FUSION FOR ENERGY

HIGHLIGHTS 2013

THE MAIN ACHIEVEMENTS

Table of contents

Foreword

"Europe's contribution to ITER is an incredible opportunity for industry. We are talking about jobs, growth and knowledge that will open new markets and make Europe more competitive. 2013 was the year that F4E reached out to industry. We listened; understood your concerns and responded with a series of measures in order to help you seize fusion's business potential"

Today, the EU imports 53% of the energy it consumes. The value of imports is more than 1 billion EUR per day. In parallel, we are facing a twofold challenge: we need to meet the increasing global demand for energy supply and minimise our dependence on fossil fuels due to the economic, environmental and political risks they present.

A diverse, sustainable and secure energy mix is needed. And fusion energy can be part of it in a few decades from now. The fuels needed for fusion are widely available and virtually inexhaustible. With fusion there are neither greenhouse gas emissions nor long-lasting radioactive waste. Furthermore fusion reactors, which should be capable of generating large amounts of electricity, are intrinsically safe with no risk of a chain reaction.

Fusion for Energy (F4E) is responsible for managing Europe's contribution to ITER, the biggest international collaboration in the field of energy that will demonstrate the viability of fusion. The project brings together half of the world's population (China, Europe, Japan, India, the Republic of Korea, the Russian Federation and US) and represents 80% of the global GDP.
Europe is the host party of this one-of-a kind scientific endeavour and is providing around one-half of the components that make up ITER. F4E is also responsible for the coordination of the European contributions to three joint fusion projects carried out in Japan known as the "Broader Approach".

Europe's participation in ITER offers an entry point to industry, SMEs and fusion laboratories that wish to enhance their competitiveness and expertise; familiarise themselves with cutting edge technologies and gain access to an energy market that will yield substantial financial benefits.
In 2013 the contracts we signed with European economic operators exceeded the total value of 800 million EUR. In some cases, the financial capital released to our contractors directly affected the value of their shares and improved their knowledge capital because of their involvement in ITER.
In parallel, we helped to kick start Europe's innovation economy by stimulating growth and contributing towards the creation of jobs.

During my first year as F4E Director, I had the privilege of witnessing some key moments in theconstruction and manufacturing of ITER. I have also taken the initiative to instil a new working culture vis à vis our stakeholders in order to listen to them and offer more incentives that could boost the industrial angle of the project.

To convey the achievements and challenges that we faced during 2013, we have put together a short report so that you see the evolution of this immensely complex but nevertheless fascinating project.

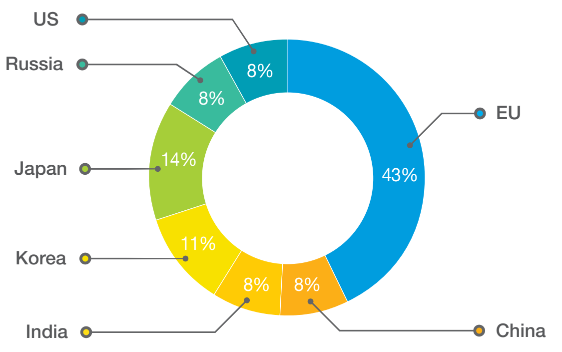
Turn the page to discover a new chapter in the field of energy!

Professor Henrik Bindslev
Director of Fusion for Energy

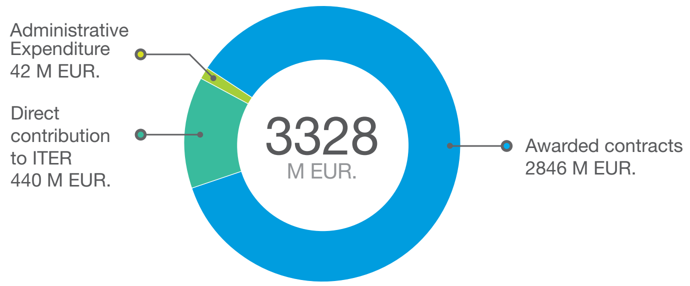
October 2014

2013 Key figures

In-kind contributions to ITER

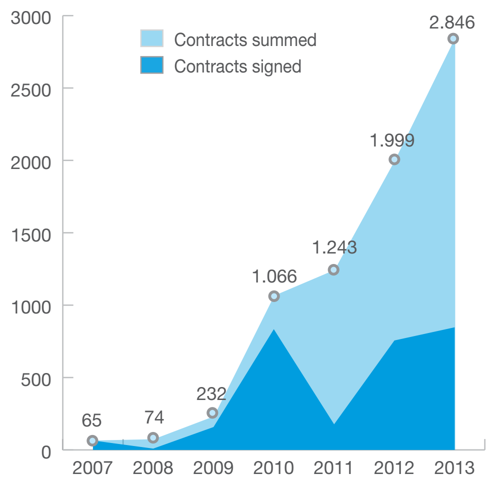


Total contributions between the different ITER parties - 2013

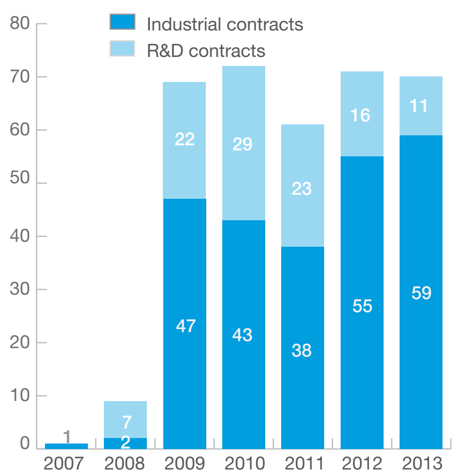


Repartition of 2013 budget

Value and quantity of awarded contracts

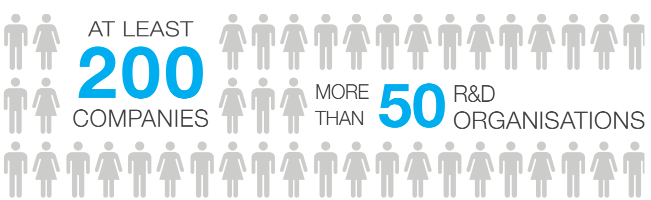


Annual and summed value of contracts awarded (>1 Million EUR)



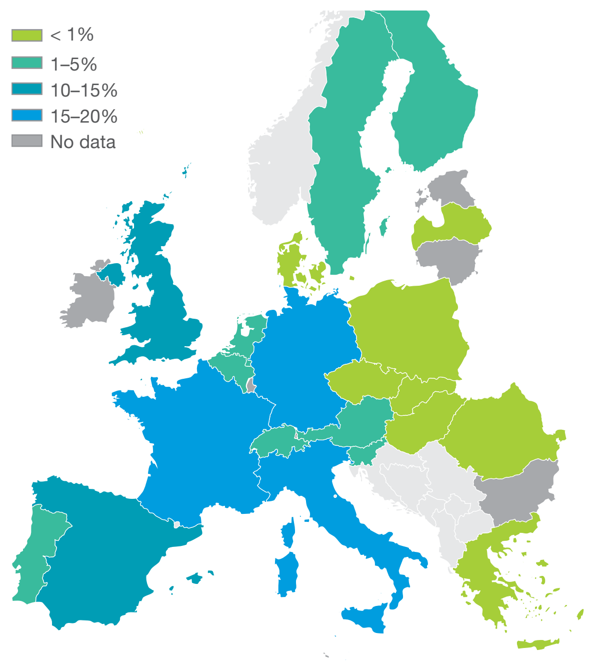
Number of contracts awarded

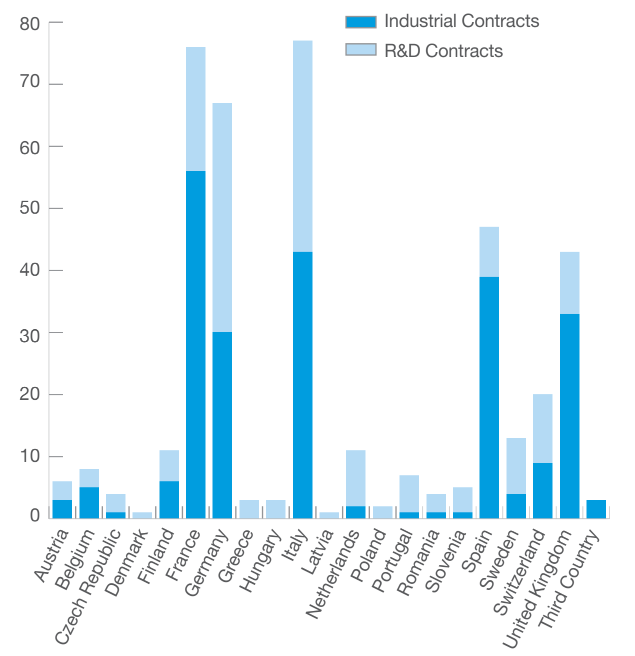
Since 2008 F4E has been collaborating with:



