **2007** |
| Energy | -14 | -1.5 | 2.5 | -2.8 | -4.4 | -6.0 |
| Electricity | -0.24 | 0.024 | 4.6 | -2.7 | -0.1 | 3.6 |
| Fossil Fuel | -18 | -2.0 | 2.0 | -2.8 | -5.6 | -6.8 |
| Est. Average Floor Area Stock | 13 | 1.3 | 1.5 | 1.1 | 1.2 | 1.2 |

Source: SEI and CSO

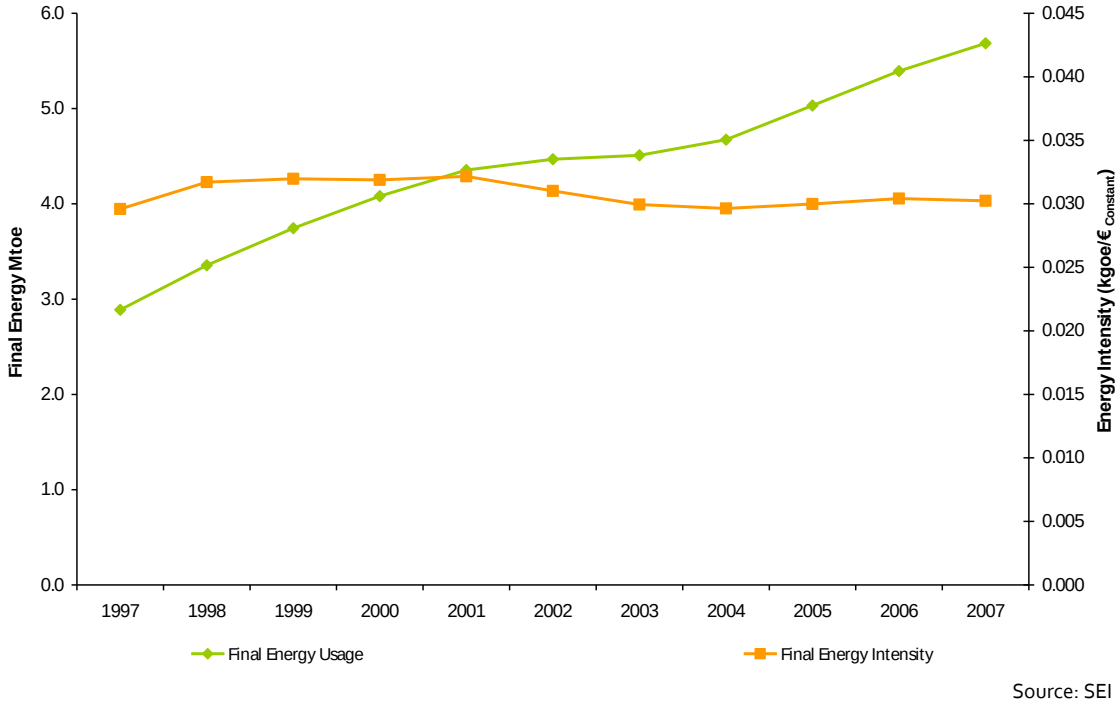
## 3.4 Transport

Figure 11 graphs final energy usage and final energy intensity[25] for the transport sector over the period 1997 to 2007. Transport energy usage was 5,685 ktoe in 2007, an increase of 97% (7 % per annum) on 1997. Energy intensity in the transport sector is measured by the ratio of final energy usage to GDP in constant 2006 money value.

[25] Intensity as measured by the ratio of final energy usage to GDP in constant 2006 money value. This is expressed as kilograms of oil equivalent per euro of GDP (kgoe /€ $_{2006}$).

It can be seen that the transport intensity increased by 2% over the period, from 29.6 goe /€ $_{2006}$ in 1997 to 30.2 goe /€ $_{2006}$ in 2007 (0.2% per annum). In other words, transport energy use grew marginally faster than GDP, which had an increase of 93% over the period (6.8% per annum).

***Figure 11 Transport – Final Energy Usage and Intensity 1997 - 2007***

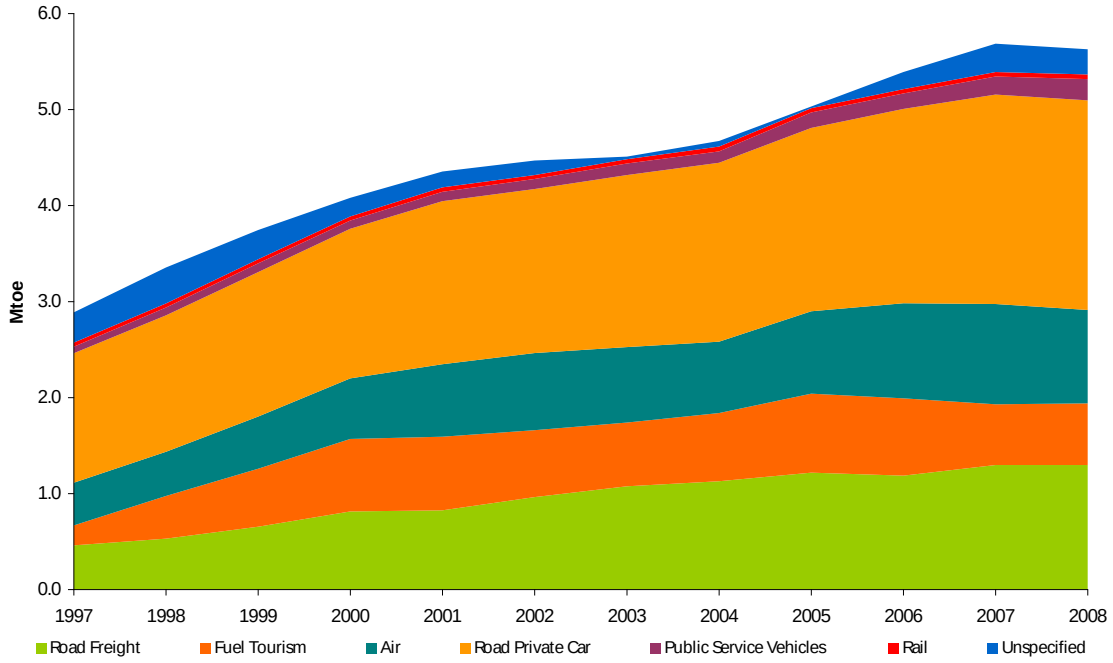



Source: SEI

The contribution from each mode of transport to energy demand is shown in Figure 12[26].

[26] Fuel tourism is defined as fuel that is bought within the State by private motorists and hauliers but consumed elsewhere.

***Figure 12 Transport Energy Demand by Mode 1997 - 2007***




Source: SEI

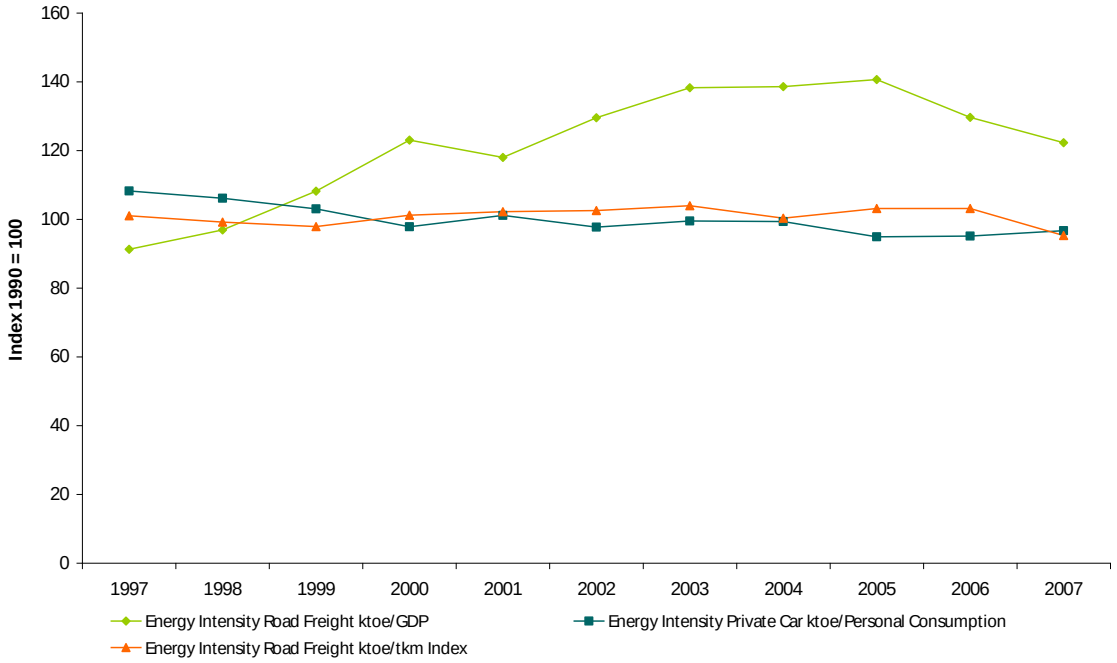
Energy use in transport was 5,685 ktoe in the year 2007[27]. Road transport accounted for 65% of this energy use (73% if fuel tourism is excluded). Private car transport was responsible for 2,183 ktoe of energy use in 2007. This represents 51% of road transport energy use (60% excluding fuel tourism) and 38% of all transport energy use (43% excluding fuel tourism).

The road freight category recorded the largest growth over the period of 182%. This is significant because the focus of attention in the sector is often the private car mode, which increased by 62%. The mode with the second largest increase was public passenger services which grew by 174%, air grew by 135% and rail consumption increased by 11%.

Figure 12 also illustrates the relative weighting of private car transport compared to road passenger services (bus) and rail travel.

[27] The category 'unspecified' in the figure refers to the difference between estimates of fuel consumption and data from the national energy balance. Included in 'unspecified' is fuel consumption by motorcycles, service vehicles (ambulances, etc), construction vehicles (excavators, loadalls, etc), lawnmowers.

***Figure 13 Road Freight and Road Private Car Final Energy Intensity 1997 - 2007***




Source: SEI

Figure 13 shows three transport intensity indicators for the period 1997 to 2007. Road freight is measured against GDP while private car final energy is compared with personal consumption of goods and services[28] in constant 2006 money value. Also shown in Figure 13 is the ratio of fuel usage of road freight (excluding light-duty vehicles) and tonne kilometres travelled.

Focusing on energy intensity of road freight, it can be seen that there has been an increase of 34% (3% per annum) in the index (1990=100) since 1997, indicating deterioration in the energy productivity of freight transport. It is likely that this is influenced by the large and increasing amount of transport for construction purposes (especially road building) that was experienced in recent years – i.e. large quantities of heavy, relatively low-value goods were being transported. The latest Road Freight Survey[29] backs up this assertion as it states that, in 2007, 29% of the total tonne kilometre of goods carried was in the group 'Crude and Manufactured Minerals, Building Materials'.

It can be seen that the ratio of fuel usage of road freight (excluding light-duty vehicles) and tonne kilometres decreased by 5.7% (0.6% per annum). This suggests that energy efficiency (i.e. the amount of energy required to transport a given quantity of

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28 Central Statistics Office: *National Income and Expenditure (*Table 6). In constant 2006 money value.

29 Central Statistics Office, various years: *Road Freight Surveys.* Available from www.cso.ie.

goods) has started to improve, having remained relatively constant over most of the period.

Finally in Figure 13, the ratio of fuel consumption of private cars and personal consumption of goods and services is shown for the period 1997 to 2007. There was a 12% (1.43% per annum) reduction in energy intensity over the period.

Specific fuel consumption for new petrol cars on the road in Ireland in 2007 was 7.2 litres/100km. This represents an increase of 1.6% (decrease in fuel efficiency) on the average consumption in 2000 and indicates that; overall, the weighted average of newly purchased petrol cars is becoming less fuel efficient. The comparable 2007 figure for new diesel cars was 6.3 litres/100km (45 mpg), which was 2.1% higher than in 2000.

Combined average mileage for petrol and diesel cars in 2007 was 16,892 kilometres (10,498 miles). Diesel cars had an average mileage of 23,811 km (14,799 miles) with the average for petrol being 15,966 km (9,923 miles).

Average mileage for all private cars has fallen by 9.9% (2.3% per annum on average) over the period 2001 to 2007. Petrol car annual mileage fell by 6.8% (1.8% per annum) while diesel car average mileage fell by 9.9% (2.7% per annum).

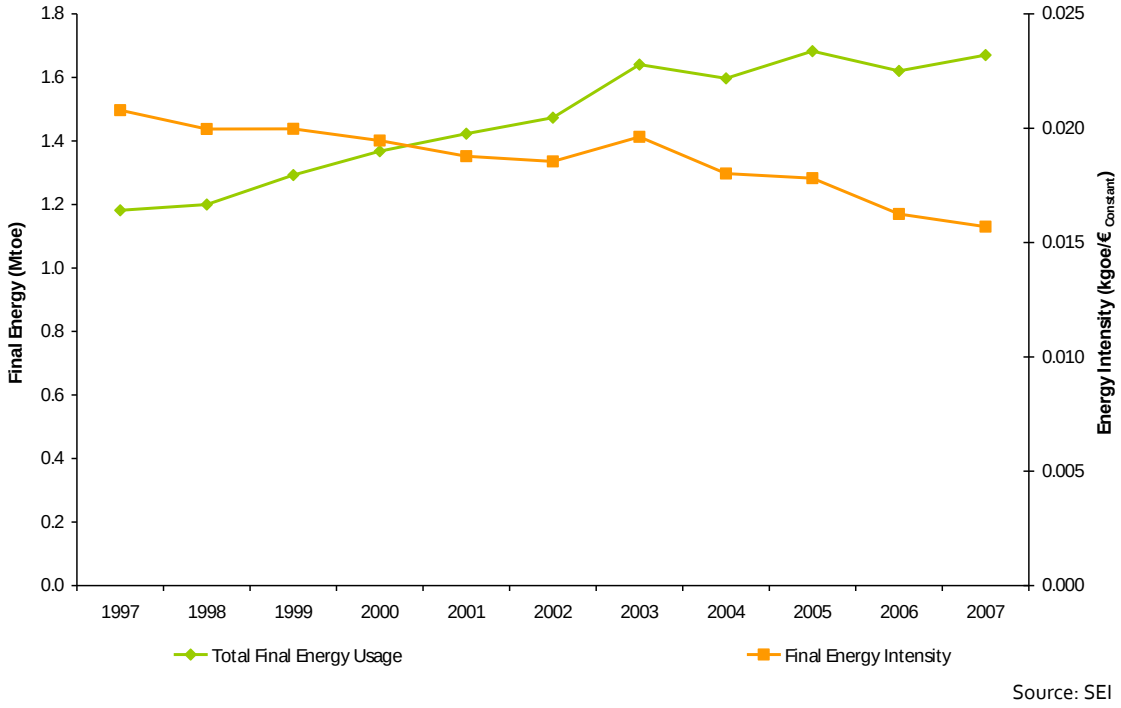
## 3.5 Services

Figure 14 graphs final energy usage and final energy intensity[30] for the services sector over the period 1997 to 2007. Energy intensity in the services sector is measured by the ratio of final energy usage to GVA in constant 2006 money value.

