# Exegy: a range of **low-carbon concrete solutions**

**VINCI Construction is stepping up the pace of sustainable construction by promoting types of concrete with lower carbon emissions. With the launch of its new Exegy range of solutions, the company is promoting the use of low-carbon concretes on its worksites.**

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| **Starting date of the project** | **2017:** Research into low-carbon concrete solutions begins<br>**14 September 2020:** Official launch of the Exegy range of solutions |
| **Project Localisation**<br>Places of implementation of the project at this stage and targeted geography if replicable. | Exegy's low-carbon concretes are used in many VINCI Construction projects in France and abroad. |
| **Project objectives**<br>Type of climate innovation of the project with a description of the problem/issue addressed | To reduce the share of GHG emissions linked to concrete production by making low-carbon concrete solutions offering optimised technical, environmental and economic performance available for all VINCI Construction worksites. |
| **Detailed project description** | As a European leader and global player in its sector, VINCI Construction's aim is to leverage the power of Exegy in order to significantly develop the use of low-carbon concrete in all types of structures.<br><br>In keeping with its pledge to curb its greenhouse gas emissions by 40% by 2030, VINCI Construction is committed to using **90% low-carbon concrete in its projects by 2030**, in order to bring down the overwhelming proportion of Scope 3 emissions represented by construction materials.<br><br>Cement alone is responsible for 85% of all greenhouse gas emissions from concrete, of which it is a traditional component. The main ingredient of cement, clinker, is obtained by heating a mixture of limestone and clay to a very high temperature (1,500°C). In addition to emissions generated by heating the kiln, during the firing process limestone releases the carbon contained in the material in gaseous form: this is known as decarbonation, which is responsible for around 60% of total emissions from cement.<br><br>By designing mixes containing little or no cement clinker and by substituting the latter with alternative cementitious materials, VINCI Construction intends to expand the use of low-carbon concrete. As part of a circular economy approach, VINCI Construction uses industrial by-products such as fly ash (a combustion by-product from thermal power plants) or blast-furnace slag (a by-product of the steel industry), combined with other mineral admixtures (limestone filler, pozzolana, metakaolins, etc.)<br><br>VINCI Construction thus offers a catalogue of low-carbon concrete solutions that meet Exegy standards, which categorise products according to their specific $CO_2$ emission levels and technical characteristics, particularly as regards compressive strength.<br><br>Exegy solutions cover three types of concrete: low-carbon concrete (between 28 and 40% fewer GHG emissions), very low-carbon concrete (between 40 and 60% fewer GHG emissions) and ultra-low-carbon concrete (over 60% fewer GHG emissions).<br>These solutions, which were designed and tested in VINCI Construction's materials laboratories and then approved and implemented on worksites, guarantee optimised technical, environmental and economic performance of the concrete. The expertise of VINCI Construction's engineers and the know-how developed by worksite teams form the core of the EXEGY range of solutions.<br><br>Exegy ultra-low-carbon concrete (ULC) deserves special mention in this regard. In addition to being the first structural concrete on the market to demonstrate such a significant reduction in $CO_2$ emissions, this material also exhibits strength and resistance properties which are equivalent – if not in some cases superior – to those of traditional concrete. In particular, it produces a milder exothermic reaction, thus reducing the risk of cracking due to differential expansion, is more resistant to chemicals and exhibits finer porosity. Furthermore, as a result of combining a novel cementitious material developed with Ecocem with an appropriate implementation method, the issue of setting time, which was originally longer than for traditional concrete, has been resolved.<br><br>Exegy ultra-low-carbon concrete was used to construct six columns supporting an eight-storey building that is part of l'archipel, VINCI's future head office. This is the first time low-carbon concrete has been used as a structural element in a building in France. |

French standards limit the amount of additives that can be used in place of cement to a maximum of 30%, or 50% when slag is used in engineered concrete.

In the case of Exegy ultra-low-carbon concrete, the work and research carried out by VINCI Construction's engineering teams have taken progress one step further by producing a concrete with almost no clinker content, but with the same technical and strength properties as traditional concrete.

Almost entirely replacing the clinker with the ECOCEM Ultra® alkali-activated binder has resulted in cutting the carbon footprint of Exegy ultra-low-carbon concrete by more than 60%. As for any concrete that is not within the standard, we have carried out the trials and performance tests to demonstrate equivalence with a traditional concrete.

