

IRISH CEMENT LIMERICK

INVESTING IN OUR FUTURE

Irish Cement

INTRODUCTION

Investing in our future.
The next phase.

A new phase of investment in Limerick will see improved environmental performance, reduced emissions and reduced dependence on imported fossil fuels with the introduction of a range of alternative fuels.

Limerick is Ireland's oldest cement plant, operating on the same site since it opened in 1938. Continuous investment in new technology has been the hallmark of Irish Cement's operations throughout the history of Limerick works. In 1983 a new dry process plant, Kiln 6, was constructed replacing the five wet process kilns. This significantly reduced emissions and improved the energy efficiency of the works. A major upgrade was completed in 2010 with the installation of a modern fabric filter.

Since the recent period of reduced domestic demand, which saw the plant operating at reduced output, production is on the increase again in Limerick with cement being dispatched to customers in Munster and export markets in the UK and Europe.

Irish Cement is committed to sustainable cement production through three principal initiatives:

1. Energy efficiency investments
2. Product innovation and
3. Fossil fuel replacement

CEMENT PRODUCTION

A precisely controlled, high temperature manufacturing process.

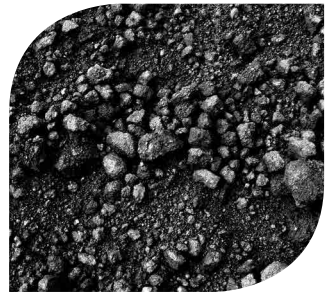
Safety is of critical importance at all stages of the cement manufacturing process.

1

RAW MATERIALS

Limestone, quarried on site, is the main raw material. Clay overburden, also from the site, with shale and small quantities of bauxite and iron ore are also required. These raw materials are crushed, ground and homogenised to produce a blend called 'raw meal'. This raw meal is then 'melted' inside the cement kiln.

2



FUEL

Traditionally fossil fuels are used to fire cement kilns. Both coal and petroleum coke have been used in Limerick and now this new investment will see the fossil fuels gradually being replaced by alternative fuels. Fuels are combusted at both ends of the kiln to provide the high temperatures needed to 'melt' the raw materials.

3

QUALITY CONTROL

Quality control is critical to each stage of the cement manufacturing process. Our laboratories which are linked to a central control room operate continuous testing regimes for raw materials, fuel and our final products.

4

CHEMISTRY

The creation of cement clinker inside the kiln is the result of a precise set of chemical reactions. The raw materials provide the following essential compounds; calcium oxide (CaO), silicon dioxide (SiO_2), aluminium oxide (Al_2O_3) and iron oxide (Fe_2O_3). At high temperatures they are broken down and then combine to form new clinker minerals.

5

TEMPERATURE

The temperature required for clinker formation is 1450°C. Large fans draw air into the kiln providing oxygen for the controlled combustion of the fuels. The raw materials 'melt' at these temperatures allowing chemical reactions to take place and clinker to form.

6

CLINKER

The clinker is cooled from 1450°C to 120°C as it exits the kiln and is then stored on site in dedicated silos. The hot air from the clinker is used to dry and preheat the raw materials.

7

CEMENT

Cement is produced by milling the clinker to a fine powder with the addition of small quantities of gypsum to control the setting time. Eco-efficient CEM II cement is produced with the addition of unburnt limestone and PFA reducing the energy requirement and carbon footprint of the cement. The finished cements are conveyed to silos for dispatch by tanker or packed into 25kg bags.

COOPER HILL FARM

Pedigree Holstein Herd

On the lands surrounding the cement works Irish Cement operates an award winning dairy herd of 850 pedigree Holstein cattle. Since the foundation of the farm back in the 1950's milk has been produced on the land.

Originally the milk was bottled on site in a small private dairy and sold to the local communities. Today the Cooper Hill herd produces consistently high milk yields and makes use of a state-of-the-art rotary milking parlour.

A more recent development on the farm has been the establishment of Cooper Hill Apiary (bee hives) run by the Limerick Beekeepers Association. The bee hives were introduced to a site on the farm in 2011 and have expanded over the last few years. Every spring the Apiary is used by the Association to run their very popular beekeeping courses.