In 2007, final energy usage in the sector was 1,670 ktoe, an increase of 41% (3.5% per annum on average) on 1997. Over the same period, energy intensity decreased by 25% (2.8% per annum) to a figure of 15.7 goe /€ $_{2006}$ in 2007. The decrease in energy intensity is partly attributable to the rapid growth in the value-added of the sector 87%.

[30] Intensity as measured by the ratio of final energy usage to GVA in constant 2006 money value. This is expressed as kilograms of oil equivalent per euro of GDP (kgoe /€ $_{2006}$).

***Figure 14 Services Final Energy Usage and Intensity 1997 - 2007***

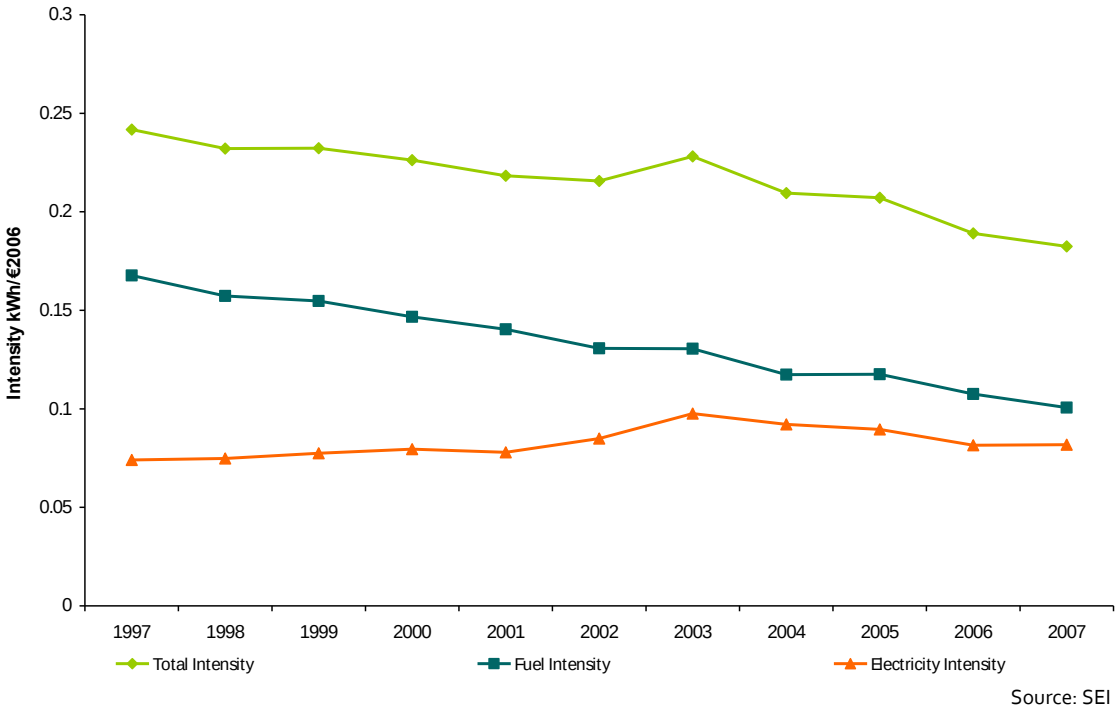



Source: SEI

Overall energy intensity is separated into fuel and electricity intensity in Figure 15. The downward trend was reversed in 2003 but continued downwards from 2004 onwards.

As can be seen in Figure 15, the fuel intensity of services continued to fall and was 40% lower in 2007 than in 1997. Electricity intensity increased by 32% from 1997 to 2003, but decreased by 11% since then.

***Figure 15 Energy Intensity of Services Sector 1997 - 2007***



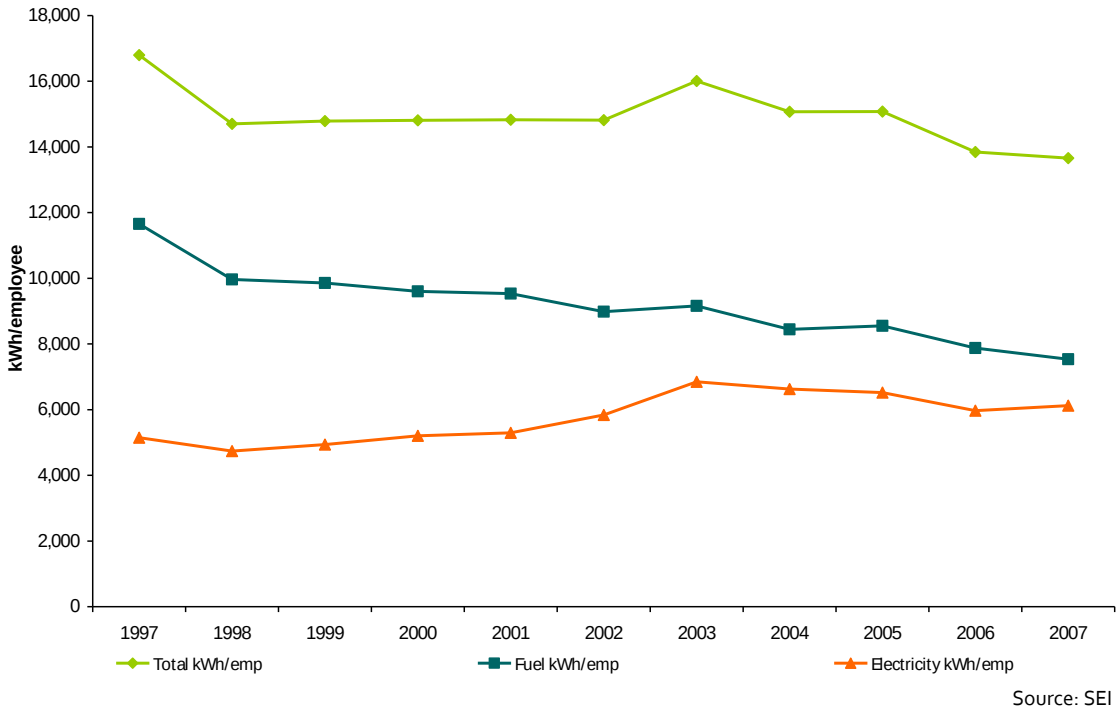

Source: SEI

Two other indicators can be used to measure energy efficiency in this sector: energy use per unit of floor area and per employee. The rationale is that consumption of oil and gas is mainly for heating purposes and is related to the floor area heated and not directly related to the number of people occupying a building at a given time. It is not currently possible to calculate the consumption per unit of floor area due to an absence of data on floor area in the sector.

Unit consumption of electricity per employee is used as an indicator of energy use in the services sector because, in the main, there is a correlation between electricity use and the number of employees.

It can be seen that the unit consumption of electricity rose since 1997. By 2003 it was 33% higher than in 1997 but fell back to 19% above 1997 levels in 2007. This can be linked to the increasing use of office equipment, computers, printers, photocopiers, etc during this time. By contrast, the fuel consumption per employee declined by 35% since 1997.

***Figure 16 Unit Consumption of Electricity per Employee in the Service Sector 1997 - 2007***




Source: SEI

It should be noted that energy statistics relating to fuel consumption for the services sector in Ireland are calculated as a residual once other sectors, for which more robust data exists, have been accounted for in the energy balance. This approach is unsatisfactory, not least because the energy use in the services sector is affected by uncertainties in all other sectors.

As a result of the heterogeneous nature of the services sector, it is difficult to assess the amount of energy consumed in it. The increasing number of energy suppliers in the liberalised market makes this task all the more difficult.

## 3.6 Assessment of energy efficiency/savings through ODEX: total and by sector

The ODYSSEE (ODEX) indicators are referenced in the Energy End-Use Efficiency and Energy Services Directive (ESD)[31] and are innovative compared to similar indices as they aggregate trends in unit consumption by sub-sector or end-use into one index per sector based on the weight of each sub-sector/end-use in the total energy consumption of the sector. The sectoral indicators are then combined into an economy-wide indicator.

[31] See www.ec.europa.eu/energy/demand/legislation/end_use_en.htm for details and a copy of the Directive.

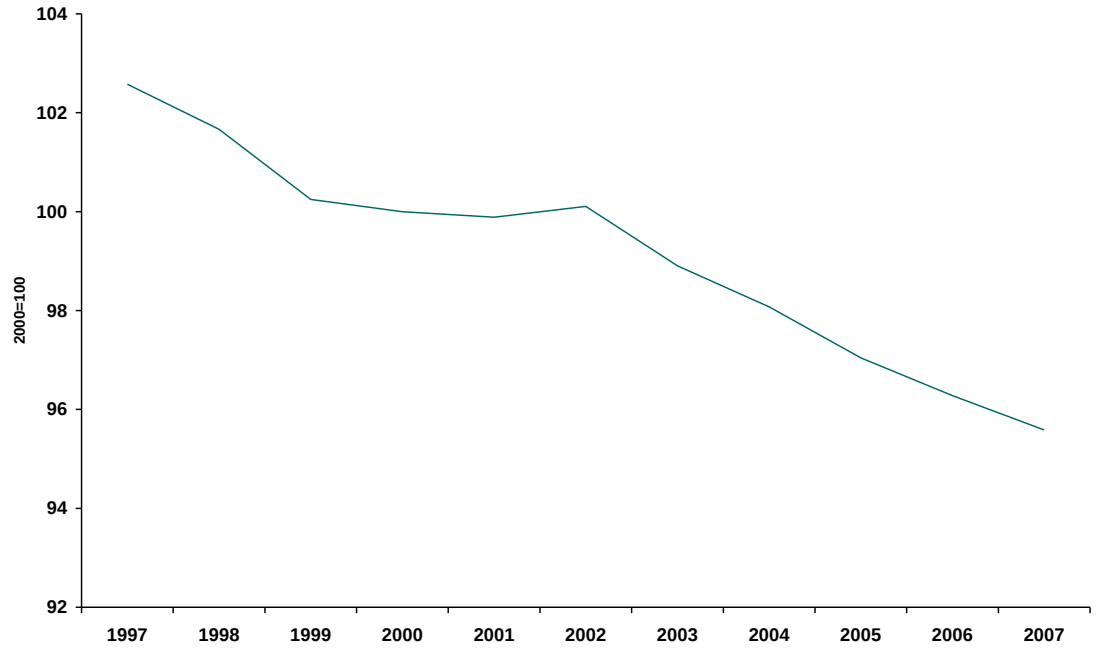
In order to better understand the trends and to clarify the role of the energy-related factors, the ODYSSEE[32] approach focusing on techno-economic effects is required to clean or remove changes due to climate fluctuations, lifestyle changes, macro-economic or structural effects[33], etc.

It is important to note that ODEX indicators only provide measurement of the gross energy savings realised within a sector or type of end-use. In addition to savings that result from energy-efficiency policies and measures, these savings include a number of factors – for example, price effects and autonomous progress[34]

Savings calculated using ODEX are data-rich but not linked to specific measures and are an example of a 'top down' approach in the ESD, whereas aggregating savings from individual policy measures is an example of a 'bottom up' approach. This latter approach requires ex-ante and ex-post analyses of measures, and will require data on energy use by households or companies targeted by specific measures.

Figure 17 presents the ODEX energy-efficiency indicator for Ireland for the period 1997 to 2007.

***Figure 17 Ireland Energy Efficiency Index 1997 – 2007***




[32]For full details of the project go to www.ODYSSEE-indicators.org

[33]Bosseboeuf D. et al, 2005: *Energy Efficiency Monitoring in the EU-15,* published by ADEME and the European Commission. Available from www.ODYSSEE-indicators.org

[34]Bosseboeuf D., Lapillonne Dr B., Desbrosses N., 2007: *Top Down Evaluative Methods for Monitoring Energy Savings,* EMEEES European Expert Group Meeting, La Colle-sur-Loup

Source: Odyssee

The global ODEX shows that between 1997 and 2007 there was a 7% (0.7% per annum on average) decrease, which indicates a 7% improvement in energy efficiency. Note that the top-down energy-efficiency index indicators are calculated as a three-year moving average to avoid short-term fluctuations due, for example, to imperfect climatic corrections, behavioural factors, business cycles, etc.

Data is not available to create an ODEX indicator for the services sector in Ireland, so the overall economy-wide indicators consist of just three sectors: industry, residential and transport.

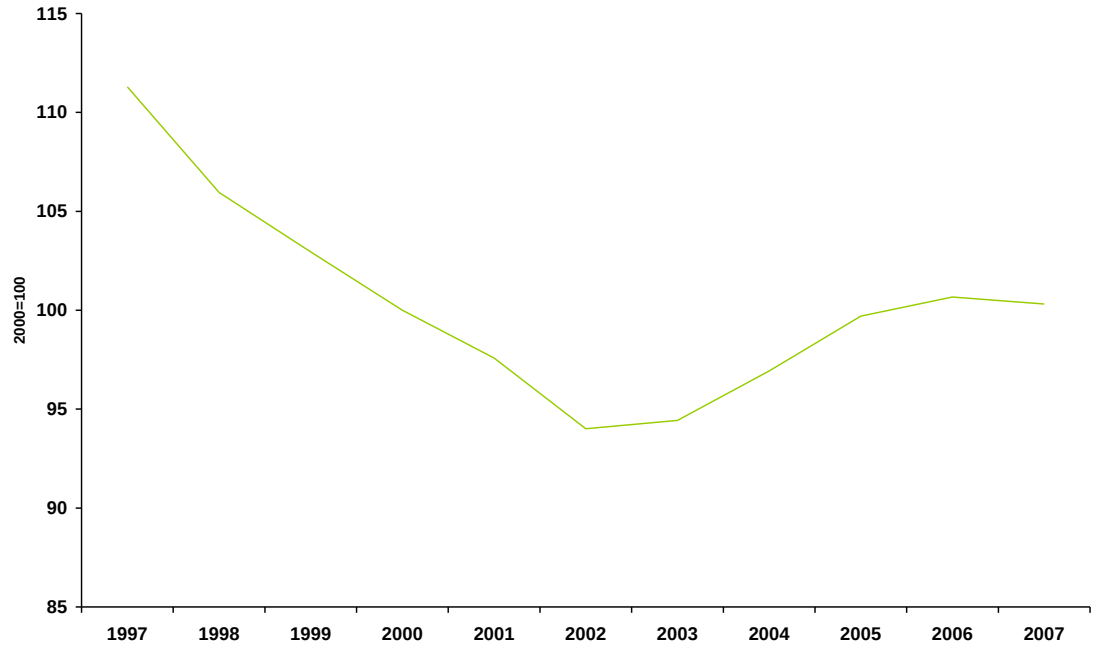
**Industry**

Energy intensity at constant structure provides a proxy measure of energy efficiency by removing the changes in energy intensity due to structural changes in industry. An alternative approach is the ODEX indicator for industry that has been constructed over the period 1997 to 2007 for Ireland. The ODEX indicator aggregates unit consumption for individual sub-sectors, weighted according to the share of industry energy demand of that sub-sector.

