FUSION FOR ENERGY

ANNUAL REPORT **2011**

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FUSION FOR ENERGY

Annual Report 2011

2011 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:	Dr Frank Briscoe
Governing Body:	Governing Board (Chair: Mr Stuart Ward, Members: 27 EU Member States, Euratom and Switzerland)
Subsidiary Bodies:	Bureau (Chair: Mr Stuart Ward, 8 Members) Administration and Finance Committee (Chair: Drs Cor Katerberg, 11 Members) Executive Committee (Chair: Mrs Lisbeth Skovsgaard Grønberg, 13 Members) Technical Advisory Panel (Chair: Dr Joaquin Sánchez Sanz, 13 Members) Audit Committee (Chair: Dr Beatrix Vierkorn-Rudolph, five Members)
Staff:	207 Officials and Temporary Agents and 95 Contract Agents
2011 Budget	EUR 492 million in commitment appropriations EUR 264 million in payment appropriations
Budget Implementation:	99.7% in commitment appropriations (99.8% operational and 98.7% administrative) 85.7% in payment appropriations (86.6% operational and 79.6% administrative)
Operational Contracts:	38 awarded for a total value of EUR 163.6 million (47 procurement procedures launched)
Administrative Contracts:	17 awarded (including seven Joint Procurements) for a total value of EUR 5.2 million (14 procurement procedures launched)
Grants:	22 awarded for a total value of EUR 13.1 million (22 grant procedures launched)
Procurement Arrangements:	Two for the ITER project - 31.79 kIUA (equivalent to EUR 50.1 million) bringing the total to 836 kIUA out of a total of 1 136 kIUA foreseen for the whole duration Ten for the Broader Approach projects - 62.67 kBAUA (equivalent to EUR 42.5 million) bringing the total to 355 kBAUA out of a total of 500 kBAUA foreseen for the whole duration
ITER Credit Awarded:	35.55 kIUA (equivalent to EUR 56.1 million)
Meetings of Committees:	Three of the Governing Board, two of the Bureau, one of the Administration and Finance Committee, six of the Executive Committee, three of the Technical Advisory Panel and three of the Audit Committee

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Chair's Foreword

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

ITER is an extraordinary project that brings together scientists and engineers from around the world to construct the world's largest experimental fusion reactor. The aim of ITER is to demonstrate that it is possible to produce significant energy from fusion, to test the key technologies required for the future and to prepare the ground for commercial systems. ITER is an experiment - there is much we do not yet know or understand – but we are confident that we can build and operate it successfully.

F4E has been entrusted by the European Union (EU) to provide almost one half of the components making up the ITER device (in-kind contributions) and the running costs of the ITER International Organization (ITER IO). The other six parties (China, India, Japan, Korea, Russia and the United States) provide the remaining contributions.

The ITER Council agreed in July 2010 an updated baseline (covering scope, schedule and cost) with the intention that ITER would generate its first plasma by the end of 2020. Taking into account the increase in the costs of materials and labour since the project was initiated, the European contribution to ITER over the construction period on this updated baseline is estimated to be EUR 6.6 billion (in 2008 values) including a 20% contribution from France as Host State. Member States of the EU also make a small direct contribution to the operating costs of F4E.

An important activity of F4E in 2011, in collaboration with the ITER IO and the Domestic Agencies in the other parties, has been to advance ITER design and construction, whilst containing costs and minimising delays, especially taking into account the impact of the Great East Japan earthquake. In November 2011 the ITER Council concluded that the project remains in accordance with the baseline of July 2010.

The agreed EU budget for the ITER construction phase requires that the EU Institutions (Council of the European Union and European Parliament) have to approve the annual budgets. Gaining this approval was a critical activity during 2011 for F4E's Governing Board and senior F4E staff. I am pleased to report that agreement on the 2012 budget was reached in December 2011. Funding for the period up to 2020 will be confirmed as part of the discussions about Horizon 2020.

During 2011 much has been achieved. The ITER site in Cadarache (France) has been levelled, the initial buildings are under construction, the site for the tokamak has been excavated and much of the foundations have been completed. F4E has placed orders in 2011 for the site works, logistics and 36 other contracts with a total value of nearly EUR 164 million. It is gratifying to report that a wide range of European companies have won these contracts through competitive tendering processes.

The preparation of major procurements, essential for F4E to fulfil its scheduled commitments has been demanding and complex. In parallel the need to control costs and to seek every opportunity for cost

saving has been a particular focus. Tough negotiations allowed a small financial contingency to be built by the end of 2011, but unceasing attention to cost control remains vital for all our future procurements. Much more remains to be done and the coming year will be crucial; contracts with a value exceeding EUR 1 300 million are due to be awarded during the year. The preparations for these tenders are proceeding apace.

The collaboration with Japan through the Broader Approach (an International Agreement between the EU and Japan being implemented by F4E) is proceeding well, despite the impact of the Great East Japan earthquake in March 2011. The Governing Board sent its commiserations to the Japanese Atomic Energy Authority in sympathy for the impact of the disaster on the country and its people.

The Governing Board met three times during 2011. During the year, a Working Group proposed a number of improvements to F4E's governance. These were fully accepted by the Governing Board and have led to significant changes in the workings of the Governing Board and its committees. This includes the creation of the Administration and Finance Committee (AFC), chaired by Cor Katerberg. The introduction of the AFC, together with an increase in delegated levels, has enabled the Executive Committee, chaired by Lisbeth Grønberg to focus to a greater extent on the preparation for major procurements. The Technical Advisory Panel, chaired by Joaquín Sánchez, has provided excellent advice in 2011 on the Toroidal Field coil strategy and on the Poloidal Field coil costings.

The Governing Board agreed during the year that the Commission's Internal Audit Service will, from the beginning of 2012, become F4E's principal Internal Auditor, supported by F4E's Internal Audit Capability. A number of major audits during the year were undertaken by the Internal Auditor which were fully discussed with the F4E's Audit Committee, chaired by Beatrix Vierkorn-Rudolph. The role of the Audit Committee has been reviewed by the Governing Board, and its mandate has been extended for a further two years.

As part of the steps taken to improve governance, the Governing Board agreed to appoint Cor Katerberg and Joaquín Sánchez as Vice Chairs. It also established a Bureau, consisting of the Governing Board Chair, the four chairs of the committees, the Commission and a representative of France (as the ITER Host State). The Bureau draws together the advice of F4E's committees and recommends action by the Governing Board. Since its introduction in September 2011, it has already proved to be a useful innovation.

The F4E Director, with strong support from the Governing Board, has continued to reform and strengthen F4E's project management capability. These changes were initiated in 2011 and are due to be concluded during 2012. As part of this process, Jean-Marc Filhol was appointed as Head of the ITER Department and Hans Jahreiss was appointed as Head of Administration. These appointments were complimented by a reorganisation which puts project management at the heart of F4E's organisation.

F4E would have achieved little without the skill, dedication and professionalism of the Director, Frank Briscoe and his staff. On behalf of the Governing Board, I would like to offer them our warm support and thanks.

I would like to thank the members of the Governing Board for their advice and encouragement throughout the year. I also would like to thank Karl Tichmann, as the retiring chair of the Executive Committee, and Minh Quang Tran, as the retiring chair of the Technical Advisory Panel, for their contributions over the previous four years and also to thank those who retired from their membership of the committees during the year. I would also like to recognise the collaboration and support that I received from the European Commission, in particular from Raffaele Liberali, former Director of Energy.

Finally, I would like to express my appreciation to the outgoing chair of the Governing Board, Professor Carlos Varandas, for his strong and perceptive leadership of the Governing Board over the first four critical years of F4E's existence.

Mr Stuart Ward
Chair of the F4E Governing Board
29 April 2012

Director's Foreword

I am very pleased to introduce Fusion for Energy's (F4E) fourth Annual Activity Report and describe how we have delivered Europe's contributions towards the international ITER and Broader Approach fusion energy projects during 2011.

In relation to the ITER project, F4E has continued to carry out its activities following the agreed baseline and good progress has been made on many fronts despite many challenges, not least the aftermath of the Tohoku earthquake in March 2011. F4E, in close collaboration with the ITER International Organization (ITER IO) and the other Domestic Agencies (DAs), worked to help contain the subsequent delays to one year, the new first plasma date of November 2020 being within the range of finish dates foreseen in the baseline approved by the ITER Council in July 2010.

At the ITER construction site at Cadarache, a joint team of F4E staff and around 200 contractors have been busy constructing the building for the Poloidal Field (PF) Coils Winding Facility as well as the excavation and foundation works for the Tokamak Complex Seismic Isolation Pit. For the Pit over 200 000 m^3 of rock was excavated to a depth of 17 metres, the first lower basemat was laid and the retaining walls put in place. On top of the basemat, 300 out of the 393 concrete pinths were laid and 150 seismic bearings installed. The PF coils building, which is approximately 250 metres long, 45 metres wide and 17 metres high, was almost fully completed on budget and schedule. This building now provides a very visible sign that ITER construction is well underway. The tenders for the main building in which the ITER device will be located and some of the other buildings started with the expectation that the contracts will be placed in 2012.

Under the management of Agence ITER France, I am pleased to note that good progress is also being made with the construction of the ITER headquarters building, which will house around 500 members of the ITER team from the third quarter of 2012 onward, as well as the electrical grid connection and the main switchyard.

In addition to providing all of the buildings, the EU is providing many of the most important ITER machine components. Again good progress has been made with the components currently on the critical path – the Toroidal Field (TF) magnets; the conductor is in production, the jacketing line has been established and qualified, and the winding equipment has been procured. There has also been a successful fabrication of two full scale radial plate prototypes for the TF magnet structures, and a tender for the series production of seventy of these structures is currently in progress.

On other fronts, there have been some setbacks which is inevitable for a project as ambitious as ITER. In relation to the Vacuum Vessel, for which the contract was placed in October 2010, there were continuing changes to the design which have delayed the purchase of the steel plates and forgings. And in relation to the Poloidal Field (PF) magnets, the tender process was delayed due to intense negotations and an independent review process. The tender process for the tokamak building was started in early 2011 but progress has been slower than hoped since information needed from the ITER IO was not avaliable at the planned time.

In 2011 agreements were signed between F4E and ITER IO as well as between F4E and Consorzio-RFX for the design and construction of the Neutral Beam

Test Facility (NBTF) in Padua, Italy which is essential for the development of ITER's plasma heating systems. In addition, design reviews were held for the many of the other components needed for the neutral beams. F4E also continued to support work for the development of prototypes for the ITER gyrotrons which provide another way to heat the plasma.

Two Procurement Arrangements (PAs) were signed with the ITER IO in relation to the cryoplant and diagnostics meaning that over 80% (in value) of the PAs for all the components under Europe's responsibility have now been concluded. The majority of the remaining PAs are functional specifications which require important R&D and design activities to be contracted out by F4E in support of the eventual manufacture. In 2011 the amount of credit awarded to F4E by the ITER IO in recognition of its contributions increased to over 50 kIUA (about EUR 80 million) which is threefold of what was achieved the previous year; this was mainly due to the achievement of milestones related to the ITER magnets.

To implement the commitments in the ITER PAs, F4E awarded over 38 operational contracts and 22 grants to industries, laboratories and other organisations for a total value of almost EUR 180 million bringing the value of running contracts that were under F4E's responsibility by the end of the year to just under EUR 1 billion. At the same time, nearly 70 new procurement or grant procedures were launched of which 70% were launched by the planned yearly quarter or the following one. Although less visible but nevertheless important for the functioning of F4E, 17 administrative contracts with a value of just over EUR 5 million were placed.

Moving to the Broader Approach, 2011 marked the transition from design to construction for the European participation in the Satellite Tokamak project under construction in Japan. The definition of technical specifications and administrative provisions have been successfully completed with the signature of the majority of the PAs (75% in value) including all time-critical ones. Moving to the IFMIF/EVEDA programme, progress was made in a number of areas although the Tohoku Earthquake has impacted upon the schedule. Finally, for the IFERC programme the main activity has been the successful assembly and testing of "Helios", the supercomputer provided by France.

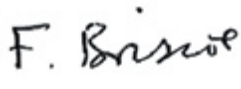
In parallel to the project work, progress has been made with the improvements to F4E as an organisation. A cost containment plan has been implemented since late 2010, and the position by the end of the year was satisfactory in so far as some adverse developments leading to cost increases were offset by some cost savings. In 2011 F4E managed its largest budget to date of just under EUR 500 million in commitments and almost EUR 300 million in payments. I am pleased to report that the level of implementation of the payments budget increased to 85%, which represents an improvement on the previous three years.

A new organisation structure was introduced in F4E from the beginning of 2011 that reinforced project management and consolidated the financial service. A new senior management team has been in place since August 2011 and I am very pleased to welcome Drs Jean-Marc Filhol and Hans Jahreiss as the new Heads of the EU-ITER and Administration Departments respectively. At the same time F4E has continued to recruit personnel throughout 2011 and by the end of the year there were over 300 staff in place. I am pleased to report that the vacancy rate in 2011 of 12% and the percentage of F4E's payments spent on staffing of 8% are at their lowest levels since F4E was created.

An important area of activity in 2011 has been to reinforce the control and management systems of F4E in accordance with the standards expected of European agencies and bodies. In particular, good progress has been made with the implementation of project management systems at F4E. Much effort has also been devoted to respond 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.

During 2011 F4E has continued to work very closely with the ITER IO, its Director General, Professor Osamu Motojima and staff. I have also appreciated the good spirit of cooperation that has developed with the Director-General for Research and Innovation at the European Commission and European Representative at the ITER Council, Mr Robert-Jan Smits as well as the Director for Energy, Mr Raffaele Liberali who retired in early 2012.

I am conscious that this will be my last Annual Report as Director of F4E since I am retiring in summer 2012. I would like to thank Mr Stuart Ward, Chair of the F4E Governing Board, as well as the Chairs of the Governing Board's advisory bodies and their members for the confidence they have placed in me. I would also like to express my appreciation for the F4E staff who have shown great professionalism and patience in the face of many challenges.



Dr Frank Briscoe
Director of Fusion for Energy
15 June 2012

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 (ITER IO) 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 the ITER IO)

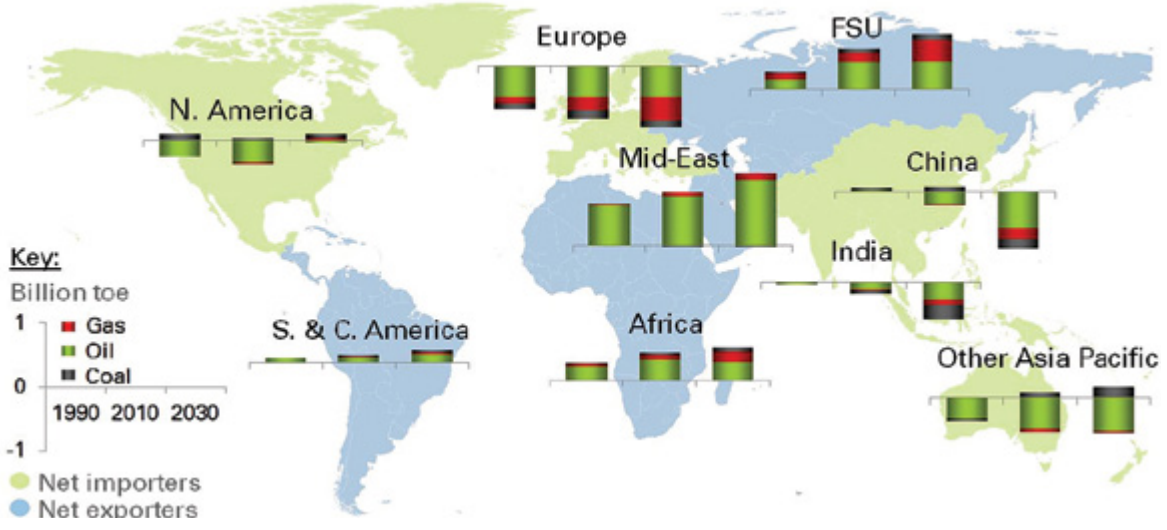
Europe's Energy Challenge

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?

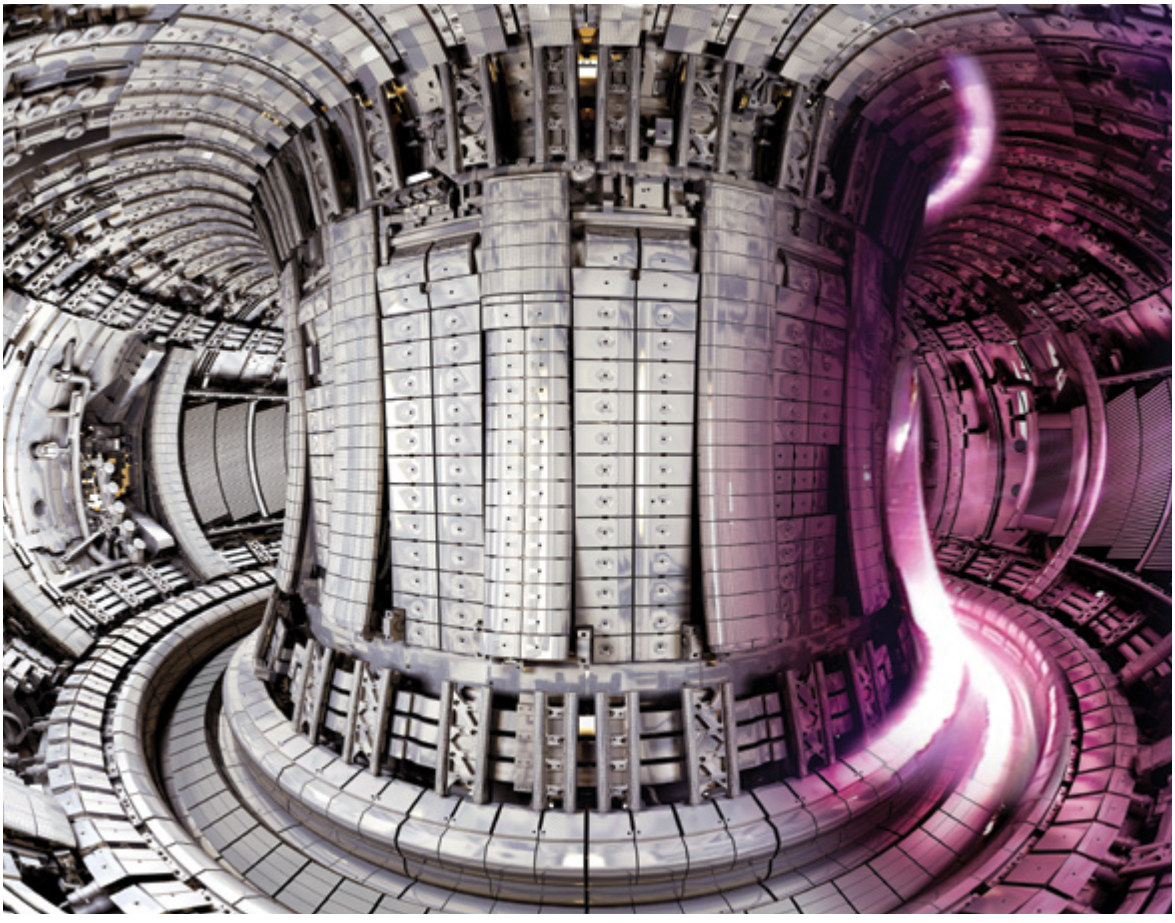
Fusion is the process that powers the sun and other stars and makes life on Earth possible. As the name suggests, the process involves fusing together light atoms to make heavier ones and occurs at the extreme pressures and temperatures caused by the gravity in the sun. During fusion reactions a small 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 in 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?

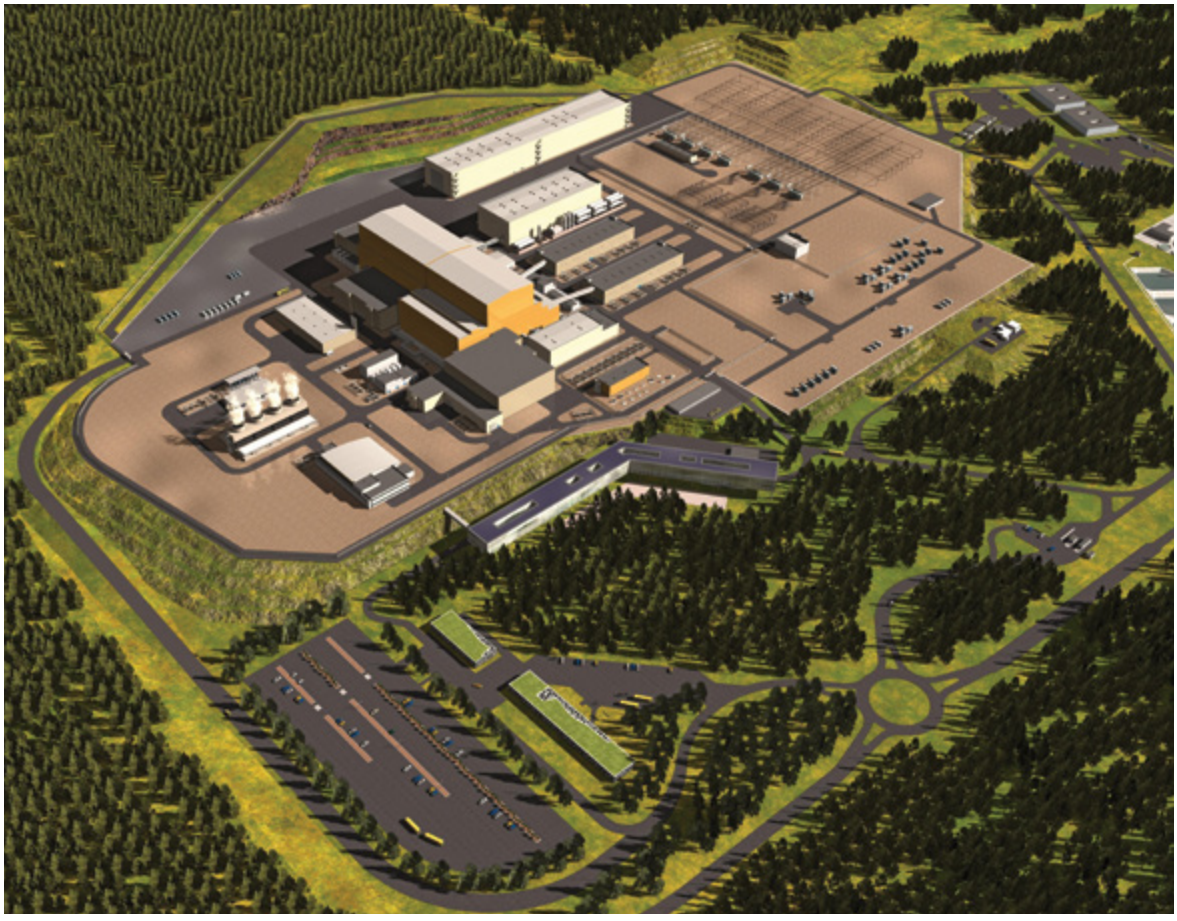
While JET and other tokamak experiments have succeeded in producing significant amounts of fusion power for short periods, none so far are capable of demonstrating fusion on a scale that would be needed for a reactor and a number of technologies that are needed to allow it to generate part of its own 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, the Republic of 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 International Organization (ITER IO) is responsible for the construction, operation, exploitation and decommissioning of the ITER device. The Director General of the ITER IO is appointed by the ITER Council which also supervises the overall activities of the ITER IO. 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 60 metres above ground level (courtesy of the ITER IO)

What is the Broader Approach?

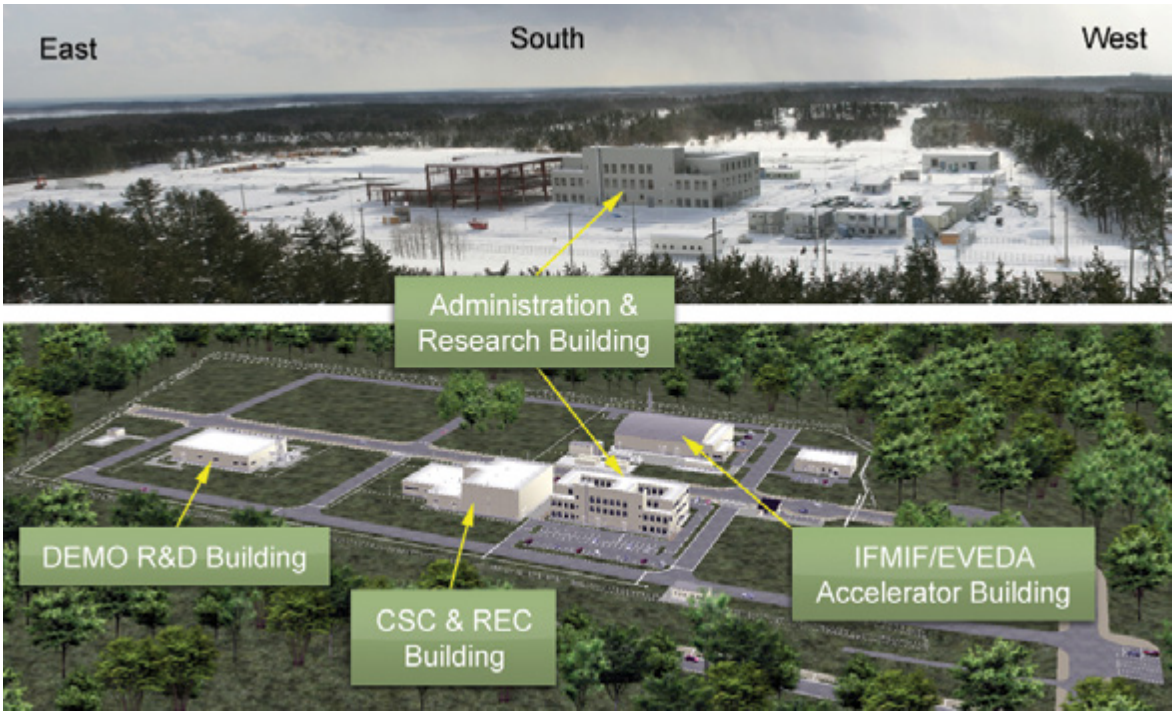
In February 2007, Europe and Japan signed the Broader Approach (BA) agreement. This aims to complement the ITER Project and to accelerate the realisation of fusion energy by carrying out R&D and developing some advanced technologies for future demonstration fusion power reactors (DEMO). Under the umbrella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



View of the Broader Approach site in Rokkasho in Japan (courtesy of JAEA)

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 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.

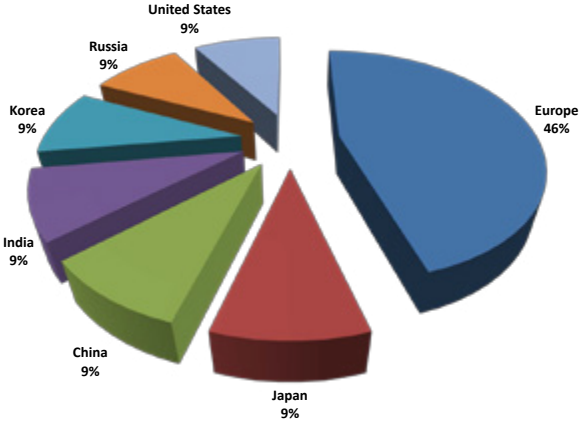
How we operate

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 Domestic Agencies (including F4E) to do 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 IO, 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 (PA) is usually concluded between F4E and the ITER IO setting out what has to be provided and by when.
- On the basis of the specifications in the PA, 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 PA and to the satisfaction of the ITER IO, 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 PAs with Japan and at the same time Agreements of Collaboration to specify what is to the 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 Parties

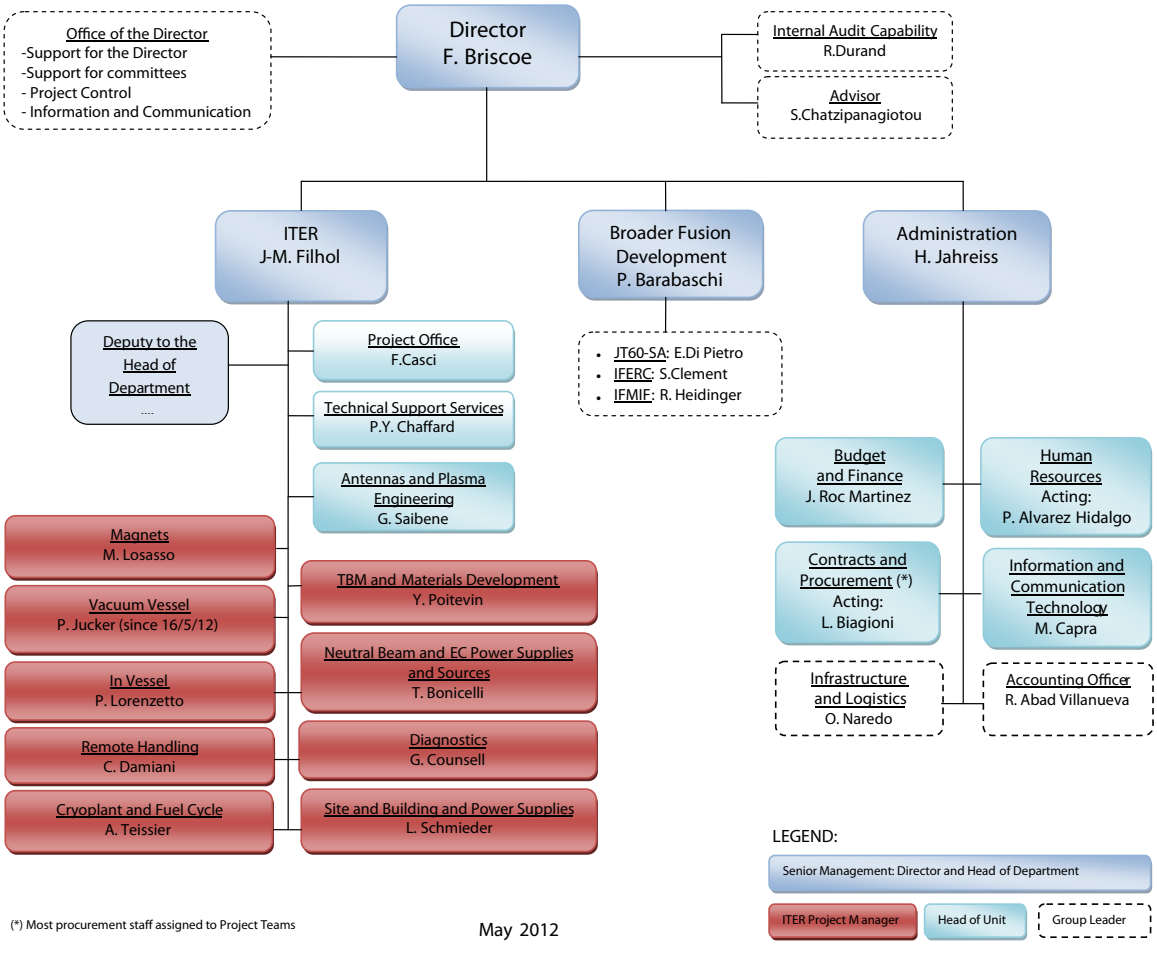


Our Organisation

In response to the Conclusions of the European Competitiveness Council of July 2010 concerning ITER, the F4E Director proposed ways to improve the organisational structure of F4E which were approved by the Governing Board in October 2010. The main aims were (a) to make F4E more project-oriented, (b) consolidate the financial service and (c) to introduce a middle level of management. A new organisational structure was introduced in January 2011 and was progressively implemented throughout the year.

Under this new organisational structure, the two former administrative departments (Contracts & Procurement and Resources) were merged into a single Administration Department. As a result the senior management team comprises the Director, the Head of the EU-ITER Department, the Head of the Administration Department, and the Head of the Broader Fusion Development Department.

The ITER work is now organised on more traditional project lines around nine Project Teams, one for each of the main ITER deliverables. Each team has a Project Manager, responsible for the specific deliverables, with clear objectives and appropriate delegated powers, and staffed by the necessary operational staff – procurement, legal and planning staff as well as technical staff working in a 'matrix management' way.