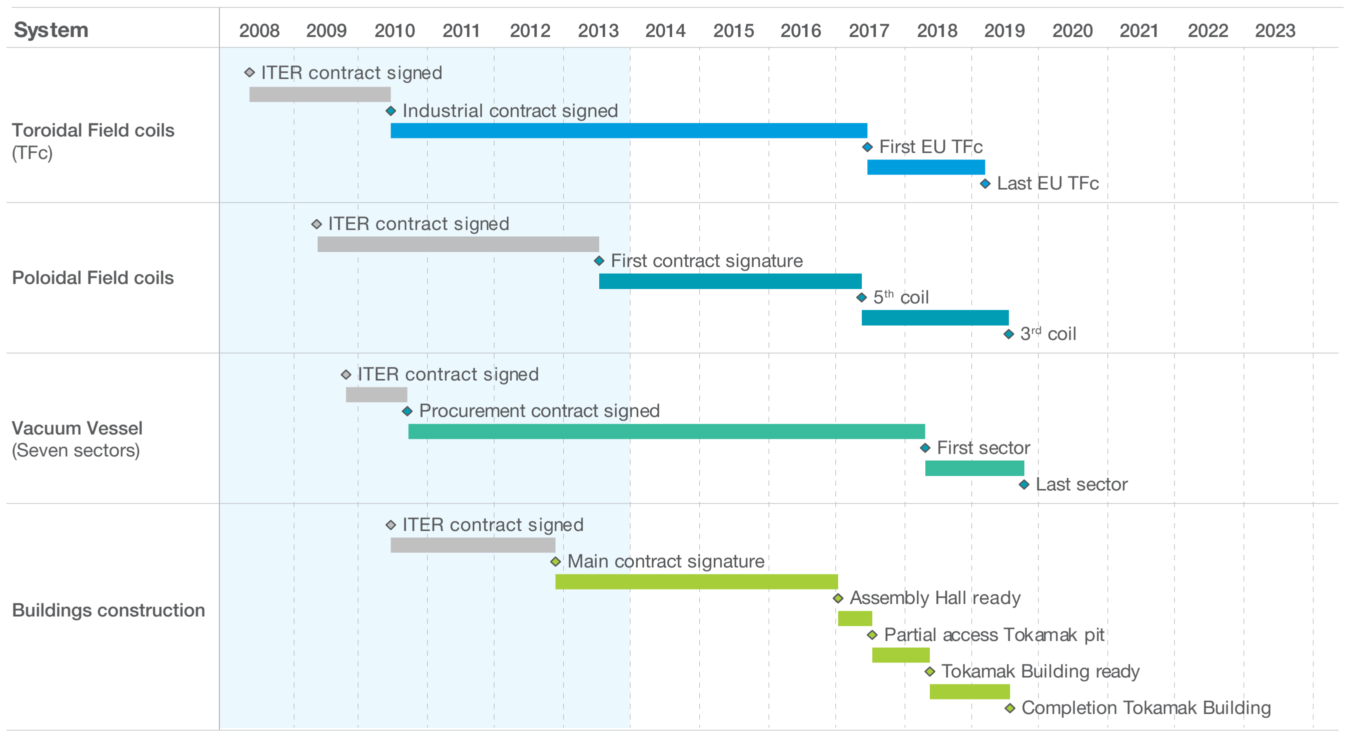
Since 2008 F4E has:

Geographical distribution of contracts awarded by F4E





Progress of the work for the main components provided by F4E

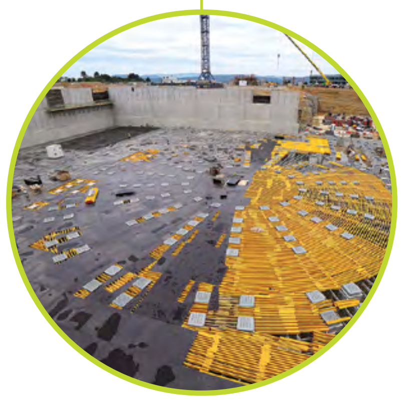


2013 at a glance

January
Professor Henrik Bindslev took up duties as Director of F4E.
The works for the ITER Assembly building progressed further.
JT-60 SA, the fusion experiment supported by Europe and Japan, entered into its assembly phase.

February
The seismic isolation of the main ITER building consisting of 493 plinths was completed.
The kick-off meeting of the civil engineering works contract of the ITER Tokamak building was held in Barcelona.

March
The conductor for the Poloidal Field coils was manufactured using cable from Russia.
The first offices to house contractors were erected on the ITER construction site.
The network of the precipitation drainage system has started taking shape.



April
Works for the Tokamak basemat, upon which the main ITER building will sit, accelerated.
The route in France for the transportation of the first ITER components started getting ready!
F4E attended the ITER Business Forum to help companies get further involved in the project.

May
EDIPO, a world-class European magnets testing facility co-financed by F4E, reported impressive results in the field of conductors. A 150 m^2 mock-up reflecting the four most complex areas of the Tokamak slab was completed in parallel with propping and formwork activities.

June
The ITER Council acknowledged the good progress of the ITER construction. The reinforcement activities of the Tokamak basemat advanced further and 80% of the propping and shoring towers were installed. IFMIF/EVEDA, an important part of the Broader Approach materials project in Japan, started testing.

July
F4E held its first ever final design review to assess the design of the ITER external coils to be located outside the Vacuum Vessel, within the cases of three Toroidal Field coils.
F4E in collaboration with Atkins Global showcased ITER at the Royal Academy of Engineering Awards in the UK.

August
The winding of Europe's first ever Toroidal Field coil full-size prototype for ITER, manufactured by a consortium of Italian and Spanish companies, was completed.
F4E presented ITER to young scientists and high-tech aficionados at the Europe Campus party in London.

September
The test of the 104 km route to transport the heavy components was successfully carried out. A ministerial-level meeting took place in Cadarache, France, to witness the progress of the project. F4E unveiled its new industrial policy and a list of measures that will boost the participation of companies.

October
F4E signed its largest contract to date with a Franco-German consortium for the services required inside the main ITER buildings (e.g. heating, ventilation, air conditioning, etc.). The value of the contract was in the range of 500 million EUR.

November
Several offices, the infirmary and canteen have been completed on the ITER site. Storage areas and workshops that measure approximately 3,000 m^2 together with 1,000 m^2 of office space were made available.
F4E collaborated with GÈANT, the world's leading high-speed research and education network.

December
The first plot of concrete was poured on the upper basemat of the Tokamak slab. F4E welcomed Croatia as the 30th member of the organisation. The 2014 budget and work programme were successfully adopted by F4E's Governing Board.

01

Building ITER

Landmark contracts have been signed and major woks have started.

The ITER platform is one of the largest man-made levelled surfaces in the world and is considered as one of the biggest building sites in Europe measuring 42 hectares.

The party responsible for the construction of 39 buildings on the site, is Europe.

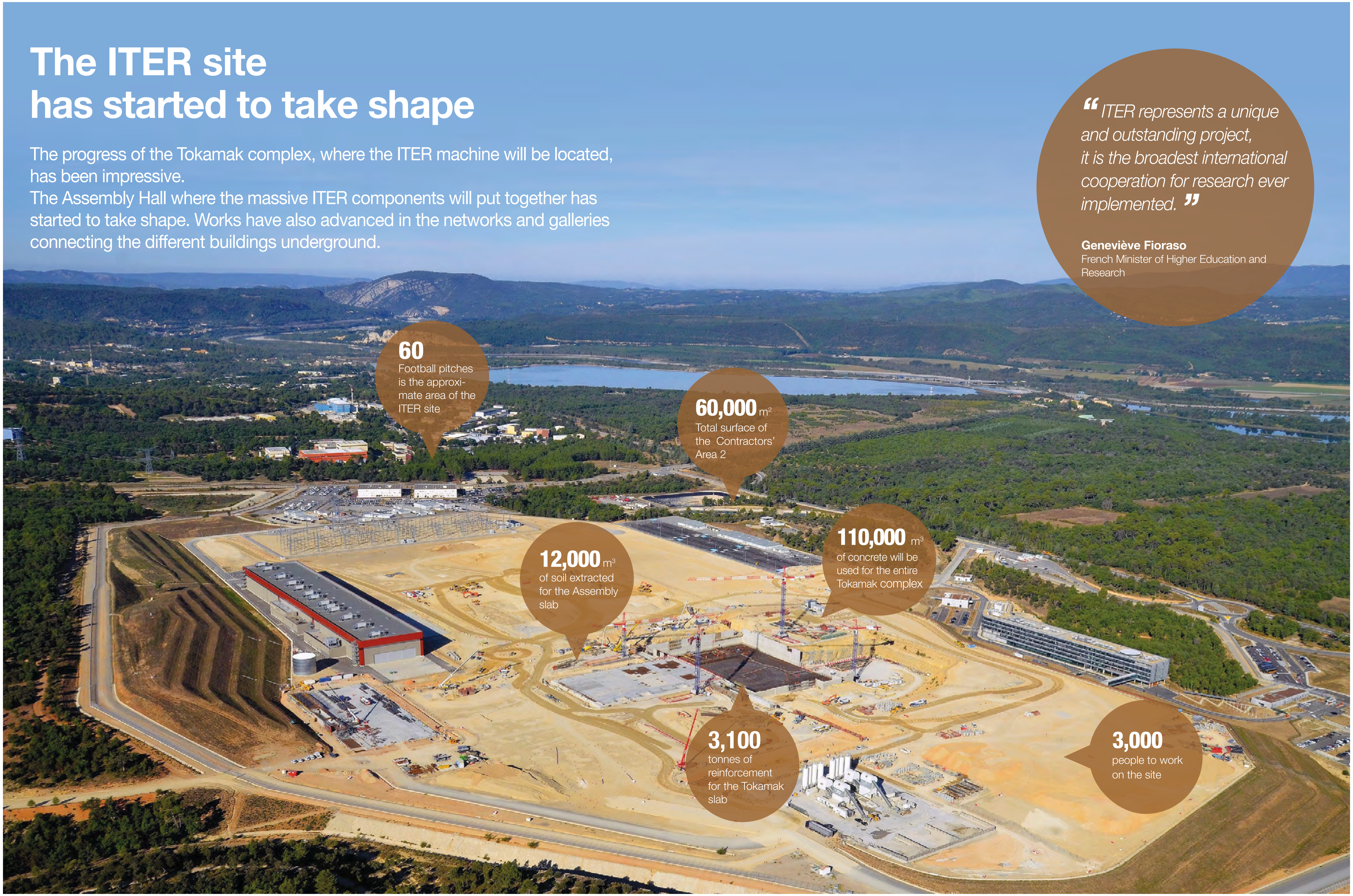
Currently, the personnel directly involved in construction counts at least 200 people and by mid-2015 it is expected to reach 3,000.

One of the key challenges will be to accommodate the rapidly growing workforce and to guarantee an optimal use of space by the different companies operating on the ground, in order to carry out the construction of all infrastructures in parallel and on time.

The ITER site has started to take shape

The progress of the Tokamak complex, where the ITER machine will be located, has been impressive.
The Assembly Hall where the massive ITER components will put together has started to take shape. Works have also advanced in the networks and galleries connecting the different buildings underground.

