**FUSION FOR ENERGY**

The European Joint Undertaking for ITER and the Development of Fusion Energy

THE GOVERNING BOARD

# DECISION OF THE GOVERNING BOARD ADOPTING THE SECOND AMENDED 2010 WORK PROGRAMME OF THE EUROPEAN JOINT UNDERTAKING FOR ITER AND THE DEVELOPMENT OF FUSION ENERGY

THE GOVERNING BOARD OF FUSION FOR ENERGY

HAVING REGARD to the Statutes annexed to the Council Decision (Euratom) No 198/2007 of 27th March 2007 establishing the European Joint Undertaking for ITER and the Development of Fusion Energy (hereinafter "Fusion for Energy") and conferring advantages upon it[1] and in particular Articles 6(3)(d) and 11 thereof;

HAVING REGARD to the Financial Regulation of Fusion for Energy[2] adopted by the Governing Board on 22nd October 2007, last amended on 18th December 2007[3] (hereinafter "the Financial Regulation"), and in particular Article 64 thereof;

HAVING REGARD to the Implementing Rules of the Financial Regulation[4] adopted by the Governing Board on 22nd October 2007 last amended on the 8th July 2008[5] (hereinafter "the Implementing Rules") and in particular Article 53 thereof;

HAVING REGARD to the Fusion for Energy Project Plan and Resource Estimates Plan adopted by the Governing Board on 26th November 2009;

HAVING REGARD to the comments of the Executive Committee on the proposal for the Amended 2010 Work Programme adopted at its meeting of 19-20th May 2010[6];

HAVING REGARD to the comments and recommendation of the Technical Advisory Panel adopted at its meeting on 26th May 2010,

WHEREAS:

(1) The Director should, in accordance with Article 8(4)(c), draw up an annual work programme;

(2) The Governing Board should adopt the work programme.

HAS ADOPTED THIS DECISION:

*Article 1*

The Amended 2010 Work Programme of Fusion for Energy annexed to this Decision is hereby adopted.

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1 O.J. L 90, 30.03.2007, p. 58.
2 F4E(07)-GB03-11 Adopted 22/10/2007
3 F4E(07)-GB04-06 Adopted 18/12/2007
4 F4E(07)-GB03-12 Adopted 22/10/2007
5 F4E(08)-GB06-06a Adopted 08/07/2008
6 F4E(10)-EC21-Summary Adopted 20/5/2010

*Article 2*

This Decision shall have immediate effect.

Done at Barcelona, 10th June 2010

For the Governing Board

**Carlos Varandas**
Chair of the Governing Board

# ANNEX I

# FUSION FOR ENERGY WORK PROGRAMME 2010 (WP2010)

## TABLE OF CONTENTS

# PART I - INTRODUCTION, ASSUMPTIONS AND OVERALL OBJECTIVES

## 1.1. INTRODUCTION

The European Joint Undertaking for ITER and the Development of Fusion Energy ('Fusion for Energy' or F4E) is a Joint Undertaking created under the Euratom Treaty by a decision of the Council of the European Union.

Fusion for Energy was established for a period of 35 years from 19th April 2007 and is located in Barcelona, Spain. The objectives of 'Fusion for Energy' are threefold:

- Providing Europe's contribution to the ITER International Fusion Energy Project as the designated Domestic Agency for Euratom;
- Implement the Broader Approach agreement between Euratom and Japan as the designated Implementing Agency for Euratom;
- Prepare in the longer term for the construction of demonstration fusion reactors (DEMO).

In accordance with the Financial Regulation, this Work Programme lays down the activities of F4E that are to be implemented and financed through the 2010 budget.

## 1.2. ASSUMPTIONS

The 2010 amended F4E Work Programme (WP2010) for ITER is based on the following assumptions:

- The European schedule is based on the Scenario 1 Modified Accelerated. This scenario was used as basis for this document;
- F4E will receive on time from IO the necessary inputs foreseen in the ITER Quality Management process deposited with the Nuclear Safety Authorities and in accordance with Build-to-Print, Detailed Design and Functional Specification status agreed in 2001;
- The necessary inputs from IO will be provided in time to allow the associated PAs to be signed according to the foreseen schedule;
- WP2010 is in line with the Additional Direct Investments and the revised sharing agreed with IO and other Domestic Agencies;
- The planning of the activities and the corresponding delivery of components by the other ITER Domestic Agencies will be respected;
- A current understanding of the ITER Design and that some modifications might be required in 2010 to adjust it to the possible ITER developments;
- F4E will continue active management of and involvement in the ongoing tasks signed under EFDA, results of which are required to initiate certain F4E activities;
- Technically and commercially complex procurements will be implemented whenever appropriate through the *Competitive Dialogue* procedure or through the negotiated procedure, in order to improve the alignment of supply chain response to F4E needs and to proactively adopt cost containment measures. This will be done in compliance with our Implementing rules;

- Grants related to recurring and sequential R&D activities, with a well defined development path eventually leading to a EU procurement package, will be implemented whenever appropriate through the *Framework Partnership Agreement* (FPA) procedure, in order to streamline and channel R&D funding, improve its effectiveness and reduce administrative burden to beneficiaries and F4E alike. In consideration of the transitional period for starting implementation of FPA, modifications may occur in the foreseen scheduling of grant activities included in WP2010;
- Procurements which encompass scope within the domain of both F4E and contracting authorities, or for which a very close coordination between F4E and other entities is needed, will be implemented whenever appropriate through the *Joint Procurement* procedure.

Regarding the amended WP2010 for Broader Approach, the main assumptions are:

- The project plans presented in this document are those approved by the Broader Approach Steering Committee;
- The Work Programmes for the projects IFMIF/EVEDA, IFERC and the Satellite Tokamak Programme will be approved by the Broader Approach Steering Committee.

## 1.3. ITER CREDITS FOR PREPARATORY ACTIVITIES

This WP2010 includes an extensive programme of R&D and preparatory activities that have to be carried out prior to signing the Procurement Arrangement for the Procurement Packages agreed to be at Build-to-Print level. Recognising that F4E is carrying out work that should have been completed by the IO, additional credit from the IO is being requested by F4E through ITER Task Agreements (ITAs). The activities indicated in this WP2010 as receiving additional (ITA) credits may be cancelled in the event that the IO would not make the requested credits available.

## 1.4. MAIN OBJECTIVES

### *1.4.1. ITER*

With respect to activities related to ITER, the main objectives are:

- The negotiation and signature of the ITER Procurement Arrangements, proposed by the ITER Organisation (IO), according to the present schedule;
- The signature of procurement contracts for those components on the critical path (in particular buildings, magnets and vacuum vessel);
- The continuation of design and R&D activities in areas including Remote Handling, Heating and Current Drive, Vacuum System, Tritium System, Diagnostics and Test Blanket Modules;
- The continuation of the preparation of safety and licensing documentation for ITER in Cadarache and related safety studies;
- The investigation of manufacturing methods and non-destructive tests of critical components from the technical point of view with the objective of minimising the cost and risk of not meeting the technical requirements (radial plates, TF double pancake, divertor, vacuum vessel, blanket and first wall);

- The preparation of new facilities to test prototypes and components during the qualification process and construction respectively;
- The continuation of the activities for the preparation of the ITER site.

The most significant procurements to be initiated within WP2010 are related to:

- Magnets, for which procurement contracts for both TF coils (initially limited to tooling and prototyping) and PF coils (initially limited to tooling) will be signed;
- Vacuum vessel, for which the main vessel procurement contract will be signed (initially limited to non recurring activities and to material for sector No 5);
- Buildings, for which the main excavation and tokamak complex foundation contract will be signed (completing the activities initiated within WP2009).

Further to provide management and follow-up of contracts signed in direct support of the ITER project, F4E continues to be responsible for the technical follow-up of a number of technology contracts previously managed by EFDA. The outcome of these contracts is an important input for many of the activities that will be initiated by F4E.

### *1.4.2. Broader Approach*

With respect to activities related to the Broader Approach (BA), the main objectives are:

- Regarding JT60SA, the procurement architecture for the TF coils ((initiated with the conductor procurement in WP2009) willbe completed by other important contracts in WP2010. Additional smaller activities foreseen in WP2010 are in support of these ongoing procurements;
- Regarding IFMIF-EVEDA, Procurement Arrangements with the Voluntary Contributors will be completed by early 2010;
- Regarding IFERC, the Procurement Arrangement for the supply and maintenance of the CSC supercomputer will be completed during 2010.

### *1.4.3. DEMO*

With respect to activities related to DEMO, in addition those undertaken under the BA IFERC project, no specific activities are foreseen to be implemented during 2010.

# PART II - ITER

In the following the activities of Fusion for Energy related to ITER are described according to the agreed Work Breakdown Structure. The tables provided in the text use the following abbreviations:

| Abbreviation | Meaning |
|---|---|
| WP ref. | Work programme reference, univocally identifying WP items.<br>WPxx/yy/zz, where xx are the last two digits of the year in which WP/budget the activity was first financed, yy is a code identifying the ITER WBS element (if available) or the F4E service in charge, zz is a sequential number for the year. |
| G | Grant |
| G(FPA) | Grant implemented through a Framework Partnership Agreement |
| P | Procurement (service, supply or works) |
| Y | Credited by ITER IO through PA |
| Y(ITA) | Credited by ITER IO through ITA |
| N | Non credited |

All activities indicated within WP2010 are planned to be committed under the 2010 budget.

During the implementation of the work programme activities, F4E may group more activities in a single call, or split one activity in more calls. This will in any case be performed preserving the scope and objective presented in WP2010.

The foreseen time of publication of calls and invitations is indicative only, and based on the present understanding of the project development.