Our Management Team

Frank Briscoe, a British national, has been F4E's Director since 16 February 2010. A mathematician with a PhD in astrophysics, Dr Briscoe OBE spent most of his career in the UKAEA most recently as Operations Director where he managed all operational activities at the Culham Science Centre including the fusion experiments MAST and JET. After leaving Culham in 2008, Dr Briscoe led an independent assessment of the cost estimates of the ITER IO for the construction of ITER.

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, 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, 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

At the 9th ITER Council in November 2011 the latest developments of the ITER schedule were presented and it was noted that the estimated first plasma date of November 2020 is within the baseline approved in July 2010.

As far as the Work Programme (WP) 2011 is concerned, 64% of the foreseen procurement procedures were started or completed, and 21% cancelled (either permanently removed from WP 2011 or moved to WP 2012 or merged with other activities).

The activities of F4E conducted at the beginning of 2011 were in line with the ITER Baseline approved by the ITER Council in July 2010 with an estimated first plasma date in November 2019.

Later in 2011, the ITER IO started an exercise, triggered by the catastrophic tsunami that hit Japan in March 2011, to define a new baseline that takes into account both the impact of this event on the capability of Japan to deliver on time their in-kind procurements as well as the slippages accumulated in the design and fabrication of the components in the critical path.

The new estimated first plasma date of November 2020 resulting from this exercise is within the Baseline approved in July 2010. As a consequence, the F4E activities were adjusted to be in line with the new first plasma date.

In 2011 F4E achieved significant progress 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).

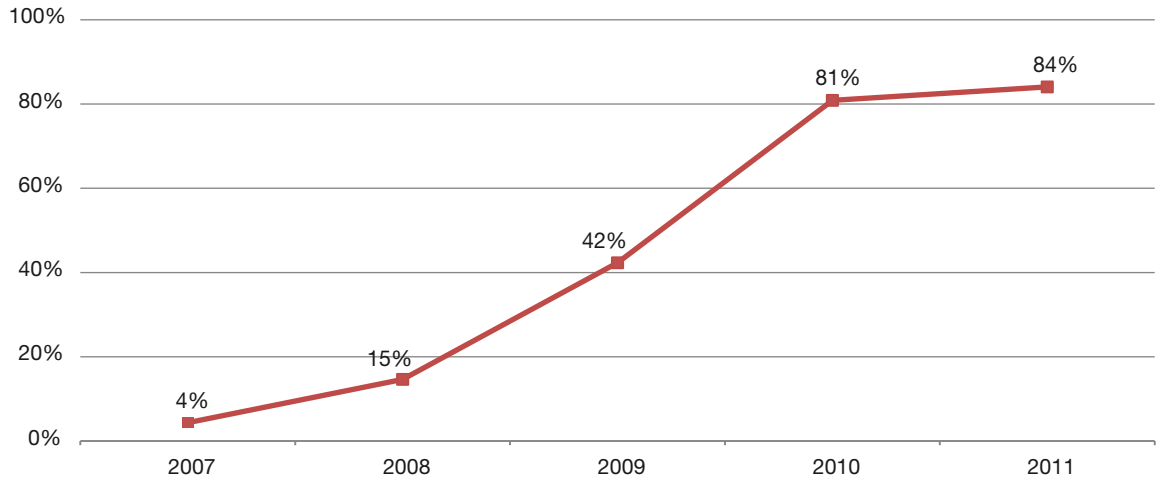
During 2011, F4E carried on with the works at the Cadarache site. Completion was achieved for the Poloidal Field (PF) coils manufacturing building, which will house the construction of the large PF coils magnets. The works on the Tokamak building foundation and pit wall progressed as well as the installation of the anti-seismic foundation pads which will be used to minimise shock on the main building during a seismic event.

Two additional Procurement Arrangements (PAs) were signed between F4E and ITER IO in 2011, thus reaching a total value of 836 kIUA (equivalent to approximately EUR 1 320 million).

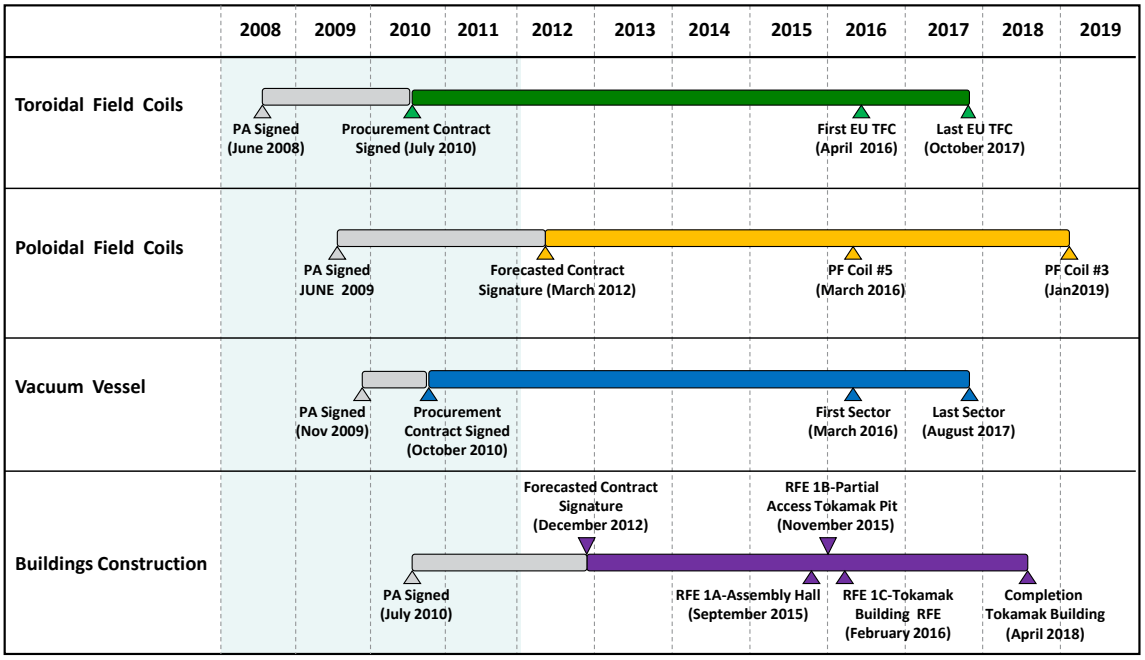
Project management activities have also been carried out not only to monitor the progress of the F4E work, but also to implement a reporting tool that will be part of the future F4E integrated project management system.

Since the transfer of the technical supervision of over 500 ITER technology contracts from the European Fusion Development Agreement (EFDA) to F4E in 2008, F4E has been progressively seeing them through to completion and as of the end of 2011 there were less than 20 that were still running and invoices of over EUR 40 million were processed.

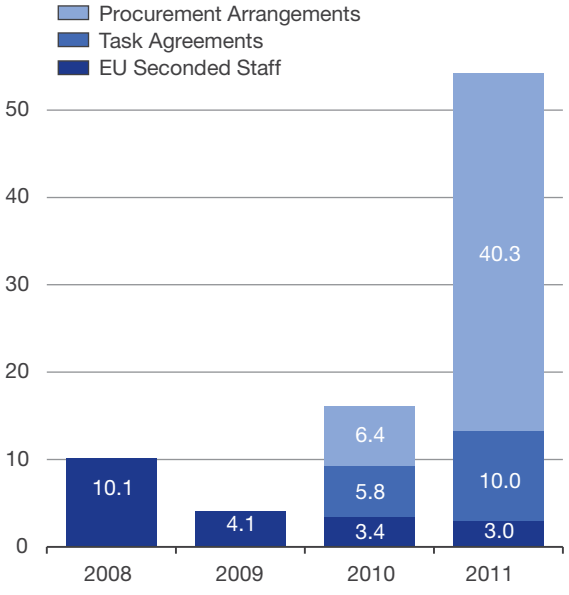
ITER Procurement Arrangements (% of total concluded in value)



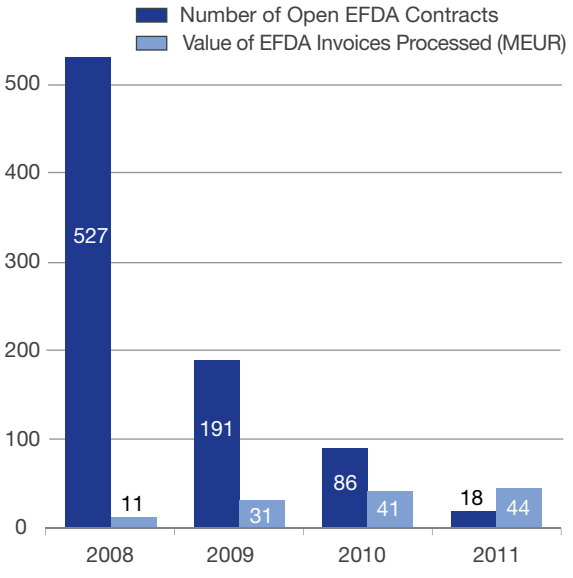
Schedule Summary for the main European procurements (status December 2011)



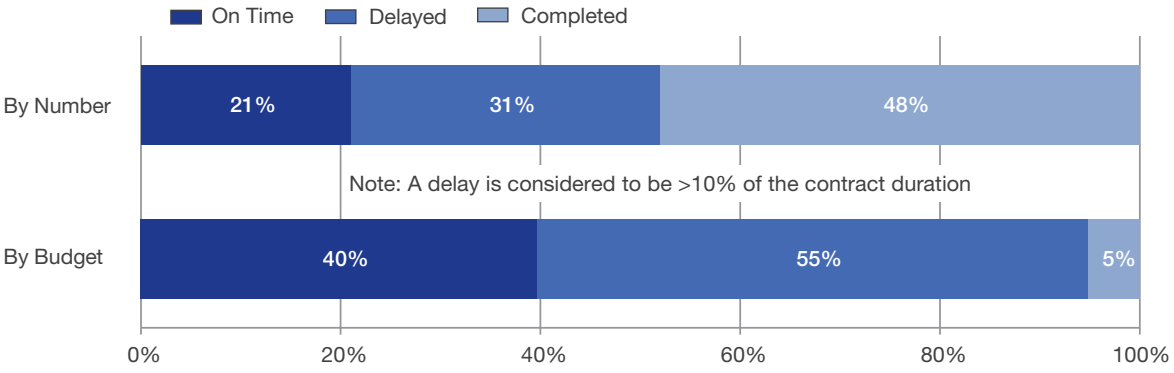
Credit awarded to F4E by ITER (EUR million)



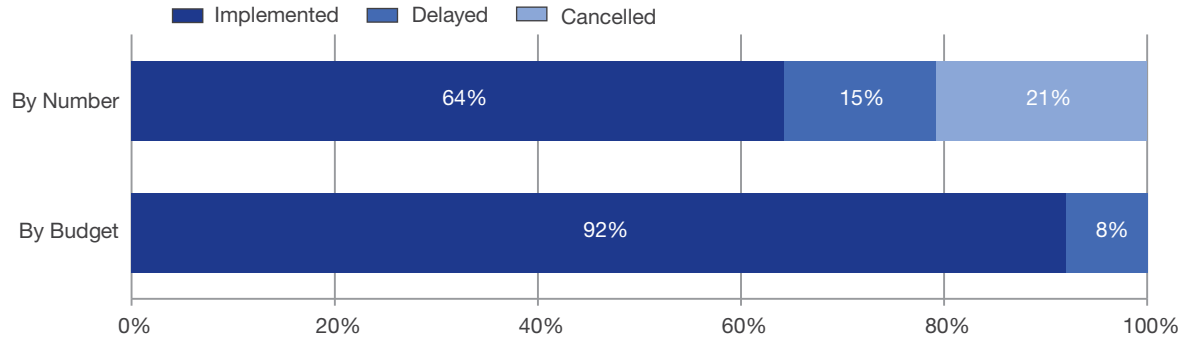
EFDA Contracts - Open and Processed



Status of Implementation of Contracts (Concluded by F4E between 2007 and 2011)
(Total of 215 contracts)



Launch of Calls for Contracts and Grants in the 2011 Work Programme
(Reference to last amendment of November 2011)



Magnet Systems

Magnets (186.36 kIUA)

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

- Ten Toroidal Field (TF) coils and 20% of the Nb_3Sn conductor to be used in the TF coils (89.74 kIUA)
- Five Poloidal Field (PF) coils and 11% of NbTi conductor for the PF coils (41.4 kIUA)
- Nine fibreglass composite pre-compression rings (0.6 kIUA)
- TF conductor and PF conductor (54.62 kIUA)

Toroidal Field Magnets

In 2011 the phase of full industrial implementation has advanced well. Progress in accordance with the Work Programme (WP) 2011 has been achieved as follows:

- Follow up of the contract for manufacturing of ten TF Winding Packs (signed in July 2010, F4E-OPE-053) and related activities including the definition of the supplier schedule.
- Support to the supplier of TF coils on the detailing of the technical specifications for the main tools contracting and manufacturing (e.g. furnace and winding line) and the manufacturing facility.
- Final phase of implementation of the procurement contract for the full-scale prototype of the Side Radial Plate (F4E-OPE-016-01). By end-2011, the manufacturing of the side Radial Plate prototype was almost completely finished with very good results as concerns the value of the achieved tolerances.
- Final phase of implementation of the procurement contract for the Radial Plates full-scale prototype (F4E-OPE-016-03). The main manufacturing processes (welding, machining, dimensional checks) has been developed and qualified during 2011, including the installation in the supplier's premises of the portal machine used for the Radial Plate final machining. By end-2011 the manufacturing phase was complete and the prototype Radial Plate was successfully produced within precise tolerances.
- Manufacturing of mock-ups to qualify the TF coil case welding closure commenced in the framework of a procurement service contract for qualification and Ultrasound Testing (UT) methods (F4E-OPE-049).
- The engineering studies for Coil cold testing and insertion contract were completed (F4E-OPE-142).

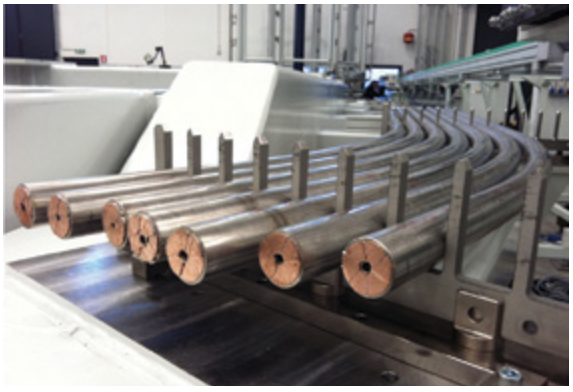
Negotiations with the sole bidder to the call for tender for the manufacturing of five PF coils (F4E-OPE-086) have continued throughout 2011.

The PF Coil Fabrication building in Cadarache was practically completed by the end of 2011, making the set-up of the manufacturing facility possible during 2012 following the awarding of a contract.

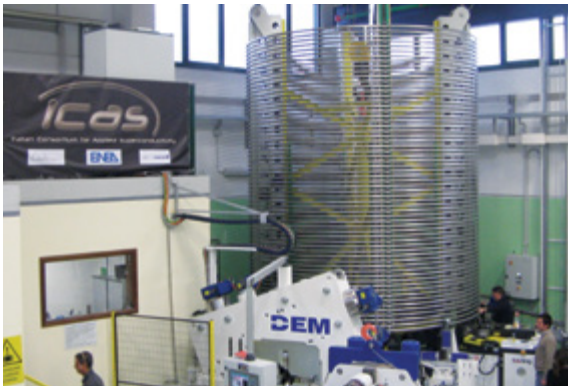
Finished Side Radial Plate (courtesy of CNIM)

Finished Regular Radial Plate (courtesy of SIMIC)

The winding line for the Double Pancakes (courtesy of ASG and TPA)



Winding trials for the Double Pancakes (courtesy of ASG and TPA)



TF dummy conductor produced, spooled and ready for compaction (courtesy of ICAS)

Conductor

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

- The supply of 58 tons of Nb_3Sn strand for the TF conductor (F4E-OPE-005-1) is progressing and more than half of the total production has been achieved with only few months of total delay on the baseline.
- A second contract (F4E-OPE-005-2) for 37 tons of Nb_3Sn strand for the TF conductor has progressed well with more than 30% of the deliverables produced by the end of the year an acceleration on the initial production rate.
- A contract for strand characterisation of TF Nb_3Sn samples has been signed (F4E-OPE-145).
- The first samples of TF strands have been successfully tested under extensive conditions of field and strain in the testing stations of Twente and Durham universities (F4E-GRT-029) and the SULTAN tests of the European conductor samples (EUPF1 and TRASEK) have also been successfully completed.
- The contract for cabling and jacketing of the ITER TF and PF conductors, as well as the JT-60SA conductors, has been implemented during 2011 (F4E-OPE-018) and after preparation and setting-up of the facility, the first production (760m of Cu dummy conductor length for TF) has been successfully achieved, on time for winding tests execution.

Pre-compression Rings

After a first call for tender for the manufacturing of nine pre-compression rings, launched at the end of 2010, a new negotiated procedure was launched at the end of 2011 involving only the bidders that passed the selection criteria of the first procedure.

MAGNET SYSTEMS:

- Production of 10 tons of TF Nb_3Sn strand;
- Two testing batches on the TF Nb_3Sn strand;
- Continuation of the tests of EUPF1 and TRASEK conductor samples carried out in the SULTAN facility;
- Set up of the jacketing line and first production of jacketed conductor for TF coils;
- Qualification activities for PF conductor jacket weld;
- Continuation of negotiation with bidder for a call for tender for the procurement of the five PF coils;
- New procedure launched for Pre-Compression Rings procurement;
- With reference to the TF Winding Packs Double Pancake Prototype (TF Coils) contract, all main tooling for series production (thermal treatment oven and winding machine) in almost final phase of fabrication and commissioning;
- Two Radial Plate prototypes manufactured with successful qualification of the fabrication processes involved.

Vacuum Vessel

Vacuum Vessel (92.19 kIUA)

F4E is responsible for the in-kind procurement of seven sectors of the Vacuum Vessel (VV).

Following the signature of a contract for the first stages of the fabrication of the seven sectors of the VV (F4E-OPE-068) in late 2010, good progress was made by AMW, the consortium of suppliers. Although the input design from the ITER IO is not yet complete, which prevents the start of detailed manufacturing design, the overall progress has been in accordance with the WP 2011 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 mock-ups for the prediction of later distortions of the sector. Detailed dynamic electromagnetic analysis on the VV solid finite element model, and finite element analysis in support of the manufacturing deviations.

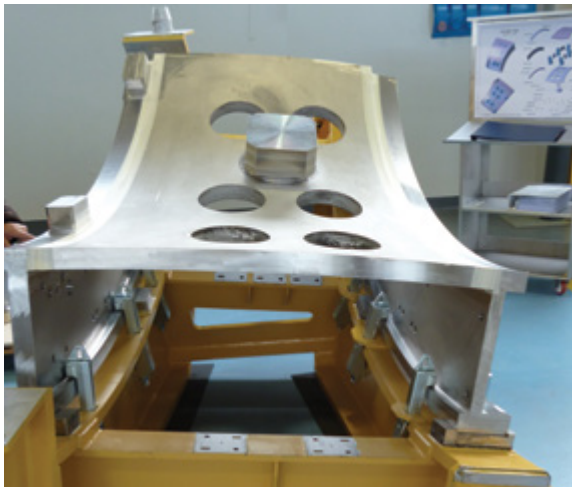
- A VV 3D solid model for the regular and irregular sectors, detailed dynamic electromagnetic analysis and seismic analysis on the VV 360º solid FE models were completed.

- 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, one plate material supplier has been qualified and three forging material suppliers are under qualification.

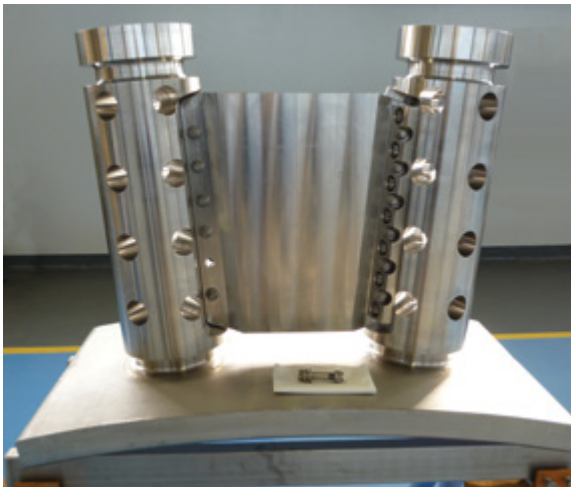
- More than 700 technical and manufacturing documents have been reviewed and approved, also with the ITER IO and Authorised Notification Body (ANB) interfaces. Development of the Smarteam Project Life Cycle Documentation Management System for the AMW consortium documentation and interface to F4E has progressed.

- An Ultrasound Testing (UT) qualification committee, to address the issue of the one-sided access closure welds (mainly the outer shell), has been set up and is defining the technique and acceptance criteria to be used according to the RCC-MR code.

- A specialised welding workshop has been set up for welding trials to develop and qualify the welding techniques to be used in the VV construction. The reduction of distortion and improvement of quality are the focus of the new procedures developed, rather than the maximisation of production capacity. 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.



Typical mock-up with Electron Beam welding



Bolted Shielding Rib mock-up

VACUUM VESSEL:

- Follow-up of the manufacturing contract for the Vacuum Vessel (VV), the largest component of the ITER device;
- Definition of design, CAD activities and stress analysis to support design changes from the ITER IO and from F4E;
- Setting up of the manufacturing facilities, preparation of mock-up for qualification and ANB approval;
- Start of the activities for the procurement of material for the first three VV sectors.

IN-VESSEL COMPONENTS:

- Award of a contract for a feasibility study for bending and shaping Blanket Cooling Manifold (BCM) piping;
- Award of a contract for a feasibility study for welding and non-destructive examination of BCM piping;
- Award of a contract for a thermal-electro-mechanical analysis of the BCM design;
- Award of a contract for the high heat flux testing of 18 First Wall (FW) mock-ups;
- Award of a grant for high heat flux testing of Be-coated semi-prototypes;
- Award of a contract for the preliminary design and analysis of six FW panels;
- Award of a contract for the fabrication of Normal Heat Flux mock-ups and semi-prototypes;
- Award of a contract for the fabrication of Enhanced Heat Flux mock-ups and semi-prototype;
- Award of a contract for the manufacture of mock-ups using alternative carbon fibre composites (CFC);
- Award of a contract for the manufacture of full tungsten mono-block mock-ups and prototypes.

In-Vessel Components

In-Vessel Components (81.82 kIUA)

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

- Blanket First Wall (FW): 48.4% of the FW panels corresponding to the Normal Heat Flux FW (42.1 kIUA)
- The Blanket Cooling Manifold (5.94 kIUA)
- Divertor - inner vertical target (20.2 kIUA)
- Cassette bodies and integration of plasma-facing components (11.2 kIUA)
- Divertor rails (2.38 kIUA)

In-Vessel Components

During 2011, progress in the development of In-Vessel Components was achieved in relation to the Blanket Cooling Manifold, the Blanket FW and Divertor components.

Blanket Cooling Manifold (BCM)

Following the acceptance by the ITER IO of the multi-pipe manifold concept proposed by F4E as the baseline design in January 2011, F4E performed the following activities to support the ITER IO for the preparation of the final design:

- A feasibility study for the bending and shaping of the BCM piping;
- A feasibility study for the welding and non-destructive examination of the BCM piping;
- Thermo-electro-mechanical analyses of the ITER BCM design.

The outcome of these studies was presented at a Conceptual Design Review meeting held on 28 September 2011. The conclusion of the review has confirmed the acceptability of the proposed design. Design activities and the preparation of procurement activities will continue in 2012. A Final Design Review is tentatively scheduled for early 2013.

Blanket First Wall

Achievements in the area of the Blanket First Wall (FW) may be grouped as follows:

- R&D in support of the FW procurement: continuation of activities on the development of Hot Isostatic Pressed CuCrZr alloy (GRT-038) and start of activities on post-irradiation thermal creep of 316L Stainless Steel/CuCrZr joints (GRT-291).
- Component design and analyses in support of the ITER IO done in the frame of the Blanket Integrated Product Team Task Agreement as follows:
  - Development by F4E of the detailed CAD models of six FW panels;
  - Design and analyses (OPE-017-01-02-14, OPE-007-02-01-05 and OPE-007-02-01-07) of the following FW panels to be procured later by F4E: FW1, FW6, FW2, FW18, FW10 and FW12;
  - Presentation of these results at the Blanket Preliminary Design Review meeting of 29 November – 1 December 2011 at Cadarache.
- Second phase of the ITER FW qualification programme to prepare for the procurement of the FW panels. Procurement contracts for the fabrication of Normal Heat Flux FW semi-prototypes (OPE-284) and of Enhanced Heat Flux FW semi-prototype (OPE-097) were placed and the related activities started. A grant (GRT-154) and a procurement contract on a world-wide based call for tender (OPE-324) were placed to cover the various high heat flux testing activities needed after the manufacture of the above mentioned mock-ups and prototypes.

The WP 2011 was not implemented as originally planned. In particular, some activities related to high heat flux testing and to the preparation of a high heat flux test facility needed for the procurement of the FW were postponed to take into account the updated overall delivery schedule of the FW panels. The overall F4E Blanket programme is in line with the ITER procurement schedule.

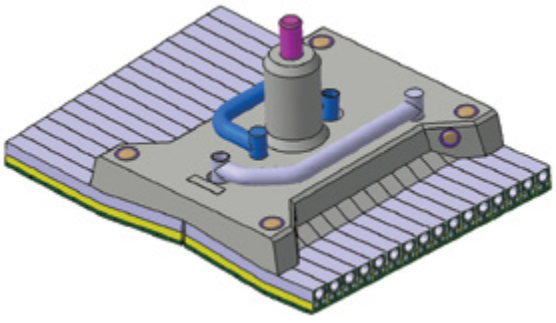
Divertor Components

During 2011, F4E has started negotiations with the ITER IO for the preparation of the documentation for the PA on Cassette Body and Integration aiming at a signature of the PA in the first half of 2012.

The main achievements associated with the PA on the Inner Vertical Target (IVT) can be summarised as follows:

- Continuation of the European industry pre-qualification activities on the use of alternative armour materials grades to mitigate technical risk and to decrease fabrication costs; awarding of a contract for the manufacture of mock-ups with two alternative CFC armour material (OPE-096-Lot 2).
- R&D on the divertor IVT including activities on full-tungsten divertor. As part of the F4E strategy to develop both the CFC/W-Divertor and full W-Divertor technologies a second contract was placed for the manufacturing of full tungsten monoblock mock-ups and prototypes (OPE-073-Lot 2). This strategy was endorsed at the 9th ITER Council meeting of 17-18 November 2011 where it was decided to keep both options in parallel for a period of time of about two years and the ITER IO selected the full W-Divertor option as reference. Thermal fatigue testing of high heat flux mock-ups and prototypes (GRT-005 and OPE-012) has been completed, validating the choice of EU fabrication technologies.
- Continuation of the activities required in the frame of the IVT PA, including the procurement of a CFC material prototypical batch (OPE-91) for the manufacture of full-size IVT prototypes, the preparation of a procurement contract for the manufacture of IVT full-size prototypes (OPE-138), the testing of Divertor target mock-ups and prototypes (OPE-311) and the characterisation of the CFC prototypical batch and tungsten alternative grades (GRT-369).

The WP 2011 was not implemented as originally planned. In particular, the signature of the contract for the full-size IVT prototypes has been delayed due to lengthy negotiations with selected companies and delays in the delivery of design inputs from the ITER IO after the decision of the ITER Project to start with a full W-Divertor. The corresponding activity on high heat flux testing has also been delayed. Nevertheless, the overall F4E divertor programme is in line with the ITER procurement schedule.



CAD model of an First Wall panel

Remote Handling

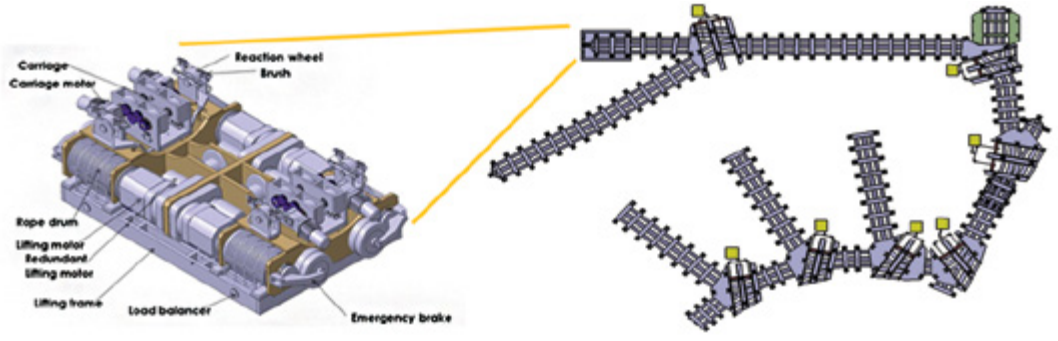
Remote Handling (42.22 kIUA)

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

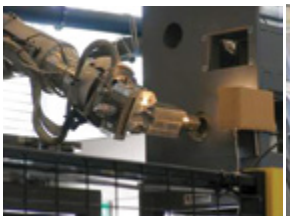
- Divertor Remote Handling (9.62 kIUA)
- Cask Transfer System (19.8 kIUA)
- In-Vessel Viewing and Metrology System (6.8 kIUA)
- Neutral Beam Remote Handling (6.0 kIUA)

Progress in 2011 has been made in various areas of the project, such as the finalisation and approval of F4E's procurement strategy, along with the launching of the call for expression of interest (OMF-340) for all packages except the In-Vessel Viewing System (IVVS), the elaboration of the road-maps for design, manufacturing, delivery and integration of the four procurement packages and continuous collaboration with the ITER IO on general topics like Remote Handling (RH) Control System (architecture, interfaces and standardisation) and radiation tolerant electronics design. On the technical implementation side, specific actions include:

- Divertor RH: The Divertor Remote Handling System (DRHS) conceptual design has been completed and reviewed. Preparations of the DRHS PA have been started. Within grant GRT-143, trials on Divertor maintenance and recovery operations have been conducted at DTP2 test facility through employing scale-one mock-ups and prototypes, based on the conceptual design studies (still ongoing). Robustness and performance of remote handling equipment prototypes were also assessed. The DRHS and its test facility are employed as a test bed for designing, implementing, demonstrating and specifying the high-level control system functionalities for the ITER RH control system.
- Transfer Cask System - aka Cask and Plug Remote Handling System (CPRHS): Performance of a new study on cask trajectories (GRT-276) to verify and optimise routes within the Tokamak and Hot Cell buildings. Completion of the Conceptual Design of an Equatorial Port Plug Cask (2008-OPE-017-03 and OPE-326) which is the basis for the generic CPRHS design. Completion of CPRHS transfer system option study (2008-OPE-017-03) to resolve interface issues with the Tokamak building. Performance of irradiation studies with respect to Blanket Module and Divertor cassette transportation by the CPRHS (2008-OPE-02-02-02).
- In-Vessel Viewing and Metrology System: Several aspects of the design were covered: (a) finalisation of design and laboratory test activities related to the development of the IVVS probe (GRT-015); (b) supply of a piezo actuator test vehicle and high-temperature tests (OPE-166); (c) electromagnetic analysis of the IVVS plug (OPE-06-06-07); (d) calculation of the In-Vessel gamma doses in and around the IVVS plug (OPE-02-01-05); (e) conceptual solutions for the actuation of the IVVS deployment system (OPE-300). Meanwhile, a substantial change of the IVVS layout was undertaken by the ITER IO (Project Change Request PCR 351) with significant involvement and contribution from F4E.
- Neutral Beam (NB) Remote Handling (RH): In preparation of the conceptual design review scheduled early 2012, various design activities for all the NB RH sub-systems were performed (F4E-GRT-051), in liaison with the design activities of the other systems hosted in the NB cell and served by NB RH (Heating Neutral Beam, Diagnostic Neutral Beam, Upper Port equipment). This included the design and documentation of a 50-ton monorail crane with lifting adaptors, beam source maintenance equipment, a beam line transporter with a dexterous manipulator mounted on a telescopic arm, and general tooling for (un)bolting, cutting and welding of both tubes and lip seals.

