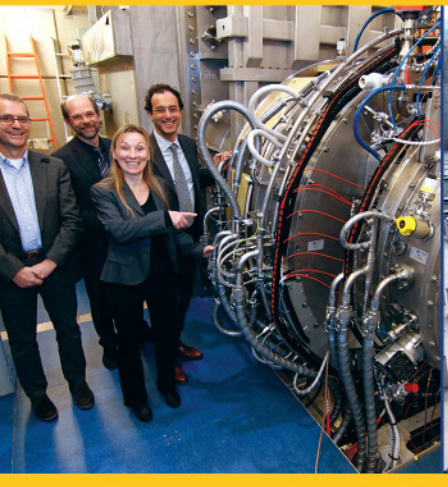
FUSION FOR ENERGY

ANNUAL REPORT **2012**



FUSION FOR ENERGY

Annual Report 2012

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2012 FACT SHEET

Name:	The European Joint Undertaking for ITER and the Development of Fusion Energy or "Fusion for Energy" (F4E)
Objectives:	(a) Providing Europe's contribution to the ITER international fusion energy project; (b) Implementing the Broader Approach agreement between Euratom and Japan; (c) Preparing for the construction of demonstration fusion reactors (DEMO).
Location:	Barcelona, Spain
Established:	19 April 2007 for a period of 35 years
Founding Legal Act:	Council Decision No. 2007/198/Euratom of 27 March 2007 establishing the European Joint Undertaking for ITER and the Development of Fusion Energy and conferring advantages upon it.
Director(s):	Didier Gambier (1 October 2007 - 15 February 2010) Frank Briscoe (16 February 2010 - 15 August 2012) Hans Jahreiss (Interim Director from 16 August – 31 December 2012) Henrik Bindslev (from 1 January 2013 - present)
Governing Body:	Governing Board (Chair: Stuart Ward, Members: 27 EU Member States, Euratom and Switzerland)
Subsidiary Bodies:	Bureau (Chair: Stuart Ward, 8 Members) Administration and Finance Committee (Chair: Cor Katerberg, 11 Members) Executive Committee (Chair: Lisbeth Grønberg, 13 Members) Technical Advisory Panel (Chair: Joaquin Sánchez, 13 Members) Audit Committee (Chair: Beatrix Vierkorn-Rudolph, five Members)
Staff:	331 (211 Officials and Temporary Agents and 120 Contract Agents)
2012 Budget:	EUR 1,263.09 million in commitment appropriations EUR 344.13 million in payment appropriations
Budget Implementation:	99.9% in commitment appropriations and 94.5% in payment appropriations
Operational Contracts:	54 signed for a total value of EUR 736 million (41 launched)
Administrative Contracts:	19 signed for a total value of EUR 13 million (eight launched)
Grants:	16 signed for a total value of EUR 20 million (16 launched)
ITER Credit Awarded:	12.86 kIUA (equivalent to EUR 20.8 million) during 2012

STUART WARD **CHAIR OF THE F4E GOVERNING BOARD**

Foreword by the Chair of the Governing Board

It is a pleasure to introduce the fifth Annual Report of Fusion for Energy (F4E) — the European Joint Undertaking for ITER and the Development of Fusion Energy.

Fusion is the process that powers the sun and stars. Recreating fusion on earth is very challenging and involves temperatures around 150 million degrees Celsius which is around ten times hotter than the core of our sun. That is the challenge for ITER.

ITER is a major international project at the cutting edge of science and engineering development that aims to demonstrate the potential of fusion to provide energy supplies for centuries to come. It is hard to put the scale and size of ITER into perspective, but perhaps three facts will help:

- The ITER device will weigh 23,000 tons, approximately three times as heavy as the Eiffel Tower and is made up of over one million components;
- Around 5,000 people will be employed in 2014/15 at the height of construction on a site as large as about sixty football pitches;
- About 80,000 kilometres of niobium-tin superconducting multifilament wire, twice the earth's circumference, are required for ITER's toroidal field magnets.

Not only is ITER an ambitious scientific and technical undertaking, it is also a global project which brings together 34 countries representing over half of the world's population: China, India, Japan, Korea, Russia, United States and Europe, representing the 27 countries of the European Union (shortly to be joined by Croatia) together with Switzerland. Fusion for Energy, or "F4E" for short, is the organisation providing almost one half of the components for ITER as Europe's ITER Domestic Agency (DA), with the other six member nations providing the remaining components.

During 2012, ITER has made significant progress in site preparation and in the construction of buildings, facilities and infrastructure for which Europe is principally responsible. The site preparations are now finished and ground support structure and seismic foundations for the tokamak complex, where the fusion experiment will be housed, have been completed during 2012. The first building on the site, for the fabrication of the poloidal field coils, was completed. Work also proceeded apace with the foundations of the assembly building and the contract for the construction of the tokamak complex was awarded by F4E. The main administration building has also been completed and the ITER Organization staff have now transferred into this building. An ITER Council meeting was held in the new building in November 2012.

An important milestone for the ITER project was achieved in June 2012 with the granting of the licence for the construction of the ITER nuclear installation. This decision, by the French Nuclear Safety Authority, is the culmination of an intensive process that started some years ago and I would like to take the opportunity to congratulate the ITER Organization, with significant support from colleagues in F4E, for the successful outcome.

In other areas of ITER technology under F4E's responsibility (the magnet systems, vacuum vessel, in-vessel systems, fuel cycle systems, plasma heating systems, diagnostics and test blanket modules), this Annual Report testifies to good progress. Almost 90% of the principal items to be procured by F4E are now agreed and F4E is moving from preparatory activities, such as R&D, prototyping and qualification, to manufacturing and industrial fabrication. A major contract has also been let for transport and logistics to ensure that all the various items from around the world can be brought safely and securely to the ITER site at Cadarache in southern France.

It is gratifying to report that there are now employees in European industries and fusion research laboratories in over 20 EU Member States and Switzerland engaged in cutting-edge R&D, design and fabrication work for F4E. In 2012 over 50 contracts were signed by F4E for a value approaching EUR 750 million and 16 grants with a value of EUR 20 million. By the end of 2012 the total value of running contracts exceeded EUR 1,600 million.

Inevitably in a project of this scale and complexity, delays and setbacks occur. In particular, the finalisation of the specifications for tokamak building and vacuum vessel was late and this has delayed the start of work for these components, but these are now underway. Also a major procurement for the fabrication of the poloidal field coils had to be cancelled by F4E in the absence of an acceptable offer, despite lengthy negotiations. A revised procurement approach has recently been agreed and launched.

Considering the ITER Project as a whole, progress in the achievement of milestones continues to be been slower than planned. The ITER Council, at which the European Commission represents Europe, met twice in 2012 and it underlined the importance that the ITER Organization and seven DAs should make all efforts to recover delays in the schedule and seek cost savings wherever possible.

The collaboration between Europe and Japan known as the "Broader Approach" is proceeding well. The "Helios" supercomputer, located in Rokkasho, was installed during 2012 and the fusion research communities in both Japan and Europe have already completed a number of computational projects. The cryostat base for the Satellite Tokamak project, manufactured by CIEMAT, the Spanish partner in the project, was completed and shipped to Japan. The superconducting coil strands required for the magnets for this project have also been manufactured. Finally, good progress has been made with the preparation, manufacturing and testing of the LIPAc injector in preparation for its shipment to Japan in mid-2013.

The F4E Governing Board met on five occasions during 2012. Following the retirement of Frank Briscoe as Director of F4E in August 2012, a major task has been the identification and appointment of a new Director. Henrik Bindslev, previously Vice-Dean for Research in Science and Technology at Aarhus University, was selected as F4E Director and started work in January 2013.

The Governing Board has paid close attention to the budget for the European contribution to the project (EUR 6.6 billion (in 2008 values)) and has encouraged F4E to pursue with vigour all cost containment actions which are under its direct control. The Governing Board has also emphasised that cost containment by the ITER Organization is vital and has encouraged the European Commission to support F4E in this regard.

The Governing Board has adopted an industrial policy which is expected to be approved by the European Commission in May 2013. On this basis, the Governing Board has invited F4E to develop proposals on how the industrial policy will be implemented. In 2012 the policy on intellectual property rights and rules for its implementation were also adopted by the Governing Board.

In response to a request by the European Competiveness Council, an independent expert (Deloitte Advisory S.L.) was appointed by the Governing Board in 2011 to carry out the first annual assessment of F4E. Deloitte presented its conclusions to the Governing Board in June 2012. The Governing Board welcomed the reassurance it gave on F4E's overall contribution to the ITER project and submitted the report with its own comments to the Council.

The F4E Director, with strong support from the Governing Board, has consolidated the management and organisational improvements that were initiated in 2011. For the first time, both the F4E Director and the Governing Board itself adopted a number of corporate objectives which were monitored during the course of the year. The Governing Board, with the support of its Audit Committee, has also continued to supervise the follow-up of recommendations from internal and external audits of F4E's activities.

I would like to thank the members of the Governing Board for their advice and encouragement throughout the year as well as the members of the subsidiary bodies of the Governing Board: the Bureau, Administration and Finance Committee, the Executive Committee, Technical Advisory Panel and Audit Committee. In particular, I would like to thank Cor Katerberg, Lisbeth Grønberg, Joaquín Sánchez and Beatrix Vierkorn-Rudolph for chairing these bodies.

I would also like to acknowledge the collaboration and support that I received from the European Commission, in particular from the Director-General for Research and Innovation, Robert Jan-Smits, and Hervé Pero, the former acting Director of Energy responsible for ITER and F4E matters.

I would like to express my appreciation for the skill, dedication and professionalism of the former F4E Director, Frank Briscoe, who retired in August 2012 and, among many achievements, introduced a new project-orientated organisational structure and culture at F4E. I would also like to thank Hans Jahreiss for serving as Interim Director of F4E in the period prior to the appointment of Henrik Bindslev as F4E's new Director with the support of the Heads of Department.

None of F4E achievements would have been possible without the skill, dedication and professionalism of its staff. On behalf of the Governing Board, I would like to offer them our warm support and thanks.

Mr Stuart Ward
Chair of the F4E Governing Board
24 May 2013

HENRIK BINDSLEV **DIRECTOR OF FUSION FOR ENERGY**

Foreword by the Director of F4E

I am very pleased to introduce F4E's fifth Annual Report and describe how we have delivered Europe's contributions towards the international ITER and Broader Approach fusion energy projects during 2012.

Before going further, I should like to acknowledge the work carried out by my predecessor, Frank Briscoe, who retired in August 2012 who oversaw a widely lauded transition of F4E to a more project-orientated organisation.

I should also like to take the opportunity to acknowledge the valuable contribution of Hans Jahreiss, who served as Interim Director of F4E with the support of the two Heads of Department, Jean-Marc Filhol and Pietro Barabaschi, until my appointment in January 2013.

In relation to the ITER project, F4E has continued to carry out its activities following the agreed baseline and steady progress has been made on many fronts as testified in this Annual Report.

At the ITER construction site at Cadarache, there is visible evidence demonstrating that the construction of the ITER project is well underway. In February 2012 the first building (250m long, 45m wide and 17m high) for the fabrication of the poloidal field coils was completed and handed over to the ITER Organization.

Progress has been made with the foundations upon which the tokamak building will sit. A joint team of F4E staff and around 200 contractor staff completed the works for the tokamak pit in April 2012; over 200,000m^3 of rock was excavated, the retaining walls were made, the lower basemat was laid, and on top of the lower basemat all of the 493 concrete plinths and their anti-seismic bearings were constructed.

Construction of the upper basemat in the 90m by 130m tokamak pit was delayed due to a problem which was detected following the Fukushima earthquake accident analyses. In particular, it was established that the design of the cryostat support system (18 steel legs) was not sufficiently strong to withstand some new accident loads and that significant design modifications were needed. To minimise the impact of these delays, F4E managed to reschedule work.

In relation to the tokamak building itself, the tender process, which had started in January 2011, was concluded by the end of the year with the signature of one of F4E's largest civil engineering contracts which is expected to run for five and a half years with a budget in the region of EUR 300 million. I am pleased to report that work on this contract commenced at the end of April 2013 on the basis that specifications are provided in stages by the ITER Organization, floor by floor.

Work advanced on the foundations of the 6,000m^2 assembly building work site whereby 1,400 tons of steel reinforcement was laid prior to the pouring of the reinforced concrete. The resulting concrete slab, 2.2m thick at the edge and 1.2m thick in the centre, will support the 57m high steel structure of the building. The steel reinforcement work is expected to be completed around February 2013. Work has also advanced on the systems for drainage and other critical networks and a 3,500m^2 area for parking, modular buildings and storage areas for building contractors.

In parallel, under the management of Agence ITER France, the electrical switchyard was constructed and the grid connection was made. The new ITER headquarters, an emblematic five-storey building which offers 19,000m^2 of workspace divided in 242 offices and meeting rooms was also completed and the ITER Organization staff moved in during the last few months of the year. In early 2012 the ITER Organization took over the full responsibility for the ITER site from Agence ITER France.

In addition to providing all of the buildings, F4E is providing many of the most important ITER machine components and I will attempt to bring out some of the highlights in the following paragraphs.

For the superconducting magnets 68.3 tons of Nb_3Sn strand has been produced. The fabrication facilities for the toroidal field coils are now in place and the first production lengths of jacketed conductor have been made. Prototypes of the regular and side radial plates have been successfully fabricated. The contract for the series production of the radial plates and pre-compression rings was signed. Regretfully it was not possible to reach a successful conclusion to the negotiation of the contract for the manufacture of the poloidal field coils and F4E has recently cancelled the tender and initiated a new procurement strategy.

Moving to the vacuum vessel, although the contract for the fabrication of the seven sectors was signed in late 2010, the input design from the ITER Organization was not made available until summer 2012 which is later than originally foreseen. Nevertheless, progress has been made in several areas including the manufacture of mock-ups, in particular, the qualification of the new precision forming and deep welding of the 60mm thick steel shell.

For the in-vessel systems, a contract was awarded for the fabrication of first wall panels prototypes that will protect the ITER vacuum vessel from the hot plasma. A procurement arrangement was signed for the divertor cassette integration and two contracts were signed for the manufacturing of inner vertical target full-size prototypes. In the area of remote handling, a procurement arrangement for the divertor remote handling system was signed and a new grant started for the validation of various aspects of divertor remote handling. A grant in support of the neutral beam remote handling conceptual design was completed in view of preparing the associated procurement arrangement.

In the areas of the cryoplant and fuel cycle systems, good progress was made with the completion of a number of preparatory activities. The procurement arrangement for the water detritiation tanks was signed and the associated procurement procedure was prepared for launch in spring 2013.

Concerning the radio and microwave heating systems that will heat the plasma, very good progress had been made towards the completion of the detailed design of the ion cyclotron heating antenna and the design of the electron cyclotron heating upper launcher was almost completed. The procurement strategy for the electron cyclotron power supplies was defined and the technical specifications for the call for tender prepared.

Moving to the neutral beam heating systems, there has been much progress in the establishment of the Neutral Beam Test Facility (NBTF) hosted by Consorzio-RFX in Padova, Italy under an agreement with F4E which was concluded in 2011. During 2012, F4E awarded several procurement contracts with a value of over EUR 15 million allowing for manufacturing of the necessary components ahead. The construction of the buildings on the site in Padova for two test beds progressed well. I am also pleased to report that ELISE, the world's largest test rig for ion sources, entered into operation.

In the area of diagnostics, significant progress has been made during 2012 with design of the magnetics diagnostic under several grants and through the signature of framework partnership agreements for the development and design phase of several other diagnostics systems including tokamak services, plasma position reflectometry, the radial neutron camera, radial gamma ray spectrometer and the pressure gauges.

Progress has been made in the design and development of the test blanket modules with the completion of four grants and one contract which is being followed by the launch of several new contracts and grants. Last but not least, significant effort has been devoted to providing engineering and analysis support to all of the above areas under F4E's responsibility in particular for plasma engineering, safety and licensing, engineering support, nuclear data and quality assurance.

In total, five procurement arrangements were signed with the ITER Organization in 2012 meaning that close to 90% (in value) of the procurement arrangements for all the components under Europe's responsibility have now been concluded. In addition, F4E was awarded credit (12.9 kIUA or EUR 26.3 million) in recognition, among others, of the completion of activities in the areas of the buildings, power supplies and neutral beam systems.

To implement the commitments in the ITER procurement arrangements, F4E awarded 54 operational contracts and 16 grants to industries, laboratories and other organisations for a total value of almost EUR 750 million bringing the value of running contracts that were under F4E's responsibility by the end of the year to around EUR 1.6 billion. At the same time, 57 new procurement or grant procedures were launched, of which 65% were launched by the planned yearly quarter or earlier.

Moving to the Broader Approach (BA), the Satellite Tokamak project made considerable progress. The first EU contribution, the cryostat base (provided by CIEMAT/Spain), was manufactured and shipped to Japan on schedule. Contracts for the cryoplant (CEA/France), switching network units (ENEA/Italy) and toroidal field coils casings (ENEA/Italy) were placed. The toroidal field coil test facility (Belgium) was also completed. The production of strand for the magnets (10,200km of NbTi and 5,100km copper) were completed in 2012.

For the BA's International Fusion Materials Irradiation Facility project, the new Project Leader took up his duties in June 2012 and a new organisation of the project team was approved. Progress has been achieved in several areas and one of the highlights is that the first deuteron beam was extracted from the LIPAc accelerator source in spring 2012 and the final acceptance tests were successfully performed in November 2012 with a long duty cycle, up to continuous beam.

The BA's International Fusion Energy Research Centre project has made the transition from a preparatory phase to an operational phase, with two of its three subprojects entering exploitation phase at the Rokkasho site in Japan. In particular, the "Helios" supercomputer was officially inaugurated in March 2012 and came fully into operation in April 2012 - on schedule. According to benchmarks, "Helios" is ranked 12th in the world ranking of supercomputers. The laboratory for DEMO R&D activities was also fully licensed, and research activities in materials have started.

Throughout the reporting period F4E has been working closely with the ITER Organization and the other ITER Domestic Agencies (DAs) via two initiatives introduced in 2012: the ITER High Level Coordination Team and the "Unique ITER Team". These bodies aim to foster a deeper collaboration and allow for more efficient and rapid decision making. I would like to take this opportunity to express my appreciation for the excellent spirit of cooperation I have enjoyed with Professor Osamu Motojima, ITER Director General and his management team.

Cost containment continues to be the leitmotiv guiding F4E decision-making on many levels. In relation to the contingency, I consider the situation to be precarious and in 2013 I have launched a number of initiatives that should allow F4E to make progress in the development of a new cost baseline and framework for the implementation of cost containment and reduction measures.

Concerning the schedule, a significant effort has been made by F4E in 2012 to support the development of detailed work schedules for the procurement packages under F4E's responsibility. At the same time, F4E's integrated project management and reporting systems have gone live which should allow for an improved monitoring of the project progress. Last but not least, there have been joint efforts with the ITER Organization and other DAs in several areas to help mitigate delays in the schedule. As recognised in the first annual assessment of F4E, the complex decision making processes of the ITER system (the ITER Organization and seven DAs) are not conducive to rapid decision-making.

In relation to culture, a first set of corporate objectives and their related key performance indicators was introduced for 2012. The corporate

objectives were translated into main priorities at the lower levels, and staff objectives have been aligned with organisational ones. Achievement of the corporate objectives has been reported upon throughout the year to the Governing Board and other supervisory bodies. This is a first step towards a more results-oriented culture that I plan to reinforce in the coming years.

In the first annual assessment of F4E conducted by Deloitte Advisory S.L. on behalf of the Governing Board, it is noted that "F4E's contribution to the ITER project is progressing reasonably bearing in mind that F4E's performance depends to a large degree on the ITER Organization information and input". F4E has drawn up an action plan in response to the recommendations of Deloitte and this was presented to the Governing Board.

In 2012 F4E managed its largest budget to date of EUR 1,263.09 million in commitment appropriations and EUR 344.13 million in payment appropriations. It should be noted, however, that the budget for commitments and payments initially adopted by the Governing Board in December 2011 had to be reduced at the end of 2012 by 7% and 32% respectively to order for it to be implemented. Furthermore, 44% of the 2012 budget in commitments is to be implemented in 2013.

At the same time F4E has continued to recruit personnel throughout 2012 and by the end of the year there were almost 350 staff in place. I am pleased to report that the vacancy rate in 2012 and the percentage of F4E's payments spent on staffing continue to fall. An important activity in 2012 was also the development of a revised personnel policy and estimation of staffing needs that were presented to the Governing Board on two occasions

Much effort continued to be devoted to responding to the recommendations from internal and external audits. At the same time, F4E is close to fully implementing the Internal Control Standards while complying with the ITER-wide quality requirements which follow the requirements of the French Nuclear Safety Authority.

Since my appointment on 1 January 2013 I have appreciated the effective cooperation between F4E and the European Commission for which I would like to thank the Director-General for Research and Innovation and European Representative at the ITER Council, Mr Robert-Jan Smits and the dedicated staff in his service.

I would also like thank Stuart Ward, Chair of the F4E Governing Board, as well as the Chairs and members of the Governing Board's subsidiary bodies for the confidence they have placed in me. I would like to conclude by expressing my appreciation for the F4E managers and staff whose professionalism and dedication has enabled impressive progress to be made in the face of many technical, administrative, organisational and political challenges.

Professor Henrik Bindslev
Director of Fusion for Energy (from 1 January 2013)
21 May 2013

Chapter 1

Introduction

Introduction

In face of the increasing global demand for energy and the economic, political and environmental risks of using fossil fuels, energy produced by fusion has the potential to make a major contribution to a diverse, sustainable and secure energy supply system in a few decades from now.

To advance fusion energy research close to the point at which the first demonstration commercial reactor could be constructed, Europe has entered into two international agreements:

- Agreement for the Establishment of the ITER International Fusion Energy Organization (the ITER Organization) for the Joint Implementation of the ITER Project (with China, Korea, India, Japan, the Russian Federation and the USA);
- Agreement for the Joint Implementation of the Broader Approach Activities in the Field of Fusion Energy Research (with Japan).

The European Joint Undertaking for ITER and the Development of Fusion Energy or Fusion for Energy (F4E) has been set up to provide Europe's contribution to these two projects and, in the long term, to prepare for the construction of a demonstration fusion reactor and material test facilities.

The signing of the ITER Agreement on 21 November 2006 at the Élysée Palace in Paris. Present are French President Jacques Chirac, European Commission President José Manuel Barroso and some 400 invited guests including high-level representatives from the ITER Parties and European Member States (courtesy of ITER Organization)

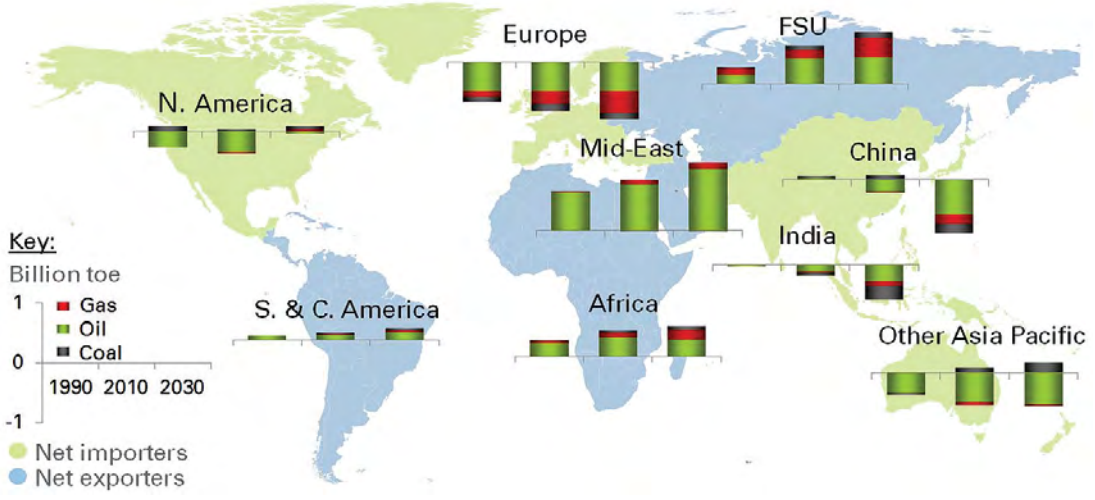
Europe's Energy Challenge

The well-being of people, industry and economy depends on the availability of safe, secure, sustainable and affordable sources of energy. World energy consumption, driven by economic development and rising populations continues to grow. At the same time, energy-related emissions account for most of the greenhouse gases released into our atmosphere. The energy challenge is thus one of the greatest tests facing society.

In the last century, world energy supply was mainly based on fossil fuels — oil, coal and natural gas. This will not change in the near future. However, in view of environmental concerns, it may prove undesirable to use mainly fossil fuels to meet the growing energy demand. Moreover, limited reserves of natural gas and oil as well as their concentration in certain areas are potential sources of conflict. It is therefore of utmost importance to expand the contribution of alternatives to fossil fuel combustion during the next decades.

Energy consumption in the EU exceeds its energy production and the shortfall is mostly met by importing oil and gas. Looking ahead to forecasts for the situation in 2030, the EU's energy deficit is expected to worsen since an increasing amount of natural gas will need to be imported (see diagram below). The security of energy supply is an important consideration when more than half of the world's natural gas is found in just three countries.

One of the objectives of EU energy policy has been to seek ways to reduce reliance on imported fossil fuels and to have a more diverse range of energy sources in order to shield the EU from potential external energy crises and achieve supply-security and environmental sustainability in the long term. In this context, fusion has been recognised as a potential important carbon-free energy source for the future and will be explained further in this chapter.



Energy dependency around the world – positive values show net exporters while negative values show net importers (courtesy of Energy Outlook 2030 BP 2012). Note that 'FSU' refers to the Former Soviet Union and 'S. & C. America' to South and Central America.

What is Fusion?

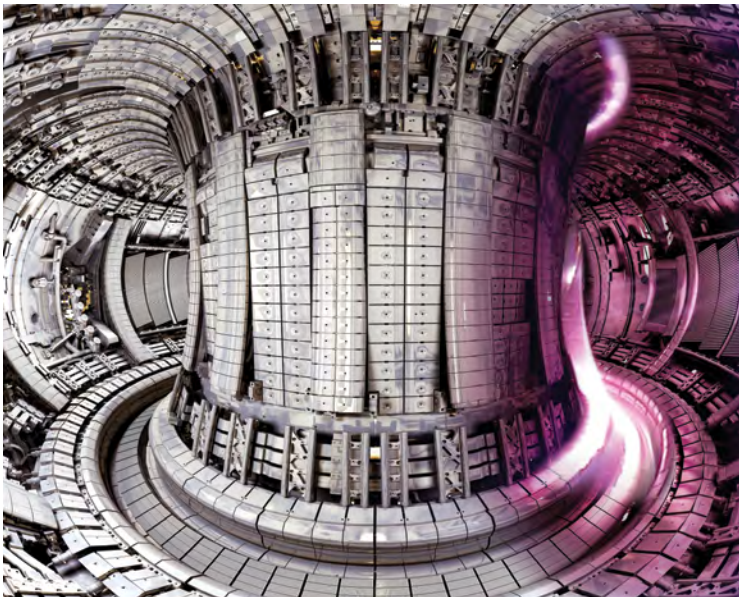
Fusion is the process that powers the sun and other stars and makes life on Earth possible. As the name suggests, the process involves fusing together light atoms to make heavier ones and occurs at the extreme pressures and temperatures caused by the gravity in the sun. During fusion reactions a small amount of mass is converted into energy, in accordance with Einstein's well-known $E = mc^2$ equation.

To make fusion happen on earth, several approaches have been explored. One of these involves heating a gas to very high temperatures (100-150 million degrees centigrade) so that it becomes a plasma which can conduct electricity. Magnetic fields can then be used to contain this plasma long enough for fusion to occur.

In fusion experiments, the magnetic confinement of the hot plasma is achieved using a doughnut-shaped vessel with magnetic coils. Since the 1950s scientists and engineers from all over the world have been carrying out research to assess the most promising approach and the tokamak configuration has emerged as a leading contender.

The merits of fusion include the abundance of the basic fuels (deuterium and lithium), the absence of greenhouse gas emissions, a very low impact on the environment with no long-lasting radioactive waste and finally the inherent safety of fusion reactors, where no meltdown or runaway reactions are possible.

Europe is at the forefront of fusion research, largely due to the integration of national fusion programmes into a single co-ordinated Euratom fusion research programme, including the construction and operation of the Joint European Torus (JET), the world's leading fusion device now under the umbrella of the European Fusion Development Agreement (EFDA).



Inside JET's doughnut shaped vacuum vessel, plasmas (overlaid image) are confined using magnetic fields and heating to enormous temperatures to create fusion reactions (courtesy of EFDA-JET)

What is ITER?

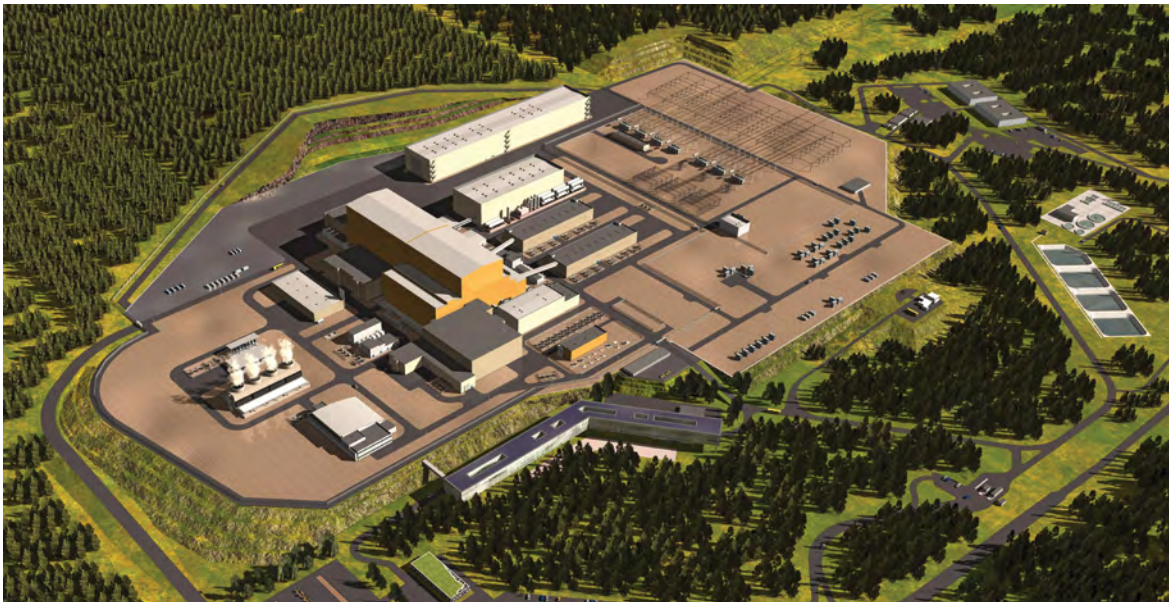
While JET and other tokamak experiments have succeeded in producing significant amounts of fusion power for short periods, none so far are capable of demonstrating fusion on a scale that would be needed for a reactor and a number of technologies that are needed to allow it to generate part of its own fuel and produce power on a more continuous basis.

ITER – "the way" in Latin - is the next major project in tokamak fusion research and is about twice as large as any existing fusion experiment today. Its objective is "to demonstrate the scientific and technological feasibility of fusion energy" and is being constructed at Cadarache in the south of France.

With seven parties participating in the project (the European Union including Switzerland, Japan, China, Korea, the Russian Federation, India, and the USA), ITER is one of the largest international scientific projects of its kind and brings together countries representing over one half of the world's population.

ITER aims to produce a significant amount of fusion power (500MW) for about seven minutes, or 300MW for 50 minutes. For the first time it will be possible for scientists to study a "burning" plasma – this is when the plasma is mostly heated by fusion reactions rather than by externally applied heating. It will also demonstrate many of the key technologies needed for future fusion reactors.

The ITER Organization is responsible for the construction, operation, exploitation and decommissioning of the ITER device. The Director General of the ITER Organization is appointed by the ITER Council which also supervises the overall activities of the ITER Organization. The European Commission represents Europe (Euratom) on the ITER Council.



An artistic impression of what the 180 hectare ITER site will look like once it is constructed. The yellow building which houses the fusion reactor rises 60m above ground level (courtesy of the ITER Organization)

What is the Broader Approach?

In February 2007, Europe and Japan signed the Broader Approach agreement. This aims to complement the ITER project and to accelerate the realisation of fusion energy by carrying out R&D and developing some advanced technologies for future demonstration fusion power reactors (DEMO). Under the umbrella of the Broader Approach agreement, three projects are being implemented in Japan:

- Producing a preliminary engineering design of the International Fusion Materials Irradiation Facility (IFMIF) with validation of the prototypes for the key subsystems – this facility is needed to test materials under the harsh conditions expected inside fusion power plants. This will allow the materials to be optimised so as to minimise their long term radioactivity and retain their structural properties. This work is being carried out at Rokkasho in Japan.

- Constructing and operating a Satellite Tokamak (also known as JT60-SA) – this is a smaller version of the ITER project which will serve as a test bed to prepare for operating ITER and carry out research for future demonstration reactors. The project is being carried out by upgrading an existing fusion experiment located in Naka, Japan, in particular by using superconducting magnets.

- Establishing the International Fusion Energy Research Centre (IFERC) with the purpose of coordinating a programme of design and R&D activities for future demonstration reactors. Using a new supercomputer it is intended that large-scale simulation experiments on fusion plasmas will be carried out. Activities to develop remote experimentation techniques will also be performed. This work is being carried out at Rokkasho in Japan.

To develop synergy with its activities related to ITER, it was decided that F4E should also be the Implementing Agency of Euratom for the Broader Approach. The resources for the implementation of the Broader Approach will be largely provided by several participating European countries (Belgium, France, Germany, Italy, Spain and Switzerland).

CEA-F4E CSC team standing between a section of the "Helios" supercomputer: from left to right, Jacques David, François Robin, Jacques Noé (CEA) and Susana Clement Lorenzo (F4E)

Fusion for Energy's Role

ITER Procurement Sharing

ITER is being constructed at Cadarache in the south of France. Europe, as the host party, and France, as the host state, have special responsibilities for the success of the project. Europe supports 45% of the construction cost and 34% of the cost of operation, deactivation and decommissioning of the facility as well as preparing the site.

Around 90% of the ITER project is built by in-kind contributions. To this end the components that make up ITER have been divided into 85 procurement "packages" which are distributed among the seven parties to the ITER Agreement to achieve the agreed level of contribution from each of them.

F4E is the European Domestic Agency (DA) for ITER and provides, on behalf of Europe, components to ITER that amount to five-elevenths (see pie chart) of the overall value of the project.

How we operate

F4E provides the EU's direct financial contribution to ITER's own running costs and the in-kind contributions of components. The typical process for providing in-kind contributions to ITER is as follows:

- If there is research, design, prototyping or other preparatory work to be done before an ITER component can be manufactured, ITER may issue a request known as an ITER task agreement (ITA) to DAs (including F4E) to do the work.

- On the basis of the specifications in the ITA, F4E contracts out work (usually to European fusion laboratories) using grants which support a proportion (usually around 40%) of the costs to carry out the work.

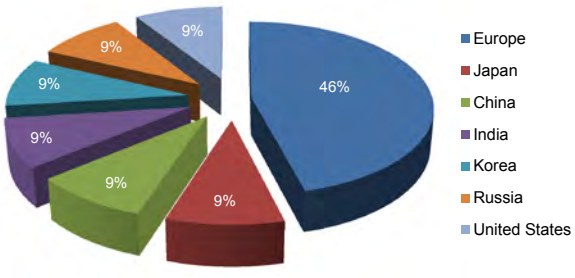
- Assuming the work is completed in accordance with the ITA and to the satisfaction of the ITER Organization, F4E will be awarded a certain amount of ITER credit in recognition of the contribution that has been provided.

- Once the design of a component is sufficiently mature, an agreement called a procurement arrangement is usually concluded between F4E and the ITER Organization setting out what has to be provided and by when.

- On the basis of the specifications in the procurement arrangement, F4E starts a procurement procedure for industries in Europe, and sometimes also outside, to competitively bid for the work. F4E contracts with the tenderer that provides the best offer in terms of quality and/or price.

- Assuming the component is fabricated in accordance with the procurement arrangement and to the satisfaction of the ITER Organization, F4E will be awarded a certain amount of ITER credit in recognition of the contribution that has been provided.

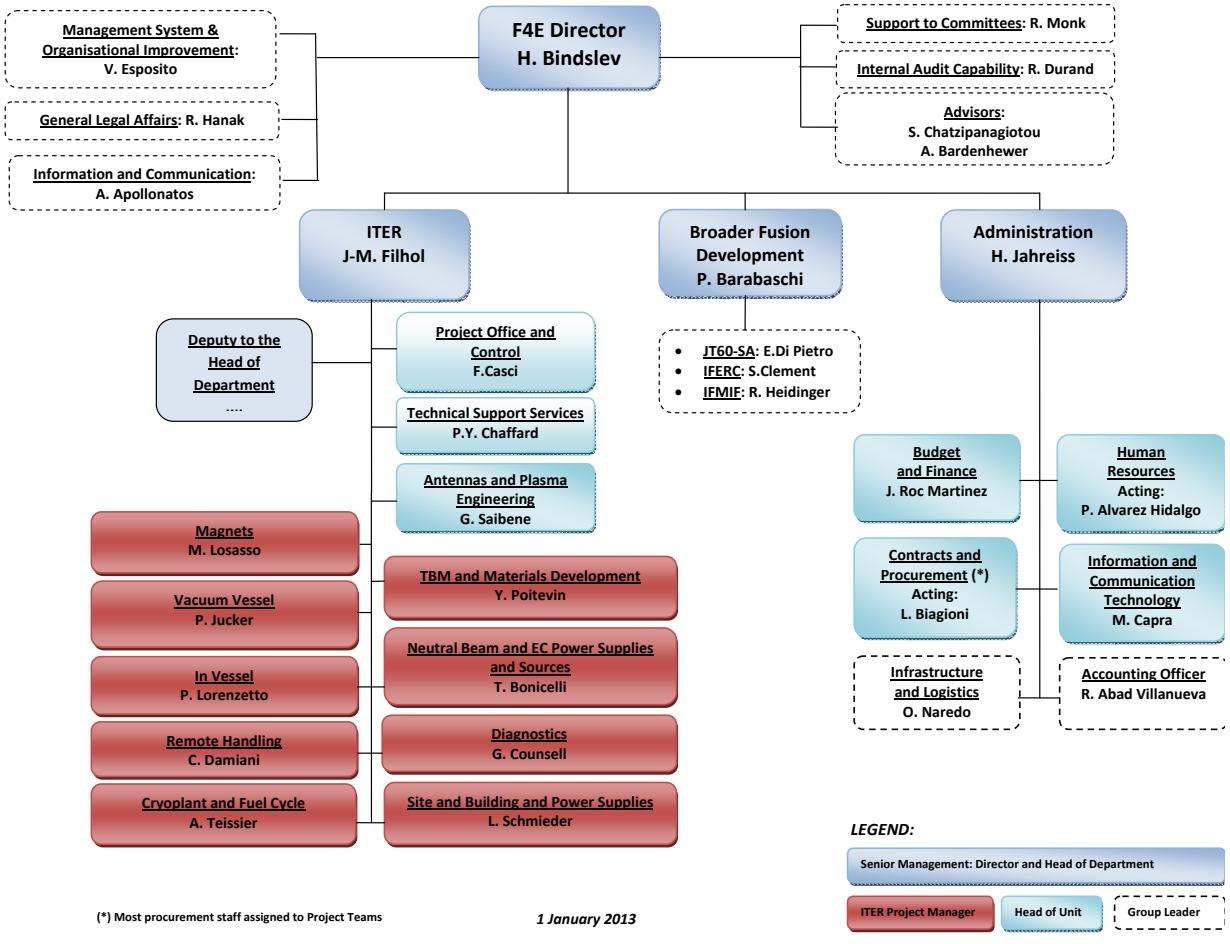
In the case of the Broader Approach, the contributions to the projects are mainly provided on a voluntary basis by some EU Member States and Switzerland. Nevertheless, F4E concludes procurement arrangements with Japan and at the same time agreements of collaboration to specify what is to be provided and by when. F4E has also supported design activities, in particular, for the Satellite Tokamak.



Sharing of the contributions to ITER by each of the ITER Parties

Our Organisation

During 2012, the new project-orientated organisational structure which was introduced in 2011 has been consolidated in accordance with the conclusions drawn by the European Competitiveness Council of July 2010 concerning ITER. In addition, a number of functions which were previously grouped under the "Office of the Director" have been separated into teams comprising "Management Systems and Organisational Improvement", "General Legal Affairs", "Information and Communication", and "Support to the Committees".



Our Management Team

Henrik Bindslev

Henrik Bindslev, a Danish national, has been Director of F4E since 1 January 2013. A physicist with a DPhil in Plasma Physics, Professor Bindslev has been engaged in energy research for more than 20 years with experience in research management, both in Denmark and internationally. Before taking up the post as Director of F4E, Professor Bindslev was Vice Dean for research at Aarhus University, Faculty of Science and Technology and past Chair of the European Energy Research Alliance (EERA). Previously, he was the Director of Risø DTU, the Danish National Laboratory for Sustainable Energy, managing around 700 staff members. Professor Bindslev has published more than 150 papers.

Jean-Marc Filhol

Jean-Marc Filhol, a French national, has been Head of F4E's ITER Department since 1 August 2011. An engineer with a PhD in nuclear instrumentation, Dr Filhol has spent the major part of his career in the field of particle accelerators. He was most recently Director of the Accelerators and Sources Division as well as Deputy Director General at SOLEIL, a third generation synchrotron radiation facility built near Paris, France.