The foreseen duration of activities is indicative only. Modifications of durations may reflect a different phasing of the activity with respect to the initial planning, in line with the financing decision nature of the WP2010 and the change in the procurement strategy, including the adoption of instruments such as stages, options, lots.

Some activities have been removed from WP2010 mainly based on the following reasons:

- Activities were moved to 2011 due to the change of reference scenario (the initial WP2010 had been defined based on the basis of Scenario 1 Modified) or to a different allocation of priorities;
- Activity are not any more required by IO (relevant to activities credited through ITAs);
- Changes in the procurement strategy were identified in order to simplify procurement procedures or to better implement cost containment and risk reduction measures.

## 2.1. WBS 1.1 - MAGNETS

### *2.1.1. Summary*

Activities will focus on the signature of further contracts for the procurement of the ITER magnet components, some minor design/R&D activities and support contracts for quality control and testing.

### *2.1.2. Procurement Arrangements*

| System | Title | ITER Credit (kIUA) | Signature due |
|---|---|---|---|
| EU11 | 1.1.P6A.EU.01 - Toroidal Field Coils Conductors | 43.39 | Dec 2007 |
| EU11 | 1.1.P1A.EU.01 - Toroidal Field Coils | 89.74* | Jun 2008 |
| EU11 | 1.1.P6C.EU.01 - Poloidal Field Magnet Conductors | 11.23** | May 2009 |
| EU11 | 1.1.P3A-B.EU.01 - Poloidal Field Coils PF2 to PF6 | 41.40** | Jun 2009 |
| EU11 | Magnet Structures: Pre-compression Rings | 0.60*** | May 2010 |

* Sum of TF Windings package credit from WBS 1.1.1A plus insertion in the case from Magnet Structures WBS 1.1.2A.

** Updated credit values awarded through PCR-164 for two double pancakes added to PF2 and PF6 coils and bilateral agreement with RF-DA.

*** Does not include DCR-48 changes (increase from 4 to 9 rings), prototype ring and testing, as well as 3 spare rings.

### *2.1.3. Main Procurements*

*WBS 1.1.1A – Toroidal Field Magnet Windings*

Following the signature of the contracts for two prototypes of the radial plates and the foreseen signature of the TF winding pack supply contract by mid-2010, the main work will focus on the start up of the manufacturing activities at the companies for the production of the first mock-ups and prototypes. For the case insertion a small R&D task will be used to assess the welding methods for the case closure and related non-destructive testing. Other tasks will regard characterization of resin or structural materials for the coils. An engineeringstudy for the insertion and cold testing of either the 10 EU TF coils or all the 19 TF coils in a common facility, in agreement with JADA,will also be launched.

*WBS 1.1.2A – Toroidal Field Magnet Structure*

It is foreseen to issues the call for tender and sign the contract for the manufacture of the pre-compression rings.

*WBS 1.1.3A + 1.1.3B – Poloidal Field Magnets (PF2 to PF6)*

The first stage of the large manufacturing contract for the production of the PF coils at the Cadarache site will be signed and will concentrate on the engineering activities for tooling and qualification processes. A preliminary study of the cold test facility required for the PF coils on-site will also be carried out.

*WBS 1.1.6A + 1.1.6C – Toroidal and Poloidal Field Magnet Conductors*

By mid-2010 the major contract for the manufacture of the conductors for the TF and PF coils will be signed (included in WP2009). Support contracts to perform the characterization of the strand (both standard and extended) and the jacket structural materials during the whole production will be initiated and signed. A new contract with the Sultan facility will also be signed in order to test few conductor samples, as during 2010 the conductor manufacturing will still be at the early stages.

### *2.1.4. List of Activities*

| WP ref. | ITER WBS/PBS | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Time of Call |
|---|---|---|---|---|---|---|
| WP09/11/03 | 1.1.1+1.1.3 | P service | Cold Test Facility Preparation for PF Coils | 11 | Y,Y(ITA) | 10Q3 |
| WP10/11/09 | 1.1.2 | P supply | Procurement of magnet structures: pre-compression rings | 58 | Y | 10Q3 |
| WP10/11/10 | 1.1.3 | P supply | Procurement of Poloidal Field coils PF2 to PF6 (Phase 1) | 25 | Y | 10Q2 |
| WP10/11/11 | 1.1.1 | P supply | Procurement of Toroidal Field coils (Phase 1) | 34 | Y | 2009 |
| WP10/11/12 | 1.1.6 | P service | Testing of TF Nb3Sn Strands | 32 | Y | 10Q3 |
| WP10/11/01 | 1.1.6 | P service | Testing and Characterisation of PF strands | 36 | Y | 10Q3 |
| WP10/11/02 | 1.1.1+1.1.3 | P service | Analysis tasks in support of magnet activities | 12 | Y | 10Q3 |
| WP10/11/04 | 1.1.1 | P service | Testing of TF Structural Materials | 43 | Y | 10Q4 |
| WP10/11/05 | 1.1.1 | P service | Procurement for Qualification of Coil Insertion and Case Welding and Definition of Facilities | 12 | Y | 10Q2 |
| WP10/11/06 | 1.1.6 | P service | SULTAN Sample Manufacture & Tests | 18 | Y | 2009 |
| WP10/11/08 | 1.1.6 | P service | Jacket Material Qualification & Testing for TF and PF Coils | 49 | Y | 10Q3 |
| WP10/11/13 | 1.1.1 | P service | Additional tests and activities on magnet components prototypes and mock-ups | 6 | Y | 10Q2 |

## 2.2. WBS 1.5 - VACUUM VESSEL

### *2.2.1. Summary*

Following the outcome of the Design Review of the "Alternative VV and Blanket design", IO has taken the decision to modify the baseline design which demonstrated not fulfilling all the requirements of the project, especially in terms of integration of components. The new design is called MDR-A (Modified Reference Design A).

The 2010 activities will be focused on the first phase of the procurement for the main vacuum vessel "first of a kind" sector (number 5) and will concentrate mainly on the engineering activities for design, validation mock-ups, tooling and materials.

### *2.2.2. Procurement Arrangements*

| System | Title | ITER Credit (kIUA) | Signature due |
|---|---|---|---|
| EU15 | 1.5.P1A.EU.01 - Vacuum Vessel Sectors Production | 92.06 | Nov 2009 |

### *2.2.3. Main Procurements*

At beginning of 2010 IO will provide F4E with drawings suitable to issue the call for tender for the EU sectors.

Important F4E commitments in 2010 include sector engineering activities and the material for the first sector manufacturing. A few smaller activities will be signed to support the preparation of technical and contractual documentation for manufacturing studies and mock-ups to speed up the finalization of the main contract for sector 5.

### *2.2.4. List of Activities*

| WP ref. | ITER WBS/PBS | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Time of Call |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| WP10/15/01 | 1.5.1 | P supply | Procurement of Main Vessel (phase 1) | 54 | Y | 10Q1 |
| | | | | | | |
| | | | | | | |
| WP10/15/04 | 1.5.1 | P service | Support in preparation of final technical documentation for VV contract | 6 | Y, Y(ITA) | 10Q2 |
| WP10/15/05 | 1.5.1 | P service | Analysis of VV Loads & Stresses | 8 | Y, Y(ITA) | 10Q2 |

| WP ref. | ITER WBS/PBS | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Time of Call |
|---|---|---|---|---|---|---|
| | | | | | | |
| WP10/15/08 | 1.5.1 | P service | Engineering Support for VV | 6 | Y,Y(ITA) | 10Q110Q2 |

## 2.3. WBS 1.6 - BLANKET

### *2.3.1. Summary*

During 2010, the activities in the blanket area will essentially focus on the FW component. They will consist of the continuation of the key tasks initiated in order to adequately prepare F4E to implement the Procurement Arrangement for the supply of 50% of the FW, planned for 2012.

### *2.3.2. Procurement Arrangements*

None in 2010.

### *2.3.3. List of Activities*

These activities cover 3 main areas as follows:

- Qualification activities, aiming at demonstrating the adequate mastery of the needed technologies for FW fabrication, applied to fully representative geometries; manufacture and high heat flux testing of qualification semi-prototypes will be a key part of the programme, to formally complete phase 2 of the ITER qualification programme; contracts for the manufacture of full-scale prototypes shall then be signed with Industry which will also include development of repair techniques for series production.
- Engineering design, covering conceptual and detailed design and analyses of the FW panels to support ITER IO in the overall design effort and subsequent preparation of the PA specifications.

| WP ref. | ITER WBS/PBS | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Time of Call |
|---|---|---|---|---|---|---|
| WP10/16/08 | 1.6.1 | P service | Completion of Be/CuCrZr joint repair technique | 16 | Y | 10Q3 |
| WP09/16/02 | 1.6.1 | G | Continuation of Be/CuCrZr HIP joining development | 18 | Y,Y(ITA) | 10Q3 |
| WP09/16/04 | 1.6.1 | P service | Engineering Support to Blanket | 12 | N | 10Q1 |
| WP09/16/05 | 1.6.1 | G | High heat flux testing of FW mock-ups before and after irradiation, and for acceptance tests | 23 | Y,Y(ITA) | 10Q2 |
| WP10/16/03 | 1.6.1 | G | Continuation of technology development for enhanced first wall design (5MW/m2) | 12 | Y | 10Q3 |
| WP10/16/04 | 1.6.1 | P service | Engineering Support for the detailed Design of ITER blanket shield and FW panels | 12 | Y,Y(ITA) | 10Q2 |
| | | | | | | |

| WP ref. | ITER WBS/PBS | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Time of Call |
|---|---|---|---|---|---|---|
| WP10/16/07 | 1.6.1 | P supply | Manufacture of a ITER standard HF full prototype | 18 | Y,Y(ITA) | 10Q3 |

## 2.4. WBS 1.7 - DIVERTOR

### *2.4.1. Summary*

During 2010, the activities in the divertor area will essentially focus on the Inner Vertical Target (IVT).