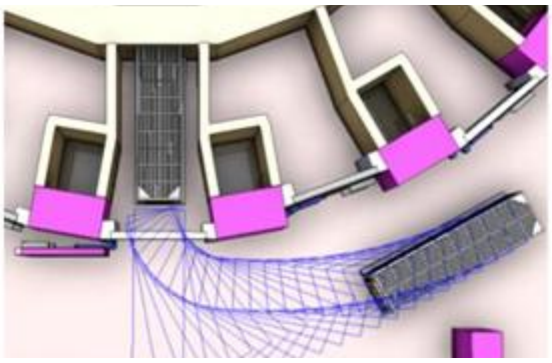


Design of a 50 ton crane hoist (left) mounted on a monorail system inside the Neutral Beam Cell

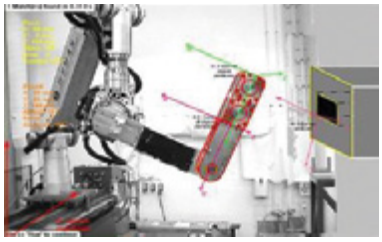


Left: Bolting tool operating the cassette locking system

Right: Trials measuring the robustness of the RH equipment when removing divertor cassettes in off-normal conditions



Plan view of cask trajectories in the Tokamak building



Tele-operation of the water-hydraulic manipulator: Machine vision is employed to assist the operator during tool alignment

REMOTE HANDLING:

- Follow-up of a grant in support of Divertor Remote Handling conceptual design and R&D;
- Placement of task orders, operational contracts and a grant in support of Cask and Plug Remote Handling System conceptual design and of trajectory studies, and related follow-up;
- Follow-up and closure of a grant, operational contracts and task orders in support of conceptual design of the In-Vessel Viewing System;
- Placement of a task order and a grant in support of Neutral Beam Remote Handling design, and related follow-up;
- Placement and follow-up of expert contracts in support of the Remote Handling Control System and Radiation Tolerant Electronics studies.

Cryoplant and Fuel Cycle Systems

Cryoplant and Fuel Cycle Systems and other systems (78.413 kIUA)

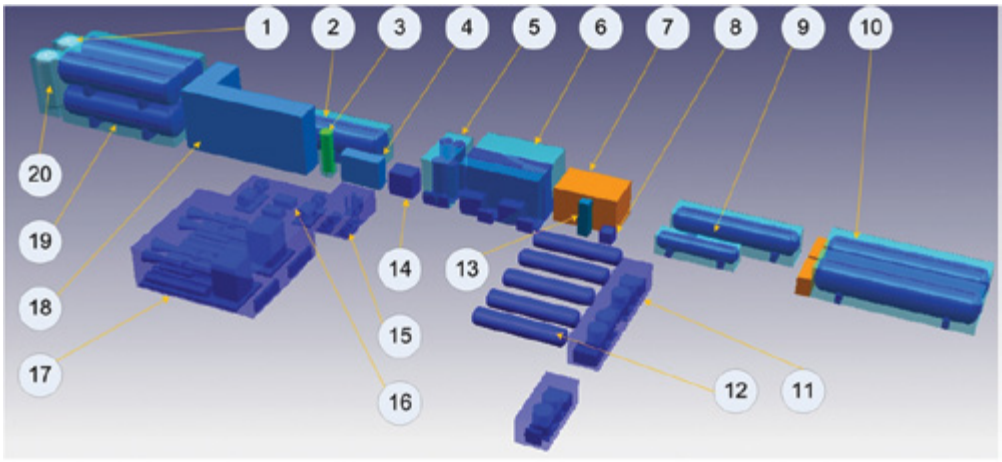
F4E is responsible for the in-kind procurement of the following:

- Liquid Nitrogen (LN_2) Plant and Auxiliary Systems, approximately one-half of the Cryoplant (30.677 kIUA)
- Eight torus and two Cryostat Cryopumps, some Cryopumps for the Neutral Beam system and leak detection and localisation (15.22 kIUA)
- Tritium Plant consisting of the Water Detritiation System (WDS) and the Hydrogen Isotope Separation System (ISS) (18.216 kIUA)
- Waste Management and Storage (10.1 kIUA)
- Radiological Protection (4.2 kIUA)

Cryoplant

As far as the LN_2 Plant and Auxiliary Systems, EU contribution to the Cryoplant is concerned, 2011 was fully devoted to the preparation of the call for tenders to be issued early 2012:

- Defining the PA, signed on 15 June 2011;
- Awarding and completing a contract (OPE-017-02-01-04) for studying compressor and cold box technologies for the 80K loops in order to identify potential issues, technical requirements and achievable performance.
- Awarding and completing a contract (OPE-292) for assessing the feasibility of a sealed compressor technology that would bring benefits in terms of leak-tightness and lay-out but required a risk analysis that has allowed the successful mitigation of risks.
- Awarding a contract (OPE-336) for pre-studies of quench tanks and test cryostat in order to identify risks and potential issues.
- Laying down the requirements of the call for tender (OPE-376) for designing, manufacturing, installing and testing the LN_2 Plant and Auxiliary Systems.



1.	IMPURE HE GAS STORAGE	8.	ELECTRICAL HEATER	15.	RECOVERY AND AIR COMPRESSORS
2.	LIN OPERATIONAL STORAGE	9.	LHE STORAGE	16.	80K LOOP COMPRESSORS
3.	LIN PRESSURISED STORAGE	10.	QUENCH TANKS	17.	LN2 PLANT COMPRESSORS
4.	GAN GENERATOR COLDBOX	11.	DRYERS	18.	ATMOSPHERIC HEATERS
5.	80K LOOP COLDBOXES	12.	GAS BAGS (UNDER BUILDING CEILING)	19.	GHE STORAGE
6.	LN2 PLANT COLDBOXES	13.	COMPRESSED AIR EQUIPMENT	20.	GAN STORAGE
7.	TEST HEATERS COLDBOX	14.	PURIFIER		

The layout of the specifies configuration of the LN_2 Plant and Auxiliary Systems - non-EU equipment is not shown on purpose

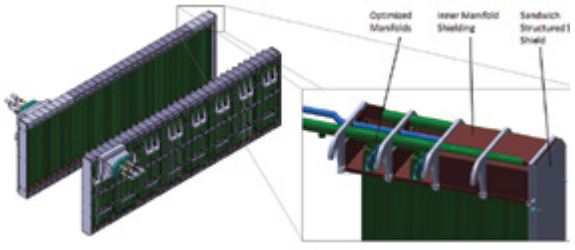
Cryopumps and Cryodistribution Lines

During 2011, major progress has been achieved in the completion of the design of the Pre-Production Cryopump (PPC) within GRT-018 and task agreement C31TD16FE. The design work is now complete and has resulted in full definition of the build-to-print (BTP) drawings and specification for the PPC.

The task agreement C32TD31FE for the BTP manufacture of the PPC has been signed and preparations for the tender action have started. A business intelligence exercise has probed and alerted the market for the intended manufacturing contract.

The contract for the Cold Valve Boxes and the Warm Regeneration System has started to deliver good results especially in the establishment of a fully traceable and validated design basis and input data.

The design of the Neutral Beam Cryopumps has been advanced significantly (GRT-032 and GRT-303), especially in the area of thermal shielding. In addition, a thorough investigation on the thermal performance of the pump's absorption panels has been launched. The finalisation of this key design feature is expected for early 2012.



Design of the Neutral Beam cryopump with details of upper manifolds and support structure

Various studies on the subject of leak localisation have been conducted with CEA (GRT-158) and provide valuable input for the ITER IO's definition of the leak localisation system. The flow of water and helium through ITER reference leaks has been investigated experimentally. Theoretical studies on the draining and drying of blanket modules, important aspects of leak detection and localisation system for the determination of water leaks, are ongoing.

The WP 2011 and Project Plan have been implemented as foreseen albeit with some delay. However, all the vacuum pumping components still remain outside the critical path for first plasma.

Tritium Plant

Water Detritiation System (WDS)

In 2011, the conceptual design of the entire WDS was finalised in the frame of the grant GRT-045 and assessed in the ITER Conceptual Design Review (CDR). The preliminary design will take into account modifications and remarks proposed by the CDR Panel. Special attention was given to the preliminary design of the large Tritiated Water Holding Tanks (TWHT) in the range between 20m^3 and 100m^3 in view of the Preliminary Design Review (PDR) planned in the first half of 2012.

R&D is on going to qualify a type of catalyst/packing mixture candidate for the use in the WDS Liquid Phase Catalytic Exchange (LPCE) columns and to check for the influence of heavy water in the LPCE columns with respect to e.g. the detritiation factor. First experimental results confirmed the expected negative impact on the separation performance of the LPCE column with increasing deuterium concentrations in the fed tritiated water (a five fold increase of the deuterium concentration in the range between 5% and 30% reduces the detritiation factor by approximately one order of magnitude).

Isotope Separation System (ISS)
At the beginning of 2011 an ITA was signed with the ITER IO to carry out the conceptual design of ISS, 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 ISS. This work is planned for 2012.

Waste Management and Storage
During 2011, activities were mainly focused on layout modifications of the Radwaste Building and the execution of the 2010 ITA in the Waste Management Systems area.

With respect to the Radwaste Building an F4E and ITER IO Task Force was set up to address the main identified issues and to provide agreed solutions and Radwaste Building layout modifications, while optimising costs, minimising changes and closing the loop to validate data and solutions. The Task Force completed its work in October with the related Project Change Request implemented in the baseline.

Moreover, during 2011, the activities for the ITA C66TD01FE were launched through the completion of the call for tender (OMF-298-LOT1), Framework Contract for the provision of the engineering services in the field of Radwaste Treatment and Storage. The preliminary results were presented to the ITER IO in June. A Task Order, to complete the scope of the ITA, will be executed during the first quarter of 2012.

Radiological Protection
In 2011 F4E and the ITER IO worked in close collaboration, on the development of the conceptual design of the Radiological and Environmental Monitoring Systems (REMS).

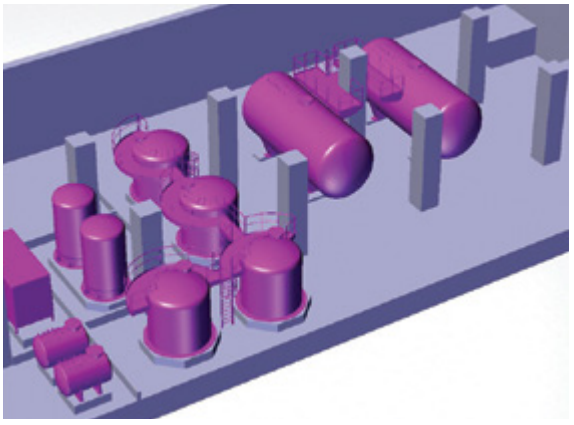
In 2011, the ITA FCIPT-10-30-EU1 in the field of REMS has been successfully and timely completed. The main REMS technologies and architectures have been selected based on the system objectives and constraints. The commercially available equipment/ instrumentation, matching the ITER requirements, have been identified together with potential suppliers. Furthermore, based on the selected components and equipment, fire, heat and electrical loads have been determined.

During 2011, a second ITA (FCIPT-11-30-EU1) has been signed and the following related tasks have been started:

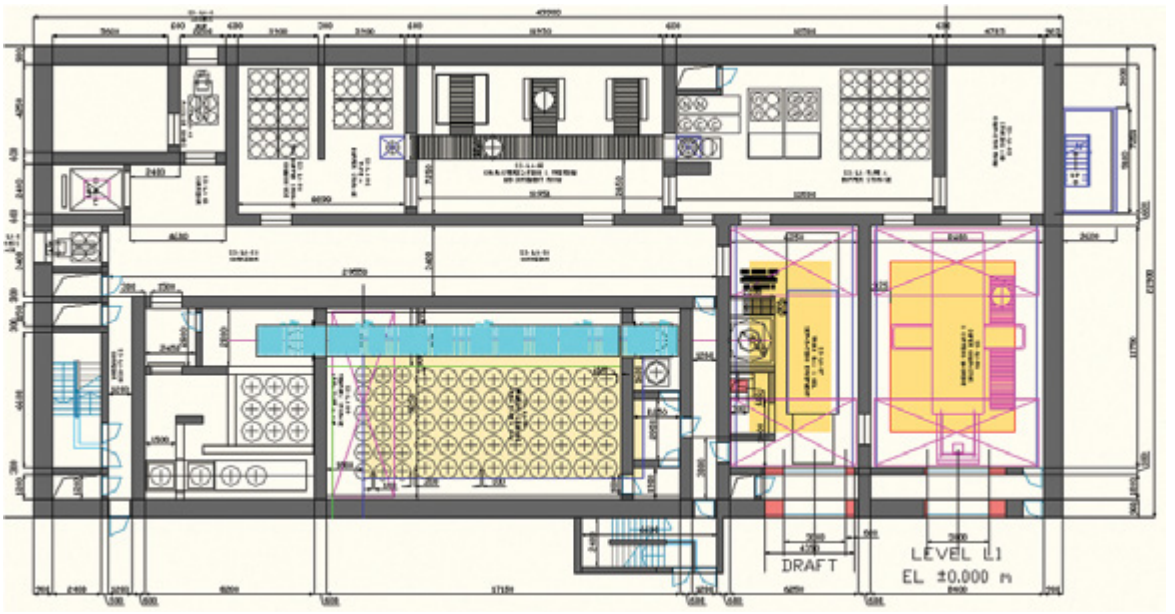
- Modelling of the transport of tritium, in order to select the best location of the tritium-in-air trigger monitors;

- Definition of the relevant structural, electromagnetic and thermal loads applicable to REMS.

In addition, during 2011, F4E and the ITER IO agreed the main system development milestones together with the overall system schedule. To date, F4E and the ITER IO schedules are matching each other.



Tritiated Water Holding Tanks of the Water Detritiation System (excerpt from the ITER Configuration Management Model, interconnecting pipe work not shown). These tanks are positioned in the lowest floor of the Tritium Building.



New layout of the ground floor of the Radwaste Building proposal

CRYOPLANT AND FUEL CYCLE SYSTEMS:

Cryoplant

- Preparation of the call for tender to be issued early 2012;
- Signature of the PA in June 2011;
- Awarding and completing a contract for studying the centrifugal compressor and cold box technologies for the 80K loops of the LN_2 Plant and Auxiliary Systems;
- Awarding and completing a contract for assessing the feasibility of a sealed compressor technology as an alternative solution for the compressor of the 80 Lithium loops;
- Awarding a contract for pre-studies of quench tanks and test cryostat for the LN_2 Plant and Auxiliary Systems;
- Laying down the requirements of the call for tender for designing, manufacturing, installing and testing the LN_2 Plant and Auxiliary Systems.

Vacuum Pumping and Leak Detection

- Signature of the ITA on the manufacture of the Pre-Production Cryoplant;
- Placement of the design contract for the Cold Valve Boxes and the Warm Regeneration System;
- Closure of the intermediate phase of the design of the NB and MITICA Cryopumps and placement of the grant for their BTP;
- Significant progress in the leak localisation pre-PA activities.

Tritium Systems

- Conceptual design review for the Water Detritiation System was carried out. Preliminary design of the large (volume ≥ 20 m^3) tritiated water holding tanks is ongoing;
- Signature of the task agreement for the conceptual design of the Isotope Separation System and supporting R&D has been signed.

Radwaste and REMS

- Completion of the ITA for the “Support to ITER IO during the conceptual design phase of REMS, part-I”;
- The ITA for the “Support to ITER IO during the conceptual design phase of REMS, part-II” has been signed;
- Completion of the call for tender to set up a framework contract for engineering support in the field of Radwaste and REMS.

Wave Heating Systems

Wave Heating Systems (41.205 kIUA)

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

- Ion Cyclotron Resonance Heating (ICRH) System (equatorial port plug incorporating one ICRH antenna and spares (3.96 kIUA))
- Electron Cyclotron Resonance Heating (ECRH) 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 17.753 kIUA respectively))

Electron Cyclotron Upper Launcher

In 2011, the collaboration between the ITER IO and F4E towards the final design of the Electron Cyclotron (EC) Upper launcher has continued. F4E concluded with the ITER IO two new ITAs for providing European support to the completion of the Launcher BTP design. The first one (C52TD44FE) defines the prototype and testing activity, and the second (52TD43FE) is in support of range of engineering activities required for the final design. As in 2010, significant effort was devoted to analysing and mapping to the launcher design the requirements related to high quality class and nuclear safety standards, as well as to the stabilisation and documentation of other technical requirements.

A grant (GRT-161) for the finalisation of the First Confinement Barrier design of the Launcher was signed in 2011 between F4E and the EC UL Consortium of Associations (KIT, CRPP, DIFFER (formerly FOM), ENEA-CNR and IPP).

Finally, F4E has provided support to the ITER IO for design reviews and technical meetings related to the Launcher and to EC system in ITER, including the Port Plug Test Facility Conceptual Design Review and the EC Transmission Lines Preliminary Design Review. Both systems have important physical and functional interfaces with the Upper Launchers.

Electron Cyclotron RF Sources and Power Supplies

After completing the refurbishment of the industrial 2MW coaxial gyrotron prototype, the tube was delivered to the EC CRPP Test Facility, installed and tested: 2MW of output power was achieved in only a few days of RF testing with efficiency of 46% and a good quality radiation output pattern. Furthermore the new internal components (electron gun, beam tunnel and launcher) were validated at short pulses in the millisecond range. Compared to the first prototype, operation at nominal parameters was successfully achieved. The RF tests were terminated due to a substantial leak from one of the cooling circuits of the gyrotron, leading to the unrecoverable damage of the tube. This failure occurred before it was possible to explore any optimisation of the performance in terms of power and efficiency. Operation outside the millisecond range could also not be investigated.

During 2011, theoretical and redesign activities for the second gyrotron prototype continued. The EC CRPP Test Facility were upgraded and equipped with improved components. The activities for the implementation of the ITA on the design verification of the ITER EC power supply system have been successfully completed.

Ion Cyclotron Heating

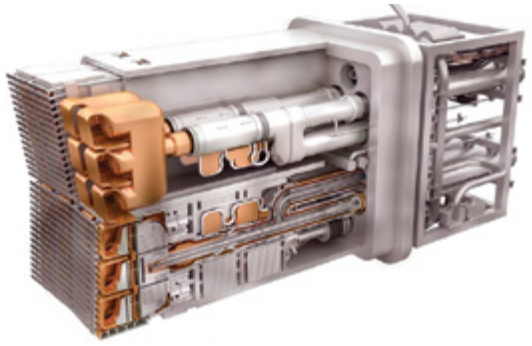
The development of the detailed design of the Ion Cyclotron Heating (ICH) antenna is continuing under GRT-026 (CYCLE Consortium: CCFE, CEA, ERM, IPP and Politecnico di Torino), in preparation for the Preliminary Design Review (PDR).

The electrical design, including its validation with mock-up studies, is practically completed and the mechanical design is being finalised, in particular in the areas of thermal analysis, assembly scheme and Remote Handling maintenance procedures.

Preparation for the neutronics analysis (under GRT-026) and for the disruption and seismic analyses (under F4E Analysis Framework contracts) of the final design is ongoing. Effort has been spent in also in dealing with antenna interfaces not yet stabilised.

Preparation of the next phase of the design, presently not covered by the ITA, is ongoing with the ITER IO.

The qualification of the Faraday Screen (FS) Be/Copper/Stainless-Steel bonds (HIP) with the fabrication of Small Scale Mock-Ups (SSMU) and of prototypes of the FS bars has started and is progressing.



An up-to-date 3D CATIA model of the ICRH antenna - plasma facing side to the left of the image - external port plug structure not shown

The cross-section of the FS bar design, necessary for the fabrication of the SSMU, has been finalised. This work is being carried out under OPE-097 Lot 2 and has profited from the synergies in scope with the Blanket project. The preparation for the contract for the high heat flux tests of FS bar SSMU and prototypes at the loads expected in ITER is ongoing, still in collaboration with the Blanket project.

The scope of the qualification of the RF window ceramics with pre- and post-irradiation measurements of relevant material properties is being finalised. This phase will now be prepared and preceded by a pre-selection of the ceramic grades aimed at risk reduction. This latter contract is under preparation. This activity is now on the critical path of the schedule.

WAVE HEATING SYSTEMS:

- Several grants and task agreements in the area of Electron Cyclotron (EC) power supplies and sources have been completed;
- The manufacture and partial testing of the 2MW prototype Gyrotron were carried out before it was irreparably damaged;
- EC Upper Launcher: the two remaining main task agreements for the completion of work until the PAs were signed – final design work for the Launcher (part 1) was started;
- Ion Cyclotron (IC) Antenna: electrical design complete – excellent progress in the mechanical design towards Preliminary Design Review.

Neutral Beam Heating

Neutral Beam Heating System (83.4 kIUA)

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:

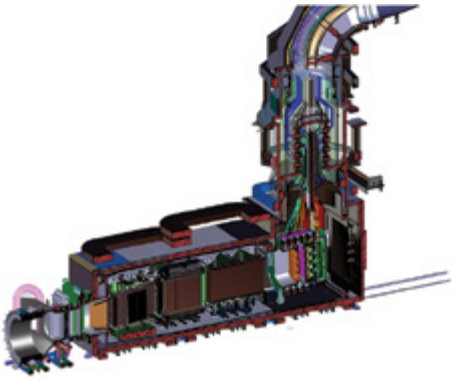
- Neutral Beam Heating System assembly (3.8 kIUA)
- Beam source and HV Bushings (3.893 kIUA)
- Beamline components (3.9 kIUA)
- Confinement and shielding (9.025 kIUA)
- Active Corrections and Compensation coils (4.4 kIUA)
- Heating and NB power supplies (31.382 kIUA)
- Neutral Beam Test Facility (27 kIUA) now included in this package, after having been approved by the ITER Council as an Additional Direct Investment.

F4E is in charge of the in-kind contributions related to six Neutral Beam (NB) Procurement Packages, which include beam sources, beam line components, confinement and shielding, coils, power supplies and assembly. The seventh major PA deals with the European procurements for the establishment of the Neutral Beam Test Facility (NBTF) in Padova, Italy.

A major achievement in 2011 was the preparation, finalisation and signature of the two agreements with the ITER IO and Consorzio-RFX (Padova, Italy) for the establishment and operation of the NBTF. Those agreements provide a stable long term framework for the NBTF activities and stipulate the reciprocal commitments amongst the Parties.

In 2011 F4E continued to provide support to ITER IO to prepare the NB technical specifications at the required level of detail. This support included most of the design and R&D activities related to the Heating NB system and the design and the establishment of the NBTF. In particular:

- The ITER Conceptual Design Review for the NB front components, confinement components and Active Corrections and Compensation coils was passed successfully in 2011. The Preliminary Design Review is foreseen for summer 2012 and the Final Review in the second semester 2013.
- In the framework of the NBTF activities, the BTP technical specifications for the SPIDER Beam Source (100kV/40A) and Vacuum Vessel were finalised and the tendering phase carried out. Tender evaluation is now ongoing.



The ITER Heating Neutral Beam Injector - updated design

- The design of all MITICA components was advanced and in particular viable solutions to manufacturing issues were identified during the completion of the detailed design phase. Considerable R&D activity on technological aspects was performed to validate the design of the mechanical components.

- Two new test stands were also built in 2011: the 800kV chamber for high voltage test of vacuum insulation and the Insulation Cooling Experiment (ICE) facility, for performing thermo-hydraulic tests of high heat flux components.

- The Detailed Design of the power supplies of the SPIDER ion source (ISEPS) was completed. ISEPS is now ready for manufacture. The evaluation of the new company taking over the previous supplier of ISEPS was completed before resuming manufacturing activities.

- Significant progress was made on the technical and contractual aspects of the competitive dialogue for the 1MV HV Deck and Bushing of MITICA and ITER injectors. In particular, a technical solution was identified using SF6 technology for the bushing.

- The procurement strategy for SPIDER HVD and TL was reviewed (new tender procedure planned in 2012).

- The specification for the NBTF Cooling Plant was reviewed and a new call for tender procedure was launched.

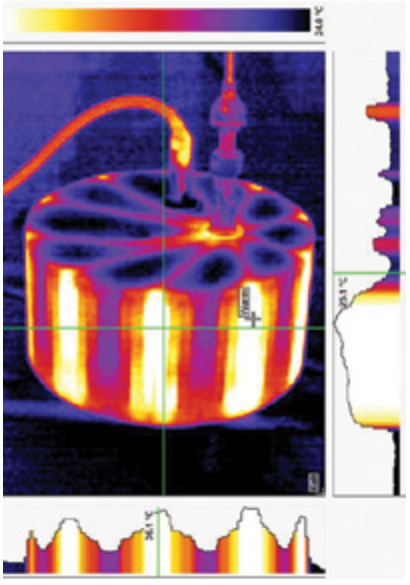
- For the NBTF CODAS, a prototype of the SPIDER control and data acquisition system was built to demonstrate the integration of the different technologies involved.

The construction of the ELISE test facility at IPP, Garching, Germany, has reached the final stages during 2011. ELISE, whose first experimental phase is planned for start in the first half of 2012, will provide a development path along which first the negative ion production in source, then the extraction of the ions to form a beam, and finally the acceleration of the beam system up to 60 kV will be investigated. The results and experience gained from each development stage will provide important inputs and will facilitate the operation of the next step devices such as SPIDER and MITICA.

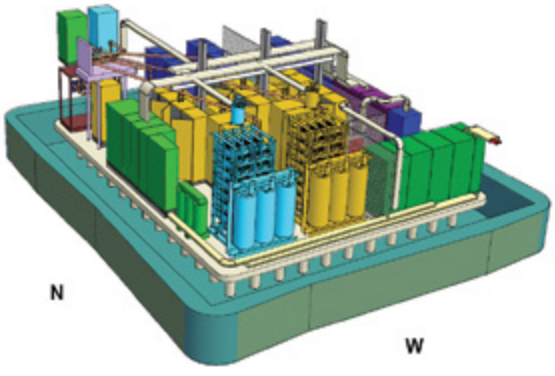
NEUTRAL BEAM HEATING:

- The Memorandum of Understanding between the ITER IO and F4E for the establishment and operation of the Neutral Beam Test Facility (NBTF) was signed;

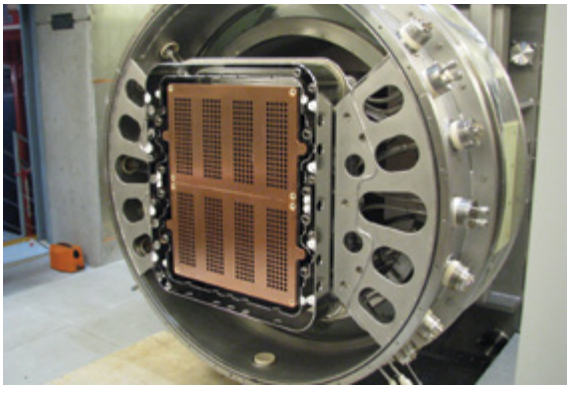
- The NBTF Agreement between F4E and Consorzio-RFX on the Neutral Beam Test Facility was signed.



ELISE - testing of the Faraday Shield of the RF ion source



Layout of SPIDER ISEPS equipment within the HV deck, North-West view



ELISE - assembly of the grids

Diagnostics

Diagnostics (35.487 kIUA)

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

- 11 diagnostic-related systems and enabling of a further three.

A PA was signed in December 2011 with a scope of supply encompassing the magnetics diagnostic; tokamak services; bolometers; inner divertor target thermocouples; pressure gauges; and plasma position reflectometer. The PA initially carried a credit of 1.1 kIUA for the magnetics diagnostic electronics and software. This will eventually rise to 14.9 kIUA as technical specifications for further systems under the PA scope of supply are added through planned amendments.

A Framework Partnership Agreement (FPA-328), F4E's first, was awarded in December 2011 to a consortium of Wigner RCP, MTA EK and Budapest University of Technology and Economics (BME). This 4-year agreement covers development and design of the diagnostics tokamak services, which include cables, conduits, feedthroughs and connectors in the ITER Vacuum Vessel and Cryostat. The FPA will be implemented through a series of individual specific grants.

Three grants were also awarded in 2011, for components of the magnetic diagnostic. These relate to development of detailed designs for the In-Vessel discrete equilibrium sensors (GRT 155 - awarded to ENEA Frascati), for the Ex-Vessel inductive sensors (GRT-157 – awarded to CEA) and for the fibre-optic current sensor (GRT-294 – awarded to SCK CEN).

Under ongoing grants or those which came to an end in 2011, significant progress has been made on a number of fronts, in particular:

- A comprehensive software toolkit has been developed, for the first time incorporating a detailed and realistic ITER machine description, to evaluate the performance of the ITER magnetics diagnostic and to optimise its design with respect to the full scope of measurement requirements (GRT-047).
- Prototypes of the outer vessel discrete and external Rogowski coils, which will be the first diagnostic components to be supplied by F4E to ITER, have been comprehensively tested and found to closely approach ITER requirements (GRT-012).

DIAGNOSTICS:

- Signature of a PA encompassing six of the thirteen ITER Diagnostic systems under European procurement;
- Award of grants for development of several aspects of the magnetic diagnostic: In-Vessel discrete equilibrium sensors, Ex-Vessel inductive sensors and the fibre-optic current sensor;
- Award of a four-year Framework Partnership Agreement covering development of diagnostic Tokamak services: cables, conduits, feedthroughs and connectors for Diagnostics mounted in the ITER Vacuum Vessel and Cryostat.

Site, Buildings and Power Supplies

Site, Buildings and Power Supplies (485.67 kIUA)

F4E is responsible for the in-kind procurement of the site infrastructure and all the concrete and steel frame buildings (454.67 kIUA) broken down into:

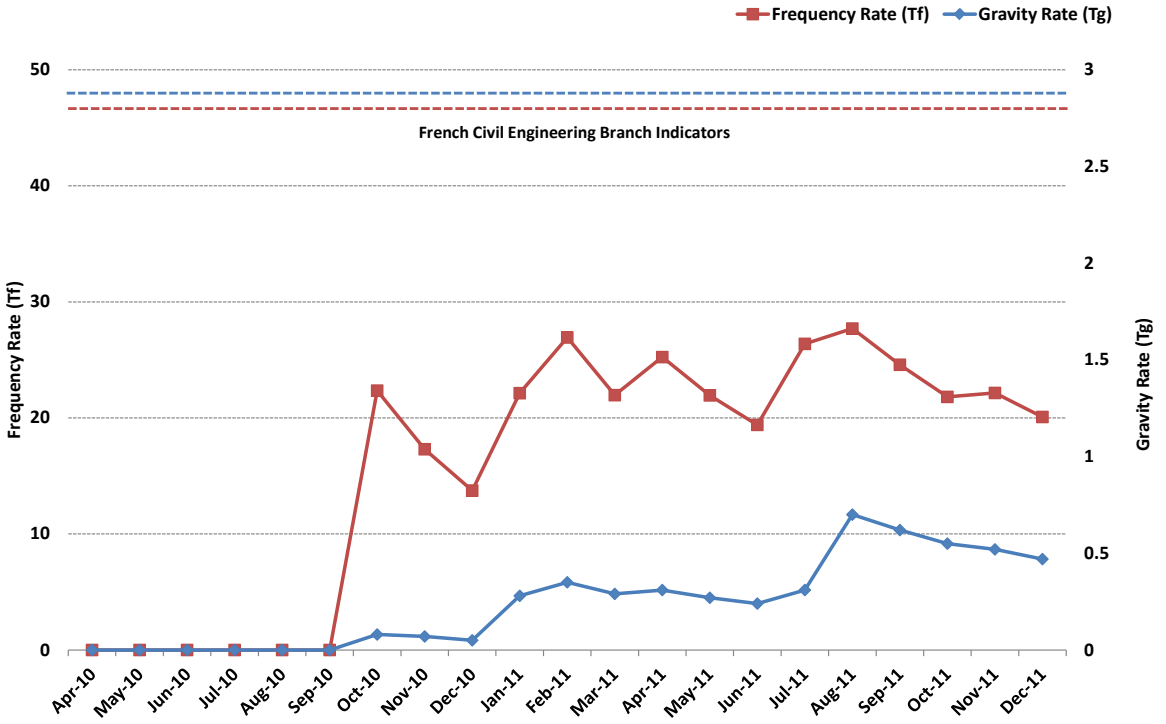
- PF Coil Winding Facility (12.8 kIUA)
- Architecture engineering services (53.63 kIUA)
- Tokamak excavation (31 kIUA)
- Supply of Anti-Seismic Bearings for Tokamak Complex (6.2 kIUA)
- Building construction (336.64 kIUA)
- Office buildings (14.4 kIUA)
- Power Supplies - pulsed power & steady state power supplies (31 kIUA)

In 2011 F4E activities for Site, Buildings and Power Supplies can be grouped into three main areas:

- Work on the Tokamak complex foundations and the PF coils building;
- Tender design delivery and call for tender packages progress by the Architect Engineer;
- Launch of the calls for tender for the Tokamak and surrounding buildings.