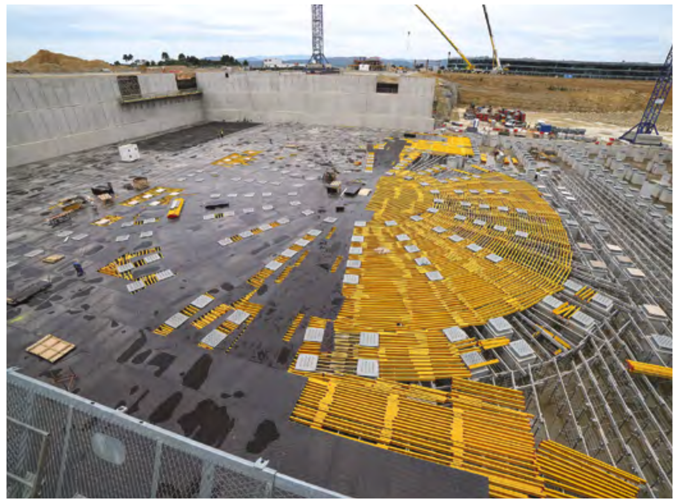
> *“ITER represents a unique and outstanding project, it is the broadest international cooperation for research ever implemented.”*
>
> **Geneviève Fioraso**
> French Minister of Higher Education and Research



ITER Aerial view - September 2013

A new concrete slab for the ITER Tokamak complex

Anti-seismic bearings installed, retaining walls constructed (January 2013)



Propping and formwork set up for the upper basemat (Summer 2013)

Reinforcement work ongoing (Autumn 2013)

Pouring the first plot of the upper basemat of the Tokamak complex (December 2013)

The works for the second concrete slab of the Tokamak complex have started. The complex will host the Tokamak, Diagnostics and Tritium buildings, which are fundamentally important for the operation of the ITER machine. Its weight will be approximately 360,000 tonnes, the equivalent of the Empire State building. The works have been considered a turning point in the construction progress of the ITER platform. The slab is going to support the 23,000 tonnes of the Tokamak machine and will require 4,000 tonnes of steel and 14,400 m^3 of concrete.

The Tokamak complex key figures

2010: Contract signed with GTM, VINCI group

Tokamak Complex
- 3 buildings: Diagnostic,Tokamak, Tritium
- 120 x 80 metres
- 17 metres deep
- 60 metres high
- 360,000 tonnes

Upper basemat
- 9,300 m^2
- 1.50 metres thick
- 15 plots to pour
- 3,100 tonnes of reinforcement
- 14,400 m^3 of concrete

ITER Tokamak Pit - The round shape of the future Tokamak is now apparent - June 2013

The ITER Assembly Hall has started to take shape!

The Assembly Hall building is where the components of the ITER device will be connected in order to be installed in the machine. There has been noticeable progress in the construction of the foundation of the building: 10,000 m³ of concrete have been poured and 1,500 tonnes of reinforcement steel have been installed using the thickest rebars that exist. Once the building is constructed, it will have a footprint of 100 x 60 metres and it will be 57 metres high.

Assembly Hall building key figures

12,000 m³ of soil extracted during the excavation phase.
Future building dimensions: 97 x 60 metres

Basemat
1,400 tonnes of steel , 5,400 m³ of concrete
Thickness: 1.2-2.2 metres, 17 plots poured

Function
Location of pre-assembly activities for the ITER device
To host custom-made tools as well as two 750-tonne cranes

"By far one of the most fascinating workshops in the world! It is where the ITER components will be assembled, lifted, rotated and finally, transported to the Tokamak"

Assembly Hall area
January 2013

Assembly Hall area
May 2013

"The Critical Network is built at a great depth, and must be completed before any other building or infrastructure."

Ben Slee
Deputy Project Manager
Fusion For Energy

Pipe laying and backfilling on going - May 2013

Networks and new buildings for contractors

The canteen on the ITER site to serve up to 1,500 meals per day

Contractors' offices

Overflow network-pipes' backfilling

Precipitation drainage system

Works have also advanced in the network of the precipitation drainage system, that connects different buildings underground along 1,2 km of pipes.
The first contractors have started using the on-site facilities. Several buildings which will house offices, the canteen and infirmary, have already been completed.

Critical Network key figures

- Consists of the precipitation drainage system and cooling water release system
- Critical in the time and the schedule
- 1.2 km of pipes
- Works from May 2012 – End 2013
- Diameter between 1 – 2.2 metres
- Technical backfilling performed manually

Landmark contract for the construction of the ITER Tokamak complex has been signed

F4E has celebrated a landmark achievement with the signature of one of the largest contacts in the field of civil engineering works. The contract covers the construction of the Tokamak complex, the building that will host the ITER machine, plus other buildings and amenities.

© Architect ingeneers

The contract will run for five and a half years and its budget is in the range of 300 million EUR. The VFR consortium, consisting of French companies VINCI Construction Grands Projets, Razel-Bec, Dodin Campenon Bernard, Campenon Bernard Sud-Est, GTM Sud and Chantiers Modernes Sud as well as Spanish company Ferrovial Agroman, has a proven track record in the field of construction.

The Tokamak complex consists of the Diagnostics, Tokamak and Tritium buildings. A total of 150,000 m³ of concrete will be used for all buildings out of which 110,000 m³ will be used for the construction of the Tokamak complex. This is the equivalent of the concrete used for 3,000 houses of 120 m². The building will be 80 metres high, 120 metres long and 80 metres wide. Its footprint will be bigger than that of a football stadium. The Tokamak building will rely on 493 plinths equipped with anti-seismic bearings, already in place and able to sustain the overall weight of the machine, which will be in the range of 23,000 tonnes – almost three times the weight of the Eiffel Tower.

Europe has signed its biggest ever contract for ITER with GDF SUEZ Group and M+W Group

Europe's biggest contract to date has been signed with Cofely Axima, Cofely Ineo, Cofely Endel (GDF Suez Group) and M+W Group. The strong expertise of the Franco-German group of companies will be used to provide the building services for the Tokamak complex, where the ITER Tokamak machine will be located, and the surrounding buildings. The contract is expected to run for six years and its budget is approximately 530 million EUR.

(left to right): Jean Pascal de Peretti de la Rocca, CEO Cofely Axima, Guy Lacroix, Managing Director GDF SUEZ Energy Services and Henrik Bindslev, Director of Fusion for Energy

“Being part of the largest international collaboration in the field of fusion energy makes us extremely proud. All the members of the consortium bring together a diversity of skills and expertise which allow us to demonstrate that we can be at the forefront of large-scale industrial projects like ITER”

Guy Lacroix
Managing Director GDF SUEZ Energy Services in charge of
Cofely Axima, Cofely Ineo and Cofely Endel

The scope and key figures of the contract:

The contract covers the design, supply, installation and commissioning of the mechanical and electrical equipment for the Tokamak complex plus the surrounding buildings which reach a total of 97,200 m³. Thanks to this contract all the necessary works for the ITER assembly phase will start in order to host ITER's high tech equipment and a Heating Ventilation Air Conditioning (HVAC). The HVAC system is powerful enough to treat the air flow of 1,000,000 m³/hour which corresponds to the volume of air inhaled and exhaled by 3.5 million people every hour.

Furthermore, Instrumentation and Control (IC) systems, power supplies, interior and exterior lighting, gas and liquid networks will be installed. State of the art fire detection and extinguishing systems, consisting of 2,000 fire detectors, will be supplied together with pipe fittings and handling equipment with various interfaces that will connect buildings and systems.

The ITER test convoy: 800 tonnes have crossed the south of France

Driving for five days and four nights on 352 tyres.

Transporting the exceptionally heavy ITER components that will be manufactured in different parts of the world will be one of the most challenging tasks. The components will be shipped to the port of Marseille and then transported to Cadarche, where they will be finally assembled on the ITER site.

A general rehearsal of the logistics and infrastructure has been carried out validating the provisions undertaken so far. A 33 metres long vehicle weighing 800 tonnes and running on 352 tyres has managed to drive through 41 villages without disturbing the daily life of the local population.

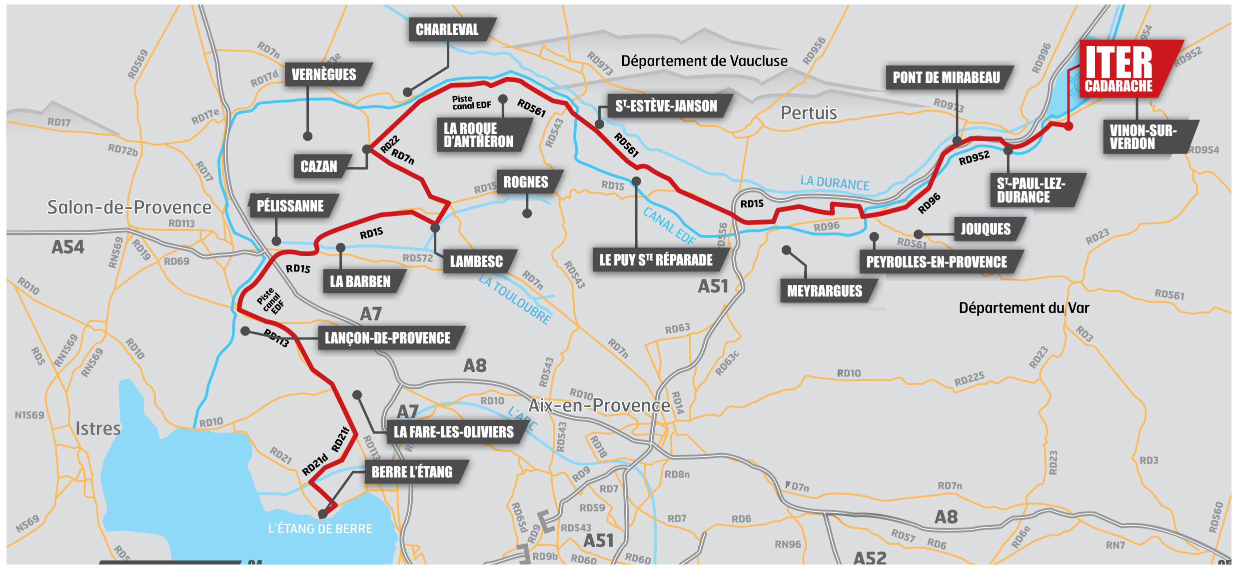
The preparatory works for the test drive, reaching a cost of 112 million EUR, started a long time ago in order to enlarge a 35 km long route, build and reinforce 26 bridges, improve the size of 19 roundabouts and develop new parts of the highway.

