FUSION FOR ENERGY

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

The Governing Board

DRAFT DECISION OF THE GOVERNING BOARD ADOPTING THE ANNUAL AND MULTI-ANNUAL PROGRAMME (2019-2023) 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 Council Decision (Euratom) No 198/2007 of 27 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] (hereinafter "the Statutes") and in particular Article 6(3)(e) thereof, last amended on 10 February 2015[2] by Council Decision Euratom 2015/224;

HAVING REGARD to Council Decision (Euratom) No 791/2013 of 13 December 2013 amending Council Decision (Euratom) No 198/2007 establishing the European Joint Undertaking for ITER and the Development of Fusion Energy and conferring advantages upon it;[3]

HAVING REGARD to the Financial Regulation of Fusion for Energy[4] adopted by the Governing Board on 2 December 2015 (hereinafter "the Financial Regulation"), and in particular Title III thereof;

HAVING REGARD to the Implementing Rules of the Financial Regulation[5] adopted by the Governing Board on 2 December 2015 (hereinafter "the Implementing Rules"), and in particular Title III thereof;

HAVING REGARD to Commission Delegated Regulation (EU) No 1271/2013 for the bodies referred to in Article 208 of Regulation (EU, Euratom) No 966/2012 of the European Parliament and of the Council of 30 September 2013,[6] and in particular Title III thereof;

HAVING REGARD to the comments and recommendations of the Joint Undertaking's Administration and Management Committee and of the Technical Advisory Panel on the present Annual and Multi Annual Programme (2019-2023);

WHEREAS:

(1) The Director shall, in accordance with Article 11 of the Statutes, prepare each year the submission of the project plan to the Governing Board, the resource estimates plan and the detailed annual work programme, now merged in the Annual and Multi Annual Programme.

(2) The Administration and Management Committee shall, in accordance with Article 8a (2) of the Statutes, comment on and make recommendations to the Governing Board on the proposal for the project plan, the work programme, the resource estimates plan, the staff establishment plan, the staff policy plan and other related matters, now part of the Annual and Multi Annual Programme drawn up by the Director;

1 O.J. L 90 , 30.03.2007, p. 58.

2 O.J. L 37 , 13.02.2015, p.8.

3 OJ L 349, 21.12.2013 p100-102.

4 F4E(15)-GB34-12.9 adopted 02.12.2015.

5 F4E(15)-GB34-12.9 adopted 02.12.2015.

6 O.J. L 328, 7.12.2013.

(3) The Technical Advisory Panel, in accordance with Article 6 (1) of the Statutes, shall advise the Governing Board on the adoption and implementation of the project plan and work programme, now part of the Annual and Multi Annual Programme;

(4) The Governing Board, in accordance with Article 6 (3) (d) of the Statutes, shall adopt the project plan, work programme, resource estimates plan, the staff establishment plan and the staff policy plan, now part of the Annual and Multi Annual Programme;

HAS ADOPTED THIS DECISION:

Article 1

The Annual and Multi-Annual Programme (2019-2023) of Fusion for Energy annexed to this Decision is hereby adopted.

Article 2

The Governing Board hereby delegates to the Director of Fusion for Energy the power to make non-substantial amendments to the annual Work Programme approved by the Governing Board.

Amendments are “non-substantial” if they do not cause the financial resources allocated to the Action concerned in Annex VI of the annual Work Programme to increase by more than EUR 1 million or 10%, whichever is higher.

In any event, the increase of the financial resource of an action shall not exceed 3% of the total budget of the annual Work Programme for the given year.

In addition, any related changes to the scope of the annual Work Programme shall not have any significant negative impact on the nature of the Actions or on the achievement of objectives of the multiannual Project Plan.

Non-substantial amendments shall not lead to any increase in the total budget of the annual Work Programme approved by the Governing Board.

Article 3

This Decision shall have immediate effect.

Done in Barcelona, 12 December 2018.

For the Governing Board

Joaquin Sanchez
Chair of the Governing Board

Annex: F4E Annual and Multiannual Programme (2019-2023) F4E_D_2BPYUA v1.1

FUSION FOR ENERGY

Annual and Multiannual Programme

Years 2019-2023

F4E_D_2BPYUA

THE EUROPEAN JOINT UNDERTAKING FOR ITER AND THE DEVELOPMENT OF FUSION ENERGY

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1. Contents

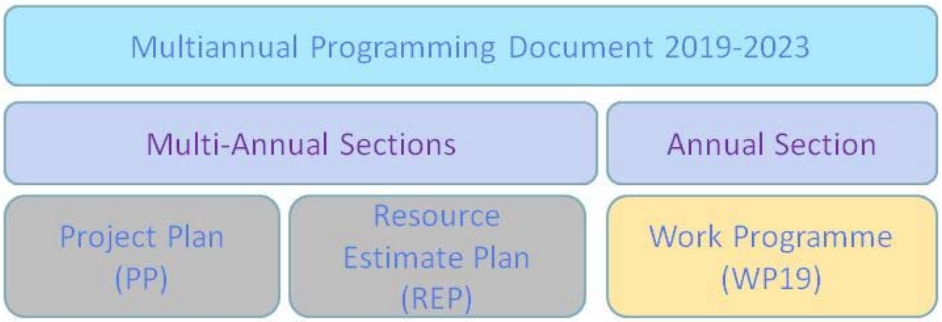
Section I. General Context

1. Foreword

According to Article 32 (Annual and Multi-Annual Programming) of the F4E Financial Regulation (F4E(15)-GB34-12.9 Adopted on 02/12/2015), the F4E Annual and Multi-Annual Programme integrates three other documents requested by the F4E rules:

1. The Project Plan (PP);
2. The Resource Estimate Plan (REP);
3. The Work Programme (WP).

The PP, REP and the WP are documents that, according to the F4E Statutes and Financial Regulation, the Director shall prepare and submit to the Governing Board (GB) for adoption. The first step of the adoption process requests the preparation of a draft Annual and Multiannual programme for the year N – N+5 to be sent in January of the year N-1 to Commission, GB Chair, EU Parliament and Council.



The information inside this document is structured as follows.

- A general context section in which F4E mission and values are presented as well as the definition of the EU contribution to ITER and to Broader Approach (BA).
- The Multiannual section is composed of the PP and the REP:
  - The PP is providing a multi-annual (up to 2023) view of the F4E objectives for ITER, BA and DEMO projects. Furthermore, it also defines the strategy to achieve them and KPIs used to measure F4E performances.
  - The REP provides the multi-annual information concerning both financial and human resources. The inclusion in the REP of detailed human resources information modifies the original document structure, previously agreed with the Commission's Services.
- The Annual section, the Work Programme 2019 (WP19), offers an exhaustive view of the F4E activities foreseen in 2019 with the necessary information to be considered a financial decision, including annual objectives, targets and resources.

The reference date for all figures in the present document is end of April 2018 with the following exceptions (specifically mentioned):

- Financial data and de-commitments: 1st August 2018;

- IC and GB Milestones[1] (i.e. Technical objective for ITER project): 1st August 2018;
- Test Blanket Module: 1st August 2018;
- Cash Contributions to IO: 8th August 2018.

The information provided is in line with the updated ITER Baseline foreseeing First Plasma (FP) in December 2025.

2. Introduction

This Annual and Multi-Annual Programme offers an overview of the activities of the European Joint Undertaking for ITER and the Development of Fusion Energy ("Fusion for Energy" or F4E) for the years 2019 to 2023.
Since its creation in 2007, Fusion for Energy is responsible to provide Europe's contribution to the work on ITER, the Broader Approach (BA) and the Demonstration Fusion Power Reactor (DEMO) projects according to the tasks entrusted to the organization.

ITER

ITER has the aim to produce a significant amount of fusion power to allow scientists to study "burning" plasma (i.e. heated by fusion reactions) and also to advance many of the key technologies needed for future fusion reactors. Euratom (represented by the European Commission) is part of this large project involving a total of seven parties that represent half the world's population – Euratom, the Russian Federation, Japan, China, India, South Korea and the United States.
The task of F4E, as the Euratom Domestic Agency for ITER, is to discharge Euratom obligations to deliver its share of in-kind components and cash contributions to the ITER project, about 45% of the total value of the project in the construction phase and 34% of the cost of operation, deactivation and decommissioning of the facility as well as preparing the site.
The main peculiarity of the project is that about 90% of the ITER project is built by in-kind contributions distributed among the seven parties through the ITER Agreement to achieve the agreed level of contribution from each of them. The coordination is managed by the Central Team of the ITER Organization (IO).

Broader Approach (BA)

The Broader Approach agreement, concluded between Euratom and Japan, includes activities which complement the ITER project and accelerate the realization of fusion energy by carrying out Research and Development (R&D) and developing some advanced technologies for future demonstration reactors. Both parties contribute equally financially. The Euratom resources for the implementation of the BA are largely provided voluntarily by several participating European states (Belgium, France, Germany, Italy, Spain and, in the past, Switzerland).

DEMO

The task of F4E is to prepare and coordinate a programme of activities in preparation for the construction of a demonstration fusion reactor and related facilities.

[1] The revised assembly strategy impacted significantly the need dates of first plasma components.

3. General background

3.1 Vision and Overall F4E Mission

“Bringing the power of the sun to earth”.
This vision communicates the active role Fusion for Energy (F4E) takes in advancing fusion towards becoming a reliable source of clean abundant base load energy. F4E is the European centre to develop and build ITER and other facilities to turn fusion into a sustainable source of energy for mankind. F4E bridges the EU research community and the EU industry, to broaden the European industrial base for fusion technology.

3.2 ITER

ITER is a complex project from the scientific, technical and organizational points of view. Its aim is to enable the study of burning plasmas (i.e. that generate more energy than what is put in to ignite it) and to advance the technologies that are necessary for the production of fusion power.
The project will reach its ultimate operational configuration [the so-called Deuterium-Tritium (DT) operation] via a series of intermediate configurations of gradually increasing capability. This is referred to as the staged approach and reflects the approach commonly adopted on complex developments with a progressive step-by-step assembly and commissioning process, validating each phase before moving on to the next. The first stage is referred to as First Plasma which is due in December 2025. The full configuration of DT operation is scheduled 10 years later in 2035.
The operational activities commence at First Plasma and continue until 2037. There will then be a deactivation and decommissioning phase through 2042 and beyond.
To meet the EU’s international obligations towards ITER, F4E is responsible for providing components “in kind” (including the buildings) representing about 45% of the nominal value of ITER under strict F4E quality and safety control.

3.2.1 F4E’s Schedule for the In-Kind Contributions to ITER

An updated Overall Project Schedule (OPS) and Overall Project Cost (OPC) for the ITER Project, together with the associated estimate of resources covering the full period 2016-2035, were approved ad referendum by the ITER Council in 2016. This updated schedule sets December 2025 as the date for First Plasma, which independent assessors consider to be the earliest possible technically achievable date. This is because the schedule does not have any contingency for work on the critical path (i.e. any delay will delay the First Plasma date).
This updated Project Baseline (Baseline 2016) is based on the Staged Approach (Figure 1) and on the state of design maturity, fabrication progress and construction readiness at that point in time. With the progress of maturity in design, fabrication and construction readiness, and the experiences
gained from resolution of various technical challenges related to First-of-a-Kind (FOAK) components and other critical systems, it has become necessary to refine and revise the need/delivery dates for various components, while still maintaining the FP Baseline date of December 2025, in line with the approved OPS and OPC.
The resulting Revised Construction Strategy remains fully consistent with the Baseline-2016 dates of Cryostat Closure by December 2024 and FP by December 2025. This Revised Construction Strategy is also in line with approved OPC (ad referendum) in the Baseline 2016. The proposed integrated

installation strategy of the various equipment and services in the Tokamak Complex Building and other auxiliary buildings by the IO is a powerful risk mitigation measure to prevent overall delay and extra cost.

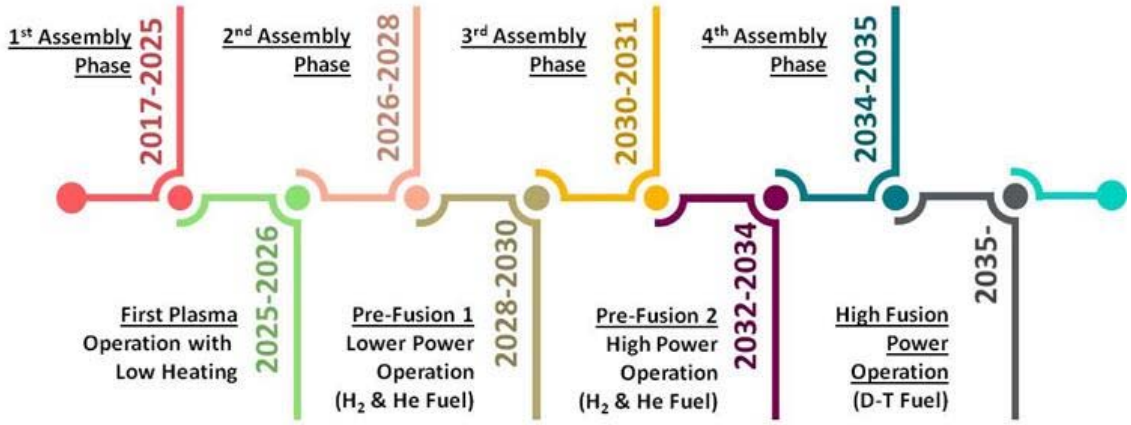


Figure 1. Detail of the Staged Approach

At its meeting on 12 April 2018, the Council of the European Union mandated the Commission to formally approve this ITER baseline at the ITER Council in June 2018. The Council conclusions underline the fundamental importance of the ITER project in the European roadmap to make fusion energy a reality in the second half of this century.

The lack of contingency in the schedule and budget is the main challenge that F4E has to confront with the ITER project. Such a large, ambitious and complex project, with many first-of-a-kind components requiring advanced and diverse technologies, entails many risks that can materialise during manufacturing and assembly. Changes can be limited but not avoided altogether. Until ITER construction is over, the possibility of further schedule delays and cost increases cannot be excluded.

The schedule along with cost and risk are key aspects of project management and control. The schedule sets out the work to be completed and allows performance monitoring and control. It is therefore very important that the schedule has a solid basis and is regularly updated.

Based upon the updated ITER schedule, F4E's own top-level schedule (fig. 2), known as "Level 0" gives an overview of the most important ITER and F4E activities. Both the EU Vacuum Vessel sectors and nuclear Buildings remain on the critical path (indicated in red). With no contingency on the critical path, the schedule remains very tight.

F4E's top-level schedule is underpinned by 60 comprehensive lower level "Detailed Work Schedules" (DWS) encompassing approx. 65,000 individual activities. These DWS have each evolved over time in terms of maturity, granularity, interface detail and scope. This "rolling wave" approach allows the detailed schedules is be continuously improved. Once a system enters a manufacturing phase, the scheduling becomes more supplier focused.

Progress has been made during the last four years to improve the content, structure and therefore the reliability and effectiveness of the schedules. Improvements have centred on data sources and forecasting. F4E has worked closely with the ITER Organization to develop the ITER Master Schedule and the monthly integration process. This is a process whereby IO receives the DWS each month from the ITER Domestic Agencies and links them together to provide the status of the whole project.

A Schedule Quality Assessment Process has been defined in line with both F4E and ITER standards in order to increase the robustness and reliability of each DWS. A biannual assessment is carried out using 31 different parameters. In addition, F4E has defined quality requirements for the suppliers' schedule, which has resulted in their schedules becoming more and more robust and reliable with more controllable data.

At the same time as the updated ITER schedule was approved ad referendum in November 2016, the ITER Council approved a set of high-level milestones for the period 2018-2025. These ITER Council milestones, adopted as technical objectives of F4E's Project Plan, track the overall progress of the project. To supplement the ITER Council milestones, F4E's Governing Board approved additional milestones. F4E regularly reports on the status of those milestones via monthly reports, tracks the risks of not achieving them and, where necessary, implements recovery actions to mitigate any forecasted delays. The Revised Construction Strategy has also triggered a modification of the baseline for the completion dates of some of these milestones. This exercise is in progress and due to be fully completed by the end of 2018.
It should also be noted that, in 2017 the ITER Organization reached 50 % of the total construction work scope to First Plasma" based on IO's project performance metrics, including design, component manufacturing, building construction, shipping and delivery, assembly, and installation.

3.2.2 Schedule after First Plasma

The achievement of the First Plasma at the end of 2025 is the first step in the operation of the machine. As shown in Figure 1, the Staged Approach foresees in the following years three additional assembly phases followed by three operation phases that culminate with the D-T Phase in 2035.
In Assembly Phase II, the in-vessel components (blanket, divertor and in-vessel coils) will be installed, the electron cyclotron heating system completed, some components of the neutral beam system will be installed and a number of further diagnostics will become available.
In Assembly Phase III, the other heating systems (neutral beam and ion cyclotron) will be installed, and the diagnostic systems will be completed.
In the fourth and final Assembly Phase (Assembly Phase IV), referred to as DT operation, the ITER machine will have the full Tritium facility available. Any necessary repairs or modifications will still be possible at this point; afterwards this will become more complicated as human access will no longer be possible everywhere.
The beginning of the D-T Phase in 2035 will mark the beginning of the full exploitation of the ITER machine.

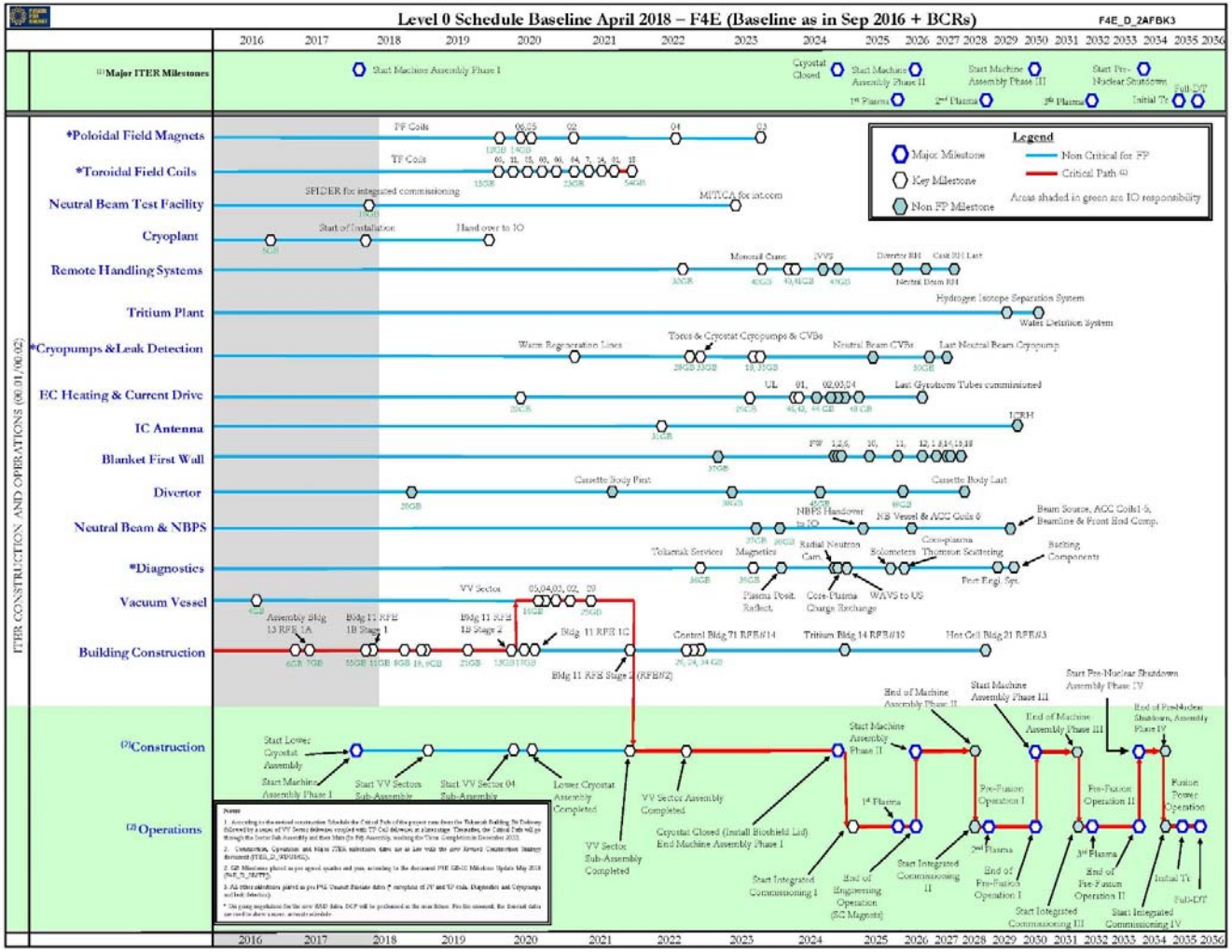


Figure 2 . F4E Top Level schedule for ITER with summary up to the DT Operation Phase (end of April 2018)

3.2.3 ITER Agreement, role of the domestic agencies and EU contribution to ITER

In 2006 the seven Parties signed the ITER International Agreement. Each of them has a Domestic Agency (DA) that has the obligation to provide components in-kind to build the machine and provides funds to finance the ITER International Organization (IO). The in-kind contribution consists of the delivery of components to be manufactured by each DA according to an agreed share (i.e. about 45% for the EU).

The Procurement Arrangements (PA), being progressively signed between the ITER Organization and each DA, define the specifications of the components to be provided in-kind. The level of detail of those specifications may vary depending on the level of development of the components. In some cases, Build-to-Print specifications will be provided, whilst in others, Detailed Design or only Functional Specifications will be available. These PAs are the basis for F4E to start the procurement procedures to competitively tender for the work. Once a contract is awarded, the work of the supplier can start. Each component has its development and manufacturing process with predefined stages and phase gates when F4E and IO will review and approve the design or manufacturing progress in order to determine the readiness to move to the next stage (see par. 3.2.6).

Table 1 provides a list of the deliverables for which the EU has an obligation to deliver to the ITER project. The list reflects the decision taken at the time of the signature of the ITER Agreement with the modifications approved by the ITER Council until the end of 2017.

PA	Description of Deliverables
1.1.P1A.EU.01 1.1.P2A.EU.01 1.1.P3A-B.EU.01 1.1.P6A.EU.01 1.1.P6C.EU.01	Magnets: • 20% of the conductor for the TF coils; • 14% of the conductor for the PF coils; • 10 TF Coils; • 5 PF coils (PF2-PF6)
1.5.P1A.EU.01	Vacuum Vessel: 5 sectors
1.6.P1A.EU.01 1.6.P6.EU.01	Blanket: • Blanket Cooling Manifold; • Blanket First Wall (215 panels)
1.7.P1.EU.01 1.7.P2B.EU.01 1.7.P2E.EU.01	Divertor: • 54 cassette bodies; • inner vertical targets; • divertor rails
2.3.P2.EU.01 2.3.P3.EU.01 2.3.P5.EU.01 5.7.P1.EU.01	Remote Handling (RH): • 1 Divertor RH system; • 15 Cask and Plug RH systems; • 6 In-Vessel Viewing systems; • 1 Neutral Beam RH system.

3.1.P1.EU.01 3.1.P1.EU.02 3.1.P1.EU.03 3.1.P1.EU.04 3.1.P3.EU.01	• Warm Regeneration lines; • Front-End Cryodistribution with 6 Torus and 2 Cryostat Cryopumps with Cold Valve Boxes (CVBs); • Cryopumps for the Neutral Beam system (ITER and MITICA); • Leak detection and Localisation System
3.2.P3.EU.01 3.2.P5.EU.01 3.2.P5.EU.02	Tritium Plant • Water Detritiation System (WDS); • Hydrogen Isotope Separation System (ISS)
3.4.P1.EU.01	Cryoplant system - LN2 Plant and Auxiliary Systems
4.1.P1A-8B.EU.01 4.1.P1A-8B.EU.02 4.1.P8A.EU.01 4.1.P8C.EU.01	Electrical Power Supply & Distribution Systems (shared with other parties)
5.1.P1.EU.01	Ion Cyclotron Resonance Heating (ICRH) System (Equatorial port plugs incorporating 2 IC antennas)
5.2.P1B.EU.01 5.2.P1B.EU.02 5.2.P3.EU.01 5.2.P4.EU.01	Electron Cyclotron Resonance Heating (ECRH) System: • EC Control System; • EC Upper Launchers (4 port plugs); • Ex-vessel Waveguide system (32 for EC Upper Launcher and 24 for EC Equatorial Launcher); • 25% EC Gyrotron Sources; • 67% EC Power Supplies.
5.3.P1.EU.01 5.3.P2.EU.01 5.3.P3.EU.01 5.3.P4.EU.01 5.3.P5.EU.01 5.3.P6.EU.01 5.3.P9.EU.01	Neutral Beam Heating System: • Assembly and testing; • NB Beam Source and HV Bushing; • Beam Line Components; • NB Pressure Vessel, Magnetic Shielding; • Compensation and Active Correction Coils; • NB Power Supply; • NB Test Facility Components.
5.5.P1.EU.n	Diagnostics (roughly 25% of all diagnostic systems)
6.2.P2.EU.01 6.2.P2.EU.02 6.2.P2.EU.03 6.2.P2.EU.04 6.2.P2.EU.05	Buildings (all concrete and steel frame buildings incl. IO ‘s Annex Office building)

6.2.P2.EU.06	
6.3.P1.EU.01	Waste treatment and storage
6.4.P1.EU.01	Radiological protection
6.4.P1.EU.02	

Table 1. List of EU Deliverables

The obligation of all the other DAs and Euratom toward ITER IO are also highlighted in yellow in ANNEX XII and are visually summarized in Figure 3.

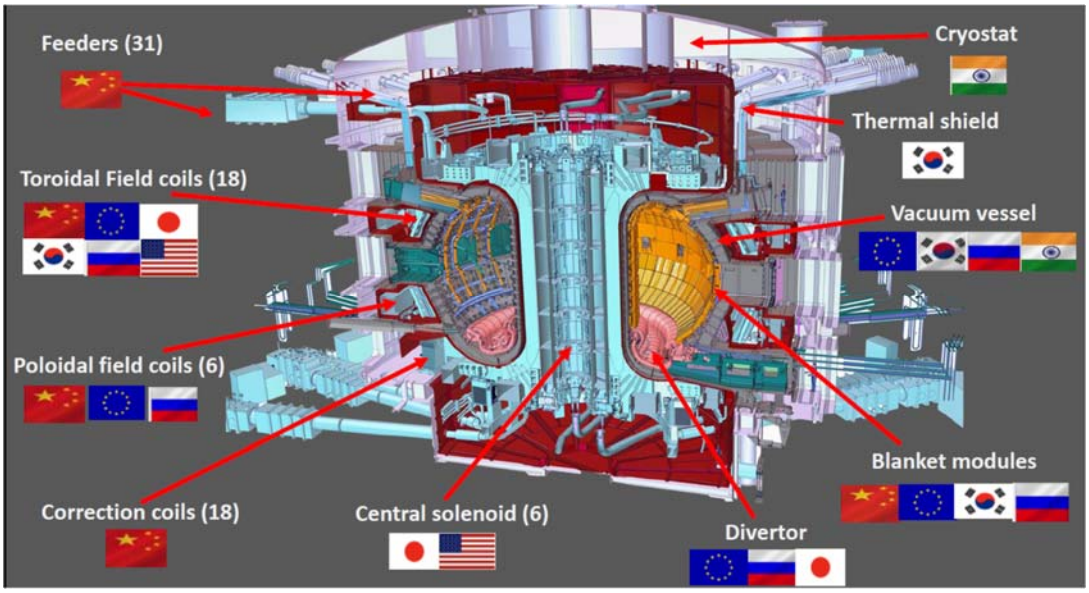


Figure 3 . DAs obligation toward ITER IO

3.2.4 The ITER Procurement arrangements (PA), the Work Breakdown Structure (WBS) and the ITER credit[2]

According to the rules for a sound project management F4E has developed its own Work Breakdown Structure (WBS) to represent the work to be executed into a tree of activities broken down and propagated down to different levels. This is a common basis across the whole organization to allow the integration of scheduling, estimating, procurement and finance systems. The WBS consists of seven levels, where the fourth is at PA/ITA level and the sixth is the level of the contract execution. This work was supplemented by the definition of specific cost centres, to be used for cost and budget management purposes. F4E has used cost centres to control the different contract allocations against its estimates.
The table below shows how the PAs relate to the clustered activities, defined as “coherent areas of action with objectives and resources” called “Actions” in this document.
These Actions capture all necessary activities, including the transversal ones, to fulfill the EU obligations as agreed in 2006 and detailed in the Annex 6.3 (Common Understandings on Procurement Allocation) of the signed ITER Agreement.

[2] IC-22/05.2 Proposal for the Update of the Overall Project Cost (OPC)- ITER_D_WCFL4A v1.1

As explained above, the in-kind contribution is organized through Procurement Arrangements. Each of them represents specific work to be performed and delivered to IO, typically the manufacturing of components. When a Procurement Arrangement is defined, a total credit value is assigned to the work foreseen to be performed. In particular, a Credit Allocation profile (CAS) is defined and a fraction of the total value is assigned to some important milestones.
F4E receives credit[3] from IO for successfully meeting specifically identified milestones. This is an earned value system. Credits do not correspond to the real costs in euros borne by F4E for the procurement of that component. Nonetheless, F4E considers that credit milestones agreed for each PA are the most relevant figures to define the progress of work with the final aim of discharging the EU obligations towards the project. They are the basis of the Earned Value Management (EVM) system used by F4E.
Table 2 shows the available information at the end of April 2018 concerning both the current and the signed credit values of the PAs for each area. The table shows the PA original value and at the current date, which includes any credit modification (both negative and positive) due to the outcome of the Project Change Requests (PCR) approved by the ITER Council during the evolution of the PA.

Actions	PAs	WBS Name	Original Value[4] (kIUA)	Current Value (kIUA)	Signed date
1 - Magnets	1.1.P1A.EU.01	Toroidal Field Magnet Windings	85.2	89.740	20-Jun-08
	1.1.P2A.EU.01	Pre-Compression Rings	5.14	0.600	12-May-10
	1.1.P3A-B.EU.01	Poloidal Field Coils PF2, PF3, PF4, PF5 & PF6	40.4	40.860	19-Jun-09
	1.1.P6A.EU.01	Toroidal Field Magnet Conductors	43.000	43.390	18-Dec-07
	1.1.P6C.EU.01	Poloidal Field Magnet Conductors	9.653	11.22881	04-May-09
2 - Vacuum Vessel	1.5.P1A.EU.01	Main Vessel	99.360	89.560	19-Nov-09
3 - In Vessel Blanket	1.6.P1A.EU.01	Blanket First Wall	26.100	40.330	29-Sep-17
	1.6.P6.EU.01	Blanket Manifold procurement	Incl. in Main Vessel	NA	NA
4 - In Vessel – Divertor	1.7.P1.EU.01	Divertor Cassette Body and Assembly	11.200	6.040	08-May-12
	1.7.P2B.EU.01	Divertor Vertical Targets	20.200	19.620	12-Mar-10
	1.7.P2E.EU.01	Divertor Rail	0.000	NA	NA
5 - Remote Handling	2.3.P2.EU.01	In-Vessel Divertor Remote Handling Equipment	12.000	9.620	31-Oct-12

[3] In the PA milestones are agreed to mark the progress in the execution of the work. Some of these milestones have a credit associated to them which is released by IO to the DA whenever the milestone is achieved. Obtaining the full credit means that the DA has achieved all milestones and therefore fully discharged its obligation towards IO for that PA.

[4] Common Understandings on Procurement Allocation (N-12 ROM Att. 5.1) and (cost) final report of negotiations on the Joint Implementation of the ITER project - Tokyo, 1April 2006

	2.3.P3.EU.01	Cask and Plug Remote Handling System	8.200	17.31337	03-Jun-15
	2.3.P5.EU.01	Ex-Vessel Neutral Beam Remote Handling Equipment	6.000	6.000	19-Jun-13
	5.7.P1.EU.01	In-vessel viewing system	6.800	6.800	19-Dec-14
6 - Cryoplant and Fuel Cycle	3.1.P1.EU.01	Front End Cryo-Distribution: Warm Regeneration Lines	7.14480	0.200	26-Sep-13
	3.1.P1.EU.02	Front End Cryo-Distribution: Front End Cryopump Distribution	2.71120	0.76518	28-Apr-17
	3.1.P1.EU.03	Cryopumps: Torus & Cryostat Cryopump	0.000	NA	NA
	3.1.P1.EU.04	Cryopumps for ITER Heating and DNB System and MITICA Test Facility	0.000	3.66400	15-Jun-16
	3.1.P3.EU.01	Leak Detection & Localisation System	4.400	NA	NA
	3.2.P3.EU.01	Hydrogen Isotope Separation System	5.456	NA	NA
	3.2.P5.EU.01	Water Detritiation System(WDS) Water Holding Tanks and Emergency Tanks	2.552	3.252	19-Dec-12
	3.2.P5.EU.02	Water Detritiation System Tanks, Water Detritiation System Main System, and Water Detritiation	10.208	NA	NA
	3.4.P1.EU.01	Cryoplant (LN2 and Auxiliary Systems) and Cryoplant	31.500	26.37110	15-Jun-11
	6.3.P1.EU.01	Waste Treatment Storage (Type A Radwaste System)	9.100	NA	NA
	6.4.P1.EU.01	Radiological Protection for design	0.600	0.600	26-Sep-13
	6.4.P1.EU.02	Radiological Protection for procurement	3.600	NA	NA
7 - Antennas and Plasma Engineering	5.1.P1.EU.01	Ion Cyclotron Antenna	3.96	NA	NA
	5.2.P1B.EU.01	Electron Cyclotron Control System	4.6992	1.400	19-Dec-14
	5.2.P1B.EU.02	Electron Cyclotron Upper Launcher	3.1328	NA	NA
	No PA	Plasma Engineering	NA	NA	NA
	No PA	Plasma Control System	NA	NA	NA
8 - Neutral Beam and EC Power Supplies and Sources	5.2.P3.EU.01	Electron Cyclotron Gyrotrons	9.96667	NA	NA
	5.2.P4.EU.01	Electron Cyclotron Power Supplies	12.788	11.628	24-May-12
	5.3.P1.EU.01	Neutral Beam	3.800	NA	NA
	5.3.P2.EU.01		4.750	NA	NA
	5.3.P3.EU.01		1.950	NA	NA
	5.3.P4.EU.01		5.950	NA	NA
	5.3.P5.EU.01		6.100	NA	NA

	5.3.P6.EU.01		23.750	31.28571	13-Jul-09
	5.3.P9.EU.01	Neutral Beam Test Facility Components	0.000	25.800	27-Oct-10
	No PA	Neutral Beam Not Credited Activities	NA	NA	NA
9 - Diagnostic	5.5.P1.EU.01	Magnetics Sensor Electronics & Software	1.112	1.112	13-Dec-11
	5.5.P1.EU.02	CER(Continuous External Rogowskis)	0.02768	0.02768	17-May-13
	5.5.P1.EU.16	Outer Coils	0.27714	0.27714	06-Feb-17
	5.5.P1.EU.17	Inner Coils	0.62904	0.62904	09-Mar-18
	5.5.P1.EU.19	Divertor Coils	0.04705	NA	NA
	5.5.P1.EU.03	Bolometry System	2.95007	NA	NA
	5.5.P1.EU.04	Core-Plasma Charge Exchange Recombination Spectrometer	3.42495	NA	NA
	5.5.P1.EU.05	Plasma position reflectometry	1.58382	NA	NA
	5.5.P1.EU.06	Equatorial Visible/Infrared Wide-Angle Viewing System	2.93098	NA	NA
	5.5.P1.EU.07	Pressure Gauges	0.95798	NA	NA
	5.5.P1.EU.08	Core Thomson Scattering	3.55361	NA	NA
	5.5.P1.EU.09	Low Field Side Collective Thomson Scattering	1.14786	NA	NA
	5.5.P1.EU.10	Port Engineering Systems	1.47867	1.47867	20-Jul-17
	5.5.P1.EU.11		2.11573	2.11573	20-Jul-17
	5.5.P1.EU.12		2.11573	2.11573	20-Jul-17
	5.5.P1.EU.13		1.47867	1.47867	20-Jul-17
	5.5.P1.EU.14		1.47867	1.47867	20-Jul-17
	5.5.P1.EU.15	Neutron Profile & Spectroscopy	1.96707	NA	NA
	5.5.P1.EU.18	In Vessel Electrical Equipment	2.74824	2.74824	06-Feb-17
	5.5.P1.EU.20	Lower Port Integration	0.02365	NA	NA
10 - Test Blanket Module	No PA	European Test Blanket System Arrangement	NA	NA	NA
	No PA	Test Blanket Systems Research & Development	NA	NA	NA
11 - Site and Buildings and Power Supplies	4.1.P1A-8B.EU.01	SSEN and PPEN Detailed System Engineering Design	7.000	6.93810	26-Oct-09
	4.1.P1A-8B.EU.02	SSEN and PPEN Installation	13.300	29.48893	05-Dec-13
	4.1.P8A.EU.01	Emergency Power Supply System	5.700	4.22273	05-Dec-13
	4.1.P8C.EU.01	SSEN Components	5.000	5.00000	05-Dec-13
	6.2.P2.EU.01	PF Coil fabrication building		12.80000	19-Nov-08

	6.2.P2.EU.02	Architect Engineering Services	392.300	55.7749	04-May-09
	6.2.P2.EU.03	TKM Excavation & Ground Support Structure		31.00000	04-May-09
	6.2.P2.EU.04	Anti-Seismic Bearing		6.20000	04-May-09
	6.2.P2.EU.05	Building Construction		351.56255	14-May-10
	6.2.P2.EU.06	Office Building		13.85000	04-Oct-12
12 - Cash contributions	No PA	Cash Contribution to ITER Organization	NA	NA	NA
	No PA	Cash Contribution to Japan DA	NA	NA	NA
13 – Technical Support Activities	No PA	ITER Programme Management	NA	NA	NA
	No PA	Transportation	NA	NA	NA
	No PA	Engineering Support and Integration	NA	NA	NA
	No PA	Engineering Analysis and Nuclear Data	NA	NA	NA
	No PA	Embedded Control Data Access and Communication	NA	NA	NA
	No PA	Materials and Fabrication Technologies	NA	NA	NA
	No PA	Nuclear Safety	NA	NA	NA
	No PA	CE Marking	NA	NA	NA
	No PA	F4E Programme Management	NA	NA	NA

Table 2. Action, WBS name and PA status (as of end April 2018)

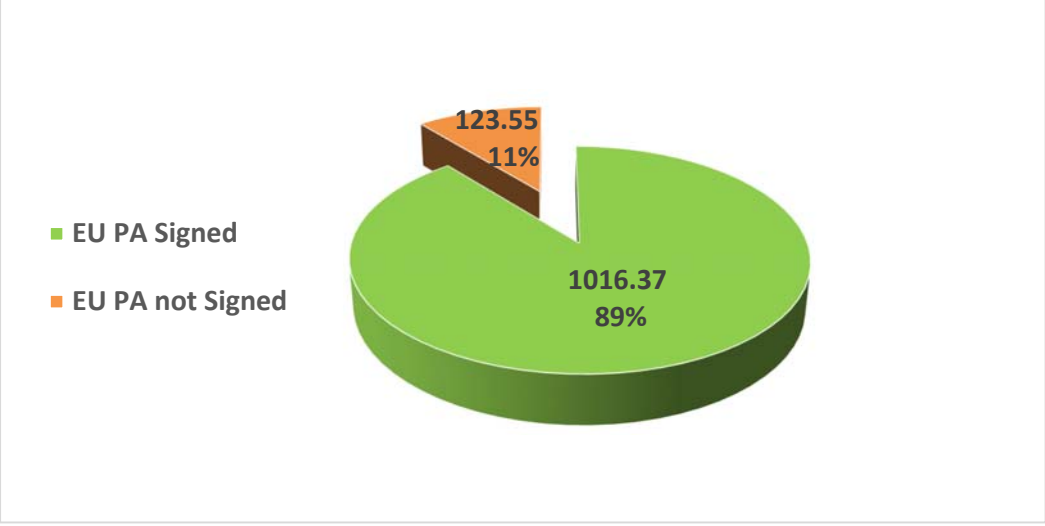


Figure 4 . PA Credits of in-kind contribution:
value of Signed/not Signed EU PA (status end of April 2018)

3.2.5 The ITER credit forecast

Table 3 shows the credit value that F4E should have earned up to end of April 2018 against the credit that F4E has actually achieved and that IO should have already released as acknowledgement of the achieved milestones. A similar table, showing all details per PA is available in Annex XI. In addition, the yearly forecast credit up to end 2024 is shown.

The difference between the achieved and the released credits is explained by the fact that once F4E achieves a credit milestone, all necessary data, reports and other information has to be collected and provided to IO. This information is linked to the delivery by the supplier of all the necessary documents and to the F4E approval of these deliverables. Furthermore, IO has to revise and validate the whole set of documents provided in order to confirm such achievement. For this reason, the process can last some months.

				Forecast (kIUA)						
Action	**Baseline to end April 2018 (kIUA)**	**Achieved Credit (kIUA)**	**Released Credit (kIUA)**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024+**
	384.20693	**351.39859**	**305.00466**	**89.923874**	**87.65188**	**92.804629**	**73.48732**	**132.32367**	**42.75514**	**249.81502**
Magnets	100.519	89.189	73.019	13.840	25.572	24.466	23.862	4.495	4.395	0.000
Vacuum Vessel	33.200	33.871	29.080	9.949	19.117	20.723	5.900	0.000	0.000	0.000
In Vessel- Blanket	0.000	0.000	0.000	1.800	2.200	0.000	1.200	1.200	2.300	36.152
In Vessel- Divertor	2.290	2.155	1.660	0.335	1.340	0.045	0.315	1.055	0.790	22.005
Remote Handling	3.200	2.000	0.800	1.800	1.900	2.300	2.200	5.100	3.900	20.533
Cryoplant and Fuel Cycle	24.760	24.480	24.362	1.520	3.521	2.655	2.093	5.306	7.286	13.502
Antenna and Plasma Eng.	0.500	0.500	0.000	0.000	0.500	0.000	1.400	4.132	1.650	19.230
Neutral Beam and EC Power Supplies and Sources	24.415	20.965	19.635	10.601	8.695	6.094	7.900	4.223	6.813	34.256
Diagnostics	0.560	0.025	0.025	0.485	1.072	2.620	3.002	2.308	2.258	17.807
Site and Buildings and Power Supplies	194.763	178.214	156.424	49.555	23.735	33.902	25.616	104.504	13.363	86.329

Table 3. ITER Credit per PA: achieved, released and forecast up to PA (as of end April 2018)[5]

[5] Forecast credit value includes credits for not yet signed PAs. In this case values are only indicative as negotiations will be carried out prior to PA signature to finalize them.

3.2.6 Progress in the delivery of the EU contributions

The System Life Cycle establishes a framework for meeting the stakeholder‘s needs in an orderly and efficient manner. It also provides a quick overview of significant dates in the development of the Systems. Essentially, the project defines lifecycle phases with predefined levels of development by using specific dates to determine the readiness to move to the next phase. The different phases are referred to as CDR (Conceptual Design Reviews), PDR (Preliminary Design Reviews), FDR (Final Design Reviews), MRR (Manufacturing Design Reviews), DEL (Delivery) and C-O (Close-Out).
The following definitions provide an explanation of the content of each of the above mentioned phases/gates.

Phase	Definition
Conceptual Design	With inputs such as Technical rules to be followed (codes & standards, handbooks, etc.), the allocation of Requirements to the systems (via SRDs) with relevant physical envelopes (CMMs) and interface design specifications (ICDs) and preliminary PBS tree, the CDR Phase aims to consolidate design inputs, to propose at least one feasible design solution describing and identifying its functionalities and main components, to flag any non-achievable requirements. The main phase output is the description of a system design solution that meets the requirements and is achievable at an acceptable risk and cost.
Preliminary Design	With input the consolidated engineering data of the CDR, the PDR phase aims to refine the Conceptual design in terms of both technical feasibility and schedule robustness, to freeze the interface specifications, to plan future steps (e.g. tests on mock-ups/prototype for design qualification/verification) and to re-assess technical risk of the proposed solution and to propose a mitigation plan before starting the detail design.
Final Design	The Final Design phase aims to refine the design of the PBS elements to allow the manufacturing, to provide a manufacturing specification clear and agreed with the manufacturer, to provide the BoM, to build the complete set of justifications for component specifications and design, qualification process specifications are frozen and to provide evidence that the manufacturability, transfer, assembly and qualification/start-up of the system are defined and agreed with the stakeholders.
Manufacturing Readiness Review	A formal design review meeting conducted to confirm the design baseline after FDR, in terms of processes, documentation, planning, resources, qualification status etc, is mature enough to authorize the start the manufacturing activities.
Delivery	It marks the time when the procured item is handed over to the user (e.g. ITER Organization) for the next phases (i.e. installation, site acceptance tests, operation).
Close-out	It marks the date of the last credit to be achieved for that specific PA. For some specific PAs this date can be earlier than the delivery date, depending on the agreed plan for the release of the credits linked to the procurement.

When more than one FDR, MRR or delivery are planned and when the system is composed of several components, the table includes the last design review or delivery date of all components composing the system.

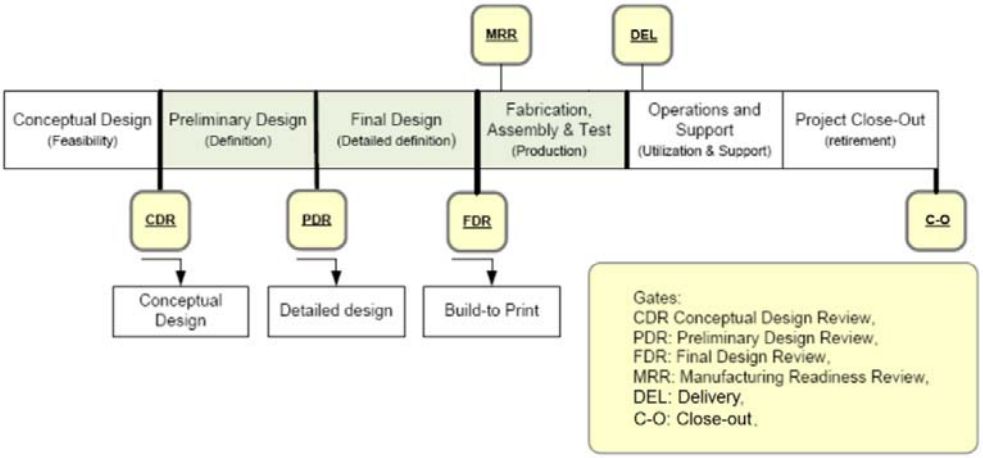


Figure 5 . Progress in the delivery of the EU contributions

In the following table the design review phases are shown per Action and per PA. Some of the dates are not within F4E's responsibility.
In a few cases, the PA may foresee the release of the last credit prior to the delivery of the item.