In order to calculate the industry ODEX the unit consumptions are expressed in terms of energy used per unit of physical output (where data are available) and production indices for the other sub-sectors relative to that in the base year (in this case 1995). It is important to note that, for some sub-sectors, the trends also include some non-technical changes, especially in the chemical industry as a result of the shift to light chemicals. Data for this sector are currently not available at a sufficiently disaggregated level to enable detailed analysis.

As shown in Figure 18, the industry ODEX for Ireland decreased from 111 in 1997 to 100.3 in 2007, indicating a 9.9% improvement in energy efficiency. Due to changes in the methodology, the Industry ODEX is not directly comparable with previously reported industry ODEX figures. The change relates to the number of industrial sub-sectors used in addition to updates on energy-consumption shares of the sub-sectors and gross value-added generated.

***Figure 18 Industry ODEX 1997 - 2007***




Source: Odyssee

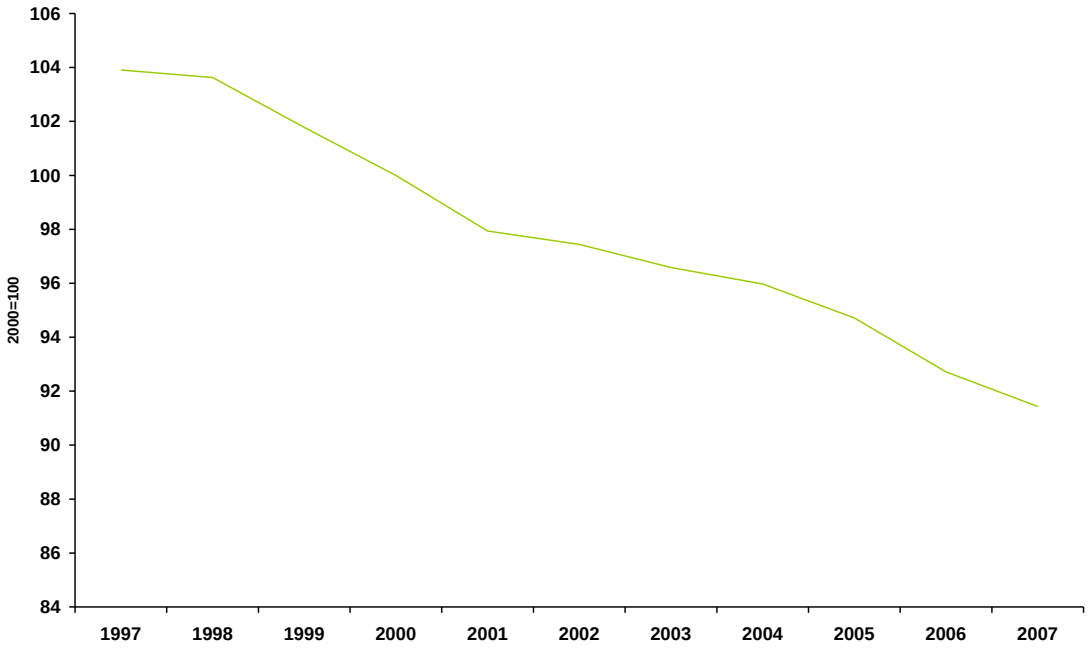
There is a methodological question about the suitability of the industrial ODEX calculation for Ireland. This methodological question is currently subject to academic investigation on behalf of SEI[35].

**Residential**

The ODEX indicator for the residential sector is shown in Figure 19. The ODEX decreased (indicating an improvement in energy efficiency) by 13% over the period (1.3% per annum).

[35]Cahill C. and Ó Gallachóir B. P., 2008: *Evaluating the effectiveness of ODEX in measuring true energy efficiency achievements: Case study Irish Industry.* Presentation to EU – ODYSSEE Workshop Nov 6 2008 Prague

***Figure 19 Household ODEX 1995 - 2007***




Source: Odyssee

**Transport**

The individual ODEX indicators for each mode of transport are combined into the overall ODEX indicator for the transport sector (shown in Figure 20). Air transport is not included, as per the Energy End-Use and Services Directive (ESD). The transport observed ODEX fell by 2.7% over the period 1997 to 2007 (0.3% per annum).

***Figure 20 Transport ODEX 1997 - 2007***

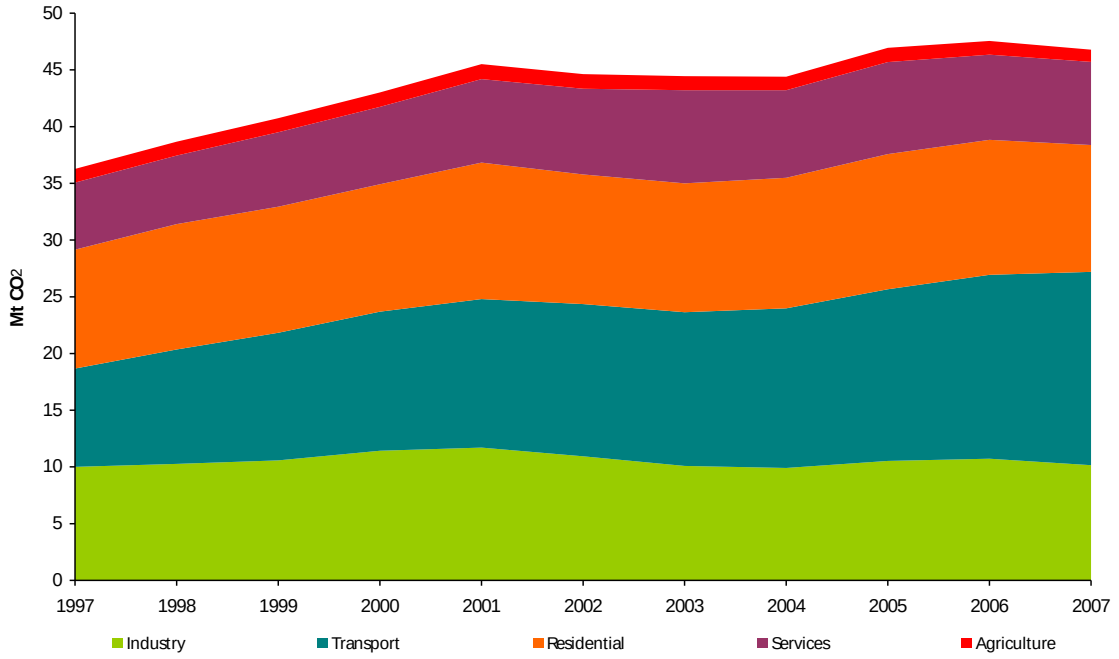

Source: Odyssee

## 3.7 $CO_2$-emissions trends

The share of GHG emissions arising from energy-related activities was 67% in 2007 compared with 57% in 1990 (59% in 1997). As 1990 is the reference year for the Kyoto protocol all $CO_2$ are compared with both the emissions in 1990 and 1997 in this section of the report.

To examine more closely where the growth has been occurring, Figure 21 shows the sectoral breakdown of energy-related $CO_2$ emissions. Energy-related $CO_2$ emissions in 2007 were 46% higher than 1990 levels (24% higher than 1997 levels).

***Figure 21 Energy-Related $CO_2$ Emissions by Sector[36]***




Source: SEI

These growth rates are also presented in tabular form in Table 6.

**Table 6 *Growth Rates and Shares of Primary Energy-Related $CO_2$ by Sector***

| | Growth % | Average annual growth rates % | | | | | Shares % | |
|---|---|---|---|---|---|---|---|---|
| | **'97 – '07** | **'97 – '07** | **'97 – '00** | **'00 – '05** | **'05 – '07** | **2007** | **1997** | **2007** |
| Industry | 1.4 | 0.1 | 4.5 | -1.6 | -1.8 | -5.4 | 27.6 | 21.7 |
| Transport | 96.7 | 7.0 | 12.3 | 4.3 | 6.1 | 5.1 | 23.9 | 36.4 |
| Residential | 6.8 | 0.7 | 2.3 | 1.2 | -3.1 | -6.0 | 28.9 | 23.9 |
| Commercial / Public | 23.9 | 2.2 | 5.0 | 3.5 | -5.0 | -2.6 | 16.3 | 15.6 |
| Agriculture | -11.4 | -1.2 | 1.2 | 0.2 | -7.9 | -9.6 | 3.4 | 2.3 |
| Total | 29.0 | 2.6 | 5.8 | 2.3 | -0.2 | 0.8 | | |

Source odyssee

[36] Figure 21 and Table 6 are based on SEI estimates and uses a different methodology to that used by EPA for compiling the national inventory. International air transport emissions are excluded from the national GHG emissions inventory in accordance with the reporting procedures of the UN Framework Convention on Climate Change (UNFCCC) guidelines and are also excluded here.

The most significant area of growth overall since 1990 was in the transport sector, where $CO_2$ emissions in 2007 were 182% higher than those in 1990 (6.3% average annual growth rate) and 97% higher than 1997 (7% average annual growth rate). Growth in transport emissions in 2007 was 5.1%, the only sector showing growth in energy-related $CO_2$ emissions. Energy use in transport accounted for more than one third (36%) of energy-related $CO_2$ emissions in 2007 and is by far the largest $CO_2$ emitting sector – emitting one and a half times the energy-related $CO_2$ emissions than industry.

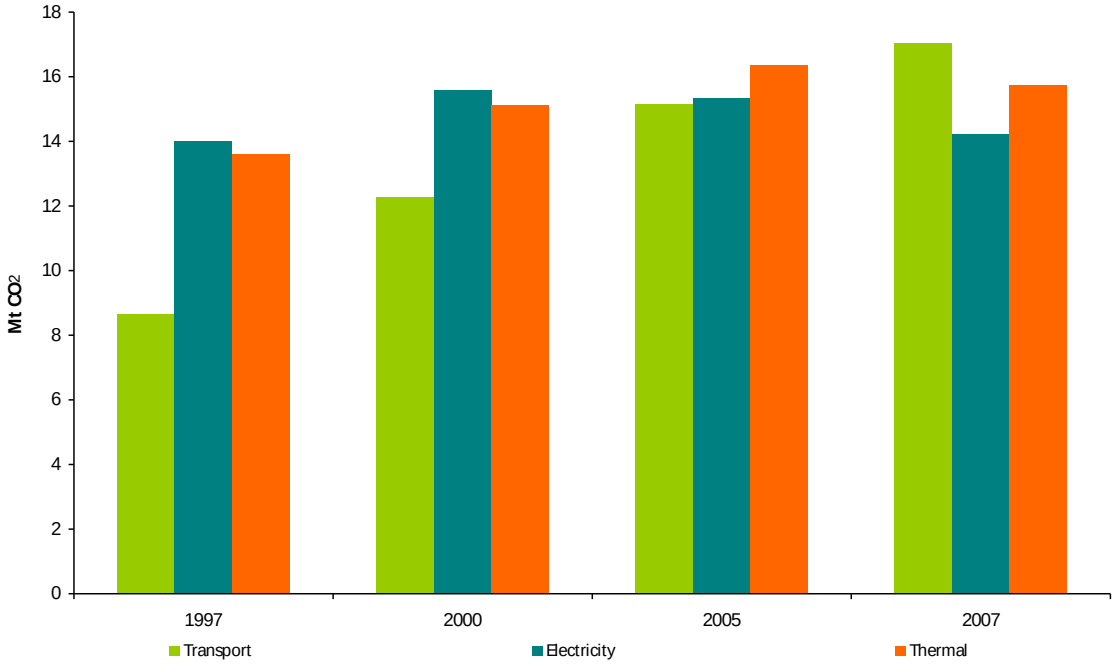
All other sectors experienced a decrease in primary energy-related $CO_2$ emissions in 2007. Industry experienced a decrease in $CO_2$ emissions of 5.4%. The overall primary energy used in industry decreased by 2.9%. This is primarily due to a reduction in electricity usage of 5.7% in 2007. Under the emissions trading scheme only the emissions directly generated on site by industrial entities is taken into account. If upstream electricity emissions are omitted industry experienced an increase in $CO_2$ emissions of 4.3% in 2007.

The residential sector experienced a reduction of 6% in primary energy related emissions. There was also an overall drop of 1% point in the percentage share of primary energy related $CO_2$ emissions in the residential sector from 25% in 2006 to 24% in 2007. As a significant portion of residential energy use relates to space heating, therefore when looking at yearly changes it is important to take the weather into account. As 2007 was a milder winter than 2006, this would have contributed to the decrease in energy and emissions.

Agricultural emissions of energy-related $CO_2$ decreased by 9.6% in 2007 however, its share of these emissions is small at less than 2.3%. This is small compared to other agriculture related greenhouse gas emissions due primarily to livestock and also fertiliser use.

Figure 22 illustrates the variations in emissions by mode of energy. Here the emissions are allocated according to whether the energy used is for mobility (transport), in the form of electricity (power) or as thermal energy (for heating). These modes also represent distinct energy markets. The graph presents the emissions at five yearly intervals and for 2007.

