Lafarge :
Innovating to build the world of tomorrow

Press kit
November 2009
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Rights: Lafarge Medialibrary - Charles Callaghan - Jean-Philippe Mesquen - Philippe Ruault - Ignus Gerber
Global economic and demographic growth means that sustainable construction methods must be used to build housing, offices, hospitals, roads, bridges, tunnels, airports, dams, ports, water distribution networks, etc. – all applications which require the use of construction materials such as concrete, aggregates, cement and gypsum. This makes concrete the most used material in the world after water, with nearly 7 billion $m^3$ of concrete consumed each year around the world, more than $1m^3$ per person.

Water, limestone, sand, gravel, gypsum… Behind the apparent simplicity of these building materials lie many properties and possibilities. In the past, cement, concrete and gypsum were only commodity products, needed above all to fulfill a structural resistance role. They were produced according to an empirically defined mixture.

These materials have now made considerable progress as a result of research and innovation, not only at a technical level, but also in terms of aesthetics and comfort. Cement, concrete and gypsum are increasingly being "made to order" in response to current needs and challenges, such as reducing their environmental footprint, making them easier to implement, improving aesthetics as well as their ever-greater contribution to buildings’ energy efficiency.

Lafarge is striving to provide a response to the new sustainable construction and global warming challenges, by improving the performances of these materials through cutting-edge scientific research bodies and by forming partnerships with other institutions and organizations to design the materials which will be used to build the world of tomorrow.
All over the world, more than 500 people working for Lafarge are devoted to Research & Development with a sole aim: inventing to build better in the future, by providing new solutions which create value for the entire construction profession and diminish the environmental footprint.

Lafarge R&D is divided between centralized research on the one hand by and decentralized development on the other, in order to pool competencies while responding as closely as possible to specific local needs.
A DEDICATED RESEARCH FACILITY: THE LAFA McGregor RES TWO-B 

In order to better serve customers and develop solutions which are ever more suited to their needs, Lafarge believes it is necessary to develop a multidisciplinary and general understanding of building materials upstream. This is exactly the role of the Lafarge Research Center (LCR).

In L'Isle d'Abeau, near Lyons (France), Lafarge’s Technology Center employs 500 people of more than 20 nationalities. It hosts the Lafarge Research Center as well as Intellectual Property & Technological Watch Departments and several key entities of the Cement business.

The Group today boasts the world’s leading building materials research facility with the Lafarge Research Center, which houses 6,000m² of laboratories equipped with highly sophisticated testing and analysis instruments. It brings together over 200 researchers from a dozen different countries, participating in three main types of projects:

- analyzing the physical or chemical properties of materials, for example to understand their behavior, their fluidity during use or their deformation when subjected to climatic variations.
- leading exploratory or experimental studies to observe the influence of each different parameter on each property of a given material. This helps to reduce costs for the factory and the customer while enhancing the consistency of the product.
- leading technological studies to obtain on-site validation of solutions found in the laboratory. The goal is to introduce products which bring real added value to the customer.

The Research Center's activity is organized by business line – Cement, Aggregates & Concrete, Gypsum – and by field of expertise, which optimizes the allocation of resources and synergies between the teams. These teams work on understanding the physical or chemical mechanisms occurring in materials, as well as on product development and long term exploratory studies in four areas of multi-product expertise:

- Active components (mineralogy; physico-chemical properties of cement, gypsum and admixtures, powder technology)
- Structured materials (rheology of concretes, mortars and plasters; micro-mechanics of hardened materials)
- Formulation and application (generation of the rules of formulation; materials-process interface)
- Analysis and Measurements (characterization techniques: DX, FX, MEB, laser granularity, etc.)

INNOVATION DEPLOYED AT A CUSTOMER LEVEL

In order to adapt innovation developed at the Research Center, Lafarge has established a network of technical centers and application laboratories. These assist plants, countries and each of the businesses in developing products tailored to local needs and improving industrial performances. On the other hand, technical centers may themselves feed back needs from local customers. Networks of local experts, available to plants and distributed all around the world, may also intervene rapidly and improve plant procedures, for example by adapting formulations to take account of local raw materials.

- In the Cement business, Lafarge has four technical centers that are located in Vienna (Austria), L'Isle d'Abeau (France), Montreal (Canada) and Kuala Lumpur (Malaysia), which operate in close contact with the network of Group plants.
The Technical Development Center for the Gypsum Business is based in Avignon, France, where the headquarters are also located. This center has the specificity to study the application of products and systems in real environments, what allows to optimize plasterboard properties to develop the aesthetic dimension, increase its mechanical strength and improve its acoustic qualities. Tests for resistance to fire, compression and humidity can therefore be carried out under actual conditions. Researchers of the TDC also seek to reduce the use of non-renewable natural resources in order to improve environmental performance.

