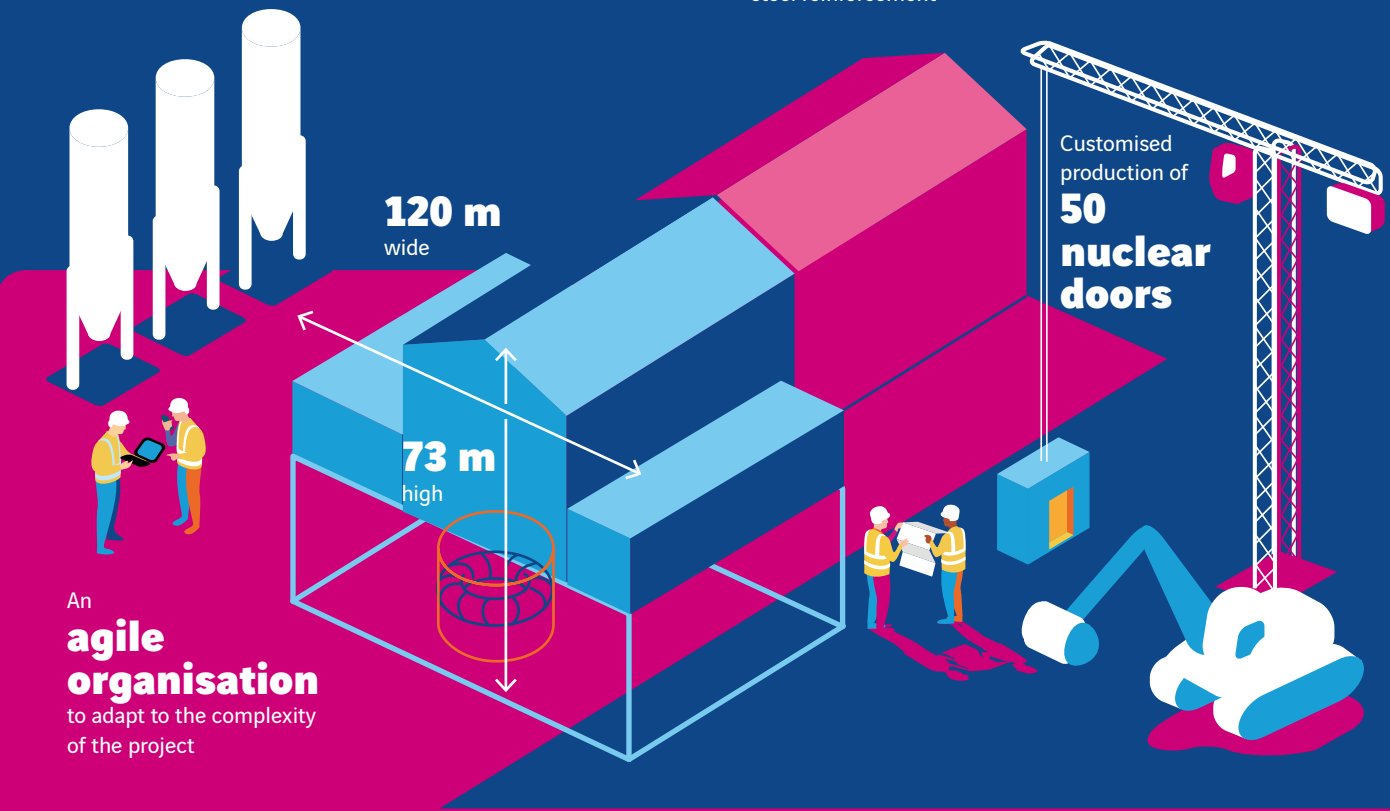
ITER: CIVIL ENGINEERING WORK ON **THE TOKAMAK BUILDING COMPLETED**

A partnership with
ITER Organization
and **Fusion for Energy**

3D modeling
Specific
concrete formulations
Ultra-dense
steel reinforcement

850
people at the peak of activity



An
agile organisation
to adapt to the complexity of the project

First experiments in 2025
objective maintained

Demonstrating the potential of fusion as a,
abundant, CO_2-free alternative energy

PRESS RELEASE

Rueil Malmaison, 8 November 2019

ITER: Civil engineering work on the Tokamak Building completed

- Performance enabling ITER to maintain its First Plasma target date in 2025
- A project of unusual technical complexity
- VINCI, an innovative and reliable partner of ambitious scientific and technical projects

ITER Organization, the international organisation set up in November 2006 to operate and subsequently dismantle the ITER facility; Fusion For Energy (F4E), the European Union organisation responsible for the European contribution to the ITER programme; and Groupe VINCI, leader of the consortium[1] in charge of constructing the main buildings at the site, today announced the completion of civil engineering works on the ITER Tokamak[2] Building at the Saint Paul lez Durance/Cadarache site in south-eastern France. This major project milestone was symbolically reached with the final concrete pour, on 7 November 2019, of the upper part of the building in which the ITER Tokamak will soon be assembled.

