Concrete progress – The Cement Industry's response to 'Kyoto'

Colm Bannon, Chairman of the Environment and Technical Committee of the Cement Manufacturers Association of Ireland writes about the challenges presented by the Kyoto Protocol and outlines the Irish cement industry's response.

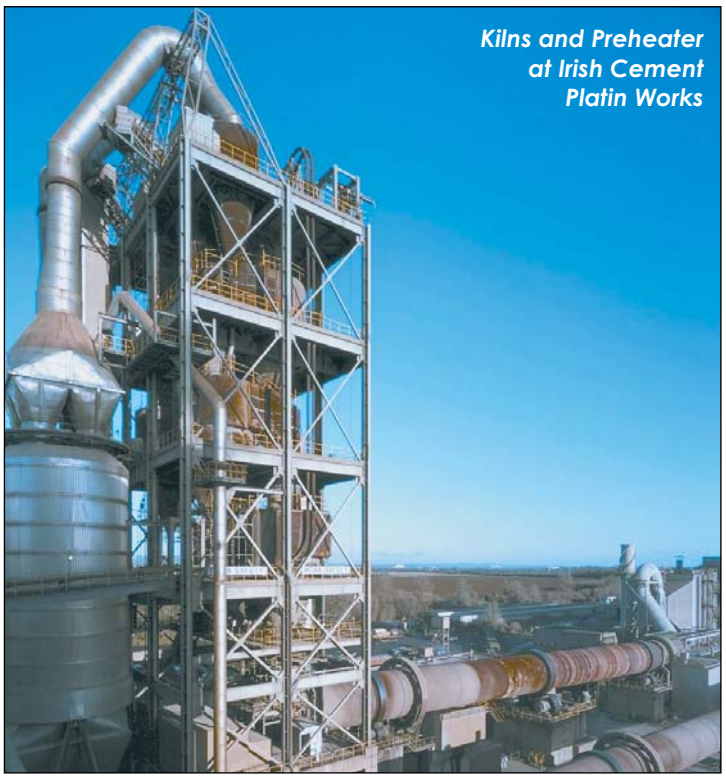
Concrete is the most consumed substance on earth after water and its ready availability and versatility is essential to the sustainable development of the Irish economy. It is used in Housing, Water Treatment and Supply, Sewage Treatment, Transport, Agriculture and all forms of Commercial, Social and Environmental Infrastructure.

The ready availability of quality concrete and concrete products throughout Ireland is facilitated not only by the abundance of high quality natural rock and gravel aggregate sources but by the presence and development of the strategically important cement industry which daily produces the most vital material of all – Portland cement.

The cement industry has been in operation in Ireland on an industrial scale since the 1930s, when its establishment was initiated by the Government.

Irish Cement's plants at Drogheda and Limerick were opened simultaneously in 1938 by Sean Lemass. These plants developed and expanded over the decades with the Drogheda plant replaced by the Platin plant in the 1970s.

A new chapter in the evolution of the industry began in recent years with the opening of a new plant at Ballyconnell, Co Cavan by the Quinn Group in 2000. The Lagan Group opened a plant in Kinnegad in 2002.



Kilns and Preheater at Irish Cement Platin Works

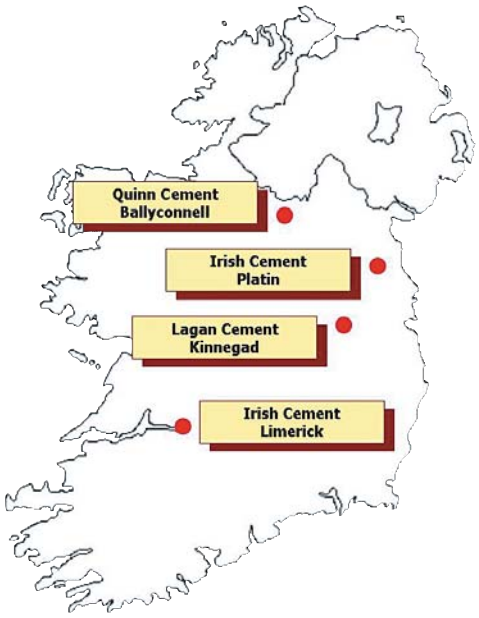
Billion Euro investment

Today, the four cement plants in Ireland represent a €1 billion investment and produce in the order of 5 million tonnes of cement annually. Additional annual investment in excess of €20 million is undertaken to ensure the industry remains efficient and maintains its focus on product quality, environmental protection and customer service. Current production levels are over twice those of a decade ago and this has only been possible due to investment by the industry in technology and people, particularly highly skilled engineering and science graduates from the Irish Universities. Consequently, the Irish cement industry is now one of the most modern and efficient in the world.