CO-PROCESSING

Our contribution to the circular economy

Since 2011, our sister plant in Platin, Co Meath has been replacing its fossil fuels with alternative fuels. The use of alternative fuels, known as 'co-processing' is the recycling of materials and the recovery of energy; two processes happening in parallel inside the cement kiln.

Co-processing is a "win: win", it contributes to improved resource efficiency, by reducing the use of primary resources, including fossil fuels and also directly reduces the need for traditional waste disposal options like landfill.

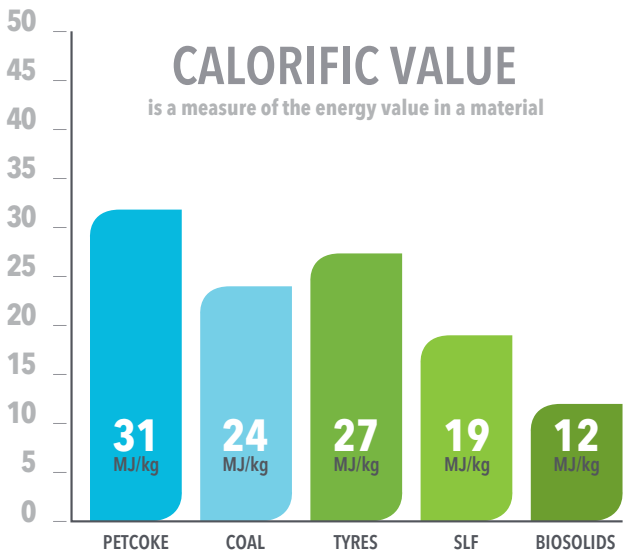
In 2012, the average fossil fuel replacement rate around Europe was 36% with some countries at much higher levels. In Germany, for example, the average replacement rate is 62% and some of the cement plants have replaced 100% of their fossil fuels. The types of alternative fuels used in Germany includes tyres, oil, paper pulp, plastics, animal meal, SRF/RDF, wood, solvent, sewage sludge.

In 2011, Irish Cement's second plant in Platin began replacing fossil fuels with solid recovered fuel (SRF) and by 2014 achieved 50% replacement. Irish Cement is now seeking the appropriate planning and licencing to allow a phased introduction of alternative fuels in Limerick to build on our success to date and to further enhance the sustainability of the operations in Limerick.

In many European countries, cement plants are considered to be essential components of national waste management infrastructure, enhancing recovery and recycling. In Switzerland, Germany and Sweden the local cement industries are actively contributing to the achievement of zero or near-zero landfill rates.

Now in Ireland the three Regional Waste Management Plans, published in 2015, for the first time recognise the important role of cement plants for the efficient recovery of residual waste.

FUELS AT LIMERICK



Existing Fossil Fuels

PETCOKE

Petcoke (petroleum coke) is a by-product of the oil refining industry. This is currently the main fossil fuel used in Limerick. It is imported by ship, delivered in trucks, milled and dried on site before being used. Calorific value 31MJ/kg.

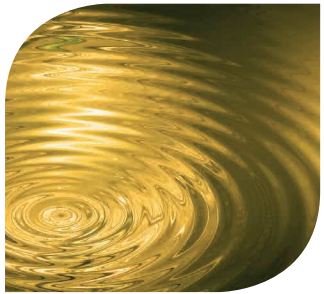
COAL

Coal has been used in the past when it was sourced from a range of overseas locations. It was imported by ship, delivered to site in trucks, milled and dried before being used. Calorific value 24MJ/kg.

On a phased basis fossil fuel replacement is proposed to begin in Limerick with the following fuels;

TYRES

Tyres consist mainly of rubber compounds, textiles and smaller quantities of wire. Whole car tyres will be delivered to Limerick where they will be mechanically conveyed for firing in the rear of the kiln. The extreme temperatures inside the kiln will ensure complete combustion. Calorific value 27MJ/kg.