***Figure 22 Energy-Related $CO_2$ Emissions by Mode of Energy Application***



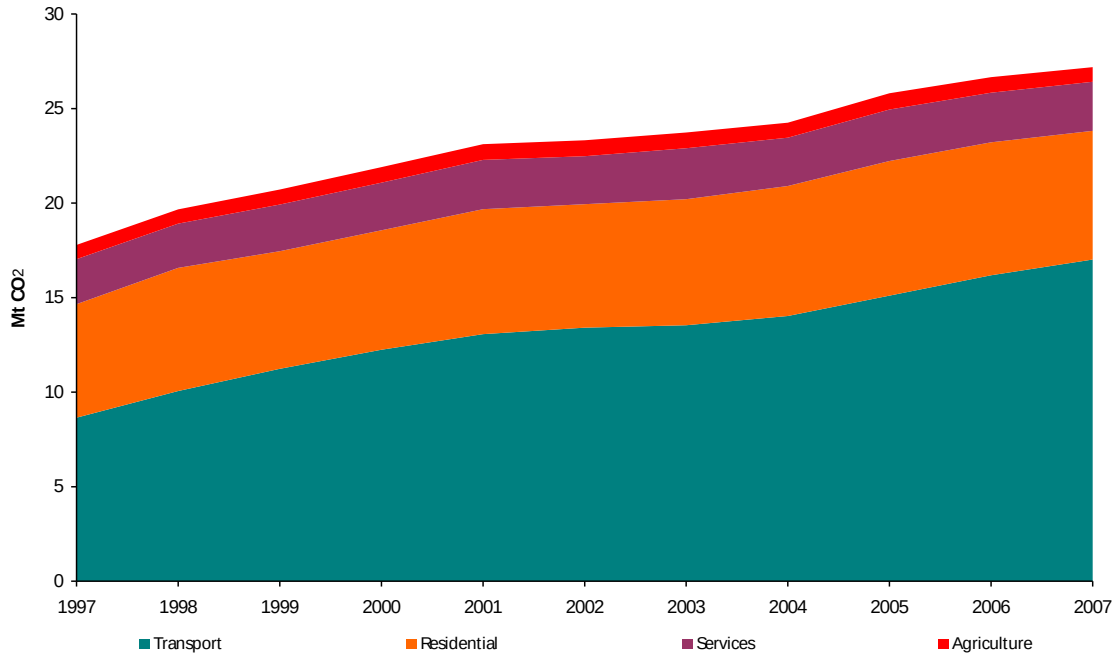

Source: SEI

The growth in emissions related to mobility is again striking. Traditionally thermal energy had the most emissions until electricity became the dominant mode in terms of emissions from 1996 until 2002. It was surpassed by thermal energy which was the dominant mode in terms of emissions between 2003 and 2005 until it was surpassed by transport in 2006. Transport is now the largest mode, emissions having decreased for both thermal and electricity generation.

In 2007, energy-related emissions from electricity decreased by 5.5% from the 2006 level compared to a decrease of 0.1% in final consumption of electricity. Overall electricity generation emissions were 34% above 1990 levels and 2% about 1997 levels. Emissions from thermal energy applications decreased by 3.4% in 2006 and continued to decrease by 0.5% in 2007, so overall the thermal mode emissions are 12.6% above 1990 levels and 16% above 1997 levels.

Given the policy focus on the non-emissions trading sectors, Figure 23 shows the trend in energy-related $CO_2$ emissions for the transport, residential, services and agriculture sectors. This excludes emissions associated with electricity usage by these sectors as these emissions are included in emissions trading. It also excludes emissions from thermal energy usage within industry, the bulk of which (60% – 70%) are also included in emissions trading. The historical data is not sufficiently disaggregated to include here the energy-related $CO_2$ emissions associated with thermal energy usage by manufacturing companies that are not participating in emissions trading.

***Figure 23 Non Emissions Trading Energy-related $CO_2$ (excluding non-ETS industry)***

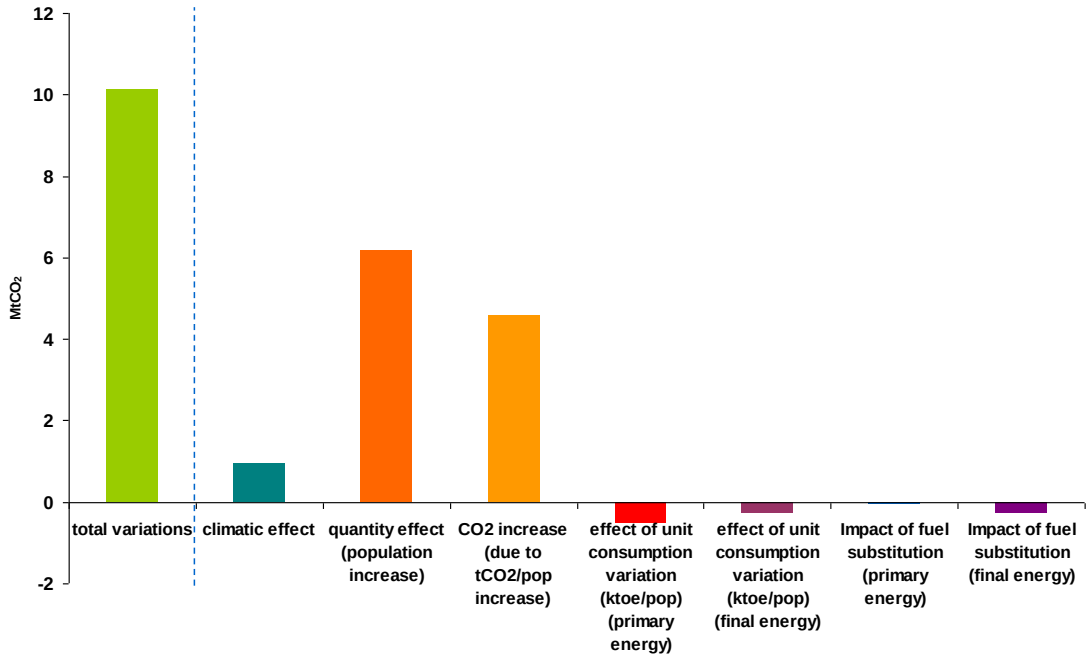



Source: SEI

Energy-related $CO_2$ emissions associated with the non-emissions trading sectors have grown by 69% (or 3.1% per annum on average) between 1990 and 2007, while since 1997 they have grown by 53% (or 4.3% per annum on average). This represents a faster growth rate than for total energy related $CO_2$ emissions, which grew by 51% (or 2.5% per annum) between 1990 and 2007 and 28% (or 2.5% per annum).

Figure 24 examines changes in the overall $CO_2$ emissions in 2007 relative to 1997. It can be seen from Figure 24 that the population increase as well as the increase in the emissions per person were a significant factor in the overall increase in emissions. For the economy as a whole these increases far outweigh the emission savings due to improvements in energy efficiency (toe/person) and fuel substitution.

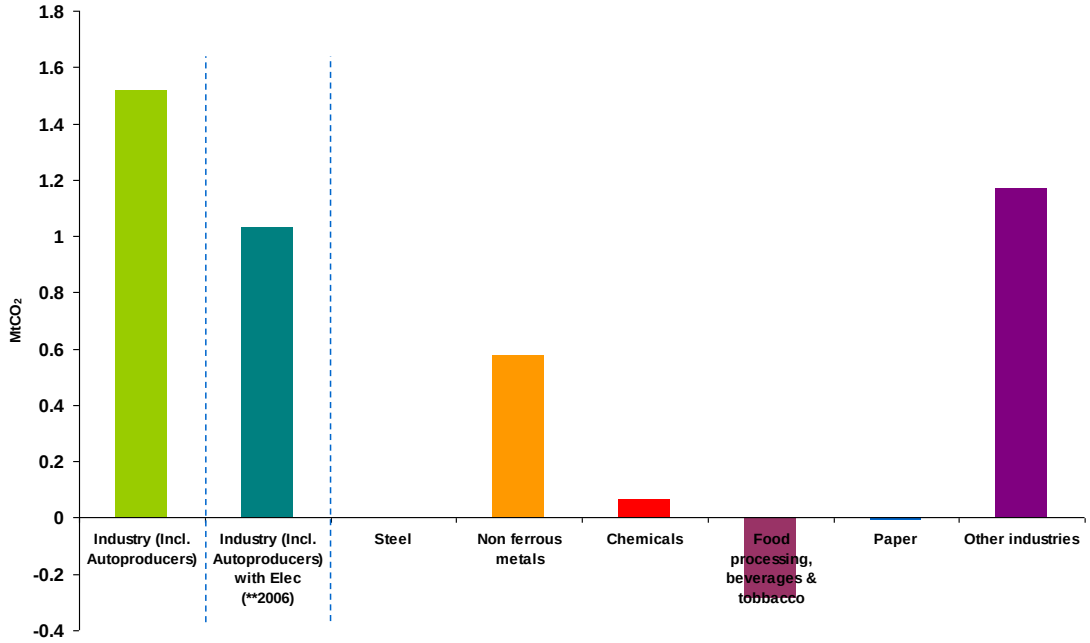
***Figure 24 Macro level $CO_2$ emission analysis***




Source: Odyssee & SEI

Figure 25 shows the emissions variation of the industrial sector relative to 1997.

***Figure 25 Analysis of emissions in the Industrial sector***



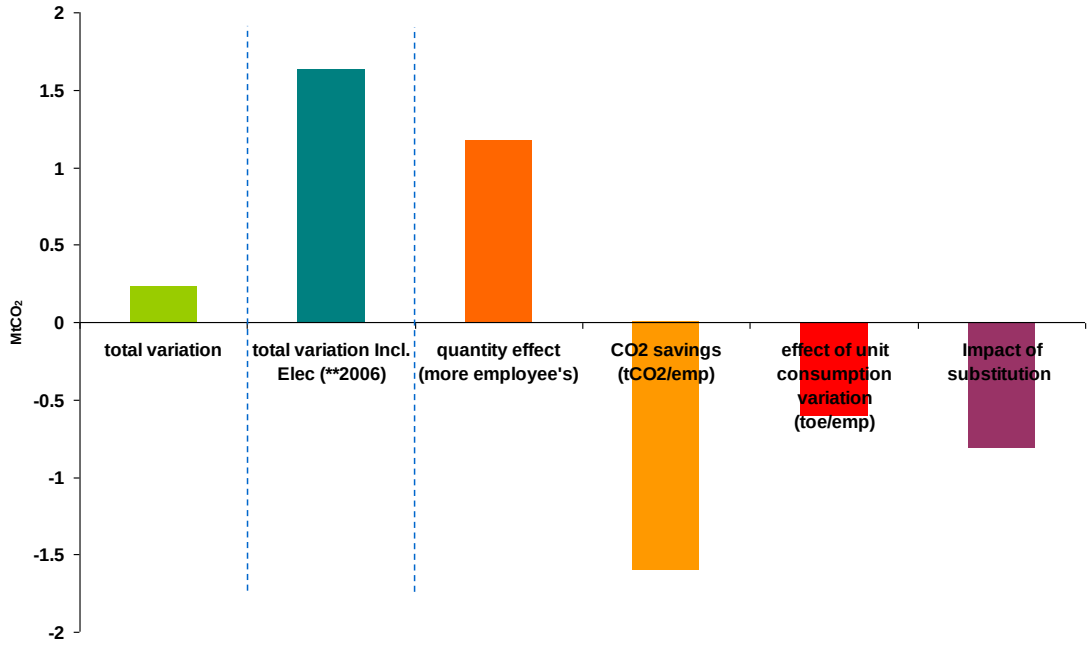

Source: Odyssee & SEI

When electricity is included ( data only available to 2006) there is a significant increase in emissions in the industrial sector primarily due to the non-ferrous metals and

other industry branches excluding food processing, beverages and tobbacco, chemicals and paper branches of industry.

More detailed analysis is possible on the services sector than in the industry sector. This analysis is detailed in Figure 26. Figure 26 shows the reduction in $CO_2$/employee compared to 1997 has resulted in significant $CO_2$ savings even though there was an increase in the number of employee's. Fuel substitution has also resulted in significant savings in emissions. The contribution of fuel substitution is over a third greater than that of energy efficiency (toe/emp) in the services sector.

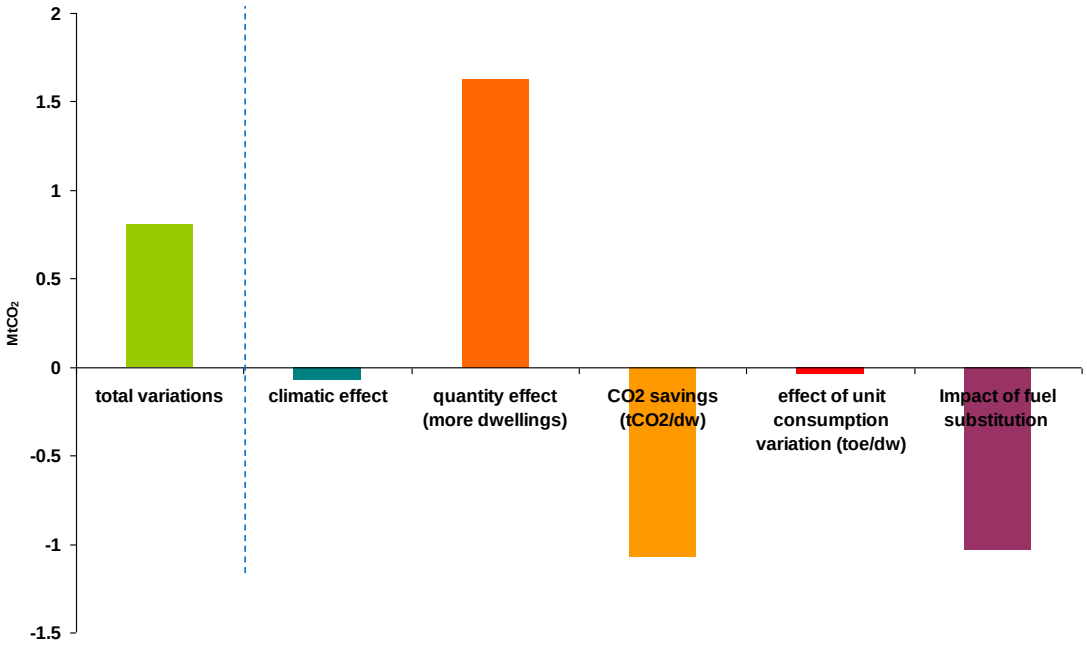
***Figure 26 Analysis of $CO_2$ emissions in the services sector***




Source: Odyssee & SEI

In the residential sector as shown in Figure 27 fuel substitution has resulted in significant emissions savings in 2007 relative to 1997. The reduction in $CO_2$/dw has also resulted in significant $CO_2$ savings. The increase in the number of houses has impacted negatively on the emissions in the residential sector. Energy efficiency in the residential sector has not resulted in as significant a reduction in emissions as the other factors of fuel substition and the consequent reduction in emissions per dwelling.