### *2.4.2. Procurement Arrangements*

| System | Title | ITER Credit (kIUA) | Signature due |
|---|---|---|---|
| EU17 | 1.7.P2B.EU.01 - Divertor Inner Vertical Target | 20.20 | Mar 2010 |

### *2.4.3. Main Procurements*

Calls for Tender will be issued for the procurement of the IVT full size prototype and for the procurement of its Carbon Fibre Composite material:

### *2.4.4. List of Activities*

Complementary activities aiming at increasing competition and decreasing fabrication costs, will include: testing of full Tungsten mock-ups and prototypes, as well as mock-ups made from alternative CFC materials,and engineering design, covering conceptual and detailed design and analyses of the IVT.

| WP ref. | ITER WBS/PBS | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Time of Call |
|---|---|---|---|---|---|---|
| WP10/17/02 | 1.7.2 | P supply | Manufacturing of Inner Vertical Target Full Size Prototypes | 27 | Y | 10Q3 |
| WP10/17/01 | 1.7.1 | P supply | Manufacture of Carbon Fibre Composite prototypical batch | 10 | Y | 10Q2 |
| WP09/17/05 | 1.7.2 | P supply | Manufacturing of mock ups and prototypes for the full W divertor | 18 | N | 2009 |
| | | | | | | |
| WP10/17/04 | 1.7.2 | P service | Engineering Support for procurement of divertor components | 12 | Y | 10Q3 |
| WP10/17/05 | 1.7.1 | G | Characterisation of CFC material | 6 | Y | 10Q3 |
| WP10/17/06 | 1.7.2 | P supply | Pre-production qualification | 52 | Y | 10Q3 |

## 2.5. WBS 2.3 - REMOTE HANDLING (RH)

### *2.5.1. Summary*

In 2010 the various design and R&D activities in the RH field will continue in order to progress with the conceptual design, the preparation of the functional specifications and interface requirements, the finalization of the scope of the supply, and the related R&D activities; all this in view of the preparation of the still-to-come Procurement Arrangements for the four different in-kind RH procurement packages under EU responsibility.

### *2.5.2. Procurement Arrangements*

None in 2010.

### *2.5.3. List of Activities*

Complementary activities will include system studies and the technological surveys on components (motors, sensors etc.) that are compatible with the ITER environmental constraints, in particular gamma radiation and, in case of the in-vessel viewing system, with vacuum, high temperature baking (~240 C) and, if required, high magnetic field (~8T).

- Divertor RH: The activities in 2010 will go on with the completion of what is covered by the present Grant with TEKES. After this, a new grant will be initiated with VTT (FI) and TUT (FI) (officially delegated by TEKES) related to the completion of the conceptual design of the DIV RH devices and tools, completion of conceptual design for the DTP2 Extension and Upgrade in view of a prototyping and testing phase and continuation of the test campaigns with the existing DTP2 hardware.
- Transfer Cask System (TCS): Design activities, by signing task orders in the frame of the existing engineering support contracts, of a generic cask-pallet system to be integrated later on with the Air Transfer System layout. A Grant is also planned to be signed in 2010 which beneficiary should play the role of design integrator in support of F4E, in view of subsequent PA and industrial procurement preparation.
- In-Vessel Viewing System (IVVS): Activities related to the execution of further R&D activities (further lab tests aiming at increases of the performances of the present proof-of-principle mock-up) and, design integration activities on the whole IVVS are planned.
- Neutral Beam RH: A Grant to review, extend and complete the present NB RH conceptual design is planned. Synergies should be established with the NBTF design activities.
- Radiation Tolerance Programme: The objective is to complete irradiation tests and to define a common strategy with other F4E groups (e.g. Diagnostics) and ITER on this subject.

| WP ref. | ITER WBS/PBS | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Unique beneficiary | Time of Call |
|---|---|---|---|---|---|---|---|
| WP10/23/04 | 2.3.2 | G | DTP2 E&U Follow-up and DTP2 Operation | 28 | Y(ITA) | VTT (FI), TUT (FI)* | 10Q2 |
| WP09/23/04 | 2.3.5 | G | Gathering of requirements for NBI RH, and feedback to/from NBI design.Start of engineering design of NBI RH | 25 | Y(ITA) | | 2009 |
| WP10/23/05 | 2.3 | G | Irradiation of RH components (motors, sensors etc.) | 8 | Y(ITA) | | 10Q4 |
| WP10/23/01 | 2.3.4 | G | IVVS Design Finalisation Including Supplementary Lab Tests | 29 | Y(ITA) | | 10Q3 |
| WP10/23/02 | 2.3.7 | G | ATS Design Completion &TCS Integration | 6 | Y(ITA) | | 10Q3 |
| WP10/23/03 | 2.3 | P service | Engineering Support for RH | 22 | Y(ITA) | | 10Q3 |
| WP10/23/06 | 2.3 | P service | R&D on IVVS piezomotors | 7 | Y(ITA) | | 10Q4 |

* Unique experimental facility (according to art.158.b of F4E Implementing Rules)

## 2.6. WBS 3.1 – VACUUM PUMPING AND FUELLING

### *2.6.1. Summary*

The close and effective collaboration with the IO in the definition and substantial progress of all pre-procurement activities in the area of vacuum pumping will continue in 2010, with several important procurements and grants being signed.

### *2.6.2. Procurement Arrangements*

None in 2010.

### *2.6.3. List of Activities*

It is intended to sign a new Grant on the finalization of the detailed design of the Cold Valve Boxes (CVB) and Cryojumpers, as well as to initiate a procurement contract on the Manufacture of Pre-Production Cryopump (PPC), its test vessel and related activities. Finally, it is also expected to finalize the design of the Heating Neutral Beam (HNB) Cryopumps and its interfaces to the cryopump in the MITICA facility.

With respect to the very important issue of Leak Detection and Localization (LD&L) in the ITER machine, grants will be signed to support R&D work that ITER IO is recommending in order to define the conceptual design of this system. Different methods will be assessed/tested in order to localize water and/or helium leaks inside the vacuum vessel or cryostat.

| WP ref. | ITER WBS/PBS | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Unique beneficiary | Time of Call |
|---|---|---|---|---|---|---|---|
| WP09/31/01 | 3.1.1 | P service | Detailed design and specification for the CVBs and cryojumpers | 17 | Y(ITA) | | 10Q2 |
| WP10/31/03 | 3.1.1 | P supply | Procurement of PPC and test vessel | 20 | Y(ITA) | | 10Q3 |
| WP09/31/04 | 3.1.3 | G | Optimisation and performance studies for leak detection system including proof-of-principle tests. Review of leak localization concepts and their possible realization | 37 | Y(ITA) | CEA (FR)* | 10Q2 |
| WP10/31/01 | 3.1.1 | P service | Follow up of procurement of PPC and test vessel | 20 | Y(ITA) | | 10Q3 |
| WP10/31/02 | 3.1.3 | G | R&D in support of Conceptual design of leak detection system and Leak Localisation systems | 29 | Y(ITA) | | 10Q4 |

* Unique tools and facilities (according to art.158.b of F4E Implementing Rules)

## 2.7. WBS 3.2 – TRITIUM PLANT

### *2.7.1. Summary*

Activities to support ITER IO in the preparation of the Procurement Agreements (PAs) for Isotope Separation System (ISS) and Water Detritiation System (WDS), the two EU in-kind contributions to the ITER Tritium Plant, will continue.

### *2.7.2. Procurement Arrangements*

| System | Title | ITER Credit (kIUA) | Signature due |
|---|---|---|---|
| EU32 | WDS part 1 – Tritiated water holding tanks (storage and emergency) | 4.78 | Apr 2011 |

### *2.7.3. List of Activities*

R&D work for specific issues (development of large size and tritium compatible electrolysers, their demonstration, etc.) as well as detailed designs will be carried out.

In particular, the contract for the detailed design for the tritiated water holding tanks of the WDS (2 large emergency tanks - 300 m3 - and other smaller holding tanks - <20 m3) will be signed.

| WP ref. | ITER WBS/PBS | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Time of Call |
|---|---|---|---|---|---|---|
| WP09/32/01 | 3.2 | G | R&D in support of conceptual design for WDS and detail design of the tanks | 26 | Y(ITA) | 2009 |
| WP09/32/04 | 3.2 | G | Preparation of tender specs for WDS Tanks and follow up of production of drawings for manufacturing | 4 | Y | 2009 |
| WP10/32/04 | 3.2 | P service | Conceptual and detailed design of WDS | 6 | Y(ITA) | 10Q3 |
| WP10/32/06 | 3.2 | P service | Conceptual and Detailed design of ISS | 22 | Y(ITA) | 10Q4 |

## 2.8. WBS 3.4 - CRYOPLANT

### *2.8.1. Summary*

The activities to be signed for the cryoplant in 2010 will focus on finalising the engineering design requirements (engineering support contracts), reviewing functional specifications and mitigating the main technical risks in the procurement (R&D on compressor technology).