“We are in charge of the transportation, customs and global logistics of all components departing from their country of origin and arriving to the ITER site in Cadarache. Overall, we were well prepared for this exercise and we were able to address all incidents”

François Genevey
DAHER Project Manager

The ITER test convoy during inspection

The ITER test convoy on its way to ITER, Cadarache © S Benacer/400ASA



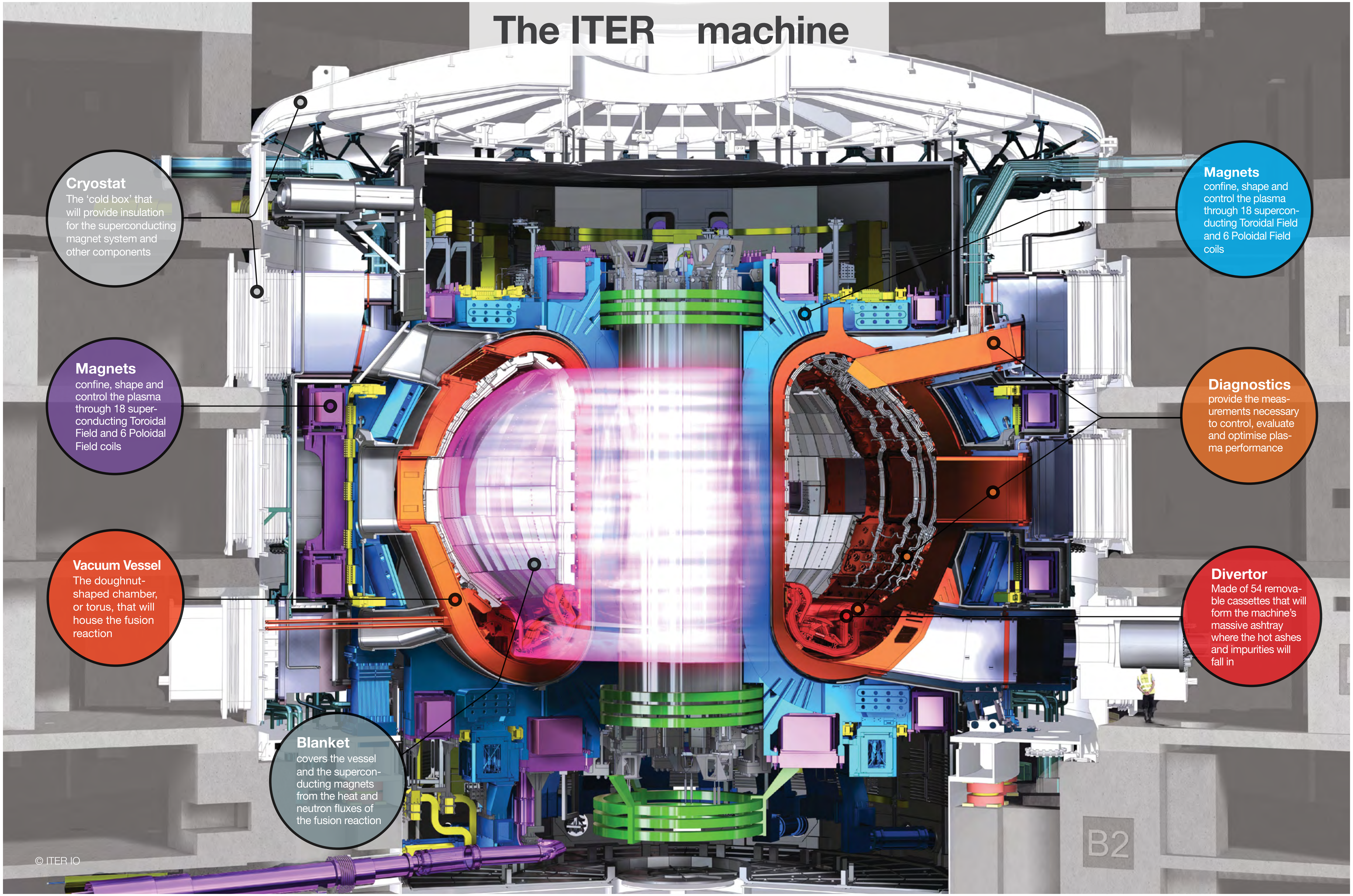
The route from Berre-l'Étang to ITER, Cadarache (© AIF)

02

Manufacturing the ITER components

The biggest ever fusion device that will demonstrate the viability of fusion energy is relying on massive, complex and impressive high-tech components that have undergone rigorous manufacturing tests and are underpinned by extreme accuracy. Components of such size have never been manufactured before!

Europe's in-kind contribution to ITER amounts to roughly 50% of the total. Its share offers an unprecedented opportunity to industry, SMEs and fusion laboratories to get involved and contribute to the biggest international collaboration in the field of energy.


The ITER machine
Cryostat
The 'cold box' that will provide insulation for the superconducting magnet system and other components
Magnets
confine, shape and control the plasma through 18 superconducting Toroidal Field and 6 Poloidal Field coils
Vacuum Vessel
The doughnut-shaped chamber, or torus, that will house the fusion reaction
Blanket
covers the vessel and the superconducting magnets from the heat and neutron fluxes of the fusion reaction
Magnets
confine, shape and control the plasma through 18 superconducting Toroidal Field and 6 Poloidal Field coils
Diagnostics
provide the measurements necessary to control, evaluate and optimise plasma performance
Divertor
Made of 54 removable cassettes that will form the machine's massive ashtray where the hot ashes and impurities will fall in
B2
© ITER IO

First ever full-size prototype component for the Toroidal Field coil has been wound

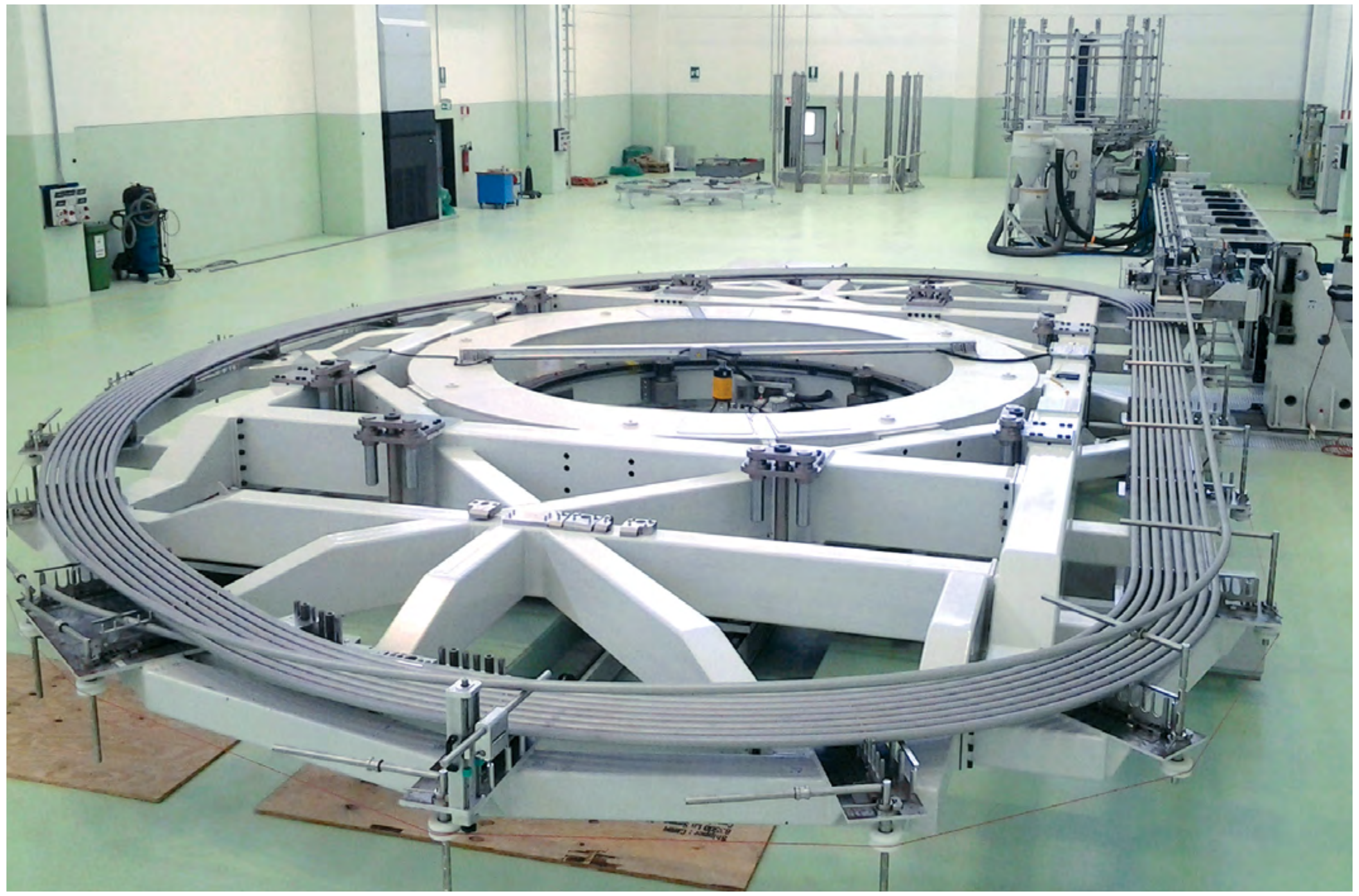
Each Toroidal Field (TF) is composed of seven modules called double pancakes because of the way they are stack (back to back).
For the first time ever, a full-size super-conducting prototype of the Double Pancake (DP) has been manufactured. The winding of the conductor, considered as the first step of the manufacturing process, has been completed. This milestone, was celebrated at the ASG facilities, where the production of the winding line is being carried out.

The TF coils are composed of a winding pack and its stainless steel coil case. Inside, a 68 KA electrical current will run along the cable-in-conduit conductor that will produce the magnetic field.
The modules will be contained in metallic structures known as radial plates.
In order to manufacture a double pancake, first, the conductor has to be bent onto a D-shaped double spiral trajectory, and then it has to be heat treated in the furnace up to 650 degrees Celsius during an entire month. We need to heat treat the conductor in order bring together the Nb, Copper and Tin and form the superconductor (Nb3Sn).