Hans Jahreiss

Hans Jahreiss, a German national, has been Head of F4E's Administration Department since 1 July 2011. With a Doctorate in Law and Assessor Juris, Dr Jahreiss was most recently the Administrative Director of Eurojust, the European Union's judicial cooperation body. Before that, he was the Head of Administration at the European Organisation for Astronomical Research in the Southern Hemisphere (ESO) in Garching and Santiago de Chile.

Pietro Barabaschi

Pietro Barabaschi, an Italian national, has been Head of the Broader Fusion Development Department at Garching since 2008 and European Project Manager for the JT-60SA Project. An electrical engineer, Dr Barabaschi started his career at the JET Project. Later, in 1992, he joined the ITER Joint Central Team, San Diego Joint Work Site and by 2006 he was the Deputy to the Project Leader as well as Head of the Design Integration Division of the ITER International Team at the Garching Joint Work Site.

Chapter 2

Our Achievements

ITER

All F4E activities in 2012, carried out according to the approved work programme 2012, were in line with the ITER baseline that foresees the First Plasma in November 2020.

In 2012 F4E took into account in its detailed work schedules (DWS) for all its in-kind procurements the schedule modifications agreed with the ITER Organization. In a limited number of cases, the discussions were still in progress at the end of the year to finalise a set of milestones to allow the accurate tracking of the project progress.

Negotiations have been carried out and are still in progress with the ITER Organization and all DAs to identify both de-scoping and deferrals of in-kind procurements during the operation phase. This exercise would allow the ITER Organization to receive additional cash during the construction phase, while still keeping the cost ceiling in the construction phase and the machine objectives throughout the D-T phase. Cost containment and cost reduction measures were also the topic of on-going discussions at the ITER Project level.

In 2012 F4E signed a number of significant contracts. Amongst them, those for the series production of the toroidal field coil radial plates, for the site infrastructure and for the construction of the main buildings at the Cadarache site.

Other important contracts were launched in 2012, such as those for the assembly hall bridge cranes and for the assembly of the toroidal field coils winding packs into their cases, with the aim of signing them in 2013.

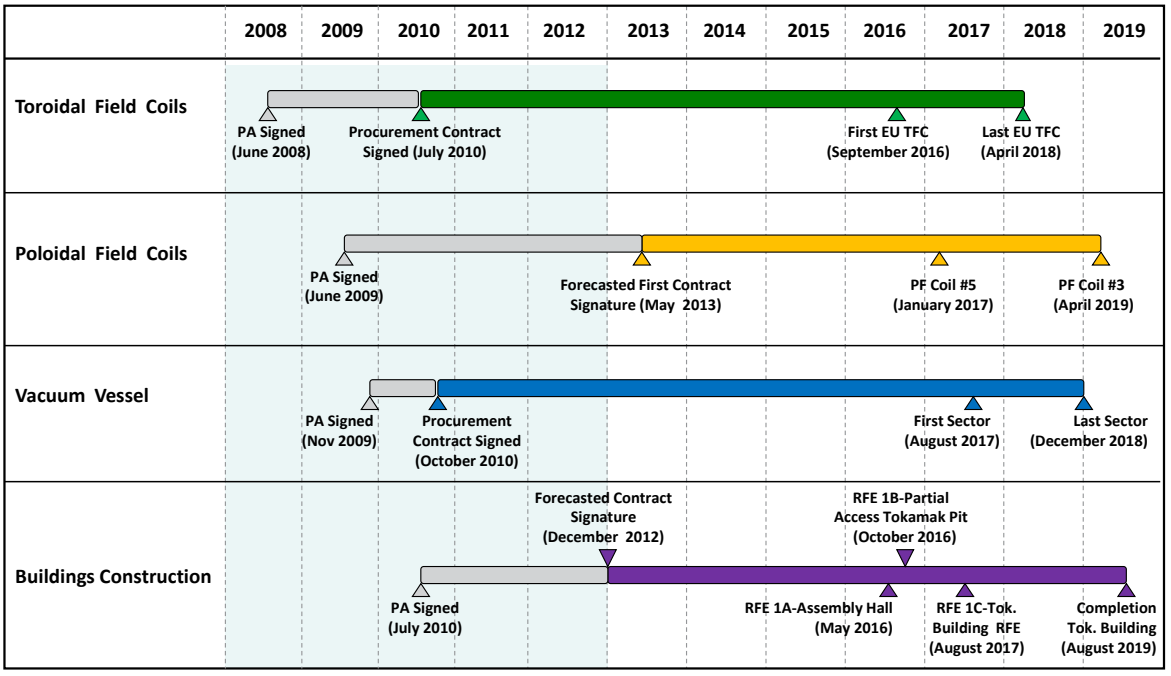
Progress was achieved in the contracts for manufacturing the toroidal field coil winding packs, the vacuum vessel and in the activities of the architect engineer (in preparation of the construction of the main ITER buildings).

Works on the tokamak building foundation and pit wall were completed with the installation of all the anti-seismic foundation pads which will be used to minimise shock on the main building during a potential seismic event. Along with this work, the handover of the first functional building of the ITER project, the PF coil building, which in addition to being completed on schedule, is to be highlighted for being the first building to be delivered.

A total of five new procurement arrangements were signed between F4E and the ITER Organization in 2012, thus reaching a total value of 48.85 kIUAs (approximately EUR 79 million). As additional data, the total kIUAs reached up to this date is 910,562 kIUAs.

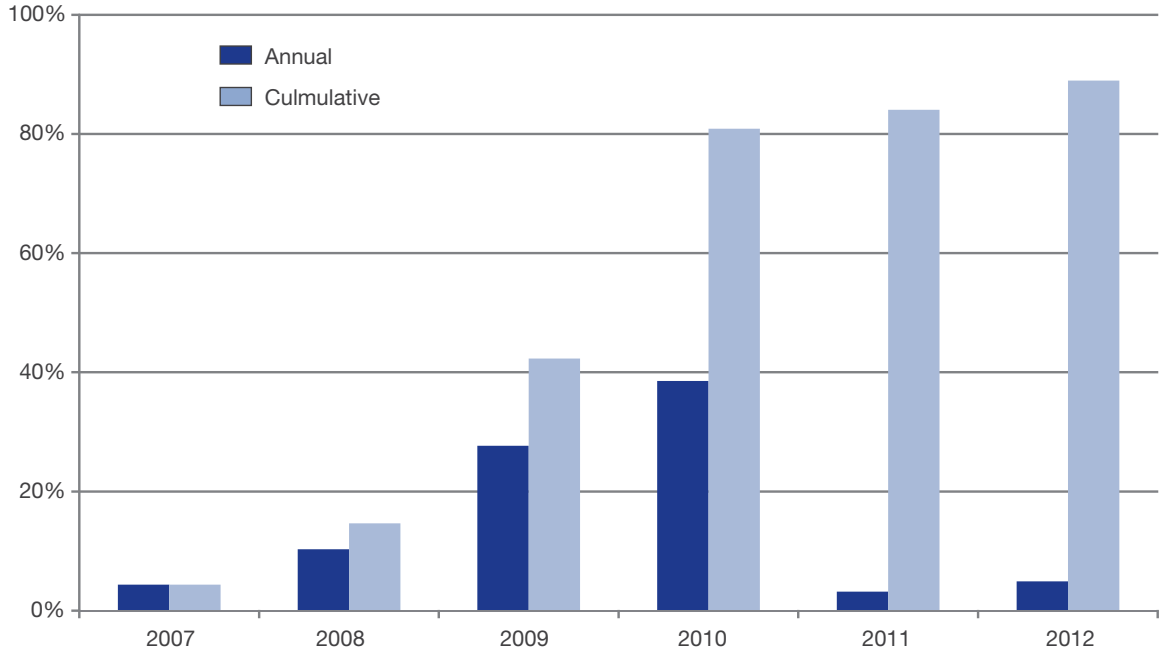
On 1 October, the F4E integrated reporting system went live. It provides integrated standard reports through a data warehouse that guarantees consistent data from several database sources (i.e. financial, human resources, planning, etc.). In parallel, F4E started the development of a contract management tool in order to give the responsible officers the capability to measure contractual progress and better monitor the implementation of their contracts, including tracking of deliverables and communications exchange.

Schedule summary for the main European procurements (status December 2012)

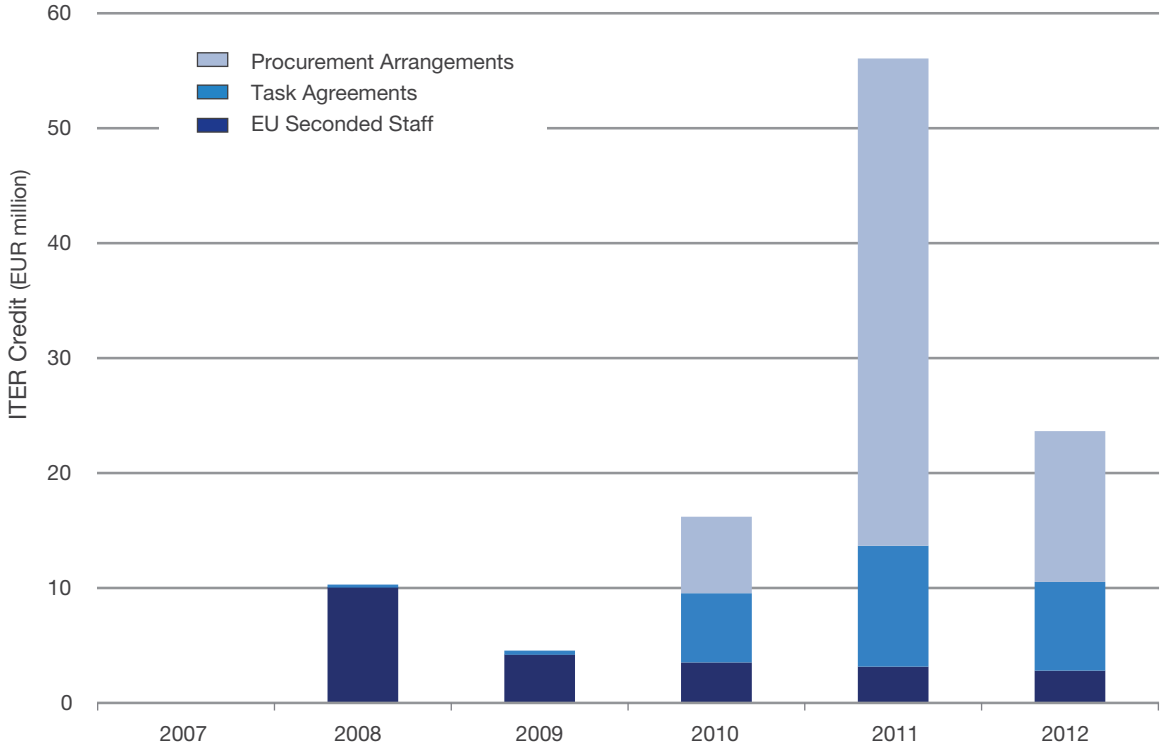


ITER Procurement Arrangements

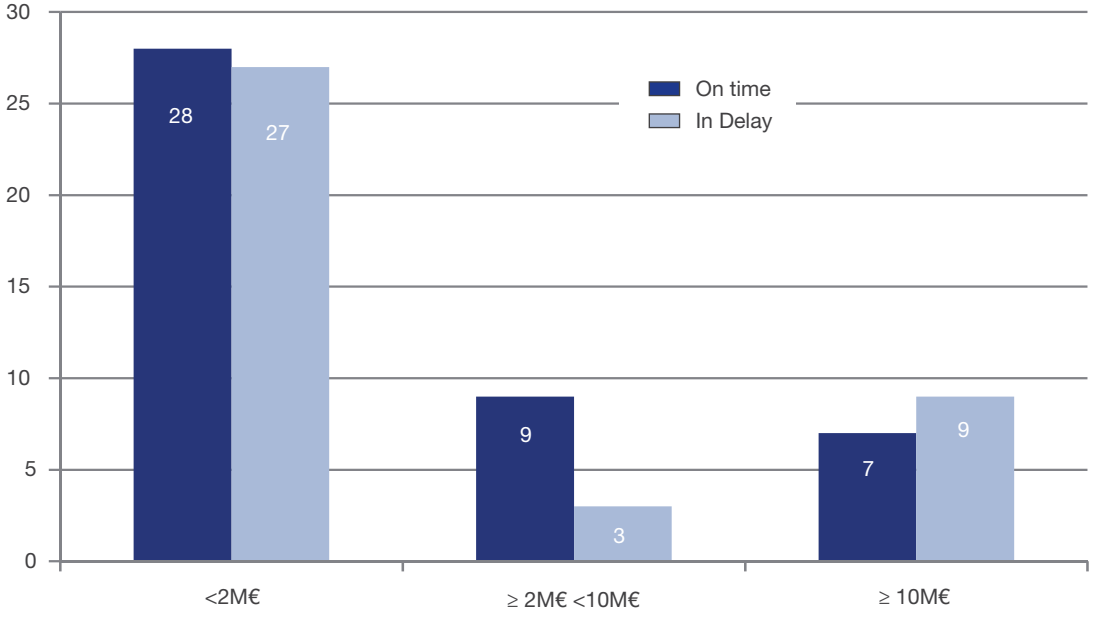
(% of total concluded in value)



Credit awarded to F4E by ITER



Status of running contracts (83 contracts on 31/12/2012)



A delay in a relevant milestone of more than one month is considered to constitute a delay. Specific contracts and specific grants under Framework Contracts and Framework Partnership Agreements respectively are not included in the dataset.

Site, Buildings and Power Supplies

Introduction

F4E is responsible for the in-kind procurement of the site infrastructure and all concrete and steel frame buildings (454.87 kIUA) divided into:

- Poloidal Field Coil Winding Facility (12.8 kIUA);
- Architecture engineering services (54.38 kIUA);
- Tokamak excavation (31 kIUA);
- Supply of anti-seismic bearings for Tokamak Complex (6.2 kIUA);
- Building construction (336.64 kIUA);
- Office buildings (13.85 kIUA);
- Power Supplies — pulsed power and steady state power supplies (31 kIUA).

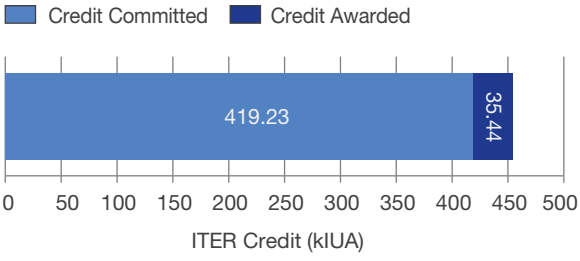
Executive Summary

In the area of site, buildings and power supplies, the main highlights during 2012 are as follows:

- Completion of tokamak complex foundation: excavation and support structure of tokamak seismic isolation pit and installation of all 493 anti-seismic bearings;
- Completion and handover of poloidal field coil manufacturing building;
- Completion and handover of the ITER Organization headquarters building;
- Signing of tokamak main civil and finishing works and heavy nuclear doors (OPE-286) and site infrastructure works (OPE-374) contracts.

ITER Credit Status

In 2012 for the site and buildings, a procurement arrangement for the new ITER headquarters building was signed in October 2012 for 13.85 kIUA. Other procurement arrangements were signed between November 2008 and May 2010. Credit for work completed was awarded to F4E in 2012 for 5.27 kIUA.



Main Milestones

In the following table, the main milestones that have been completed in 2013 are shown compared with the dates foreseen in the ITER baseline.

F4E Work Breakdown Structure	Milestone Title	ITER Baseline Date	Actual Date
EU.01.41.01.53-56 **Power Supplies**	Architect engineer tender design complete for high voltage, medium voltage and low voltage distribution. Emergency power supply except 400kV part	Mar 2012	Mar 2012
EU.01.62.02.53-57 **Buildings**	Poloidal field coils manufacturing building - Final acceptance	Jun 2012	Jun 2012
	Excavation and support structure - final acceptance	Jun 2012	Jul 2012
	Anti-seismic bearings - final acceptance	Jun 2012	Jun 2012
	Contract signed for civil works buildings 11,13-17,36,42-47,51-53,61,71-75 & PCD (TB03)	Feb 2013	Dec 2012
	Contract signed for site infrastructure (TB08)	Nov 2012	Dec 2012
Site	Handover of ITER headquarters to the ITER Organization	Dec 2012	Dec 2012

Work Progress

In 2012, the F4E Site, Buildings and Power Supplies team of around 20 staff continued the implementation of strategy developed by F4E in 2009.

During the year the following construction works were successfully completed:

- The poloidal field coil manufacturing building (February 2012). This contract (OPE-026) was managed within schedule and budget.
- The construction of the ITER Organization headquarters building arrangement with Agence ITER France (AIF) — the building was handed over to ITER Organization on 5 October 2012.

Aerial view of the F4E work site

Handover of the poloidal field coil manufacturing building to the ITER Organization

- Works related to tokamak seismic isolation pit (assembly hall and upper basemat) excavation and support structure (contract OPE-095) were finished in July 2012, and the assembly hall foundation was started.

- Completion of the installation of 493 anti-seismic bearings (bearings able to mitigate the horizontal seismic effects on the tokamak building) was finished in May 2012 (contract OPE-065).

During the year the site adaptation works to allow contractors for the main phase to enter and install on the site were on-going as well.

The new ITER Organization headquarters building (courtesy of the ITER Organization)

Foundation of the tokamak complex with 493 anti-seismic bearings installed

Procurement Activities

Despite the unexpected changes in the agreed scope initiated by the ITER Organization, during 2012 F4E team co-ordinated the preparation of eight packages of tender documentation.

Three competitive dialogues were managed in parallel and were completed by the end of the year:

- Execution of tokamak main civil and finishing works and heavy nuclear doors to the amount of EUR 295 million. The contract OPE-286 was signed in December 2012;
- Construction of tokamak cargo lift and tokamak/assembly hall cranes (OPE-287);
- Tokamak HVAC, electrical services, instrumentation and control, handling, fluid networks (OPE-301).

The competitive dialogue procedure was chosen as it provides F4E with the opportunity to involve in the competition the most qualified representatives of the industry and results in the development of the best technical solutions and the most effective contract execution strategies.

In December 2012 the contract for conducting site infrastructure works (OPE-374) was signed as well.

The signature of the contract for the building of galleries and tunnels around the tokamak (OPE-406) was prepared within three months using an accelerated restricted procedure and was signed in July 2012. This additional call was initiated by F4E in 2012 to mitigate the delay in construction schedule caused by the delayed data delivery by the ITER Organization.

Construction of galleries and tunnels around the tokamak

The following documentation packages were completed in 2012 and calls for tender were launched with an aim to sign contracts within the first semester of 2013:

- Electrical building (steel frame) design and build package (OPE-378);
- High voltage electrical external power supplies (OPE-428);
- Water cooling building (concrete structure) – design and build package (OPE-429).

In 2012 the tender design of all the ITER buildings was completed, although it was delayed by several months due to the unavailability and/or immaturity of the data provided by the ITER Organization.

All the mentioned activities were supported by F4E contractors:

- Architect engineer (ENGAGE ~180 staff) - Scope: studies, design, scheduling, evaluation of contractors, technical monitoring of construction contracts.
- Support to the owner (ENERGHIA ~25 staff) - Scope: daily support to F4E in monitoring contracts (including the review of the design).
- Health, safety and legal inspection services (APAVE ~10 staff) - Scope: compliance to health and safety requirements, to French and European construction norms, access to the site.

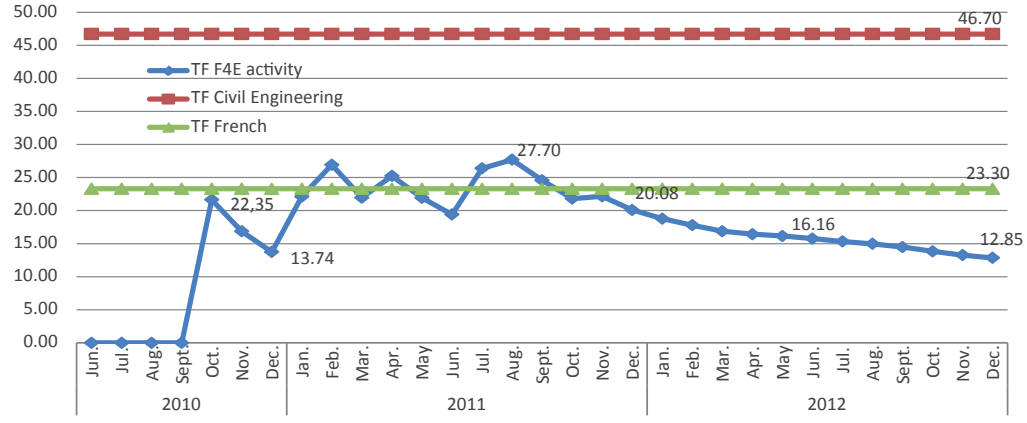
Development of construction design and construction supervision of works by the architect engineer is on-going. In 2012, during around 324,000 working hours, the architect engineer issued 3,298 drawings, 270 calculation notes, 97 procedures and 1,374 other documents.

Health and Safety on the ITER Site

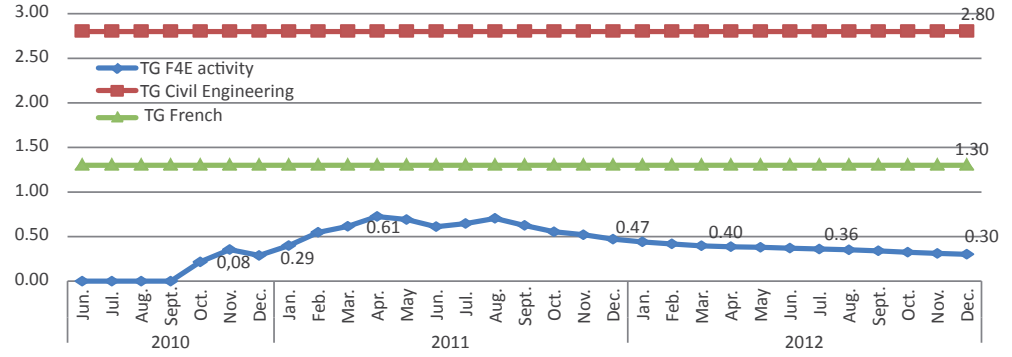
Health and safety management of the on-site activities at the ITER site is of paramount importance and no accidents/injuries leading to lost working days occurred during 2012. During the year, 120 people who worked for a total of 224,240 hours, were employed in the construction activities. Health and safety indicators are evaluated on a monthly basis.

The following graphs represent the results for mentioned indicators at ITER worksite in comparison with the data for French companies and civil engineering in general for the same period.

Indicators of Safety at the ITER Worksite



Graph frequency rate (number of accidents with lost working days / total working hours x 1,000,000)



Graph severity rate (number of lost working days / total working hours x 1,000)

Power Supplies

In 2012, activities focused on the preparation for the procurement of the Pulsed Power Electrical Network and the Steady State Electrical Network, in particular:

- Completion of tender design studies on the whole electrical network (in August 2012 approval of PBS-43 tender design);
- Progress on the tendering process of main tender batches involving power supply activities (finalisation of tender documentation, launch of call for tender and call for expression of interest).

Although the tender documentation is already completed by F4E, related procurement arrangements with the ITER Organization are still in the negotiation phase as intensive discussions and meetings with the ITER Organization with resulting reports and mitigation plans about the huge evolution of the ITER Organization electrical loads (project change request PCR-476) impacting procurement arrangements, tender documentation, schedule of works and design organisation are still on-going.

Overall, the site, buildings and power supplies activities were implemented as foreseen in the 2012 work programme and in accordance with the project plan and ensuring the requested quality of works delivered on the construction site. Nevertheless due to the delay on the delivery of data by the ITER Organization and additional scope (project change requests) some tasks foreseen by the end of 2012 have been postponed to 2013.

In addition the slippage in the construction schedule for around 18 months as well as the corresponding increase of project execution costs can be forecasted as a result of changes in the scope by the ITER Organization including numerous project change requests, increasing complexity of requirements, extra duration of studies and input data delays.

Magnet Systems

Introduction

In terms of the scope of the supply for which F4E is responsible:

- Ten toroidal field coils and 20% of the Nb_3Sn conductor to be used in the toroidal field coils (89.74 kIUA);
- Five poloidal field coils and 11% of NbTi conductor for the poloidal field coils (40.87 kIUA);
- Nine fibreglass composite pre-compression rings (0.6 kIUA);
- Toroidal field conductor and poloidal field conductor (54.618 kIUA).

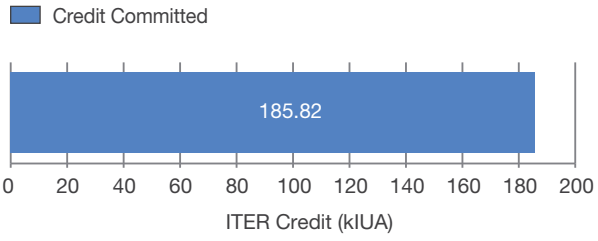
Executive Summary

In the area of magnets significant progress has been made during 2012 of which the highlights include:

- Production of 68.3 tons of toroidal field Nb_3Sn strand;
- Testing of TFEU7 and TFEU8 at the SULTAN test facility;
- Fabrication of superconducting lengths and first production lengths of jacketed conductor for toroidal field coils;
- Qualification activities for poloidal field conductor jacket weld;
- Successful completion of side radial plate prototype;
- Successful completion of regular radial plate prototype;
- Installation and successful commissioning of double pancake heat treatment furnace and main tooling (winding line, laser welding tooling and others);
- Sign off of radial plate series production contract;
- Published call for tender for the cold test and assembly of the winding pack into coil cases;
- Developed and approved new procurement strategy for the poloidal field coils manufacturing;
- First two calls for tender documentation for poloidal field coils production almost completed;
- The pre-compression rings fabrication contract has been signed off.

ITER Credit Status

All the procurement arrangements for the magnets were concluded between June 2008 and May 2010.



Main Milestones

In the following table, the main milestones that have been completed in 2013 are shown compared with the dates foreseen in the ITER baseline.

F4E Work Breakdown Structure	Milestone Title	ITER Baseline Date	Actual Date
EU.01.11.01.51 **Magnets – Toroidal Field**	Radial plate prototypes completed	Feb 2012	Apr 2012
	Contract signature for radial plate procurement	Nov 2012	Dec 2012
EU.01.11.02.51 **Magnets – Pre-Compression Rings**	Contract signature for pre-compression rings	Dec 2011	Oct 2012
EU.01.11.04.51 – 52 EU.01.11.04.52 **Magnets – Toroidal Field and Poloidal Field Conductors**	Toroidal field conductor manufacture phase 2: process qualification	Oct 2012	Dec 2012

Progress Report on the Toroidal Field Magnets

Related to the production of the toroidal field coils in 2012, the sub-project team completed the follow-up of major milestones along with managing the main contracts and providing support to the industry. The following progress is highlighted:

- Completion of the side radial plate full-scale prototype manufacturing (F4E-OPE-016-01), with achieved geometrical accuracy within the ITER Organization specified tolerances requirement.

- Completion of the regular radial plate full-scale prototype manufacturing (F4E-OPE-016-03), with achieved geometrical accuracy within the ITER Organization specified tolerances requirement. In this contract we have also manufactured, installed and commissioned a portal machine, belonging to F4E that will be used for the radial plate series production.

- Follow up of the contract for manufacturing of ten toroidal field winding packs (signed in July 2010, F4E-OPE-053) and related activities. This included:

  - Manufacturing, installation and commissioning of winding pack main tooling, including winding line, heat treatment furnace and laser welding tooling.

  - Redefinition with agreement by the ITER Organization of the manufacturing route, in order to minimise risk during the production of the double pancakes.

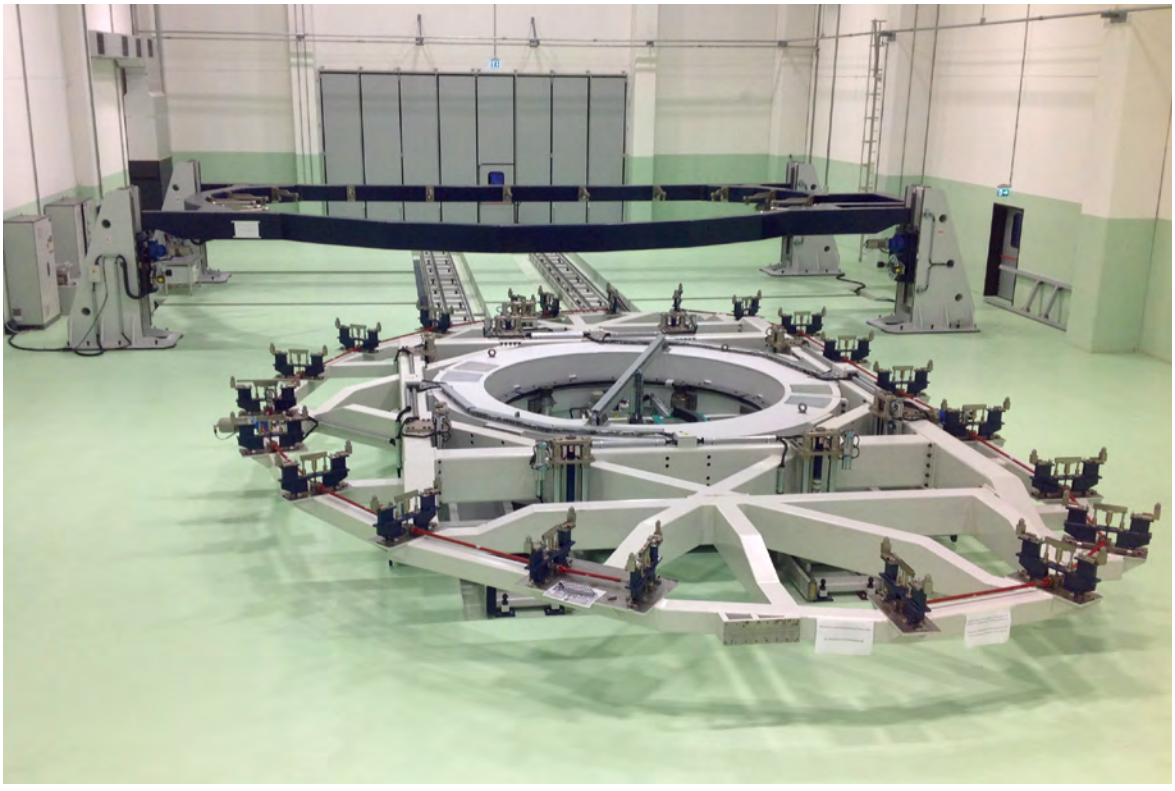
- Redefinition of the radial plate manufacturing route, based on the technologies qualified with the prototypes, in order to minimise risks during production of the double pancakes.

- Contract sign off for the series production of the 70 radial plates – one of the key components for the winding pack manufacturing (F4E-OPE-355).

- Launch of the call for tender for the cold test and the winding packs insertion into the coil cases. Two information meetings were arranged with bidders in order to clarify the technical content, contract details and quality requirements and to generate interest in the tender.

Heat treatment furnace and loading carriage (courtesy of ASG)

TF coils double pancake insulating tool (courtesy of ELYTT Energy)



Radial plate insertion tooling (courtesy of ASG)

Cover plate laser welding station (courtesy of ASG)

Progress Report on the Poloidal Field Magnets

A new procurement strategy for the poloidal field coils production was approved by the Executive Committee. This strategy foresees the splitting of the management, tooling and the manufacturing processes into separate contracts. An information day was held in Barcelona with many interested companies participating, where details of the strategy and rules of the procurement were explained.

The documentation for the first call for tender, engineering integrator (F4E-OPE-344), was approved and prepared to be announced in early January 2013. The documentation for the successive call for tender, winding tooling (F4E-OPE-463), was almost completed at the end of 2012.

External view of the poloidal field coils building completed, January 2012

Progress Report on the Conductors

For the conductor, the industrial production phase is underway, in particular:

- The supply of 58 tons of Nb_3Sn strand for the toroidal field conductor (F4E-OPE-005-1) is almost completed with 51.2 tons delivered and approved so far.

- A second contract (F4E-OPE-005-2) for 37 tons of Nb_3Sn strand for the toroidal field conductor is progressing with 17.1 tons delivered and approved so far. The progress advanced well in 2012 with more than 30% of the deliverables produced by the end of the year, this is a substantial acceleration on the initial production rate.

- The contract for strand characterisation of toroidal field Nb_3Sn strand samples (F4E-OPE-145) is progressing well and has already provided the verification tests needed for the ATPP clearance of 40% and 30% of the total amount of billets foreseen respectively for F4E-OPE-005-01 and F4E-OPE-005-02.

- The SULTAN tests of the Phase II F4E toroidal field conductor lengths (TFEU7 and TFEU8) were successfully completed at CRPP, thus clearing the qualification phase.

- The contract for cabling and jacketing of the ITER toroidal field and poloidal field conductors, as well as the JT-60SA conductor is proceeding with the more than 5,000m of both final conductor fabricated. In particular for the ITER toroidal field conductor after preparation and setting-up of the facility, the first production (760m of Cu dummy conductor length for toroidal field) was successfully achieved on time for winding tests execution. In addition the two superconducting toroidal field qualification lengths were fabricated together with four production lengths.

Progress Report on the Pre-Compression Rings

The call for tender for the manufacturing of nine pre-compression rings (F4E-OPE-345), which was launched in December 2011, resulted in the signature of the manufacturing contract in October 2012. The preparation of the qualification and the subsequent manufacturing are underway.

Conductor sDP1 at storage place ready for shipment (courtesy of ICAS)

Vacuum Vessel

Introduction

F4E is responsible for the in-kind procurement of seven sectors of the vacuum vessel (92.19 kIUA).

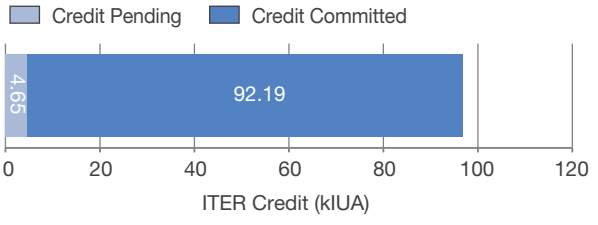
Executive Summary

In the area of the vacuum vessel progress was slower than anticipated due mainly to the late arrival of input data from the ITER Organization. Nevertheless, the highlights were as follows:

- Follow-up of the manufacturing contract for the vacuum vessel, the largest component of the ITER device;
- Definition of design, CAD activities and stress analysis to support design changes from the ITER Organization and from F4E;
- Setting up of the manufacturing facilities, preparation of mock-up for qualification and agreed notified body approval;
- Start of the activities for the procurement of material for the first three vacuum vessel sectors.

ITER Credit Status

The procurement arrangement for the supply of the vacuum vessel sectors was concluded in November 2009.



Main Milestones

No main milestones as referred to in the project plan were completed during the reporting period.

Progress Report

Following the signature of a contract for the first stages of the fabrication of the seven sectors of the vacuum vessel (F4E-OPE-068) in late 2010, progress was made by AMW, a consortium of suppliers. Although the input design from the ITER Organization is not yet complete, which prevents the start of detailed manufacturing design, the overall progress has been in accordance with the work programme 2012 and project plan. The major achievements are:

- The support to the supplier consortium in gaining acceptance of the required deviations in order to be able to convert the ITER design to a manufacturing design in accordance with the applicable code (RCC-MR) and under French Nuclear Authority control.
- The manufacture of mock-ups to provide input on the manufacturing procedure, the welding, assembly and inspection issues, and calibration and control of distortions.
- Structural finite element method analysis for the validation of welding distortions on coupons and mock-ups for the prediction of later distortions of the sector, and optimise the manufacturing sequence. Fabrication of real coupons and mock-ups to validate simulations. Detailed thermal and electro-mechanic analysis on the VV solid finite element model, and finite element analysis in support of the manufacturing deviations.
- A vacuum vessel 3D solid model for the regular and irregular sectors, detailed dynamic electromagnetic analysis and seismic analysis on the vacuum vessel 360° solid FE models were completed.
- The material to be procured in the form of plates and forgings for the qualification of the material suppliers according to RCC-MR code requirements is well advanced. Up to now, the main plate material supplier has been qualified and four forging material suppliers are under qualification.
- More than 200 technical and manufacturing documents have been reviewed within this year, also with the ITER Organization and authorised notification body interfaces. Parallel review of

documentation was agreed for some documents and carried out to improve the efficiency of the approval of documentation.

- Development of the SmarTeam project life cycle documentation management system for the AMW consortium documentation and interface to F4E has progressed.

- An ultrasound testing qualification committee, to address the issue of the one-sided access closure welds (mainly the outer shell), is defining the technique and acceptance criteria to be used according.

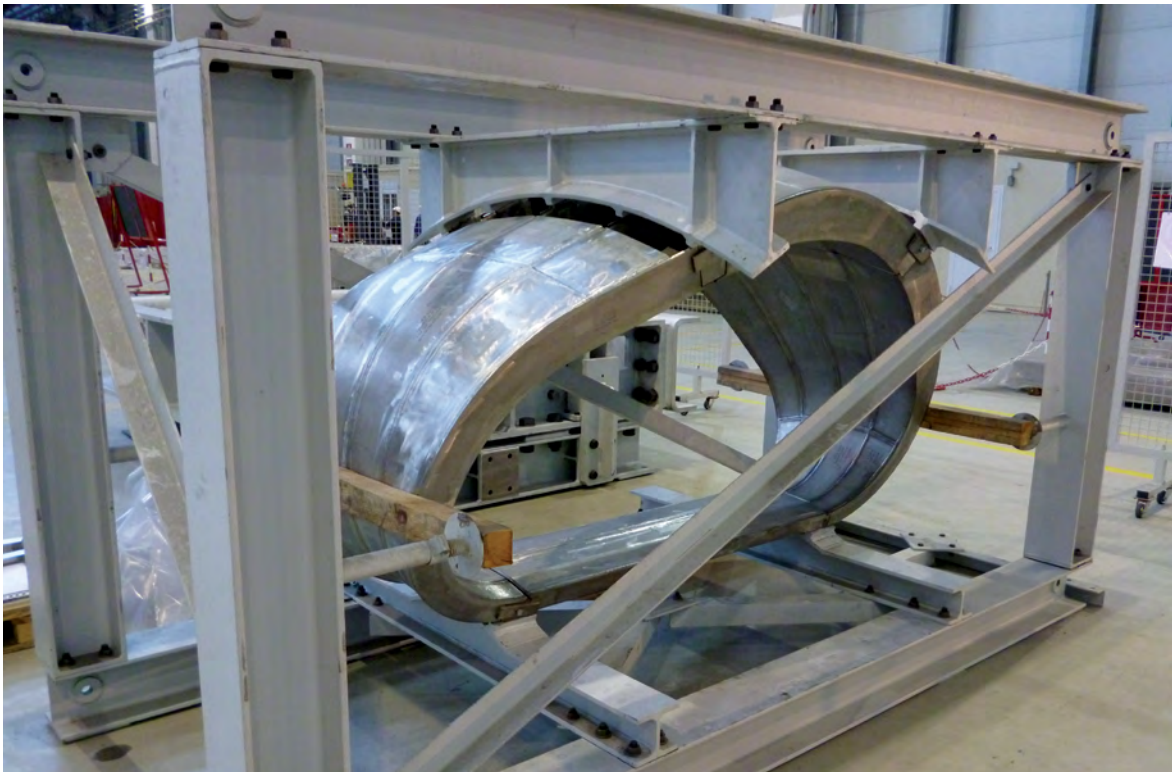
- A specialised welding workshop has been set up for welding trials to develop and qualify the welding techniques to be used in the vacuum vessel construction. The reduction of distortion and improvement of quality are the focus of the new procedures developed. To this end, welding robots are used whenever possible. In addition, Europe's largest robotic electron beam welding facility in Pro-Beam (Burg, Germany) is being utilised by running many trials.

- Two cooperation meetings were organised to collaborate among all stakeholders of the project: Korean industry and colleagues from the Korean Domestic Agency together with the ITER Organization representatives were invited to share with F4E and its supplier the experiences and progress of the project.

- Two CAD joint works have been carried out to harmonise the 3D model with the latest updated introduced by project changes requests from the ITER Organization and deviation requests from the F4E supplier.

- The agreed notified body approved the bolted ribs design for the joining of the ribs to the flexible housings after checking the full set of technical justifications provided by F4E.

- A plates hot forming qualification process was performed during this year in the supplier's premises.



Reduced scale mock-up (1/5) of the vacuum vessel

In-Vessel Components

Introduction

F4E is responsible for the in-kind procurement of the following:

- Blanket first wall: 48.4% of the first wall panels corresponding to the normal heat flux first wall (42.1 kIUA);
- Blanket cooling manifold (4.652 kIUA);
- Divertor - inner vertical target (20.2 kIUA);
- Cassette bodies and integration of plasma-facing components (11.2 kIUA);
- Divertor rails (2.38 kIUA).

Executive Summary

In the area of the in-vessel components, the main highlights of the achievements during 2012 are as follows:

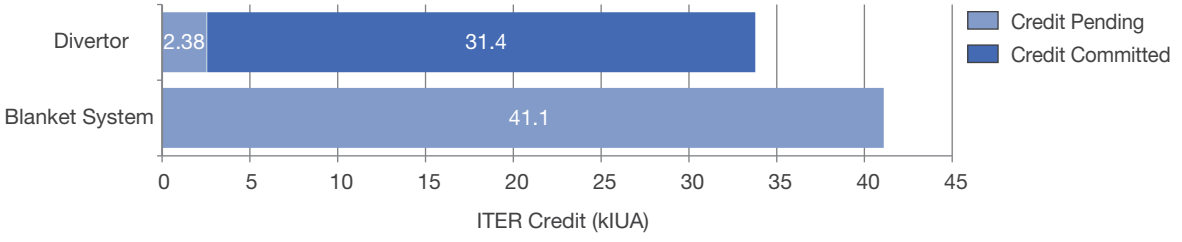
- Award of a contract for the independent evaluation of EM loads;
- Award of a contract for the purchase of CuCrZr plates;
- Award of a contract for the fabrication of normal heat flux first wall mock-ups and semi-prototype;
- Award of a contract for the high heat flux testing of faraday screens and enhanced heat flux first wall mock-ups and semi-prototype;
- Signature of the procurement arrangement 1.7.1 divertor cassette integration;
- Signature of the ITA TD-BIPT-DIV-FULL-W-EU for the full-W divertor qualification programme;
- Award of two contracts for the manufacturing of inner vertical target full-size prototypes;
- Award of a contract for high heat flux testing.