### *2.8.2. Procurement Arrangements*

| System | Title | ITER Credit (kIUA) | Signature due |
|---|---|---|---|
| EU34 | LN2, 80 K Loop and Ancillary Equipment | 30.677 | Dec 2010 |

### *2.8.3. List of Activities*

| WP ref. | ITER WBS/PBS | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Time of Call |
|---|---|---|---|---|---|---|
| | | | | | | |
| WP09/34/02 | 3.4 | P service | Engineering Support to cryoplant | 10 | Y | 10Q1 |
| WP09/34/03 | 3.4 | P service | Optimization of Cryoplant Design | 16 | Y | 10Q4 |
| WP10/34/01 | 3.4 | P service | R&D on compressor technology | 8 | Y | 10Q3 |

## 2.9. WBS 4.1 and 4.3 – POWER SUPPLIES

### *2.9.1. Summary*

Activities will be focusing on the preparation for the procurement of the Pulsed Power electrical network and the Steady State electrical network including: detailed design of ITER electrical distribution system, and qualification of components with respect of operation under magnetic field.

### *2.9.2. Procurement Arrangements*

| System | Title | ITER Credit (kIUA) | Signature due |
|---|---|---|---|
| EU41, EU43 | 4.1.P1A-P8B.EU.01 - Detailed design of the SSEN and PPEN | 7.00 | Oct 2009 |
| EU41, EU43 | Assembly of the SSEN and PPEN, and SSEN cables | 13.30 | Feb 2011 |

### *2.9.3. List of Activities*

| WP ref. | ITER WBS/PBS | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Time of Call |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |

## 2.10. WBS 4.5 - CODAC

### *2.10.1. Summary*

The CODAC system, up to the local controllers, will be developed by ITER using Fund, with the help of the Domestic Agencies and with direct help from industry. Fusion for Energy role will be to manage the instrumentation and control functions contained in the procurement arrangements.

### *2.10.2. Procurement Arrangements*

Not applicable.

### *2.10.3. List of Activities*

A service contract related to Instrumentation and Control (I&C) for systems procured by F4E will be signed in 2010. This service contract will produce the design of I&C systems according to IO CODAC standards and support F4E suppliers in the procurement of I&C hardware. A smaller contract will be signed in order to prepare a resource loaded schedule for I&C and to support F4E with the technical specification of the service contract.

| WP ref. | ITER WBS/PBS | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Time of Call |
|---|---|---|---|---|---|---|
| WP10/45/04 | 4.5 | P service | Review of ITER I&C specifications | 3 | N | 2009 |
| WP10/45/03 | 4.5 | P service | Support on I&C design and implementation in the frame of EU PAs | **12** | Y | 10Q3 |
| WP10/45/05 | 4.5 | P service | Case study of the application of the CODAC I&C standards to a existing fusion machine | 4 | N | 10Q3 |
| WP10/45/06 | 4.5 | P service | Support on I&C design and implementation in the frame of EU PAs | **13** | N | 10Q4 |

## 2.11. WBS 5.1.1 – ION CYCLOTRON H&CD ANTENNA

### *2.11.1. Summary*

The IC Antenna procurement type is Build-to-Print, with 100% EU sharing. Critical procurement contracts will be signed in 2010, specifically for the RF vacuum windows and Faraday screens bars.

### *2.11.2. Procurement Arrangements*

None in 2010.

### *2.11.3. List of Activities*

| WP ref. | ITER WBS/PBS | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Time of Call |
|---|---|---|---|---|---|---|
| WP10/51/01 | 5.1 | P supply | Faraday Screen R&D | 20 | Y(ITA) | 10Q3 |
| WP09/51/03 | 5.1 | P supply | RF Vacuum Windows R&F | 27 | Y(ITA) | 10Q2 |

## 2.12. WBS 5.2 - ELECTRON CYCLOTRON

*WBS 5.2.1B –ELECTRON CYCLOTRON UPPER LAUNCHER*

### *2.12.1. Summary*

In 2010 all the major prototype contracts will be signed, in support of the design and for completion before the PAs for the system are signed. The design work will be oriented towards the production of a final detailed design. In addition, support will be provided to the IO on some critical issues on the area of ECH, such as performance analysis update, common component strategy (with JADA), and general integration of the Electron Cyclotron H&CD in the ITER system.

### *2.12.2. Procurement Arrangements*

None in 2010.

### *2.12.3. List of Activities*

| WP ref. | ITER WBS/PBS | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Time of Call |
|---|---|---|---|---|---|---|
| WP09/52/07 | 5.2.1 | G | Detailed design, analysis, testing and documentation | 18 | Y(ITA) | 10Q3 |
| WP09/52/08 | 5.2.1 | P service | Engineering activities in support of EC Upper Launcher | 22 | Y(ITA) | 10Q3 |
| WP09/52/09 | 5.2.1 | P supply | EC UL prototypes | 40 | Y(ITA) | 10Q2 |

*WBS 5.2.3 ELECTRON CYCLOTRON POWER SOURCES AND WBS 5.2.4 EC POWER SUPPLIES*

### *2.12.4. Summary*

The development of the European gyrotron for ITER will continue signing the grant for the test of the first gyrotron prototype which refurbishment, performed on the basis of the results of the first test campaign, will be completed by industry in summer 2010. The tests on the refurbished 2 MW gyrotron prototype will yield essential experimental results for the decision on the future European development programme in this area. In addition, support will be provided to IO on some critical issues on the area of ECH, e.g. space allocation in the RF building, preparation of specification for the PA for the gyrotrons and the EC Power Supplies.

### *2.12.5. Procurement Arrangements*

None in 2010.

### *2.12.6. List of Activities*

| WP ref. | ITER WBS/ PBS | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Unique beneficiary | Time of Call |
|---|---|---|---|---|---|---|---|
| WP09/52/02 | 5.2.4 | P service | Engineering Support to EC PS | 12 | Y | | 10Q4 |
| WP09/52/03 | 5.2.4 | G | Support to ITER Organization | 16 | Y(ITA) | | 2009 |
| WP09/52/05 | 5.2.3 | G | Tests with the refurbished 2MW 1st prototype gyrotron | 4 | Y | CRPP (CH)* | 10Q1 |
| WP10/52/03 | 5.2.3 | P supply | Mirrors for RFCU | 5 | Y | | 10Q1 |
| WP10/52/04 | 5.2.3 | P supply | Supply of extra consumables for gyrotron testing | 10 | Y | | 2009 |

* Unique experimental facility (according to art.158.b of F4E Implementing Rules)

## 2.13. WBS 5.3 – NEUTRAL BEAM SYSTEM

### *2.13.1. Summary*

The substantial support provided by Europe to IO for the development of the NB system will continue in 2010. Several procurement contracts related to the Test Facility will be initiated and signed (cooling and cryo-systems, beam source etc.). The implementation of the PA on the NB Power Supply, signed in 2009, will enter in its most active phase with the signature of the first procurement contracts.

### *2.13.2. Procurement Arrangements*

The details about the second PA have now been added toafter the table below after the positive decision of the ITER Council to include the NBTF into the ITER baseline and on the subsequent agreement by the EU that this facility will be subject of an in-kind procurement of the EU.

| System | Title | ITER Credit (kIUA) | Signature due |
|---|---|---|---|
| EU53 | 5.3.P6.EU.01 - Procurement of NB power supplies and related systems | 19.52 | Jul 2009 |
| EU53 | The full size ITER injector Ion Source Test Facility and MV Test Facility (SPIDER/PRIMA/MITICA)* | 47.5* | Jul 2010 |

*The total credit allocated for the NBTF is 60 kIUA. Additional 8.8 kIUA from the IO R&D fund have already been agreed by the ITER Council. The total considered here is therefore 68.8 kIUA. The actual sharing amongst DAs is now being finalized. Small changes may still apply.

### *2.13.3. List of Activities*

| WP ref. | ITER WBS/PBS | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Unique beneficiary | Time of Call |
|---|---|---|---|---|---|---|---|
| WP10/53/09 | 5.3 | P supply | Infrastructures of the neutral beam test facility - Cooling system | 49 | Y | | 10Q3 |
| WP10/53/10 | 5.3 | P supply | Ion Source Test Facility - Ion Source | 21 | Y | | 10Q1 |
| WP10/53/11 | 5.3 | P supply | Ion Source Test Facility - Vessel | 16 | Y | | 10Q1 |
| WP09/53/06 | 5.3 | P supply | Ion source test facility (power supplies - HVD and TX Line) | 24 | Y | | 10Q2 |
| | | | | | | | |

| WP ref. | ITER WBS/PBS | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Unique beneficiary | Time of Call |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| WP10/53/02 | 5.3 | P supply | Infrastructures of the neutral beam test facility - High Voltage Deck and Bushing | 9 | Y | | 10Q2 |
| | | | | | | | |
| WP10/53/05 | 5.3 | P service | Engineering support in the NB area | 15 | Y | | 10Q1 |
| | | | | | | | |
| WP10/53/08 | 5.3 | P supply | SPIDER Control & DAQ | 25 | Y | | 10Q3 |
| WP10/53/15 | 5.3 | P supply | Ion source test facility power supplies – optional supplies | 22 | Y | | 2009 |
| WP10/53/13 | 5.3 | P supply | Infrastructures of the Neutral Beam Test Facility - Accelerator and Ground Related Power Supplies | 36 | Y | | 10Q3 |
| WP10/53/14 | 5.3 | G (FPA) | Design, development, support to the procurement up to acceptance, of the infrastructures, sub-systems and components of the NBTF | 48 | Y | Consorzio RFX (IT)* | 10Q3 |

* Unique technical competence (according to art.158.c of F4E Implementing Rules)

## 2.14. WBS5.5 – DIAGNOSTICS

### *2.14.1. Summary*

Contracts to be signed within this work programme will focus on developing system-level designs for the main diagnostics; completing R&D on the critical path for each system; and advancing designs of principal sub-assemblies.