F4E Milestone Completed		IO Milestone Completed		F4E Milestone Forecast		IO Milestone Forecast

			1.CDR	2.PDR	3.FDR	4.MRR	5.Delivery	6.Close-Out
Magnets	**Toroidal Field Coils**	**BP**	-	-	-	29/06/2018	09/11/2021	09/11/2021
	Pre Compression Rings	**BP**	-	-	-	31/07/2018	23/08/2019	23/08/2019
	Poloidal Field Coils	**BP**	-	-	-	10/07/2018	15/09/2023	15/09/2023
	Magnet Conductors	**BP**	-	-	-	26/06/2015	-	04/11/2016
Vacuum Vessel	**Main Vessel**	**BP**	-	-	-	15/05/2013	07/05/2021	07/05/2021
In Vessel- Blanket	**Blanket Manifolds**	**BP**	28/09/2011	-	24/06/2016	12/06/2025	01/04/2027	01/04/2027
	Blanket and First Wall Panels	**BP**	02/02/2010	01/12/2011	11/04/2013	18/01/2023	21/12/2027	21/06/2028
In Vessel- Divertor	**Divertor Cassette Body**	**BP**	-	-	-	12/06/2020	05/04/2028	25/04/2028
	Divertor Vertical Target	**BP**	-	-	02/04/2012	08/02/2022	05/07/2028	21/08/2028
	Divertor Rails	**BP**	-	-	12/03/2019	12/06/2024	10/11/2025	10/11/2025
Remote Handling	**Divertor Remote Handling System**	**FS**	28/02/2012	28/11/2018	11/04/2022	11/10/2023	20/01/2026	23/07/2026
	Cask & Plug Remote Handling System	**FS**	30/01/2014	04/03/2020	11/07/2024	08/08/2025	13/09/2027	31/07/2028
	Neutral Beam Remote Handling System	**FS**	31/10/2012	23/10/2020	19/03/2024	06/03/2025	10/11/2026	30/06/2027
	In Vessel Viewing System	**FS**	01/08/2014	09/10/2019	30/11/2021	14/06/2022	30/01/2025	07/07/2025
Cryoplant and Fuel Cycle	**Cryopumps**	**BP and DD**	-	25/03/2010	22/07/2022	12/01/2024	17/05/2027	17/05/2027
	Leak Detection and Localization System	**FS**	14/12/2018	12/07/2021	23/02/2022	23/02/2022	29/09/2023	29/09/2023
	Hydrogen Isotope Separation System	**DD**	-	-	08/08/2024	24/08/2026	10/07/2029	10/07/2029

	Water Detritiation System	DD	-	25/08/2016	11/06/2025	11/12/2026	28/06/2030	11/02/2033
	Liquid Nitrogen Plant and Auxiliary Systems	FS	07/01/2011	20/10/2014	09/11/2015	01/08/2016	10/10/2019	08/10/2020
	Radiological and Environmental Monitoring System	FS and BP	-	06/06/2025	20/05/2027	07/12/2028	04/10/2029	31/08/2029
	Radiological and Conventional Waste Treatment and Storage	FS	24/04/2014	18/08/2021	22/09/2023	10/04/2025	-	13/02/2026
Antenna and Plasma Engineering	Ion Cyclotron Antenna	BP	21/03/2011	01/07/2013	05/10/2022	05/02/2026	02/07/2030	14/12/2029
	Electron Cyclotron Upper Launcher	BP	-	30/09/2011	04/09/2020	03/06/2021	22/05/2025	22/05/2025
	Electron Cyclotron Control System	BP	29/01/2014	-	06/03/2026	19/02/2027	-	14/04/2027
Neutral Beam and EC Power Supplies and Sources	Electron Cyclotron Gyrotrons	FS	-	16/03/2017	03/02/2023	02/02/2024	26/01/2027	03/06/2027
	Electron Cyclotron Power Supplies	FS	-	15/10/2014	05/12/2014	31/07/2015	16/07/2020	27/10/2022
	Neutral Beam Source and High Voltage Bushing	BP	-	-	-	22/09/2026	10/08/2029	26/09/2029
	Beamline Components	BP	-	-	-	14/04/2025	31/07/2029	19/09/2029
	Pressure Vessel and Magnetic Shielding	DD	18/07/2011	15/12/2014	04/09/2020	10/04/2024	20/05/2027	21/04/2027
	Active Correction and Compensation Coils	DD	-	-	31/07/2019	03/03/2023	27/02/2029	27/02/2029
	Neutral Beam Power Supplies	FS	-	26/08/2015	26/06/2020	01/12/2022	05/06/2023	14/12/2026
	Neutral Beam Test Facility	FS	11/02/2013	26/04/2017	11/05/2020	22/06/2021	-	24/10/2023
Diagnostics	Magnetics	FS	-	22/03/2021	12/04/2024	12/04/2024	04/11/2025	04/11/2025
	Bolometers	FS	-	14/11/2022	30/08/2023	19/11/2025	08/07/2027	08/07/2027
	Plasma Position Reflectometry	FS	-	12/06/2023	12/09/2024	09/07/2026	02/01/2029	14/08/2028
	Pressure Gauges	FS	-	06/08/2019	02/03/2021	22/12/2022	10/04/2028	10/04/2028
	Radial Neutron Camera - Gamma Spectrometer	FS	27/12/2017	01/06/2022	05/09/2024	10/06/2026	07/10/2027	10/01/2029

	Core-plasma Thomson Scattering		-	26/04/2023	07/05/2024	25/05/2026	30/04/2029	11/07/2030
	Low Field Side Collective Thomson Scattering	**FS**	-	05/04/2019	07/05/2020	09/09/2021	10/05/2022	14/07/2023
	Core-Plasma Charge Exchange Recombination Spectrometer	**FS**	-	13/12/2024	18/12/2025	20/04/2027	03/05/2028	03/05/2028
	Equatorial Visible/Infrared Wide-Angle Viewing System	**FS**	-	03/12/2025	08/11/2027	24/11/2027	18/08/2028	18/08/2028
	Port Engineering Systems	**FS**	-	20/08/2020	08/06/2023	20/02/2025	12/03/2030	20/09/2030

The table above shows the F4E status in the life cycle of each Action/PA (extracted from Primavera P6 tool at end of April 2018).

	Nr and Name of Building (yellow where construction has started)	**RFOC Date**	**RFE Date**	**Completion Date**
11-Site and Buildings and Power Supplies	**11 - Tokamak Building**	Apr-2019 (Pit)	Apr-2018 RFE 1B stage 1	Jul-2022
		-	Mar-2020 RFE 1B stage 2	
		Mar-2020 (Crane Hall)	Aug-2020 RFE 1C	
		-	Oct-2021 RFE 2 Stage 2	
	13 - Assembly Building	Sep-2016	Jun-2017	Oct-2018
	14 - Tritium Building	Jul-2021 (B2 Level)	Mar-2025	Oct-2025
		Jul-2021 (B1 Level)	Mar-2025	Oct-2025
	15 - RF Heating Building	Jun-2017	Mar-2019 RFE Stage 1	Jun-2021
	21 - Hot Cell	N/A, no RFOC as Design & Built contract	Nov-2028	Dec-2028
	23 - Radwaste Building	N/A, no RFOC as Design & Built contract	Feb-2027	Sep-2027

	24 - Personnel Access Control Building	N/A, no RFOC as Design & Built contract	Mar-2027	Oct-2027
	32 - Magnets Power Conversion Building	N/A, no RFOC as Design & Built contract	Jul-2017 (IO Early access)	Aug-2018
		-	Dec-2017 (RFE)	
	33 - Magnets Power Conversion Building	N/A, no RFOC as Design & Built contract		Aug-2018
		-	Dec-2017 (RFE)	
	34 - NB Power Supply Building	N/A, no RFOC as Design & Built contract	Sep-2022	Apr-2023
	37 - NB High-Voltage Power Supply Building	N/A, no RFOC as Design & Built contract	Feb-2023	Sep-2023
	51 - Cryoplant Compressor Building	Sep-2017	Sep-2017 (RFE 8A)	Jul-2019
		-	Oct-2018 (RFE 8B)	
	52 - Cryoplant Coldbox Building	Sep-2017	Sep-2017 (RFE 8A)	Jul-2019
		-	Oct-2018 (RFE 8B)	
	53 - Cryoplant Infrastructure Building	-	Sep-2017 (RFE 8A Stage 2)	Dec-2018
			Dec-2017 (RFE 8A Stage 4)	
	61 - Site Services Building	Aug-2016	Apr-2017 (RFE 17A)	Jul-2019
			Mar-2018 (RFE 17B)	
	71 - Control Building (non-PIC)	Sep-2021	Jun-2022	May-2023
	74 - Diagnostics Building	Sep-2018 (B2 Level)	Nov-2021	May-2022

Table 4 . Life cycle of the EU procurements (as of 24 April 2018)

3.2.7 Cash contribution to IO

In addition to the in-kind contributions, which comprise very significant components of the ITER machine, the EU makes a substantial cash contribution to IO to support its internal operating costs. The sum of the EU in-cash and in-kind contribution is a fixed amount corresponding to the 45.46% of the total project costs during the construction phase.
F4E pays its cash contribution share in yearly contributions.
The table below shows the yearly cash contribution already paid to IO and the current forecast up to 2023.

Contribution Year	Gross In-Cash Contribution to IO (A)	In-Cash from Staff Secondments to IO (B)	In-Cash from ITAs (C)	Net in-Cash (D=A-B-C)
	In-Year Value	In-Year Value	In-Year Value	In-Year Value
	(EUR)	(EUR)	(EUR)	(EUR)
2006	2,046,000.00	0	0	**2,046,000.00**
2007	25,762,255.00	5,814,255.00	0	**19,948,000.00**
2008	40,559,448.60	4,174,642.71	149,815.55	**36,234,990.34**
2009	45,542,005.03	4,220,556.69	309,518.00	**41,011,930.34**
2010	65,247,558.94	3,510,933.10	6,019,586.72	**55,717,039.12**
2011	82,538,412.26	3,155,372.37	10,519,813.89	**68,863,226.00**
2012	97,799,847.80	2,810,278.03	7,714,938.77	**87,274,631.00**
2013	70,574,478.68	2,092,787.90	6,108,338.78	**62,373,352.00**
2014	96,449,698.00	2,412,032.00	14,618,812.00	**79,418,854.00**
2015	86,113,178.00	2,247,024.00	3,855,001.00	**80,011,153.00**
2016	125,364,099.01	1,914,730.00	5,630,831.00	**117,818,538.01**
2017	139,529,383.36	1,550,905.00	4,727,379.00	**133,251,099.36**
2018	144,151,729.00	1,419,501.00	1,720,228.00	**141,012,000.00**
2019 (Forecast)	227,000,000.00	2,500,000.00		**224,500,000.00**
2020 (Forecast)	265,000,000.00	11,500,000.00		**253,500,000.00**
2021 (Forecast)	295,200,000.00	6,600,000.00		**288,600,000.00**
2022 (Forecast)	304,971,126.51			
2023 (Forecast)	308,970,994.43			
Total	2,422,820,214.62			

Table 5 . EU cash contribution to IO (as of 8th August 2018)

3.2.8 Cash contribution to Japan

According to the ITER Agreement, there is a transfer of 10% of in-kind procurement responsibility from Euratom to Japan under the supervision of the ITER Organization. This is financed through a cash contribution from EU to Japan paid by F4E. F4E provides a yearly payment based on the documented achievement of progress. The full payments of five PAs have already been completed. Commitments of two new PAs (one of them split into two phases) are foreseen in 2019 and after 2020. In addition, F4E will pay a specific contribution to Japan in 2022 to fulfill a settlement agreement between EU and Japan agreed in 2014.

System	Description	Percentage of System financed by EU through cash contribution to JA (approximate %)	Value of Cash Contribution (kIUA)	Forecasted Commitment Date	Paid by F4E until end April 2018 (kIUA)
Magnets	Toroidal Field Magnet w indings 1B	8.96%	7.7362	Already Committed	**1.6298**
	Toroidal Field Magnet Structure 2A-B	54.92%	49.3605	Already Committed	**49.3605**
	Toroidal Field Magnet Conductors	40.14%	21.5	Already Committed	**21.5**
	Central Solenoid Magnet Conductors	100%	90	Already Committed	**90**
Tritium	Atmosphere Detritiation (1st Part)	50%	2.3	Q2/2019	**0**
	Atmosphere Detritiation (2nd Part)		12.8	Q2/2022	**0**
Neutral Beam H&CD	Beam Source and High Voltage Bushing	100%	2.075	Already Committed	**2.075**
	Pow er Supply for NBTF	46.50%	22.622	Already Committed	**22.622**
	Pow er Supply Heating Neutral Beam-Cadarache		20.296	Q2/2019	**0**
	Settlement Agreement betw een EU and Japan agreed in 2014		66.6 $MEuro_{2008}$	Q2/2022	**0**

Table 6. EU cash contribution to Japan.

3.3 Broader Approach

3.3.1 Overall scenario

Fusion for Energy is the Implementing Agency for the EU contribution to the three BA projects, designated by the European Commission to discharge its obligations as defined in the BA Agreement. In particular, F4E is the organization delegated to agree and conclude Procurement Arrangements (PAs) with the Japanese Implementing Agency (QST).
To a large extent the EU activities to be undertaken in the frame of the BA agreement are provided in-kind by Voluntary Contributors (VC). These are some of the EU member states represented in the GB of F4E which pledged to contribute to the BA projects, namely Belgium, France, Italy, Germany, Spain. In turn, each VC channels its contributions through the procurement arm of "Designated Institutions" (VC-DIs). F4E leads and integrates activities and concludes Agreements of Collaboration (AoCs) with the VC-DI, to secure delivery of the EU contributions and hence meet the requirements of each Procurement Arrangement. The direct contribution of F4E through its own budget is limited in general to a supporting, qualifying or integration role, with some direct procurement for agreed EU contributions not covered by the VCs.
Each of the BA Projects, while having some important differences, shares the common feature of being based on a collaboration in which the Parties contribute both to the definition of the overall integrated design and to the detailed design and realization.
The table below defines a summary of the BA action value. Further details are available in Annex XIII.

ACTIONS	WBS Name	BA EU Commitment kBAUA	Signed EU PAs (or equivalent) kBAUA
14 - Broader Approach	Satellite Tokamak (JT-60SA)	236.413	236.403
	IFMIF/EVEDA Project	147.325	147.325
	International Fusion Energy Research Centre	116.25	116.25

Table 7 . Correspondence between Actions, WBS and WP ref for BA

3.3.2 Satellite TOKAMAK programme

Scope and Schedule

The mission of the JT-60SA project is to contribute to the early realization of fusion energy by supporting the exploitation of ITER and research towards DEMO by addressing key physics issues associated with these machines, in particular by designing, constructing and operating a device:
1. Capable of confining break-even equivalent class high-temperature deuterium plasmas lasting for a duration longer than the timescales characteristic of plasma processes.
2. Pursuing full non-inductive steady-state operation with high plasma beta close to and exceeding no-wall ideal stability limits.
3. Establishing ITER-relevant high density plasma regimes well above the H-mode power threshold.

The primary reference for the Satellite Tokamak Programme is the Project Plan yearly revised and submitted for endorsement to the BA Steering Committee (see BA SC 20-7.4 Project Plan v1.0 (F4E_D_29SHY5 v1.0)[6].

[6] An update of the Project Plan is foreseen to be approved by the BA SC in December 2018 in which activities for BA Phase II will also be listed and scheduled.

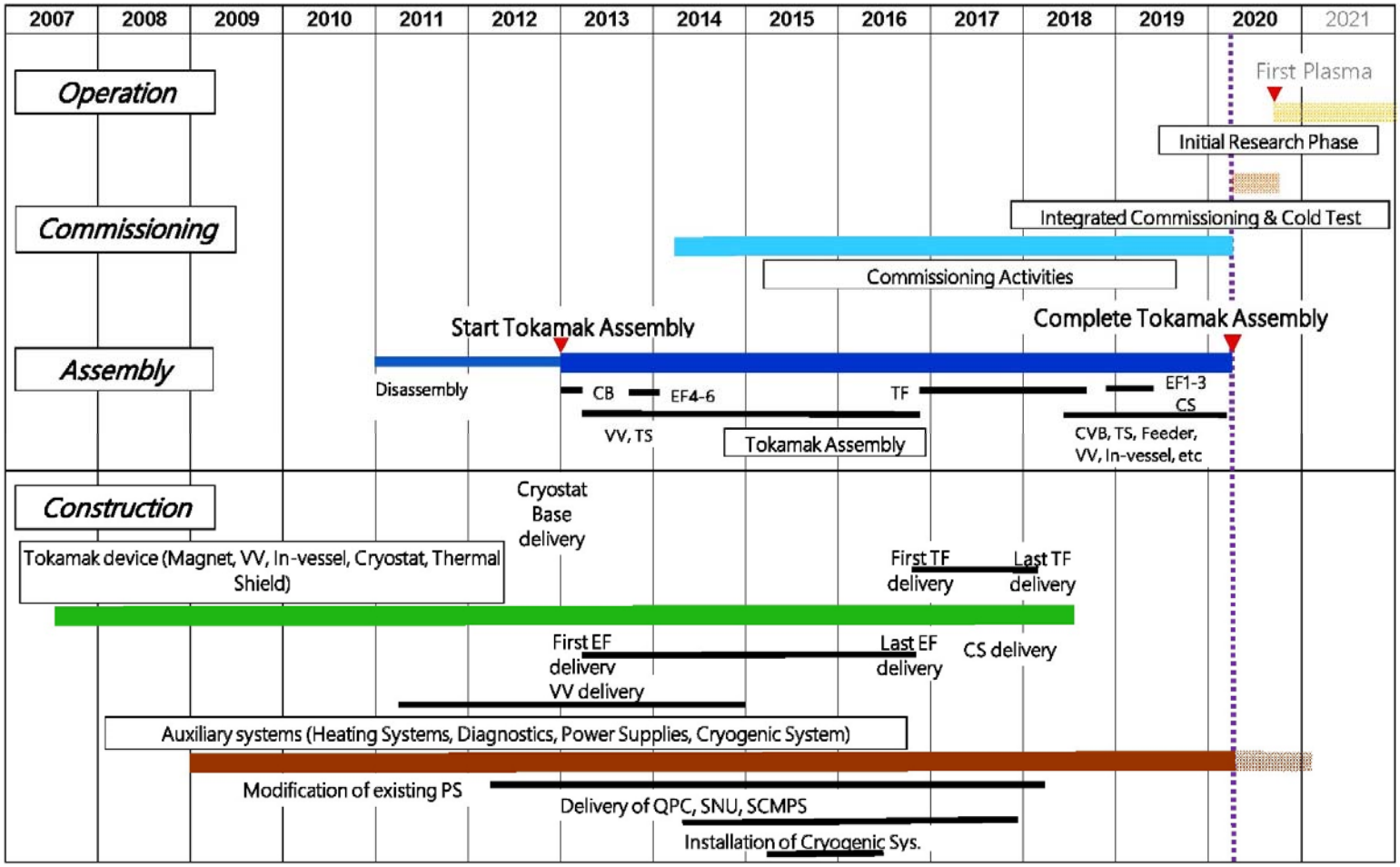


Figure 6 . High-level Schedule (as approved by BASC 20th April 2017) (Project Baseline Schedule)

All the EU Procurement Arrangements and the relevant corresponding industrial contracts have been placed and are well underway. All the European contributions are in line with the project baseline schedule.
The facility is going to be completed by March 2020 within the presently agreed Broader Approach (BA) period. The integrated commissioning of the system including initial plasma operation from September 2020 is foreseen to be part of BA Phase 2, presently under negotiation with Japan. In addition, a collaboration between F4E (through EUROfusion) is on-going with QST (i.e. the Japanese Implementing Agency) for the preparation of the research plan and the BA Phase 2 joint exploitation phase of the device. A "JT-60SA Research Plan" was established at the end of 2011 and the latest version was released in 1st March 2016.After 2020 the JT-60SA facility will start its joint EU-JA operation phase, which will include joint integrated commissioning, exploitation as well as machine enhancements. The close collaboration between F4E, VC-Dis, as well as EUROfusion is envisaged to continue in that phase as well. If agreed between Euratom and Japan, within Europe F4E and VC-Dis would jointly focus on the integration, enhancements and hardware operation while EUROfusion is instead going to focus on the scientific use of the facility.

PA Credit Summary

The total commitment for the EU corresponding to the STP (JT-60SA) amounts to 236,413 BAUA. At present date (22 May 2018) the credit awarded to EU is 218,093 BAUA. The remaining credits to be earned amount to 18,320 BAUA (from now until March 2020).

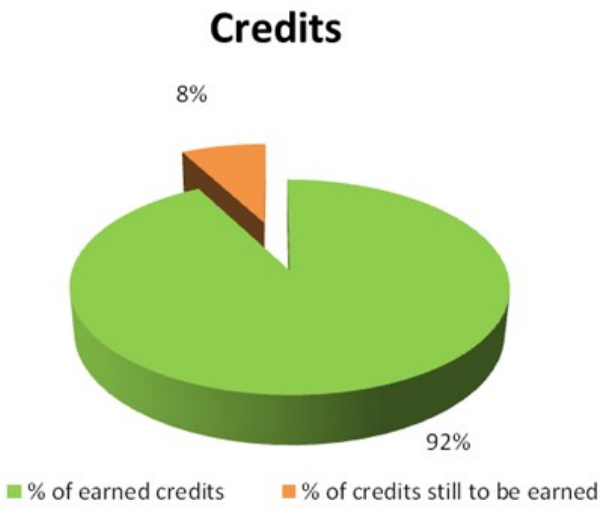


Figure 7. JT-60SA: percentage of earned/not yet earned credits in BAUA (Status May 2018)

3.3.3 IFMIF/EVEDA

Scope and Schedule

The IFMIF/EVEDA Project (Engineering Validation and Engineering Design Activities for IFMIF) started in June 2007 and has since undergone a re-scoping in 2010 and an extension until March 2020 approved by the BA Steering Committee in April 2017. Its mission is to produce the engineering design of IFMIF (International Fusion Materials Irradiation Facility) and to establish an experimental data base to support such design. The R&D facilities built to that end are:

- the Accelerator Facility ("LIPAc"),
- the Lithium Target Facility,
- the Test Facilities.

The schedule for completing the IFMIF/EVEDA Project by the end of March 2020 is shown in Figure 8. Indeed, the engineering design of IFMIF as well as all the deliverables associated with the Lithium Target facility and Test Facilities have been achieved. Validation activities of the LIPAc accelerator remain underway. These will take place over 4 phases:

- Phase A: Commissioning of the ion source (Injector).
- Phase B: Commissioning of the Injector + RF Quadrupole + Medium Energy Beam Transport line + Diagnostics Plate + Low Power Beam Dump planned until the end of 2018.
- Phase C: Integrated commissioning of the LIPAc accelerator (with its Superconductive Cavities, High Energy Beam Transport and its Beam Dump) at low duty cycles – planned until March 2020.
- Phase D: Integrated commissioning of the LIPAc accelerator and performance validation under continuous wave conditions, completing the IFMIF/EVEDA Project within the presently agreed Broader Approach (BA) period by March 2020.

In addition to the above activities F4E is engaged with EUROfusion for the preparation of the necessary supporting documents for deciding and starting the IFMIF-DONES project (building a scaled down IFMIF plant with number of accelerators reduced from 2 to 1). If decided within the EU and at international level with Japan, we expect the construction of this facility to start after 2020.
In that timeframe, the LIPAc facility should be used for developing advanced operational procedures and for constant beam operation (CW) over extended periods, to prove both reliability and availability. This will be instrumental to achieve the required reliability and availability of the IFMIF-DONES neutron source and is foreseen to be part of BA Phase 2, presently under discussion between Euratom and Japan.

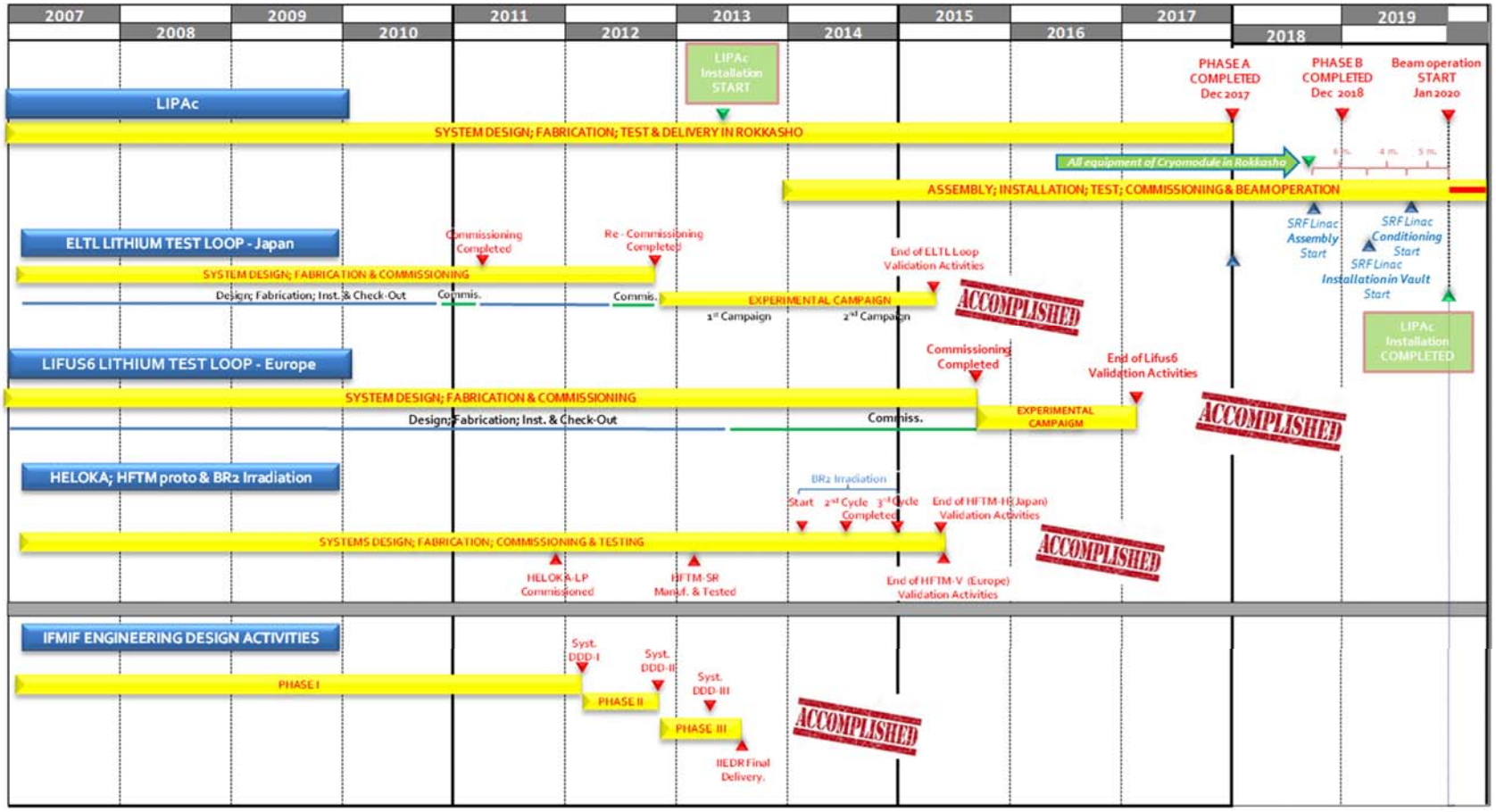


Figure 8 . High-level Project Schedule (as approved by BASC-20th April 2017)

PA Credit Summary

The global total commitment for the EU corresponding to the IFMIF/EVEDA amounts to 147,330 BAUA. At present date (22 May 2018) the credit awarded to EU is 128,862 BAUA. The remaining credits to be earned amount to 18,468 BAUA (from now till March 2020).

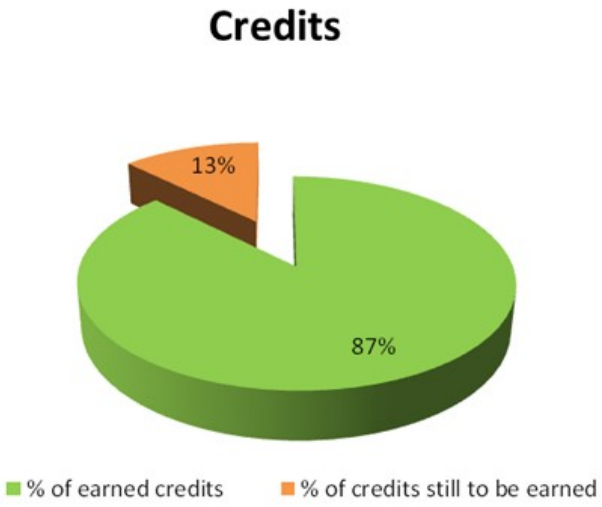


Figure 9 . IFMIF/EVEDA: percentage of earned/not yet earned credits in BAUA (Status May 2018)

3.3.4 IFERC

Scope and Schedule

The IFERC activities include three sub projects:

- DEMO Design and R&D activities,
- establishment and operation of a Computer Simulation Centre (CSC),
- establishment and operation of a Remote Experimentation Centre (REC)

DEMO Design and R&D

EUROfusion acts as a Voluntary Contributor in performing DEMO Design Activities. After an initial phase of analysis (common elements for DEMO in EU and JA, 2007-2010), the work moved on to more detailed studies to: a) follow-up work on key design issues and options and narrow down design options; b) define design criteria; c) evaluate ranges of DEMO parameters.

DEMO R&D Activities

The DEMO R&D activities focus on materials for blankets in order to establish a common basis for a DEMO design.

Five R&D task areas were defined:

- T1: Functional materials for DEMO Blanket (SiC/SiC composites),
- T2: Tritium Technology,
- T3: Structural Materials for DEMO Blanket,
- T4: Advanced Neutron Multiplier for DEMO Blanket,
- T5: Advanced Tritium Breeders for DEMO Blanket.

In the first years of BA these tasks were conducted in the Voluntary Contributors laboratories and were mostly completed by 2015; activities currently continue with under the DEMO Design umbrella, with EUROfusion acting as Voluntary Contributor.

It should also be noted that the scope of work on DEMO design and R&D in the BA is defined for the extension of the Programme until 2019. F4E currently negotiates the following phase (BA Phase II) with the relevant stakeholders.

Computer Simulation Centre (CSC)

The EU procured and delivered the Helios supercomputer for the Rokkasho CSC. Operation of Helios started on schedule in January 2012, and was carried out until the end of 2016. The system had minor upgrades in 2014, 2015 and 2016, and has been used as main supercomputing tool by the EU fusion community. It was dismantled in the 1st semester of 2017.

Remote Experimentation Centre (REC)

The Remote Experimentation Centre in Rokkasho aims to facilitate broad participation of scientists into ITER experiments. Remote experimentation techniques will be tested on existing machines, such as JT60-SA, JET and WEST. Most of the contribution to REC is provided by F4E.

	2007		2008		2009		2010		2011		2012		2013		2014		2015		2016		2017		2018		2019		2020
	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	Q1
DEMO Design			Workshops/Meetings						Joint Works/Safety research												voluntary Joint Work						
DEMO R&D			Execution of R&D Tasks/ Reporting																		voluntary Work						
CSC			Preparation/Procurement								Operation of CSC										Dismantling						
REC											Plan		Preparation				Set-up/verification				Demo		extra tests				
Site/Buildings			Design		Construction			Adaptation			Maintenance/upgrade										Maintenance						

Table 8 . IFERC High Level Project Schedule

PA Credit Summary

The total commitment for the EU corresponding to the IFERC amounts to 116,250 BAUA. At present date (22 May 2018) the credit awarded to EU is 114,070 BAUA. The remaining credits to be earned amount to 2,180 BAUA (from now till March 2020).

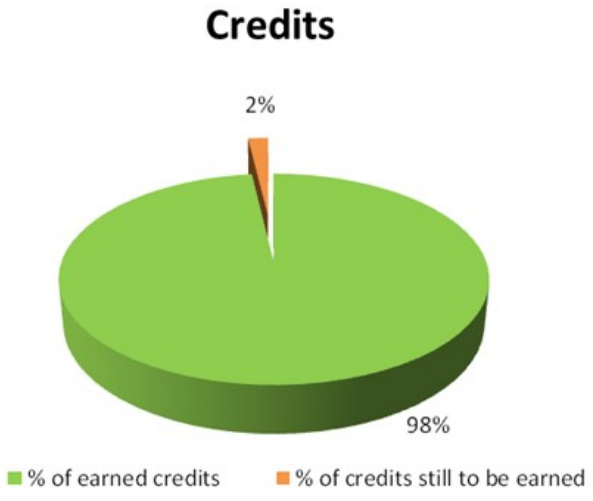


Figure 10 . IFERC: percentage of earned/not yet credits in BAUA (Status May 2018)

3.4 DEMO and IFMIF preparatory activities

The Statutes of F4E include amongst its tasks (Art 1. 2-c) the execution of preparatory activities for the construction of DEMO and related facilities such as IFMIF.

In line with the present priorities of F4E, namely ITER and the BA Projects, all preparatory activities for DEMO are currently confined to those included in the frame of the IFERC project within the BA Agreement itself (see 3.3.4), as well as to a limited support function (1 FTE) to EUROfusion, who is now

carrying forward such preparatory work in F4E's stead, with a view to take over from EUROfusion when the ITER first plasma will be achieved.
Finally F4E is also carrying out interactions with its governance to prepare the possible construction of IFMIF-DONES, this being done in-line with the activities being performed in the frame of the BA Agreement (i.e. IFMIF/EVEDA, see 3.3.3)

3.5 Progress, Achievement and performance indicators

F4E has identified specific Key Performance Indicators (KPI) in order to measure how effectively the organization achieves the target set in different areas (i.e. schedule, cost, risk, budget consumption, etc.). F4E monitors these KPIs and reports to the Project Steering Meeting (PSM) to discuss any possible event or risk that could threaten their achievement.
The basis of comparison for the adopted KPIs is the F4E current baseline, in schedule, cost and budget. The current baseline is continuously kept updated through the change control process. A Change Control Board (CCB) meets on a weekly basis to discuss the requested changes and decide on whether or not to implement them.
Dashboards are available with the possibility of drilling down for more details, both at a global F4E level and individually per PT. KPIs information is included in many F4E documents and reports.
How KPIs are defined and used at F4E is further illustrated in par. 4.2.6 and 4.2.7.

3.6 Changes and developments over the last year (up to April 2018)

In this period of time F4E and ITER IO management have closely worked together to stabilize and optimize the ITER project plan and schedule. The following more significant points should be mentioned:

- Work has progressed following the updated schedule for the period 2016-2035, as agreed at the ITER Council of November 2016;
- Management attention still focused on the two most critical F4E projects: Buildings and Vacuum Vessel. On top of monthly reviews at the Project Steering Meeting (PSM) with focus on all different aspects of these projects (i.e. schedule analysis, progress, evolution of risks and cost, etc.), the Senior Management has dedicated a large share of its time on both projects.
    - o **vacuum vessel**: a large number of European companies is now involved in the fabrication of this component and the coordination of the work and its follow-up is a key element that absorbed a large amount of F4E resources. In 2018 the manufacturing rate of the vacuum vessel sectors improved significantly. However, further improvements are required in order to avoid further slippage of the delivery dates.
    - o **Buildings TB03**: The Tokamak Building construction is running at full speed. Design and construction sequence optimizations have allowed to stabilize as far as possible the construction schedule and target date for the main ITER critical construction milestone. By end of January 2018, with the completion of the Bio-shield walls (culminating at level L3), a first
    important milestone has been achieved. The Revised Construction Strategy exercise carried out by IO with the support of all DAs for the part of the ITER construction schedule leading to First Plasma, has allowed to revise the need dates for the delivery of the machine components and therefore absorb the delays in the construction accumulated until now.

    - o **Buildings TB04**: The Final Design of the Tokamak Complex TB04 equipment was completed and approved by IO. F4E and IO have now completed the agreement for transferring from F4E to IO the installation of all the TB04 components, via a partial novation of the TB04 contract with

the OMEGA consortium. This important decision was approved by both the ITER Council and the Governing Board and its implementation is in progress.

- F4E is still paying reinforced attention, efforts and resources to minimize the number of changes (PCRs) decided at the ITER project level and impacting the F4E in-kind contribution and to get their cost impacts compensated by the ITER Reserve Fund.
- Works in other areas have progressed, new contracts have been launched and important milestones have been achieved. Among them, the delivery of the last TF coil to Japan for the JT-60SA project as part of the BA agreement;
- F4E has further developed its PM tools, enhancing the reporting system with more dashboards and reports and the implementation of ECOSys Enterprise Project Control System to be able to manage and control the Estimate Cost at completion, commitments and budgets in the same tool.

Section II. Multi-annual programming 2019-2023

4. Project Plan

4.1 Introduction

In accordance with the Financial Regulation of F4E and its Implementing Rules, this Multiannual programming document is composed of a Project Plan (PP) that lays down an overall strategic programing foreseen to cover five years (i.e. 2019-2023). The Resource Estimate Plan (REP) complements it.
Within the scope of the Broader Approach programme, this document includes three individual projects: Satellite Tokamak Programme, IFMIF/EVEDA and IFERC.
DEMO, still in a far earlier stage if compared to ITER or BA, is also presented here with the provision of high level information.

4.1.1 Input timeframe

The Project Plan covers 5 years; from 2019-2023 both inclusive. However, the 2018 information has still been kept in the tables. It should be mentioned that currently, although the path to First Plasma (FP) in December 2025 is well defined and specific milestones have been agreed at ITER Council level, the decision process on the budget after 2020 is still ongoing and will last at least until 2019. Therefore all plans concerning the years after 2020 are indicative only.

4.1.2 Schedule

The dates provided in this document are according to the F4E Detailed Work Schedule (DWS) submitted to IO at the end of April 2018.

4.2 Multiannual Objectives

This section of the document describes the strategic medium term objectives of F4E and the way the progress in their achievement is monitored.
F4E's objectives are divided in two types:

- Technical Objectives;
- Non-technical objectives or, so called, Corporate Objectives.

This paragraph describes the criteria used to select these objectives, the KPIs used to monitor them, the way KPIs are computed and their thresholds (where applicable). In addition, the strategy to achieve them will be presented as well as the way F4E manages them whenever they become critical.

F4E has a number of additional corporate objectives covering other important areas, including Health & Safety and nuclear safety. The ones included here are the most relevant ones to measure the progress of the project.

4.2.1 Selection Criteria

It is important to pick objectives which are not only top-level ones but also representatives of the work to be performed in the forthcoming years. The existing IC/GB milestones are ideal for the purpose as they are not only critical path oriented but they cover a larger group of components at different stages of their development. Most of them are key to achieve FP, but some of them also relate to non-FP systems due to be delivered in other phases of the Staged Approach. The IC Milestone list is updated each year with a rolling wave approach. This is why F4E has decided that its technical objectives will be the achievement on time of the IC/GB milestones.
In order to show the close link between the long-term (i.e. Project Plan) planning and the short-term (i.e. workprogramme) activities, F4E is tracking in the Workprogramme some selected existing technical milestones leading to the IC/GB ones (i.e. the predecessors) and in the chain of all critical and near-critical paths. Therefore such milestones in the short-term will act as an alert against the increasing risk of missing any critical and near-critical path milestones in the longer term.
Regarding the non-Technical Objectives, F4E has selected them to monitor those activities that have been identified during the last years as being most relevant for F4E stakeholders, both external (Commission, EU Member States, IO, etc) and internal (F4E staff). Some of them have been defined after specific request from Commission, other ones from audit survey and others because defined after staff surveys or suggested by the F4E Staff Committee.

4.2.2 Technical objectives for the ITER project

As anticipated, the technical objective is the achievement on time of the IC-GB milestones.
Considering the progress in design and construction, the project has recently launched an action to refine and revise the need/delivery dates for various components, while still maintaining the FP Baseline date of December 2025, in line with the approved OPS and OPC. This Revised Construction Strategy has also triggered a modification of the baseline for the completion dates of some of these milestones. The Revised Construction Strategy exercise is being conducted in stages [called ‘waves’]. IO has completed wave 1, covering the most critical components required for First Plasma, and the GB and IC Milestones shown in the table below include the wave 1 changes agreed at IC-22 and GB 41 in June/July 2018. IO will continue to work on the Revised Construction Strategy and expects to finalise wave 2, comprising the other First Plasma components, later in 2018. The achieved milestones are in pale green.

IC/GB Reference	Action	Milestone	Type of Milestone	Agreed Quarter	PA
GB00/IC02	11-Buildings Infrastructure and Power Supplies	Start of B1 civil works in Tokamak building	IC	Q1 2016	6.2.P2.EU.05
GB01/IC04	11-Buildings Infrastructure and Power Supplies	Erection of Tokamak Main Cranes in Assembly Hall	IC	Q2 2016	6.2.P2.EU.05
GB02/IC05	1-Magnets	TF Coil: Completion of first EU TF winding pack	IC	Q2 2016	1.1.P1A.EU.01

GB03/IC09	11-Buildings Infrastructure and Power Supplies	Installation of WDS tanks in Tritium building	IC	Q2 2016	6.2.P2.EU.05
GB04/IC13	2- Vacuum Vessel	First Sub Segment Assembly of VV Sector 5 completed	IC	Q4 2016	1.5.P1A.EU.01
GB05/IC14	6-Cryoplant & Fuel Cycle	First Liquid Nitrogen Refrigerator equipment Factory Acceptance Tests completed	IC	Q4 2016	3.4.P1.EU.01
GB06/IC19	11-Buildings Infrastructure and Power Supplies	Energisation of 400KV switch yard	IC	Q1 2017	4.1.Pn.EU
GB07/IC21	11-Buildings Infrastructure and Power Supplies	Completion of RFE 1A (Assembly Hall)	IC	Q2 2017	6.2.P2.EU.05
GB08/IC24	11-Buildings Infrastructure and Power Supplies	Tokamak Concrete crown civil works achieved	IC	Q3 2018	6.2.P2.EU.05
GB09/IC25	11-Buildings Infrastructure and Power Supplies	Civil works and finishing performed in B2 level allowing TB04 installation to begin in tokamak building B2 level	IC	Q4 2018	6.2.P2.EU.05
GB10/IC30	8-Neutral Beam Heating & Current Drive	Neutral Beam Test Facility (NBTF): Start of integrated commissioning of SPIDER beam	IC	Q1 2018	5.3.P9.EU.01
GB11/IC33	11-Buildings Infrastructure and Power Supplies	First limited access to Tokamak pit for installation without large crane availability (RFE 1B stage 1)	IC	Q4 2018	6.2.P2.EU.05
GB12/IC42	1-Magnets	PF Coil: EU PF 5 coil ready for cold test	IC	Q1 2020	1.1.P3A-B.EU.01
GB13/IC50	11-Buildings Infrastructure and Power Supplies	Limited crane access between Assembly Hall and Tokamak Building (RFE 1B stage 2)	IC	Q1 2020	6.2.P2.EU.05
GB14/IC54	1-Magnets	PF Coil: Manufacturing complete for EU PF 6 Coil and delivery to site	IC	Q2 2020	1.1.P3A-B.EU.01
GB15/IC53	1-Magnets	TF Coil: Complete FAT for PA work scope for First EU TF Coil	IC	Q1 2020	1.1.P1A.EU.01
GB16/IC58	2- Vacuum Vessel	First EU Vacuum Vessel Sector fabrication complete and delivered to IO site	IC	Q4 2020	1.5.P1A.EU.01
GB17/IC55	11-Buildings Infrastructure and Power Supplies	Full crane access between Assembly Hall and Tokamak Building to allow lowering of Vacuum Vessel Sectors into Pit (RFE 1C)	IC	Q2 2020	6.2.P2.EU.05
GB18/IC76	6-Cryoplant & Fuel Cycle	Commissioning: Cryostat Leak Detection and Localization System delivery to site	IC	Q3 2023	3.1.P3.EU.01
GB19	11-Buildings Infrastructure and Power Supplies	Cryoplant Compressor Building (51) RFE (RFE #8B)	GB	Q4 2018	6.2.P2.EU.05

GB20	4-Divertor	Delivery of the first all-Tungsten prototype test assembly of the Divertor Inner Vertical Target to the RF test facility.	GB	Q4 2018	1.7.P2B.EU.01
GB21	11-Buildings Infrastructure and Power Supplies	Construction of Cryoplant Coldbox Building (52) Completed	GB	Q3 2019	6.2.P2.EU.05
GB22	7-RF Heating & Current Drive	Manufacturing of 1st batch of Diamond Disks for EC Upper Launcher 1 finished	GB	Q2 2020	5.2.P1B.EU.02
GB23	1-Magnets	TF Coil : Delivery of TF04 (EU 07) by EU-DA to ITER Site	GB	Q4 2020	1.1.P1A.EU.01
GB24/IC64	11-Buildings Infrastructure and Power Supplies	Medium Voltage distribution LC1A Ready for Equipment	IC	Q4 2022	6.2.P2.EU.05 4.1.Pn.EU
GB25	2- Vacuum Vessel	Delivery of Sector 9 by EU-DA to ITER Site	GB	Q2 2021	1.5.P1A.EU.01
GB26	11-Buildings Infrastructure and Power Supplies	Medium Voltage Distribution Building LC/2B (47) RFE (RFE #10)	GB	Q1 2022	6.2.P2.EU.05 4.1.Pn.EU
GB27	8-Neutral Beam Heating & Current Drive	Start of Installation of Acceleration Grid Power Supplies - Converter System of Neutral Beam Injector-1 Q2	GB	Q3 2023	5.3.P6.EU.01
GB28	6-Cryoplant & Fuel Cycle	Delivery of Cold Valve Boxes and Cryojumpers 5-8 (4 no.) Batch 2 by EU-DA to Site	GB	Q3 2021	3.1.P1.EU.02
GB29	7-RF Heating & Current Drive	Manufacturing of 1st batch of Waveguides for EC Upper Launcher 1 finished	GB	Q4 2021	5.2.P1B.EU.02
GB30	8-Neutral Beam Heating & Current Drive	Start of Installation of High Voltage Dec 1 of Neutral Beam Injector -1	GB	Q1 2024	5.3.P6.EU.01
GB31	7-RF Heating & Current Drive	Manufacturing of the Ion Cyclotron RF Window Prototype finished	GB	Q2 2022	5.1.P1.EU.01
GB32	5-Remote Handling	Task Order Signed for Manufacturing for Cask and Plug Remote Handling System (CPRHS)	GB	Q3 2022	2.3.P3.EU.01
GB33	6-Cryoplant & Fuel Cycle	Delivery of Torus & Cryostat Cryopumps by EU-DA to ITER Site	GB	Q3 2022	3.1.P1.EU.03
GB34	11-Buildings Infrastructure and Power Supplies	Control Building (71) RFE (RFE #14)	GB	Q4 2022	6.2.P2.EU.05

GB35	6-Cryoplant & Fuel Cycle	Delivery of Primary (VV)Leak Detection and Localisation by EU-DA to ITER Site	GB	Q4 2023	3.1.P3.EU.01
GB36	9-Diagnostics	In-V Elec Feedthroughs Delivered to ITER Site	GB	Q4 2022	5.5.P1.EU
GB37	3-Blanket	Completion of the qualification phase prior to start of Blanket First Wall series production	GB	Q1 2023	1.6.P1A.EU
GB38	4-Divertor	Completion of Stage I of the series production of Divertor Cassette Bodies.	GB	Q2 2023	1.7.P1.EU.01
GB39	9-Diagnostics	Electronics and Software for Magnetics Delivered to ITER Site	GB	Q3 2023	5.5.P1.EU
GB40	5-Remote Handling	Equatorial Port Plug First Assembly Cask Delivered to ITER Site	GB	Q4 2023	2.3.P3.EU.01
GB41	5-Remote Handling	Upper Port Plug First Assembly Cask Delivered to ITER Site	GB	Q4 2023	2.3.P3.EU.01
GB42	5-Remote Handling	Monorail crane of Neutral Beam Remote Handling System and Delivered to ITER Site	GB	Q1 2024	2.3.P5.EU.01
GB43	7-RF Heating & Current Drive	8th Set of Main High Voltage Power Supplies & Body Power Supplies (MHVPS & BPS) Delivered to ITER Site by EU-DA	GB	Q2 2024	5.2.P4.EU.01
GB44	7-RF Heating & Current Drive	EC Upper Launcher Control System ITER Site Acceptance completed	GB	Q3 2024	5.2.P1B.EU.01
GB45	4-Divertor	Completion of Stage I of the series production of Divertor Inner Vertical Target.	GB	Q3 2024	1.7.P2B.EU.01
GB46	7-RF Heating & Current Drive	Delivery 1st EC Upper Launcher from EU-DA to IO	GB	Q4 2023	5.2.P1B.EU.02
GB47	5-Remote Handling	In Vessel Viewing System Unit #1 Delivered to ITER Site	GB	Q4 2024	5.7.P1.EU.01
GB48	7-RF Heating & Current Drive	Delivery of 1st Set (1MW) of Gyrotrons Tubes by EU-DA to ITER Site	GB	Q1 2025	5.2.P3.EU
GB49	4-Divertor	Delivery of the Divertor Rails to the ITER Site.	GB	Q1 2026	1.7.P2E.EU.01

GB50	6-Cryoplant & Fuel Cycle	Delivery of Heating Neutral Beam Cryopumps 1 from EU-DA to ITER Site	GB	Q1 2027	3.1.P1.EU.04
GB51/IC43	11-Buildings Infrastructure and Power Supplies	Assembly building complete	IC	Q4 2018	6.2.P2.EU.05
GB53/IC66	11-Buildings Infrastructure and Power Supplies	Tokamak building construction complete	IC	Q3 2022	6.2.P2.EU.05
GB54/IC67	1-Magnets	TF Coils: Complete FAT for PA work scope for 18 TF Coils	IC	Q4 2021	1.1.P1A.EU.01
GB55/IC32	11-Buildings Infrastructure and Power Supplies	Cryostat support bearings full scale prototype delivery to site	IC	Q2 2018	6.2.P2.EU.05
GB56	7-RF Heating & Current Drive	1st Set of Main High Voltage Power Supplies & Body Power Supplies (MHVPS & BPS) Delivered to ITER Site by EU-DA	GB	Q3 2019	5.2.P4.EU.01

Table 9 . Technical objectives of the ITER project (IC-GB milestones) (as of 1st August 2018).