ITER Credit Status

In 2012 the procurement arrangement for the divertor cassette integration was signed in April for 20.2 kIUA, bringing the total to 31.4 kIUA. See graph below.

Main Milestones

In the following table, the main milestones that have been completed in 2013 are shown compared with the dates foreseen in the ITER baseline.



F4E Work Breakdown Structure	Milestone Title	ITER Baseline Date	Actual Date
EU.01.17.02.51 **Divertor Inner Vertical Target**	Publication of Award Decision for Pre Production Qualification-Lot 1	Jun 2012	May 2012
	Publication of Award Decision for Pre Production Qualification-Lot 2	Jun 2012	Mar 2012
EU.01.17.01.51 **Divertor Cassette Body & Assembly**	Signature of Procurement Arrangement	Mar 2012	Apr 2012

Progress Report on In-Vessel Components

During 2012, progress in the development of in-vessel components was achieved in relation to the blanket cooling manifold, the blanket first wall and the divertor systems.

Progress Report on the Blanket Cooling Manifold

The design of the blanket cooling pipes keeps evolving to accommodate the numerous constraints (i.e. lack of space, insufficient shielding, change of design requirements with frozen interfaces with the vacuum vessel etc.) while the principle of the multi-pipe concept is definitely adopted by the ITER Organization. The design in the standard sector remains based on 20 pipe-bundles (eight for the inboard and 12 for the outboard). In the neutral beam injector sectors, the lack of space in the upper port requires the routing of some pipes through the lower ports to feed the additional blanket modules. For shielding improvement reason, flatter and wider pipe bundles have been adopted.

As a continuation of the theoretical feasibility studies performed in 2011, a program aiming at demonstrating the manufacturing feasibility of the blanket cooling pipes with the required accuracy was initiated. This program consists in manufacturing at least one partial full-scale prototype. The call for tender (F4E-OPE-431) was launched in August 2012. The evaluation of the offers is in progress.

Progress Report on the Blanket First Wall

Achievements in the area of the blanket first wall may be grouped as follows:

- R&D in support of the first wall procurement: completion of activities on the development of CuCrZr alloy for the first wall panel hot isostatic pressing manufacturing route (GRT-038) and preliminary activities on post-irradiation thermal creep of 316L Stainless Steel/CuCrZr joints (GRT-291) and on irradiation and post-irradiation mechanical characterisation of CuCrZr alloy (GRT-043).

- Component design and analyses in support of the ITER Organization done in the frame of the Blanket Integrated Product Team Task Agreement as follows:
  - o Development by F4E of the detailed 3D CAD models and associated 2D drawings of four first wall panels;
  - o Design and analyses (OPE-437, OPE-031.01.03, F4E-2008-OPE-07-02-01-08, F4E-2008-OPE-07-02-01-09, F4E-2008-OPE-07-02-02-10, F4E-2008-OPE-07-02-03-11) of the following first wall panels to be procured later by F4E: FW6, FW2, FW18 and FW12;
  - o Preparation for presenting these results at the blanket final design review meeting of April 2013 at Cadarache.

- Second phase of the ITER first wall qualification programme to prepare for the procurement of the first wall panels. As foreseen in the first wall procurement strategy, a procurement contract for the fabrication of normal heat flux first wall mock-ups and semi-prototype (OPE-394) was placed and the related activities started. High heat flux testing activities as specified in the grant GRT-154 and the procurement contract OPE-362 have started to check the performance of the first wall mock-ups manufactured under contracts placed in 2011.

The work programme 2012 was implemented as originally planned with the exception of the activity related to the preparation of a high heat flux test facility needed for the acceptance tests of the FW panels. The award was postponed to the second quarter of 2013 to take into account the updated overall delivery schedule of the first wall panels. The overall F4E blanket programme is in line with the ITER procurement schedule. In particular, the only SMP milestone for 2012, related to the signature of an ITA for the performance of fabrication and testing of full scale normal heat flux first wall prototypes, was signed on time on 29 October 2012.

Progress Report on the Divertor Components

The main achievement during 2012 was the signature of the procurement arrangement 1.7.1 divertor cassette and integration (8 May 2012) following a negotiation started in 2011. F4E has started the preparation of the documentation for the launch of the call for tender for the procurement of the cassette bodies (prototypes and series production, OMF-444).

The main achievements associated with the procurement arrangement on the inner vertical target can be summarised as follows:

- An ITER task agreement (TD-BIPT-DIV-FULL-W-EU) to implement the full-tungsten (W) qualification programme was signed on 10 October 2012. It concerns mainly extensive high heat flux testing to be performed in the EU, load carrying capability tests and supply of mock-ups and prototypes for testing at Efremov Institute, St. Petersburg, Russia.

- The activities aiming at manufacturing the inner vertical target full-size prototypes have started. Having taken into account the ITER Organization proposal to investigate the possibility to start ITER operation with a full-W divertor, two full-size full-W prototypes and two sets of eight carbon fibre composite (CFC)-W plasma facing units will be fabricated by the two EU pre-qualified companies (OPE-138 Lot 1 and Lot 2).

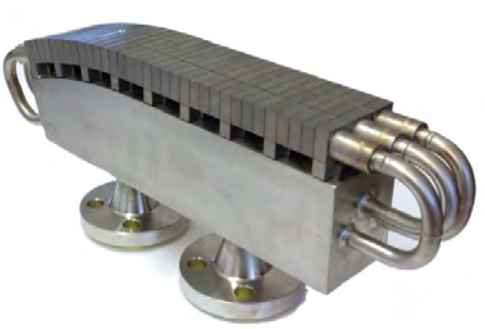
- The procurement contracts for the fabrication of mock-ups with alternative CFC grade have been completed (OPE-096 Lot 1 and Lot 2). These contracts have been launched in the ambit of the European industry pre-qualification programme on the use of alternative armour materials grades to promote competition, mitigate technical risks and to decrease fabrication costs.

- The R&D on the full-W divertor inner vertical target was continued. The mock-ups and medium size prototypes have been manufactured in line with the IVT schedule (OPE-073 Lot 1 and Lot 2).

- The thermal fatigue testing of high heat flux mock-ups and prototypes for the qualification of alternative CFC armour grade and full-W divertor has been undertaken (OPE 423).

- The procurement of a CFC material prototypical batch (OPE-91) for the manufacture of full size IVT prototypes has been completed.

Full-tungsten inner vertical target qualification prototype from Plansee



Full-tungsten inner vertical target prototype from Ansaldo Nucleare

Remote Handling

Introduction

- Divertor remote handling (9.62 kIUA);
- Cask transfer system (18.3 kIUA);
- In-vessel viewing and metrology system (6.8 kIUA);
- Neutral beam remote handling (6.0 kIUA).

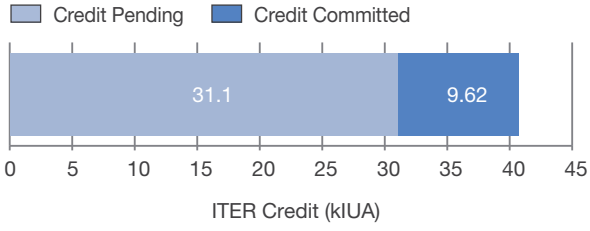
During 2012 there have been some important achievements by the remote handling project team. In particular, the first procurement arrangement has been signed; i.e. on the divertor remote handling system, and the competitive dialogue with four selected tenderers (following the call for expression of interest already launched in November 2011) was initiated in December 2012. This opens the important phase of collaboration with the European industry. The remaining three packages will follow the same process according to their schedules.

Executive Summary

In the area of remote handling, the main highlights of the achievements during 2012 are as follows:

- Start of a new grant for the validation of various aspects of divertor remote handling;
- Signature of the procurement arrangement for divertor remote handling system;
- Start of the related dialogue-tendering process with pre-selected European industry;
- Placement of task order for the preparation of the DIV remote handling procurement (risk and cost analyses);
- Placement of task orders in support of cask and plug remote handling system design in view of the future conceptual design review;
- Placement of a new grant and of task orders in support of conceptual design of the in-vessel viewing system probe in view of the future conceptual design review;
- Successful completion of the grant in support of neutral beam remote handling conceptual design, and start of the procurement arrangement preparation in liaison with the ITER Organization;
- Placement of new expert contracts in support of the remote handling control system and radiation tolerant electronics studies.

ITER Credit Status



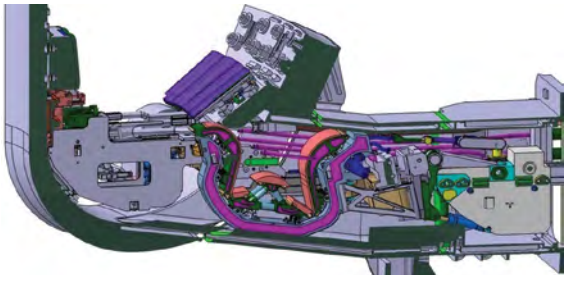
Main Milestones

In the following table, the main milestones that have been completed in 2013 are shown compared with the dates foreseen in the ITER baseline. In 2012 the procurement arrangement for the divertor remote handling was signed in September for 9.62 kIUA.

F4E Work Breakdown Structure	Milestone Title	ITER Baseline Date	Actual Date
EU.01.23.02.51 **Divertor Remote Handling**	Signature of procurement arrangement	Sep 2012	Oct 2012
EU.01.23.05.51 **Neutral Beam Remote Handling**	Conceptual Design Review completed	Oct 2012	Oct 2012

Progress Report on Divertor Remote Handling

The procurement arrangement for the divertor remote handling system was signed in October between the ITER Organization and F4E. In parallel, following the call for expression of interest launched in November 2011, four selected companies have been invited to the competitive dialogue that started in December 2012 as part of the divertor remote handling procurement procedure (F4E-OMF-340-1) which covers design and construction of the divertor remote handling. Meanwhile, the concept design validation program is still on-going and full scale demonstrations were conducted at the divertor test platform (DTP2) facility (located in Tampere, Finland). Two contracts have been performed in order to verify the remote exchange of the ITER divertor (F4E-GRT-143, under completion, followed by F4E-GRT-401 launched in December).

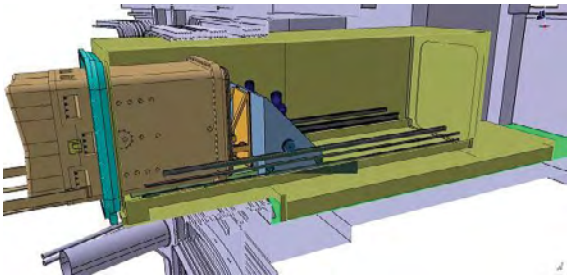


Concept design of the ITER divertor remote handling system

Concept prototypes and mock-ups of the ITER divertor remote handling system (DTP2 test facility)

Progress on the Cask and Plug Remote Handling System (also known as the Transfer Cask System)

The conceptual design of the generic cask and plug remote handling system (2008-OPE-017-04) was completed and incorporates the main functions related to nuclear confinement and transportation. This has been followed by the advancement of the conceptual designs for the cask and plug remote handling system variants, related to the other ITER components to be transported, along with the development of the detailed system requirements (OMF-272-01-01). Work was also started on the preparation of the cask and plug remote handling system design for the conceptual design review (OMF-272-01-05) which will take place in July 2013.



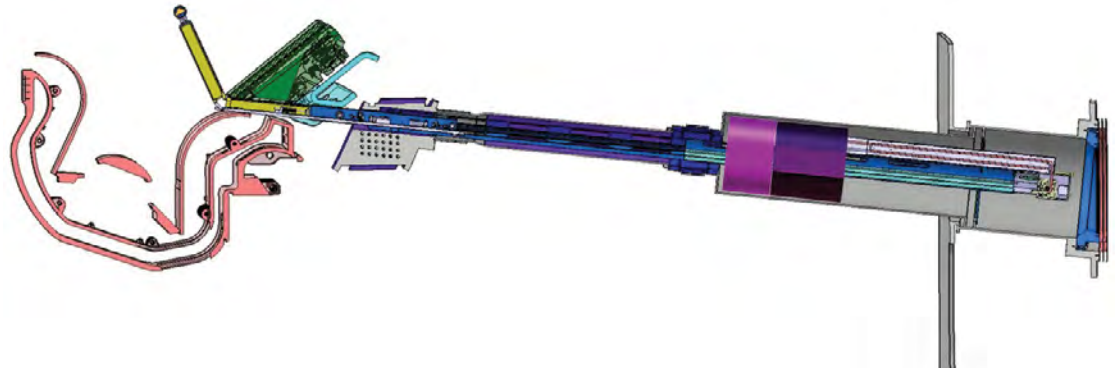
Equatorial port plug handling using the cask and plug remote handling system

Progress on the In-Vessel Viewing and Metrology System (IVVS)

In preparation for the conceptual design review planned in mid-2013, various design and experimental activities were started in 2012 in order to address the areas of the design which needed further development. These areas included, but were not limited to, the probe layout refinement, compatibility check of its key components with magnetic field and prolonged exposure to gamma rays (F4E-GRT-282), development of conceptual design solutions and integration of the in-vessel viewing system plug assembly (F4EOMF-272-01-03). These design activities were supported by the development of a high-speed software tool simulating the system performance inside the vacuum vessel (F4E-2008-OPE-07-02-06) and by performing a full nuclear analysis with the aim to estimate the neutron fluence and gamma activation in the various parts of the eight metre long in-vessel viewing system plug (F4E-2008-OPE-02-01-06).

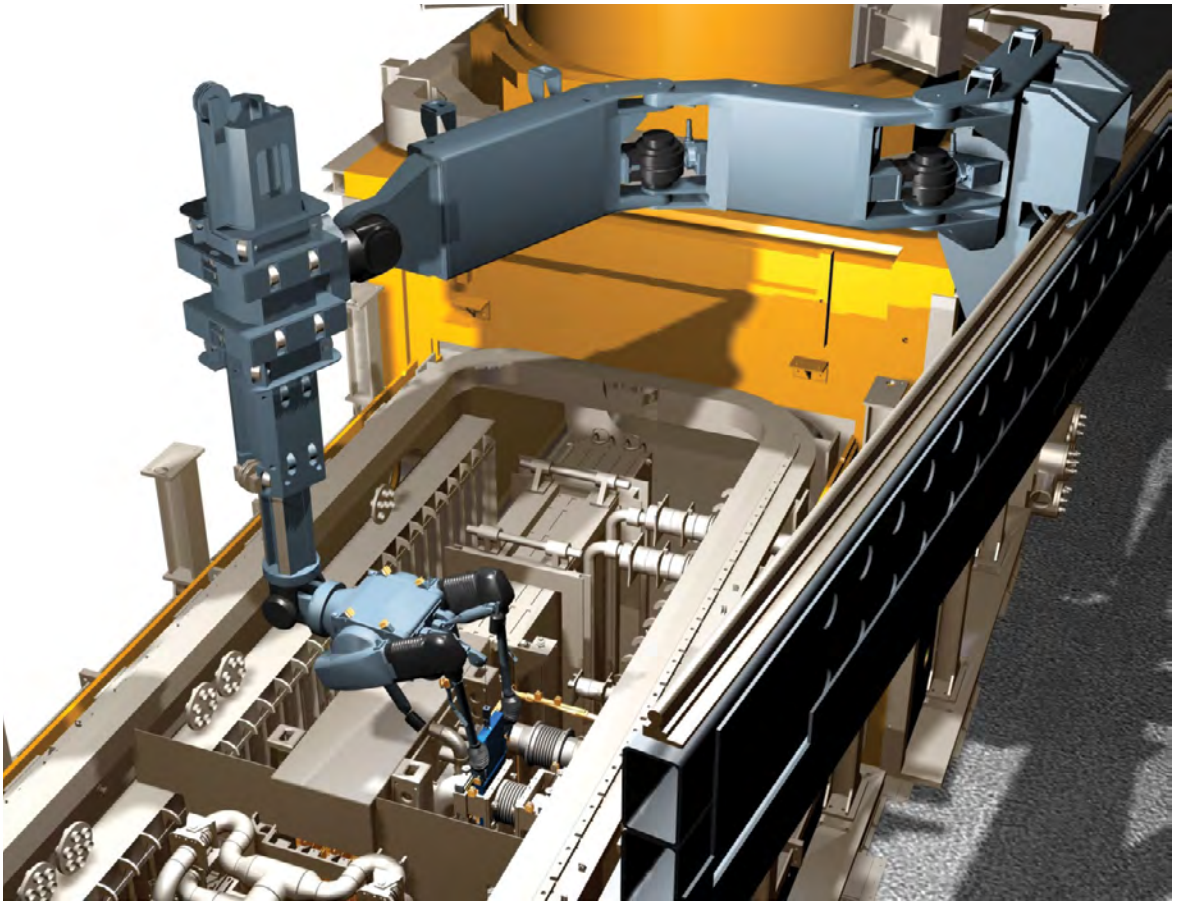
Progress on Neutral Beam Remote Handling

The conceptual design of the neutral beam remote handling system was completed (supported by the activities of the F4E-2009-GRT-051) and reviewed, in liaison with the design activities of all the interfacing



Section view of the port extension including the in-vessel viewing system plug

systems hosted in the neutral beam cell and served by the neutral beam remote handling system. This included a 50 ton monorail crane with lifting adaptors, beam source maintenance equipment, a beam line transporter with dexterous manipulator mounted on a telescopic arm, and general tooling for (un)bolting, cutting and welding of both pipes and lip seals. Preparations of the in-kind neutral beam remote handling system procurement arrangement have been initiated in November, together with an option study for the inclusion of commercial of the shelf components in an embarked control unit on the monorail crane (OMF-272-01-06).



Neutral beam remote handling beam line transporter during maintenance of the residual ion dump (RID)

Cryoplant and Fuel Cycle Systems

Introduction

F4E is responsible for the in-kind procurement of the following:

- Liquid nitrogen (LN_2) plant and auxiliary systems, approximately one-half of the cryoplant (30.677 kIUA);
- Front-end cryodistribution with cold valve boxes, torus and cryostat cryopumps, cryopumps for the neutral beam system and leak detection and localisation (14.226 kIUA);
- Tritium plant consisting of the water detritiation system and the Hydrogen isotope separation system (18.216 kIUA);
- Waste management and storage (10.1 kIUA);
- Radiological protection (4.2 kIUA).

Executive Summary

In the area of the cryoplant, fuel cycle and other systems, the main highlights of the achievements during 2012 are as follows:

Cryoplant

- Optimisation of the system configuration (in particular for helium storage) and associated update of the layout;
- Completions of a contract (OPE-336) for pre-studies of quench tanks and test cryostat in order to identify risks and potential issues;
- Refinement of the interface definition with other systems;
- Finalisation of the specifications for the call for tender taking into account the results of the market survey and technical pre-studies;
- Launch of call for tender OPE-376 (LN_2 plant and auxiliary systems) in October 2012.

Cryopumps and Cryodistribution Lines (Vacuum Pumping and Leak Detection)

- All contracts for the manufacture of the pre-production cryopump have been placed;
- The design for the cold valve boxes and the warm regeneration system has progressed significantly;
- The design of the neutral beam and MITICA cryopumps has also advanced;
- Significant progress has been achieved in the leak localisation pre-procurement arrangement activities via the conclusion of GRT-158;
- An extensive business intelligence analysis with the proposed ITER design for the warm regeneration lines is defining the optimum way forward for these components.

Tritium Systems (Tritium Plant)

- Preliminary design review for the water detritiation system large (volume $\geq$ 20m^3) tritiated water holding tanks was successfully carried out;
- The procurement arrangement for the procurement of the tanks has been signed and the procurement contract is under preparation (publication of the call for tender in first half 2013);
- Call for tender for the contracts for the conceptual design of the isotope separation system and supporting R&D have been published and are scheduled to be implemented in the first half of 2013.

Radwaste and Radiological and Environmental Monitoring Systems

- Completion of the ITER task agreement for the "Support to the ITER Organization during the conceptual design phase of radiological and environmental monitoring systems, part-II" has been carried out;
- Radiological and environmental monitoring systems conceptual design phase has been closed and conceptual review meeting was carried out;
- Framework contract for engineering support in the field of radiological and environmental monitoring systems was signed;
- The ITER task agreement for the "Radwaste process optimisation" was executed;

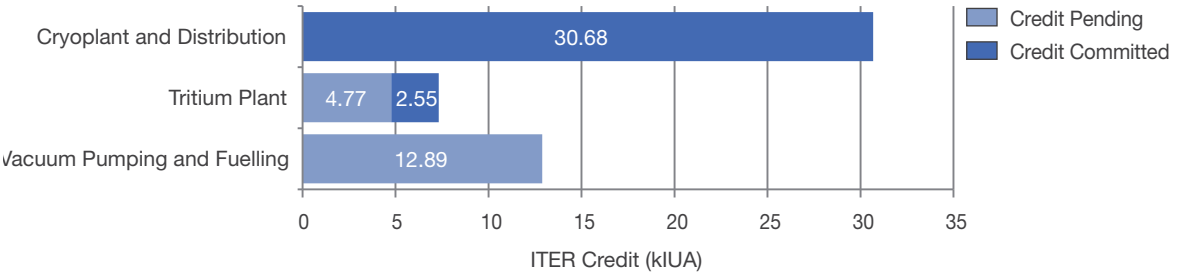
- The framework contract for engineering support in the field of radwaste was signed;
- The new system requirement document has been reviewed in the frame of PCR-300.

ITER Credit Status

In 2012, the procurement arrangement for the first part of the water detritiation system of the tritium plant was signed in December for 2.552 kIUA. The procurement arrangement for the cryoplant was already signed in June 2011. See graph below.

Main Milestones

In the following table, the main milestones that have been completed in 2013 are shown compared with the dates foreseen in the ITER baseline.



F4E Work Breakdown Structure	Milestone Title	ITER Baseline Date	Actual Date
EU.01.31.02.51 **Vacuum Systems / Leak Detection Systems**	Start manufacture of Pre-Production Cryopump	Aug 2012	Nov 2012
	Completion of R&D on Leak Localization in the Tokamak Cooling Water System (GRT-158)	Aug 2012	Aug 2012
EU.01.32.02.51-52 **Tritium Systems / Water Detritiation System (WDS)**	Conceptual Design entire Water Detritiation System (WDS) approved by the ITER Organization	Jun 2012	Jun 2012
	Procurement arrangement for procurement of tanks signed	Sep 2012	Dec 2012
	Preliminary Design of “Large Tanks” completed and approved by the ITER Organization	Sep 2012	Dec 2012
EU.01.34.01.51 **Cryoplant**	Supply of a full set of technical input data by the ITER Organization	Mar 2012	Mar 2012

Progress Report on the Cryoplant

As far as the European contribution to the cryoplant is concerned, 2012 was mainly devoted to the finalisation of the main call for tender for the design, supply, installation (as an option) and testing of the LN_2 plant and auxiliary systems (OPE-376) which was launched in October 2012. This involved the following activities:

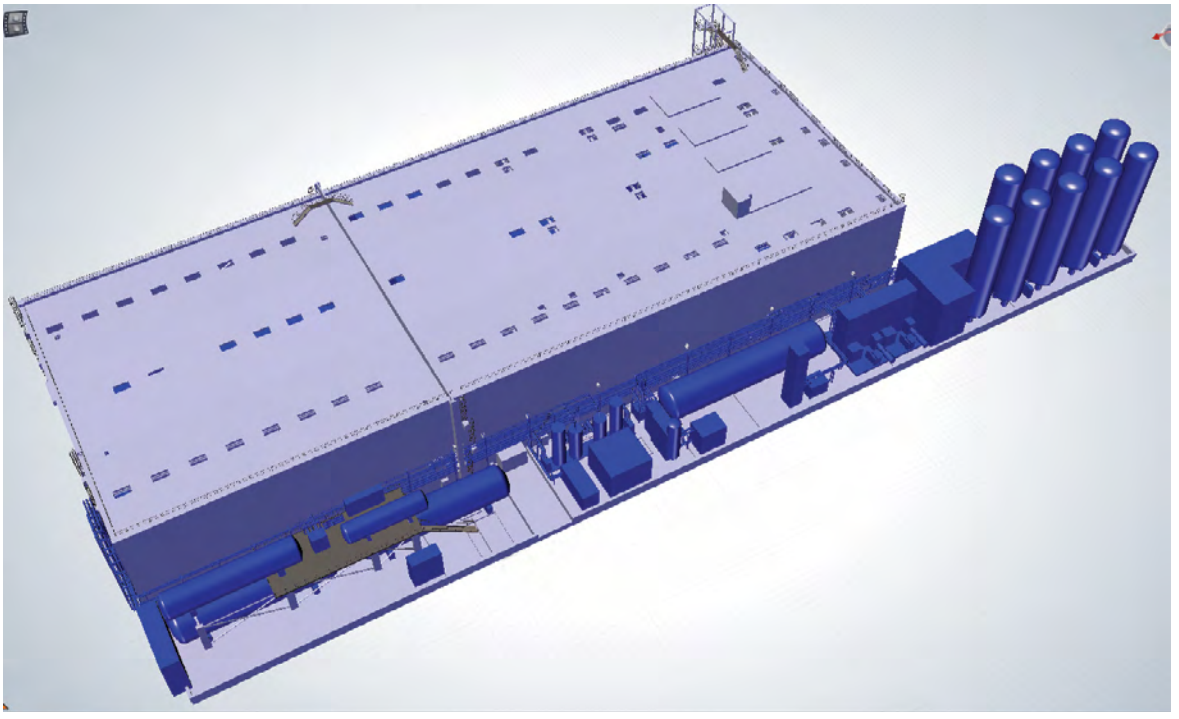
- Optimisation of the system configuration (in particular for helium storage) and associated update of the layout;
- Completions of a contract (OPE-336) for pre-studies of quench tanks and test cryostat in order to identify risks and potential issues;
- Refinement of the interface definition with other systems;
- Finalisation of the specifications for the call for tender taking into account the results of the market survey and technical pre-studies.

Progress Report on the Cryopumps and Cryodistribution Lines

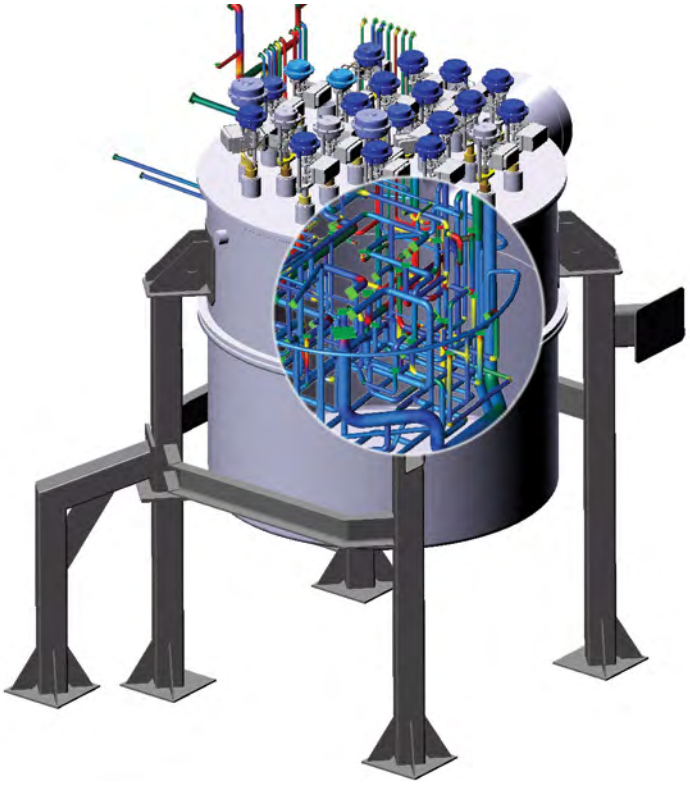
All three contracts for the manufacture of the pre-production cryopump have been placed. Significant progress has been reached in setting up the quality plan packages for this key activity. It is reminded, that the pre-production cryopump manufacture, under the task agreement C32TD31FE, is a major pre-procurement arrangement activity for the built-to-print definition of the torus and cryostat cryopumps and that the pre-production cryopump is also intended as a spare cryopump.

The contract for the cold valve boxes and the warm regeneration system has progressed significantly developing the detailed design of the cold value boxes and warm regeneration lines. Such a design has to satisfy not only the very tight ITER geometrical environment but it shall also be optimised in terms of thermal losses, stresses and pressure drops.

Significant progress has been made in the preparation for the procurement arrangement of the warm regeneration lines. The detailed design proposed by the ITER Organization has been thoroughly analysed and a business intelligence exercise has probed the market to optimise the way forward.



Optimised layout in area 53 including large liquid and gas storage tanks



Design features of an ITER cold valve box (courtesy of IDOM)

The design of the ITER and MITICA neutral beam cryopumps has also further advanced (GRT-303 with RFX), while GRT-158 with CEA has been concluded. The grant GRT-158 has made a major contribution to leak localisation studies and especially to draining and drying of blanket modules. These are important aspects for the detection and localisation of water leaks in complex parallel pipe systems.

Progress on the Tritium Plant

Water Detritiation System (WDS)

The preliminary design of the water detritiation system large tritiated water holding tanks (four 20m^3 tanks and two 100m^3 emergency tanks) was finalised in the frame of the grant GRT-045 and passed the ITER preliminary design review. The final design will take into account modifications and remarks proposed by the project design review panel. Following the preliminary design review the procurement arrangement for the supply of the tanks to the ITER Organization was prepared and signed at the end of 2012. The procurement arrangement includes final design, manufacturing and delivery of the tanks to the ITER site and the relative contract is planned to be launched in the second half of 2013.

R&D continued (GRT-045) to qualify a type of catalyst/packing mixture candidate for the use in the water detritiation system liquid phase catalytic exchange columns. The influence of heavy water in the LPCE columns with respect to the detritiation factor is being investigated. Experimental campaign is close to completion and the results confirm the expected negative impact on the separation performance of the liquid phase catalytic exchange column of the deuterium concentration increase in the fed tritiated water. The outcome of the R&D will be used in the optimisation of the design parameters for the liquid phase catalytic exchange column (e.g. hydrogen gas/liquid water ratio, length of the column) in order to achieve the ITER required detritiation of the hydrogen to be exhausted.

In the frame of the same contract, a study was completed for the incorporation of a vapour phase catalytic exchange reactor to treat very highly

tritiated water in order to reduce the load on the water detritiation system. Comparing investments and operation costs, and taking into account the reduction in the number of needed electrolyser units, it was concluded that a vapour phase catalytic exchange reactor would bring some benefits with respect the water detritiation system processing capacity and safety aspects related to the electrolyser.

Isotope Separation System (ISS)

In the frame of the ITER task agreement signed at beginning of 2011, the calls for tender have been published for performing the conceptual design of isotope separation system (OPE-441), to perform the experimental characterisation of packing used in cryodistillation columns with respect to certain parameters (height equivalent theoretical plate, liquid hold-ups, etc.) and to find or develop suitable (validated) software to be used in the design of isotope separation system (GRT-440). This work is scheduled for 2013.

Progress on the Radwaste and Radiological and Environmental Monitoring Systems

Waste Management and Storage

The call for tender for the provision of engineering support in the field of radwaste was finalised and the contract signed. This framework contract was used to implement the ITA C66TD01FE, through a single task order. The activities included in the first task order were timely finalised. These activities were mainly focused on radwaste process optimisation for type A and TFA waste in the radwaste building. Processes as well as building modifications were provided to the ITER Organization.

In addition, the F4E/ITER Organization process to amend the ITER task agreement C66TD01FE to include new tasks was also started together with negotiations on scope.

The new system requirement document was reviewed, in the frame of PCR-300.

Radiological Protection

F4E and the ITER Organization worked in close collaboration on the development of the conceptual design of the radiological and environmental monitoring systems achieving the system conceptual design in August 2012.

The ITER task agreement (FCIPT-11-30-EU1) was completed and the task results were timely provided to the ITER Organization for the conceptual design review meeting. The following tasks were executed:

- Modelling of the tritium transport in process rooms, in order to identify best locations of the tritium-in-air trigger monitors;

- Definition of loads specification applicable to radiological and environmental monitoring systems.

During the second half of 2012, the procurement arrangement cost assessment was finalised and the results were used as basis for procurement arrangement negotiations. In addition, in the last months of 2012, F4E drafted the task order for the radiological and environmental monitoring systems preliminary design development.

Radio and Microwave Heating Systems

Introduction

F4E is responsible for the in-kind procurement of the following:

- Ion cyclotron resonance heating system (equatorial port plug incorporating one ion cyclotron antenna) (3.96 kIUA);
- Electron cyclotron resonance heating system (four upper port plugs incorporating launchers (9.632 kIUA), 32% of the gyrotron sources and 67% of the power supplies (9.86 kIUA and 11.628 kIUA respectively).

Executive Summary

In the area of the radio and microwave heating systems, the main highlights during 2012 are as follows:

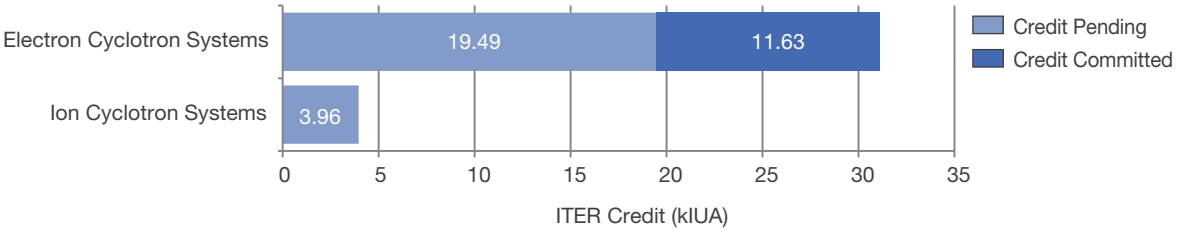
- Excellent progress toward completion of the work of GRT-026, detailed design of the ion cyclotron heating antenna;
- Electron cyclotron upper launcher design is in the final design phase. High priority has been given to the design and analysis of the SIC1 components (ex-vessel);
- Several grants and task agreements in the area of electron cyclotron power supplies and sources have been completed;
- The procurement strategy for the electron cyclotron power supplies was defined and the technical specifications for the call for tender prepared.

ITER Credit Status

In 2012 the procurement arrangement for the electron cyclotron radio-frequency power supplies was signed in May 2012 for 11.628 kIUA. See graph below.

Main Milestones

In the following table, the main milestones that have been completed in 2012 are shown compared with the dates foreseen in the ITER baseline.



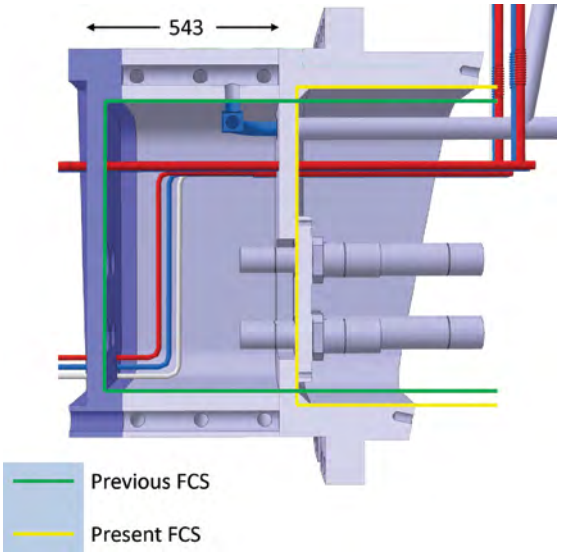
F4E Work Breakdown Structure	Milestone Title	ITER Baseline Date	Actual Date
EU.01.51.01.51 **H&CD / Ion Cyclotron Antenna**	Preliminary design review of the antenna	May 2012	May 2012
EU.01.52.02.51 **H&CD / Electron Cyclotron Power Sources**	Decision to Continue on the Coaxial Cavity Gyrotron Programme	Jul 2012	Jul 2012
EU.01.52.03.51 **H&CD / Electron Cyclotron Power Supplies**	Procurement arrangement for EU 5.2P4 RF Power Supplies signed	May 2012	May 2012

Progress on the Electron Cyclotron Upper Launcher

The design of the electron cyclotron launchers has entered the final design phase.

The launcher design and analysis work in 2012 has taken place under the umbrella of GRT-161, an agreement between F4E and the electron cyclotron upper launcher consortium of associations (KIT, CRPP, DIFFER, ENEA-CNR and IPP).

The technical work has been focused on the launcher components that are classified as SIC1 (that is providing primary confinement for the ITER tokamak). These components include all the ex-vessel components (waveguides and waveguide components, isolation valves and high-power diamond windows), as well as the rear part of the port plug (providing the seal between the port plug and the vacuum vessel) and feed-throughs.

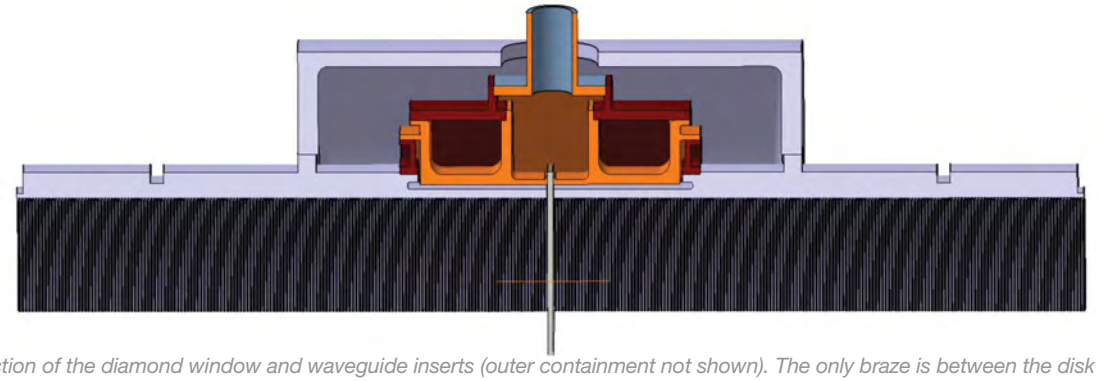


New design of the port plug backend for reduction of SIC1 welds and improved access (courtesy of the electron cyclotron upper launcher consortium of associations)

Manufacturing simplifications and inspection requirements are being integrated in all aspects of the design, as well as compliance with safety and quality rules. As an example of this work, the design of the port plug back plate has been modified (change of SIC1 boundary) to decrease the number of SIC1 welds, as well as for facilitating maintenance and access. The diamond window design has also been upgraded eliminating all metal-to-metal brazing and brazing-water contact in its construction (weak barrier).

F4E is supporting this work (in collaboration with the ITER Organization) with the identification, definition/update of requirements as well as by specific studies on mechanical codes and standards (manufacturing optimisation) and pressure code directive application to the launcher (design adaptations for exemption).

The technical preparation for the prototype and qualification of the electron cyclotron windows has been completed this year, and contracts will be soon launched in 2013. Finally, F4E has continued to provide support to the ITER Organization for design reviews and technical meetings related to the launcher and to electron cyclotron system in ITER, including the electron cyclotron system design review, where F4E has presented the engineering system put in place for the launcher development.



Section of the diamond window and waveguide inserts (outer containment not shown). The only braze is between the disk and the copper structure, with no water contact (courtesy of the electron cyclotron upper launcher consortium of associations)

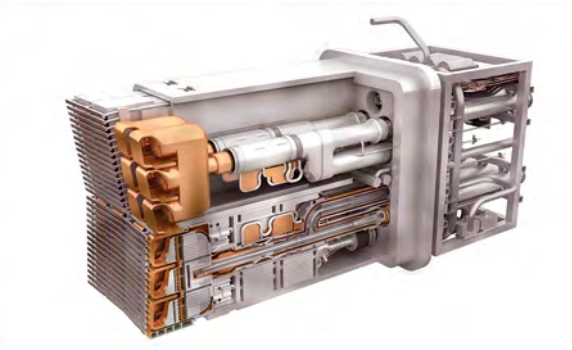
Progress on the Ion Cyclotron Heating

The development of the detailed design of the ion cyclotron heating antenna is continuing under GRT-026 (CYCLE consortium: CCFE, CEA, ERM, IPP and Politecnico di Torino). The preliminary design review took place in May 2012 and a number of Category 1 chits were raised. As a result of one of these chits a preliminary design review dealing with the Faraday screen design is planned for March 2013. The resolution of Category 1 chits is on-going and is planned to be completed in March 2013.

The validation of the radiofrequency design with mock-up studies is completed and the ITER task agreement is closed. The results of the electromagnetic analysis of the antenna were provided to CYCLE by F4E (under F4E analysis framework contracts), seismic analysis of the antenna has started (under F4E analysis framework contracts), and CYCLE is performing mechanical analysis of the antenna under the foreseen loads. Preparation for the neutronics analysis (under F4E analysis framework contracts) has been completed and the work is planned for 2013). Effort has been spent in also in dealing with antenna interfaces not yet stabilised.

The preparation for the next phase of the design in 2012, presently not covered by the ITER task agreement has involved the completion of the technical specifications of a new framework contract for the design of the antenna, to cover the completion of the design, the preparation of the built to print drawings and of the technical specifications for procurement and general support to procurement preparation. This contract is expected to start in March 2013.

The qualification of the Faraday screen Be/Copper/stainless steel bonds (HIP) with the fabrication of small scale mock-ups and of prototypes of the Faraday screen bars is progressing.