Health and safety indicators are evaluated on a monthly basis at the ITER site and the diagram below shows that both the Frequency Rate (number of accidents with lost working days / total working hours 1 000 000) as well as the Severity Rate (number of lost working days / total working hours x 1000) are well below the average rates in France for the civil engineering branch. In any event, the main objective of F4E on the ITER site is to have no accidents whatsoever.

Health and Safety Indicators at the ITER Construction Site (see legend)



ITER platform, September 2011 (courtesy of the ITER IO)

Work Progress and Main Achievements

The Tokamak pit excavation and support structure contract (OPE-095)
After the realisation of the Tokamak pit excavation in 2010, F4E completed the lower basemat. A 1.5m thick concrete slab of 10 000m^2 area has been poured in 15 plots. On top of the slab 493 plinths have been erected and 400 were poured by the end of the year.

Anti-Seismic Bearings contract (OPE-065) (bearings able to mitigate seismic effects on the Tokamak building)
300 Anti-Seismic Bearings out of 493 have been installed and controlled during the year.

The Design and Construction of the PF coils manufacturing building contract (OPE-026)
The PF coils manufacturing building is close to be completed by the end of 2011. The handover is foreseen to take place in February 2012. This contract has been managed within schedule and budget.

The Construction of the ITER IO Headquarters building arrangement with Agence ITER France (AIF)
The civil work of the ITER Headquarters building started in 2010 is close to be completed by the end of 2011. In the meantime, the other trades started in order to handover the building to ITER IO in July 2012.

A panoramic view of the Tokamak complex in late December 2011 showing the progress of the anti-seismic bearings

View of the four plinths with anti-seismic bearings on top

Design Progress Main Achievements

Architectural and Engineering Services contract (OPE-058)
The preliminary design delivered by the end of 2010 has been approved by ITER IO.

The tender design of all the ITER buildings has been delivered to the ITER IO and is under approval. The tender design has been delayed by several months due to unavailability of data.

Based on the tender design, the contractor (Engage), delivered technical tender packages to F4E. F4E launched three competitive dialogues in 2011:

- Tender batch 02: Tokamak Cargo Lift and Tokamak/Assembly Hall Cranes;
- Tender batch 03: Tokamak Complex Construction, surrounding buildings and heavy nuclear doors;
- Tender batch 04: HVAC, Electrical, I&C, Handling Equipment and Gas and Liquid Networks for Tokamak Complex and Surrounding Buildings.

In addition, the Engage supervision team has implemented the technical and contractual supervision of the Tender Batch 01 (Site Adaptation Works).

Internal view of the PF Coils building

ITER Headquarters Reception Building

Pouring concrete in the Tokamak complex at 5:00am, August 2011 (courtesy of the ITER IO)

Taking into consideration the revised layout resulting from the tender design, F4E has delivered an updated version of the construction permit files.

By end-2011, almost 400 people were employed in the on-site excavation and construction activities. Health and Safety management of the on-site activities is of paramount importance and no major injuries were recorded.

Overall, the Site, Buildings and Power Supplies activities were implemented as foreseen in the WP 2011 and in accordance with the Project Plan. Nevertheless due to delay on the delivery of data by the ITER IO some tasks foreseen by the end of 2011 have been postponed to 2012. The delay on input data, the changes in the ITER IO requirements, and the inaccuracy of some input data led also to maintain the full design team longer than expected, resulting in a cost increase of the design.

Power Supplies

In 2011, activities focused on the preparation for the procurement of the Pulsed Power electrical network and the Steady State electrical network, in particular:

- Direct support to PA preparation activities as requested by the ITER IO (finalisation of the technical requirements);
- Qualification of components with respect of operation under magnetic fields (contracted experts);
- Negotiation with the US Domestic Agency on the Steady State Electrical Network procurement sharing.

SITE, BUILDINGS AND POWER SUPPLIES:

- Achievement of the preliminary and tender design by the Architect Engineer;
- Preparation of the call for tender for the Tokamak and surrounding buildings tender batches 02, 03 and 04;
- Achievement of Tokamak Pit Excavation followed by the start of Ground Support Structure and plinths to support the Anti-Seismic Bearings;
- Production of 100% and installation of 50% of the anti-seismic bearings;
- Achievement of the design followed by the construction of the PF Coil manufacturing building;
- Enforcement of the global insurance and the decennial insurance for PF Coils building and for buildings not subject to mandatory decennial insurance;
- Award of several assistance contracts including additional technical expertise and legal and contractual support.

Test Blanket Modules (TBM)

An important activity of F4E concerns the Test Blanket Modules (TBMs) which are components that would allow the breeding of tritium in a fusion reactor. The TBMs are not among the items which are obliged to be provided by Europe to the ITER IO. Instead the TBMs are to be procured separately by the interested Parties and installed in ITER whereupon a TBM testing programme will be conducted by ITER.

The development of the European TBM Systems Conceptual Design (GRT-09) has progressed in 2011 with the finalisation of the first detailed version of Design Description Documents (DDD) and CAD models for the TBMs and their ancillary systems, the consolidation of space reservation in the ITER building and the identification of key technical interfaces with ITER. The first version of the TBM Systems Preliminary Safety Reports has been issued after review by a specialised company in nuclear area (OPE-017-4.1). Two service contracts (OPE-02-01.04 and OPE-17-1.12) have allowed more analysis of detailed engineering aspects like the neutron/gamma shielding and dose rate in the TBM Port Cell and the review of welds design in the TBM structure according to Codes and Standards.

A grant has been awarded (GRT-288) for studying alternative TBM design options aimed at reducing the amount of ferromagnetic materials in the ITER (and subsequently the induced TF ripple). It has already allowed the identification of critical issues in some of the back-up options which is an important input for refining technical risk plans.

The upgrade of the European Breeder Blanket Test Facility in ENEA/Brasimone, Italy, has been achieved with the installation of a new Helium turbo-circulator (procured under EFDA-06-1912) featuring a technology relevant to an operation in ITER environment (tritium compatibility) and with the implementation of a new Data Acquisition and Control System (GRT-044) ensuring a full and integrated operability of the Helium and the PbLi loops. The facility is now ready for TBM relevant tests at full scale.

Similarly, the commissioning of the HELOKA facility, KIT/Karlsruhe, with a similar Helium turbo-circulator technology has been successfully achieved (EFDA TW5-TTB-001).

Other activities in the area of development/ characterisation of TBM functional materials have progressed satisfactorily (GRT-030): A detailed development plan for functional materials has been elaborated, an alternative route for beryllium pebbles production has been identified and a large part of the Post Irradiation Examination of beryllium materials from the HIDOBE-01 irradiation campaign has been achieved.

A grant was awarded for the development of tritium cycle modelling capabilities and preliminary design of the tritium accountancy system (TAS) (GRT-254).First results on the TAS design were achieved with the selection of a dynamic configuration (mass flow-rate plus ionisation chamber) for all the TBS ancillary loops interfacing with the ITER Tritium Processing System except for HCLL-TRS where a static configuration (PVT-c method) was suggested.

Left: European Breeder Blanket Test Facility (EBBTF) at ENEA/ Brasimone (Italy) and its new Helium turbo circulator able to reach TBM full-scale prototype testing

Right: HELOKA facility at KIT/Karlsruhe (Germany) - view of the test section area

TEST BLANKET MODULES:

- Completion of three grants for (i) the development of the conceptual design of the Test Blanket Module (TBM) Systems, (ii) the establishment of a development plan for functional materials and (iii) the upgrade of the European Breeder Blanket Test Facility (EBBTF) at ENEA/Brasimone (Italy);
- Implementation of a service contract for the review of the TBM welds design with respect to Nuclear Codes and Standards;
- Award of a contract for the supply of feasibility mock-ups of TBM box structures and the establishment of preliminary welding procedure specifications according to Codes and Standards;
- Award of a grant action for the study of alternative TBM design options aimed at reducing the amount of ferromagnetic materials in ITER;
- Award of a grant action for the tritium migration modelling and conceptual design of the Tritium Accountancy Systems for the European TBM Systems;

- Signature of three specific contracts for (i) the improvement of TBMs neutron shielding and evaluation of dose rates in the TBMs Port Cell; (ii) seismic analyses of the TBM Systems in ITER and (iii) Electromagnetic analyses of the TBMs;
- Launch of a call for tender for an engineering framework contract for the Supply of engineering services in the area of TBM Systems design and technological demonstration;
- Launch of a call for proposals for a framework partnership agreement on R&D experimental activities in support of the conceptual and preliminary design of the European TBM Systems.

Technical Support Activities

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:

- Plasma Engineering;
- Safety and Licensing;
- Engineering Support;
- Nuclear Data;
- Quality Assurance.

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 2011, 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 laboratory conditions and enhanced (housing, electronics and cables). They have been installed in ASDEX UG and will be tested in a Tokamak environment in early 2012. In addition, the design of a Divertor Erosion Monitor system, based on the Speckle interferometry technique, has been further developed. Finally, an existing facility has been enhanced for testing a possible measurement of In-Vessel "Hot Dust" by injecting small amount of steam in the vessel.

A new contract (OPE-347) was launched in support to the ITER strategy for In-Vessel tritium inventory control.

Two other new contracts on "Fusion Component Failure Rate Database" (OPE-79) and on "Busbar Arcing" (GRT-273) were launched in order to provide ITER with relevant information for component design.

Finally, a call for proposals for "In-Vessel Hydrogen/ Dust Explosion" aiming at studying and characterising the specific behaviour of Beryllium-like dust was issued.

ITER Licensing Process – F4E Nuclear Safety Follow Up of EU PAs

Important milestones for the ITER licensing process have been achieved in 2011. The milestones included "Arrêté Prefectoral EP", the "enquête publique" and the "Instruction of RPrS by Groupe Permanent". On a more specific level the first ASN in-situ inspections took place on the construction of the Tokamak building and the installation of the anti-seismic bearings.

F4E has defined and formalised the process in order to follow up on the safety requirements ("Safety Arrangements Follow-Up" and "F4E Supervision Plan" instruction documents).

A training course on Nuclear Safety and the French Order of 10 August 1984 has been given to 85 F4E technical and management staff.

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 of SIC components.

Throughout 2011 a call for tender has been issued for the procurement of Nuclear Safety Analysis Support on F4E PAs. The contract will be awarded beginning of 2012.

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 or Design Work Orders), as well as to the F4E procurement contracts.

As far as the direct support to the ITER IO is concerned, in 2011 the final report on the Structural Design Criteria for In-Vessel Components (SDC-IC) was delivered on time to the ITER IO which recognised the excellent quality of the work performed.

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) about 15 Task Orders were placed and followed-up in 2011. Among the various engineering analysis studies commissioned to European industries it is worth mentioning those in support to the Vacuum Vessel manufacturing and to the blanket and manifolds Preliminary Design Report activities.

Moreover, support to the Architect Engineer and, closely linked to it, to the ITER IO 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.

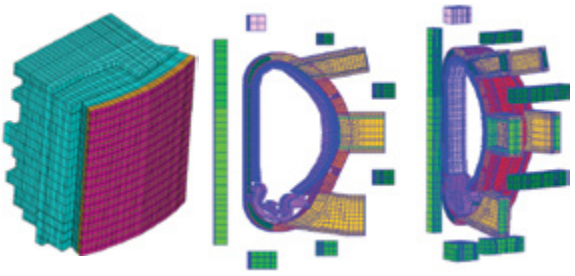
In addition, resources were devoted to the follow-up of the EDIPO project which aims to build a 12.5T superconducting magnet by Babcock-Noell and to install and commission it at CRPP-PSI by the end of 2011.

Lastly, the manufacturing contract of the EDIPO magnet with BNG was successfully completed by the delivery of the magnet to CRPP-PSI on 13 May 2011. Following the delivery, the CRPP team has proceeded with the installation work which came to a halt on 4 December 2011 due to the highest priority given to the ITER IO samples test campaigns by CRPP personnel.

A Framework Partnership Agreement (FPA-168) was prepared and awarded to the European Consortium on Nuclear Data Development to update and improve the Nuclear Data libraries relevant for fusion experiments (four-year programme). In parallel, a number of associations kept working in two experimental fields: the validation of the above mentioned libraries, and the development and testing of the experimental techniques required for nuclear data measurements in ITER.

Materials and Fabrication

The 2011 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 series production stages of various EU-ITER subsystems. Five contracts were signed for the assessments of corrosion data to support qualification of In-Vessel and Vacuum Vessel materials (GRT-243, GRT-268, OPE-244, OPE-318 and OPE-338). Two Framework Contracts were signed to support characterisation and validation of materials included in the supply of different ITER components (OPE-084 and



Left: Half Blanket Shield and First Wall model for module 12. Right: Electromagnetic model of the Vacuum Vessel

OFC-167) and one task order on cryogenic material testing was conducted to support the Series Production of TF-Conductor and Pre-Qualification of TF-Coil Case Closure Welding. One contract OPE-160 was launched to follow up on tube joining processes for the Divertor.

The on-demand support to the F4E-ITER department on material and fabrication related issues increased with various technical topics. 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 30 tasks during 2011. Additionally, support was provided to the In-Vessel and Magnets Teams to realise launching and implementation of contracts aimed at characterisation and assessment of materials data.

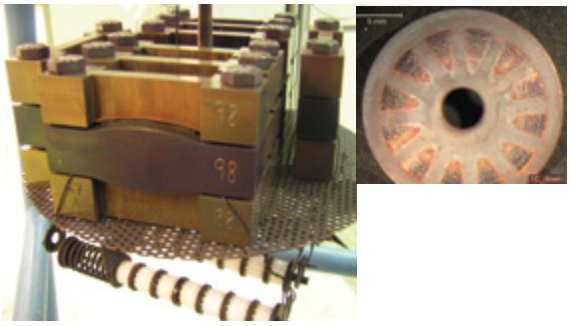
Instrumentation and Control - CODAC

In 2011, the F4E CODAC team's procurement strategy reached a stable definition. The F4E CODAC group is supporting the implementation of all bespoke Instrumentation and Control (I&C) components by providing a set of standard services to the F4E Project Teams.

This strategy hinges on the selection of an integrator which will design and test all these components (a framework contract will be awarded in 2012), and on a set of hardware supply contracts aimed at producing fully ITER compliant and integrated I&C cubicles.

The strategy was initially developed as a means to address risks associated with scattering the development of ITER custom interfaces and complex scientific systems among many contractors. At the same time, the ITER IO requested a much more uniform and standardised development of these systems in order to minimise integration risks.

Over the same period of time, the F4E CODAC team has placed a framework contract for the supply of support services in the I&C area. This contract is meant to provide support to the F4E CODAC team



Left: the Crevice Bent Beam (CBB) and crevice corrosion test assembly at Studsvik. Right: an image of 316(N)-IG after long time exposure under ITER relevant conditions revealing little sensitivity to crevice corrosion with minor surface effects.

in their collaboration with the various Project Teams. In the longer term the contract will be the main tool for the preparation and management of integrator specific contracts.

Plasma Engineering

F4E activities are mostly carried out on the basis of competitive ITAs, i.e. awarded, as the result of competition between Domestic Agencies. In 2011, F4E was awarded three ITAs. These ITAs cover different areas of the ITER design:

- ITA C19TD46FE deals with the edge MHD stability and the uncontrolled ELM energy losses for ITER H-mode plasmas;
- ITA C19TD49FE has a broad scope regarding the engineering optimisation of the ITER scenarios and the analysis of the magnetic control system;
- ITA TA-I&C IPT-EU-01 deals with the design of the Plasma Control System (PCS) of ITER.

To implement existing and new ITAs, F4E awarded in 2011: five grants (GRT-265, GRT-267, GRT-315, GRT-334, and GRT-346), two procurement contracts (OPE-148, OPE-349) and one task order (OPE-06-11).

In addition to the new activities, work has continued on grants and contracts issued before 2011: GRT-017, GRT-055 and GRT-255 and one procurement contract: OPE-258. The implementation of the above grants and contracts involves several European fusion laboratories (CEA, ENEA, CCFE, FZJ, Austrian Association, CRPP and IPP).

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

Other activities in the area of plasma engineering in 2011 included:

- Studies of the impact on operational space of the proposed performance reduction of the CS coil, in support to the EU members of STAC;
- Support to the I&C IPT for the initial design of the ITER Plasma Control System.

Some activities foreseen in WP 2011 were cancelled because the related ITAs were not issued by the ITER IO and other activities were postponed due budget constraints of the ITER IO. In general, the WP implementation for plasma engineering activities is dependent on ITAs being issued as foreseen by the ITER IO.

Project Management and Scheduling Activities

During 2011, F4E has carried out extensive activities covering multiple areas such as scheduling, configuration control, quality assurance and project management, including risk and monitoring tasks.

As far as planning activities are concerned, F4E has contributed to the establishment of a new scheduling approach to be used by the ITER IO to follow-up the activities in the DAs and also to assess their performance. The Detailed WBS Schedules (DWS), to be provided for each procurement at the beginning of each month by the DAs and the ITER IO, are now the basis for measuring project performance. Key milestones are being agreed and extracted to be part of a so-called Strategic Management Plan (SMP) that will be closely monitored by the ITER IO and DAs management. At the 9th ITER Council in November 2011 the latest developments of the ITER schedule were presented and it was noted that the new estimated first plasma date of November 2020 is within the baseline approved in July 2010.

A thorough identification of the risks associated with each EU procurement started in 2011 and the first results have been provided in the 2011 Project Plan. The work is still in progress and, once completed, it will allow having risk logs and therefore a monitoring of both risks and recommended mitigation actions.

Work on export control has progressed. F4E is actively participating to the ITER Export Control Working Group established by the ITER Council. A first analysis was carried out by F4E on the components under its responsibility and issued a draft of the possible dual-use

items. This list is updated based on feedback received from the F4E technical officers and F4E suppliers. An F4E internal process is being developed as well as a specific tool to manage and track the export control activities. In addition, training sessions to F4E staff have been provided to inform on rules and processes. Since October 2011 F4E is enrolled in the Spanish Dual Use Register.

In the area of Quality Assurance (QA), quality officers have supported the Project Teams in their activities devoted to their in-kind procurements and R&D activities. This way it is assured that the work is carried out according to the quality standards required by the project. Audits have been carried out in both laboratories and industries. A contract has been awarded for the provision of QA inspection services to control the manufacturing of the EU components.

The award of the joint procurement between the ITER IO and F4E to manage components transportation with associated insurance and logistic organisation is being finalised. Test convoys are foreseen in 2012.

TECHNICAL SUPPORT ACTIVITIES:

- Award of a framework contract to support the characterisation of magnets materials;
- Plasma engineering: Successful competition of three new ITAs, award of seven new grants/ contracts for task agreements implementation.

Risk Management

Risk Management at F4E is addressed at two different levels: Corporate and Project. Project Risk management implementation started in 2011 while Corporate Risk Management is an objective of F4E to be implemented in 2012.

Project Risk Management (PRM) covers three main aspects (i) the analysis of event risks, (ii) the risk assessments for in-kind procurements and (iii) the schedule uncertainty analysis. This work has been carried out via in-house analysis, external contracts and feedback from the suppliers (whenever a manufacturing contract was in place).

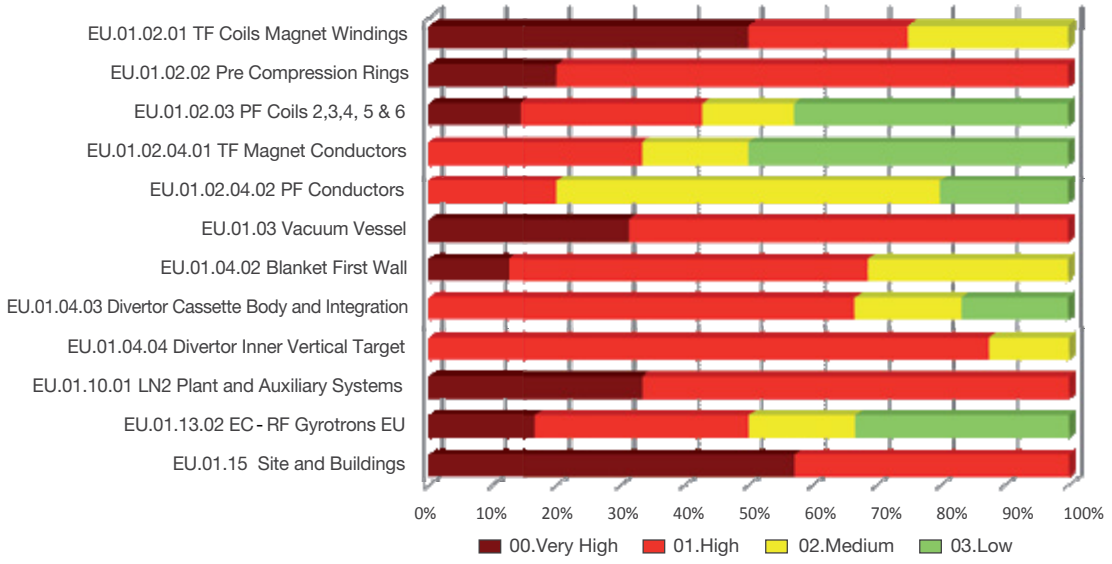
The PRM analysis has concentrated on the components on the critical path which are considered to be a priority for F4E. During 2011, 12 PAs have been subject to PRM and coverage to all EU PAs is expected to be completed during 2012. Under F4E's PRM, the risk level ranking in order to define the priorities of the risk events is the following:

The distribution of the risk level per PA in percentage (with comparison current situation and residual risk level) is shown hereafter. Most of the events categorised as High and Very High have a mitigation plan that reduces the residual risk to an acceptable level. The following charts show the outcome of the PRM process for the 12 PAs that have been treated.

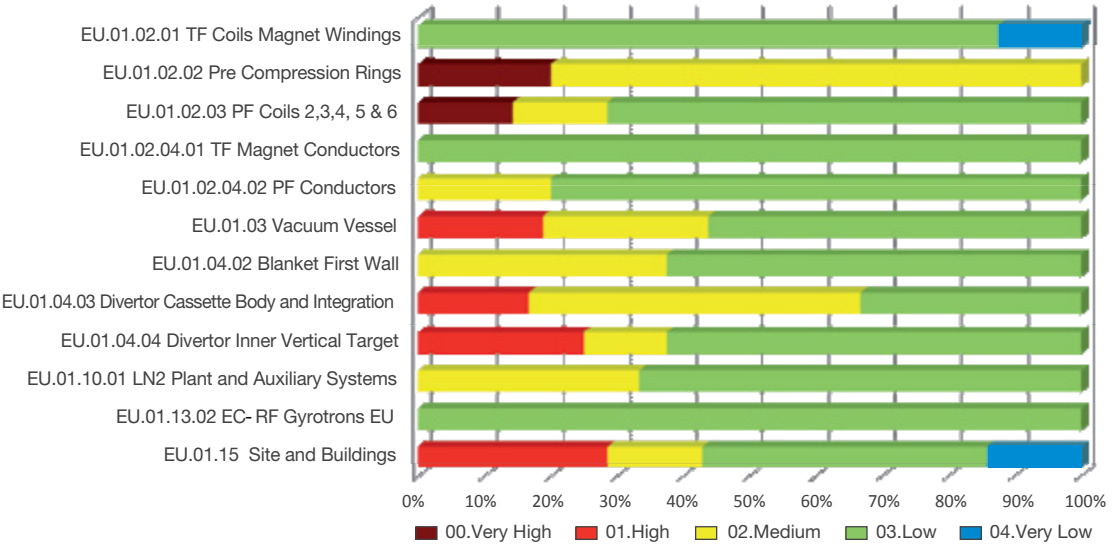
F4E's strategy to manage risks is to decrease the risk level of the event by using a mitigation plan. This is the reason why the following pie-chart of the type of risk response used (reduce, accept, transfer or avoid) shows only 5% of the risk events as being accepted. The small percentage of accepted risks and the associated PAs are expanded on the right-hand side of the diagram.

Level	Actions
VERY LOW	They are included in the risk file and reviewed by the Work Package Manager concerned. Actions are evaluated in order to reduce the risk.
LOW	They are included in the risk file and reviewed by the Work Package Manager concerned. Actions are evaluated in order to reduce the risk.
MEDIUM	An owner is appointed to monitor the risk evolution and report to the Work Package Manager concerned. Actions are evaluated in order to reduce the risk.
HIGH	Same as the MEDIUM level but also with definition of specific mitigation actions. These actions are defined by the Work Package Manager concerned with the risk, which identifies also possible trigger events to start them. The owner monitors the risks and these trigger events.
VERY HIGH	Planned mitigation actions are started as scheduled. The risk owner is designated directly by the Project Manager, who closely monitors the effectiveness of the mitigation actions at each project review meeting

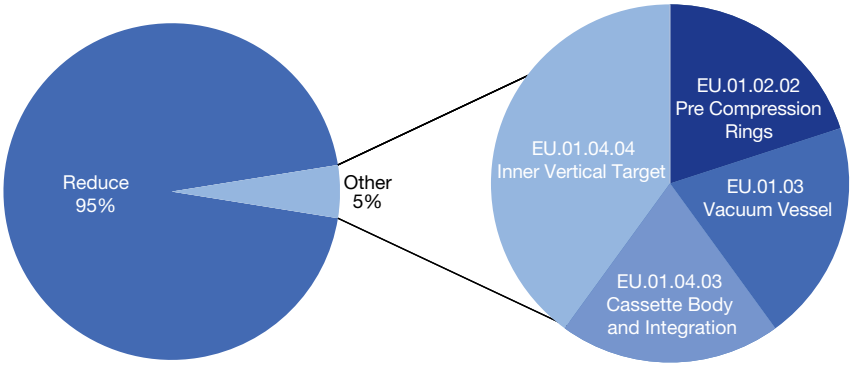
Current situation risk level distribution per PA (December 2011)



Residual risk level distribution per PA (December 2011)



Tendency of the handling strategy (reduce, accept, transfer or avoid)



Broader Approach

Satellite Tokamak Programme

The Satellite Tokamak Programme during 2011 is surely marked by the Great Eastern Japan Earthquake which struck heavily also in the Naka area on the 11 March 2011.

The message of Dr Ishida at the 12th Technical Coordination Meeting held briefly after the event read as follows:

"On 11 March, 2011, the great earthquake struck the east Japan. We would like to express our heartfelt sympathy for those affected by this massive quake and tsunami.

We, however, are all safe, and did not see serious damages by the earthquake on the facilities and equipment to be utilised for JT-60SA from their appearances, nor did we suffer from the tsunami at the Naka site. Although having been temporarily closed due to limited damages (e.g. on the water supplies) by the earthquake, the institute already resumed regular working hours, and detailed inspection and restoration for JT-60SA were launched. We are now making our best efforts to get things back to normal as soon as possible."

Shinichi Ishida

Project Leader of the Satellite Tokamak Project

The year 2011 marked, as far as Europe is concerned, the passage from design phase to construction and an acceleration of the pace of the project.

Activities progressed in the time-critical area of the Toroidal Field (TF) coils manufacturing with the production of strand and conductor starting and the contracts for the TF coil manufacturing being launched.

The vast majority of the Procurement Arrangements (PAs), covering 75% of the total EU share of JT-60SA, were signed by the end of 2011, and a number of critical issues were solved in terms of procurement sharing.

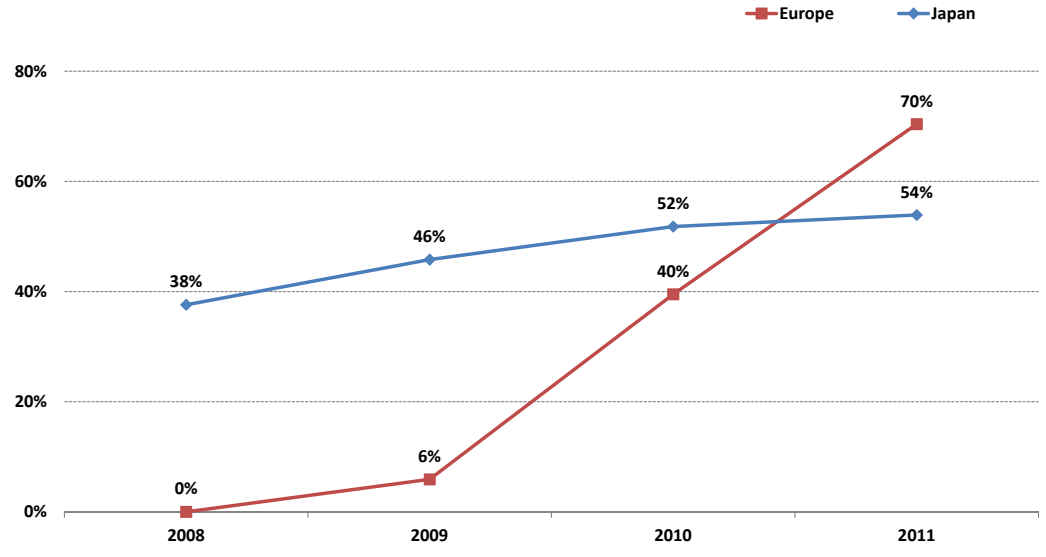
Main Achievements

The design of the Satellite Tokamak (JT-60SA) has reached a mature and stable status and this is described in detail in the Plant Integration Document (PID) and in a number of presentations and articles.

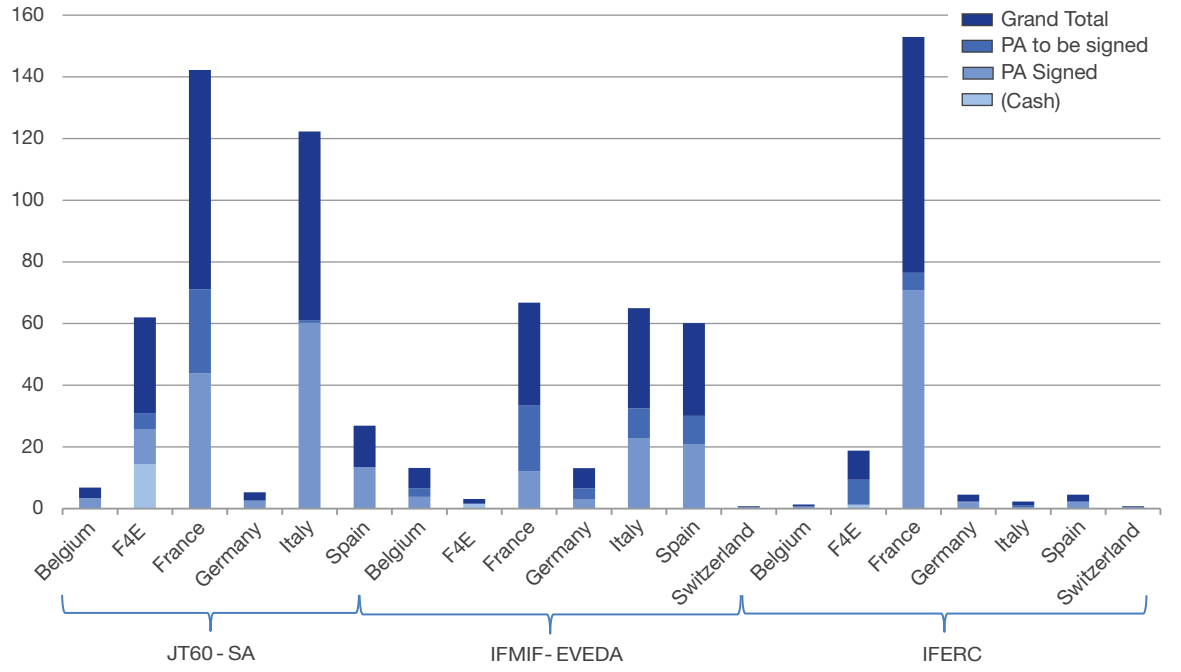
The definition of technical specifications and administrative provisions has been successfully completed with the signature of the majority of the PAs (75% in value) including all the time-critical ones.

In 2011, the European contribution to JT-60SA entered into the most interesting and critical phase of construction of the TF coils, which are on the project critical path.

