AETHER® LOWER CARBON CEMENTS

With the contribution of the LIFE+ financial instrument of the European Community
ABOUT PROJECT AETHER

Through Project Aether, Lafarge has developed a new generation of lower-carbon Aether® cements. These cements can be made from conventional raw materials, in existing industrial installations and offer similar performances to Ordinary Portland Cement, but with 25-30% lower CO₂ emissions. Lafarge is developing Aether® based concretes for a range of ready-mix and precast applications.

Lafarge has worked on Project Aether in partnership with BRE, the UK’s leading centre of expertise on building and construction, and the Institute of Ceramics and Building Materials (ICiMB), a Polish research unit.

Project Aether received financial support from the European Union’s LIFE+ financial instrument for the environment from September 2010 to August 2013.

Why does cement manufacturing generate CO₂?

Cement is vital for a country’s economic development as it is a key ingredient in concrete, which is used to build housing and infrastructure. Cement acts as the ‘glue’ to bind aggregates, sand and water together to make concrete. It is produced through the heating of limestone and clay to a temperature of around 1450°C. This sets off a chemical reaction known as ‘decarbonation’, releasing CO₂ and transforming the limestone into clinker, the basic component of cement. CO₂ is also generated through the use of fossil fuels to heat the limestone.
TWO SUCCESSFUL INDUSTRIAL TRIALS

As part of Project Aether, Lafarge has carried out two industrial trials, confirming the feasibility of industrial-scale production of Aether® cements in existing installations and using traditional raw materials, for a lower overall environmental footprint.

Thanks to support from the EU’s LIFE+ environmental funding programme, Lafarge carried out trials at two of its French cement plants, the first in February 2011 and the second in December 2012. Following on from pilot tests at ICiMB facilities in Poland, these two industrial trials confirmed that Aether® cements could be produced in plants designed for ordinary cement production.

The trials were also very encouraging in terms of environmental performance, confirming that Aether® cements could be produced at lower temperatures of 1225-1300°C, compared to 1400-1500°C for Ordinary Portland Cement. Significantly less energy was also used, both to heat the raw materials in the kiln and to grind the resulting clinker with additions to make cement.

Overall, this meant that the expected objective of a 25-30% reduction in CO₂ emissions per ton of cement was met.

For more information, see www.aether-cement.eu/results.html
A ROBUST TESTING PROGRAM

Tests carried out by Lafarge research teams and BRE have shown that concretes made with Aether® cements offer higher early strength gain and lower shrinkage than concretes made with Ordinary Portland Cement. Durability testing has also demonstrated similar or better performance compared to standard concrete.

Tests run by Lafarge researchers and BRE on the mechanical properties of concretes made with Aether® cements have shown that these concretes achieve similar strength to standard concrete at 28 days, the reference timeframe in the construction industry. In addition, concretes made with Aether® cements achieve higher early strength than standard concrete and demonstrate 50% less ‘shrinkage’, the phenomenon by which concrete shrinks as it sets, causing cracking.

BRE has also tested Aether® cement-based concrete samples for their resistance to a number of common phenomena that can reduce concrete durability. These include:

- absorption of CO₂ from the atmosphere, that can lead to corrosion of the steel reinforcements used in structural concrete,
- exposure of concrete to salt water, which can also increase the risk of steel corrosion,
- acid attack.

During these tests, Aether®-based concretes have shown similar or better performance compared to standard concretes.

For more information, see www.aether-cement.eu/results.html

DEVELOPING AETHER® CEMENTS FOR CONCRETE

Lafarge is developing Aether® cements for a range of ready-mix and precast concrete applications.

Using the results of the testing program, Lafarge’s research and marketing teams are working hand in hand to identify the most appropriate market segments and develop Aether® cements for specific applications.

The ultimate aim is to offer a viable, lower-CO₂ alternative to Ordinary Portland Cement for the construction industry, in a wide range of applications.
REDUCING CO₂ EMISSIONS THANKS TO AETHER® CEMENTS

1. Ordinary Portland Cement is generally made from a ‘raw mix’ composed of around 80% limestone and 20% clay.
   The raw mix used to produce Aether® cements has a lower limestone content.

2. For ordinary cement production, the raw mix is heated to around 1450°C in a rotary kiln, releasing CO₂ through a chemical reaction called ‘decarbonation’ and producing clinker, the basic component in cement.
   Less limestone in the Aether® raw mix means less decarbonation and so lower CO₂ emissions. In addition, a lower production temperature of ~1300°C reduces energy consumption and therefore CO₂ emissions from the use of fossil fuels.

3. The clinker is cooled and then ground with sulphates (e.g. gypsum) and other additions to make cement.
   Easier grinding of Aether® clinkers reduces energy consumption and therefore CO₂ emissions during this phase.

- Lower limestone in Aether® raw mix
- Less decarbonation
- Lower energy consumption for burning and grinding

25-30% reduction in CO₂ emissions.
With the contribution of the LIFE+ financial instrument of the European Community