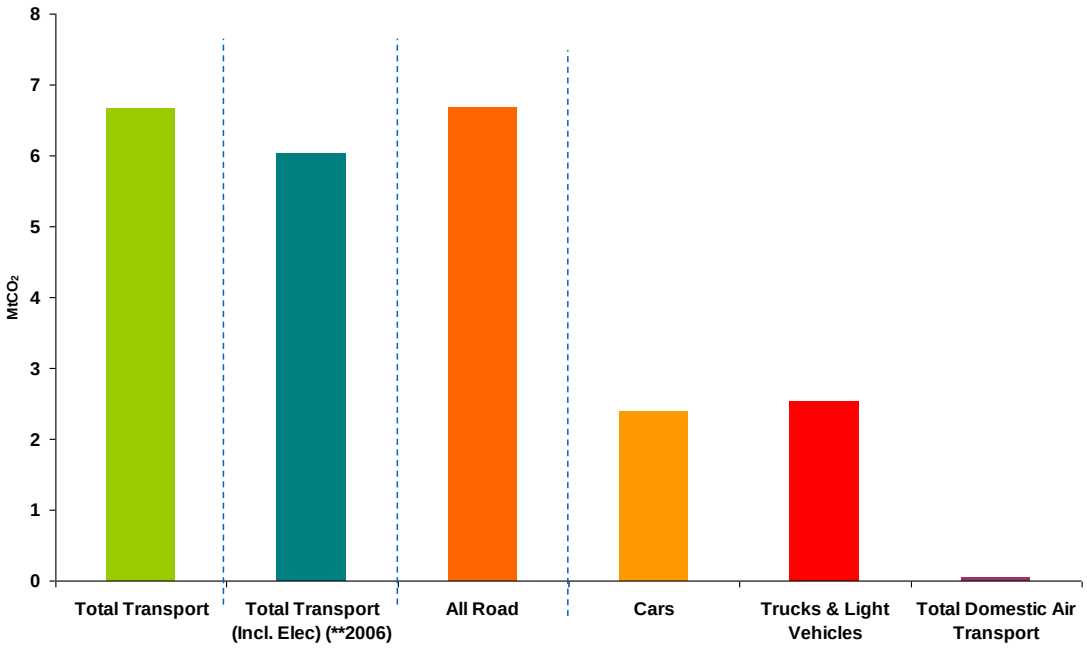
***Figure 27 Analysis of $CO_2$ emissions in the Residential sector***




Source: Odyssee & SEI

In the transport sector the increases in emissions has been most significant from road transport, as shown in Figure 28.

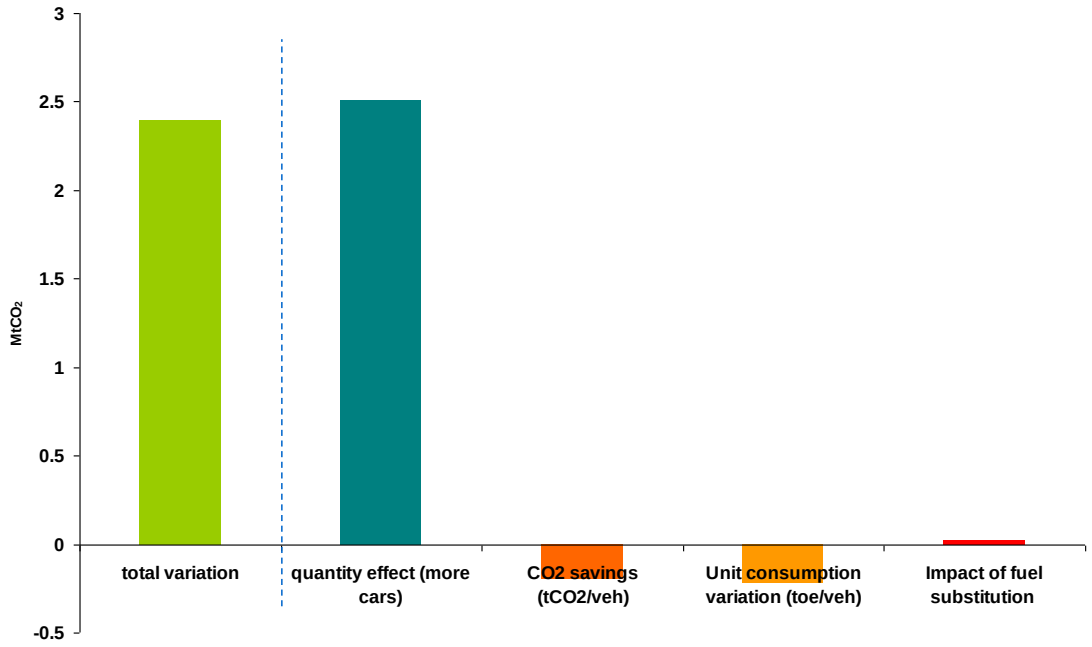
***Figure 28 Analysis of $CO_2$ emissions in the transport sector***




Source: Odyssee & SEI

Examining emissions from cars in more detail in Figure 29 reveals that improvements in energy efficiency since 1997 was the single most important factor in reductions in $CO_2$ emissions in 2007.

***Figure 29 Analysis of $CO_2$ emissions of cars***




Source: Odyssee & SEI

# 4 Energy efficiency measures

## 4.1 Recent Energy Efficiency Measures

### Residential Sector

New building regulations **(Technical Guidance Document L – Conservation of Fuel and Energy)** came into effect on 1st July 2008. The goal of the new standards is to reduce energy requirements by 40% in new dwellings, depending on the type and size of the dwelling. A commitment was also made to review and improve regulations in 2010 with the ultimate aim of achieving a zero carbon standard for new houses in the medium to long term.

Since March 31st 2008, when installing a replacement oil or gas boiler it is now a requirement that the boiler be condensing where practical (Section L3, Building Regulations Part L amendment – S.I. No.847 of 2007).

The most innovative energy efficiency scheme in the residential sector is a **pilot Home Energy Savings Scheme** which was introduced in 2008 to reduce energy and $CO_2$ emissions from the existing housing stock. The subsequent full national **Home Energy Saving Scheme**[37] was launched on 8th February 2009, with a budget of €50 million in 2009. The scheme is expected to support the upgrade of at least 25,000 homes.

### Transport Sector

It is now mandatory under EU (Council Directive 99/94/EEC) and Irish law for the motor industry to clearly **display the fuel economy and $CO_2$ emissions** of new passenger cars, allowing consumers to make informed purchasing choices on both environmental and economic grounds.

This requires the placing of fuel consumption and $CO_2$ emissions labels on all new cars on display for sale or lease at forecourts and showrooms. All points of sale or lease for new cars must also display posters with this information and include it in all promotional literature and material. The Regulations (SI 339 of 2001) came in to force, in Ireland, on 24 August 2001. A new labeling system came into effect on 1st July 2008 to coincide with the introduction of the new $CO_2$-based tax structure for cars. It was introduced initially on a non-statutory basis, in cooperation and with the agreement of the Society of the Irish Motor Industry and applies to all new cars at

[37] Sustainable Energy Ireland Home Energy Savings Scheme
www.sei.ie/Grants/Home_Energy_Saving_Scheme

point of sale. It is intended that the new system will be established on a statutory basis in late 2009.

In 2007 the Government introduced changes to **Vehicle Registration Tax**[38] (VRT) and **annual motor tax** (AMT) for new cars registered on or after 1st July 2008. Both taxes for new registered cars are now calculated on the basis of carbon dioxide ($CO_2$) emissions from vehicles. Initial indications are that, in the short term at least, purchasing behaviour has altered towards buying lower-$CO_2$ vehicles, which are more energy-efficient. This scheme is an innovative implementation of the polluter pays principle being applied to the transport sector.

The **2008 Finance Bill provides relief for hybrid, electric and flexible-fuel vehicles** of up to €2,500 for cars registered between 1st July 2008 and 31st December 2010 on the VRT payable, in addition to the benefit of the new VRT $CO_2$ emission-related system.

**Industry Sector**

There are a number of key energy efficiency programmes in the industry sector operated by SEI. **The Large Industry Energy Network** (LIEN) is for the largest industrial energy consumers in Ireland, i.e. those with an annual energy spend of over 1M Euros. The Network is developing a set of role-model companies who recognise the benefits of better energy management for their own competitiveness, for Ireland's economy and for the environment.

In addition, in order to help companies reduce energy costs, SEI has developed the **Energy Agreement programme for industry** based on the Irish energy management standard **IS393**. The programme is based a Negotiated Agreement pilot that SEI carried out in 2003. By joining the Energy Agreement programme, companies will work towards certification to the new Irish Standard on Energy Management Systems, IS 393. In return SEI will offer tailor-made support in obtaining the energy management standard, and in benefiting as fully as possible from the process.

**SEI's service for small and medium enterprises (SMEs), which** offers energy advice, assessment and monitoring, with the aim of cutting their energy use by 20%.

The **Accelerated Capital Allowance**[39] (ACA) scheme was introduced in the Finance Act 2008. This is the most innovative scheme in the Industry sector. This scheme enables businesses to write off the entire cost of a specified set of energy-efficient

38 Vehicle Registration Tax: www.environ.ie/en/LocalGovernment/MotorTax

39 Accelerated capital allowance scheme: www.sei.ie/Your_Business/Accelerated_Capital_Allowance

motors, lighting and building energy-management systems in the first year of purchase.

**Tertiary Sector**

The Government has assigned the public sector an exemplar role in improving energy efficiency due to its significant size and its considerable purchasing power. The **Public Sector Programme** promotes energy-efficient design, technologies and services in new and retrofit public-sector projects. These projects are excellent examples of good practice and a demand leader for the services and technologies involved. The programme has three main elements:

- A Design Study Support Scheme which provides support for professional expertise to examine the technical and economic feasibility of design and technology solutions.
- A Model Solutions Investment Support Scheme which supports energy management and technology solutions in existing buildings and new-build specifications.
- An Energy Management Bureau which supports outsourced energy management services to report on energy usage and identify energy-related projects.

**Cross-cutting measures**

The **European Energy Performance of Buildings Directive (EPBD)**[40] was adopted into Irish law as Statutory Instrument No. 666 of 2006. This is a cross-sectoral measure encompassing energy efficiency in the built environment as a whole. This directive includes a common methodology for calculating the integrated energy performance of buildings; minimum standards on the energy performance of new buildings and existing buildings that are subject to major renovation; systems for the energy certification of new and existing buildings and, for public buildings; regular inspection of boilers and central air-conditioning systems in buildings, and an assessment of heating installations in which the boilers are more than 15 years old.

As part of the EPB Directive, a **Building Energy Rating**[41] (BER) certificate, which is effectively an energy label, is now required at the point of sale or rental of a building, or on completion of a new building. Since January 2009 this labelling system applies to existing buildings as well as new domestic and non-domestic buildings in Ireland.

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[40] Commission of the European Communities, 2002 and recast 2008: Energy Performance of Buildings Directive www.ec.europa.eu/energy/strategies/2008/doc/2008_11_ser2/buildings_directive_proposal.pdf

[41] Building Energy Rating www.sei.ie/Your_Building/BER

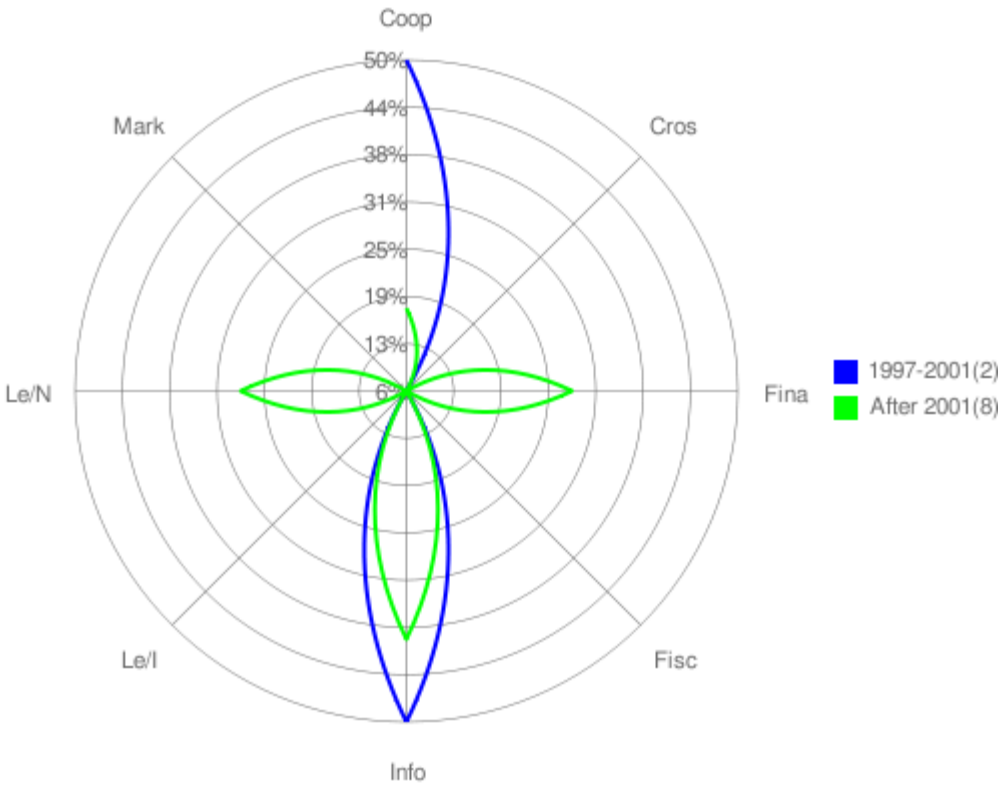
The **Combined Heat and Power Deployment Scheme which** provides grant support to assist the deployment of small-scale (<1MWe) fossil-fired CHP and biomass (anaerobic digestion and wood residue) CHP systems.

## 4.2 Patterns and Dynamics of Energy Efficiency Measures

In this section the composition of measures and policies in Ireland are examined for each sector. The period examined is from 1997 to 2007. Two intervals of 5 years are used to examine changes of focus in measures and policies over the ten year period. The diagrams are shown in the form of a spider's web with the measure types on the spokes of the web. The greater the preference for a certain measure type the more the pattern will resemble the hands of a watch indicating the preference. The broader the policies in a sector, the more equally spread the measures on the different axes.