The IC/GB milestones concern the in-kind procurements and do not include the Test Blanket Module (TBM) for which the work is not covered by a standard Procurement Arrangement, but by specific TBM Arrangements (TBMA), a new type of legal instrument between IO and the DAs in line with the special character of the TBM Program. Through the TBMAs signed by F4E in 2014, EU has committed to deliver two Test Blanket Systems and the associated equipment/tools to the ITER Site according to an agreed schedule. At the same time, the TBMAs also commit IO to prepare all necessary interfaces to host and operate the TBM Systems.

The EU TBMAs foresaw two independent European TBM Systems to be tested in ITER, a Helium-cooled Lead-Lithium (HCLL) and a Helium-cooled Pebble-Bed (HCPB).

F4E, in line with the 2017 recommendations of the working group for the realignment of the TBM and DEMO Breeding Blanket programmes, is reorganizing the TBM project as follows:

i) scope change: a Water-cooled TBM shall replace one of the two Helium-cooled TBM concepts;

ii) joint co-operation by F4E and EUROfusion, both coordinating their activities and resources within a single project team.

A detailed implementation plan, developed in 2018, has been approved by the F4E Governing Board. The scope change and the cooperation with EUROfusion do not result, overall, in a change of the F4E budget for the TBM project. EUROfusion has already earmarked EUR 10 million for 2018-2020 activities on the TBM project and is working for confirming its detailed funding capacity after 2020.

Also in line with the 2017 recommendations, and in order to maintain the possibility to deliver the new Water-Cooled Lead-Lithium (WCLL) TBM System to ITER still as scheduled in ITER, F4E and EUROfusion Consortium agreed to start already in 2018 the conceptual design. Consequently,

- The first phase of the conceptual design of the WCLL TBM System will be implemented in 2018 by the EUROfusion Consortium, under the Consortium own rules and budget, and under technical specifications issued by F4E (F4E keeps the design responsibility);
- The progress of activities will be monitored jointly by F4E and EUROfusion;
- After endorsement of the new project organization, the nomination of EUROfusion Members' staff to functions in the new TBM project team shall be made, including provisions for secondment to F4E premises, when needed.
- The compatibility between EUROfusion Quality Management System (QMS) and F4E Quality Assurance (QA) obligations vis-à-vis ITER Organization shall be documented;

- F4E shall enter in negotiation with IO and the ITER Members for formalizing the change of coolant on one of the European TBM Systems;
- A long-term agreement of collaboration between Fusion for Energy and EUROfusion for the implementation of the TBM project will be prepared and presented to governing bodies before signature.

Reference	Action	Milestone	Date
TBM01	10-Test Blanket Module	Initiation of the official process for changing one European TBM System and preparation of a new TBM Arrangement	2018
TBM02	10-Test Blanket Module	Signature of the WCLL TBM Arrangement	2020
TBM03	10-Test Blanket Module	WCLL TBS Conceptual Design Review (CDR)	Q3 2020
TBM04	10-Test Blanket Module	WCLL TBS and HCPB TBS Preliminary Design Review (PDR)	Q4 2022
TBM05	10-Test Blanket Module	WCLL TBS and HCPB TBS Final Design Review (FDR)	Q4 2025
TBM06	10-Test Blanket Module	Signature of procurement of WCLL and HCPB ancillary systems	Q4 2026
TBM07	10-Test Blanket Module	Signature of procurement of WCLL TBM and HCPB TBM	Q1 2027
TBM08	10-Test Blanket Module	Delivery of WCLL and HCPB ancillary systems to ITER site	Q4 2028
TBM09	10-Test Blanket Module	Delivery of WCLL and HCPB TBM to ITER site	Q3 2029

Table 10 . Technical objectives of the modified TBM project (accounting for the change of the WCLL TBM System)

4.2.3 Technical Objectives for the Broader Approach

The technical objective for the European part of the BA projects, as presently defined in the Project Plan approved by the BA Steering Committee, is the achievement on time of the milestones that are listed, project by project, in the tables below in which the achievements are shown in pale green.
These simplified tables are largely based on the grouping of the relevant project milestones, originally defined and valorized in the EU relevant Procurement Arrangements.
Beyond the completion of the presently agreed BA scope, i.e. beyond 2020, F4E is preparing plans for the Joint Exploitation Phase with Japan of the JT-60SA device, on the follow-up of the commissioning phase for the LIPAc accelerator as well as the preparation of the IFMIF-DONES.

Related PA (BA)	Description	Baseline[7] Achievement Date	Credit Allocation (kBAUA)
Integrated Commissioning and Initial Operation	Common activities required to support JT-60SA activities, not covered under specific WBS sub elements of JT-60SA - 2017 Part	Dec-17	1.128
EU Contribution to Assembly	Cash contribution in support of assembly	Oct-18	1.592
STP-EU-TFC + STP-EU-TFCTF	Transport and Delivery of TF coils and accessories - 2017 part	Dec-17	44.302
STP-EU-TFC + STP-EU-TFCTF	Transport and Delivery of TF coils and accessories - 2018 part	Mar-18	24.190
STP-EU-TFCSP	1st TF spare coils and Spare TF Coil Winding Pack	Sep-19	5.197
STP-EU-TFC	2nd TF spare coils	Sep-18	5.197
STP-EU-HTSCL	Transport of the PF/CS HTSCLs - 2017 Part	Dec-17	1.280
STP-EU-TFCPRE	Assembly or support of assembly of various components under European responsibility - 2017 Part	Dec-17	1.475
STP-EU-TFCPRE	Assembly or support of assembly of various components under European responsibility - 2018 Part	Aug-18	0.738
STP-EU-SNU	Transport and Installation of the SNUs -2017 part	Jun-17	1.062
STP-EU-SCMPS	Transport and installation of the SCMPSs -2017 part	Dec-17	7.229
STP-EU-SCMPS	Transport and installation of the SCMPSs -2018 part	Jan-19	2.410
STP-EU-RWMPS	Design of RWMPSs	Jan-18	0.575
STP-EU-RWMPS	Approval of Report on RWM Factory Test	Oct-18	0.345
STP-EU-RWMPS	Transport and delivery on Site of the RWMPSs	Nov-18	0.230
STP-EU-ECRHPS	Implementation of the procurement of the ECRH Power Supplies –Approval of First Design Report	Jun-17	1.119
STP-EU-ECRHPS	Implementation of the procurement of the ECRH Power Supplies – Approval of Report on Factory Test	Oct-18	1.119
STP-EU-ECRHPS	Implementation of the procurement of the ECRH Power Supplies – Delivery on Site	Apr-19	0.746
STP-EU-ECRHPS	Implementation of the procurement of the ECRH Power Supplies – Acceptance Tests on Site	Sep-19	0.746
STP-EU-CR02	Cryostat Vessel Body Cylindrical Section completion of factory test	Nov-17	7.824
STP-EU-CR02	Final acceptance of the Cryostat Vessel Body Cylindrical Section	Feb-18	2.609

Table 11 . Technical objectives JT-60SA

[7] The baseline achievement date of the technical objectives has been defined in the Project Plan of each project and approved by the BA Steering Committee on 27th April 2017.

Objectives IFMIF/EVEDA:

Related PA (BA)	Description	Baseline Achievement Date	Credit Allocation (kBAUA)
IFMIF-EU-PA-04	SRF Linac with its Delivery Report at BA site in Rokkasho	Mar-19	3.060
IFMIF-EU-PA-05	MEBT components with its delivery report at the BA site in Rokkasho	Mar-17	1.040
IFMIF-EU-PA-06	RF Power System with its Delivery Report at BA site in Rokkasho	Dec-17	17.400
IFMIF-EU-PA-07	HEBT & Beam Dump components with its delivery report at the BA site in Rokkasho	Mar-19	3.843
IFMIF-EU-PA-10-A	Phase A: Completion commissioning @ 100 keV	Dec-17	1.410
IFMIF-EU-PA-10-B	Phase B: Completion commissioning @ 5 MeV	Dec-18	3.470
IFMIF-EU-PA-10-C	Phase C: Commissioning of the full LIPAc @ 9 MeV at low duty cycle	Mar-20	3.890
IFMIF-EU-PA-10-D	Phase D: Commissioning of the full LIPAc @ 9 MeV in Continuous Wave	Mar-20	2.590
IFMIF-EU-PA-12	Cryoplant Installation and Acceptance Test Report at Rokkasho BA Site	Sep-17	1.870

Table 12 . Technical objectives IFMIF/EVEDA

Objectives IFERC:

Related PA (BA)	Description	Baseline Achievement Date	Credit Allocation (kBAUA)
(Supercomputer) CSCPA01 CSCPA02	Successful termination of operation, exploitation, dismantling	Jun-17	7.38
(DEMO Design Activities) DPA01-JA-EU	Deliver reports on the agreed design activities	Feb 20	1.22
(Remote Exper. Centre) RECPA01-EU	Delivery of software codes and reports on remote participation tests	Sep-19	0.850

Table 13 . Technical objectives IFERC

4.2.4 Technical Objectives for DEMO

The revised DEMO development plan foresees the following three phases:

(i) a Pre-Concept Design Phase to explore a number of DEMO plant concepts and develop system requirements up to 2020;

(ii) a Conceptual Design Phase to mature and validate the baseline concept up to 2027; and

(iii) an Engineering Design Phase beginning roughly around 2030 to develop the detailed design and prepare for the launch of major procurement activities.

The scope of the activities, carried out by EUROfusion, to be carried out in the period up to 2022, includes:

a) Converge on main design requirements, general plant functions, configuration, and layout;
b) Define the functions and main requirements for all plant systems;
c) Identify and solve design integration and safety issues. Study critical design and technology issues which could impact feasibility or compromise system performance or safety;
d) Identify and address physics basis development needs;
e) Key trade studies to settle major design features. Plant systems architecture studies (e.g, systems code, physics simulations, and engineering assessments). Sensitivity analyses to understand the impact of uncertainties on physics assumptions;
f) Study alternative design concepts. Multiple plant design concepts assessed in parallel, and compared against a reference concept (referred to as the “baseline”). Emphasis should be on engineering and operational challenges, safety, power conversion aspects of the power plant;
g) Evaluate and screen the most promising options. Define selection criteria. Evaluate architecture design options and select best candidate(s) to be further assessed and taken in the conceptual design phase;
h) Determine and address critical DEMO R&D requirements (e.g., potential showstopper or issues that propagate throughout the all plant), by involving more industry).
i) Preliminary cost estimates.

The activities (a) through (g) are also partially conducted as part of the BA effort. This phase shall culminate in the selection of a concept with the highest likelihood of success (the baseline at the time of down-selection) by the end of 2020, and potentially one back-up alternative design for risk mitigation and exploitation of potential opportunities (e.g. enabling technology dependent).
A gate review is planned for the pre-concept design activities of EUROfusion during the second half of 2020, to assess and determine whether continued investment in the project is warranted, considering the balance of risk/reward, and to assess the investment necessary to execute the subsequent phase of the project.

Once the pre-concept phase gate has been passed, the activities of the project must be reoriented to focus on the core scope of the next phase. In particular, the selected architectures are taken into the conceptual design phase and further assessed and compared, with a single architecture (still with sub-variants) to be selected in the mid 2020’s, in preparation for a concept design review by 2027. Targeted technology R&D expected during this phase shall be driven by requirements of the DEMO system and respond to critical design feasibility and integration risks. Large scale demonstration R&D and testing are not foreseen during the conceptual design phase. Nevertheless, some initial manufacturing tests or system component performance tests would be required. This phase culminates in a rigorous CDR process where the key design features of the DEMO power plant are frozen and a consistent nuclear safety case is defined, the systems that are considered safety related or important to safe plant operations are designed, the plant licensing strategy is established, and the remaining plant systems, structures, and components will be further defined.

4.2.5 Non-Technical Objectives

Despite the fact that F4E has well defined technical objectives, F4E acknowledges that the same attention shall be granted to other relevant tasks that are important for the organization to run smoothly. They are translated into objectives to be achieved by the organization. The Non-Technical Objectives are the ones shown in Table 14.

AREA	OBJECTIVE
Overall Costs	- Cost estimation until 2020 should be less than total budget available until 2020
Annual budget	- Implementation of Annual budget achieved [100%]
Annual payment	- Implementation of payment fully achieved. [100%]
Quality	- To reduce the number of Long Non Conformity Report (NCRs) compared to the previous year. IO defines Long NCRs the ones open for more than 180 Days. NCRs to be closed in less than 9 months on average
Human Resources	- Staff Turnover rate should be less than < 4%

Table 14 . F4E Non-technical Objectives

4.2.6 KPI Calculation

Technical

The KPI for the technical milestone is the variance, i.e. the comparison of the forecast milestone date with the last day of the agreed target quarter. If the agreed target quarter for a milestone is e.g. Q1 2019, then the KPI is the number of days before 31 March 2019.

The basis of measurement is the currently agreed list of target quarters. If the target quarter is changed after agreement with IC/GB, then the new target quarter is taken as the baseline and as basis of measurement

$$\text{Achieved Date - Foreseen Date}$$

Equation 1: Variance

$$\frac{\text{Number of milestones which are in the current baseline with baseline dates later than the beginning of the 2017 and have been achieved}}{\text{Number of milestones which are in current baseline with baseline dates later than the beginning of the 2017 with baseline dates before the end of the current month}}$$

Equation 2: Schedule Performance Index (SPI)

Non-technical

$$\frac{\text{Budget available to F4E until 2020}}{\text{Cost estimation until 2020}}$$

Equation 3: Overall Costs

$$\frac{\text{Actual commitment executed to date} + \text{remaining commitment planned to be executed between date and year's end}}{\text{Latest approved annual commitment budget}}$$

Equation 4: Annual commitment

$$\frac{\text{Actual payment executed to date} + \text{remaining payment which is planned to be executed between date and year's end}}{\text{Latest approved payment appropriation for the year}}$$

Equation 5: Annual payment

$$\frac{\text{F4E NCRs open for more than 12 months}}{\text{Total F4E NCRs open}}$$

Equation 6: Quality

$$\frac{\text{Number of vacant posts}}{\text{Total authorised posts in the Establishment Plan (FO, TA and CA)}}$$

Equation 7: Vacancy rate

$$\frac{\text{Number of departures}}{\text{Total authorised posts in the Establishment Plan (FO, TA and CA)}}$$

Equation 8: Turnover rate

$$\frac{\text{Cumulative number of days of sick leave of all active staff member}}{\text{Total number of active staff member * number of days in the month}}$$

Equation 9: Absenteeism rate

4.2.7 Thresholds

Each KPI has thresholds:

Green	The KPI is within the accepted range.
Amber	The KPI is at risk of moving outside of the accepted range.
Red	The KPI is outside of the accepted range.

A project manager may choose to flag a KPI as at risk whenever there is a risk that the KPI may move outside of the accepted range. This step should be reflected in the identification of specific risks in the risk log with a consequent tracking and mitigation actions.
The objective of the KPIs is to ensure that the project is proceeding in line with the overall plan so that

1. The long-term project schedule and deliverables are on schedule.
2. The project costs are under control.
3. The project quality management process is functioning as planned.
4. The Establishment Plan is being utilized effectively.

List of main KPIs monitored during the year and associated Thresholds

- Variance (IC-GB Milestones)

Blue	Milestone completed
Green	Forecast date more than one month before the end of target quarter
Amber	Forecast date in the final month of target quarter (or Project Manager has flagged KPI as being at risk)
Red	Forecast date later than end of target quarter

- Schedule Performance Index (SPI)

Green	SPI ≥ 1.0
Amber	1.0 > SPI ≥ 0.80 (or Project Manager has flagged KPI as being at risk)
Red	SPI < 0.80

- Overall Costs (Estimate At Completion [EAC])

Green	KPI ≥ 1.0
Amber	1.0 > KPI ≥ 0.95 AND (EAC-Project Budget) ≤ €5M (or Project Manager has flagged KPI as being at risk)
Red	KPI < 0.95 OR (EAC-Project Budget) > €5M

- Annual Commitment (overall at F4E Level)

Green	0.9 ≤ KPI ≤ 1.0
Amber	0.75 ≤ KPI < 0.9
Red	KPI <0.75

- Annual Payment (overall at F4E Level)

Green	0.95 ≤ KPI ≤ 1.0
Amber	0.85 ≤ KPI < 0.95
Red	KPI <0.85

- Quality (Open NCRs)

Green	KPI ≤0.1
Amber	KPI >0.1 and KPI <0.4
Red	KPI ≥ 0.4

- Vacancy rate

Green	KPI ≤0.04
Amber	KPI >0.04 and KPI <0.07
Red	KPI ≥ 0.07

- Turnover rate

Green	KPI ≤0.04
Amber	KPI >0.04 and KPI <0.07
Red	KPI ≥ 0.07

- Absenteeism rate

Green	KPI ≤0.02
Amber	KPI >0.02 and KPI <0.04
Red	KPI ≥ 0.04

4.3 Multiannual Programme

4.3.1 Overview

F4E is facing a number of significant challenges, which will continue for the coming years. These may be considered in terms of the technical and procurement challenges and human resource challenges.

Technical and Procurement Challenges

The most significant challenges for F4E are related to its major task of delivering its in-kind contributions to ITER. The nature of the F4E activities with respect to ITER is changing throughout its lifecycle. While at the beginning the focus was on the launching of the procurement of the EU in-kind components, the work has evolved into the follow-up of the manufacturing activities and will further evolve in the coming years with a higher degree of involvement in the assembly and testing of the machine.
The next years, covered by this MAP, represent the peak workload for the organization. Very significant efforts will be required to maintain the programme through to the major milestone of First Plasma and for the preparatory work for the subsequent assembly phases. F4E will face the parallel activities of launching a large number of new contracts, while at the same time managing the ongoing delivery of the running contracts and supporting ITER IO with assembly.

Human Resources Challenges

F4E recognises that it must carry out its activities following its statutes annexed to the legal basis, in particular regarding staff regulations, and the associated implementing rules. Balancing the strict requirements of the regulatory framework with the flexibility needed to efficiently respond to the project's HR needs will therefore remain a key endeavour for the organisation.

In addition, looking ahead F4E recognizes that its staff population will need to adapt to the evolving needs of the project. There will be a reducing need for staff working in the initial contracting phases and an increased requirement for staff experienced in supplier management and technical integration.

4.3.2 ITER

F4E is operating within the classical project 'iron triangle' of time, cost and quality, with quality interpreted in the general sense of achieving all the project scope objectives. This requires a continual balance of prioritisations made at management level, and in the daily work of all the staff.
The management of the Project decided to assign the main priority to those activities that are relevant for achieving a FP in 2025. The recent exercise of the Revised Construction Strategy is also in-line with this approach and remains fully consistent with the Baseline-2016 dates of Cryostat Closure by December 2024 and FP by December 2025. The F4E strategy for ITER may be summarized as follows:

- To prioritise the available resources, both human and financial, together with the associated management effort, on the components required for first plasma.
- To maintain, to the extent necessary and possible, the progress on other activities required in preparation for the subsequent project stages.
- To implement risk mitigation actions towards protecting the first plasma schedule. F4E will be ready to implement risk mitigation measures, and where necessary schedule recovery measures, based on the following criteria:
    - The expected benefit in terms of schedule recovery is adequate to justify the investment
    - F4E must remain within the capped budget of EUR 6.6bn [2008] to end 2020.

As noted above, F4E is now at the peak period of its activities to deliver the various components under its responsibility to IO. The success of this will be critically dependent upon several factors:

- The performance of the various suppliers, and their ability to overcome the inevitable technical challenges and maintain the schedule and quality through the delivery;
- F4E's management of the suppliers, working with them to ensure a good performance in terms of schedule, quality and cost;
- The avoidance of changes in requirements, design and/or interfaces of the various components to ensure a smooth progression into production and test without perturbations. This has been a significant problem in the past, and considerable efforts have been devoted by both IO and F4E to achieving a stability in requirements and design.

4.3.3 Broader Approach

All BA projects are now in an advanced implementation stage. The early defined strategy to implement these projects has proven to be successful and hence continues to be employed. This is underpinned by the very close collaboration with QST in Japan and all other European stakeholders: the EU Voluntary Contributors (EU-VCs) as well as EUROfusion. The management model follows the agreed Common Quality Management System, defining resources and processes crossing the lines between organizations. Such an approach has allowed avoiding any significant cost overruns by the EU-VCs as well as F4E and will continue to be pursued. For JT60-SA the same strategy is planned also for the period beyond 2020, that is when the facility will be jointly operated and enhanced by the EU and JA. For the IFMIF the R&D results planned to be achieved by the beam commissioning of the full LIPAc accelerator - first in low duty cycle, then in continuous wave should provide good grounds for the full experimental phases to follow in LIPAc after 2020 as well as the final design and specifications of the IFMIF-DONES. For IFERC F4E will continue to rely on the full support of EUROfusion whereby the EU-JA joint DEMO design activities led by EUROfusion will be firstly completed for the extent planned within the present BA phase, and carried forward also in BA phase 2 with QST in JA.

4.3.4 DEMO

EUROfusion is currently most active in DEMO-related activities. F4E will play a stronger role once ITER activities decrease. A continued and strengthened coordination between F4E and the EUROfusion DEMO activities has been suggested in recent reviews[8]. In particular, it will be desirable that F4E gradually becomes more involved on key design decisions, and cost & schedule parameters during the DEMO pre-conceptual/conceptual design phase and is linked in the EUROfusion Project Governance of the DEMO design activities and other associated supporting technology projects (e.g., ITER TBM and DEMO breeding blanket work packages).
As a step in this direction, a DEMO Programme Steering Board has been established at the end of 2017, with the aim to establish high-level coordination of the DEMO Programme between EUROfusion and F4E, ensuring consistency between design activities and high-level milestones (i.e. IFMIF/DONES, DEMO Design, TBM/BB, BA etc.). F4E is represented by its Director and the Chairman of the Governing Board, EUROfusion is represented by the Programme Manager, the Chair of the General Assembly. In addition, the two Directorates of the EU Commission that are involved in Fusion, namely Research & Technology Development (RTD) and Energy policy (ENER) are represented in this Board together with Industry.

A stronger collaboration is expected with EUROfusion on the activities of the TBM. A thorough technical and programmatic assessment of the DEMO breeding blanket program in EUROfusion and the EU

[8] Management / Governance Assessment of EUROfusion & Industry Engagement, 11/07/2016, Ernst & Young.

ITER TBM program in F4E, was conducted by an independent expert panel in 2017 and a number of urgent steps were recommended by a Working Group to achieve an efficient implementation of the needed activities.

4.3.5 Implementation of the F4E Strategy to achieve the objectives and define recovery plans

The achievement of the objectives is based on the strategies defined in the previous paragraphs. The schedule has been reorganized so as to minimize the risks of delay for the delivery of the components on the critical path. Furthermore, resources have been redistributed to better support the areas where more effort is needed.
The forum for reviewing project progress and taking any necessary actions to maintain or recover the project status is the Project Steering Meeting (PSM), held once a month with the participation of both senior and middle management. On top of scheduled presentations on progress, KPIs and milestones trend analyses, the Project team leaders who have identified a specific issue in their areas are requested to present the reason of the issue and to propose a strategy to recover it. The proposal is discussed and an immediate decision is taken.
Actions are assigned to support the decision taken and due dates for the actions are agreed.
The record of recovery plans and issues arising from KPIs are the Record of Decisions (RoD) of the PSM.

"Red-flagging" and KPI Control Process

The Project Management KPI process runs on a monthly basis in the background of the PSM.
In the case that a KPI is either amber or red, the Project Manager may propose one of the following alternatives:

- Accept: The Project Manager proposes in the PSM that the KPI value is accepted. This may be, e.g. because the milestone is not critical, a global commitment is allowed instead of an individual one, etc. If the Director accepts the proposal, the Project Manager will continue to monitor the KPI and either he/she or the Project Planning and Controlling Group may raise the issue again at a subsequent PSM if the situation regarding the KPI changes or worsens.
- Recover: The Project Manager presents in the PSM the recovery actions launched to bring back the KPI within the accepted range. A due date is also assigned for the completion of the action.

The Project Manager will report on its progress in subsequent PSMs. When reporting on a recovery plan, the Project Manager may propose the following alternatives:

- Close: The Project Manager demonstrates in the PSM that the KPI has returned within the agreed range;
- Accept: The Project Manager proposes in the PSM that the current KPI value is accepted. If the Director accepts this proposal, the Project Manager will continue to monitor the KPI and either he/she or the Project Planning and Controlling Group may raise the issue again at a subsequent PSM if the situation regarding the KPI changes or worsens;
- Continue to recovery: The Project Manager presents the progress on the existing recovery actions in the PSM and updates the PSM on the time period in which the recovery will be complete.

In the case that the Project Manager has exhausted all available actions to solve the issue, it should be escalated to the next level of management.

5. Resource Estimates Plan

5.1 Introduction

The REP sets out the indicative resources deemed necessary for the implementation of the Project Plan and includes the following information according to the Article 32 of the Financial Regulation and to the guidelines received from the European Commission:

1. Forecast of annual revenue and expenditure of the Joint Undertaking for the following five financial years with reference to the previous and current years.
2. Detailed forecast in revenue and expenditure for the following 2 years according to:
    a. the planned revenue from the contributors;
    b. The expenditure planned in commitment according to the corresponding Work Programme;
    c. The detailed payment forecast.

5.2 Assumptions, Exclusions and Inclusions

The Council conclusions from 7 July 2010 set up the ceiling amount at EUR 6.6 billion in 2008 euro value (commitments), for the period until 2020[9].

The Council Decision (Euratom) n°791/2013[10] stemming from the adoption of the MFF 2014-2020 establishes the amount of EUR 2 915.015 million (commitments) set up in current values for the period of reference.

The 2019 figures are subject to the final agreement to be reached on Draft Budget 2019. The 2020 figures are subject to the outcome of Draft Budget 2020 budgetary procedure. Such constraints from the budgetary authority may also impact the estimated staff levels indicated below.

The information provided for 2021 to 2023 is purely indicative and the final EU budgetary allocation for this period will be subject to the final decision by the EU Budgetary Authority on the next Multiannual Financial Framework.

The information presented in the Resource Estimates Plan (REP) is based on the general assumptions introduced in previous sections of this Annual and Multiannual Programme 2019-2023 and in specific assumptions as follows:

[9] Draft Council conclusions on ITER Status and possible way forward (11902/10 RECH255 ATO32 BUDGET45)

[10] Council Decision (Euratom) n°791/2013 amending Decision 2007/198/Euratom establishing the European Joint Undertaking for ITER and the development of Fusion for Energy and conferring advantages upon it (OJ L 349/100,21.12.2013)

Staff[11]

It is assumed a reduction of the Staff from 467 to 455 in 2020 and 455 Staff beyond 2021 and over the whole period covered by this plan (2019-2023).

Escalation rate

The escalation rate used to convert between current Euro and 2008 Euro value is set to 2.6% for operational commitment expenditure related to the delivery of the in-kind contributions for the period 2007 to 2020. The standard factor of 2% applies to in-cash contribution and administrative expenditure until 2020 and to all expenditure after 2020. An escalation rate table is provided in Table 15.

Planning and Baseline

The present REP is based on F4E needs as planned with the responsible Project Teams.

For ITER it implements Euratom's scope as defined by the ITER agreement, on a timescale defined by the ITER baseline of IC-19 (November 2016). An updated Overall Project Schedule (OPS) and Overall Project Cost (OPC) for the ITER Project, together with the associated estimate of resources covering the full period 2016-2035, were approved ad referendum by the ITER Council in 2016. This updated schedule sets December 2025 as the date for First Plasma.

Likewise, for Broader Approach Projects, until 2020 F4E will execute activities in line with the scope defined in the BA Agreement while, beyond 2020, F4E plan to undertake activities foreseen in the forthcoming BA Agreement Phase-2 and IFMIF DONES.

Cash Contribution to IO

The figures for the Cash Contribution until 2020 are the latest received from IO (8th August 2018) and they will have to be confirmed at IC-23. The amount until 2020 will be now again very close to the original cash contribution of the IC-21.

The re-use of previously unused appropriations and decommitments

F4E is planning to use the entire amount of unused appropriations until the end of 2020 to complete the execution of the 6.6 billion euro. The evolution is specified in section 5.4.2.

5.3 Definitions

5.3.1 The Budget

The budget is the sole instrument establishing the annual revenue and expenditure considered necessary for F4E, including staffing. Each annual budget refers to the present Multi Annual Programme.

5.3.2 The Revenue

F4E revenue is made up of the:

[11] The 2 positions to be reduced as a consequence of the TB04 novation are not taken into account in these figures. An analysis of the resources in the F4E Site and Buildings and Power Supplies Project Team, including matrix support, is being carried out to identify these 2 positions. This offsetting will be reflected in the MAP 2020-2024.

- Euratom contribution;
- the ITER Host State contribution;
- the annual membership contributions from members other than Euratom;
- the miscellaneous revenue;
- the revenue from the Reserve Fund.

The Euratom contribution (European Union)

The contribution from Euratom constitutes the main source of revenue for F4E. This contribution is foreseen at the Article 16 of the EU MFF for the period 2014-2020[12] as contribution to the financing of large-scale projects.

An amount of EUR 2 707 million in 2011 value is reserved for the ITER project. The contribution is detailed in the Council decision 2013/791/Euratom[13] amending the Decision 2007/198/Euratom establishing Fusion for Energy (F4E), for the period 2014-2020. The amount of EUR 2 915.015 million is set up in current values for the period of reference and the annual breakdown is provided in its accompanying legal financial statement.

The annual contribution is determined in the European Union General Budget in Commitment and in Payment appropriation, as well as the F4E establishment plan.
The revenue received from Euratom is earmarked for operational expenditure and for administrative expenditure (running costs).
The Euratom revenue covers the main part of the administrative expenditure.

The ITER Host State Contribution (France)

The contribution from the ITER Host State constitutes the second source of revenue for F4E. It corresponds to the commitment from the Host State to cover 9.09% of the total costs of the ITER construction phase, equivalent to 20% of F4E budget for ITER construction excluding expenditure related to Transportation and Test Blanket Modules.

The precise scope, conditions and the global amount of the French contribution for the ITER construction phase have been established in a formal exchange of letters between France and the European Commission in 2011[14].

This contribution is earmarked to ITER construction expenditure.

The Membership Contributions (F4E Members except Euratom)

The Annual Membership Contributions are established and adopted annually within the budget. It corresponds to 10% of the administrative budget calculated at the time of the adoption of the previous edition of the REP.

The individual contribution of each member is composed of:

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[12] Council regulation (EU, Euratom no 1311/2013) laying down the multiannual financial framework for the years 2014-2020 (2 December 2013).

[13] Council decision (2013/791/Euratom) amending Decision 2007/198/Euratom establishing the European Joint Undertaking for ITER and the Development of Fusion Energy and conferring advantages upon it (13 December 2013).

[14] Contribution financière française à la construction d'ITER - Letter from the Haut Representant pour ITER to the EU Commission on 08/09/2011 and reply on 17/11/2011.

- a minimum contribution of 0.1% of the total amount of annual membership contributions and,
- an additional contribution calculated in proportion to the Euratom financial participation (excluding JET) in the Member's expenditure in the framework of the Community Fusion Research Programme in the year before last.

The revenue from the Membership contributions is not earmarked.

Reserve Fund

The Revenue from the Reserve Fund managed by the IO is assigned to the implementation of change orders originating from IO, which take place in the framework of the contractual relationships between F4E and the various suppliers.

The revenue from the Reserve Fund is earmarked for financing the corresponding requests for change from IO introduced after 05/03/2015.

5.3.3 The Expenditure

The F4E expenditure is divided in:

- Operational expenditure for projects;
- Administrative expenditure and running costs;
- Expenditure related to the Reserve Fund.

The Operational Expenditure

The operational expenditure corresponds to F4E tasks discharging Euratom obligations regarding:

1. The contribution of Euratom to the IO, in accordance with the ITER Agreement.
2. The contribution of Euratom to the BA activities, in accordance with the BA Agreement with Japan.
3. The preparation and coordination of a programme of activities in preparation for the construction of a demonstration fusion reactor (DEMO).

F4E's activities are grouped under two headings:

1. The ITER project represents the core activity of F4E and consists of:
   (a) The tasks related to the ITER construction phase according to the PAs and ITAs signed with IO.
   (b) The contribution in cash to ITER Organization to ensure the financing for its management, the research and development and for the participation to the ITER fund.
   (c) The contribution in cash to Japan within the frame of the transfer of procurement responsibilities from Euratom to Japan.
   (d) The ITER site support activities.
2. The Technology project groups the R&D activities necessary for ITER and Broader Approach:
   (a) Technology for ITER and DEMO, to allow extra R&D activities, in particular related to the completion of specification for ITER and the preparation of DEMO.
   (b) Technology for BA corresponding to the Euratom contribution managed by F4E for IFMIF-EVEDA, the IFERC at Rokkasho and the JT-60SA Tokamak.
   (c) Technology for DONES/IFMIF construction.

The Administrative Expenditure

Administrative expenditure is composed of F4E functioning and operating costs, mainly related to Staff.

The Reserve Fund

This is the expenditure (mainly amendment to existing contracts) related to the requests for change initiated by IO and approved for financing from the Reserve Fund.

5.4 Budget forecast

5.4.1 Reference

The European Council has fixed the global amount deemed necessary for all F4E activities during the ITER construction phase to EUR 6.6 billion until 2020, expressed in 2008 euro value.

Figures are quoted in 2008 economic conditions. When converting from current year values to 2008 economic conditions and vice-versa the following escalation/de-escalation rates are applied:

Item/Year	≤ 2020	2021 and above
Operational Expenditure linked to the delivery of in-kind contributions	2.6%	2%
Cash Contribution (IO, Japan, NBTF, BA etc.)	2%	2%
Administration (Title I and II)	2%	2%
Reserve Fund	2%	2%

Table 15 . Escalation Rate

The link between 2008 value and economic condition (current value) is detailed with the expenditure in commitment appropriations in table 18. All other tables are in current value.

The values provided beyond 2020 are based on F4E planned needs. The planned needs provide the Indicative Forecast for the Years Y ≥ (Current Year + 2).

5.4.2 The estimate of revenue

Euratom contribution:

The yearly breakdown of the Euratom contribution until 2020 was established with the Legal Financial Statement accompanying the Council Decision (2013/791/Euratom), which has been slightly adjusted over time, also to incorporate part of the Swiss Contribution to Euratom's fusion activities.

The present edition of the REP includes the decrease of a total current EUR 80.0 million for the years 2019 and 2020, corresponding to the transfer from the ITER project to the European Defence Fund decided by the EU Commission[15][16].

[15] Proposal for a regulation of the European Parliament and the Council establishing the European Defence Industrial Development Programme aiming at supporting the competitiveness and innovative capacity of the EU defence industry (COM(2017) 294 final of 7.6.2017).

[16] Depending on EU budget availability, the Commission tries to minimise the negative impact of the European Defence Fund in F4E budgets of 2019 and 2020. For instance for 2019, the Commission provided already EUR 12.2 million for F4E commitment appropriations and this is already included in the 2019 Euratom's contribution.

ITER Host State Contribution:

Based on the Council conclusions mentioned above, the ITER Host State contribution is strictly earmarked to ITER Construction and represents 20% of the cost of ITER construction according to the perimeter of contribution already mentioned (excluding BA, Transportation, Test Blanket Modules and Administrative Expenditure). This contribution is adjusted to the actual cost for the domain of participation of the ITER Host State and is taking into account the decrease of the Euratom contribution as per paragraph above.

Membership Contribution:

This revenue is calculated with reference to an earlier stage in the planning process, thus avoiding changes along the budgetary procedure and allowing the Members to plan in advance their contribution.

To be noted, from 2016 onwards, the breakdown by Member is established by Euratom on the basis of the figures provided by EUROfusion, in the respect of the frame defined in F4E statutes.

Revenue from the ITER Reserve Fund and Refunds:

The revenue from the Reserve Fund and refunds are excluded from the EUR 6.6 billion (2008 euro value) ceiling, due to the fact that both correspond to reimbursements or reimbursement-like revenue already accounted against the EUR 6.6 billion.

Utilisation of unused commitment appropriations

According to the annuality principle of the F4E Financial Regulation (FR), unused appropriations at the end of each year are cancelled, as well as de-commitments (cancellation of budgetary commitments). A table reporting the de-commitment by budget year is provided in Annex XIX. In particular, the table shows the main de-commitment for 2018 on budget year 2017 (cash contribution to IO 24.35 million euro) and on budget 2016 1.7 million euro (for multiple de-commitments).

The F4E Financial Regulation foresees the possibility to make those appropriations available again in subsequent budgets, according to the needs for the project, as universal (not assigned) revenue.

It should be noted this financial mechanism applies to operational annual budget of F4E, to the exclusion of Assigned Revenue (ITER Host State contribution, Reserve Fund) and administrative expenditure, both following specific rules.

The annual amounts cancelled and to be made available again later are detailed in Table 16.

F4E anticipates requiring the full EUR 6.6 billion (2008 euro value) budget for the period until 2020. Consequently, all previously cancelled appropriations are planned to be reintroduced before the end of 2020.

Commitment Appropriation Current Value MEUR		2007-2013 FP VII	2014 Executed	2015 Executed	2016 Executed	2017 Executed	2018 Forecast	2019 Forecast	2020 Planned needs	TOTAL
Commitment Appropriation	Cancelled	302.421	280.268	52.604	3.363	24.923	-	-	-	**663.578**
	Made available again	9.760	-	-	-	96.000	93.707	140.019	324.093	**663.578**
	Total CA still to be made available again	**292.661**	**572.929**	**625.533**	**628.896**	**557.819**	**464.112**	**324.093**	**0.000**	**0.000**

Table 16 . Commitments appropriations made available again (in current value)

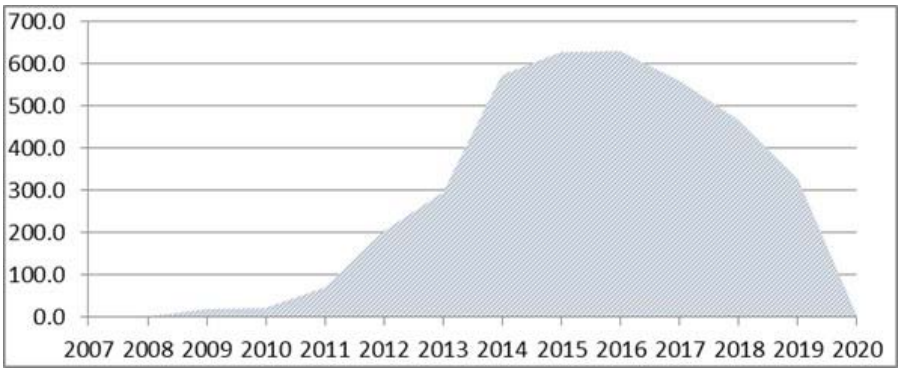

Figure 11 . Estimated evolution of the cancelled appropriations

Current Value MEUR		< 2007	2007-2020			2021-2023	TOTAL
			2007-2013	2014-2020	TOTAL 07-20		
Commitment Appropriations	Euratom contribution	40.645	3,272.633	2,864.119	**6,136.752**	2,770.688	**8,948.084**
	France contribution	1.484	516.202	860.214	**1,376.416**	609.900	**1,987.800**
	F4E Members contribution	-	21.018	34.570	**55.588**	18.400	**73.988**
	Miscellaneous revenue	-	1.697	0.442	**2.140**	-	**2.140**
	F4E Total Budget	**42.129**	**3,811.550**	**3,759.345**	**7,570.895**	**3,398.988**	**11,012.012**
	Reserve Fund	-	-	139.614	**139.614**	64.574	**204.188**
	Refund (Reimbursment)	-	0.010	3.328	**3.339**	-	**3.339**
	F4E Total Revenue	**42.129**	**3,811.560**	**3,902.288**	**7,713.848**	**3,463.562**	**11,219.539**
Payment Appropriations	Euratom contribution	40.645	1,196.580	4,014.485	**5,211.066**	1,941.614	**7,193.324**
	France contribution	1.484	261.802	888.800	**1,150.602**	424.500	**1,576.587**
	F4E Members contribution	-	21.403	34.647	**56.050**	18.400	**74.450**
	Miscellaneous revenue	-	1.697	0.442	**2.140**	-	**2.140**
	F4E Total Budget	**42.129**	**1,481.483**	**4,938.375**	**6,419.857**	**2,384.514**	**8,846.501**
	Reserve Fund	-	-	83.271	**83.271**	63.000	**146.271**
	Refund (Reimbursment)	-	0.010	3.328	**3.339**	-	**3.339**
	F4E Total Revenue	**42.129**	**1,481.493**	**5,024.974**	**6,506.467**	**2,447.514**	**8,996.110**

Table 17 . Revenue in commitment and payment appropriations (details in Annex XIV and XV)

5.4.3 The Estimate of Expenditure

The operational expenditure

This expenditure is based on the needs for the execution of the ITER and Broader Approach projects as described in the “Final Report of Negotiations on ITER Implementation, 1 April 2006 (Attachment 2_C)” and in the Broader Approach Agreement F4E_D_22FTK5.

For 2019, F4E has kept the draft Budget 2019. F4E defers the request for increasing the 2019 budget by making available again unused appropriations until next GB when a more accurate forecast will be available.

The administrative expenditure

This expenditure is recurrent and mainly based on the establishment plan (salaries).

The forecast is based on the following main assumptions:

- Annual salary adjustment: 2%, based on Brussels reference with correction for Spain cost of living;
- Evolution of the establishment plan: 1% annually, according to promotions and departures;
- Vacancy rate: 3%;
- Inflation on other administrative expenditure: 2%.