In the Concrete business, Lafarge inaugurated a new technological building in October 2007 dedicated to concrete innovation. This 2,500sqm building is a key element to accelerate the development of new products as it allows testing of the results obtained from laboratory research on an industrial scale. It also houses zones dedicated to trials or treatment of materials. Therefore, this new research facility makes it possible to carry out formulation trials or treatment of materials. Thus, this new research structure makes it possible to carry out formulation trials or life-size experimental plans, while totally controlling external factors like temperature or hygrometry. This considerably accelerates the transfer of research results towards putting innovative products and solutions for the construction sector on the market.

**Partnerships**

Lafarge wants to go beyond the boundaries of its own industrial sites and to make partnerships to promote and collaborate on more sustainable materials. With these partnerships, the Group is looking to cover the entire value creation chain in the building industry, from its suppliers to its end-customers, to better understand the impact of its products throughout their entire life span.

- In 2002, Lafarge signed a framework agreement with the CNRS (France's national scientific research center), the largest facility for fundamental research in Europe. This aims to facilitate and encourage the development of joint research projects. Thus for Ductal® concrete, about ten CNRS laboratories worked with Lafarge on Reactive Powder Concrete.

- The Nanocem European Research Network was set up in 2004 and federates twelve European cement manufacturers, including Lafarge, and twenty-one academic institutions in a bid to further knowledge about construction materials. Combining company R&D with European scientific research and federating motivation and resources generate the tools and skills essential for identifying, analyzing and understanding the basic mechanisms behind cement and concrete behavior.

- The Lafarge research teams work in collaboration with the world’s most prestigious universities and engineering schools. Among these are Ecole Polytechnique and Ecole des Ponts in France, MIT (Massachusetts Institute of Technology), Berkeley and the University of Princeton in the United States, Laval and Sherbrooke Universities in Canada and Ecole Polytechnique Fédérale of Lausanne, Switzerland. In 2006, Lafarge founded a teaching and research chair in “the Science of materials for sustainable construction”, bringing together the scientific competence of Ecole Polytechnique and Ecole des Ponts with the expertise of its own Research Center.

- With the WBCSD (World Business Council for Sustainable Development) grouping together 180 companies, Lafarge is the driving force behind the creation and management of the five-year action program called “Towards a sustainable cement industry”. The 19 cement companies involved in this unique sector-wide initiative are seeking solutions to protect the climate and reduce fuel and raw materials consumption. In 2006, still within the WBCSD, Lafarge joined forces with United Technologies Corp. to create the EEB – Energy Efficiency in Buildings project to identify the changes needed to design energy self-sufficient buildings.

- Lafarge has also set up partnerships with architects. Significant work has been undertaken with them to promote advancement in building methods (aesthetic appearance, height, new designs, energy efficiency) and pave the way for sustainable construction.
By 2025, the world population is expected to rise by 33%, to reach 9 billion. Two billion additional human beings will need housing, places of work and infrastructure to ensure their mobility. This means we will have to build, but differently, because the building sector alone accounts for around 37% of world energy consumption and 40% of CO2 emissions.

Sustainable construction is a first response. Born in the 1990s, the principle is based on the major principles of sustainable development. For the construction sector this involves limiting the impact of buildings, while guaranteeing them superior quality in terms of aesthetics, durability and resistance. Sustainable construction takes into account the entire life cycle of constructions and aims to reduce the impact at every stage, from the initial choice of products through to the demolition phase. This involves the sustainable exploitation of natural resources, reduction of the disturbance linked with work sites, better thermal and acoustic insulation of buildings, the construction of energy positive buildings, the controlled ageing of structures and the recycling of materials and structures.

Lafarge has placed innovation at the heart of its strategy and intends to tackle the challenges of sustainable construction by taking account of environmental, economic and social concerns in its R&D. The Group has identified six challenges to which it is trying to offer a response.
**ENVIRONMENTAL FOOTPRINT**

Lafarge supplies construction materials whose production has an impact on the environment: Made from local resources, these mostly require a firing phase which inherently generates CO₂ emissions.

This is especially the case for the Cement business, as the production of cement naturally consumes non-renewable raw materials – limestone and clay are the basic elements of the material – while the mainly-fossil fuels used (coal, coke, etc.) are vital to fire them. Furthermore, it intrinsically generates CO₂ during firing of the material at very high temperatures in the kiln: firstly, the material reacts chemically and releases CO₂ and, secondly, the combustion of fossil fuels required to heat the kiln also releases CO₂.