**Industrial Sector**

***Figure 30 Policy focus in the industrial sector***




Source : Mure

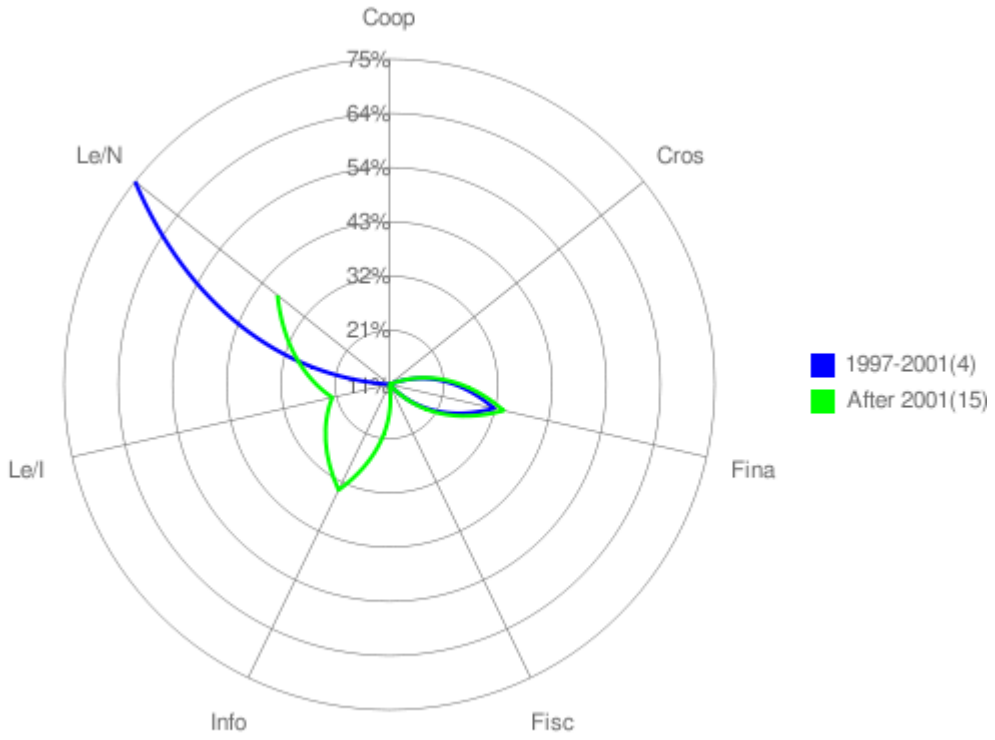
In the industrial sector the measure focus has changed from informative and cooperative to include financial and legislative normative measures. The most innovative measure in the industrial sector is the Accelerated Capital Allowance scheme (ACA).

This scheme is discussed in more detail in Section 4.3 Innovative Energy Efficiency Measures.

### Residential Sector

It can be seen from Figure 31 that the policy focus of the residential sector changed from being legislative normative between 1997 and 2002 to include more informative and legislative informative measures since 2002. An informative campaign named the power of one campaign is the most successful of the informative measures.

***Figure 31 Policy focus of the residential sector***



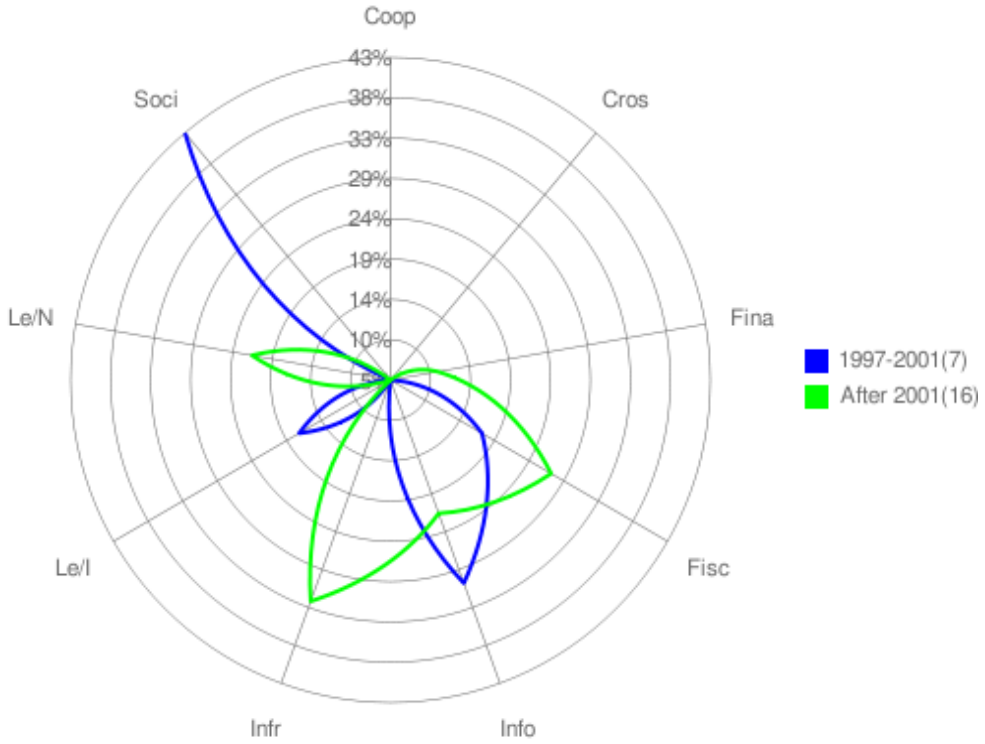

Source : Mure

During the period examined the EU introduced the energy performance of buildings directive. As part of the EPBD each building must have and Building Energy Rating certificate when being sold or leased.

The general trend in the measures is a change from legislative normative to legislative informative or informative measures. There is approximately the same emphasis on financial measures throughout the period examined.

**Transport Sector**

***Figure 32 Policy focus in the transport sector***

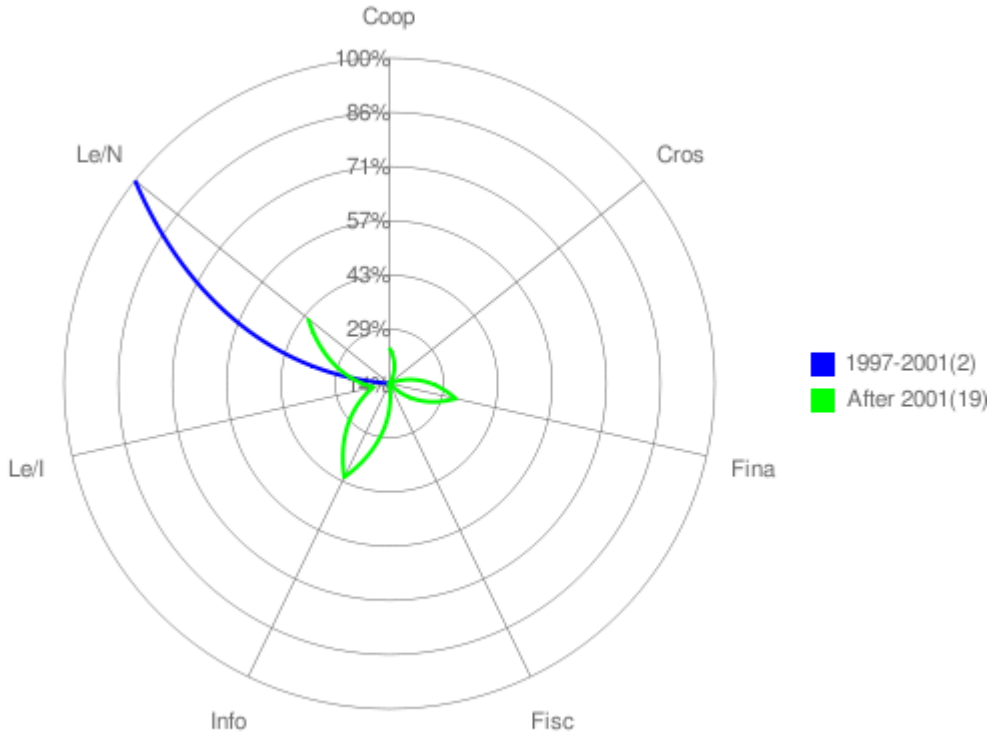



Source : Mure

In the transport sector the emphasis has changed from sociological and informative measures to infrastructural, fiscal and financial measures. There was also a shift from legislative informative measures to legislative normative measures.

**Tertiary Sector**

***Figure 33 Policy focus in the tertiary sector***

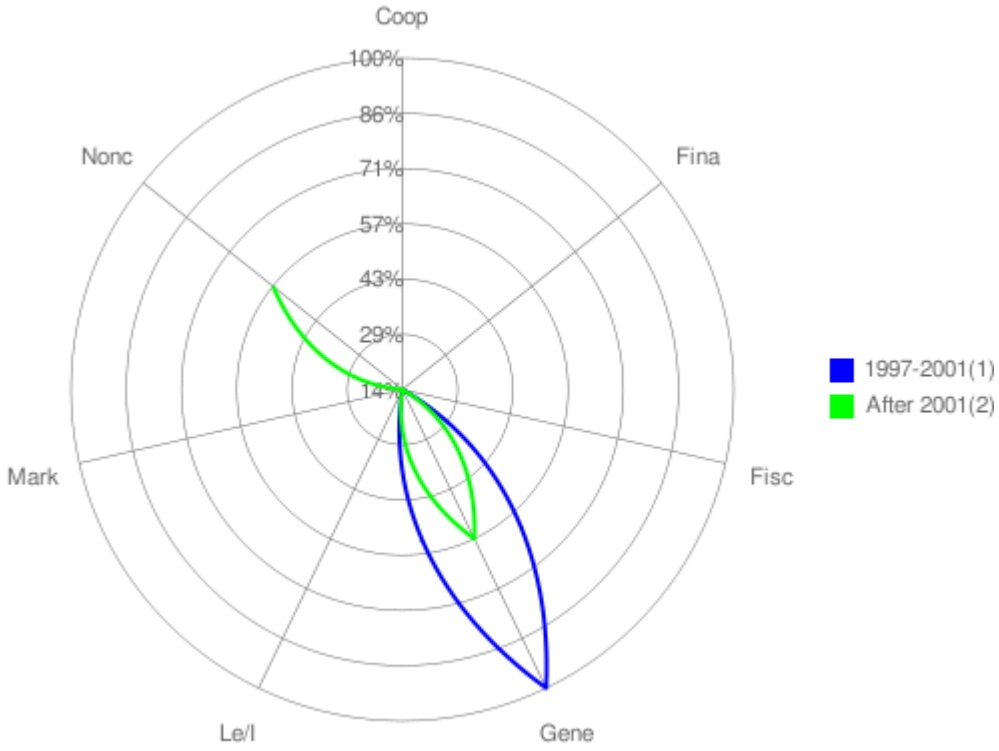



Source : Mure

In the tertiary sector most of the policy measures between 1997 and 2001 were legislative normative measures. After 2001 there was a shift to more informative, financial and to lesser extent cooperative measures.

**Cross-cutting measures**

***Figure 34 Policy focus of cross cutting measures***




Source : Mure

The only significant change in the type of measures being implemented over the two periods examined is that there has been more EU measures adopted in the second period (after 2001).

## 4.3 Innovative Energy Efficiency Measures

**Accelerated Capital Allowance – Industry and Services Sectors**

The Accelerated capital allowance (ACA) is a tax incentive for companies paying corporation tax and aims to encourage investment in energy efficient equipment. The ACA offers an attractive incentive whereby it allows companies to write off 100% of the purchase value of qualifying energy efficient equipment against their profit in the year of purchase. With the existing Capital Allowances tax structure, when money is spent on “capital equipment” companies can deduct the cost of this equipment from their profits proportionally over a period of 8 years, i.e. the annual taxable profit is only reduced by 1/8 (12.5%) of the total equipment cost.

The ACA benefits companies by:

- Reducing their tax bill.
- Increasing their cash flow.
- Reducing their energy bills.

This tax incentive measure was introduced under section 46 of the Finance Act 2008 to encourage companies to purchase the most energy efficient plant, machinery and equipment for use within their business. Existing categories include lighting, lighting controls, motors, variable speed drives and building energy management systems. The scheme was expanded in the Finance Act 2009 to include Biofuel conversion kits, IT infrastructure hardware and associated cooling equipment, Electricity generation equipment (for company's own use) e.g. Solar PV, wind turbines, CHP and anaerobic digestion equipment, Boiler equipment and control and recovery systems, Heating, ventilation and air conditioning systems (HVAC), Advanced liquid and gas handling equipment. Businesses can write off 100% of the cost of purchase of electric vehicles against tax under the Accelerated Capital Allowance Scheme.

**Electric Vehicles – Transport Sector**

The Irish government is actively promoting the use of electricity in transport and is committed to reducing CO2 emissions in the transport sector. The use of electric vehicles on Irish roads will lead to reduced CO2 levels critical to meeting Ireland's emissions targets. Ireland's dependency on imported oil will also be reduced by a greater uptake of electric vehicles.

The Government aims to have 10% of the transport fleet fully electric by the year 2020. Based on current numbers, this equates to approximately 230,000 cars. One of the primary roles of the Government's Electric Vehicles Strategy is to ensure that Ireland is at the forefront of developments in this field. An Electric Vehicles Working Group has been set up which involves a number of state departments and agencies. Sustainable Energy Ireland (SEI) is also conducting a €1 million pilot scheme to assess the suitability of Ireland for electric vehicles, and to demonstrate and test various infrastructural systems.

The Government and the semi-state electricity supplier ESB have each signed a Memorandum of Understanding with the Renault-Nissan alliance to promote the introduction of electric vehicles in Ireland and to help meet the target of 10 percent of the national car fleet by 2020. The Memoranda of Understanding will create favourable conditions for the distribution of electric vehicles to the Irish market by Renault-

Nissan. The Irish Government's intentions are not product-exclusive. There are a number of electric vehicles currently on sale in Ireland and a number of conversions of existing vehicles are also available.

Ireland is an excellent location for the roll out of electric cars. The battery range of electric vehicles is best suited to the size of the country Ireland does not have an indigenous car manufacturing base so as a country is 'car neutral'. The electricity network is owned and operated by a single entity, ESB Networks. The regulatory framework exists to allow multiple suppliers to provide electricity to their EV customers.

The high level of home ownership as opposed to multiple occupancy buildings is also advantageous in that there will be less need for charging points on street for overnight trickle charge as individual homes can use their domestic electricity supply. Ireland has one of the highest penetration of wind in Europe, this renewable energy resource is better utilised in charging electric vehicles which effectively provide storage facilities for the wind generated at non peak load times.

**The Home Energy Savings Scheme – Residential Sector**

The Home Energy Savings Scheme (HESS) offers grants of up to 40% of the typical cost of energy efficiency upgrade measures, varying depending on the measure concerned. Homeowners who avail of the full range of measures can expect to save approximately €700 per annum.

The economic contribution of the Home Energy Saving Scheme is in evidence, with reports of insulation companies creating employment as a direct result. 2,100 construction workers had registered to carry out works under the Scheme in June 2009.

The three-strand insulation programme will cut heating bills for householders, reduce carbon emissions and create thousands of jobs both directly and indirectly over the course of 2009.