The industry is justifiably proud that it has never once failed to meet the huge increased demand from the construction industry as the National Development Plan progressed. The cements produced by the industry enjoy a very high reputation with Irish concrete producers, contractors, consulting engineers and architects.

The industry is fully committed to the principles of sustainable development. All four plants are licensed by the Environmental Protection Agency under national IPC Legislation and, in addition, management systems employed at the four sites are founded on ISO 9001 Quality Management Systems and ISO 14001 Environmental Management Systems.

Cements produced by the four plants fully comply with the harmonised European Cement Standard EN 197-1, which demands rigorous third party control and assessment of both the production process and product performance, and cements are CE Marked in accordance with the Construction Products Directive.



Plant Locations

Climate Change – an important issue

Climate change is arguably one of the most important issues facing mankind. There is no doubt that the greenhouse effect has now accelerated to a stage whereby very

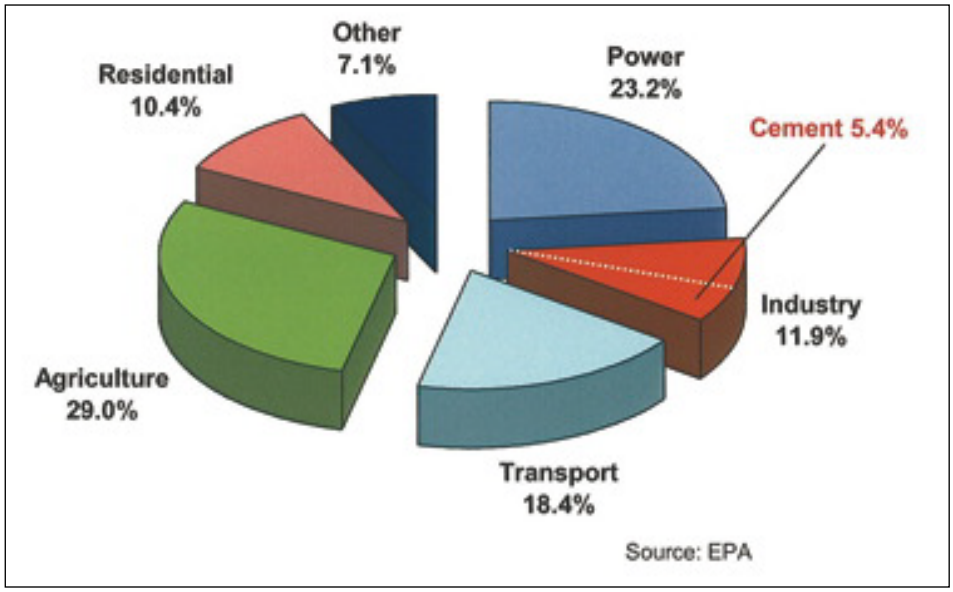


Figure 1. Sectoral Contribution to Ireland's Greenhouse Gas Emissions

significant and unacceptable climate effects are occurring. It has been established that the twentieth century was the warmest century of the millennium and the 1990's was the warmest decade of the 20th century.

A major international agreement, the 1997 Kyoto Protocol, which aims to reduce Green House Gas (GHG) emissions from developed countries by 5% on 1990 levels by 2010, finally came into effect in early 2005.

The EU is committed under the Protocol to reduce emissions by 8% and under a subsequent Burden Sharing Agreement Ireland committed to an increase of 13% on 1990 emissions by 2010.

Sadly, this deal failed to appropriately recognise Ireland's unique infrastructural disadvantage when compared with all other major European economies, all of whom carried out their key phases of national development in the decades following the Second World War.

Nevertheless, Ireland's commitment must be honoured.

Emissions Trading Scheme

The EU has now developed legislation which introduces a 'cap and trade' Emissions Trading Scheme, whereby large point source emitters of greenhouse gases have their emissions capped and any breaching of the cap must be met by 'emission credits' purchased in a 'carbon market'.

About a third of Ireland's GHG emissions are included in this Scheme. The power sector is included, as are process industries such as cement and lime and combustion plants in other industrial sectors.

While we are working to adapt to this Scheme, it remains our firm contention that this unilateral action by the EU represents a significant threat to the competitiveness of process industries within the European Union which are exposed to global competition. The Scheme requires major adjustment and revision if EU industry is not to be irreparably damaged over the coming decade.