Lafarge is committed to reducing its environmental impact using three levers:
- improving the performance of its kilns
- replacing some of the clinker with industrial residues (fly ash and slag) to save energy
- a program to replace fuels with alternative fuels (industrial, household or plant waste).

As a result of this work, Lafarge is in the process of reaching its voluntary commitment to reducing its CO₂ emissions by 20% per tonne of cement between 1990 and 2010. By the end of 2008, the Group had already achieved an 18.4% reduction, representing a saving of more than 150kg of CO₂ for every tonne of cement.

In the concrete business, Lafarge research teams work on the optimization of granular stacking, which allows to replace some of the water used in the composition of concrete and to produce a more compact, resistant, longer lasting concrete which uses less water.

In terms of concrete’s ingredients, Lafarge is continuing with its target of recycling almost all materials extracted from quarries in order to preserve natural resources. The Group is also working on the production of aggregates by recycling demolished concrete and recovering concrete not consumed in plants.

Although plasterboard is almost completely recyclable, the Group is focusing on two areas:
- Adding additives increases the fluidity of the gypsum and reduces the amount of water used. Less water used to produce plasterboard means less energy wasted during drying. Lafarge is working on a real technological breakthrough: removing the use of water in the manufacture of plasterboard.
- The use of recycled paper or gypsum for the manufacturing of new plasterboards.
IMPLEMENTATION

Firstly created in laboratories, the various product ranges developed by Lafarge come into their own on worksites. Lafarge strives to innovate to constantly improve the service it offers customers, and therefore tries to develop products which meet their expectations, paying particular attention to lowering worksites’ financial, environmental and social cost. In real terms, this means focusing on:

- ease of implementation, to reduce inconvenience
- energy savings
- limiting disturbance around the worksite
- reducing time spent
- improving value for money.

As well as new products, to make implementation easier, Lafarge also offers its customers a range of related services such as:

- support from technical-sales teams
- networks of builders for some high-tech products
- turnkey solutions for the construction of schools, hospitals, hotels, etc.

OTHER SOLUTIONS... Extensia®, a concrete designed for constructing slabs up to 400m² without joints – chape liquide®, a self-spreading and self-leveling mortar – Synia®, a plasterboard that ensures complete evenness – Sensium®, a technological dust-free cement – Chronolia®, a concrete with a fast increase in resistance that allows the framework to be removed just four hours after pouring

SERVICES

Concerning services, the Group focuses on two priorities: improving its customer relations and optimizing the logistics chain.

In line with its multilocal strategy, which enables it to adapt as closely as possible to specific demands and markets, it encourages local initiatives aimed at developing innovative value-added services for customers. In practice, in order to design its services as well as possible, Lafarge listens to its customers’ expectations and establishes solutions tailored to the specific nature of their requests and of markets.

This is translated on the ground by innovative uses of ITC, via the web, SMS, etc. – all communications methods which enable real-time monitoring, for example, optimizing the logistics chain.
ENERGY COST

While the building sector accounts for around 37% of world energy consumption, 85% of this energy is consumed during the phase of building use – for heating, ventilation, cooling, lighting and hot water. Indeed, the analysis of the life-cycle of a building shows that the production of construction materials is responsible for 12% of the total energy consumption of a construction with a life-span of 50 years. In order to combat climate change, improving the energy efficiency of buildings is therefore vital.

Lafarge is similarly working on developing solutions to make buildings more energy efficient. The Life Cycle Assessment (LCA), which quantifies a building’s environmental impact, confirms that concretes developed by Lafarge achieve excellent environmental results.

As well as the environmental aspect, Lafarge has shown that constructing sustainably does not mean excessive costs. Concrete's long life adds to its environmental appeal and construction systems using concrete provide a high level of comfort and increased energy efficiency for a low cost.

However, it is necessary to work with all players in the construction value chain when tackling questions of improved energy efficiency. This is why Lafarge, working with United Technologies Corp. as part of the WBCSD, launched the EEB (Energy Efficiency in Buildings) project in 2006 in order to carry out joint consideration of the concept of how zero net energy buildings can be constructed for the best cost.

**Lafarge’s Solution...** Thermedia™ 0.6B

Launched in 2009 in partnership with Bouygues Construction, Thermedia™ 0.6B has a thermal conductivity cut by two-thirds compared with standard concrete while retaining identical structural properties. It reduces heat loss through the building’s envelope and so actively contributes to improving construction methods incorporating internal thermal insulation.