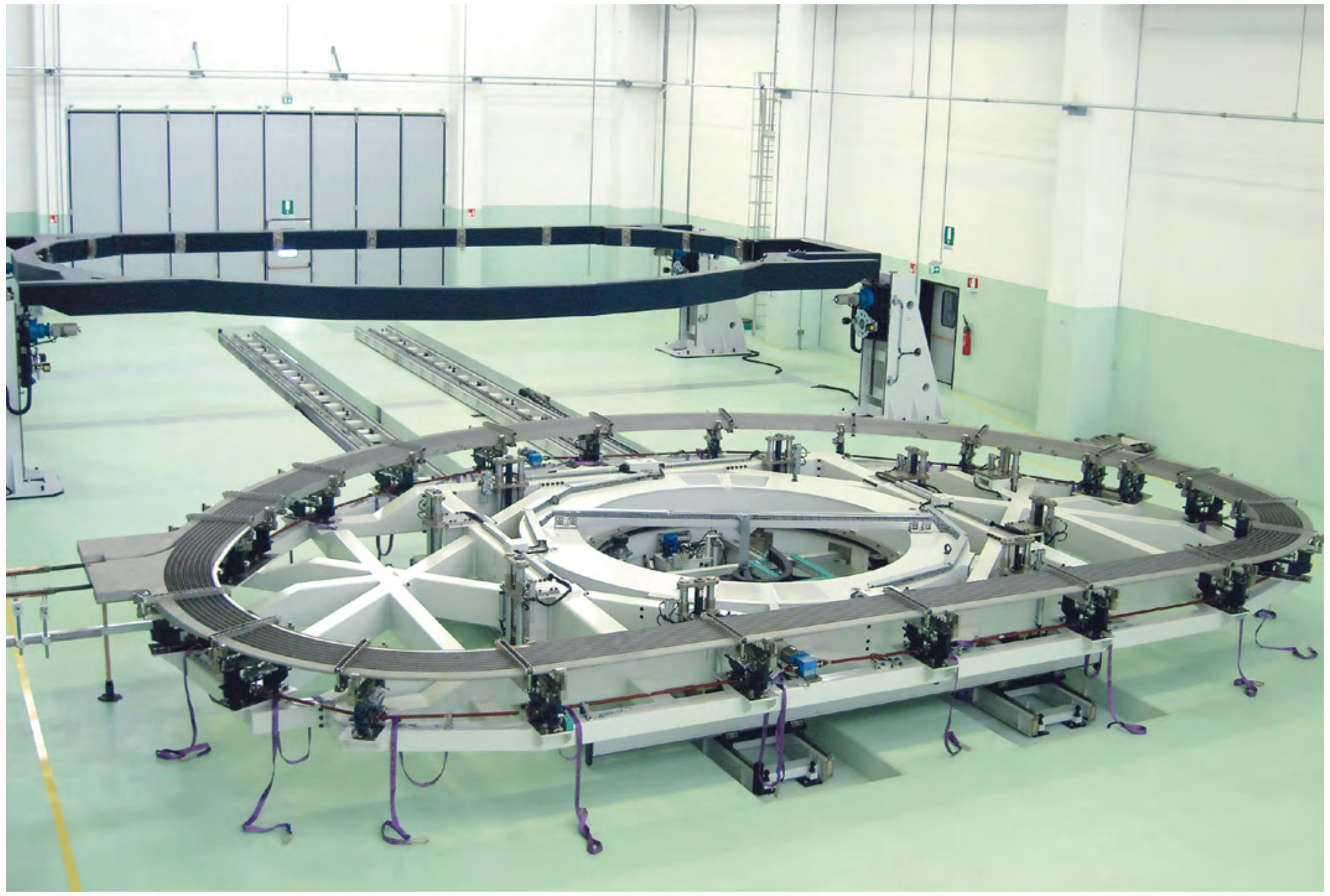
80,000 km
of niobium-tin (Nb3Sn) superconducting wires are used for ITER's magnets - this is long enough to wrap twice around the earth.

Learn more about the TF Coils

The TF coils are "D" shaped gigantic superconducting magnets that will create a magnetic cage to confine the plasma.
ITER will have 18 TF coils in total. Europe will manufacture 10 out of the 18 TF coils.
Each TF coil is 15 metres high, 9 metres wide and has a cross section of about 1m^2.
It weighs approximately 340 tonnes, which compares to six Boeing 737-800 planes!
These will be the biggest Nb3Sn magnets ever manufactured which will generate a magnetic field about one million times stronger the magnets of earth.



The double pancake prototype being wound at the ASG facilities in La Spezia, Italy (© ASG)



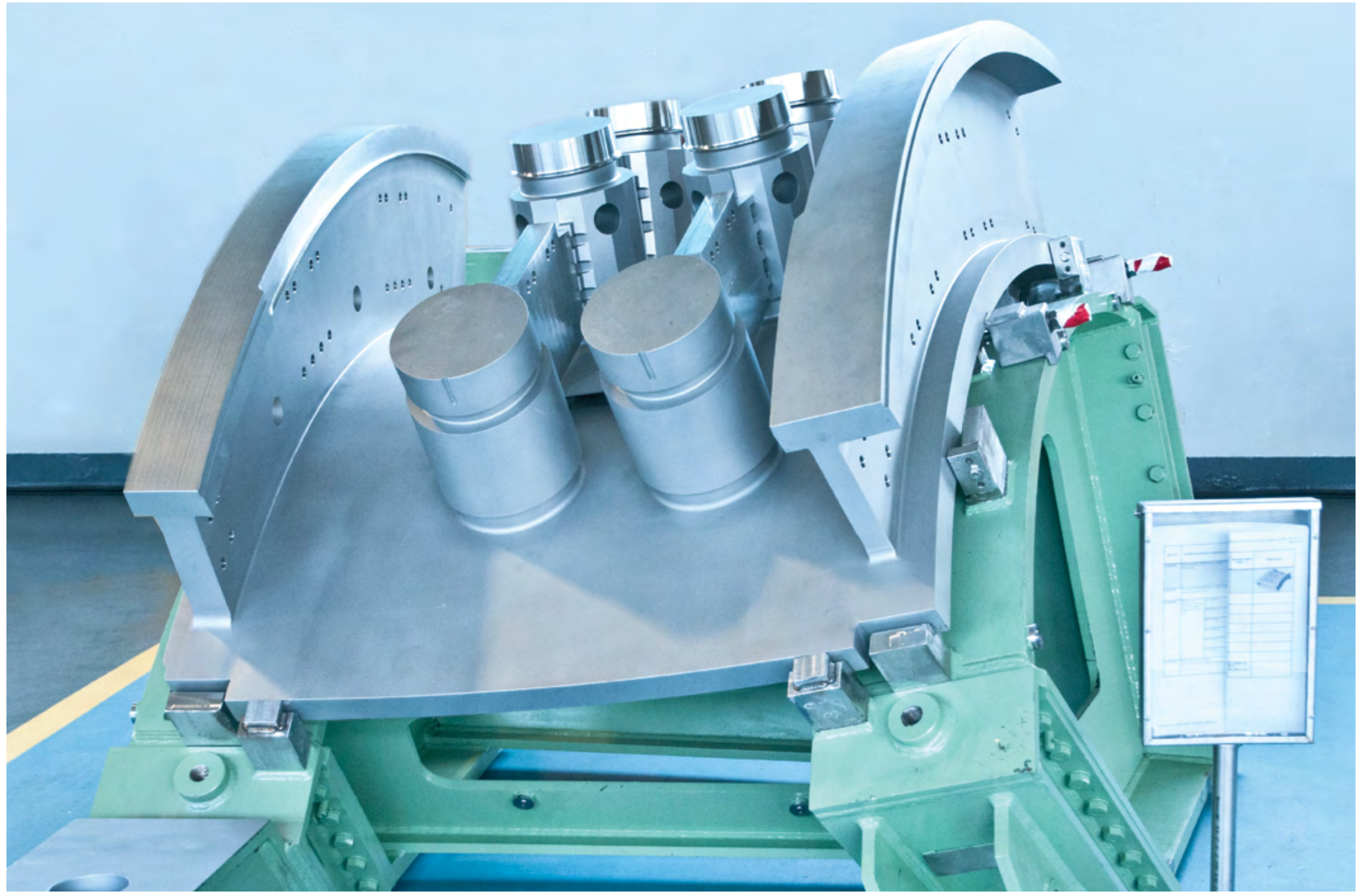
The wound conductor being inserted into the grooves of the metal plates (© ASG)

© Walter Tosto

The ITER Vacuum Vessel is the largest component of the machine.
It is located inside the cryostat and its main function is to host the fusion reaction.
Within this torus-shaped vessel, made of stainless steel, plasma particles collide and release energy without touching any of its walls due to the process of magnetic confinement.

Testing the Vacuum Vessel prototype

Europe is responsible for seven out of the nine sectors of the ITER Vacuum Vessel. The manufacturing of the prototype is nearly completed. Its aim is to test the technology that will be used during the production of the Vacuum Vessel sectors.



Vacuum Vessel port mock-up. ©Walter Tosto

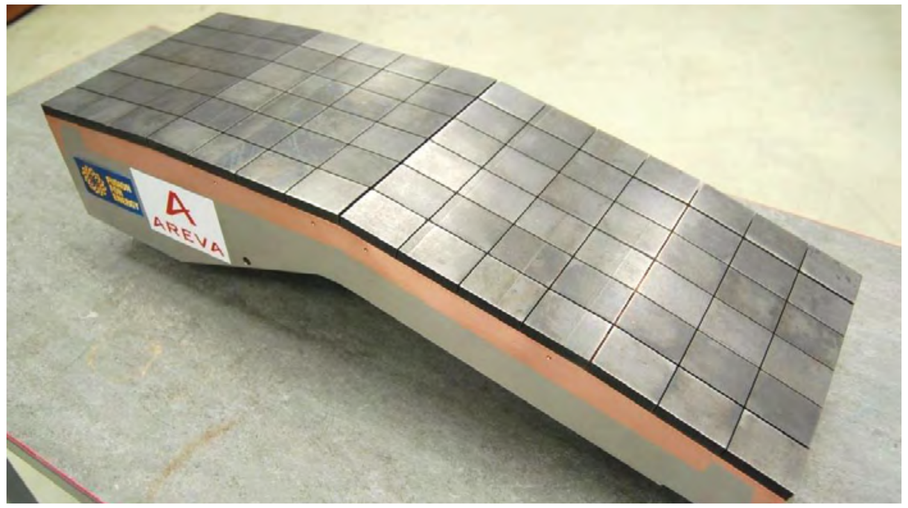
Bending testing of the prototype of the Vacuum Vessel is currently underway and carried out by Walter Tosto. The prototypes are three-dimensional, one-third of the size of the full-scale component and consists of austenitic steel which is advantageous in terms of being non-magnetic, non-corrosive and heat-resistant. The bend-testing is a vital step in manufacturing the full-prototype and is a vital milestone in Europe's work to deliver the ITER Vacuum Vessel.