It shall be noted that the administrative budget is capped to the revenue from Euratom for administrative expenditure plus Membership contributions. A cost containment exercise has been launched to match that revenue, but an additional transfer from operational expenditure might be necessary depending on the final adjustment of salaries for the budgets 2019 and 2020.

Following the recommendation of the Assessors’ Report 2017, the cost of human resources should be fully allocated to the project expenditure. As precondition for the full cost allocation, in 2019 the mission budget for operational purpose is allocated to the operational expenditure.

Expenditure Tables

In commitment appropriations, in Current value and 2008 euro value:

Constant Value MEUR(2008)		< 2007	2007-2020			2021-2023	TOTAL
			2007-2013	2014-2020	TOTAL 07-20		
Commitment Appropriations	ITER Construction	M€ 43.9	M€ 2,987.6	M€ 2,915.4	M€ 5,903.1	M€ 2,292.4	M€ 8,239.4
	Of which Transportation		*M€ 1.6*	*M€ 44.5*	*M€ 46.1*	*M€ 14.9*	*M€ 61.1*
	Technologies		M€ 45.7	M€ 80.7	M€ 126.4	M€ 128.9	M€ 255.2
	Technology for ITER		M€ 26.1	M€ 35.5	M€ 61.5	M€ 18.9	M€ 80.4
	(Of which Test Blanket Modules)		*M€ 16.0*	*M€ 17.3*	*M€ 33.4*	*M€ 18.9*	*M€ 52.2*
	Technology for Broader Approach		M€ 19.6	M€ 45.2	M€ 64.8	M€ 90.0	M€ 154.8
	Technology for DONES				€ -	M€ 20.0	M€ 20.0
	Other Expenditure		M€ 4.9	M€ 20.9	M€ 25.8	M€ 11.4	M€ 37.2
	F4E Administration		M€ 173.6	M€ 298.8	M€ 472.4	M€ 140.6	M€ 613.0
	F4E Total Budget	M€ 43.9	M€ 3,211.8	M€ 3,315.9	M€ 6,527.7	M€ 2,573.2	M€ 9,144.8
	Reserve Fund			M€ 112.5	M€ 112.5	M€ 49.1	M€ 161.7
	F4E Total Expenditure	M€ 43.9	M€ 3,211.8	M€ 3,428.4	M€ 6,640.2	M€ 2,622.4	M€ 9,306.4

Current Value MEUR		< 2007	2007-2020			2021-2023	TOTAL
			2007-2013	2014-2020	TOTAL 07-20		
Commitment Appropriations	ITER Construction	42.129	3,238.763	3,613.017	6,851.780	3,027.784	9,921.693
	Of which Transportation	*-*	*1.853*	*57.283*	*59.135*	*19.547*	*78.682*
	Technologies	-	48.396	99.488	147.884	170.690	318.574
	Technology for ITER	-	27.803	42.718	70.521	25.000	95.521
	(Of which Test Blanket Modules)	*-*	*17.350*	*21.159*	*38.509*	*25.000*	*63.509*
	Technology for Broader Approach	-	20.593	56.770	77.363	118.770	196.133
	Technology for DONES	-	-	-	-	26.920	26.920
	Other Expenditure	-	*5.313*	*26.808*	*32.122*	15.000	*47.122*
	F4E Administration	-	*183.991*	358.457	*542.448*	185.514	*727.962*
	F4E Total Budget	42.129	3,476.464	4,097.770	7,574.234	3,398.988	11,015.351
	Reserve Fund	-	-	139.614	139.614	64.574	204.188
	F4E Total Expenditure	42.129	3,476.464	4,237.384	7,713.848	3,463.562	11,219.539

Table 18 . Expenditure in commitment appropriations (details in Annex XVI and XVII)

In payment appropriations:

Current Value MEUR		< 2007	2007-2020			2021-2023	TOTAL
			2007-2013	2014-2020	TOTAL 07-20		
Payment Appropriations	ITER Construction	42.129	1,221.090	4,505.504	5,726.594	2,121.900	7,890.623
	Of which Transportation	-	*6.417*	*26.622*	*33.039*	*7.356*	*40.395*
	Technologies	-	29.005	94.732	123.737	62.100	185.837
	Technology for ITER	-	15.231	48.221	63.452	14.700	78.152
	(Of which Test Blanket Modules)	-	*17.350*	*51.097*	*68.447*	*25.172*	*93.619*
	Technology for Broader Approach	-	13.774	46.511	60.285	43.600	103.885
	Technology for DONES				-	3.800	3.800
	Other Expenditure	-	4.283	26.134	30.417	15.000	45.417
	F4E Administration	-	183.991	358.457	542.448	185.514	727.962
	F4E Total Budget	42.129	1,438.370	4,984.826	6,423.196	2,384.514	8,849.839
	Reserve Fund	-	-	83.271	83.271	63.000	146.271
	F4E Total Expenditure	42.129	1,438.370	5,068.097	6,506.467	2,447.514	8,996.110

Table 19 . Expenditure in payment appropriations (details in Annex XVIII)

5.5 Estimates of Revenue and Expenditure for the next five years

5.5.1 Revenue in commitment appropriations

REVENUE Commitment appropriations (EUR)	2017 Budget Execution	2018 Budget		Envisaged in 2019			Envisaged in 2020		Envisaged in 2021		Envisaged in 2022		Envisaged in 2023	
		Budget (amd1)	Forecast	Draft Budget	Forecast	VAR 2019/18	Planned needs*	VAR 2020/19	Planned needs*	VAR 2021/20	Planned needs*	VAR 2022/21	Planned needs*	VAR 2023/22
1 REVENUE FROM FEES AND CHARGES														
2. EU CONTRIBUTION	316,236,996.60	382,228,862.32	382,228,862.32	399,088,332.40	399,088,332.40	4.4%	343,361,000.00	-14.0%	923,081,000.00	168.8%	756,463,000.00	-18.1%	1,091,144,000.00	44.2%
of which Administrative (Title 1 and 2)	*48,671,440.00*	*48,016,981.00*	*48,016,981.00*	*49,517,000.00*	*49,517,000.00*	*3.1%*	*52,605,000.00*	*6.2%*	*65,000,000.00*	*23.6%*	*66,000,000.00*	*1.5%*	*67,000,000.00*	*1.5%*
of which Operational (Title 3)	*266,512,997.00*	*333,028,782.00*	*333,028,782.00*	*348,608,200.00*	*348,608,200.00*	*4.7%*	*290,756,000.00*	*-16.6%*	*858,081,000.00*	*195.1%*	*690,463,000.00*	*-19.5%*	*1,024,144,000.00*	*48.3%*
of which recovery from previous years admin	*1,052,559.60*	*1,183,099.32*	*1,183,099.32*	*963,132.40*	*963,132.40*	-		-		-		-		-
of which rec. from previous years operational						-		-		-		-		-
3 THIRD PARTIES CONTRIBUTION	149,860,000.00	146,920,000.00	146,920,000.00	135,600,000.00	135,600,000.00	-7.7%	85,013,500.00	-37.3%	209,000,000.00	145.8%	168,600,000.00	-19.3%	250,700,000.00	48.7%
Of which ITER Host State contribution	*145,000,000.00*	*142,000,000.00*	*142,000,000.00*	*130,000,000.00*	*130,000,000.00*	*-8.5%*	*79,213,500.00*	*-39.1%*	*203,000,000.00*	*156.3%*	*162,500,000.00*	*-20.0%*	*244,400,000.00*	*50.4%*
Of which Membership contribution	*4,860,000.00*	*4,920,000.00*	*4,920,000.00*	*5,600,000.00*	*5,600,000.00*	*13.8%*	*5,800,000.00*	*3.6%*	*6,000,000.00*	*3.4%*	*6,100,000.00*	*1.7%*	*6,300,000.00*	*3.3%*
4 MISCELLANOUS REVENUE	*658.04*	*0.00*	*0.00*			-		-		-		-		-
5 ADMINISTRATIVE OPERATIONS														
6 REVENUES FROM SERVICES RENDERED AGAINST PAYMENT														
7 CORRECTION OF BUDGETARY IMBALANCES														
8 INTERESTS GENERATED	*0.00*	*0.00*	*0.00*			-		-		-		-		-
9 UNUSED APPROPRIATIONS FROM PREVIOUS YEARS - CARRIED OVER	*23,905,348.96*	*10,437,705.30*	*10,437,705.30*											
9 BIS UNUSED APPROPRIATIONS FROM PREVIOUS YEARS - MADE AVAILABLE AGAIN	*96,000,000.00*	*93,706,781.00*	*93,706,781.00*	*139,690,868.00*	*140,019,168.00*	49.1%	324,092,762.87	131.5%		-		-		-
TOTAL REVENUE	586,003,003.60	633,293,348.62	633,293,348.62	674,379,200.40	674,707,500.40	6.5%	752,467,262.87	11.5%	1,132,081,000.00	50.4%	925,063,000.00	-18.3%	1,341,844,000.00	45.1%
RESERVE FUND AND REFUND	2,913,054.37	38,087,580.93	38,087,580.93	10,700,000.00	10,700,000.00	-	74,572,654.00	-	29,851,894.00	-	17,188,932.00	-	17,532,710.00	-
of which Reserve Fund	*714,815.39*	*37,341,853.22*	*37,341,853.22*	*10,700,000.00*	*10,700,000.00*		*74,572,654.00*		*29,851,894.00*		*17,188,932.00*		*17,532,710.00*	
of which Reserve Fund Carried over	*1,293,565.23*	*558,146.78*	*558,146.78*											
of which Refund	*892,931.73*	*479.77*	*479.77*											
of which Refund carried over	*11,742.02*	*187,101.16*	*187,101.16*											
TOTAL REVENUE AVAILABLE	588,916,057.97	671,380,929.55	671,380,929.55	685,079,200.40	685,407,500.40	2.0%	827,039,916.87	20.7%	1,161,932,894.00	40.5%	942,251,932.00	-18.9%	1,359,376,710.00	44.3%

VAR: Variation compared to the previous budget
*Planned needs=Indicative Forecast for the Years ≥ (Current Year+2)

Table 20 . Revenue in Commitment for 2017-2023

5.5.2 Revenue in payment appropriations

REVENUE Payment appropriations	2017 Budget Execution	2018 Budget		Envisaged in 2019			Envisaged in 2020		Envisaged in 2021		Envisaged in 2022		Envisaged in 2023	
		Budget (amd1)	Forecast	Draft Budget	Forecast	VAR 2019/18	Planned needs	VAR 2019/18	Planned needs	VAR 2021/20	Planned needs	VAR 2022/21	Planned needs	VAR 2023/22
1 REVENUE FROM FEES AND CHARGES														
2. EU CONTRIBUTION	717 684 707.74	511 120 844.32	659 120 844.32	630 753 760.63	630 753 760.63	-4.3%	656 805 000.00	4.1%	608 882 000.00	-7.3%	642 008 000.00	5.4%	690 724 000.00	7.6%
of which Administrative (Title 1 and 2)	*48 671 440.00*	*48 016 981.00*	*48 016 981.00*	*49 517 000.00*	*49 517 000.00*	*3.1%*	*52 605 000.00*	*6.2%*	*65 000 000.00*	*23.6%*	*66 000 000.00*	*1.5%*	*67 000 000.00*	*1.5%*
of which Operational (Title 3)	*667 940 000.00*	*457 222 443.00*	*605 222 443.00*	*564 000 568.00*	*564 000 568.00*	*-6.8%*	*604 200 000.00*	*7.1%*	*543 882 000.00*	*-10.0%*	*576 008 000.00*	*5.9%*	*623 724 000.00*	*8.3%*
of which recovery from previous years admin	*1 052 559.60*	*1 183 099.32*	*1 183 099.32*	*963 132.40*	*963 132.40*	*-18.6%*		-		-		-		-
of which rec. from previous years operational	*20 708.14*	*4 698 321.00*	*4 698 321.00*	*16 273 060.23*	*16 273 060.23*	*246.4%*		-		-		-		-
3 THIRD PARTIES CONTRIBUTION	129 937 000.00	134 920 000.00	134 920 000.00	155 600 000.00	155 600 000.00	15.3%	169 600 000.00	9.0%	138 200 000.00	-18.5%	146 800 000.00	6.2%	157 900 000.00	7.6%
Of which ITER Host State contribution	*125 000 000.00*	*130 000 000.00*	*130 000 000.00*	*150 000 000.00*	*150 000 000.00*	*15.4%*	*163 800 000.00*	*9.2%*	*132 200 000.00*	*-19.3%*	*140 700 000.00*	*6.4%*	*151 600 000.00*	*7.7%*
Of which Membership contribution	*4 937 000.00*	*4 920 000.00*	*4 920 000.00*	*5 600 000.00*	*5 600 000.00*	*13.8%*	*5 800 000.00*	*3.6%*	*6 000 000.00*	*3.4%*	*6 100 000.00*	*1.7%*	*6 300 000.00*	*3.3%*
4 MISCELLANOUS REVENUE	*658.04*	*0.00*	*0.00*							-		-		-
5 ADMINISTRATIVE OPERATIONS														
6 REVENUES FROM SERVICES RENDERED AGAINST PAYMENT														
7 CORRECTION OF BUDGETARY IMBALANCES														
8 INTERESTS GENERATED	*0.00*	*0.00*	*0.00*							-		-		-
9 UNUSED APPROPRIATIONS FROM PREVIOUS YEARS	*876 532.60*	*1 516 602.86*	*1 516 602.86*							-		-		-
TOTAL REVENUE	848 498 898.38	647 557 447.18	795 557 447.18	786 353 760.63	786 353 760.63	-1.2%	826 405 000.00	5.1%	747 082 000.00	-9.6%	788 808 000.00	5.6%	848 624 000.00	7.6%
RESERVE FUND AND REFUND	16 415 364.50	10 821 910.20	30 787 580.93	0.00	18 000 000.00	-	30 000 000.00	-	13 000 000.00	-	25 000 000.00	-	25 000 000.00	-
of which Reserve Fund	*11 184 575.01*		*19 965 670.73*		*18 000 000.00*		*30 000 000.00*		*13 000 000.00*		*25 000 000.00*		*25 000 000.00*	
of which Reserve Fund Carried over	*4 120 733.99*	*10 634 329.27*	*10 634 329.27*											
of which Refund	*892 931.73*	*479.77*	*479.77*											
of which Refund carried over	*217 123.77*	*187 101.16*	*187 101.16*											
TOTAL REVENUE AVAILABLE	864 914 262.88	658 379 357.38	826 345 028.11	786 353 760.63	804 353 760.63	-4.8%	856 405 000.00	6.5%	760 082 000.00	-11.2%	813 808 000.00	7.1%	873 624 000.00	7.4%

VAR: Variation compared to the previous budget

Table 21 . Revenue in Payment for 2017-2023

5.5.3 Expenditure in commitment appropriations

EXPENDITURE In Commitment Appropriations (EUR)	2017 Budget Execution	2018 Budget		Envisaged in 2019			Envisaged in 2020		Envisaged in 2021		Envisaged in 2022		Envisaged in 2023	
		Budget (amd1)	Forecast	Draft Budget	Forecast	VAR 2019/18	Planned needs	VAR 2020/19	Planned needs	VAR 2021/20	Planned needs	VAR 2022/21	Planned needs	VAR 2023/22
Title 1 Staff Expenditure	**46,721,950.68**	**45,853,030.32**	**48,544,500.00**	**48,005,000.00**	**48,852,500.00**	**-1.1%**	**50,612,200.00**	**3.6%**	**52,131,000.00**	**3.0%**	**53,694,000.00**	**3.0%**	**55,305,000.00**	**3.0%**
Salaries & allowances	39,762,317.74	40,027,030.32	43,126,000.00	42,089,000.00	44,303,500.00	-2.4%	45,972,200.00	3.8%	47,398,000.00	3.1%	48,866,000.00	3.1%	50,381,000.00	3.1%
Of which establishm ent plan posts	*29,773,636.27*	*29,283,030.32*	*32,304,000.00*	*31,334,000.00*	*33,281,000.00*	*-3.0%*	*34,400,000.00*	*3.4%*	*35,369,500.00*	*2.8%*	*36,341,000.00*	*2.7%*	*37,319,000.00*	*2.7%*
Of which external personnel	*9,988,681.47*	*10,744,000.00*	*10,822,000.00*	*10,755,000.00*	*11,022,500.00*	*-0.6%*	*11,572,200.00*	*5.0%*	*12,028,500.00*	*3.9%*	*12,525,000.00*	*4.1%*	*13,062,000.00*	*4.3%*
Expenditure relating to Staff recruitment	890,829.91	1,137,000.00	836,500.00	1,160,000.00	853,000.00	38.7%	870,000.00	2.0%	887,000.00	2.0%	905,000.00	2.0%	923,000.00	2.0%
Mission expenses	3,000,000.00	1,400,000.00	1,400,000.00	1,400,000.00	450,000.00	0.0%	460,000.00	2.2%	470,000.00	2.2%	480,000.00	2.1%	490,000.00	2.1%
Socio-medical infrastructure	361,500.00	420,000.00	420,000.00	428,000.00	428,000.00	1.9%	437,000.00	2.1%	446,000.00	2.1%	455,000.00	2.0%	464,000.00	2.0%
Training	640,803.03	831,000.00	650,000.00	848,000.00	663,000.00	30.5%	676,000.00	2.0%	690,000.00	2.1%	704,000.00	2.0%	718,000.00	2.0%
External Services														
Receptions, events and representation	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	0.0%	10,000.00	0.0%	10,000.00	0.0%	10,000.00	0.0%	10,000.00	0.0%
Social welfare	50,737.00	52,300.00	52,300.00	53,500.00	53,500.00	2.3%	54,800.00	2.4%	56,000.00	2.2%	57,200.00	2.1%	58,400.00	2.1%
Other Staff related expenditure	2,005,763.00	1,975,700.00	2,049,700.00	2,016,500.00	2,091,500.00	-1.6%	2,132,200.00	1.9%	2,174,000.00	2.0%	2,216,800.00	2.0%	2,260,600.00	2.0%
Title 2 Infrastructure and operating expenditure	**6,709,113.61**	**8,267,050.00**	**7,314,705.00**	**8,075,000.00**	**7,555,800.00**	**10.4%**	**7,792,800.00**	**3.1%**	**7,951,000.00**	**2.0%**	**8,114,000.00**	**2.1%**	**8,319,000.00**	**2.5%**
Rental of buildings and associated costs	1,340,000.00	1,489,000.00	1,400,000.00	1,526,000.00	1,428,000.00	9.0%	1,457,000.00	2.0%	1,486,000.00	2.0%	1,516,000.00	2.0%	1,547,000.00	2.0%
Information, communication technology and data proc.	2,840,478.11	3,500,000.00	3,500,000.00	3,570,000.00	3,570,400.00	2.0%	3,641,800.00	2.0%	3,714,000.00	2.0%	3,789,000.00	2.0%	3,864,000.00	2.0%
Movable property and associated costs	268,750.00	856,050.00	250,705.00	504,000.00	261,000.00	101.0%	265,000.00	1.5%	269,000.00	1.5%	273,000.00	1.5%	317,000.00	16.1%
Current administrative expenditure	1,104,121.60	1,384,000.00	1,150,000.00	1,406,000.00	1,244,000.00	22.3%	1,344,000.00	8.0%	1,365,000.00	1.6%	1,386,000.00	1.5%	1,407,000.00	1.5%
Postage / Telecommunications	377,000.00	425,000.00	375,000.00	443,000.00	391,000.00	18.1%	409,000.00	4.6%	427,000.00	4.4%	446,000.00	4.4%	466,000.00	4.5%
Meeting expenses	365,000.00	314,000.00	340,000.00	320,000.00	355,400.00	-5.9%	363,000.00	2.1%	370,000.00	1.9%	377,000.00	1.9%	384,000.00	1.9%
Running costs in connection with operational activities														
Information and publishing	33,000.00	15,000.00	15,000.00	21,000.00	21,000.00	40.0%	21,000.00	0.0%	21,800.00	3.8%	22,600.00	3.7%	23,500.00	4.0%
Studies														
Other infrastructure and operating expenditure	380,763.90	284,000.00	284,000.00	285,000.00	285,000.00	0.4%	292,000.00	2.5%	298,200.00	2.1%	304,400.00	2.1%	310,500.00	2.0%
Title 3 Operational expenditure	**498,115,940.93**	**579,360,849.23**	**577,621,724.55**	**618,299,200.40**	**618,299,200.40**	**7.0%**	**694,062,262.87**	**12.3%**	**1,071,999,000.00**	**54.5%**	**863,255,000.00**	**-19.5%**	**1,278,220,000.00**	**48.1%**
ITER construction including site preparation	317,313,135.47	406,900,232.25	405,161,107.57	468,143,200.40	468,213,200.40	15.5%	601,786,416.87	28.5%	818,689,000.00	36.0%	650,275,000.00	-20.6%	948,920,000.00	45.9%
Technology for ITER and DEMO	6,582,279.88	7,300,000.00	7,300,000.00	3,304,000.00	3,304,000.00	-54.7%	2,062,346.00	-37.6%	6,500,000.00	215.2%	5,900,000.00	-9%	12,600,000.00	113.6%
Technology for Broader Approach	10,997,850.25	6,696,970.36	6,696,970.36	11,870,000.00	11,800,000.00	77.2%	6,000,000.00	-49.2%	38,810,000.00	546.8%	39,580,000.00	2.0%	40,380,000.00	2.0%
Technology for DONES													26,920,000.00	-
Other Expenditure	4,605,947.50	6,025,941.32	6,025,941.32	4,982,000.00	4,982,000.00	-17.3%	5,000,000.00	0.4%	5,000,000.00	0.0%	5,000,000.00	0.0%	5,000,000.00	0.0%
ITER construction- from ITER host state contribution	158,616,727.83	152,437,705.30	152,437,705.30	130,000,000.00	130,000,000.00	-14.7%	79,213,500.00	-39.1%	203,000,000.00	156.3%	162,500,000.00	-20.0%	244,400,000.00	50.4%
TOTAL BUDGET	**551,547,005.22**	**633,480,929.55**	**633,480,929.55**	**674,379,200.40**	**674,707,500.40**	**6.5%**	**752,467,262.87**	**11.5%**	**1,132,081,000.00**	**50.4%**	**925,063,000.00**	**-18.3%**	**1,341,844,000.00**	**45.1%**
Reserve Fund	1,450,233.84	37,900,000.00	37,900,000.00	10,700,000.00	10,700,000.00		74,572,654.00	597%	29,851,894.00	-	17,188,932.00	-	17,532,710.00	-
TOTAL EXPENDITURE	**552,997,239.06**	**671,380,929.55**	**671,380,929.55**	**685,079,200.40**	**685,407,500.40**	**2.0%**	**827,039,916.87**	**20.7%**	**1,161,932,894.00**	**40.5%**	**942,251,932.00**	**-18.9%**	**1,359,376,710.00**	**44.3%**

VAR: Variation compared to the previous budget

Table 22 . Expenditure in Commitment for 2017-2023

5.5.4 Expenditure in payment appropriations

EXPENDITURE In Payment Appropriations (EUR)	2017 Execution	2018 Budget (amd1)	2018 Forecast	2019 Draft Budget	2019 Forecast	VAR 2019/18	2020 Planned needs	VAR 2020/19	2021 Planned needs	VAR 2021/20	2022 Planned needs	VAR 2022/21	2023 Planned needs	VAR 2023/22
Title 1 Staff Expenditure	**46 721 950.68**	**45 853 030.32**	**48 544 500.00**	**48 005 000.00**	**48 852 500.00**	**-1.1%**	**50 612 200.00**	**3.6%**	**52 131 000.00**	**3.0%**	**53 694 000.00**	**3.0%**	**55 305 000.00**	**3.0%**
Salaries & allowances	39 762 317.74	40 027 030.32	43 126 000.00	42 089 000.00	44 303 500.00	-2.4%	45 972 200.00	3.8%	47 398 000.00	3.1%	48 866 000.00	3.1%	50 381 000.00	3.1%
Of which establishment plan posts	*29 773 636.27*	*29 283 030.32*	*32 304 000.00*	*31 334 000.00*	*33 281 000.00*	*-3.0%*	*34 400 000.00*	*3.4%*	*35 369 500.00*	*2.8%*	*36 341 000.00*	*2.7%*	*37 319 000.00*	*2.7%*
Of which external personnel	*9 988 681.47*	*10 744 000.00*	*10 822 000.00*	*10 755 000.00*	*11 022 500.00*	*-0.6%*	*11 572 200.00*	*5.0%*	*12 028 500.00*	*3.9%*	*12 525 000.00*	*4.1%*	*13 062 000.00*	*4.3%*
Expenditure relating to Staff recruitment	890 829.91	1 137 000.00	836 500.00	1 160 000.00	853 000.00	38.7%	870 000.00	2.0%	887 000.00	2.0%	905 000.00	2.0%	923 000.00	2.0%
Mission expenses	3 000 000.00	1 400 000.00	1 400 000.00	1 400 000.00	450 000.00	0.0%	460 000.00	2.2%	470 000.00	2.2%	480 000.00	2.1%	490 000.00	2.1%
Socio-medical infrastructure	361 500.00	420 000.00	420 000.00	428 000.00	428 000.00	1.9%	437 000.00	2.1%	446 000.00	2.1%	455 000.00	2.0%	464 000.00	2.0%
Training	640 803.03	831 000.00	650 000.00	848 000.00	663 000.00	30.5%	676 000.00	2.0%	690 000.00	2.1%	704 000.00	2.0%	718 000.00	2.0%
External Services														
Receptions, events and representation	10 000.00	10 000.00	10 000.00	10 000.00	10 000.00	0.0%	10 000.00	0.0%	10 000.00	0.0%	10 000.00	0.0%	10 000.00	0.0%
Social welfare	50 737.00	52 300.00	52 300.00	53 500.00	53 500.00		54 800.00		56 000.00		57 200.00		58 400.00	
Other Staff related expenditure	2 005 763.00	1 975 700.00	2 049 700.00	2 016 500.00	2 091 500.00	-1.6%	2 132 200.00	1.9%	2 174 000.00	2.0%	2 216 800.00	2.0%	2 260 600.00	2.0%
Title 2 Infrastructure and operating expenditure	**6 709 113.61**	**8 267 050.00**	**7 314 705.00**	**8 075 000.00**	**7 555 800.00**	**10.4%**	**7 792 800.00**	**3.1%**	**7 951 000.00**	**2.0%**	**8 114 000.00**	**2.1%**	**8 319 000.00**	**2.5%**
Rental of buildings and associated costs	1 340 000.00	1 489 000.00	1 400 000.00	1 526 000.00	1 428 000.00	9.0%	1 457 000.00	2.0%	1 486 000.00	2.0%	1 516 000.00	2.0%	1 547 000.00	2.0%
Information, communication technology and data proc.	2 840 478.11	3 500 000.00	3 500 000.00	3 570 000.00	3 570 400.00	2.0%	3 641 800.00	2.0%	3 714 000.00	2.0%	3 789 000.00	2.0%	3 864 000.00	2.0%
Movable property and associated costs	268 750.00	856 050.00	250 705.00	504 000.00	261 000.00	101.0%	265 000.00	1.5%	269 000.00	1.5%	273 000.00	1.5%	317 000.00	16.1%
Current administrative expenditure	1 104 121.60	1 384 000.00	1 150 000.00	1 406 000.00	1 244 000.00	22.3%	1 344 000.00	8.0%	1 365 000.00	1.6%	1 386 000.00	1.5%	1 407 000.00	1.5%
Postage / Telecommunications	377 000.00	425 000.00	375 000.00	443 000.00	391 000.00	18.1%	409 000.00	4.6%	427 000.00	4.4%	446 000.00	4.4%	466 000.00	4.5%
Meeting expenses	365 000.00	314 000.00	340 000.00	320 000.00	355 400.00	-5.9%	363 000.00	2.1%	370 000.00	1.9%	377 000.00	1.9%	384 000.00	1.9%
Running costs in connection with operational activities														
Information and publishing	33 000.00	15 000.00	15 000.00	21 000.00	21 000.00	40.0%	21 000.00	0.0%	21 800.00	3.8%	22 600.00	3.7%	23 500.00	4.0%
Studies														
Other infrastructure and operating expenditure	380 763.90	284 000.00	284 000.00	285 000.00	285 000.00	0.4%	292 000.00	2.5%	298 200.00	2.1%	304 400.00	2.1%	310 500.00	2.0%
Title 3 Operational expenditure	**778 633 624.18**	**593 624 947.79**	**739 885 823.11**	**730 273 760.63**	**729 945 460.63**	**-1.3%**	**768 000 000.00**	**5.2%**	**687 000 000.00**	**-10.5%**	**727 000 000.00**	**5.8%**	**785 000 000.00**	**8.0%**
ITER construction including site preparation	635 401 538.87	438 608 344.93	584 869 220.25	563 673 760.63	563 345 460.63	-3.6%	584 240 000.00	3.7%	534 200 000.00	-8.6%	564 000 000.00	5.6%	599 200 000.00	6.2%
Technology for ITER and DEMO	10 437 716.66	9 000 000.00	9 000 000.00	4 200 000.00	4 200 000.00	-53.3%	4 760 000.00	13.3%	4 100 000.00	-13.9%	4 300 000.00	4.9%	6 300 000.00	46.5%
Technology for Broader approach	5 389 757.79	6 500 000.00	6 500 000.00	7 400 000.00	7 400 000.00	13.8%	10 200 000.00	37.8%	11 500 000.00	12.7%	13 000 000.00	13.0%	19 100 000.00	46.9%
Technology for DONES													3 800 000.00	-
Other Expenditure	2 895 596.95	8 000 000.00	8 000 000.00	5 000 000.00	5 000 000.00	-37.5%	5 000 000.00	0.0%	5 000 000.00	0.0%	5 000 000.00	0.0%	5 000 000.00	0.0%
ITER construction- from ITER host state contribution	124 509 013.91	131 516 602.86	131 516 602.86	150 000 000.00	150 000 000.00	14.1%	163 800 000.00	9.2%	132 200 000.00	-19.3%	140 700 000.00	6.4%	151 600 000.00	7.7%
TOTAL BUDGET	**832 064 688.47**	**647 745 028.11**	**795 745 028.11**	**786 353 760.63**	**786 353 760.63**	**-1.2%**	**826 405 000.00**	**5.1%**	**747 082 000.00**	**-9.6%**	**788 808 000.00**	**5.6%**	**848 624 000.00**	**7.6%**
Reserve Fund	4 670 979.73	10 634 329.27	30 600 000.00		18 000 000.00		30 000 000.00	-	13 000 000.00	-	25 000 000.00	-	25 000 000.00	-
TOTAL EXPENDITURE	**836 735 668.20**	**658 379 357.38**	**826 345 028.11**	**786 353 760.63**	**804 353 760.63**	**-4.8%**	**856 405 000.00**	**6.5%**	**760 082 000.00**	**-11.2%**	**813 808 000.00**	**7.1%**	**873 624 000.00**	**7.4%**

VAR: Variation compared to the previous budget

Table 23 . Expenditure in Payment for 2017-2023

5.5.5 Information on previous outturn

The outturn is established at the beginning of the following year with the preparation of the provisional accounts and recovered by Euratom. It is systematically included in the preparation of the following draft budget:

Budget outturn	2015	2016	2017
Revenue actually received (+)	526,207,476.99	724,394,086.29	860,132,786.99
Payments made (-)	520,107,959.73	710,869,498.62	832,636,609.01
Carry-over of appropriations (-)	5,932,046.73	8,843,632.49	16,437,092.48
Cancellation of appropriations carried over (+)	925,783.04	1,202,662.37	943,268.23
Adjustment for carry over of assigned revenue appropriations from previous year (+)		24,879.81	5,214,390.36
Exchange rate differences (+/-)	- 19,985.83	- 27,076.85	19,448.54
Adjustment for negative balance from previous year (-)			
Total	**1,073,267.74**	**5,881,420.51**	**17,236,192.63**

Table 24 . 2015, 2016 and 2017 Budget Outturns

The outturn for each financial year is calculated as the total revenue actually cashed minus the total payments incurred during the year, minus the appropriation carried over to the following year. It is made of the unused payment appropriations, cancelled at the end of the year.

Regarding the 2017 outturn:

- There were no carry over in payment appropriation from 2017 to 2018, beyond the automatic cases for assigned revenue and non-dissociated appropriations.
- Unused carried-over non differentiated appropriations (administrative expenditure) from 2016 were cancelled at the end of 2017 and included in the 2017 budget outturn.

5.5.6 In-kind contribution to F4E

There is no in-kind contribution to the F4E Budget, except the premises hosting the Joint Undertaking provided by the Host Country (Spain). The office building used by F4E is free of charge. For the year 2018, this service in-kind amounts to EUR 3 million.

5.6 Human Resources – Outlook for 2019 – 2023

5.6.1 Strategic perspective

Section 4.3.1.2 of the document already featured the wider strategic objectives in the area of human resources. The key change initiatives currently on-going and leading to the former objectives include:

- Review of the selection and recruitment processes and reducing the time to hire;
- Review of the F4E contract policy;
- Development of the HR metrics and reporting system; This would allow F4E to establish targets in the area of HR in addition to vacancy rate (4%), staff turnover (4%) and absenteeism rate (2%);
- Better alignment of learning and development initiatives with strategic priorities;
- Establishment of a career management and competency framework;
- Enhancement of performance management and corresponding link with corporate performance;

Taken together these improvement initiatives are also expected to help promulgate a stronger corporate culture while at the same time be beneficial for the engagement levels of staff.

5.6.2 Staff population overview

Staff population and its evolution, overview of all categories of staff

Staff population (1)		Actually filled as of 31.12.2016	Authorised under 2017 EU budget (2)	Actually filled as of 31.12.2017 (3)	Authorised under 2018 EU budget	Requested for 2019 (8)	Envisaged in 2020	Envisaged in 2021 (9)	Envisaged in 2022	Envisaged in 2023
Officials	AD	37	39	37	39	40	40	40	40	40
	AST	15	12	14	12	11	11	11	11	11
	AST/SC		-							
TA	AD	183	205	194	204	205	202	202	202	202
	AST	27	27	31	28	27	27	27	27	27
	AST/SC	-	-	-	-	-	-	-	-	-
Sub Total[4] Establishment Plan		**262**	**283**	**276**	**283**	**283**	**280**	**280**	**280**	**280**
CA GFIV		100	107	105	107	104	98	98	98	98
CA GF III		48	50	54	50	50	55	55	55	55
CA GF II		19	24	15	24	24	19	19	19	19
CA GFI										
Sub Total CA[5]		**167**	**181**	**174**	**181**	**178**	**172**	**172**	**172**	**172**
SNE		2	3	2	3	3	3	3	3	3
TOTAL		**431**	**467**	**452**	**467**	**464**	**455**	**455**	**455**	**455**
Structural service providers [6]		18.33		21	tbd	tbd	tbd	tbd	tbd	tbd
External staff for occasional replacement [7]		12.83		16	16	16	16	16	16	16

[1] All F4E staff is EU-Financed.

[2] As authorised for officials and temporary agents (TA) and as estimated for contract agents (CA) and seconded national experts (SNE).

[3] Of which 1 sent (and accepted) Temporary Agent offer letter and 2 sent (and accepted) Contract Agent offer letters.

[4] Headcounts.

[5] Filled including job offer letters sent and accepted in Full time Equivalent (FTE).

[6] Filled in and envisaged FTE. Service providers are contracted by a private company selected through framework contracts /specific task orders. They have individual contracts with F4E .They carry out specialised outsourced tasks of horizontal/support nature, for instance in the area

[7] Filled in and envisaged FTE, as instance for replacement due to maternity or long sick leave.

[8] Conversion of 1 FO AST into 1 FO AD in view of a certification procedure. In addition, conversion of 1 TA AST into 1

[9] The 2021, 2022 and 2023 forecasts are consistent with the figures included in the Draft MFF 2021-2027

Table 25 . Overview of staff population and its evolution

5.6.3 Multiannual staff policy plan

Multi-annual staff policy plan 2019-2023																
Category and grade	Establishment Plan in EU Budget 2017 [1]		Filled as of 31/12/2017		Establishment plan in voted EU Budget 2018		Establishment plan in Draft EU Budget 2019 [2]		Establishment plan 2020		Establishment plan 2021		Establishment plan 2022		Establishment plan 2023	
	officials	TA	officials	TA	officials	TA	officials	TA	officials	TA	officials	TA	officials	TA	officials	TA
AD 16	0	0	0	0					0	0	0	0	0	0	0	0
AD 15	0	1	0	0		1		1	0	1	0	1	0	1	0	1
AD 14	1	0	0	1	3	1	5	2	7	3	9	5	9	5	9	5
AD 13	13	6	8	6	14	7	14	7	14	11	14	12	14	12	14	12
AD 12	17	13	9	0	15	17	14	21	13	22	11	25	11	25	11	25
AD 11	5	21	6	17	4	21	3	23	2	24	2	26	2	26	2	26
AD 10	0	25	2	21		26		28	0	31	0	33	0	33	0	33
AD 9	0	29	1	30		35		39	0	41	0	42	0	42	0	42
AD 8	1	40	9	57	1	40	1	37	1	33	2	27	2	27	2	27
AD 7	0	37	1	23		28	1	21	2	15	2	12	2	12	2	12
AD 6	0	33	1	39	1	28	2	25	1	20		18	0	18	0	18
AD 5	2	0	0	0	1			1	0	1		1	0	1	0	1
Total AD	**39**	**205**	**37**	**194**	**39**	**204**	**40**	**205**	**40**	**202**	**40**	**202**	**40**	**202**	**40**	**202**
AST 11	4	0	0	0	4		4		5	0	5	0	5	0	5	0
AST 10	2	0	1	0	2		2		1	0	2	0	2	0	2	0
AST 9	3	0	1	0	3		4		4	0	3	1	3	1	3	1
AST 8	1	0	2	0	2	1	1	1	1	2	1	2	1	2	1	2
AST 7	2	1	3	0	1	1		3	0	4	0	5	0	5	0	5
AST 6	0	5	1	2		8		9	0	10	0	10	0	10	0	10
AST 5	0	14	0	12		12		11	0	9	0	8	0	8	0	8
AST 4	0	7	3	5		5		3	0	2	0	1	0	1	0	1
AST 3	0	0	2	12		1			0	0	0	0	0	0	0	0
AST 2	0	0	1	0					0	0	0	0	0	0	0	0
AST 1	0	0	0	0					0	0	0	0	0	0	0	0
Total AST	**12**	**27**	**14**	**31**	**12**	**28**	**11**	**27**	**11**	**27**	**11**	**27**	**11**	**27**	**11**	**27**
Tot AST/SC	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
TOTAL	**51**	**232**	**51**	**225**	**51**	**232**	**51**	**232**	**51**	**229**	**51**	**229**	**51**	**229**	**51**	**229**
GRAND TOTAL	**283**		**276**		**283**		**283**		**280**		**280**		**280**		**280**	

[1] The conversion of 1 FO AD13 into TA AD13 in the EP 2017 was not updated in the Draft Budget 2018 (point 2.1 Establishment Plan posts). However, it was approved by the F4E Governing Board in February 2017 along with the Budget.

[2] Conversion of 1 FO AST into 1 FO AD in view of a certification procedure. In addition, conversion of 1 TA AST into 1 TA AD5

Notes:

- The requested posts for 2019 and the forecasts in 2020 and 2021 are calculated according to the promotions slots rates of Annex I of the Staff Regulations. The excess of TA AD14 posts above the F4E Director post will be used in lower category slots.
- F4E does not use of the flexibility rule (Art 38 of FR). The corresponding colums, systematically showing no changes in the establishment plan are not shown.
- The 2021, 2022 and 2023 forecasts are consistent with the figures included in the Draft MFF 2021-2027

Table 26 . Multi-annual staff policy Plan 2019-2023

5.6.4 Recruitment policy

The Fusion for Energy personnel structure consists of EU Officials, Temporary Agents and Contract Agents.
All F4E recruitments are consistent with article 53 of the Condition of Employment of Other Servants for Temporary Agents and article 80 of Condition of Employment of Other Servants for Contract Agents, as well as their Model Decision on the engagement and use of Temporary staff under article 2.f.
The tasks related to the operational mission of F4E require highly specialized profiles especially in the core areas related to the ITER and Broader Approach projects. This is also true for many of the staff working in the support functions as the project complexity and amount of capital involved are considerable.
EU Officials (FO) and Temporary Agents (TA) may be recruited under two function groups:

- Administrator (AD) profiles for senior and non-senior technical/legal/financial/procurement officers, contract managers, etc.
- Assistant (AST) profiles for senior and non-senior assistant positions.

Contract Agents (CA) work under the supervision of EU Officials and/or Temporary Agents and may be recruited under four function groups (from FGI to FGIV). However, F4E typically recruits the majority of its contract agents at the level of:

- FGII, who are in charge of clerical and secretarial tasks
- FGIII, who are in charge of administrative and financial tasks in various support and operational units (e.g. Team Assistants) and
- FGIV, who are mainly specialized technical staff (e.g. Technical Support Officers, Project Management Support Officers) and qualified specialists in administrative fields (e.g. human resources, procurement, project management, legal, finance, etc.).

In terms of contract duration, F4E distinguishes between (1) long-term and (2) short-term employment contracts as follows:

1. Long-term employment

EU Officials – appointed by F4E from reserve lists or transferred from other EU institutions.
Temporary Agents - recruited on five year renewable contracts which can be extended once for another period of five years and which are then followed by an indefinite duration contract if extended beyond the end of the first extension.
Contract Agents - recruited on a three year renewable contract which can be extended once for a further period of four years, and which is then followed by an indefinite duration contract if extended beyond the end of the first extension.

2. Short-term employment.

The employment contract of the F4E Director falls under the short-term category as it cannot be extended more than once and is hence limited to a maximum period of two consecutive 5 year periods i.e. 10 years.

Pursuant to the temporary reinforcement agreed in 2014 with the Commission (exchange of letters between F4E and Commissioners Mr H. Oettinger (Vice-President of the European Commission and Commissioner for Energy) and Mr J. Dominik (Commissioner for Financial Programming and the Budget) on 23 October 2014)), the budget authority granted 24 CA short-term posts in 2015 and 21 TA short-term posts in 2016.

These posts are filled using non-renewable short-term contracts not exceeding 3 years.
Fusion for Energy may also employ Seconded National Experts (SNE). These are seconded to F4E for an initial maximum period of two years, renewable for another period of two years and up to a total

maximum period of four years. SNEs are paid by the seconding organization (although F4E may reimburse the annual emoluments to the seconding organization) and receive a daily allowance and monthly allowance paid for by F4E.

5.6.5 Selection procedures

F4E applies the General Implementing Provisions (GIP) on the Procedure governing the Engagement and use of Temporary Agents by analogy. Pending the adoption by the Commission of the same rules for Contract Agents, F4E follows the same provisions for the engagement and use of its contract agents. For the selection and use of EU Officials, F4E follows the rules applied by the Commission, by analogy. In agreement with the Commission and following a verification exercise by the European Personnel Selection Office (EPSO) of the F4E selection procedures, F4E has been selecting staff on the basis of both interviews and written tests since April 1st, 2013 for all long-term employment contracts.
Vacancy announcements have typically been advertised on the career opportunities section of F4E's website. Various other job portals and specialized media are also used to attract applicants from as wide a geographical basis as possible. The increased reliance on social media is part of a sourcing strategy emphasizing a more tailored approach to filling vacancies. As such, F4E is increasingly trying to reach skilled candidates that are not necessarily looking for new employments or who would not typically be exposed to EU employment opportunities.

1. Selection of Established Officials

Vacant permanent posts intended to be occupied by already established Officials and/or candidates on reserve lists, are filled in conformity with the Staff Regulations. Interviews are conducted by a Panel (composed by a representative of the administration and a representative of the concerned department) using pre-defined criteria stipulated in the corresponding vacancy notice and a standard evaluation grid based on the aforementioned criteria.
Since 2007, F4E has launched 64 publications for FO positions. However, in an effort to harmonize its workforce structure and in keeping with the time limited mandate of F4E, a decision was taken to stop expanding the F4E FO staff contingent. This decision was taken during 2015 and provides that whenever FO positions become vacant, they shall be replaced by equivalent or lesser graded TA positions.

2. Selection of Temporary Agents

These are typically organized on the basis of the following grade brackets:

- AST 1 – AST 4 for assistant positions (technical and administrative).
- AD5 – AD12 for technical and administrative profiles;
- AD9 – AD12 for managerial and senior profiles (technical/scientific experts, group leaders depending on the group and functions to be developed);
- AD 13 for Heads of Department[17].
- AD14 for the F4E Director.

5.6.6 Performance management

Staff performance is assessed annually based on an F4E-wide performance appraisal. The latter serves the purposes of improving individual staff performance by establishing and subsequently reducing gaps between desired and actual performance. The key constituent parts of the mechanism are:

1. Establishment of "SMART" and jointly agreed performance objectives.

[17] While the model Implementing Rule on middle-management applicable to agencies only considers management to be senior as of grade AD14. F4E considers the role of Head of Department as an intermediate step between the Director (senior management) and the Heads of Unit (Project managers in the ITER Department).

2. Self-assessment by the staff member.
3. Performance review and dialogue with the line manager.
4. Definition of career development and training objectives addressing agreed areas of improvement and career aspirations. The assessment period coincides with the calendar year and runs from January, 1st to December, 31st. In keeping with the staff regulations, the appraisal assesses three main areas of competence as follows: efficiency, ability and conduct in the service. The use of languages and the level of responsibility exercised are two additional constituent components of the merit rating.

Looking ahead, and in keeping with its project nature, F4E will further optimise the annual performance appraisal system to increase the effectiveness of the matrix structure. One aim is to better capture performance feedback from both line managers and functional managers of staff having dual reporting lines in the framework of the matrix structure. Another objective is to better cascade the corporate objectives down to individual objectives and to implement mid-year performance reviews. In keeping with the corporate challenge of enhanced accountability, F4E also looks to establish standardized performance objectives for different workforce population groups. These standards will be based on a job classification review aimed at establishing clearly defined responsibility standards for each grade. These are major steps forward in optimizing performance management. ,
Other information on Advancement, Reclassification and balances are provided in Annex VII.