**Other Solutions...** a Ductal®-based thermal breaker providing perfect insulation and a mechanical link between the concrete slab and the external wall – Prégymax™ 29.5, made up of plasterboard and an elasticized PSE-Graphite panel making it the solution with the lowest thermal conductivity of all thermal-acoustic insulation available on the market.
ADAPTING TO SPECIFIC NEEDS

The construction sector is not consistent. Climate, cultural customs and availability of resources vary from one country, or even one region, to the next, encouraging suppliers of building materials to offer tailored solutions.

This is especially true of Lafarge, present in 79 countries, which has had to develop a local approach to its international development, by offering responses to this wide range of needs. As an example, some countries favor the use of powders for renders, while others prefer ready-mixed plaster.

Procurement of natural resources is a real challenge in all the Group’s activities, since Lafarge has committed to providing materials of a consistent quality between countries, using resources available locally. It is therefore necessary to adjust the composition while guaranteeing optimum quality.

Lafarge also supplies materials with characteristics adapted to their end use: improved permeability, resistance, workability, etc.

OTHER SOLUTIONS... Durabat®, a cement enabling to lay foundations in difficult ground in contact with dirty or corrosive water in aquacultural, oysterfarming or wine growing environments – Platec®, a gypsum product line prefabricated to order according to the customer’s specifications

LAFARGE’S SOLUTION... Wab®

Wab® is a plasterboard providing a whole construction system (render, taping, joining, screws, etc.) that offers very high resistance to water and humidity.

It is therefore suitable for building partitions in humid environments as well as for designing covered external ceilings. It also works in tropical or very humid climates, where it retains its level of performance and aesthetics qualities whatever the ambient humidity. It can also be stored in the open air for six months without damage.

COMFORT AND AESTHETICS

LAFARGE’S SOLUTION... Ductal®

Ductal® is a fiber-reinforced, ultra-high performance concrete displaying superior tensile and compressive strength. Its ductility enables it to withstand significant deformations without failure.

The result of ten years of research, it is suitable for structural civil engineering applications as well as architectural applications.

Concepts of aesthetics, comfort and resistance to wear and tear are essential criteria in the construction industry. They promote the usage value of buildings and their insertion into their landscape and are therefore closely linked to the concept of sustainable construction.

For several years, Lafarge has collaborated with well-known architects to better understand their needs and develop materials which will enable them to produce ever-bolder buildings. Whether in relation to large architectural projects or family homes, aesthetics, comfort and resistance to wear and tear are among the criteria guiding the Group’s R&D. From this perspective, homes, offices and public spaces must meet increasingly high standards. Lafarge is responding to this by developing many thermal insulation, thermo-acoustic and moisture-resistant products.
FOCUS ON OUR BUILDING MATERIALS

What is cement?

Cement, which comes in powder form, is a hydraulic bonding agent used as a fundamental ingredient in concretes and mortars.

Its use is very ancient – early lime-based compositions date back to the Egyptians in 2600 AD. Its modern formulation, however, dates from the 19th century.

Manufacturing cement involves extracting and then firing limestone and clay to produce clinker, which is then milled finely with gypsum.

The raw materials, mainly limestone and clay, are extracted from the quarry by blasting (1) before being transferred to a dumper (2).

After crushing, they are transported to the plant on a conveyor belt (3) where they are stored and standardized.

Very fine milling produces a raw meal (4), which is pre-heated and then transferred into the kiln (5). A 2,000°C flame heats the material to 1,500°C, before it is cooled by air blown over it. After firing, the result is called clinker.

The clinker is milled very finely with gypsum (6) to obtain “pure cement”. Additions may be combined to produce composite cements.

Cements stored in silos are shipped in bags or bulk to their site of consumption.
**What are aggregates and concrete?**

**What are aggregates?**

An aggregate is a very small fragment of ore. This may be sand, gravel or grit, of natural origin (from the sea, rivers or land) or artificial (recycled demolition materials). Aggregates are essential in the production of concrete as well as production of basic materials for the construction of roads, embankments and buildings.

**What is concrete?**

Concrete is an inorganic material, made up of a combination of aggregates, sand and water combined with a bonding agent (generally cement), with the possible addition of admixtures and additives. The bonding agent “glues” the aggregates to one another, forming a construction material as hard as stone. Its qualities of resistance and durability make it the second most-used material in the world after water.

In its most common form, concrete is combined with steel to obtain a material which enjoys resistance to both compression and traction – reinforced concrete.
What is gypsum?

Gypsum can be natural (sedimentary rock extracted from underground or open-cast quarries which will then be crushed and milled) or synthetic (recycled industrial waste). The plaster obtained is then fired at 150°C.

Gypsum mainly comes in board form, although Lafarge also produces other gypsum-based products such as plaster and plaster blocks.