Broader Approach Procurement Arrangements (% of Total Concluded)



Status of Procurement Arrangements by Voluntary Contributor (EUR million - escalated to 2011 values)

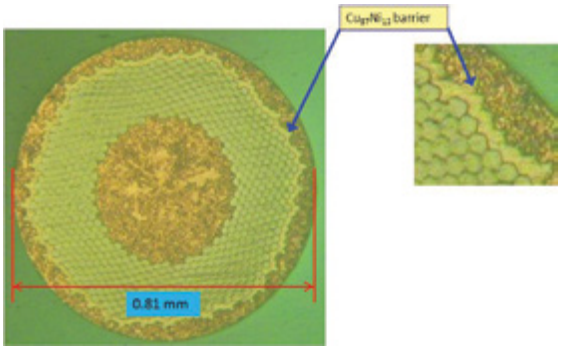


Toroidal Field (TF) Coils

Europe is committed to provide the full TF magnets system. For this purpose, F4E is procuring 27km of TF conductor, a cable-in-conduit type conductor with 486 strands (2/3 NbTi - 1/3 copper) embedded in a rectangular stainless steel jacket. The procurement is split into two main contracts, one for the production of the NbTi strand and one for the strand processing into the TF conductor by cabling and jacketing operations. The NbTi and copper strand supplier qualified the production processes in the beginning of 2011 and the first superconducting strand was delivered to the conductor supplier (ICAS, Italy). By December 2011 the first unit lengths of conductor have been produced allowing the set-up of the cabling and jacketing lines. The qualification is expected to be completed in April 2012. Then the mass production of conductor will start, presently on schedule with the needs of the TF coils suppliers.

CEA and ENEA, early in 2011, completed the TF technical specifications and launched the calls for tenders for the supply of the TF coils. The two contracts were placed 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. Its delivery is expected in November 2012.

By the end of 2011 ENEA completed the technical specification of the TF coils casing and started the tender. The contract is expected to be signed in April 2012.



JT-60SA Niobium Titanium Strand Cross-Section with detail of CubroNickel barrier

TF Conductor Cabling Line - new machines for final cabling stage

Left: Superconducting cable - final cabling; Right: TF Conductor - jacketing line

Superconducting cable - external appearance of cable produced for tests at the Sultan facility

CEA progressed with the qualification activities for the Outer Intercoil Structures and Gravity Support, which advanced well in the second half of 2011 and is expected to be completed in March 2012. In December 2011, CEA started the call for tender for these components.

TF Coil Test

The TF coils are foreseen to be tested prior to the shipment to Japan. For this purpose the creation of a specific facility (the TF Coil Test Facility) is underway, to which France and Belgium are committed to contribute.

The signature of the PA for the "Setup of the Cryogenic Test Facility and the Performance of the Tests of the TF Coils" took place in December 2011.

During 2011, a CEA-internal design review approved the cryogenic concept of the test facility. The concept is based on a cryogenic circulator to supply the TF winding and casing with supercritical helium and hence make circulation independent from the cold end of the refrigerator. The facility will use high temperature superconducting current leads to connect the warm and cold busbars. Some tests have been performed after modifying the existing refrigerator to ensure that the plant has enough capacity to supply helium with a temperature of 50K for the current leads. In 2011 CEA refurbished the testing area and started relocation of the helium refrigerator.

Design of the valve box, which will connect the refrigerator with the test Cryostat, was finalised by CEA. The interfaces between the valve box, the Cryostat, the power supply and the helium refrigerator were fixed.

The Belgian Voluntary Contributor (ACM) has continued manufacturing the Cryostat. Integration of the thermal shields was started and most of the interfaces were finished by the end of 2011. Structural analyses by CEA and industry indicated that tight closure of the Cryostat cover requires several strong bolts to fix the two mating flanges. The procedure for the final acceptance test has been drafted and is being reviewed by CEA and F4E. Acceptance tests will include leak tests of the Cryostat Vessel and the helium circuits, handling tests, and dimensional control of the Cryostat before and after evacuation. The test frames which will support the coils during the cryogenic tests, and which will also be used for unloading and loading of the coils, will undergo a load test. Delivery of the Cryostat by boat from Liege to Paris and further to CEA by truck is now planned for May 2012.

Detailed design of the valve box vessel was continued, and manufacture of the vessel body has started. Delivery of the vessel to CEA for integration is planned for August 2012.

High Temperature Superconducting – Current Leads

Work for the High Temperature Superconducting (HTS) - Current Leads (CLs) manufacture is proceeding as planned. The HTS CLs interfaces were agreed in March 2011. The delivery of all required HTS material was finished by autumn 2011. Each HTS stack has been tested and meets the specified requirements.

The procurement of other raw materials for the fabrication of the current leads has started. The design of the heat exchanger, which is a pressure vessel, is being 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.

Cryostat Base Manufacturing - advanced stage of radial legs preparation

At KIT a dedicated test facility is being set up which allows testing of pairs of the JT-60SA HTS CLs. This test facility essentially comprises a test Cryostat with a thermal shroud, connections to the power supplies, to the helium supply, and to the data acquisition system.

JT-60SA Power Supply Systems

The European contribution for the JT-60SA Power Supply (PS) Systems includes the PS System for the TF 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 CS1-4 modules 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.

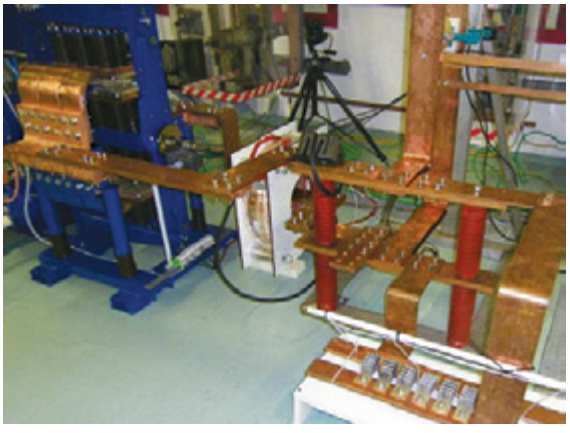
The following general interface issues have been defined:

- Recovery sequence in case of fault;
- Voltage and duration of factory and on-site high voltage tests vs. ground tests;
- Coil current scenarios to be used for the thermal design of the SCMPS, taking into account the flexibility required by the possible JT-60SA plasma scenarios and the possibility of optimising the SCMPS design;
- Interface between the PS System and central control of JT-60SA based on reflective memory;
- General conditions and rules for the on-site installation work to be performed by the PS suppliers.

(1) Quench Protection Circuit
The contractual activities started in December 2010, and the detailed design phase finished in July 2011 with the approval of the First Design Report. This report concluded that the Quench Protection Circuit (QPC) design had been worked out fulfilling the required ratings with considerable safety margins and assuring high reliability of the system even in anomalous conditions. During the design phase particular attention was paid to the study of the possibility of reducing as much as possible the maximum reapplied voltage to the TFC in case of QPC operation even in transient conditions still fulfilling the maximum I_2t requirement in case of quench resulting from the magnet design. This has been obtained by reducing the discharge resistor value and exploiting the thermal effect on the discharge resistor to remain inside the maximum I_2t requirement. The contractual activities proceeded according to schedule during 2011 and the type tests on the prototype of two components of the QPC (the Pyrobreaker and the By-Pass Switch) were successfully completed on June and December 2011 respectively.

(2) Switching Network Units
The Switching Network Units (SNU) PA was signed in December 2010. During 2011 the SNU PA Annex B was amended eliminating some unnecessary routine tests to be performed on the discharge resistors, and the QA documents required by the PA have been prepared. The call for tender is expected to be issued in February 2012, and the contract signature is expected in July 2012.

(3) Superconducting Magnets Power Supplies
The Superconducting Magnets Power Supplies (SCMPS) PA has been signed in February 2011. During 2011 the SCMPS PA Annex B has been amended with minor modifications, in particular related to thyristor temperature margins and to reference current scenarios to be used for the thermal design of converters, and the new version is currently under formal review and approval process in DMS. The QA documents required by the PA have been prepared and they are presently under formal review and approval process. During 2011, two different technical specifications to be used for call for tender have been prepared by CEA and ENEA for the respective procurements. The technical specifications have been discussed and the CEA ones were agreed during DRM-MPS07 in September 2011. The ENEA technical specifications were agreed during DRM-MPS08 in November 2011, after the agreement on the reference current scenarios to be used for the thermal design of converters. The call for tender procedure has been started by CEA in May 2011, with a call for interest identifying a list of interested and qualified suppliers, followed by the official call for tender issued in December 2011. The CEA contract signature is expected in July 2012. Similarly, the call for tender procedure has been started by ENEA in



QPC - Test of the By-pass switch prototype at RFX (Padova, Italy)

November 2011, selecting a number of interested and qualified suppliers. The official ENEA call for tender is expected to be issued in February 2012, and the contract signature is expected in December 2012.

(4) Resistive Wall Mode Power Supplies
During 2011 the design of the Resistive Wall Mode (RWM) control coils has been changed moving the position from external to internal with respect to stabilising plates and reducing the number of turns. Following this modification, joint work between JAEA and Consorzio RFX has been carried out to characterise the load electrical parameters and coil efficiency in producing the magnetic field by means of Finite Element Method analyses, to update the main RWM Power Supplies (PS) requirements resulting from the new coil design, and to agree a draft schematic of the overall RWM control system. The main requirements for RWM PS were discussed and agreed during the Technical Coordination Meeting in December 2011.

Cryostat

The procurement of the cryostat for JT-60SA is now subdivided into four PAs: 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.

(1) Cryostat Base
Felguera Construcciones Mecanicas (FCM), the company originally contracted by CIEMAT to manufacture the Cryostat base, decided in November 2010 to reduce its workforce and pass the contract to a former competitor, IDESA. CIEMAT received a formal technical proposal from IDESA at the end of December 2010 and the transfer of the contract was legally secured at the beginning of February 2011. All material ordered and drawings prepared by FCM previously were transferred to IDESA. Following a period of further preparation by IDESA, a second contract kick-off meeting was held in March 2011 between IDESA, F4E and CIEMAT.

The procurement of Cryostat Base Material was completed in May 2011 when the last SS304 low cobalt plate arrived in Spain, following the correction of a number of non-conformities by Outokumpu. Water jet cutting of the material began on May 2011. IDESA made a number of changes to the proposed fabrication sequence and a baseline manufacturing schedule was agreed between IDESA, CIEMAT and F4E in July 2011.

Manufacturing progress was initially slow, but was better during September – November with welding proceeding in two shifts. During the welding phase the Cryostat base is well suited to parallel work once each first-of-a-kind operation has been completed successfully. Deformations due to welding have been small thanks to the processes chosen.

CIEMAT was successful in securing their first choice of subcontractors for the final machining and trial assembly of the components: ASTURFEITO is both well equipped with large-capacity machines and conveniently located very close to IDESA and to the port of Aviles. The machining of the first sectors will begin in February 2012. The final geometric inspection of the Cryostat base is planned to take place at ASTURFEITO premises in October 2012, from where it will be collected by F4E.

In 2011 F4E visited the ports of Aviles in Spain and Hitachi in Japan, and in February 2012 they will tender for the transportation of the Cryostat Base to Hitachi. Transport to the port in Aviles is particularly straightforward due to the proximity of the manufacturer (<1km), while transport from Hitachi port to Naka, which is the responsibility of JAEA, has already been studied and two possible routes identified. Delivery to Naka is expected in December 2012.

TF Coil Test Facility Cryostat under construction - closure lid (left) and cryostat tank (right)

(2) Cryostat Vessel Body
The PA for the Cryostat Vessel Body (CVB) was reorganised and a new agreement was reached between F4E/CIEMAT and JAEA which was based on a revised sharing of the scope. Broadly, JAEA will provide the full set of plates necessary for the construction and will fabricate the top lid, while F4E/CIEMAT will fabricate the CVB (including all penetration and flanges), with the exception of the above-mentioned top lid. As a consequence, two PAs (CVB Cylindrical Section Fabrication (EU), CVB Materials (JA)) were prepared in 2011. The PA for Cryostat Top Lid (JA) will be prepared a few years later.

A design review meeting for the CVB was held in February 2011. The PA for the fabrication of the CVB Cylindrical Section (CS) by CIEMAT, under an Agreement of Collaboration with F4E, was signed on 25 July 2011. CIEMAT has now started preparing to tender for the manufacture of the CVBCS, the drawings and technical specification having been reviewed by JAEA and F4E. The call for tender was delayed slightly due to the change of government in Spain during which such activities were halted. It is hoped that the contract can be placed in time for the delivery of the CVBCS material by JAEA in June 2012. F4E remains responsible for the eventual transport of the CVBCS to Naka. There is currently substantial margin for the final delivery of the CVBCS to Naka in the overall project plan.

The detailed specification of the CVB material was finalised by JAEA. The material is 304 stainless steel with low cobalt content (less than 0.05wt%). The relative magnetic permeability is less than 1.1. F4E/CIEMAT and JAEA agreed on the size and quantity of 304 stainless steel plates. The CVB Material PA entered into force in July 2011. JAEA awarded Outokumpu K.K. the contract for the material (SUS304 with low cobalt content) in October 2011.

Cryoplant

The technical and procurement preparation activities proceeded in 2011. A "competitive dialogue" was started by CEA in July 2011. Following the first offers from the two interested companies, at the end of November 2011 formal discussions were held by CEA with the bidders to discuss open issues and to give guidelines for the preparation of the second offers. The final offers which are expected in March 2012, the interfaces with the buildings and the utility requirements, will be fixed and the PA together with its Annex B will be finalised.

General issues related to on-site work and to transportation from the Japanese port of entry to the final destination were regularly discussed by a panel of members from the Project Team, and the Japanese and European Home Teams.

Key Performance Indicators

The key performance indicators are those indicated in the F4E 2012 Corporate Objectives – Annex 1 in the section 'Meeting European Obligations under the Broader Approach Agreement'.

With regard to the main quantitative indicator, that is the signature of PAs, about 75% in value have been signed by the end of 2011, with the remaining share largely allocated to the TF coils test facility (actually concluded in January 2012) and the Cryogenic System in an advanced state of definition.

The progress has been performed with the continuous mutual support between F4E and the EU Voluntary Contributors (VC). This is reflected in the good level of technical integration between F4E and the laboratories entrusted by the EU VC to provide the in-kind contribution, in the substantial respect of the EU VC budgetary constraints, and in the clear relationships and roles in the management of contracted activities.

F4E is progressing on time in the execution of the contracts for the manufacturing of strand and conductor and is preparing for the transport contracts necessary to deliver JT-60SA components to Japan.

IFMIF/EVEDA Programme

The progress in the IFMIF/EVEDA project was influenced by three major events and decisions:

(1) The BA Steering Committee (BASC) approved, in December 2010, a rescoping of the project which had the following consequences:

- A priorisation process was implemented by which the highest priority was given to the Accelerator Prototype. With support of the key accelerator expert seconded from CEA Saclay to Garching, F4E has taken direct responsibility for its design and manufacturing, and then to its installation, checkout and commissioning at Rokkasho by managing a (sub-) project called LIPAc (Linear IFMIF Prototype Accelerator).

- The LIPAc part of the Engineering Validation activities is now following an extended schedule foreseeing activities till the end of the BA agreement by 2017.

- While IFMIF Engineering Design Activities was reduced, the European work in this field was re-organised as a (sub-)project managed by the European institutes to ensure the issuing of an Intermediate IFMIF Engineering Design Report in June 2013.

(2) The East Japan Earthquake on 11 March 2011 caused damage to the Experimental Lithium Test Loop and stopped the experimental programme for recovering the facilities. The actual time shift is estimated to be 16 months which prevented also the shipping of the European sensors for impurity and cavitation monitoring.

(3) The Project Leader left the project for personal reasons in July 2011. An Interim Project Leader was nominated and the process to find new leader was started with an open position published by F4E. The Interim Project Leader restructured the Project Team to reflect more an integrated approach to the accelerator prototype and the engineering design activities.

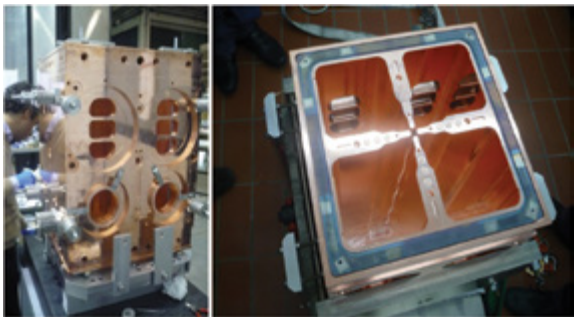
Main Achievements

The LIPAc Accelerator

The design of the LIPAc accelerator is described and managed in a Plant Integration Document (PID). At F4E, an European CAD platform has been established that has taken charge of the complete digital mock-up and design integration for the LIPAc accelerator. Similarly, an Interface Management System was set up there to manage the definition and the design of the interfaces through a web-based system. Technical issues with respect to the licensing process for cryogenic components have been sorted out involving the implementing agencies and the technical officers at the institutes.

After initial operation in pulsed mode, the Injector at CEA Saclay produced the first continuous beam (extracted from hydrogen plasma) in September 2011. The initial beam intensity of 40 mA extracted at 60 keV was increased to over 150 mA at 100 keV (target: 140mA) in pulsed mode.

The procurement of Radiofrequency Quadrupole (RFQ) by INFN, Legnaro, is composed of a low energy, a medium energy and a high energy Supermodule (SM). The modules for the high energy SM are in production, the 16th module has already been machined, characterised and brazed, the entire set of modules is expected in June 2012. The results of the first technological prototype (first brazing in horizontal position) showed that the average vane displacement which is the critical performance criterion was lower than the acceptance criteria (56 μm versus 100 μm). For the 16th module, which was brazed in an Italian industry in vertical direction, preliminary RF and dimensional measurements are even more promising as with typical deviations are apparently considerably smaller than in the prototype.



The 16th module (before and after vertical brazing) forming part of the high energy supermodule of the RFQ at INFN, Padova

For the Medium Energy Beam Transfer line (MEBT), a buncher design with an optimised structure, a 5-gap IH cavity, passed a Detailed Design Review at CIEMAT that signed then a contract with an industrial company. Based on a detailed design, a first mechanical mock-up has been fabricated and fabrication details studied.

For the Superconducting RF linac, prototypes of the Half-Wave Resonator (HWR) cavities were investigated in cold test at CEA, Saclay. Technical difficulties appeared in the end when they were with the frequency tuning system (plunger part). It was clearly shown that the present limitation of the cavity performance (Q_o degradation and thermal quench at low field) comes from the tuning system (plunger), including the gasket configuration. Improvements in the design have been submitted to an external review and an experimental verification plan established. For licensing, an “application form” document for the superconducting cavity has been delivered to JAEA in October 2011 which contains all details of mechanical calculations, standards applied for design and realisation, raw material certificates, welding qualifications, etc. Negotiations between JAEA and the Japanese licensing body are now in progress.

The detailed design of the HEBT line and beam dump has been finished and passed a detailed design review. As central element of the beam dump, a 1:1 scale cartridge prototype was successfully submitted to first hydraulic tests at nominal flow and pressure conditions.

For the RF power system, CIEMAT concluded on the manufacturing design of the RF Modules and the High Voltage Power Supply (HVPS) and launched the manufacturing of the RF Module prototype platform and the first HVPS unit. Whereas the manufacturing process of the driver (cavity and tetrode) and final (tetrode) amplifiers is ongoing, the RF final amplifier sub-module prototype (cavity and auxiliaries) were received from SCK-CEN, Mol.

The software development for the gateway between local central control system was concluded at CEA Saclay and validated on the Injector control system. An acquisition system was delivered to INFN for evaluation of the RF Quadrupole.

IFMIF Plant Engineering Design Activities

The design features of the IFMIF plant have been assembled in the Plant Integration Document that covers the mission statement, the plant level requirements and design description (including Top Level Requirements, Operation Scenario, Plant Configuration and Layout, Plant Control System, Safety Specifications and Site Assumptions), the system level requirements and plant description. A revision of the maintenance strategy for IFMIF was done, the scheduled maintenance plan for the annual campaign was reduced to one long maintenance period of 20 days for general maintenance and one intermediate maintenance period of three days for short-term maintenance activities in the accelerator and in other auxiliary and conventional systems.

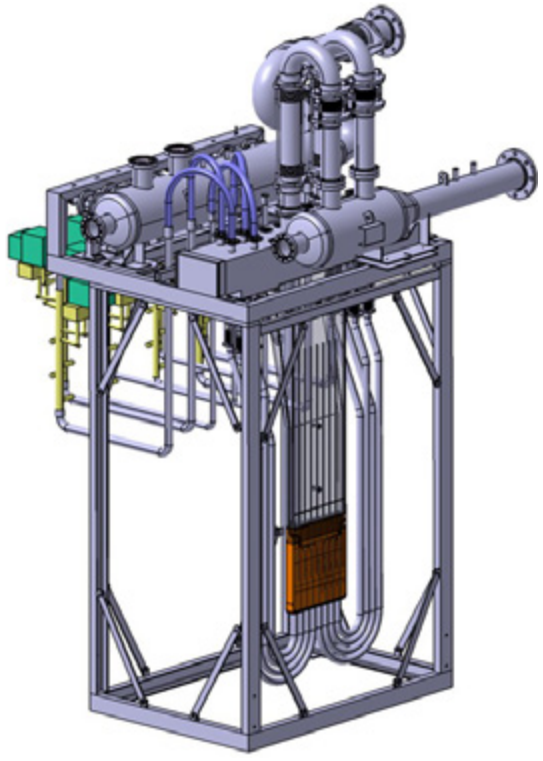
For the conventional facilities, the accelerator facility, the lithium target facility, the test facilities and the post-irradiation examination (PIE) facility pre-design reviews have been conducted in the framework of the annual IFMIF workshop in December 2011 where the system definition was given and their boundaries were presented. Specificities of the dedicated test modules, such as the High Flux Test Module (HFTM), the Cyclic Fatigue Test Module, the Tritium Release Test Module, the Liquid Breeder Test Module, the Start-up Test Module, and the Low Flux Test Module were described.

The Design of the Test Cell successfully passed the Detailed Design Review and its refinement with respect to its interfaces with the Lithium Loop and the Accelerator Facility is being pursued.

Design Validation in the HELOKA Facility, the Cycle Fatigue Test Module and the Belgian Reactor 2 Irradiation

The HELOKA-LP Helium Loop facility has been planned, constructed and commissioned at KIT, Karlsruhe. During the commissioning tests which were concluded in 2011, it had been verified that the facility meets all the acceptance criteria specified in the related PA, regarding the range of process variables (mass flow, pressure, temperature) and the installed equipment such as the process control system and the HFTM heater power supplies.

Additionally, the facility was thoroughly tested, and



3D-CAD design of the HFTM test section port ('TS-Port') when integrated into the HELOKA-LP facility at KIT

lessons learnt were documented regarding the power consumption, leak tightness and helium impurity ingress. The HELOKA-LP facility is therefore fully commissioned, and ready to begin the tests with HFTM mock-ups.

After short term testing of the equipment for the Creep Fatigue Test Module at CRPP, Villigen, which includes a switch box, a vacuum vessel with a vacuum control system, an eddy current heating system and a cooling system for the specimens, the first long run test with one actuator was successfully started at the beginning of November a force range between -12.5kN and 12.5kN and temperature changes from 25°C up to 300°C.

For the start of the Belgian Reactor 2 irradiation of HFTM related specimens at SCK-CEN, Mol, the following preparations have been concluded in 2011. The final thermo-hydraulic calculation note and the note about accidents involving chemical reactions have been written. The HFTM capsules parts have been manufactured, assembled and filled with specimens. After pressure and tightness testing, the first filling with a sodium-potassium alloy was accomplished. Two Japanese sandwich plates have been delivered. The electrical cabinet delivered by KIT, Karlsruhe, was assembled.

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

In spite of the timely and successful commissioning of the Experimental Lithium Test Loop at Oarai by JAEA, an extension of the Validation Activities at JAEA is required to compensate for the extra work required for recovering from damage caused by the East Japan Earthquake on 11 March 2011. The actual delay is estimated to be 16 months. The delays in loop testing also affected the European contributions to this facility. In particular, the delivery of the resistivity meter, the cavitation monitor and the bayonet backplate from ENEA, Brasimone, had to be shifted to 2012.

The experiments with Lithium loops at ENEA, Brasimone, are targeted on corrosion tests over EUROFER 97 and AISI 316L steels, as well as on lithium purification and monitoring experiments. The operation of the initial LIFUS-3 loop was affected by several problems, mainly due to the complexity of system hydraulics, with the main circuit and the purification circuit working in parallel using only one pump, and the original commitments were found not to be fully in reach. For this reason it was decided to build a new experimental facility, simplified from the hydraulic point of view, capable to perform the set of tests required by the IFMIF community. This new loop, named LIFUS-6, was designed and assembly prepared in 2011.

In addition, remote handling test campaigns are being prepared at the remote handling test at ENEA, Brasimone, for the validation of the refurbishment procedures for the Lithium target assembly with the bayonet backplate. The simulation activity carried out highlighted that, with the robotic arm available, it is possible only to perform the backplate replacement and under defined conditions. Indeed the replacement of the target assembly requires the availability also of a robotic arm having a high dexterity. To fulfil these requirements a new robotic arm, to be attached to the exiting one, has been fabricated.

Key Performance Indicators

With regard to the main quantitative indicator, that is the Conclusion of PAs, about 63% in value has been reached at the end of 2011, with the remaining share largely allocated to the Engineering Design Activities and the Installation, Set-up and Commissioning of the LIPAc accelerator which are in an advanced status of definition.

The progress has been performed with the continuous mutual support between F4E and the EU VCs. This is reflected in the new organisation of the activities in the form of (sub-) projects which are led either by F4E (LIPAc) or programme managers from the VCs (EDA, HELOKA and LIFUS-6).

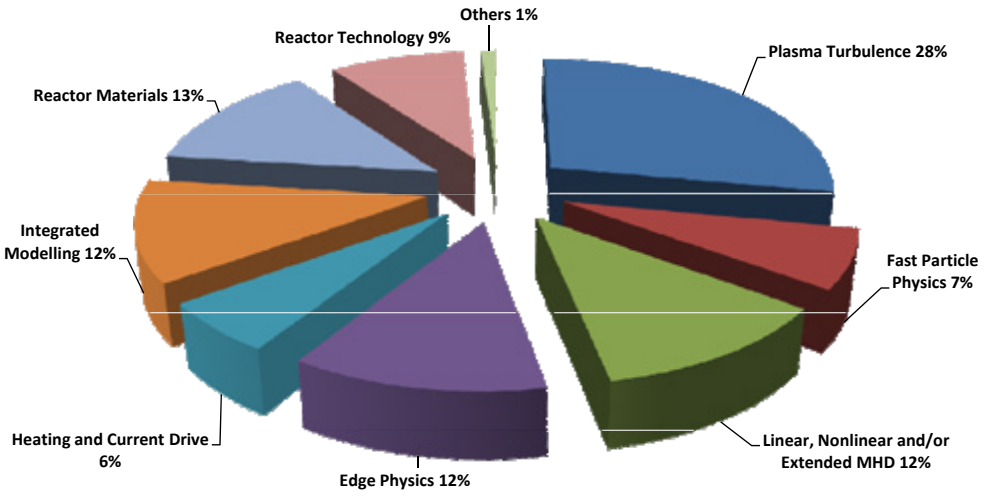
F4E is preparing for the transport contracts necessary to the first delivery of LIPAc accelerator components in 2013 to the BA site at Rokkasho.

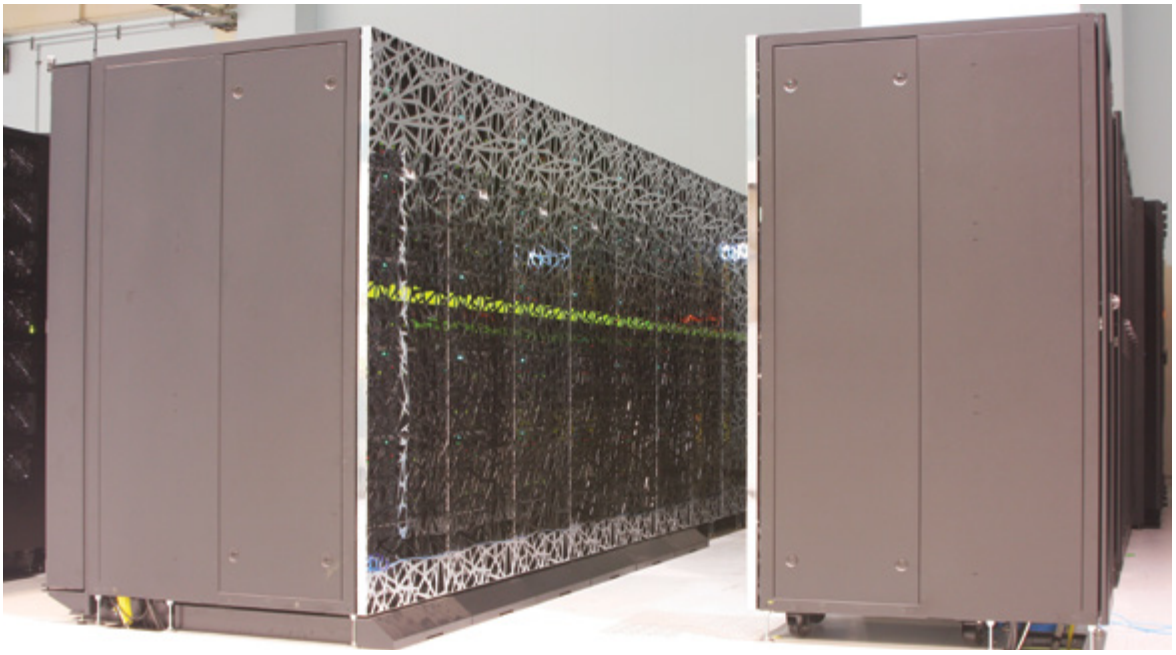
IFERC Programme

In the IFERC Programme, the main activity has been in the Computer Simulation Centre. The assembly and reception tests of Helios, the supercomputer provided by CEA under a contract with Bull as part of France's voluntary contribution, were completed on 22 December 2011. The supercomputer successfully passed the benchmark and Linpack tests, achieving a performance of 1.132 Petaflops in the latter. All required parameters were achieved or exceeded, enabling F4E to accept the ownership of the supercomputer, and operation to start on schedule in early January 2012. The organisation of the Computer Simulation Centre operation has proceeded in parallel. In 2011 the user's rules for utilisation of the supercomputer were defined, a Standing Committee to perform calls, select and evaluate projects was nominated, and the first call for proposals was completed on 1 December 2011. Four "lighthouse projects" were selected for the first three months of operation, to demonstrate the performance of Helios and fine-tune the system. Normal operation will start in April 2012, with the projects selected in the first call. A total of 94 proposals (44 from JA, 50 from EU) was received, oversubscribing the available computer time by about a factor of three, and demonstrating the interest of the EU and JA fusion communities in the project. The distribution by subject is shown on the following page.

The DEMO R&D activities in materials in the EU have continued as planned in five PAs. A joint PA for DEMO Design Activities (DDA) was signed in spring 2011, and tasks in the EU have stated as part of the EFDA Work Programme. The main guidelines for a programme to implement an activity on safety in fusion reactors has been agreed between the DDA and the Implementing Agencies. The practical implementation details will be decided in early 2012.

Distribution of the proposals received in the first call for simulation projects for the Helios supercomputer





The Helios supercomputer in the Computer Simulation Centre, Rokkasho

Contracts and Procurement

Procurement Activities

Procurement procedures at F4E cover 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, F4E places contracts with external experts and supports European participation in calls for nomination issued by the ITER IO.