5.6.7 Schooling

In the absence of a European School in F4E's Barcelona and Cadarache work sites, the Agency established Service Level Agreements with a number of international schools located in and around these two sites. Under these agreements, F4E staff enjoys easier access to school registration and enrolment for their dependent children. The agreements also provide a framework for the direct settlement of school fees by the Agency. The number of international schools making up the F4E schooling offer has gradually grown over the years and is currently a prominent part of F4E's employee value proposition. In addition, F4E continues to be involved in the governance of the International School of Manosque where it is part of the international Advisory Council and where it strives to uphold the interests of its staff with dependent children in that establishment. While, F4E does not currently envisage any further actions at this time, it will endeavor to maintain its appeal in this domain for both existing and prospective staff members.
Taken together, Service Level Agreements have been established with 28 international schools of which 24 in the area of Barcelona and 4 in Cadarache (France).

1. American School of Barcelona	15. Swiss School
2. Deutsche Schule Barcelona	16. Highlands School
3. Europa International School	17. École Bel Air Sitges
4. Hamelin International School	18. Benjamin Franklin
5. Lycée Français de Barcelona	19. Agora Sant Cugat
6. Saint Paul's School	20. Escoles Betlem
7. Istituto Statale Italiano Comprensivo	21. La Miranda
8. St. Peter's School	22. Bon Soleil
9. Escoles Pérez Iborra	23. Santa Clara International School
10. The British School	24. Fundación Akua
11. Scuola Materna Montessori	25. Sainte Victoire International School (SVIS) - Cadarache
12. École Ferdinand de Lesseps	26. CIPEC - Cadarache
13. Kensington School	27. IBS - Cadarache

14. Col.legi Paideia	28. EPIM - Cadarache

Table 27. Service Level Agreements with International schools

5.6.8 Staff mobility

1. Internal mobility

Increased career mobility consistently features as the foremost concern of staff. In recognition of this wish, the agency adopted an internal mobility policy in June 2015 foreseeing that all vacancies are subject to internal selections prior to opening them externally. The policy only provides for horizontal mobility and complements vertical mobility, which is only possible through external selection procedures and/or promotion/reclassification decisions.

In keeping with its project nature and matrix organization, F4E will also seek to increase the effectiveness of its workforce management through increased flexibility and transience of project assignments. As part of this endeavor F4E will seek to progressively 'flatten' its structure and reduce the number of vertical levels currently in place. In parallel F4E will increase the number of clearly visible project manager roles thereby creating more attractive internal development paths.

2. Inter-agency job Market

While the inter-agency job market remains to be developed and while it will predominantly concern support and administrative profiles rather than operational and technical staff, the continued harmonization of policies and rules across the EU Agency landscape will progressively foster mobility opportunities.

5.7 Other information

5.7.1 Building policy

Surface area (in square metres) *- Of which office space* *- Of which non-office space*	9 000 m^2 *8 250 m^2* *750 m^2*
Annual rent (in EUR)	Rent paid by Spain
Type and duration of rental contract	Long term lease agreement until 2042
Host country grant or support	Rent paid by Spain
Present value of the building	N/A

Table 28 . F4E building

In accordance with the 2007 Host Agreement, Spain (Host State) shall provide permanent premises in Barcelona. After several suggestions for a new building, the Spanish Ministry offered in April 2016 to fix F4E's permanent premises at its current location, which was deemed to be of temporary nature only. This offer consisted of a long-term lease agreement until 2042 for the current premises and an extension of approximately 1 000m2 of additional space[18]. A cafeteria for staff is planned at the ground floor. The offer also included that Spain will cover the costs of the refurbishment works of this additional space. In May 2016, the long term agreement was signed between Spain, the building owner, and F4E.

[18] Works will be carried out in 2018. Early 2019 it will be available for offices/meeting rooms/main reception and canteen.

The expenditure for the refurbishment of the additional space is foreseen at an estimated cost of EUR 1.5 million that will be financed by Spain and the building owner. An annual expenditure for the operation of the cafeteria and the additional space will be charged on the F4E budget. The possibility of a subsidy has been also included to keep a competitive price level for the meals.
Following a decision taken by the GB, discussions with the Host State will be held concerning the associated refurbishment costs for all the other floors of the building. The multi-annual planning will then be up-dated accordingly.

5.7.2 Privileges and immunities

Joint undertaking privileges	Protocol of privileges and immunities (PPI) / diplomatic status granted to Staff
Privileges provided by the Host State and concluded in the seat agreement: - VAT exemptions - Building free of charge	Diplomatic status only for the Director, and the person appointed to replace him in his absence - The PPI applies to all staff - VAT reimbursements during the first year on goods and furniture. - Purchase of one motor vehicle without taxes. - Exemption of import tax registration for vehicles (if done through the Spanish Ministry of Foreign Affairs) - No privilege granted regarding education/day care

Table 29 . Privileges and Immunities

5.7.3 Evaluations, Internal monitoring and Assessment

When the EU Council discussed the status of ITER and possible ways forward on 12th July 2010, it asked, inter alia:

1. "F4E to report at least once a year on (a) the progress achieved in implementing the cost containment and savings plan, (b) as well as the performance and management of the

Agency and the ITER project, and (c) the fulfillment of the scheduled activities within its annual budget.

2. The F4E Governing Board (GB) to appoint an independent expert who will assess the [ITER] project progress on the basis of existing reports and will submit this opinion to the Governing Board and to the Competitiveness Council once a year".

Accordingly, each year F4E reports to the Council on the status of the ITER Project, the evolution of the Cost containment and savings plan, an overview of the performance and management of the organization and ITER Project, the progress related to the fulfillment of scheduled activities and F4E's Response to the External Annual Assessment.

The actions on F4E resulting from the external assessment are added to the F4E Action Plan and the progress in their completion is reported by the Director at each Governing Board meeting.

5.7.4 Organization chart (2018)

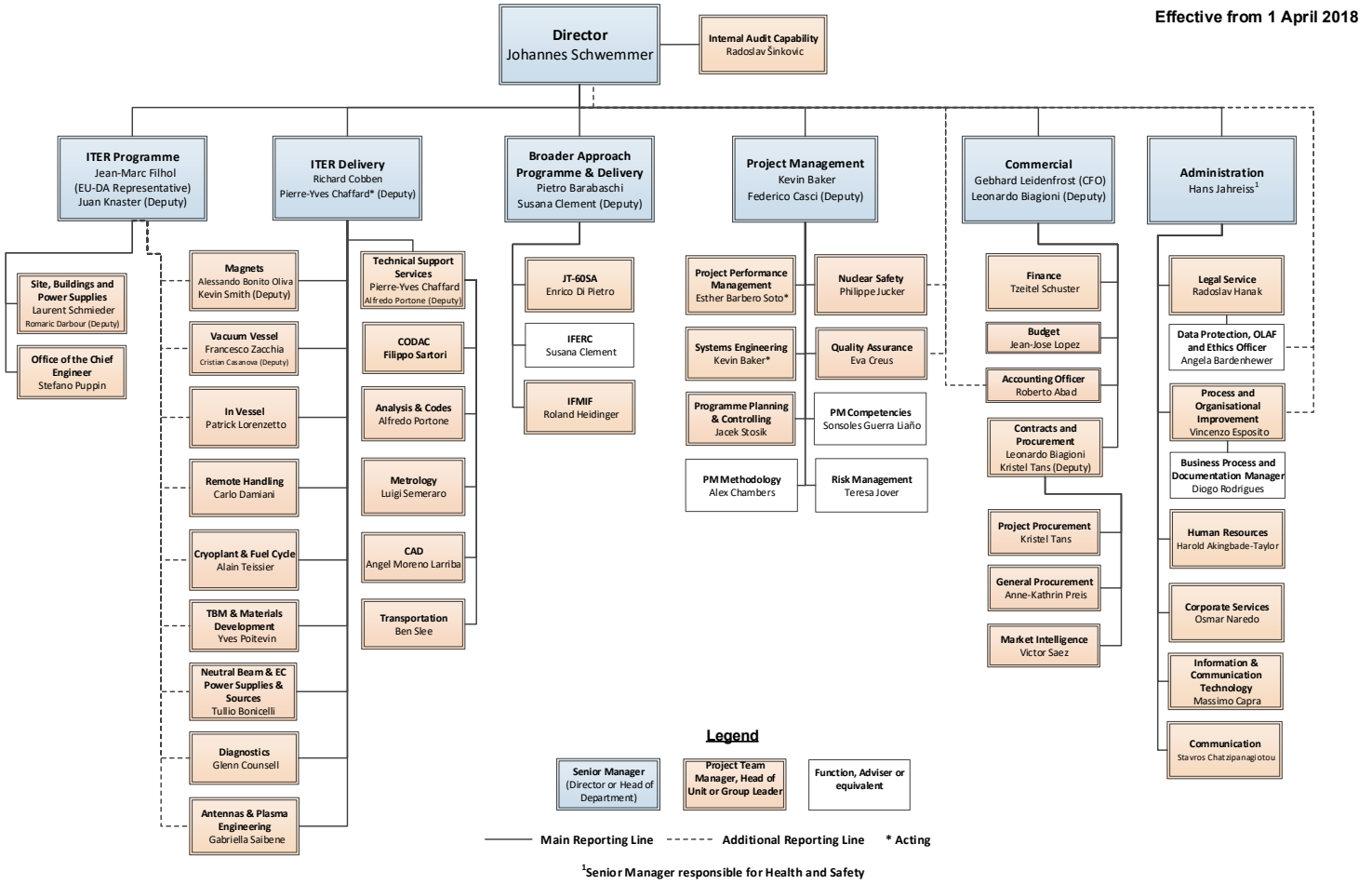

Figure 12 . Organization Chart (2018)

Section III. Work Programme Year 2019

6. Annual Programme

6.1 Executive summary for the annual Work Programme 2019

This Work Programme 2019 (WP19) offers an overview of the objectives of the European Joint Undertaking for ITER and the Development of Fusion Energy (F4E) for 2019 and also identifies the financial decisions for the actions that are planned to be carried out in 2019 with the available budget. It covers the work on both ITER and Broader Approach (BA) according to the tasks entrusted to the organization.

Concerning ITER, the task of F4E is to discharge EU obligations to deliver its share of in-kind components and cash contributions to the ITER project, about 45% of the total value of the project in the construction phase. This work is carried out under the coordination of the ITER Organization (IO) and it creates many challenges both from the technical and from an organizational point of view. The priority is on the activities required to achieve First Plasma (FP) in 2025 resulting in slowing down other projects until after 2020. A suitable scenario was selected for the other, non-FP systems, in order to minimize delays to the later machine phases and minimize costs associated with the slowdown.

The 2019 objectives, the main milestones and the allocation of the human resources provide a good idea of the complexity of the tasks to be carried throughout the year and of the technical challenges they entail.

2019 is mostly focused on the following activities (FP-relevant areas are shown):

- Magnets (FP): All major contracts have already been signed. For the pre-compression rings the series production will continue for both technologies. The first EU TF Coil will be completed, As for the PF coils, winding pack assembly and impregnation will be completed for PF Coil #5 and #6. The production of the Double Pancakes for PF #2 will also progress through their winding and impregnation stages.
- Main Vacuum Vessel (FP): Full production will be in progress for all 20 segments of the 5 sectors, heading towards completion of five poloidal segments for sectors 5 and 4. Inspectors task orders will be placed according to the manufacturing rate as well as support tasks for the resolution of design changes and non-conformities.
- Blanket System (non-FP): The manufacturing of First Wall (FW) Full Scale Prototypes will be completed. The tendering phase for the series production and the negotiations with the potential manufacturers will be concluded, too.
- Divertor (non-FP): for the divertor inner vertical target (IVT), the manufacture of full-scale prototypes will continue. Main procurement activities will concern the development of plasma-facing units by using an alternative tube transition and using alternative tungsten grades. For the divertor cassette, the work will proceed under the contracts launched for the manufacturing of the cassette body pre-series. The main procurement activities will concern the follow-up of the contract(s) for the cassette body production.
- Remote Handling (partly FP): The procurement of the Remote Handling Systems (RHS) will mainly focus on the continuation of preliminary design activities and starting, in some areas, the final design activities. Complementary RH technology-related design activities, prototyping and qualification will be performed. The procurement activities aim at supporting the preliminary design activities and starting in some areas the final design activities.
- Vacuum Pumping (Partly FP): The tendering process for the procurement of Leak Detection systems will be started. MITICA and NB Cryopumps contracts will focus on manufacturing and

assembly. As for the Front End Cryopump Distribution, activities will focus on design and start of manufacturing. As for the Warm Regeneration lines, the contract will be completed.

- Fuel Cycle (non-FP): First pre-PA activities will start in support of the Hydrogen Isotope Separation system. As for REMS (Radiation and Environmental Monitoring Systems), the tendering activities for the final design and procurement contract for the Beryllium monitors will start.
- Cryoplant (FP): End of installation and most of site acceptance test for LN2 Plant and Auxiliary Systems components will take place. The contract for MITICA Cryoplant will be completed.
- RF Heating & Current-Drive (partly FP): The Ion Cyclotron antenna will be in its final design phase. A contract will be signed for the manufacturing and testing of RF Window mock-ups and prototype. As for the Electron Cyclotron (EC) system, the upper launcher will be in its final design phase. Prototypes will be manufactured in different areas as well as testing will be carried out in the FALCON test facility. Contracts will be placed for the series production and testing of the Diamond Disks. The first part of the EC Control System will be delivered to IO. Other units will enter into the design phase.
- Neutral Beam Heating and Current Drive (non-FP): As for the NB Test Facility, the SPIDER experiments will continue, while the MITICA activities will progress with commissioning and testing of vessel and power supplies and with the assembly of the auxiliaries. As for the NB at Cadarache, the procurement of Ion Source Extraction PS (ISEPS) will progress with design finalization/manufacturing and with design finalization for the Accelerator Ground Power Supplies.
- Diagnostics (partly FP): Manufacturing activities for several Diagnostic components and systems most of them essential for First Plasma will continue. Design of all remaining diagnostics systems will progress as well as the integration of diagnostics into the ports. Several diagnostics systems will finalize either the preliminary design phase or the final design phase with the approval of the relevant design review. Procurement activities will be focussed on two different areas: placement of manufacturing contracts for the production of components to be delivered to ITER for First Plasma and contract/grants for the completion of the design of less mature Diagnostics systems.
- Test Blanket Systems (TBM – non-FP): The overall focus of the activities in the development of the TBM project will be devoted to the Preliminary Design Phase. The irradiation of EUROFER sample will continue as well as the contract for EUROFER handling and storage. The Framework Contracts for the Preliminary Design of the TBM Set of the Ancillary Systems and of the related Safety and Accidental Analyses will be signed and its first specific contract released.
- Site, Buildings and Power supply: The focus will be on the progress of works of the Tokamak Complex with the first phase concrete works nearing completion and the finishing works progressing. The prefabrication of the steel structure of the Crane Hall will be progressing with cladding installation to start. TB04 procurement activities will continue for the Tokamak Complex and construction design will progress with IO approval of all levels (services) foreseen early 2020. TB19 painting and coating works will commence in the Tokamak Complex. TB06 works on High Voltage buildings, areas and power supplies equipment will be near completion. The tender process for TB18 (Tritium building civil works and finishing above L2) will be commenced. A call for tender for a new Architect Engineer in charge of the design activities associated with the Hot Cell Complex is planned to be launched. Specific contracts will be signed under ongoing framework support services and works contracts. Changes and exercise of options to the ongoing services and construction contracts in relation with Project Changes Requests (PCRs), input data delays, and re-allocation of scope between contracts will be implemented through amendments to the ongoing contracts in line with the provisions of the Financial Regulations.

Concerning BA, the EU activities are carried out in the frame of the agreement, concluded with Japan, consisting in activities, which complement the ITER project and accelerate the realization of fusion energy. Both parties contribute equally financially. The European resources for the implementation of the BA are largely volunteered by several participating European countries. 2019 is mostly focused on the following activities:

- Satellite Tokamak (JT-60SA): In 2019, the remaining parts of EU contribution will be delivered to the JT-60SA site. The actions will focus on the completion of fabrication, testing, transportation and on-site installation. Preliminary activities for BA Phase II will be initiated. The activities under the responsibility of F4E are carried out through grants, task orders of existing/new framework contracts or existing/new supply and service contracts.
- IFMIF/EVEDA: In 2019 the LIPAc (Linear IFMIF Prototype Accelerator) operation at Rokkasho will undergo a transition phase from testing the subsystem at 5 MeV to commissioning the full

accelerator at 9 MeV. Additional contracts will have to be placed for these continued testing activities. F4E will be continuously supported by experts, and on-site health and safety services to ensure safe operations, funded respectively by F4E through expert contracts and specific contracts. Cash contributions will be made to maintain project team common expenses (e.g. missions) and common funds (e.g. repairs and spare parts).

- IFERC: The IFERC project comprises two activities, DEMO design and R&D activities, and REC (Remote experimentation Centre). The REC activities are mostly under the financial responsibility of F4E, and are performed under F4E contracts or agreements of collaboration with EUROfusion, to provide software and services. Integrated tests (participation in the operation of a European Tokamak from Rokkasho) will take place in 2018/2019.

6.2 Introduction to the Annual Work Programme 2019[19]

The 2019 Work Programme takes into account to the extent possible the EU Commission guidelines for the Programming document as requested by the Financial Regulation. It comprises a general overview of the procurement activities that will be committed during 2019, detailed objectives, expected results and target for each WP Action (see 6.2.2). The main information due to be presented according to the provided Commission guideline are explained and detailed in par.6.2.2.

6.2.1 Main assumptions

The following assumptions are considered as the basis of the Work Programme 2019:

- The F4E schedule used for the preparation of this document is the one submitted to IO at the end of April 2018.
- The F4E schedule supporting FP by the end of 2025 takes into account:
  - ✓ The latest input and developments of the schedules from the F4E suppliers, taking into account the agreed fabrication routes and showing the real development of the work.
  - ✓ The most realistic assumption of Procurement Arrangement (PA) signature dates based on the current status of the design of components and on the forecasted dates of the required design reviews prior to the PA signature.
  - ✓ The available manpower in F4E, taking into account bottlenecks in specific areas where staffing is not sufficient to grant a prompt process of the work. In specific cases, F4E foresees to satisfy its manpower needs by using external contractors.
  - ✓ The available yearly commitment and payment budgets for the work on the EU in-kind procurements until end 2020. It should be borne in mind that the current F4E budget is assigned only until the end of 2020 and therefore the achievement and completion of activities beyond this date depend on the availability of the required budget after 2020.
  - ✓ The most realistic assumptions on the input data availability from IO to take into account the existing delays and the agreed dates of data delivery.
  - ✓ The information provided by the other DAs through their monthly Detailed Work Schedule to take into account any possible delay in the delivery of items to F4E that can cause delays to the EU in-kind procurements.
- In order to achieve an improvement of the quality of the PAs that need still to be signed, a common F4E/IO effort is still in progress to better identify the requirements that are linked to the specific procurement.
- 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 F4E Financial Regulations.
- Grants related to recurring and sequential R&D activities, with a well-defined development path eventually leading to an EU procurement package, will be implemented whenever appropriate,

[19] To be noticed that, as this part of the document is focused on a specific year, its content is totally different compared to the Work programme of the previous year. Only few tasks, delayed from the previous year to this year, will be the same.

through Framework Partnership Agreements (FPA), in order to streamline and channel R&D funding, improve its effectiveness and decrease the administrative burden to beneficiaries and F4E alike.

- Procurements which require a very close coordination between F4E and other entities will be implemented, whenever appropriate, through the Joint Procurement procedure.
- All the activities described in the overview of each Action and the list of contracts in Annex VIII is intended as credited by PA or ITA. If an Action is not credited, then it is explicitly mentioned in the overview. This is not applicable for the Action “Broader Approach” (i.e. not credited).
- F4E endorsement of the Japanese Procurement Arrangement that foresees an EU financial contribution will be preceded by a budgetary commitment for the entire amount of the F4E contribution.
- Changes originated by IO, or other DA’s, will be fully compensated by the IO Reserve Fund.
- Regarding the WP2019 for Broader Approach, the main assumptions are that this is to be coherent with the individual BA Projects' Work Programmes and Project Plans as approved by the Broader Approach Steering Committee.
- The Art. 5 of the F4E Statutes states that the Joint Undertaking may award grants and prizes in accordance with the rules of its financial regulation. In this regard, Essential selection, award criteria and Upper funding limits are defined in ANNEX II.

6.2.2 Definitions and supporting information

1. "Action" for the purposes of Work Programme means “a coherent area of action with objectives and resources”. The list of the Actions and their definition is available in Table 2.

2. Each Action of WP2019 comprises:

(a) **General overview** that is split into two parts. The “Progress of Work” part aims at providing the information concerning the activities foreseen during 2019 in that area. The “Procurement Activities” part instead focuses on the legal commitments foreseen during the year and to be covered by the financial decision and to be financed under the budget 2019. Furthermore, it includes (even if not explicitly mentioned):

i. Provisions for urgent general support tasks as cost/risk analysis, engineering support/analysis, I&C develop and support, quality assurance and quality control, nuclear safety, CE marking analysis, transportation, storage, material characterization and qualification activities, metrology and external legal support, cost of legal proceedings and alternative dispute settlement, including arbitration, as needed[20]. These tasks will be mainly implemented through specific contracts under existing framework contracts.

ii. Provisions for payment of liquidated damages, late payment interests, cost escalation, claims, release of options, indexation and other financial compensations that F4E may be obliged to pay under its contracts.

iii. Provisions for amendments to ongoing contracts covered by a previous financing decision(s) in accordance with the Implementing Rules.

(b) **Annual objectives** defined as the achievement on time of the following milestones:

i. ITER Council/Governing Board (IC/GB) milestones in 2019 – see 4.2.2 (if applicable);

ii. Milestones that will lead to the achievement of the future IC/GB milestones from the following years (defined as predecessor of future IC/GB milestones (if applicable).

iii. Key milestones marking significant schedule progress (only in the event that none of the above are applicable).

iv. Link with the ITER Project multi-annual objectives (defined as the whole set of IC/GB milestones): when a WP annual objective is a predecessor of a multi-annual objective (IC/GB milestones), it is clearly identified to which milestone is linked in the column “type of milestone”.

(c) The **expected results** define the main outcomes of the Actions.

[20] In accordance to F4E WBS implementation rules, whenever a procurement activity is in support of a specific WBS L3, the related procurement should be implemented under the mentioned WBS L3. This is not the case for general technical support activities to multiple WBSs (e.g. external resource to support overall risk management, etc.). In this case, they are included under Action 13

(d) The **target** is defined, when applicable, as the cumulative CAS foreseen to be achieved by the end of 2019 per PA (PAs associated with each Action are listed in Table 2).The value is according to the CAS profile proposed by F4E to IO and implemented in the F4E DWS. Some of these profiles are being updated with agreements between F4E and IO.

(e) **Human resources** (see ANNEX X). The table shows an indicative estimate of the Full Time Equivalent (FTE) staff assigned to the specific Action to cover all the activities carried out during 2019. Per each Action it is identified the "core" team and the additional staff (i.e. legal, financial, contractual, project management) assigned to the action according to the F4E matrix structure. Remaining staff from the Commercial Dept., Admin. Dept. and Office of the Director is instead allocated per action on a pro-rata basis.

(f) **Procurement plan**:

i. Main Procurement Initiatives (see Annex VIII): these are, per Action, the list of the foreseen main contracts with value higher than 144,000 Euros[21]. Amendments, claims, reimbursement, indexation, late interest and budget reserve are grouped together due to the sensitivity of this information. The list is based on the current information at the time of writing the Work Programme. During the implementation of the Work Programme activities, F4E may identify the need for new calls, 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 WP2019. Contracts that do not fulfill the Work Programme scope identified for each Action are not covered by this financial decision and therefore will not be authorized. A change to this list shall be considered as a non-substantial for the purposes of the Article 32 point 4 of the F4E Financial Regulations if not affecting the available budget for 2019 within the limit of the flexibility rule and if any related changes to the scope of the annual Work Programme do not have significant impact on the nature of the Actions or on the achievement of objectives of the multiannual Project Plan.

ii. Value per Action: ANNEX VI presents an indicative value of financial resources corresponding to each Action. F4E has evaluated the level of commitments planned for the Actions in 2019 by taking into account the progress of the project and the available manpower. A good implementation of the annual commitment is one of the objectives for F4E (see par.4.2.5). Any additional budget required and exceeding the currently available one will consist of unused appropriations adjusted to match the final needs.

iii. Indicative timeframe for launching the procurement and type of procedure/contract: the foreseen time of publication of calls and type of contracts is shown in ANNEX III. The dates are indicative only and based on the present understanding of the project development. For specific contracts and specific grants or use of Joint Procurements the foreseen time of publication of calls is not included as no formal publication will take place (the signature date is used to give anyway an indication of time). Publication of the call for tender is intended as the date of publication on the Industry Portal (for open procedures/call for proposals) and the date of the Invitation letter to be sent out to the Suppliers (for negotiated procedures). For restricted procedures and competitive dialogues this milestone refers to the date of the call for expression of interest (first phase of the procedure).

iv. The plan may cover some activities moved from previous years into WP2019 due to changes in the overall planning and priorities.

v. The plan does not (and cannot) include the consequences for the Action of PCRs and deviations approved by the IO Director General or his delegates in the frame of Reserve Fund Management Plan. As a result, these will be implemented under the budget line 3.6. For information, F4E will present to the final meeting of the GB each year, in an amendment to the Work Programme, a summary of the PCRs agreed within the year and the activities that the PCRs (including those agreed in previous years) have funded.

vi. Grants and specific Grants are clearly identified and information is provided to fulfill art.58 of the Financial Regulation (see ANNEX IX).

vii. Framework Partnership Agreements (FPA) or Framework Contracts (FWC) are included in the year of signature for clarification purposes only and do not constitute part of the financing decision.

3. Some of the Work Programme activities refer to provision for recurrent activities with the same ultimate objective of supporting the final achievement either of the design (e.g. CAD support,

[21] The threshold has been selected so to be in line with the FR.

engineering analyses, etc.), the manufacturing process (e.g. QA/QC Inspectors, engineering support for deviations analyses, CE marking, etc.) as requested in ITAs/PAs, or the site support services (access control and security, Facility Management Services, etc.). Therefore the description in term of the financing decision does not change significantly from one year to the next.

6.2.3 Objectives and Key performance Indicators

The objectives for the WP are:

Technical: F4E defines as its technical objectives the achievement on time of the selected milestones (see definition in par. 6.2.2). The technical objectives are provided in each Action (see par. 6.3).

Non-technical: F4E defines as its non-technical objective the implementation of the budget allocated to each Action (see ANNEX VI). As this definition is applicable to all the Actions, this objective is not repeated in the description of each Action.

The KPI for technical objectives is the variance (as defined in par. 4.2.6 Equation 1: Variance) while the KPI for the budget is the annual commitment (as defined in Equation 4: Annual commitment).

6.3 Actions

6.3.1 Action 1. Magnets

Action 1	Magnets

Pre-Compression Rings and Conductors

Progress of Work
For the Pre-Compression Rings (PCR) it is foreseen to continue the series production for both Automated Filament Placement and Pultrusion technologies. The final quantity of PCRs produced with each technology will depend on the results of the two technologies qualification.

Procurement Activities
For both technologies, the contracts to provide inspection services during manufacturing will continue.

Toroidal Field Coils

Progress of Work
The first of the three major contracts for the production of the Toroidal Field Coils (70 Radial Plates) was completed in 2017, while the second one, (10 Winding Packs) series manufacture will run all the year. The manufacturing planning may be adjusted to suit the delivery rate of the Coil Cases from the Japanese Domestic Agency.
The third major contract (WP cold test and Insertion) will be at full speed during 2019, depending also on the delivery dates of the TF Coil Cases from Japan. The first EU TF Coil will be completed in 2019.

Procurement Activities (contracts and grants)
The TF Coils transportation contract from the Insertion supplier to Cadarache shall be awarded in 2019. Throughout 2019, some inspector contracts will be renewed for Magnet activities.

Poloidal Field Coils

Progress of Work
In 2019 the series manufacturing of the Double Pancakes (DP) along with the winding pack assembly and impregnation of Poloidal Field (PF) Coil #5 and PF Coil #6 (by ASIPP in China) should be completed. The final assembly of these two coils will also take place and the production of the DPs for PF Coil #2 should also progress through to their winding and impregnation stages. Reconfiguration of most of the coil tooling to adapt to the larger PF Coil #3 and PF Coil # 4 will also happen in the year.

Procurement Activities (contracts and grants)
Specific contracts for further tests and contract extensions for inspection services may also be required in 2019.

ANNUAL OBJECTIVES

Milestone ID	Scope Description	Forecast achievement date	Type of milestone	PA
EU11.1A.19546	IO Approval for Assemble cooling pipe and instrumentation (8.4.4) TFWP01	Q3 2019	GB23 Predecessor	1.1.P1A.EU.01
EU11.1A.21823	Completion of Ground Insulation / TFWP14	Q1 2019	IC67/GB54 Predecessor	1.1.P1A.EU.01

EU11.1A.22866	Completion of TF-EU01 Gap Filling	Q2 2019	IC53/GB15 Predecessor	1.1.P1A.EU.01
EU11.3B.554710	Start of PF6 Cold Test	Q4 2019	IC54/GB14 Predecessor	1.1.P3A-B.EU.01
EU11.3B.554730	PF5 DP1 completed. Last PF5 DP	Q2 2019	IC42/GB12 Predecessor	1.1.P3A-B.EU.01

EXPECTED RESULTS AND TARGET

The main expected results for this action are:
1. Completion of the 7th WP.
2. 1st TF Coil completed.
3. PCRs all spare and lower PCRs completed.
4. PF5 Winding Pack assembly completed.
5. PF6 Winding Pack impregnation completed.

The target of 2019 is the achievement of a cumulative value expressed in kIUA (CAS)

PA 1.1.P1A.EU.01 Procurement of Toroidal Field Magnets	57.662
PA 1.1.P2A.EU.01 Pre Compression Rings	0.6
PA 1.1.P3A-B.EU.01 Poloidal Field Magnets 2,3,4,5,6	15.72
PA 1.1.P6A.EU.01 Toroidal Field Conductors	43.39
PA 1.1.P6C.EU.01 Poloidal Field Conductor	11.22881

6.3.2 Action 2. Vacuum Vessel

Action 2	Vacuum Vessel

Progress of Work

During 2019, the European Vacuum Vessel (VV) will continue to be in full production for all 20 segments of the 5 sectors, heading towards completion of five poloidal segments for the sectors 5 and 4. This assumes the successful execution of the outer shell welding at HHI (KO DA), enabling the European VV supplier to replicate the Korean manufacturing approach.

FREE-ISSUED ITEMS

The following free-issued items shall be delivered during 2019 by other DAs for assembly by the European supplier during segments and sectors fabrication:

- In-Wall Shielding parts from IN-DA
- Upper Port Stub Extensions from RF-DA
- Equatorial and lower Port Stub Extensions from KO-DA

SUPPORTING ACTIVITIES

Preparatory activities by the F4E VV supplier required to assemble the 4 segments into a sector will be ongoing:

- For sector 5: at Monfalcone (Mangiarotti)
- For sector 4: at Ortona (Walter Tosto)

Procurement Activities

Provisions will be made for the transportation frames, for the free-issued items received from the other DAs (i.e. additional tests at acceptance stage, if required), for the commissioning of the sectors baking facility and for site acceptance tests.

To support the work on the manufacturing sites, inspector contracts will be placed according to the manufacturing rate as well as technical support tasks possibly required for the resolution of the design changes, or studies in support of the non-conformities resolutions. Other provisions that include, inter alia, legal support or project management support may be requested for the follow-up of the main vacuum vessel contract.

ANNUAL OBJECTIVES				
Milestone ID	Scope Description	Forecast achievement date	Type of milestone	PA
EU15.1A.3037140	S5 PS1_Inner Assembly part with T-Rib at the back of Divertor Rail Machining	Q2 2019	IC58/GB16 Predecessor	1.5.P1A.EU.01
EU15.1A.3037380	S5 PS2-A2_RH Global Sub-Assy - Dim. Check and final Bevelling after FSHs EB Welding on inner shell	Q2 2019	IC58/GB17 Predecessor	1.5.P1A.EU.01
EU15.1A.3037400	S5 PS2-A2_Final Assembly – Toroidal Ribs plates welding (Nr.4 sub-assies)	Q2 2019	IC58/GB18 Predecessor	1.5.P1A.EU.01
EU15.1A.109090	S9 PS1_EBW Welding Repair (17th step)	Q3 2019	GB25 Predecessor	1.5.P1A.EU.01
EU15.1A.1130210	S9 PS2-B2_Central Sub-Assy - EB Welding of Port with bottom sub-assy and FSHs on inner shell	Q3 2019	GB25 Predecessor	1.5.P1A.EU.01

EXPECTED RESULTS AND TARGET

1. Completion of machining of sector 5 poloidal segment 1 Inner Assembly part with T-Rib at the back of Divertor Rail, under control plan 37;
2. Completion of Dimensional check and final bevelling after flexible housings electron-beam welded on inner shell for sector 5 poloidal segment 2, under control plan 224;
3. Completion of welding of sector 5 poloidal segment 2 Assembly, before IWS support ribs reverse, under control plan 276;
4. Completion of electron beam welding of flexible housings on inner shell of sector 9 poloidal segment 1, under control plan 35;
5. Completion of electron beam welding of all sub-sub-assemblies of central subassembly of sector 9 poloidal segment 2, under control plan 131.

The target of 2019 is the achievement of a cumulative value expressed in kIUA (CAS)

PA 1.5.P1A.EU.01 Vacuum Vessel - Main Vessel	62.937

6.3.3 Action 3. In Vessel – Blanket

Action 3	In Vessel - Blanket

Blanket First Wall

Progress of Work

By 2019 the manufacturing of blanket First Wall (FW) Full Scale Prototypes is planned to have been completed along with the preparatory activities launched on design improvement, fabrication automation and new material grades qualification. The tendering phase for the Series production and the negotiations with the potential manufacturers will be concluded.

Procurement Activities

In 2019 the main activity foreseen is the signature of the contract(s) for Phase I (engineering and set-up of the production line) for the production of the First Wall Panels. The above manufacturing activities will require the support of external resources and inspectors taken in the frame of on-going F4E framework contracts. Two Task orders will be signed to perform the High Heat Flux testing of two Full Scale Prototypes. Two options are currently considered to complete the Alternative Design Mock-Ups with a Be armour made of a new Be grade recently formally qualified for use on the First Wall.

Blanket Cooling Manifolds

Progress of Work

Feasibility studies of alternative Blanket Cooling Manifold (BCM) pipe supports will have been carried out followed by the signature of the Procurement Arrangement (PA) for the supply of the Manifolds.

ANNUAL OBJECTIVES

Milestone ID	Scope Description	Forecast achievement date	Type of milestone	PA
EU16.1A.11700	Signature of PA 1.5.P1A.EU.02 Blanket Manifold	Q4 2019	WP2019 Objective	1.5.P1A.EU.02
EU.16.01.20870	Delivery of Full Scale Prototype to Plzen, Czech republic - OPE-443 Lot 1	Q3 2019	GB37 Predecessor	1.6.P1A.EU.01
EU.16.01.21470	Final Non Destructive Examination (NDE) for Full Scale Prototype - OPE-443 Lot 2	Q3 2019	WP2019 Objective	1.6.P1A.EU.01
EU.16.01.21550	Delivery of Full Scale Prototype to Plzen, Czech republic - OPE-443 Lot 2	Q4 2019	GB37 Predecessor	1.6.P1A.EU.01
EU.16.01.100010	Contract Signed for Normal Heat Flux (NHF) First Wall Panels	Q4 2019	GB37 Predecessor	1.6.P1A.EU.01

EXPECTED RESULTS AND TARGET

1. End of the manufacturing of all the Full Scale Prototypes;
2. Start of the High Heat Flux Testing of two Full Scale Prototypes;
3. Conclusion of the High Heat Flux Testing on one Full Scale Prototype;
4. Conclusion of the negotiation for the tendering of the Series fabrication;
5. Signature of the contract for Phase I (Engineering and set-up of the production line). This is aimed at procuring the long lead items and preparing the production line for the following phases of qualification and series production;
6. Signature of the Procurement Arrangement for the Blanket Cooling Manifolds.

The target of 2019 is the achievement of a cumulative value expressed in kIUA (CAS)

PA 1.5.P1A.EU.02 Blanket Manifolds	0.4
PA 1.6.P1A.EU.01 Blanket First Wall	3.6

6.3.4 In Vessel – Divertor

Action 4	In Vessel – Divertor

Inner Vertical Target

Progress of Work

For the divertor inner vertical target (IVT), the manufacture of full-scale prototypes will continue at the four EU companies. In particular ,after the completion of the high heat flux testing of Ansaldo Nucleare plasma facing units at Efremov Institute (Russia), the assembly of the final Inner Vertical Target prototype

will start (contract OPE-138-01). The qualification of tube transition will be completed and the fabrication of the full size plasma facing units will start under the contracts for the qualification of additional suppliers (OMF-567 Lots 1,2,3).

Procurement Activities

The main activities foreseen concern the development of plasma facing units by using an alternative tube transition and using alternative tungsten grades. All the above activities will require the support of external resources and inspectors taken in the frame of on-going F4E framework contracts.

Cassette Body

Progress of Work

For the divertor cassette, the work will proceed under the contracts launched for the manufacturing of the cassette body pre-series. The main part of the work will consist in the engineering phase and launch of material procurement.

Procurement Activities

The main activities to be launched under this subsystem concern the follow-up of the contract(s) for the cassette body production. In fact, all the above manufacturing activities will require the support of external resources and inspectors taken in the frame of on-going F4E framework contracts. A minor procurement activity concerns the fabrication of ultrasonic test specimens to be used for the checking of testing equipment.

ANNUAL OBJECTIVES

Milestone ID	Scope Description	Forecast achievement date	Type of milestone	PA
EU17.01.100140	Cassette Body Series Quality Plan approved	Q2 2019	GB38 Predecessor	1.7.P1.EU.01
EU17.2B.92950	F4E to send IO the Qualification of the CuCrZr/316L tube-to-tube joint - OPE-567-01-01	Q2 2019	GB45 Predecessor	1.7.P2B.EU.01
EU17.2B.66620	F4E to send IO Ultrasonic / X-ray examination of steel structures - OPE-567-02-01	Q4 2019	GB45 Predecessor	1.7.P2B.EU.01
EU17.2B.84950	Geometrical shape and tolerances of twisted tapes - OPE-567-03-01	Q4 2019	GB45 Predecessor	1.7.P2B.EU.01
EU17.03.1040	Signature of PA 1.7.P2E.EU.01 Divertor Rails	Q4 2019	GB49 Predecessor	1.7. P2E.EU.01

EXPECTED RESULTS AND TARGET

1. Approval of the cassette body series quality documentation;
2. Signature of the contract for the ultrasonic test blind specimens;
3. Completion of the qualification of the tube transition at the additional suppliers;
4. Start of the fabrication of the plasma facing units at the additional suppliers;
5. Signature of the Procurement Arrangement for the Divertor Rails.

The target of 2019 is the achievement of a cumulative value expressed in kIUA (CAS)

PA 1.7.P1.EU.01 Cassette Body	0.54
PA 1.7.P2B.EU.01 Inner Vertical Target	3.09
PA 1.7.P2E.EU.01 Divertor Toroidal and Radial Rails	0.2

6.3.5 Action 5. Remote Handling

Action 5	Remote Handling

Progress of Work
The procurement of the Remote Handling Systems (RHS) will mainly focus on the continuation of preliminary design activities and starting in some areas the final design activities.

Procurement Activities
The activities to be launched under this action will aim at supporting the preliminary design activities and starting in some areas the final design activities. Specific contracts under the on-going framework of the main operational activities and grants will be foreseen, to cover the different needs.

Divertor Remote Handling System (DRHS)
Progress of Work
After closing the preliminary design phase with a successful design review, activities of DRHS will focus on the final design.

Procurement Activities
Specific contracts under the on-going framework contract will be signed in order to carry out final design activities.

Neutral Beam Remote Handling System (NBRHS)
Progress of Work
Activities will be covering preliminary design related activities of first and second priority items and starting gradually with the final design phase of the first priority items.

Procurement Activities
Specific contracts under the on-going framework contract will be signed in order to carry out preliminary design related activities of first and second priority items and starting gradually with the final design phase of the first priority items.

Cask and Plug Remote Handling System (CPRHS)
Progress of Work
It is foreseen to focus further on the preliminary design of different cask variants and gradually move towards the final design phase by preparing the design activity for one cask typology.

Procurement Activities
Specific contracts under the on-going framework contract will be signed in order to carry out the preliminary design of different cask variants and gradually move towards the final design phase by preparing the design activity for one cask typology.

In-vessel Viewing System (IVVS)
Progress of Work
The activities will be dedicated to the finishing of preliminary design activities and gradually moving towards the final design phase.

Procurement Activities
Specific contracts under the on-going framework contract will be signed in order to carry out the finishing of preliminary design activities and gradually moving towards the final design phase.

Common activities

Progress of Work

Engineering support activities will be performed for the four main operational activities, where needed. Complementary RH technology related design activities, qualification and prototyping will be carried out with a great focus on the field of control system, radiation hard technologies like electronics, camera.

Procurement Activities

Specific contracts under the on-going framework contract will be signed in order to carry out engineering support activities for the four main operational activities and for complementary RH technology related design activities, qualification and prototyping.

ANNUAL OBJECTIVES

Milestone ID	Scope Description	Forecast achievement date	Type of milestone	PA
EU23.01.900820	ADP approved for Manufacturing of Rad Hard BiSS ASICs Front End Electronics	Q3 2019	GB42 Predecessor	Transversal (2.3.P2,2.3.P3, 2.3.P5,5.7.P1)
EU23.03.05003	CPRHS design completed for one cask variant - Preliminary Design EPP cask Phase 2 Completed	Q4 2019	GB32 Predecessor	2.3.P3.EU.01
EU23.05.00440	EU NBRHS Monorail crane (Incl. other first priority items) Preliminary Design Hold Point released	Q4 2019	GB42 Predecessor	2.3.P5.EU.01
EU57.01.14047300	M12 - IVVS Task Order 08 Final ADP approved by F4E	Q3 2019	GB47 Predecessor	5.7.P1.EU.01
EU57.01.50120	IVVS Preliminary Design Approved	Q4 2019	GB47 Predecessor	5.7.P1.EU.01

EXPECTED RESULTS AND TARGET

1. Solving open issues of preliminary design review of Divertor Remote Handling System and starting the final design phase;
2. Advance with the preliminary design of one cask variant that is needed for the first assembly phase;
3. Preliminary design review of the monorail crane of Neutral Beam Remote Handling system that is a first plasma component and will be installed during the first assembly phase;
4. Preliminary design review of the In-Vessel Viewing System;
5. Advanced design of the radiation hard electronics and GENROBOT tool to support the four main procurements.

The target of 2019 is the achievement of a cumulative value expressed in kIUA (CAS)

PA 2.3.P2.EU.01 Divertor Remote Handling System	2
PA 2.3.P3.EU.01 Cask and Plug Remote Handling System	2.1
PA 2.3.P5.EU.01 Neutral Beam Remote Handling System	0.6
PA 5.7.P1.EU.01 In-Vessel Viewing System	1

6.3.6 Action 6. Cryoplant and Fuel Cycle

Action 6	Cryoplant and Fuel Cycle

Fuel Cycle

Progress of Work

In the frame of the PA for leak detection and localization system, following the PA signature for the first phase (Primary), the tendering process for the procurement of the Leak Detection systems will be started. The amendment of the second phase will be signed.
First Pre-PA activities in support of Hydrogen Isotope Separation system are expected in 2019. No F4E involvement is expected for WDS (Water Detritiation System), as contract for tanks should be finished in 2018 and first Pre-PA activities for WDS Main will be scheduled in 2020.
The type A radwaste treatment and storage system should be transferred to IO in 2019.
In the frame of the design PA for REMS (Radiological and Environmental Monitoring Systems), the tendering activities for the contract for Final Design and Procurement of Beryllium Monitors will be started.

*Procurement Activities*The activities in the field of vacuum pumping will grow significantly:

- For the Torus and Cryostat Cryopumps, after PA signature in 2018, the tendering for procurement of Torus and cryostat Cryopumps will be started in 2019 with expected contract signature by the end of the year.
- For MITICA and Neutral beam cryopumps, the contract execution for MITICA cryopump Lot1, Lot2 and Lot3 will continue focusing on activities for manufacturing and assembly.
- For Warm regeneration lines, last activities will be performed to achieve the contract completion in 2019.
- The activities for Front End Cryodistribution system will continue: the contract for procurement of Torus and Cryostat Cold Valve Boxes will focus activities on design and start of manufacturing; the contract for final design, manufacturing and delivery of the Johnston coupling and cryojumpers signed end 2018 will focus on design and manufacturing; contract I&C software design will be signed and tendering process for contract for cabling manufacturing will start.

Procurement Activities

- Contract supply signature for Torus and Cryostat Cryopumps
- TO to be signed under a Framework contract for the I&C of Front end cryodistribution system
- TO to be signed under a Framework contract for the MITICA cryopump installation tool

Cryoplant

Progress of Work

End of installation and most of site acceptance test for LN2 Plant and Auxiliary Systems components will take place in 2019. The contract for MITICA Cryoplant is expected to finish in 2019 with the on-site assembly and testing activities.

Procurement Activities

- Contract supply for utilities of Commissioning phase
- Contract services: Logistics for Test & Commissioning of LN2 Plant & Auxiliary System.