Meanwhile, the Environmental Protection Agency is currently engaged in the difficult and complex task of developing a methodology to allocate carbon allowances to individual installations within the Scheme for the Kyoto period 2008 – 2012. As the amount of allowances made available by the Government is significantly short of the projected requirements of industry, a major challenge lies ahead for all involved.

The overall breakdown of Ireland's GHG emissions as published for 2004 by the EPA is shown in Figure 1.

It is noteworthy that industrial production (Industry and Process) accounts for less than 12% of national emissions. The cement industry accounts for only just over 5% of national GHG emissions.

Cement Industry and Greenhouse Gas Emissions

The cement industry is energy intensive and produces carbon dioxide in the production process through decarbonation of limestone ('process' emissions) and also through the combustion of fossil fuels ('combustion' emissions). Approximately 0.75 – 0.80 tonne of carbon dioxide arises per tonne of Portland cement produced.

'Process' emissions account for approximately 60% of carbon dioxide emissions from clinker production. It is not possible to reduce the carbon dioxide produced from the decarbonation of limestone.

The four cement plants in Ireland produce cement clinker in modern energy efficient dry process kilns. When Irish Cement converted its plants from the wet process to the dry process in the 1970s and 1980s, energy savings of the order of 40% were achieved. The Quinn and Lagan plants were built with dry process kilns.

Energy efficiency improvements

As already stated, the cement industry in Ireland is one of the most energy efficient in the world. The reduction in energy use in the cement industry in Europe over the past 40 years is outlined in Figure 2 which also shows the position of the industry in Ireland.