### *2.14.2. Procurement Arrangements*

| System | Title | ITER Credit (kIUA) | Signature due |
|---|---|---|---|
| EU55 | Phase 1 and Phase 2 Diagnostics | 35.49 | Dec 2010 |

### *2.14.3. List of Activities*

Systems required for ITER first plasma will see the design of key components progressed beyond Preliminary Design Review level. To facilitate the R&D activities, frameworks will be established for the conduct of necessary irradiation testing and for the procurement of supplies and analytical support, including fabrication of prototypes and provision of test equipment. An independent activity will be initiated to undertake the design integration of diagnostic systems in ports under EU responsibility, including port plug design and/or customisation and integration in the ports of systems to be provided by other Domestic Agencies.

Concerns over the lifetime of optical assemblies close to the plasma, which is an issue common to several diagnostics, will be addressed through specific R&D aimed at identifying design opportunities and providing generic design guidelines. Finally, an activity will be initiated to provide diagnostic-specific technical support for F4E in its negotiations with ITER IO of the Diagnostic Procurement Arrangements, which are due to be signed in 2010 and 2011.

Activities will focus on completion of the designs for the diagnostics and associated port plugs in the nine diagnostic procurement packages for which the EU is responsible, to the level appropriate for a conceptual design review. In a few cases the design may be advanced to a more detailed level. The activities will include design and engineering studies; system-level optimisation to meet measurement requirements to be agreed with ITER IO; prototyping and testing of relevant components; and assessment of the Procurement Arrangement technical specifications.

| WP ref. | ITER WBS/PBS | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Unique beneficiary | Time of Call |
|---|---|---|---|---|---|---|---|
| WP09/55/02 | 5.5 | G | Complete Design of in-vessel Diagnostics to Conceptual Design Review level | 24 | Y,Y(ITA) | | 2009 |

| WP ref. | ITER WBS/PBS | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Unique beneficiary | Time of Call |
|---|---|---|---|---|---|---|---|
| WP10/55/10 | 5.5 | G | Complete Design of port plug-based Diagnostics to Conceptual Design Review level | 24 | Y(ITA) | | 10Q3 |
| WP10/55/11 | 5.5 | P service | Engineering Support for diagnostic integration | 18 | Y | | 10Q3 |
| WP10/55/12 | 5.5 | P service | Irradiation and post-irradiation testing of diagnostic components and assemblies | 24 | Y | | 10Q3 |
| WP10/55/13 | 5.5 | P service | Port plug design, testing and diagnostic integration | 24 | Y | | 10Q3 |
| WP10/55/14 | 5.5 | P supply | Supplies and Support for Design of Diagnostics and Port Plugs | 61 | Y,Y(ITA) | | 10Q3 |
| WP09/55/23 | 5.5 | G | Support for Finalization of Technical Specifications for Port-based Diagnostics | 24 | Y | | 10Q3 |
| WP10/55/09 | 5.5 | G | R&D/Design of IVS Joints, Feedthroughs and Connectors | 34 | Y | | 10Q3 |
| WP10/55/15 | 5.5 | G | Design of Magnetics Diagnostics to Conceptual Design Review level | 29 | Y(ITA) | CEA (FR)* CRPP (CH)* ENEA (IT)* SCK-CEN (BE)* VTT (FI)* | 10Q2 |

* Unique technical competence (according to art.158.c of F4E Implementing Rules)

## 2.15. WBS 6.1 - SITE and WBS 6.2 - BUILDINGS

### *2.15.1. Summary*

During 2010 the Architect Engineer will develop the design of the buildings from the conceptual design to a design stage detailed enough to allow the issueing of the call for tender for the construction of the civil engineering of the Tokamak complex.

Work programme 2010 activities will prepare the site and the Tokamak pit to allow the beginning of the Tokamak complex civil engineering construction in 2011.

### *2.15.2. Procurement Arrangements*

| System | Title | ITER Credit (kIUA) | Signature due |
|---|---|---|---|
| EU62 | 6.2.P2.EU.01 - PF Coil Fabrication Building (B55) | 12.80 | Nov 2008 |
| EU62 | 6.2.P2.EU.04 - Tokamak Complex Anti-Seismic Bearings Supply | 6.20 | May 2009 |
| EU62 | 6.2.P2.EU.03 - Tokamak Excavation & Support Structure | 31.00 | May 2009 |
| EU62 | 6.2.P2.EU.02 - Architectural and Engineering Services | 54.70 | May 2009 |
| EU62 | Construction of all buildings | 349.47 | May 2010 |

### *2.15.3. List of Activities*

| WP ref. | ITER WBS/PBS | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Time of Call |
|---|---|---|---|---|---|---|
| WP09/62/03 | 6.2 | G | Support Study for Accidental Scenarios | 12 | N | 10Q3 |
| WP10/62/03 | 6.2 | P supply | Anti-Seismic Bearings Fabrication | 25 | Y | 10Q2 |
| WP09/62/07 | 6.2 | P works | Tokamak Complex Foundations | 12 | Y | 2009 |
| WP09/62/11 | 6.2 | P service | Global construction insurance | 12 | Y | 2009 |
| WP10/62/01 | 6.1&6.2 | P service | Analysis, design optimization and cost reduction strategies for the ITER building structures | 12 | Y,Y(ITA) | 10Q1 |
| WP10/62/02 | 6.2 | P service | Mandatory and complementary building insurance | 73 | Y | 10Q3 |
| WP10/62/04 | 6.2 | P works | Construction site update and adaptation | 6 | Y | 10Q4 |

| WP ref. | ITER WBS/PBS | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Time of Call |
|---|---|---|---|---|---|---|
| WP10/62/06 | 6.2 | P service | Site support 2010 | 12 | Y | 2009 |
| WP10/62/07 | 6.2 | P service | Support for construction contracts preparation | 6 | Y | 10Q2 |

## 2.16. MATERIALS DEVELOPMENT

Material development focuses on the further optimization and validation of materials foreseen for ITER TBM modules, in particular on EUROFER, the structural material for the EU reference concepts, and on EUROFER ODS as well as SiC/SiC composites for thermal and electrical insulation (SiC-Dual), both, for dual coolant options that could be tested at a later stage or in collaboration with partners.

Activities foreseen in 2010 are in particular on characterization of EUROFER base material (new heat EUROFER-97/3 fabricated in 2009) and various joints needed in the TBM project (different weld processes, diffusion bonding, solid HIP & different weld-geometries). The activities are complemented by further development on missing design rules including a review by industry, maintenance of the data base and R&D on improvement of the materials.

The SiC-Dual material fabricated by industry shall be characterized and screened by a low dose irradiation campaign.

Furthermore, F4E will continue to develop EUROFER-ODS material. The next steps include further optimization of properties, in particular of the fabrication process, preparation for fabrication at industrial level and multi-ion-beam irradiation.

| WP ref. | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Time of Call |
|---|---|---|---|---|---|
| WP10/MD/01 | G | Characterization and validation of EUROFER and EUROFER welds for TBM use. | 24 | N | 10Q2 |
| WP09/MD/02 | G | Design rules for EUROFER (Creep-fatigue) | 18 | N | 10Q3 |
| WP10/MD/03 | G | Development of SiC-SiC composites (basic characterisation and irradiation campaigns) | 36 | N | 10Q3 |
| WP10/MD/02 | G | Development of SiC-SiC composites (characterisation of physical properties) | 12 | N | 10Q3 |
| WP10/MD/04 | G | Development: EUROFER and EUROFER ODS [Optimisation of properties and processes] EUROFER ODS [Ion Beam and n-Irradiation campaigns] | 24 | N | 10Q4 |
| WP10/MD/05 | G | Development: EUROFER ODS [Optimisation of properties and processes] | 18 | N | 10Q4 |
| WP10/MD/08 | G | EUROFER base materials&welding for TBM use: Irradiation campaigns. Characterisation and validation | 39 | N | 10Q2 |

| WP ref. | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Time of Call |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| WP10/MD/06 | G | EUROFER Data base and design rules | 30 | N | 10Q4 |
| WP09/MD/10 | P service | EUROFER TBM design rules: for EUROFER welds. Rules for welds | 18 | N | 10Q4 |
| WP10/MD/07 | P service | EUROFER TBM design rules: High Temperature rules | 18 | N | 10Q3 |
| | | | | | |
| WP10/MD/11 | G(FPA) | Low dose irradiation and post-Irradiation examination for EUROFER base and weld materials for TBM application | 48 | N | 10Q3 |

## 2.17. TEST BLANKET MODULES

The Test Blanket Modules (TBM) will be unique components in ITER as they use the ITER machine as a test facility and are the only components to be installed in ITER which are not part of the EU in-kind commitment.