SLF

SLF (Secondary Liquid Fuel) is produced to a defined specification and is a blend of solvents used in industrial processes. The solvents are blended off site in licenced facilities before being delivered to site in dedicated tankers. The SLF arrives 'ready to use' and is pumped to the kiln burners. Calorific value 19MJ/kg.

BIOSOLIDS

Biosolids are produced by modern waste-water treatment plants such as the one located close to the cement works in Limerick. The solid pellets are produced following the effluent treatment process and will be delivered to site in sealed tankers and will be fed directly to the kiln. Calorific value 12MJ/kg.

ALTERNATIVE FUELS AND RAW MATERIALS

Irish Cement intends to apply for planning permission and a review of the Industrial Emission (IE) licence in Limerick to allow for the introduction of alternative fuels (AF) and alternative raw materials (ARM). A range of materials have been selected as suitable for Limerick following reference to existing permissions and guidance by the Environmental Authorities in Switzerland and Germany. These materials are already licensed by the Environmental Protection Agency (EPA) as fuels for cement production in Ireland. The use of these additional materials will allow for replacement of fossil fuel, recovery of resources and a reduction in emissions.

Emissions from industrial facilities, like cement plants, are tightly controlled under European Regulations. Experience in Europe, together with Irish Cement's own experience over the past 5 years, demonstrates that emissions do not increase with the use of alternative fuels. All of these materials can be processed safely in Limerick because of the high operating temperatures which ensures complete consumption. All materials accepted in Limerick will be subjected to testing to ensure they meet the agreed specifications and that they comply with strict quality control standards.

The range of materials have been grouped into five general categories and includes; fine, coarse and 'free-flowing' solids, pumpable fluids such as solvents and waste oils and alternative raw materials. The cement industry has been safely consuming these materials throughout Europe for more than 35 years.

FINE SOLIDS

e.g. chipped timber, shredded plastics, shredded textiles, tyre fluff, SRF

These fine materials (typically sized 10-50mm) will be delivered to site, ready to use and offloaded from trucks into enclosed storage bays or halls from where they will be pneumatically conveyed to the kiln system. This system will be similar to the existing SRF handling and feeding system in Platin.

COARSE SOLIDS

e.g. shredded wood, dry filter cakes, shredded rubber

These materials will be prepared off site to a defined specification before being delivered to site. The materials will typically have a larger particle size (30-120mm) and will be offloaded from trucks into bunkers inside enclosed halls and then transferred using screw-feeders or overhead cranes to the kiln feeding system.

FREE-FLOWING SOLIDS

e.g. sewage sludge pellets, SRF pellets

Some fuels will be 'free-flowing' solids or powders that will be offloaded into sealed silos. From here, they will be pneumatically conveyed to the kiln burners in enclosed pipelines.

PUMPABLE FLUIDS

e.g. secondary liquid fuels (SLF), waste oils, paint sludge

These fuels will be delivered by tanker and offloaded using pumps into on site storage tanks located in bunded areas. The fuels will be pumped to the kiln burners in enclosed pipelines.

ALTERNATIVE RAW MATERIALS

e.g. water treatment filter cake, soils and stones

These materials can have a variable consistency from sludges, filtercakes, powders, dust, etc. They will be stored on site in covered areas and conveyed using the existing raw materials handling and dosing systems. The use of these materials will allow Limerick to replace some of the virgin raw materials it currently consumes.

ENVIRONMENT

Limerick, like all large industrial facilities, operates under an Industrial Emission (IE) licence from the Environmental Protection Agency (EPA) and all emissions are strictly monitored and controlled. The plant also operates to the international environmental management standard ISO 14001. As part of our new plans an application will be submitted to the EPA for a revision of the existing licence to allow for the introduction of alternative fuels and alternative raw materials at Limerick.

The IE licence is based on European Environment Regulations which sets out minimum temperatures and residence time limits for the use of waste fuels. Both the temperature and residence time in our kiln systems significantly exceed what is required under current Regulations.

When alternative fuels were first introduced to European cement plants, local communities naturally had questions, particularly in relation to emissions and traffic. These concerns were addressed by engaging in open dialogue and by providing information about the fuels, the technology and controls in place. Furthermore, the successful use of alternative fuels over time in Europe has contributed to confidence among the communities. We also have the positive experience of the safe use of alternative fuels at our sister plant at Platin Co Meath.