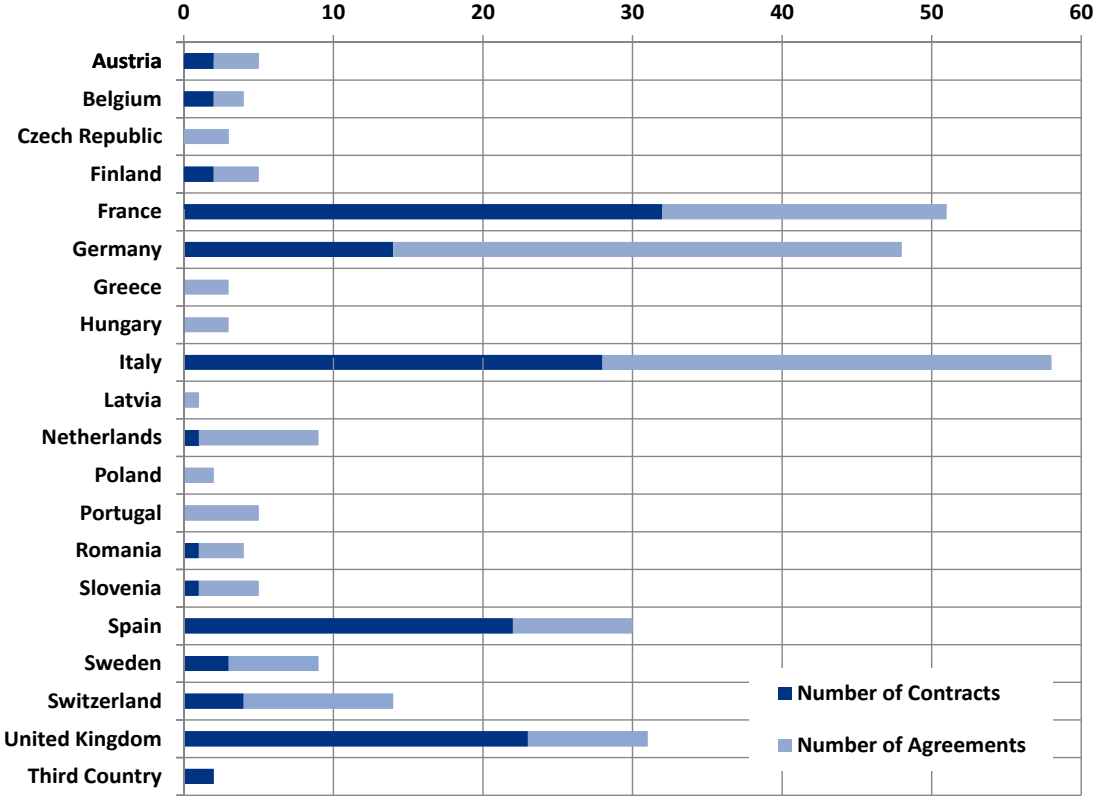
The year 2011 marked an important transition for F4E's procurement activities, as the total residual value of the contracts being implemented during the year exceeded for the first time the total value of the contracts awarded during the year. This transition was indeed perceivable in the day-to-day activities, as workload related to follow-up became comparable in magnitude to the workload related to award procedure, a pattern which will be maintained in the next few years.

During 2011, a total of 47 operational procurement procedures were launched, 45 evaluations were completed, 38 procurement contracts were awarded (including two joint procurement procedures with the ITER IO) and 38 procurement contracts were signed. Major operational procurements were awarded in the area of ITER buildings and in relation to transport, logistics and insurance services.

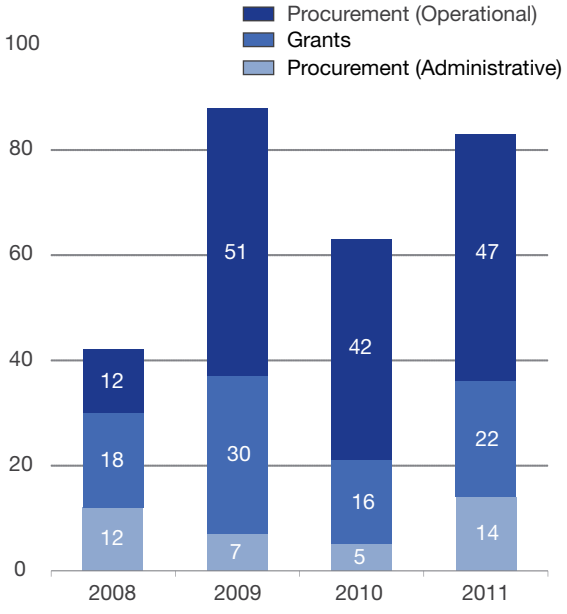
In particular the year saw the completion of the first phase of the competitive dialogues for the main portion of the ITER buildings (including nuclear ones), which marked a very important milestone for the project: the ITER buildings are completely belonging to the European contribution and represent themselves as one of the largest construction projects in Europe at the moment. The competitive dialogues for selecting and awarding the various lots of the construction activities are demanding an unprecedented effort from F4E's services.

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 2011, a total of 22 grant procedures were launched, 23 evaluations were completed, 22 grant agreements were awarded and 23 grant agreements were signed.

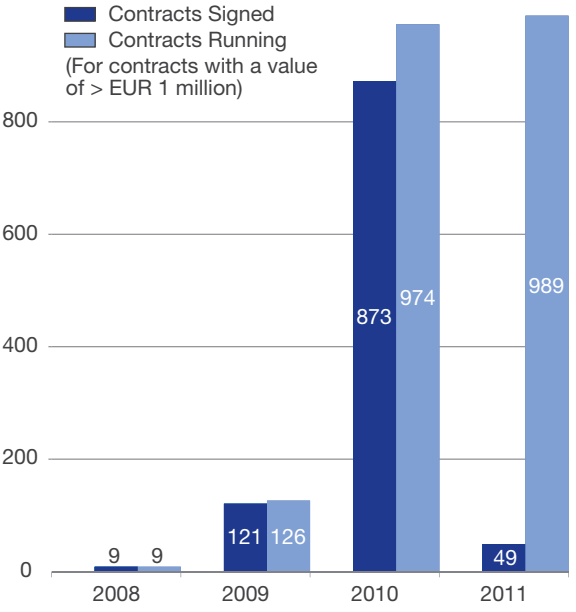
Geographical distribution of operational procurement contracts and grant agreements (2008-2011)



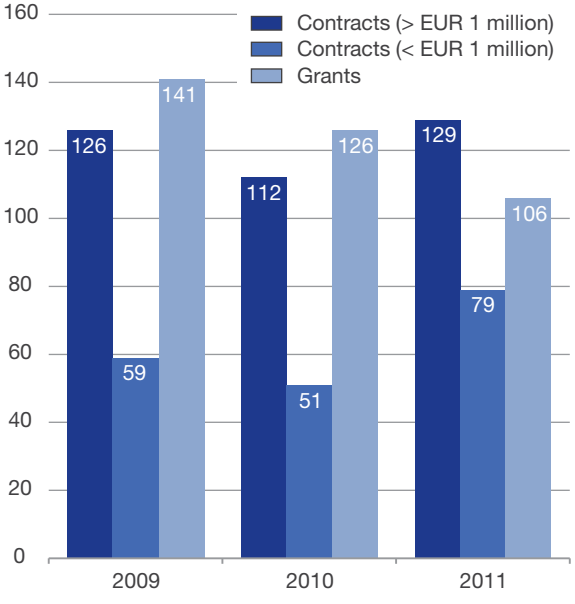
Procurement and Grant Procedures Launched (Number) (excluding Task Orders)



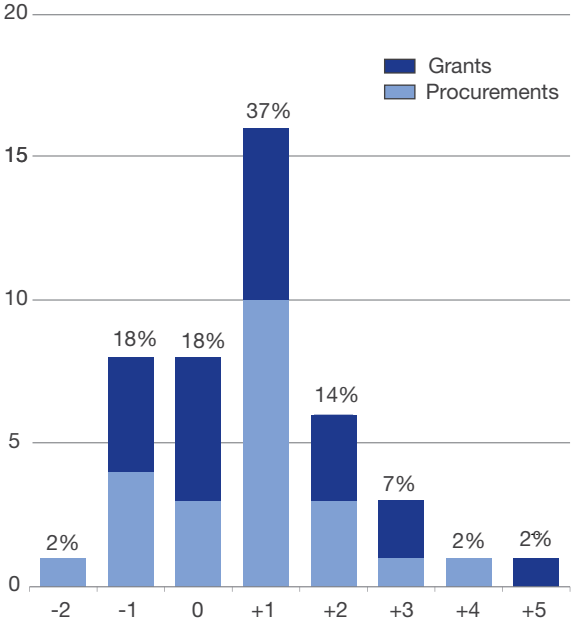
Value of Signed and Running Contracts (EUR million)



Average Time to Award Contracts and Grants (Days from submission deadline to award)



Difference between Planned and Actual Launch for Call for Tender/Proposals (Number and %) (as planned in the 2011 Work Programme - last amended November 2011)



For the procurements procedures listed in the Annexes, the average number of calendar days from the submission of the tender to the awarding of the contract by F4E was 90. For the grants procedures, the average number of calendar days from the submission of the proposal to the awarding of the grant agreement by F4E was 106.

During 2011 a total of 14 administrative procurement procedures were launched, resulting in the award of 10 contracts of which eight were signed by year end. Moreover, four contracts were signed in early 2011 following procedures launched during 2010. Among the contracts awarded are the one for the external annual assessments of F4E, the contract for the Engineering Data Management system and legal service framework contracts.

In order to obtain technical and/or scientific expertise not available internally, F4E awards support contracts to external experts. During 2011, 45 contracts for external experts were awarded for an amount of about EUR 1.2 million.

Business Intelligence

In 2011 through its pre-procurement activities and tools, F4E has consolidated its interactions with European industries and Associations in view of enhancing the efficiency of its procurement actions.

During 2011:

- Five Industrial Liaison Officer (ILO) meetings took place, of which two took place at the ITER site in Cadarache and three at the F4E offices in Barcelona.
- F4E organised nine information days and in relation to specific procurement actions. The number of participants at the information days increased to 476 from 337 in 2010.
- An overall industry mapping covering most of the competences and skills sought for the ITER project have been initiated. This mapping describes the potential European capabilities in line with F4E procurement needs.
- For more precise identification of capabilities, 27 market surveys have been published through the F4E Industry Portal. Most have been targeted to assess the market in view of forthcoming procurement procedures.
- In 2011, F4E Industry and Associations Portal (https://industryportal.f4e.europa.eu) has become the main contact point with F4E for companies. The Supplier database reached about 1 000 registered users, of which more than half have initiated a generic pre-qualification process.

Legal Matters

Optimisation of F4E's Procurement Processes

Taking into account the specific nature of the procurements, grants and other activities managed by F4E, its budgetary and schedule constraints as well as experience from contract negotiations and feedback from the ILOs, F4E:

- Modified the Implementing Rules (IR) of the Financial Regulation to increase the threshold for the Executive Committee (ExCo) approval of contracts to EUR 10 million and for grants to EUR 400 000;
- Continued several actions to optimise the contractual clauses in its model contracts to better take into account the nature of F4E's activities and the market situation.

Litigation in front of the European Court of Justice (ECJ)

In 2011, the litigation in relation with the award of the contract for Cabling and Jacketing of TF and PF Conductors continued with the submission of the F4E defence on 5 October 2011.

Intellectual Property Management

During 2011 F4E has further refined its approach to the management of Intellectual Property (IP) to better serve its interests and those of its contractors. F4E has reinforced its channels of communication with industry through a specific IP web site and the agreement with the IPR Helpdesk for providing support to SMEs on IP related matters. During 2011 F4E continued to provide IP advice to F4E's staff and contractors on IP related issues.

Budget, Finance and Accounting

Budget Establishment

F4E's budget for 2011 was initially adopted for the global amount of EUR 482.19 million in commitment appropriations and EUR 280.13 million in payment appropriations. Following budget amendments approved by the Governing Board, the final authorised F4E budget for 2011 was EUR 491.95 million in commitment appropriations and EUR 263.57 million in payment appropriations.

Implementation of the Authorised 2011 Budget

Revenue	**92%** of the foreseen revenue was collected
Commitments	**99.7%** implemented **98.7%** of the administrative budget **99.8%** of the operational budget of which **28%** of individual commitments
Payments	**85.7%** implemented **79.6%** of the administrative budget **86.6%** of the operational budget **0.5%** of the payment appropriation cancelled

Payments

During 2011, the number of payments being processed by F4E increased by 16% over 2010. A total of 3 218 payments (excluding individual salary payments) were carried out, with the average time to pay being around 38 days (28 days in the second six months of the year), which is within the maximum 45-day period foreseen in the Implementing Rules of the Financial Regulation.

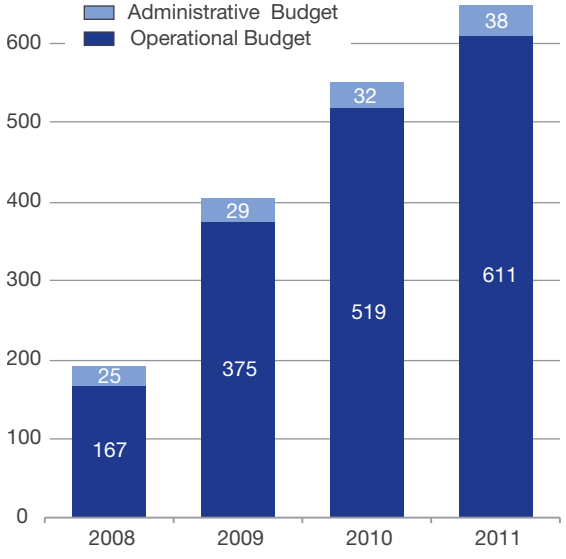
Legal Framework - Accrual Accounting Standards in F4E

According to its statutes, the annual accounts of F4E are fully consolidated with those of the European Union. The 2011 financial statement was established by using the consolidation package provided by the European Commission.

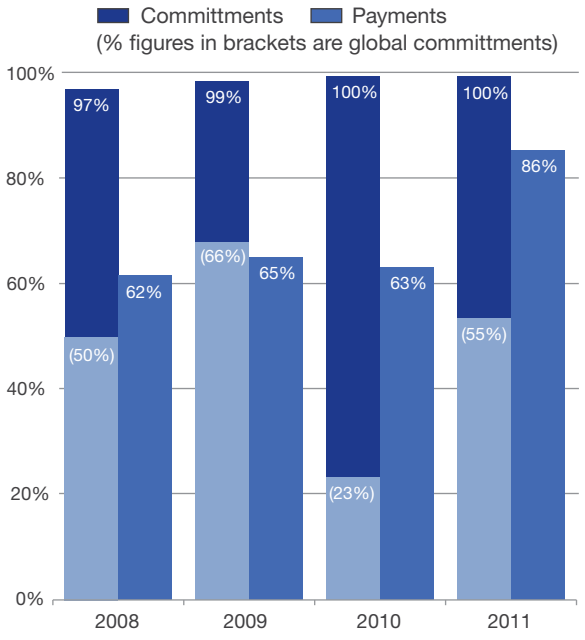
The accounting rules and regulations used in the annual accounts are also laid down by the European Commission. In addition they are on an accrual basis and are compliant with the International Public Sector Accounting Standards (IPSAS).

F4E uses the ABAC system (Accrual Based Accounting) owned by the European Commission and used by many EU bodies.

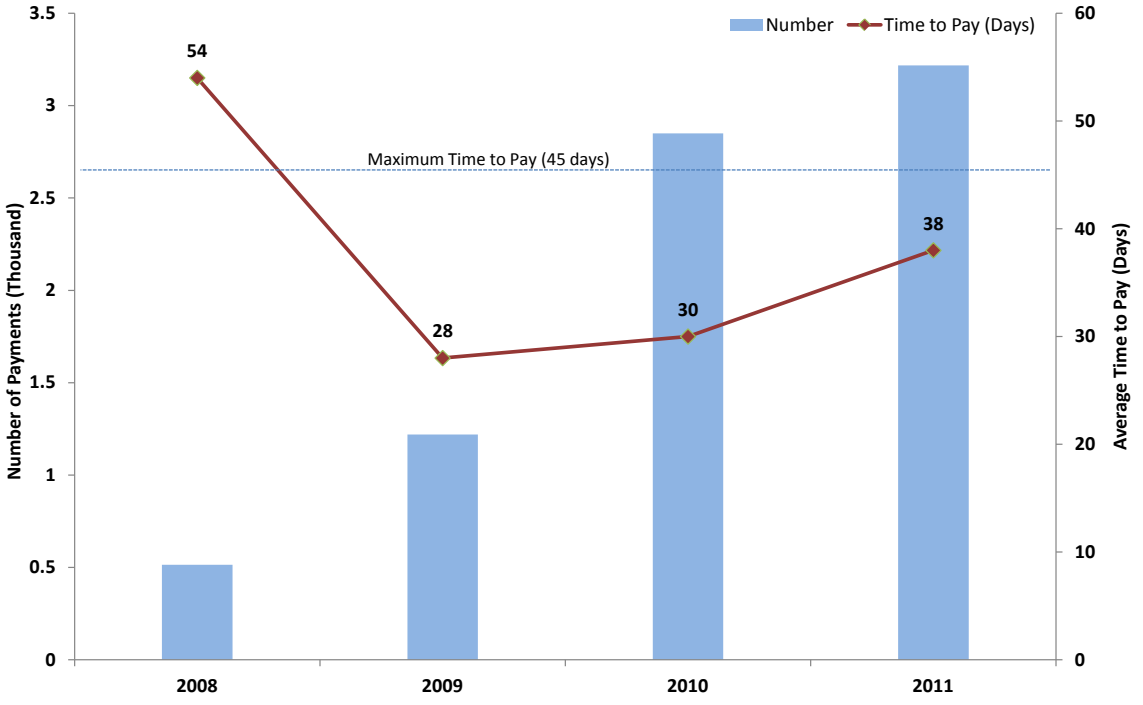
F4E's Available Budgets in Commitment Appropriations (EUR million)
(Operational Budget includes assigned revenue from the ITER Host State carried over from the previous year)



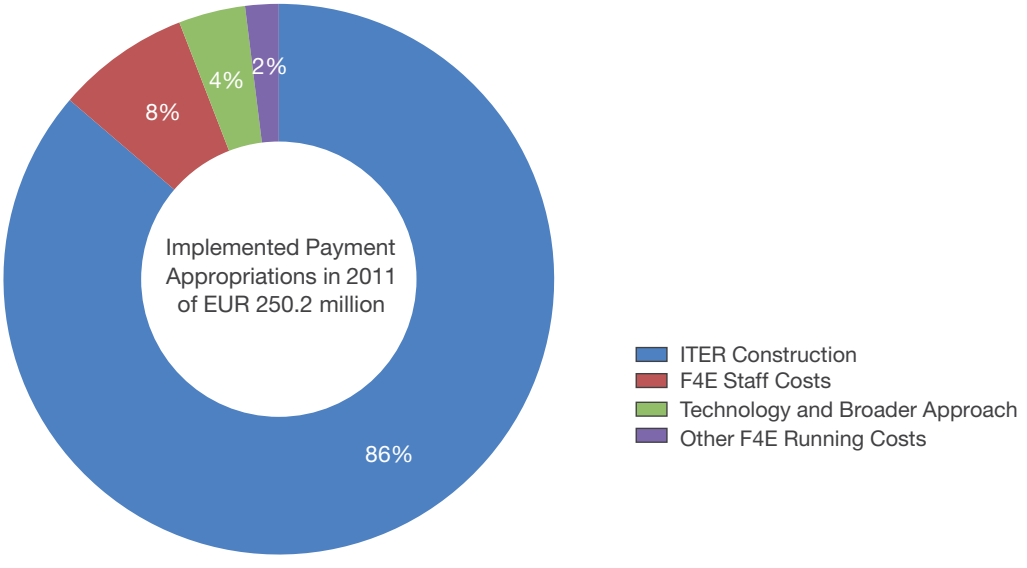
Overall Implementation of F4E's Available Budgets (%)



Payment Statistics



Breakdown of 2011 Payment Appropriations



Human Resources

Personnel Policy

2011 was mainly devoted to implement the legal framework required by the reorganisation. Amongst other actions undertaken: the job titles were reviewed to match the new structure along with the job descriptions for each member of staff, preparation of the required administrative decisions, alignment of internal delegation of powers and signature, revision of the appraisal and promotion decisions, etc.

The consolidation of the necessary provisions in respect of different HR issues has also progressed during the reference period: preparation of different implementing rules (part-time, leave, parental leave), conclusion of the first appraisal and promotion exercises and launching and conclusion of the second one, guidelines regarding Temporary Agents (contract duration and renewal), guidelines on time compensation for missions during a weekend or a public holiday.

Personnel Selections

During 2011, 28 vacancy notices were published (eight for Officials, seven for Temporary Agents, 12 for Contract Agents and one Internal Call for Expression of Interest). Out of these selection procedures, 21 were completed.

In order to better target the selection procedures for support staff, F4E launched a call for expression of interest for candidates who had already passed a selection procedure managed by the EU's Personnel Selection Office. This call covered 26 profiles covering a wide range of domains indentified by F4E as relevant.

The time to recruit was reduced by two months in 2011. The resulting average is 5.5 months, while the time to offer period has been reduced to 3.5 months compared with the average in 2010. This figure does not include the EU-ITER Project Manager selections which took longer (10 months) awaiting, among other things, the Head of the ITER Department to take up his duties.

Recruitment

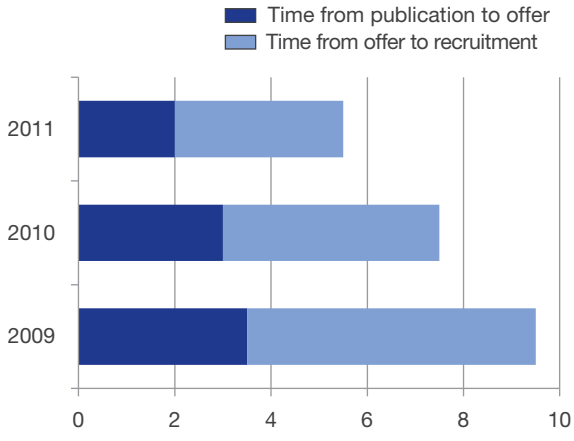
Nine Officials, 33 Temporary Agents and 40 Contract Agents took up duties as per the following table (distributed by type of contract, category and department):

Entity	Officials	Temporary Agents	Contract Agents
Office of the Director	1		4
ITER Department	2	21	12
Broader Approach & DEMO Department		3	3
Administration Department	6	9	21

As of 31 December 2011, the total number of occupied posts at F4E was 211 Officials and Temporary Agents, and 99 Contract Agents. In addition, F4E benefited from 21 interim staff and six Seconded National Experts.

The vacancy rate for professional staff (number of staff recruited versus staff authorised by the budgetary authority) has decreased by almost half (around 11% compared to more than 21% in 2010) approaching a standard vacancy rate for the EU institutions.

Time to Recruit (months)



Social Policy

- Establishment of the medical service in Barcelona as from October, which has allowed to address not only pre-recruitment visits and annual checks in house but also actions to improve safety at work, ergonomics, health campaigns, etc.
- Launching and conclusion of a call for tender for complementary health insurance aiming at improving the access to medical services in Catalonia for staff members and families as well as limitating the financial impact of medical care for the staff members.
- Preparation and launching of a call for tender for relocation services so as to support F4E newcomers to settle and relocate smoothly and widening the services already offered.
- The number of agreements with international schools in Barcelona and surroundings has increased to 14, covering most of the F4E staff families' needs.
- F4E has in addition concluded an administrative agreement with a local school devoted to children with special care needs.

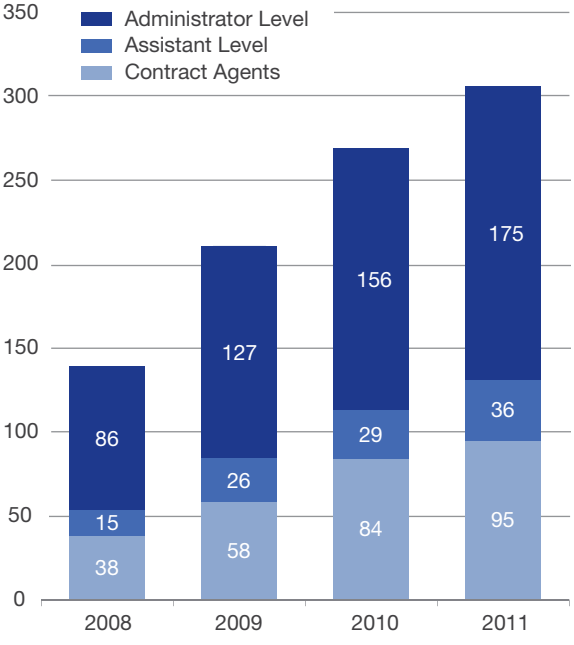
Training

Several actions have been implemented to better address the F4E staff training needs, in particular to support the new organisational structure and reinforce project management training.

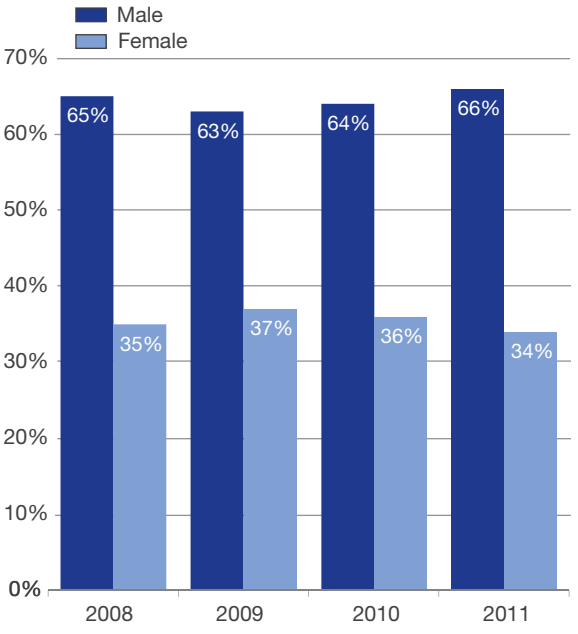
Some figures related to the training activities in 2011:

- Number of training courses followed under the Service Level Agreement concluded with the European Commission: 75
- Number of external training courses followed: 87
- Number of people following language courses in F4E: 216
- Average number of training days per staff member: 4.5

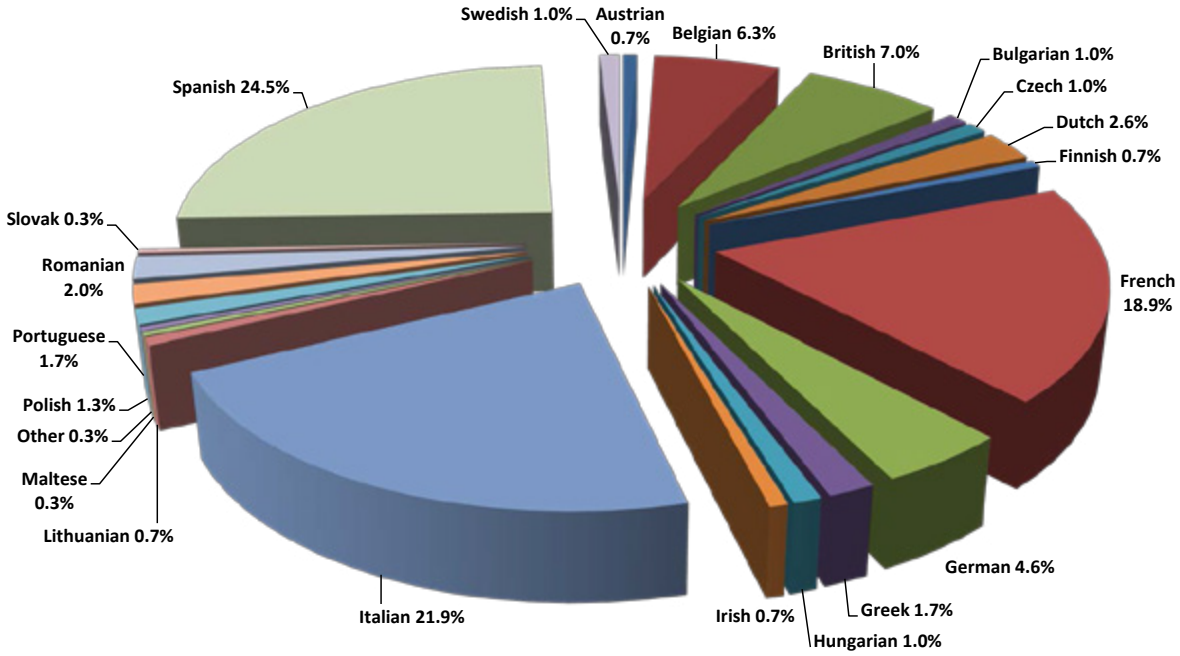
Evolution of Staff Complement (number)



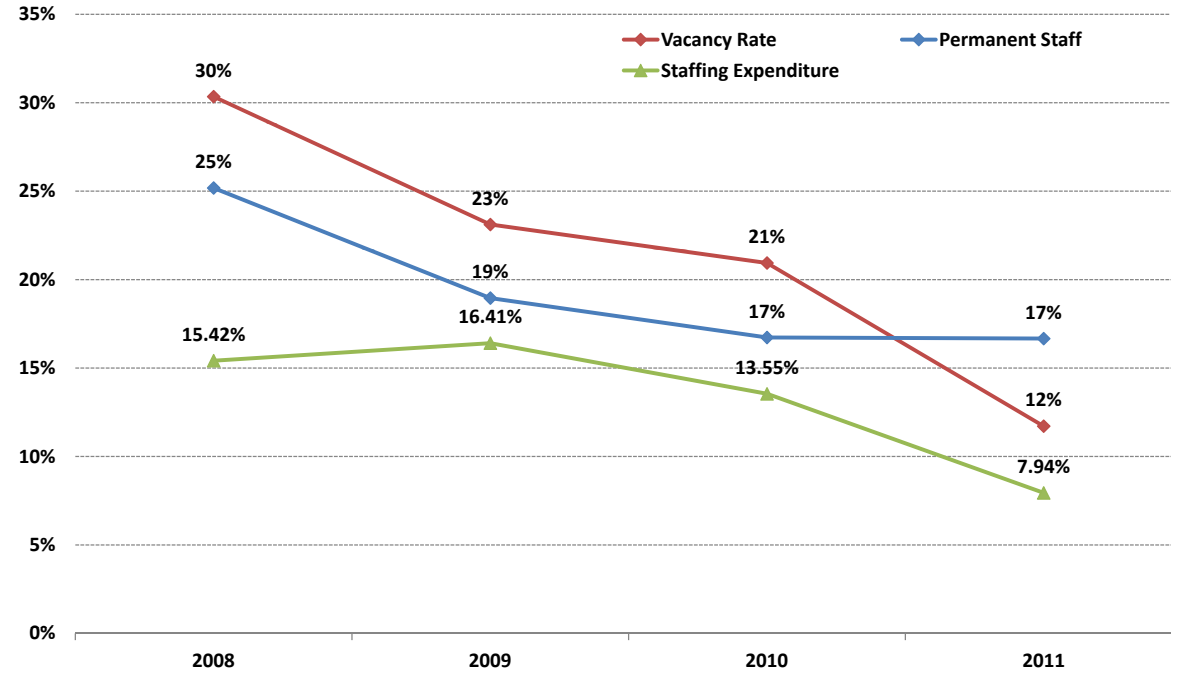
Gender - All Staff (%)



Staff Nationality



Indicators related to Staffing (%)



Control Environment

Internal Audit

Two audit engagements were closed (final report issued) during 2011; they covered operational pre-procurement activities (i.e. the processes that precede the launch of calls for tenders) and the management of expert contracts. The finalisation of two new audits launched during the year had to be carried over to early 2012. 74% (2010: 72%) of the available resources of the internal audit function were directly dedicated to those main engagements.

Since the creation of this function, 121 audit recommendations have been issued, of which 99% were accepted by the management and gave rise to action plans. In that respect, an audit follow-up policy was formally adopted in May, and follow-up tools developed.

In 2011 the audit governance was further strengthened, with the Audit Committee starting its work in February, and arrangements finalised to specify the modalities of cooperation with the Internal Audit Service (IAS) of the European Commission from 2012. An auditors' risk assessment was conducted jointly with the IAS in June, which served as a basis for the first joint, multi-annual, strategic audit plan (2012-2014).

Internal Control

Due to the complexity of the ITER project, F4E operates within two control environments: (a) the EU Internal Control Standards (ICS), and (b) the ITER-wide Quality Requirements, the latter in compliance with the requirements of the French Nuclear Safety Authority. F4E is also putting in place arrangements to comply with general safety law in relation to the work on the Cadarache site.