The activities on the TBMs to be signed in 2010 include the following:

- Continuation of the conceptual design (e.g. TBM re-design in case of limitation on the amount of ferromagnetic materials in ITER, further validation / optimization of He flow in manifolds at the back of the TBMs, etc.)
- Definition of fabrication procedures on the basis of nuclear standards, the fabrication of subcomponents test mock-ups and the transfer to Industry have been initiated in the work program 2009 and will continue in 2010 in the field of assembly of subcomponents by welding to form the TBM box structure
- Integration of TBM Systems into the ITER machine
- Development of materials database and computer codes for TBM safety analyses

| WP ref. | ITER WBS/PBS | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Unique beneficiary | Time of Call |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| WP09/56/03 | 5.6 | P service | Engineering Support for PrSR of TBM | 10 | N | | 10Q2 |
| WP10/56/06 | 5.6 | P service | Engineering Support to TBM | 20 | N | | 10Q2 |
| WP09/56/06 | 5.6 | G | HCLL/HCPB TBMs Preliminary Safety Report (PrSR) | 10 | N | | 10Q4 |
| WP10/56/07 | 5.6 | G | Completion of DB and definition of EN computed code for TBM | 18 | N | | 10Q3 |
| WP09/56/11 | 5.6 | G | Tritium Extraction System (TES) for HCLL-TBM: Test campaign in TRIEX | 12 | N | ENEA (IT)* | 10Q4 |
| WP10/56/01 | 5.6 | G | TBM systems conceptual design | 12 | N | | 10Q3 |
| WP10/56/02 | 5.6 | G | TBM conceptual design | 12 | N | | 10Q3 |
| WP10/56/05 | 5.6 | P service | TBM fabrication qualification | 12 | N | | 10Q3 |
| WP10/PE/14 | 5.6 | G | TF and TBM ripple analysis for ITER | 24 | N | | 10Q3 |

| WP ref. | ITER WBS/PBS | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Unique beneficiary | Time of Call |
|---|---|---|---|---|---|---|---|
| WP10/PE/13 | 5.6 | P service | Engineering support and analysis for PE (TBM) | 12 | N | | 10Q3 |
| WP10/56/08 | 5.6 | G(FPA) | R&D in support to the finalization of the TBM Systems conceptual design | 24 | N | | 10Q3/4 |

* Unique experimental facility (according to art.158.b of F4E Implementing Rules)

## 2.18. PLASMA ENGINEERING

Plasma engineering will continue providing support to ITER-IO for the design and preparation for operation of the ITER machine. The 2010 activities range from optimization of plasma scenarios and systems to the evaluation of the impact of design changes on the machine performance and operation.

These activities are in large part, funded by means of competed ITAs which are published by ITER-IO as open calls to all the DAs and assigned on the basis of the DAs replies.

In 2010, ITAs on the following general areas are expected:

- Plasma Operation & Control;
- Plasma wall interaction and runaway modelling;
- Development of analysis tools.

| WP ref. | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Time of Call |
|---|---|---|---|---|---|
| | | | | | |
| WP10/PE/01 | G | Edge modelling coordination and simulations (incl dust) | 12 | Y(ITA) | 10Q4 |
| WP10/PE/02 | P service | SOLPS code development | 12 | Y(ITA) | 10Q3 |
| WP10/PE/03 | G | Evaluation of 3D magnetic field in ITER | 24 | Y(ITA) | 10Q4 |
| WP10/PE/04 | G | Plasma control (incl extended RT), control system design, simulation and VDE analysis | 18 | Y(ITA) | 10Q3 |
| WP10/PE/05 | G | Development of run-away (RE) code for ITER and simulation of RE (damage) in ITER | 12 | Y(ITA) | 10Q3 |
| WP10/PE/06 | G | MHD stability and pedestal - including controlled ELM regimes | 18 | Y(ITA) | 10Q3 |
| WP10/PE/07 | G | Engineering models for plasma feedback control. | 12 | Y(ITA) | 10Q3 |
| WP10/PE/08 | G | Conceptual design of plasma control and protection system | 12 | Y(ITA) | 10Q3 |
| WP10/PE/09 | G | Study of a pulse sequence simulator for tokamak. | 12 | Y(ITA) | 10Q4 |

| | | | | | |
|---|---|---|---|---|---|
| WP10/PE/10 | P service | Engineering support and analysis for PE | 18 | Y,Y(ITA) | 10Q2 |
| WP10/PE/11 | G | ITER scenario and plasma perfomance analysis | 12 | Y(ITA) | 10Q3 |
| WP10/PE/12 | G | Plasma control developement & integration | 12 | Y(ITA) | 10Q4 |
| | | | | | |
| | | | | | |

| WP ref. | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Time of Call |
|---|---|---|---|---|---|
| WP10/PE/15 | G | Study of plasma start up | 12 | Y(ITA) | 10Q2 |
| WP10/PE/16 | G | The study of control of plasma current, position and shape | 12 | Y(ITA) | 10Q3 |
| WP10/PE/17 | G | Self-consistent simulations of plasma scenarios | 12 | Y(ITA) | 10Q2 |
| WP10/PE/18 | G | Magnetic reconstruction of the plasma boundary | 12 | Y(ITA) | 10Q3 |
| WP10/PE/19 | G | Analysis of Resistive Wall Mode control by in-vessel (RMP) coils | 12 | Y(ITA) | 10Q3 |
| | | | | | |
| WP10/PE/21 | G | Edge magnetic field structure for ELM control in ITER and associated power/particle fluxes to plasma-facing components | 12 | Y(ITA) | 10Q1 |
| | | | | | |

## 2.19. SAFETY

Activities will focus on the support of the ITER licensing process, by performing related safety studies and R&D, and to support EU-PA activities by giving on request safety related advice.

To control the dust and tritium inventories inside the vacuum vessel, techniques for their quantification, monitoring and removal are investigated. Supporting safety analyses will include calculations for accident sequences and application of ALARA to occupational radiation exposure for inspection, maintenance and repair activities inside the cryostat and for coil and power supply distribution systems.

*Radiological and Environmental Monitoring System*

A first activity in this area aims at the development of specific monitoring devices for red zones highly tritiated and irradiated and containing activated Beryllium dust.

*Radwaste Treatment and Storage*

Concerning storage and disposal of radioactive and tritiated wastes, R&D activities are planned to limit and/or control the tritium out-gassing from the waste packages, to measure their tritium content and to decontaminate tools from the hot cell facility.

| WP ref. | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Time of Call |
|---|---|---|---|---|---|
| WP10/SF/05 | G | Busbar arc model validation and supporting experiments | 18 | Y(ITA) | 10Q3 |
| WP10/SF/06 | G | Combined H2/Dust explosion computer code development | 45 | Y(ITA) | 10Q4 |
| WP09/SF/04 | G | In vessel dust measurement and removal techniques assessment and validation - diagnostics | 18 | Y(ITA) | 2009 |
| | | | | | |
| | | | | | |
| WP09/SF/06 | G | Supporting safety analysis to follow up ITER design evaluation and licensing process | 24 | Y(ITA) | 10Q3 |
| WP09/SF/07 | P service | Support to ORE and Safety analysis in support of ITER licensing | 12 | Y(ITA) | 10Q2 |
| WP10/SF/08 | P service | Supporting safety analyses to follow up ITER design evolution and licensing process | 12 | Y(ITA) | 10Q1 |
| WP09/SF/11 | G | The ALARA application to Occupational Radiation Exposure based on ITER design evolution | 12 | Y(ITA) | 10Q3 |
| WP10/SF/09 | P service | The ALARA application to Occupational Radiation Exposure based on ITER design evolution | 12 | Y(ITA) | 10Q3 |

| WP ref. | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Time of Call |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| WP10/SF/04 | G | In vessel tritium inventory control by laser spectroscopy | 24 | Y(ITA) | 10Q4 |
| WP10/SF/01 | P service | Radiological and Environmental Monitoring System Support | 12 | Y(ITA) | 10Q3 |
| WP10/SF/10 | P service | Engineering studies for radwaste processes | 12 | Y(ITA) | 10Q3 |

## 2.20. ENGINEERING SUPPORT

Activities listed here are in addition to the ones indicated in each of the previous areas and focus upon Engineering Analyses, Code and Standards and foresees new step of contracts in support of the design of components and systems and their cost optimization. The Codes and Standards activity in 2010 is devoted to the tracking of international codes for analyses and design of mechanical and electrical systems, assess and follow up of notified body, inspection entities, etc.

Most of the engineering support activities will be implemented through specific contracts to be signed within existing Framework Contracts.

| WP ref. | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Unique beneficiary | Time of Call |
|---|---|---|---|---|---|---|
| WP09/ES/02 | G | Electromagnetic analyses | 12 | Y,Y(ITA) | | 10Q3 |
| | | | | | | |
| WP09/ES/07 | P service | Thermo-hydraulic analyses | 12 | Y,Y(ITA) | | 10Q2 |
| WP09/ES/08 | G | Thermo-hydraulic modeling | 12 | Y,Y(ITA) | | 10Q3 |
| WP10/ES/01 | P service | Electromagnetic analyses | 12 | Y,Y(ITA) | | 10Q1 |
| WP10/ES/02 | P service | Neutronic analyses | 12 | Y,Y(ITA) | | 10Q1 |
| WP10/ES/03 | P service | Mechanical analyses | 12 | Y,Y(ITA) | | 10Q1 |
| WP10/MF/02 | P service | Material characterization at room/elevated temperatures | 12 | N | | 10Q2 |
| WP10/MF/03 | P service | Material characterization at cryogenic temperatures | 12 | N | | 10Q2 |
| WP10/MF/04 | P service | Support for the quality control of components | 12 | N | | 10Q4 |
| WP10/MF/05 | P service | Joining technologies and qualification | 12 | N | | 10Q3 |
| WP10/ES/08 | P service | Support on Codes & Standards and review of Structural Design Criteria | 12 | Y(ITA) | | 10Q3 |
| WP10/MF/01 | G | Corrosion Assessment for water cooled components | 12 | Y(ITA) | | 10Q3 |
| WP10/MF/06 | G | Assessment of the EU materials database | 12 | N | | 10Q4 |
| WP10/MF/07 | P service | Corrosion issues | 23 | Y(ITA) | | 10Q4 |
| WP10/ES/09 | P service | Electrical Engineering | 12 | N | | 10Q3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| WP10/ES/10 | G | Alternative code for neutronics calculations | 12 | Y,Y(ITA) | CEA (FR)* | 10Q4 |

* Unique technical competence (according to art.158.c of F4E Implementing Rules)

## 2.21. NUCLEAR DATA

This mid term activity for 2010 focuses on the development of tools, improvements and update of Nuclear Data files mainly in support of TBM and Broader Approach (IFMIF) activities. In addition nuclear data experiments for validation have to be pursued and measurement techniques still developed.

| WP ref. | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Time of Call |
|---|---|---|---|---|---|
| WP09/ND/01 | G | Development of tools, improvements of data and validation in support of TBM activities | 24 | N | 10Q1 |
| WP10/ND/01 | G | Nuclear Data improvements and development of tools | 24 | N | 10Q1 |

## 2.22. ACTIVITIES OF QUALITY ASSURANCE (QA) AND PROJECT MANAGEMENT

A follow-up of activities at the supplier's premises is necessary to assure the correct execution of the contracts in compliance with the technical and management specifications and the contractual Quality Plans. Assistance to F4E is also requested to prepare such activities, including assessment and risk management for the procurements and advise in the definition of the inspection procedures.
This follow-up is achieved by sending qualified Inspectors from verifying bodies to the suppliers' premises (and their subcontractors) to follow and verify the progress of work on F4E's behalf. The inspectors shall be the witnesses of F4E for the correct execution of the manufacturing sequences, manufacturing procedures, test methods, test performance and test reports during the production of the services and components. They shall report on Quality, Production and Schedule to the F4E Technical Responsible Officer defined in the relevant contract.
For a proper preparation of the inspection procedures to be included into the manufacturing contracts and in order to be ready for the time when manufacture will start, a framework contract is planned to be signed in 2010.