Learn more about the Vacuum Vessel

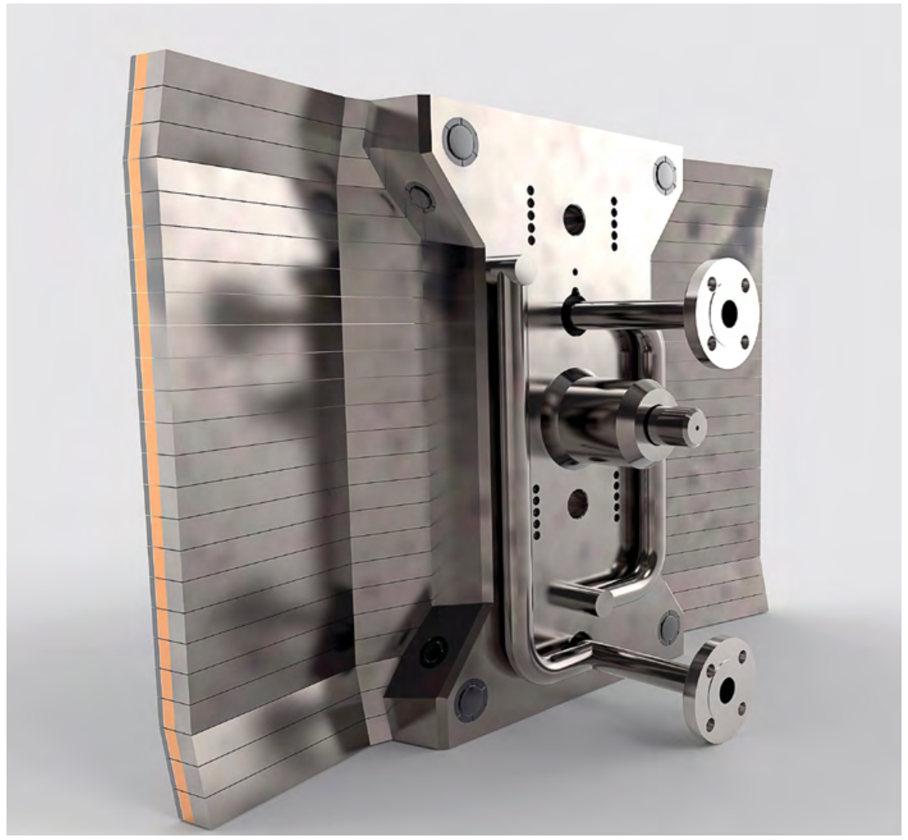
- 9 sectors in total: 7 will be manufactured in Europe and 2 in Japan
- The component will measure over 19 metres across by 11 metres high
- Each sector will be 13 metres high, 6,5 metres wide and 6,3 metres deep
- 500 tonnes the weight of each sector
- 5,000 tonnes the weight of the entire component
- 2 times bigger and 16 times heavier than any vacuum vessel in a previous Tokamak machine

ITER's First Wall Panels

A semi-prototype of the Blanket First Wall has recently been manufactured. It is about 1/6 of the actual panel which will be used in ITER. The wall itself will consist of 440 such panels.



The first wall panels are 1 metre x 1.5 metres detachable elements which together with the shield block (a block of stainless steel on which the first wall panels are fixed) form the Blanket modules. The Blanket is the part of the ITER machine that acts as a first barrier and protects the Vacuum Vessel, which is the heart of the ITER machine, from the neutrons and other energetic particles that are produced by the hot plasma. The First Wall consists of 440 panels, of which F4E will provide about half.

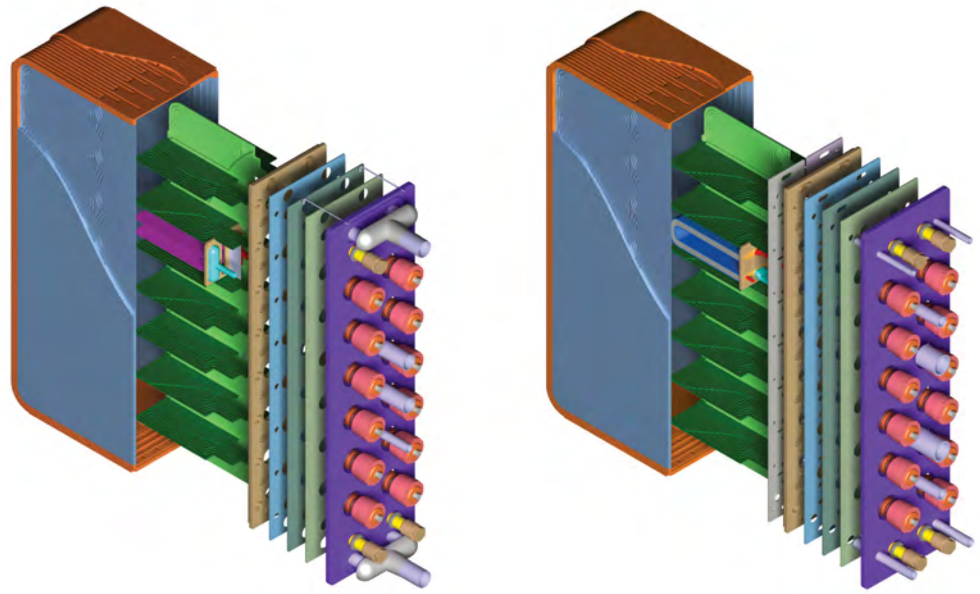


Top image: The semi-prototype of the Blanket First Wall. This prototype is about 1/6 of the actual panel which will be used in ITER.
The wall itself will consist of 440 such panels. © Areva, France

Bottom image: 3D imagery of full-size prototype of a blanket first wall panel. © ITER Organization

A new chapter for the ITER Test Blanket Modules

Apart from deuterium, ITER will require the administration of tritium in order to make the fusion reaction happen.
In DEMO, it will need to be bred continuously within the reactor in order to keep the fusion reaction going. How will this be achieved?



(Left to right) HCLL – Global view of the "Helium-Cooled Lithium Lead", HCPB- Global view of the "Helium-Cooled Pebble Bed" - © IDOM

Tritium can be produced within the reactor once the neutrons of the fusion reaction bounce on lithium, which is contained in the reactor's blanket. The objective is to test the prototypes of future breeding blankets in real fusion conditions offered by ITER and then export that knowledge to DEMO.

We have opened a new chapter in this field by collecting new data, developing new codes and extrapolating them to DEMO. This has been a real opportunity for Europe's research and industrial communities to collaborate and develop together a vital technology for fusion reactors.

The transition from research to licensing and fabrication is challenging. F4E has been collaborating with specialised engineering companies like IDOM, Atmostat, Iberdrola, AMEC, Empresarios Agrupados to take stock of their expertise. Similarly, for the design and qualification phases the input received by laboratories like KIT, CEA, ENEA, CIEMAT, UJV, KFKI, NRG, etc. has proved extremely valuable. Approximately 30 contracts have already been signed in this domain and the work has increased in volume.

In terms of the Test Blanket Modules structural materials, Europe has set its hopes on EUROFER, a newly developed reduced activation ferritic/martensitic (RAFM) steel developed in Europe, which provides adequate resistance to neutron irradiation, corrosion and with acceptable resistance at high temperatures.

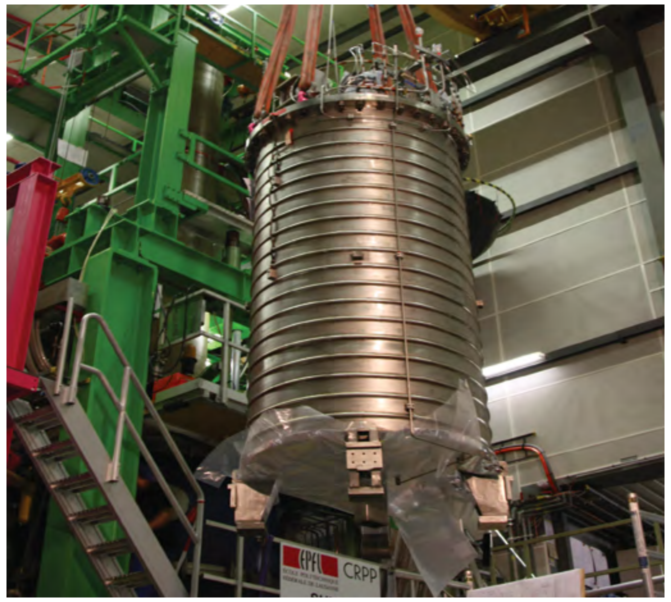
Learn more about the Test Blanket Modules

The Test Blamket Moduels are the prototypes of future breeding blankets that will be tested in real fusion conditions offered by ITER, and then all knowledge will be subsequently exported to DEMO. In essence, we are generating a new component and qualifying it in unprecedented conditions. Through this process, we are licensing a nuclear system based on advanced materials and top fabrication technology. This is a real opportunity for Europe's research and industrial communities to collaborate and develop together a vital technology for fusion reactors.

EDIPO: a world class facility for testing short samples of superconducting magnets

The European Dipole (EDIPO) facility, has reached world status offering the possibility to the fusion community to test short Cable-In-Conduit Conductors (CICCs) samples, rather than the whole magnet, at unprecedented high levels of magnetic fields up to 12.5 Tesla in order to verify their properties before production.