ANNUAL OBJECTIVES				
Milestone ID	**Scope Description**	**Forecast achievement date**	**Type of milestone**	**PA**
EU31.03.25800	PA Amendment for phase II - Cryostat LDLS signed	Q4 2019	GB18/IC76 Predecessor	3.1.P3.EU.01
EU31.01.11910	Final Design Review torus and Cryostat Front end Cryodistribution & connecting cryolines	Q4 2019	GB28 Predecessor	3.1.P1.EU.02
EU31.01.104400	Published call for tender for procurement Torus and cryostat cryopumps	Q4 2019	GB33 Predecessor	3.1.P1.EU.03
EU31.03.28000	Published call for expression of interest for procurement of components for Primary- Lead Detection and localization system	Q3 2019	GB35 Predecessor	3.1.P3.EU.01
EU31.01.303360	Acceptance of batches cryopumps2 and Thermal radiation shield at the places of delivery	Q3 2019	GB50 Predecessor	3.1.P1.EU.04

EXPECTED RESULTS AND TARGET

1. Published call for tender for procurement Torus and Cryostat cryopumps
2. Final Design Review Torus and cryostat Front End Cryodistribution & Connecting Cryolines
3. Review and approval of Qualification of the assembly process for the pumping sections
4. Published call for Expression of Interest for procurement of components for LDLS- Primary
5. Submission of Acceptance Data Package for Mechanical Acceptance Test of Equipment Inside Area 53 – LN2

The target of 2019 is the achievement of a cumulative value expressed in kIUA (CAS)

PA 3.1.P1.EU.03 Torus and Cryostat Cryopumps	0.522
PA 3.1.P1.EU.04 Neutral Beam Cryopumps	0.18
PA 3.1.P1.EU.01 Warm Regeneration Lines	0.2
PA 3.1.P1.EU.02 Front End Cryopump Distribution Cold Valve Boxes and Warm Regeneration Box	0.22979
PA 3.1.P3.EU.01 Primary Leak Detection and Localization System	0
PA 3.1.P3.EU.01 Cryostat Leak Detection and Localization System (phase II)	0
PA 3.2.P3.EU.01 Isotope Separation System	0
PA 3.2.P5.EU.01 Water Detritiation System - Tanks	3.252
PA 3.2.P5.EU.02 Water Detritiation System - Main System	0
PA 3.4.P1.EU.01 Liquid Nitrogen Plant and Auxiliary Systems	25.13609974
PA 6.4.P1.EU.01 for Design of REMS	0
PA 6.4.P1.EU.01 Amendment for REMS Design to procure Be-EN monitors	0
PA 6.3.P1.EU.01 Type A Radwaste Treatment and Storage System	0

6.3.7 Action 7 Antenna & Plasma Engineering

Action 7	Antennas and Plasma Engineering

Ion Cyclotron Antenna

Progress of work

The ICH antenna project is in the final design phase. The design is in progress through a Framework Contract signed in 2014. The work for the final design also includes prototyping/testing and R&D for the Faraday Screen and the RF vacuum window. Challenges in ICH Antenna project are still found in interfaces and requirements not yet stabilised, as well as in redesign of some components for compliance with loads and improved manufacturability.

Procurement activities

Design work will continue in 2019 by means of specific contracts for final design, analysis and requirement management and verification (under the existing framework contracts), as well as necessary support contracts. The R&D will be developed during 2019 by the signature of a contract for manufacturing and testing of ICH RF Window mock-ups and Prototype, as well as prototypes for other critical components of the Antenna and other R&D contracts as needed.

Electron Cyclotron (EC) Upper Launcher and ex-vessel equatorial launcher

Progress of work

The EC Upper Launcher project is in the final design phase. Main on-going activities will be related to design, prototype fabrication and testing as well as qualification and requirements identification & verification. Management of changes (requirements, and interfaces) as well as technical complexity and diversity of launcher components will be the main challenges.

Procurement activities

Support for Final and Build-to-print design will be ongoing during 2019, mainly performed through specific contract as part of an existing framework, in preparation of some of the Final Design Reviews. On prototyping, mm/wave components prototyping programme will be further developed with the signature of contracts for manufacture of window, valve and waveguide prototypes. Specific contracts under the existing framework contract for setup and operation of the EC components test facility (FALCON) are envisaged in 2019, including mm-wave testing of window and valve prototypes and manufacturing and testing of feedthrough prototypes. On engineering support, specific contracts for nuclear safety, analysis and engineering verification will be signed. Launcher procurement phase will start with contracts for series production and testing of the Diamond Disks, as well as some initial inspection and procurement support contracts as needed.

Electron Cyclotron Control System

Progress of work

The Electron Cyclotron Control System development follows a staged approach. In 2019 the first system will be delivered to ITER-IO: the EC Plant Control system (ECPC) Stage 2, which allows to operate the Gyrotron Commissioning Components (GCC) plant. The ECPC Stage 3 and the Subsystem Control Unit of the Upper Launcher (EC-UL-SCU) Stage 2 for first plasma will both start in 2019 the design phase.

Procurement activities

The main activities for 2019 will mainly regard the procurement of hardware and the installation of the ECPC Stage 2 and the design and FDR preparation of EC-UL SCU Stage 2.

Plasma Engineering (PE)

Procurement activities
A relevant part of the PE activity responds to (often urgent) requests and hence it is difficult to plan in advance. PE group in 2019 is going to focus on transversal activities in support to F4E procurements, as well as in providing in-sourcing for Engineering Support in this action.
As for 2019, Plasma Engineering Studies and Engineering Support for PE and Antennas will mainly not be credited through PAs.

ANNUAL OBJECTIVES

Milestone ID	Scope Description	Forecast achievement date	Type of milestone	ITA/PA
EU51.01.202315	Design for manufacture of IC RF Window mock-ups ready	Q4 2019	GB31 Predecessor	ITA (C51TD38FE)
EU52.01.950110	Full prototype of GCC Plant Control System implemented in FALCON	Q4 2019	GB44 Predecessor	5.2.P1B.EU.01
EU52.01.950120	Testing of TL prototypes: 63.5mm window mock testing completed	Q2 2019	GB46 Predecessor	5.2.P1B.EU.02
EU52.01.950130	Manufacturability study of UL Port Plug completed	Q1 2019	GB46 Predecessor	5.2.P1B.EU.02
EU52.01.950140	UL Port Plug Final Design Review	Q3 2019	GB46 Predecessor	5.2.P1B.EU.02

EXPECTED RESULTS AND TARGET

Design for manufacture of IC RF Window mock-ups ready
Full prototype of GCC Plant Control System implemented in FALCON
Testing of TL prototypes: 63.5mm window mock testing completed
Manufacturability study of UL Port Plug completed
UL Port Plug Final Design Review

The target of 2019 is the achievement of a cumulative value expressed in kIUA (CAS)

PA 5.1.P1.EU.01 Ion Cyclotron Antenna	0
PA 5.2.P1B.EU.02 Electron Cyclotron Upper Launcher	0
PA 5.2.P1B.EU.01 Electron Cyclotron Control System	1

6.3.8 Action 8. Neutral Beam and EC Power Supplies and Sources

Action 8	Neutral Beam and EC Power Supplies and Sources

Electron Cyclotron (EC) Gyrotrons, Power Sources and Power Suppliers (PS)

Progress of Work
For the EC Power Supplies, the manufacturing and testing of the MHVPS & BPS units will continue in accordance with the contractual plan, and the delivery, installation and commissioning of the first unit on the ITER site will start. The technical support to the EC Power Supplies activities will continue.
Procurement Activities
Options for the contract Procurement of Body PS & MHVPS will be released.

Neutral Beam (NB)

Progress of Work

NB Test Facility (NBTF) at RFX-Padua:

The experiments of SPIDER will continue in accordance with the applicable roadmap towards development of the Heating NBs for ITER. For MITICA, the activities will progress with commissioning and testing of vessel and power supplies (ISEPS), and with assembly of auxiliaries (CODAS, Interlock, and Safety) and progress of the MITICA Beam Source contract.

NB at ITER-Cadarache:

Subject to the negotiation to adapt the contractual schedule with the readiness of buildings, presently it is foreseen that in 2019, the procurement of Ion Source Extraction PS (ISEPS) for the ITER NBIs will progress with design finalization/manufacturing and with design finalization for AGPS/GRPS.

Procurement Activities

Specific contracts will be signed in support of NBTF activities, namely for NBTF Control, Interlock and Safety, MITICA diagnostics, MITICA Beam Line Components and PRIMA Assembly, Option for Vacuum and Gas Injection Plant, services for Static Tests and Inspection "Collaudo", NBTF technical follow-up and Spot Inspectors.

As far as cash contribution is concerned, during 2019 it may be necessary to amend the NBTF Agreement 2019 with RFX, to cover activities for the exploitation of SPIDER and construction and preparation for the exploitation of MITICA.

ANNUAL OBJECTIVES

Milestone ID	Scope Description	Forecast achievement date	Type of milestone	PA
EU52.04.22995[22]	1st Set of MHVPS & BPS Delivered to ITER Site by EU-DA	Q3 2019	GB56	5.2.P4.EU.01
EU53.06.06970	Start of Commissioning of ISEPS of MITICA	Q3 2019	Execution Milestone	5.3.P6.EU.01
EU53.06.07920[23]	Stage # 2 of Contract for EU-HVD1 & EU-Bushing - Start of Performance for NBI-1 (target date) (2.CM.0)	Q3 2019	GB30 Predecessor	5.3.P6.EU.01
EU53.TF.08700	Task Order Signed for SC#1 (Stage 2) MITICA Beam Line Components	Q3 2019	Contract Signature	5.3.P9.EU.01
EU53.TF.14000	Commitment for Specific Contract - MITICA CODAS 1, Interlock (FW Contract NBTF Control, Interlock and Safety)	Q4 2019	Contract Signature	5.3.P9.EU.01

EXPECTED RESULTS AND TARGET

1 1st Set of MHVPS & BPS Delivered to ITER Site
2 Commitment for Specific Contract - MITICA CODAS 1, Interlock (FW Contract NBTF Control, Interlock and Safety)

[22] Depending on availability of Building B15 in Cadarache.

[23] Depending on availability of Building B37 in Cadarache.

3 Task Order Signed for SC#1 (Stage 2) MITICA Beam Line Components 4 Specific Contract Signed - MITICA Diagnostics 5 Specific Contract Signed – PRIMA Assembly, Assembly The target of 2019 is the achievement of a cumulative value expressed in kIUA (CAS)	
PA 5.2.P3.EU.01 Electron Cyclotron Gyrotrons	0
PA 5.2.P4.EU.01 Electron Cyclotron High Voltage Power Supply	8.491
PA 5.3.P1.EU.01 Neutral Beam Assembly and Testing (OPTION A: ASSY + TOOLING)	0
PA 5.3.P2.EU.01 Heating Neutral Beam Beam Source	0
PA 5.3.P3.EU.01 Heating Neutral Beam Beamline Components	0
PA 5.3.P4A.EU.01 Heating Neutral Beam Vacuum Vessel & Drift Duct	0
PA 5.3.P4D.EU.01 Heating Neutral Beam Absolute Valve (BtP)	0
PA 5.3.P5.EU.01 Heating Neutral Beam Active Correction Coils	0
PA 5.3.P6.EU Neutral Beam Power Supply	14.16
PA 5.3.P9.EU.01 Neutral Beam Test Facility Components	17.61

6.3.9 Action 9. Diagnostics

Action 9	Diagnostics

Progress of Work

The Diagnostics team will continue the manufacturing of several components to be delivered to ITER for first plasma during 2019 including, among others, manufacturing of several magnetic sensors, captive components for the plasma position reflectometry system and the mineral insulated cabling that will provide electrical service to all the diagnostic sensors located in-vessel.

The design of all remaining Diagnostics systems will also progress mainly under the on-going Framework Partnership Agreements as will the integration of the Diagnostics systems in the Ports.

Several diagnostics systems will finalize either the preliminary design phase or the final design phase with the approval of the relevant design review including for: , in vessel and ex-vessel transmission lines for the plasma position reflectometers, electrical Tokamak services (feedthroughs and in-divertor components), the low field side collective Thomson scattering, diagnostics pressure gauges and the port plug components of the equatorial visible/infrared wide-angle viewing system and the radial neutron camera.

Procurement Activities

Procurement activities will be focussed in two different areas: placement of manufacturing contracts for the production of components to be delivered to ITER mainly for First Plasma and contract/grants for the completion of the design of less mature Diagnostics systems. Those will be complemented with contracts and task orders for the production and testing of prototypes and for the production of manufacturing specifications. In-sourcing of personnel to cover the needs of the team during 2019 is also foreseen.

Manufacturing contracts:

During 2019 the launch and/or signature of contracts for the manufacturing of electrical cabling and auxiliary components (including clips, clamps, bosses and critical junction boxes) is envisaged.

These electrical services will provide the transmission line for all the diagnostic sensors located in-vessel. They have been specifically designed to withstand the radiation inside the vacuum vessel and to be compatible with its ultra-high vacuum environment.

A contract will also be signed for the manufacturing of three distinct types of in-vessel magnetic sensors and for the captive components for the plasma position reflectometry system.

Design contracts:

Although most of the long term specific grants under the on-going Framework Partnership Agreements will already be in place for the design of the Diagnostics systems, new specific grants are foreseen for the design of the radial neutron camera. A framework contract for the design of the core-plasma Thomson scattering system will be signed, completing the portfolio of all major Diagnostics systems.

ANNUAL OBJECTIVES

Milestone ID	Scope Description	Forecast achievement date	Type of milestone	PA
EU55.01.102577	Delivery of RH Platforms Baseplates & Bosses (AA/AB/AC/AJ) Excluding Sector 6 Trapped Bosses from EU-DA to IO	Q4 2019	Delivery Milestone	5.5.P1.EU.01-02-16-17-19
EU55.01.203550	Contract Signed for Procurement and Delivery for Inner-Vessel Coils - Sensor Heads (LTCC) - Lot 1	Q2 2019	Contract Milestone	5.5.P1.EU.01-02-16-17-19
EU55.06.681710	Receipt of Approval of Preliminary Design Review for Feedthroughs components from IO to EU-DA	Q2 2019	GB36 Predecessor	5.5.P1.EU.18
EU55.09.407410	Published Call for Tender for Single Framework Contract for Services for Design for CPTS	Q2 2019	Contract Milestone	5.5.P1.EU.01
EU55.14.632140	Preliminary Design Review Meeting for EQ01 - T04	Q4 2019	Annual Objective	5.5.P1.EU.10-11-12-13-14

EXPECTED RESULTS AND TARGET

1. Delivery of remote handling platforms baseplates & bosses for the Inner Vessel magnetic sensors;
2. Contract signed for the procurement and delivery for Inner-Vessel Coils - Sensor Heads (Lot 1 - LTCC);
3. Approval of preliminary design review for Tokamak electrical feedthroughs;
4. Published call for tender for single framework contract for services for design for Core-Plasma Thomson Scattering;
5. Preliminary design review meeting for the equatorial port -01.

The target of 2019 is the achievement of a cumulative value expressed in kIUA (CAS)

PA 5.5.P1.EU.01-02-16-17-19 Diagnostics - Magnetics	0.69074
PA 5.5.P1.EU.03 Diagnostics - Bolometers	0.0
PA 5.5.P1.EU.05 Diagnostics - Plasma Position Reflectometry	0.09503
PA 5.5.P1.EU.07 Diagnostics - Pressure Gauges	0.13209
PA 5.5.P1.EU.18 Diagnostics - Tokamak Services	0
PA 5.5.P1.EU.15 Diagnostics - Radial Neutron Camera/Gamma Spectrometer	0.13769
PA 5.5.P1.EU.01 Diagnostics - CPTS 55.C1	0
PA 5.5.P1.EU.09 Diagnostics - Low Field Side Collective Thomson Scattering	0.17217999
PA 5.5.P1.EU.04 Diagnostics - Core-Plasma Charge Exchange Recombination Spectrometer	0
PA 5.5.P1.EU.06 Diagnostics - Equatorial Visible/Infrared Wide-Angle Viewing System	0.11724
PA 5.5.P1.EU.10-11-12-13-14 Diagnostics - Port Engineering Systems	0

6.3.10 Action 10. Test Blanket Module

Action 10	Test Blanket Module

Progress of Work

The overall focus of the activities in the development of the TBM project will be devoted to the Preliminary Design Phase of the Helium-cooled Pebble-Bed (HCPB) TBM System and Conceptual Design of the Water-Cooled Lead-Lithium (WCLL) TBM System (in collaboration with EUROfusion).

R&D activities will continue to define the Preliminary Welding Procedures Specifications needed for the manufacturing of the TBM box and with the development of EUROFER design and qualification rules.

The irradiation and post-irradiation examination of EUROFER samples started in 2015 and needed for its qualification will continue with the contract already placed.

The contract for Handling and Storage of EUROFER will continue in 2019.

Procurement Activities

The first specific contract of the Framework Contracts for the Preliminary Design of the HCPB TBM Set of the Ancillary Systems and of the related Safety and Accidental Analyses will be signed.

A specific contract for the continuation of Handling and Storage of EUROFER will be signed.
The Test Blanket Module procurement plan is not in response to PA or ITA but to the TBM Arrangements (TBMAs).

ANNUAL OBJECTIVES

Milestone ID	Scope Description	Forecast achievement date	Type of milestone	PA
EU56.02.1220300	TO#3 signed for Handling and Storage of EUROFER semifinished Products	Q1 2019	Contract Milestone	TBMAs
EU56.01.130320	FwC signed for Preliminary Design of TBM Set	Q2 2019	Contract Milestone	TBMAs
EU56.01.1226780	TO signed for Preliminary Design of TBM Set Phase I	Q3 2019	Contract Milestone	TBMAs
EU56.01.1230420	FwC signed for Preliminary Design of Ancillary Systems	Q2 2019	Contract Milestone	TBMAs
EU56.01.1232800	FwC signed for Safety Analysis for TBS Preliminary Design	Q2 2019	Contract Milestone	TBMAs

EXPECTED RESULTS AND TARGET

1. The start of the Preliminary Design Activities for the HCPB TBM Set, the Ancillary Systems and the Safety Analysis with the signature of the 1st Task Orders;
2. The start of the activities of the EUROfusion-F4E TBM coordinated programs.

Target credit NA

6.3.11 Action 11. Site and Buildings and Power Supplies

Action 11	Site and Buildings and Power Supplies

Progress of Work

The focus for 2019 will be on the completion works of the Tokamak Complex with the first stage concrete works coming to completion and the finishing works progressing. The prefabrication of the steel structure of the Crane Hall will be progressing with cladding installation to start.

Overview on TB03

The concrete Civil Works of Buildings 74 (Diagnostic Building) is foreseen to be completed with B74 (Diagnostic Building) foreseen to be weather-tight. and the first stage concrete Civil Works for Building 11 (Tokamak Building) is foreseen to be completed.

The installation of the Cargo Lift lobby doors, Port Cell doors and other shielding / confinement doors will continue.

Overview on TB04

Following novation of TB04 installation scope to IO, TB04 remaining procurement activities will be started for the Tokamak Complex and construction design will progress with IO approval of all levels (services) foreseen early 2020. The TB04 installation works in Auxiliary buildings will largely be complete by end 2019.

Overview on Remaining TBs

TB06: Tender Batch 06 (electrical distribution Load Centres and Building 36) will be near completion.

TB11: The finishing works (metal works, painting) will be completed in B74 (Diagnostic Building) and will continue in B11 and auxiliary buildings.

TB12: The Final Design Review should be undertaken for Buildings 34 / 37 with design moving into the Construction Design phase. The Final Design and Construction Design for Building 71 and Building 75 will be undertaken and submitted to IO for Approval.

TB13: The Final Design for Buildings 44(Emergency Power Supply Building Train A), 45 (Emergency Power Supply Building Train B), 46 (Medium Voltage Distribution Building LC/1A), 47(Emergency Power Supply Building Train B), 48 (Medium Voltage Distribution Building LC/2B) will be undertaken.

TB16: The infrastructure works will continue on zone by zone basis with design and construction works. The foundation works on Load Centres 01 should be completed ready for the installation of the Load Centre equipment by others.

TB19: Painting and coating works will commence in the Tokamak Complex

Procurement Activities[24]

TB12 contract and options will be signed covering B34 (NB Power Supply Building), B37 (NB high Voltage Power Supply Building), B71 (Control building – non PIC part), B75 (Fast Discharge Reactor Building).

TB13 contract will be signed covering B44 (Emergency Power Supply Building (Train A)), B45 (Emergency Power Supply Building (Train B)), B46 (Medium Voltage Distribution Building LC/1A) and B47 (Medium Voltage Distribution Building LC/2B).

[24] TB12, TB13 & TB19 contracts were initially part of WP2018. After the cut-off date of April 2018, their foreseen signature date was postponed from 2018 to 2019.
TB12 option 1 was foreseen to be part of WP2020. After the cut-off date of April 2018, the foreseen signature date was brought forward to Q1 2019.

The TB19 contract will be signed to cover painting and coating in the Tokamak Complex.
The call for tender for Tender Batch 18 (Tritium building civil works and finishing above L2) will be launched with a contract to be signed by end 2019. A call for tender for a new Architect Engineer in charge of the design activities associated with the Hot Cell Complex will be launched to enable a potential signature in 2020.
Specific contracts will be signed under ongoing framework support services and works contracts. This includes, for example, TB11, Facility Management, Site Security and Reception Services, Structural analysis, Building HMI Development, Engineering and Contract Management Consultancy Services (with special respect to cost and schedule assessment) and consultancy for advice on interpretation of French Regulatory Law 2012.
Changes and exercise of options to the ongoing services and construction contracts in relation with PCRs, input data delays, and re-allocation of scope between contracts will be implemented through amendments to the ongoing contracts in line with the provisions of the Financial Regulation.
Cash contribution will cover the ITER Site Host Agreement and the ITER Site Services Agreement.

ANNUAL OBJECTIVES

Milestone ID	Scope Description	Forecast achievement date	Type of milestone	PA
EU62.05.655	Tokamak Building (11) RFE Level B1 Stage 1 (RFE #2)	Q2 2019	RFE Milestone	6.2.P2.EU.05
EU62.05.20916	RFOC Tokamak Building (11) Central Pit	Q2 2019	GB13/IC50 Predecessor	6.2.P2.EU.05
EU62.05.460	Construction of Cryoplant Coldbox Building (52) Completed	Q3 2019	GB21	6.2.P2.EU.05
EU62.02.72066	IO approval of Contractor Final Design for Bldg 46	Q4 2019	GB24/IC64 Predecessor	6.2.P2.EU.05
EU62.05.20929	Ready for TB02 Crane rails installation in the Crane Hall area	Q4 2019	GB13/IC50 Predecessor	6.2.P2.EU.05

EXPECTED RESULTS AND TARGET

1. In 2019, the first stage Civil work construction of the B11 (Tokamak Building) will be completed and Crane Hall Steel Structure, Cladding & roofing ongoing. The B74 (Diagnostic Building) civil work construction, Cladding & roofing will be completed as well.
2. RFE Tokamak Levels B1 & L1 achieved.
3. Building services Construction Design of the Tokamak Complex approved for levels B2 to L2.
4. The Building services installation are due to be completed and Tests & Commissioning ongoing in the B13 (Assembly Hall Building) , B17 (Cleaning Facility Building), B51/52 (Cryoplant Buildings) and B61 (Site Services Building).
5. RFE B15 (RF Heating Building) achieved.
6. TB12: Tender Batch for B34 (NB Power Supply Building), B37 (NB high Voltage Power Supply Building), B71 (Control building – non PIC part), B75 (Fast Discharge Reactor Building – non PIC part): Design works ongoing.
7. TB13: Tender Batch for B44 (Emergency Power Supply Building (Train A)), B45 (Emergency Power Supply Building (Train B)), B46 (Medium Voltage Distribution Building LC/1A) and B47 (Medium Voltage Distribution Building LC/2B). Design works ongoing.
8. Taking Over of LC05/MV03, LC14, LC03/MV01, LC01, LC02, LC10/MV02 & MV05/MV04/MV06.
9. TB18 (B14 Civil works): Contract is planned to be signed end 2019.
10. TB12: Contract is planned to be signed Q1 2019.
11. TB13: Contract is planned to be signed Q1 2019.
12. TB19: Contract is planned to be signed Q1 2019.

The target of 2019 is the achievement of a cumulative value expressed in kIUA (CAS)

COMMON	41.3956001
TOKAMAK COMPLEX	45.33458406
AUX BUILDINGS TB03/TB04	71.4536391
AUX BUILDINGS D&B TB05	15.15
AUX BUILDINGS D&B TB06	7.21071001
AUX BUILDINGS D&B TB07	6.37442002

AUX BUILDINGS TB09/TB10	0
AUX BUILDINGS D&B TB12	0
AUX BUILDINGS D&B TB13	0
AUX BUILDINGS D&B TB17	0
LOAD CENTERS	7.91699992
INTERCONNECTING ACTIVITIES	0.72834998
COMMON CONTRACTUAL ACTIVITIES	42.09
PA 6.2.P2.EU.06 Headquarters Building	13.85

6.3.12 Action 12 Cash Contributions

Action 12	Cash Contributions

Overview

Cash Contribution to IO

In accordance with the ITER Agreement, the financing of the ITER Organization is ensured through contributions made to IO in the form of cash (10%) or in kind (90%) from Members. Cash contributions from ITER Members to IO are determined annually, based on estimates of the IO budget for the following year. The final figure is approved or modified by the ITER Council.

Cash Contribution to Japan

According to the ITER Agreement, there is a transfer of procurement responsibility from Euratom to Japan under the supervision of the ITER Organization. This is financed through a cash contribution from EU to Japan paid by F4E. An update of the schedule of payments is provided by the Japanese Domestic Agency (JA DA) twice a year.

ANNUAL OBJECTIVES

	2019
Cash to IO – Commitment (in MEuros)[25]	253.5[26]
Cash to Japan – Commitment (in MEuros) • PA 3.2.P4.JA.01 (Atmospheric Detritiation System) • PA 5.3.P6.JA.02 (NB Power Supplies for Cadarache)	3.956 35.643

EXPECTED RESULTS AND TARGET

The expected result for this Action is to pay to IO the contribution as agreed by the ITER Council and to Japan as defined in the schedule for the relevant credits assigned to JA DA for those components transferred by the EU to them.

As far as the cash to IO is concerned, the target for 2019 is to commit the cash contribution for 2020 according to the decisions due to be taken by the ITER Council in November 2019.
As far as the cash to Japan is concerned, the target for 2019 is to commit the amount agreed in the Annexes C to the Japanese PAs 3.2.P4.JA.01 and 5.3.P6.JA.02 due to be signed in Q2 2019.

[25] The cash contribution required by IO for the year N is committed by F4E at the end of the year (N-1). E.g. the commitment shown here in WP 2019 is the cash contribution to IO for 2020.

[26] Update from IO on 8th August 2018.

6.3.13 Action 13 Technical Support Activities

Action 13	Technical Support Activities

The procurement of the supporting activities is mainly performed through Framework contracts and specific contracts.

Technical Support to In-Kind Procurement

Engineering Support activities

Technical Support Service Unit (TSS) during 2019 will continue supporting the ITER Departments project Teams (and to a limited extend the BA department) by providing them technical expertise in the key domains of engineering and fusion technologies.

The unit will provide technical expertise in the following areas:

Design office activities, Analysis: Mechanical, Structural Dynamics, Civil engineering, Fluid Dynamics, Electro Magnetism, Nuclear Analyses; Design Codes and Standards; Instrumentation and Control; Metrology.

Beyond the preparation of task orders, the procurement activities in TSS will be mainly focused on renewing Framework Contract providers for keeping the same level of support to project teams.

Material and Fabrication

The Materials and Fabrication group at the Technical Support Services has the aim to support the ITER Departments Project Teams (and to a limited extent the BA department) by providing technical expertise in the domains of Materials Science, Materials Technologies and Manufacturing Processes.

The group supervises development and qualification of material and joints. The group also supports material procurement and fabrication follow-up.

The focus for 2019 will be to support critical component fabrication for Magnets, Vacuum Vessel and In-Vessel.

Assembly Integration and Validation (AIV)

Support to F4E management on review and assessment of proposed AIV policies and plan. Support to Configuration Management in the expected upcoming set of PCRs/Deviation related to AIV scope of work; support to F4E teams in relation to AIV responsibilities on site (e.g. logistics, deliveries portal); supporting decisions on transfer of F4E AIV responsibilities to IO.

Nuclear Safety

The scope includes the oversight of the implementation of all nuclear safety requirements by F4E and its contractors. The Nuclear Safety activities also provides support to the project teams involved in PIC/PIA (Protection Important Components/Activities) to ensure compliance with the necessary regulation. This includes support to the various safety analyses, identification of optimum design solutions and review of relevant documentation.

Quality Assurance, Quality Control

The scope includes the support to project teams to ensure that the F4E quality requirements are correctly implemented and managed for the F4E contribution to ITER. In particular, support is provided in both domains of Quality Assurance (QA) and Quality Control (QC).

As for QA, support aims at ensuring that F4E's QA processes are properly followed in the development of the different ITER projects and in line with the F4E Quality Management Policy. As for QC, the support

to the projects will be provided in the follow-up and control of the activities performed by F4E's contractors.
To this aim, a framework contract will be signed during the year.

CE marking
The scope includes the support to the project teams in providing assessments, for each PBS, of the compliance with CE marking directives & regulations (mainly the Construction Product Regulation, the Machinery Directive, the Low Voltage Directive and the Electromagnetic Compatibility Directive).

Systems Engineering
The scope includes the development and implementation of Systems Engineering practices, processes and tools and to support their correct deployment by the Project Teams. To cover this scope, external manpower is needed across several areas, including Requirements Management and Verification (RMV) with more emphasis on Verification, Configuration Management, Design and Manufacturing Readiness Reviews, Interface Management, and other Systems Engineering topics.
A set of specific contracts will be signed during the year to continue to support the F4E Project Teams both at Barcelona and Cadarache.

Office of the Chief Engineer
The Office of the Chief Engineer will support the Head of ITER Programme Department respect to the scope of the EU in-kind components for ITER and representing F4E towards the ITER Organisation. Among the main tasks are: the interaction with IO on the project technical baseline including change control and participation to the Configuration Control Boards, the management of transversal technical issues impacting several PTs, the coordination of F4E participation to ITER Independent Reviews and working groups focused on technical matters and the assurance of consistency, adequacy and maturity in relevant Design Reviews.
The procurement activities of the Office of the Chief Engineer for 2019 are devoted to extend the in-house Configuration Management and Issues Management capabilities with expert support from specialized companies.

ANNUAL OBJECTIVES

Milestone ID	Scope Description	Forecast achievement date	Type of milestone	PA
EU.ES.02.51240	Framework Contract Signed for support in the area of thermohydraulic and fluid dynamic analyses	Q3 2019	Contract Signature	All
EU.ES.02.58460	Contract signed for support in the area of structural dynamics for earthquake and dynamic-type transient load	Q1 2019	Contract Signature	All
EU.MF.01.20220	Contract Signed for Provision of material characterization at cryogenic temperatures	Q3 2019	Contract Signature	All
EU.NS.01.30640	Task Order signed for Nuclear Safety Support	Q2 2019	Contract Signature	All
EU.PM.49340	OMF-557 Task Order signed for QA Support to QA Group	Q2 2019	Contract Signature	All
EU.PM.3033480	Framework Contract signed for Quality & Surveillance Inspection	Q1 2019	FWC Signature	All
EU.PM.3023240	OMF-436 Lot 5 Task Order signed for CE Marking Support activities	Q1 2019	Contract Signature	All

EU.PM.44240	OMF-783 Lot 1 Task Order signed for CM & SE Senior Support	Q3 2019	Contract Signature	All
EU.PM.3030690	OMF-783 Lot 2 Task Order signed for MIR Layer DXL Support	Q4 2019	Contract Signature	All
EU.PM.45380	Task Order Signed for Expert Support in Deviation and PCR control	Q1 2019	Contract Signature	All
EU.PM.46340	Task Order Signed for Support in Issues Management	Q2 2019	Contract Signature	All

EXPECTED RESULTS AND TARGET

1. Implementation of the framework contract which will provide F4E with framework contracts in the field of Thermo Hydraulics and Fluid Dynamics and Seismic analysis and design of building and mechanical components of the ITER facility
2. Completion of PLM project Phase I
3. Implementation of the Configuration Management In-depth Independent Reviews (IIR) outcomes
4. PA Applicable Documents Update
5. The expected result for the activities in Nuclear Safety, Quality Assurance & Quality Control, CE Marking, System Engineering is to provide the requested support to all Project Teams on these matters.

The target for 2019 is to contribute in achieving the cumulative credit forecasted for each action in this WP2019 thanks to the support granted to the work under each specific action.

Transportation

During 2019, TSS/Transportation will be in charge of the management, on the F4E side, of technical aspects of the joint procurement with IO for the transportation of ITER components to the site in Cadarache. The scope includes the transportation of all ITER Components from the port/airport of entry (Fos or Marignane) to ITER site.
During 2019,this activity will mainly cover transportation of NON EU loads between Fos and Cadarache (EU-leg). The main cost driver is for Highly Exceptional Loads (HEL) that follows the dedicated ITER itinerary.
In 2019 focus will be again put on the optimization of the number of HELs and the related number of convoys, this jointly with IO, all DA's and Daher.

ANNUAL OBJECTIVES

Milestone ID	Scope Description	Forecast achievement date	Type of milestone	PA
EU.PM.3004900	Extension of Convention 3 for Gendarmerie for Real Convoys. Period 2020-2024	Q4 2019	Contract Signature	All

EXPECTED RESULTS AND TARGET

1. Transportation of Highly Exceptional Loads amongst others, first JA-DA TF coils, F4E PF6 from China and from KO-DA first VV-sector well as Sub-Assembly tooling including up-ending tool (2 HEL) between Maritime Port of Marseille and ITER site.
2. Extension of Gendarmerie contract for support on HEL convoys (OPE-597).

Target Credit NA

Other Technical Support Activities

Programme Management

Main focus will be the performance monitoring and reporting, scheduling support, the maintenance and update of the costing, the further improvement of the risk registers in all project areas, the increase in the number of standard reports available to the organization, the implementation of the Internal

Compliance Programme for export control. Overall project management support and support to related tools are included, too.
Specific contracts will be signed during the year to support the F4E Project Teams at Barcelona and Cadarache.

Other Expenditures
A general provision is foreseen for experts and consultancy service (e.g. participation to specific committees, support/advice to F4E Management, technical support, management retreat, etc.) as well as provision for interim management services, operational missions and audit.
It also includes the provision of ICT support (hardware, software and services) for the specific benefit of the operational activities.
Logistic and legal support to operational activities are also included.

ANNUAL OBJECTIVES

Milestone ID	Scope Description	Forecast achievement date	Type of milestone	PA
EU.PM.3050500	OMF-556 Task Order signed for Planning & Scheduling Support	Q1 2019	Contract Signature	6.2.P2.EU.01
EU.PM.3050120	OMF-556 Task Order signed for Planning & Scheduling Support	Q1 2019	Contract Signature	1.5.P1A.EU.01
EU.PM.3063610	OMF-895 Lot 1 Task Order signed for Project Performance Management Support	Q3 2019	Contract Signature	5.5.P1.EU.01
EU.PM.3062410	OMF-895 Lot 3 Task Order signed for Planning Support	Q3 2019	Contract Signature	5.3.Px.EU.01
EU.PM.3060440	OMF-895 Lot 2 Task Order signed for Risk Management Support	Q4 2019	Contract Signature	All
EU.PM.3058920	OMF-831 Lot 2 Task Order signed for SAP Business Objects Support	Q4 2019	Contract Signature	All

EXPECTED RESULTS AND TARGET

The expected result for this Action is to provide the requested support to all Project Teams on matters concerning Programme management and additional services (i.e. experts, logistics, ICT, legal, etc.).

The target for 2019 is to contribute in achieving the cumulative credit forecasted for each action in this WP2019 thanks to the support granted to the work under each action.

6.3.14 Action 14 Broader Approach

Action 14	Broader Approach

JT-60SA
Progress of work
In 2019 the remaining parts of EU contribution will be delivered to the JT-60SA site. The actions will focus on the completion of fabrication, testing, transportation and on-site installation. Preliminary activities will be initiated in preparation for BA Phase II.
The installation of the Electron Cyclotron Resonance Heating power supplies will be delivered to site, installed and tested.
The fabrication and delivery to Japan of the Spare TF Coil Winding Pack is going to be completed mid 2019 and delivery to the JT-60SA site is foreseen within the third quarter of 2019.

Procurement Activities (contracts and grants)
The activities under the responsibility of F4E are carried out through grants, specific contracts under existing/new framework contracts or existing/new supply and service contracts.
On the basis of risk assessment, it is also identified the possible need to perform actions in the area of re-machining of components, replacement of parts and systems on short notice, execution of on-site repairs and re-tests. F4E on site presence for the follow-up of the activities of installation of systems and components will continue to be supported by experts and health and safety services to ensure safe operations. Engineering and other auxiliary activities in support of the integrated assembly and commissioning are also planned. Contracts in support of the BA Phase II preliminary activities may be placed in 2019.

IFMIF/EVEDA

Progress of work
In 2019 all work will be devoted to the LIPAc (Linear IFMIF Prototype Accelerator) installation and commissioning. The LIPAc operation at Rokkasho will undergo a transition phase from testing the subsystem at 5 MeV to commissioning the full accelerator at 9 MeV. In order to start the final LIPAc commissioning phase, the SRF Linac will be assembled in the clean room facility and completed in the accelerator vault. In addition, it is intended to use the time before its setting-up in early 2019 to extend the testing of subsystems at 5 MeV from pulsed operation to steady state operation.

Procurement Activities (contracts and grants)
The work described above falls under the responsibility of F4E and will be carried out through existing/new supply and service contracts. Additional contracts will have to be placed for services, materials and components to support these continued testing activities. F4E will be continuously supported by experts, and on-site health and safety services to ensure safe operations, funded respectively by F4E through expert contracts and specific contracts. Cash contributions will be made to maintain project team common expenses (e.g. missions) and common funds (e.g. repairs and spare parts).

IFERC

Progress of work
The IFERC project comprises two activities, DEMO design and R&D activities, and REC (Remote experimentation Centre). The DEMO design activities are at the pre-conceptual design level and are performed by EUROfusion acting as a Voluntary Contributor. Integrated tests (participation in the operation of a European Tokamak from Rokkasho) will take place in 2018/2019.

Procurement Activities (contracts and grants)
The REC activities are mostly under the financial responsibility of F4E, and are performed under F4E contracts or agreements of collaboration with EUROfusion, to provide software and services.

ANNUAL OBJECTIVES

Milestone ID	Scope Description	Forecast achievement date	Type of milestone	PA
EU.BA.01.6520	Delivery of Acceptance Test of ECH PS	Q2 2019	Delivery milestone	STP-EU-ECRHPS
EU.BA.01.6580	Delivery of JT-60SA Toroidal Field Magnet – Spare TF coil 21	Q4 2019	Delivery milestone	STP-EU-TFCSP
EU.BA.01.6420	Delivery of Beam Dump Ionization Chambers	Q1 2019	Delivery milestone	IFMIF-EU-PA-07
EU.BA.01.6460	Cryomodule assembled	Q2 2019	WP milestone	IFMIF-EU-PA-04

EU.BA.01.5260	Delivery of software codes and reports on remote participation tests	Q3 2019	Delivery milestone	IFERC-RECPA01-EU

EXPECTED RESULTS AND TARGET

1. The installation of the superconducting magnet power supplies (SCMPS) for JT-60SA is completed.
2. The acceptance test of the electron cyclotron range of frequency (ECRF) system for JT-60SA is completed.
3. The cryomodule of the Linear IFMIF Prototype Accelerator (LIPAc) is assembled.
4. The Beam Dump Ionization Chambers for LIPAc are delivered to the Rokkasho site.
5. Software codes and reports on remote participation tests are delivered.

The target of 2019 is the achievement of a total value of 11.624 kBAUA (CAS)

STP-EU-ECRHPS	1.492
STP-EU-TFCSP	5.197
IFMIF-EU-PA-AF04	3.06
IFMIF Common Fund	0.13
IFMIF Common Expenses	0.12
IFERC-RECPA01-EU	0.75
IFERC-T2PA01-FR	0.055
IFERC-DDA	0.820

ANNEXES

ANNEX I 2019 Work Programme Budget Summary

Budget article		Commitment appropriations (EUR)
3 1	ITER construction including site preparation	468,213,200.40
3 2	Technology for ITER	3,304,000.00
3 3	Technology for Broader Approach & DEMO	11,800,000.00
3 4	Other expenditure	4,982,000.00
3 5	Appropriations from the ITER Host State contribution	130,000,000.00
Total Title III of the Budget		**618,299,200.40**
3 1 to 3 4	Additional non-budgeted revenue	0.00
3 5	Host State contribution carried over from previous year (Available in July)	0.00
3 6	Additional revenue from the Reserve Fund Allocation scheme with ITER Organization	10,700,000.00
Total amount available for the operational expenditure		**628,999,200.40**

Work Programme		Commitment appropriations (EUR)		
		Grants	Procurement	Cash
3 1+3 5+3.6	Expenditure in support of ITER Construction	1,693,000.00	312,623,630.40	294,596,570.00
	Sub total ITER construction + RF	**608,913,200.40**		
3 2	Design and R&D in support of ITER, not credited	0.00	2,039,000.00	1,265,000.00
	Sub total technology for ITER	**3,304,000.00**		
3 3	Expenditure in support of Broader Approach	0.00	11,575,000.00	225,000.00
	Sub total Technology for Broader Approach and DEMO	**11,800,000.00**		
3 4	Other Expenditure (EU.PM.PM)		4,982,000.00	
	Sub total Other Expenditure	**4,982,000.00**		
Totals Operational Expenditure		***1,693,000.00***	***331,219,630.40***	***296,086,570.00***
		628,999,200.40		

(As of 1st August 2018)

ANNEX II Essential selection, award criteria and Upper funding limits for Grants

With regard to grant actions referred to in this Work Programme, the essential selection and award criteria are:

Essential Selection Criteria

- The applicants' technical and operational capacity: professional, 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.
- Effectiveness of the implementation as well as of the management structure and procedures in relation to the proposed action.
- Cost-effectiveness and sound financial management, specifically with regard to F4E's needs and objectives and the expected results.

With regard to the specific action, more details will be provided in the call for proposals. Thresholds and weighting for the essential and additional award criteria will also be indicated in the call for proposals.

A proposal which does not fulfill 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 aggregated amounts for the actions are defined in this Work Programme.

Upper funding Criteria

With the entry into force of the recast F4E Financial Regulation and Implementing Rules on 1st January 2016, the following upper funding limits apply for grants:

1.	Research, technological development and demonstration activities	40%
2.	Purchase/manufacturing of durable equipment or assets and of ancillary services approved by the Joint Undertaking as necessary to carry out such activities	100%
3.	Coordination and support actions, including studies	100%
4.	Management activities, including certificates on the financial statements, and other activities not covered by paragraphs 1 and 2	100%

ANNEX III Time of call for the procurement plan

Indicative number, type of contract and timeframe for launching the procurement procedures.

Procurement Procedures	Q1 2018	Q2 2018	Q3 2018	Q4 2018	Q1 2019	Q2 2019	Q3 2019	Q4 2019
P Serv - Contract	1	2	3	3	9	10	3	8
P Supply - Contract	1	5	6	12	9	8	13	8
Pserv - Specific Contracts	4	14	14	22	28	30	25	24
PSupply - Specific Contracts	0	3	5	4	5	3	3	3

NB:

- During the implementation of the Work Programme activities, F4E may identify the need for new calls, 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 WP2019.
- When a call for tender is not defined yet, the call is indicativelly assigned to 6 months before the signature of the contract.
- For the specific contract, as they do not have call for tender, the table refers to its signature date.

ANNEX IV Risk and Opportunity Management

F4E Risk Management Framework

The Risk Management at F4E currently consists of 3 different levels: Corporate (implemented since 2012), Project Level (the bigger part implemented since 2011) and the Supplier Risk Management. All risks and opportunities are evaluated in probability, schedule and cost. The information of the risk exposure is used to calculate the risk provision of the Estimate at Competition.
Suppliers risk registers are provided by the different suppliers once the contract is signed in order to share and inform F4E of the identified risks and the planned mitigation actions.

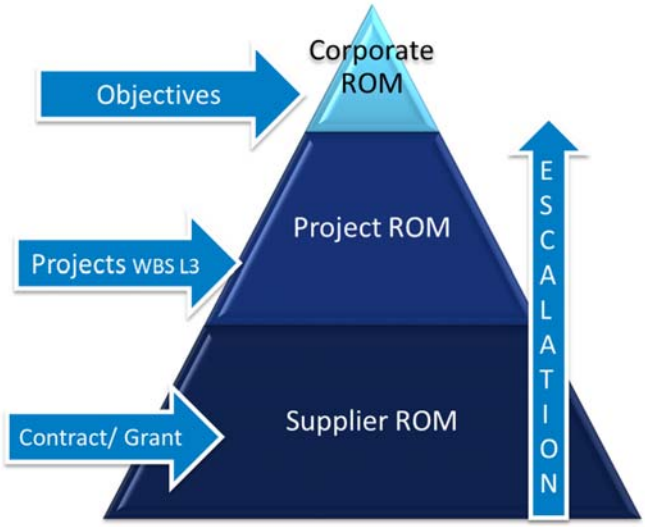

Figure 13 . F4E Risk Management levels

Corporate Risks

The Corporate Risk and Opportunity log is validated at the Senior Management Meeting and the sources of risk identification are the following:

1. Critical Project Risks (local).
2. Project aggregated risks.
3. Risk from F4E horizontal activities.
4. Risk identified during Audits/Reviews.

The summary as May 2018 update is shown in the following table. F4E has 4 “Very High” risks, while another one decreased to “High”. The action plans to control those risks are critical for F4E and the cost impact associated to them is the result of the identified cost impact by the probability of the risk.

ID	Description	Note for the update May 2018	TREND Nov-17/May-18
CR-065	Changes in requirements or additional scope	Updated action plan	●
CR-053	Requirements not properly propagated	Updated action plan	●
CR-003	Delay in the reception of data/items from the IO or other DA's during the implementation of the PA's	Update action plan, pending agreement on need dates to reevaluate	●

CR-061	Delay of systems in Critical Path to FP in 2025	Update action plan, pending agreement on need dates to reevaluate	●

Table 30 . List of F4E Very High risks

Risks associated to the Multi Annual Programme

From a multi-annual perspective, a large list of risks exists and they can be associated with each of the procurements depending on the phase of development.
Some of the risks that are considered for each system are the following ones:

Threat	Mitigation Action
Lack of Competition in the industry causing increase of costs.	Reinforce market analysis. Procurement with negotiated procedure. In specific cases, qualify additional suppliers to create competition.
Lack of expertise in industry or laboratories due to the long-lead procurements.	These two risks are considered as directly linked to the previous one and therefore that mitigation applies.
Lack of continuity in the fusion research causing lack of interest from industry.	
First of a kind R&D project: technical requirements may not be met as expected.	Risk accepted. Testing in place where needed.
Large number of deviations and non-conformities causing delays and over-costs.	Enhancement of follow-up and quality control at factory.
Late input by IO of design or late changes triggering delays and over-costs.	Strict configuration management of all packages by Project Teams. Put on hold procurement of equipment until all systems have reached construction design.
Possible claims from companies causing an increase of costs.	Implement working group in claims management (BIPS)

As far as the EU in-kind procurements are concerned, the risk analysis has progressed through in-house analysis and feedback from the suppliers (whenever a manufacturing contract was in place).