Ahead of this proposed replacement of fossil fuels, detailed monitoring and modelling of future emissions and traffic have been completed. This work demonstrates no significant increases in emissions from our operations nor traffic impacts on any local roads around Limerick works.

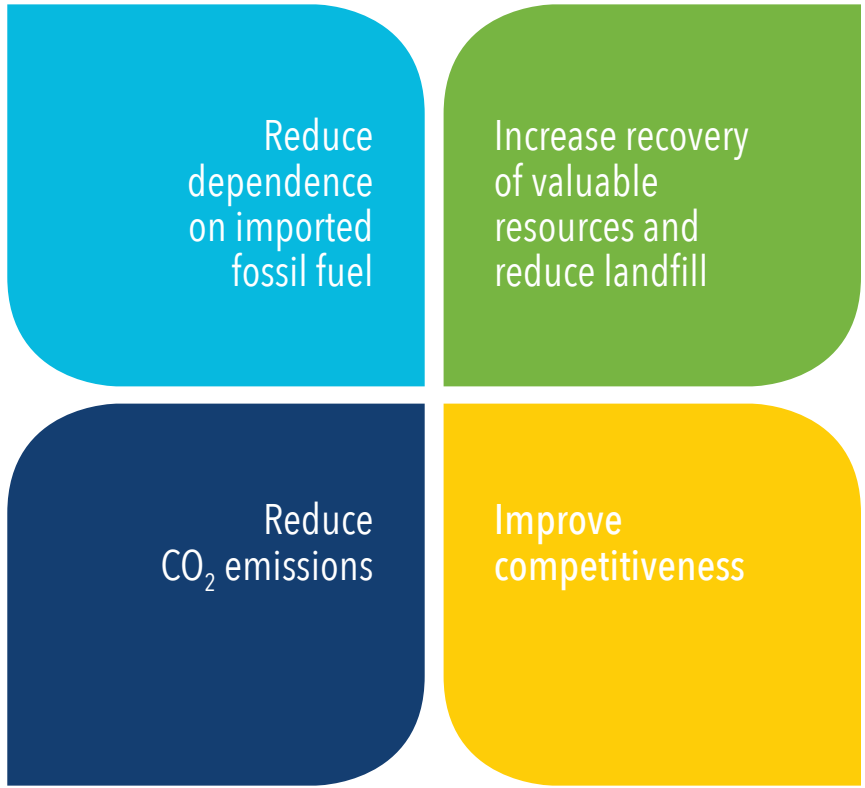
HEALTH AND SAFETY

The health and wellbeing of our employees, visitors and neighbours is a primary concern for Irish Cement. All operations in Limerick must be carried out in full compliance with Irish Cement's safety procedures.

For Irish Cement managing health and safety at our facilities is our primary concern. Safety Managers work closely with and assist managers and supervisors in developing safety management systems, improving safety performance and encouraging a 'Safety Culture' on site. The activities of our Safety Committee, which has members from across the workforce, helps to ensure employee engagement in eliminating day to day risks and identifying 'better ways of working'. Safety Statements provide the necessary detail for safe operations and work practices on site. Through the use of risk assessments, safety inductions and regular safety training, Irish Cement is dedicated to the ongoing safety of our employees, contractors, visitors and neighbours. Measurement and reporting against targets ensures that safety remains a top priority for workers and management alike.

Irish Cement's parent company, CRH also sets the highest priority on Health and Safety and ensures that safety management is a daily priority for managers in every CRH location. CRH health and safety management systems are well established and are regularly reviewed taking into account international best practice. Knowledge-sharing around the CRH Group also plays an important part in maintaining focus on safe working practices and elimination of risks.

KEY BENEFITS OF CO-PROCESSING ALTERNATIVE FUELS



ADVANTAGES OF CEMENT KILNS

1. High temperatures and long residence times ensure complete combustion
2. Extremely efficient at capturing energy from alternative fuels
3. Produce no residual wastes

If you have any questions or would like to discuss any of the information contained within, please contact us.

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