With the on-time completion of the Tokamak Building civil engineering works, the metal frame of the roof can be installed and the ambitious First Plasma[3] target in 2025 maintained.

The civil engineering project, which got under way in 2010, called for exceptional complex project management capabilities and cutting-edge expertise.

The teams working within the VINCI-led consortium set up an agile project organisation enabling them to integrate all design changes requested by the ITER scientific teams as construction proceeded.

Beside the use of cutting-edge digital design tools, the construction of the 73 metre high, 120 metre wide Tokamak Building also required production of highly specific concretes. The worksite teams developed about 10 formulations, some of which have unique features enabling them to shield workers and the environment from fusion-generated radiation. Some parts of the Tokamak Building also called for steel reinforcement density rarely used on projects on this scale. Lastly, access to the heart of the Tokamak

[1] The consortium in charge of construction of the main ITER buildings is led by VINCI via its subsidiaries VINCI Construction Grands Projets, VINCI Construction France and Dodin Campenon Bernard. It also includes the Ferrovial (Spain) and Razel-Bec (France) companies. The heavy doors were designed and produced by VINCI Énergies in partnership with Sommer (Germany).

[2] A tokamak is an experimental machine designed to exploit fusion energy. In a tokamak, three conditions must be met to obtain a fusion reaction: very high temperature (about 150 million degrees Celsius); sufficient particle density to produce a very large number of possible collisions; and sufficiently long energy confinement time to ensure that the collisions occur at the highest possible speed. Tokamak is a Russian acronym standing for "toroidal chamber with magnetic coils".

[3] The plasma, the fourth state of matter, is achieved when a gas is raised to a very high temperature, dissociating electrons and nuclei. In this medium, hydrogen nuclei can fuse and release energy.

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Building required customised production of 46 heavy doors. Each 70-tonne door is manufactured in Germany, brought to the site, filled with concrete and assembled in the heart of the Tokamak Building.

"*In deciding to take part in the leading construction of the particularly complex ITER buildings, VINCI undertook to help write a new chapter in one of the most ambitious and promising research programmes ever undertaken - a programme designed to reproduce on Earth the reactions that have been taking place in the heart of the Sun and stars for billions of years. Its goal is to harness hydrogen fusion and thereby pave the way for a new era for all humanity by making available a massive source of energy that can be varied at will, is intrinsically safe and has no impact on the climate and the environment. This was a huge challenge to which the men and women at VINCI have been tenaciously and resourcefully rising for nearly a decade. We want to warmly thank Vinci for having been a highly capable, reliable partner sharing our objectives, our standards and our determination. The success of ITER will be theirs.*" said Bernard Bigot, Director-General of ITER Organization.

"*We are pleased to announce the completion, following a lengthy and complex process, of the civil engineering works for the main building that will house the ITER Tokamak, the world's largest fusion machine. Europe is the party responsible for building the infrastructure of this extremely ambitious programme. Our close collaboration with VINCI, its partners and more than 700 workers has enabled us to successfully finalise this stage of the project in compliance with the safety, security and quality requirements.*" said Laurent Schmieder, who oversees the F4E team in charge of building construction and electrical systems for the ITER project.

"*VINCI Construction and its partners Razel-Bec and Ferrovial are extremely proud of having carried out the ITER civil engineering works. ITER is a one-of-a-kind research programme in terms of its complexity, precision and size. It is an extraordinary human undertaking, but also a huge technical challenge, and we were constantly called on to innovate and expand our expertise. With ITER, we are humbly helping to implement one of the greatest and most ambitious energy projects of our time, designed to make electricity available throughout the world without CO_2 emissions or radiological risk. For us, as a builder, it is a matter of great pride to have laid the cornerstone of a structure of such importance to humanity.*" said Jérôme Stubler, Chairman of VINCI Construction.

About VINCI
VINCI is a global player in concessions and contracting, employing over 210,000 people in some 100 countries. We design, finance, build and operate infrastructure and facilities that help improve daily life and mobility for all. Because we believe in all-round performance, above and beyond economic and financial results, we are committed to operating in an environmentally and socially responsible manner. And because our projects are in the public interest, we consider that reaching out to all our stakeholders and engaging in dialogue with them is essential in the conduct of our business activities. VINCI's goal is to create long-term value for its customers, shareholders, employees, and partners and for society at large. www.vinci.com

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