Latest CATIA model of the ITER ion cyclotron resonance heating antenna design (courtesy of the CYCLE consortium)

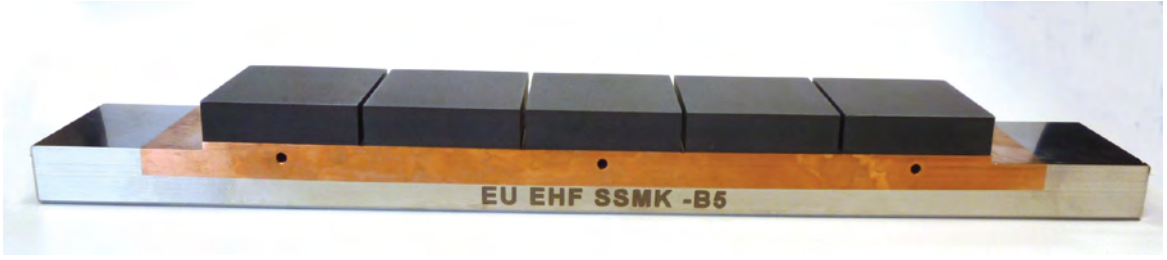
This work is being carried out under OPE-097 Lot 2 and is profiting from the synergies in scope with the blanket project. The small-scale mock-ups are in the last steps of manufacture.

The contract for the high heat flux tests of Faraday shield bar small-scale mock-ups and prototypes at the loads expected in ITER has been signed, still in collaboration with the blanket project. The next steps are the delivery and testing of the small-scale mock-ups and start of manufacture of the prototypes.

The scope of the qualification of the radio frequency window ceramics with pre- and post-irradiation measurements of relevant material properties is being finalised and the preparation of the technical specification for the first phase of the work is almost completed. This activity is now on the critical path of the schedule.

Progress on the Electron Cyclotron Radio Frequency Sources and Power Supplies

Following the Technical Advisory Panel's ad-hoc group recommendations on the gyrotron strategy and the F4E project plan, in 2012 F4E re-oriented the existing activities for the development of the EU



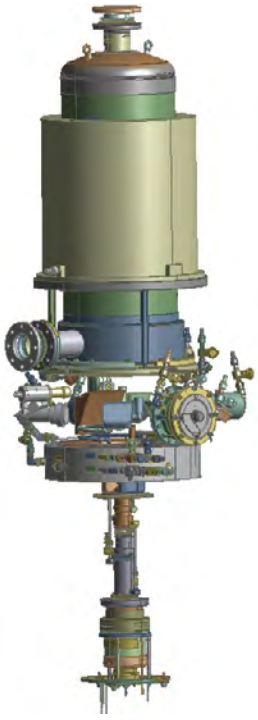
Small scale mock-up of the ion cyclotron resonance Faraday shield (courtesy of Atmostat)

gyrotron for ITER towards the design review of the 1MW gyrotron. In this process, the 1MW gyrotron design was validated by the industrial partner and assessed to be compatible with the existing technologies developed for the series production of the W7-X gyrotron.

According to the 2012 work programme, the grant agreement F4E-GRT-432 for the continuation of the 1MW gyrotron development was prepared and signed in December 2012, and the call for tender for the short pulse 1MW gyrotron launched.

The upgrades on the electron cyclotron test facilities and the implementation of the ITER task agreement for the analysis of gyrotron integration issues were completed.

The procurement arrangement on the European contribution to the electron cyclotron power supplies system was signed in June 2012. During the second half of the year the call for tender for the supply of the electron cyclotron power supplies for ITER was prepared. The individual procurement strategy for the main supply contract was presented and approved at the Executive Committee meeting of 25 October 2012. The procurement description was presented to the ITER Organization in December 2012 and approved.



3D gyrotron assembly

Neutral Beam Heating

Introduction

F4E is responsible for the in-kind procurement of the following:

Neutral beam heating system (100% assembly and testing, 100% beam line components, 100 % of compensation and active correction coils, around 50% of the remaining components broken down into:

- Neutral beam heating system assembly (3.8 kIUA);
- Beam source and high voltage bushings (3.893 kIUA);
- Beamline components (3.9 kIUA);
- Confinement and shielding (9.025 kIUA);
- Active corrections and compensation coils (4.4 kIUA);
- Heating and neutral beam power supplies (31.382 kIUA);
- Neutral Beam Test Facility (27 kIUA) approved by the ITER Council as an additional direct investment.

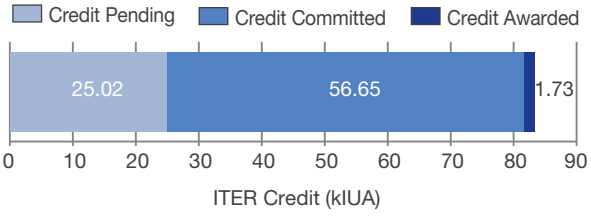
Executive Summary

In the area of the neutral beam heating systems, the main highlights during 2012 are as follows:

- Many major procurement contracts for the Neutral Beam Test Facility were signed in 2012 and the tendering procedures for many others were launched and progressed;
- The construction of the Neutral Beam Test Facility buildings at the Consorzio-RFX site in Padova started;
- Design work on towards the build-to-print specifications of the heating neutral beam core components and front end progressed well, with the ITER Organization preliminary design review being successfully passed;
- The ELISE experiment in IPP entered into operation.

ITER Credit Status

Procurement arrangements for the neutral beam systems were signed in July 2009 and October 2010. In addition, credit has been awarded to F4E in both 2011 and 2012 for work completed.



Main Milestones

In the following table, the main milestones that have been completed in 2013 are shown compared with the dates foreseen in the ITER baseline.

F4E Work Breakdown Structure	Milestone Title	ITER Baseline Date	Actual Date
EU.01.53.(01-07).51 **H&CD – Neutral Beam**	Signature of NBTF Back to Back agreement	Jan 2012	Jan 2012
	Signature of PRIMA Cooling plant contract	Aug 2012	Sep 2012
	Signature of SPIDER Beam Source and Vessel contract	Aug 2012	Oct 2012

Progress Report

The Neutral Beam Test Facility entered the construction phase in 2012, with the start of the works for the erection of the buildings in Padova. The buildings, managed by Consorzio RFX are part of the Italian contribution to the establishment of the Neutral Beam Test Facility.

In 2012, F4E continued to provide support to the ITER Organization to prepare the neutral beam technical specifications at the required level of detail. This support included most of the design and R&D activities related to the heating neutral beam system and the design and the establishment of the Neutral Beam Test Facility. In particular:

- The ITER preliminary design review for four of the neutral beam front components (drift duct, VVPSS box, exit scraper and fast shutter) was approved successfully in 2012. The preliminary design review for the beam line and beam source vessel, the passive magnetic shield and active correction and compensation coils are foreseen for April 2013 final review in 2013 included.

- The design of the megavolt ITER injector and concept advancement (MITICA) components was advanced: in March the preliminary design reviews of the neutral beam line components (neutraliser, electrostatic residual ion dump and calorimeter) and of the MITICA vacuum vessel were performed and all the components were accepted for the subsequent final design phase.

- An intense R&D activity was performed to verify the applicable technology for the fulfilment of the stringent requirement of the high heat flux components.

- The test facility for ultra-high voltage tests for vacuum insulation was fully commissioned and several experimental campaigns have been performed to verify electrostatic configuration of the beam source accelerator also in the presence of transversal magnetic field.

- Manufacturing activities for the ion source and extractor power supplies (ISEPS) started in May and have been progressing well. The EGPS modules production started after successful prototyping, the prototyping and testing of the electronics is in progress (MFC control electronics, RAAD, PLC based controllers, and the development of the radio frequency generators by Himmelwerk is on-going. A quality assurance audit of the main supplier OCEM Energy Technology was conducted in November, with satisfactory results.

- The major contract for the procurement of the SPIDER beam source and vacuum vessel was signed, being those are the core components of the SPIDER test bed.

- The technical exchanges held within the competitive dialogue for the 1MV deck and bushing of MITICA and ITER injectors came to a successful conclusion in November in particular the critical interface with the SF6 transmission line provided by

Neutral Beam Test Facility building construction

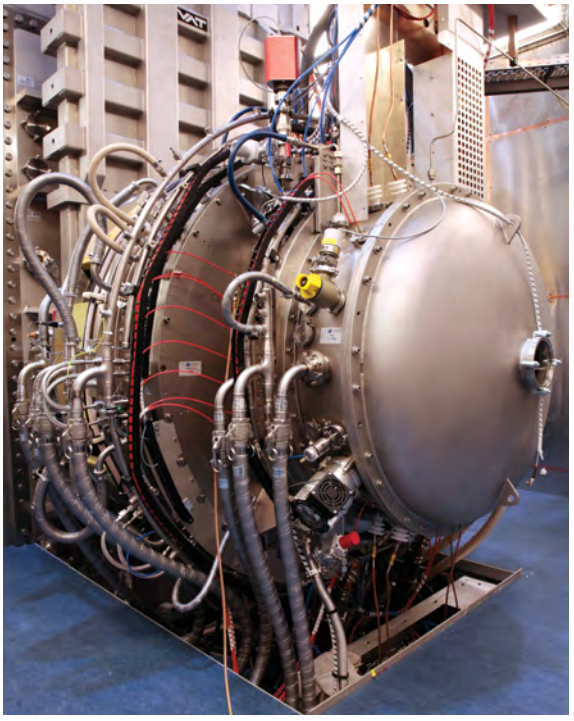
the Japanese Domestic Agency. The procurement is now due to start soon. SPIDER high voltage deck and transmission line. The procurement is expected to start in the first months of 2013.

- The call for tender (negotiated procedure) for the Neutral Beam Test Facility cooling plant was launched as foreseen in 2011, first offers were received in January 2012 and the contract was signed in September 2012.

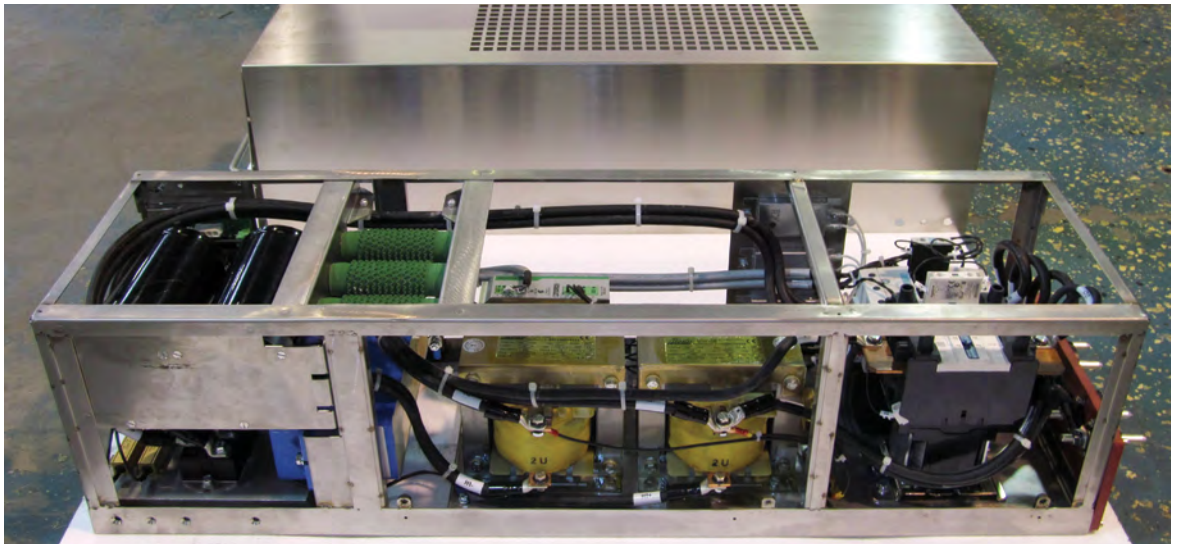
- The contract for the procurement of the gas storage and distribution, vacuum and gas injection systems for the Neutral Beam Test Facility was signed in December 2012.

The assembly of the Experiments of Large Radiofrequency Ion Source (ELISE) at the Institute of Plasma Physics (IPP) in Garching was completed in November 2012 and during the same month the test facility was inaugurated celebrating the starting of the experiments. An ad-hoc group of experts has been appointed by F4E to constitute the ELISE Programme Advisory Committee (EPAC), whose mission is supporting the IPP team in preparing the experimental program and reviewing the results of the experiments.

Water basins for the cooling plant at the PRIMA site



ELISE



First EGPS module for the ISEPS procurement (courtesy of OCEM ET)

Diagnostics

Introduction

F4E is responsible for the in-kind procurement of the following:

- 13 distinct diagnostics systems; tokamak services (cables, feed-throughs and connectors on the ITER vessel); and integration of diagnostics into seven ports housing 22 diagnostics systems from Europe, the ITER Organization and five other Domestic Agencies;
- F4E is responsible of about one quarter of the ITER Diagnostics.

Significant progress has been made during 2012 with design of the magnetics diagnostic under several grants and through signature of framework partnership agreements (FPA) for the development and design phase of several other diagnostics systems.

An FPA establishes a long-term collaboration (for up to four years) with a beneficiary or consortium by defining a set of rules (i.e. a framework) for conduct of the work; with the work itself performed under separate specific grants agreements. FPAs have been chosen as providing the best tool for these diagnostics, which are typically 'first-of-a-kind', require a large specialised design base and need long continuity of the design team.

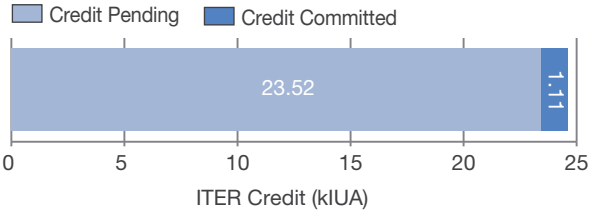
Executive Summary

In the area of diagnostics, the main highlights during 2012 are as follows:

- Preliminary design reviews held for the continuous external Rogowski coil and micro-electromechanical system magnetometers;
- FPA signed for tokamak services;
- FPA signed for plasma position reflectometry;
- FPA signed for radial neutron camera and radial gamma ray spectrometer;
- FPA signed for pressure gauges;
- Call for tender launched for the framework contract for integration designs of the diagnostics into ITER ports;
- Call for tender launched for the framework contact for irradiation and post-irradiation testing of diagnostics components and assemblies;
- Call for proposals launched for bolometers diagnostics;
- Call for proposals launched for equatorial visible IR wide angle viewing system;
- Call for proposals launched for low field side collective Thomson scattering;
- Call for proposals launched for core-plasma charge exchange recombination spectroscopy.

ITER Credit Status

A procurement arrangement for the first part of the diagnostics was already signed in December 2011 for 1.112 kIUA.



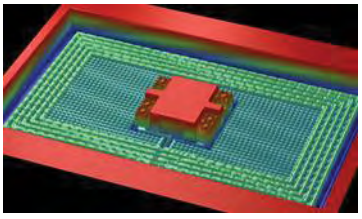
Main Milestones

No main milestones as referred to in the project plan were completed during the reporting period.

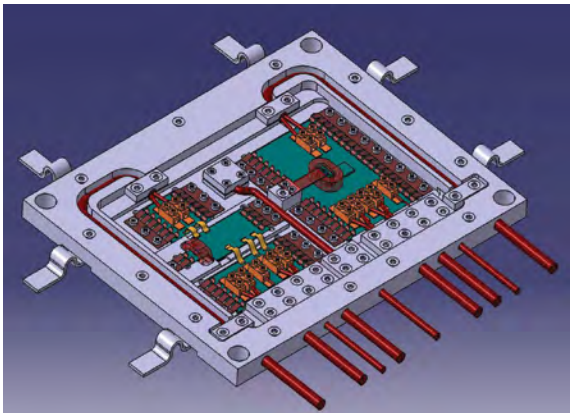
Magnetic Diagnostics

Successful preliminary design reviews were held for two key components: the continuous external Rogowski coil, being designed under grant GRT-157 (signed with CEA) and the micro-electromechanical system magnetometers under grant GRT-156 (signed with VTT). The continuous external Rogowski coils are aimed at providing a robust and simple method of measuring the toroidal current flowing inside the toroidal field coil contour, which approximates to the plasma current under steady conditions. The micro-electromechanical system is aimed at measuring the tangential and normal magnetic field at several locations on the outer surface of the vacuum vessel. The

micro-electromechanical system relies on the torque generated on a current carrying loop placed in the magnetic field to be measured. By contrast to inductive sensors, this approach has the advantage that it does not require integration of the signal over time, to retrieve the magnetic field – a process which limits the duration for which the requisite measurement accuracy can be maintained. The micro-electromechanical system can measure the absolute magnetic field, whereas inductive sensors only measure changes in magnetic field from the start of the ITER pulse. Successful demonstration of this measurement in an ITER-relevant configuration was achieved ahead of the micro-electromechanical system preliminary design review.



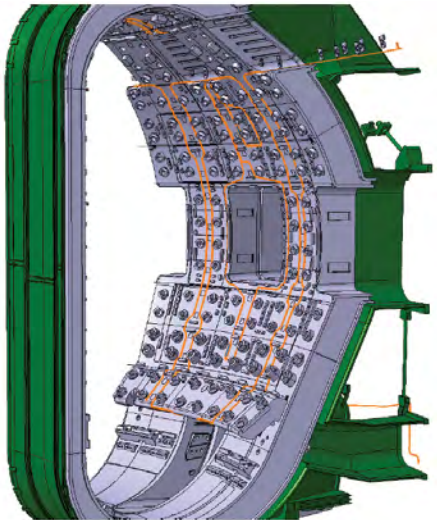
A profilometer image of the micro-electromechanical system sensor within the calibration coils. The rectangular plate shown in green contains the current carrying coil, which experiences a force when placed in a magnetic field. The force is measured via changes it produces in capacitance between the plate and the silicon cap (not shown). The dimensions of the plate are 2.1 x 1.2mm (courtesy of VTT).



Micro-electromechanical system sensor head assembly (with the enclosure lid removed), showing external connections routed to two sensors (within the oval structures) oriented to measure two orthogonal components of the magnetic field. The oval structures contain coils which can be energised to calibrate the sensors in situ. External dimensions of the assembly are 250 x 210 x 10.5mm (courtesy of VTT).

Tokamak Services

FPA-328, the first FPA launched by F4E, was signed in March 2012 with a consortium consisting of three laboratories from the Hungarian Fusion Association: Wigner RCP, MTA EK and BME. The framework covers R&D, engineering, quality and testing of the diagnostics tokamak services, which include cables, conduits, feed-throughs and connectors in the ITER vacuum vessel and cryostat. Work has started with the signature of two specific grants, covering the planning phase for the overall implementation and execution of the FPA, and the creation of a Coordination Support Office that will provide assistance and support to F4E in the coordination of the execution of the FPA. Due to the tight schedule for these components, among the first diagnostic systems to be delivered to ITER, the signed specific grants also include prototype specification for the most critical items.



In-vessel looms (outboard and inboard central) installed after some magnetics and the thermal shield (courtesy of the ITER Organization)

Plasma Position Reflectometry

The plasma position reflectometry system determines the density profile at the plasma edge and the distance between the plasma and tokamak wall, through measurement of a radio frequency signal injected into the plasma. The control of the plasma density profile is critical in order to keep the plasma stable and prevent it from touching the wall, leading to a plasma disruption which would stop the fusion process. FPA-375, for the design of the plasma position reflectometry systems (including antennas, waveguides, microwave electronics and real time

analysis software) was signed with a consortium consisting of IST, CIEMAT and IFP-CNR. The first specific grant was signed in December 2012.

Radial Neutron Camera and Radial Gamma Ray Spectrometer

The radial neutron camera infers the neutron emissivity profile in a poloidal cross-section of the plasma through the measurement of collimated neutron fluxes. To achieve this goal, the radial neutron camera consists of a fan-shaped array of collimators, which forms a number of lines of sight viewing the plasma from an equatorial port and through a vertical cut-out in the blanket shield module. Each collimator is equipped with a set of dedicated neutron detectors able to measure neutrons produced by either the deuterium-deuterium or tritium-deuterium neutrons. The radial neutron camera also contributes to the determination of the thermonuclear fusion power released by the plasma, production of which is a primary goal of the ITER project. In December 2012, F4E signed FPA-327 for the design of the radial neutron camera (including the enabled radial gamma-ray spectrometer) with a consortium consisting of ENEA, IFP-CNR, UNIMIB, IFJPAN, IPPLM and IST, supported in the work by five third parties.

Diagnostic Pressure Gauges

The diagnostic pressure gauges aim at measuring the neutral gas pressure at various locations inside the ITER vacuum vessel during plasma operation, which is critical to the control of the plasma breakdown and to the characterisation and assessment of ITER divertor performance. FPA-364, for the design of the diagnostic pressure gauges was signed in December 2012 with a consortium consisting of IPP and SGENIA Soluciones.

Plasma position reflectometry FPA signature ceremony (from left to right): Head of IFP-CNR, Dr Maurizio Lontano; President of IPFN-Lisbon, Bruno Gonçalves; Portugal Secretary of State of Science, Dr Leonor Parreira; President IST-Lisbon, Arlindo Oliveira; F4E Director, Henrik Bindslev; Head of Research Unit of CIEMAT, Dr Joaquin Sanchez.

Test Blanket Modules and Materials Development

Introduction

Test blanket module systems shall allow testing tritium breeding and recovery in the ITER environment with materials and technologies relevant to tritium breeder blankets of future fusion reactors. The test blanket modules are not among the items which are obliged to be provided by Europe to the ITER Organization. Instead the test blanket modules are to be procured separately by the interested parties and installed in ITER whereupon a test blanket module testing programme will be conducted by ITER.

Executive Summary

In 2012 the main achievements in the area of the test blanket modules is as follows:

- Completion of four grants for (i) Study of three design configurations for HCLL and HCPB test blanket modules; (ii) test blanket modules functional materials (beryllium, ceramic breeder, Pb-Li) Development/Qualification - screening of an alternative production route/capacity for Be pebbles; (iii) post-irradiation examination of beryllium pebbles irradiated in the HIDOBE campaign; (iv) determination of the amount of tritium accountable in TBS over a given time period; development of the conceptual design of the tritium accountancy system;

- Completion of a specific contract (TO-04) for the shielding analysis of the test blanket module systems in equatorial port and improvement of shielding performances;

- Award of a contract (OPE-412) for inspection, handling and storage of EUROFER-97 batch#3 semi-finished products;

- Signature of a grant action (GRT-410) for the upgrade of the EUROFER database and appendix for RCC-MRx;

- Signature of five engineering framework contracts (OMF-331-1/2/3/4/5) for (i) Design of test blanket module sets and analyses including neutronics, shielding, dose rate and waste; (ii) design of test blanket modules ancillary systems and integration in ITER; (iii) nuclear maintenance studies and design of associated equipment; (iv) TBS transient and accidental analyses & safety studies; (v) development and characterisation of preliminary welding procedure specifications for the test blanket module box assembly by welding and fabrication of feasibility/demonstration mock-ups;

- Award of four R&D framework partnership agreements (FPA-372, FPA-380-1/2/3) for (i) Experimental Activities in support of the design of HCLL and HCPB-TBS using the TBM-CA experimental facilities; (ii) Experimental Activities in support of the design of HCLL and HCPBTBS using other facilities; (iii) test blanket system instrumentation development; (iv) qualification of functional materials for test blanket module applications.

Progress Report

The development of the European test blanket modules systems conceptual design has progressed in 2012, in particular with engineering contracts dedicated to seismic and electro-magnetic analyses and with the design of a tritium accountancy station (GRT-254). The conceptual design of the seven HCLL/HCPB ancillary systems has been further developed and is now an important reference for many components, in particular in terms of technology selection and preliminary performance evaluation. A systematic review of technical regulatory aspects like the PED/ESPN classification of the TBS equipment has also been achieved. Integration in ITER has progressed, in particular with the preliminary integration of the plant interlock/safety systems within ITER.

The development and standardisation of fabrication technologies for test blanket module structures with embedded cooling channels (first wall, cooling/stiffening plates and side caps) have progressed (OPE-305). Within this framework new fabrication benches have been fabricated and detailed fabrication procedure specification is being developed on the basis of codes and standards.

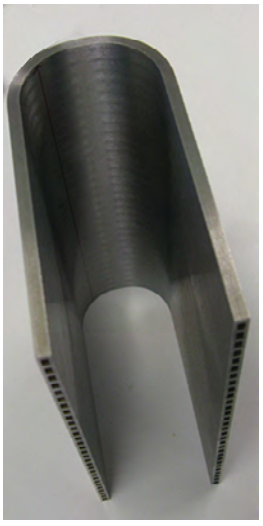
As a result of the grant GRT-10, the EUROFER-97 structural material that will be used for test blanket modules has been introduced, for the first time, in a nuclear code: the RCC-MRx Edition 2012. For the time being, EUROFER-97 is introduced under

probationary phase and with partial list of material properties.

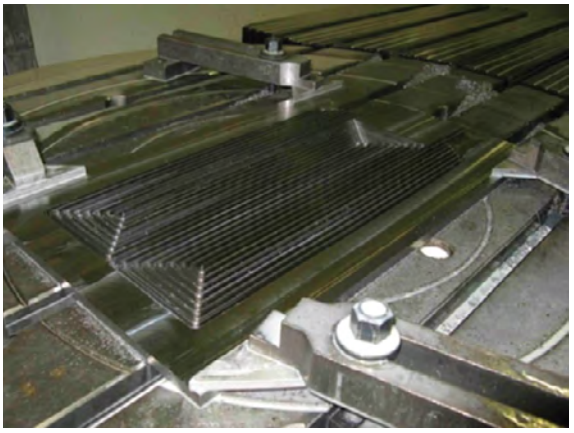
Other activities in the area of development/ characterisation of test blanket module functional materials have progressed satisfactorily. For instance the post-irradiation examination of the beryllium pebbles irradiated in the HIDOBE campaign has been achieved (GRT-30-3). In addition, investigation on alternative fabrication routes for beryllium pebbles (GRT-30-2) has shown that the "impact grinding" method is not recommended for a use in test blanket modules in particular because of excessive amounts of impurities. At least, preliminary investigations have showed the advantages of beryllium pebbles with grain sizes ranging from 10 to 30 μm over higher grain size (tritium release measurements, chemical composition and pebble density).

In the area of numerical modelling, a tool able to simulate tritium migration/processing in the test blanket module systems has been developed (GRT-254). This tools is unique in Europe and likely worldwide; it is now used for consolidating essential data for test blanket module safety demonstration in ITER and estimation of radwaste data.

Within the framework of the test blanket module programme committee activities, the following progresses have been obtained (i) the main legal provisions which shall govern the future test blanket modules arrangement to be signed between each ITER member that is planning testing of a test blanket module in ITER and the ITER Organization have been negotiated and endorsed by the ITER Council. They address in particular the role and responsibility of ITER members and ITER Organization, intellectual property rights and nuclear liability; (ii) the radwaste management strategy and updated radiological data for the European test blanket module systems have been transmitted to the Agence ITER France (AIF), as well as a preliminary study on the feasibility of transportation of irradiated TBMs outside ITER site for Post Irradiation Examination in European nuclear facilities.



Mock-up of a helium-cooled pebble bed (HCPB) test blanket module cooling plate (courtesy of KIT/Karlsruhe)



Mock-up of a helium-cooled lead-lithium (HCLL) test blanket module cooling plate (courtesy of ATMOSTAT-CEA)

Technical Support Activities

Introduction

In carrying out its tasks, F4E also carries out a number of technical support activities which support the above-mentioned activities and cover the following areas:

- Safety and Licensing;
- Analysis and Codes;
- Materials and Fabrication;
- Instrumentation and Control;
- Plasma Engineering;
- Project Management, Risk and Scheduling Activities.

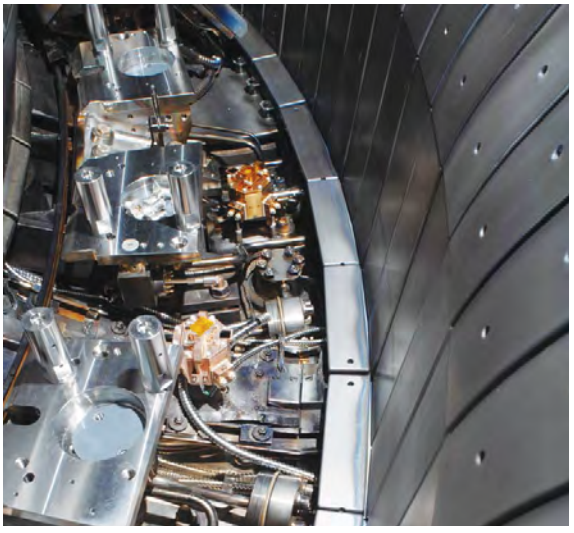
Safety and Licensing

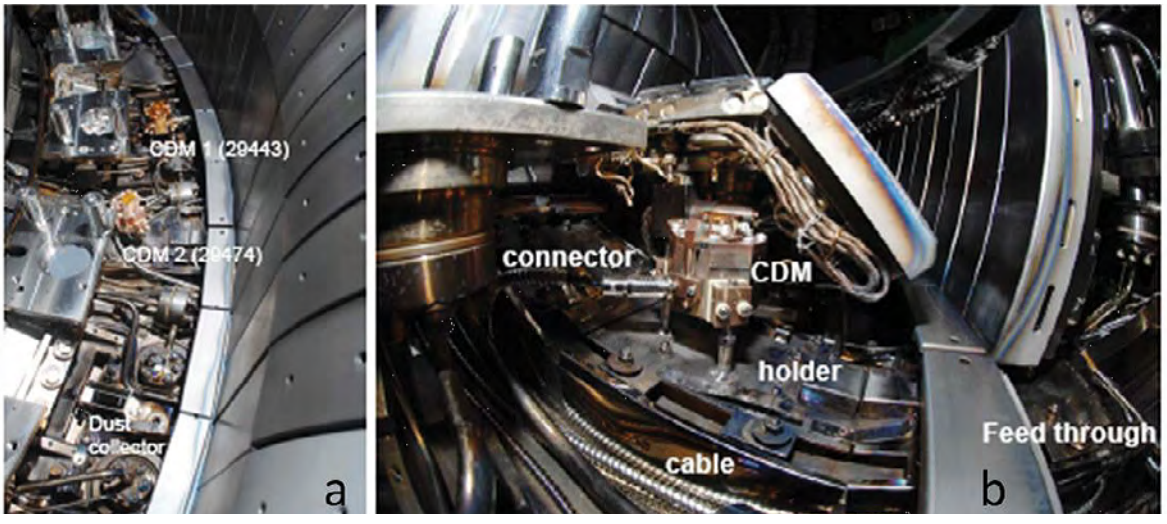
R&D Activities in Support to ITER Nuclear Safety and Licensing

Important issues related to the future ITER licensing were addressed through R&D activities which are included in the R&D plan outlined in the ITER Preliminary Safety Report (RPrS) for the in-vessel dust and tritium management.

In 2012, three contracts for diagnostics for in-vessel dust inventory measurement were managed (GRT-50). In particular, gauges for in-vessel dust measurement have been extensively tested in relevant conditions in the Tokamak ASDEX Up-Grade. In addition, the design of a divertor erosion monitor system, based on the Speckle interferometry technique, has been issued taking into account key interfaces. Finally, experiments, for testing a possible measurement of in-vessel "hot dust" by injecting small amount of steam in the vessel, have been carried out.

The contract OPE-347 ,carried out and closed in 2012),has provided fruitful information (release rates of deuterium from heated prototypic beryllium layers) in support to the ITER strategy for in-vessel tritium





Capacitive diaphragm monitors (gauges for dust measurement) installed for testing in ASDEX UG

inventory control (periodic heating of the divertor up to 350°C to release significant amount of tritium from beryllium co-deposits).

Two other contracts "Fusion Component Failure Rate Database" (OPE-79) and "Busbar Arcing" (GRT-273) have delivered valuable input for component design. Finally, a contract (GRT-371) for "In-Vessel Hydrogen/Dust Explosion" aiming at studying and characterising the specific behaviour of beryllium-like dust was launched and first results were obtained.

ITER Licensing Process – F4E Nuclear Safety Follow-Up of EU Procurement Arrangements

An extremely important milestone for the ITER licensing process has been achieved in 2012:

In November 2012 the ITER license was signed by the French Prime Minister Ayrault and published in the "Journal Officiel de la Republique Française".

On a more specific level the ASN held several in-situ inspections on the construction of the Tokamak building and the installation of the nearly 500 anti-seismic bearings.

F4E has defined and re-formalised the process in order to follow up on the safety requirements and the non-conformity requests from the supplier.

A training course on Nuclear Safety and the French Order of 10 August 1984 was given to more than 100 technical and management staff of various suppliers involved in the design and construction of the buildings and the vacuum vessel.

An internal independent nuclear safety review has been performed on various technical and management specifications and in parallel a review on nuclear safety took place on all deviation requests and non-conformities of SIC components.

Throughout 2012 a contract has been signed for the procurement for nuclear safety analysis support on F4E procurement arrangements. The first task will start at the beginning of 2013 on the electron cyclotron remote handling antenna.

Analysis and Codes

The activities in this area have been focusing on two main lines, namely to provide support to the development of the ITER design (through, for example, task agreements), as well as to the F4E procurement contracts.

As far as the direct support to the ITER Organization is concerned in 2012, it has to be mentioned that an ITER task agreement was placed by the ITER Organization with F4E to study the newly designed support to the tokamak machine by the reinforced concrete crown and sliding bearings. The execution of such a task was critical in terms of budget and schedule and the results of the study have allowed performing the design of the interface between the machine and the building basemat.

As far as the analysis work is concerned, this is mostly implemented via the placement of service contracts to qualified companies. Within the context of the existing framework contracts (covering both analysis and engineering support) approximately 15 task orders were placed and followed-up in 2012.

Among the various mechanical analysis studies commissioned to European industries, it is worth mentioning those in support to the vacuum vessel manufacturing, which is in the critical path in terms of schedule. In particular, these analyses allowed F4E to justify the deviation requests from the manufacturer in front of the ITER Organization and the Agreed Notified Body. Additionally, several mechanical task orders were placed to support the in-vessel project team for the first wall final design review activities, to be held in April 2013.

The activity in the area of electromagnetic analysis during 2012 has consisted in the management of several contracts. Some contracts have dealt with very important and critical topics such as design reviews of blanket modules and manifolds and the electro-dynamical loads computation of the vacuum vessel due to both symmetric and asymmetric MDs and VDEs. Other electromagnetic task orders have been implemented for several ITER components (ICRH antenna, test blanket modules, toroidal field coils and error field analysis).

In the area of neutronics several calculations were completed in support of the TBM and remote handling programmes. The study of tritium transients in the Tritium Plat and the thermal hydraulic performance

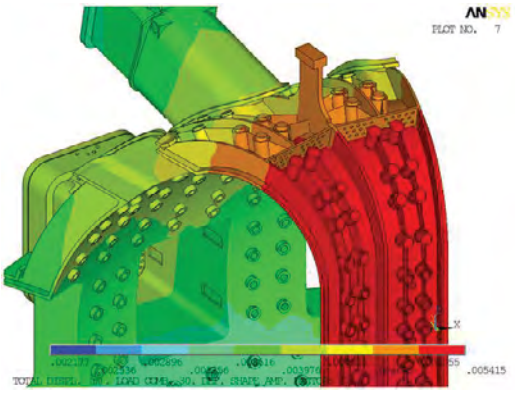
of the vacuum vessel and first wall were the most remarkable CFD activities.

Moreover, support to the architect engineer and, closely linked to it, to the ITER Organization building team, was provided through several detailed structural analysis studies simulating, in particular, the seismic behaviour of the buildings consistently coupled to the ITER device.

In addition, some resources were also devoted to follow-up the installation and commissioning at CRPP of the EDIPO magnet whose aim is to provide a new, more powerful test facility alternative to the existing 11 T SULTAN test facility. Indeed, the 12.5 T EDIPO facility is now scheduled to be commissioned by the end of July 2013.

An FPA (FPA-395) involving six Euratom Associations was launched for the validation of nuclear data libraries, and the development and testing of the experimental techniques required for nuclear data measurements in ITER (four-year programme).

A first specific grant under the FPA, FPA-168 was signed for a period of two years. It encompasses activities for the improvement of nuclear data libraries and related codes and models.



Effect of upper rib disconnection in the vacuum vessel baseline model

Materials and Fabrication

The 2012 activities in this area included characterisation and assessment of materials data under ITER operation conditions via irradiation campaigns, testing at cryogenic temperatures, thermal fatigue testing and assessment of corrosion parameters. Assessments of materials data were performed by non-destructive testing, mechanical and physical characterisation of materials and joints. The activities were linked with R&D, qualification and validation of series production stages of various EU ITER and JT-60SA subsystems.

Four contracts were signed, or amended to cover more topics, for the assessments of corrosion data to support qualification of in-vessel and vacuum vessel materials (GRT-243, GRT-268, OPE-338 and OPE-388). One framework contract was signed to support joining and NDT technologies included in the supplies of different ITER components (OPE-149). Four tasks on cryogenic material testing (OPE-084) were conducted to support the series production of ITER toroidal field conductor and qualification of JT-60SA toroidal field conductor. A task to qualify materials (OFC-167) within prototype manufacturing for the ITER first wall panels was launched. The collaboration in the framework of TWI membership (The Welding Institute) intensified significantly due to an increase in the welding related activities within the F4E ITER department and resulted in a total of 40 tasks during 2012. Two contracts were signed to manufacture and characterise enhanced tungsten grades to support the full tungsten vertical target (GRT-389 and GRT-390).

The on-demand support to the F4E ITER department on material and fabrication related issues increased with various technical topics. In particular the support to project teams approaching industrial manufacturing of large series and final components increased. Especially for the in-vessel and magnets teams to realise launching and implementation of contracts aimed at characterisation and assessment of materials data and qualification of manufacturers and manufacturing processes.

Explosion bonded CuCrZr to 316L pipe sections (3D metal forming BV, NL)

Instrumentation and Control - CODAC

In 2012, an important milestone of F4E CODAC team's procurement strategy was reached. After a long tender review process a company was selected for the role of system integrator. The choice has been challenging both because of the large number of participants and because of the overall high quality of the offers. The winner is a Spanish company, GTD, who specialises in aerospace instrumentation and control both working in the ground segment and in the payload areas.

The scope of F4E CODAC group has also been progressively consolidating:

- Implementation of all diagnostic control systems;
- Development of building alarm survey system;
- Integration to CODAC of the following systems: building, cryogenics;
- Support to the implementation of remote handling control systems;
- Collaboration with ITER on the development of the electron cyclotron heating master control system;
- Collaboration with ITER on the development of PCS;
- Collaboration with ITER on the vacuum vessel instrumentation.

In particular the following major achievements have been reached during 2012:

1. First integration of an ITER plant system to the ITER Organization CODAC team

On 2 October 2012 F4E and the ITER Organization have successfully performed the first site acceptance test of a CODAC integration of a plant system: B55 (poloidal field coil building) controller. The work has been performed by F4E CODAC team in collaboration with the building project team and involved several industrial collaborators.

The B55 building is 253 metres long and will be used for the manufacturing of the poloidal field coil which can reach 25 meters in diameter.

The main purpose of this activity was to integrate the local B55 alarm monitoring system into a global site alarm survey system which should manage the building construction activities in the next eight years.

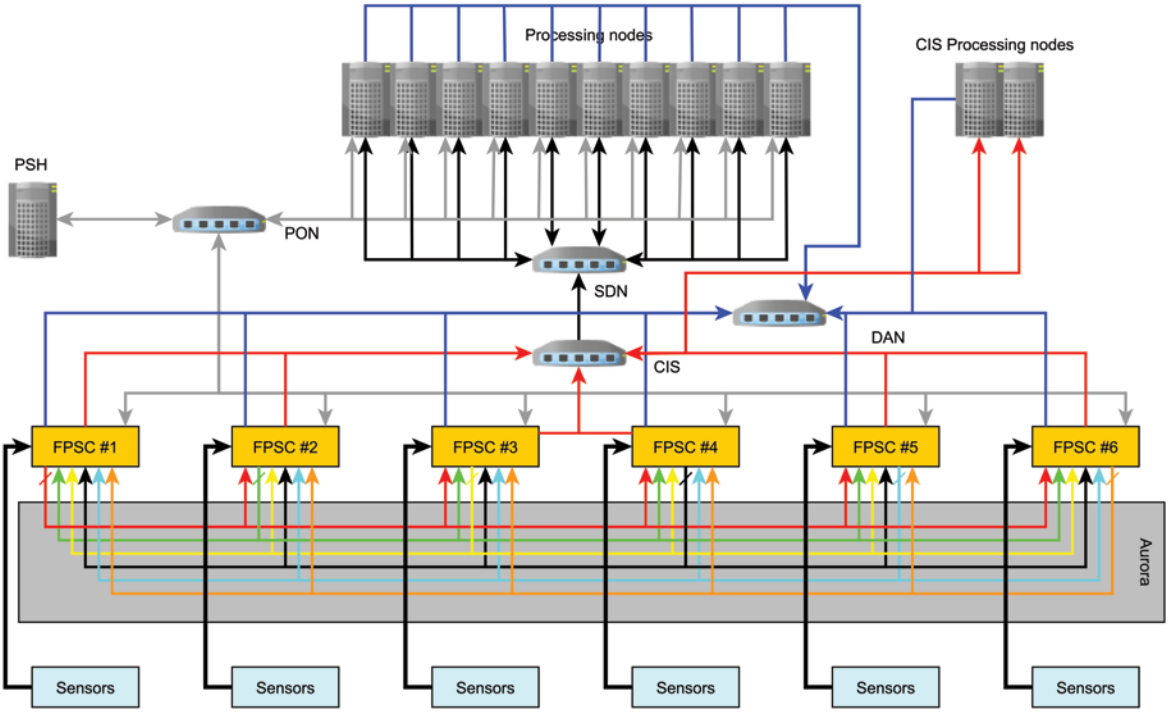
This project was successfully achieved following the architecture described in the PCDH (Programmable Logic Controller, Plant System Host, Mini-CODAC), and using the ITER Organization CODAC technologies (CODAC Core System v3.0 and tools).