Risks associated to the Work Programme 2019

As far as Work Programme 2019 is concerned, the following preliminary list of main risks has been derived (not in order of priority). A provision for these risks has been included in the WP when necessary.

Threat	Mitigation Action
Lack of clear definition of requirements from IO, especially for the safety ones	Increase awareness among Project Team members and harmonise and challenge requirements, with special attention to the Safety ones.
Uncertainties in the manufacturing process	Include an appropriate buffer in the planning to clarify possible issues.
Delay in the reception of the free-issued items from other DAs	Plan regular meeting with the DAs and directly involve IO in the topic. Agree delivery dates with both DAs and IO.
Company failed in passing either a qualification step or full-scale prototype acceptance tests	Prepare plans to launch new contracts in parallel for manufacturing the item with different technology.
Lack of competition resulting in overpriced bids	Qualify additional suppliers to create competition (multi-annual activity)
Delays due to lack of agreement with contractors on the consequence of changes received from IO through F4E	Implement working group in claims management.
Slippage in BA activities due to either delayed or no funding from Voluntary Contributors.	Contingency planning.

ANNEX V Quality Assurance

Integrated Management System Framework

The Integrated Management System being applied, which includes all quality-related processes, merges the requirements of the two control environments in which F4E operates since the beginning: the (ISO-based) ITER-wide Quality System, which is intended to ensure the performance of ITER and the compliance with the nuclear safety requirements, and the (COSO-based) Internal Control Standards as implemented by the European Commission.

Quality processes are implemented through a Quality Assurance Group, which provides an effective and efficient method to perform the tasks, a perspective on the organization and its risks. It allows F4E to continually improve the way of working and to reinforce the F4E corporate culture towards the stakeholder's expectations.

The Quality Assurance Group will continue foster the quality approach and quality system in F4E, as well as to contributing to the process development and improvement in F4E.
As the project continues its evolution into manufacturing, further effort will be put on Product Quality Assurance and Quality Control.

Figure 14 . F4E Integrated Management System

Quality Related to ITER Procurements

The F4E Integrated Management System, which includes all quality processes, implements, for safety relevant components and activities, the requirements of the INB Order of the 07 February 2012 (replaced from the 01 July 2013 the Quality Order of 10 August 1984), emphasizing putting the application of quality to assure safety.

The overall framework to achieve the quality criteria for items and services provided by F4E to the ITER project is established in the F4E QA Programme for the ITER Project (a specific project QA Programs of the quality system). This QA Programme (for the procurement of the EU in-kind components) is approved by the F4E Director and by IO.
As part of the formalization and approval of the F4E commitments toward the ITER Project, F4E develops a strategy proposal for each project. Based on this strategy, F4E issues a specific Project Management Plan describing and defining the implementing provisions, the interfaces and breakdown of the project.

Suppliers are bound to follow a Quality System for their work. They provide a dedicated Quality Plan that describes the quality provisions to be implemented in order to comply with the F4E Supplier Quality Requirements as defined in the call and contractual documentation. Once approved by F4E, it can be

used and is physically transferred to F4E at the end of the collaboration in order to ensure traceability of the delivered products over the whole project life.

Quality Related to Broader Approach Procurements

For the BA projects a project-wide Common Quality Management System (CQMS) was introduced. The CQMS describes general features of common work within each project, allowing the Integrated Project Team to function as a single team with shared procedures and tools. In addition the Home Teams in each project are bound by their respective JA and EU Quality Management Systems, which themselves point to the Quality Management Systems of the actual procuring institutions concerned. The specific Procurements QA follow the same rules and principles as the ITER Project procurements.

Product Quality Assurance (QA) and the Quality Requirements

Quality Assurance (focused on providing confidence that quality requirements will be fulfilled) encompasses several tasks, including:

1. Support Project Teams in preparation and implementation of ITAs and PAs, ensuring compliance with the F4E QA Programme.
2. Support Project Teams in preparation and implementation of Contracts and Grants, ensuring compliance with the F4E QA Programme.
3. Ensure that quality processes are aligned with customer requirements and procedures are followed and implemented.
4. Training on QA to all the operational officers and suppliers.
5. Verification of the Suppliers Quality Plans and all the contract implementation quality documentation, including supplier quality audits and surveillance.
6. Coordination of Nonconformities and corresponding remedial actions and corrective and preventive action plans raised and registered in F4E.
7. Perform audits and surveillance activities at F4E and supply chain.
8. Support to and liaison with the management in all topics involving QA.

The standard quality and management requirements are defined in the ‘Supplier Quality Requirements’ (F4E-QA-115). For every procurement, the contractual Management Specification refers to that specification, as a base for requirements, defining the applicability of each requirement to the Supplier’s project organization and the dispositions implemented to ensure a proper monitoring of the contract or grant agreement. The Quality Assurance of the contracts/grants is under the responsibility of the Quality Assurance Group.

Product Quality Control (QC)

Quality Control (focused on fulfilling quality requirements) is applied during the whole project life cycle and includes the following:

1. Monitoring the quality of the deliverables and processes is being met and detecting defects by using the established tools, procedures and techniques.
2. Analyzing possible causes of defects.
3. Determining the preventive actions and deviation requests.
4. Communicating the corrective actions and deviation requests to the appropriate project organization members.
5. Perform monitoring activities at supply chain.
6. Coordinating on-site inspection activities

The Quality Control of the contracts/grants implementation is under the responsibility of the Quality Assurance Group with the technical support and guidance of the Project Teams, ensuring the adequate monitor and surveillance of the contract/grant implementation by the Supply chain. This includes regular visits and telecoms, scheduled quality surveillance audits and follow-up of the specific work-package control plan.

The supplier monitoring is being supported by a framework contract of inspectors for manufacturing follow-up managed by the Quality Assurance Group.

Quality Audit

Quality audits are performed to verify the state of the Quality System and Quality Plans in accordance with the quality criteria and stakeholder requirements. The methodology regarding the planning, preparation, implementation and recording of internal and external quality audits is defined in a documented process.

The objective of the Quality Audits is to:

- Assure the conformity of the implemented quality system and processes
  - Internal: Relative to defined Internal and/or stakeholder requirements
  - Supplier: Relative to the Supplier's Quality Plan
- Verify the effectiveness of the requirements propagation, the implementation of the quality system and its maintenance
- Supply the necessary suggestions to the adequate functioning of the quality system.

Internal audits are performed by the Process and Organizational Improvement Unit. Suppliers' audits are performed by the Quality Assurance Group.The quality audit results are recorded and analyzed, and may trigger corrective actions, arising from nonconformities, or preventive actions, arising from comments. The reports of quality audits are one of the main inputs of the quality improvement.

Quality Target

During 2017, the Quality Assurance Group has defined several activities to improve the performance of the supply chain. To monitor the effectiveness of these actions, an IO requirement has been taken as reference for the acceptance level of long-term open non-conformities (NCR). The maximum acceptable time defined by IO to close an NCR is 12 months. A plan has been agreed with IO to gradually reduce the number of long lasting NCRs.

The objective for 2019 is to reduce the number of NCRs open for longer than 12 months to less than 10% of the total number of open NCRs and to reach the target of 0% set by IO in the following years.

This time reduction in closing NCRs implies an improvement in the management of the actions to fix the defects and problems on ITER parts.

ANNEX VI Indicative Value of Financial Resources for the actions in WP2019

The WP2019 represents the financial decision to be adopted by the Governing Board in order to allow F4E to commit budget for the listed activities.
The table below shows the commitment forecast for the projects/actions in 2019 by taking into account the progress and the available manpower.
This value is the goal of the organisation.
If necessary, F4E will submit an amending budget to the Governing Board during 2019, recalling unused appropriations that can be adjusted to match the final needs.
In any case, the GB will be kept informed on the evolution of the budget implementation (both in commitments and payments) through the monthly report that F4E delivers to its Governance bodies. This report will also provide a timely indication in the case that additional budget needs to be recalled from the unused appropriations.

Action #	Action	Assigned Share of Available Budget
1	Magnets	16,536,831
2,3,4,10[27]	Main Vessel	33,040,942
5	Remote Handling	17,781,559
6	Cryoplant & Fuel Cycle	8,403,856
7	Antennas and Plasma Engineering	5,329,337
8	Neutral Beam and EC Power Supplies and Sources	26,773,199
9	Diagnostics	16,170,926
11	Site and Buildings and Power Supplies	169,969,643
12	Cash Contributions	293,099,374
13	Supporting Activities	29,963,533
14	Broader Approach	11,930,000
	Total	**628,999,200**

(As of 1st August 2018)

NB: Budget shown according to WP action and not budget line

[27] The Actions of Vacuum Vessel, In-Vessel Blanket, In-Vessel Divertor and Test Blanket Module are presented merged in one single line due to commercial sensitive information.

ANNEX VII HR Snapshot

1. Advancement, reclassification and promotion

Staff who has been at one step in their grade for two years shall automatically advance to the next step in that grade, unless their performance has been evaluated as unsatisfactory pursuant to their last performance assessment report.

By decision of the appointing authority and/or authority authorized to conclude contracts, staff shall also be entitled to appointment to the next higher grade of their function group. Such decisions shall be made as part of an annual promotion/reclassification exercise which considers the comparative merit of staff.

Promotions and reclassifications shall be exclusively by selection from officials, temporary agents and contract agents who have completed a minimum of two years in their grade.

Promotion/reclassification takes place on the 1 January of the year of the exercise (N) (or on the first day of the month following that in which the 2 years seniority are acquired). In recognition of the need to be in alignment with the promotion rates foreseen in the relevant implementing rule F4E will endeavor to align its rate of promotion/reclassification to the average duration grades foreseen in the staff regulation and associated implementing rules. Illustratively, F4E significantly reduced the rate of promotion in 2017 for temporary agents and officials in grades AD8 and above. The Tables below provide an overview of the number of promotions awarded in each grade during the last exercise.

Reclassification of temporary staff / promotion of officials in 2017

Category and grade	Staff in activity at 01.01.2016[1]		Number of staff members promoted / reclassified in 2017		Average number of years in grade of reclassified/promoted staff members
	officials	TA	officials	TA	
AD 16					
AD 15					
AD 14		1			
AD 13	8	2			
AD 12	9	2			
AD 11	3	5			
AD 10	4	25	1	4	4.38
AD 9	2	20	1	1	3.09
AD 8	1	23		6	3
AD 7	7	47	1	16	2.31
AD 6	2	41		6	2.43
AD 5	1		1	0	3.72
Total AD	**37**	**166**	**4**	**33**	**-**
AST 11					
AST 10	1				
AST 9	1				
AST 8	1		1		4
AST 7	1				
AST 6	3		1		3
AST 5	2	1		1	2
AST 4	2	13		4	2.75
AST 3	1	11		3	3.27
AST 2	2		1		4
AST 1	1				
Total AST	**15**	**25**	**3**	**8**	**-**
Total AST/SC	**0**	**0**	**0**	**0**	-
Total	**52**	**191**	**7**	**41**	**-**

[1] On 01.01.16 the 2015 reclassification and promotion exercise had not been finished yet.

Reclassification of contract staff in 2017

Function Group	Grade	Staff in activity at 01.01.2016[1]	How many staff members were reclassified in 2017	Average number of years in grade of reclassified staff members
CA IV	18			
	17			
	16	4	1	5.88
	15	14	7	2.47
	14	42	6	2.65
	13	32	7	2.52
CA III	12			
	11	5		
	10	15	5	2.94
	9	21	2	2.42
	8	7		
CA II	7			
	6	5	2	2.5
	5	11	3	2.64
	4	2		
CA I	3			
	2			
	1			
Total		**158**	**33**	**-**

[1] On 01.01.16 the 2015 reclassification exercise had not been finished yet.
[2] The progression rates reflect that many of the organisation's top talents were hired as CA staff and perform the same tasks at the same level as their TA/FO counterparts for whom the foreseen average duration between reclassification is significantly lower. In the absence of possibilities to transition CA staff to TA/FO contracts, F4E is bound to provide faster CA reclassifications if it is to recognize merit fairly and avoid losing its highly qualified and difficult to replace CA contingent to outside recruitment.

Table 31 . Reclassification of temporary staff and contractual agents /promotion of officials

2. Gender balance

The Table below shows the gender balance as at 31.12.2017 based on the filled in posts on 31.12.2017 (accepted job offers are included).
The figures are consistent with workforce statistics in the industry sectors related to the core tasks of the Agency and show a predominance of male colleagues in the technical functions. Conversely female colleagues are predominantly represented in administrative and support roles. F4E will continue to try to address the issue and try to increase the representation of female staff. Special efforts will be made for the managerial functions where F4E has only three female staff members.

Staff	EU Official		TA		CA	SNE	TOTAL
	AD	*AST*	*AD*	*AST*			
Female	11	9	43	11	90		164
Male	26	5	151	20	84	2	288
Total	**37**	**14**	**194**	**31**	**174**	**2**	**452**

Table 32 . Gender balance on 31/12/2017

3. Geographical balances

The table below provides the geographical distribution as at 31.12.2017 based upon the filled in posts on 31.12.2017 (accepted job offers are included).

The over representation of Spanish nationals follows from the Agency being headquartered in Spain and from the large proportion of short-term non-renewable positions which typically do not entice non-Spaniards to apply. A diversity policy is being developed to address the imbalance.

Looking forward F4E will continue to strike a balance between ensuring a broad geographical distribution of staff and the non-discrimination principle enshrined in its selection and recruitment policies.

Staff	EU Official		TA		CA	SNE	TOTAL
	AD	*AST*	*AD*	*AST*			
Belgian	1	1	7	4	7		**20**
British	1		14	3	6		**24**
Bulgarian			1		3		**4**
Czech			2		2		**4**
Dutch			4		1		**5**
Estonian					2		**2**
Finnish			3		1		**4**
French	5	4	48	9	16		**82**
German	3		6	1	9	1	**20**
Greek	1	1	4		2		**8**
Hungarian	2		1		4		**7**
Irish			3	1			**4**
Italian	13	3	36	5	33		**90**
Lithuanian		1		1	2		**4**
Maltese	1						**1**
Moroccan			1				**1**
Polish			3		2		**5**
Portuguese		1	4		6		**11**
Romanian			5	1	4		**10**
Slovak	1						**1**
Spanish	8	3	50	6	73	1	**141**
Swedish	1		2		1		**4**
Total	**37**	**14**	**194**	**31**	**174**	**2**	**452**

Table 33 . Geographical balance on 31/12/2017

NB: figures are based on filled in posts including staff in place and employment offers.

ANNEX VIII 2019 Main Procurement Activities (per Action)

Action	Signature	Type of contract
Magnets		
Contract signature for Transportation of TF Coils from Manufacturer to ITER	Q4	PServ
Release of Option for Additional Working Shift. Standard Effective Working Hours/Number of Workers in 2019	Q4	Option
Task Order Signed for Extension of 2nd Inspector for PF Coils Manufacturing in Cadarache	Q1	SC-PServ
Task Order Signed for Inspection Services for TF Coils Insertion and Cold Test. Resident Inspector for SIMIC	Q1	SC-PServ
Task Order TO29.1 Signed for Inspector to Follow-up the Plan B PC Rings Manufacturing Contract	Q2	SC-PServ
Provision for Amendments, claims, reimbursement, indexation, late interest and budget reserve	N/A	N/A
Vacuum Vessel		
Commitment and Task Order Signed - TO #21 for 1 VV Resident Inspectors	Q2	SC-PServ
Commitment and Task Order Signed - TO #22 for 1 VV Resident Inspectors	Q3	SC-PServ
Commitment and Task Order Signed - TO #23 for 1 VV Resident Inspectors	Q3	SC-PServ
Commitment and Task Order Signed - TO #25 for 1 VV Resident Inspectors	Q1	SC-PServ
Commitment and Task Order Signed - TO #29 for 1 VV Resident Inspectors	Q4	SC-PServ
Commitment and Task Order Signed - TO #31 for 1 VV Resident Inspectors	Q1	PServ
Commitment for Contract for Transportation frame for sectors delivery	Q2	PSupply
Provision for Amendments, claims, reimbursement, indexation, late interest and budget reserve	N/A	N/A
In Vessel- Blanket		
Blanket and Divertor Testing Facility_Flat Rate for 2020	Q4	PSupply
Blanket and Divertor Testing Facility_Flat Rate for Jul-Dec 2019	Q2	PSupply
OPE-443-01 Option I Be armour for manufacturing of mock-ups without SS pipes	Q2	Option
OPE-443-03 Option I Be armour for manufacturing of mock-ups without SS pipes	Q2	Option
Contract for phase 1 First Wall series fabrication (in view of industrial organization)	Q3	PSupply
TO 02 OPE-319-01 High Heat Flux Testing of FW full scale-prototype n.2	Q1	SC-PServ
TO 03 OPE-319-01 High Heat Flux Testing of FW full scale-prototype n.3	Q1	SC-PServ
Task Order for Inner Vertical Target Inspectors	Q3	SC-PServ
Provision for Amendments, claims, reimbursement, indexation, late interest and budget reserve	N/A	N/A
In Vessel- Divertor		
Development of the Tube to Tube Transition and Fabrication of PFU with New W Grade	Q4	PServ
Task Order for Inspectors 2019 – Inner Vertical Target	Q3	SC-PServ

Task Order for Resources 2019 - Cassette	Q1	SC-PServ
Provision for Amendments, claims, reimbursement, indexation, late interest and budget reserve	N/A	N/A
Remote Handling		
Task Order signed for GENROBOT Update Phase 2	Q2	SC-PServ
Task Order Signed for Final Design Phase 1 for DRHS	Q1	SC-PSupply
Task Order Signed for Final Design Phase 1 for IVVS	Q3	SC-PSupply
Task Order Signed for Final Design Preparatory Activities for In Vessel Viewing System	Q2	SC-PSupply
Task Order Signed for Final Design priority items for CPRHS	Q4	SC-PSupply
Task Order TO#05 signed for Preliminary Design, first design review and test bench mfg for NBRHS	Q1	SC-PServ
Task Order TO#06 signed for Final Design of Monorail Crane, Preliminary Design of Vessel Opening System for NBRHS	Q4	SC-PSupply
Provision for Amendments, claims, reimbursement, indexation, late interest and budget reserve	N/A	N/A
Cryoplant and Fuel Cycle		
Contract Signed for Call for tender for Torus and Cryostat Cryopumps	Q4	PSupply
Contract Signed for I&C and software design	Q2	PServ
Contract Signed for Provision of logistics for test & Commissioning of LN2 Plant & Auxiliary Syst.	Q3	PServ
MITICA Cryopump Installation tool	Q1	PSupply
Provision of utilities such as fluid, gases, electricity or similar for Commissioning	Q3	PSupply
Provision for Amendments, claims, reimbursement, indexation, late interest and budget reserve	N/A	N/A
Antenna and Plasma Engineering		
Contract Signed for Hardware procurement for EC Plant Control System Stage 2	Q3	PSupply
Contract Signed for Manufacture development and optimisation of Waveguide prototypes for EC Launchers	Q2	PServ
Contract Signed for Manufacturing and Testing of ICH RF Window mock-ups and Prototype	Q3	PSupply
Contract Signed for Manufacturing and vacuum qualification of EC Isolation Valve prototype	Q3	PSupply
Contract signed for Series production of EC Window Diamond Disks	Q2	PSupply
Contract Signed for Testing of Hydrogen embrittlement of Ti-SS joints	Q1	PServ
Task Order 1 Signed for In-sourcing for Support to EC UL Series production	Q3	SC-PServ
Task Order Signed for Design of ATLIS & Transition frame for the ICH Antenna - Part 2 TO 08	Q2	SC-PServ
Task Order Signed for Development of EC Instrumentation for ITER	Q2	SC-PSupply
Task Order Signed for Neutronic, mechanical and RF analysis of the ICH Antenna	Q1	SC-PServ
Task Order Signed for Procurement and testing of Feedthrough prototypes	Q1	SC-PSupply
Task Order Signed for Procurement of Mirrors and Steering Mechanism prototypes	Q2	SC-PSupply
Task Order Signed for Testing of Diamond Disks for EC Windows	Q2	SC-PServ

Task Order Signed for Testing of EC Window prototypes	Q1	SC-PServ
Task Order Signed for Testing of Window and Valve prototypes	Q1	SC-PServ
Task Order Signed for Nuclear safety, analysis and engineering verification	Q3	SC-PServ
Provision for Amendments, claims, reimbursement, indexation, late interest and budget reserve	N/A	N/A
Neutral Beam and EC Power Supplies and Sources		
Commitment for Specific Contract - MITICA CODAS 1, Interlock and Safety FW Contract NBTF Control, Interlock and Safety	Q1	SC-PSupply
Contract Signed - MITICA Diagnostics	Q3	PServ
Contract Signed - PRIMA#3 Assembly	Q3	SC-PSupply
Contract Signed - PRIMA#4 Assembly	Q4	SC-PSupply
Release of Additional Options 2019 for the Contract Procurement of Body PS & MHVPS Main Contract	Q4	Option
Release of Option 1 - 5 years spare parts for the Contract Procurement of Body Power Supplies & MHVPS	Q4	Option
Release of Option 8 - 1-year extension of warranty - HVD1 & Bushing of MITICA	Q1	Option
Release of the Second Group of Options - SC#1 MITICA Beam Source	Q4	Option
Task Order Signed for SC#1 Stage 2 MITICA Beam Line Components	Q3	SC-PSupply
Task Order Signed for Services for NBTF Site Supervision and Support - 06	Q4	SC-PServ
Commitment for Budget for NBTF Technical Follow-up 2020	Q4	Cash
Amendment Budget for NBTF Agreement 2019 NOT Credited part	Q3	Cash
Provision for Amendments, claims, reimbursement, indexation, late interest and budget reserve	N/A	N/A
Diagnostics		
Baseline Signed for Preliminary Design CPTS	Q4	SC-PServ
Commitment for Contract for Procurement and Delivery for Inner-Vessel Sensor Head HF - Lot 2	Q1	PSupply
Commitment for Contract for Procurement and Delivery for in-vessel clips, clamps, bosses and critical junction boxes	Q3	PSupply
Commitment for TO for Irradiation Testing for Bolometer Sensor Prototype & Electrical Connections	Q1	SC-PServ
Contract Signed for Final Design of RH Connector and Ancillary Components	Q2	PServ
Contract Signed for Procurement and Delivery for Inner-Vessel Coils - Sensor Heads LTCC - Lot 1	Q1	PSupply
Contract Signed for Procurement and Delivery for PPR Captive Ex-Vessel Transmission Components	Q4	PSupply
Contract Signed for Procurement and Delivery of In-vessel cabling	Q2	PSupply
Contract signed for Supplies and Support of CTS Critical Prototypes	Q4	PSupply
Fission Chamber Prototype & Series Production	Q2	PSupply
Commitment for Future Activities for in-source personnel under OMF-0871	Q2	SC-PServ
Task Order Signed for Irradiation Testing for Feedthroughs	Q1	SC-PServ
Task Order Signed for TO#3 Engineering Analysis Support for DPG Development	Q1	SC-PServ

TO signed for Engineering Analysis Thermohydraulic FDR of CTS	Q3	SC-PServ
TO signed for Engineering Support in components for passing EC Resonance of CTS	Q3	SC-PServ
Contract signed for Single Framework Contract for Services for Design for CPTS	Q4	FwC
Provision for Amendments, claims, reimbursement, indexation, late interest and budget reserve	N/A	N/A
Test Blanket Module		
Task Order Signed for Preliminary Design of Ancillary Systems phase I	Q2	SC-PServ
Task Order Signed for Preliminary Design of TBMs set phase I	Q2	SC-PServ
Task Order Signed for Safety Analyses for TBS PD phase I	Q2	SC-PServ
Provision for Amendments, claims, reimbursement, indexation, late interest and budget reserve	N/A	N/A
Site and Buildings and Power Supplies		
Commitment for TB11 - Completion works Contract - 2019	Q1	SC-PSupply
Contract Signed for TB18 Contract	Q4	PSupply
Site Security and Reception Services for the ITER Site 2019 signed	Q1	SC-PServ
TB12 - Commitment for Contract for Design & Build of Bldgs 34, 37, 71 non PIC, 75 non PIC	Q1	SC-PSupply
TB13 - Commitment for Contract for Design & Construction of Bldgs 44, 45, 46 & 47	Q1	SC-PSupply
TB19 - Commitment for Contract for Painting and Coating for Buildings Tokamak Complex	Q1	SC-PSupply
TB12 - Commitment for Option 1 - Building 71 North part (CODAS) - Non PIC	Q1	Option
TB12 - Commitment for Option 5.1 - Supply and Inst. PBS44 cable trays BLDG in the Baseline	Q3	Option
TB19 - Commitment for Option 2: Diagnostics above L2	Q1	Option
ITER Site Cooperation Agreement for 2019	Q4	Cash
ITER Site Host Agreement for 2019	Q2	Cash
Provision for Amendments, claims, reimbursement, indexation, late interest and budget reserve	N/A	N/A
Technical Support Activities		
Commitment 2019 for Corporate services Unit	Q4	PServ
Commitment 2019 for Operational Missions	Q1	PServ
Commitments 2019 for ICT	Q4	PSupply
Task Order signed for Convention 4 for Real Convoys	Q2	SC-PServ
Convention Signed for Gendarmerie Services Real Convoys Escort of Convoys	Q4	SC-PServ
SLA OPE-XXX Service Level agreement in the area of Support in the area of Structural Dynamics	Q4	PServ
Framework Contract for Engineering Support services in Thermo Hydraulics and Fluid Dynamics	Q3	FWC
Framework Contract for Seismic analysis and design of building and mechanical components of the ITER facility	Q1	FWC
Framework Contract for Provision of System, Instrumentation and Control Engineering - support for conventional I&C systems	Q4	FWC
Framework Contract for Provision of material characterization at cryogenic temperatures	Q2	FWC

Task Order Signed for TO03 Lot 2 in Support of the MIR layer - DXL Senior/Junior	Q4	SC-PServ
Task Order Signed for TO26.1 for QA Support Staff QAG	Q3	SC-PServ
Task Order Signed for TO31.1 for QA Support Staff QAG	Q2	SC-PServ
Task Order Signed for TO32.1 for QA Support Staff QAG	Q2	SC-PServ
Task Order Signed for TO36.1 for QA Support Staff QAG	Q3	SC-PServ
TO 01.1 for FwC F4E-OMF-0895 Lot 2: Risk Management Support	Q4	SC-PServ
TO 02.1 for FwC F4E-OMF-0895 Lot 2: Risk Management Support	Q4	SC-PServ
TO 03 for OMF-0895 Lot 1: Project Performance Management Support - Diagnostics	Q3	SC-PServ
TO 04 for OMF-0895 Lot 1: Project Performance Management Support-Technical Support Systems	Q3	SC-PServ
TO 05 for OMF-0895 Lot 1: Project Performance Management Support - Antennas	Q4	SC-PServ
TO03 for OMF-0895 Lot 3: Planning Support Vacuum Vessel	Q3	SC-PServ
TO04 for OMF-0895 Lot 3: Planning Support Neutral Beams	Q3	SC-PServ
TO05 for OMF-0895 Lot 3: Planning Support BIPS	Q4	SC-PServ
TO06 for OMF-0895 Lot 3: Planning Support Configuration	Q3	SC-PServ
TO for Transportation Management fees 2020	Q4	SC-PServ
Provision for Amendments, claims, reimbursement, indexation, late interest and budget reserve	N/A	N/A
Broader Approach		
Architecture of integration platform for BA Phase II	Q4	PServ
Contract signed for Engineering support for installation in Rokkasho 2019	Q4	PServ
Future contract for Materials and components for LIPAC installation 2019	Q4	PSupply
Health and safety for operations on site JT-60SA	Q3	SC-PServ
Remote handling preliminary studies and R&D	Q1	PServ
Support of design of cryopumps	Q1	PServ
Contract for Engineering activities in support of enhanced TF coil performance	Q1	PServ
TO 02 for Engineering and research and development support for JT-60SA commissioning	Q1	SC-PServ
TO 03 for Engineering and research and development support for JT-60SA commissioning	Q2	SC-PServ
TO 04 for Engineering and research and development support for JT-60SA commissioning	Q3	SC-PServ
TO 05 for Engineering and research and development support for JT-60SA commissioning	Q4	SC-PServ
Contract for Equilibrium Field coils PS spare parts	Q1	PSupply
Contract signed for cryoplant spare/replacement parts Part 2	Q2	PSupply
Contract signed for Enhancements for injector components	Q2	PSupply
Contract signed for JT-60SA Cryopump Design and Manufacturing part 1	Q3	PSupply
Contract signed for JT-60SA Divertor VUV spectrometer part 1	Q3	PSupply

Contract signed for JT-60SA Fast Ion Loss Detector part 1	Q3	PSupply
Contract signed for JT-60SA Pellet Injector Design and Manufacturing part 1	Q3	PSupply
Contract signed for JT-60SA YAG Thomson scattering system part 1	Q3	PSupply
Contractual activities for On-site assistance from PS suppliers	Q1	PServ
Engineering support for diagnostics	Q2	PServ
Provision for Amendments, claims, reimbursement, indexation, late interest and budget reserve	N/A	N/A

ANNEX IX Preliminary List of 2019 Grants per Action

Action	Value (Euros)	Time of call	Budget line
Diagnostics			
Specific Grant Signed for Design and R&D for Radial Neutron Camera/ Gamma Spectrometer – Phase 1 SG7	1,693,000	Q3 2019	3.1+3.5

NB: For the specific grants, as they do not have call for tender, the table refers to their signature date.

ANNEX X Human Resources per action for WP2019

	Core Staff	Assigned (Matrixed) Staff	Direct Staff	Management & Overhead	Total Staff
Magnets	24.00	8.20	32.20	10.93	43.13
Vacuum Vessel	20.00	5.70	25.70	8.72	34.42
In-Vessel Blanket	6.00	3.20	9.20	3.12	12.32
In-Vessel Divertor	6.00	3.10	9.10	3.09	12.19
Remote Handling	14.00	4.20	18.20	6.18	24.38
Cryoplant & Fuel Cycle	13.00	4.90	17.90	6.07	23.97
Antennas & Plasma Engineering	10.00	2.90	12.90	4.38	17.28
Neutral Beam & EC Power Supplies and Sources	17.00	6.40	23.40	7.94	31.34
Diagnostics	14.00	5.60	19.60	6.65	26.25
Test Blanket Modules	8.00	1.80	9.80	3.33	13.13
Site and Buildings and Power Supplies	20.00	25.40	45.40	15.40	60.80
Technical Support Activities	82.70	12.51	95.21	32.30	127.51
Broader Approach	28.00	2.08	30.08	10.21	40.29
Total	262.70	85.99	348.69	118.31	**467.00**

It should be noted that the staff costs represent a very small part of the total investment.
The numbers provided in the table above show just a snapshot of the situation. Assigned staff includes the persons working in a matrix structure within the teams (i.e. Project Performance Management, QA/QC, Contract & Procurement, Legal, Finance). The support value instead takes into account the remaining staff, assigned to the teams on a pro-rata basis.
The allocation of the F4E manpower, consisting of both F4E staff members and external contractors in-sourced through existing framework contract, varies according to the needs of the project and it depends on the nature of the work, its complexity and the required expertise.

ANNEX XI Credits per PA

					Forecast (kIUA) Current year includes only part not yet achieved						
Action	**PA**	**Baseline to end April 2018 (kIUA)**	**Achieved Credit (kIUA)**	**Released Credit (kIUA)**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024+**
		384.20693	**351.39859**	**305.00466**	**89.923874**	**87.65188**	**92.804629**	**73.48732**	**132.32367**	**42.75514**	**249.81502**
Magnets	PA 1.1.P1A.EU.01 Procurement of Toroidal Field Magnets	35.2	31.6	18.40000	7.2	18.862	15.216	16.862	0	0	0
	PA 1.1.P2A.EU.01 Pre Compression Rings	0.33	0	0.00000	0.39	0.21	0	0	0	0	0
	PA 1.1.P3A-B.EU.01 Poloidal Field Magnets 2,3,4,5,6	10.37	2.97	0.00000	6.25	6.5	9.25	7	4.495	4.395	0
	PA 1.1.P6A.EU.01 Toroidal Field Conductors	43.39	43.39	43.39000	0	0	0	0	0	0	0
	PA 1.1.P6C.EU.01 Poloidal Field Conductors	11.22881	11.22881	11.22881	0	0	0	0	0	0	0
Vacuum Vessel	PA 1.5.P1A.EU.01 Vacuum Vessel - Main Vessel	33.2	33.871	29.08000	9.949	19.117	20.723	5.9	0	0	0
In Vessel-Blanket	PA 1.5.P1A.EU.02 Blanket Manifolds	0	0	0.00000	0	0.4	0	0	0	0.8	3.322
	PA 1.6.P1A.EU.01 Blanket First Wall	0	0	0.00000	1.8	1.8	0	1.2	1.2	1.5	32.83
In Vessel-Divertor	PA 1.7.P1.EU.01 Cassette Body	0.53	0.395	0.00000	0.135	0.01	0.02	0.09	0.83	0.38	4.18
	PA 1.7.P2B.EU.01 Inner Vertical Target	1.76	1.76	1.66000	0.2	1.13	0.025	0.025	0.025	0.21	16.245
	PA 1.7.P2E.EU.01 Divertor Toroidal and Radial Rails	0	0	0.00000	0	0.2	0	0.2	0.2	0.2	1.58
Remote Handling	PA 2.3.P2.EU.01 Divertor Remote Handling System	1	0.6	0.00000	1	0.4	0.4	0.3	1.3	0	5.62
	PA 2.3.P3.EU.01 Cask and Plug Remote Handling System	1.6	0.8	0.00000	0.8	0.5	1.1	0.6	1.2	3	9.31337

	PA 2.3.P5.EU.01 Neutral Beam Remote Handling System	0.2	0.2	0.00000	0	0.4	0.4	0	1.8	0	3.2
	PA 5.7.P1.EU.01 In-Vessel Viewing System	0.4	0.4	0.80000	0	0.6	0.4	1.3	0.8	0.9	2.4
Cryoplant and Fuel Cycle	PA 3.1.P1.EU.03 Torus and Cryostat Cryopumps	0	0	0.00000	0	0.522	0	0	4	0	0
	PA 3.1.P1.EU.04 Neutral Beam Cryopumps	0.18	0	0.00000	0.18	0	1.02	0	0	0	2.464
	PA 3.1.P1.EU.01 Warm Regeneration Lines	0.16	0.06	0.02000	0.14	0	0	0	0	0	0
	PA 3.1.P1.EU.02 Front End Cryopump Distribution Cold Valve Boxes and Warm Regeneration Box	0	0	0.00000	0.0766	0.15319	0	0.0766	0.30638	0	0.15319
	PA 3.1.P3.EU.01 Primary Leak Detection and Localization System	0	0	0.00000	0	0	0.2	0.5	0.5	0.8	0
	PA 3.1.P3.EU.01 Cryostat Leak Detection and Localization System (phase II)	0	0	0.00000	0	0	0.2	1	0	0.8	0
	PA 3.2.P3.EU.01 Isotope Separation System	0	0	0.00000	0	0	0	0.456	0.5	0	4.5
	PA 3.2.P5.EU.01 Water Detritiation System - Tanks	2.652	2.652	2.65200	0.6	0	0	0	0	0	0
	PA 3.2.P5.EU.02 Water Detritiation System - Main System	0	0	0.00000	0	0	0	0	0	0.531	0.90007999
	PA 3.4.P1.EU.01 Liquid Nitrogen Plant and Auxiliary Systems	21.76777979	21.76777979	21.68978	0.523	2.84531995	1.235	0	0	0	0
	PA 6.4.P1.EU.01 for Design of REMS	0	0	0.00000	0	0	0	0	0	0.105	0.435
	PA 6.4.P1.EU.01 Amendment for REMS Design to procure Be-EN monitors	0	0	0.00000	0	0	0	0.06	0	0	0
	PA 6.3.P1.EU.01 Type A Radwaste Treatment and Storage System	0	0	0.00000	0	0	0	0	0	5.05	5.05

Antenna and Plasma Engineering	PA 5.1.P1.EU.01 Ion Cyclotron Antenna	0	0	0.00000	0	0	0	0	0	0	14.73
	PA 5.2.P1B.EU.02 Electron Cyclotron Upper Launcher	0	0	0.00000	0	0	0	1.4	4.132	1.65	4.1
	PA 5.2.P1B.EU.01 Electron Cyclotron Control System	0.5	0.5	0.00000	0	0.5	0	0	0	0	0.4
Neutral Beam and EC Power Supplies and Sources	PA 5.2.P3.EU.01 Electron Cyclotron Gyrotrons	0	0	0.00000	0	0	0	0	0	1.193	5.17
	PA 5.2.P4.EU.01 Electron Cyclotron High Voltage Power Supply	2.325	2.325	2.32500	1.231	4.935	1.974	0	1.163	0	0
	PA 5.3.P1.EU.01 Neutral Beam Assembly and Testing	0	0	0.00000	0	0	0	0	0	0	3.572
	PA 5.3.P2.EU.01 Heating Neutral Beam Beam Source	0	0	0.00000	0	0	0	0	0	0	3.89300005
	PA 5.3.P3.EU.01 Heating Neutral Beam Beamline Components	0	0	0.00000	0	0	0	0	0	0	3.9
	PA 5.3.P4A.EU.01 Heating Neutral Beam Drift Duct + NB Vessel + Absolute Valve + PMS	0	0	0.00000	0	0	0	0	0.2	1.2	7.5248999
	PA 5.3.P5.EU.01 Heating Neutral Beam Active Correction Coils	0	0	0.00000	0	0	0	0	0.44	0.22	3.52000003
	PA 5.3.P6.EU Neutral Beam Power Supply	10.91	10	10.00000	3.06	1.1	2.55	7.9	0	0	6.67571001
	PA 5.3.P9.EU.01 Neutral Beam Test Facility Components	11.18	8.64	7.31000	6.31	2.66	1.57	0	2.42	4.2	0
Diagnostics	PA 5.5.P1.EU.01-02-16-17-19 Diagnostics - Magnetics	0.38768	0.02491	0.02491	0.48471	0.18112	0.14688	0.59624	0	0.4	0.25905
	PA 5.5.P1.EU.03 Diagnostics - Bolometers	0	0	0.00000	0	0	0.42395001	0.30669001	0.42146001	0.0151	1.09212002
	PA 5.5.P1.EU.05 Diagnostics - Plasma Position Reflectometry	0	0	0.00000	0	0.09503	0.09503	0.3326	0	0.31676	0.7444
	PA 5.5.P1.EU.07 Diagnostics - Pressure Gauges	0	0	0.00000	0	0.13209	0	0.13209	0.10421	0	0.29205

	PA 5.5.P1.EU.18 Diagnostics - Tokamak Services	0	0	0.00000	0	0	0.37879001	0	0.56817999	0	1.80127002
	PA 5.5.P1.EU.15 Diagnostics - Radial Neutron Camera/Gamma Spectrometer	0	0	0.00000	0	0.13769	0	0.13769	0.07868	0	1.61301
	PA 5.5.P1.EU.01 Diagnostics - CPTS 55.C1	0	0	0.00000	0	0	0	0	0	0.88840002	2.66520996
	PA 5.5.P1.EU.09 Diagnostics - Low Field Side Collective Thomson Scattering	0.17217999	0	0.00000	0	0.17217999	0.17217999	0.17217999	0.60836002	0.02296	0
	PA 5.5.P1.EU.04 Diagnostics - Core-Plasma Charge Exchange Recombination Spectrometer	0	0	0.00000	0	0	0.13562	0.15887	0	0.15887	1.51195003
	PA 5.5.P1.EU.06 Diagnostics - Equatorial Visible/Infrared Wide-Angle Viewing System	0	0	0.00000	0	0.11724	0.11724	0.11724	0.52758	0.11724	1.93444003
	PA 5.5.P1.EU.10-11-12-13-14 Diagnostics - Port Engineering Systems	0	0	0.00000	0	0.23659	1.15021998	1.04828999	0	0.33851999	5.89384997
Site and Buildings and Power Supplies	COMMON	26.375	24.02	23.32000	15.4756001	1.9	8.375	1.425	14.87	1.5	15.05929999
	TOKAMAK COMPLEX	30.97750002	30.69492993	27.90000	5.78131374	8.85834039	20.72538864	7.6125	57.10276953	0.935	17.01762012
	AUX BUILDINGS TB03/TB04	57.18011914	55.08915912	50.39416	8.36843994	7.99604004	0	6.65	0	0	0
	AUX BUILDINGS D&B TB05	12.87	12.87	0.00000	2.28	0	0	0	0	0	0
	AUX BUILDINGS D&B TB06	3.2	0.5	0.00000	5.98	0.73071001	0.5	0	0	0	0
	AUX BUILDINGS D&B TB07	5.4542002	0	0.00000	6.3742002	0	0	0.03	0	0	0
	AUX BUILDINGS TB09/TB10	0	0	0.00000	0	0	0	0	0	0	42.4625
	AUX BUILDINGS D&B TB12	0	0	0.00000	0	0	0	6.19166016	4.00603003	10.28829001	0
	AUX BUILDINGS D&B TB13	0	0	0.00000	0	0	0	2.04	5.57	0	0

	LOAD CENTERS	3.66665995	0	0.00000	3.66665995	4.25033997	4.30132999	1.66666996	0	0	0
	INTERCONNECTING ACTIVITIES	0	0	0.00000	0.72834998	0	0	0	22.95501953	0	0
	AUX BUILDINGS D&B TB17	0	0	0.00000	0	0	0	0	0	0	9.69
	COMMON CONTRACTUAL ACTIVITIES	41.19	41.19	40.96000	0.9	0	0	0	0	0.64	2.1
	PA 6.2.P2.EU.06 Headquarters Building	13.85	13.85	13.85000	0	0	0	0	0	0	0

ANNEX XII European Obligation to ITER project[28]

Procurement Package			Package Total (kIUA)	Funding Source	IC-22 Value kIUA	Notes
1.1 Magnets	P1A	Toroidal Field Magnet Windings	89.74000	EU	89.74000	
	P1B	Toroidal Field Magnet Windings	86.38600	EU-JA	7.73620	
				JA	78.64980	
	P2A	Toroidal Field Magnet Structures	46.86000	EU	0.60000	
				EU-JA	46.26000	
	P2B	Toroidal Field Magnet Structures	43.85280	EU-JA	3.10050	
				JA	40.75230	
	P2C	Magnet Supports	22.86000	CN	22.86000	
	P3A	Poloidal Field Coil PF1	6.80000	RF	6.80000	
	P3A-B	Poloidal Field Coil PF2, PF3, PF4, PF5 & PF6	40.86000	EU	40.86000	
	P3C	Correction Coils	5.51000	CN	5.51000	
	P4A-B	Central Solenoid Magnet & Magnet Assembly	53.47490	US	49.84000	
				IO	3.63490	(3)
	P5A	Feeders	31.98556	CN	31.98556	
	P5B	Feeder Sensors	34.16925	IO	34.16925	
	P5C	Magnets and feeders workshop	13.14060	IO	13.14060	
	P6A	Toroidal Field Magnet Conductors	215.01000	CN	16.15000	
				EU	43.39000	
				EU-JA	21.50000	
				JA	32.23000	
				KO	43.39000	
				RF	41.54000	
				US	16.81000	
	P6B	Central Solenoid Magnet Conductors	90.00000	EU-JA	90.00000	
	P6C		83.02744	CN	54.83576	

[28] IC-22/05.2 (MAC-25) Proposal for the Update of the Overall Project Cost – June 2018

		Poloidal Field Magnet Conductors & Feeders/Correction Coils Conductors		EU	11.22881	
				RF	16.96287	
1.5 Vacuum Vessel	P1A	Vacuum Vessel - Main Vessel, Vacuum Vessel - Blanket Manifolds & Hydraulic Connectors, and Vacuum Vessel	118.50911	EU	89.56000	
				KO	25.20000	
				IO	3.74911	(3)
	P1B	In-Wall Shielding (VV-IWS) Block Assemblies - Divertor Pipe Enclosures	38.14396	IN	37.50791	
				IO	0.63605	
	P2A	Equatorial and Lower Ports	55.30949	KO	55.30949	
	P2B	Upper Ports	20.24241	RF	20.24241	
	P3A	ELM and VS Coils	33.35113	IO	33.35113	
	P3B	Power Supplies for IV Coils	47.76387	IO	47.76387	(1)
				KO	0.00000	
	P4	VV In-Service Inspection	13.68535	IO	13.68535	
	P5	Sealing Flange Procurement	0.97431	IO	0.97431	(2)
1.6 Blanket System	P1A	Blanket First Wall	84.52000	CN	10.69000	
				EU	40.33000	
				RF	33.50000	
	P1B	Blanket Shield Blocks	56.34000	CN	28.27000	
				KO	28.07000	
	P1C	Diagnostic First Wall	6.97372	IO	6.97372	
	P2	Port Limiters	0.00000	US	0.00000	
	P3	Blanket Module Connections	9.71000	RF	9.71000	
	P4	Vacuum Vessel Protection System First Plasma	6.31624	IO	6.31624	
	P5	Diagnostic Neutral Beam Liner	2.39268	IO	2.39268	
	P6	Blanket Manifolds	4.42901	EU	4.42901	
1.7 Divertor	P1	Cassette Body and Assembly	6.04000	EU	6.04000	
	P2A	Outer Targets	27.69000	JA	27.69000	
	P2B	Inner Targets	19.62000	EU	19.62000	
	P2C	Dome	14.57000	RF	14.57000	
	P2D	Plasma-Facing Component Testing	8.00000	RF	8.00000	
	P2E	Divertor Rail	2.33061	EU	2.33061	
	P3	Tungsten Divertor	12.64449	IO	12.64449	