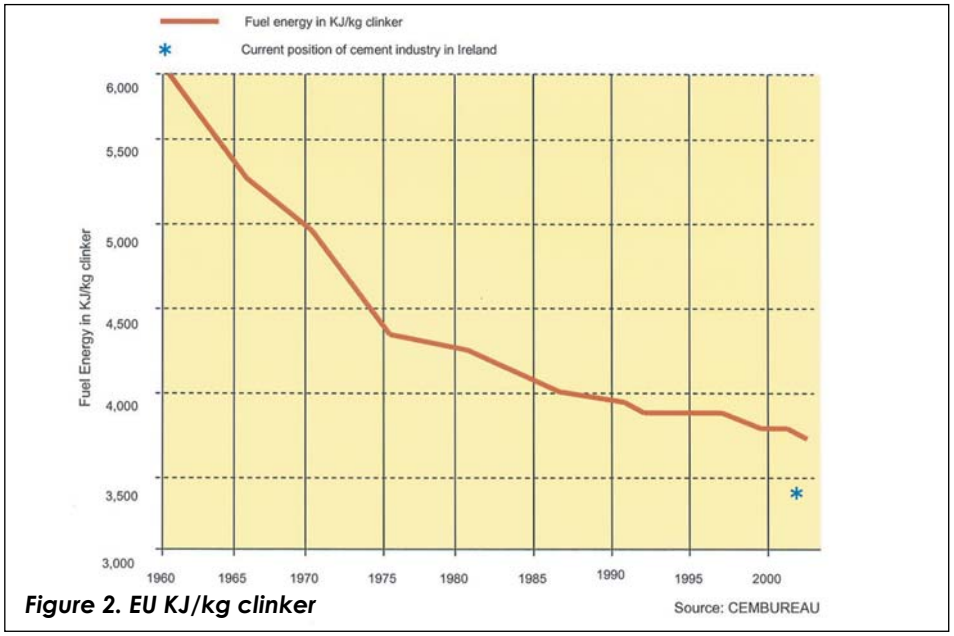


Figure 2. EU KJ/kg clinker

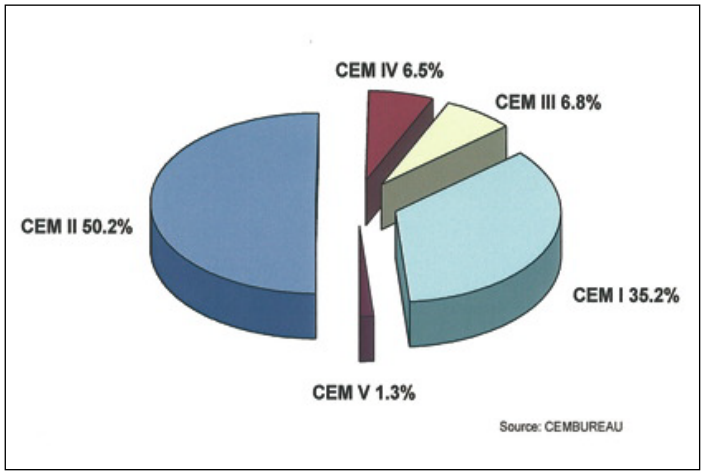


Figure 3a. Domestic Deliveries by Cement Type – 2000. European Union 15

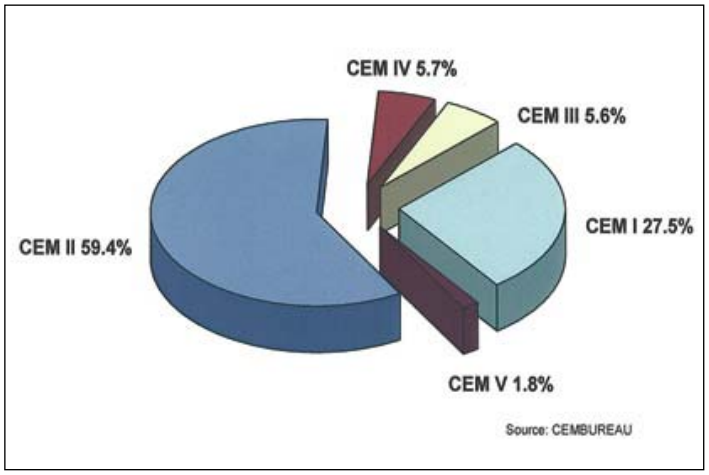


Figure 3b. Domestic Deliveries by Cement Type – 2004. European Union 15

The scope for further improvements in energy efficiency, and a consequent reduction in 'combustion' emissions, is extremely limited.

Investment in closed circuit raw material and clinker milling systems has lead to substantial improvements in electrical energy efficiency in the industry. This ensures that indirect carbon emissions from electricity used in cement manufacture is minimised.

Opportunities for reductions in 'combustion' emissions can arise from the use of alternative fuels, some of which have lower carbon emissions than conventional fuels. The use of alternative fuels has been progressed in the cement industry in Europe and currently approximately 17% of the heat input to cement kilns in the EU is derived from such fuels.

There are significant regulatory barriers to progressing with this issue in Ireland as a new Planning Permission and a new IPC Licence are required even to carry out trials to demonstrate the environmental compatibility of the use of alternative fuels.

The availability in the required quantities and qualities of appropriate materials is limited. The industry is also currently working at capacity, and experimenting with small quantities of fuel sources which have a negative impact on kiln output is not appropriate. This is an issue for the future and will be kept under constant review by the industry.

Reducing carbon intensity

Despite the fact that cement production contributes only just over 5% to Ireland's GHG emissions, the industry has been exploring ways to reduce the carbon intensity of its products. The EU Standard for Common Cements recognises 5 broad categories of cement for use in concrete across Europe. The five cement types are based on composition and specifically the quantity of clinker incorporated and the type and quantity of secondary materials used. The 5 cement types are outlined in Table 1.

Table 1: Cement Types according to EU Cement Standard EN 197-1

CEM I	Portland Cement	Based on Cement Clinker (> 95%)
CEM II	Portland Limestone Cement Portland Fly Ash Cement Portland Slag Cement	Based on Cement Clinker (> 65%) and Relevant Material (< 35%)
CEM III	Blast Furnace Cement	Based on Cement Clinker and Slag (High Slag %)
CEM IV	Pozzolanic Cement	Based on Cement Clinker and Pozzolanic Materials
CEM V	Composite Cement	Based on Cement Clinker and Specific Quantities of Other Materials

The traditional cement produced in Ireland has been CEM I Portland Cement and this cement has gained a reputation for consistency and reliability in a wide variety of civil engineering and architectural applications. However, Figure 3 clearly demonstrates the predominant role and recent growth in European production of CEM II cements, largely driven by the carbon agenda.