Recognized for its fire retardant properties, its qualities of acoustic and thermal insulation and its ability to regulate humidity, gypsum is mainly used for interior architecture, to produce walls and ceilings in residential constructions.

Consumption of gypsum is closely linked to two factors:

- construction methods in each country; for instance, demand for plasterboard is higher in the United States (50% of global demand), Japan and Australia than in Western Europe.
- the level of maturity of a country's residential market. Markets in which per capita GDP is growing experience an increase in demand for gypsum solutions. As an example, in 2005 Lafarge invested in the first gypsum plant ever built in Vietnam, a country in which gypsum solutions are achieving a penetration rate of more than 20%.
Lafarge is the world leader in building materials, with top-ranking positions in all of its businesses: Cement, Aggregates & Concrete and Gypsum. Following the acquisition of Orascom Cement in January 2008, the Group now has 84,000 employees in 79 countries.

Lafarge posted sales of **19.03 billion euros** and net income of **1.5 billion euros** in 2008. The Group is listed on the Euronext Paris stock exchange.

In 2009 and for the fifth year in a row, Lafarge was listed in the ‘Global 100 Most Sustainable Corporations in the World’. With the world’s leading building materials research facility, Lafarge places innovation at the heart of its priorities, working for sustainable construction and architectural creativity.

### Key Figures

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<td>Earnings per Share</td>
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### Sales by Line

- **Cement**: 35%
- **Aggregates & Concrete**: 57%
- **Gypsum**: 8%

### Sales by Region

- Western Europe: 23%
- North America: 14%
- Latin America: 11%
- Sub-Saharan Africa: 9%
- Asia: 5%
- Middle East: 4%
- Mediterranean Basin: 4%
- Central and Eastern Europe: 3%
- Other: 2%
A well balanced geographical portfolio, with a worldwide presence in 79 countries

### Lafarge Key Dates

- **1833**: Lafarge founded in France
- **1864**: The Group signs its first major international contract for the supply of 110,000 tons of lime for the construction of the Suez Canal
- **1887**: Lafarge opens its first central research laboratory at Le Tetail in the south of France
- **1956**: Lafarge builds its first North American cement plant at Richmond in Canada
- **1990**: Creation of Lafarge Research Centre (LCR) at L’Isle d’Abeau, near Lyon, the word’s largest building materials research facility
- **1994**: Lafarge enters the Chinese market
- **1997**: Acquisition of Redland, strengthening the Group’s position in aggregates and concrete and allowing it to enter the roofing market
- **2000**: Signature of a voluntary environmental conservation partnership agreement with the WWF
- **2001**: Acquisition of Blue Circle, making Lafarge the world’s leading cement producer
- **2005**: Renewal of partnership with the WWF International
- **2006**: Buyout of minority stake in Lafarge North America
  
  - Announcement of strategic plan “Excellence 2008” to ensure sustainable world leadership
  - Announcement of sale of Roofing business to PAI
- **2007**: Acquisition of Orascom Cement, marking an acceleration in the Group’s strategy for cement in emerging markets and reinforcing its presence in the Middle East and Mediterranean Basin
- **2008**: Lafarge acquires L&T Concrete to become the leader in the Indian Ready-mix concrete market

### Key events 2007 - 2009

- **May 2007**: Bruno Lafont is appointed Chairman and CEO
  
  - Lafarge presents its Sustainability Ambitions 2012, as renewal for sustainable leadership
- **June**: Lafarge presents Extensia™ and Chronokia™, two new value-added concrete products
- **December**: Acquisition of Orascom Cement, cement leader in the Middle East and Mediterranean Basin
- **February 2008**: Lafarge exceeds most of its Excellence 2008 objectives a year early
- **May**: Earthquake in Sichuan Province, China, damages two of Lafarge’s cement plants. Lafarge helps with relief efforts and donates 1.5 M€
- **June**: Launch of the 1st “Health and Safety Month”, in the 2200 Lafarge sites all around the world, to create awareness on safety at work issues with employees
- **November**: Lafarge announces the divestment of its Cement and Aggregates & Concrete activities in Italy
  
  - Announcement of the plan for strengthening the financial structure including a capital increase of €1.5 billion with preferential subscription rights
- **April**: Lafarge inaugurates the largest cement plant in Iraq, in Bazian (Kurdistan)
  
  - Lafarge and WWF International renew their partnership
- **May**: Lafarge announces the divestment of its Cement, Concrete and Aggregates activities in Turkey
  
  - Lafarge inaugurates a new production line in its Otsavlo cement plant, Ecuador
- **June**: Lafarge renews its partnership with CARE on health issues, economic and social development of communities around its sites
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