INDRA (OFC-169) contractor showing the new CODAC mimics developed for the interface to the building B55

2. Consolidation of System Requirements for the implementation of the magnetic diagnostics Procurement Arrangement 5.5.P1.EU.01

Procurement arrangement documentation contained an incomplete, somewhat incoherent, and in places excessive definition of requirements. Use of SRD and other applicable documents was attempted at first in order to resolve the issues; at the end a series of coordination meetings with ITER has been the mechanism that allowed solving most of the issues.

Magnetic signal integration, needed to convert coil voltages into magnetic field measurements has been identified as a major project risk. One such device has never been developed fulfilling all ITER requirements. For this reason a strategy comprising initially two contracts has been put in place. With the first contract we ensure access to current EU state-of-the-art in the field, with the second we ask an industrial player to optimise it and reach ITER specifications. The technical specifications for both contracts have been produced.

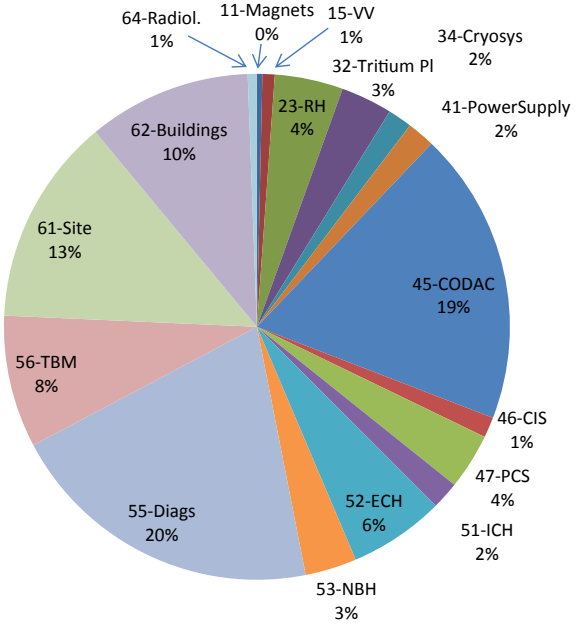


The proposed high level architecture for the magnetic diagnostic which shows how the data acquisition may be distributed among six distinct systems.

A second element of risk was identified to be the extensive interface to machine protection. For this reason a system level architectural design has been performed aiming at identifying a solution that maximised system availability. This resulted in identifying a design methodology which allowed assigning each of the 3,000 input channels to an appropriate magnetic probe so that the impact of any individual fault in the system would be reduced in terms of functions unavailability. This preliminary study allowed identifying an overall architecture consisting of six interlinked systems.

3. General support activities performed as part of OFC-169 task order 1

A large number of small and medium activities have been performed in order to support the activity of all project teams providing a total of around 6ppy of effort. The following graph shows the breakdown of the activity among various ITER PBS:



Distribution of INDRA effort among the various ITER PBSs

Plasma Engineering

F4E activities are mostly carried out on the basis of competitive ITER task agreements (ITAs), i.e. awarded, as the result of competition between domestic agencies. In 2012, F4E was awarded two ITAs. These ITAs cover different areas of the ITER design:

- C19TD51FE: dealing with the evaluation of fuelling requirements and transient density behaviour in ITER reference operational scenarios.

- ITA C52TD45FE: dealing with the design of the electron cyclotron plant control system.

To implement existing and new ITAs, F4E awarded in 2012: two new grants (GRT-379, GRT-418) and one contract (OPE-397).

In addition to the new activities, a substantial part of work consisted in the follow up of a large number of grants and contracts issued before 2012: GRT-055, GRT-255, GRT-265, GRT-267, GRT-315, GRT-334, GRT-346, OPE-148, OPE-258, OPE-349, OPE-06-06-11. The implementation of the above grants and contracts involves several European fusion laboratories (Aalto Uni, CEA, ENEA, CCFE, CNR, FZJ, KIT, Austrian Association, CRPP and IPP).

The contracts and grants in place cover the following main topics: plasma control; ITER scenarios development; assessment of loads on plasma-facing components; assessment of disruption loads and disruption mitigation techniques; verification of first wall shaping.

Other activities in the area of plasma engineering in 2012 included:

- Support to the EU members of the ITER Science and Technology Advisory Committee (STAC) for the evaluation of the impact of the issues related to the qualification of the CS conductor;

- Support to the ITER Organization on the evaluation of the proposal of partial or alternative assembly plans for the ITER machine;

Some activities foreseen in 2012 work programme were cancelled because the related ITAs were not issued by the ITER Organization and other activities were postponed due budget constraints of the ITER Organization.

Project Management, Risk and Scheduling Activities

In 2012 the F4E Project Office has carried out extensive transversal activities in support of the project teams and, more generally, of the ITER department. The areas spanned from scheduling to configuration control and system engineering, to quality assurance and project management, including risk and monitoring tasks.

The Project Office structure was modified with the creation of a project control group with the task of providing the organisation with the necessary project management tools to control the evolution of the project and to use them in the monitoring of the activities implementation in relation to scope, cost and schedule management. On 1 October, the F4E Integrated Reporting System went live. It provides integrated standard reports through a data warehouse that guarantees consistent data from several database sources (i.e. financial, HR, planning, etc.). In parallel, the development of a contract management tool started in F4E to give the responsible officers the capability to measure contractual progress and better monitor the implementation of their contracts, including tracking of deliverables and communications exchange.

As far as planning activities are concerned, F4E has further developed its schedules based on both project development and input from its suppliers. Detailed WBS Schedules (DWS) updates are provided to the ITER Organization at the beginning of each month to allow the ITER Organization to carry out an overall integration with the schedules from all parties and to cross check with the domestic agencies their achievement of milestones compared with the agreed baseline (Strategic Management Plan - SMP) with a first plasma date in November 2020.

Project management support was provided on several topics linked to the day-by-day progress of the work, such as the preparation of the procurement arrangements and the management of the task agreements with the ITER Organization. Programmatic documents have been prepared as well as reports to identify the progress in the implementation of the work. Cash contributions to both the ITER Organization and Japan have been managed together with the Budget and Finance team. In 2012 the number of the procurement arrangements assessed for technical risk has

increased from 12 to 23. The risk logs are available and a regular update is carried out by the project teams, including recommended mitigation actions. For each new signed procurement arrangement, an assessment is carried out and a log is created. The Project Office has also provided support to the F4E Director in the preparation of a corporate risk assessment and in the identification of the ten top risks for the organisation to be mitigated and tracked.

Work on export control has progressed. Support was provided to the project teams to identify and to deal with dual use items. More contacts have taken place with the Spanish authorities on this topic. An analysis was carried out to evaluate possible solutions for a tool to support F4E in managing and controlling documents/technologies according to the requirements of the specific process.

In the area of configuration control, Project Change Requests (PCRs), deviation requests and nonconformities have been managed on a daily basis both internally and in liaison with suppliers and the ITER Organization according to F4E quality assurance procedures.

The year 2012 has been an important year for the evolution of the system engineering aspects in F4E with specific focus on the management of requirements and their verification. Six pilot projects have been implemented with the IBM Rational DOORS tool requirements database and collaboration is in progress with the ITER Organization to allow the propagation of the requirements to the required levels.

In the area of quality assurance, quality officers have supported the project teams in their activities devoted to their in-kind procurements and R&D activities. Audits have been carried out in both laboratories and industries. External inspectors have been used through an external F4E service contract to support F4E in such audits.

A task order was signed with the selected ITER logistic service provider to survey the French heavy haul itinerary to be used for the transportation of the heavy exceptional loads to the ITER site. This is the first step towards the performance of the test convoy due to happen in 2013. At the same time negotiations have been carried out with all involved entities to sign conventions that will allow the test convoy to be performed.

Broader Approach

Satellite Tokamak Programme

The year 2012 was characterised by acceleration in project implementation. F4E and EU voluntary contributors demonstrated their strong commitment, which resulted in the placement of a number of large time-critical contracts and in the timely execution of running contracts.

Main Achievements

Thanks to the dedication of the EU voluntary contributors, in year 2012 the contracts for cryoplant (CEA), switching network units (ENEA) and toroidal field coil casings (ENEA) were placed and a number of others were tendered and are now close to signature.

The first EU contribution, the cryostat base (provided by Spain/CIEMAT) was successfully completed and shipped to Japan on schedule, receiving the vivid appreciation of JAEA management and considerable resonance in Japanese media.

CNR-RFX proceeded substantially on schedule with the qualification of the quench protection system and now series production has started.

The Belgian voluntary contribution to the toroidal field coil cold test facility (TFC CTF) has been completed. The test cryostat together with associated equipment was transported to CEA Saclay (France) where the test facility is currently being installed.

F4E, as EU Implementing Agency continued to exercise its role of interface to JAEA, overall management, technical guidance and support. In addition F4E continued to monitor the progress of the contracts for toroidal field coil strands (completed on schedule on 10 December 2012) and TF conductor (progressing ahead of schedule). The first and relatively new experience of the shipment of a large component (the cryostat base, contracted by F4E) was successfully completed.

In March and April 2012 the project achieved two important results, from the management and technical point of view:

- With a common effort of the JT-60SA Integrated Project Team, a revised schedule baseline has been prepared, now based on sound information from established industrial contracts of critical path items and detailed analyses of time-critical assembly operations. The new schedule baseline has been unanimously approved by the Broader Approach (BA) Steering Committee (SC) on its 10th meeting in Naka on 24 April. On one side it is to be regretted that the first plasma of JT-60SA is now delayed to March 2019; on the other hand the new schedule provides a serious baseline in which critical items are identified and progress can be assessed.

- The need for a spare toroidal field coil as a fundamental risk mitigation tool has been strongly justified and has obtained the unanimous endorsement at the BA SC on its 10th meeting in Naka on 24 April. On this basis F4E prepared for the procurement of the 19th toroidal field coil.

The vast majority of the procurement arrangements, covering 85% of the total EU share of JT-60SA, were signed by the end of 2012, and a number of critical issues were solved in terms of procurement sharing.

Toroidal Field Coils

Europe is committed to provide the full toroidal field magnet system. For this purpose, F4E is procuring 27km of toroidal field conductor, a cable-in-conduit type conductor with 486 strands (2/3 NbTi - 1/3 copper) embedded in a rectangular stainless steel jacket.

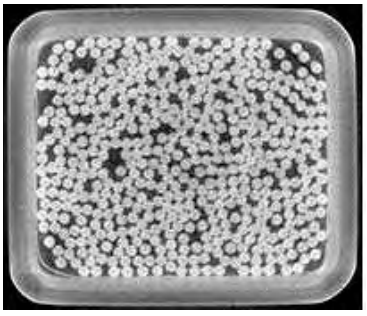
Toroidal Field Superconducting Strand and Conductor (F4E)

The procurement is split into two main contracts, one for the production of the NbTi strand and one for the strand processing into the toroidal field conductor by cabling and jacketing operations.

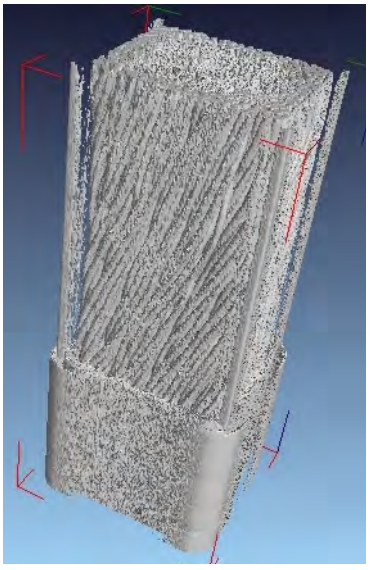
The NbTi and copper strand supplier already qualified the production processes in the beginning of 2011. The production of strand progressed smoothly during 2012 and was completed (the full 10,200 km of NbTi strand and 5,100km copper), on schedule, on 10 December 2012. The various batches of production were accepted by the approval of the associated quality control documentation (filed, reviewed and approved in a dedicated electronic repository). The strand has been divided into a number of shipments with arrival of strand to the conductor manufacturer ensuring always a buffer of several months of cable production.

F4E has placed a new contract for the measurement of superconducting strand properties with the University of Twente, while complementary measurements are continuing at ENEA (Italy) and are completed at CEA (France). The programme of measurements of superconducting properties produced independent statistical confirmation of the fulfilment of the specification. The programme of characterisation of JT-60SA toroidal field conductor included non-destructive examinations by X-ray tomography by INFLPR (Romania), and hydraulic measurements at room temperature in hydraulically similar conditions (operation Reynold number) by CEA which have provided useful feedback to cryoplant circulators design.

The qualification phase for the toroidal field conductor production was completed at ICAS with the fabrication of two dummy cables (JC001 and JC002) identical to the actual production cable, with the exception of the use of the cheaper superconducting strand purchased by F4E for the purpose.



Tomography of toroidal field conductor (2D reconstruction)



Tomography of toroidal field conductor (3D reconstruction)

F4E - Production of cable (JC-006 to JC-008) at ICAS

The two cables were used to qualify jacketing/ compaction and spooling processes in May/June 2012. The resulting cables were then sent to the toroidal field coils manufacturers, ASG (Italy) and ALSTOM (France) in time for the execution of testing of the winding machines at tooling manufacturer premises.

In parallel, two full-size conductor samples were produced, featuring the NbTi strand to be used in real production, and, after assembly at CEA, the samples were tested in the SULTAN facility at CRPP (Switzerland). The tests were successfully completed in three test campaigns confirming the design temperature margins and cable losses in relevant operative conditions.

From September 2012, the real production of toroidal field conductor started and by the end of the year the first set of twelve 'production conductor' lengths (JTF-003 to JTF-014) were manufactured and leak, pressure and flow-tested. Delivery to ASG and ALSTOM started.

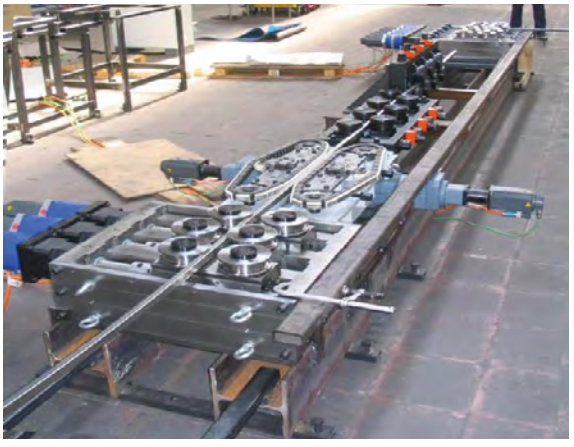
Following the decision to build a 19th spare toroidal field coil the contract for strand was amended for the production of NbTi and copper for the JT-60SA spare toroidal field coil in December.

F4E - JTF-003 Pressure test / helium leak test at ICAS

Toroidal Field Coils Manufacturing

The responsibility to provide the JT-60SA toroidal field coils is an in-kind obligation of France (CEA) and Italy (ENEA), which placed two contracts, respectively, with ALSTOM (in July 2011) and ASG (September 2011). Manufacturing design started in September 2011. By the end of 2011 the qualification programmes for all fundamental production steps were defined. The winding tooling was designed and ordered.

While the tooling was being manufactured, the suppliers started the comprehensive experimental programme required to validate critical points of the manufacturing process, like helium inlet manufacturing, epoxy impregnation, electrical joint samples and bending tests for qualification of the winding machine at its sub-supplier. In parallel a number of detailed analyses have been performed



ENEA/ASG – Toroidal field coil winding line - Straightening and bending test for JT-60SA (Courtesy of ASG)

ENEA/ASG – Toroidal field coil winding line - Straightening and bending test for JT-60SA (Courtesy of ASG)

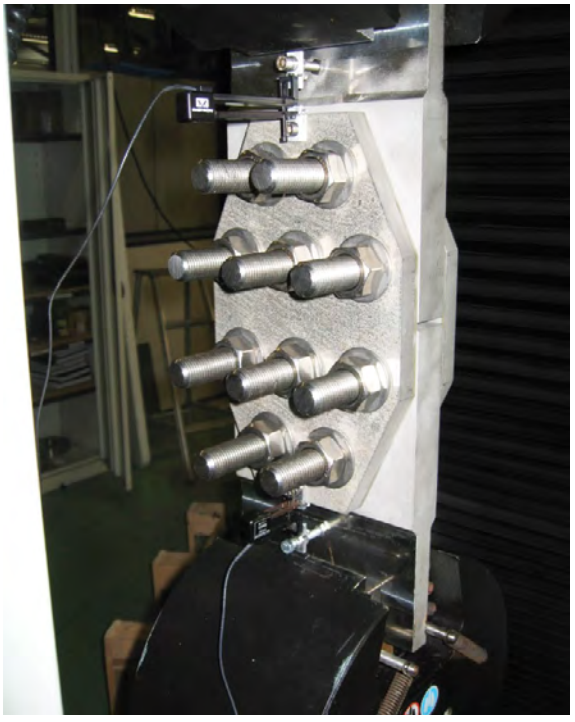
to solve some minor problems of stress on the terminations support and on supports for the helium pipes. By April 2012, the scheme for welding the toroidal field coils was considered and some preliminary tests of the casing transverse welds commenced.

By August 2012 the winding line for ASG (control system and data acquisition, unspooling tooling, straightening unit, bending unit, conductor cleaning equipment, sandblasting unit, glass tape wrapping machine, moving/rotary winding table) was in advanced status of manufacturing and testing at the sub-supplier's premises. Additional process equipment was received at ASG including the vacuum chamber and pumping unit for conductor acceptance inspection, winding pancakes support/assembly and handling tools, coil impregnation mould and toroidal field coil winding pack vacuum testing chamber for flow and leak tests. ASG ordered all materials and components necessary for the winding packs and coil manufacturing; the quantity necessary to start production was in-house by the end of 2012.

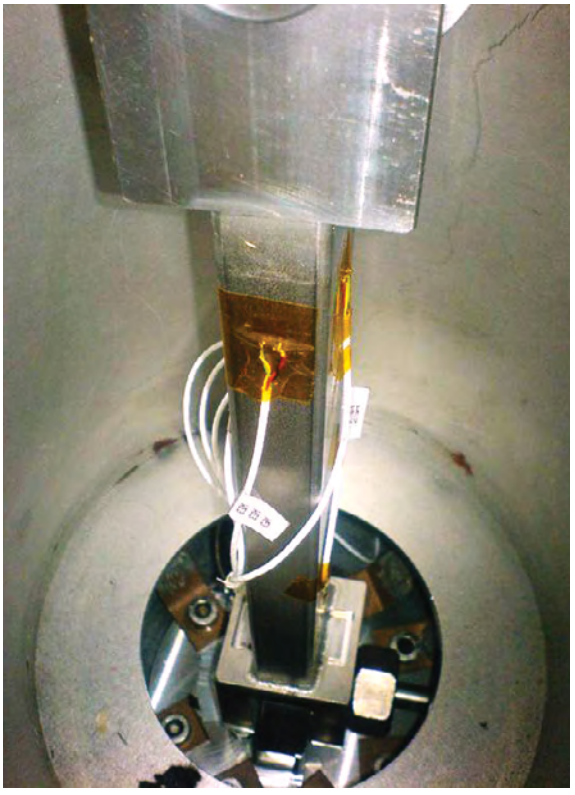
Activities at ALSTOM encountered some additional complexity in the preparation of the manufacturing facility, which is a nice example of refurbishment, for production purposes, of an historical building of the ALSTOM plant of Belfort. The preparation of tooling and process qualification proceeded on a similar path to the one followed by ASG (actually the two companies share some of the same sub-suppliers in particular for the winding line fabrication).

Outer Intercoil Structures and Gravity Supports

CEA continued in 2012 with the qualification activities for the outer intercoil structures (OIS) and gravity supports devoted, in particular, to the evaluation of friction coefficient of the OIS shear panel steel/epoxy interface, behaviour at 4K of friction coefficient, creep and bolts preload loss and practical aspects of load application (tools, bolt loading sequence etc.). In June 2012, the design passed a production readiness review and the OIS tender was launched. Following intensive technical exchanges with potential suppliers, a revised technical spec was eventually issued and final offers were received in December 2012. The activities of the gravity supports tendering proceeded in parallel. Contracts are planned to be placed in the first quarter 2013.



CEA Saclay - Scaled cryogenic test for OIS friction joint



CEA Saclay - Friction tests of gravity supports

Toroidal Field Coil Casings

The contract for the toroidal field coil casings has been placed by ENEA with the Walter Tosto Company in June 2012. The contract has progressed well, with all raw materials ordered and most of them available for the commencement of manufacture in December 2012. The detailed design phase allowed items such as weld details and the final breakdown of components for the winding pack manufacturers to be finalised.

Toroidal Field Coil Cold Test Facility

The toroidal field coils will be tested at cryogenic temperature and their nominal current of 25.7 kA, prior to their shipment to Japan. For this purpose the creation of a specific facility (the Toroidal Field Coil Cold Test Facility) is underway at CEA Saclay, to which France and Belgium are contributing. The test facility is being prepared at CEA Saclay.

The procurement arrangement for the "Setup of the Cryogenic Test Facility and the Performance of the Tests of the Toroidal Field Coils" was signed on 24 January 2012, but preliminary studies and construction for the set-up of the test facility had started already in 2009 and has made significant progress since then.

In 2012 the Belgian voluntary contributor has completed the manufacture of the test cryostat, the valve box vessel, the vacuum pumping system and some handling tools. The full Belgian contribution was delivered them to CEA Saclay in September 2012. Acceptance tests including the leak tests of the cryostat vessel and the helium circuits of the test frames, handling tests, and dimensional control of the cryostat before and after evacuation were successfully completed by the end of the year.

During, 2012 CEA relocated and tested an existing helium refrigerator system. A liquid nitrogen supply tank and a gaseous helium storage tank were installed. The bridge crane, serving the the test area, was replaced to allow handling of the heavy test equipment and the toroidal field coils.

The HTS current leads and a cryogenic circulator were contracted.

High Temperature Superconducting – Current Leads

The 26 high temperature superconducting current leads (HTS CL) which connect the superconducting feeders with the power supply busses are provided by Germany through its designated voluntary contributor Karlsruhe Institute of Technology (KIT). The procurement of all raw materials for the fabrication of the current leads has been completed. The design of the heat exchanger has been reviewed for approval by the German Third Party Authority (TÜV). The procedure to get approval for the heat exchanger by the Japanese Prefecture has been agreed with JAEA.

A dedicated test facility is being installed at KIT. This facility allows testing two current leads at a time.

CEA Saclay - JT-60SA Toroidal Field Coil Cold Test Facility – Cryostat (Belgian contribution) positioned in the test hall

JT-60SA Power Supply Systems

The European contribution for the JT-60SA power supply (PS) systems includes the PS System for the toroidal field magnet, the central solenoid (CS) and equilibrium field (EF) coils and the fast plasma position control coils (collectively named Superconducting Magnet Power Supplies - SCMPS), the switching network units (SNUs) for CS modules 1-4 to provide the requested voltage for plasma breakdown, the quench protection circuits (QPCs) for all superconducting coils, and the PS system for the in-vessel sector coils for resistive wall mode (RWM) control.

Quench Protection Circuit

The work in 2012 was dedicated to performing the main part of the detailed qualification process of the toroidal field and poloidal field full scale QPC prototypes, after the approval of the detailed design. The main type test campaigns are listed below:

- Type tests on by-pass switch prototype completed in February (Siemens, Ritter and AREVA premises, Germany);
- Type tests on two prototypes of pyrobreaker completed in January (Efremov's premises, St. Petersburg, Russia);
- Type tests on four discharge resistor prototypes completed in February (Telema's premises, Piacenza, Italy);
- Type tests on IGCTs power modules of the SCB completed in March and July for PF and TF prototypes respectively (ASI's premises, Milan, Italy);
- Type tests on the whole PF and TF QPC prototypes carried out in Apr-May and Aug-Sep 2012 respectively (Consorzio RFX, Padova, Italy).

Referring in particular to the last two main test campaigns, a major effort has been made to comply with the very tight schedule which required the prototypes to be ready in time for the two fixed time windows of the RFX-mod shutdowns. After the prototype installation and commissioning, several hundred pulses have been performed in total at different current levels, many of them at and above the design current. On top of this, additional, not pre-specified, tests have been carried out to thoroughly qualify the prototype operation. These included a current interruption test, at full performance with a large inductive load, to verify that the transient overvoltage remains within the specified limits in a condition very close to the real one. They also included the arrangement of a test bed to make a preliminary test of the reflective memory interface to gain confidence in advance on this matter and prevent possible future problems during the final commissioning in Naka. The last months of 2012 have been devoted to completing the few remaining tests at ASI's premises and to finalising the "factory type test report" which was submitted in December.

The results of this qualification process, described in that report, allowed a comprehensive characterisation of the QPC operation and performance that has proved the suitability of the design, the high margins achieved and its full compliance with the requirements.

Consortium CNR-RFX - Type tests for the toroidal QPC prototype

Switching Network Units

The call for tender for the design, manufacture, factory test and delivery to the port of entry of the SNUs has been performed by ENEA using the revised technical specification agreed in May 2012. The assignment to start the contract activities has been entrusted by ENEA to Energy Technology – OCEM

in August, enabling the start of the design activities, followed by the formal signature of the contract on 29 October 2012. The SNU detailed design has been started in the last quarter of 2012, and is expected to be completed in the first half of 2013.

Superconducting Magnets Power Supplies

The first call for tender was issued by CEA in December 2011, but it was declared unsuccessful in March 2012. In fact only one potential supplier answered within the call for tender deadline, and the related commercial offer presented over-costs exceeding the available budget. Consequently some modifications to the technical specification to be used for the CEA second call for tender have been agreed in May. Subsequently CEA has started a new market survey to pre-select a number of potential suppliers with adequate experience, and the second CEA call for tender was issued in July 2012. The offers from five industrial suppliers have been received by CEA in October 2012, and are currently under evaluation at CEA, taking into consideration both technical and economical aspects. The CEA contract signature is expected in March 2013.

In the first months of 2012 ENEA performed some analysis to define the new reference current scenarios to be inserted in the technical specification as the reference for the thermal design of converters. In November 2012 ENEA has started revising the administrative documentation for issuing the call for tender, which is expected to be issued in the first months of 2013.

Resistive Wall Mode Power Supplies

Based on the physics requirements for the RWM PS agreed in September 2011, a new conceptual design of the RWM PS was developed and presented by Consorzio RFX in April 2012 and the related technical specification were prepared and distributed by Consorzio RFX in May. Meanwhile, a proposal was made by JAEA in May 2012, related to the possibility that JAEA could take the responsibility for installation, commissioning and test on site of RWM PS if the EU could provide as many additional PS units as budget availability allows. In order to define the precise number of PS units to be procured by the EU and to gain confidence on technical feasibility, switch availability and cost, the development of a prototype inverter has been started by Consorzio RFX in the second half of 2012. Moreover a new conceptual coil design has been presented by JAEA in July 2012, with an increased turn number with respect to the previous coil design, implying a reduction of the current and a possible increase of the voltage required from the RWM PS. Detailed verifications have been started in the second half of 2012 for obtaining a final definition of the new RWM PS required ratings in terms of output current and voltage. The joint EU-JA activities related to the detailed analyses toward the final definition of the new RWM PS ratings and the inverter prototype development, proceeding in parallel during 2013, are expected to lead to the procurement arrangement definition and signature in the first months of 2014.

Cryostat

The procurement of the cryostat for JT-60SA is subdivided into four procurement arrangements: cryostat base (EU), the cryostat vessel body (EU), the cryostat lid (JA) and the material for cryostat vessel body (JA). All the EU contribution is provided by Spain through CIEMAT.

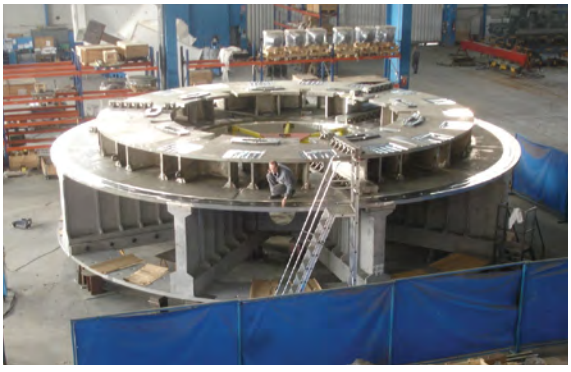
Cryostat Base

The procurement arrangement for the cryostat base entered into force on 7 December 2009. F4E established an agreement of collaboration with CIEMAT covering the full scope of supply (with the exclusion of transport which is handled and paid for by F4E). Having solved a number of contractual problems, the fabrication proceeded as planned in 2011 and 2012 by IDESA in Aviles, Spain. It was completed, on schedule, in October 2012 when the full cryostat base was temporarily assembled and underwent extensive dimensional control. Outstanding results were obtained with sub-millimetre tolerances achieved on a welded component of more than 11m diameter. The formal 'Works Acceptance' inspection of the component was witnessed by CIEMAT, F4E and JAEA representatives on the 26 October 2012. The cryostat base was shipped to Japan on 22 November 2012.

Cryostat Vessel Body

The procurement arrangement for the cryostat vessel body was reorganised in 2011, and a new agreement was reached between F4E/CIEMAT and JAEA which is based on a revised sharing of the scope. On this basis, JAEA has provided the full set of plates necessary for the construction (68 stainless steel plates with a total weight of 346 tonnes were

A lower sector of the JT-60SA cryostat base being machined by subcontractor ASTURFEITO



JT-60SA Cryostat base fully pre-assembled in factory in Spain, during final laser-tracker measurements

JT-60SA Cryostat base being loaded on cargo at Aviles port on 22 November 2012

delivered to a storage place in Asturias, Spain in July 2012) and will fabricate the cryostat top lid, while F4E/CIEMAT will fabricate the cryostat vessel body cylindrical section (including all penetration and flanges).

Though the procurement arrangement for the cryostat vessel body cylindrical section was signed on 25 July 2011 and the technical documentation (specifications and drawings) were promptly prepared, the implementation of the activities was kept on hold, waiting for ministerial level authorisation to tender in Spain. At the very end of December 2012 the Spanish government allocated part of the necessary funds to CIEMAT.

Cryogenic System

The superconducting coils, thermal shields, HTS CL and divertor cryopumps require refrigeration at 3.7K to 100K provided by a cryoplant with an equivalent refrigeration capacity of about 8kW at 4.5K provided in-kind by France (CEA). The tender process for the cryogenic system was completed in 2012. After a comprehensive competitive dialogue with two qualified European suppliers the final offers were received at the end of June. After evaluation of the two offers CEA concluded a contract with Air Liquide Advanced Technology (ALAT) in November 2012. The kick-off meeting was held on 18 December 2012.

The procurement agreement between F4E and JAEA as well as the agreement of collaboration between F4E and CEA were also signed in November 2012. In the agreement of collaboration, F4E agreed to provide several warm helium vessels to store the helium inventory.

Based on the information provided with the final offer, the interfaces between the cryogenic system and the buildings at Naka could be agreed with JAEA. This was important in particular for the new compressor building where JAEA was finalising the construction specification.

ALAT prepared an application for the Ibaraki Prefecture describing and justifying the design, manufacturing and testing approach for the cryogenic system with respect to the requirements of the Japanese High Pressure Gas Law.

IFMIF/EVEDA Programme

The following activities addressing managerial aspects were essential to the progress in the IFMIF/EVEDA project:

- The new Project Leader, Juan Knaster, took up duties on 18 June 2012. This fact related with the new phase, into which the project is entering, led to present a new organisation to the BASC-11 in December and to receive its approval.

- An effort to overcome the situation of uncredited deliverables pending in the project was implemented with the allocation of credits for work accomplished and approval of pending procurement arrangements. All procurement arrangements are actually approved in DMS. The related agreementss are being processed in the EU-HT; all procurement arrangements will be signed within the next months.

- Significant efforts were in place in the past to build a sound quality assurance (QA) system of IFMIF/EVEDA to be used as working frame amongst all parties involved. To be practical, and rapidly accepted by the users, the QA system has been adapted to working reality and does not impose beyond this reality. In particular, the tight schedule of the accelerator facility validation activities demanded a practical and robust QA system rapidly accepted by the community. A complete QA system adapted to LIPAc, based on the working QA system of JT-60SA, was developed jointly by both Implementing Agencies.

- The growing visibility of the IFMIF/EVEDA project is apparent by contributions being selected for the oral overview papers given the year (TOFE in August, SOFT in September) and project team members having received and accepted calls for invited papers for next year conferences (IPAC in May 2013, SOFE in June 2013 and ISFNT in September 2013).

- Preparation of the Accelerator Hall at Rokkasho to efficiently face the installation tasks of the first LIPAc accelerator system (injector) to arrive by end of March 2013 has been pursued following up a week-long meeting held November coordinated by the Project Leader and with the participation of seven scientists from the EU-HT and JA-HT. The upgrade of the crane and upgrade of survey network is under implementation and will be covered by the Common Fund.

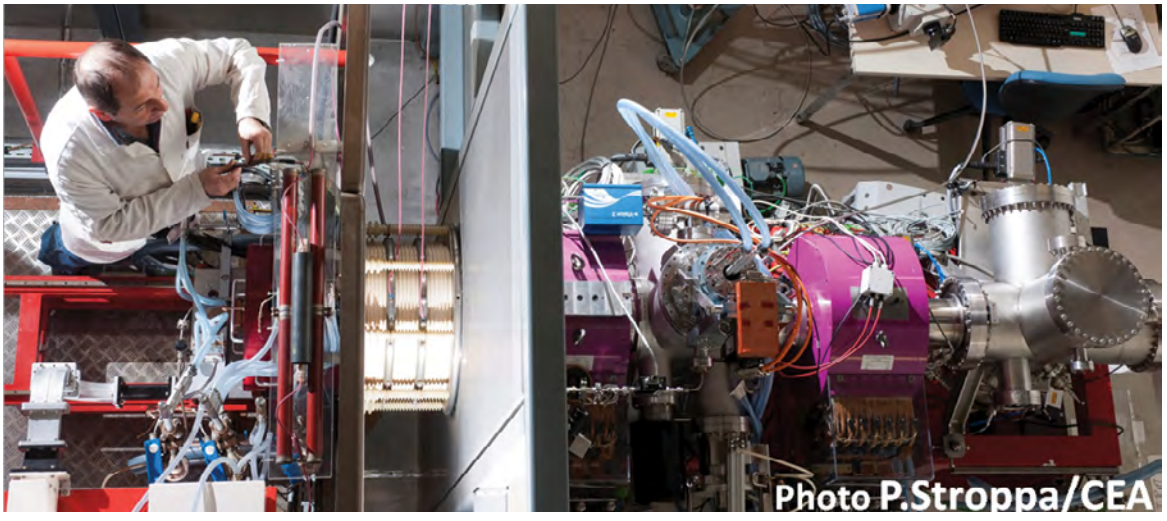
Main Achievements

The LIPAc Accelerator

The year 2012 was especially rich in terms of achievements about the LIPAc components. Prototyping, final manufacturing and tests with beam are summarised hereunder for the subsystems.

Injector

After the first deuteron beam extracted from the source, in pulsed mode with a 1% duty cycle in



Injector during assembly at CEA Saclay

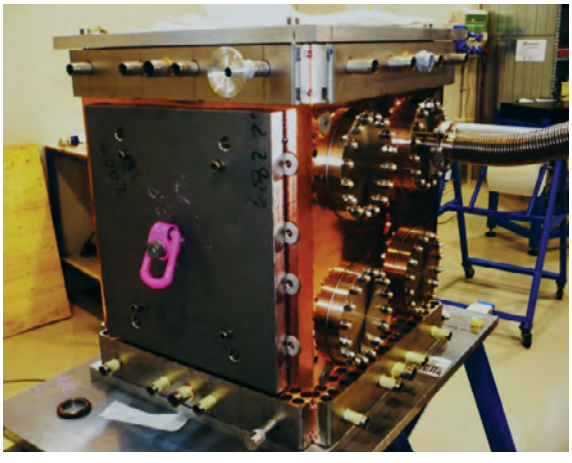
spring 2012, the final acceptance tests in Europe have been successfully performed in November 2012 with long duty cycle, up to continuous beam. A current of 140mA with an energy of 100keV was achieved (resulting in a total current of more than 170mA). The emittance was within the range of the specification (0.2 to 0.3π mm•mrad) but could not be measured at full duty cycle as the present emittance scanner could not sustain the 14kW beam power yielding unaffordable beam power density.

The injector was disassembled; the packaging was completed on 21 January 2013, ready to be shipped to Rokkasho.

Radio Frequency Quadrupole

After the prototyping phase to develop the technology, the production of the radio frequency quadrupole modules could proceed. Improvements in design and realisation procedure after the first module produced (module #16) have been implemented and resulted in a successful fabrication of module #17 after machining and brazing (average vane tip displacement lower than the 50μm target value).

The three modules, as well as the radio frequency plug unit, needed for the high power tests at INFN/Legnaro, will be ready in June 2013. The test facility, which includes a 220 kW radio frequency amplifier and the cooling system, is under preparation and will be ready in April 2013 for the tests of the two couplers provided by JAEA.



Module #17 during vacuum tests

SRF Linac

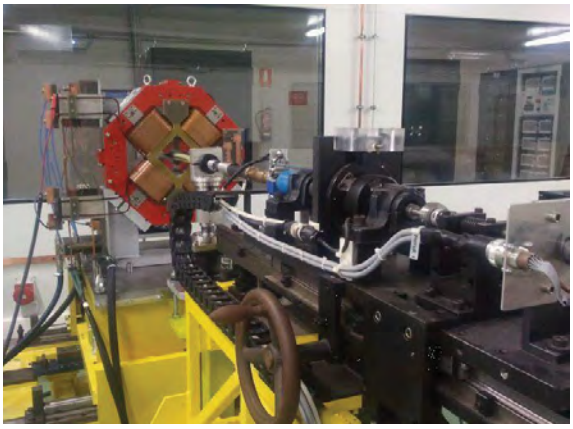
After removing and closing of the plunger port, the prototype P02 reached 8MV/m (above the specification of 4.5MV/m) during tests at 4.2K in December 2012, with a Qo at low field (2 109) over specified values. The onset of field emission at 5MV/m stems likely from the history of cavity (change of a pick-up antenna because of a leaking junction). In conclusion, the radio frequency design of the HWR is qualified, provided that the internal radius of the HPR port base is smooth enough (radius larger than a few mm).

The design of a new tuning method, based on elastic deformation of the cavity, and the revised design of the cavity (in particular lower thickness of the niobium walls to make the tuning by compression easier while keeping the inner geometry of the cavity) are now completed. The FEM stress analysis has been checked by an external certified company, the raw material (Nb and Nb/Ti) have been ordered and the call for tender of the series cavities will be launched at the end of March 2013.

Repaired HWR cavity with the removal of the plunging system

Medium Energy Beam Transport line

The first prototype quadrupole magnet was tested (electrically and water leaks) and successfully characterised on a magnetic test bench. The manufacturing of the first beam scraper has been completed and tests started. The buncher cavity is under fabrication, the low power tests are planned in April 2013 and the high power tests in August 2013.



Prototype quadrupole during magnetic test (rotating coil)

Radio Frequency Power System

The installation of the prototype radio frequency module has been completed by industry, including equipment in the racks, power amplifiers, circulators. The two tetrodes were prepared for conditioning in January 2013.

Prototype radio frequency module installed in the test facility

High Energy Beam Transport line and Beam Dump

Copper cone prototypes of the beam dump cartridge have been built (combining electron beam welding and electro-deposition) to select the best technology. A hydraulic test bench has been installed to study the fluid-dynamics aspects of the beam dump cooling (vibrations, heat transfer coefficient estimation, hydrophone responses, etc.). The design of the beam dump shielding has been completed and radioprotection calculations have been launched for estimation of the dose rates (prompt dose and residual activation).

Hydraulic circuit for testing of the beam dump prototype

Beam instrumentation

A series of beam diagnostics (current, position, profile, bunch length, beam loss and interceptive monitors) has been developed. In particular, the profile monitors based on ionisation and fluorescence of the residual gas have been tested successfully with beam.

Residual gas profile monitors: ionisation profile monitor (left) and fluorescence profile monitor (right)

The Engineering Design Activities for the IFMIF plant

The preparation of the design description documents (DDD) for the Intermediate IFMIF Engineering Design Report (IIEDR) extends over three phases till March 2013. Based on the Peer Review for the design description documents generated in phase II in September 2012, the phase could be concluded by 15 November 2012. With initiation of final phase of working out the Detailed Design Description documents and the accomplishment of major Plant Requirement Definitions, an Editors Working Group has been formed that revises the presently available input documents to the IIEDR to be issued by June 2013.

The digital mock-up (DMU) of the overall IFMIF Plant was worked out as the building and different systems

were defined. The 3D model was progressively developed based upon a comprehensive analysis of the functions and implantation of the different rooms, the description of the whole plant and of each room (including access, handling, lift, etc.) as well as the main equipment footprints (volume/ space reservation). Lay-out plan of all the main conventional facilities equipment was also determined.

Engineering design activities have successfully respected the tight schedule. New contracts with industry (Tractebel and Mitsubishi) could be placed to foster a mature and thorough IIEDR.