	P4	Divertor Integration	17.94895	IO	17.94895	
2.2 Machine Assembly	P1	Assembly Operations	965.62717	IO	965.62717	(3)
	P2A	Machine Assembly Tooling 3-11	18.53300	KO	18.53300	
	P2B	Assembly Tooling 1-2, 12-13	4.92287	IO	4.92287	(3)
	P3	Assembly Steel Platforms	0.00000	IO	0.00000	(3)
2.3 Remote Handling Equipment	P1	In-Vessel Blanket Remote Handling Equipment	42.50000	JA	42.50000	
	P2	In-Vessel Divertor Remote Handling Equipment	9.62000	EU	9.62000	
	P3	Cask and Plug Remote Handling System	17.31337	EU	17.31337	
	P3	Cask and Plug Remote Handling System	0.25391	IO	0.25391	
	P4	In-Vessel Remote Handling Viewing & Metrology	0.00000	EU	0.00000	
	P5	Ex-Vessel Neutral Beam Remote Handling Equipment	6.23974	EU	6.23974	
	P6	Hot Cell Maintenance Equipment	64.49161	IO	64.49161	(1)
	P7	Tokamak Remote Handling Equipment	21.36043	IO	21.36043	
2.4 Cryostat	P1A	Cryostat	76.26075	IN	73.23222	
		Cryostat Rectangular Bellows		IO	3.02853	
	P1B	Vacuum Vessel Pressure Suppression System	8.86366	IN	8.78812	
				IO	0.07554	
	P1C	Cryostat Support Bearings	4.08856	IO	4.08856	
2.6 Cooling Water	P1A-B	Tokamak Cooling Water System: Material & Transportation	64.47842	US	64.47842	
	P1C	Tokamak Cooling Water System: Engineering, On-Site	0.64118	IO	0.64118	(3)
	P2A	Heat Rejection System (HRS) & Comp Cooling Water System	50.59206	IN	50.59206	
	P2B	Heat Rejection & Comp Cooling Water: Engineering, On-Site	0.87110	IO	0.87110	(3)
	P3	Piping inside site buildings beyond 10 m	8.21205	IO	8.21205	
2.7 Thermal Shield	P1	Thermal Shield	26.88300	KO	26.88300	
				IO	0.00000	(3)

3.1 Vacuum Pumping & Fuelling	P1	Torus & Cryostat Cryopumps, Valveboxes and NB Cryopumps and Cryopumps	9.60040	EU	9.45118	
				IO	0.14922	(3)
	P2	Roughing Pumps and Roughing Pumps (VS-RP)	6.56583	US	5.85348	
				IO	0.71235	(3)
	P3	Leak Detection (VS-LD) and Leak Detection	4.40000	EU	4.40000	
				IO	0.00000	(3)
	P4	Standard Components, Vacuum Auxiliary Systems Early Delivery, and Vacuum Auxiliary Systems Late Delivery	7.89215	US	3.19800	
				IO	4.69415	(3)
	P5	Pellet Injector and Pellet Injection System	6.41887	US	3.81993	
				IO	2.59894	
	P6	Gas Injection System & GDC and Gas Injector Valve Boxes & Glow Discharge Cleaning Cond System	6.77985	CN	6.77985	
				IO	0.00000	(3)
	P7	Vacuum Laboratory	7.54578	IO	7.54578	
	P8	Sealing Flange	0.45637	IO	0.45637	(2)
3.2 Tritium Plant	P1	Tokamak Exhaust Processing System	9.94276	US	9.89259	(1)
				IO	0.05017	(3)
	P2	Storage & Delivery and Fuel Storage & Delivery (SDS) System	12.50494	KO	11.78630	
				IO	0.71864	(3)
	P3	Isotope Separation System (ISS) and Hydrogen Isotopes Separation	6.67324	EU	5.19406	(1)
				IO	1.47918	(3)
	P4	Atmosphere Detritiation and Detritiation Core System	85.23026	EU-JA	14.06213	(1)
				IO	71.16813	
	P5	Water Detritiation System Tanks, Water Detritiation System Main System, and Water Detritiation	16.46166	EU	11.52114	(1)
				IO	4.94052	
	P6	Tritium Analysis & Control	20.96148	IO	20.96148	
	P7	Tritium Plant Equipment	19.40029	IO	19.40029	
3.4 Cryoplant & Distribution	P1	Cryoplant (LN2 and Auxiliary Systems) and Cryoplant	85.71759	EU	26.37110	
				IO	59.34649	(1)
	P2	Lower Pipe Chase Cryolines and Later Delivery Cryolines	17.68000	IN	15.29000	
				IO	2.39000	(2)
	P3	Cryodistribution Components	18.45929	IN	18.45929	

4.1 Electrical Power Supply & Distribution System	P1A-8B	SSEN & PPEN Design	6.93810	EU	6.93810	
	P1B	Pulsed Power Electrical Network (PPEN)	21.89000	CN	21.89000	
	P2	AC/DC Convertors and RPC-HF	122.61342	CN	77.03471	
				KO	45.57871	
	P3	Switching Network, Fast Discharge Units, DC Busbar & Instrumentation	70.85588	RF	53.40841	
				IO	17.44747	
	P8A	Emergency Power System	4.22273	EU	4.22273	
	P8B	SSEN & PPEN Assembly	29.48893	EU	29.48893	
	P8C	SSEN Components	20.00000	EU	5.00000	
				US	15.00000	
	P9	Cable Procurement	30.29109	IO	30.29109	
4.5 CODAC	P1	Control and Data Access & Communication	70.39886	IO	70.39886	
5.1 IC H&CD	P1	IC Antenna	22.03373	EU	14.73000	(1)
				IO	7.30373	(3)
	P2	IC Transmission Lines	8.32629	US	7.31807	(1)
				IO	1.00822	(3)
	P3	IC RF Power Sources	20.04593	IN	18.00000	
				IO	2.04593	(3)
	P4	IC RF HV Power Supply	12.66791	IO	5.80076	(1)
				IN	6.86715	
5.2 EC H&CD	P1A	EC Equatorial Launcher	6.42250	JA	5.26874	
				IO	1.15376	(3)
	P1B	EC Upper Launcher PTB Window, EC Upper Launcher PTB Main Plug, and EC Upper Launcher	23.57149	EU	12.68200	
				IO	10.88949	(3)
	P2	EC Main Transmission Line	14.24457	US	12.69906	
				IO	1.54551	(3)
	P3	EC RF Gyrotrons	31.74301	EU	7.95511	
				IN	2.44985	
				JA	11.49219	
				RF	9.84586	
	P4	EC HV Power Supply	15.99467	EU	11.62800	
				IN	4.20100	
				IO	0.16567	(3)

5.3 NB H&CD	P1	NB Assembly and Testing	3.80000	EU	3.80000	
	P2	NB Beam Source and HV Bushing, Accelerator	11.50000	EU	3.89300	
				EU-JA	2.07500	
				JA	5.53200	
	P3	NB Beamline Components	3.90000	EU	3.90000	
	P4	NB Pressure Vessel, Magnetic Shielding	11.83790	EU	10.65795	
				EU-JA	0.00000	
				IO	1.17995	(2)
	P5	NB Active Correction and Compensation Coils	4.38821	EU	4.16428	
				IO	0.22393	(2)
	P6	NB Power Supply	92.14579	EU	31.28571	
				EU-JA	42.91800	
				JA	17.94208	
	P7A	Diagnostic Neutral Beam Power Supply	9.67475	IN	9.67475	
	P7B	Diagnostic Neutral Beam Beamline	13.10000	IN	13.10000	
	P8	SF6 Gas System	6.21258	JA	0.00000	
				IO	6.21258	
	P9	Neutral Beam Test Facility Components	26.71000	EU	25.80000	
				IN	0.91000	
				JA	0.00000	
	P10	Heat Protection Panels in VV CD	0.87775	IO	0.87775	
	P11	Temporary Items from Four-Staged Approach	0.88267	IO	0.88267	
	P12	Component Qualification	1.06289	IO	1.06289	
5.5 Diagnostics	P1	Diagnostic Systems	205.66200	CN	3.90042	
				EU	32.04861	(1)
				IN	3.63417	
				JA	19.50047	
				KO	4.11268	
				RF	17.86483	
				US	15.94669	(1)
				IO	108.65413	

5.7 IVVS	P1	In-Vessel Viewing System	6.80000	EU	6.80000	
5.8 Port Plug Test Facility	P1	Port Plug Test Facility	11.71805	RF	8.72983	
				IO	2.98822	
6.2 Buildings	P1/01	Concrete Buildings	506.59051	EU	0.00000	
	P2/01	PF Coil Winding Building		EU	12.80000	
	P2/02	AE Services		EU	55.77490	
	P2/03	Tokamak Excavation & Ground Support Structure		EU	31.00000	
	P2/04	Anti-Seismic Bearings		EU	6.20000	
	P2/05	Buildings Construction		EU	349.06661	
	P2/06	Office Building		EU	13.85000	
	P2	Buildings		IO	37.89900	
6.3 Waste	P1	Waste Treatment Storage (Type A Radwaste System)	36.49575	EU	10.05610	
	P2	Waste Treatment Storage		IO	23.74373	
	P3	Tokamak Assembly Preparation Building		IO	2.69592	(2)
6.4 Radiological	P1	Radiological Protection	4.20000	EU	4.20000	
6.9 Access Control	P1	Access Control and Security Systems	11.39853	IO	11.39853	
				In-Kind PA (a)	**2,892.89691**	
		Transfers from the Reserve Fund to In-Kind (b)			**3.00380**	
				IO Fund (c)	**1,813.43510**	
		Transfers from the Reserve Fund to IO Fund for IO and DAs (d)			**94.13099**	
				TBM (e)	**50.36541**	
		Total Direct Capital Cost (a + b + c + d + e)			**4,853.83221**	

Notes:
1) Includes previously deferred items.
2) Represents a new Procurement Package introduced in this report.
3) Costs of Installation and Assembly have been centralized and moved to 2.2.P1.IO. The remaining amount, if any, reflects the cost of minor components.

ANNEX XIII PAs, cash contributions, secondment agreements for Broader Approach

Title	BA EU Commitment kBAUA	Signed EU PAs (or equivalent) kBAUA	Original EU PA (or equivalent) Signed date
Supply of the Toroidal Field Magnet (EU-TFC)	99.413	99.413	12/07/2010
Supply of One Spare Toroidal Field Coil (EU-STFC)	5.197	5.197	13/03/2014
Toroidal Field Coil Pre-assembly (EU-PAS)	2.950	2.950	06/06/2014
Supply of HTS Current Leads for the TF, CS and EF coils (EU-HTSCL)	3.420	3.420	08/02/2010
Setup of a Cryogenic Test Facility and the Performance of Tests of the TF coils (EU-TFCTF)	18.603	18.603	24/01/2012
Supply of the Quench Protection Circuits for Poloidal and Toroidal Field Coils (EU-QPC)	19.150	19.150	03/12/2009
Supply of Toroidal Field, Poloidal Field, and Fast Plasma Position Control Coils Power Supplies (EU-SCMPS)	20.080	20.080	16/02/2011
Supply of the Switching Network Units for Central Solenoids (EU-SNU)	7.080	7.080	28/12/2010
Supply of the Resistive Wall Mode Control Coil Power Supply system (EU-RWMPS)	1.150	1.150	21/04/2015
Supply of Cryostat Base (EU-CR01)	4.348	4.348	07/12/2009
Supply of Cryostat Vessel Body Cylindrical Section (EU-CR02)	13.042	13.042	25/07/2011
Supply of the Cryogenic System (EU-CRYO)	35.250	35.250	29/11/2012
Supply of the ECRF Power Supply system (EU-ECRFPS)	3.730	3.730	22/07/2015
Integrated commissioning / initial operation, Commissioning (EU)	1.408	1.408	21/04/2015
Other Diagnostics	0.020	0.010	
EU Contribution to assembly	1.572	1.572	23/03/2018
Satellite Project (Total)	**236.413**	**236.403**	
TF01 Engineering Design of HFTM (EU)	2.065	1.465	13/06/2011
TF01bis Engineering Design of HFTM (EU)		0.600	02/09/2014
TF02 Irradiation Tests in Fission Reactor (EU)	1.850	1.850	30/09/2014
TF04 Other Engineering Validation Tasks (EU)	5.260	4.660	11/11/2011
TF04bis Other Engineering Validation Tasks (EU)		0.600	20/11/2014
LF01 EVEDA Li Test Loop (EU)	0.800	0.800	23/07/2010
LF03 Erosion/Corrosion (EU)	1.220	1.220	23/07/2010
LF04 Purification (EU)	0.490	0.490	23/07/2010
LF05 Remote Handling (EU)	1.710	1.710	22/04/2011
AF01 Tranversal Activities of the Accelerator Prototype (EU)	16.700	16.700	27/01/2014

AF02 Injector (EU)	4.580	4.580	18/12/2009
AF03 Radiofrequency Quadrupole (EU)	25.370	25.370	14/12/2010
AF03.2 Backup Set of RFQ Couplers (EU)	1.000	1.000	07/10/2014
AF04 First Cryomodule of SRF LINAC (EU)	6.110	6.110	26/04/2011
AF05 Medium Energy Beam Transport line MEBT (EU)	3.470	3.470	24/06/2011
AF06 RF Power (EU)	23.200	23.200	18/05/2010
AF07 High Energy Beam Transport line HEBT and Beam Dump (EU)	5.490	5.490	24/06/2011
AF08 Auxiliary Systems (Control Systems and support) (EU)	1.600	1.600	04/10/2010
AF09 Diagnostics (EU)	1.520	1.520	14/11/2012
AF10-WP1 Installation, Checkout, Startup and Commissioning (EU)	4.150	4.150	27/01/2014
AF10-WP2 Installation, Checkout, Startup and Commissioning (EU)	2.540	2.540	20/06/2014
AF10-WP3 Installation, Checkout, Startup and Commissioning (EU)	3.570	3.570	02/09/2014
AF10-WP4 Installation, Checkout, Startup and Commissioning (EU)	1.590	1.590	22/07/2015
AF12 Supply of the Cryoplant of the Prototype Accelerator	2.490	2.490	23/03/2015
ED01 Eng. Design of IFMIF Plant (EU)	2.610	2.610	28/03/2013
ED02 Eng. Design of Accelerator Facility (EU)	6.360	6.360	29/03/2013
ED03 Eng. Design of Lithium Target Facility (EU)	0.800	0.800	18/03/2013
ED04 Eng. Design of Test Facility (EU)	4.270	4.270	27/03/2013
Secondments Professional Staff (EU)	13.120	13.120	15/11/2007
Common Expenses (EU)	1.580	1.580	15/05/2008
Common Fund (EU)	1.810	1.810	15/12/2010
IFMIF/EVEDA (Total)	**147.325**	**147.325**	
IFERC-DPA01-JA.EU (Phase Two DEMO Design Activities (DDA) for the IFERC Project)	6.040	6.040	17/06/2011
IFERC-T2PA01-JA.EU (R&D on Tritium Technology in phase 2-3 part 2 for the DEMO R&D for IFERC)	0.550	0.550	16/07/2014
IFERC-T1PA01-EU.CIEMAT (DEMO R&D Activities on SiC/SiC Composites for the IFERC Project)	2.849	2.849	14/12/2010
IFERC-T1PA01-EU.ENEA (DEMO R&D Activities on SiC/SiC Composites for the IFERC Project)	0.442	0.442	25/01/2011
IFERC-T1PA02-EU.ENEA (DEMO R&D on SiC/SiC Composites for the IFERC Project: erosion/corrosion of SiC and SiC/SiC in liquid metal)	1.032	1.032	31/01/2012
IFERC-T3PA01-EU.CRPP (DEMO R&D Activities in DEMO Blanket for the IFERC Project)	0.425	0.425	14/12/2010

IFERC-T3PA01-EU.SCK.CEN (DEMO R&D Activities in DEMO Blanket for the IFERC Project)	0.825	0.825	14/12/2010
IFERC-T3PA01-EU.KIT (DEMO R&D Activities in DEMO Blanket for the IFERC Project)	2.647	2.647	14/12/2010
IFERC-CSCPA01-EU.CEA (Supply of the supercomputer and peripheral equipment for the IFERC project (CSC activity))	91.500	91.500	28/04/2010
IFERC-CSCPA02-EU.CEA (Enhancement of the Computational Simulation Centre in IFERC)	6.320	6.320	01/11/2013
IFERC-RECPA01-JA.EU (Outline of the Requirements for REC for the IFERC Project)	0.100	0.100	26/08/2013
IFERC-RECPA01-EU (Supply Remote Data Access Software Framework & Integrated Software Platform)	1.500	1.500	28/01/2014
Secondments by EU	1.320	1.320	15/11/2007
Cash Contributions by EU	0.700	0.700	15/12/2010
IFERC (Total)	**116.250**	**116.250**	

ANNEX XIV Annual Revenue in commitment appropriations

	Current Value MEUR	< 2007 Final Execution	2007 Executed	2008 Executed	2009 Executed	2010 Executed	2011 Executed	2012 Executed	2013 Executed	Total 2007-2013
Commitment Appropriations	Euratom contribution	40.645	73.503	142.710	282.720	374.240	387.660	1,106.900	904.900	**3,272.633**
	France contribution	1.484	2.658	48.945	61.200	66.500	90.700	141.200	105.000	**516.202**
	F4E Members contribution	-	-	2.683	2.900	3.400	3.835	3.900	4.300	**21.018**
	Miscellaneous revenue	-	-	-	0.252	0.105	0.186	1.046	0.109	**1.697**
	F4E Total Budget	**42.129**	**76.160**	**194.338**	**347.072**	**444.245**	**482.381**	**1,253.046**	**1,014.309**	**3,811.550**
	Reserve Fund	-	-	-	-	-	-	-	-	**-**
	Refund (Reimbursement)	-	-	-	-	-	-	-	0.010	**0.010**
	F4E Total Revenue	**42.129**	**76.160**	**194.338**	**347.072**	**444.245**	**482.381**	**1,253.046**	**1,014.319**	**3,811.560**
	Carry Over from the previous year	-	-	-	3.457	23.552	0.467	39.325	25.959	**92.759**
	Recovery of the budgetary outturn	-	-	-	8.308	-	-	10.045	2.458	**20.812**
	Utilisation of unused appropriations	-	-	-	-	-	9.760	-	-	**9.760**
	F4E Total available Revenue	**42.129**	**76.160**	**194.338**	**358.837**	**467.796**	**492.607**	**1,302.416**	**1,042.737**	**3,934.891**

	Current Value MEUR	2014 Executed	2015 Executed	2016 Executed	2017 Executed	2018 Forecast	2019 Forecast	2020 Planned needs	Total 2014-2020	Total 2007-2020	2021 Planned needs	2022 Planned needs	2023 Planned needs	Total 2021-2023	Total <2007-2023
Commitment Appropriations	Euratom contribution	720.918	382.215	323.270	315.184	381.046	398.125	343.361	**2,864.119**	**6,136.752**	923.081	756.463	1,091.144	**2,770.688**	**8,948.084**
	France contribution	170.000	64.000	130.000	145.000	142.000	130.000	79.214	**860.214**	**1,376.416**	203.000	162.500	244.400	**609.900**	**1,987.800**
	F4E Members contribution	4.400	4.390	4.600	4.860	4.920	5.600	5.800	**34.570**	**55.588**	6.000	6.100	6.300	**18.400**	**73.988**
	Miscellaneous revenue	0.210	0.207	0.024	0.001	-	-	-	**0.442**	**2.140**	-	-	-	**-**	**2.140**
	F4E Total Budget	**895.528**	**450.813**	**457.894**	**465.045**	**527.966**	**533.725**	**428.375**	**3,759.345**	**7,570.895**	**1,132.081**	**925.063**	**1,341.844**	**3,398.988**	**11,012.012**
	Reserve Fund	-	1.301	14.984	0.715	37.342	10.700	74.573	**139.614**	**139.614**	29.852	17.189	17.533	**64.574**	**204.188**
	Refund (Reimbursement)	0.004	1.996	0.435	0.893	0.000	-	-	**3.328**	**3.339**	-	-	-	**-**	**3.339**
	F4E Total Revenue	**895.531**	**454.110**	**473.313**	**466.653**	**565.308**	**544.425**	**502.947**	**3,902.288**	**7,713.848**	**1,161.933**	**942.252**	**1,359.377**	**3,463.562**	**11,219.539**
	Carry Over from the previous year	21.109	10.793	13.461	25.211	11.183	-	-	**81.756**	**174.516**	-	-	-	**-**	**174.516**
	Recovery of the budgetary outturn	1.873	2.998	1.028	1.053	1.183	0.963	-	**9.098**	**29.909**	-	-	-	**-**	**29.909**
	Utilisation of unused appropriations	-	-	-	96.000	93.707	140.019	324.093	**653.819**	**663.578**	-	-	-	**-**	**663.578**
	F4E Total available Revenue	**918.513**	**467.902**	**487.802**	**588.916**	**671.381**	**685.408**	**827.040**	**4,646.961**	**8,581.852**	**1,161.933**	**942.252**	**1,359.377**	**3,463.562**	**12,087.543**

F4E Total Budget: The revenue made of annual contributions, without carry over, recovery of outturn and commitments made available again, according to the Council Decisions and the reference to the EUR 6.6 billion (Euro 2008 value)
F4E Total Revenue: F4E Total Budget plus the revenue made available from reimbursement to F4E and Reserve Fund.
F4E Total available Revenue: F4E Total revenue plus appropriations carried over or made available again.
EU Contributions for administrative expenditure in 2019 and 2020 are the balance to the ceiling of EUR 325.0 million foreseen in the period 2014-2020

ANNEX XV Annual Revenue in payment appropriations

	Current Value MEUR	< 2007 Final Execution	2007 Executed	2008 Executed	2009 Executed	2010 Executed	2011 Executed	2012 Executed	2013 Executed	Total 2007-2013
Commitment Appropriations	Euratom contribution	40.645	1.113	123.500	131.790	207.600	226.336	261.240	245.002	**1,196.580**
	France contribution	1.484	2.658	25.145	30.400	13.600	12.000	48.000	130.000	**261.802**
	F4E Members contribution	-	-	2.683	3.285	3.400	3.835	3.900	4.300	**21.403**
	Miscellaneous revenue	-	-	-	0.252	0.105	0.186	1.046	0.109	**1.697**
	F4E Total Budget	**42.129**	**3.770**	**151.328**	**165.727**	**224.705**	**242.357**	**314.186**	**379.411**	**1,481.483**
	Reserve Fund	-	-	-	-	-	-	-	-	**-**
	Refund (Reimbursement)	-	-	-	-	-	-	-	0.010	**0.010**
	F4E Total Revenue	**42.129**	**3.770**	**151.328**	**165.727**	**224.705**	**242.357**	**314.186**	**379.422**	**1,481.493**
	Carry Over from the previous year	-	-	-	24.000	51.188	48.626	32.995	0.836	**157.645**
	Recovery of the budgetary outturn	-	-	-	8.308	17.096	-	29.944	52.133	**107.481**
	F4E Total available Revenue	**42.129**	**3.770**	**151.328**	**198.035**	**292.988**	**290.983**	**377.124**	**432.391**	**1,746.619**

	Current Value MEUR	2014 Executed	2015 Executed	2016 Executed	2017 Executed	2018 Forecast	2019 Forecast	2020 Planned needs	Total 2014-2020	Total 2007-2020	2021 Planned needs	2022 Planned needs	2023 Planned needs	Total 2021-2023	Total <2007-2023
Commitment Appropriations	Euratom contribution	421.101	386.171	567.040	716.611	653.239	613.518	656.805	**4,014.485**	**5,211.066**	608.882	642.008	690.724	**1,941.614**	**7,193.324**
	France contribution	123.000	77.000	120.000	125.000	130.000	150.000	163.800	**888.800**	**1,150.602**	132.200	140.700	151.600	**424.500**	**1,576.587**
	F4E Members contribution	4.400	4.390	4.600	4.937	4.920	5.600	5.800	**34.647**	**56.050**	6.000	6.100	6.300	**18.400**	**74.450**
	Miscellaneous revenue	0.210	0.207	0.024	0.001	-	-	-	**0.442**	**2.140**	-	-	-	**-**	**2.140**
	F4E Total Budget	**548.711**	**467.768**	**691.664**	**846.549**	**788.159**	**769.118**	**826.405**	4,938.375	6,419.857	**747.082**	**788.808**	**848.624**	2,384.514	8,846.501
	Reserve Fund	-	-	4.121	11.185	19.966	18.000	30.000	**83.271**	**83.271**	13.000	25.000	25.000	**63.000**	**146.271**
	Refund (Reimbursement)	0.004	1.996	0.435	0.893	0.000	-	-	**3.328**	**3.339**	-	-	-	**-**	**3.339**
	F4E Total Revenue	**548.714**	**469.765**	**696.220**	**858.627**	**808.126**	**787.118**	**856.405**	5,024.974	6,506.467	**760.082**	**813.808**	**873.624**	2,447.514	8,996.110
	Carry Over from the previous year	17.022	33.000	0.025	5.214	12.338	-	-	**67.599**	**225.244**	-	-	-	**-**	**225.244**
	Recovery of the budgetary outturn	1.881	23.317	28.289	1.073	5.881	17.236	-	**77.678**	**185.159**	-	-	-	**-**	**185.159**
	F4E Total available Revenue	**567.617**	**526.082**	**724.534**	**864.914**	**826.345**	**804.354**	**856.405**	5,170.251	6,916.870	**760.082**	**813.808**	**873.624**	2,447.514	9,406.514

F4E Total Budget: The revenue made of annual contributions, without carry over, recovery of outturn and commitments made available again, according to the Council Decisions and the reference to the EUR 6.6 billion (Euro 2008 value)
F4E Total Revenue: F4E Total Budget plus the revenue made available from reimbursement to F4E and Reserve Fund.
F4E Total available Revenue: F4E Total revenue plus appropriations carried over or made available again.
EU Contributions for administrative expenditure in 2019 and 2020 are the balance to the ceiling of EUR 325.0 million foreseen in the period 2014-2020

ANNEX XVI Annual Expenditure in commitment appropriations in 2008 euro value

Constant Value MEUR(2008)		< 2007 Final Execution	2007 Executed	2008 Executed	2009 Executed	2010 Executed	2011 Executed	2012 Executed	2013 Executed	Total 2007-2013
Commitment Appropriations	**ITER Construction**	**M€ 43.9**	**M€ 75.6**	**M€158.1**	**M€272.0**	**M€364.3**	**M€336.8**	**M€ 996.7**	**M€ 784.1**	**M€ 2,987.6**
	(of Which Transportation)						*M€ 0.3*	*M€ 0.0*	*M€ 1.3*	*M€ 1.6*
	Technology			**M€ 4.0**	**M€ 16.2**	**M€ 8.2**	**M€ 6.8**	**M€ 1.8**	**M€ 8.7**	**M€ 45.7**
	Technology for ITER			M€ 3.9	M€ 6.4	M€ 2.3	M€ 6.1	M€ 0.7	M€ 6.6	M€ 26.1
	(of which TBM)			*M€ 3.2*	*M€ 0.7*	*M€ 0.6*	*M€ 5.6*	*M€ 0.1*	*M€ 5.9*	*M€ 16.0*
	Technology for Broader Approach			M€ 0.1	M€ 9.9	M€ 5.9	M€ 0.6	M€ 1.1	M€ 2.1	M€ 19.6
	Technology for DONES									
	Other Expenditure			**M€ 0.5**	**M€ 0.4**	**M€ 0.7**	**M€ 1.6**	**M€ 1.0**	**M€ 0.8**	**M€ 4.9**
	F4E Administration		**M€ 1.1**	**M€ 13.9**	**M€ 23.8**	**M€ 28.3**	**M€ 33.9**	**M€ 36.4**	**M€ 36.2**	**M€ 173.6**
	F4E Total Budget	**M€ 43.9**	**M€ 76.8**	**M€176.4**	**M€312.5**	**M€401.5**	**M€379.0**	**M€1,035.8**	**M€ 829.8**	**M€ 3,211.8**
	Reserve Fund									
	F4E Total Expenditure	**M€ 43.9**	**M€ 76.8**	**M€176.4**	**M€312.5**	**M€401.5**	**M€379.0**	**M€1,035.8**	**M€ 829.8**	**M€ 3,211.8**

Constant Value MEUR(2008)		2014 Executed	2015 Executed	2016 Executed	2017 Executed	2018 Forecast	2019 Forecast	2020 Planned needs	Total 2014-2020	Total 2007-2020	2021 Planned needs	2022 Planned needs	2023 Planned needs	Total 2021-2023	Total <2007-2023
Commitment Appropriations	**ITER Construction**	**M€ 485.1**	**M€297.3**	**M€325.4**	**M€383.8**	**M€441.9**	**M€465.9**	**M€ 515.9**	**M€2,915.4**	**M€ 5,903.1**	**M€ 789.8**	**M€616.0**	**M€ 886.7**	**M€ 2,292.4**	**M€ 8,239.4**
	(of Which Transportation)	*M€ 3.2*	*M€ 5.4*	*M€ 4.4*	*M€ 4.0*	*M€ 5.2*	*M€ 12.4*	*M€ 9.9*	*M€ 44.5*	*M€ 46.1*	*M€ 9.0*	*M€ 3.7*	*M€ 2.2*	*M€ 14.9*	*M€ 61.1*
	Technology	**M€ 13.8**	**M€ 13.2**	**M€ 10.8**	**M€ 14.3**	**M€ 11.1**	**M€ 11.5**	**M€ 5.9**	**M€ 80.7**	**M€ 126.4**	**M€ 35.0**	**M€ 34.5**	**M€ 59.4**	**M€ 128.9**	**M€ 255.2**
	Technology for ITER	M€ 8.2	M€ 6.2	M€ 5.6	M€ 5.5	M€ 5.9	M€ 2.6	M€ 1.5	M€ 35.5	M€ 61.5	M€ 5.0	M€ 4.5	M€ 9.4	M€ 18.9	M€ 80.4
	(of which TBM)	*M€ 7.1*	*M€ 3.3*	*M€ 2.3*	*M€ 0.2*	*M€ 1.6*	*M€ 1.4*	*M€ 1.5*	*M€ 17.3*	*M€ 33.4*	*M€ 5.0*	*M€ 4.5*	*M€ 9.4*	*M€ 18.9*	*M€ 52.2*
	Technology for Broader Approach	M€ 5.6	M€ 7.1	M€ 5.2	M€ 8.8	M€ 5.2	M€ 8.9	M€ 4.4	M€ 45.2	M€ 64.8	M€ 30.0	M€ 30.0	M€ 30.0	M€ 90.0	M€ 154.8
	Technology for DONES									€ -			M€ 20.0	M€ 20.0	M€ 20.0
	Other Expenditure	**M€ 1.4**	**M€ 2.2**	**M€ 1.6**	**M€ 3.7**	**M€ 4.7**	**M€ 3.8**	**M€ 3.7**	**M€ 20.9**	**M€ 25.8**	**M€ 3.9**	**M€ 3.8**	**M€ 3.7**	**M€ 11.4**	**M€ 37.2**
	F4E Administration	**M€ 37.9**	**M€ 38.3**	**M€ 40.7**	**M€ 44.7**	**M€ 45.8**	**M€ 45.4**	**M€ 46.1**	**M€ 298.8**	**M€ 472.4**	**M€ 46.4**	**M€ 46.8**	**M€ 47.3**	**M€ 140.6**	**M€ 613.0**
	F4E Total Budget	**M€ 538.2**	**M€351.1**	**M€378.5**	**M€446.5**	**M€503.6**	**M€526.4**	**M€ 571.6**	**M€3,315.9**	**M€ 6,527.7**	**M€ 875.1**	**M€701.1**	**M€ 997.0**	**M€ 2,573.2**	**M€ 9,144.8**
	Reserve Fund	**€ -**	**M€ 1.1**	**M€ 11.7**	**M€ 1.2**	**M€ 31.1**	**M€ 8.6**	**M€ 58.8**	**M€ 112.5**	**M€ 112.5**	**M€ 23.1**	**M€ 13.0**	**M€ 13.0**	**M€ 49.1**	**M€ 161.7**
	F4E Total Expenditure	**M€ 538.2**	**M€352.2**	**M€390.2**	**M€447.7**	**M€534.7**	**M€535.0**	**M€ 630.4**	**M€3,428.4**	**M€ 6,640.2**	**M€ 898.2**	**M€714.1**	**M€ 1,010.0**	**M€ 2,622.4**	**M€ 9,306.4**

Note: The Transportation and TBM domains are shown for the purpose of establishment of the ITER Host State contribution

ANNEX XVII Annual Expenditure in commitment appropriations in current value

	Current Value MEUR	< 2007 Final Execution	2007 Executed	2008 Executed	2009 Executed	2010 Executed	2011 Executed	2012 Executed	2013 Executed	Total 2007-2013
Commitment Appropriations	ITER Construction	42.129	73.656	158.059	278.766	382.487	361.879	1,097.671	886.244	3,238.763
	(of Which Transportation)						*0.352*	*0.010*	*1.491*	*1.853*
	Technology			3.995	16.658	8.593	7.308	1.956	9.886	48.396
	Technology for ITER			3.883	6.526	2.431	6.640	0.794	7.530	27.803
	(of which TBM)			*3.188*	*0.709*	*0.660*	*6.065*	*0.072*	*6.656*	*17.350*
	Technology for Broader Approach			0.112	10.132	6.162	0.669	1.162	2.357	20.593
	Technology for DONES									
	Other Expenditure			0.452	0.450	0.743	1.691	1.060	0.918	5.313
	F4E Administration		1.113	13.884	24.258	29.428	35.932	39.445	39.932	183.991
	F4E Total Budget	42.129	74.769	176.390	320.132	421.251	406.810	1,140.132	936.980	3,476.464
	Reserve Fund									
	F4E Total Expenditure	42.129	74.769	176.390	320.132	421.251	406.810	1,140.132	936.980	3,476.464
	F4E Total available budget (In revenue)	42.129	76.160	194.338	358.837	467.796	492.607	1,302.416	1,042.737	3,934.891
	% of implementation	100%	98%	91%	89%	90%	83%	88%	90%	88%

	Current Value MEUR	2014 Executed	2015 Executed	2016 Executed	2017 Executed	2018 Forecast	2019 Forecast	2020 Planned needs	Total 2014-2020	Total 2007-2020	2021 Planned needs	2022 Planned needs	2023 Planned needs	Total 2021-2023	Total <2007-2023
Commitment Appropriations	ITER Construction	563.554	350.433	386.288	475.930	557.599	598.213	681.000	3,613.017	6,851.780	1,021.689	812.775	1,193.320	3,027.784	9,921.693
	(of Which Transportation)	*3.731*	*6.438*	*5.347*	*5.087*	*6.712*	*16.474*	*13.494*	*57.283*	*59.135*	*11.637*	*4.941*	*2.969*	*19.547*	*78.682*
	Technology	16.037	15.648	13.059	17.580	13.997	15.104	8.062	99.488	147.884	45.310	45.480	79.900	170.690	318.574
	Technology for ITER	9.521	7.198	6.750	6.582	7.300	3.304	2.062	42.718	70.521	6.500	5.900	12.600	25.000	95.521
	(of which TBM)	*8.278*	*3.844*	*2.791*	*0.211*	*2.100*	*1.872*	*2.062*	*21.159*	*38.509*	*6.500*	*5.900*	*12.600*	*25.000*	*63.509*
	Technology for Broader Approach	6.516	8.451	6.309	10.998	6.697	11.800	6.000	56.770	77.363	38.810	39.580	40.380	118.770	196.133
	Technology for DONES	-	-	-	-	-	-	-	-	-	-	-	26.920	26.920	26.920
	Other Expenditure	1.672	2.615	1.908	4.606	6.026	4.982	5.000	26.808	32.122	5.000	5.000	5.000	15.000	47.122
	F4E Administration	42.653	44.031	47.670	53.431	55.859	56.408	58.405	358.457	542.448	60.082	61.808	63.624	185.514	727.962
	F4E Total Budget	623.916	412.727	448.924	551.547	633.481	674.708	752.467	4,097.770	7,574.234	1,132.081	925.063	1,341.844	3,398.988	11,015.351
	Reserve Fund	-	1.301	13.690	1.450	37.900	10.700	74.573	139.614	139.614	29.852	17.189	17.533	64.574	204.188
	F4E Total Expenditure	623.916	414.028	462.614	552.997	671.381	685.408	827.040	4,237.384	7,713.848	1,161.933	942.252	1,359.377	3,463.562	11,219.539
	F4E Total available budget (In revenue)	918.513	467.902	487.802	588.916	671.381	685.408	827.040	4,646.961	8,581.852	1,161.933	942.252	1,359.377	3,463.562	12,087.543
	% of implementation	68%	88%	95%	94%				91%	90%				100%	93%

Note: the Transportation and TBM domains are shown for the purpose of establishment of the ITER Host State contribution

ANNEX XVIII Annual Expenditure in payment appropriations

	Current Value MEUR	< 2007 Final Execution	2007 Executed	2008 Executed	2009 Executed	2010 Executed	2011 Executed	2012 Executed	2013 Executed	Total 2007-2013
Commitment Appropriations	ITER Construction	42.129	2.658	83.822	109.308	157.077	209.784	314.272	344.170	1,221.090
	(of Which Transportation)						*2.283*	*2.515*	*1.277*	*6.075*
	Technology			0.112	1.361	4.293	9.207	6.469	7.563	29.005
	Technology for ITER			-	1.229	4.027	4.282	3.415	2.279	15.231
	(of which TBM)			*3.188*	*0.709*	*0.660*	*6.065*	*0.072*	*6.656*	*17.350*
	Technology for Broader Approach			0.112	0.132	0.266	4.925	3.054	5.285	13.774
	Technology for DONES									
	Other Expenditure			0.085	0.539	0.645	0.647	1.118	1.249	4.283
	F4E Administration		1.113	13.884	24.258	29.428	35.932	39.445	39.932	183.991
	F4E Total Budget	42.129	3.770	97.903	135.466	191.443	255.570	361.304	392.914	1,438.370
	Reserve Fund									
	F4E Total Expenditure	42.129	3.770	97.903	135.466	191.443	255.570	361.304	392.914	1,438.370
	F4E Total available budget (In revenue)	42.129	3.770	151.328	198.035	292.988	290.983	377.124	432.391	1,746.619
	% of implementation	100%	100%	65%	68%	65%	88%	96%	91%	82%

	Current Value MEUR	2014 Executed	2015 Executed	2016 Executed	2017 Executed	2018 Forecast	2019 Forecast	2020 Planned needs	Total 2014-2020	Total 2007-2020	2021 Planned needs	2022 Planned needs	2023 Planned needs	Total 2021-2023	Total <2007-2023
Commitment Appropriations	ITER Construction	450.975	467.697	649.149	759.911	716.386	713.345	748.040	4,505.504	5,726.594	666.400	704.700	750.800	2,121.900	7,890.623
	(of Which Transportation)	*4.702*	*4.255*	*5.564*	*4.900*	*2.800*	*0.985*	*3.417*	*26.622*	*32.697*	*2.055*	*2.142*	*3.159*	*7.356*	*40.053*
	Technology	11.350	11.058	14.437	15.827	15.500	11.600	14.960	94.732	123.737	15.600	17.300	29.200	62.100	185.837
	Technology for ITER	5.905	5.342	8.576	10.438	9.000	4.200	4.760	48.221	63.452	4.100	4.300	6.300	14.700	78.152
	(of which TBM)	*8.278*	*3.844*	*2.791*	*0.211*	*2.100*	*15.562*	*18.310*	*51.097*	*68.447*	*12.514*	*8.122*	*4.537*	*25.172*	*93.619*
	Technology for Broader Approach	5.445	5.715	5.862	5.390	6.500	7.400	10.200	46.511	60.285	11.500	13.000	19.100	43.600	103.885
	Technology for DONES	-	-	-	-	-	-	-	-	-	-	-	3.800	3.800	3.800
	Other Expenditure	0.912	2.027	2.300	2.896	8.000	5.000	5.000	26.134	30.417	5.000	5.000	5.000	15.000	45.417
	F4E Administration	42.653	44.031	47.670	53.431	55.859	56.408	58.405	358.457	542.448	60.082	61.808	63.624	185.514	727.962
	F4E Total Budget	505.890	524.813	713.555	832.065	795.745	786.354	826.405	4,984.826	6,423.196	747.082	788.808	848.624	2,384.514	8,849.839
	Reserve Fund	-	-	-	4.671	30.600	18.000	30.000	83.271	83.271	13.000	25.000	25.000	63.000	146.271
	F4E Total Expenditure	505.890	524.813	713.555	836.736	826.345	804.354	856.405	5,068.097	6,506.467	760.082	813.808	873.624	2,447.514	8,996.110
	F4E Total available budget (In revenue)	567.617	526.082	724.534	864.914	826.345	804.354	856.405	5,170.251	6,916.870	760.082	813.808	873.624	2,447.514	9,406.514
	% of implementation	89%	100%	98%	97%				98%	94%				100%	96%

Note: The Transportation and TBM domains are shown for the purpose of establishment of the ITER Host State contribution

ANNEX XIX Annual Individual De-commitments by budget year

In EUR on 01/08/2018

B031 to B034	B- 2007+2008	B-2009	B-2010	B-2011	B-2012	B-2013	B-2014	B-2015	B-2016	B-2017	Total
De-Committed 2010	134,180.33	496,850.87									631,031.20
De-Committed 2011	644,552.35	629,541.85	231,028.85								1,505,123.05
De-Committed 2012	95,582.87	26,253.74	470,930.22	2,292,137.16							2,884,903.99
De-Committed 2013	2,642.56	15,127.12	704,525.17	584,724.68	515,177.41						1,822,196.94
De-Committed 2014		16,933.20	43,760.96	309,306.49	670,750.15	1,098,405.68					2,139,156.48
De-Committed 2015		433,380.71	506,888.11	3,642,410.52	636,770.29	1,200,472.93	349,886.69				6,769,809.25
De-Committed 2016	800,000.00			14,527.00	16,197.53	1,247,691.55	7,653,928.92	247,491.28			9,979,836.28
De-Committed 2017		0.01		509,400.84	25,972,209.45	3,992,505.29	1,917,872.56	3,869,573.45	1,588,799.49		37,850,361.09
De-Committed 2018			35,129.97	106,421.97		329,590.53	630,756.77	516,881.34	1,762,332.52	24,751,519.22	28,132,632.32
Total De-commitmer	1,676,958.11	1,618,087.50	1,992,263.28	7,458,928.66	27,811,104.83	7,868,665.98	10,552,444.94	4,633,946.07	3,351,132.01	24,751,519.22	91,715,050.60

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AGPS	Accelerator Ground Power Supplies
ASN	Autorité de Sûreté Nucléaire
ATS	Air Transfer System
BA	Broader Approach
BAUA[29]	Broader Approach Unit of Account.
BA SC	Broader Approach Steering Committee
C-O	Close-Out
CD	Current Drive
CDR	Conceptual Design Review
CQMS	Common Quality Management System
COSO	Internal Control standard
CXRS	Core plasma charge-exchange Recombination Spectroscopy
DA	Domestic Agency
DEL	Delivery
DEMO	Demonstration fusion reactor
DIV	Divertor
DT	Deuterium Tritium
DWS	Detailed Work Schedule
EB	Electron Beam
EBBTF	European Breeding Blanket Test Facilities
EC	Electron Cyclotron
EC UL	Electron Cyclotron Upper Launcher
ECH	Electron Cyclotron Heating
ELM	Edge Localized Mode
Euratom	The European Atomic Energy Community
F4E	Fusion for Energy
FAT	Factory Acceptance Test
FDR	Final Design Review
FP	First Plasma
FW	First Wall
GB	Governing Board
HCLL	Helium Cooled Lithium-Lead
HCPB	Helium Cooled Pebble Bed
H&CD	Heating & Current Drive
HHF	High Heat Flux
HV	High Voltage
HVD	High Voltage Deck
IC	Ion Cyclotron or ITER Council

[29] 1,000 BAUA equal to 678,000 EUR (value 5 May 2005).

I&C	Instrumentation and Control
ICH	Ion Cyclotron Heating
IFERC	International Fusion Energy Research Center
IFMIF	International Fusion Materials Irradiation Facility
INB	Installation Nucleaire de Base
IO	ITER Organization
IR	Infra-Red
IRS	Internal Reporting system
ISEPS	Ion Source and Extraction Power Supplies
ISS	Isotope Separation System
ITA	ITER Task Agreement
ITER	International Thermonuclear Experimental Reactor
IUA[30]	ITER Unit of Account.
IVT	Inner Vertical Target
IVVS	In-Vessel Viewing System
KPI	Key Performance Indicator
LIPAc	Linear IFMIF Prototype Accelerator
MV	Medium Voltage
NB	Neutral Beam
NBI	Neutral Beam Injector
NBTF	Neutral Beam Test Facility
PA	Procurement Arrangement
PBS	Product Breakdown Structure
PCR	Project Change Request
PDR	Preliminary Design Review
PE	Plasma Engineering
PF	Poloidal Field
PIC	Protection Important Components
PM	Project Management
PP	Project Plan
QA	Quality Assurance
QC	Quality Control
QST	Japanese Implementing Agency
R&D	Research & Development
REC	Remote Experimentation Centre
REM	Radiological Environmental Monitoring
RF	Radio Frequency
RFCU	Radio Frequency Control Unit
RFE	Ready For Equipment (when access is granted to IO)

[30] In 2008, the IUA exchange rate approved by the ITER Council corresponded to 1498.16 Euros.

RFOC	Ready for other contractors (when civil work is complete enough to enable access to other contractors)
RH	Remote Handling
RWM	Resistive Wall Mode
SAT	Site Acceptance Test
SC	Specific Contract
SiC-Dual	SiC/SiC composite material for electrical and thermal Insulation
SR2FP	Straight Road to First Plasma
SS	Steady State
STP	Satellite Tokamak Programme
TBM	Test Blanket Module
TF	Toroidal Field
TFC	Toroidal Field Coils
TFWP	Toroidal Field Winding Pack
TO	Technical Officer
VAR	Variation
VC	Voluntarily Contribution
VCDIS	Voluntarily Contribution Design Institutions
Vis	Visible
VS	Vertical Stability
VV	Vacuum Vessel
WAVS	Wide Angle Viewing System
WBS	Work Breakdown Structure
WDS	Water Detritiation System
WP	Work Programme