Contracts supporting F4E on project management matters are also planned to be signed in 2010. Professional support (1-2 ppy) on this topic from an engineering company is required for specific tasks such as consultancy for the preparation of technical/management specifications and cost/risk estimates, in the definition of internal processes and in the management of the documentation.

| WP ref. | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Time of Call |
|---|---|---|---|---|---|
| WP10/PO/08 | P service | Support of Project Management | 5 | N | 10Q3 |
| WP09/PO/01 | P service | Service of inspectors for ITER project contracts follow-up | 12 | Y | 10Q3 |

## 2.23. CONTRIBUTIONS IN CASH

### *2.23.1. Contribution to CEA for ITER Site Support*

F4E shall contribute through CEA/AIF to certain ITER expenditures, in some cases by reimbursing CEA/AIF of costs incurred to provide site support to the ITER Organization, in accordance with the Annex on Site Support attached to the ITER Agreement. The site support activities to be financed by F4E in 2010 shall include fees to be paid to CEA for the use of some of the existing temporary buildings by the ITER Organization in accordance with the arrangement signed between CEA, the Commission and Fusion for Energy in 2009.

### *2.23.2. Contribution to the ITER Organization*

This corresponds to the annual EU share of the 2011 contributions in cash to the ITER Organisation for its management, to be adopted during the next ITER Council.

### *2.23.3. Contribution to Japan*

This cash contribution to Japan corresponds to the transfer of procurement responsibility from EURATOM to Japan under the supervision of the ITER Organisation.

## 2.24. EXPERTS FOR TECHNICAL ASSISTANCE TO F4E

F4E has issued a call for expressions of interest for individual experts to provide technical assistance in a number of specific areas related to ITER and the Broader Approach. Provision is included here for a total number of approximately 2800 days for experts in 2010.

## 2.25. URGENT ACTIVITIES IN SUPPORT OF COST AND RISK ASSESSMENT

Some activities (corresponding to a total of about 5 man-years) may be necessary to be carried out in the estimation of costs and in the assessment of risk during the course of the year. Such activities could be both grants and procurements under the 3.1 or 3.2 budget line.

| WP ref. | Activity Type | Activity Title | Duration of contract (months) | Credit Status | Time of Call |
|---|---|---|---|---|---|
| WP10/PO/01 | P service | Urgent Activities in support of cost and risk assessment | 5 | Y,Y(ITA) | 10Q2 |
| WP10/PO/03 | P service | Urgent Activities in support of cost and risk assessment | 5 | N | 10Q2 |
| WP10/PO/04 | G | Urgent Activities in support of cost and risk assessment | 5 | Y,Y(ITA) | 10Q2 |
| WP10/PO/06 | G | Urgent Activities in support of cost and risk assessment | 5 | N | 10Q2 |

# PART III - BROADER APPROACH

## 3.1. INTRODUCTION

The European contributions to the Broader Approach Activities are financed to a large extent by contributions in kind from the following Members of F4E: France, Germany, Italy, Spain, Switzerland and Belgium. Only in limited number of cases, where no contribution by these Members is foreseen, the contribution will have to be financed by the F4E budget.

For the contributions to be provided by Members of F4E, Procurement Arrangements will be concluded in late 2009 and 2010 between F4E and the Japanese Implementing Agency, subject to the conclusion of corresponding Agreements of Collaboration between F4E and the Members concerned. The list of procurement arrangements planned and the status of implementation is reported below and in the Project Plan.

In the following the activities of Fusion for Energy related to BA are described. The tables provided in the text use the following abbreviations:

| Abbreviation | Meaning |
|---|---|
| WP ref. | Work programme reference, univocally identifying WP items.<br>WPxx/yy/zz, where xx are the last two digits of the year in which WP/budget the activity was first financed, yy is a code identifying the ITER WBS element (if available) or the F4E service in charge, zz is a sequential number for the year. |
| G | Grant |
| P | Procurement |

All activities indicated within WP2010 are planned to be committed under the 2010 budget.

During the implementation of the work programme activities, F4E may group more activities in a single call, or split one activity in more calls. This will in any case be performed preserving the scope and objective presented in WP2010.

The foreseen time of publication of calls and invitations is indicative only, and based on the present understanding of the project development.

## 3.2. JT60SA

### *3.2.1. F4E Funded Activities*

For JT60SA, direct procurement activities in 2010 will include the superconducting strands for the TF coils, which will conclude the first phase of the TF procurement strategy initiated in WP2009. Activities Activities are listed in the table below.

In addition F4E will conclude Procurement Arrangements with JAEA, backed by corresponding Agreements of Collaboration.

| WP ref. | Activity Type | Activity Title | Duration of contract (months) | Time of Call |
|---|---|---|---|---|
| WP10/BA/01 | G | Conductor insert manufacture and tests | | 10Q3 |
| WP10/BA/02 | P service | SULTAN production sample manufacture and tests | | 10Q3 |
| WP10/BA/03 | P service | Strand qualification phase tests | 18 | 10Q1 |
| WP10/BA/04 | P service | Strand production control tests | 18 | 10Q1 |
| WP10/BA/05 | P supply | SC dummy conductor manufacturing | | 10Q3 |
| WP09/BA/01 | P supply | TF Coils conductor SC and copper strands | | 2009 |
| WP10/BA/06 | P supply | Magnets preassembly tooling | | 10Q4 |

### *3.2.2. Procurement Arrangements*

In accordance with the EU Project Execution Plan for the JT-60SA project, the following Procurement Arrangements are expected to be signed between F4E and JAEA for components under the responsibility of the EU.

- Cryostat Body (2010 Q3). This will cover the supply of the cylindrical part of the cryostat. This supply will be covered by an AoC with CIEMAT (Spain).
- Power Supplies (2010 Q3). This PA will cover the supply of the power supplies for all superconducting magnets as well as for the in-vessel coils. This supply will be covered by AoCs with ENEA (Italy) and CEA (France).
- ECH Power Supplies (2010 Q4). This PA will cover the supply of 2 EC Gyrotrons power supplies. Originally this supply was to be covered by an AoCs with CRPP (Switzerland) but recently the Swiss Government has indicated their will to withdraw from this project and hence the matter is under discussion.
- Cryogenic System (2010 Q3). This PA will be for the supply of the entire cryogenic system for the magnet. This supply will be covered by an AoCs with CEA (France).
- Sector Coils power supplies (2010 Q4). This PA will cover the supply of the power supplies for the sector coils. This supply will be covered by an AoCs with CNR-RFX (Italy).

## 3.3. IFMIF

### *3.3.1. F4E Funded Activities*

In terms of direct contributions from F4E, as part of F4E contributions to the IFMIF/EVEDA BA Project, "*cash contributions to the common expenses of the Project Team*" are to be foreseen in the 2010 budget for an expected total of 260 k€, this budget will cover the missions outside Japan of the EU members of the Project Team.

In addition F4E will conclude a Procurement Arrangements with JAEA, backed by corresponding Agreements of Collaboration.

### *3.3.2. Procurement arrangements*

Most procurement arrangements for IFMIF/EVEDA are planned to be signed by July 2010. Only a remaining PA for diagnostics is expected for 2010 Q4 to be backed by an Agreement of Collaboration with CEA (France).

## 3.4. IFERC

### *3.4.1. F4E Funded Activities*

No activities for the IFERC projects are foreseen to be directly funded by F4E in 2010.

### *3.4.2. Procurement Arrangements*

The main procurement arrangement for the IFERC project, for the supply and maintenance of the Supercomputer for the CSC Subproject, is planned to be signed in the second quarter of 2010. This PA will be backed by a corresponding Agreement of Collaboration with CEA (France).