Design Validation in the HELOKA facility, the Cycle Fatigue Test Module and the BR2 reactor irradiation

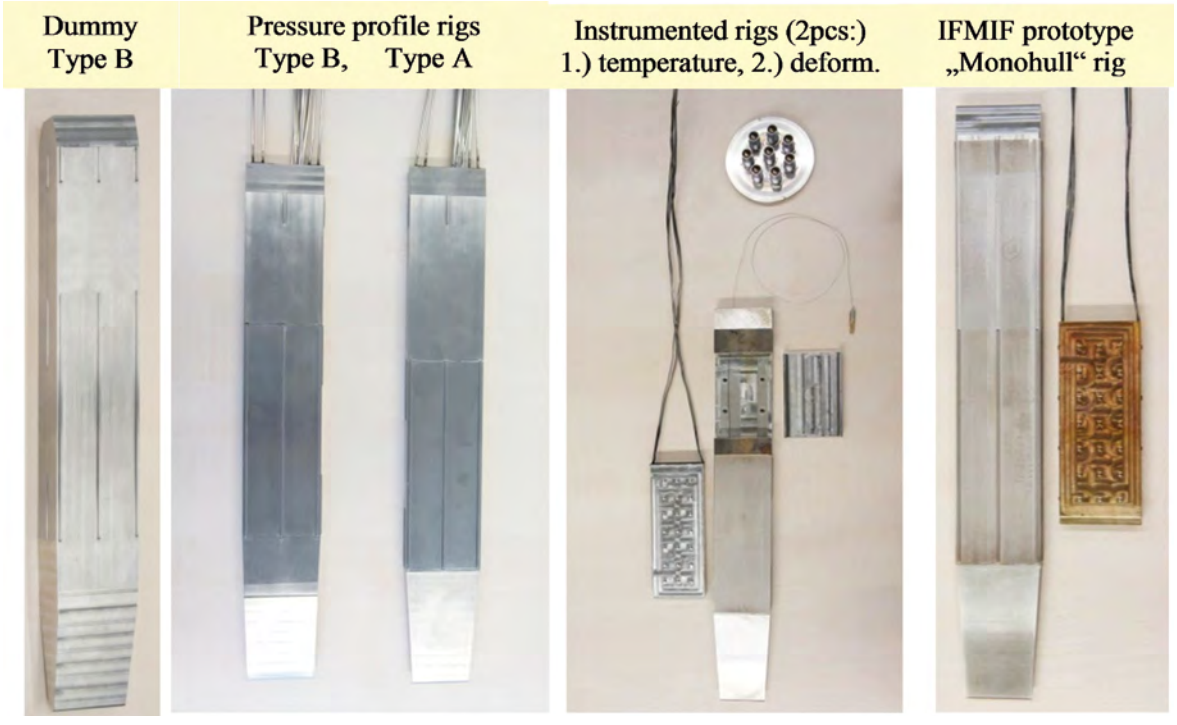
Single rig experiments have been conducted to test the thermal performance of the key elements of a high flux test module. Temperature and pressure profiles were measured in a combined experiment with companion heaters.

For tests of the multi rig configuration, the container was manufactured as well as most parts of the test section and the heaters and thermocouples of the capsules. At present it is foreseen to complete the multi rig experiments by March 2013.

The blocking of the procurement arrangement for the BR2 irradiation was removed in an interface meeting in which it was agreed that the current KIT methodology to fill the irradiation capsules with the NaK heat spreader would be replaced with the established SCK-CEN methodology and would be used for the newly prepared irradiation capsules. Start of the irradiation campaign is now targeted for last BR2 cycle before summer 2013.

Design Validation in the Experimental Lithium Test Loop (JAEA Oarai) and LIFUS-6 (ENEA Brasimone)

Repair work after the damages caused by the east Japan great earthquake was completed by the end of January 2012, including the replacement and painting of L-type braces and the un-installation of the construction stages. Pressure test for the Li piping of the ELTL was completed by mid-March 2012. A general performance test (re-commissioning) was performed from mid-May to the end of July 2012. After the general test described above, the so called ELTL Validation Tests #1 was carried out from September to November 2012



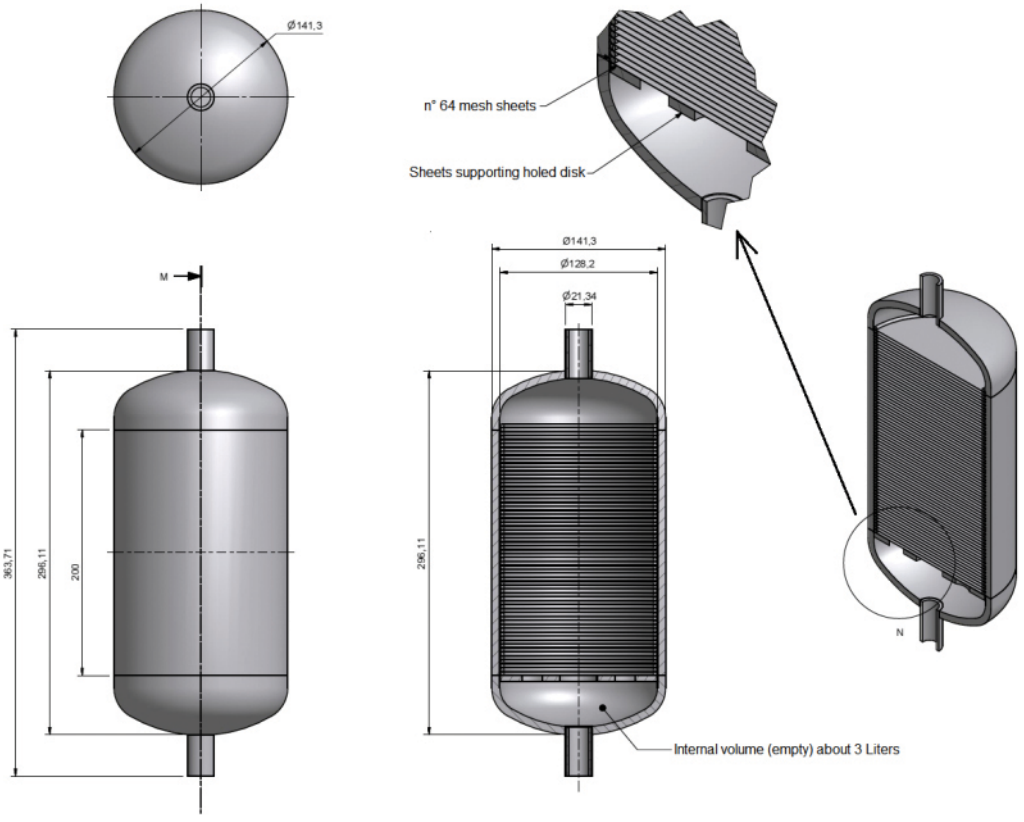
Single rig configuration for testing the thermal performance of key elements of a high flux test module

during which the following studies were performed: Li target operational test; Electro-magnetic pump performance test; electro-magnetic flow meter calibration; Image measurement of surface wave on the Li target; Image measurement of the surface wake on the Li target; cavitation tests. During these studies, The EVEDA lithium test loop (ELTL), the world largest liquid Lithium facility, achieved 20 m/s flow speed achieving a world record in this domain.

The European contributions (cavitation sensor, resistivity meter) to Experimental Li Test Loop in Oarai, were tested by ENEA before shipment to Japan. Actual shipment was executed in mid-December with departure from Brasimone on 11 December 2012 and arrival at Oarai on 19 December 2012.

Mechanical assembly of the resistivity meter (left) and its sensor head (right)

The design of the cold trap for the purification of lithium from carbon, oxygen and hydrogen has been completed. The trap consists of a cylindrical geometry made in AISI 316L, with an inner gettering volume of about 3L. The gettering volume was realised by disposing a high number (64) of stainless steel mesh sheets, parallel packed inside the body of the trap.



Design of the cold trap for the LIFUS 6 experiment (all dimensions indicated are in mm)

IFERC Programme

In 2012, the IFERC project has made the transition from a preparatory phase to an operational phase, with two of its three subprojects entering exploitation phase at the Rokkasho site:

- the Computational Simulation Centre (CSC) has come fully into operation, on schedule;
- the laboratory for DEMO R&D activities was fully licensed, and research activities in materials have started in Rokkasho.

Regarding the third sub-project, the ITER Remote Experimentation Centre (REC), preparatory activities started in 2012 with the aim of re-defining the scope and schedule of the REC activities. REC is due to start operation in the two last years of the BA, 2016-2017.

Main Achievements

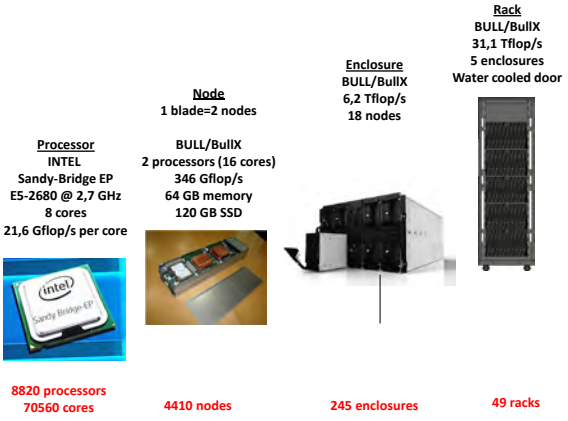
- Successful start-up of the operation of the supercomputer Helios in the CSC, and completion of computational projects selected in the first call
- Successful start-up of research activities in the newly commissioned DEMO R&D materials laboratory

Computational Simulation Centre

The CSC was officially inaugurated on 19 March 2012, with the attendance of 150 guests including government, Commission and F4E Governing Board representatives. The assembly and reception tests of Helios (the supercomputer provided by CEA under a contract with Bull as part of France's voluntary contribution) had been completed on 22 December 2011, and Helios operation started on schedule in early January 2012.

The first three months of operation were dedicated to "lighthouse projects", both to demonstrate the performance of Helios, and to fine-tune the system. The "lighthouse projects" were four codes (two from the EU, two from JA) selected among those used as benchmark tests in the acceptance of the computer, and were given the full resources of Helios. A number of start-up problems were found and solved, and good scientific output obtained from the exercise. Overall, Bull fulfilled

Inauguration ceremony of the CSC on 19 March 2012



Technical characteristics of Helios: 70560 computing cores for a nominal peak computing power of 1.5 Pflop/s

the contractual commitments for availability of the system, with the availability of the computer nodes around 95%, well above the 90% specified for the two first months of operation.

Normal operation started in April 2012, with the projects selected in the first call. In the period from April to July 2012, a number of improvements and small upgrades were been made, and the overall availability of the computer nodes around was 98%. A new Linpack test performed during a maintenance period achieved a peak performance of 1.237 PFlop/s, placing Helios officially in the 12th place in the world ranking of supercomputers. In this period, priority was given to improve the support to users. In particular, the EU users benefit from the collaboration of the IFERC team with the EFDA funded High Level Support Team (HLST). The Chair of HLST participates to the monthly CSC management videoconferences and the EU

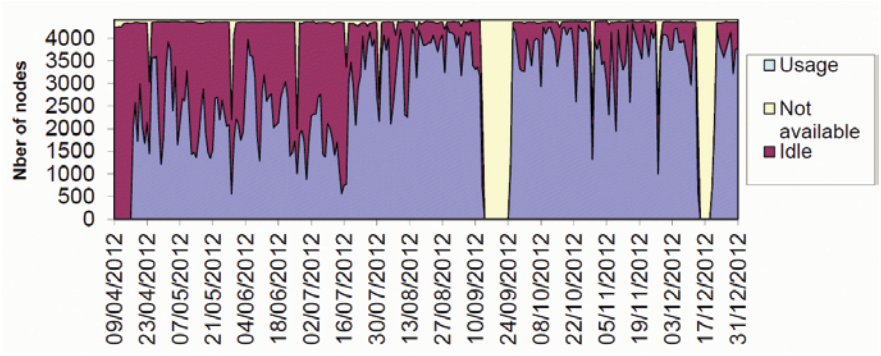
The supercomputer Helios in operation: Helios dissipates nearly 3MW when working at full power.

Cooling system for the Helios supercomputer.

users have expressed satisfaction with the help. The progressive improvement in the service to users is reflected in the increase in usage of the compute nodes, very clear after the interventions in July 2012. In the last six months of 2012, routine operation for medium/large jobs was established, with some problems subsisting in the execution of very large codes using above 2,000 nodes. These were the object of attention in the second half of 2012. Overall a user survey has shown satisfaction with the service.

The organisation of the CSC operation has been completed in 2012, with the establishment of monthly management meetings, meetings with the users, and training courses for users. The Information Security Committee was established and met regularly to oversee security issues.

From the science point of view, a total of 94 proposals (50 from the EU, 44 from JA) had been received on the technical and scientific topics specified in the call (plasma turbulence and related transport processes, fast particle physics, linear, nonlinear and/or extended MHD, edge physics, heating and current drive, integrated modelling of fusion plasmas, reactor materials and reactor technology). The first cycle of projects ended in November 2012, and, together with the Lighthouse Projects, has resulted in 39 publications and a further 20 papers submitted. For the second cycle, 81 simulation projects were selected (51 for the EU, 30 for JA) with around 270 users. While some of the projects were a continuation of those in the first cycle, 19 new projects were submitted by the EU and six by JA scientists. In addition to the open call, 10% of the computer time is allocated to each side for discretionary use. In the case of the EU, a large part of this time was used by the HLST in their support and debugging tasks.



Progress in the usage of the computer resources during 2012: evolution of the number of unavailable, idle, and used nodes out of a total of 4,096. The two yellow bands in September and December correspond to planned shutdowns due to maintenance.

DEMO Materials R&D Programme and Design Activities

In 2012, the materials laboratory in the IFERC site became fully operational. The hardware has been largely part of the JA contribution, although the EU contributes also a piece of equipment to be delivered in 2013. The laboratory includes beryllium, tritium, and other radioisotopes handling areas, besides a complete set of analysis and testing apparatus. The first experiments of beryllium synthesis by plasma sintering were carried out in 2012. New collaborations with the EU are being established, for instance for the analysis of JET tiles exposed to beryllium in the last JET experimental campaign.

In 2012, an external review of the materials programme under IFERC was completed, to assess the progress made according to the project plan aims, and to adapt the programme to the needs expressed by the scientists involved in DEMO design activities. The report of the peer review group made recommendations that have been implemented in new proposals for the remaining BA period.

Tritium area in the DEMO materials laboratory

Manipulators in the materials test area of the DEMO materials laboratory

In the EU, the DEMO related activities have continued as planned in five procurement arrangements for the materials area, and in the joint procurement arrangement for DEMO design activities, implemented as a part of the EFDA work programme. In addition, a procurement arrangement for a programme to implement an activity on safety in fusion reactors has been agreed between the DEMO design activities and the Implementing Agencies. In 2012, an EU expert in safety visited Rokkasho to finalise the detailed programme, including the transfer of safety codes developed for this activity.

Remote Experimentation Centre

In the initial IFERC project plan, the Remote Experimentation Centre (REC) should have been demonstrated by proving remote experimentation from Rokkasho of the JT60-SA machine. In view of the delay of the start-up of JT60-SA, the scope and schedule of REC were re-examined in 2012 by a joint group of the two Implementing Agencies and EU experts. The group presented its conclusions to the Steering Committee in November 2012, making as recommendations that every effort should be made to optimise the usage of resources and to benefit the CSC and JT-60SA projects. The group also recommended to explore the possibility of demonstrating REC in an existing experimental facility in operation.

Contracts and Procurement

Introduction

In May 2012 an important reorganisation took place in the Joint Undertaking's Administration Department, with all the services involved in the procurement and contractual aspects being grouped in a single new entity, the Contracts and Procurement Unit, with overall responsibility for the administrative aspects the full lifecycle of procurement actions.

Procurement Activities

The Project Procurement Group (PPG) and the General Procurement Group (GPG) are in charge of all procurement procedures for both operational expenditure (i.e. those procurements and grants which are associated with F4E's objectives) and administrative expenditure (i.e. those procurements supporting the internal working of F4E). In addition, the GPG manages contracts with external experts and supports European participation in calls for nomination issued by the ITER Organization.

The year 2012 continued the transition started in 2011 from a start-up phase in the procurement lifecycle (in which most activities were related to the signature of new contracts) to a steady state one (in which activities are equally distributed between the signature of new contracts and the implementation of those signed during previous years). This was particularly the case in those project areas which are more mature and have already started the main phase of their procurement lifecycle (such as buildings, vacuum vessel and magnets).

During 2012, a total of 41 operational procurement procedures were launched and 54 procurement contracts were signed for a value of approximately EUR 736 million. Major operational procurements were awarded and signed in the area of buildings and magnets, but significant procurements were also signed in relation to neutral beam, cryoplant, in-vessel and test blanket module projects. The time to contract increased during 2012 with respect to the previous years, mostly due to the significant number of complex and large competitive dialogue and negotiated procedures which took place during the year. The average time to contract for procurements above EUR 1 million was 165 days during 2012, while the median was 150 days.

In particular the year saw the successful conclusion of the competitive dialogue for the main portion of the ITER buildings (comprising the Tokamak complex building), F4E's most challenging procurement procedure to date. The competitive dialogues for selecting and awarding most of the remaining lots of the construction activities will be concluded during 2013, still demanding a significant effort from F4E's services.

A second significant procurement milestone during 2012 was the conclusion and signature of the competitive dialogue for the radial plates which will be an element of the toroidal field coils. This was one of the last large procurement milestones for the toroidal field coils.

Also signed during 2012 was the joint procurement with the ITER Organization for the transportation of ITER components across France from Marseille (Fos) to Cadarache. This important contract will be instrumental for fulfilling the obligations to other international parties, and will allow for the large components to be delivered as needed to the ITER site.

Although a smaller activity in financial terms, implementation of grants for R&D activities continues to have a high strategic importance for Europe's capability to deliver the full contribution to the ITER and Broader Approach projects and to positively exploit their scientific and technological

results. During 2012, a total of 16 grant procedures were launched and 16 grant agreements (or framework partnership agreements) were signed. This corresponds to a grant budget of over EUR 20 million.

During 2012 a total of eight administrative procurement procedures were launched and 19 procurement contracts were signed, with a budget of EUR 13 million. In order to obtain technical and/or scientific expertise not available internally, F4E awards support contracts to external experts. During 2012, 26 contracts for external experts were awarded for an amount of about EUR 0.7 million.

Market Policies, Analysis and Reporting

The creation of the Market Policies, Analysis and Reporting Group in 2012 brought together the responsibility for market surveys, commercial risks analysis, Intellectual Property (formerly within the Legal Group) and reporting (formerly within the Procurement Group).

Intellectual Property Rights

As regards the activities in relation to intellectual property it is worth mentioning the adoption by the Governing Board of F4E's intellectual property rights policy (pending approval by the European Commission). The purpose of this new policy is to facilitate the use of the knowledge generated within F4E's activities by those who have produced them i.e. the EU industry. F4E thus proposes a revised approach to ownership clauses within its contracts allowing its contractors to become owners of such results under certain specific conditions.

Business Intelligence

As regards the activities related to business intelligence, during 2012 F4E further developed its pre-procurement activities and tools. F4E has enriched its interactions with European industry and associations in view of enhancing the efficiency of its procurement actions. Through the F4E Industry Portal and the industry liaison officers' network, F4E has various direct channels of communication with European industry. In particular, during 2012:

- An overall industry mapping covering most of the competences and skills sought for the ITER project was initiated. This mapping describes the potential European capabilities in line with F4E procurement needs. This exercise is performed through channels such as industrial liaison officers, F4E Industry Portal suppliers database, information days and direct meetings with industry.

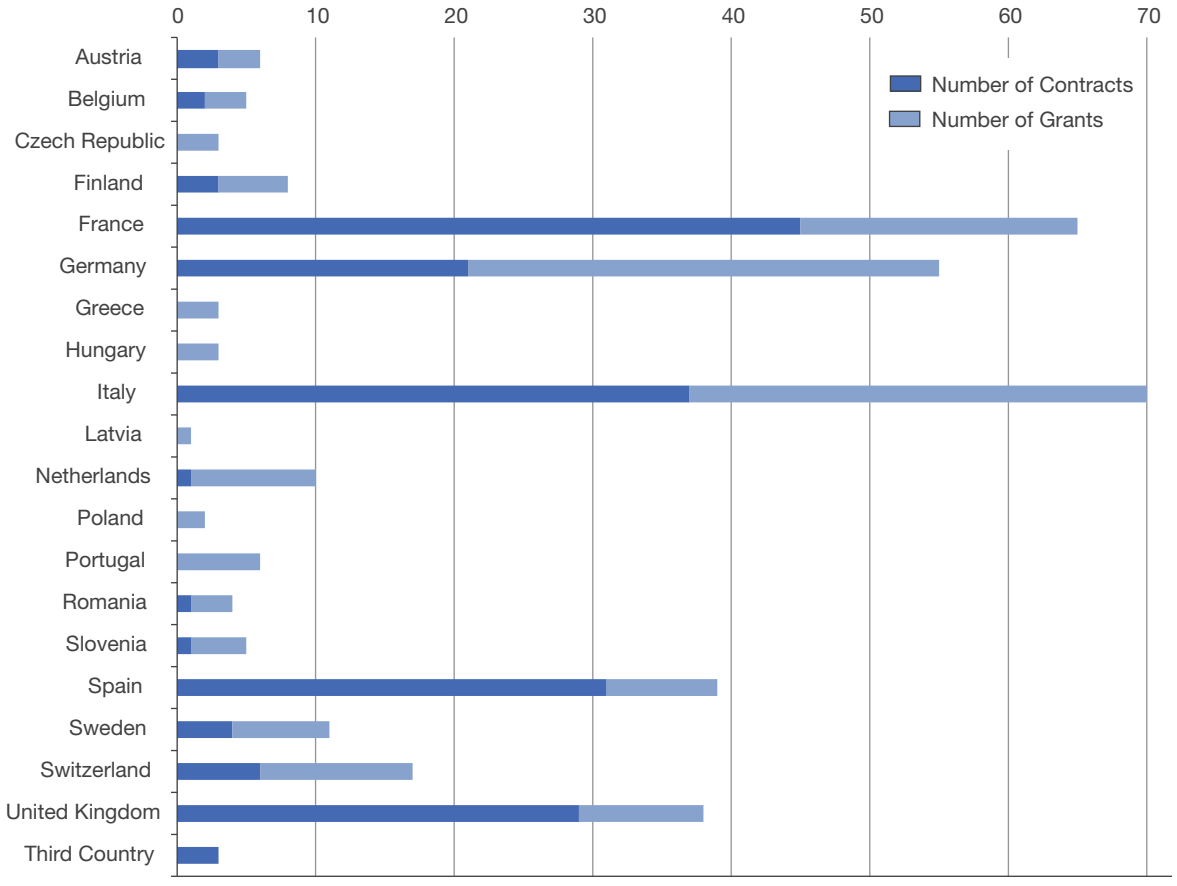
- Five meetings of the industrial liaison officers took place, one of which was held at the ITER site in Cadarache, another was held in Liège, Belgium, during the 27th Symposium On Fusion Technology (SOFT 2012) and three at the F4E offices in Barcelona. These meetings have supported wide dissemination of information on past, on-going and future procurement activities and related needs for the fulfilment of the European contribution to ITER.

- F4E organised five information days in relation to specific procurement actions and one general information meeting for UK industry. F4E representatives also attended meetings, seminars and conferences organised in the EU Member States, mainly as part of the preparation of procurement activities in various technical areas.

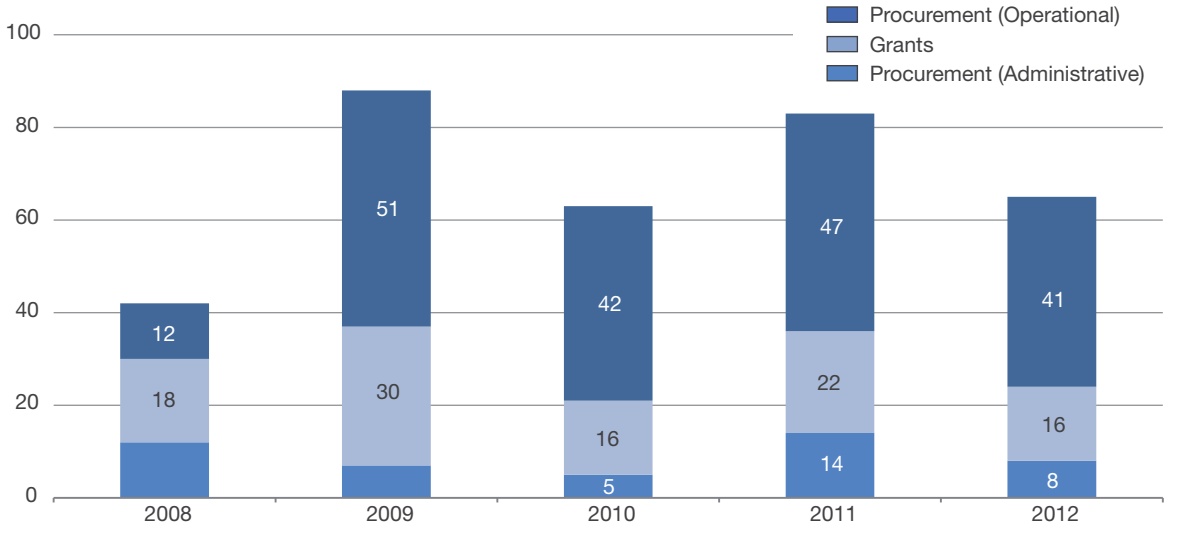
- For more precise identification of capabilities, eleven market surveys have been published through the F4E Industry Portal. Most of the market surveys launched in 2012 have been targeted to assess the market in the view of forthcoming procurement procedures, while some have been used to identify potential commercial risks in relation to the signature of specific procurement arrangements with ITER. In this regard, direct consultations with the concerned companies were also carried out.

- In 2012, the F4E Industry and Associations Portal (https://industryportal.f4e.europa.eu) has become the main contact point for companies interested in or already working with F4E. The supplier database reached about 1,300 registered users, of which more than half have initiated a generic pre-qualification process. The publication of announcements on the portal aiming at delivering dynamic information and updated on F4E procurement and pre-procurement activities has also significantly increased.

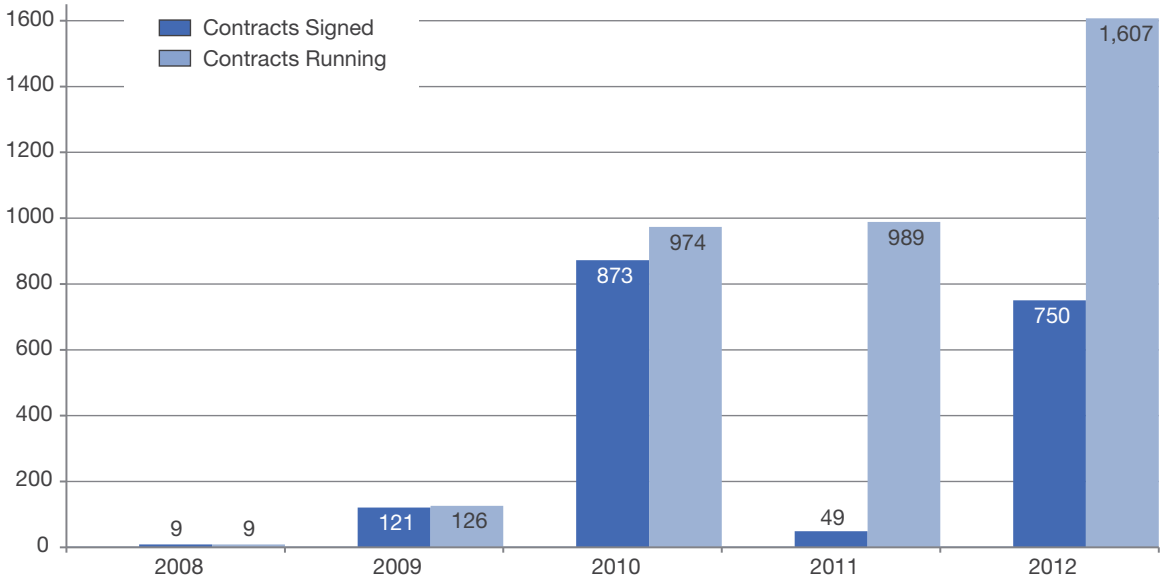
Geographical distribution of awarded contracts and grants (Number in the period 2008-2012)



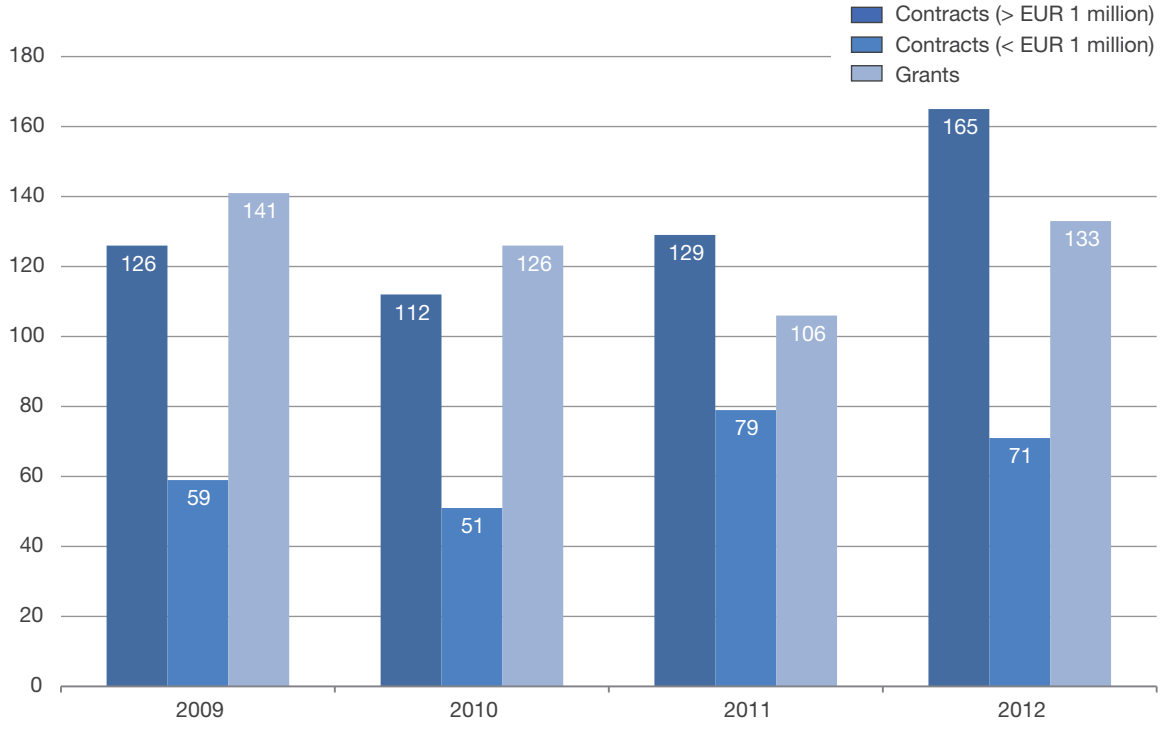
Procurement and grant procedures launched (number – excluding Task Orders)



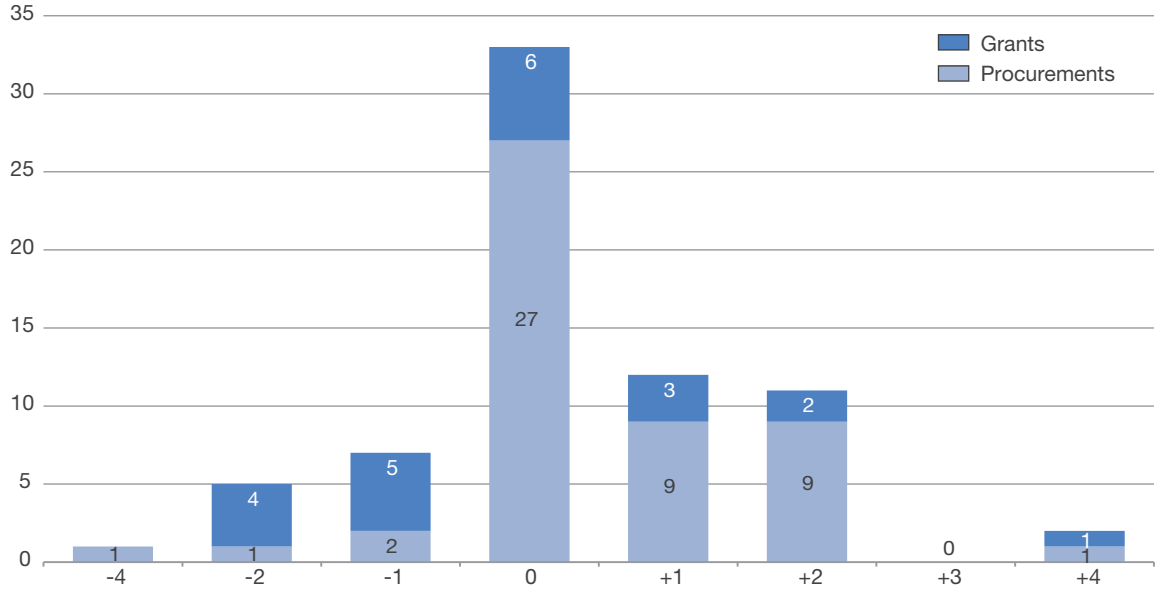
Value of signed and running contracts (For contracts with a value of > EUR 1 million)



Average time to award contracts and grants (days from submission deadline to award)



Difference between planned and actual quarter of calls for tender/proposals (Number)



Legal Matters

Optimisation of F4E's Procurement Process

Taking into account the specific nature of the procurements, grants and other activities managed by F4E as well as the recommendations of the working group set up by the Governing Board, F4E modified the Implementing Rules of the Financial Regulation (decision of the Governing Board, F4E(12)-GB24-13b on 29/06/2012) as follows:

Procurement

- A definition for 'building contracts';
- The possibility for launching a negotiated procedure with prior publication;
- The (re)definition of clear rules for the publication of the tenders, the award decisions and the standstill periods;
- The number of candidates to participate in a restricted procedure and a competitive dialogue;
- Time-limits for the receipt of tenders following a procurement procedure.

Grants

- Possibility for an easier exception to the rule on providing evidence of co-financing;
- Possibility for an easier exception to the rules on audit certificates;
- Limitation of the scope of the obligation of the beneficiary to indicate the different sources of funding.

Budget Implementation

- The possibility for heads of department to sub-delegate to the project managers/heads of unit the implementation of commitments;
- The interest rate to be imposed for the late payment of membership contributions.

Litigation before the European Court of Justice (ECJ)

In 2012, the litigation in relation with the award of the contract for cabling and jacketing of toroidal field and poloidal field conductors continued and hearings took place in Luxembourg on 26 November 2012. On 20 March 2013 the ECJ took the decision to dismiss all the pleas aiming at the annulment of the award decision related to this contract.

Budget, Finance and Accounting

The 2012 financial statements, the 2012 budget implementation and reporting on the budgetary and financial management in 2012 are detailed in the 2012 annual accounts which are published seperately.

Budget Establishment

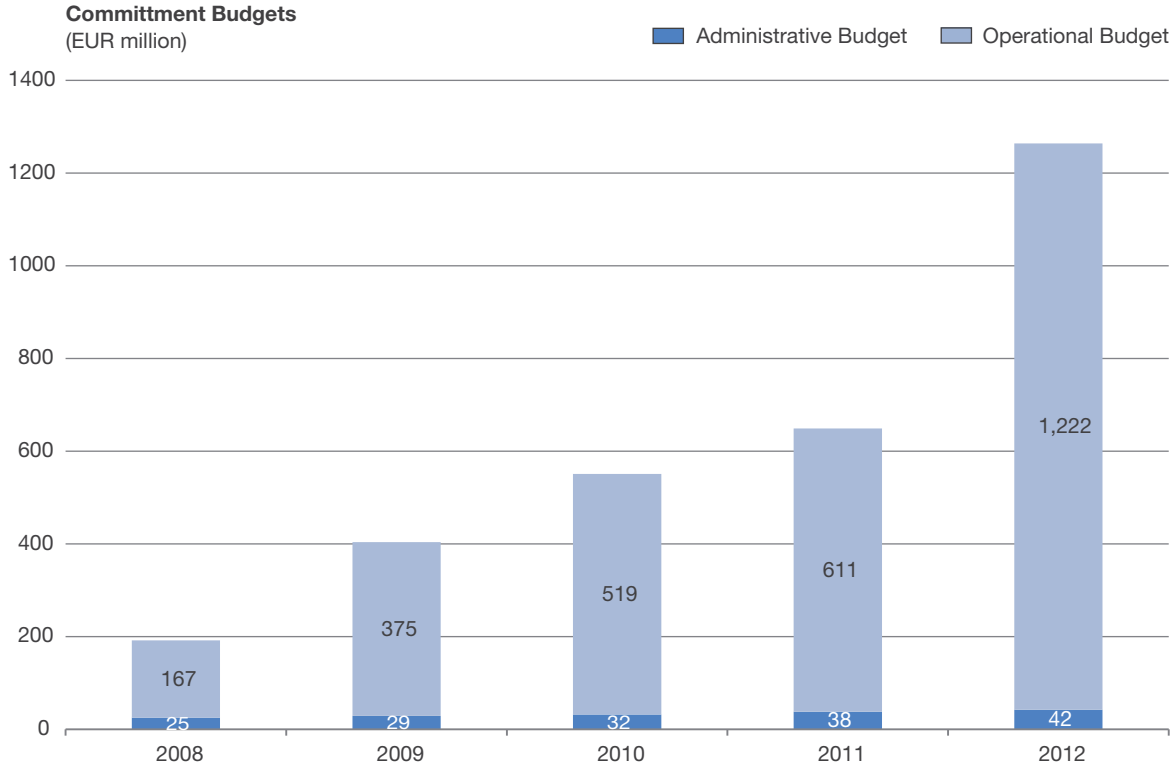
F4E's budget for 2012 was initially adopted for the global amount of EUR 1,362.05 million in commitment appropriations and EUR 503.00 million in payment appropriations. Following budget amendments approved by the Governing Board, the final authorised F4E budget for 2012 was EUR 1,263.09 million in commitment appropriations and EUR 344.13 million in payment appropriations.

Revenue

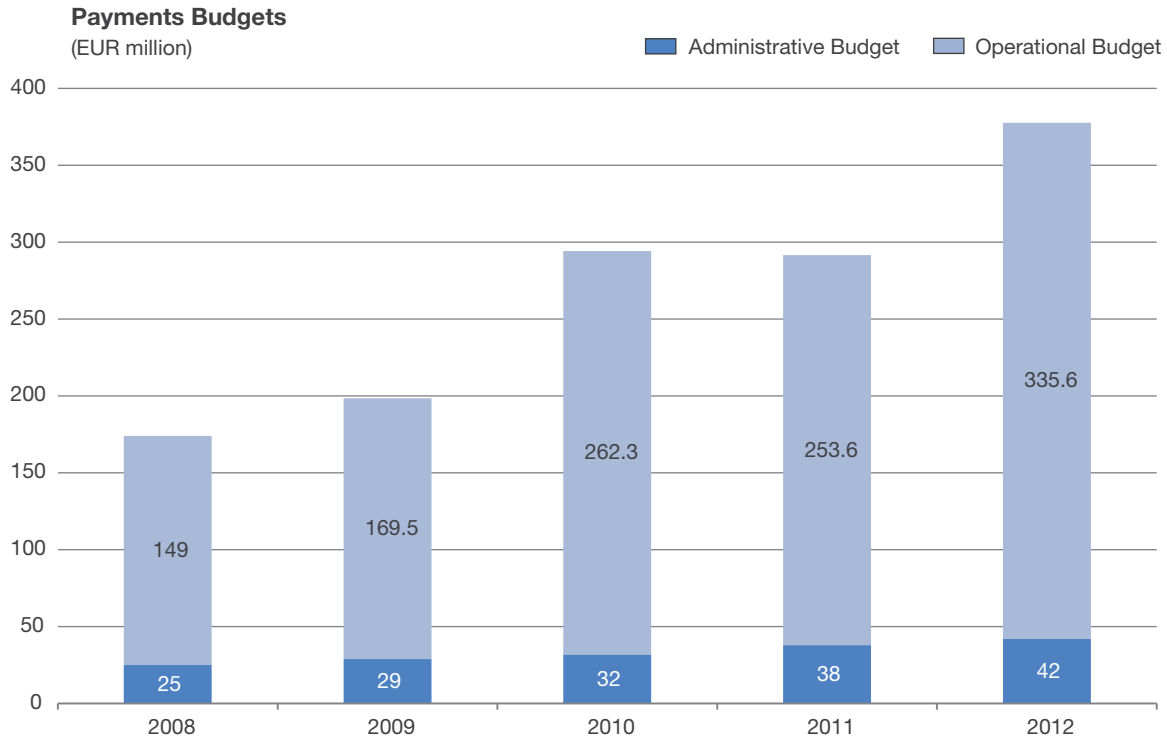
The breakdown of revenue for 2012 is in line with the relative share of the contributors for the overall period of ITER construction with 77% from Euratom, 22% from the ITER Host State (France) and 1% from the Members of F4E in the form of Annual Membership Contributions.