## 4.4 Energy efficiency measure evaluations

### 4.4.1 Semi-quantitative Impact Estimates of Energy Efficiency Measures

**Residential Sector**

In the residential sector legislative policy measures appear to have the highest impact. The summary of measures in the residential sector along with the semi-quantitative estimate of the impact of the measures is given in Annex 1 Table 8. Recent and more frequent revisions of the building regulations along with the implementation of the EPBD have had the most impact in the residential sector.

**Transport Sector**

Fiscal measures appear to have the highest impact in the transport sector. Recent measures such as the changes to the vehicle registration tax and the annual motor tax appear have had a semi-quantitative impact with a high rating. Along with the excise relief for bio-fuels, another legislative normative measure associated with bio-fuels, namely the bio-fuels obligation scheme is also rated as having a high impact. The ambitious infrastructural project 'Transport 21' is also expected to have a large impact. Other significant transport measures with medium impact fall into the Informative/Educational/Training type. The list of measures in the transport sector are summarised in Table 9 in Annex1.

**Industrial Sector**

A summary of measures in the industrial sector along with an estimate of the semi-quantitative impact of the measures is given in Table 10 of Annex 1. It is interesting to note that in the industrial sector measures that an informative/educational/training measure and a cooperative measure, namely the Large Industry Energy Users project and demand side management have a high impact. Most of the measures in this sector are of the informative/educational/

**Tertiary Sector**

In the tertiary sector, similar to the industrial sector measures which are informative/educational/training or cooperative in nature have the highest impact. The service sector measures are summarised in Annex1 Table 11. There are also a number of financial measures targeting the services sector which are expected to have a medium semi-quantitative impact. These include the accelerated capital allowance scheme, the energy audit grant scheme and the combined heat and power grants program.

**Cross-cutting measures**

As most of the cross-cutting measures align with general government policies on climate change, energy efficiency and renewables the impact of the measures in this category all have a high semi-quantitative impact. The measures are listed in Annex 1 Table 12. Probably the most significant measure in this section was the establishment of Sustainable Energy Authority of Ireland in 2002.

### 4.4.2 Lessons from Quantitative Energy Efficiency Measure Evaluations

**Evaluation of building regulation – Dwelling Energy Assessment Procedure**

Dwelling Energy Assessment Procedure (DEAP) is the Irish official procedure for calculating and assessing the energy performance of dwellings. With the introduction of the EPBD and the development of the DEAP software program the impact of the 2008 building regulations was assessed using DEAP.

The procedure takes account of the energy required for space heating, ventilation, water heating and lighting, less savings from energy generation technologies. For standardised occupancy, it calculates annual values of delivered energy consumption, primary energy consumption, carbon dioxide emissions and costs, both totals and per square metre of total floor area of the dwelling. It does provide a standardised method to evaluate the impact of building regulations but it is not an absolute measure of energy use. DEAP requires a lot of assumptions such as occupancy levels and heating times and does not include a 'rebound effect' factor and does not estimate energy use for appliances.

As all new buildings require building a energy rating certificate DEAP specifies at the design stage whether a building is compliant with building regulations. Prior to the availability of the DEAP software at the design stage this was a manual test. Physical checks/audits are still required to see if building regulations are being adhered to in the building phase not just the design phase. The software provides a metric for energy use of the building which can be used as a reference for the building occupiers on what the required energy use/spend.

The development of the DEAP software required a considerable length of time and resources. It is however an extremely valuable tool which covers a lot of functions not just for the evaluation of building regulations. It is also used to provide a energy rating certificated for existing stock.

The visible impact of building certificates to the general public as a result of the software development has allowed for a greater impact than the semi-quantitative 'high' impact. This high impact when measures using the energy savings from the DEAP

assessment on improved energy regulations per number of new houses being building using these new regulations.

### Evaluation of $CO_2$-taxation - Vehicle Registration Tax and Annual Motor Tax Changes

From 1 July 2008 the Irish motor tax moved from a system of bands based on engine size to one based on CO2 emissions. With seven bands in total the annual motor tax ranges from €104 a year for the greenest cars, to €2080 for cars with the highest emissions ratings. The emissions motor tax system applies to all new vehicles and newly imported cars registered on or after July 1 of 2008. Cars purchased pre-July 2008 cars continue to be taxed on the basis of engine size.

The objective of this new motor tax system was to influence the purchasing decisions of consumers by rewarding the buyers of low-emitting cars and charging a premium on less efficient vehicles.

Indicators were used to

- Identify the need to rebalance the tax system in order to meet the EU target of an average emission new passenger cars not exceeding 130g CO2 by 2012
- Provide evidence based data on how the rebalancing should be implemented
- Monitor the impact the car tax change on purchasing behaviour

The indicators used were:

- Number of new cars in each emission band
- New car engine size profile,
- Share of petrol and diesel cars
- Average specific CO2 emissions.

In order to monitor the impact of this tax change a lot of detailed data was required. The indicators were monitored both before and after the tax change. The specific CO2 emissions of new cars were also monitored and used as one of the main metrics for the success of the tax change.

In the evaluation of the impact of the measure it was observed that there was a step-change in the average specific CO2 emission for new cars with the introduction of the tax change. Petrol cars changed from:160g CO2/km in Jan – Jul ‘08 - 146 g CO2/Km

in Jul – Dec ’08. New diesel cars changed from:163g CO2/km in Jan – Jul ‘08 to 140 g CO2/Km in Jul – Dec ’08. Average specific consumption of new cars in 2008 was 158 g CO2/Km still a D band. The pre tax change average specific emission of all new cars was 161g CO2/km (D band). The post tax change average specific emissions of all new cars 142g CO2/Km C band but bordering on a B band.

Anecdotally the impact of the tax change was attributed to a change in purchasing patterns to smaller car this was not the actual change that occurred. The indicators identified that a shift to diesel cars within the large engine size bands was the biggest change in purchasing behaviour. This evaluation example highlights that a number of detailed indicators are required in order to accurate access the impact of energy efficiency measures.

# 5 National Developments under the EU Energy Efficiency Directive and the 20% Energy Efficiency Target of the EU

The *National Energy Efficiency Action Plan* was finalised in April 2009 and outlines the proposals to meet the European Energy Servies Directive target and the European target of a 20% improvement in energy efficiency by 2020.

**Table 7** ***Summary of measures proposed in the National Energy Efficiency Action Plan***

| | GWh PEE | ktCO2 |
|---|---|---|
| **Business and Public sectors** | | |
| SEI Public Sector Building Demonstration Programme—support for new and retrofit public sector building initiatives | 140 | 40 |
| Building Regulations 2005—improved efficiency of non-residential buildings | 560 | 133 |
| Building Regulations 2010—30% improvement on energy performance of non-residential buildings relevant to current building regulations | 1,360 | 322 |
| SEI Large Industry Programmes (Energy Agreements (IS393 and Large Industry Energy Network) | 4,070 | 887 |
| SEI small business supports—Energy MAP and training for small businesses | 565 | 141 |
| Existing ESB demand side management initiatives | 435 | 96 |
| Renewable Heat Deployment Programme (ReHeat) | 410 | 92 |
| Accelerated Capital Allowance Scheme (ACA) for energy-efficient equipment | 800 | 143 |
| ***Sector Total*** | **8340** | **1854** |
| | | |
| **Residential sector** | | |
| Building Regulations 2002—improved energy performance of residential buildings | 1,015 | 266 |
| Building Regulations 2008—40% improvement on energy performance of residential buildings relative to current building regulations | 2,490 | 615 |
| Building Regulations 2010—60% improvement of residential buildings relative to current building regulations | 1,100 | 272 |
| Low Carbon Homes 2016—70% improvement of residential buildings relative to current building regulations | 395 | 98 |
| House of Tomorrow programme—developer support for buildings exceeding existing building regulations | 30 | 7 |
| Warmer Homes Scheme | 170 | 42 |
| Home Energy Saving Scheme—improving current residential building stock in Ireland | 600 | 157 |
| Smart meter installation—estimated efficiency gains among domestic users | 690 | 120 |
| Greener Homes Scheme | 265 | 64 |
| Lighting Efficiency Standard | 1,200 | 210 |
| Efficient Boiler Standard | 2,400 | 585 |
| ***Sector Total*** | **10,355** | **2,436** |
| | | |
| **Transport sector** | | |
| Improved fuel economy of private car fleet | 1530 | 412 |
| Efficient driving measures | 655 | 176 |
| Electric Vehicles Deployment | 955 | 350 |
| Mobility management - Travel Plans | 1090 | 294 |
| Vehicle Registration Tax (VRT) / Annual Motor Tax (AMT) changes | 200 | 54 |
| E-Working | 150 | 40 |
| More sustainable public transport fleets | 90 | 24 |
| ***Sector Total*** | **4670** | **1350** |
| | | |

| | | |
|---|---|---|
| **Energy Supply sector** | | |
| Transmission and distribution efficiencies improvement—reaching loss target of 7.5% | 310 | 72 |
| Winter Peak Demand Reduction Scheme | 55 | 10 |
| ***Sector Total*** | **365** | **82** |
| | | |
| **TOTAL PROJECTED SAVINGS** | **23,730** | **5,722** |
| | | |
| **National 20% Savings Target** | **31,925** | |
| | | |
| **Additional Savings to be captured** | **8,195** | |

# Annex 1

# Energy Efficiency Measure Summary by Country

**Table 8** ***Summary of measures in the Residential Sector***

| Code | Title | Status | Type | Start | End | Semi-quantative impact |
|---|---|---|---|---|---|---|
| IRL12 | Building Regulations 1991 | Completed | Legislative/Normative | 1992 | 1998 | High |
| IRL13 | Building Regulations 1997 | Completed | Legislative/Normative | 1998 | 2002 | High |
| IRL14 | Energy Conservation Standards for New Dwellings (Revised Building Regulations) 2002 | Completed | Legislative/Normative | 2003 | 2007 | High |
| IRL15 | Minimum Efficiency Standards for Appliances and Lighting | Ongoing | Legislative/Normative | 1999 | | Medium |
| IRL18 | Programme “Energy Action” in Dublin | Ongoing | Financial | 1988 | | Low |
| IRL19 | Warmer Home Scheme (Low Income Housing Strategy) | Ongoing | Financial | 2002 | | Low |
| IRL20 | Sustainable Energy Ireland | Ongoing | Information/Education | 2002 | | High |
| IRL21 | Irish Response to the Energy Performance of Buildings Directive | Ongoing | Legislative/Informative | 2007 | | High |
| IRL22 | The Greener Homes Scheme | Ongoing | Financial | 2006 | 2011 | Medium |
| IRL23 | Minimum Efficiency Standards for Boilers | Ongoing | Legislative/Normative | 1995 | | Medium |
| IRL24 | Power of One - Information Campaign | Ongoing | Information/Education | 2006 | | Medium |
| IRL25 | Building Regulations 2007 | Ongoing | Legislative/Normative | 2008 | | High |
| IRL26 | Best Practice Design for | Ongoing | Informati- | 2007 | | Medium |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Social Housing | | on/Education | | | |
| IRL27 | Energy Efficient Lighting | Proposed (advanced) | Legislative/Normative | 2009 | | Medium |
| IRL28 | Boiler Efficiency Campaign | Ongoing | Information/Education | 2007 | | Low |
| IRL29 | Smart Metering - (Pilot Scheme) | Ongoing | Information/Education | 2008 | | Low |
| IRL30 | Upgrade of Older Housing Stock - Home Energy Savings Scheme & Housing Aid for Older People Scheme | Ongoing | Financial | 2009 | | Medium |
| IRL31 | House of Tomorrow | Completed | Financial | 2001 | 2006 | Low |
| IRL32 | Micro CHP | Proposed (medium/long-term) | Financial | 2012 | | Unknown |
| IRL34 | Condensing Boilers - Minimum Boiler Efficiency | Ongoing | Legislative/Normative | 2008 | | Medium |
| IRL35 | Periodic Mandatory inspection of Boilers | Proposed (medium/long-term) | Legislative/Normative | 2012 | | Unknown |
| IRL36 | Mandatory labelling of electrical appliances | Ongoing | Legislative/Normative | 1995 | | Unknown |
| IRL37 | Energy efficient communities through spacial and planning policies | Ongoing | Unknown | 2002 | | Medium |
| IRL38 | Low Carbon Homes Scheme | Completed | Financial | 2006 | 2009 | Low |

Source : Mure

**Table 9** ***Summary of measures in the transport sector***

| Code | Title | Status | Type | Start | End | Semi-quantative impact |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| IRL2 (ex H0IRL2) | Carfree Day | Ongoing | Information /Education/ Training | 2000 | | Low |
| IRL3 (ex G0IRL2) | Mobility Management Plans | Completed | SocialPlanning/ Organisational | 1999 | 2001 | Low |
| IRL4 (ex I0IRL3) | Operational Programme for Transport 1994 to 1999 | Completed | Infrastructure | 1994 | 1999 | Low |
| IRL5 (ex E0IRL1) | Dublin Transportation Initiative | Ongoing | Infrastructure | 1994 | 2011 | Low |
| IRL6 (ex H0IRL3) | Labelling of Motor Cars | Ongoing | Legislative/ Informative | 2001 | | Low |
| IRL7 (ex D0IRL1) | Public Information /Education | Completed | Information /Education/ Training | 1991 | 2007 | Low |
| IRL8 (ex D0IRL3) | Vehicle Registration Tax for Hybrid Vehicles | Ongoing | Fiscal | 2001 | | Medium |
| IRL9 (ex F0IRL1) | Investment in Mainline Rail | Ongoing | Infrastructure | 1994 | | Medium |
| IRL10 | Excise Tax Relief for Biofuels | Ongoing | Fiscal | 2005 | 2010 | High |
| IRL11 | Transport 21- Capital investment in Infrastructure (2006-2015) | Ongoing | Infrastructure | 2006 | 2015 | High |
| IRL12 | Sustainable Travel and Transport Action Plan | Ongoing | Infrastructure | 2009 | | Medium |
| IRL13 | Advice to Fleet Managers | Ongoing | Information /Education/ Training | 2007 | | Medium |
| IRL14 | How Clean is Your Car? | Ongoing | Information /Education/ Training | 2007 | | Medium |
| IRL15 | Rebalancing of Annual Motor Tax on the basis of CO2 Emissions | Ongoing | Financial | 2008 | | High |
| IRL16 | Rebalancing of Vehicle Registration Tax (VRT) on the basis of CO2 Emissions | Ongoing | Financial | 2008 | | High |
| IRL17 | Speed Limits | Ongoing | Legislative/ Normative | 2005 | | Low |
| IRL18 | Mineral Oil Tax | Ongoing | Fiscal | 2008 | | Unknown |
| IRL19 | Speed Limiter for Lorries | Ongoing | Legislative/ Normative | 2005 | | Medium |
| IRL20 | Biofuels Obligation | Ongoing | Legislative/ | 2008 | | High |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Scheme | | Normative | | | |
| IRL21 | National Cycling Policy Framework | Ongoing | Information/ Education/ Training | 2009 | | Low |
| IRL22 | Electric Vehicles | Ongoing | Co-operative Measures , Financial, Fiscal, Legislative/ Normative | 2008 | | Low |