Switzerland's Paul Scherrer Institute (PSI), at the Centre of Research in Physics and Plasma (CRPP), is hosting this facility that has been constructed thanks to a collaboration that counts eight years, between CRPP, BNG (Babcock Nöll), F4E and the European Commission.
Europe's leading facility will be at the service of the entire fusion community. It has the potential of becoming an internationally renowned reference point in testing magnets technology.



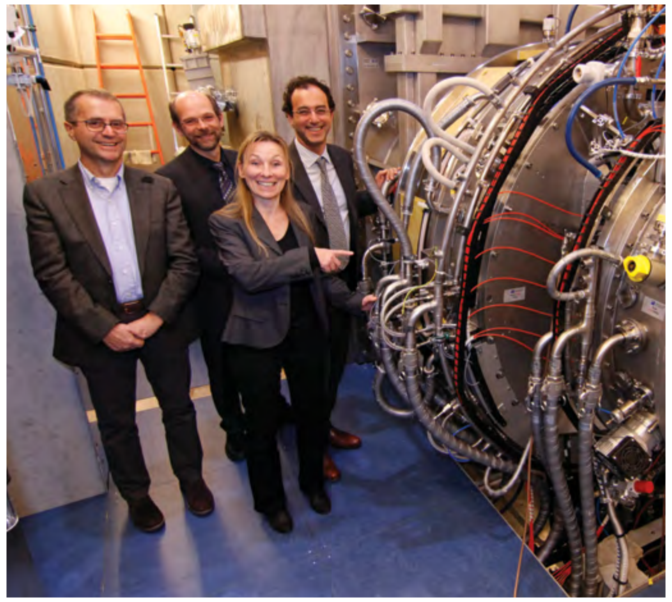
The EDIPO magnet getting ready to be inserted in the cryostat

World's largest test facility for negative ion sources ready to help ITER

The test facility of the ITER Neutral Beam Ion Source, ELISE (Extraction from a Large Ion Source Experiment), has been inaugurated at the Max Planck Institute for Plasma Physics (IPP) in Garching, Germany.

ELISE is a key experiment in conducting research to develop one of the main heating systems of ITER – the Neutral Beam Injector – which will contribute heating the plasma to million degrees necessary for a fusion reaction to occur. ELISE is funded by F4E by means of a contract worth about 4 million EUR.

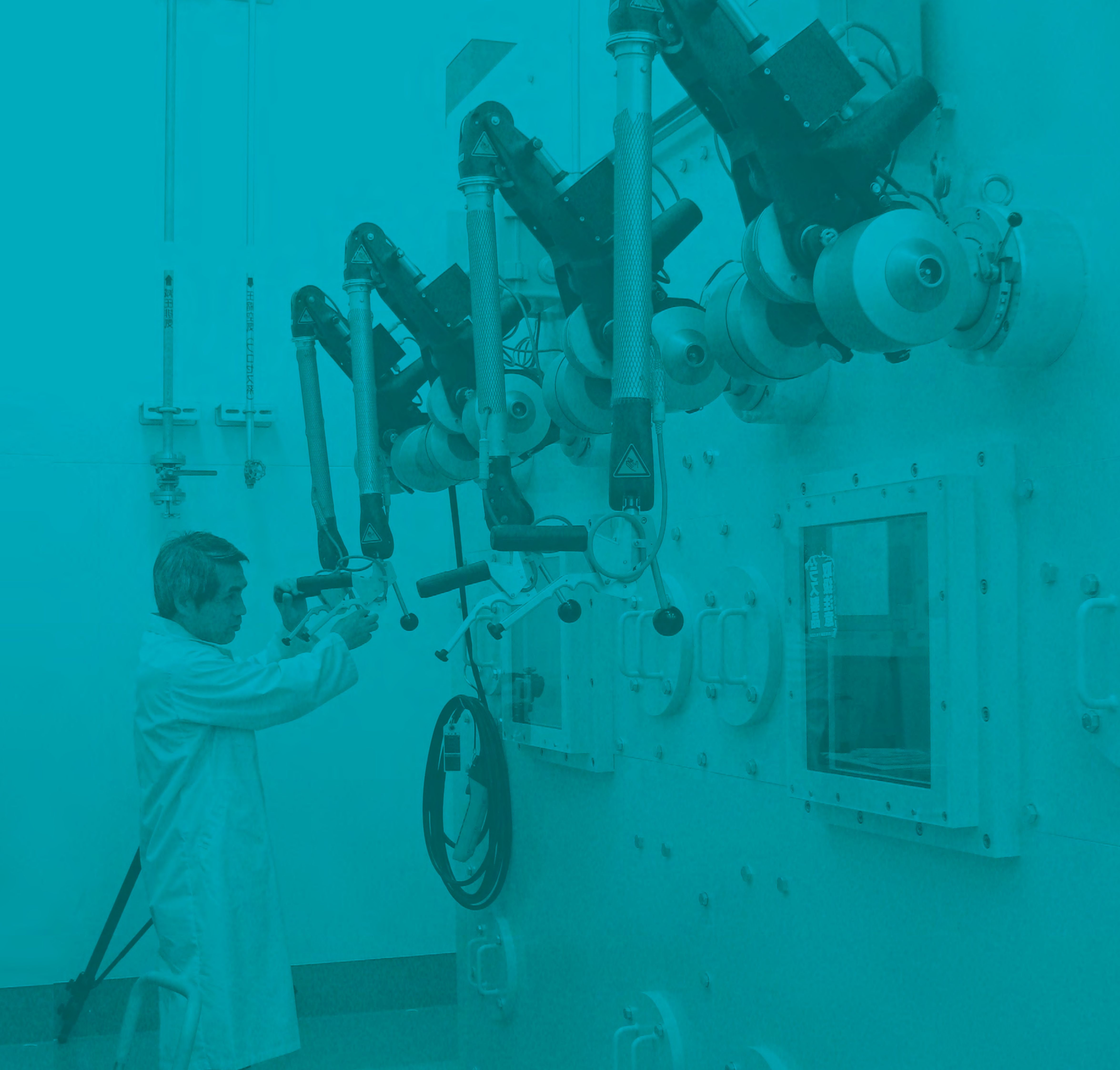
As the world's largest system of its kind, ELISE has taken three years to be assembled. The system's core is uniquely comprised of 640 ion beamlets, making up one beam which has an intensity of up to 20A and with energy up to 60keV. The overall beam has an area of approximately 1 m^2 and can reach 1.2 MW of power.



Representatives from F4E, IPP and ELISE attended the inauguration of the ELISE test facility in Garching, Germany

" ELISE has the first large radio frequency driven negative hydrogen ion source in the world "

Peter Franzen
Max-Planck-Institut für Plasmaphysik (IPP)



03

The Broader Approach

Boosting fusion know how through Research & Development

Thinking in broad terms and combining vision and precision in order to address short and long term challenges summarises the spirit of collaboration between Europe and Japan in the area of fusion research. In February 2007, an Agreement was signed between the two parties complementing the ITER project in order to accelerate the realisation of fusion energy through R&D and the development of key technologies.

The Broader Approach consists of three main projects, namely:

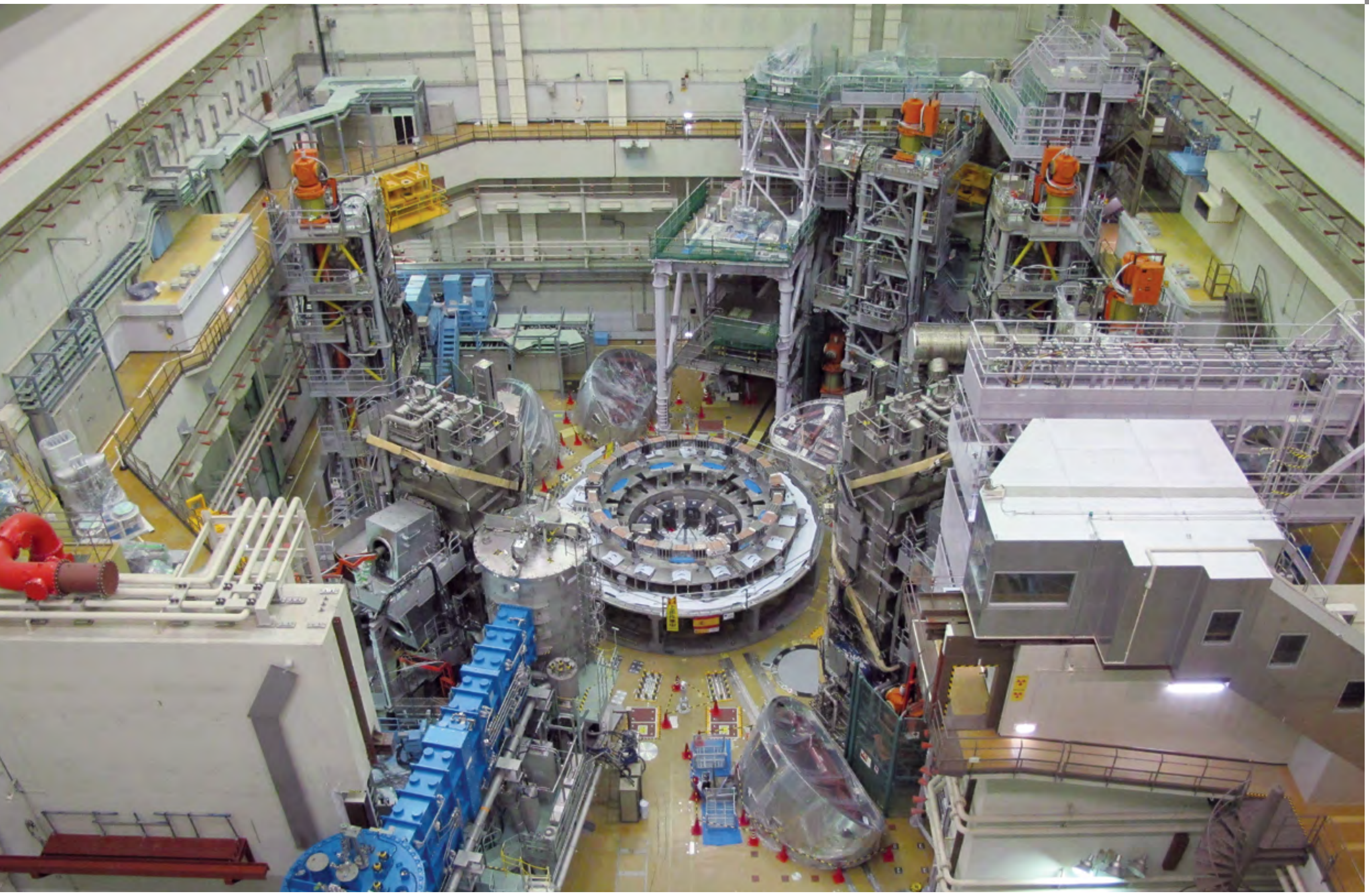
- The Satellite Tokamak Programme (STP) JT-60SA “satellite” facility of ITER in order to model proposals for optimising plasma operation
- The International Fusion Materials Irradiation Facility - Engineering Validation and Engineering Design Activities (IFMIF-EVEDA) to carry out testing and qualification of advanced materials in an environment similar to that of a future fusion power plant
- The International Fusion Energy Research Centre (IFERC) through the DEMO Design Research and Development Coordination Centre, the Computational Simulation Centre and the Remote Experimentation Centre