Commitments and Payments

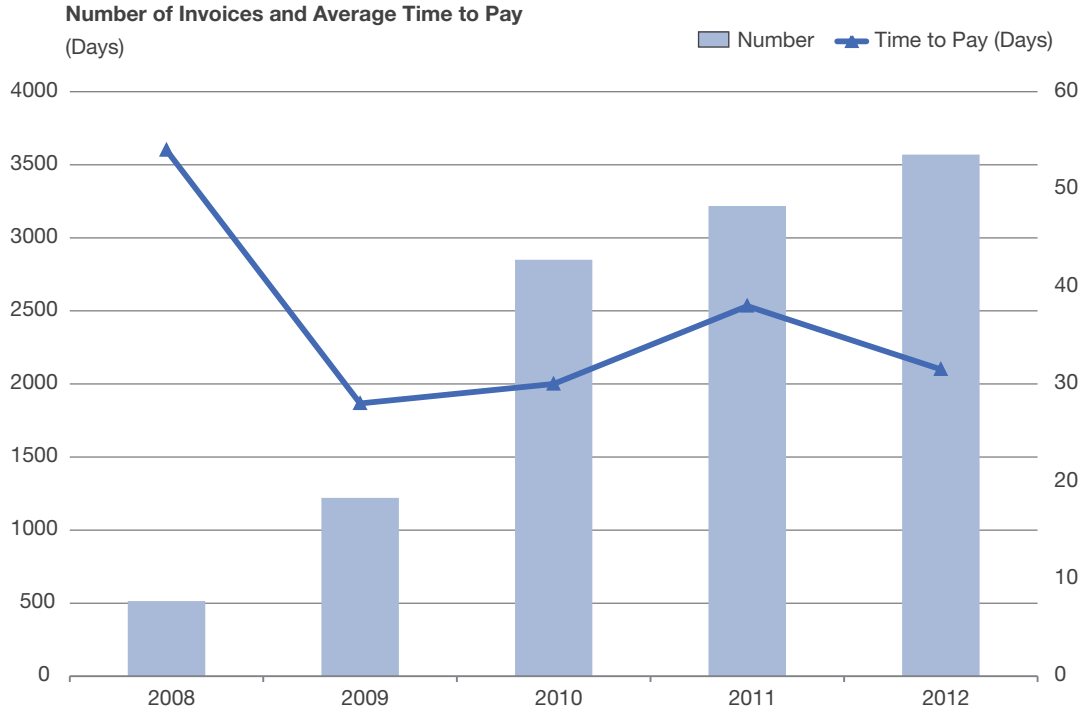
In the following graph the available budgets of F4E in commitment appropriations (EUR million) since 2008 are shown:



Similarly, F4E available budgets in payment appropriations (EUR million) since 2008 are shown below:



In 2012 F4E managed its largest ever budgets in terms of both commitments and payments.



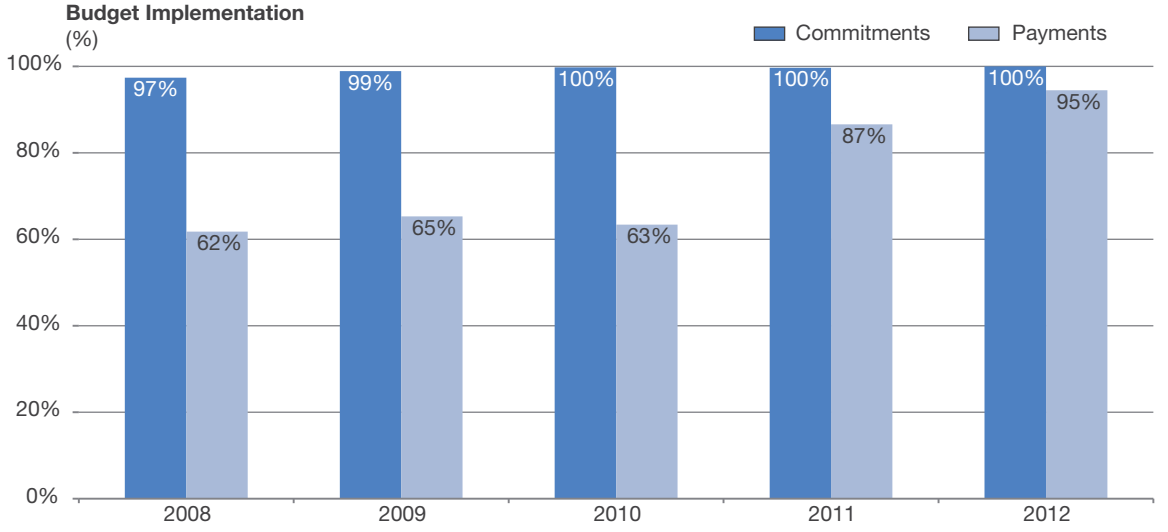
Moving to statistics on payments, the previous graph shows that the number of transactions increased by 9% over 2011 to over 3,500 (excluding individual salary payments) and the average time to pay was 31 days, which is well within the maximum 45-day period foreseen in the Implementing Rules of the Financial Regulation.

Implementation of the 2012 Budget

In terms of the implementation of the 2012 Budget, the overall outcome was very positive as follows:

- For **revenue** 100% of the foreseen revenue was collected;
- For **commitments** 99.9% was implemented, of which:
  - 99.5% was implemented of the administrative budget; and
  - 100% was implemented of the operational budget.
- For **payments** 94.5% was implemented, of which:
  - 83.3% was implemented of the administrative budget; and
  - 95.9% was implemented of the operational budget.

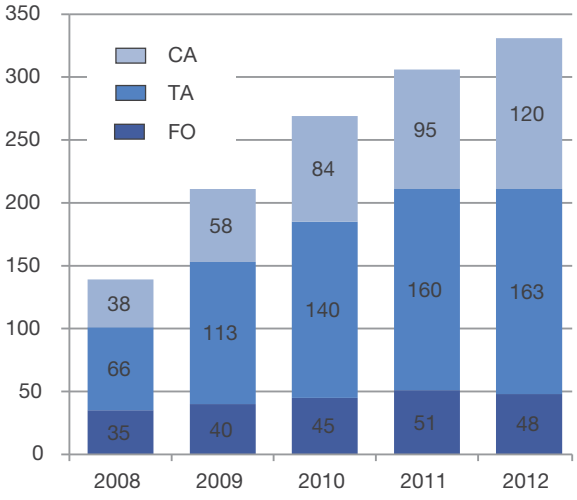
The following graph shows the achieved levels of budget implementation since 2008 which demonstrates that the highest level of implementation for payments was achieved in 2012.



Human Resources

Personnel Selection and Recruitment

As of 31 December 2012, the total number of occupied posts at F4E was 218 Officials and Temporary Agents, and 125 Contract Agents. In addition, F4E counted on the support of 18 interim (16 in Barcelona and two in Cadarache) and four Seconded National Experts (SNEs). In this context neither the interim staff nor the SNEs are considered to be F4E staff.



Evolution of the staff complement from 2008 to 2012 where FO stands for Officials, TA for Temporary Agents and CA for Contract Agents

During 2012, 30 vacancy notices were published (five for established EU Officials, 13 for Temporary Agents, nine for Contract Agents and three internal calls for expression of interest). Overall, 22 selection procedures were completed: 15 from the positions published in 2012 and seven selections from the positions published end of 2011. A total of two Officials, 13 Temporary Agents and 41 Contract Agents took up duties as per the following table (distributed by type of contract, category and department):

Department	FO	TA	CA
Office of the Director			1 FGIV
ITER		9 AD 1 AST	18 FGIV 12 FGIII
Broader Fusion Development		2 AD	
Administration	2 AST	1 AD	3 FGIV 7 FGIII

In order to better target the selection procedures for support staff, F4E published a call for expression of interest addressed to candidates who had already passed a selection procedure (CAST) managed by the EU's Personnel Selection Office (EPSO). This call referred to 26 profiles covering a wide range of domains identified by F4E as relevant. Following this call, five CAST procedures were successfully launched and candidates were recruited.

The average time to select in 2012 was four months. The time to recruit has been reduced - due in particular to the establishment of the medical services in Barcelona - to an average of four months. This figure also includes the compulsory legal notice, which might represent significant delays depending on the contract of employment.

All the Project Team Managers and Heads of Unit in the ITER Department were appointed in 2012, as well as the Head of Unit for Information and Communication Technologies within the Administration Department.

Personnel Policy

The following Implementing Rules were adopted by the Governing Board in 2012: part-time work, appraisal of the Director, criteria applicable to classification in grade and step on appointment or engagement, family leave, parental leave and transfer

of pension rights. Some other key Implementing Rules were drafted and were prepared for adoption: new appraisal and promotion/reclassification system, use and engagement of Temporary Agents, prevention of harassment. Internal guidelines to deal with complaints and appeals were also initiated. The corresponding part of the Manual of Procedures aiming at ensuring compliance with internal controls and quality assurance framework was also prepared.

In the area of data protection, the Human Resources Unit developed a central function in what concerns data protection. All notifications that are to be sent for prior checking to the European Data Protection Supervisor (EDPS) concerning staff issues, together with their privacy notices are drafted by the Human Resources Unit. During 2012 a number of them were prepared, namely appraisal and promotion, probationary period, prevention of harassment and complementary health insurance; as well, the necessary follow up was provided by the Human Resources Unit on the some of the prior-checking procedures (on invalidity and medical control, health screening programs, annual medical check-ups, pre-recruitment medical examinations and sick leaves, probationary period reports).

Summer Studentships

In March 2012, F4E launched its summer studentship scheme for the third year running. The scheme aims to provide short-period training (2 to 3 months) to university students as well as to promote awareness, knowledge and understanding of F4E's role in the ITER project and within the European context. In total, 11 studentships were awarded and the students were assigned to the ITER Department.

Training

Simplification of the procedures and targeting training to F4E needs have been key in 2012. Collective training courses in topics such as "CAPM", "Ethics and Integrity", "Setting out as Head of Unit", "Raising awareness on Harassment"," were organised. In-house training courses on financial, IT matters as well as on human resources issues were also provided throughout the year. Some figures related to the training activities in 2012 are as follows:

- Number of training courses followed under the Service Level Agreement concluded with the European Commission: 64;
- Number of collective courses organised in the F4E premises: 36;
- Number of external training courses followed: 83;
- Number of people following language courses in F4E: 219;
- Number of seminar requests: 43;
- Average number of training days per staff member: 4.6.

Working Conditions/Social Policy

Some of the main achievements in 2012 related to working conditions and advancement of the social policy at F4E included

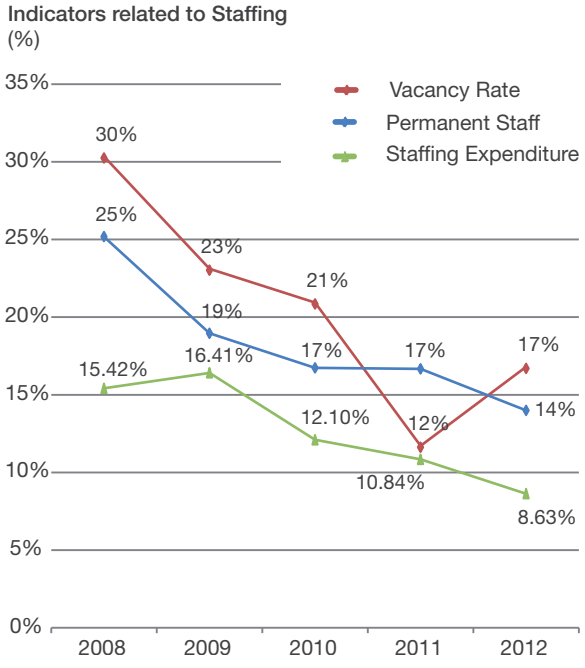
- 30 newcomers were provided with support for relocation services.
- The F4E medical service completed a full first year of activities. Since the start-up in October 2011, the following activities were performed: 45 visits of pre recruitment, 143 annual check-up, 45 flu vaccinations, 287 medical consultations, 60 follow-up visits, organisation and follow-up of a training in ergonomics.
- In January 2012 F4E concluded an agreement with a complementary health insurance company. The management of this contract includes around 600 affiliates.
- The appraisal and promotion/reclassification exercise was launched concerning 254 staff members.
- A call for expression of interest for confidential counsellors at F4E was launched. A selection was made and four staff members were nominated in this role as foreseen as part of F4E's policy on the prevention of harassment.
- Three new administrative agreements were signed with international schools in Barcelona and the surrounding area bringing the total number of agreements to 17 which covers

the needs of staff members from a variety of backgrounds. As of 31 December 2012 64 parents made use of this option and 95 children are currently enrolled in the international schools with which F4E has concluded administrative agreements.

- Two students from a secondary school in Barcelona participated in the summer studentship programme. This summer training aims to promote awareness, knowledge and understanding of F4E's role in the ITER project and within the European context.

Overall Indicators

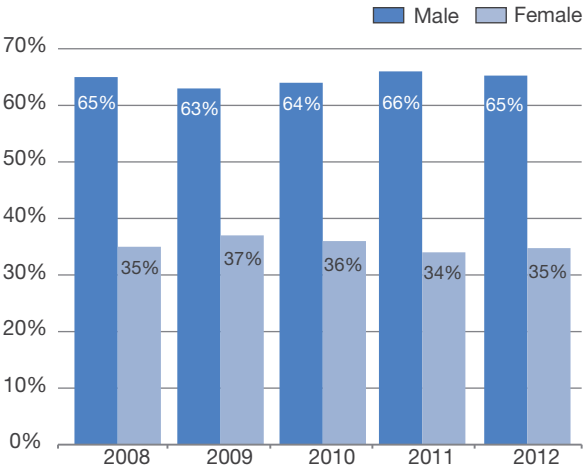
In terms of overall indicators, the following graph demonstrates that the percentage expenditure on staffing and the number of permanent staff continued to fall. At the same time there was a modest increase in the vacancy rate which can associated with the maintenance of a reserve of positions for the new Director.



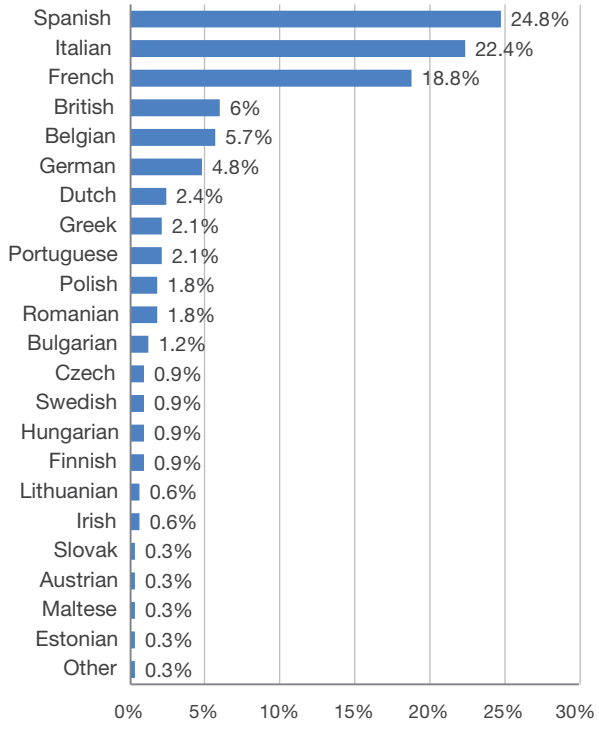
Other Staffing Statistics

In the following graphs statistics on the gender and nationality of F4E staff is provided.

Gender distribution for all staff (%)



Breakdown of staff nationality (%)



Control Environment

Internal Audit

Since 1 January 2012, F4E's revised Financial Regulation assigns the role of Internal Auditor to the Internal Audit Service of the European Commission (IAS). According to the Strategic Audit Plan 2012-2014, the IAS will conduct one audit engagement per year, thus complementing the activities of the statutory, local internal audit function (IAC) and in full coordination with it.

Two audit engagements were closed (final report issued) during 2012; they covered respectively the preparation of procurement arrangements with the ITER Organization (IAS), and procurement in the area of ITER buildings (IAC). From the other audits planned for 2012, one has been suspended, and the reporting phase on two other large engagements has been carried over to 2013.

Since the creation of the internal audit function in 2009, 160 internal audit recommendations (31/12/2011: 121) have been issued, of which at year-end 96% (31/12/2011: 99%) were accepted by the management. In response to these recommendations, more than 300 remedial actions were identified.

The overall implementation of action plans in response to internal audits remained beyond schedule (self-assessed: approximately 60% in average at year-end 2012). Therefore, only one interim follow-up audit could be conducted in 2012; it validated the implementation of a number of actions initiated in response to the recommendations of the Financial Circuits audit (2010).

66% (2011: 74%) of the available IAC resources were directly dedicated to assurance engagements. In addition, the IAC advised the Director, inter alia, on setting-up the corporate risk management system, and designing a training programme on "ethics and integrity".

Internal Control

F4E continues the further development and customisation of its Internal Control environment in order to address the specific requirements of the fields in which it operates. To this end, F4E developed a number of components to support its control environment during 2012.

Overall Control and Monitoring Strategy

F4E defined an "overall control and monitoring strategy" to strengthen F4E's control environment ensuring that the organisation is able to meet its strategic and operational objectives. It should also ensure that the operational and financial transactions are implemented according to the highest standards expected for such a project as ITER. This strategy contributes to the "assurance chain" providing to the F4E Director and external stakeholders reasonable assurance on the state of Internal Control in F4E and was presented to the Governing Board in December 2012, following its endorsement by the Audit Committee.

Multi-Annual Ex-Post Control Strategy

This Multi-Annual Ex-Post Control Strategy, established in 2012, endorsed by the Audit Committee and presented to the Governing Board in December 2012, aims at reducing and controlling risk by performing on-the-spot checks in order to assure that contractual obligations are met.

Integrated Management System

In July 2012, the F4E Director approved the Integrated Management System which merges the requirements of the two control environments in which F4E operates (since the beginning):

(a) the ISO 9001-based, ITER-wide quality system which is intended to ensure the performance of ITER and the compliance with the nuclear safety requirements;

(b) The COSO-based Internal Control Standards as applied in European institutions to manage the organisation and referred to in Annex III to the statutes of F4E.

The Integrated Management System was adopted by the Audit Committee of the Governing Board following its presentation on 16 November 2012.

Corporate Risk Management

An inter-departmental working group was set up to design the process for the identification, assessment and monitoring of the corporate risks. This process based on the 'market standard' for risk management and was approved by F4E in July 2012. Subsequently, the roles for the Risk Assessment Network were defined for maintaining the F4E Corporate Risk Log, the Corporate Risk Map and the reporting templates.

Tools and Instruments

F4E has developed an **"F4E Manual"** to provide a centralised access to all practical information required to consistently perform all F4E activities (rules, policies, processes, procedures, checklists, routing sheets, templates, etc.). The F4E Manual is a living undertaking, which needs to be further developed in line with the standardisation of processes being set up as well as new processes, guidelines, rules, etc. to be adopted in the near future.

All observations and recommendations stemming from internal as well as external audits, controls and assessments are being registered in a central follow-up database. In addition, they have been linked to the F4E Integrated Management Standards thereby defining the key areas of improvement.

The **Integrated Reporting System** of F4E was officially announced to all F4E staff on 28 September 2012. This integrated reporting system combines various information sources such as financial data, project management information, control environment in view to increase the monitoring and reporting.

External Audit

In the following table the status of the follow-up to observations from audits by the Court of Auditors in the period 2008-2012 is summarised:

Area	Completed	In Progress	No Action	Total
Annual Activity Report	2			2
Audit Committee of the Joint Undertaking	1			1
Commission Internal Audit Service	1			1
Financial Regulation and Implementing Rules	3		1	4
Grants and procurement		2	1	3
Host State agreement		1		1
Implementation of the Budget	1		2	3
Internal Control Systems	11			11
IT systems	1			1
Late payment of membership contributions	5			5
Presentation of the accounts: members' contributions	1		2	3
Reorganisation of the Joint Undertaking and internal control systems	1	1	1	3
Status of the financing of the ITER project			6	6
The role of the Internal Audit Service of the Commission	2			2
Total	**29**	**4**	**13**	**46**

Quality Management System

In 2012, F4E continued the implementation and development of the Quality Management System through four main activity areas:

- Implementation of an integrated management system;
- Establishment and continual improvement of the system;
- Process development and reviewing;
- Quality audits (internal and external);
- Quality Assurance in the operational projects.

Integrated Management System

The Integrated Management System is a single integrated system to manage the totality of the F4E's processes in order to meet the organisation's mission and objectives.

It combines the two control environments which F4E operates within - the ITER-wide quality system which is intended to ensure the performance of ITER and the compliance with the nuclear safety requirements, and the EU Internal Control Standards to manage the organisation.

The backbone of this system is the Integrated Management System Standards. A set of standards specifically developed by F4E, integrating the ISO-9001 quality requirements, the F4E EU Internal Control Standards and the ITER Project quality and safety requirements.

F4E Integrated Management System

Establishment and Continual Improvement

The status and roadmap of the management system establishment and improvement is portrayed below:

Area	Activity/Milestone
Overall System	Development of Procurement Macro process
	Issue of the Overall Control & Monitoring Strategy
	Issue of the F4E Multi-Annual Ex-Post Control Strategy
	Issue of the Integrated Management System Standards
	Issue of the Integrated Management System Policy
	Issue of the Manual of Procedures (Operational and Administrative)
	Issue of the QAO Charter
	Development of the Integrated management System Manual
	Development of the Standard content of the files to the AO(S)
	Update of the F4E Quality Classification (QA-010)
	Update of the Nonconformity approach by F4E (and all related processes)
	QA Guidance Training to all operational officers
	Started the QA Training of the Suppliers of Safety Important Class items
	Continuation of the update and issue of processes.
Quality Audit	Preparation and execution of the year quality audits
	Issue of the 2013 Quality Audit Plan (2013-QAP)
	Update of the Quality Audit Guideline
Documentation	Issue of the overall F4E Documentation Policy (exchange, registration, signature and archival)
	Development of the F4E Retention List - Documentation Archival
	Update of the ITER Project Sign-Off Authority Policy
Risk Management	Issue of the Corporate Risk Management (including the process and the corporate risk exercise)

Process Development and Reviewing

F4E continued the implementation of the process approach in line with the ISO 9001 and IAEA GS-R-3 requirements (International Atomic Energy Agency Safety Requirements no. GS-R-3). Processes are being defined for all the identified processes needed for achieving the intended organisation outputs. For each process all the actions, documentation, appropriate review and approval, reporting and records are defined:

Processes Status (out of 120)	**Approved**			**In Development**			**Software tool based**
	Process	Procedure/ Policy	Updating	Review	Mapped	Preparation	
	41	10	12	13	8	7	5

To complement the processes, F4E is defining the methods of working in the Manual of Procedures (first version issued).

Quality Audits

F4E has an established a quality audit framework that provides F4E and its stakeholders (e.g. the ITER Organization) with the assurance that our suppliers are being monitored and that quality is adequately being implemented:

- Each audit result is recorded in an audit report, which includes the identification of any strong areas, improvement areas and nonconformities;
- Where improvements or nonconformities are identified the report is followed by an action plan from the auditee;
- The implemented Annual Quality Audit Plan for 2012:
    - 18 quality audits on operational procurements (Supplier Quality Plan provisions and implementation);
    - 5 quality audits on grant agreements (Supplier Quality Plan provisions and implementation);
    - 3 internal audits to the Implementation of the Quality Processes by F4E during the: implementation of procurement arrangements and task agreements; management of the Configuration; and launching procurement procedures;
    - 1 audit by the ITER Organization to the F4E QA Programme: that resulted in five minor corrective actions and seven improvement actions identified.

Quality Assurance in the Operational Projects

One of the major QA activities is the support to the operational projects to ensure the correct implementation of the quality programme. These activities can be divided in:

- Support and review of the procurement arrangements and ITER task agreements to ensure conformance with the F4E QA Programme, the ITER Organization-Domestic Agency coordination meetings in quality and safety and issue of the implementation templates;
- Guidance training on QA to all the operational officers;
- Full support to the technical departments on quality issues of Contracts and Grants, verification of the calls documentation (including full review of the management specifications) for compliance with the F4E QA Programme and issue of the follow-up documentation templates;
- Training on QA (and nuclear safety) to suppliers providing Safety Important Class items and/or services;
- Verification of the suppliers' quality plans and all the contract implementation quality documentation;
- Supplier quality audits and full support on QA to the kick-off, progress meetings and control point quality related visits.

Data Protection

F4E continued to implement the requirements of Regulation (EC) 45/2001 concerning the protection of individuals with regard to the processing of personal data by the Community institutions and bodies. The main objective is to guarantee the lawfulness of the processing of personal data, its security and confidentiality as well as to provide data subjects (i.e. F4E staff, Committee members as well as external experts) with the possibility to exercise their rights regarding the treatment of their personal data.

For 2012 the following is to be emphasised:

- A new F4E Data Protection Officer (DPO) was nominated and according to the restructuring of the F4E Administration Department, new Data Protection Coordinators have been nominated. Close contacts with the EDPS, COM and other DPOs were reinforced in order to efficiently apply data protection rules.
- Progress in evaluation of the personal data compliance in F4E, with the involvement of the DPO advising on privacy notices and data processing related e.g. to the staff evaluation, health procedures, Mobile Phone Policy and handling of data in the IT tools.
- The F4E manual of procedures and intranet were updated as well as a new inventory established in view of the notifications to be done, taking

into account a deadline set (June 2013) by the European Data Protection Supervisor (EDPS).

- Notifications validating the processing of personal data were adopted, for example on the Internal Audit Process, the selection of Executive Committee and Technical Advisory Panel members, Studentship, Parking Policy, internal list presenting F4E staff.

- Where a prior checking to the EDPS is required because of sensitivity of the data processing, further progress has been made and draft notifications were sent to the EDPS, regarding for example the Invalidity Procedure and Medical Control.

- Horizontal issues are at stake with the EDPS: e.g. the notifications on the staff evaluation procedure have been suspended, as the general issue on the exact retention period of personal data needs to be solved for all EU institutions and bodies. Thus, the EDPS set up an inter-institutional working group for this issue.

- The DPOs of all EU institutions and bodies meet regularly in order to exchange experience, streamline processes and discuss important issues with the EDPS (status of DPOs, retention period, prior check procedures etc.).

Meeting of the Data Protection Officers in Frankfurt

Information and Communication Technology

During 2012 the main achievements in the area of Information and Communication Technology (ICT) were the following:

- The **F4E Integrated Reporting System** was finalised and opened to users at the end of September. From that moment new reports were added, data quality issues were addressed and the tool itself has gained in quality and popularity.

- The ICT Unit developed the **Contract Management tool** after a Fit and Gap analysis with respect to Oracle Primavera Contract Management that was carried out early 2012. The final application will be delivered to the ITER Department's Project Office in January 2013 according to schedule.

- Upon request of the Contract and Procurement Unit, the ICT Unit collected the requirements for a new tool called **Procurement Portal** aiming at supporting Project Teams in pre-tendering and tendering activities. A request for bids was sent out and a company was awarded the implementation phase that should start beginning of 2013.

- A first phase for scope and requirements definition for **F4E SmarTeam solution** was completed successfully and a second specific contract for a first implementation was signed. The new platform will be released during Q2 2013.

- A new version of the **Industry Portal** was rolled-out to production during the first quarter of 2012. Several months of user testing was carried out in order to reach full satisfaction of the business owner by mid-2012.

- **HR tools**: The new eHR database project started in Q4 2011 was completed in Q4 2012 and, after proper testing, will be rolled-out to production in Q1 2013.

- **IDM**: The platform is stable and operates flawlessly with a good stability internally and externally. Several agreed enhancements have been implemented and rolled out to production in conjunction with the ITER Organization.

- **IT Infrastructure**: A new Microsoft Windows architecture has been implemented and the migration to Windows 7 was successfully completed at the end of the year.

- **IT Application Support**: On-going maintenance of existing applications and support of all F4E users was provided. The vast majority of requests were resolved within one month.

- **IT Service Desk**: On-going support for all F4E users has been regularly provided with a high degree of customer satisfaction. During 2012 around 4,200 requests were submitted and as many were resolved. The overall backlog at the end of the year is 12 open requests.

- In the area of IT governance the ICT Unit progressed at a fast pace in the definition and adoption of policies and processes. The ISO 20000 framework was adopted for service management. The following documents were adopted and made public:

    - ICT Strategy;
    - ICT Information System Security Policy;
    - ICT Service Catalogue;
    - Project Selection Process;
    - Incident and Service Request Management;
    - Change Management;
    - Problem Management;
    - Configuration Management;
    - Release Management.

None of the F4E IT services suffered any severe discontinuity during 2012.

Infrastructure and Logistics

Offices and other Support Services

Activities in this area by the Infrastructure and Logistics Group aim to ensure a functional and safe workplace for all people working within the F4E premises.

During 2012, the main priority for the Infrastructure and Logistics Group was to adapt the existing infrastructure by the full installation and equipment of the last quarter of the 10th floor and half of the 12th floor of the F4E building. A total of 40 new staff members were installed and 166 internal moves were organised.

As a result of the installation of new areas on both the 10th and 12th floors, the whole fire detection and extinguishing systems as well as the Emergency Procedure Manual were updated.

In 2012, the Infrastructure and Logistics group carried out the second inventory assets exercise.

The group received 285 calls for tenders and then dispatched them accordingly to the responsible departments. A total of 925 invoices from external providers were registered in ABAC.

The group also dealt with the implementation and management of an imprest account as from 1 January 2012 including regular reporting of the transactions carried out to the F4E Accounting Officer.

The Infrastructure and Logistics Group took over the responsibility for the management of all F4E requests for translations through the translation centre.

External Visits and Meetings

In 2012, 89 meetings with the attendance of external participants took place at the F4E premises. Each meeting counted with the necessary logistical support.

As an indicator for the substantial growth of activities in the logistics area and F4E in general, it should be noted that 4,153 visitors were accredited in 2012 representing around 10% more in relation to the previous year.

Safety

The Infrastructure and Logistics Group is also responsible for the implementation of health and safety rules in F4E's premises. For that reason, the First Aid Workers participated to a training on the use of the AED (Automated External Defibrillator) organised by the Red Cross. A fire drill was carried out and it showed very good results.

A risk assessment for health and safety at work was organised together with the Human Resources Unit for colleagues located on the new areas of the 10th and 12th floors. A refresher risk assessment was organised for all F4E staff.

Social Actions

In 2012, several social actions were carried out, including an F4E staff blood donation, food collection campaign and a Christmas toy collection for underprivileged children living in Barcelona.

Implementing the Host Agreement

An infrastructure and logistics database was designed and developed to facilitate the management of all the CIEMAT and F4E requests and to have a better control over the infrastructure and logistics budget consumption.

Formal contact with the French authorities continued during 2012 for issues related to the application of the PPI in Cadarache, which resulted in November to the recognition from the French authorities of the official presence of F4E in France.

Information, Communication and External Relations

In the area of external communication, our key objective has been to improve the visibility of Europe's contribution to ITER through a mix of instruments such as press releases, audiovisual clips, photos, technical briefings and events.

In terms of targeting the media, a technical briefing with a group of journalists was organised in Cadarache offering technical talks on the progress of the ITER construction and a guided tour on the ITER site. Furthermore, a series of communication activities were launched in coordination with the F4E contractors and the European Commission representations giving us visibility in 105 online and print media. F4E took the opportunity to attend the European Open Science Forum, a venue that brings together science journalists and communicators from all over Europe in order to showcase the ITER project, Europe's contribution and the merits of fusion energy.

The F4E external website remained the main gateway for the different target audiences interested in the latest contracts that F4E has signed, the progress on the ITER site, as well as the events that F4E organised and attended. The website statistics show that in 2012 there were 200,000 individual visitors, who visited the website 1.5 times and viewed on average four pages per visit. The F4E external website was regularly updated with new content reaching 39 articles which were also posted on Twitter in order keep more than 600 followers informed.

With respect to audiovisual material, we continued covering the ITER construction progress by means of 850 quality photos and 10 short films, including two on the manufacturing of components. The material was distributed to different multipliers and was uploaded on the F4E YouTube channel reaching 14,400 viewings. An audiovisual collaboration was also established with Intel to report on Helios, the Broader Approach supercomputer.

F4E participated in 27 events and key conferences such as SOFT for which new communication materials had to be produced (pop up stands, conference brochures). F4E developed new publications such as the F4E fact sheets and continued with recurrent ones (F4E News, Annual Report). For the launch of the Industry and Associations portal, four online tutorials were produced internally and a working method for the distribution of communication material was

F4E new Fact sheets

Professor Osamu Motojima, DG of ITER International Organization and Frank Briscoe, F4E Director, inaugurate the PF coils building

established between industrial liaison officers and F4E. In addition, two open calls for tender in the area of audiovisual production and media monitoring were launched and subsequently signed in order to offer continuity of services and measure the impact of F4E communication activities.

In terms of internal communication, our main focus was the launch of the new internal website (F4ENet) offering new design, layout and functionalities. The regular content updates amounted to 72 articles and a list of communication guidelines for the F4E manual of internal procedures. In order to take stock of the different activities running in the organisation, a group bringing together the communications representatives from different departments was established. Communications support was offered for 13 internal campaigns and good progress was also made regarding the corporate look and feel of templates, business cards and stationery.

1 L'UE dans la compétition économique mondiale

	UE	États-Unis	Japon	Chine
Puissance économique				
Population (2009) • en millions d'habitants • en % du monde	501 7,3	307 4,5	127 1,9	1 338 19,6
PIB (2009, en milliards de dollars) **PIB / habitant** (en dollars)	16 450 32 830	14 260 46 440	5 070 39 940	4 910 (1) 3 670 (1)
Exportations mondiales (2008, en %) • de marchandises • de services	34 42	8 14	5 4	8 (2) 5,3
Stock IDE* (2009, en % du monde)	42	18	1	8 (2)
Nombre de multinationales parmi les 500 premières (chiffre d'affaires, 2010)	161	136	71	46
Émission de CO_2 (2009, en % du monde)	10	19	8	5
Dynamique économique				
PIB mondial (en %) • 1973 • 2009	27,5 28,4	22 24,8	7,7 8,7	4,6 8,5
Taux chômage (2010, en %)	9,8	9,6	5,2	4
Croissance du PIB (taux moyen annuel en %) • 2000-2007 • 2008-2009	2,4 – 4	2,6 – 1,3	1,7 – 3,2	9,6 9,5
Puissance scientifique				
Dépenses en R & D (2008-2009, en milliards de dollars)	319	390	170	75
Nombre de publications scientifiques (2006, en %)	33	28	8	7

(1) Hong Kong inclus. OMC ; Eurostat ; FMI ; CNUCED ; OCDE ; OST

3 L'UE, première donatrice mondiale

L'Union européenne (États membres et institutions européennes confondus) fournit environ 55 % du total mondial de l'aide publique au développement, ce qui en fait de loin le premier bailleur de fonds aux pays en développement.

En 2008, le premier contributeur européen (et deuxième mondial) est l'Allemagne avec près de 14 milliards de dollars (soit 0,38 % de son revenu national brut), suivie par le Royaume-Uni (12 milliards, soit 0,43 % du RNB) et la France (11 milliards, soit 0,39 % du RNB). Le premier contributeur mondial reste les États-Unis (27 milliards de dollars), le cinquième est le Japon (10 milliards de dollars).

Inscrite dans le traité de Rome et initialement concentrée sur les anciennes colonies des États membres, l'aide de l'Union européenne s'est élargie mondialement.

Distribuée à plus de 160 pays, territoires ou organisations, cette aide œuvre à la réalisation des « Objectifs du Millénaire* » de l'ONU : promotion de la démocratie et de la sécurité, équité sociale, prospérité économique, défense de l'environnement. L'Autorité des territoires palestiniens, l'Éthiopie, la Turquie, l'Afghanistan et le Maroc sont les premiers bénéficiaires de l'aide européenne en 2008.

Toute l'Europe, www.toute-leurope.eu, OCDE, 2010.

2 Au premier plan pour l'énergie de fusion

L'UE a créé « Fusion for Energy » pour renforcer son rôle au niveau mondial dans le développement de l'énergie de fusion et gérer sa participation au projet international ITER en cours de réalisation à Cadarache (France).

4 Un président pour l'Union européenne

« Avec Herman Van Rompuy, l'Europe a enfin un président capable de parler d'égal à égal avec Barack Obama et Hu Jintao. »

Dessin de Ruben dans *De Standaard* (Bruxelles), 25 novembre 2009.

L'ancien Premier ministre belge, peu connu sur la scène internationale, devient le premier président du Conseil européen, pour deux ans et demi renouvelables, avec l'entrée en vigueur du traité de Lisbonne le 1er décembre 2009.

Chapitre 9 L'Union européenne dans la mondialisation 249

F4E and fusion become part of national curriculum France et Europe, Géographie. Editions Magnard 2011

Filming the progress of the TF Coils, ASG facility, La Spezia (IT)

ESOF 2012 in Dublin hosted a number of different talks and activites for over 20,000 international participants

F4E Task force at SOFT 2012

Staff Committee

The Staff Committee was active during 2012 on several fronts which can be summarised as follows:

- Providing comments under formal Implementing Rules consultations for: harassment, appraisal and promotion of Officials, Temporary Agents and Contract Agents, and Temporary Agent contracts;
- Participating in personnel selection committees;
- Conducting a survey regarding job satisfaction of F4E staff;
- Working with the Human Resources Unit and with working groups in the following areas: appraisal and promotion, contracts policy, harassment, schooling and nursery, building and office space;
- Providing recommendations on the evaluation and promotion for Temporary and Contract Agents;
- Organising training for staff for preparing EPSO tests;
- Improving the procedures for the budget implementation of the Staff Committee as well as keeping up-to-date the Staff Committee website;
- Actively participating in the Assembly of Agency Staff Committees;
- Organising social activities, clubs and events to promote team building of staff members;
- Supporting parents at work over the school holiday period by organising summer activities for their children;
- Channelling staff contributions to solidarity actions organised by non-profit organisations such as the organisation of charitable collections in case of catastrophes.

Chapter 3

Our Governance

Governing Board

The Governing Board is responsible for the supervision of F4E in the implementation of its activities. It makes recommendations and takes decisions on a wide range of matters.

Composition

Each member of F4E is represented in the Governing Board by two representatives, one of which has scientific and/or technical expertise in the areas related to its activities. The list of representatives on 31 December 2012 is shown in the table.

Austria	Harald	Weber
	Daniel	Weselka
Belgium	Theofiel	Van Rentergem
	Eric	Van Walle
Bulgaria	Troyo Dimov	Troev
Cyprus	Panicos	Demetriades
	Leandros	Nicolaides
Czech Republic	Pavel	Pavlo
	Jan	Kysela
Denmark	Gorm	Bramsnaes
Estonia	Rein	Kaarli
	Ergo	Nömmiste
Euratom	Robert-Jan	Smits
	Hervé	Pero
Finland	Tuomas	Tala
	Kari	Koskela
France	Bernard	Bigot
	Bernard	Salanon
Germany	Harald	Bolt
	Beatrix	Vierkorn-Rudolph
Greece	Eleni	Stavrianoudaki
	Anastasios	Youtsos

Hungary	Barbara	Tóth-Vizkelety
	Sándor	Zoletnik
Ireland	Miles	Turner
	Bob	Hanna
Italy	Aldo	Pizzuto
Latvia	Maija	Bundule
	Andris	Šternbergs
Lithuania	Sigitas	Rimkevičius
	Stanislovas	Žurauskas
Luxembourg	Pierre	Decker
	Léon	Diederich
Malta	Nicholas	Sammut
	Ian	Gauci Borda
Netherlands	Cor	Katerberg
	Tony	Donné
Poland	Łukasz	Ciupiński
	Paulina	Styczen
Portugal	Carlos	Varandas
	Maria Helena Alves	Ramos
Romania	Florin	Buzatu
	Florin	Spineanu
Slovakia	Stefan	Matejcik
	Jozef	Pitel
Slovenia	Jože	Duhovnik
	Milan	Cercek
Spain	Luis Eduardo	Ruiz López de la Torre
	Joaquín	Sánchez Sanz
Sweden	James R.	Drake
	Pär	Omling
Switzerland	Andreas	Werthmueller
	Minh Quang	Tran
United Kingdom	Steve	Cowley
	Alison	Wall
Chair	Stuart	Ward

Mr Stuart Ward was appointed Chair of the Governing Board on 1 July 2011 for a period of two years and replaced Professor Carlos Varandas. Drs Cor Katerberg and Dr Joaquín Sánchez were appointed as Vice Chairs of the Governing Board on 1 July 2011 both for a period of two years.

Activities

The Governing Board met on five occasions during 2012. The summaries of the meetings and the main decisions of the Governing Board are made public and accessible via F4E's website.

Ad-Hoc Groups

During 2012 the Governing Board established the following ad-hoc groups:

- The ad-hoc group on partnerships with European Fusion Associations – by decision of the Governing Board of 11 December 2012;

- Renewal of the Annual Assessment Steering Committee – by decision of the Governing Board of 11 December 2012.

Bureau

The Bureau is a subsidiary body of the Governing Board and provides support for communication and coordination between the Governing Board, F4E committees and F4E management. In advance of Governing Board meetings, the Bureau proposes recommendations in writing on each proposed Governing Board decision drawing on the opinions of F4E committees.

The Bureau, chaired by the Chair of the Governing Board, is composed of the following members:

- The Chairs of the:
  - o Governing Board
  - o Executive Committee
  - o Technical Advisory Panel
  - o Administration and Finance Committee
  - o Audit Committee
- A representative of Euratom
- A representative of the ITER Host State (France)

The Bureau met on three occasions in 2012 and the main activities involved reviewing key documents and proposing recommendations on Governing Board decisions.

Administration and Finance Committee

The Administration and Finance Committee (AFC) assists the Governing Board and Director in administrative and financial matters related to ITER, the Broader Approach and preparations for demonstration fusion reactors (DEMO).

Composition

The AFC is composed of 11 members appointed by the Governing Board for a period of two years. One member of the AFC is Euratom. The other ten appointed members represent twelve member States: Austria, Belgium, France, Finland, Germany, Portugal, Slovenia, Spain, the UK, and Denmark, Sweden and Switzerland (jointly). The members of the AFC are:

- Cor Katerberg (Chair)
- Thierry Brosseron
- Guadalupe Córdoba Lasunción
- Nicolas Hirsch
- Eric Hollis
- Juha Linden
- Simon Ošo
- Carlos Silva
- Harald Weber
- Andreas Werthmueller / Jeppe Sondergaard
- Chantal Cortvriendt
- Marina Zanchi
- Marc Pipeleers

The Chair of the AFC is appointed by the Governing Board for a period of two years. The AFC Chair is also Vice Chair of the Governing Board. Drs Cor Katerberg was appointed AFC Chair by the Governing Board on 1 July 2011.

Activities

The AFC had two official and one unofficial meetings in 2012.The main activities included:

- Discussing and preparing opinions on:
- Financial Planning and Budget proposals;
- Resource Estimates Plan and related matters;
- Staff establishment plan and related matters.