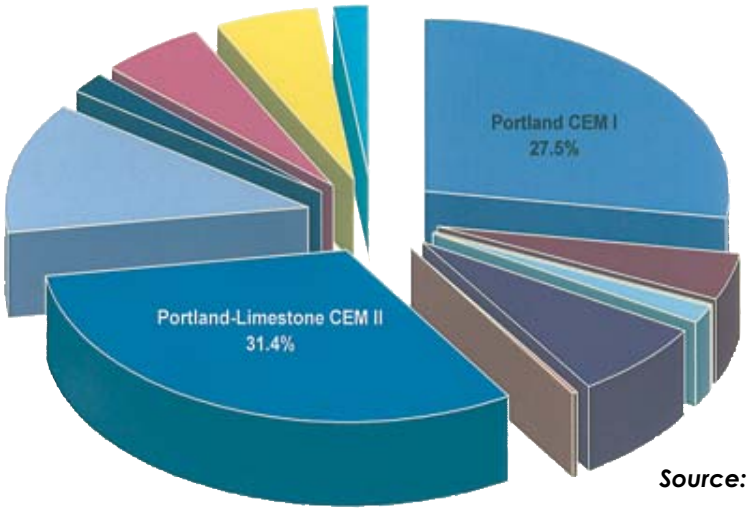
CEM II Cements

CEM II cements are produced by inter grinding or inter blending secondary materials – notably limestone, pulverised fuel ash or blast furnace slag - depending on availability and quality with cement clinker to produce the final cement.

Pulverised fuel ash is available in Ireland from Moneypoint Power Station and Kilroot Power Station in Northern Ireland. This material is currently being used to the maximum extent possible by the cement industry as a raw material substitute and as a secondary material in accordance with Standards requirements. One plant is currently manufacturing CEM II cement based on the use of fly ash and depending on the quality and quantity of supplies into the future, there may be further possibilities to expand the production of this type of cement.

Blast furnace slag is not produced in Ireland. It is a by-product of the steel industry and when granulated is commonly used by the cement industry situated close to a steel works to produce CEM II and CEM III cements. It has been suggested that the importation of slag and its replacement of cement clinker could represent a 'green' solution for cement production in Ireland.

This ignores the fact that slag emanates from a production process



Source: CEMBUREAU

Figure 4. Domestic Deliveries by Cement Type – 2004. European Union 15. (CEM I &CEM II Limestone).

which generates significant quantities of carbon dioxide and other emissions. For every tonne of slag that arises in steel production 5 tonnes of carbon dioxide is generated. Carbon emissions also arise in transporting the material to Ireland and in subsequent processing.

The use of slag does not represent a sustainable basis for the development of cements with reduced carbon intensity in Ireland. Aside from the emissions noted above, the 'proximity' principle would not be respected. Significant issues also arise relating to the quality and consistency of the material and the reliability of supply lines. It is worth noting in the current market situation in Ireland, with cement plants producing at capacity and the industry importing clinker and cement to meet demand, that the use of slag in Ireland is not making any contribution to a reduction in Ireland's greenhouse gas emissions.

Portland Limestone Cements – the way forward

Five years ago the Irish cement industry began to seriously research the potential for the development of CEM II cements based on cement clinker and Irish limestone. Laboratory research, plant trials and market assessments have confirmed the viability of moving forward and the industry will during 2006 roll-out the production of CEM II Portland Limestone Cement. Work to date has clearly indicated that CEM II cements with limestone addition rates in the range 10-20% can deliver performance similar to CEM I cement.

For applications where bagged cement has been traditionally used such as plastering, rendering and block laying, Portland Limestone Cements have been shown to deliver significant workability benefits. Research into durability performance undertaken at the Department of Civil Engineering at UCD confirms the experience elsewhere in Europe of the excellent performance of CEM II Portland Limestone Cements.

Figure 4 shows the significant position enjoyed by CEM II Limestone Cements in Europe in 2004.

Proactive stance

The Irish cement industry, along with the industry throughout the EU, is faced with a significant challenge in dealing with the effects of the EU Emissions Trading Scheme.

However, the industry is committed to responding positively to the global challenge of climate change and to assisting in meeting Ireland's Kyoto commitments.

CEM II Portland Limestone Cements are now playing a significant role in European construction - in France they accounted for over 30% of domestic deliveries and in Italy over 60% of domestic deliveries in 2004.

Based on European experience and significant development work in Ireland, the industry is now taking a proactive stance to reduce the carbon intensity of cements produced in Ireland and is committed to the development of CEM II Portland Limestone Cements. The introduction of a truly sustainable and truly Irish 'green' cement is at hand for the Irish construction industry.

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Colm is Technical Director of Irish Cement Limited and is Chairman of the Environment and Technical Committee of the Cement Manufacturers Association of Ireland. He is a Civil Engineering Graduate of University College Dublin from where he also holds an MBA. Colm is a Past President of the UCD Engineering Graduates Association and a Past Chairman of the Irish Concrete Society. Colm served as Technical Director of CEMBUREAU, The European Cement Association, based in Brussels, for a three year period in the mid 1990s. He has been closely involved for many years in industry liaison with Government and the EU Institutions on environmental and product legislation relating to the Building Materials Industry.

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