In the second half of 2010, the F4E Director put in place a Management Improvement Plan with a focus on project management and other key processes which are important elements of the F4E Management System, including Quality Management and Internal Control. In relation to the ICS, by the end of the year 12 out of the 15 standards were very nearly or fully implemented. The situation of the remaining three ICS is as follows:

- Objectives and Performance Indicators: F4E has objectives in place at the working level but lacks top-level objectives for the organisation as a whole – these are going to be introduced for 2012. Similarly, F4E has in place a number of performance indicators, but needs more or better ones. In terms of the two key performance indicators for measuring the progress of the project work, the schedule performance indicator is already measured on a monthly basis although some shortcomings in terms of precision still need to be addressed (March 2012), while the cost performance index will come from the current improvements to the Project Management System (mid-2012).

- Risk Management Processes: F4E routinely performs risk management in relation to the project work, but so far has not performed risk management at the corporate level. A specific exercise is currently in progress to address this weakness and should be finished by mid-2012.

- Management Information and Reporting: As for the 'Objectives and Performance Indicators', a number of reports are in place at all levels and a bi-monthly summary report is produced for the F4E management and Supervisory Bodies, but important improvements still need to be made. Again these will come from the current improvements to the project management system (mid-2012).

In the frame of the development of an Integrated Quality Assurance Management System, an exercise is currently underway to evaluate the merger of the 15 COSO (Committee of Sponsoring Organizations of the Treadway Commission) based Internal Control standards with the ISO 9001:2008 equivalent.

External Audit

Each year the annual accounts are audited by the European Court of Auditors. The table below shows the Court's observations of the combined exercises for the financial years 2008 and 2009 as well as the recently adopted observations for the 2010 exercise. From the 2008 exercise, 75% of all observations have been closed while the remaining 25% were recurring in the 2009 report (Implementation of the Budget and Internal Controls). These recommendations have also been addressed by the European Parliament during the discharge procedure (approving the F4E Annual Accounts).

European Court of Auditors Observations 2009 and 2010				
Area	**Completed**	**Underway**	**No Action**	**Total**
Financial Regulation of F4E	1			1
Implementation of the budget		2		2
Grants and procurement	1	2		3
Internal control systems and reorganisation	2	7	1	10
Late payment of membership contributions	3			3
IT systems		1		1
Presentation of the accounts: members' contributions	1		2	3
Status of the ITER project	3		3	6
Commission Internal Audit Service and Audit Committee	4			4
Host State Agreement		1		1
Total	**15**	**13**	**6**	**34**

Quality Management System

In 2011, F4E continued the implementation and development of the Quality Management System (QMS) through four main activity areas:

- Establishment and Continual Improvement of the Quality System;
- Process development and reviewing;
- Quality Audits (internal and external);
- Quality Assurance in the Operational Projects.

Establishment and Continual Improvement

The status and roadmap of the Quality Management System establishment and improvement is portrayed below:

Overall QMS:

- Full update of the intranet QA webpage;
- Update of the 'QA Programme for ITER Project';
- Update of the F4E standard 'Supplier Quality Requirements' (QA-115);
- Implementation of the QA reporting;
- QA Guidance Training for all operational officers;
- Implementation of checklists in the core processes;
- Development of Integrated Standards Strategy;
- Development of Manual of Procedures;
- Development of the F4E Cluster Coding;
- Update and issue of new processes: PA and ITA Processes, Dual Use, Design Review, Experts Control, Safety Follow-up and Data Protection.

Quality Audit:

- Preparation and execution of the year quality audits;
- Issue of the 2012 Quality Audit Plan.

Documentation:

- Development of the F4E Documentation Policy (exchange, registration, signature and archival);
- Implementation of the ITER Project Sign-Off Authority Policy;
- Development of the F4E Style Guide.

Risk Management:

- Development of the Corporate Risk Management approach (Organisation);
- Update of the Project Risk Management Process.

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:

Process Status (out of 92)	Approved		In Development			Software tool based
	Process	Procedure / Policy	Review	Mapped	Preparation	
	38	7	4	9	3	7

To complement the processes, F4E is establishing the operational and administrative methods of working in the Manuals of Procedures.

Quality Audits

F4E has an established a Quality Audit framework that provides F4E and its stakeholders (e.g. the ITER IO) 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 2011:
  - 15 Quality Audits on operational procurements (Supplier Quality Plan provisions and implementation);
  - Six Quality Audits on grant agreements (Supplier Quality Plan provisions and implementation);
  - One internal audit to the Implementation of the Quality Processes by F4E during the work package implementation;
  - One audit by the ITER IO to the F4E QA Programme.

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 actives can be divided in:

- Support and review of the PAs and ITAs to ensure conformance with the F4E QA Programme, the ITER IO-DA 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;
- 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.

Meeting of the IO-DA Safety and Quality Assurance Working Group (SQAWG) at the ITER Site in Cadarache to which F4E participated

Main Results

- Full update of the 'QA Programme for ITER Project' with the subsequent approval by the ITER IO;
- Full update of the 'Suppliers Quality Requirements' (F4E-QA-115);
- Development of 'F4E Documentation Policy' (exchange, registration, signature and archiving);
- Development of the 'F4E Style Guide';
- Development of the F4E Manual of Procedures.

Data Protection

In 2011, F4E took further steps towards the implementation of the data protection requirements stipulated in the Regulation. The main achievements have been the following:

- F4E established, with the active contribution of the F4E Data Protection Officer (DPO), a system for health-data processing in the organisation (pre-recruitment medical examination, annual medical check-ups, medical follow-up to health screening programmes and in procedures for managing absences on grounds of health or accident), based on external contractors with whom F4E concluded detailed agreements on the modalities of data processing.
- Seven new notifications of data processing operations were submitted to the DPO and subsequently notified to the European Data Protection Supervisor (EDPS) for prior-checking; those included notifications of data processing with regard to the secondment of national experts, calls for expression of interest for the ExCo and TAP and health-data processing.
- The updated inventory of data processing operations, documenting the progress achieved in the field of data protection and taking into account the new organisational structure at F4E, was sent to the EDPS, replacing the inventory submitted in 2010.
- The EDPS closed its prior-checking proceedings with regard to F4E notification on the selection and recruitment of staff, following an exchange of correspondence with F4E Data Controllers.
- The information sections on the F4E intranet and the public website were further improved and developed in particular by publication of additional privacy notices.
- The processes and procedures related to the notification of processing operations were further improved, mapped, submitted to the EDPS and included in the Administrative Manual being prepared at F4E.
- Progress in evaluation of the personal data compliance within F4E, with the involvement of the DPO advising on data processing related to the staff evaluation, F4E parking policy, publication of information on newcomers in the F4E intranet, handling of data in the IT tools and exchange of data with third parties.
- The DPO represented F4E in two regular meetings and one training course with the EDPS and the DPOs of the European institutions and bodies.

Information Technology

During 2011 the main activities in the area of Information Technology were as follows:

- e-Appraisal: the electronic staff appraisal platform was delivered at the end of March to facilitate a timely, efficient and paperless execution of the 2011 exercise. All 204 staff members whose performance is being appraised in 2011 used the system.

- IT Infrastructure: a review of the F4E infrastructure layer (security, networking, servers, storage, and virtualisation) was undertaken with the aim of ensuring that it can cope with F4E's technological requirements. A new Microsoft Windows architecture has been finalised and the related implementation has started. Migration to Windows 7 will take place during 2012.

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

- HR tools: eRecruitment Phase 2: a new version of the application was developed and tested. The new eHR database project started in Q4 and is planned to be completed by Q3 2012.

- 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 IO.

- IT Service Desk: Ongoing support for all F4E users has been regularly provided with a high degree of customer satisfaction. During 2011 around 4000 requests were submitted and as many were resolved. The overall backlog at the end of the year is 16 open requests.

- A new version of the Industry Portal application has been delivered by an external contractor to F4E for final acceptance. It is planned to be rolled-out to production during the first quarter of 2012.

- The IT Team has developed a Data Warehouse framework for the implementation of an F4E integrated reporting system. Work to generate reporting data has provided first results with HR appraisal data and Primavera scheduling.

- The IT Team provided support to the ITER Department's Project Office for the requirement specification of a Contract Management tool whose Fit & Gap analysis with respect to Oracle Primavera Contract Management will be carried out during January 2012.

- The evaluation of the Call for tender for Dassault's SmarTeam consultancy services was completed with success and the contract awarded.

- The IT Team started several projects in the Governance area: definition of an IT Strategy, definition of its internal processes according to ISO 20000 standard, definition of an IT Service Catalogue.

Approximately 80% of the projects carried out by the IT Team were completed on time. About 10% were delayed due to contractual and administrative reasons while 10% were late due to delays in the project execution.

None of the IT services suffered from severe discontinuity during 2011.

Business ownership and a formalised approach to launching new projects are two risks the IT Team is focusing on. The objective is to have processes in place to mitigate such risks.

Infrastructure and Logistics

Offices and Support Services

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

During 2011, the main priority was to adapt the existing infrastructure by the full installation and equipment of the 10th floor. A total of 46 new staff members and 24 interims were installed and 110 internal moves were organised including the associated support arrangements.

The infrastructure for the new medical service was provided and fully equipped in three offices within F4E's premises.

The Logistics Team organised the first and second shipment of material from Furukawa to Tratos as requested by the Broader Approach. The procedure also included the customs formalities and tax exemptions.

Following the feedback received in the 2010 Logistics survey, the Logistics Team launched the first F4E Green campaign. During one week, F4E staff was encouraged to save energy and to be more environmentally friendly.

External Visits and Meetings

As an indicator for the substantial growth of activities in the logistics area and F4E in general, it should be noted that 3 743 visitors were accredited in 2011 representing around 10% more in relation to the previous year.

Safety

The Logistics Team 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. Refresher trainings for the F4E Fire Pickets were also conducted in order to ensure the good evacuation of employees in case of a fire emergency. 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 Team.

Social Actions

In 2011, several social actions were carried out, including an F4E staff blood donation and a christmas toys collection which were donated to underprivileged children living in Barcelona.

Implementing the Host Agreement

The new CIEMAT Agreement was prepared and signed. This agreement, based on the F4E Host Agreement, covers the administrative support provided by CIEMAT for the supply of goods and provision of services needed by F4E for its administrative infrastructure.

F4E made formal contact with the French Ministry of Foreign Affairs and organised a meeting in Paris in relation to the application of the "Protocol on Privileges and Immunities of the European Union" for F4E staff members in Cadarache.

Discussion continued with the Spanish authorities on the permanent premises for F4E and the current temporary office space. However the discussion will need to resume with the new Spanish government in 2012.

Information, Communication and External Relations

During 2011, F4E managed to raise awareness about its mission amongst European policy makers and the scientific community through its participation to 28 events. For example: the exhibition of the EU Agencies at the European Parliament, the visit of the European Parliament's delegation to ITER, the 22nd International Conference on Magnet Technology (MT-22), the Intellectual Property Rights conference, Industrial Liaison Officer meetings and the Catalan Science Week.

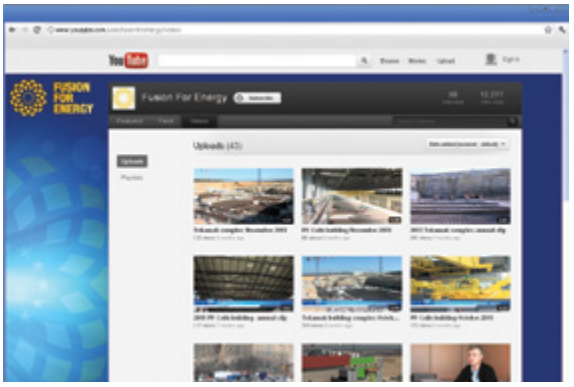
To help different target audiences and media follow the ITER construction, a series of 27 audiovisual clips and at least 800 images were commissioned. A specific F4E series of clips was also produced where management and members of staff explained Europe's contribution to ITER.

The publication of articles describing the nature of F4E's tasks, the science behind fusion, the ITER project, spin offs and procurement opportunities have increased compared to last year reaching 196 clippings in total. Contributions varied from television and radio to documentaries and articles. A new corporate brochure was produced and F4E News, our quarterly newsletter, has run successfully for its second year.

In order to keep external audiences and members of staff up to date with developments, 94 articles were published on the external and internal websites, which represent a 40% increase compared to 2010. According to our monitoring of the external website, the total view of pages has increased to three per user, reaching a total number of 66 000 pages per month. The launch of the F4E YouTube channel and the release of stories through F4E's account on Twitter have given a new impulse on our communication outreach activities reaching nearly 3 000 views on YouTube and gathering more than 300 followers on Twitter.

In terms of internal communication, the internal website has been redesigned and new sections have been added to reflect the new organisational structure of F4E. Guidelines for internal communication, typography and visual identity were produced and support was offered to other services of the organisation for the realisation of several campaigns.

Members of the European Parliament visiting the ITER site, Cadarache



The F4E YouTube channel

French school visit

The F4E taskforce at the MT-22

Staff Committee

The Staff Committee was active during 2011 on several fronts which can be summarised as follows:

- Providing recommendations on the evaluation and promotion for Temporary and Contract Agents;
- Participating in personnel selection committees;
- Managing a contract for complementary health insurance on behalf of about 250 staff members and their family members;
- Conducting a survey regarding the well-being at work of F4E staff;
- Setting up a working group with HR for the implementation of a policy framework on harassment and mobbing;
- Organising eight activities 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.

'Meeting the energy of the future' by Gregory Dubus - winner of the Staff Committee's photo contest

Chapter 3

Our Governance

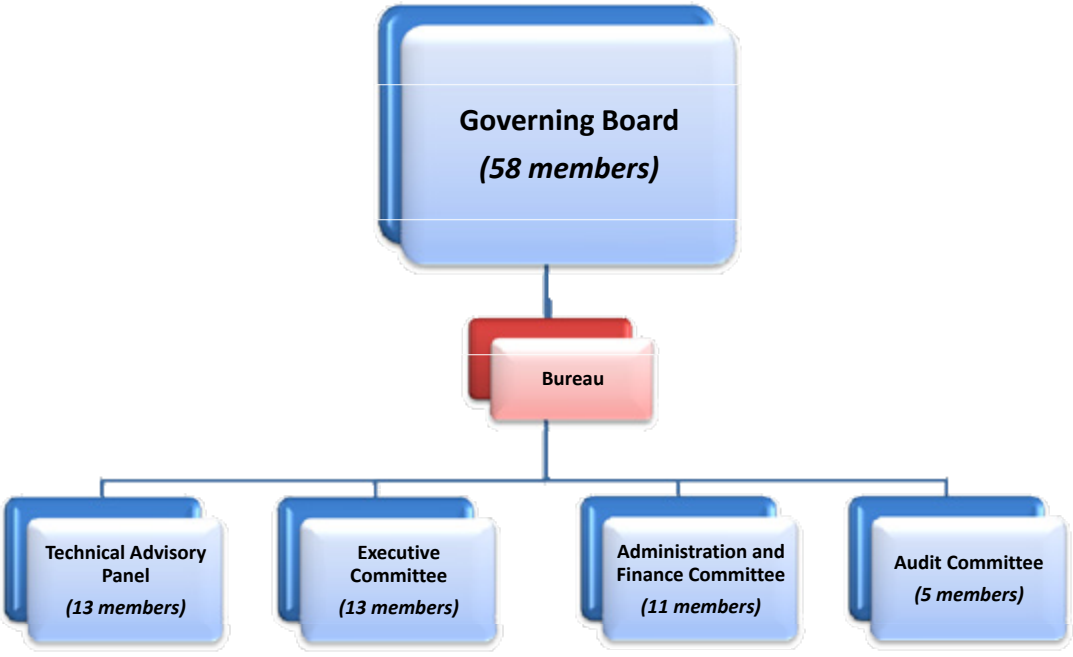
Improved Governance Structure

On the 9 July 2010, the European Competiveness Council adopted conclusions in relation to the status of the ITER Project and the possible way forward. In this context, and in particular in relation to governance and management, the Council asked for improvements.

In response to the Council's request, the F4E Governing Board established a Working Group which put forward proposals on how the governance of F4E might be improved among other aspects. On this basis the GB established a new governance structure during its 20th meeting of 31 May – 1 June 2011.

The main new elements of the new governance structure include:

- Establishment of the following new subsidiary bodies:
  - Bureau;
  - Administration and Finance Committee.
- Raising of the thresholds for the ex ante approval of the award of contracts and grants by the Executive Committee;
- Introduction of new tasks for the Executive Committee including the prior approval of individual procurement strategies;
- A range of other amendments to the Rules of Procedure of the Governing Board, Executive Committee and Technical Advisory Panel.



The new governance structure

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 is shown on the following page.

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 three occasions during 2011. 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 2011 the Governing Board established the following ad-hoc groups:

- The Working Group on Industrial Policy – by decision of the Governing Board of 25 November 2011;
- The Annual Assessment Steering Committee – by decision of the Governing Board of 25 November 2011.

Bureau

The Bureau is a subsidiary body of the Governing Board and provides support for communication and co-ordination 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:
  - Governing Board
  - Executive Committee
  - Technical Advisory Panel
  - Administration and Finance Committee
  - Audit Committee
- A representative of Euratom
- A representative of the ITER Host State (France)

The Bureau met on two occasions in 2011 and the main activities involved reviewing key documents and proposing recommendations on Governing Board decisions.

The F4E Governing Board

GOVERNING BOARD REPRESENTATIVES

Chair	Stuart	Ward		
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	Henrik	Bindslev	Gorm	Bramsnaes
Estonia	Rein	Kaarli	Ergo	Nömmiste
Euratom	The Director General for DG Research and Innovation of the European Commission		The Director of the Directorate Energy of the European Commission	
Finland	Seppo	Karttunen	Juha	Linden
France	Bernard	Bigot	Florent	Staley
Germany	Harald	Bolt	Beatrix	Vierkorn-Rudolph
Greece	Anastasios	Youtsos	Eleni	Stavrianoudaki
Hungary	Barbara	Tóth-Vizkelety	Sándor	Zoletnik
Italy	Aldo	Pizzuto	Romano	Toschi
Latvia	Maija	Bundule	Andris	Šternbergs
Lithuania	Sigitas	Rimkevicius	Stanislovas	Žurauskas
Luxembourg	Pierre	Decker	Leon	Diederich
Malta	Nicholas	Sammut	Ian	Gauci Borda
Netherlands	Cor	Katerberg	Niek	Lopes Cardozo
Poland	Łukasz	Ciupinski	Leszek	Grabarczyk
Portugal	Carlos Matos	Ferreira	Maria Helena Alves	Ramos
Romania	Florin	Buzatu	Florin	Spineanu
Slovakia	Stefan	Matejcik	Jozef	Pitel
Slovenia	Joze	Duhovnik	Milan	Cercek
Spain	Joaquín	Sánchez	Carlos	Martinez Riera
Sweden	James	Drake	Sven Anders	Flodström
Switzerland	Andreas	Werthmueller	Minh Quang	Tran
United Kingdom	Steve	Cowley	Alison	Wall

AD-HOC GROUP MEMBERS

Working Group on Industrial Policy		
Member	Henrik	Bindslev (Denmark)
Member	Harald	Bolt (Germany)
Member	Steve	Cowley (UK)
Member	Christopher	Ibbott (Commission)
Member	Aldo	Pizzuto (Italy)
Annual Assessment Steering Committee		
Chair	Stuart	Ward
Member	Ian	Gauci Borda
Member	Andrea	Carignani di Novoli
Member	Joaquín	Sánchez
Member	Andreas	Werthmueller

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).

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.

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
- Chantal Cortvriendt
- Alexis Loncke
- Andrea Carignani di Novoli

Activities

The AFC met for the first time on 10 October 2011 and 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:
  - Two amendments to the 2011 Work Programme;
  - The 2010 Annual Activity Report;
  - The 2012 Work Programme.

The Administration and Finance Committee (top to bottom and left to right): Simon Ošo, Nicolas Hirsch, Harald Weber, Andreas Werthmueller, Eric Hollis, Juha Linden, Carlos Silva, Chantal Cortvriendt, Andrea Carignani di Novoli (Euratom), Alexis Loncke, Cor Katerberg (Chair), Frank Briscoe (F4E Director), Thierry Brosseron, Guadalupe Cordoba

Executive Committee

The Executive Committee (ExCo) reviews draft ITER PAs and overall strategies for delivering ITER procurement packages, approves the award of the ensuing contracts and grants and, since 5 December 2011, as well as the underlying individual procurement strategies and draft calls for tender of proposals. 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. One member of the ExCo is Euratom. The ExCo members are independent in the performance of their duties and act in the general interest of F4E. Both the Chair and members of the ExCo are appointed by the Governing Board for a period of two years, renewable once.

On 1 June 2011, the Governing Board appointed Mrs Lisbeth Skovsgaard Grønberg as Chair of the ExCo.

The members of the ExCo are:

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

Activities

The ExCo met on six occasions in 2011.

It adopted the amended Rules of Procedure which had previously been approved by the Governing Board during its 20th meeting. The aim of the amendment is to allow the Committee to focus more on the most important contracts and grants as well as to provide expertise before such contracts and grants are launched.

The ExCo reviewed Overall Procurement Strategies for the following items: Buildings and the Neutral Beam Test Facility, Remote Handling, the Divertor Inner Vertical Target, the Blanket First Wall, ITER LN_2 Plant and Auxiliary Systems (Cryoplant), Test Blanket Module Systems, Diagnostics, Diagnostics for PF Coils manufacturing and supply. The ExCo also examined and approved five Individual Procurement Strategies / Calls.

In 2011, the ExCo approved four major contracts, as well as one grant. It also looked ex-post at 19 grants and 15 contracts awarded by F4E.

The Executive Committee (standing, left to right): Dan Cooke, Pierre Van Doorslaer, Giuseppe Mazzitelli, Pedro Girao, Herman ten Kate, Pilar Ramiro, Eric Capelle, Itziar Echeverria, Krzysztof Kurzydłowski, Fabrizio Felici, Herkko Plit, Hans Jahreiss (F4E Head of the Administration Department), (seated left to right): Andrea Carignani di Novoli (Euratom), Giancarlo Sordon (Euratom), Lisbeth Grønberg (Chair), Frank Briscoe (F4E Director), Walter Schuster (Secretary)

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
- Rubel Marek
- Vincent Massaut
- Olaf Neubauer
- Mathias Noe
- Noud Oomens

Activities

The TAP met on three occasions during 2011 and the main activities included:

- Taking note of information from F4E, and discussing the procurement strategies as outlined in the Project Plan, with particular emphasis on Diagnostics, Heating and Current Drive systems and TBMs;
- Discussing and endorsing the outcome of assessments performed by the three ad-hoc groups created on request of the F4E Director and the Governing Board and composed of TAP members and external experts, on:
  - Assessment of the TF coil strategy group (19th Coil Strategy, a continuation of the Cold Test strategies for the ITER coils group) met twice;
  - Assessment of the strategy to develop a 2MW gyrotron source for ECH group met four times in 2011;
  - Assessment of the PF coil costing: the PF Assessment Group met on two occasions.
- Providing comments and recommendations on the 2011 Project Plan and Work Programme.

The Technical Advisory Panel (standing, left to right): Noud Oomens, André Grosman, Horacio Fernandes, Marek Rubel, Olaf Neubauer, Enrique Ascasibar, Mathias Noe, Flavio Crisanti, (seated, left to right): Vincent Massaut, Derek Stork, Joaquín Sánchez (Chair), Frank Briscoe (F4E Director), Paola Batistoni, Antonino Cardella, Jean-Marc Fihol (F4E Head of the ITER Department)

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)
- Philippe Coenjaarts (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 2011 and the main activities included:

- Financial Reporting and Accounting:
  - The examination of the annual accounts for 2010 and the recommendation to the Governing Board for their adoption.
- Governance, Internal Control and Risk Management:
  - The examination of the changes in the audit governance of F4E made in accordance with the recommendations of the European Court of Auditors;
  - The assessment of progress made in setting-up new management systems.
- External Audit and Internal Audit:
  - The analysis of audit reports of European Court of Auditors and F4E's reply hereto;
  - The analysis of the final internal audit reports;
  - The examination of reports to the discharge authority (European Parliament);
  - The assessment of the Internal Audit annual planning for 2011 and 2012, and of the strategic audit plan 2012-2014;
  - The endorsement of a follow-up policy for internal audits.

Annexes

ITER PROCUREMENT ARRANGEMENTS

Reference	Title	Date	Value (kIUA)
3.4.P1.EU.01	Cryoplant (LN_2 and Auxiliary Systems)	15/06/2011	30.677
5.5.P1.EU.01	Diagnostic Systems	13/12/2011	1.112 out of a Total Value of 32.13517 (Phased PA)

BROADER APPROACH PROCUREMENT ARRANGEMENTS

Reference	Title	Date	Value (kBAUA)
STP-EU-PA-CR02	Procurement Arrangement for the Supply of the Cryostat Vessel Body Cylindrical Section Fabrication for the Satellite Tokamak Programme	25/07/2011	13.042
STP-EU-PA-SCMPS	Procurement Arrangement for the supply of Toroidal Field, Poloidal Field and Fast Plasma Position Control Coils Power Supplies for the Satellite Tokamak Programme	16/02/2011	20.080
BA-IFMIF-EU-PA-TF01	Procurement Arrangement for the supply of the Engineering Design and Engineering Validation of the High Flux Test Module (HFTM) with vertical rigs for the IFMIF/EVEDA Project	10/06/2011	2.07
BA-IFMIF-EU-PA-TF04	Procurement Arrangement for the supply of the Engineering Design and Validation Activities of other Modules for the IFMIF/EVEDA Project	11/11/2011	5.26
BA-IFMIF-EU-PA-LF05	Procurement Arrangement for the Design, Construction of IFMIF Target Assembly Mockup and Testing of the RH Refurbishment Operations for the IFMIF/EVEDA Project	27/04/2011	1.71
BA-IFMIF-EU-PA-AF04	Procurement Arrangement for the supply of the Superconducting RF Linac of the Accelerator Prototype for the IFMIF/EVEDA Project	26/04/2011	6.11
BA-IFMIF-EU-PA-AF05	Procurement Arrangement for the supply of the Medium Energy Beam Transport line for the IFMIF/EVEDA Project	24/06/2011	3.47
BA-IFMIF-EU-PA-AF07	Procurement Arrangement for the supply of the High Energy Beam Transport Line and Beam Dump of the Accelerator Prototype for the IFMIF/EVEDA Project	24/06/2011	5.49
IFERC-TIPA01-EU. ENEA	Procurement Arrangement for the DEMO R&D on SiC/SiC Composites for the IFERC project	25/01/2011	0.442
IFERC-DDA-PA	Procurement Arrangement for the Phase Two DEMO Design Activities (DDA) for the IFERC Project	04/08/2011	5

BROADER APPROACH AGREEMENTS OF COLLABORATION

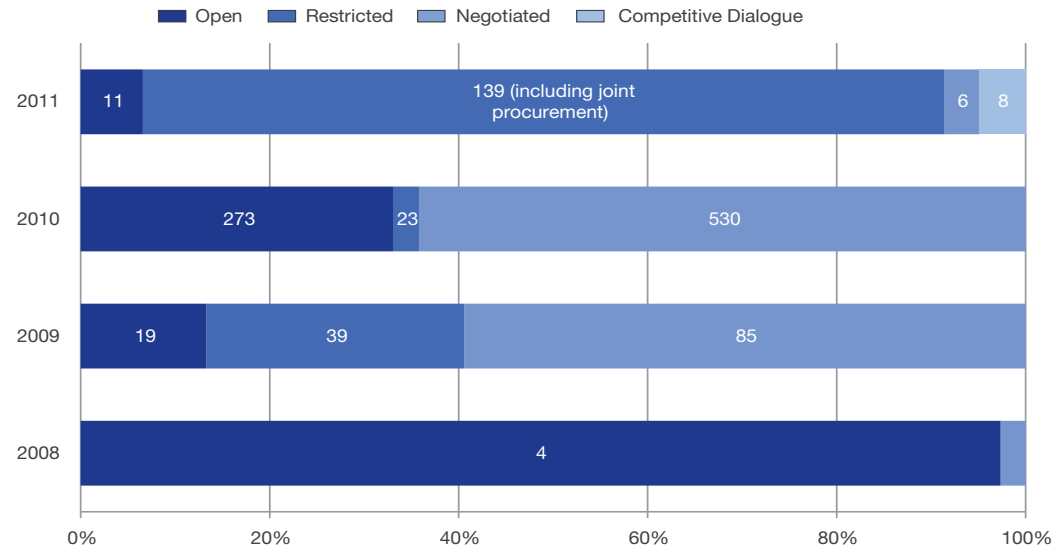
Reference	Title	Date	Value (kBAUA)
STP-EU-AoC–CR02-CIEMAT	Agreement of Collaboration between F4E and CIEMAT for the joint implementation of the Procurement Arrangement for the Supply of the Cryostat Vessel Body Cylindrical Section Fabrication for the Satellite Tokamak Programme	25/06/2011	
STP-EU-AoC-SCMPS-CEA-ENEA	Agreement of Collaboration between F4E, CEA and ENEA for the joint implementation Procurement Arrangement for the supply of Toroidal Field, Poloidal Field and Fast Plasma Position Control Coils Power Supplies for the Satellite Tokamak Programme	02/02/2011	
BA-IFMIF-EU-AoC-TF01-KIT	Agreement of Collaboration F4E-KIT for the supply of the Engineering Design and Engineering Validation of the High Flux Test Module (HFTM) with vertical rigs for the IFMIF/EVEDA Project	28/04/2011	2.07
BA-IFMIF-EU-AOC-TF04-CIEMAT	Agreement of Collaboration F4E-CIEMAT for the supply of the Engineering Design and Validation Activities of other Modules for the IFMIF/EVEDA Project	10/10/2011	1.90
BA-IFMIF-EU-AOC-TF04-KIT	Agreement of Collaboration F4E-KIT for the supply of the Engineering Design and Validation Activities of other Modules for the IFMIF/EVEDA Project	10/10/2011	1.70
BA-IFMIF-EU-AOC-TF04-SCK-CEN	Agreement of Collaboration F4E-SCK_CEN for the supply of the Engineering Design and Validation Activities of other Modules for the IFMIF/EVEDA Project	20/09/2011	1.17
BA-IFMIF-EU-AOC-LF05-ENEA	Agreement of Collaboration F4E-ENEA for the Design, Construction of IFMIF Target Assembly Mockup and Testing of the RH Refurbishment Operations for the IFMIF/EVEDA Project	27/04/2011	1.71
BA-IFMIF-EU-AOC-AF04-CEA	Agreement of Collaboration F4E-CEA for the supply of the Superconducting RF Linac of the Accelerator Prototype for the IFMIF/EVEDA Project	29/07/2011	4.86
BA-IFMIF-EU-AOC-AF04-CIEMAT	Agreement of Collaboration F4E-CIEMAT for the supply of the Superconducting RF Linac of the Accelerator Prototype for the IFMIF/EVEDA Project	29/07/2011	1.25
BA-IFMIF-EU-PA-AF05-CIEMAT	Agreement of Collaboration F4E-CIEMAT for the supply of the Medium Energy Beam Transport line for the IFMIF/EVEDA Project	06/06/2011	3.47
BA-IFMIF-EU-PA-AF07-CIEMAT	Agreement of Collaboration F4E-CIEMAT for the supply of the High Energy Beam Transport Line and Beam Dump of the Accelerator Prototype for the IFMIF/EVEDA Project	06/06/2011	5.49
AoC-IFERC-TIPA02-EU. ENEA	Agreement of Collaboration F4E-ENEA for the joint Implementation of the 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	23/12/2011	1.032