JT-60SA: The assembly of the Tokamak machine has begun

JT-60SA, the "satellite" facility of ITER to optimise plasma operations and investigate advanced modes that will be tested on ITER or DEMO, has achieved an important milestone.
The assembly of the machine has started with the Cryostat Base (CB), the first major component to be delivered by Europe.

The CB supports the weight of the entire Tokamak. It has a diameter of 12 metres, a height of 3 metres and weighs 250 tonnes. It consists of a double ring in three sectors, a lower structure in three sectors, and an inner cylinder and is assembled using connecting bolts. The manufacturing of the CB has been carried out in Aviles, Spain, by IDESA and final machining and pre-assembly was done by ASTURFEITO, under the supervision of CIEMAT.

JT-60 SA Tokamak assembly



Supercomputer bullx® series. © Bull

IFERC and GÉANT have joined forces for data highway in fusion research

An important collaboration between the International Fusion Energy Research Centre (IFERC) and GÉANT, the world's leading high-speed research and education network managed and operated by DANTE, has paved the way for a fast data highway that will be available to all fusion scientists around the world.

IFERC hosts Helios, one of the most powerful supercomputers in the world. The Helios supercomputer is provided and operated by the French Alternative Energies and Atomic Energy Commission (CEA), and is a resource of F4E.

Helios will be producing vast amounts of data, which need to be shared with scientists all over the world. Via the Japanese National Research and Education Network (NREN) SINET, IFERC is connected to the pan-European GÉANT network, and to all European NRENs, like RENATER, DFN, SWITCH, JANET and many others, supporting research activities for fusion in Europe.

Learn more about GÉANT

GÉANT is the high speed European communication network dedicated to research and education.
In combination with its NREN partners, GÉANT creates a secure, high-speed research infrastructure that serves 40 million users in over 8,000 institutions across 40 European countries.

04

Working together with stakeholders

In order to better serve the various communities that have a vested interest in the ITER project, we have developed different platforms to listen, understand and respond to their needs.
F4E explored together the different committees and the network of ITER Industrial Liaison Officers (ILOs) a series of measures that would stimulate further the participation of industry and SMEs.

F4E has delivered a new industrial policy

ITER is by far the biggest international partnership in the field of energy and it can only be realised in collaboration with industry, SMEs and research organisations. They are the backbone of this project and without their commitment commercial fusion will remain a distant dream. Therefore, getting the business sector on board and finding the best possible way to work together is high on the agenda. It is in Europe's interest to broaden its industrial capacity in this domain and improve its competitiveness in a field that promises to yield long term benefits.

One of the first objectives of the new industrial policy was to foster an open and constructive dialogue with industry, SMEs and the network of ITER Industrial Liaison Officers.
Four specific actions underpin this new collaborative framework:
first, F4E will proactively facilitate and assist with business opportunities;
second, financial risks will be shared with contractors and liabilities together with guarantees will be limited;
third, the rules in the field of intellectual property have been revised;
fourth, the administrative burden will be reduced.

Additional actions have started be introduced in order to ease business participation in F4E calls: more Info Days and awareness campaigns have been organised to reach out to stakeholders, financial compensation may be provided for the preparation of bids in the framework of competitive dialogue and last but not least, networking events between SMEs and large industrial suppliers will be planned.

There have also been modifications in the areas of financial risk and liabilities to help future contractors.

F4E will align the obligations and liabilities of contractors to standard industrial practices. In the area of Intellectual Property Rights (IPR), IP ownership in most cases will be in the hands of contractors. Furthermore, contractors will be offered the exclusive rights for the exploitation of IP acquired in the fields outside fusion and non-exclusive rights in the field of fusion.

Cutting down the administrative burden is another commitment undertaken by F4E. Standardised tender documentation and model contracts will be created.

Finally, we will be moving towards E-procurement and further improvements on the Industry and European Fusion Laboratories portal will be implemented.

"Europe's contribution to ITER is an opportunity for industry. In essence this means jobs, growth and knowledge that will generate new technologies and open new markets"

Professor Henrik Bindslev
Director of Fusion for Energy

"ITER offers the possibility to build new business partnerships for new energy markets"

Sabine Portier
ILO France

"The knowledge that we will acquire from ITER will be deployed in markets exploring the use of hydrogen and helium"

Xavier Vigor
CEO Air Liquide Advanced Technologies

"A project like ITER will improve the capability of industry in terms of engineering, fabrication and create spin-offs for other business"

Kurt Ebbinghaus
ILO Germany

"Thanks to ITER we managed to grow as a company and improve both on project management and technical aspects"

Marianna Ginola
SIMIC Commercial Manager

"ITER is not a project only for big players"

Christian Dierick
ILO Belgium

05

Events

Spreading the word on Europe's contribution to ITER

F4E participated in 21 events in order to promote different aspects of its work to diverse target groups such as companies, technology communities, scientists, policy-makers and younger audiences. In this section we look back at some of the key events that marked the year.

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The inauguration of the ITER International Organization Headquarters

The brand new ITER Headquarters Building in Cadarache has been inaugurated by the EU Commissioner for Energy Günther Oettinger and Geneviève Fioraso, French Minister of Higher Education and Research.
Together with the Director General of ITER International Organization, Professor Osamu Motojima, they unveiled the marble plaque that was created for the entrance of the building. In his opening speech the Commissioner outlined the EU's intention to support ITER's work.

ITER IO Headquarter's building – © ITER IO

Geneviève Fioraso, Günther Oettinger and Osamu Motojima, unveil the plaque – © ITER IO

Building specifications:

- Construction period: 2 years (August 2010-August 2012)
- Surface: 20,500 m²
- Length: 180 metres
- Height: 20 metres
- Storeys: A basement and five storeys (6 levels)
- Capacity: office space for about 500 people
- Rudy Ricciotti, architect / Laurent Bonhomme, architect / SNC-Lavalin / Cap-Ingelec

“ ITER, one of the world's biggest scientific collaborations, has a key role to play in establishing fusion as a sustainable energy source. Moreover, it benefits the economy of the countries, especially through the high tech SMEs sector. With ITER being located on EU territory we play a key role in global energy technology research now and in the future ”

Commissioner Oettinger.
EU Commissioner for Energy

ITER Business Forum: industry and SMEs roll up their sleeves to deliver ITER

Company representatives exchanging contacts during the IBF business meetings

750 participants from at least 350 companies based in 26 countries have met in the context of thematic sessions, discussions, networking events and one to one business meetings.

The third ITER Business Forum (IBF) was by all means the biggest and most diverse in terms of participation. The response from industry, SMEs and fusion laboratories has grown for two main reasons: first, there has been real progress in the areas of construction and manufacturing with companies seeing the different pieces of the puzzle a bit more clearly; second, contracts have been signed and companies have moved from the learning curve to the phase of delivery.

Fusion technology breakthroughs and business incentives join forces at ISFNT-11

The International Symposium on Fusion Nuclear Technology (ISFNT-11) has gathered more than 800 participants with particular focus on plasma technology, breeding blanket technology, the Broader Approach and DEMO in order to exchange know-how, debate technology breakthroughs and report on new achievements carried out by fusion laboratories and industry.

Right to left: H.Bindslev, F4E Director, welcomes P.Torres, Secretary of Enterprise and Competitiveness of Catalonia and J.Sanchez, CIEMAT Director at the F4E exhibition stand

During the different sessions, industry and SMEs had the opportunity to present the direct benefits through their involvement.

The Director of F4E Professor Henrik Bindslev, took the opportunity to welcome all participants to Barcelona, the seat of F4E, and highlighted the need for closer collaboration between laboratories, industry and policy-makers. “We need to work in this knowledge triangle and deliver fast. We need to build communication channels between these communities so that technology breakthroughs turn into commercial realities” he explained.

Professor Osamu Motojima, ITER IO Director General with Jean-Marc Filhol, F4E Head of ITER Department

Energy decision makers meet at MIIFED 2013

The Monaco International Fusion Energy Days (MIIFED) have celebrated their second anniversary between 2nd and 4th of December gathering 350 guests from policy, industry and research at the Grimaldi Forum.

Maria van der Hoeven, Executive Director of the International Energy Agency (IEA), delivers MIIFED keynote lecture

Members of the F4E delegation to MIIFED meet at the corporate stand

MIIFED has become a platform for further cooperation in the fields of energy-related research across a wide web of actors. The Principality of Monaco has also been linking this event to the financing of five Post-Doctoral Fellowships awarded every year.

The event has grown in size and ambition. Prestigious keynote speakers at the opening ceremony launched interesting debates which continued in the 20 roundtable sessions. Delegations from different ITER Domestic Agencies and ITER International Organization took this opportunity to report on the state of the project and their respective procurement packages. The global energy landscape, the policies and the industrial challenges we still face as well as the opportunities ahead, were at the centre of this conference.

“ITER and fusion energy have a tremendous potential to change the world”

Maria van der Hoeven
Executive Director of the International Energy Agency (IEA)