Source : Mure

**Table 10** ***Summary of measures in the Industrial Sector***

| Code | Title | Status | Type | Start | End | Semi-quantative impact |
|---|---|---|---|---|---|---|
| IRL1 (ex A0IRL17) | Boiler System Evaluation Scheme | Completed | Information/ Education/ Training | 1997 | 2000 | Medium |
| IRL2 (ex A0IRL16) | Best Practice Programme - Large Industry Energy Network | Ongoing | Information/ Education/ Training | 1995 | | High |
| IRL3 (ex A0IRL2) | Energy Efficiency Investment Support Scheme | Completed | Financial | 1995 | 1999 | Medium |
| IRL4 (ex A0IRL14) | Powerful Savings for Industry | Completed | Information/ Education/ Training | 1990 | 1995 | Low |
| IRL5 (ex A0IRL10) | Demand Side Management | Ongoing | Co-operative Measures | 1991 | | High |
| IRL8 (ex A0IRL1) | The Energy Audit Grant Scheme | Completed | Financial | 1994 | 1997 | Medium |
| IRL9 (ex A0IRL5) | Least Cost Planning for Ireland | Completed | Co-operative Measures | 2000 | | Medium |
| IRL10 | Sustainable Energy Awards | Ongoing | Information/ Education/ Training | 2003 | | Medium |
| IRL11 | Combined Heat and Power (CHP) Grants Programme | Ongoing | Financial | 2006 | | Medium |
| IRL12 | Energy Agreements | Ongoing | Co-operative Measures | 2006 | | High |
| IRL13 | Energy Man- | Ongoing | Information/ | 2006 | | Low |

| | | | | | | |
|---|---|---|---|---|---|---|
| | agement Action Programme | | Education/ Training | | | |
| IRL14 | Assessment of Renewable Energy Alternatives at Design Stage | Ongoing | Legislative/ Normative | 2008 | | Medium |
| IRL15 | SME Energy Efficiency | Ongoing | Information /Education/ Training | 2007 | | Low |
| IRL16 | Building Energy Rating | Proposed (advanced) | Legislative/ Normative | 2008 | | Medium |
| IRL17 | Tax Relief for Energy Saving Equipment | Ongoing | Financial | 2008 | | Medium |

Source : Mure

**Table 11** ***Summary of measures in the Services Sector***

| Code | Title | Status | Type | Start | End | Semi-quantative impact |
|---|---|---|---|---|---|---|
| IRL8 | Public Sector Energy Efficiency Programme | Completed | Co-operative Measures, Financial, Information /Education/ Training | 1994 | 2007 | Medium |
| IRL11 | Building Regulations 1991 | Completed | Legislative/ Normative | 1992 | 1998 | High |
| IRL12 | Building Regulations 1997 | Ongoing | Legislative/ Normative | 1998 | | High |
| IRL14 | Sustainable Energy Ireland | Ongoing | Information/ Education/ Training | 2002 | | High |
| IRL15 | Sustainable Energy Awards | Ongoing | Information/ Education/ Training | 2003 | | Medium |
| IRL16 | Bioheat Boiler Deployment Programme | Ongoing | Financial | 2006 | | Low |
| IRL17 | Building Regulations 2005 | Completed | Legislative/ Normative | 2005 | 2008 | High |
| IRL18 | SEBNet/ Standards/ Certification | Ongoing | Co-operative Measures | 2004 | | Low |
| IRL19 | Demand Side Management Measures | Ongoing | Information/ Education/ Training | 1991 | | High |
| IRL20 | Energy Management Action Programme | Ongoing | Information/ Educa- | 2006 | | Low |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | tion/Training | | | |
| IRL21 | SME Energy Efficiency | Ongoing | Information/ Education/Training | 2007 | | Low |
| IRL22 | Assessment of Renewable Energy Alternatives at Design Stage | Ongoing | Legislative/ Normative | 2008 | | Medium |
| IRL23 | Energy Agreements | Ongoing | Co-operative Measures | 2006 | | High |
| IRL24 | Building Energy Rating | Proposed (advanced) | Legislative/ Normative | 2008 | | Medium |
| IRL25 | Action Plan for the Public Sector | Ongoing | Financial | 2007 | | Medium |
| IRL26 | Energy Efficient Lighting | Proposed (advanced) | Legislative/ Normative | 2009 | | Medium |
| IRL27 | Power of One at Work | Ongoing | Information/ Education/Training | 2007 | | Low |
| IRL28 | Energy Star | Ongoing | Information/ Education/Training | 2008 | | Medium |
| IRL29 | Air Conditioning | Ongoing | Legislative/ Informative | 2008 | | Medium |
| IRL30 | Tax Relief for Energy Saving Equipment - Accelerated Capital Allowance | Ongoing | Financial | 2008 | | Medium |
| IRL31 | CHP grants programme | Ongoing | Financial | 2006 | | Medium |
| IRL33 | Minimum efficiency standards for boilers | Ongoing | Legislative/ Normative | 2008 | | Medium |
| IRL35 | 2008 Building Regulations - Adjustments to Part L- Conservation of Fuel and Energy | Ongoing | Legislative/ Normative | 2008 | | Medium |

Source : Mure

**Table 12** ***Summary of cross-cutting measures***

| Code | Title | Status | Type | Start | End | Semi-quantative impact |
|---|---|---|---|---|---|---|
| IRL1 | Energy Performance of Buildings Directive | Ongoing | Non-classified Measure Types | 2007 | | High |
| IRL2 | National Climate Change Strategy | Ongoing | General Energy Efficiency / Climate Change / Renewable | 2000 | | High |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | Programmes | | | |
| IRL3 | Sustainable Energy Ireland | Ongoing | Non-classified Measure Types | 2002 | | High |
| IRL4 | Energy White Paper | Ongoing | General Energy Efficiency / Climate Change / Renewable Programmes | 2007 | | High |

Source : Mure

# Annex 2

# Country Profile

# Energy Efficiency Profile : Ireland

October 2008

## Energy Efficiency Trends

### *Overview*

Over the period 1995 to 2006 the energy efficiency index (ODEX) for the whole economy decreased (which indicates an energy efficiency improvement) by 14% in Ireland. Between 2000 and 2006 the improvement was 4% compared to an EU-27improvement of 7%. The improvement in Ireland in the late 90's is due, largely, to the increased efficiency in the industrial sector whereas the more recent improvement is accounted for by households.

### *Industry*

In the industrial sector there has been a reduction in the ODEX index of 18% over the period 1995 to 2006 which indicates that significant energy savings have been made in the sector. Overall, Irish manufacturing continued a structural shift throughout the 1990's towards less energy intensive, high value added industries. However, since 2003 there has been an increase in the index of approximately 7%.

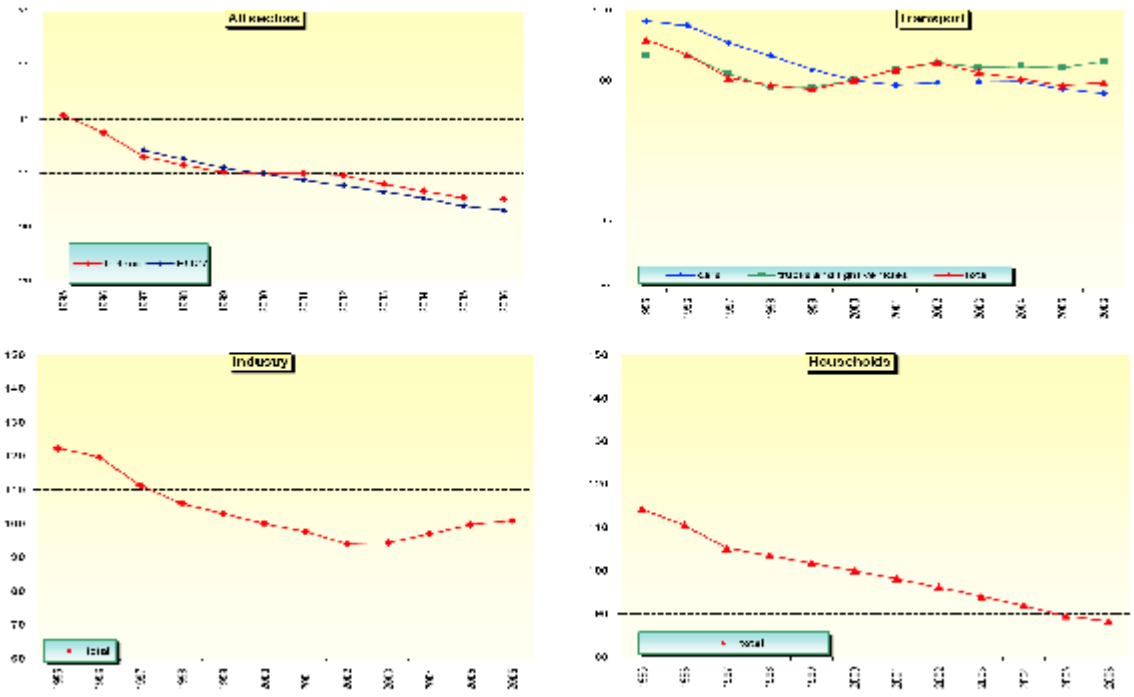
### *Households*

Between 1995 and 2006 the energy efficiency index in the household sector improved by 13.8%. This can be attributed to improvements in the efficiency of the building stock (this is made up of the large number of new houses which adhere to more stringent building regulations as well as retrofitting of existing stock) and fuel switching to oil and gas from solid fuels. The effect of fuel switching was especially noticeable in the early 1990's. Between 2000 and 2006 the household index improved by 4.5%, reflecting the more efficient additions to the stock as a result of the building boom.

### *Transport*

During the period 1995 to 2006, the energy efficiency index in the transport sector decreased by 6.5%, however between 2000 and 2006 there was a lot of fluctuation on a year by year basis with no overall improvement on the 2000 level by the end of 2006.

**Energy efficiency index , base 100=2000**




Source: ODYSSEE data base

## Energy Efficiency Policy Measures

### Institutions and programmes

**Sustainable Energy Ireland** (SEI) is Ireland's national energy authority charged with implementing significant aspects of government policy on sustainable energy and climate change abatement, including improving energy efficiency and reducing the environmental impact of energy production and use.
In March 2007 the Government published a **White Paper** on sustainable energy which set out the Government's Energy Policy Framework 2007-2020 to deliver a sustainable energy future for Ireland. One of the main goals of the White Paper is to achieve 20% savings (33% for the public sector) in energy across the electricity, transport and heating sectors by 2020. Ireland's draft **National Energy Efficiency Action Plan (NEEAP)** was released for public consultation in September 2007.
The **Power of One Campaign** is Ireland's national energy efficiency awareness programme for everywhere energy is used, including homes and workplaces. It is a media campaign which encourages everyone to be more energy aware by providing energy efficiency facts and energy saving tips.

### Industry

There are a number of key energy efficiency programmes in the industrial sector operated by SEI. **The Large Industry Energy Network** (LIEN) is for the largest industrial energy consumers in Ireland. The Network is developing a set of role-model companies to demonstrate better energy management. A scheme for **small and medium enterprises** (SME'S) offers energy advise, assessment and monitoring with the aim of cutting 20% off there energy use. The **Energy Agreement programme for industry** is based on a new Irish energy management standard IS 393. The **Accelerated Capital Allowance** (ACA) scheme was introduced in the Finance Act 2008. This scheme enables businesses to write off the entire cost of a limited set of energy efficient motors, lighting and building energy management systems in the first year of purchase.

### Households, Services

New building regulations (**Proposed Energy Conservation Standards for New Dwellings**) came into effect on 1st January 2003 and the 1st July 2008. It was estimated that the new standards would reduce energy requirements by 23% to 33% and 40% respectively in new dwellings depending on the type and size of the dwelling.
The **EU Directive on the energy performance of buildings** (EPBD) was adopted into Irish law in 2006. As part of the Directive, a **Building Energy Rating** (BER) certificate, which is effectively an energy label, will be required at the point of sale or rental of a building, or on completion of a new building.
Energy efficiency programmes run by SEI include the **Low Carbon Homes** programme. The programme explores the technical solutions that have the potential to reduce $CO_2$ emissions from energy use in a typical new home by at least 70% relative to a "reference dwelling" built to baseline Building Regulations 2005 standards.
The **Low Income Housing** programme supports energy efficiency upgrading measures in low income homes. Core delivery of the low income housing scheme is through the **Warmer Home Scheme** which incorporates the installation of attic insulation, draught proofing, lagging jackets, energy efficient lighting, cavity wall insulation and energy advice.
A pilot **Home Energy Savings** scheme was introduced in 2008 to reduce energy and $CO_2$ emissions from the existing housing stock. This scheme is due to be extended to run nationally in 2009.

### Transport

In 2007 the Government introduced changes to **Vehicle Registration Tax (VRT)** and **annual motor tax** for new cars registered on or after 1st July 2008. Both taxes for new registered cars are now calculated on the basis of carbon dioxide ($CO_2$) emissions from vehicles. Initial indications are that, in the short term at least, purchase behaviour has altered towards lower $CO_2$ vehicles.
The 2001 Finance Bill provided for the refund of 50% of vehicle registration tax (VRT) in respect of motor vehicles fitted with **hybrid and electric engines**. The 2008 Finance Bill provides relief for **hybrid, electric and flexible fuel vehicles** of up to €2,500 for cars registered between 1 July 2008 and 31 December 2010 on the VRT payable, in addition to the benefit of the new VRT CO2 emission related system.

## Selected Energy Efficiency Measures

| Sectors | Title of measures | Since | Energy | Avoided $CO_2$ |
|---|---|---|---|---|
| All | National Energy Efficiency Action Plan Draft (NEEAP) | 2007 | | 9.5Mt by 2020 |
| Public | White Paper Target of 33% improvement | 2007 | 3240 GWh PEE saved by 2020 | |
| Residential | Proposed Energy Conservation Standards for New Dwellings (Revised Building Regulations) | 2002 | 9770 GWh PEE by 2020 | |
| Transport | Fiscal and Carbon Budget changes | 2008 | | 0.2Mt per yr |
| Industry | Large Industry Energy Network (LIEN) | 1993 | 483 GWh avoided in 2004 | 133,589 tonnes in 2004 |

Source: MURE data base
www.mure2.com

Source: Odyssee