CONTRACTS AND GRANTS

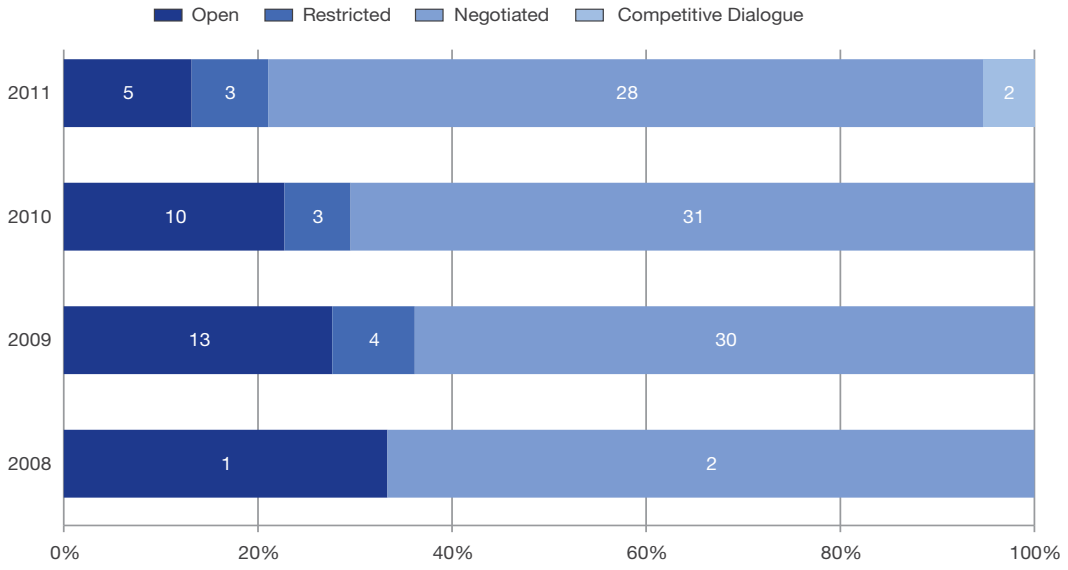
OPERATIONAL PROCUREMENT CONTRACTS

SUMMARY BY TYPE OF PROCEDURE

Contracts by Procurement Procedure (EUR million)



Contracts by Procurement Procedure (Number)



NEGOTIATED PROCEDURES (ABOVE EUR 250 000)

	Number	Value (kEUR)
Negotiated above threshold	6	4 463
(of which due to cancellation of previous competitive procedure)	5	4 171

Reference	Title	Contractor	Value (kEUR)
F4E-OPE-073-02 (MS-IV)*	Supply of 15 W Monoblock Mock-Ups and 2 W Vertical Target Qualification Prototypes and special tooling	Plansee SE	1 000
F4E-OPE-079 (ES-SF)*	Fusion Component Failure Rate Database	ENEA - Agenzia Nazionale per le Nuove Tecnologie, l'Energia e lo Sviluppo Economico Sostenibile	95
F4E-OPE-096-02 (MS-IV)*	Supply of 10 CFC Monoblock Mock-Ups and special tooling	Plansee SE	418
F4E-OPE-097 (MS-IV) Lot 2	Fabrication of pre-qualification Semi-Prototypes of the ITER First Wall (FW) Panels	Atmostat S.A.S.	1 656
F4E-OPE-148 (MS-IV)*	Independent assessment of the proposed quantitative ITER FW shaping	United Kingdom Atomic Energy Authority (CCFE)	190
F4E-OPE-160-01*	Heat treatment and validation of CuCrZr-IG/AISI 316L tube-to-tube transition joint and supply of mock-ups for ITER Divertor application	3D-Metal Forming B.V.	13
F4E-OFC-167-01 (ES-MF)	Framework Service Contract - Material characterisation at room and elevated temperatures	Fundación Tecnalia Research & Innovation	600
F4E-OFC-169 (PS-IC)	Framework Service Contract - Provision of System and Instrumentation Engineering Support	Indra Sistemas S.A.	4 000
F4E-OPE-244 (ES-MF)*	Supply of Equipment for Corrosion Assessment for Water Cooled Components	Studsvik Nuclear AB	141
F4E-OPE-251 (SB.PS)	Site Adaptation Works	COMSA S.A.U.	11 307
F4E-OPE-264*	Risk Analysis and Cost Assessment of the ITER Core-Plasma LIDAR Thomson Scattering Diagnostic	United Kingdom Atomic Energy Authority (CCFE)	50
F4E-OPE-271*	Further support in industrial risk analysis	NIER Ingegneria S.p.A.	50
F4E-OMF-272	Multiple Framework Contract in Cascade - Provision of Engineering Support in the area of Remote Handling	Assystem UK Ltd (first ranked)	3 500
F4E-OPE-277 (MS-IV)*	Feasibility study for the Welding and NDE of Blanket Cooling Manifold Piping	TWI Ltd	29
F4E-OPE-281 (ES-SF)*	Supply of equipment for the adaptation of the DUSTEX facility	Karlsruhe Institute of Technology (KIT)	42
F4E-OPE-284 (MS-IV)*	Supply of 4 FW mock-ups and two FW panel semi-prototypes of NHF design	AREVA NP S.A.S.	2 061
10/11/6000000081	Framework Service Contract - Facility Management Services for the ITER site	VEOLIA consortium: DALKIA France Veolia Eau - Compagnie Generale des Eaux Veolia Propreté Industries Services	7 500

Reference	Title	Contractor	Value (kEUR)
F4E-OPE-289-01*	Update and completion of the design of the front-end Cryopumps Cryodistribution	IDOM Ingeniería y Sistemas S.A.	317
F4E-OPE-292 (PNS-CP)*	Sealed Helium compressor feasibility study	Howden UK Ltd	170
F4E-OPE-296 (MS-IV)*	Feasibility study for the bending and shaping of blanket cooling manifold piping	Proform S.A.	50
F4E-OPE-297 (ES-AC)*	TFC Case Welding Simulation	NATEC Ingenieros	47
F4E-OMF-298.01	Framework Service Contract - Provision of engineering support services in the area of Radwaste Treatment and Storage System (RWT&SS)	Serco Limited	1 000
F4E-OPE-300 (RH)*	Feasibility analysis and proposal of conceptual solutions for the actuation of the IVVS/GDC deployment system	Oxford Technologies Ltd	39
7607000/1 400692/000	Decennial Insurance cover for the PF Coil Building	Société Mutuelle d'Assurance du Bâtiment et des Travaux Publics Grands Comptes (SMABTP)	92
Policy N° 7400021006	Decennial Insurance Cover for buildings not subject to mandatory decennial insurance	Zurich Insurance plc (Succursale pour la France)	7 883
IO/10/4043/CFT/DC	Framework Service Contract - Provision of global transport, logistics and insurance services	Daher International	120 000
F4E-OPE-318 (ES-MF)*	Review of corrosion materials data for bolts	Studsvik Nuclear AB	25
F4E-OPE-323*	Provision of UT qualification support for the inspection of one-side weldments of the ITER vacuum vessel sectors	Vincotte International Ltd	48
F4E-OPE-326-01*	Design justification related to the conceptual Design of the cask & plug Remote Handling system	Assystem UK Ltd	50
F4E-OPE-329*	Hydraulic and magnetic measurements of the JT-60SA conductors and strands	Commissariat à l'Energie Atomique et aux Energies Alternatives (CEA)	50
F4E-OPE-330-01*	Supply of "TF superconductor dummy" NbTi strands	Luvata Pori Oy	43
F4E-OPE-336*	Provision of pre-studies on force cooled quench tanks and on test cryostat	SDMS	46
F4E-OPE-338*	Characterisation of Corrosion Parameters of Alloy 660	Studsvik Nuclear AB	89
Contract Amendment No. 3 to F4E-2008-OPE-009-01(PMS-H.CD), and its amendment No. 1 and 2*	Coaxial Gyrotron Development Prototype 1, 170GHz, 2MW, 1s refurbishment	Thales Electron Devices S.A.	292

Reference	Title	Contractor	Value (kEUR)
F4E-OPE-347*	Supply of experimental data on "Deuterium Desorption from Beryllium Layer" (phase II)	Max-Planck-Gesellschaft zur Förderung der Wissenschaften e.V. (MPG) Institut für Plasmaphysik (IPP)	50
F4E-OPE-349 (PMS-PE)*	Analysis of real time construction in ITER	Consorzio RFX	49
F4E-OPE-362*	High Heat Flux Tests of ITER First Wall Mock-Ups	Alphysica GmbH	376
Contract Amendment No1 to F4E-2008-OPE-07-01 (ES-AC)*	Provision of Engineering Support in the Area of Mechanical Analysis - "Vacuum Vessel Analysis"	Iberdrola Ingenieria y Construccion S.A.U. Numerical Analysis Technologies S.L. (NATEC) ELYTT ENERGY S.A.	192

ADMINISTRATIVE PROCUREMENT CONTRACTS

SUMMARY BY TYPE OF PROCEDURE

Procedure	Number	Value (kEUR)
Open	2	1 650
Restricted	0	0
Negotiated	7	2 125.8
Re-opened competition implementing a Framework	1	185.7
Joint Procurements*	7	1 200.2**
Total	**17**	**5 161.7****

* Award decisions following joint tendering are not systematically signed by F4E

** While the number of contracts awarded is known, the values of some contracts ensuing from Joint Procurements with the European Commission have not yet been communicated to the participating entities

NEGOTIATED PROCEDURES (ARTICLES 126 AND 127 OF THE IMPLEMENTING RULES, ABOVE EUR 60 000)

Reference	Title	Contractor	Type	Value (kEUR)
F4E-ADM-260	Legal Services IPR	Oficina Ponti	Framework Service	600
F4E-ADM-312	Legal assistance procedures OPE-285 and OPE-286	Norton Rose	Direct service	180.8
F4E-ADM-314	Legal services EU public procurement	Hogan Lovells International LLP	Framework Service	480
F4E-ADM-317	Complementary Health Insurance	Sanitas	Direct service	600
F4E-ADM-321	Adjudication services	Mr Robert Gaitskell	Framework Service	600
F4E-ADM-354	Legal services TB4	Norton Rose	Direct service	175

AWARDED CONTRACTS

Reference	Title	Type	Date	Value (kEUR)
F4E-ADM-260	Legal Services IPR	Framework Service	30/04/2011	600
F4E-ADM-312	Legal assistance procedures OPE 285 and OPE 286	Direct Service	21/03/2011	180.8
F4E-ADM-314	Legal services EU public procurement	Framework Service	19/10/2011	480
F4E-ADM-317	Complementary Health Insurance	Direct Service	18/11/2011	600
F4E-ADM-321	Adjudication services	Framework Service	17/11/2011	600
F4E-ADM-354	Legal services TB4	Direct Service	04/12/2011	175
F4E-ADM-377	HR Services	Direct Service	14/11/2011	60
F4E-ADM-333	Additional legal advice for OPE 262	Framework Service	14/04/2011	30
F4E-ADM-250	Engineering data management	Framework Service	20/12/2011	800
F4E-AFC-337	Annual assessment of F4E	Framework Service	09/11/2011	850
F4E-2008-ADM/ IT-04.03.09	eHR Applicaton and LeaMa phase 2 (Sharepoint)	Specific Service (Competitive Framework)	08/07/2011	185.7
F4E-2010-FW-20	Devices and services for printing, copying and scanning	Framework Service	19/08/2011	n/a*
F4E-2011-FW-31	Provision of services concerning professional training	Framework Service	19/10/2011	455.04
F4E-2011-FW-32	Insurance internal staff	Direct Service	14/03/2011	N/A*
F4E-2011-FW-33	Insurance cover for Professional Civil Liability	Direct Service	17/05/2011	N/A*
F4E-2011-FW-34	Microsoft Licenses	Framework Service	02/05/2011	N/A*
F4E-2011-FW-35	Microsoft High level Services	Framework Service	02/05/2011	745.2
F4E-2011-FW-40	SAP (Systems, Applications and Products in Data Processing)	Framework Service	09/06/2011	N/A*

* The values of some contracts ensuing from Joint Procurements with the European Commission have not yet been communicated to the participating entities.

GRANTS *(* Unique Beneficiaries)*

Reference	Title	Beneficiary	Value (kEUR)
F4E-GRT-154 (MS-IV)	High heat flux testing of FW mock-ups before and after irradiation, including transportation	Forschungszentrum Jülich GmbH	802

Reference	Title	Beneficiary	Value (kEUR)
F4E-GRT-155 (PMS-DG)*	R&D Design of Sensors for the ITER Magnetics Diagnostic: In-Vessel Discrete Sensors Assemblies - Equilibrium Sensors, HF Coils and RWM Coils	Consorzio RFX	303
F4E-GRT-157 (PMS-DG)*	R&D Design of Sensors for the ITER Magnetics Diagnostic: Design of Ex-Vessel Inductive Sensors	Commissariat à l'Energie Atomique et aux Energies Alternatives (CEA)	198
F4E-GRT-161-01	Design, Analysis and Documentation to Produce the ITER EC H&CD Upper Launcher Final Design - Part 1	Consortium ECHUL-CA: Karlsruhe Institute of Technology (KIT) Ecole Polytechnique Fédérale de Lausanne (EPFL) - Centre de Recherches en Physique des Plasmas (CRPP) Stichting voor Fundamenteel Onderzoek der Materie (FOM) Istituto di Fisica del Plasma, Consiglio Nazionale delle Ricerche (CNR) Max-Planck-Gesellschaft zur Förderung der Wissenschaften e.V. (MPG) - Institut für Plasmaphysik (IPP)	2 098
F4E-GRT-163 (ES-AC)	4C Benchmark and Validation Study	Politecnico Di Torino	40
F4E-GRT-168*	Framework Partnership Agreement - Development of Nuclear Data Files	Consortium on Nuclear Data Development and Analysis: Karlsruhe Institute of Technology (KIT) United Kingdom Atomic Energy Authority (CCFE) The Nuclear Research and Consultancy Group (NRG) Jožef Stefan Institute (JSI) Technische Universität Wien (TUW) Horia Hulubei National Institute of Physics and Nuclear Engineering (IFIN-HH) Centro de Investigaciones Energéticas, Medioambientales y Tecnológícas (CIEMAT)	500
F4E-GRT-265	Evaluation of edge MHD stability and uncontrolled ELM energy losses for ITER H-mode plasmas in non-active, DD and DT operational scenarios	Commissariat à l'Energie Atomique et aux Energies Alternatives (CEA)	159
F4E-GRT-267	Plasma evolution and performance during plasma regimes with controlled ELMs in ITER	Max-Planck-Gesellschaft zur Förderung der Wissenschaften e.V. (MPG) Institut für Plasmaphysik (IPP)	157
F4E-GRT-268	Assessment of erosion corrosion parameters	Studsvik Nuclear AB	98
F4E-GRT-273 (ES-MF)*	Supply of documentation of Busbar Arc model validation & supporting experiments	Karlsruhe Institute of Technology (KIT)	73
F4E-GRT-276-01 (MS-RH)	Optimisation of trajectories for the Cask and Plug Remote Handling System in the Tokamak Building and Hot Cell	Instituto Superior Técnico (IST) Astrium S.A.S. (ASTRIUM-ST)	80
F4E-GRT-288 (TBM-MD)	Study of 3 design configurations for HCLL and HCPB TBM	Ingeniería IDOM Internacional S.A.	348

Reference	Title	Beneficiary	Value (kEUR)
F4E-GRT-294 (PMS-DG)*	R&D Design of Sensors for the ITER Magnetics Diagnostic: Design of Fibre Optic Current Sensor	Studiecentrum voor Kernenergie / Centre d'Etude de l'Energie Nucléaire (SCK-CEN)	102
F4E-GRT-303 (PMS-H.CD)*	Finalisation of the design of Heating Neutral Beam (HNB) and MITICA Cryopumps	Consorzio RFX	165
F4E-GRT-306 (PMS-H.CD)*	Development of Cooling & Cryogenic Plants, Auxiliary systems for NBTF and Power Supply systems for NBTF and ITER	Consorzio RFX	575
F4E-GRT-313 (PMS-H.CD)*	Development of the Neutral Beam Mechanical Components at the NBTF	Consorzio RFX	1 318
F4E-GRT-315-01	Simulations of ITER First Wall Energy loading during mitigated disruptions and runaway electrons	Karlsruhe Institute of Technology (KIT)	100
F4E-FPA-328 (PMS-DG)	Framework Partnership Agreement - Provision of Tokamak services for Diagnostics	Wigner Research Centre for Physics, Hungarian Academy of Sciences (MTA Wigner RCP) Centre for Energy Research, Hungarian Academy of Sciences (MTA EK) Budapest University of Technology and Economics (BME)	3 730
F4E-GRT-334	Model validation of 3D MHD code and construction of ITER model for simulation of asymmetric VDEs and associated electro-magnetic load	Consorzio RFX	60
F4E-GRT-346 (PMS-PE)	Study of EC assisted Plasma Start Up in ITER	Istituto di Fisica del Plasma, Consiglio Nazionale delle Ricerche (CNR)	75
Amendment No. 1 to F4E-GRT-026-01*	Amendment No. 1 to Grant Agreement F4E-GRT-026-01 "Detailed Design of the ITER ICH Antenna"	Consortium CYCLE: United Kingdom Atomic Energy Authority (CCFE) Commissariat à l'Energie Atomique et aux Energies Alternatives (CEA) Patrimoine de l'Ecole royale militaire/EURATOM - Laboratoire de Physique des Plasmas (ERM) Max-Planck-Gesellschaft zur Förderung der Wissenschaften e.V. (MPG) Institut für Plasmaphysik (IPP) Politecnico Di Torino (POLITO)	1 566
Amendment No. 2 to F4E-GRT-049 (PMS-H.CD)*	Amendment No. 2 to F4E-GRT-049 (PMS-H. CD) "Additional effort on modelling and experiments for the design and development of the European Gyrotron"	EGYC Consortium: Karlsruhe Institute of Technology (KIT) Ecole Polytechnique Fédérale de Lausanne (EPFL) - Centre de Recherches en Physique des Plasmas (CRPP) Research Unit of the Association Euratom-Hellenic Republic (HELLAS) Istituto di Fisica del Plasma, Consiglio Nazionale delle Rícerche (CNR)	514

ITER TASK AGREEMENTS CLOSED IN 2011

Reference	Title	Value Effort	Amount	Date
C11PP167FE	Pre-compression Ring Fabrication Assessment and Glass Fibre-epoxy Composite Mechanical Characterisation(1.1EU7)	PPY	2	05/01/2011
C11TD178FE	Eddy Current Analysis of the Magnet Structures	IUA	160	07/02/2011
C31PP12FE	ITER Vacuum System (31EU1~3.1EU6) Cryopumps and CVBs design updating including I&C and design of the leak detection system	PPY	9.8	17/01/2011
C41PP22FE	Components Grounding inside the Tokamak, Diagnostic and Tritium plant buildings, and the Assembly Hall (4.1EU1)	PPY	1.66	04/07/2011
C52PP26FE	Design of Top Launcher (5.2EU2)	PPY	0.1	20/05/2011
C53TD56FE	Design of the NBTF Components	IUA	1936.23	06/12/2011
C53TD59FE	Design of the NBTF Components Part 2	IUA	1610.45	23/11/2011
C55PP24FE	The mechanical design of the Diagnostic Equatorial Port Plug BSM Attachment (5.5EU01)	PPY	0.25	13/01/2011
C55PP25FE	Diagnostic Equatorial Port Plug Procurement Technical Specification (5.5EU02)	PPY	0.25	13/01/2011
C55PP26FE	Detailed design of the in-vessel magnetic sensor common mechanical and electrical platform (5.5EU3)	PPY	0.5	15/12/2011
C55TD29FE	Generic Diagnostic Equatorial Port plug Preliminary Design	IUA	150	23/11/2011
C74TD16FE	Update of the Structural Design Criteria for In-Vessel Components (SDC-IC)	IUA	392.16	22/12/2011
C76TD07FE	Electro-Magnetic Analysis and Mechanical Loads Analysis for TBM Port Plug Frame Conceptual Design	IUA	45.04	14/02/2011
C81TD35FE	Activated corrosion product generation, transport and deposition: verification of PACTITER code and its validation against fusion specific experiments	IUA	300	12/07/2011
CAD - Eng-EU	CAD/Engineering works to support the ITER procurement arrangement specification (EU)	IUA	390	08/11/2011
DWO-16-311-JPR-EU	CAD-Eng-EU: Cad/Engineering works to support the ITER procurement arrangement specification (EU)	IUA	90	22/03/2011
DWO-23-118-JPR-EU	TA-CAD/Eng-EU: Cassette Toroidal Mover (CTM) Design Update	IUA	51	12/01/2011
DWO-23-119-JPR-EU	TA-CAD/Eng-EU: CMM End-Effectors for Central and Standard Cassettes	IUA	51	12/01/2011
DWO-73-301-MJL-EU	TA-CAD/Eng-EU: Development and Validation of a Torus-equivalent Boundary Neutron source for ITER Radiation Transport Analyses	IUA	60	10/03/2011
DWO-52-107-CDS-EU	Common Matching Optics Unit design feasibility study	IUA	28.1	30/03/2011

Reference	Title	Value Effort	Amount	Date
DWO-17-125-MMA (2DLA9F)	Divertor Inner Target and Cassette Body	IUA	45.5	21/03/2011
DRWG8-EU-01	EU Support to the Work Programme of the In-Vessel Components Working Group	PPY	4.6	04/04/2011
G11TD150FE	Specification and Industrial Qualification of TF resin systems for Vacuum Impregnation (ITA 11-30 and 11-75)	---	---	13/01/2011
G11TD153FE	Conductor Coupling Loss Characterisation, CS, PF, TF and CC (ITA 11-50)	---	---	13/01/2011
G11TD154FE	Pre-compression Ring Fabrication Definition and Pre-Compression System Final Design for the ITER Magnet System (ITA 11-82)	---	---	13/01/2011
G15TD46FE	Development of Vacuum Vessel Manufacture Methods	---	---	16/02/2011
G15TD50FE	Support for completion of the Vacuum Vessel specification documents	---	---	15/11/2011
G15TD64FE	Vacuum Vessel Poloidal Segment Mock-up Manufacture	---	---	8/11/2011
G74TD08FE	New revision of the ITER MPH for In-Vessel materials	---	---	31/05/2011
N11TD139FE	Thermohydraulic analysis for the ITER superconducting coils (ITA 11-42-EU (part2))	---	---	13/01/2011
N11TD140FE	Review of PF2 -PF5 Winding Design	PMY	1	13/01/2011
N11TD143FE	Manufacture and test of Nb_3Sn Prototype conductor samples (Sultan type) for the TF and CS coils	---	---	13/01/2011
N11TD154FE	Pre-compression Ring Fabrication Definition and Pre-compression System Final Design for the ITER Magnet System	---	---	12/01/2011
N11TD155FE	NDT using ultrasonics of circle-in-square butt welds for CS and PF conductor jackets	PMY + 100 IUA	---	13/01/2011
N11TD99FE	Design and Testing of Reduced-scale Mock-ups for the ITER Magnet Pre-Compression Rings	---	---	13/01/2011
N53TD33FE	Development of the SINGAP negative ion accelerator	---	---	07/06/2011
N55TD15FE	Development of the guiding principles for the design and engineering of the diagnostic ports contributing to a Diagnostic Port Engineering Task Force	---	---	13/01/2011
N55TD20FE	Support to the ITER Diagnostic Design: magnetics, thermography, polarimetry, motional Stark effect, active charge-exchange spectroscopy, X-ray/VUV spectroscopy, neutron cameras, reflectometry and collective Thomson scattering	---	---	13/01/2011
TA - FCIPT-10-30 EU1	Support for Radiological and Environmental Monitoring during CDR Phase	IUA	67	22/07/2011

ITER CALLS FOR NOMINATION OR EXPERTISE MANAGED BY F4E

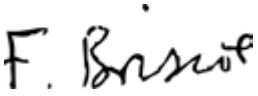
ITER Ref. No.	Title	Deadline
IO/11/4705/CFE	Engineering Work for the Instrumentation of Coils and Feeder	11/02/2011
ITER/CFE/11/4701/JTR	Accelerator and Beam Physics Design Analyses for the ITER Neutral Beam System	21/02/2011
IO/11/4412/CFE	Technical support and preparation of documentation for the ITER Magnet feeder System	22/02/2011
ITER/CFT/11/4695	Facility management services for the ITER site	23/02/2011
ITER/CFT/11/4696	Site security services for the ITER site	23/02/2011
IO/11/4414/CFE	Technical Support in Monitoring Manufacture of Superconducting Strands for the ITER Magnets System	28/02/2011
IO/11/4930/CFE	Expert's support of design review of the ITER Water Detritiation System	17/03/2011
IO/11/4796/CFN	Engineering Technical Support for the ITER Tokamak Directorate	08/03/2011
IO/11/4931/CFE	Expert's support of design review of the ITER Water Detritiation System	17/03/2011
ITER/CFN/11/4584	EPICS Software Support and Training Services	07/04/2011
IO/11/4982/CFE	Institutional Industrial Membership for Welding	26/04/2011
ITER/CFE/11/4840/5115/BHS	Engineering Support in the Areas of Vacuum and Cryogenics for the ITER Magnet Feeder and the ITER Vacuum System	22/04/2011
IO/11/5008/CFN	Engineering Support Services for In-Vessel Coil (IVC) Power Supply Systems	17/04/2011
ITER/CFN/11/5146	Prototype of the CODAC Archiving System	08/05/2011
ITER/CFN/11/5255/PBS	Provision of IT Hardware to the ITER IO	22/05/2011
ITER/C4N/11/5179/JTR	I & C Support Services for ITER Control Systems (CODAC)	13/06/2011
ITER/CFE/11/5376/JTR	Support the design and progression of the Diagnostics Active Spectroscopy Systems on ITER	23/06/2011
IO/11/5281/CFE	Integrated Logistics Processes and Systems Integration Management Support	23/06/2011
ITER/CFE/11/5493/JTR	Atomic physics and plasma impurity emission modelling in support of diagnostics activities	11/07/2011
ITER/CFE/11/5502/JTR	Neutral Beam Engineering support in Diagnostics Neutral Beam & NB Beamline components design (two profiles)	20/07/2011
ITER/CFE/11/5511/JTR	Integration and Diagnostics Support on ITER	18/07/2011
IO/11/5565/CFE	MAI Expert Planning Resources	07/07/2011
ITER/CFE/11/5591/JTR	Development of Dust, Tritium and Erosion Diagnostics on ITER	25/07/2011
IO/11/5610/CFE	Management of the requirements of the ITER Technical Baseline Documentation	25/07/2011
ITER/CFN/11/5682/PBS	Health, Safety and Environmental Management oversight for the ITER Worksite	21/07/2011
ITER/C4N/11/5531/JTR	Engineering Support to ITER Diagnostics	07/08/2011

ITER Ref. No.	Title	Deadline
IO/CFT/11/10005680	Cryostat Concentration Map Technique	28/07/2011
IO/11/5600/CFN	Development of Light Weight Sensors for Remote Leak Detection and Localisation	27/07/2011
IO/11/5726/CFE	Vacuum Leak Engineering Support	08/08/2011
IO/11/5840/CFN	Investigation of Distributed Sensing Techniques Based on Fibre Optic Technology and their Applicability to ITER Leak Localisation	25/08/2011
ITER/C4N/11/5799/AJB	Provision of Local IT System Administrative Services	30/08/2011
IO/11/5818/CFE	Engineering Support in the Areas of Vacuum Testing	08/09/2011
IO/CFT/11/10005509	Support of design of the ITER atmosphere Detritiation Systems (6 lots)	08/09/2011
IO/11/5616/CFE	Remote Handling System Engineering and R&D Expert	22/09/2011
ITER/11/C4N/5717/JTR	Engineering Support to ITER Central Interlock System	15/09/2011
ITER/11/C4N/5805/JTR	Engineering Support to ITER Controls	29/09/2011
IO/11/5754/CFN	Irradiation and Testing of Blanket First Wall Mock-ups	19/09/2011
IO/CFN/11/5660	R&D on Capture and Exchange Method for Processing Highly Tritiated Water	20/09/2011
IO/CFT/11/6162	Vacuum Vessel Assembly Welding	06/11/2011
ITER/CFE/11/6053/JTR	Diagnostics Irradiation Testing of Electrical Components and Cables	11/11/2011
IO/11/6212/CEF	Support of modular design of tritium plant systems	24/11/2011
IO/11/6270/CEF	Metrology Engineering Services	16/12/2011
ITER/C4N/11/7-0002/JTR	Window Assembly Manufacture and Testing	03/01/2012
ITER/C4T/11/70000000/PBS	Site Security and Reception services for the ITER Site	09/01/2012
ITER/CFE/11/6306/JTR	Analysis of the performance of ITER slow interlock prototypes	31/01/2012

DECLARATION OF ASSURANCE

I, undersigned, Frank Briscoe, 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;
- Following a report of the Internal Auditor of F4E, a reservation was taken in 2010 in respect to the effectiveness of the financial circuits of the organisation. During 2011, significant efforts were made to implement the action plan of the aforementioned audit in parallel with the F4E ongoing organisational changes that were addressed. The implementation of the new financial circuits has been completed successfully, ensuring a stronger segregation of duties between the financial actors and clarifying their responsibilities and provide a reasonable assurance concerning the legality and regularity of financial transactions. I can therefore confirm that the reservation does not have to be maintained for 2011;
- Based on the annual reports of the Court of Auditors of previous years as well as their 2011 preliminary findings, I make the following observation concerning the overall Internal Control Environment of F4E. While the organisation continued to build and expand its overall control Framework in 2011, the remaining actions are being implemented in 2012;
- Confirm that I am not aware of anything not reported here which could harm the interests of F4E and the European institutions in general.



Dr Frank Briscoe
Director of Fusion for Energy
18 June 2012

ANALYSIS AND ASSESSMENT BY THE GOVERNING BOARD

Introduction

Article 43 of the Financial Regulation (FR) 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.

2011 was an important year, with a lot of changes, both within F4E and within the Governing Board. Concerning F4E, a new organisational structure was implemented in response to the Conclusions of the Competitiveness Council of July 2010. Concerning the Governing Board, a new governance model was introduced including the creation of an Administration and Finance Committee and a Bureau.

Against this background the Governing Board made an analysis and assessment of the 2011 Annual Activity Report and came to the following conclusions.

The Governing Board:

(1) Notes that the authorising officer fulfilled the task given to him in Article 43 of the FR;

(2) Welcomes the overall achievements presented in the 2011 Annual Activity Report of F4E and the strong commitment shown by the Director and his staff during a challenging period;

(3) Welcomes the implementation by the F4E Director of a new organisational structure and successful recruitment of new heads of department and other key staff members;

(4) Appreciates that F4E has now turned into a 'mature' organisation concerning personnel and social policy;

(5) Notes that the implementation of the payment budget has significantly improved compared with the ex ante budget than the years before. However, there is still a gap of 14% between the ex post payment budget and the ex ante payment budget;

(6) Notes that while 99.7% of the commitment budget was implemented, 49% of those commitments were 'global commitments';

(7) In the light of the two findings above, constant attention should continue to be paid by both F4E and the Governing Board regarding the implementation of the budget;

(8) Regrets that there is no information on the geographical distribution of the value of grants and contracts and asks F4E to include this information in future Annual Reports;

(9) Welcomes the clear structure, homogeneity and the detailed content of the technical chapters which makes F4E´s Annual Report a real working tool for the expert community;

(10) Welcomes the start of credit reception from the ITER IO, showing that F4E is already delivering equipment and services to ITER;

(11) Welcomes the implementation of the first Framework Partnership Agreements and encourages F4E to exploit this tool to enhance the engagement with Fusion Research Organisations;

(12) Welcomes the progress in the fabrication of key high value components such as Magnets and Vacuum Vessel, but notes that the delay reported in the delivery of the Vacuum Vessel detailed design and the slow progress in the negotiated procedure for the fabrication of the Poloidal Field (PF) coils requires urgent attention by the ITER IO and F4E;

(13) Welcomes the progress in the site preparation and in the construction of the PF coil building, but notes that the delay in the finalisation of the detailed designs of the main ITER buildings also requires urgent attention by the ITER IO and F4E.

Mr Stuart Ward
Chair of the F4E Governing Board
29 June 2012

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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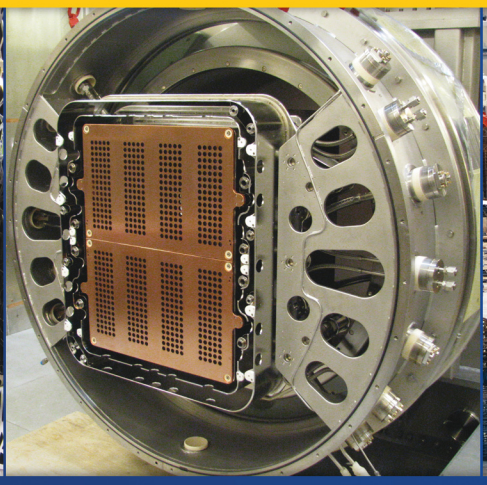

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