**Main project's drivers for reducing the greenhouse gas emissions**

| Reduction levers | Details on the aspects of the project |
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| ☒ Energy and resource efficiency (including behaviour) | Quantity of concrete used in structures, from project design to execution, is optimised. |
| ☐ Energy Decarbonisation | |
| ☐ Energy efficiency improvements | |
| ☒ Improving efficiency in non-energy resources | Amount of clinker used in concrete is reduced. |
| ☐ Emissions absorption: creation of carbon sinks, negative emissions (BECCS, CCU/S, ...) | |
| ☐ Financing low-carbon producers or disinvestment from carbon assets | |
| ☐ Reduction of other greenhouse gases emission | |

**Emission scope(s) on which the project has a significant impact and quantification of GHG emission reductions per emission scope**

| | Aspects of the project contributing to the reduction of emissions by emission category | Quantification of associated GHG emissions by emission category<br><br>Please follow the quantification methodology used in the Afep guidelines. |
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| **Reduction of the company's carbon dependency** | | |
| **Scope 1**<br>*Direct emissions generated by the company's activity.* | | |
| **Scope 2**<br>*Indirect emissions associated with the company's electricity and heat consumption.* | | |
| **Scope 3**<br>*Emissions induced (upstream or downstream) by the company's activities, products and/or services in its value chain.* | Use of low-, very-low- and ultra-low-carbon concrete. | 600,000 $tCO_2eq$/year by 2030 .<br><br>of which 180,000 $tCO_2eq$/year resulting from use of EXEGY Ultra-Low-Carbon concrete. |
| **Increase of carbon sinks** | | |
| **Emissions absorption**<br>*Creation of carbon sinks (BECCS, CCU/S, ...)* | | |
| **GHG emissions avoided by the company at third parties** | | |
| **Avoided Emissions**<br>*Emissions avoided by the activities, products and/or services in charge of the project, or by the financing of emission reduction projects.* | | |

**Clarification on the calculation or other comments:**

VINCI Construction aims to use 15% Exegy ultra-low-carbon concrete on its sites by 2030, amounting to 1,400 cu. metres.

An emission factor of 100 $kgCO_2eq$/cu. metre is assumed for ULC concrete.

Conventional concrete, which ULC concrete replaces, exhibits an emission factor of 230 $kgCO_2eq$/cu. metre.

Hence the reduction of approximately 180,000 $tCO_2eq$/year in 2030 (compared to 2020).

**Modality of verification of the quantification.**

**Calculation standard used (ADEME base, GHG Protocol, etc.):** VINCI Construction's internal estimate of the carbon footprint of concretes used on its sites.

**Verification of the calculation (internal or external):** VINCI Construction internal verification

**Other environmental and social benefits of the project**

The Exegy range of concrete contributes to the following SDGs:

- SDG 6 – Clean water and sanitation: cement production consumes a large amount of water (up to 30% water in the paste when wet process is used)
- SDG 12 – Responsible consumption and production: fostering circular economy solutions (blast furnace slag, fly ash)

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| | • SDG 13 – Climate action: avoiding $CO_2$ emissions from cement production as a means of fighting climate change |
| **Project maturity level** | ☐ Prototype laboratory test (TRL 7)<br>☐ Real life testing (TRL 7-8)<br>☐ Pre-commercial prototype (TRL 9)<br>☒ Small-scale implementation<br>☒ Medium to large scale implementation<br><br>**Remarks:**<br>• Exegy ultra-low-carbon concrete implemented on small scale due to the need to test performance of the material on each target site pending approval of ECOCEM Ultra® alternative binder in summer 2021<br>• Low- and very low-carbon Exegy implemented on medium to large scale. |
| **Capacity and conditions of the project reproducibility, with associated climate impact mitigation potential** | VINCI Construction has launched the Exegy approach to expand the use of low-carbon concrete.<br>Exegy solutions are distributed and sold via a network of partner concrete producers or, when possible, in mobile plants on worksites with the assistance of VINCI Construction engineers and experts. Exegy ultra-low-carbon concrete is expected to become a market success once it can be offered as a conventional engineering concrete, which will become possible once the ECOCEM Ultra® alternative binder is approved in the summer of 2021. |
| **Amount of investment made (in €)** | Investment made jointly by VINCI Construction and ECOCEM (total amount confidential)<br>• VINCI Construction's share in the investment (R&D regarding mix design, laboratory testing and use cases): €500,000 |
| **Economic profitability of the project (ROI)** | ☐ ST (0-3 years)<br>☒ MT (4-10 years)<br>☐ LT (>10 years)<br><br>**Remarks:** Exegy solutions offer a number of economic benefits to stakeholders:<br>• VINCI Construction sites gain access to competitively priced low-carbon concretes, giving them unique advantages when bidding for works contracts.<br>• There is a shared incentive for ECOCEM to sell alkali-activated slag and for VINCI Construction to distribute and sell Exegy ultra-low-carbon concrete. |
| **Engaged partnerships** | Exegy ultra-low-carbon concrete was developed by VINCI Construction and ECOCEM, working in partnership. |
| **Open comments from the project owner** | / |
| **For more information on the project** | |
| **Contact the company carrying the project** | Contact: Bruno PAUL-DAUPHIN<br>exegy-solutions@vinci-construction.com |
| **Project URL links** | https://vinci-construction.com/media/uploads/dossier-de-presse-exegy.pdf |
| **Illustrations of the project** |  |


VINCI Construction
accélère sur
les bétons bas carbone
Chantier de l'archipel (Nanterre, France) - futur siège VINCI