Providing comments and recommendations on:

- Three amendments to the 2012 Work Programme;
- The 2011 Annual Report;
- Two amendments 2012 Budget;
- The 2013 Work Programme;
- 2013 Budget.

Executive Committee

The Executive Committee (ExCo) reviews draft ITER Procurement Arrangements and Overall Strategies for delivering ITER procurement packages, as well as Individual Procurement Strategies and the ensuing contracts and grants before they are awarded. The ExCo also makes recommendations on F4E's Project Plan, Work Programme, Resource Estimates Plan, annual budget and accounts.

Composition

The ExCo comprises a chair and 13 members appointed by the Governing Board for a period of two years, renewable once. One member of the ExCo is Euratom. The ExCo chair and members are independent in the performance of their duties and act in the general interest of F4E. Mrs Lisbeth Skovsgaard Grønberg is the current Chair of the ExCo.

The members of the ExCo are:

- Lisbeth Grønberg (Chair)
- Eric Capelle
- Dan Cooke
- Itziar Echeverria
- Fabrizio Felici
- Pedro Silva Girão
- Krzysztof Jan Kurzydlowski
- Giuseppe Mazzitelli
- Herkko Plit
- Don-Pierre Pompei
- Pilar Ramiro
- Herman ten Kate
- Pierre van Doorslaer
- Euratom

Activities

The ExCo met on 11 occasions in 2012.

The ExCo reviewed overall procurement strategies for the following items: divertor cassette body and integration, test blanket module systems, EU high voltage power supply of the electron cyclotron and current drive system, buildings construction, materials development and poloidal field coils. The ExCo also examined and approved 17 individual procurement strategies/calls.

In 2012, the ExCo approved three major contracts before their award. It also looked ex-post at 19 grants and 15 contracts awarded by F4E.

Technical Advisory Panel

The Technical Advisory Panel (TAP) assists the Governing Board and Director in engineering, scientific and technological matters in particular, the adoption of the Project Plan and Work Programmes.

Composition

The TAP is composed of 13 members appointed by the Governing Board. The Governing Board appointed Dr Joaquín Sánchez as Chair of the TAP on 1 July 2011. The members of the TAP are:

- Joaquín Sánchez (Chair)
- Derek Stork (Vice Chair)
- Enrique Ascasíbar
- Paola Batistoni
- Antonino Cardella
- Flavio Crisanti
- Horacio Fernandes
- André Grosman
- Marek Rubel
- Vincent Massaut
- Olaf Neubauer
- Mathias Noe
- Noud Oomens

Activities

The TAP met on three occasions during 2012 and the main activities included:

- Providing comments and recommendations on two amendments to the 2012 Work Programme and the 2012 Annual Report;
- Providing comments and recommendations on the draft 2013 Project Plan and Work Programme;
- Reviewing and commenting upon the overall strategy for the divertor, test blanket modules and materials programme;

The TAP also established an ad-hoc group on the strategy for the European gyrotrons for ITER which reported in 2012.

Audit Committee

The Audit Committee (AC) is an advisory committee to the Governing Board, charged with the oversight of financial reporting and accounting, Internal Control and Risk Management matters, External and Internal Audit.

Composition

The AC is composed of a Chair and four members appointed by the Governing Board on a proposal of the F4E Director. One member of the committee is proposed by Euratom. All members are appointed for a period of two years. The members of the AC are:

- Beatrix Vierkorn-Rudolph (Chair)
- Paul Webb (European Commission)
- Jean-Marie Haensel
- Jurij Von Kreisler
- Thomas O'Hanlon

On 5 October 2010 the Governing Board appointed Mr Stuart Ward as the first AC Chair. Following his election as Governing Board Chair on 1 June 2011, the Governing Board appointed Mrs Beatrix Vierkorn-Rudolph as AC Chair for a term of two years, effective 1 July 2011.

Activities

The AC met on three occasions during 2012 and the main activities included:

- Reviewing the implementation of action plans by F4E in response to internal audits in the areas of pre-procurement, buildings and procurement arrangements;
- Reviewing the implementation of recommendations by F4E in response to external audits of the European Court of Auditors;
- Examination of the 2011 Annual Accounts and observations thereupon by the Court of Auditors;
- Reviewing the state of the validation of the accounting systems by the F4E Accounting Officer;
- Considering the implementation of F4E's risk and project management systems as well as its audit-related strategies and integrated management standards;
- Commenting upon F4E's draft 2011 Annual Report.

FUSION FOR ENERGY

Annexes

ANNUAL REPORT 2012

ITER PROCUREMENT ARRANGEMENTS

Note that those procurement arrangements (PAs) that have been signed between F4E and the ITER Organization are shaded in grey.

Procurement Arrangement Title	PA Signature Date (SMP Baseline)	PA Signature Date (F4E Forecast 4th Feb 2013)	Credit (kIUA)
Magnets - Toroidal Field Coils	Jun 2008	Jun 2008	89.74000
Magnets - Poloidal Field Coils	Jun 2009	Jun 2009	40.87000
Magnets - Pre-Compression rings	May 2010	May 2010	0.60000
Magnets - PF Conductor	May 2009	May 2009	11.22881
Magnets - TF Conductor	Dec 2007	Dec 2007	43.39000
Vacuum Vessel Sectors	Nov 2009	Nov 2009	92.19000
Divertor Cassette Integration	Mar 2012	Apr 2012	11.20000
Divertor – Inner Vertical Target	Mar 2010	Mar 2010	20.20000
Divertor Remote Handling	Sep 2012	Sep 2012	9.62000
Remote Handling –Cask and Plug RH System	Jul 2013	Nov 2013	18.30000
Remote Handling - In-Vessel Viewing System	Jun 2013	Sep 2013	6.80000
Neutral Beam Remote Handling	Jan 2013	May 2013	6.00000
Water Detritiation System - 1st part: Tritiated water holding tanks (storage and emergency)	Sep 2012	Dec 2012	2.55200
Cryoplant: LN2 Plant and Auxiliary Systems	Jun 2011	Jun 2011	30.67700
Detailed design of the Steady-State Electrical Network (SSEN) and Pulsed Power Electrical Network (PPEN)	Oct 2009	Oct 2009	7.00000
Installation and Commissioning of the Steady-State Electrical Network (SSEN) and Pulsed Power Electrical Network (PPEN) and SSEN cables	Apr 2013	Apr 2013	13.30000
Material procurement for SSEN	Apr 2013	Apr 2013	5.00000
Material procurement for SSEN Emergency Power Supply	Apr 2013	Apr 2013	5.70000
Electron Cyclotron Radio-Frequency Power Sources	Jun 2012	Dec 2013	9.86000
Electron Cyclotron Radio-Frequency Power Supplies	Dec 2011	May 2012	11.62800
Neutral Beam Power Supplies and Related Systems	Jul 2009	Jul 2009	31.38200
Neutral Beam Test Facility	Oct 2010	Oct 2010	27.00000
Diagnostics 1st Part	Nov 2011	Dec 2011	1.11200
Diagnostics 2nd Part	-	-	30.633
Poloidal Field Coil Manufacturing Building	Nov 2008	Nov 2008	12.80000
Architectural and Engineering Services	May 2009	May 2009	54.38000
Tokamak Excavation and Support Structure	May 2009	May 2009	31.00000
Anti-seismic Bearings	May 2009	May 2009	6.20000
Construction (Reinforced Concrete Buildings and Steel Frame Buildings)	Jul 2010	May 2010	336.64000
New ITER Headquarters Building	-	Oct 2012	13.85000
Radiological and Environmental Monitoring Systems	Oct 2012	Jun 2013	4.20000

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BROADER APPROACH PROCUREMENT ARRANGEMENTS

Reference	Title	Date signed	Value (kBAUA)
STP-EU-PA Setup Cryogenic Test Facility & tests of TF Coils	Procurement Arrangement on the Setup of a Cryogenic Test Facility and the Performance of Tests of the TF Coils for the Satellite Tokamak Programme	24/01/2012	18.603
STP-EU-Amendment PA - Supply of Cryostat Base	Amendment to the Procurement Arrangement for the Supply of Cryostat Base for the Satellite Tokamak Programme	25/07/2012	4.348
STP-EU-PA & Sub-arrangement Supply of Cryogenic Systems	Procurement Arrangement on the supply of the Cryogenic System for the Satellite Tokamak Programme	29/11/2012	35.250
IFMIF-PA-EU-AF09	Procurement Arrangement for the Supply of the Accelerator Prototype Diagnostics for the IFMIF/EVEDA Project	14/11/2012	1.52
IFERC-T1PA02-EU.ENEA	Procurement Arrangement for the DEMO R&D on SiC/SiC Composites for the IFERC Project: erosion/corrosion of SiC and SiC/SiC in liquid metal	31/01/2012	1.032

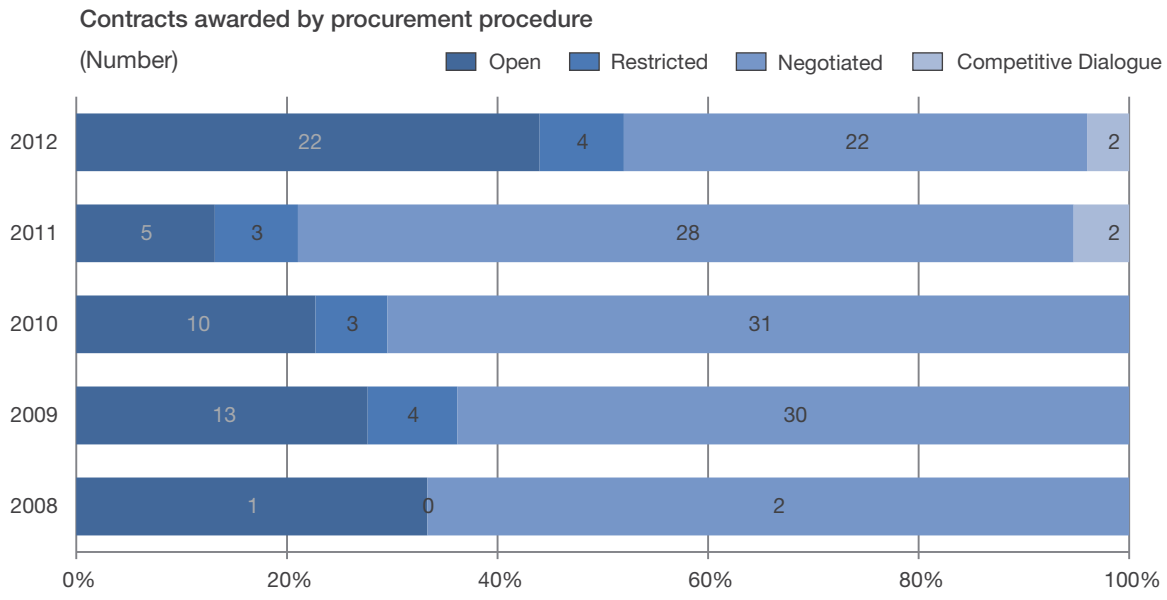
BROADER APPROACH AGREEMENTS OF COLLABORATION

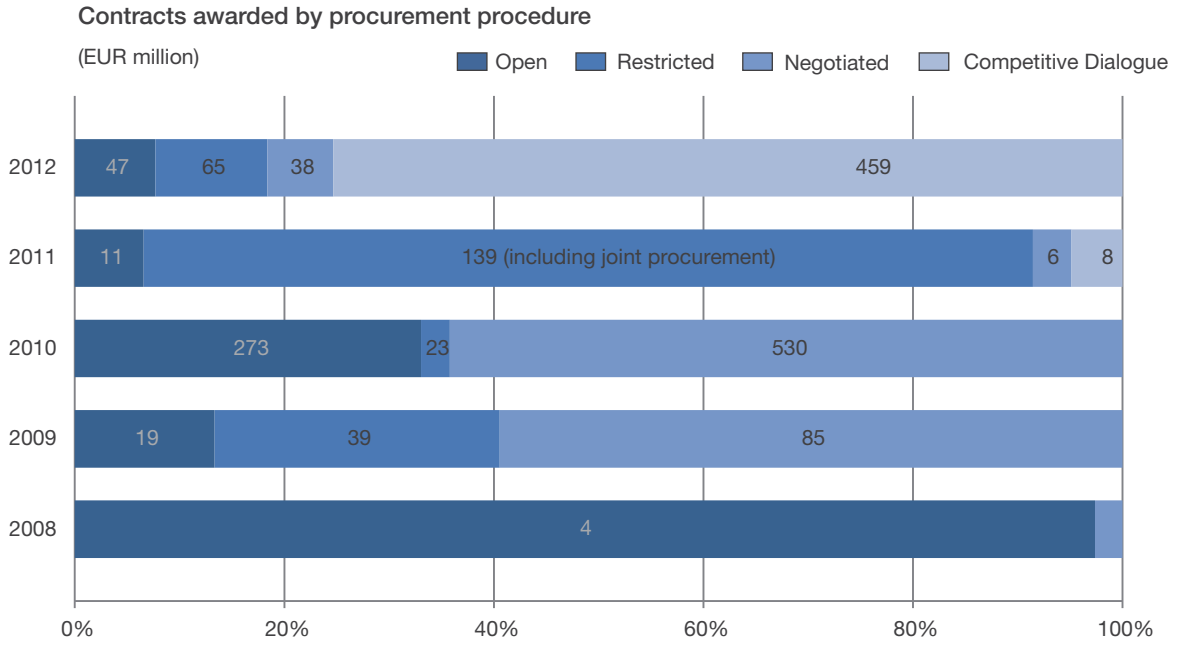
Reference	Title	Date signed	Value (kBAUA)
STP-AoC with CEA for the Supply of Cryogenic Systems	Agreement of Collaboration F4E-CEA for the Joint Implementation of the Procurement Arrangement on the supply of the Cryogenic System for the Satellite Tokamak Programme	21/11/2012	31.858
STP- Amendment -AOC F4E-CIEMAT Supply of Cryostat Base	JT-60SA Amendment to Agreement of Collaboration F4E-CIEMAT for the joint Implementation of the procurement Arrangement for the Supply of Cryostat Base for the Satellite Tokamak Programme	04/12/2012	
BA-IFMIF-AoC-EU-AF09-CEA	Agreement of Collaboration F4E-CEA for the Joint Implementation of the Procurement Arrangement for the Supply of the Accelerator Prototype Diagnostics for the IFMIF/EVEDA Project	18/09/2012	1.52

CONTRACTS AND GRANTS

Operational Procurement Contracts

Summary by Type of Procedure





Negotiated procedures (above EUR 250,000)

	Number	Value (EUR)
Negotiated above threshold	7	37,173,511

Awarded Contracts (* Negotiated Procedures)

Reference	**Title**	Contractor
F4E-OPE-360*	Procurement of powder-solid 316L(N)-IG HIP joints	METSO MINERALS OY METSO MATERIALS TECHNOLOGY
F4E-OPE-149 (ES-MF)	Framework Contract - Provision of Engineering Support on Joining and Non-Destructuve Testing Technologies for Production of ITER Components	TWI Ltd
F4E-OFC-392*	Provision of support services on issues regarding the implementation of ITER and Broader Approach activities to Fusion for Energy - WP 2012 Section 2.25	iConSA GmbH & Co. KG
F4E-OPE-138 (MS-IV)*	Pre-Production Qualification for the Procurement of the ITER Divertor IVT	PLANSEE S.E.
F4E-OMF-298	Provision of engineering support in the areas of radiological waste, radiological and environmental monitoring systems and compliance with ITER safety requirements	SERCO Limited
F4E-OPE-366*	Engineering Support for the Faraday Screen qualification programme for the ITER ICRH Antenna	CEA
F4E-OPE-381*	Expertise Support on JT-60SA TF Strand and TF Conductor Manufacture	CEA, DSM, RFM, STEP
F4E-OPE-293*	Joint Procurement between IO and DAs for the Operation of Sultan Test Facility	EPFL-CRPP
F4E-OPE-305 (TBM-MD)	Supply of preliminary fabrication & welding procedure specifications and feasibility mock-ups for TBMs EUROFER subcomponents	KIT
F4E-OMF-298	Provision of engineering support in the areas of radiological waste, radiological and environmental monitoring systems and compliance with ITER safety requirements	NIER Ingegneria S.p.A
F4E-OPE-138 (MS-IV)*	Pre-Production Qualification for the Procurement of the ITER Divertor IVT	Ansaldo Nucleare Spa
F4E-OPE-398*	Paschentests on insulated conductor samples	IPP Greifswald
F4E-OFC-252 (PO-PS)	Planning and scheduling support services	NUCLEAR TECHNOLOGIES
F4E-OPE-406	Galleries and drainage works	COMSA SAU
F4E-OPE-434*	QUALITY CONTROL MONITORING OF NbTi STRANDS FOR JT-60SA TFCOILS: DC+AC	ENEA
F4E-OPE-435*	Quality Control Monitoring of NbTi Strands for JT 60SA TF Coils: “DC + geometry”	CEA

F4E-OPE-399	Transport of JT-60SA Cryostat Base from Spain to Japan	FAGIOLI SPA
F4E-OPE-412 (TBM-MD)*	Handling and Storage Services for the EUROFER-97-HEAT 3 Semi Finished products	Karlsruhe Institute of Technology (KIT)
F4E-OPE-081 (PMS-H. CD)	The beam source and the vacuum vessel of SPIDER	THALES ELECTRON DEVICES S.A.
F4E-OPE-397*	Update of the SOLPS code for the simulation of the plasma scrape of layer	Forschungszentrum Jülich GmbH
F4E-OPE-345*	Pre-Compression Rings	EADS Astrium
F4E-OPE-391*	Provision of expert support on decennial insurance contract management	SIACI SAINT HONORE
F4E-OPE-351*	Supply of the Cooling Plant for the SPIDER and MITICA Experiments	DELTA TI IMPIANTI SPA
F4E-OPE-438*	Design review of the vacuum vessel instrumentation system	Culham Science Centre (CCFE)
F4E-OPE-385	Site Security and Reception Services for the ITER Site	Consortium MAIN Sécurité (ONET Group) & Cléore S.A.S.
F4E-OPE-453*	Accelerated SULTAN Test of IO-Das Samples	EPFL-CRPP
F4E-OMF-331 (TBM-MD) LOT 5	LOT 5 - Development and characterisation of pWPS for the TBM box assembly by welding and Feasibility Mock-Ups	Atmostat
F4E-OMF-331 (TBM-MD) LOT 3	LOT 3 - Nuclear maintenance studies and design of associated equipments	AMEC NUCLEAR (UK)
F4E-OPE-387 LOT 1	Manufacturing of the preproduction of the cryopump	ERA Instruments
F4E-OPE-387 LOT 2	Manufacturing of the preproduction of the cryopump	SDMS
F4E-OPE-387 LOT 3	Manufacturing of the preproduction of the cryopump	KIT
F4E-OMF-356	Framework service contract for the provision of engineering support in the area of mechanical analysis for the vacuum vessel	IBERDROLA
F4E-OPE-388*	Procurement of Engineering Services to Assess Corrosion Sensitivity Issues for CuCrZr	STUDSVIK
F4E-OPE-423*	High heat flux testing of mock-ups and pre-qualification inner vertical target prototypes	AREVA NP
F4E-OMF-331 (TBM-MD) LOT 4	LOT 4 - TBS transient and accidental analyses and safety studies	AMEC NUCLEAR (UK)
F4E-OMF-331 (TBM-MD) LOT 2	LOT 2 - Conceptual Design of TBM Ancillary Systems and integration in ITER	Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile (ENEA) (first ranked)
F4E-OMF-331 (TBM-MD) LOT 1	LOT 1 - Design of TBM sets, analyses and design validation. Design of TBM Prototypical mock-ups. Assessment of TBS neutronics, shielding, dose rate, decay heat, hazards, ORE and waste.	IDOM
F4E-OPE-437 (IV-PT)*	Independent verification of Electro-mechanical analyses of ITER blanket module 1	EnginSoft SPA

F4E-OPE-279 (PMS-H. CD)	Gas Storage and distribution, vacuum and gas injection systems (GVS) Supply of gas storage and distribution, vacuum and gas injection systems (GVS)	ANGELANTONI INDUSTRIE SPA
F4E-OMF-357-01-01	Framework for the Provision of CAD Design Support	Assystem Iberia SL
F4E-OMF-357-01-02	Framework for the Provision of CAD Design Support	SERVICIOS DE INGENIERIA Y TECHNOLOGIAS DE DISENO S.A.
F4E-OMF-357-01-03	Framework for the Provision of CAD Design Support	LGAI Technological Center SA
F4E-OPE-374	Site Infrastructure Works (TB08)	COMSA SAU
F4E-OPE-462*	Amendment No. 2 to the existing contract F4E-BAO-002	Furukawa Electric Co. Limited
F4E-OPE-286	Civil Engineering and Finishing works for Tokamak Complex, Assembly Hall and surrounding buildings including Design and Build of Heavy Nuclear Doors - TB03	Consortium VFR: Vinci Construction Grands Projets SAS (Leader), Ferrovial Agroman SA, Razel-Bec SAS.
F4E-OPE-355	Manufacturing of the Radial Plates for the ITER TF Coils	SIMIC
F4E-OPE-461*	Forged CuCrZr Plates for First Wall Panel Prototype	Le Bronze Industriel SAS
F4E-OPE-400	High Heat Flux testing of Faraday Screens and EHF FW semi-prototypes	Alphysica GmbH
F4E-OFC-361	Single I&C Integrator	GTD Sistemas de Informacion
F4E-OMF-451	Broader Approach Transport Framework Contract	GEODIS WILSON SPAIN SLU

Administrative Procurement Contracts

Summary by type of procedure

Type of Procedure	Number	Value (kEUR)
Open	6[1]	1360
Restricted	0	0
Negotiated	4[2]	1 991
Re-Opened competition implementing a Framework	1[3]	100
Joint Procurements*	12[4]	8 508
Total	**23**	**1159**

*while the number of contract signed in 2012 ensuing from Joint Procurements with the EC is known, the values of some of them have not been yet communicated to the participating entities.

Negotiated Procedures above EUR 60,000

Reference	Title	Contractor	Type
F4E-ADM-363.01	Legal services in the field of industrial contracting	Baker McKenzie Barcelona	Multiple Framework Service Contract in Cascade with 2 Contractors
F4E-ADM-363.02		Hogan Lovells International LLP	
F4E-ADM-425	Legal Services support for buildings	Norton Rose LLP	Direct Service Contract
F4E-ADM-455	Consultancy Services advice to the Director of F4E	Mr. Frank Briscoe	Direct Service Contract

*Amount for all contracts of the cascade.

Awarded Contracts

Reference	Relocation Services	Type	Date
F4E-ADM-350.01	Relocation Services	Multiple Framework Service Contract in Cascade with 3 Contractors	26/04/2012
F4E-ADM-350.02			
F4E-ADM-350.03			
F4E-ADM-363.01	Legal services in the field of industrial contracting	Multiple Framework Service Contract in Cascade with 2 Contractors	05/03/2012
F4E-ADM-363.02			
F4E-ADM-367	Provision of Company ratings and reports	Direct Service Contract	02/04/2012

1 ADM-350.01/.02/.03; ADM-367; ADM-416; ADM-424.
2 ADM-363.01/.02; ADM-425; ADM-455.
3 F4E-2008-ADM/IT-04.03.10.
4 FW-31.03/.05/.07;FW-37;FW-38;FW-39;FW-41;FW-43;FW-48.01/.02; FW-50.

F4E-ADM-416	Audiovisual and Photographic Services	Framework Service Contract	29/10/2012
F4E-ADM-424	Media Monitoring	Framework Service Contract	14/11/2012
F4E-ADM-455	Consultancy Services advice to the Director of F4E	Direct Service Contract	21/08/2012
F4E-ADM-425	Legal Services support for buildings	Direct Service Contract	17/07/2012
F4E-2008-ADM/IT-04.03.10	Sharepoint development services	Specific Contract (re-opened competition)	03/10/2012
F4E-2011-FW-31.03	Professional Trainings	Framework Service Contracts	21/02/2012***
F4E-2011-FW-31.05			
F4E-2011-FW-31.07			
F4E-2011-FW-37	Financial Trainings	Framework Service Contract	13/02/2012***
F4E-2011-FW-38	Networking, telephony and videoconferencing equipment	Framework Supply Contract	09/03/2012***
F4E-2011-FW-39.01	ICT Trainings for IT Staff	Framework Service Contracts	15/02/2012***
F4E-2011-FW-39.02			
F4E-2011-FW-41	Large Account Reseller services and acquisition of Microsoft Software Products and Licenses	Framework Service Contract	01/02/2012***
F4E-2011-FW-43	External Network Services	Framework Service Contract	20/07/2012***
F4E-2012-FW-48.01	ICT Trainings end-users	Framework Service Contract	12/12/2012***
F4E-2012-FW-48.02			
F4E-2012-FW-50	EPSO marketing of staff selection procedures of the institutions of the European Union	Framework Service Contract	03/02/2012***

* award decision signed by the European Commission.
** the exact value of the contract attributed to F4E has not been communicated.
*** award decision signed by the European Commission.

Grants (* Unique Beneficiaries)

Procedure Reference	Agreement Description	Beneficiary
F4E-FPA-327	Radial neutron camara - FPA open call	ENEA (Italy), CNR (Italy), IFJ PAN (Poland), IST (Portugal), IPPLM (Poland), UNIMIB (Italy)
F4E-FPA-364	Diagnostic Pressure Gauges (DPGs)	Max Planck-Gesellschaft zur Förderung der Wissenschaften e.V. – Max-Planck-Institut für Plasmaphysick (IPP), Sgenia Soluciones S.L.

F4E-FPA-372	R&D experimental activities in support of the conceptual design of the European Test Blanket System	TBM-Consortium of Associates (KIT, CIEMAT, CEA, ENEA, CVR, WIGNER Research centre)
F4E-FPA-375	Plasma Position Reflectometry	Instituto Superior Técnico (IST), Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (CIEMAT), Consiglio Nazionale delle Ricerche, Istituto di Fisica del Plasma "Piero Caldirola", Associazione EURATOM-ENEA-CNR sul la Fusione (IFP-CNR)
F4E-GRT-282	In Vessel Viewing System (IVVS) probe design finalisation, including supplementary laboratory tests	Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile (ENEA)
F4E-GRT-291	In-pile creep relaxation and post-irradiation thermal creep testing	TÜV Rheinland Industrie Service GmbH, SCK.CEN Belgian Nuclear Research Centre
F4E-GRT-369*	Characterisation of altemative divertor armor materials	Forschungszentrum Jülich GmbH, Nuclear Research and Consultancy Group (NRG)
F4E-GRT-371*	Identification of a Beryllium substitute - Small/Medium Scale Experiments - Physics Models Validation	Karlsruhe Institute for Technology (KIT)
F4E-GRT-379	Calculation of the TBM-Induced Ripple in ITER, Wall Loads, Impact on Plasma and Optimization	Aalto University (FI)
F4E-GRT-389	Characterization of Enhanced Tungsten	Stockholm University
F4E-GRT-390	Characterization of Enhanced Tungsten by High Heat Flux Tests	Forschungszentrum Jülich GmbH
F4E-GRT-401	DTP2 Extension and upgrades with new prototypes	Teknologian tutkimuskeskus VTT, TUT-Foundation
F4E-GRT-410	Maintenance and upgrade of EUROFER data base for engineering and design	CEA
F4E-GRT-418	Design of the ITER Plasma Control System	C.R.E.A.T.E. Consorzio di Ricera per l'energia e le applicazioni tecnologiche dell'elettromagnetismo, Max Planck-Gesellschaft zur Förderung der Wissenschaften e.V. – Max-Planck-Institut für Plasmaphysick (IPP), United Kingdom Atomic Energy Authority (CCFE), Commissariat à l'énergie atomique et aux énergies alternatives (CEA)
F4E-GRT-432	Design and development activities for the European gyrotron	Ecole Polytechnique Fédérale de Lausanne (EPFL) - Centre de Recherches en Physique des Plasmas (CRPP), Karlsruhe Institute for Technology (KIT), Research Unìt of the Association Euratom-Hellenic Republic (HELLAS), Istítuto di Fisica del Plasma, Consiglio Nazionale delle Ricerche (CNR)
F4E-FPA-395	Nuclear Data Experiments and Measurements techniques	Consortium for Nuclear Data, ENEA, KIT, AGH-UST, JSI, ASCR, CCFE

ITER TASK AGREEMENTS CLOSED IN 2012

In the following a list of ITER Task Agreement which have been closed (i.e. the final report accepted by the ITER Organization) is given. Note that the closing date is the date reflected on the closure letter send by the ITER Organization and PPY shows the effort in person per year. These ITAs are voluntary contributions.

Reference	Title	Value / Effort	ITA Total Amount	Closing Date
C11PP170FE	R&D needs assessment for the ITER TF Coils (1.1EU6)	PPY	0.65	23/03/2012
C16TD152FE	Blanket First Wall independent surface shaping verification	IUA	93.828	28/11/2012
C19TD33FE	Task on magnetic reconstruction of the plasma boundary	IUA	117	21/05/2012
C19TD34FE	Task on analysis of Resistive Wall Mode control by in-vessel (RMP) coils	IUA	137	07/02/2012
C19TD35FE	Task on self-consistent simulations of plasma scenarios	IUA	157	04/12/2012
C19TD36FE	Task on the study of plasma start-up	IUA	137	27/02/2012
C19TD37FE	Task on the study of control of plasma current, position and shape	IUA	137	27/02/2012
C19TD41FE	Task on the study of power and particle fluxes to plasma-facing components during ELM Control by in-vessel coils in ITER and evaluation of plasma response effects	IUA	131	18/12/2012
C23PP47FE	In-vessel viewing system (IVVS) conceptual design	PPY	10	04/05/2012
C23PP48FE	Cask and Plug Remote Handling System (CPRHS) design Related Activities: Air Transfer System Conceptual Design and Requirement Definition	PPY	3	04/12/2012
C23TD51FE	Cask and Plug Remote Handling System (CPRHS) Design Related Activities: Conceptual Design of the Generic CPRHS	IUA	180.386	04/12/2012
C23TD53FE	R&D on RH Control System using DTP2 Platform	IUA	133	21/11/2012
C23TD55FE	Cask Transfer system R&D, alternative concept design	IUA	64.423	21/11/2012
C31TD16FE	ITER Vacuum System: Updating and completion of the design of the Pre-Production Cryopump	IUA	133	07/05/2012
C34TD17FE	4C Benchmark/Validation Study	IUA	11.2	23/10/2012
C51TD39FE	ITER IC Antenna R&D programme: Exploitation of Antenna Low Power Mock-Ups	IUA	*72.69367	19/12/2012
C52PP36FE	Preparation work for gyrotron integration and for the associated Procurement Arrangement	PPY	2	19/12/2012
C52TD37FE	Preparation work for the Procurement Arrangement for EC power supply system	IUA	67	27/02/2012

C53TD65FE	Design of the NBTF Components -Part III	IUA	1076.1	10/10/2012
C55TD31FE	Detailed Design, Prototyping and Testing of Ex-Vessel Magnetic Sensors for ITER	IUA	101	31/08/2012
C74TD19FE	Gamma Doses in the Port Cell and Galleries	IUA	51.4	04/12/2012
DRWG7-EU-01	ITER Design Review 2007 WG7 TA	PPY	13.8	06/03/2012
G74TD11FE	R&D in support of materials qualification for in-vessel components	--	--	20/01/2012
N55TD09FE	Diagnostic Design and Development of Bolometers	--	--	24/04/2012
N55TD21FE	Support to the ITER Diagnostic Design for a range of systems: wide-angle viewing/ thermography system, calorimetry, q-profile determination, reflectometry, core-plasma LIDAR Thomson scattering, and divertor spectroscopy	--	--	24/04/2012
N55TD22FE	R&D in support of ITER diagnostic design: development of first mirrors, MI-cables and long pulse integrators	--	--	24/04/2012
N55TD23FE	Support to the ITER Diagnostic Design for a range of ITER systems: radial neutron camera, charge-exchange recombination spectroscopy, collective Thomson scattering, shutters and magnetics (EU reference TWP2004)	--	--	24/04/2012
RHIPT-10-EU/1	EU-DA support to Remote Handling IPT (2010) – work package 1	IUA	65	20/09/2012

*Note: This ITA's total credit also includes + EUR 112,500.00 paid in cash in 2008, on top of its 72.69367 IUAs worth.

Declaration of Assurance

I, undersigned, Henrik Bindslev, Director of the European Joint Undertaking for ITER and the Development of Fusion Energy (F4E) in my capacity as Authorising Officer:

- Declare that the information contained in this report gives a true and fair view;

- State that I have reasonable assurance that the resources assigned to the activities described in this report have been used for their intended purpose and in accordance with the principles of sound financial management. This reasonable assurance is based on my own judgment and on the information at my disposal;

- Based on the assurance analysis performed in F4E in the context of handover process, it may be observed that, although the Internal Control Environment of F4E has not reached full maturity yet, the organisation is continuing to build and expand its overall control Framework environment throughout 2012 and 2013;

- Confirm that I am not aware of anything not reported here which could harm the interests of F4E and the European institutions in general.

Professor Henrik Bindslev
Director of Fusion for Energy (from 1 January 2013)
1 June 2013

Analysis and Assessment by the Governing Board

INTRODUCTION

Article 43 of the Financial Regulation states that

1. The authorising officer shall report to the Governing Board on the performance of his/her duties in the form of an annual activity report, together with financial and management information confirming that the information contained in the report presents a true and fair view except as otherwise specified in any reservations related to defined areas of revenue and expenditure.

The annual activity report shall indicate the results of his/her operations by reference to the objectives set, the risks associated with these operations, the use made of the resources provided and the efficiency and effectiveness of the internal control system. The internal auditor referred to in Article 75 shall take note of the annual activity report and any other pieces of information identified.

2. By no later than 15 June each year, the Governing Board shall send the Council, the European Parliament and the Court of Auditors an analysis and an assessment of the authorising officer's annual report on the previous financial year. This analysis and assessment shall be included in the annual report of the Joint Undertaking, in accordance with the provisions of the Statutes.

In light of the above, the Governing Board Vice-Chairs conducted an analysis and assessment of the 2012 Annual Report on the basis of the comments made by the committees (AFC, TAP, ExCo and AC) and came to the following conclusions.

ANALYSIS AND ASSESSMENT

THE GOVERNING BOARD:

(1) Notes that the Authorising Officer fulfilled the tasks given to him in Article 43 of the Financial Regulation;

(2) Welcomes the overall achievements presented in the 2012 Annual Activity Report of Fusion for Energy (F4E);

(3) Welcomes the presentation of the Annual Report and notes that it is accessible to the public while maintaining its value as technical reference for the expert community;

(4) Welcomes the overall progress in the ITER project with the commissioning of several buildings and the launching of most of the large contracts for Europe´s commitments to ITER;

(5) Draws attention to the granting of the licence for the construction of the ITER installation by the French

Nuclear Safety Authority which represents an important landmark;

(6) Welcomes the fact that the European scientific community is becoming heavily involved in the development of ITER systems through several Framework Partnership Agreements for diagnostics which were signed or awarded during 2012;

(7) Welcomes that the construction of many of the hi-tech components required for ITER is progressing without insurmountable technical barriers;

(8) Notes that, where there are delays, these are mainly due to exceptional market situations for some key compenents, or from the difficulty in consolidating final designs, particularly for the buildings and for the vacuum vessel, where there are a significant number of interfaces. Nonetheless F4E and the ITER Organization should seek to expedite the design process to avoid delays;

(9) Welcomes the progress made in the Broader Approach projects, with the advanced construction of many components and the delivery to Japan of important elements, like the Helios supercomputer and the JT60 cryostat base;

(10) Welcomes the consolidation of the project-orientated organisational structure of F4E and development of a middle management structure;

(11) Notes that the implementation of the payment budget has significantly improved compared to previous years. However, this was primarily due to amendments to the original budget;

(12) Considers that constant attention should continue be paid by both F4E and the GB regarding the implementation of the budget.

Mr Stuart Ward
Chair of the F4E Governing Board
24 May 2013

List of Acronyms

A/E	Architect Engineer
AC	Audit Committee
AFC	Administration and Finance Committee
ANB	Authorised Notification Body
ATO	Analysis Task Order
BA	Broader Approach
BASC	Broader Approach Steering Committee
BAUA	Broader Approach Units of Account
BCM	Blanket Cooling Manifold
BSM	Blanket Shield Module
BTP	Build-to-Print
CAD	Computer Aided Design
CB	Cryostat Base
CCFE	Culham Centre for Fusion Energy
CEA	Le Commissariat à l'Énergie Atomique et aux Énergies Alternatives
CFTM	Cyclic Fatigue Test Module
CIEMAT	Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas
CMM	Cassette Multifunctional Mover
CN-DA	Chinese Domestic Agency
CPRHS	Cash and Plug Remote Handling System
CREATE	Consorzio di Ricerca per l'Energia e le Applicazioni Tecnologiche dell Elettromagnetismo
CRPP	Centre de Recherches en Physique des Plasmas
CS	Central Solenoid
CVB	Cold Valve Boxes
CVBCS	Cryostat Vessel Body Cylindrical Section
CW	Continuous Wave
DA	Domestic Agency
DC	Direct Current
DEMO	Demonstration Fusion Reactors

DNV	Det Norske Veritas
DNB	Diagnostic Neutral Beam
DTP	Divertor Test Platform
EBBTF	European Breeding Blanket Test Facilities
EC	Electron Cyclotron
ECH	Electron Cyclotron Heating
ECRH	Electron Cyclotron Resonance Heating
ECWG	Export Control Working Group
EFDA	European Fusion Development Agreement
EHF	Enhanced Heat Flux
ELM	Edge Localised Mode
EPC	Engineering Procurement Contract
ESC	Engineering Support Contract
EU	European Union
EUROFER	A 9% Cr reduced activation ferritic-martensitic steel
EUROFER ODS	Oxide Dispersion – Strengthened version of EUROFER steel
ExCo	Executive Committee
FC	Framework Contract
FW	First Wall
FZK	Forschungszentrum Karlsruhe
GB	Governing Board
GS	Gravity Support
HCLL	Helium-Cooled Lithium-Lead
H&CD	Heating & Current Drive
HFTM	High Flux Test Module
HIP	Hot Isostatic Pressing
HNB	Heating Neutral Beam
HTS CL	High Temperature Superconducting Current Leads
HV	High Voltage
HVPS	High Voltage Power Supply
HWR	Half Wave Resonator
I&C	Instrumentation and Control
IC	Ion Cyclotron
ICH	Ion Cyclotron Heating
ICRH	Ion Cyclotron Resonance Heating
IFERC	International Fusion Energy Research Centre
IFMIF	International Fusion Materials Irradiation Facility
ITER IO	ITER International Fusion Energy Organization

IP	Intellectual Property
IPP	Max-Planck Institut fuer Plasmaphysik
ISEPS	Ion Source and Extraction Power Supplies
ISS	Isotope Separation System
ITA	ITER Task Agreement
IUA	ITER Units of Account
IVT	Inner Vertical Target
IVVS	In-Vessel Viewing System
JAEA	JA Implementing Agency
KIT	Karlsruhe Institute of Technology
LIPAc	Linear IFMIF Prototype Accelerator
LN_2	Liquid Nitrogen
LPCE	Liquid Phase Catalytic Exchange
MAC	Management Advisory Committee
MEBT	Medium Energy Beam Transfer
MFG	Motor Flywheel Generators
NB	Neutral Beam
NBI	Neutral Beam Injector
NBTF	Neutral Beam Test Facility
NbTi	Niobium Titanium
NHF	Normal Heat Flux
ODS	Oxide Dispersion Strengthened
OIS	Outer Intercoil Structure
PA	Procurement Arrangement
PF	Poloidal Field
PID	Plant Integration Document
PIE	Post Irradiation Examination
PPC	Pre-Production Cryopump
PrSR	Preliminary Safety Report
PS	Power Supply
PTC	Prototype Torus Cryopump
Q1/2/3/4	Quarter
QA	Quality Assurance
QMS	Quality Management System
QPC	Quench Protection Circuit
RAFM	Reduced Activation Ferritic Martensitic
RCC-MR	Règles de Conception et de Construction des Matériels Mécaniques des Îlots Nucléaires RNR
REMS	Radiological and Environmental Monitoring Systems

RF	Radio Frequency
RFQ	Radio Frequency Quadrupole
RH	Remote Handling
RMP	Resonant Magnetic Perturbation
RWM	Resistive Wall Mode Control
RWMPS	Resistive Wall Modes (Coils) Power Supplies
SCMPS	Superconducting Magnets Power Supplies
SDC	ITER SDC (Structural Design Criteria/Code)
SHPC	Safety and Health Protection Coordination
SLA	Service Level Agreement
SNU	Switching Network Unit
STAC	ITER Science and Technology Advisory Committee
STC	Single Tender Contract
STP	Satellite Tokamak Programme
SWG	Special Working Group
TAP	Technical Advisory Panel
TBM	Test Blanket Modules
TF	Toroidal Field
TÜV	Technischer Überwachungs - Verein
UT	Ultrasound Testing
VC	Voluntary Contributor
VV	Vacuum Vessel
WBS	Work Breakdown Structure
WDS	Water Detritiation System
WP	Work Programme
WRS	Warm Regeneration System

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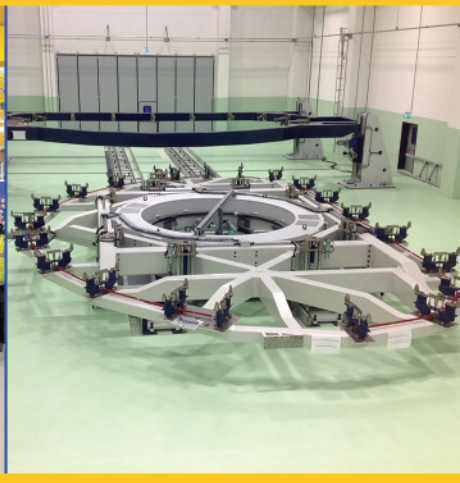

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