# APPENDIX I - TABLE OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| A/E | Architect Engineer |
| AGPS | Accelerator Power Supplies |
| ALARA | As Low As Reasonably Achievable |
| ANB | Authorized Notification Body |
| ANS | Analytical System |
| AVDEs | Asymmetric Vertical Displacement Event |
| ATS | Air Transfer System |
| BSM | Blanket Shield Module |
| BTP | Build-to-Print |
| C&I | Control and instrumentation |
| CFC | Carbon Fibre Composites |
| CMM | Cassette Multifunctional Mover |
| CVB | Cold Valve Boxes |
| CVD | Chemical Vapour Deposition |
| CXRS | Core Plasma Charge-Exchange Recombination Spectroscopy System |
| DA | Domestic Agency |
| DACS | Data Acquisition and Control System |
| DCLL | Dual Coolant Lithium Lead |
| DCR | Design Change Request |
| DEMO | Demonstration Fusion Reactors |
| DGEBF | Di-Glycidyl Ether of Bisphenol F (impregnation resin) |
| DIV | Divertor |
| DNB | Diagnostic neutral beam |
| DTP | Divertor Test Platform |
| EAF | European Activation File |
| EB | Electron Beam |
| EBBTF | European Breeding Blanket Test Facilities |
| EC | Electron Cyclotron |
| EC UL | Electron Cyclotron Upper Launchers |
| ECH | Electron Cyclotron Heating |
| EFDA | European Fusion Development Agreement |
| EFF | European Fusion File |
| ELM | Edge Localized Mode |
| EPC | Engineering Procurement Contract |
| F4E | Fusion for Energy |
| FS | Functional Specification |
| FW | First Wall |
| FWP | First Wall Panel |
| HAZOP | Hazard Operability studies |
| HCLL | Helium-Cooled Lithium-Lead |

| | |
|---|---|
| HCPB | Helium Cooled Pebble Bed |
| H&CD | Heating & Current Drive |
| HIP | Hot Iso-static Pressing |
| HNB | Heating Neutral Beam |
| HV | High Voltage |
| HVAC | Heating Ventilation &Air Conditioning |
| HVD | High Voltage Deck |
| HW | Hardware |
| IC | Ion Cyclotron |
| I&C | Instrumentation and Control |
| ICH | Ion Cyclotron Heating |
| IFMIF | International Fusion Materials Irradiation Facility |
| INB | Installation Nucleaire de Base |
| IO | ITER Organization |
| IR | Infra Red |
| ISEPS | Ion Source and Extraction Power Supplies |
| ISS | Isotope separation system |
| ITA | ITER Task Agreement |
| IVT | Inner Vertical Target |
| IVVS | In-Vessel Viewing System |
| LD&L | Leak Detection and Localization |
| LFS-CTS | Low Field Side – Collective Thomson Scattering |
| MAR | Materials Assessment Report |
| MDR | Modified Design Reference |
| MHB | Material Handbook |
| MHD | Magneto-Hydro-Dynamic |
| MIG | Metal Inert Gas |
| MV | Medium Voltage |
| NB | Neutral Beam |
| NBI | Neutral Beam Injector |
| NBPS | Neutral Beam Power System |
| NBTF | Neutral Beam Test Facility |
| ODS | Oxide Dispersion Strengthened |
| ORE | Occupational Radiation Exposure |
| P&ID | Process and Instrumentation Diagram |
| PA | Procurement Arrangement |
| PF | Poloidal Field |
| PFC | Plasma Facing Components |
| PFD | Process Flow Diagram |
| PIE | Post Irradiation Examination |
| PMU | Prototypical Mock-Up |
| PP | Procurement Package |
| PPC | Pre-Production Cryopump |

| | |
|---|---|
| PrSR | Preliminary Safety Report |
| PTC | Prototype Torus cryopump |
| 10Q(1,2,3,4) | Quarter 1,2,3,4 2010 |
| QA | Quality Assurance |
| R&D | Reasearch & Development |
| RAFM | Reduced Activation Ferritic Martensitic |
| RF | Radio Frequency |
| RFCU | Radio Frequency Control Unit |
| RH | Remote Handling |
| RMP | Resonant Magnetic Perturbation |
| RNC | Radial Neutron Camera |
| RWM | Resistive Wall Mode Control |
| SDC | ITER SDC (Structural Design Criteria/Code) |
| SHPC | Safety and Health Protection Coordination |
| SiC-Dual | SiC/SiC composite material for electrical and thermal Insulation |
| SS | Steady State |
| SW | Software |
| TBM | Test Blanket Module |
| TCS | Transfer cask System |
| TES | Test Extraction System |
| TF | Toroidal Field |
| TH | Thermal Hydraulical |
| UT | Ultrasonic |
| VS | Vertical Stability |
| VV | Vacuum Vessel |
| WAVS | Wide Angle Viewing System |
| WBS | Work Breakdown Structure |
| WDS | Water Detritiation System |
| WP | Work programme |

# APPENDIX II - SUMMARY OF THE WP2010 BUDGET

| Ref | Budget Line | Activity Title | 2010 Budget (M€) | | |
|---|---|---|---|---|---|
| | | | Grants | Procurements | Cash |
| | 3.1+3.5 | Expenditure in support of ITER, credited by ITER IO through PA | 10.962 | 266.551 | - |
| | 3.1 | Expenditure in support of ITER through host organization | - | 0.500 | - |
| | 3.1+3.5 | Contribution in cash in support of ITER | - | - | 60.000 |
| | 3.1+3.5 | Contribution in cash for transfer of procurements to Japan | - | - | 17.700 |
| | 3.1+3.5 | Design and R&D in support of ITER, credited by ITER IO through ITA | 19.565 | 18.027 | - |
| | 3.6 | Expenditure budgeted against other revenue | - | - | - |
| | | *Subtotals* | *30.527* | *285.278* | *77.700* |
| **3.1+3.5+3.6** | | **Total ITER construction** | **393.505** | | |
| | 3.2 | Design and R&D in support of ITER, not credited by ITER IO (incl. materials, TBM, nuclear data) | 7.300 | 4.492 | - |
| **3.2** | | **Technology for ITER** | **11.792** | | |
| | 3.3 | Expenditure in support of Broader Approach | 0.060 | 6.323 | - |
| | 3.3 | Contribution in cash in support of IFMIF-EVEDA Project Team | - | - | 0.260 |
| | | *Subtotals* | *0.060* | *6.323* | *0.260* |
| **3.3** | | **Technology for Broader Approach and DEMO** | **6.643** | | |
| | 3.4 | Appointment of experts for Technical assistance to F4E | - | - | 1.300 |
| **3.4** | | **Other expenditure** | **1.300** | | |
| **3** | | **Total operational expenditure** | **413.240** | | |
| | | *Total expenditure by type* | *37.887* | *296.093* | *79.260* |

Notes

- A table showing the indicative budget for grants to be awarded in this Work Programme, both credited and non-credited by ITER, is provided in Appendix III.
- Figures corresponding to items to be credited by IO through ITA are provisional, and are based on the present understanding of the share of work to be assigned to F4E by IO

# APPENDIX III -
# SUMMARY OF THE AVAILABLE BUDGETS FOR GRANTS

| | WBS | CREDITED (in M€) | NOT CREDITED (in M€) |
|---|---|---|---|
| 1.1 | Magnets | - | - |
| 1.5 | Vacuum Vessel | - | **0** |
| 1.6 | Blanket | **1.200** | - |
| 1.7 | Divertor | **0.080** | - |
| 2.3 | Remote Handling | **2.931** | - |
| 3.1 | Vacuum Pumping & Fuelling | **0.660** | - |
| 3.2 | Tritium Plant | **0.470** | - |
| 3.4 | Cryoplant | **0** | - |
| 4.1/4.3 | Power Supplies | **0** | - |
| 4.5 | CODAC | - | - |
| 5.1 | Ion Cyclotron | - | - |
| 5.2 | Electron Cyclotron | **2.049** | - |
| 5.3 | Neutral Beam System | **6.500** | - |
| 5.5 | Diagnostics | **9.103** | - |
| 6.2 | Buildings | - | **0.150** |
| | Material Development | - | **4.410** |
| | Test Blanket Module | - | **1.460** |
| | Plasma Engineering | **4.145** | **0.360** |
| | Safety | **2.330** | - |
| | Engineering Support | **0.560** | **0.050** |
| | Nuclear Data | - | **0.620** |
| | Urgent activities in support of cost and risk assessment | **0.500** | **0.250** |
| | Broader Approach | - | **0.060** |
| **Total** | | **30.527** | **7.360** |

NB: Figures shown in this table are the currently estimated values. Modifications may occur within the budget limits.

# APPENDIX IV -
# ESSENTIAL SELECTION AND AWARD CRITERIA FOR GRANTS

As regards grant actions referred to in this work programme, the essential selection and award criteria, in accordance with Articles 165 and 166 of the Implementing Rules of the Financial Regulation, are:

**Essential Selection Criteria**

- The applicants' technical and operational capacity:

  professional, i.e. scientific and/or technological competencies, qualifications and relevant experience required to complete the action.

- The applicants' financial capacity :

  stable and sufficient sources of funding in order to maintain the activity throughout the action.

**Essential Award Criteria**

- Relevance and quality of the proposal with regard to the objectives and priorities set out in this work programme and in the relevant call for proposals.

- Efficiency of the implementation as well as of the management structure and procedures in relation to the proposed action.

- Budget and cost-effectiveness in particular with regard to the objectives and the respected results.

With regard to the specific action, more details will be provided in the call for proposals. Evaluation thresholds and weighting will also be given in the call for proposals.

A proposal which does not fulfil the conditions set out in the work programme or in the call for proposals shall not be selected. Such a proposal may be excluded from the evaluation procedure at any time.

The timetable and indicative amounts for the actions are defined in this Work Programme.

# APPENDIX V -
# MAXIMUM REIMBURSEMENT RATES FOR GRANTS

The upper limits for the reimbursement of eligible costs for grants are laid down in Article 153 of the Implementing Rules of the Financial Regulation of the Joint Undertaking and are summarised in the following table.

| | |
|---|---|
| Research, technological development and demonstration activities | 40% |
| Coordination and support actions | 100% |
| Management, audit certificates and other specific activities | 100% |